The Inference of Phylogenetic Relationships among the Main Lineages of Terrestrial Plants, With Emphasis on the Positions of the Major Bryophyte Groups, Using Small-Subunit Ribosomal RNA Gene Sequences

Volume I

A Thesis
Submitted to the Faculty of Graduate Studies and Research
in Partial Fulfillment of the Requirements
for the Degree of
Master of Science
in Biology
University of Regina

by

Nick A. Antonishyn
Regina, Saskatchewan

September, 1997

0-612-30437-X

ABSTRACT

The precise phylogenetic relationships among the major lineages of terrestrial plants remain uncertain. Small-subunit ribosomal RNA gene sequences were used to infer a molecular phylogeny of all major groups of land plants and contribute to the understanding of the evolutionary events underlying the transition from algal ancestors to land flora. Emphasis was placed on the phylogenetics of lower plants, with a special focus on bryophyte phylogeny. A well-constructed set of rDNA sequences from representative green plant taxa was accomplished through filling out gaps in the available data by sequencing rDNA in five additional taxa from a range of lower plants. Only sequences which are relatively error free and at least 93% complete were included. The alignment of the nuclear-encoded rRNA sequences was achieved using secondary structure information. The aligned sequences were subjected to both character and distance based methods of phylogenetic analysis. The results of this study suggest that 18S rDNA sequence data do not contain sufficient phylogenetic signal to resolve the relationship of the bryophytes amongst themselves or to other lower plants. A well constructed set of representative taxa from most major plant groups coupled with complete 18S rDNA sequence, the most appropriate alignment, and exhaustive phylogenetic analyses fail still to provide clusters with reasonable confidence as measured by bootstrap or decay analysis. Evidence for the lack of phylogenetic signal to resolve deep phylogenetic branches among lower plants is demonstrated by low confidence values in the phylogenetic trees regardless of the method employed. Further support for this contention is provided with analysis using random tree-length distribution and by phylogenetic analyses with different categories of sites classified according to substitution rate calculations. The graphical display of relative substitution rate variabilities using the lower plant 18S rRNA variability model displays the extent of conservation of the 18S rRNA gene sequence among the lower plants.

ACKNOWLEDGMENTS

First and foremost, I would like to give special thanks to Deanne Grass whose support and encouragement made this project possible. I would like to recognize my supervisor, Dr. N.W. Ashton, for his guidance and patience throughout this project. The expert advice and direction of Dr. W. Chapco towards the phylogenetic analysis portion of this project are greatly appreciated.

Saskatchewan Provincial Laboratory deserves a special acknowledgment for providing opportunities to make a large portion of this project feasible. Part of this project was also supported by an NSERC operating grant awarded to Dr. Ashton.

TABLE OF CONTENTS

Volume I

TABLE OF CONTENTS

Volume II

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

A	adenine
bp	base pairs
C	cytosine
CTAB	cetyltrimethylammonium bromide
dATP	2′-deoxyadenosine 5′-triphosphate
DCSE	Dedicated Comparative Sequence Editor
dCTP	2′-deoxycytidine 5′-triphosphate
dGTP	2′-deoxyguanosine 5′-triphosphate
dITP	2′-deoxyinosine 5′-triphosphate
DNA	deoxyribonucleic acid
dNTP	2′-deoxynucleoside 5′-triphosphate
dTTP	2′-deoxythymidine 5′-triphosphate
EDTA	ethylenediaminetetraacetic acid
G	guanine
h	hour
indels	insertions / deletions
kb	kilobase
min	minute
OTUs	operational taxonomic units
PCR	Polymerase Chain Reaction
Physcomitrella	*P. patens*
rDNA	ribosomal RNA gene
RNA	ribonucleic acid
RNase A	Ribonuclease A
rRNA	ribosomal RNA
s	second
T	thymine
TE	10 mM Tris, 1 mM EDTA, pH 8.0 buffer
Tris	tris(hydroxymethyl)aminomethane
U	uracil

1. INTRODUCTION

The reconstruction of deep phylogenetic relationships among lower land plants is necessary for elucidating important events in the evolution of green plants and especially green terrestrial plants. Plants are defined here to include a broad assemblage of photosynthetic organisms that all contain chlorophylls *a* and *b*, store their photosynthetic products as starch inside the chloroplasts, and have cell walls made of cellulose (Raven *et al.*, 1992). This assemblage is compiled from several thousand classically-defined green algae and several hundred thousand land plants.

Two major lineages of plants have been placed in a single monophyletic group, the subkingdom Chlorobionta (Bremer, 1985). This study has focused on the evolution of one of these major lineages which includes land plants and closely related 'green algae'. This lineage of green plants has been called the Streptophytes (Bremer, 1985), and consists of some organisms conventionally considered green algae plus the more familiar green plants found mostly on land. Traditionally, the green algae in this lineage are included in the Class Charophyceae, but some members of this class are related more closely to higher plants than to other members of the class (Mattox and Stewart, 1984; Mishler, 1985; McCourt, 1995; Melkonian and Surek, 1995). Specifically, *Chara* and related algae (Order Charales) and *Coleochaete* and related algae (Order Coleochaetales) are probably the closest living 'green algal' relatives of land plants.

Ultrastructural and morphological studies were the first to support the relationship of these orders of green algae to land plants (embryophytes) (Pickett-Heaps, 1975; Mishler, 1985; Graham *et al.*, 1991). These orders of green algae have been placed in the Class Charophyceae (Mattox and Stewart, 1984), and recent analyses suggests that the Charophyceae is a paraphyletic group with the orders circumscribed within it being placed at the base of the Streptophyta lineage (Bremer, 1985; McCourt, 1995; Surek *et al.*, 1995). Some of the more recent molecular studies corroborate earlier cladistic analyses based on ultrastructural and biochemical data (Mishler and Churchill, 1985) which propose that the 'charophycean' algae, specifically Coleochaetales, are closest to the embryophyte clade (Kranz *et al.*, 1995).

Although there is considerable evidence supporting the evolution of land plants from these green algal ancestors (Chapman and Buchheim, 1991; Surek *et al.*, 1993; Bhattacharya *et al.*, 1994; Mishler *et al.*, 1994; Kranz *et al.*, 1995), the precise relationships amongst major land plant groups are still unclear. The evolutionary transition from algal ancestors to land flora will be understood best with elucidation of the phylogenetics of lower plants. Bryophyte genealogy is believed to be of paramount importance in understanding this evolutionary transition (Hedderson *et al.*, 1996). Studying bryophyte phylogeny should provide insight into the evolutionary events underlying the colonization of the terrestrial habitat and, furthermore, will help with the differentiation of major lower plant lineages.

Bryophytes consist of approximately 18,000 species which are traditionally defined to three major groups; namely hornworts (Anthoceropsida), liverworts

(Hepaticopsida), and mosses (Byropsida). Recent analyses, using diverse data sets, suggest that the phylogenetic position of bryophytes is between the green algal ancestors of the land plants and the tracheophytes or vascular plants (Mishler *et al.*, 1984; Bremer, 1985; Bremer *et al.*, 1987; Raubeson *et al.*, 1992; Waters *et al.*, 1992; Garbary *et al.*, 1993; Mishler *et al.*, 1994). Over the past two decades, several phylogenetic studies have focused on the relationships among the three main groups of bryophytes and have utilized morphological, ultrastructural and molecular data (Renzaglia, 1978; Crandall-Stotler, 1980, 1986; Mishler and Churchill, 1984, 1985; Schuster, 1984; Schofield, 1985; Duckett and Renzaglia, 1988; Mishler *et al.*, 1992; Waters *et al.*, 1992; Garbary *et al.*, 1993; Mishler *et al.*, 1994; Kranz *et al.*, 1995; Bopp and Capesius, 1995,1996; Hedderson *et al.*, 1996).

Despite these efforts, there is no clear consensus as to the relationships among the three main groups of the bryophytes. Cladistic analyses of combined morphological, ultrastructural, and biochemical data have implied that the bryophyte clade is a paraphyletic assemblage with the Byropsida a sister group to the tracheophytes, the Anthoceropsida a sister group to the Byropsida-tracheophyte lineage, and the Hepaticopsida as basal group among the land plants (Mishler and Churchill, 1984, 1985). Investigations using characters derived from male gametogenesis suggest different relationships, in which bryophytes are a monophyletic group with Anthoceropsida a sister group to a Byropsida-Hepaticopsida lineage (Garbary *et al.*, 1993). The bryophyte clade is proposed to share a common ancestor with the Lycopodopsida group, and this monophyletic bryophyte-Lycopodopsida clade is a sister group to the remaining land plants.

In recent years, the sequences of the small-subunit ribosomal RNA genes have been used increasingly to investigate plant evolution (Hamby and Zimmer, 1992). Investigation of these nuclear genes has provided evidence for their potential phylogenetic usefulness at the deeper hierarchical level (Zimmer *et al.*, 1989; Kantz *et al.*, 1990; Zechman *et al.*, 1990; Hillis and Dixon, 1991; Lewis *et al.*, 1992; Waters *et al.*, 1992; Wilcox *et al.*, 1992; Ashton *et al.*, 1994). Analysis of these gene sequences has been applied to the study of bryophyte phylogeny, and preliminary results place an Anthoceropsida-Byropsida clade as a sister to the tracheophytes with the Hepaticopsida remaining basal to the other land plants (Waters *et al.*, 1992). However, the topology of Mishler and Churchill (1984, 1985) can be imposed upon the rRNA tree of Waters *et al.* (1992) by increasing tree length by a single step. Cladistic analyses of the green plants that combine and compare available morphological and molecular data sets have resulted in poorly resolved phylogenies (Mishler *et al.*, 1994). A more comprehensive analysis to determine the origin of land plants using complete small-subunit ribosomal RNA gene sequences found conflicting resolutions depending on phylogenetic methods employed (Kranz *et al.*, 1995). This study found maximum parsimony and maximum likelihood analyses implied a successive evolution from 'charophycean' algae to bryophytes, lycopods and seed plants whereas, distance matrix methods implied a separate evolution of the lycopods and seed plants by grouping the bryophytes together with the 'charophycean' algae. Conversely, more recent work of Hedderson *et al.* (1996) resolved hornworts as the basal group among the land plants with the liverworts and mosses forming a monophyletic clade sister to the tracheophytes.

The pattern of diversification of the bryophytes is not the only aspect of the evolution of land plants that remain imperfectly known. The relationships of the morphologically and biologically diverse lineages that constitute the vascular cryptograms also remain controversial (Bremer *et al.*, 1987; Niklas and Banks, 1990; Garbary *et al.*, 1993; Stewart and Rothwell, 1993; Hasebe *et al.*, 1995; Kranz *et al.*, 1995; Manhart, 1995; Pryer *et al.*, 1995; Kenrick and Crane, 1997; Kranz and Huss, 1997). For example, there is debate as to whether the Lycopodiophyta are polyphyletic (Garbary *et al.*, 1993) or monophyletic (Niklas and Banks, 1990; Kranz and Huss, 1997). In addition, some studies suggest that the Psilotophyta form the basal lineage of vascular plant evolution (Bremer *et al.*, 1987) whereas, others suggest Lycopodiophyta fill this role (Stewart and Rothwell, 1993; Kranz and Huss, 1997). Similarly, the relationships among and placement of the Filicophyta have also been the subject of considerable controversy (Stewart and Rothwell, 1993; Hedderson *et al.*, 1996). Clearly, precise relationships among basal lineages of land plants including the bryophytes remain unclear.

Other studies using nuclear encoded rRNA gene sequences have placed in doubt previously unquestioned bryophyte genealogy. The monophyly of the Hepaticopsida is brought into dispute by suggestions that only the complex thalloid liverworts (Class Marchantiopsida) are a sister group to the tracheophytes (Chapman and Buchheim, 1991, 1992; Mishler *et al.*, 1994). The remaining hepatics comprised of simple thalloid and leafy liverworts (Class Jungermanniopsida) are proposed to form a monophyletic group with Anthoceropsida and Byropsida or Anthoceropsida alone. More recent studies, again using 18S rRNA genes, but including only strictly bryophyte taxa, have attempted to resolve the questionable monophyly of the liverworts (Capesius, 1995; Bopp and Capesius, 1995). These studies support placing Marchantiidae at the base of the Byropsida-Jungermanniidae clade, but disagree on the monophyly of the Bryopsida lineage. Phylogenies constructed with nucleotide sequence data of chloroplast gene *rbc*L corroborate the separation between complex thalloid and leafy/simple thalloid liverworts but could not reject the monophyly of the liverworts (Lewis *et al.*, 1997).

Some aspects of the origin and evolution of land plants do appear to be approaching resolution. It is now accepted widely that the Charophyceae are a sister group to the embryophytes (lands plants including bryophytes and tracheophytes) which together form a monophyletic lineage. The bryophytes occupy a phylogenetic position between the Charophyceae and the tracheophytes. The seed plants are a monophyletic group containing the monophyletic angiosperms and the gymnosperms, although the gymnosperm monophyly is still under investigation (Chaw *et al.*, 1997). Nonetheless, several issues on the origin and evolution of land plants remain unresolved. This study set out to investigate some of the issues regarding the resolution of basal lineages of land plants with a specific focus on bryophyte genealogy.

Recent advances have provided some insight into the aforementioned discrepancies among the several studies using nuclear-encoded rRNA sequence data. The quantity and quality of sequence data, the assessment of homology provided by sequence alignment, taxon sampling and methods of phylogenetic analysis all have profound effects on the outcome of phylogenetic investigation using molecular data (Charleston *et al.*, 1994; Lecointre *et al.*, 1993; Yang, 1997). There are five basic steps in the phylogenetic analysis of DNA sequences, although all previous investigators of bryophyte phylogeny have either excluded or at least de-emphasized some of the steps. The steps involved are discussed in the following five sections and are: 1) choice of DNA sequence, 2) sampling of appropriate taxa, 3) sequence alignment 4) assessment of phylogenetic signal and 5) choosing a method of phylogenetic inference.

1.1 Nuclear-encoded rRNA sequence data

The partial or complete DNA sequences of single genes comprise the most common type of sequence sample used in molecular phylogenetic studies. Although some effort has been made to study the phylogenetic utility of particular genes (Friedlander *et al.*, 1992; Graybeal, 1994), the location and length of sequences are chosen generally on the basis of factors other than their ability to accurately represent the genome. These factors include interest in the functional characteristics of a region, its historical use in systematic studies, and several technical considerations which are often unrelated to its ability to reconstruct whole-genome relationships. Indeed, how well a gene represents the entire genome is difficult to evaluate *a priori*.

The potential usefulness of rRNA for phylogenetic inference has been established and merits for its use include universality, functional constancy, ease of identification and isolation, and apparent lack of horizontal gene transfer (Olsen, 1988). The development of 'universal' rDNA-specific primers has revolutionized the process of rRNA gene sequence determination (Sogin, 1990; White *et al.*, 1990). In addition, DNA sequencing technologies have progressed to a point where complete or nearly complete nucleotide sequence data for rRNA genes can be obtained readily. One of the greatest assets of rRNA-based phylogenetic analysis is the availability of pre-determined ribosomal RNA gene sequences from several public databases (Benson *et al.*, 1997; Maidak *et al.*, 1997; Van de Peer *et al.*, 1997).

The rRNAs can be identified by their typical eukaryotic sedimentation values: 5S, 5.8S, 18S, and 28S. In eukaryotes, two internal transcribed spacers designated ITS-1 and ITS-2 separate the 18S, 5.8S and 28S genes. The 18S rRNA gene was chosen for use in this study based largely on the availability of 'universal' primers, and the large body of previously determined plant 18S rDNA sequence data. Previous studies into the elucidation of bryophyte phylogeny were able to utilize only partial sequence data of genes for 18S rRNA (Waters *et al.*, 1992; Mishler *et al.*, 1992; Mishler *et al.*, 1994). Only recently has complete or nearly complete sequence data for bryophytes been available for use in phylogenetic analyses (Bopp and Capesius; 1995, 1996; Capesius, 1995; Kranz *et al.*, 1995; Hedderson *et al.*, 1996). This investigation included an 18S rRNA gene in the data set only if a minimum of 93% of its sequence had been determined.

1.2 Taxon sampling

The previous section addressed the assumption that the sampled nucleotide sequences are representative of the genomes from which they are drawn. Similarly, inferred phylogenetic relationships are presumed to represent those of the organisms involved. Although, in general, sampling properties of DNA sequence data are assessed quite well, species sampling has received little to no attention. When a species is sampled, it is assumed implicitly that its sequence is representative of the sequences in the supposed monophyletic group of which the chosen species is a member. In practice, however, it has been shown that radically different phylogenies can be obtained if the same presumed monophyletic groups are sampled differently (Lecointre *et al.*, 1993). Several studies have shown that significant variations in robustness and topology of trees obtained depend on species representation of the taxa (Patterson, 1989; Hendriks *et al.*, 1990; Adoutte and Philippe, 1993; Lecointre *et al.*, 1993; Charleston *et al.*, 1994). The impact of species sampling can be minimized with sampling several species per presumed monophyletic group (Lecointre *et al.*, 1993).

Incomplete taxon sampling is likely to explain some of the discrepancies among the different studies of bryophyte phylogeny. Some studies into the bryophyte phylogeny have restricted the taxa to strictly bryophyte species (Capesius, 1995; Bopp and Capesius, 1995, 1996). All other studies looking at deeper phylogenetic relationships have had the foresight to include other major lineages but the inclusion of representative taxa is generally weak (Renzaglia, 1978; Crandall-Stotler, 1980, 1986; Mishler and Churchill, 1984, 1985; Schuster, 1984; Schofield, 1985; Duckett and Renzaglia, 1988; Mishler *et al.*, 1992; Waters *et al.*, 1992; Garbary *et al.*, 1993; Mishler *et al.*, 1994; Kranz *et al.*, 1995; Hedderson *et al.*, 1996). For example, the most complete taxa set used in phylogenetic investigation of bryophytes included 18 bryophyte taxa with only two hornworts and six taxa from fern and seed plants representing all tracheophytes

(Hedderson *et al.*, 1996). Kranz *et al.* (1995) propose a bryophyte phylogeny with only three representatives from the group and none from the hornworts. However, this study does include representative taxa from all major lineages of plants and is comprised of 54 species spanning seven phyla and fifteen families.

1.3 Sequence alignment and secondary structure information

One of the essential steps in the reconstruction of phylogenetic history is the determination of character homology among the taxa being studied. One of the basic principles of systematics is that only homologous characters can provide meaningful markers of genealogical descent. Consequently, the accuracy of a phylogeny from molecular data is critically dependent on the accuracy of sequence alignment. Hence, mistaken hypotheses of character-state homology are a primary source of error in evolutionary studies (Morrison and Ellis, 1997). Molecular sequence data are exceptionally susceptible to these errors since assessment of homology involves the alignment of nucleotides or amino acids with one hypothesis of homology for each position. Positional homology in orthologous sequences can fall into one of three categories; 1) identical character states, 2) substitutions representing point mutations or 3) insertions/deletions (indels). The positioning of indels is the most problematic aspect of sequence alignment which becomes more acute with divergent taxa. The purpose of sequence alignment is to introduce gaps into the sequences only when they truly represent insertion or deletion events during the course of evolution.

Insertions and deletions are common in genes for rRNA (Kjer, 1995) and require the introduction of gaps into sequences for the purpose of alignment. Until recently, studies of bryophyte phylogeny relied on computer programs to align rRNA gene sequences, often followed by manual adjustments and exclusion of regions containing ambiguous alignment (Chapman and Buchheim, 1992; Mishler *et al.*, 1992; Ashton *et al.*, 1994; Hedderson *et al.*, 1996). Mishler *et al.* (1994) stated simply that their alignments of molecular data were done 'by eye'. Some authors of studies in bryophyte phylogeny even fail to mention this very important step, perhaps providing insight into their assessment of this critical first step of systematics (Capesius, 1995; Bopp and Capesius, 1995, 1996). The central assumption for both the manual and computer-assisted alignments referred to above is that they maximize nucleotide identity. The computer programs for sequence alignment function by invoking gap penalties. These gap penalties are assigned arbitrarily by the investigator since neither the causes nor consequences of these gaps are understood (Kjer, 1995). Arguably, the assignment of gap penalties may be appropriate for polypeptide encoding sequences but is not so for rRNA genes. Some regions of rRNA genes are extremely intolerant to changes in length while other regions vary without any apparent constraints, suggesting that each region and possibly each position within the rRNA molecule would be better served with its own individual 'gap penalty' (Kjer, 1995). In addition, neither these manual nor computer-assisted alignments optimize the alignment of homologous positions within structurally conservative stems that lack significant nucleotide identity. For example, a point mutation has at least 50% likelihood that its new nucleotide state is identical to one of its nonhomologous neighbors.

If this mutation occurs near a gap, it could be systematically misaligned when alignments are based strictly on maximizing nucleotide identity.

Small-subunit rRNA is a molecule for which there is an *a priori* biological model of secondary structure (Gutell *et al.*, 1994). In addition, primary and secondary structures are well conserved even among very divergent taxa (Hillis and Dixon, 1991). Although the secondary structure of rRNA is not identical across all taxa, it is still more highly conserved than the nucleotide sequences (Kjer, 1995). Recent advances in homology assessment suggest that secondary structure information can be used to enforce sequence alignment (Kjer, 1995; Hickson *et al.*, 1996). Since the sequences of the rRNA genes (rDNA) are constrained by the secondary structures of their products, this allows knowledge of the secondary structure to be used for the alignment of the rDNA sequences. Furthermore, the helix (or stem) and single-stranded (or loop) regions can be treated as separate divisions of nucleotide site change provided the paired bases of the helices result from compensatory mutations (Vawter and Brown, 1993; Muse, 1995).

There are two main methods for predicting secondary structure of ribosomal RNA molecules: phylogeny and energy minimization studies (Jaeger *et al.*, 1990). Energy minimization utilizes thermodynamic parameters and computer algorithms which determine minimum and near minimum free energy folding of RNA. Predictions based on phylogeny relies on primary structure alignments with subsequent folding of several sequences into similar structures for functionally analogous RNA. Certainly, structural and evolutionary studies are complementary since the derivation of evolutionary trees requires a dependable sequence alignment as a starting point, and the establishment of such an alignment is enhanced by the knowledge of secondary structure landmarks. Secondary structure landmarks include boundaries of helices and loops and the existence of compensating substitutions in complementary strands.

Comparative sequence analysis of RNA structure is based on the simple principle that homologous RNA molecules will adopt the same secondary and tertiary structures with different primary sequences. Practically, comparative studies identify secondary structure base pairings by finding compensatory base changes or covariations in alignments of homologous sequences. This approach has been successfully applied to several classes of RNA molecules (Woese *et al.*, 1980; Glotz *et al.*, 1981; Zwieb *et al.*, 1981; Noller *et al.*, 1981; Maly and Brimacombe, 1983; Woese *et al.*, 1983; Gutell, 1996). Analysis of 16S and 23S rRNA sequences have revealed that many positions are restricted to certain types of pairing sequences, either subsets of the four Watson-Crick pairings or non-canonical base-pairs, such as A:C and G:U or A:G and G:A (Gutell, 1996). The majority of restricted variations in rRNA base pair sequences are of the purine:pyrimidine type (Gautheret and Gutell, 1997).

It has become evident to investigators of phylogenetics using rRNA gene sequence data that secondary structure information is indispensable (Morrison and Ellis, 1997). Certainly, erroneous homology statements due to alignment inaccuracies are as problematic as other well-known problems associated with sequence length and tree-inference methods (Russo *et al.*, 1996). Previous studies on the phylogeny of bryophytes have failed to consider structural aspects of rRNA when aligning their sequences and discrepancies amongst their trees are probably attributable largely to the alignments employed (Chapman and Buchheim, 1992; Mishler *et al.*, 1992; Ashton *et al.*, 1994; Capesius, 1995; Bopp and Capesius, 1995, 1996; Hedderson *et al.*, 1996). This study utilizes both primary and secondary structure information for homology assessment.

1.4 Assessment of phylogenetic signal and variability

Once sequences have been aligned, some assessment of the presence of phylogenetic signal is necessary. Phylogenetic signal is the information used to infer phylogenetic history. There is obviously no purpose in additional analysis if all sequences are identical; likewise, extremely divergent sequences may be randomized with respect to phylogenetic history giving a phylogenetic hypothesis that might as well have been selected at random. The reasonable alignment of DNA sequences is not sufficient to justify the use of the sequences in phylogenetic analysis. Analysis of most aligned sequences may produce an optimal tree with a given method, but without some assessment of phylogenetic signal, there is insufficient reason to expect that the optimal tree is a good estimate of phylogeny (Hillis *et al.*, 1993).

DNA sequences compared among organisms may contain phylogenetic signal, or they may be randomized with respect to phylogenetic history. To order to proceed with an appropriate analysis of a particular data set, phylogenetic signal needs to be distinguished from random noise. This is especially important when considering the fact that random data frequently produce a single most-parsimonious tree often considerably shorter than the second-best alternative (Hillis and Huelsenbeck, 1992). Mistakenly, several investigators cite confidence in their molecular data by quoting high decay indices on their single most-parsimonious tree without first establishing phylogenetic signal (Mishler *et al.*, 1994).

In addition, the usefulness of small-subunit rRNA gene sequence data for phylogenetic inference has been determined largely on groups of taxa other than lower land plants. Until recently, the greatest justification for use of rRNA had been successful analyses of bacterial evolution (Woese, 1987). The usefulness of this gene for phylogenetic inference of lower land plant relationships has not been fully justified but rather implied from other studies with bacterial (Woese, 1987; Turner *et al.*, 1989), animal (Hillis and Dixon, 1989; Larson and Wilson, 1989; Sogin *et al.*, 1989) and some higher plant (Gouy and Li, 1989; Hamby and Zimmer, 1992; Wolfe *et al.*, 1989) taxa. Plant DNA sequences shows extensive homoplasy in comparison to those derived from animals (Syvanen *et al.*, 1989) and, furthermore, it has been established that rates of synonymous substitution vary among evolutionary lineages of plants (Bousquet *et al.*, 1992; Gaut *et al.*, 1996; Eyre-Walker and Gaut, 1997). These facts justify the need to determine independently the utility of 18S rDNA for phylogenetic inference of relationships among lower land plants and specifically of those involving bryophytes.

One method of detecting the presence of phylogenetic signal in a given data set is to examine the shape of the tree-length distribution for a random subset of all trees resulting from a parsimony analysis (Hillis and Huelsenbeck, 1992; Hillis *et al.*, 1993). Only a strongly left-skewed tree-length distribution indicates good phylogenetic signal. The skewness test statistic, g_1, can provide a rapid and efficient test for significant structure in data matrices for phylogenetic analysis (Hillis and Huelsenbeck, 1992). Data sets with no correlated characters produce distributions that are close to symmetrical and suggest phylogenetic signal is not sufficient to warrant further phylogenetic analysis of the data.

The determination of the presence or absence of phylogenetic signal can be complemented by characterizing the extent and location of nucleotide variability. Several studies have shown that most constrained molecules, such as rRNAs, exhibit a considerable variation in substitution rate (Uzzell and Corbin, 1971; Golding, 1983; Holmquist *et al.*, 1983; Van de Peer *et al.*, 1993; Wakeley, 1993; Sullivan *et al.*, 1995; Yang, 1995). Consequently, the probability of these molecules sustaining a substitution is different for different sites, possibly because selective and functional constraints are not identical in different parts of the molecule. Several studies have revealed that rate variation among sites is a very important issue in the framework of phylogenetic inference. These studies have shown that ignorance of this variation leads to underestimation of transition/tranversion rates (Wakeley, 1994), evolutionary distances and branch lengths (Jin and Nei, 1990; Ota and Nei, 1994; Tateno *et al.*, 1994). The underestimation of branch lengths can affect profoundly tree reconstruction by distance matrix methods (Olsen, 1987; Jin and Nei, 1990; Tateno *et al.*, 1994; Van de Peer *et al.*, 1996). The ignorance of site variability has especially drastic effects on the construction of universal trees (Yang and Roberts, 1995). To many systematists interested in phylogeny, the identification and acknowledgment of partitions in the sequence data provided by assessment of site variability may seem irrelevant at best. However, ignoring details of evolutionary processes presupposes falsely that phylogeny reconstruction methods are robust to such influences (Bull *et al.*, 1993).

A recently developed method for estimating the variability of nucleotide sites in a sequence alignment was used in this study (Van de Peer *et al.*, 1996c). This method defines the variability of each nucleotide site as its evolutionary rate relative to the average evolutionary rate of all the nucleotide sites of the molecule. This variability measurement was used in a distance-based phylogenetic method (Van de Peer *et al.*, 1996c) which provided a precise estimation of evolutionary distances. The site variability information was also used to divide the alignment positions into a number of sets of increasing relative substitution rate. This provided a means to determine which nucleotides generate phylogenetic signal for phylogeny reconstruction and exactly where the signal allows resolution in the tree. In addition, site variabilities were calculated from representative taxa of all major lower plant lineages and were used to construct a quantitative map of nucleotide substitution rates in lower plant nuclear small-subunit rRNA. The variability map for lower plant 18S rRNA was constructed by superimposing on to the secondary structure model of *Physcomitrella patens* 18S rRNA the calculated site variabilities where the variability of each nucleotide site is indicated by means of a colored dot (Van de Peer *et al.*, 1996a). This colored map provides a detailed and quantitative description of positional variability with respect to secondary structure of the molecule.

1.5 Phylogenetic analysis

It is not the intention or purpose of this thesis to educate the reader on the different methods of phylogenetic inference. However, a brief synopsis of the phylogenetic methods employed in this study is justified. A phylogenetic tree is a form of a graph composed of nodes and branches. The nodes in the trees presented in this thesis represent the 18S rRNA gene and the branches represent the topological relationships between the nodes. Nodes can be divided into internal and external types where the latter are also called operational taxonomic units (OTUs). All trees in this thesis are rooted by identifying a special node, called the root, using the outgroup method. The outgroup method determines of the relationship of *n* sequences by adding one or more sequences that are known to be outside the clade of *n* sequences or basal in phylogenetic lineage. The number of possible topologies for an unrooted strictly bifurcating tree with the 67 OTUs examined in this thesis is approximately $2.1253 * 10^{109}$. Clearly, the application of computers is warranted and several software packages that are available for phylogenetic investigation have been employed in this study. The number of trees is significant since it dictates the use of heuristic methods and often the choice of phylogenetic method and the number of OTUs is limited by computational considerations (CPU time for some of the methods engaged in this study required several weeks for calculation).

Several methods have been proposed for building a phylogenetic tree from observed data. Tree-building methods can be divided into two groups in terms of the type of data they use: distance-based methods and character-based methods. Distance-based methods use distance matrices which consist of all possible pairwise distances, whereas character-based methods use an array of character states. The distance-based analyses used in this study incorporate the neighbor-joining method (Saitou and Nei, 1987) which is applied to distance matrices calculated by using various parametric models (Jin and Nei, 1990; Jukes and Cantor, 1969; Kimura, 1980; Tajima and Nei, 1984; Van de Peer *et al.*, 1996c). The character-based methods used in this study consist of the maximum parsimony method (Fitch, 1971) and the maximum likelihood method (Felsenstein, 1981).

In comparative analysis of homologous DNA sequences, nucleotide substitution is commonly assumed to follow a homogeneous Markov process (Yang, 1994). The Markov process is specified by a rate matrix, Q, whose elements represent instantaneous substitution rates among the four nucleotides. For mathematical simplicity and ease of computation, normally extra restrictions have been placed on the structure of Q, leading to various parametric models. These parametric models are assumed to correct for superimposed mutations when calculating distance values between sequences. The parametric models or distance methods fit a tree to a matrix of pairwise distances between the sequences - the rate matrix, Q. Each distance is based on the fraction of positions in which two sequences differ and is defined as dissimilarity, S. This dissimilarity is actually an underestimation of the true evolutionary distance since some of the sequence positions likely represent multiple events. Furthermore, since mutations are fixed in DNA sequences, there is an increasing chance with time that mutations occur at the same nucleotide position, creating a superimposed mutation. Therefore, different parametric models each try to estimate the number of unseen mutations with distinct assumptions about the nature of evolutionary changes. Such models can be used to construct estimates of evolutionary distances in pairwise sequence comparisons and are used also in maximum likelihood joint comparisons of all sequences. The evolutionary distance between two sequences is then assumed to be proportional to the time that separates them.

The neighbor-joining method of phylogenetic tree construction (Saitou and Nei, 1987) takes the distance matrix built by one the parametric models and modifies it. This modified distance matrix is constructed so that the separation between each pair of nodes is adjusted on the basis of their average divergence from all other nodes. This has the effect of normalizing the divergence of each OTU for its average clock rate (Swofford and Olsen, 1990). The neighbor-joining algorithm then joins the least distant pair of OTUs as defined by the modified distance matrix into a new OTU. This new OTU is added to the tree while the replaced OTUs and their respective branches are removed from the tree. This process converts the newly added OTU into a terminal node on a tree of reduced size. At each stage of the process, two terminal OTUs are replaced by a new one. The process is complete when only two OTU remain, separated by a single branch. The neighbor-joining approach does not depend on ultrametric data (Swofford and Olsen, 1990) which is appropriate for 18S rDNA and its unequal rates of evolution across the broad selection of taxa used in this study.

Character-based methods treat each substitution separately rather than reducing all of the variation to a single divergence value. The character-based method of maximum parsimony (Fitch, 1971) partitions similarities between DNA sequences on a character-by-character basis. Alternative trees are evaluated, one character at a time, to determine how many evolutionary events they each require. By the criterion of parsimony, the 'best' or most parsimonious tree is the one requiring the fewest total events. Parsimony is the principle of logic that the simplest explanation should be preferred over the more complex. In the context of phylogenetic investigation, the most parsimonious tree is the one requiring the fewest evolutionary events to explain the differences between DNA sequence data. Maximum likelihood (Felsenstein, 1981) is the other character-based method used in this study. Maximum likelihood is a statistical model which considers each character separately for the likelihood of observed change given a particular topology and model of molecular evolution.

Once the topology is constructed, it is necessary to evaluate the reliability of the tree by assessing the confidence in the robustness of the phylogeny provided by the sequence data. Bootstrap analysis can be used to place confidence intervals on phylogenies and is a type of statistical analysis to test the reliability of certain branches in the evolutionary tree (Felsenstein, 1985; Swofford and Olsen, 1990). Bootstrapping involves resampling the data with replacement to create a series of bootstrap samples of the same size as the original data. Nucleic acid sequences provide resampled data in the form of nucleotides of a sequence, while the statistical significance of a cluster is given by the fraction of trees, based on the resampled data, containing that cluster. Bootstrapping is the most popular method used to evaluate tree robustness and has been extensively tested and assessed as an estimator of robustness (Hillis and Bull, 1993; Felsenstein and

Kishino, 1993). Problems with bootstrapping stem from several assumptions that the bootstrap places on the data. Two of these assumptions have been identified as most troublesome when dealing with molecular data (Hillis and Bull, 1993). These are: 1) that characters are independent and 2) that characters are a representative sample from an underlying universe of character data. DNA sequence character data are neither independent (Gatesy *et al.*, 1993) especially ribosomal RNA genes (Wheeler and Honeycutt, 1988) nor a representative sample of the universe of character data (DeSalle *et al.*, 1994). Nevertheless, bootstrapping can be applied, provided the investigator understands these caveats when interpreting bootstrap values which underestimate consistently the accuracy of a phylogenetic hypothesis.

To ensure the confidence in clusters based on bootstrap values was not being misinterpreted, another method was employed for testing the statistical significance of a particular branching pattern of a phylogenetic tree. Decay analysis is an alternative method for evaluating support for clades and has been well studied for its merits (Bremer, 1988; Donoghue *et al.*, 1992; Graham *et al.*, 1991; Källersjö *et al.*, 1992; Mishler *et al.*, 1991). Decay analysis works by obtaining the strict consensus of trees that are one step longer than the most parsimonious tree(s), two steps longer, and so on until all resolution is lost. The 'decay index' provides the confidence estimate and is defined as the number of steps maximum parsimony must be relaxed to cause a particular clade to lose its support (Mishler *et al.*, 1991).

It is now evident that different methods used in phylogenetic analysis may not give the same branching pattern in phylogenetic trees (Barnabas *et al.*, 1995; Kranz *et al.*, 1995; Yang, 1997). Hence, it is necessary to construct trees by more than one type of method and make cooperative use of information to arrive at a possible species phylogeny (Kim, 1993). It is this author's contention that none of the distance-based or character-based methods, when appropriately employed in phylogenetic inference, warrant complete condemnation or approval. Instead, a comparative approach, as taken in this study, will avoid making any unduly algorithm-weighted or philosophy-laden phylogenetic judgement.

There must be certain *a priori* knowledge to make justifiable claims for one particular treatment to be unequivocally the best in any particular situation (Avise *et al.*, 1994). Most investigators of phylogeny using a specific set of sequence data do not have precise knowledge of DNA evolutionary rates, extent of variability, or processes underlying character transformation. Consequently, determination of which phylogenetic method is the most apt for the data is not possible since the conformity of the data to a particular set of assumptions underlying each phylogenetic method is uncertain. Therefore, it is reasonable to compare results of several analyses and subsequently to place greater emphasis and confidence in phylogenetic outcomes derived from multiple approaches than in those which, idiosyncratically, are generated by only one or a few methods (Avise and Nelson, 1995). As stated by Avise *et al.* (1995); "...outcomes robust to alternative analyses and databases should be less controversial than those which are strongly analysis- or data-dependent", which is in agreement with Felsenstein's (1982) sentiment; "It is essential that we not adopt a single method [of phylogenetic inference] as a universal panacea." This study employed two distinct character-based phylogenetic approaches, maximum parsimony and maximum likelihood, and several distance-based phylogenetic algorithms, against nine data sets for a total of 40 treatments overall.

1.6 Purpose and strategy of investigation

Previous investigations into the evolution and origin of lower land plants have failed to address thoroughly one or more of the aforementioned considerations. This study will attempt to resolve issues of bryophyte phylogenetics with all the elements of phylogenetic analyses addressed properly. The phylogenetic approach taken in this thesis, which in most contexts is appropriately conservative, was to apply a variety of conceptually and operationally distinct phylogenetic algorithms to the well-aligned, nuclear-encoded, small-subunit rRNA gene sequence data-set, coupled with a complete cross section of representative taxa from all major lineages of land plants.

This study expects that the putative secondary-structure model employed here is likely to have produced a multiple-sequence alignment that is closer to the true alignment by evidently aligning homologous nucleotides. The usefulness of the 18S rDNA gene sequence for deeper-level phylogenetic inference of lower plant evolution was addressed by examining the data set for the amount, location and level of phylogenetic signal. Furthermore, the higher-order structures, coupled with variability information presented here using substitution-rate calculations, provide a powerful way to identify phylogenetically important elements in the 18S rRNA molecular structure.

2. MATERIALS AND METHODS

2.1 Taxa and sequence data

The sequence data used in this study are derived from 18S rRNA genes in which a minimum of 93% of the nucleotides has been determined. Furthermore, only sequences which can be assumed on the basis of reasonable criteria to be error-free, have been utilized. The data comprise 67 unique sequences from 57 species of plants spanning seven phyla and fifteen families, seven species of green algae spanning two phyla and five families and three species of fungi belonging to three families. The list of taxa with classification and GenBank accession numbers are presented in Table 2 (see vol. II, p. 32). The list of taxa contains five original sequences which include two moss species: *Physcomitrella patens, Sphagnum palustre*; two hornworts: *Megaceros aenigmaticus, Notophylas breutelu*; and a fern: *Pteris vittata.*

The taxa set designations are outlined in Table 3 (vol. II, p. 35). Taxa set A is the original collection of 41 18S rDNA sequences. Taxa set B contains the 18S rDNA sequences of 67 taxa which includes all the sequences of taxa set A and 27 additional taxa. Taxa set C is a subset of taxa set B and consists of 43 18S rRNA gene sequences representing strictly lower plant taxa.

2.2 DNA isolation

Physcomitrella total genomic DNA was extracted from approximately 4 g (fresh weight) of gametophytic tissue grown on solid medium covered with cellophane overlays

(Ashton *et al.*, 1985) by the CTAB method of Doyle and Doyle (1990) after removal of excess water from the tissue by gentle vacuum filtration and grinding to a powder in liquid nitrogen. Using this procedure, about 25 μg of DNA were isolated per gram (wet weight) of moss. RNA was digested using RNase A (10 μg/ml) followed by precipitation of the DNA using a standard procedure, outlined by Doyle and Doyle (1990), and redissolving in TE. DNA concentrations and purity of the solutions were estimated from the absorbances at 260 nm and 280 nm of diluted samples and also from ethidium bromide fluorescence of electrophoresed samples.

Pteris vittata spores were collected in Barbados by Dr. N. Ashton and gametophytic tissue was provided by Ryan McDonald. Whole genomic DNA was extracted in a similar fashion to the procedure outlined above.

Total genomic DNAs from *Sphagnum palustre*, *Megaceros aenigmaticus*, and *Notophylas breutelu*, which had been purified by CsCl centrifugation and quantified, were gifts from Dr. K.S. Renzaglia (Southern Illinois University).

2.3 DNA amplification

2.3.1 Oligonucleotide synthesis

Oligonucleotides for use as primers for amplification and cycle sequencing of 18S rDNA fragments were synthesized using an Applied Biosystems 391 DNA Synthesizer PCR-MATE (Perkin-Elmer) in the 'Trityl-off' mode. In this mode, the dimethoxytrityl group at the 5' terminal of the oligonucleotide is removed at the end of the synthesis. The oligonucleotides were cleaved from the support by incubation at room temperature for 2 h with fresh concentrated ammonium hydroxide, followed by deprotection with ammonium hydroxide at 55°C for 20-40 h. Each cleaved and deprotected oligonucleotide was dispersed into small aliquots, evaporated to dryness and stored dry or re-dissolved in a small volume of sterile distilled water and stored at -20°C. Primer concentrations in aqueous stock solutions were calculated from absorbances of diluted samples measured at 260 nm. Unpurified primers were used for both PCR and sequencing reactions.

The primers used for DNA amplification and cycle sequencing of three regions, collectively comprising approximately 94% of the complete 18S rRNA gene, are described in Table 1 (vol. II, p. 2). The location of the primer binding sites relative to the 18S rRNA gene is graphically depicted in Fig. 1 (vol. II, p. 3).

2.3.2 Reaction mixtures

Sequencing templates were generated using nested and semi-nested PCR. Long PCR constituted the first round of DNA amplification to generate an approximately 1800 bp PCR amplicon under high fidelity PCR conditions. This full length fragment was generated using primers NS1 and NS8 and 500 ng of whole genomic DNA with water substituted for the template in the negative controls. Long PCR reaction mixtures using hot-start with a total volume of 100 µl consisted of 1.25 units of *Taq* DNA polymerase (Gibco), 0.28 µg of TaqStart™ antibody (Clontech), 20 mM Tris-HCl (pH 8.4), 50 mM KCl, 2.5 mM $MgCl_2$, 125 µM of each dATP, dCTP, dGTP and dTTP, 0.5 µM (50 pmol) of each primer (NS1 and NS8), and approximately 500 ng of genomic DNA.

Nested and semi-nested PCR reactions constituted the second round of amplification using first round products as template, with negative controls also using first round negative reaction mixtures in place of template. Second round PCR reactions using hot-start with a total volume of 100 µl were done in triplicate, each reaction mixture comprising 2.5 units of *Taq* DNA polymerase (Gibco), 0.55 µg of TaqStart™ antibody (Clontech), 20 mM Tris-HCl (pH 8.4), 50 mM KCl, 2.5 mM $MgCl_2$, 200 µM of each dATP, dCTP, dGTP and dTTP, 50 pmol of each forward and reverse primer, and 2 µl of first round amplification products. The primer pairs used for semi-nested PCR were NS1 & NS2, NS5 & NS8, and NS7 & NS8. The primer pair, NS3 & NS4, was used for nested PCR. These primer pairs with their respective predicted PCR amplicon sizes are described in Table 1 (vol. II, p. 2).

2.3.3 Thermal cycling parameters and PCR product detection

All DNA amplifications were carried out on a PE 9600 thermal cycler (Perkin-Elmer). All thermal cycling regimes were preceded by a 2 min, 95°C incubation period, and succeeded by an additional extension time of 10 min at 72°C immediately followed by 4°C incubation until placed in storage at -20°C. Long PCR reactions were cycled 25 times through the following temperature regimes: 94°C for 30 s, 55°C for 45 s, 72°C for 120 s. Nested and semi-nested PCR reactions were cycled for a total of 40 cycles using a 3 stage touch-down PCR thermal cycling regime. The first stage consisted of 5 cycles through the following temperature regimes: 94°C for 10 s, 64°C for 20 s, 72°C for 30 s.

The second stage consisted of 5 cycles through the following thermal cycling regimes: 94°C for 10 s, 62°C for 15 s, 72°C for 30 s. The final stage consisted of 30 cycles through the following thermal cycling regime: 92°C for 10 s, 60°C for 10 s, 72°C for 30 s.

Thermal cycled PCR mixtures (10 µl) were resolved electrophoretically on 1.6% agarose gels and visualized by ethidium bromide fluorescence. Sizes of amplified fragments were estimated by comparison with a 100 bp DNA ladder (Gibco).

2.4 DNA sequencing

2.4.1 Template preparation

Three 90 µl post-PCR reactions mixtures in which agarose gel electrophoresis had revealed a single product of expected size, were purified using the Wizard™ PCR Prep DNA purification system (Promega), producing 50 µl of solution containing the amplified rDNA in distilled water. The purified sequencing template was quantified using the DNA DipStick™ Kit (Invitrogen).

2.4.2 Cycle sequencing

The purified and quantified double-stranded PCR products were used in fluorescence-based dideoxy cycle sequencing reactions using the PRISM™ Ready Reaction DyeDeoxy™ Terminator Cycle Sequencing Kit (Applied Biosystems). The cycle sequencing reaction mixtures of 20 µl final volume contained the following ingredients: 100-200 ng of template DNA, 9.5 µl of terminator premix [1.6 µM A-DyeDeoxy, 94.7

μM T-DyeDeoxy, 0.4 μM G-DyeDeoxy, 47.4 μM C-DyeDeoxy, 79.0 μM dITP, 15.8 μM dATP, 15.8 μM dCTP, 15.8 μM dTTP, 168.4 mM Tris-HCl (pH 9.0), 4.2 mM $(NH_4)_2SO_4$, 42.1 mM $MgCl_2$, 0.42 units/μl AmpliTaq® DNA polymerase], and 3.2 pmol of primer. The sequencing primers were the same as those used in the DNA amplification reactions namely; NS1, NS2, NS3, NS4, NS5, NS7 and NS8. Individual primers with appropriate rDNA PCR products were combined in seven different sequencing reactions which facilitated the acquisition of double-stranded sequence data for the majority of the 18S rRNA gene.

Cycle sequencing reactions were carried out on a PE 2400 (Perkin-Elmer) thermal cycler. The sequencing reactions were set up on ice and placed in the thermal cycler which was preheated to 96 °C. The thermal cycle sequencing regime consisted of 25 cycles and was as follows: 96 °C for 10 s, 50 °C for 5 s, 60 °C for 4 min. The reactions were held at 4 °C until purification which was typically performed within 1 h of the final cycle.

2.4.3 Purification of sequencing reaction products

Subsequent to cycle sequencing, the reactions were passed through Sephadex G-50 spin columns (Centri-Sep™ columns, Princeton Separations) to remove unincorporated dye terminators. The purified reaction mixtures were spun in a vacuum centrifuge (Centrivap®, Labconco) at room temperature until just dry (typically 5 min). The reaction pellets were resuspended in 3 μl of loading buffer [5 parts deionized formamide to one part 50 mg blue dextran / 25 mM EDTA (pH 8.0)].

2.4.4 DNA sequence determination

Automated sequencing was employed using the ABI PRISM™ 377 DNA Sequencer (Applied Biosystems). The resuspended reaction pellets were immediately heat shocked at 94 °C for 5 min and then transferred to a Labtop™ cooler (Nalgene) to snap cool them at -20 °C. Samples were electrophoresed at 100 nucleotides/h with 1680 volts, 150 watts (floating), and 50 mAmp (floating) through denaturing polyacrylamide gels (4% acrylamide, 5% cross-linked, 6 M urea) at a run temperature of 51 °C with a gel thickness of 0.2 mm and a well-to-read distance of 36 cm. The fluorescent images were captured with virtual filter set A and 2400 scans/h using ABI PRISM™ Collection Software v1.1.0 (Applied Biosystems). The raw sequencing data were processed using multicomponent analysis, baseline subtraction and scaling with ABI PRISM™ DNA Sequencing Analysis Software v2.1.1 (Applied Biosystems) using the SemiAdaptive BaseCalling module. All base calls were confirmed manually by visual inspection of the electropherograms.

The double-stranded DNA sequence information was assembled from consensus sequence data using the simple homology matching algorithm and contig manager of MacDNASIS® Pro Sequence Analysis Software v3.6 (Hitachi Software). Sequence data corresponding to primer binding sites were removed and replaced with the ambiguity code 'N'.

2.5 Sequence alignment

The manual sequence alignment procedure used was that described by Van de Peer *et al.* (1996c). Manual alignment was facilitated with DCSE v2.54 (De Rijk and De Wachter, 1993). The alignment defines the complete secondary structure of the 18S rRNA molecule. The alignment process was iterative, beginning with the juxtaposition of regions of extensive primary structure similarity. The alignment was then refined in regions of greater variability through the use of secondary structure information available from the SSU rRNA Database (Van de Peer *et al.*, 1997). The secondary structures were inferred by comparative analysis relying on the search for compensatory base substitutions or positional covariance (Gutell, 1996).

The DCSE sequence alignment file was imported into MacClade v3.05 (Maddison and Maddison, 1992) to facilitate data manipulation, character annotation and file conversion for various phylogenetic analysis software packages.

2.6 Tree length distribution skewness

The g_1 statistic was used to test for possible presence of significant phylogenetic signal (Huelsenbeck, 1991; Hillis *et al.*, 1993). The g_1 statistic based on the length distribution of 50,000 randomly sampled trees from a set of all possible trees was generated by the RANDOM TREES command of PAUP 3.1.1 (Swofford, 1993). The g_1 statistic was determined for both taxa set B and C.

2.7 Phylogenetic analyses

All phylogenetic analyses were applied to the entire 18S rRNA sequence excluding ambiguous alignment positions. Phylogenetic analyses were performed on two taxa sets, designated A and B as indicated in Table 3 (vol. II, p. 35). Taxa set A consisted of a subset of taxa set B comprising 41 representative taxa from all major plant groups. *Chara foetida* was used as the outgroup for all phylogenetic analyses with taxa set A. Taxa set B consisted of the entire species collection comprising 57 representative taxa from all major plant groups, seven species of green algae and three species of fungi. *Saccharomyces cerevisiae* was used as the outgroup for phylogenetic analyses with taxa set B except as otherwise indicated for parsimony and neighbor-joining analyses. The outgroup selection for taxa set B was chosen after sampling successive outgroups to ensure tree topology was not dramatically affected as described by Lecointre *et al.* (1993).

2.7.1 Character-based phylogenetic analyses

2.7.1.1 Parsimony

Phylogenetic searches under the principle of maximum parsimony were conducted using PAUP 3.1.1 (Swofford, 1993). Heuristic search strategies were employed with the MULPARS option in effect, random taxon addition with 100 replicates, and tree-bisection-reconnection (TBR) branch swapping was performed. Gaps were treated as missing data and uninformative positions were excluded from analysis. The outgroup for taxa set B was defined with 2 species of fungi: *Saccharomyces cerevisiae* and *Schizosaccharomyces pombe*. Whenever more than one most parsimonious tree was found, the output was displayed as a 50% majority-rule consensus tree with the frequency of clustering indicated at each node as a percentage.

Confidence estimates for clustering groups were obtained by bootstrap analysis using identical heuristic search parameters. Results of the bootstrap analyses are displayed on 50% majority-rule bootstrap trees with nodes showing less than 50% confidence collapsed to yield polytomies. Computational limitations dictated the maximum number of replicates performed with each data set. Taxa set B was analyzed with 50 bootstrap replicates each with 5 random taxon additions. Taxa set A was analyzed with 100 bootstrap replicates each with 10 random taxon additions.

Additional confidence estimates provided by decay analysis (Bremer, 1988) were obtained from the taxa set A parsimony analysis using TreeRot software (Sorenson, 1996). A strict consensus tree was generated from the most parsimonious trees found during the heuristic search with taxa set A. TreeRot was used to generate a PAUP command file to examine each node on the strict consensus tree using heuristic search parameters (MULPARS option in effect, 10 random taxon additions with TBR performed and only keeping trees not compatible with constraint-tree) and a constraint statement. Decay indices were generated for all nodes of the strict consensus tree using this constraint statement approach and applied to the tree at each respective node.

2.7.1.2 Maximum likelihood

Maximum likelihood analysis was performed only on taxa set A using fastDNAml v1.1.1a (Olsen *et al.*, 1994). The analysis parameters were set to randomize the sequence addition order. The expected transition/transversion ratio was given the value 1.71 (estimated from data set B, S.E. 0.07). The distances were calculated based on the Felsenstein's (1981) model which allows the four nucleotides to have unequal frequencies. Confidence in clusters was estimated from 10 bootstrap replicates using the same analysis parameters, with corresponding bootstrap values shown in percentage displayed on a 50% majority-rule bootstrap tree.

2.7.1.3 Quartet puzzling

Maximum likelihood analysis was also applied to both taxa sets using a fast tree search algorithm called quartet puzzling (Strimmer and Haeseler, 1996). Quartet puzzling consists of three steps; maximum likelihood, puzzling and consensus. Quartet puzzling applies maximum likelihood tree reconstruction to all possible quartets from *n* sequences. This reconstructs all possible quartet maximum likelihood trees. The second step called puzzling involves repeatedly combining the quartet trees to an overall tree. The final step computes the majority-rule consensus of all intermediate trees giving the quartet puzzling tree. The analysis was performed by using PUZZLE v3.0 from The PUZZLE Software web page (http://www.zi.biologie.uni-muenchen.de/~strimmer/) by Strimmer and Haeseler (Zoologisches Institut, Universität München, Germany). Tree reconstruction used 1000 puzzling steps with the HKY (Hasegawa *et al.*, 1985) model of substitution. The model of Hasegawa *et al.* (1985) allows both different rates for transitions and transversions and different nucleotide frequencies. All parameters including rate heterogeneity were estimated from the data sets by maximum likelihood. The estimations of support for internal branches is calculated automatically and assigned to nodes on the tree and shown in percent.

2.7.2 Distance-based phylogenetic analyses

Distance matrices were calculated from data sets A and B, and superimposed mutations were accounted for by using several distance algorithms. The distance-based phylogenetic analysis and the construction and drawing of evolutionary trees based on the calculated distance matrices were accomplished with TREECON for Windows v1.2 (Van de Peer and De Wachter, 1994).

The transformation of sequence data into evolutionary distances is performed by the program MATRIXW of TREECON for Windows v1.2 (Van de Peer and De Wachter, 1994) which produces a matrix of dissimilarities based on N(N-1)/2 pair-wise comparisons between N sequences. The various distance algorithms which were implemented using the software package are outlined in subsequent sections (see 2.7.2.1 - 2.7.2.8).

The neighbor-joining method (Saitou and Nei, 1987) was implemented for tree construction using the program TREE of TREECON for Windows v1.2 (Van de Peer and De Wachter, 1994). The program ROOT of TREECON for Windows v1.2 (Van de Peer and De Wachter, 1994) was used to place a root on the initially unrooted tree topologies produced by the neighbor-joining method. Taxa set B topologies were rooted with *Saccharomyces cerevisiae*. Taxa set A topologies were rooted with *Chara foetida*.

Confidence estimates in topologies were provided by bootstrap analysis based on 100 resampled data sets and conducted using the program MATRIXW of TREECON for

Windows v1.2 (Van de Peer and De Wachter, 1994). A 50% majority-rule bootstrap tree was generated for each distance calculation algorithm. The 50% majority-rule bootstrap trees constructed with TREECON are not consensus trees from a number of bootstrap trees, as constructed in the PHYLIP package (Felsenstein, 1995). The generation of bootstrap values were achieved by selecting one sequence, from each data set, as the chosen outgroup for the bootstrap analysis. The program rooted every bootstrap tree and the original tree with this particular outgroup sequence. *Saccharomyces cerevisiae* was used to root trees for taxa set B, while *Chara foetida* was used as the outgroup sequence for taxa set A. All 100 bootstrap trees were based on the 100 resampled data sets and compared with the tree based on the original sequence alignment. The fraction of bootstrap trees containing specific clusters, as defined by the original tree, was computed. This calculation was performed for all clusters found in the original tree and is displayed as a percentage adjacent to the corresponding node.

The DRAW program of TREECON for Windows v1.2 (Van de Peer and De Wachter, 1994) was used for graphical manipulation and annotation of the trees. Taxa set B topologies were rerooted at the internode between the fungi (*Saccharomyces cerevisiae, Schizosaccharomyces pombe* and *Dictyostelium discoideum*) and the remainder of the taxa. The trees generated from each analysis were subjected to manual branch rotations at appropriate internodes. The branch rotations maintained similar tree order thereby facilitating tree-to-tree comparisons without altering tree topology.

The series of distance-based phylogenetic analyses on taxa set A and B using various distance calculation algorithms are summarized in Tables 8 and 9 (vol. II, p. 68-

69). The results from each analysis are depicted graphically with a set of four trees. Each set consisting of a pair of trees with distance scales and a pair of trees with bootstrap values. The first pair of trees contains branch length information with the accompanying distance scale. The second pair of trees contains topology confidence measurements depicted on a 50% majority-rule bootstrap tree. The bootstrap trees contain only the clusters maintaining 50% majority-rule such that clusters with less than 50% support are drawn as polytomies. The second tree of each pair facilitates visual inspection by using triangles which represent the most consistent monophyletic clusters (clusters of taxa that share a basal node and are retained in the majority of distance calculations).

2.7.2.1 Jukes & Cantor (1969) distance calculation

The correction algorithm of Jukes and Cantor (1969) is the simplest method for nucleotide substitution estimation. The one parameter model maintains the following assumptions; 1) that all substitutions at a given sequence position are independent, 2) that all sequence positions are equally subject to change, 3) that substitutions occur randomly among the four types of nucleotides such that there is no bias in the direction of change, and 4) that no insertions or deletions have occurred. The Jukes and Cantor (1969) model estimates evolutionary distance from observed dissimilarity based on these assumptions. The number of nucleotide substitutions per site that actually have occurred since divergence of sequences A and B (evolutionary distance D_{AB}) is estimated by:

$$D_{AB} = -\frac{3}{4}\ln\left(1 - \frac{4}{3}S\right)$$

where S (dissimilarity) is the fraction of different nucleotides between two sequences.

2.7.2.2 Tajima & Nei (1984) distance calculation

The Tajima and Nei (1984) algorithm estimates the number of substitutions based on a four parameter model, assuming a so-called 'equal input' model. In this model, the rate of nucleotide substitution is assumed to be the same. Consequently, this algorithm does not take into account unequal rates of substitution among different nucleotide pairs. The TREECON program uses an average base composition computed from all sequences analyzed (Van de Peer and De Wachter, 1994). In the correction of Tajima and Nei, the evolutionary distance (D_{AB}) is estimated by:

$$D_{AB} = -b \ln\left(1 - \frac{1}{b} S\right)$$

where

$$b = 1 - \sum_{i \in N} f_i^2$$

where S (dissimilarity) is the fraction of different nucleotides between two sequences and f_i is the frequency of the i-th type of nucleotide belonging to the set of possible nucleotide types N (=A,G,C,orT) in the sequences being compared.

2.7.2.3 Kimura (1980) distance calculation

The Kimura algorithm is a two parameter model which provides a method for inferring evolutionary distance in which transitions and tranversions are treated separately (Kimura, 1980). In the correction of Kimura, the evolutionary distance (D_{AB}) is estimated by:

$$D_{AB} = -\frac{1}{2}\ln\left[(1-2P-Q)\sqrt{1-2Q}\right]$$

where P is the fraction of sequence positions differing by a transition and Q is the fraction of sequence positions differing by a transversion.

2.7.2.4 Jin & Nei (1990) distance calculation

Several studies suggest that the rate of nucleotide substitution varies approximately according to the gamma distribution (Jin and Nei, 1990; Nei, 1991). This gamma distribution is specified by a parameter 'a' which is the square of the inverse of the coefficient of variation of substitution rate (Nei, 1991). The Jin and Nei (1990) model does not assume that the rate of nucleotide substitution is the same for all sites as this assumption rarely holds for real sequences (Van de Peer *et al.*, 1993). For the Jukes and Cantor's one parameter model, the evolutionary distance (D_{AB}) is calculated as follows (Jin and Nei, 1990):

for a=1:

$$D_{AB} = \frac{S}{1-\frac{4}{3}S}$$

where the parameter 'a' was set to 1 for both data sets (Kumar and Rzhetshy, 1996) and where S (dissimilarity) is the fraction of different nucleotides between two sequences.

For the Kimura's two parameter evolution model, the evolutionary distance (D_{AB}) is calculated as follows (Jin and Nei, 1990):

for a=1

$$D_{AB} = \frac{2P+Q}{2(1-2P-Q)} + \frac{Q}{2(1-2Q)}$$

where the parameter 'a' was set to 1 for both data sets and where P is the fraction of sequence positions differing by a transition and Q is the fraction of sequence positions differing by a transversion.

2.7.2.5 Transversions only distance calculation

Distance calculation with tranversions only is suggested to be more informative by removing transition 'noise' which could block phylogenetic signal (Woese *et al.*, 1991). The evolutionary distance (D_{AB}) is then estimated by (Tajima and Nei, 1984; Swofford and Olsen, 1990):

$$D_{AB} = -b \ln\left(1 - \frac{1}{b}Q\right)$$

where Q is the fraction of transversions and

$$b = 1 - \left[(f_A + f_G)^2 + (f_C + f_T)^2\right]$$

and $f_A + f_G$ being the fraction of purines, and $f_C + f_T$ being the fraction of pyrimidines, computed over the complete alignment.

2.7.2.6 No correction distance calculation

The sequences were analyzed also using distance calculation where no algorithms were used to correct for superimposed mutations such that dissimilarity is equal to distance. The evolutionary distance (D_{AB}) is estimated by:

D_{AB}=S

where S (dissimilarity) is the fraction of different nucleotides between two sequences.

2.7.2.7 Van de Peer & De Wachter (1994) distance calculation

The Van de Peer and De Wachter algorithm computes evolutionary distance between sequences taking into account the relative substitution rate of the individual positions in an alignment (Van de Peer *et al.*, 1996c). The estimation of relative nucleotide substitution rates and computation of the evolutionary distances taking into account rate calibration were done as follows:

For an alignment of N sequences, N(N-1)/2 pairwise evolutionary distances *d* are computed according to the equation of Jukes and Cantor (1969):

$$d = -\frac{3}{4}\ln\left(1 - \frac{4}{3}f\right) \quad (1)$$

where f is the dissimilarity or fraction of observed substitutions between two sequences. After all pairwise distances were computed, they were classified into a number of distance intervals, and the fraction of sequence pairs which fell within a certain distance interval and were characterized by a nucleotide change was calculated. This was done for every nucleotide position and the fraction was plotted against the mean distance interval (Van de Peer *et al.*, 1996c).

A curve obeying equation:

$$p_i = \frac{3}{4}\left[1 - \exp\left(-\frac{4}{3}v_i d\right)\right] \quad (2)$$

was then fitted to these points by nonlinear regression. Equation 2 expresses the probability p_i that an alignment of position *i* contains a different nucleotide in two sequences, as a function of the evolutionary distance d separating these sequences. The slope of the curve in the origin yields the specific nucleotide substitution rate v_i for the position under consideration.

At this point, the estimated nucleotide substitution rates were derived on the basis of a distance matrix computed by means of equation 1 and, therefore, are not yet optimal. This equation provides only an initial approximation of the relation between dissimilarity and distance, since it starts from the unrealistic assumption that all nucleotides have the same substitution rate (Jukes and Cantor, 1969). Therefore, after estimation of all v_i values, alignment positions were grouped into sets of similar variability producing a spectrum of relative nucleotide substitutions rates. Once the shape of the spectrum was known, the following equation was used to determine dissimilarity, f, as a function of the evolutionary distance d (Van de Peer *et al.*, 1996c):

$$f = \frac{3}{4}\left\{1 - \exp\left[-\frac{4}{3}p\ln\left(1 + \frac{d}{p}\right)\right]\right\} \quad (3)$$

The value of the parameter p depends on the shape of the substitution rate spectrum. The inverse of equation 3 gives:

$$d = p\left[\left(1 - \frac{4}{3}f\right)^{-\frac{3}{4p}} - 1\right] \quad (4)$$

The equation 4 calculates a more accurate conversion of dissimilarity into distance than equation 1. Equation 4 was used to convert pairwise sequence dissimilarities into evolutionary distances. Then relative substitution rate of each alignment position was estimated again on the basis of these new evolutionary distances, as described above, and a new spectrum of evolutionary rates is derived. This iterative process was repeated several times until the nucleotide substitution rates, v_i, stabilized. Three iterations were found empirically to be sufficient for both taxa set A and B.

2.7.2.8 No correction distance calculation with compartmentalization

The variable nucleotide positions in taxa set B were partitioned equally into five categories (1 through 5) based on their relative nucleotide variabilities (v_i). The categories were developed by determining first v_i for each nucleotide position as previously described by Van de Peer *et al.* (1996c). The v_i values were calculated using the program MATRIXW of TREECON for Windows v1.2 (Van de Peer and De Wachter, 1994). The relative nucleotide substitution rates were estimated for each of the alignment positions that were not conserved absolutely and that contained a nucleotide in at least 25% of the aligned sequences. The output file generated by MATRIXW was imported into a computer spreadsheet program (Excel v5, Microsoft) for manipulation and sorting.

Absolutely conserved alignment positions were assigned to category '6'. All alignment positions which contained nucleotides in less than 25% of the aligned sequences were placed in the category '0'. All nucleotide positions which contain alignment ambiguities were categorized in '-1'.

The distance calculation made without compensation for superimposed mutations was described above. The distance calculation was performed on a series of subsets of the original data set B. Each subset or compartment included only nucleotide positions which fitted within defined categories. Three compartments were formed as follows: A) categories 0,1,2,3,4 B) categories 0,1,2 and C) categories 2,3,4,5,6. This compartmentalization provided subsets of alignment positions representing data of sorted variability from the taxa set B alignment. These subsets were subjected to phylogenetic analysis using distance-based calculations with no algorithmic correction for superimposed mutations.

2.7.2.9 Accounting for insertions & deletions

All distance calculations were performed also with insertions and deletions taken into account. This calculation was performed as an option using the program MATRIXW of TREECON for Windows v1.2 (Van de Peer and De Wachter, 1994). The MATRIXW program provides output that was used as an input file for the neighbor-joining tree construction method. For example, the evolutionary distance according to the Jukes and Cantor (1969) model is then calculated as (Van de Peer *et al.*, 1996c):

$$D_{AB} = -\frac{3}{4}\ln\left[1-\frac{4}{3}\left(\frac{S_U}{I+S_U}\right)\right]\left[1-\frac{G}{T}\right]+\frac{G}{T}$$

where I is the number of identical nucleotides, S_U is the number of positions showing a substitution and G is the number of gaps in one sequence with respect to the other. T is the sum of I, S and G. The first term of the equation accounts for substitutions and comprises the Jukes and Cantor correction factor for multiple mutations per site. The second term accounts for deletions and insertions. A row of adjacent gaps is treated as one gap, regardless of its length. Ambiguities (N) are not taken into account.

2.7.3 Overall strict consensus tree

The overall strict consensus tree represents absolute corroboration of clusters in the bootstrap trees which were generated from all tree construction methods. Dendrograms for taxa set A and B representing a strict overall consensus tree were constructed by visual inspection of all 50% majority-rule bootstrap trees. Only clusters which are maintained strictly in the bootstrap trees from all phylogenetic analyses are depicted. Any variation of taxa clustering among the phylogenetic approaches resulted in those affected taxa being displayed as polytomies.

2.8 Secondary structure

The secondary structure model for Physcomitrella 18S rRNA was drawn clockwise in the 5'→3' direction. Helix numbering is according to Van de Peer *et al.* (1997). The primary structure data for Physcomitrella was collected from GenBank accession X80986. The secondary structure information along with helix numbering was extracted from the DCSE alignment file described above. The model was constructed manually using a computer graphics program (FreeHand v7.0, Macromedia) with some sections preassembled using a RNA secondary structure computer program (loopDloop, Gilbert, 1992).

2.9 Variability map

A secondary structure model for lower plant small-subunit rRNA was generated by superimposing relative substitution rate variabilities on the 18S rRNA secondary structure model of Physcomitrella (vol. II, p. 57). The relative substitution rates (v_i) were calculated using 43 taxa representing all major groups of lower land plants, designated taxa set C and are listed in Table 3 (vol. II, p. 35). The positions belonging to five sets of average variability based on a quantitative estimate of relative substitution rates are indicated by different colors. These colors in order of most variable to least are red, orange, yellow, green and blue. The five categories represented by these colors were assigned by equally partitioning the alignment positions for which quantitative estimates of relative substitution rates could be calculated. The absolutely conserved positions ($v_i = 0$) are indicated in purple. Sites colored white belong to areas that are highly variable but are deleted in at least 75% of the sequences thereby not allowing accurate measurement of their relative evolutionary rate. Gray sites indicate alignment positions in which primary and secondary structure information did not provide enough information to allow unequivocal alignment.

3. RESULTS AND DISCUSSION

3.1 Nuclear-encoded rRNA sequence data acquisition

3.1.1 Species sampling

Green plant 18S rDNA sequence data from the several public databases provided ample representatives from most major monophyletic lineages, although, at the outset of this project, there was significantly poorer representation in a few groups. In the Bryophyta, several 18S rDNA sequences from the Hepaticopsida and Bryopsida were available, but sequence data for only one species from Sphagnopsida and two species from the Anthocerotopsida were listed. In addition, Filicophyta representation was relatively sparse.

To reduce the impact of species sampling artifacts upon inferred phylogenies, it was imperative that these putative monophyletic groups were represented properly. The Filicophyta group was strengthened by addition of another fern, *Pteris vittata*. The Antherocerotopsida class was augmented with two additional species of hornworts, *Megaceros aenigmaticus* and *Notophylas breutelu*. The Sphagnopsida class was enhanced by the addition of *Sphagnum palustre*. *P. patens* was added to the Bryopsida class, principally to determine the placement of this moss species which is used extensively in developmental studies and is becoming a quite important plant model system (Ashton *et al.*, 1993).

3.1.2 DNA amplification

The results of the first round of PCR, which generated NS1-NS8 PCR products used subsequently as templates for the semi-nested and nested PCRs, is shown in Fig. 2 (vol. II, p. 5). The resulting PCR amplicons produced the expected fragment size of approximately 1800 bp without any nonspecific amplification products. Fig. 3 (vol. II, p. 7) shows the results of the semi-nested and nested PCRs using the NS1-NS8 amplicon as template. Each reaction produced an amplicon of expected sized with the corresponding 'no DNA reamplification' controls showing no bands indicative of clean amplification reactions.

3.1.3 DNA sequencing

A typical electropherogram generated by analyzing gel images captured on the DNA sequencer is shown in Fig. 4 (vol. II, p. 9). Each electropherogram represents the results of a single DNA sequencing reaction and the assemblage of the cycle sequencing results for *P. patens*, *M. aenigmaticus*, *N. breutelu*, *P. vittata* and *S. palustre* are shown in Fig. 5, 6, 7, 8, and 9 respectively (vol. II, p. 12-26).

After initiation of the project, the sequence of the Physcomitrella 18S rRNA gene was determined independently by Capesius, 1995 (GenBank accession # X80986), and the sequence data obtained in this project was compared *via* a homology alignment in Fig. 10 (vol. II, p. 27). The locations of the primers used in this study relative to the complete sequence of the Physcomitrella 18S rRNA gene are identified in Fig. 1 (vol. II, p. 3) and correspond to the sequence presented in the lower line of the homology alignment in Fig. 10. The upper line of the homology alignment represents

Physcomitrella 18S rDNA sequence data generated in this project with 'Ns' representing unresolved nucleotides. The location of the primers used for the PCR and sequencing reactions dictated that only approximately 94% of the whole Physcomitrella 18S rRNA gene sequence could be determined. Almost 100% of the obtainable sequence data was determined for the Physcomitrella 18S rRNA gene with the exception of the four nucleotides at positions 1123, 1131, 1139 and 1171 as indicated with 'Ns' in Fig. 10.

The homology assessment between the two independently determined Physcomitrella 18S rDNA sequences revealed over 99.8% agreement. Only two differences were found. The nucleotide at position 1519 is recorded as a 'G' in GenBank # 80986 but was identified as an 'A' by the sequencing work of this project. The other disagreement between the two sequences stems from the placement of a 'C' either at position 1526 or 1530.

3.2 Sequence alignment and secondary structure information

The results of the sequence alignment of the 18S rRNA genes for 67 taxa designated as taxa set B (Table 3, vol. II, p. 35) are presented in Appendix G (vol. II, p. 220-265). The aligned sequence length is 2,198 nucleotides of which 1,165 positions (53%) are invariant across all taxa. A position with a single nucleotide aligned against a gap or missing data in the other sequences is treated as invariant, as are positions with identical nucleotides in all sequences. The remaining 1,033 nucleotide positions represent either point mutations (substitutions in one or more orthologous sequences) or indels in one or more of the sequences.

The DCSE alignment presented in Appendix G contains the postulated 18S rRNA secondary structure pattern for all 67 taxa in encoded form. The symbols used to indicate the secondary structure elements are described in Appendix G (vol. II, p. 219) and are used in concert with the helix numbering (Row 63) proposed by Van de Peer *et al.* (1997). The 18S rRNA sequences are written in the 5′ to 3′ orientation with the secondary structure symbols intercalated between the primary sequence characters.

The most problematic aspect of the sequence alignment was the positioning of the indels through the introduction of gaps into the sequences and ensuring that these gaps truly represented insertion and deletion events. Secondary structure information was used to assist in the alignment of these areas. A typical example illustrating the usefulness of the secondary structure information in the sequence alignment procedure is located on p. 235 (vol. II). At position 766, 767 and 768 there are three 'Cs' in the sequence of Physcomitrella (Row 67). These three nucleotides represent the 5' strand of helix E23-1 immediately before the terminal loop of the helix containing the sequence 'CUUGU'. The alignment of the most 3' 'C' of these three nucleotides and the nucleotides in the loop is quite arbitrary based on primary sequence structure and several alignment rearrangements would satisfy the maximized nucleotide identity principle. Typically, these nucleotides would be removed from the analysis and labeled as arbitrary alignment positions or worse they would be retained for phylogenetic analysis and perhaps aligned incorrectly with a correspondingly erroneous homology statement. However, secondary structure information about the 3' region of the E23-1 helix immediately following the terminal loop shows that three 'Gs' would pair up with the three 'Cs' on the 5' region of the E23-1 helix. Consequently, the alignment of the most 3' 'C' and likewise the most 5' 'G' are no longer arbitrary and can be used correctly in phylogenetic estimation. The alignment of 'CUUGU' remains arbitrary but is recognized as such since it is identified to lie in a highly variable terminal loop region of helix E23-1.

The alignment of 67 orthologous 18S rDNA sequences produced 66 positions for which homology assessment remained arbitrary. These positions are indicated with '-1' in the column headings of the MacClade matrix (Appendix H, vol. II, p. 268-344) and were removed for all phylogenetic estimations. This exclusion reduced the data set in a procedure termed 'culling' which has been generally accepted as an appropriate method for the objective treatment of 'alignment ambiguous' sites (Gatesy *et al.*, 1993; Wheeler *et al.*, 1994).

The proposed secondary structure can also provide corroborating evidence for sequence accuracy. The accuracy of the sequence data used in this project and their error status are indicated in Table 3 (vol. II, p. 35). The proposed secondary structure of helix 46 for 18S rRNA provided additional support for the Physcomitrella sequence data presented in this project. The Physcomitrella 18S rRNA sequence given in GenBank # 80986 requires the integrity of helix 46 to be maintained with only five conventional base pairings which are split with three unconventional base pairings containing an internal bulge with one unpaired base and forcing an unstable terminal loop of three unpaired nucleotides (Fig. 14, vol. II, p. 52). The corrected Physcomitrella 18S rRNA secondary structure, deduced from primary sequence data generated in this project, proposes a much more stable helix 46 consisting of six conventional base pairings interrupted with only two unconventional pairings and with a more stable terminal loop of four unpaired bases (Fig. 15, vol. II, p. 54).

3.3 Assessment of phylogenetic signal and variability

Waters *et al.* (1992) estimated the phylogenetic signal in plant, including bryophyte, 18S rDNA using homoplasy excess ratio (HER) (Archie, 1989). Farris (1991) describes both the computational drawbacks and statistical inconsistencies of HER and associated statistics as derived by Archie (1989). Because of these statistical inconsistencies, the practical use of HER is diminished (DeSalle *et al.*, 1994). Furthermore, Ashton *et al.* (1992) pointed out that the signal was assessed on a data set containing sequencing errors and ambiguities, poorly aligned sequences and where some sequences were less than 50% complete.

Estimation of phylogenetic signal for the 18S rRNA gene sequence data used in this study are found in Appendix C (vol. II, p. 36). The shape of the tree-length distribution that results from a parsimony analysis of a random subset of all trees for taxa set B is given in the upper graph of Fig. 11 (vol. II, p. 37). The frequency distribution of lengths of random trees for taxa set B is visually close to symmetrical and the skewness, as measured by the g_1 statistic (-0.6235), indicates that a limited amount of phylogenetic signal exists in the data. The results of this test provide some indication that the data in taxa set B is more structured than random sequences and that further phylogenetic analysis is warranted. However, the signal is weak as evidenced by the symmetry of the distribution and the g_1 statistic of -0.6235. A study by Huelsenbeck (1991) examined the relationship between length of the correct tree and skewness of the tree-length distribution in simulated phylogenies. Using simulated phylogenies, in which the true tree was known, the study found that the optimal or most parsimonious tree is likely to be the correct tree only in analyses of data sets that produced tree-length distributions which are significantly more skewed than expected from random data. The 99% confidence limit for the skewness statistic (g_1) for random DNA sequence data was for values greater than -0.46. Examples of data sets, that gave correct tree topologies, had produced also significantly skewed tree-length distributions with g_1 statistics lower than -2.0. The g_1 statistic of -0.5330 for taxa set C and the close to symmetrical frequency distribution of random tree-lengths (lower graph of Fig. 11, vol. II, p. 37) suggests that very little phylogenetic signal exists in the lower plant 18S rDNA sequences.

To complement the determination of phylogenetic signal, Appendix D (vol. II, p. 39) contains data which characterize the extent and location of nucleotide variability. Fig. 12 (vol. II, p. 40) displays graphically the distribution of relative substitution rates estimated from the alignment of 18S rDNA of taxa set B. For taxa set B, 649 positions were partitioned into 59 sets of similar variability and then further categorized into five sets of equal size as indicated by color. These five sets do not include 1152 invariant positions or 65 'alignment ambiguous' positions, nor do they include 319 positions that contain a gap in more that 75% of the aligned sequences. The graph demonstrates that the amount of variability, as measured by v_i (relative substitution rate), is not distributed evenly with respect to the number of positions. In fact, some degrees of variability are represented over 40 times more frequently than others. Also, the graph illustrates that after disregarding absolutely conserved residues, the most variable sites have a substitution rate ~800 times higher than the least variable ones.

Certainly, this variability data invites examination of the utility of parsimony for the phylogenetic estimation using 18S rDNA sequence data. Parsimony involves very stringent assumptions concerning the process of sequence evolution which includes the constancy of substitution rates across nucleotide sites (Stewart, 1993). Clearly, this assumption is not met with 18S rRNA gene sequence data and caution should be exercised with the utility of parsimony by complementing the analyses with other methods.

A theoretical underpinning of phylogenetic analyses using 18S rDNA molecular data is the assumption that the 18S rRNA gene mutates at a rate which is slow enough to avoid spurious homoplasy. However, there are eight regions of the eukaryotic 18S gene that have been identified to be locations of increased variability (Neefs *et al.*, 1993). It is important to ensure that the regions of increased variability do not contain too much 'noise' through multiple substitutions. The inclusion of this highly variable data may be required for local analysis of closely related taxa but may translate into 'noisy data' and obscure phylogenetic signal for global analyses of the diverse plant taxa used in this study.

Certainly, some parts of the gene are invariant and are easily recognized by visual inspection of the data matrix (e.g. positions 461-480, vol. II, p. 229). Conversely, visual inspection of the data matrix for highly variable positions is very subjective and error-prone. In addition, the variable regions for 18S rRNA genes identified by Neefs *et al.* (1993) are not consistent with the taxa used in this study. Fig. 13 (vol. II, p. 42) displays the distribution of relative substitution rates with respect to the MacClade matrix (Appendix H) estimated from the alignment of 18S rDNA sequence data of taxa set B. This figure depicts graphically that the distribution of variability is not confined to particular regions nor are there clearly delimited sections of extensive hypervariability.

Closer inspection of the alignment positions and their associated variabilities are presented in Table 4 (vol. II, p. 44). The site number refers to the alignment position in the data matrix (MacClade matrix, Appendix H) where nonvariable alignment positions are excluded from the table. All other positions that contain a nucleotide in at least 25% of the aligned sequences have a variability score which was generated with 3 iterations of the substitution rate calculation (Van de Peer *et al.*, 1996c). The category numbers and their respective color codes were derived from the defined categories displayed in Fig. 12 (vol. II, p. 40). The categories divided the variable positions equally into five subsets from highest variability (category 1) to lowest variability (category 5). The relative rate limits of the subsets and corresponding category numbers are as follows: $< 10^{-0.498}$ (category 5); $10^{-0.498} - 10^{0.051}$ (category 4); $10^{0.051} - 10^{0.502}$ (category 3); $10^{0.502} - 10^{0.850}$ (category 2); $10^{0.850} - 10^{1.625}$ (category 1). Absolutely conserved positions ($v_i = 0$) are assigned to category 6. Alignment ambiguous positions are assigned to category -1. Category 0 sites correspond to alignment positions that are extremely variable, but that are deleted in too many sequences to allow a sufficiently accurate measurement of their relative evolutionary rate. The MacClade data matrix (Appendix H) contains the category assignment for each alignment position in the individual column headings.

The most variable alignment position for which homology assessment was possible is position # 819 (refer to Table 4, vol. II, p. 62 and Appendix H, vol. II, p. 295). Visual inspection of the nucleotide variability with reference to closely related taxa suggests a small degree of spurious homoplasy. For example, the character state 'G' is found from yeast to corn, although, the character state is variable within the same genus of liverwort (*Sphaerocarpus*) and lycopod (*Selaginella*). This position would be useful for local analyses but could contribute 'noise' in global analyses of all green plant taxa. If extensive homoplasy exists in the data set, the resulting 'noise' may be obscuring phylogenetic signal.

Each position was assessed for its contribution to this 'noise' factor and analyses indicated that spurious homoplasy is not an issue with the data set used in this study. The extent of variability decreased sharply from the most variable position # 819 with a variability score of 42 to only 17 for position # 2126 which is the 15th most variable site. Consequently, the number of sites exhibiting significant variability is very low and this corroborates the initial assessment of phylogenetic signal. For example, position # 2126 maintains only two character states over all lower and higher land plants (refer to Appendix H, vol. II, p. 338).

The location and extent of nucleotide variability were used in phylogenetic tree construction with a distance-based method (Van de Peer *et al.*, 1996c) to ensure branch lengths were not underestimated. This novel method for measuring the substitution rates of individual nucleotides provides a more realistic relationship between sequence dissimilarity and evolutionary distance. Van de Peer *et al.* (1996b) have confirmed the successful use of this method for phylogenetic inference using small subunit rRNA of green algae.

The assigned categories were used also to compartmentalize the data into subsets based on variability. This gave a means to determine which nucleotides render phylogenetic signal for phylogeny reconstruction and to show exactly where in the tree the alignment positions with their associated signal provide resolution.

3.3.1 Variability map for 18S rRNA of lower plants

Figure 16 (vol. II, p. 56) shows a secondary structure model for lower plant 18S rRNA, where the positions belonging to eight sets of site variability data are indicated by colored dots. Five of these colors indicate different average variability and are; (in order of most to least variable) red, orange, yellow, green and blue. These five sets of variability were calculated, as described previously, using taxa set C (Table 3, vol. II, p. 35) representing only lower plant taxa. Figure 17 (vol. II, p. 58) shows the distribution of relative substitution rates estimated from the alignment of lower plant taxa 18S rDNA. The colored areas in the spectra define sets of nucleotides indicated by colored dots on the variability map in Fig. 16 (vol. II, p. 56). In Fig. 16, the variability of the nucleotide sites of lower plant 18S rRNA is mapped in the shape of the secondary structure model by superimposing the colors in Table 5 (vol. II, p. 60) on to the 18S rRNA secondary structure model of Physcomitrella shown in Fig. 15 (vol. II, p. 54).

The alignment positions and their associated variabilities are presented in Table 5 (vol. II, p. 61-64). The site number refers to the alignment position in the data matrix (MacClade matrix, Appendix H, vol. II, p. 268-344) where nonvariable alignment positions are excluded from the table. All other positions that contain a nucleotide in at least 25% of the aligned sequences have a variability score which was generated with 3 iterations of substitution rate calculation (Van de Peer *et al.*, 1996c). The category numbers and their respective color codes were derived from the defined categories displayed in Fig. 17 (vol. II, p. 58). The categories divided equally the variable positions into five subsets from highest variability (category 1) to lowest variability (category 5). The relative rate limits of the subsets and corresponding categories and colors are as follows: $<10^{-0.128}$ (5, blue); $10^{-0.128}$-$10^{0.106}$ (4, green); $10^{0.106}$-$10^{0.428}$ (3, yellow); $10^{0.428}$-$10^{0.909}$ (2, orange); $10^{0.909}$-$10^{1.570}$ (1, red). Absolutely conserved positions (v_i=0) are assigned to the category 6 and given the color purple. Alignment ambiguous positions are assigned to category -1 and the 'color' grey. Category 0 and the 'color' white correspond to alignment positions that are highly variable, but that are deleted in too many sequences to allow a sufficiently accurate measurement of their relative evolutionary rate.

The debate over differential weighting of stems and loops is influenced largely by the assumption that stem regions are more conservative than the single stranded loop regions (Wheeler and Honeycutt, 1988; Vawter and Brown, 1993). Intuitively, it seems logical that base paired regions should require compensatory mutations and consequently are less prone to point mutations. However, helix 10 (Fig. 16, vol. II, p. 56), with a green and orange dot both facing a purple dot, illustrates that this is not an absolute truth.

However, in general, the two nucleotides of a base pair have the same or a neighboring color indicating they are about equally variable.

The variability map presented in Fig. 16 illustrates also that even highly conserved stems can have highly variable positions. For example, helix 49, which is found in all small-subunit ribosomal RNA, is highly variable as evidenced by red, orange and yellow colored dots. Interestingly, helix 49 in bacterial rRNA shows extensive variability as well (Van de Peer *et al.*, 1996a). Likewise, several single stranded regions are highly conserved as indicated with purple dots (e.g. the internal bulge joining helices 33, 34, 45, and 47). These examples demonstrate the need for visualization and description of structural features as done in this study.

In addition, the possible stabilizing effect of non-Watson-Crick base pairs providing transitional structures that could serve as intermediates in the evolution of standard base pairs places the practice of differential weighting for transitions and transversions in question, especially when considering repetitive genes such as 18S rDNA. This statement can be substantiated easily with a rapid examination of the variability map in concert with the secondary structure model for 18S rRNA of Physcomitrella (Fig. 15 and 16) which verifies within several helices that variable positions contain non-canonical sequences (e.g. helix E23-1).

Other notable features of the variability map (Fig. 16) include the curious phenomenon of single highly variable nucleotides amongst several absolutely conserved nucleotides (e.g. the single red dot in the internal bulge adjacent to helix 26). The variability map also illustrates that the exclusion of hypervariable regions, such as E23-1, would discard some of the most informative characters. The variability map graphically depicts the extent of nucleotide conservation in lower plant 18S rRNA as shown by the high number of purple dots.

3.4 Phylogenetic analyses

In an attempt to facilitate practical discussion and concentrate on the deeper phylogenetic relationships of lower plants, all tree descriptions will focus on significant differences from previous analyses which are characterized by confidence measurements indicating greater than 50% support. Minor changes in topology could be discussed at length, but would conflict with the overall philosophy of the approach taken in this thesis which is to place emphasis and confidence in phylogenetic outcomes shared by multiple methods.

3.4.1 Character-based phylogenetic analyses

All phylogenetic trees pertaining to character-based phylogenetic analyses using parsimony can be cross-referenced with Table 6 (vol. II, p. 66), and maximum likelihood can be similarly indexed with Table 7 (vol. II, p. 67).

<u>3.4.1.1 Parsimony</u>

Character-based analysis under the parsimony criterion produced four equally most parsimonious trees (length=1589; CI=0.402; RI=0.619) for phylogenetic analysis with taxa set A. These trees were based on 369 parsimony-informative characters from a data matrix containing 587 variant positions. These optimal trees were found with replicate number 5 and occupy 3 tree islands. These optimal trees were found 85 additional times in 100 random-addition replicates with tree-bisection-reconnection (TBR) branch-swapping performed (total number of rearrangements tried = 13,730,714).

The 50% majority-rule consensus tree of these four most parsimonious trees is displayed in Fig. A (vol. II, p. 72). These trees differed mostly in positioning of *Sphagnum sp.* and Filicophyta taxa. One of these trees differed considerably with respect to the placement of Bryophyta species and basal branching of all lower plant taxa. The consensus tree suggests a polyphyletic phylogeny of Byropsida and Hepaticopsida clades. The tree also proposes higher plants are a monophyletic assemblage with all lower plants including ferns evolving separately with the exception of *Selaginella sp.* which have been placed basal to all land plants. This last relationship is dramatically different from those found frequently in the literature and is most likely an artifact of the analyses due to branch attraction effects of *Selaginella sp.* to the outgroup. Van de Peer *et al.* (1993) have demonstrated that sequences of OTUs with higher evolutionary rates tend to cluster closer to the base of the tree. *Selaginella sp.* 18S rRNA gene sequences demonstrate high evolutionary rates which is evidenced by their long branches. These long branches contain over eighty steps in each of the four most parsimonious trees (data not shown) and is also seen in phylograms of all distance-based analyses. Consequently, this branch attraction effect was witnessed in all subsequent phylogenetic estimations with taxa set A and this artifact will be appropriately removed from any further discussion.

All relationships of lower plant taxa and basal lineages are dissolved completely in the 50% majority-rule bootstrap tree presented in Fig. B (vol. II, p. 73). This indicates that the data have provided little support for these relationships, and consequently, we cannot assume any confidence in the relationships of the Byropsida or other lower plant taxa. Hillis and Bull (1993) have pointed out that bootstrap analyses resulting in 50% majority-rule bootstrap trees can result in overestimates of accuracy for correctly inferring the true phylogeny. They demonstrated that sequences which exhibit unequal rates of evolutionary change are most susceptible to this phenomenon. In an effort to ensure the bootstrap values are not being misinterpreted, decay analyses were performed and the results are presented in Fig. C (vol. II, p. 74). The decay indices concur with the bootstrap values by providing correspondingly weak support for the relationships suggesting bryophyte genealogy and other relationships among the lower plant taxa. Specifically, decay indices as low as 2 are found supporting clusters of bryophyte classes which correlate with bootstrap values of <50%. Similarly, a decay index of 30 is found supporting the relationship between two *Sphagnum* species and this corresponds to a bootstrap value of 100%. Clearly, both assessments of confidence suggest that the data set supports the resolution of closely related species but offers little confidence with respect to the revelation of deeper phylogenies.

The phylogenetic analysis of taxa set A using maximum parsimony produced dendrograms which appeared susceptible to taxon sampling and outgroup effects. The acquisition of a faster computer later in the study permitted a more comprehensive analysis with taxa set B. The addition of 26 sequences to taxa set A allowed better representation of the presumed monophyletic groups and allowed the addition of green algae and fungi to the analysis. The addition of the green algae provided a 'buffer-zone' between the fungal outgroup and the taxa of phylogenetic investigation. Character-based analysis of taxa set B, under the parsimony criterion, produced 88 equally most parsimonious trees (length=3156; CI=0.357; RI=0.595). These trees were based on 586 parsimony-informative characters from a data matrix containing 993 variant positions. These optimal trees were found with replicate number 17 and occupy 4 tree islands. These optimal trees were found 46 additional times in 100 random-addition replicates with tree-bisection-reconnection (TBR) branch-swapping performed (total number of rearrangements tried = 159,744,909). The 50% majority-rule consensus tree of these 88 most parsimonious trees is displayed in Fig. D (vol. II, p. 75).

In all optimal trees found, the following groups were monophyletic: Anthocerotopsida, Magnoliophyta, Pinophyta, Isoetopsida, Lycopodiella, Charaphyta, and Chlorophyta. These monophyletic clades agree with the established phylogeny for these taxa, with the exception of Charaphyta since most phylogenies suggest this group is paraphyletic with Coleochaetales closest to the embryophyte clade (Kranz *et al.*, 1995). However, several relationships of the clades presented in Fig. D concur with recent analyses in the literature. The Charophyceae and the orders circumscribed within it are placed basal to the Streptophyta lineage (Bremer, 1985; McCourt, 1995; Surek *et al.*, 1995). The angiosperms are a monophyletic group and are a sister group to the gymnosperms, which is in agreement with the widely accepted phylogeny of these groups (Chaw *et al.*, 1997).

The placement of the green algae at the base of Streptophyte lineage and higher plants at the top (e.g. Magnoliophyta and Pinophyta taxa) coincides with the demonstrated phylogeny of this lineage. Accordingly, these taxa were included mainly to provide 'boundaries' or 'guideposts' for the focus of this investigation which is the placement of the taxa between these two groups. The placement of the lower plants has already been established to lie somewhere in the middle of these two groups and the dendrogram presented in Fig. D does not disagree with this contention. This 'framing' of the lower plant taxa provided a buffer-zone which diminishes the artifactual effects of taxon sampling and outgroup selection which was suspected to be problematic in taxa set A (the original data set).

The tracheophyte lineage begins with the monophyletic Lycopodiophyta. Recent work of Stewart and Rothwell (1993) and Kranz and Huss (1997) support the placement of Lycopodiophyta at the base of the tracheophyte lineage. The monophyly of Lycopods is in agreement with the work by Niklas and Banks (1990) and Kranz and Huss (1997) but disagrees with polyphyletic phylogeny presented by Garbary *et al.* (1993). The tracheophyte lineage continues with the paraphyletic phylogeny of the ferns, within which the horsetails and whiskferns branch, and the lineage ends with the higher plants as expected.

Debate concerning bryophyte phylogeny has been whether the group is paraphyletic (Mishler and Churchill, 1984, 1985; Waters *et al.*, 1992; Hedderson *et al.*, 1996) or monophyletic (Garbary *et al.*, 1993). The bryophyte phylogeny determined with parsimony analysis using taxa set B supports the paraphyletic assemblage with most of the Bryopsida a sister group to the tracheophytes. Two moss species; *Atrichum undulatum* and *Polytrichum formosum* formed a sister group along with some liverworts to the monophyletic hornwort clade. This hornwort-moss-liverwort group was found to be a sister clade to the tracheophyte lineage. Interestingly, two moss species are found more closely related to higher plants than all other lower plants including ferns. The two *Sphagnum* species occurred in this position in 84 of the 88 most parsimonious trees.

Some Hepaticopsida emerge as a basal group among the land plants which is supported by earlier work (Mishler and Churchill, 1984, 1985; Mishler *et al.*, 1992; Waters *et al.*, 1992) but disagrees with the more recent work of Hedderson *et al.* (1996) which places hornworts as the basal group among land plants. Furthermore, the Hepaticopsida group is not monophyletic since some liverwort taxa group with the Anthocerotopsida clade which is contrary to work of Garbary *et al.* (1993). These liverworts which group with the hornworts comprise the subclass of leafy liverworts called Jungermanniopsida. Interestingly, the liverwort taxa which form the basal group to all land plants consist of only thalloid liverworts which comprises the Subclass Marchantiopsida. There appears to be a distinctly separate evolution of these two subclasses of liverworts and this separation has been reported elsewhere (Capesius, 1995; Bopp and Capesius, 1996; Capesuis and Bopp, 1997).

Clearly, the phylogeny of lower plants illustrated in Fig. D (vol. II, p. 75) presents some relationships which could find support with one or a few previous publications. However, the resolution of the debate over the phylogeny of lower plants should not be conducted by strengthening the support for particular relationships or finding weakness in others by quoting the number of published trees conforming or disagreeing with a phylogeny. This would be especially inappropriate given the concerns identified in the introduction of this thesis which pertain to the questionable phylogenetic estimation of most if not all the published trees. Therefore, this thesis will claim support for phylogenetic relationships only by measuring confidence with bootstrap analyses.

The 50% majority-rule bootstrap tree found using maximum parsimony with taxa set B is presented in Fig. E (vol. II, p. 76). The tree is highly polytomous for deeper levels of lower plant phylogeny. The strongly supported clusters of lower plants presented in Fig. E is found primarily at the tips of the branches. Again, the data set allows the resolution of closely related species but offers little confidence in deeper phylogenetic separations. The only deep phylogenetic separation of the lower plants which is supported by bootstrap analyses is the suggested monophyly of the Lycopodiophyta group but with only 55% confidence.

3.4.1.2 Quartet puzzling

The maximum likelihood method for reconstructing phylogenetic relationships is another character-based method and works by trying to evaluate the probability of observing a particular set of data. Maximum-likelihood techniques are championed by many researchers from the population genetics tradition as the preferred phylogenetic estimation approach (Mishler, 1994). However, maximum likelihood's computational complexity prevents phylogenetic estimation for large numbers of taxa. Quartet puzzling can be applied to data sets with a much greater number of taxa than can other search algorithms such as stepwise addition (e.g. fastDNAml, Olsen *et al.*, 1994). However, it has been recognized that quartet puzzling's ability to reconstruct the true tree is less than that of fastDNAml (Strimmer and Von Haeseler, 1996). Nevertheless, the large number of taxa in this study and popular acceptance of the validity of the maximum likelihood approach justify amply the employment of quartet puzzling.

The results of quartet puzzling on taxa set A is presented in Fig. F (vol. II, p. 77) and the results using taxa set B is presented in Fig. G (vol. II, p. 78). The deeper phylogenetic relationships remain unresolved as was the case using parsimony analysis and taxa set B. However, taxa set A (Fig. F) proposes a separate evolution of the higher plant taxa (e.g. Magnoliophyta and Pinophyta) from all other tracheophytes and lower land plants. This is a controversial finding and conflicts dramatically with accepted phylogeny of the streptophyte lineage. Such a result may depend upon a taxon sampling effect confounded by the maximum likelihood principle as a similar result was obtained with fastDNAml (see below).

3.4.1.3 Maximum likelihood

The traditional maximum likelihood calculation with stepwise addition generated long run times. Consequently, analyses was performed only on the reduced taxa set, A. The results of the calculation are shown in Fig. H (vol. II, p. 79). The maximum likelihood analysis was conducted on 681 distinct data patterns found in taxa set A, and examined 3493 alternative trees producing the final tree with Ln likelihood of -13491.72. The results of the bootstrap analysis are given in Fig. I (vol. II, p. 80).

The phylogeny in Fig. I coincides with results obtained using quartet puzzling since it too suggests a separate evolution of the higher plant taxa. However, such a phylogeny requires confirmation derived from other analytical methods (see above). The computational requirements of this method permitted only 10 bootstraps of the data and therefore extra caution is needed for interpretation of the confidence measurements. In fact, the bootstrap tree produces a different phylogeny from that of the original analysis by clustering the ferns and some fern allies with the higher plants. This reinforces the conviction that trees displaying a completely separate evolution of higher land plant taxa are spurious. The remainder of the tree fails also to determine deeper green plant phylogenies. However, branch tips are resolved as with previous data sets and methods.

3.4.2 Distance-based phylogenetic analyses

All phylogenetic trees pertaining to distance-based phylogenetic analyses can be cross-referenced with Table 8 for taxa set A (vol. II, p. 68) and Table 9 for taxa set B (vol. II, p. 69). Each phylogenetic estimation using distance-based approaches resulted in the production of four trees. The first pair of trees are phylograms depicting branch length and have the accompanying distance scale located at the top of the page. The second pair of trees display the results of bootstrap analyses and have the accompanying bootstrap values shown as percent. All branches yielding less than 50% support are collapsed to produce a 50% majority-rule bootstrap tree. It is important to note, however, that these bootstrap trees are not constructed with the consensus tree approach as are the 50% majority-rule bootstrap trees used in the character-based analyses. Rather, the results of the bootstrap analyses for distance-based analyses are displayed on the original phylogram with branches showing less than 50% support collapsed to produce polytomies.

Table 10 (vol. II, p. 70) summarizes consistent monophyletic clusters found in all distance-based analyses. These monophyletic clusters constitute the triangles shown in the second tree of each pair of trees. The trees with the monophyletic clusters displayed as triangles have the same figure label as the original tree on the preceding page. The second tree with the monophyletic clusters shown as triangles is used to illustrate the relationships among the major groups more clearly.

3.4.2.1 Neighbor-joining analysis with Jukes & Cantor (1969) distance calculation

Figure A1B (vol. II, p. 147-148) shows the results of the neighbor-joining analysis on taxa set B using Jukes and Cantor (1969) distance calculation with branches showing less than 50% support by bootstrap analysis dissolved to form polytomies. The significance difference seen with this phylogenetic estimation is the placement of *Klebsormidium flaccidum* and *Coleochaete scutata*. These results place Coleochaetales as the closest green algae to the embryophyte clade. Resolution of the relationships of the bryophytes and other lower land plants remained unsupported which is indicative of the poor phylogenetic signal available for deeper phylogenetic analyses. Again, the phylogeny of closely related taxa and other overall relationships identified in previous descriptions for taxa set B remain unchanged both with and without correction for insertions and deletions.

Jukes & Cantor distance calculation on taxa set A with no correction for indels displays a separate evolution of the higher plants (i.e. Pinophyta and Magnoliophyta) from the rest of the Streptophyta lineage (Fig. A1S, vol. II, p. 81-82). This arrangement concurs with parsimony analyses of taxa set A (refer to Fig. A, vol. II, p. 72). Analysis of taxa set A with correction for insertions and deletions (Fig. A2S, vol. II, p. 85-86) produces no significant changes in tree topology but does produce reduced bootstrap support for some deeper clustering of the lower plant taxa. However, bootstrap analyses provides 75% support with correction for indels and 73% confidence without indel correction for a separate evolution of the higher plants (Fig. A2SB, vol. II, p. 87-88). Although this arrangement has been seen in previous character-based analyses with taxa set A, this is the first time bootstrap analyses supports this separate evolution of higher plants. As discussed previously, this arrangement is highly controversial and suspect due to outgroup and other species sampling concerns with taxa set A. Notably, taxon arrangements at the tips of the branches maintain both identical clustering and high bootstrap support with all previous analyses including taxa set B (e.g. the topology of very closely related species is maintained).

Further evidence which substantiates bootstrap values is branch length. All distance-based phylogenetic trees are displayed as phylograms thereby depicting genetic distance between nodes. The branch length is congruent with the amount of phylogenetic signal supporting each cluster in the tree with short branches indicative of low phylogenetic signal supporting the corresponding cluster. All phylograms produce repeatedly short branches for deep phylogenetic relationships of the lower land plants. Conversely, closely related taxa and their consistent clustering which are demonstrating high bootstrap support have also long branch lengths. The consistency of this observation is significant but for the sake of brevity will not be reiterated with each distance calculation analysis.

3.4.2.2 Neighbor-joining analysis with Tajima & Nei (1984) distance calculation

All phylogenetic trees produced by neighbor-joining with Tajima & Nei (1984) distance calculation and with correction for indels for both taxa set A and B produced trees identical to those obtained from the previous distance calculation. Similar shuffling of branches was noted with taxa set A, although, no significant alternations to tree topology were observed. The results of neighbor-joining analyses with Tajima & Nei distance calculation can be found on p. 89-97 (vol. II) for taxa set A (Fig. B1S, B1SB, B2S, and B2SB) and p. 153-160 (vol. II) for taxa set B (Fig. B1, B1B, B2, and B2B).

3.4.2.3 Neighbor-joining analysis with Kimura (1980) distance calculation

Neighbor-joining analysis with Kimura (1980) distance calculation produced a tree topology for taxa set A (Fig. C1S, vol. II, p. 97, 98 & Fig. C2S; vol. II, p. 101, 102) which was fully restored to the topology observed with Jukes & Cantor distance calculation (Fig. A1S & A2S, vol. II, p. 81-85) regardless of treatment of indels. Taxa set B (Fig. C1, vol. II, p. 161 & Fig. C2, vol. II, p. 165) retains similar topology with all previous distance calculation analyses.

3.4.2.4 Neighbor-joining analysis with Jin & Nei (1990) distance calculation

The results of Jin & Nei distance calculation with both Jukes & Cantor and Kimura 2-p evolution models can be found on p. 105-120 (vol. II) for taxa set A (Fig. D1.1S, D1.1SB, D1.2S, D1.2SB, D2.1S, D2.1SB, D2.2S, and D2.2SB) and p. 169-184 (vol. II) for taxa set B (Fig. D1.1, D1.1B, D1.2, D1.2B, D2.1, D2.1B, D2.2, and D2.2B). Again, no significant changes are observed for either taxa set from the topologies previously described.

3.4.2.5 Neighbor-joining analysis with transversions only distance calculation

Dramatic topology changes are observed with tranversion only distance calculation for both taxa sets. The results of these analyses can be found on p. 121-128 (vol. II) for taxa set A (Fig. E1S, E1SB, E2S, and E2SB) and p. 185-192 (vol. II) for taxa set B (Fig. E1, E1B, E2, and E2B). Taxa set B produced several rearrangements and changes in taxa affiliation, most of which disappeared when bootstrap confidences of ≥50% were applied. However, taxa set A topology associated ferns and fern allies with higher plant taxa making them a sister group to the Pinophyta and Magncliophyta lineage. These relationships were seen also in trees derived from character-based analyses using maximum likelihood methods (refer to Fig. H, vol. II, p. 79).

3.4.2.6 Neighbor-joining analysis with no correction distance calculation

Phylogenetic analysis using distance calculation with no correction for superimposed mutations was performed strictly with the intention of obtaining a reference point for the level of correction the other parametric models imposed on the raw data. Consequently, the results of these analyses were not factored into the construction of the overall consensus tree. The topologies produced with this method fit well with other methods described previously. The results of these analyses indicate that the level of influence each distance method imposes is not as great as imagined initially. The results of these analyses can be found on p. 129-136 (vol. II) for taxa set A (Fig. F1S, F1SB, F2S, and F2SB) and p. 193-200 (vol. II) for taxa set B (Fig. F1, F1B, F2, and F2B).

3.4.2.7 Neighbor-joining analysis with Van de Peer & De Wachter (1994) distance calculation

Unlike previous distance calculation models, the novelty and appropriateness of this distance calculation method merits its description here. This distance-based method is the most appropriate parametric model for phylogenetic estimation using 18S rRNA gene sequence data. This method accounts for the local sequence variability in the computation of evolutionary distance. The calculation utilizes a parameter in an equation which expresses the probability that the alignment position contains a different nucleotide in orthologous sequences. This probability is expressed as a function of the distances separating these sequences (i.e. the number of nucleotide substitutions that occurred since the divergence of two sequences). The distances computed for 18S rDNA using this method are reputed to be more precise than those obtained with other distance-based methods (Van de Peer *et al.*, 1993).

The results of neighbor-joining phylogenetic analysis using the Van de Peer and De Wachter (1994) distance calculation method for taxa set A are given in Fig. G1S & G2S (vol. II, p. 137-144) and Fig. G1 & G2 (vol. II, p. 201-208) for taxa set B. The most notable difference in topology is seen with the clustering of fern and fern allies as a sister group to the higher plants. It would appear that this proposed phylogeny is beginning to carry some weight despite the low bootstrap value of 53%. This relationship is seen with taxa set A and B and with both distance-based and character-based methods. However, this method could not produce any revelations concerning the relationships of other lower land plants or resolve any of the debates over the genealogy of the bryophytes. It is evident now that there is simply insufficient phylogenetic signal in 18S rRNA gene sequences to resolve unequivocally and in detail the evolutionary transition from algal ancestors to land flora.

3.4.2.8 Neighbor-joining analysis with no correction distance calculation and compartmentalization

The background work required for this analysis was described in section 3.3 (Assessment of Phylogenetic Signal and Variability, I; p. 53). The categories determined by the data presented in Table 4 (vol. II, p. 44) were used to compartmentalize the data into subsets based on variability. This provided a means to determine which nucleotides render phylogenetic signal for phylogeny reconstruction and to show exactly where in the tree the alignment positions with their associated signal provide resolution. If the data matrix contains homoplasy due to excessive variability, then the more variable positions (e.g. categories 0, 1, 2) should be most appropriate for closely related taxa but only contribute 'noise' for global analyses with widely divergent taxa. Likewise, the more conserved alignment positions (e.g. categories 3, 4, 5) should contribute phylogenetic signal appropriate for deeper phylogenetic relationships. However, if phylogenetic signal is sufficiently weak due to low variability then all the variability and hence signal will be useful only for phylogenetic study of closely related taxa and resolution of deeper phylogenetic relationships would not be possible.

The first subset utilized characters assigned to categories 0, 1, 2, 3, and 4 which essentially removed only the most invariant alignment positions. The results of these analyses are presented in Fig. H1B (vol. II, p. 209, 210). The topology of this analysis is compared most appropriately to distance-based analysis with no correction and these results are presented in Fig. F1B (vol. II, p. 195, 196). Comparison between these two trees reveal only minor differences which is somewhat contrary to what should be expected with the removal of the most conserved nucleotides if in fact these positions contribute to deeper relationships.

The next subset retains the most variable nucleotides corresponding to categories 0, 1, and 2. The results of these analyses are presented in Fig. H2B (vol. II, p. 211-212). The topology remains unchanged and indicates the vast majority of the phylogenetic signal providing the resultant tree resides in the most variable sites. Deeper phylogenetic relationships remain unresolved as in all previous analyses suggesting even the positions in categories 3, 4, and 5 are too conserved to provide phylogenetic signal.

The final subset includes all the variable nucleotides by retaining categories 2, 3, 4, and 5, except the 'hypervariable' ones within categories 0 and 1. The resulting tree is presented in Fig. H3B (vol. II, p. 213-214). The monophyly of three clades loses support with the removal of these positions but deeper relationships are not 'unmasked'. This indicates clearly that the data set and all phylogenetic analyses are not suffering from extensive homoplasy but that conversely the most variable nucleotides contain data suitable only for resolving clades of closely related taxa. Consequently, it seems that the 18S rDNA gene is too similar within lower plant taxa to allow informative deeper level phylogenetic analyses. This degree of similarity among 18S rRNA gene sequences could indicate that extant species of lower plants are evolutionary younger than other terrestrial plants.

3.4.3 Overall strict consensus tree

In an effort to summarize the many trees generated by this study, an overall strict consensus tree was developed for both taxa sets. These consensus trees based on all analyses represent a very conservative view of the clades and phylogenetic relationships for which this project provides complete support. Only clusters which were maintained strictly in the 50% majority-rule bootstrap trees from all phylogenetic analyses are depicted. Any variation of taxa clustering emanating from the various phylogenetic approaches resulted in those affected taxa being displayed as polytomies. These trees are presented in Fig. 18 (vol. II, p. 215) pertaining to taxa set A and Fig. 19 (vol. II, p. 217) pertaining to taxa set B.

These figures delineate graphically the overall conclusion of this project. The phylogenetic relationships of the bryophytes and other lower plant taxa cannot be resolved with 18S rDNA sequence data. The data provides good resolution for closely related taxa, the phylogeny of higher plants and the placement of the bryophytes between the green algae and the tracheophytes. Any other claims would be unwarranted.

3.5 Conclusion

The final inference is that 18S rDNA sequence data do not have sufficient resolving power to contribute significantly to our understanding of phylogenetic relationships of the bryophytes and other lower plant taxonomic groups. This study strove to resolve unequivocally the evolutionary transition from putative algal ancestors to the extant land flora by elucidating bryophyte phylogeny and differentiating major lower plant lineages thereby providing insight into the sequence of evolutionary events which accompanied colonization of the terrestrial habitat. In doing so, it became evident that there is insufficient phylogenetic signal in 18S rRNA to elucidate satisfactorily lower plant phylogenies.

The notion that 18S rRNA gene sequence data is not sufficient to solve the problem at hand is not a novel revelation. Capesius and Van de Peer (1997) share this contention and state "that the 18S rRNA is not very well suited to resolve all branching patterns within the different orders and families of bryophytes". A recent study by Tourasse and Gouy (1997) suggests that the large-subunit rRNAs appear to be more suitable than small-subunit rRNAs for reconstructing universal phylogenies. In addition, several studies suggest that sequence data from several independent loci must be used to obtain the correct 'species tree' (Saitou and Nei, 1986; Bull *et al.*, 1993; Kim, 1993; Cao *et al.*, 1994; Avise and Nelson, 1995).

Methods for inferring phylogeny from DNA sequences have proliferated in the last few years. Unfortunately, decisions concerning which of many described methods will be used in a given study are rarely made by weighing the advantages and disadvantages of each approach. Similarly, the choice of DNA sequence has not been examined closely. Instead, issues of availability or historical inertia often dictate such choices. Future investigations examining the phylogeny of lower plants cannot afford to continue in this vein. This study illustrates that obtaining sufficient data and the complete application of appropriate methods of phylogenetic inference are essential for the reconstruction of deep phylogenetic relationships of lower land plants. Although this study satisfied the latter criterion, it showed clearly that plant 18S rRNA gene sequence data are insufficient for the purpose proposed at the outset of this project. Consequently, future investigations should be scrutinized carefully when proposing bryophyte or lower plant phylogeny based strictly on this gene.

3.5.1 Future work

As the underlying theme of this thesis maintains, it is preferable that when a putative clade fails to appear consistently across several alternative phylogenetic procedures, as applied here to 18S rDNA, the fruitful approach will be to gather and analyze additional data, including those from unlinked regions, rather than to proclaim what may be a fragile truth from one preferred method of phylogeny estimation.

There are several possible strategies for improving the power of phylogenetic inference using DNA sequence data. Certainly, increasing the number of nucleotides will increase the chance of obtaining a whole-genome tree, whereby whole-genome trees are closer to species trees than any specific gene tree. Focusing on a single gene increases the chance that phylogenetic inference is affected by location-dependent processes in sequence evolution (Cummings *et al.*, 1995) in turn resulting in the generation of trees characterized by spurious associations. This can be avoided by sampling sites from different genes or even genomes (i.e. chloroplast, nuclear).

The 18S rRNA gene sequence data should not be discarded but rather combined with more data. Furthermore, this and previous studies have not utilized all phylogenetic information in rRNA gene sequences associated with features such as base-paired versus non based-paired nucleotides, compensatory mutations, and types of secondary structure. The merits for doing so are obvious. Structural aspects of rRNA offer a number of opportunities for informed examination of the data for phylogenetic information. Different positions of the molecule may have very rigid evolutionary constraints connected with function either by sequence or structure.

The culling method used in this study for accommodating 'alignment ambiguous' sites is not the only appropriate method for dealing with the multiple putative homology statements. Certainly to date, the process of incorporating several possible alignment solutions into phylogenetic analysis has not been well delineated. Another possible solution involves stringing the multiple alignments together into a single grand alignment (Wheeler *et al.*, 1995). This procedure, termed 'elision', ensures that positions with alignment of unambiguous sites will occur more often than alignment-ambiguous sites and will thus carry greater weight. This procedure allows phylogenetic analysis to be performed on the entire data set whereby a less extreme form of weighting is implemented relative to culling.

4. REFERENCES

Adoutte, A. and H. Philippe. (1993). The major lines of metazoan evolution: Summary of traditional evidence and lessons from ribosomal RNA sequence analysis. pp. 1-30. *In*: Pichon, Y. (Ed.) Comparative Molecular Neurobiology. Birkhaüser Verlag, Basel.

Archie, J.W. (1989). Homoplasy excess ratios: New indices for assessing levels of homoplasy in phylogenetic systematics and a critique of the consistency index. Syst. Zoo. **38**: 253-269.

Ashton, N.W., A. Schulze, P. Hall and R.S. Bandurski. (1985). Estimation of indole-3-acetic acid in gametophytes of the moss, *Physcomitrella patens*. Planta **164**: 142-144.

Ashton, N.W., T.A. Zacharias and D.F. Fracchia. (1993). Genetic analysis of phytohormone action and morphogenesis in *Physcomitrella patens*. Mem. Torrey Bot. Club **25**: 11-20.

Ashton, N.W., N. Antonishyn, K. Baker and W. Chapco. (1994). Molecular phylogenetic aspects of genetical and physiological studies of moss development. J. Hattori Bot. Lab. **76**: 41-57.

Avise, J.C., W.S. Nelson and C.G. Sibley. (1994). Why one-kilobase sequences from mitochrondrial DNA fail to solve the Hoatzin phylogenetic enigma. Mol. Phylogenet. Evol. **3**: 175-184.

Avise, J.C. and W.S. Nelson. (1995). Reply to the editor: A commentary on the use of sequence data for phylogeny reconstruction. Mol. Phyl. Evol. **4**: 350-356.

Barnabas, S., S. Krishnan and J. Barnabas. (1995). The branching pattern of major groups of land plants inferred from parsimony analysis of ribosomal RNA sequences. J. Biosci. **20**: 259-272.

Benson, D.A., M.S. Boguski, D.J. Lipman and J. Ostell. (1997). GenBank. Nuc. Acids Res. **25**: 1-6.

Bhattacharya, D., B. Surek, M. Rüsing, S. Damberger and M. Melkonian. (1994). Group I introns are inherited through common ancestry in the nuclear-encoded rRNA of Zygnematales (Charophyceae). Proc. Natl. Acad. Sci. USA **91**: 9916-9920.

Bopp, M., and I. Capesius. (1995). New aspects of the systematics of bryophytes. Naturwissenschaften **82**: 193-194.

Bopp, M., and I. Capesius. (1996). New aspects of bryophyte taxonomy provided by a molecular approach. Botanica Acta **109**: 368-372.

Bousquet, J., S.H. Strauss, A.H. Doerksen and R.A. Price. (1992). Extensive variation in evolutionary rate of *rbc*L gene sequences among seed plants. Proc. Natl. Acad. Sci. USA **89**: 7844-7848.

Bremer, K. (1985). Summary of green plant phylogeny and classification. Cladistics **1**: 369-385.

Bremer, K., C.J. Humpries, D.B. Mishler and S.P. Churchill. (1987). On cladistic relationships in green plants. Taxon **36**: 339-349.

Bremer, K. (1988). The limits of amino acid sequence data in angiosperm phylogenetic reconstruction. Evolution **42**: 795-803.

Bull, J.J., J.P. Huelsenbeck, C.W. Cunningham, D.L. Swofford and P.J. Waddell. (1993). Partitioning and combining data in phylogenetic analysis. Syst. Biol. **42**: 384-397.

Capesius, I. (1995). A molecular phylogeny of Bryophytes based on the nuclear-encoded 18S rRNA genes. J. Plant. Physiol. **146**: 59-63.

Capesius, I. and M. Bopp. (1997). New classification of liverworts based on molecular and morphological data. Pl. Syst. Evol. **207**: 87-97.

Capesius, I. and Y. Van de Peer. (1997). Secondary structure of the large ribosomal subunit RNA of the moss *Funaria hygrometrica*. J. Plant Phys. **151**: 239-241.

Cao, Y., J. Adachi, A. Janko, S. Paabo and M. Hasegawa. (1994). Phylogenetic relationships among eutherian orders estimated from inferred sequences of mitochondrial proteins: Instability of a tree based on a single gene. J. Mol. Evol. **39**: 519-527.

Chapman, R.L. and M.A. Buchheim. (1991). Ribosomal RNA gene sequences: Analysis and significance in the phylogeny and taxonomy of green algae. Crit. Rev. Pl. Sci. **10**: 343-368.

Chapman, R.L. and M.A. Buchheim. (1992). Green algae and the evolution of land plants: Inferences from nuclear-encoded rRNA gene sequences. Biosystems **28**: 127-137.

Charleston, M.A., M.D. Hendy and D. Penny. (1994). The effects of sequence length, tree topology, and number of taxa on the performance of phylogenetic methods. J. Comp. Biol. **1**: 133-151.

Chaw, S.M., A. Zharkikh, H.M. Sung, T.C. Lau and W.H. Li. (1997). Molecular phylogeny of extant gymnosperms and seed plant evolution: Analysis of nuclear 18S rRNA sequences. Mol. Biol. Evol. **14**: 56-68.

Crandall-Stotler, B. (1980). Morphogenetic designs and a theory of bryophyte origins and divergence. Bioscience **30**: 580-585.

Crandall-Stotler, B. (1986). Morphogenesis, developmental anatomy, and bryophyte phylogenetics: contradications of monophyly. J. Bryol. **14**: 1-23.

Cummings, M.P., S.P. Otto and J. Wakeley. (1995). Sampling properties of DNA sequence data in phylogentic analysis. Mol. Biol. Evol. **12**: 814-822.

De Rijk, and R. De Wachter. (1993). Dedicated Comparative Sequence Editor v2.54, an interactive tool for sequence alignment and secondary structure research. Comput. Applic. Biosci. **9**: 735-740.

DeSalle, R., C. Wray and R. Absher. (1994). Computational problems in molecular systematics. Mol. Ecol. Evol. **69**: 353-370.

Doyle, J.J., and J.L. Doyle. (1990). Isolation of plant DNA from fresh tissue. Focus **12**(1): 13-15.

Duckett, J.G. and K.S. Renzaglia. (1988). Cell and molecular biology of bryophytes: ultimate limits to the resolution of phylogenetic problems. Bot. J. Linn. Soc. **98**: 225-246.

Eyre-Walker, A. and B.S. Gaut. (1997). Correlated rates of synonymous site evolution across plant genomes. Mol. Biol. Evol. **14**: 455-460.

Farris, J.S. (1991). Excess homoplasy ratios. Cladistics 7: 81-91.

Felsenstein, J. (1981). Evolutionary trees from DNA sequences: A maximum likelihood approach. J. Mol. Evol. **17**: 368-376.

Felsenstein, J. (1985). Confidence limits on phylogenies: An approach using the bootstrap. Evolution **39**: 783-791.

Felsenstein, J. (1995). PHYLIP v3.5c: PHYlogeny Inference Package. Department of Genetics, University of Washington, Seattle.

Felsenstein, J. and H. Kishino. (1993). Is there something wrong with the bootstrap on phylogenies. Syst. Biol. **42**: 193-199.

Fitch, W.M. (1971). Toward defining the course of evolution: Minimal change for a specific tree topology. Syst. Zool. **20**: 406-416.

Friedlander, T.P., J.C. Regier and C. Mitter. (1992). Nuclear gene sequences for higher level phylogenetic analysis: 14 promising candidates. Syst. Biol. **41**: 483-490.

Garbary, D.G., K. Renzaglia and J.G. Duckett. (1993). The phylogeny of land plants: A cladistic analysis based on male gametogenesis. Pl. Syst. Evol. **188**: 237-269.

Gatsey, J., W.C. Wheeler and R. DeSalle. (1993). Alignment ambiguous nucleotide sites and the removal of phylogenetic information. Mol. Phyl. Evol. **2**: 152-158.

Gaut, B.S., B.R. Morton, B.M. McCaig and M.T. Clegg. (1996). Substitution rate comparisons between grasses and palms: Synonymous rate differences at the nuclear gene *Adh* parallel rate differences at the plastid gene *rbc*L. Proc. Natl. Acad. Sci. USA **93**: 10274-10279.

Gautheret, D. and R.R. Gutell. (1997). Inferring the conformation of RNA base pairs and triples from patterns of sequence variations. Nuc. Acids Res. **25**: 1559-1564.

Gilbert, D.G. (1992). *LoopDloop*, a Macintosh program for visualizing RNA secondary structure. Published electronically on the Internet, available via anonymous ftp to ftp.bio.indiana.edu.

Glotz, C., C. Zwieb, R. Brimacombe, K. Edwards and H. Kossel. (1981). Secondary structure of the large subunit ribosomal RNA from *Escherichia coli*, *Zea mays* chloroplast, and human and mouse mitochondrial ribosomes. Nuc. Acids Res. **9**: 3287-3306.

Golding, G.B. (1983). Estimates of DNA and protein sequence divergence: An examination of some assumptions. Mol. Biol. Evol. **1**: 125-142.

Gouy, M. and W.-H. Li. (1989). Molecular phylogeny of the kingdoms Animalia, Plantae, and Fungi. Mol. Biol. Evol. **6**: 109-122.

Graham, L.E., C.F. Delwiche and B.D. Mishler. (1991). Phylogenetic connections between the 'Green Algae' and the 'Bryophytes'. Adv. Bryol. **4**: 213-244.

Graybeal, A. (1994). Evaluating the phylogenetic utility of genes: A search for genes informative about deep divergences among vertebrates. Syst. Biol. **43**: 174-193.

Gutell, R.R. (1996). Comparative sequence analysis and the structure of 16S and 23S rRNA. pp. 111-128 *In:* R.A. Zimmerman and A.E. Dahlberg (Eds.), Ribosomal RNA. CRC Press, Boca Raton, Fla.

Gutell, R.R., N. Larsen and C.R. Woese. (1994). Lessons from an evolving rRNA: 16S and 23S rRNA structures from a comparative perspective. Microbiol. Rev. **58**: 10-26.

Hamby, R.K. and E.A. Zimmer. (1992). Ribosomal RNA as a phylogenetic tool in plant systematics. pp. 50-91. *In*: P.S. Soltis, D.E. Soltis and J.J. Doyle (Eds.), Molecular Systematics in Plants. Chapman & Hall, New York.

Hasebe, M., P.G. Wolf, K.M. Pryer, K. Ueda, M. Ito, R. Sano, G.J. Gastony, J. Yokoyama, J.R. Manhart, N. Murakami, E.H. Crane, C.H. Haufler and W.D. Hauk. (1995). Fern phylogeny based on *rbc*L nucleotide sequences. Amer. Fern J. **85**: 134-181.

Hasegawa, M., H. Kishino, and K. Yano. (1985). Dating of the human-ape splitting by a molecular clock of mitochondrial DNA. J. Mol. Evol. **22**: 160-174.

Hedderson, T.A., R.L. Chapman and W.L. Rootes. (1996). Phylogenetic relationships of bryophytes inferred from nuclear-encoded rRNA gene sequences. Pl. Syst. Evol. **200**: 213-224.

Hendriks, L., Y. Van de Peer, M. Van Herks, J.M. Neefs and R. De Wachter. (1990). The 18S ribosomal RNA sequence of the sea anemone *Anemonia sulcata* and its evolutionary position among other eukaryotes. FEBS Lett. **269**: 445-449.

Hickson, R.E., C. Simon, A Cooper, G.S. Spicer, J. Sullivan and D. Penny. (1996). Conserved sequence motifs, alignments, and secondary structure for the third domain of animal 12S rRNA. Mol. Biol. Evol. **13**: 150-169.

Hillis, D.M., M.W. Allard and M.M. Miyamoto. (1993). Analysis of DNA sequence data: Phylogenetic inference. Methods Enyzm. **224**: 456-487.

Hillis, D.M. and J.J. Bull. (1993). An empirical test of the bootstrapping as a method for assessing confidence in phylogenetic analysis. Syst. Biol. **42**: 182-192.

Hillis, D.M. and M.T. Dixon. (1989). Vertebrate phylogeny: Evidence from 18S ribosomal DNA sequences. pp. 335-367. *In:* Fernholm, B., K. Bremer and H. Jörnvall (Eds.), The Hierarchy of Life. Elsevier Science Publishers, Amsterdam.

Hillis, D.M. and M.T. Dixon. (1991). Ribosomal DNA: Molecular evolution and phylogenetic inference. Quart. Rev. Biol. **66**: 411-453.

Hillis, D.M. and J.P. Huelsenbeck. (1992). Signal, noise, and reliability in molecular phylogenetic analyses. J. Hered. **83**: 189-195.

Holmquist, R., M. Goodman, T. Conroy and J. Czelusniak. (1983). The spatial distribution of fixed mutations within genes coding for proteins. J. Mol. Evol. **19**: 437-448.

Huelsenbeck, J.P. (1991). Tree length distribution skewness: An indicator of phylogenetic information. Syst. Zool. **40**: 257-270.

Jaeger, J.A., D.H. Turner and M. Zuker. (1990). Predicting optimal and suboptimal secondary structure for RNA. Methods Enzym. **183**: 281-306.

Jin, L. and M. Nei. (1990). Limitations of the evolutionary parsimony method of phylogenetic analysis. Mol. Biol. Evol. 7: 82-102.

Jukes, T.H. and C.R. Cantor. (1969). Evolution of protein molecules. pp. 21-132. *In:* Munro, H.N. (Ed.), Mammalian Protein Metabolism. Academic Press, New York.

Källersjö, M., J.S. Farris, A.G. Kluge and C. Bult. (1992). Skewness and permutation. Cladistics **8**: 275-287.

Kantz, T.S., E.C. Theriot, E.A. Zimmer and R.L. Chapman. (1990). The Pleurastrophyceae and Micromonadophyceae: A cladistic analysis of nuclear rRNA sequence data. J. Phycol. **26**: 711-721.

Kenrick, P. and P.R. Crane. (1997). The origin and early evolution of plants on land. Nature (in press).

Kim, J. (1993). Improving the accuracy of phylogenetic estimation by combining different methods. Syst. Biol. **42**: 331-340.

Kimura, M. (1980). A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. J. Mol. Evol. **16**: 111-120.

Kjer, K.M. (1995). Use of rRNA secondary structure in phylogenetic studies to identify homologous positions: An example of alignment and data presentation from the frogs. Mol. Phylogenet. Evol. **4**: 314-330.

Kranz, H.D. and V.A.R. Huss. (1997). Molecular evolution of pteridophytes and relationships to seed plants: Evidence from complete 18S rRNA gene sequences. Plant Syst. Evol. (in press).

Kranz, H., D. Miks, M.-L. Siegler, I. Capesius and C.W. Sensen. (1995). The origin of land plants: Phylogenetic relationships among charophytes, bryophytes, and vascular plants inferred from complete small-subunit ribosomal RNA gene sequences. J. Mol. Evol. **41**: 74-84.

Kumar, S. and A. Rzhetsky. (1996). Evolutionary relationships of eukaryotic kingdoms. J. Mol. Evol. **42**: 183-193.

Larson, A. and A.C. Wilson. (1989). Patterns of ribosomal RNA evolution in salamanders. Mol. Biol. Evol. **6**: 131-154.

Lecointre, G., H. Philippe, H.L. Vân Lê and H. Le Guyader. (1993). Species sampling has a major impact on phylogenetic inference. Mol. Phyl. Evol. **2**: 205-224.

Lewis, L.A., L.W. Wilcox, P.A. Fuerst and G.L. Floyd. (1992). Concordance of molecular and ultrastructural data in the study of zooporic Chlorococcalean green algae. J. Phycol. **28**: 375-380.

Lewis, L.A., B.D. Mishler and R. Vilgalys. (1997). Phylogenetic relationships of the liverworts (Hepaticea), a basal embryophyte lineage, inferred from nucleotide sequence data of the chloroplast gene *rbc*L. Mol. Phylogenet. Evol. 7: 377-393.

Maddison, W.P. and D.R. Maddison. (1992). MacClade: Analysis of phylogeny and character evolution. Version 3.05. Computer program distributed by Sinauer Associates, Sunderland, Massachusetts.

Maly, P. and R. Brimacombe. (1983). Refined secondary structure models for the 16S and 23S ribosomal RNA of *Escherichia coli*. Nuc. Acids Res. **11**: 7263-7286.

Manhart, J.R. (1995). Chloroplast 16S rDNA sequences and phylogenetic relationships of fern allies and ferns. Amer. Fern J. **85**: 182-192.

Mattox, K.R. and K.D. Stewart. (1984). Classification of the green algae: A concept based on comparative cytology. pp. 29-72. *In*: D.E.G. Irvine and D.M. John. (Eds.), Systematics of the Green Algae. Academic Press, London.

Maidak, B.L., G.J. Olsen, N. Larson, R. Overbeek, M.J. McCaughey and C.R. Woese. (1997). The RDP (Ribosomal Database Project). Nuc. Acids Res. **25**: 109-110.

McCourt, R.M. (1995). Green algal phylogeny. Trends in Ecology and Evolution **10**: 159-163.

Melkonian, M. and B. Surek. (1995). Phylogeny of the Chlorophyta: Congruence between ultrastructural and molecular evidence. Bull. Soc. Zool. Fr. **120**: 191-208.

Mishler, B.D. (1985). Transition to a land flora: phylogenetic relationships of the green algae and bryophytes. Cladistics **1**: 305-328.

Mishler, B.D. (1994). Cladistic analysis of molecular and morphological data. Amer. J. Phys. Anthro. **94**: 143-156.

Mishler, B.D. and S.P. Churchill. (1984). A cladistic approach to the phylogeny of the 'bryophytes'. Brittonia **36**: 406-424.

Mishler, B.D. and S.P. Churchill. (1985). Transition to a land flora: Phylogenetic relationships of the green algae and bryophytes. Cladistics **1**: 305-328.

Mishler, B.D. and E. De Luna. (1991). The use of ontogenetic data in phylogenetic analyses of mosses. Adv. Bryol. **4**: 121-167.

Mishler, B.D., P.H. Thrall, J.S. Hopple, E. De Luna, R. Vilgalys. (1992). A molecular approach to the phylogeny of bryophytes: cladistic analysis of chloroplast-encoded 16S and 23S ribosomal RNA genes. Bryologist **95**: 172-180.

Mishler, B.D., L.A. Lewis, M.A. Buchheim, K.S. Renzaglia, D.J. Garbary, C.F. Delwiche, F.W. Zechman, T.S. Krantz and R.L. Chapman. (1994). Phylogenetic relationships of the 'green algae' and 'bryophytes'. Ann. Missouri Bot. Gard. **81**: 451-483.

Morrison, D.A. and J.T. Ellis. (1997). Effects of nucleotide sequence alignment on phylogeny estimation: A case study of 18S rDNAs of Apicomplexa. Mol. Biol. Evol. **14**: 428-441.

Muse, S.V. (1995). Evolutionary analyses of DNA sequences subject to constraints on secondary structure. Genetics **139**: 1429-1439.

Nei, M. (1991). Relative efficiencies of different tree-making methods for molecular data. pp. 90-128. *In*: Miyamoto, M.M. and J. Cracraft. (Eds.), Phylogenetic Analysis of DNA Sequences. Oxford University Press, New York.

Neefs, J-M, Y. Van de Peer, P. De Rijk, S. Chapelle and R. De Wachter. (1993). Compilation of small ribosomal subunit RNA structures. Nuc. Acids Res. **21**: 3025-3049.

Niklas, K.J. and H.P. Banks. (1990). A reevaluation of the Zosterophyllophytina with comments on the origin of lycopods. Amer. J. Bot. 77: 274-283.

Noller, H.F., J. Kop, V. Wheaton, J. Brosius, R.R. Gutell, A.M. Kopylov, F. Dohme, W. Herr, D.A. Stahl, R. Gupta and C.R. Woese. (1981). Secondary structure model for 23S ribosomal RNA. Nuc. Acids Res. **9**: 6167-6189.

Olsen, G.J. (1987). Earliest phylogenetic branchings: Comparing rRNA-based evolutionary trees inferred with various techniques. Cold Spring Harb. Symp. Quant. Biol. **52**: 825-837.

Olsen, G.J. (1988). Phylogenetic analysis using ribosomal RNA. Methods Enyz. **164**: 793-812.

Olsen, G.J., Matsuda, H., Hagstrom, R., and Overbeek, R. (1994). fastDNAml: A tool for construction of phylogenetic trees of DNA sequences using maximum likelihood. Comput. Appl. Biosci. **10**: 41-48.

Ota, T. and M. Nei. (1994). Estimation of the number of amino acid substitutions per site when the substitution rate varies among sites. J. Mol. Evol. **38**: 642-643.

Patterson, C. (1989). Phylogenetic relations of major groups: Conclusions and prospects. pp. 471-488. *In*: Fernholm, B., K. Bremer and H. Jörnvall. (Eds.) The Heirarchy of Life. Molecules and Morphology in Phylogenetic Analysis. Oxford, New York.

Pickett-Heaps, J.D. (1975). Green Algae: Structure, Reproduction and Evolution in Selected Genera. Sinauer Associates, Inc., Sunderland, Massachusetts.

Pryer, K.M., A.R. Smith and J.E. Skog. (1995). Phylogenetic relationships of extant ferns based on evidence from morphology and *rbc*L sequences. Amer. Fern J. **85**: 205-282.

Raubeson, L.A. and R.K. Jansen. (1992). Chloroplast DNA evidence on the ancient evolutionary split in vascular plants. Science **255**: 1697-1699.

Raven, P.H., R.H. Evert and S.E. Eichhorn. (1992). Biology of Plants. 5th Edition. Worth Publishers, New York.

Renzaglia, K.S. (1978). A comparative morphology and developmental anatomy of *Anthocerotophyta*. J. Hattori Bot. Lab. **44**: 31-90.

Russo, C.A.M., N. Takezaki and M. Nei. (1996). Efficiencies of different genes and different tree-building methods in recovering a known vertebrate phylogeny. Mol. Biol. Evol. **13**: 525-536.

Saitou, N. and M. Nei. (1986). The number of nucleotides required to determine the branching order of three species, with special reference to the human-chimpanzee-gorilla divergence. J. Mol. Evol. **24**: 189-204.

Saitou, N. and M. Nei. (1987). The neighbor-joining method: a new method for reconstructing phylogenetic trees. Mol. Biol. Evol. **4**: 406-425.

Schofield, W.B. (1985). Introduction to bryology. New York: Macmillian.

Schuster, R.M. (1984). Chapter 15. Evolution, phylogeny and classification of the *Hepaticae*. pp. 760-891. *In*: Schuster, R.M. (Ed.), New Manual of Bryology. Nichinian, Hattori Botanical Laboratory.

Sogin, M.L. (1990). Chapter 37. Amplification of ribosomal RNA genes for molecular evolution studies. pp. 307-314. *In*: Innis, M.A., D.H. Gelfand, J.J. Sninsky and T.J. White. (Eds.), PCR Protocols: A Guide to Methods and Applications. Academic Press Inc., San Diego, California.

Sogin, M.L., U. Edman. and H. Elwood. (1989). A single kingdom of eukaryotes. pp. 133-143. *In:* Fernholm, B., K. Bremer and H. Jörnvall (Eds.), The Hierarchy of Life. Elsevier Science Publishers, Amsterdam.

Sorenson, M.D. (1996). TreeRot: Computer program which aids in the determination of decay indices. University of Michigan, Ann Arbor.

Stewart, C-B. (1993). The powers and pitfalls of parsimony. Nature **361**: 603-607.

Stewart, W.N. and G.W. Rothwell. (1993). Paleobotany and the evolution of plants. 2nd edn. Cambridge University Press, Cambridge.

Strimmer, K. and A. von Haeseler. (1996). Quartet puzzling: A quartet maximum-likelihood method for reconstructing tree topologies. Mol. Biol. Evol. **13**: 964-969.

Sullivan, J., K.E. Holsinger and C. Simon. (1995). Among site rate variation and phylogenetic analysis of 12S rRNA in Sigmodontine rodents. Mol. Biol. Evol. **10**: 512-526.

Surek, B., U. Beemelmanns, M. Melkonian and D. Bhattacharya. (1993). Ribosomal RNA sequence comparisons demonstrate an evolutionary relationship between Zygnematales and charophytes. Pl. Syst. Evol. **191**: 171-181.

Swofford, D.L. (1993). PAUP: Phylogenetic analysis using parsimony. Version 3.1.1. Computer program distributed by the Illinois Natural History Survey, Champaign, Illinois.

Swofford, D.L., and G.L. Olsen. (1990). Phylogeny reconstruction. pp. 411-501. *In*: Hillis, D.M. and C. Moritz. (Eds.), Molecular Systematics. Sinauer Associates, Sunderland.

Syvanen, M., H. Hartman and P.F. Stevens. (1989). Classical plant taxonomic ambiguities extend to the molecular level. J. Mol. Evol. **28**: 536-544.

Tajima, F. and M. Nei. (1984). Estimation of evolutionary distance between nucleotide sequences. Mol. Biol. Evol. **1**: 269-285.

Tateno, Y., N. Takezaki and M. Nei. (1994). Relative efficiencies of the maximum-likelihood, neighbor-joining and maximum-parsimony methods when substitution rate varies with site. Mol. Biol. Evol. **11**: 261-277.

Tourasse, N.J. and M. Gouy. (1997). Evolutionary distances between nucleotide sequences based on the distribution of substitution rates among sites as estimated by parsimony. Mol. Biol. Evol. **14**: 287-298.

Turner, S., T. Burger-Wiersma, S.J. Giovannoni, L.R. Mur and N.R. Pace. (1989). The relationship of a prochlorophyte Prochlorothrix hollandica to green chloroplasts. Nature **337**: 380-382.

Uzzell, T. and K.W. Corbin. (1971). Fitting discrete probability distributions to evolutionary events. Science **172**: 1089-1096.

Van de Peer, Y., J.M. Neefs, P. De Rijk, and R. De Wachter. (1993). Reconstructing evolution from eukaryotic small ribosomal subunit RNA sequences: calibration of the molecular clock. J. Mol. Evol. **37**: 221-232.

Van de Peer, Y., and R. De Wachter. (1994). TREECON for Windows: a software package for the construction and drawing of evolutionary trees for the Microsoft Windows environment. Comput. Applic. Biosci. **10**: 569-570.

Van de Peer, Y., S. Chapelle and R. De Wachter. (1996a). A quantitative map of nucleotide substitution rates in bacterial rRNA. Nuc. Acids Res. **24**: 3381-3391.

Van de Peer, Y., S.A. Rensing, U.-G. Maier and R. De Wachter. (1996b). Substitution rate calibration of small subunit ribosomal RNA identifies chlorarachniophyte endosymbionts as remnants of green algae. Proc. Natl. Acad. Sci. USA **93**: 7732-7736.

Van de Peer, Y., G. Van der Auwera, and R. De Wachter. (1996c). The evolution of Stramenopiles and Alveolates as derived by 'substitution rate calibration' of small ribosomal subunit RNA. J. Mol. Evol. **42**: 201-210.

Van de Peer, Y., J. Jansen, P.De Rijk, and R. De Wachter. (1997). Database on the structure of small ribosomal subunit RNA. Nuc. Acids Res. **25**: 111-116.

Vawter, L. and W.M. Brown. (1993). Rates and patterns of base change in the small subunit ribosomal RNA gene. Genetics **134**: 597-608.

Wakeley, J. (1993). Substitution rate variation among sites in hypervariable region 1 of human mitochondrial DNA. J. Mol. Evol. **37**: 613-623.

Wakeley, J. (1994). Substitution-rate variation among sites and the estimation of transition bias. Mol. Biol. **11**: 436-442.

Waters, D.A., M.A. Buchheim, R.A. Dewey and R.L. Chapman. (1992). Preliminary inferences of the phylogeny of bryophytes from nuclear-encoded ribosomal RNA sequences. Amer. J. Bot. **79**: 459-466.

Wheeler, W.C., J. Gatesy and R. DeSalle. (1995). Elision: A method for accommodating multiple molecular sequence alignments with alignment-ambiguous sites. Mol. Phyl. Evol. **4**: 1-9.

Wheeler, W.C. and R.L. Honeycutt. (1988). Paired sequence difference in ribosomal RNA's: Evolutionary and phylogenetic implications. Mol. Biol. Evol. **5**: 90-96.

White, T.J., T. Bruns, S. Lee and J. Taylor. (1990). Chapter 38. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. pp. 315-322. *In*: Innis, M.A., D.H. Gelfand, J.J. Sninsky and T.J. White. (Eds.), PCR Protocols: A Guide to Methods and Applications. Academic Press Inc., San Diego, California.

Wilcox, L.W., L.A. Lewis, P.A. Fuerst and G.L. Floyd. (1992). Assessing the relationship of autosporic and zooporic chlorococcalean green algae with 18S rDNA sequence data. J. Phycol. **28**: 381-386.

Woese, C.R. (1987). Bacterial evolution. Microbiol. Rev. **51**: 221-271.

Woese, C.R., L. Achenbach, P. Rouviere, and L. Mandelco. (1991). Archaeal phylogeny: reexamination of the phylogenetic position of *Archaeoglobus fulgidus* in light of certain composition-induced artifacts. System. Appl. Microbiol. **14**: 364-371.

Woese, C.R., R. Gutell, R. Gupta and H.F. Noller. (1983). Detailed analysis of the higher-order structure of 16S-like ribosomal ribonucleic acids. Microbiol. Rev. **47**: 621-669.

Woese, C.R., L.J. Magrum, R. Gupta, R.B. Siegel, D.A. Stahl, J. Kop, N. Crawford, J. Brosius, R. Gutell, J.J. Hogan and H.F. Noller. (1980). Secondary structure model for bacterial 16S ribosomal RNA: Phylogenetic, enzymatic and chemical evidence. Nuc. Acids Res. **8**: 2275-2293.

Wolfe, K.H.. M. Gouy, Y.-W. Yang, P.M. Sharp and W.-H. Li. (1989). Date of the monocot-dicot divergence estimated from chloroplast DNA sequence data. Proc. Natl. Acad. Sci. USA **86**: 6201-6205.

Yang, Z. (1994). Estimating the pattern of nucleotide substitution. J. Mol. Evol. **39**: 105-111.

Yang, Z. (1995). Evaluation of several methods for estimating phylogenetic trees when substitution rates differ over nucleotide sites. J. Mol. Evol. **40**: 689-697.

Yang, Z. (1997). Letter to the Editor: How often do wrong models produce better phylogenies? Mol. Biol. Evol. **14**: 105-108.

Yang, Z. and D. Roberts. (1995). On the use of nucleic acid sequences to infer early branchings in the tree of life. Mol. Biol. Evol. **12**: 451-458.

Zechman, F.W., E.C. Theriot, E.A. Zimmer and R.L. Chapman. (1990). Phylogeny of the Ulvophycean (Chlorophyta): Cladistic analysis of nuclear-encoded rRNA sequence data. J. Phycol. **26**: 700-710.

Zimmer, E.A., R.K. Hamby, M.L. Arnold, D.A. LeBlanc and E.C. Theriot. (1989). Ribosomal RNA phylogenies and flowering plant evolution. pp. 205-214. *In*: B. Fernholm, K. Bremer and H. Jornvall (Eds.), The Heirarchy of Life. Elsevier, Amsterdam.

Zwieb, C., C. Glotz and R. Brimacombe. (1981). Secondary structure comparisons between small subunit ribosomal RNA molecules from six different species. Nuc. Acids Res. **9**: 3621-3640.

The Inference of Phylogenetic Relationships among the Main Lineages of Terrestrial Plants, With Emphasis on the Positions of the Major Bryophyte Groups, Using Small-Subunit Ribosomal RNA Gene Sequences

Volume II

A Thesis
Submitted to the Faculty of Graduate Studies and Research
in Partial Fulfillment of the Requirements
for the Degree of
Master of Science
in Biology
University of Regina

by
Nick A. Antonishyn
Regina, Saskatchewan
September, 1997

TABLE OF CONTENTS

Volume II

APPENDIX A: Raw Data

Table 1. Primers

Name	Sequence[a]	Primer Ln	Size (bp)[b]	Tm (°C)[c]
NS1	GTA GTT ATA TGC TTG TCT C	19	521	45.4
NS2	GGC TGC TGG CAC CAG ACT TGC	21		74.7
NS3	GCA AGT CTG GTG CCA GCA GCC	21	566	74.7
NS4	CTT CCG TGA ATT CTT TTA AG	20		63.6
NS5	AAC TTA AAG GAA TTG ACG GAA	22	628	62.8
NS7	GCA ATA ACA GGT CTG TGA TGC	21	337	62.7
NS8	TCC GCA GGT TCA CCT ACG GA	20		70.7

[a] Sequences are written 5'-3'. All odd-numbered primers are 5' primers; even numbers indicate 3' primers.

[b] Product sizes are approximate based on the 18S rDNA gene of *Physcomitrella patens* . the size of the region amplified is the product size minus the primers.

[c] T_m's were calculated by the neighbor-joining method.

Figure 1.

Locations of primers on the 18S rDNA gene.

The arrowheads represent the 3' end of each primer.

Primer	Location*
NS1	20-38
NS2	560-580
NS3	560-580
NS4	1146-1165
NS5	1143-1164
NS7	1437-1456
NS8	1794-1814

* location is identified with respect to *Physcomitrella patens* (X80986)

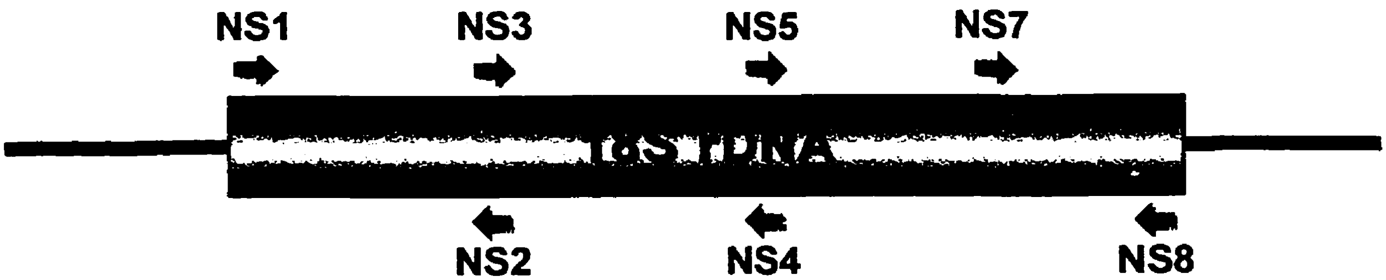

NS1
NS3
NS5
NS7
18S rDNA
NS2
NS4
NS8

Figure 2.

Photograph of NS1-NS8 PCR products subsequently used as templates for semi-nested and nested PCRs.

NS1-NS8 PCR products used as template for subsequent PCRs were sized using electrophoresis on an 1% agarose gel; stained with ethidium bromide and visualized with UV (312nm) light. The image was captured on Polaroid 667 film.

The expected amplicon size ~1800 bp.

Lane	Content
M	100 bp DNA Ladder
1	*Pteris vittata*
2	*Physcomitrella patens*
3	*Notophylas breutelu*
4	*Megaceros aenigmaticus*
5	*Sphagnum palustre*

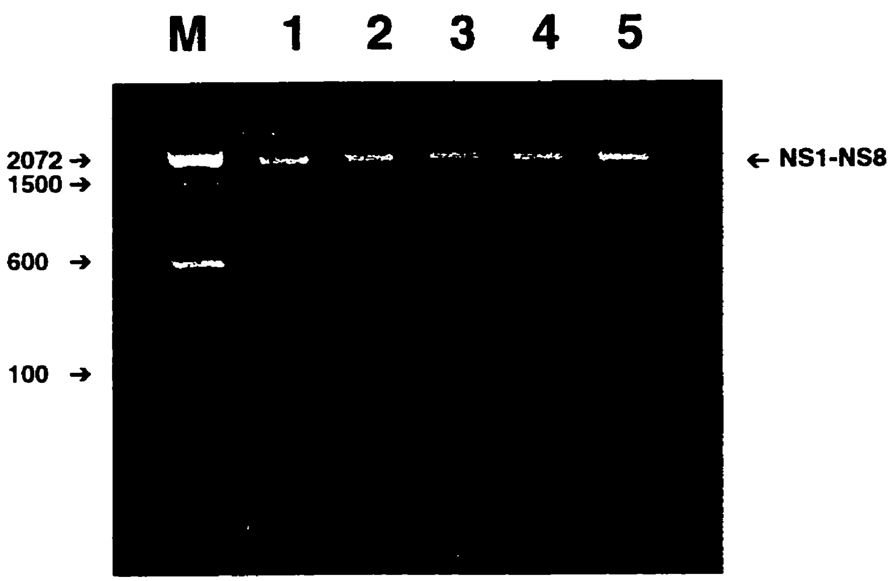

M
1
2
3
4
5
2072 →
1500 →
600 →
100 →
← NS1-NS8

Figure 3.

Photographs of semi-nested and nested PCR products subsequently used as sequencing templates.

Semi-nested and nested PCR products using NS1-NS8 amplicon as template were sized using electrophoresis on 1.6% agarose gels; stained with ethidium bromide and visualized with UV (312nm) light. Images were captured on Polaroid 667 film.

Photo	Taxa
a	*Physcomitrella patens*
b	*Sphagnum palustre*
c	*Megaceros aenigmaticus*
d	*Notophylas breutelu*
e	*Pteris vittata*

Lane	Content
M	100 bp DNA Ladder
1	NS1-NS2 PCR product (expected size ~ 561 bp)
2	NS1-NS8; no DNA reamplification control
3	NS3-NS4 PCR product (expected size ~ 607 bp)
4	NS1-NS8; no DNA reamplification control
5	NS5-NS8 PCR product (expected size ~ 670 bp)
6	NS1-NS8; no DNA reamplification control
7	NS7-NS8 PCR product (expected size ~ 378 bp)
8	NS1-NS8; no DNA reamplification control

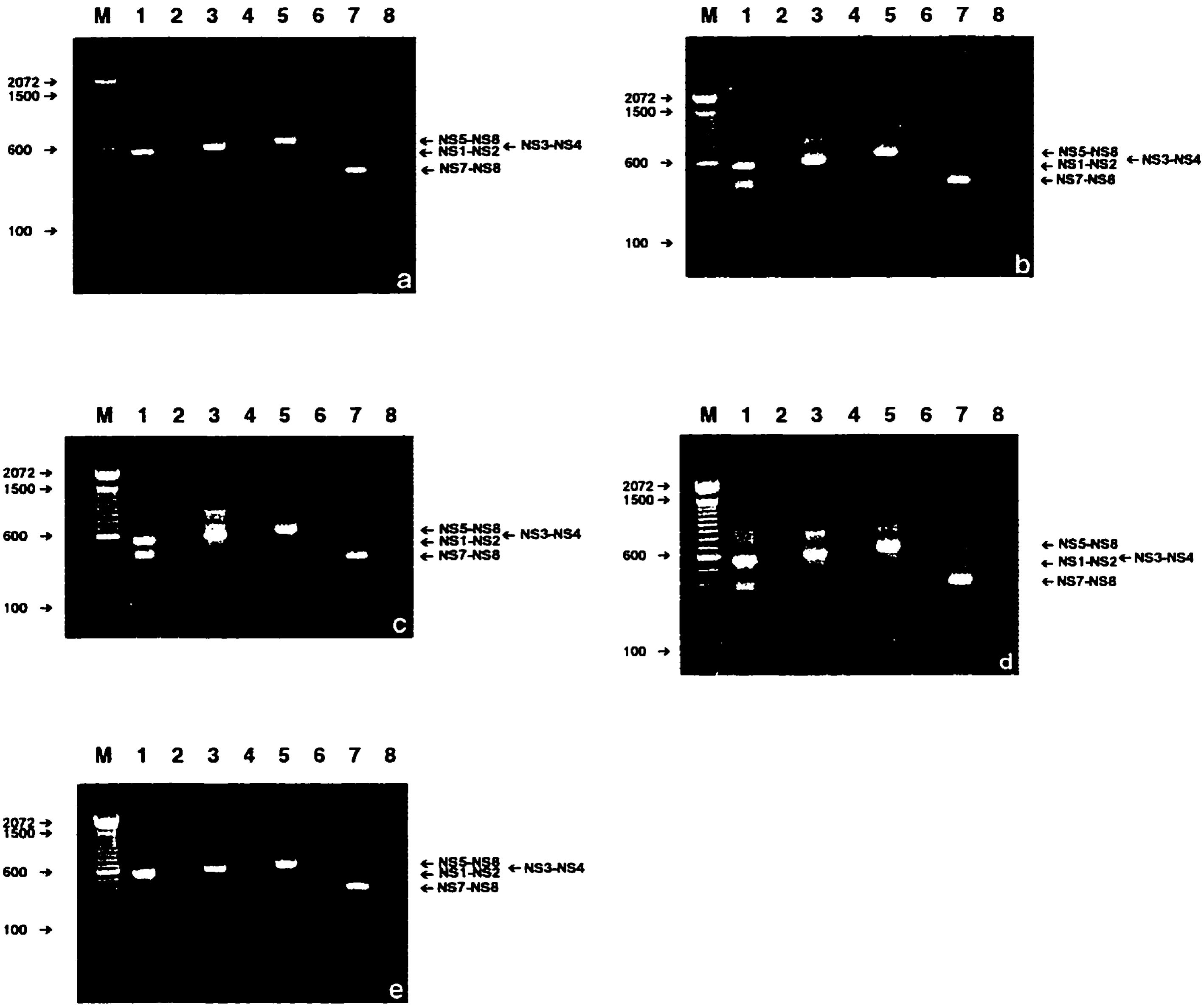

M 1 2 3 4 5 6 7 8
2072
1500
600
100
NS5-NS8
NS1-NS2
NS3-NS4
NS7-NS8
a
b
c
d
e

Figure 4.

Typical electropherogram.

Generated by analyzing gel images captured on the ABI 377 DNA Sequencer. The electropherograms were analyzed using ABI Prism DNA sequencing analysis software (version 2.1.1). The electropherograms represent 520 bp of double-stranded sequence data of the 5' portion of the 18S rDNA gene for *Physcomitrella patens.*

02. NS1.1 is the forward strand, Page 10
04. NS2.1 is the reverse strand, Page 11

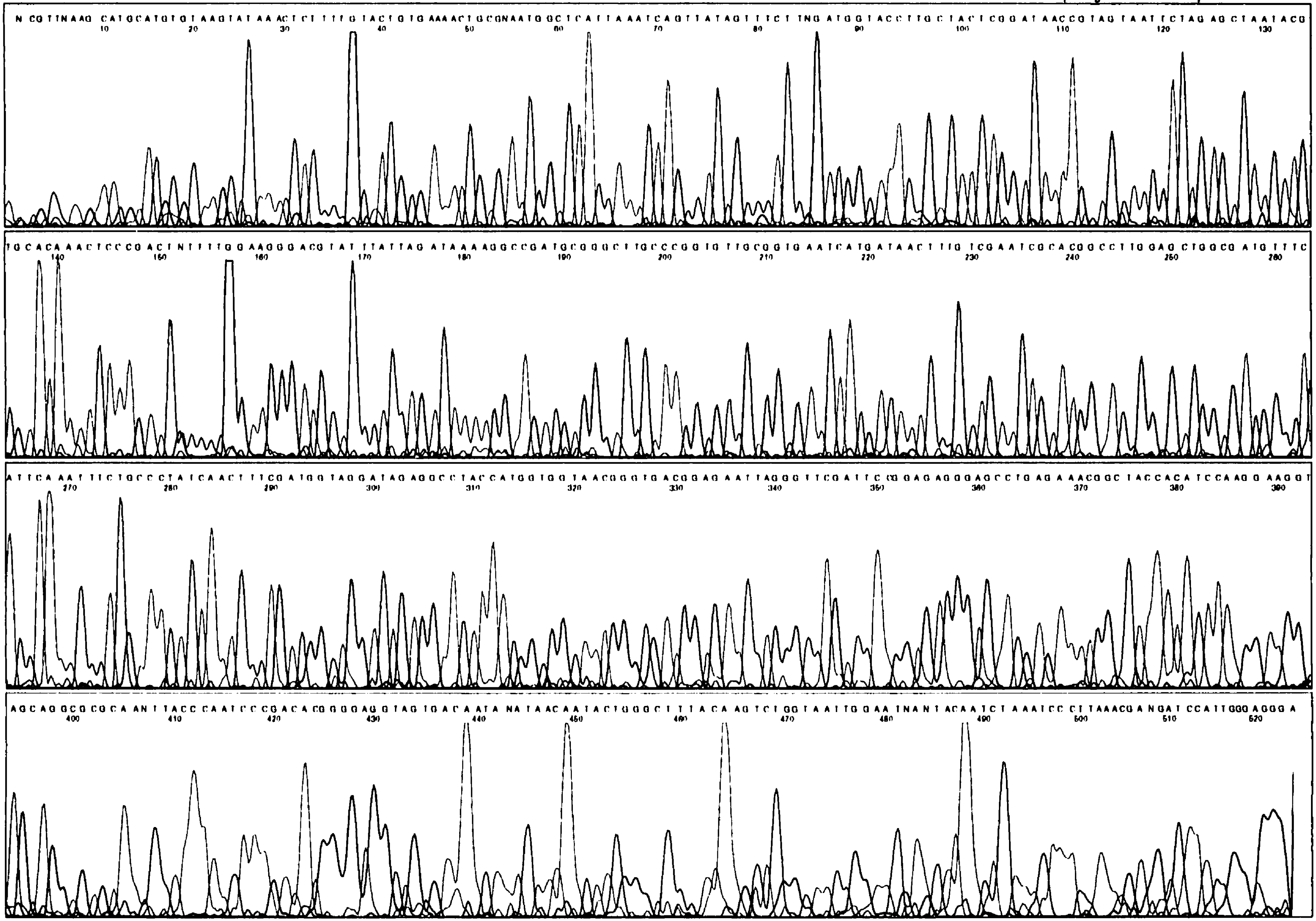
ABI PRISM

Model 377
Version 2.1.1

02•NS1.1
PATENS 1-2/1.5 1 in 5 dilutio
NS1
Lane 2

Signal G:307 A:206 T:138 C:61
DT4%Ac{A Set-AnyPrimer}
377-95020199
Points 950 to 5919   Base 1: 950

Sun, Apr 13, 1997 2:10 PM
Mon, Oct 2, 1995 1:02 AM
Spacing: 10.39 SemiAdaptive



ABI PRISM

Model 377
Version 2.1.1

04•NS2.1
PATENS 1-2/1.5 1 in 5 dilutio
NS2
Lane 4

Signal G:291 A:294 T:273 C:154
DT4%Ac{A Set-AnyPrimer}
377-95020199
Points 962 to 5907 Base 1: 962

Mon, Oct 2, 1995 10:19 AM
Mon, Oct 2, 1995 1:02 AM
Spacing: 10.40 SemiAdaptive

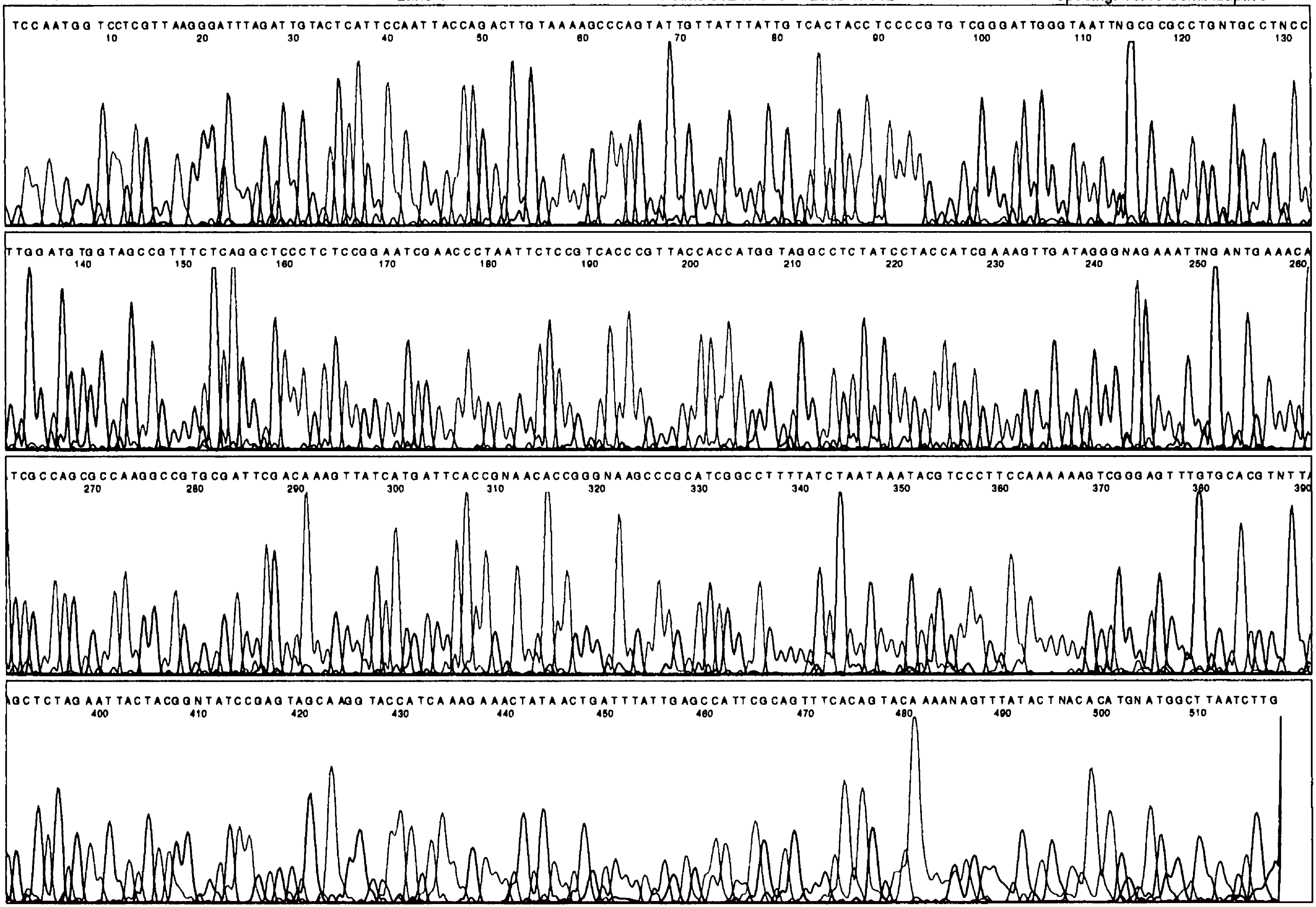


Figure 5.

18S rDNA sequence data for *Physcomitrella patens*.

The entire gene is displayed with "N" showing unsequenced regions.
The sequence was determined by double-stranded cycle sequencing using the primers listed in Table 1 (Page 2).

Base Usage

Code	Count	%
A	429	24
C	347	19
G	466	26
T	471	26
N	104	5
TOTAL	1818	

10	20	30	40	50	60
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNAA	AGATTAAGCC	ATGCATGTGT
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNTT	TCTAATTCGG	TACGTACACA
70	80	90	100	110	120
AAGTATAAAC	TCTTTTGTAC	TGTGAAACTG	CGAATGGCTC	ATTAAATCAG	TTATAGTTTC
TTCATATTTG	AGAAAACATG	ACACTTTGAC	GCTTACCGAG	TAATTTAGTC	AATATCAAAG
130	140	150	160	170	180
TTTGATGGTA	CCTTGCTACT	CGGATAACCG	TAGTAATTCT	AGAGCTAATA	CGTGCACAAA
AAACTACCAT	GGAACGATGA	GCCTATTGGC	ATCATTAAGA	TCTCGATTAT	GCACGTGTTT
190	200	210	220	230	240
CTCCCGACTT	TTTTGGAAGG	GACGTATTTA	TTAGATAAAA	GGCCGATGCG	GGCTTGCCCG
GAGGGCTGAA	AAAACCTTCC	CTGCATAAAT	AATCTATTTT	CCGGCTACGC	CCGAACGGGC
250	260	270	280	290	300
GTGTTGCGGT	GAATCATGAT	AACTTTGTCG	AATCGCACGG	CCTTGGCGCT	GGCGATGTTT
CACAACGCCA	CTTAGTACTA	TTGAAACAGC	TTAGCGTGCC	GGAACCGCGA	CCGCTACAAA
310	320	330	340	350	360
CATTCAAATT	TCTGCCCTAT	CAACTTTCGA	TGGTAGGATA	GAGGCCTACC	ATGGTGGTAA
GTAAGTTTAA	AGACGGGATA	GTTGAAAGCT	ACCATCCTAT	CTCCGGATGG	TACCACCATT
370	380	390	400	410	420
CGGGTGACGG	AGAATTAGGG	TTCGATTCCG	GAGAGGGAGC	CTGAGAAACG	GCTACCACAT
GCCCACTGCC	TCTTAATCCC	AAGCTAAGGC	CTCTCCCTCG	GACTCTTTGC	CGATGGTGTA
430	440	450	460	470	480
CCAAGGAAGG	CAGCAGGCGC	GCAAATTACC	CAATCCCGAC	ACGGGGAGGT	AGTGACAATA
GGTTCCTTCC	GTCGTCCGCG	CGTTTAATGG	GTTAGGGCTG	TGCCCCTCCA	TCACTGTTAT
490	500	510	520	530	540
AATAACAATA	CTGGGCTTTT	ACAAGTCTGG	TAATTGGAAT	GAGTACAATC	TAAATCCCTT
TTATTGTTAT	GACCCGAAAA	TGTTCAGACC	ATTAACCTTA	CTCATGTTAG	ATTTAGGGAA
550	560	570	580	590	600
AACGAGGATC	CATTGGAGGN	NNNNNNNNNN	NNNNNNNNNN	GCGGTAATTC	CAGCTCCAAT
TTGCTCCTAG	GTAACCTCCN	NNNNNNNNNN	NNNNNNNNNN	CGCCATTAAG	GTCGAGGTTA
610	620	630	640	650	660
AGCGTATATT	TAAGTTGTTG	CAGTTAAAAA	GCTCGTAGTT	GGATCTTGGG	TCGGGGGGAG
TCGCATATAA	ATTCAACAAC	GTCAATTTTT	CGAGCATCAA	CCTAGAACCC	AGCCCCCCTC
670	680	690	700	710	720
CGGTCCGCCC	CTTGTGGGTG	TGCACTGGTC	CACTCGGCCT	TCTTGCCGGG	GACGCGCTCC
GCCAGGCGGG	GAACACCCAC	ACGTGACCAG	GTGAGCCGGA	AGAACGGCCC	CTGCGCGAGG
730	740	750	760	770	780
TGGTTTTAAT	TAATCGGGAC	GCGGAGTCGG	CGATGTTACT	TTGAAAAAAT	TAGAGTGCTC
ACCAAAATTA	ATTAGCCCTG	CGCCTCAGCC	GCTACAATGA	AACTTTTTTA	ATCTCACGAG
790	800	810	820	830	840
AAAGCAAGCC	TATGCTCTGA	ATACATTAGC	ATGGAATAAC	GTGATAGGAC	TCTGGTCCTG
TTTCGTTCGG	ATACGAGACT	TATGTAATCG	TACCTTATTG	CACTATCCTG	AGACCAGGAC
850	860	870	880	890	900
TTCGTGTTGG	TCTTCGGGAC	CGGAGTAATG	ATTAATAGGG	ACGGTTGGGG	GCATTCGTAT
AAGCACAACC	AGAAGCCCTG	GCCTCATTAC	TAATTATCCC	TGCCAACCCC	CGTAAGCATA

910	920	930	940	950	960
TTCATTGTCA	GAGGTGAAAT	TCTTGGATTT	ATGAAAGACG	AACTTCTGCG	AAAGCATTTG
AAGTAACAGT	CTCCACTTTA	AGAACCTAAA	TACTTTCTGC	TTGAAGACGC	TTTCGTAAAC
970	980	990	1000	1010	1020
CCAAGGATGT	TTTCATTAAT	CAAGAACGAA	AGTTGGGGGC	TCGAAGACGA	TCAGATACCG
GGTTCCTACA	AAAGTAATTA	GTTCTTGCTT	TCAACCCCCG	AGCTTCTGCT	AGTCTATGGC
1030	1040	1050	1060	1070	1080
TCCTAGTCTC	AACCATAAAC	GATGCCGACT	AGGGATTGGC	GGATGTTACT	TTGATGACTC
AGGATCAGAG	TTGGTATTTG	CTACGGCTGA	TCCCTAACCG	CCTACAATGA	AACTACTGAG
1090	1100	1110	1120	1130	1140
CGCCAGCACC	TTATGAGAAA	TCAAAGTTTT	TNGGTTCCGG	GGNGAGTATG	NTCGCAAGNC
GCGGTCGTGG	AATACTCTTT	AGTTTCAAAA	ANCCAAGGCC	CCNCTCATAC	NAGCGTTCNG
1150	1160	1170	1180	1190	1200
TGAANNNNNN	NNNNNNNNNN	NNNNNNGCAC	NACCAGGAGT	GGAGCTGCGG	CTTAATTTGA
ACTTNNNNNN	NNNNNNNNNN	NNNNNNCGTG	NTGGTCCTCA	CCTCGACGCC	GAATTAAACT
1210	1220	1230	1240	1250	1260
CTCAACACGG	GGAAACTTAC	CAGGTCCAGA	CATAGTAAGG	ATTGACAGAT	TGAGAGCTCT
GAGTTGTGCC	CCTTTGAATG	GTCCAGGTCT	GTATCATTCC	TAACTGTCTA	ACTCTCGAGA
1270	1280	1290	1300	1310	1320
TTCTTGATTC	TATGGGTGGT	GGTGCATGGC	CGTTCTTAGT	TGGTGGAGTG	ATTTGTCTGG
AAGAACTAAG	ATACCCACCA	CCACGTACCG	GCAAGAATCA	ACCACCTCAC	TAAACAGACC
1330	1340	1350	1360	1370	1380
TTAATTCCGT	TAACGAACGA	GACCTCAGCC	TGCTAACTAG	TTACGCGAAG	GATTTTTTCC
AATTAAGGCA	ATTGCTTGCT	CTGGAGTCGG	ACGATTGATC	AATGCGCTTC	CTAAAAAAGG
1390	1400	1410	1420	1430	1440
TTTGCGGCCA	ACTTCTTAGA	GGGACTATCG	GCGTCTAGCC	GATGGAAGTT	TGAGGCAATA
AAACGCCGGT	TGAAGAATCT	CCCTGATAGC	CGCAGATCGG	CTACCTTCAA	ACTCCGTTAT
1450	1460	1470	1480	1490	1500
ACAGGTCTGT	GATGCCCTTA	GATGTTCTGG	GCCGCACGCG	CGCTACACTG	ATGAATTCAA
TGTCCAGACA	CTACGGGAAT	CTACAAGACC	CGGCGTGCGC	GCGATGTGAC	TACTTAAGTT
1510	1520	1530	1540	1550	1560
CGAGTTTATA	ACCTGGACCG	ATAGGTCTGG	GTAATCTTTT	GAAATTTCAT	CGTGATGGGG
GCTCAAATAT	TGGACCTGGC	TATCCAGACC	CATTAGAAAA	CTTTAAAGTA	GCACTACCCC
1570	1580	1590	1600	1610	1620
ATAGATCATT	GCAATTATTG	ATCTTCAACG	AGGAATTCCT	AGTAAGCGCG	AGTCATCAGC
TATCTAGTAA	CGTTAATAAC	TAGAAGTTGC	TCCTTAAGGA	TCATTCGCGC	TCAGTAGTCG
1630	1640	1650	1660	1670	1680
TCGCGTTGAC	TACGTCCCTG	CCCTTTGTAC	ACACCGCCCG	TCGCTCCTAC	CGATTGAATG
AGCGCAACTG	ATGCAGGGAC	GGGAAACATG	TGTGGCGGGC	AGCGAGGATG	GCTAACTTAC
1690	1700	1710	1720	1730	1740
GTCCGGTGAA	GTTTTCGGAT	TGCGGCGATG	CCGGCGGTTC	GCCGCCGGTG	ACGTTGGGAG
CAGGCCACTT	CAAAAGCCTA	ACGCCGCTAC	GGCCGCCAAG	CGGCGGCCAC	TGCAACCCTC
1750	1760	1770	1780	1790	1800
AAGTTCATTA	AACCTTATCA	TTTAGAGGAA	GGAGAAGTCG	TAACAAGGTT	TCCGTAGGTN
TTCAAGTAAT	TTGGAATAGT	AAATCTCCTT	CCTCTTCAGC	ATTGTTCCAA	AGGCATCCAN
1810	1820	1830	1840	1850	1860
NNNNNNNNNN	NNNNNNN...	....	....	....	....
NNNNNNNNNN	NNNNNNN...	....	....	....	....

Figure 6.

18S rDNA sequence data for *Megaceros aenigmaticus*.

The entire gene is displayed with "N" showing unsequenced regions.
The sequence was determined by double-stranded cycle sequencing using the primers listed in Table 1 (Page 2).

Base Usage

Code	Count	%
A	448	25
C	344	19
G	457	25
T	464	25
N	111	6
TOTAL	1824	

10	20	30	40	50	60
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNA	AGATNNAGCC	ATGCATGTGT
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNT	TCTANNTCGG	TACGTACACA
70	80	90	100	110	120
AAGTATAAAC	ACTTTTGTAC	TGTGAAACTG	CGAATGGCTC	ATTAAATCAG	TTATAGTTTC
TTCATATTTG	TGAAAACATG	ACACTTTGAC	GCTTACCGAG	TAATTTAGTC	AATATCAAAG
130	140	150	160	170	180
TTTGATGGTA	CCTTGCTACT	CGGATAACCG	TAGTAATTCT	AGAGCTAATA	CGTGCAACAA
AAACTACCAT	GGAACGATGA	GCCTATTGGC	ATCATTAAGA	TCTCGATTAT	GCACGTTGTT
190	200	210	220	230	240
CTCCCGACTT	CTGGGANGGG	GCGTATTTAT	TAGATATAAG	GCCGATATGG	GTCTTGATCC
GAGGGCTGAA	GACCCTNCCC	CGCATAAATA	ATCTATATTC	CGGCTATACC	CAGAACTAGG
250	260	270	280	290	300
CGGTATTACG	GTGAATCATG	ATAACTCCTC	GAATGCTCAA	CGGCCTCTGG	CGCTGGCGAT
GCCATAATGC	CACTTAGTAC	TATTGAGGAG	CTTACGAGTT	GCCGGAGACC	GCGACCGCTA
310	320	330	340	350	360
ATTTCATTCA	AATTTCTGCC	CTATATAACT	TTCGATGGTA	GGATAGAGGC	CTACCATGGT
TAAAGTAAGT	TTAAAGACGG	GATATATTGA	AAGCTACCAT	CCTATCTCCG	GATGGTACCA
370	380	390	400	410	420
GGTAACGGGT	GACGGAGAAT	TAGGGTTCGA	TTCCGGAGAG	GGAGCCTGAG	AAACGGCTAC
CCATTGCCCA	CTGCCTCTTA	ATCCCAAGCT	AAGGCCTCTC	CCTCGGACTC	TTTGCCGATG
430	440	450	460	470	480
CACATCCAAG	GAAGGCAGCA	GGCGCGCAAA	TTACCCAATC	CCGACACGGG	GAGGTAGTGA
GTGTAGGTTC	CTTCCGTCGT	CCGCGCGTTT	AATGGGTTAG	GGCTGTGCCC	CTCCATCACT
490	500	510	520	530	540
CAATAAATAA	CAATACTGGG	CTTTTACAAG	TCTGGTAATT	GGAATGAGTA	CAATCTAAAT
GTTATTTATT	GTTATGACCC	GAAAATGTTC	AGACCATTAA	CCTTACTCAT	GTTAGATTTA
550	560	570	580	590	600
CCCTNAACGA	GGATCCATTG	GAGGNNNNNN	NNNNNNNNNN	NNNNNGCGGT	AATTCCAGCT
GGGANTTGCT	CCTAGGTAAC	CTCCNNNNNN	NNNNNNNNNN	NNNNNCGCCA	TTAAGGTCGA
610	620	630	640	650	660
CCNATAGCGN	NTAATAAAGT	TGTTGCAGTT	AAAAAGCTCG	TAGTTGGATC	TCGGGGTGGG
GGNTATCGCN	NATTATTTCA	ACAACGTCAA	TTTTTCGAGC	ATCAACCTAG	AGCCCCACCC
670	680	690	700	710	720
GTGACTGGTC	CGCCTCTCAA	GGTGTGGTAC	TGGGTGACTC	CANTCCTTCT	GGTCGGGGAC
CACTGACCAG	GCGGAGAGTT	CCACACCATG	ACCCACTGAG	GTNAGGAAGA	CCAGCCCCTG
730	740	750	760	770	780
GATGCTCCTG	GACTAAACTG	CCTGGGACGC	GGAGTCGACG	ATGTTACTTT	GAAAAAATTA
CTACGAGGAC	CTGATTTGAC	GGACCCTGCG	CCTCAGCTGC	TACAATGAAA	CTTTTTTAAT
790	800	810	820	830	840
GAGTGCTCAA	AGCAAGCCTC	ATGCTCTGAA	TACATTAGCA	TGGAATAACG	TGATAGGACT
CTCACGAGTT	TCGTTCGGAG	TACGAGACTT	ATGTAATCGT	ACCTTATTGC	ACTATCCTGA
850	860	870	880	890	900
CCTGGTCCTA	TTGTGTTGNT	CTACGGGATC	GGAGTAATGA	TTAATAGGGA	CAGTTGGGGG
GGACCAGGAT	AACACAACNA	GATGCCCTAG	CCTCATTACT	AATTATCCCT	GTCAACCCCC

910	920	930	940	950	960
CATTCGTATT	TCATTGTCAG	AGGTGAAATT	CTTGGATTTA	TGAAAGACGA	ACTTCTGCGA
GTAAGCATAA	AGTAACAGTC	TCCACTTTAA	GAACCTAAAT	ACTTTCTGCT	TGAAGACGCT
970	980	990	1000	1010	1020
AAGCATTTGC	CAAGGCATGT	TTTCATTAAT	CAAGAACGAA	AGTTGGGGGC	TCGAAGACGA
TTCGTAAACG	GTTCCGTACA	AAAGTAATTA	GTTCTTGCTT	TCAACCCCCG	AGCTTCTGCT
1030	1040	1050	1060	1070	1080
TCAGATACCG	TCCTAGTCTC	AACCATAAAC	GATGCCGACT	AGGGATTGGC	GGATGTTAAT
AGTCTATGGC	AGGATCAGAG	TTGGTATTTG	CTACGGCTGA	TCCCTAACCG	CCTACAATTA
1090	1100	1110	1120	1130	1140
TAGATGACTC	CGCCAGCACC	TTATGAGAAA	TCAAAGTTTT	TGGNTTCCGG	GGGNAGTATG
ATCTACTGAG	GCGGTCGTGG	AATACTCTTT	AGTTTCAAAA	ACCNAAGGCC	CCCNTCATAC
1150	1160	1170	1180	1190	1200
NTCGCAAGNC	TGAANTNNNN	NNNNNNNNNN	NNNNNNGNAN	CACNAGGAGT	GGAGCTGCGG
NAGCGTTCNG	ACTTNANNNN	NNNNNNNNNN	NNNNNNCNTN	GTGNTCCTCA	CCTCGACGCC
1210	1220	1230	1240	1250	1260
CTTAATTTGA	CTCAACACNG	GGAAACTTAC	CAGGTCCAGA	CATAGTAAGG	ATTGACAGAT
GAATTAAACT	GAGTTGTGNC	CCTTTGAATG	GTCCAGGTCT	GTATCATTCC	TAACTGTCTA
1270	1280	1290	1300	1310	1320
TGAGAGCTCT	TTCTTGATTC	TATGGGTGGT	GGTGCATGGC	CGTTCTTAGT	TGGTGGAGTG
ACTCTCGAGA	AAGAACTAAG	ATACCCACCA	CCACGTACCG	GCAAGAATCA	ACCACCTCAC
1330	1340	1350	1360	1370	1380
ATTTGTCTGG	TTAATTCCGT	TAACGAACGA	GACCTCAGCC	TGCTAACTAG	TTACACGAAG
TAAACAGACC	AATTAAGGCA	ATTGCTTGCT	CTGGAGTCGG	ACGATTGATC	AATGTGCTTC
1390	1400	1410	1420	1430	1440
AATCTTCTTC	GTGGCCAACT	TCTTAGAGGG	ACTATTTGCG	TCTAGCGAAT	GGAAGTTTGA
TTAGAAGAAG	CACCGGTTGA	AGAATCTCCC	TGATAAACGC	AGATCGCTTA	CCTTCAAACT
1450	1460	1470	1480	1490	1500
GGCAATAACA	GGTCTGTGAT	GCCCTTAGAT	GTTCTGGGCC	GCACGCGCGC	TACACTGATG
CCGTTATTGT	CCAGACACTA	CGGGAATCTA	CAAGACCCGG	CGTGCGCGCG	ATGTGACTAC
1510	1520	1530	1540	1550	1560
AATTCAACGA	GTTTATAACC	TGGGCCGAGA	GGTTTGGGTA	ATCTTTTGAA	ATTTCATCGT
TTAAGTTGCT	CAAATATTGG	ACCCGGCTCT	CCAAACCCAT	TAGAAAACTT	TAAAGTAGCA
1570	1580	1590	1600	1610	1620
GATGGGGATA	GATCATTGCA	ATTATTGATC	TTCAACGAGG	AATTCCTAGT	AAGCGCGAGT
CTACCCCTAT	CTAGTAACGT	TAATAACTAG	AAGTTGCTCC	TTAAGGATCA	TTCGCGCTCA
1630	1640	1650	1660	1670	1680
CATCAGCTCG	CGTTGACTAC	GTCCCTGCCC	TTTGTACACA	CCGCCCGTCG	CTCCTACCGA
GTAGTCGAGC	GCAACTGATG	CAGGGACGGG	AAACATGTGT	GGCGGGCAGC	GAGGATGGCT
1690	1700	1710	1720	1730	1740
TTGAATGGTC	CGGTGAAGTT	TTCGGATTGC	GGCGACACCG	GCGGGTAACT	GCCGGCGACG
AACTTACCAG	GCCACTTCAA	AAGCCTAACG	CCGCTGTGGC	CGCCCATTGA	CGGCCGCTGC
1750	1760	1770	1780	1790	1800
TTGTGAGAAG	TTCATTAAAC	CTTATCATTT	AGAGGAAGGA	GAAGTCGTAA	CAAGGTTTCC
AACACTCTTC	AAGTAATTTG	GAATAGTAAA	TCTCCTTCCT	CTTCAGCATT	GTTCCAAAGG
1810	1820	1830	1840	1850	1860
GTAGGTGANN	CTGNNNNNNN	NNNN......	....	....	....
CATCCACTNN	GACNNNNNNN	NNNN......	....	....	....

Figure 7.

18S rDNA sequence data for *Notophylas breutelu.*

The entire gene is displayed with "N" showing unsequenced regions.
The sequence was determined by double-stranded cycle sequencing using the primers listed in Table 1 (Page 2).

Base Usage

Code	Count	%
A	455	25
C	359	20
G	473	26
T	444	24
N	102	5
TOTAL	1833	

10	20	30	40	50	60
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNAA	AGATNAAGCC	ATGCATGTGT
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNTT	TCTANTTCGG	TACGTACACA
70	80	90	100	110	120
AAGTATAAAC	TCTTATGTAC	TGAGAAACTG	AGAATGGCTC	ATTAAATCAG	TGATAGTATC
TTCATATTTG	AGAATACATG	ACTCTTTGAC	TCTTACCGAG	TAATTTAGTC	ACTATCATAG
130	140	150	160	170	180
TGAGAGGGCA	CCTCGCTACG	GCGGATAACC	GGAGATAATT	CTAGAGCTAA	TACGTGCAAA
ACTCTCCCGT	GGAGCGATGC	CGCCTATTGG	CCTCTATTAA	GATCTCGATT	ATGCACGTTT
190	200	210	220	230	240
AACTCCCGAC	TCTTGGGGGG	GAAGGGTTTT	TTTTAGATAA	AGAGGACGAT	GCGGGCTTGA
TTGAGGGCTG	AGAACCCCCC	CTTCCCAAAA	AAAATCTATT	TCTCCTGCTA	CGCCCGAACT
250	260	270	280	290	300
CCCGGTATTC	ACGGTGAATC	ATGGATAACT	CCTCGAATCG	CACGGCCCTG	GCGCTGGCGA
GGGCCATAAG	TGCCACTTAG	TACCTATTGA	GGAGCTTAGC	GTGCCGGGAC	CGCGACCGCT
310	320	330	340	350	360
TGTTTCATTC	AAATTCCTGC	CCTATCAACT	TTCGATGGTA	GGATAGAGGC	CTACCATGGT
ACAAAGTAAG	TTTAAGGACG	GGATAGTTGA	AAGCTACCAT	CCTATCTCCG	GATGGTACCA
370	380	390	400	410	420
GGTAACGGGT	GACGGAGAAT	TAGGGTTCGA	TTCCGGAGAG	GGAACCTGAG	AAACGGCTAC
CCATTGCCCA	CTGCCTCTTA	ATCCCAAGCT	AAGGCCTCTC	CCTTGGACTC	TTTGCCGATG
430	440	450	460	470	480
CACATCCAAG	GAAGGCAGCA	GGCGCCCAAA	TTACCCAATC	CCGACACGGG	GAGGTAGTGA
GTGTAGGTTC	CTTCCGTCGT	CCGCGGGTTT	AATGGGTTAG	GGCTGTGCCC	CTCCATCACT
490	500	510	520	530	540
CAATAAATAA	CAATACTGGG	CCTTTACAAG	TCCTGGTAAT	TGGAATGAGT	ACAATCTAAA
GTTATTTATT	GTTATGACCC	GGAAATGTTC	AGGACCATTA	ACCTTACTCA	TGTTAGATTT
550	560	570	580	590	600
TCCCTTAACG	AGGATCCATT	GGAGGNNNNN	NNNNNNNNNN	NNNNNNGCGG	TAATTCCAGC
AGGGAATTGC	TCCTAGGTAA	CCTCCNNNNN	NNNNNNNNNN	NNNNNNCGCC	ATTAAGGTCG
610	620	630	640	650	660
TCCAATAGCG	TACAATAAAG	TTGTTGCAGT	TAAAAAGGTC	GTAGTTGGAT	CTCGGGGCGG
AGGTTATCGC	ATGTTATTTC	AACAACGTCA	ATTTTTCCAG	CATCAACCTA	GAGCCCCGCC
670	680	690	700	710	720
GGTGATTGGT	CCGCCTCCNG	AGGGGTCTAC	TAGGGACCTC	ACCCCTCTCC	TCGGGAGCAT
CCACTAACCA	GGCGGAGGNC	TCCCCAGATG	ATCCCTGGAG	TGGGGAGAGG	AGCCCTCGTA
730	740	750	760	770	780
GCTCCTGTTC	TACCTTAGCT	TGGTACGGGG	AGTGCGACGA	TGTTTCTTTG	GAAAAAATTA
CGAGGACAAG	ATGGAATCGA	ACCATGCCCC	TCACGCTGCT	ACAAAGAAAC	CTTTTTTAAT
790	800	810	820	830	840
GGAGTTCTCA	AAGGAAGCCA	TCATGCTCTA	ATTACATAAG	AATGGATTAA	CGATTATAGG
CCTCAAGAGT	TTCCTTCGGT	AGTACGAGAT	TAATGTATTC	TTACCTAATT	GCTAATATCC
850	860	870	880	890	900
ACTCTGGTCC	TATTGGGTTG	GTCTCCGGGC	ATCGGAGTAA	TGATTAATAG	GGACAGTTGG
TGAGACCAGG	ATAACCCAAC	CAGAGGCCCG	TAGCCTCATT	ACTAATTATC	CCTGTCAACC

```
       910        920        930        940        950        960
GGGCATTCGT ATTTCGATTG TCAGAGGTGA AATTCTTGGA TTTATGAAAG ACGAACTTCT
CCCGTAAGCA TAAAGCTAAC AGTCTCCACT TTAAGAACCT AAATACTTTC TGCTTGAAGA

       970        980        990       1000       1010       1020
GCGAAAGCAT TTGCCAAGGA TGTTTTCATT AATCAAGAAC GAAAGTTGGG GGCTCGAAGA
CGCTTTCGTA AACGGTTCCT ACAAAAGTAA TTAGTTCTTG CTTTCAACCC CCGAGCTTCT

      1030       1040       1050       1060       1070       1080
CGATCAGATA CCGTCCTAGT CTCAACCATA AACGATGCCG ACTAGGGATT GGCGGGTGTT
GCTAGTCTAT GGCAGGATCA GAGTTGGTAT TTGCTACGGC TGATCCCTAA CCGCCCACAA

      1090       1100       1110       1120       1130       1140
AATAAGATTG ACCCCCCCGG CCACCCTTAT TGAAGAAACC AAAGTTTTTG GGTTCCGGGG
TTATTCTAAC TGGGGGGGCC GGTGGGAATA ACTTCTTTGG TTTCAAAAAC CCAAGGCCCC

      1150       1160       1170       1180       1190       1200
GATATGTTGC AAGCTGANNN NNNNNNNNNN NNNNNNNNNN GNANCACNAG GAGTGGAGCT
CTATACAACG TTCGACTNNN NNNNNNNNNN NNNNNNNNNN CNTNGTGNTC CTCACCTCGA

      1210       1220       1230       1240       1250       1260
GCGGCTTAAT TTGACTCAAC ACGGGGAAAC TCACCAGGTC CAGACATAGT AAGGATTGAC
CGCCGAATTA AACTGAGTTG TGCCCCTTTG AGTGGTCCAG GTCTGTATCA TTCCTAACTG

      1270       1280       1290       1300       1310       1320
AGATTGAGAG CTCTTTCTTG ATTCTATGGG TGGTGGTGCA TGGCCGTTCT TAGTTGGTGG
TCTAACTCTC GAGAAAGAAC TAAGATACCC ACCACCACGT ACCGGCAAGA ATCAACCACC

      1330       1340       1350       1360       1370       1380
AGTGATTTGT CTGGTTAATT CCGTTAACGA ACGAGACCTC AGCCTGCTAA CTAGTTACAC
TCACTAAACA GACCAATTAA GGCAATTGCT TGCTCTGGAG TCGGACGATT GATCAATGTG

      1390       1400       1410       1420       1430       1440
GAAGAACCTT CTGCGGGGTC AACTTCTTAG AGGGACTATT TGCGTCTAGT GAATAGAAGT
CTTCTTGGAA GACGCCCCAG TTGAAGAATC TCCCTGATAA ACGCAGATCA CTTATCTTCA

      1450       1460       1470       1480       1490       1500
TTGAGGAAAT AACAGGTCTG TGATGCCCTT AGATGTTCTG GGCCGCACGC GCGCTACACT
AACTCCTTTA TTGTCCAGAC ACTACGGGAA TCTACAAGAC CCGGCGTGCG CGCGATGTGA

      1510       1520       1530       1540       1550       1560
GATGAATTCA ACGAGTTTAT AACCTGGGCC GAGAGGTCTG GGTAATCTGC TGAAATTTCA
CTACTTAAGT TGCTCAAATA TTGGACCCGG CTCTCCAGAC CCATTAGACG ACTTTAAAGT

      1570       1580       1590       1600       1610       1620
TCGTGATGGG GATAGATCAT TGAAATTATT GCTCTCCAAC GAGGAATTCC TAGTAAGCGC
AGCACTACCC CTATCTAGTA ACTTTAATAA CGAGAGGTTG CTCCTTAAGG ATCATTCGCG

      1630       1640       1650       1660       1670       1680
GAATCATCAG CTCGCGTTGA CTACGTCCCT GCCCTTTGTA ACACACCGCC CGTCGTTCCT
CTTAGTAGTC GAGCGCAACT GATGCAGGGA CGGGAAACAT TGTGTGGCGG GCAGCAAGGA

      1690       1700       1710       1720       1730       1740
ACCGATTGAT TGGTCCGGGG AAGTTTTCGG ATTGGTGGCG ACACCGGGGG GTCACCGCCG
TGGCTAACTA ACCAGGCCCC TTCAAAAGCC TAACCACCGC TGTGGCCCCC CAGTGGCGGC

      1750       1760       1770       1780       1790       1800
GCGACGTTGT GAGAAGTTCA TCAACCCTTA TCATTTAGAG GAAGGAGAAG TCGTCGTAAC
CGCTGCAACA CTCTTCAAGT AGTTGGGAAT AGTAAATCTC CTTCCTCTTC AGCAGCATTG

      1810       1820       1830       1840       1850       1860
AAGGTTTCCG TAGGTGANCN NNNNNNNNNN NNN....... .......... ..........
TTCCAAAGGC ATCCACTNGN NNNNNNNNNN NNN....... .......... ..........
```

Figure 8.

18S rDNA sequence data for *Pteris vittata*.

The entire gene is displayed with "N" showing unsequenced regions.
The sequence was determined by double-stranded cycle sequencing using the primers listed in Table 1 (Page 2).

Base Usage

Code	Count	%
A	424	23
C	363	20
G	459	25
T	446	25
N	118	7
TOTAL	1810	

10	20	30	40	50	60
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNAA	AGNTTAAGCC	ATGCATGTGT
NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNNN	NNNNNNNNTT	TCNAATTCGG	TACGTACACA
70	80	90	100	110	120
AAGTATAAAC	TCTTTTGTAC	TGTGAAACTG	CGAATGGCTC	ATTAAATCAG	TTATAGTTTC
TTCATATTTG	AGAAAACATG	ACACTTTGAC	GCTTACCGAG	TAATTTAGTC	AATATCAAAG
130	140	150	160	170	180
TTTGATGGTA	CCTNGCTACT	CGGATAACCG	TAGTAATTCT	AGAGCTAATA	CGTGCACCAA
AAACTACCAT	GGANCGATGA	GCCTATTGGC	ATCATTAAGA	TCTCGATTAT	GCACGTGGTT
190	200	210	220	230	240
ATCCCGACTT	CTGGAAGGGA	CGCATTTATT	AGATAAAAGG	CCGATGCGGG	CTCGCCCGGT
TAGGGCTGAA	GACCTTCCCT	GCGTAAATAA	TCTATTTTCC	GGCTACGCCC	GAGCGGGCCA
250	260	270	280	290	300
AATGCGGTGA	ATCATGATAA	CTTCCCGAAT	CGCACGGCCT	TGGCGCCGGC	GATGCTTCAT
TTACGCCACT	TAGTACTATT	GAAGGGCTTA	GCGTGCCGGA	ACCGCGGCCG	CTACGAAGTA
310	320	330	340	350	360
TCAAATTTCT	GCCCTATCAA	CTTTCGATGG	TAGGATAGAG	GCCTACCATG	GTGGTGACGG
AGTTTAAAGA	CGGGATAGTT	GAAAGCTACC	ATCCTATCTC	CGGATGGTAC	CACCACTGCC
370	380	390	400	410	420
GTGACGGAGA	ATTAGGGTTC	GATTCCGGAG	AGGGAGCCTG	AGAAACGGCT	ACCACATCCA
CACTGCCTCT	TAATCCCAAG	CTAAGGCCTC	TCCCTCGGAC	TCTTTGCCGA	TGGTGTAGGT
430	440	450	460	470	480
AGGAAGGCAG	CAGGCGCGCA	AATTACCCAA	TCCCGACACG	GGGAGGTAGT	GACAATAAAT
TCCTTCCGTC	GTCCGCGCGT	TTAATGGGTT	AGGGCTGTGC	CCCTCCATCA	CTGTTATTTA
490	500	510	520	530	540
AACAATACTG	GGCTTTTTCA	AGTCTGGTAA	TTGGAATGAG	TACAATCTAA	ATCCCTTAAC
TTGTTATGAC	CCGAAAAAGT	TCAGACCATT	AACCTTACTC	ATGTTAGATT	TAGGGAATTG
550	560	570	580	590	600
GAGGATCCAT	TGGAGGGCAA	NNNNNNNNNN	NNNNNNNNNG	GTAATTCCAG	CTCCAATAGC
CTCCTAGGTA	ACCTCCCGTT	NNNNNNNNNN	NNNNNNNNNC	CATTAAGGTC	GAGGTTATCG
610	620	630	640	650	660
GTATATTTAA	GTTGTTGCAG	TTAAAAAGCT	CGTAGTTGGA	TCTCGGGGCG	GGGCGAGCGG
CATATAAATT	CAACAACGTC	AATTTTTCGA	GCATCAACCT	AGAGCCCCGC	CCCGCTCGCC
670	680	690	700	710	720
TCCGCCTCCT	TTGGTGTGCA	CTGGTCGCTC	CGCCCTTTCT	GTCGGGGACG	CGCTCCTGGC
AGGCGGAGGA	AACCACACGT	GACCAGCGAG	GCGGGAAAGA	CAGCCCCTGC	GCGAGGACCG
730	740	750	760	770	780
CTTAATTGGC	TGGGACGCGG	ATTCGGCGAT	GTTACTTTGA	AAAAATTAGA	GTGCTCAAAG
GAATTAACCG	ACCCTGCGCC	TAAGCCGCTA	CAATGAAACT	TTTTTAATCT	CACGAGTTTC
790	800	810	820	830	840
CAAGCCTATG	CTCTGAATAC	ATTAGCATGG	AATAACGCGA	TAGGACTCTG	GTCCTATTGT
GTTCGGATAC	GAGACTTATG	TAATCGTACC	TTATTGCGCT	ATCCTGAGAC	CAGGATAACA
850	860	870	880	890	900
GTTGGTCTTC	GGGACCGGAG	TAATGATTAA	TAGGGACGGT	TGGGGGCATT	CGTATTTCAT
CAACCAGAAG	CCCTGGCCTC	ATTACTAATT	ATCCCTGCCA	ACCCCCGTAA	GCATAAAGTA

910	920	930	940	950	960
TGTCAGAGGT	GAAATTCTTG	GATTTATGAA	AGACGAACTA	CTGCGAAAGC	ATTTGCCAAG
ACAGTCTCCA	CTTTAAGAAC	CTAAATACTT	TCTGCTTGAT	GACGCTTTCG	TAAACGGTTC
970	980	990	1000	1010	1020
GATGTTTTCA	TTAATCAAGA	ACGAAAGTTG	GGGGCTCGAA	GACGATCAGA	TACCGTCCTA
CTACAAAAGT	AATTAGTTCT	TGCTTTCAAC	CCCCGAGCTT	CTGCTAGTCT	ATGGCAGGAT
1030	1040	1050	1060	1070	1080
GTCTCAACCA	TAAACGATGC	CGACTAGGGA	TTGGCGGATG	TTACTTTGAT	GACTCCGCCA
CAGAGTTGGT	ATTTGCTACG	GCTGATCCCT	AACCGCCTAC	AATGAAACTA	CTGAGGCGGT
1090	1100	1110	1120	1130	1140
GCACCTTATG	AGAAATCAAA	GTTTTTGGTT	TCCGGGGGGA	GTATGGTCGC	AAGGCTGAAN
CGTGGAATAC	TCTTTAGTTT	CAAAAACCAA	AGGCCCCCCT	CATACCAGCG	TTCCGACTTN
1150	1160	1170	1180	1190	1200
NNNNNNNNNN	NNNNNNNNNN	NNNNNCACCA	GGAGTGGAGC	CTGCGGCTTA	ATTTGACTCA
NNNNNNNNNN	NNNNNNNNNN	NNNNNGTGGT	CCTCACCTCG	GACGCCGAAT	TAAACTGAGT
1210	1220	1230	1240	1250	1260
ACACGGGGAA	ACTTACCAGG	TCCAGACATA	GTAAGGATTG	ACAGATTGAG	AGCTCTTTCT
TGTGCCCCTT	TGAATGGTCC	AGGTCTGTAT	CATTCCTAAC	TGTCTAACTC	TCGAGAAAGA
1270	1280	1290	1300	1310	1320
TGATTCTATG	GGTGGTGGTG	CATGGCCGTT	CTTAGTTGGT	GGAGTGATTT	GTCTGGTTAA
ACTAAGATAC	CCACCACCAC	GTACCGGCAA	GAATCAACCA	CCTCACTAAA	CAGACCAATT
1330	1340	1350	1360	1370	1380
TTCCGTTAAC	GAACGAGACC	TCAGCCTGCT	AACTAGTTAC	ACGAAGGATC	CTCTTCGTGG
AAGGCAATTG	CTTGCTCTGG	AGTCGGACGA	TTGATCAATG	TGCTTCCTAG	GAGAAGCACC
1390	1400	1410	1420	1430	1440
CCAACTTCTT	AGAGGGACTA	TGGCCGTCTA	GGCCATGGAA	GTTTGAGGCA	ATAACAGGTC
GGTTGAAGAA	TCTCCCTGAT	ACCGGCAGAT	CCGGTACCTT	CAAACTCCGT	TATTGTCCAG
1450	1460	1470	1480	1490	1500
TGTGATGCCC	TTAGATGTTC	TGGGCCGCAC	GCGCGCTACA	CTGATGAATT	CAACGAGTTT
ACACTACGGG	AATCTACAAG	ACCCGGCGTG	CGCGCGATGT	GACTACTTAA	GTTGCTCAAA
1510	1520	1530	1540	1550	1560
ACCACCTGGG	CCGACAGGCC	CGGGTAATCT	TTTGAAATTT	CATCGTGATG	GGGATAGATC
TGGTGGACCC	GGCTGTCCGG	GCCCATTAGA	AAACTTTAAA	GTAGCACTAC	CCCTATCTAG
1570	1580	1590	1600	1610	1620
ATTGCAATTA	TTGATCTTCA	ACGAGGAATT	CCTAGTAAGC	GCGAGTCATC	AGCTCGCGTT
TAACGTTAAT	AACTAGAAGT	TGCTCCTTAA	GGATCATTCG	CGCTCAGTAG	TCGAGCGCAA
1630	1640	1650	1660	1670	1680
GACACGGTCC	CTGCCCTTTG	TACACACCGC	CCGTCGCTCC	TACCGATTGA	ATGGTCCGGT
CTGTGCCAGG	GACGGGAAAC	ATGTGTGGCG	GGCAGCGAGG	ATGGCTAACT	TACCAGGCCA
1690	1700	1710	1720	1730	1740
GAAGTTTTCG	GATCGCGACG	ACGCTGGCGG	NTTCTCCGCC	GGTGACGTTG	TGAGAAGTTC
CTTCAAAAGC	CTAGCGCTGC	TGCGACCGCC	NAAGAGGCGG	CCACTGCAAC	ACTCTTCAAG
1750	1760	1770	1780	1790	1800
ATTAACCTTA	TCATTTAGAG	GAAGGAGAAG	TCGTANCAGN	NNNNNNNNNN	NNNNNNNNNN
TAATTGGAAT	AGTAAATCTC	CTTCCTCTTC	AGCATNGTCN	NNNNNNNNNN	NNNNNNNNNN
1810	1820	1830	1840	1850	1860
NNNNNNNNNN	....	....	....	....	....
NNNNNNNNNN	....	....	....	....	....

Figure 9.

18S rDNA sequence data for *Sphagnum palustre*.

The entire gene is displayed with "N" showing unsequenced regions.
The sequence was determined by double-stranded cycle sequencing using the primers listed in Table 1 (Page 2).

Base Usage

Code	Count	%
A	418	23
C	380	21
G	487	27
T	432	24
N	103	5
TOTAL	1820	

```
        10         20         30         40         50         60
NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNAA AGNNTNAGCC ATGCATGTGT
NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNTT TCNNANTCGG TACGTACACA

        70         80         90        100        110        120
AAGTATAAAC TCTTTTGTAC CGTGAAACTG CGAATGGCTC ATTAAATCAG TTATAGTTTC
TTCATATTTG AGAAAACATG GCACTTTGAC GCTTACCGAG TAATTTAGTC AATATCAAAG

       130        140        150        160        170        180
TTTGATGGTA CCTTGCTACT CGGATAACCG TAGTAATTCT AGAGCTAATA CGTGCACCGA
AAACTACCAT GGAACGATGA GCCTATTGGC ATCATTAAGA TCTCGATTAT GCACGTGGCT

       190        200        210        220        230        240
CTCCCGACCC CGCAAGGGGA AGGGACGTAT TTATTAGATA AAAGGCCGAT GCGGGCTCGC
GAGGGCTGGG GCGTTCCCCT TCCCTGCATA AATAATCTAT TTTCCGGCTA CGCCCGAGCG

       250        260        270        280        290        300
CCGGTATTGC GGTGAATCAT GATAACTCGT CGAATCGCAC GGCCCTGGCG CCGGCGATGT
GGCCATAACG CCACTTAGTA CTATTGAGCA GCTTAGCGTG CCGGGACCGC GGCCGCTACA

       310        320        330        340        350        360
TTCATTCAAA TTTCTGCCCT ATCAACTTTC GACGGTAGGA TAGAGGCCTA CCGTGGTGGT
AAGTAAGTTT AAAGACGGGA TAGTTGAAAG CTGCCATCCT ATCTCCGGAT GGCACCACCA

       370        380        390        400        410        420
GACGGGTGAC GGAGAATTAG GGTTCGATTC CGGAGAGGGA GCCTGAGAAA CGGCTACCAC
CTGCCCACTG CCTCTTAATC CCAAGCTAAG GCCTCTCCCT CGGACTCTTT GCCGATGGTG

       430        440        450        460        470        480
ATCCAAGGAA GGCAGCAGGC GCGCAAATTA CCCAATCCCG ACACGGGGAG GTAGTGACAA
TAGGTTCCTT CCGTCGTCCG CGCGTTTAAT GGGTTAGGGC TGTGCCCCTC CATCACTGTT

       490        500        510        520        530        540
TAAATAACGA TACCGGGCTT TTACAAGTCT GGTAATCGGA ATGAGTACAA TCTAAATCCC
ATTTATTGCT ATGGCCCGAA AATGTTCAGA CCATTAGCCT TACTCATGTT AGATTTAGGG

       550        560        570        580        590        600
TTAACGAGGA TCCATTGGAG GNNNNNNNNN NNNNNNNNNN NNGCGGTAAT TCCAGCTCCA
AATTGCTCCT AGGTAACCTC CNNNNNNNNN NNNNNNNNNN NNCGCCATTA AGGTCGAGGT

       610        620        630        640        650        660
ATAGCGTATA TTTAAGTTGT TGCAGTTAAA AAGCTCGTAG TTGGATCTCG GGGCGGGGCG
TATCGCATAT AAATTCAACA ACGTCAATTT TTCGAGCATC AACCTAGAGC CCCGCCCCGC

       670        680        690        700        710        720
GGCGGTCCGC CCTCTTTGGG GGTGTGCACC GGCCTCCCCG TCCTTAGTGC CGGGGACGCG
CCGCCAGGCG GGAGAAACCC CCACACGTGG CCGGAGGGGC AGGAATCACG GCCCCTGCGC

       730        740        750        760        770        780
CTCCTGGCCT TGACTGGTCG GGACGCGGAT TCGGCGACGT TACTTTGAAA AAATTAGAGT
GAGGACCGGA ACTGACCAGC CCTGCGCCTA AGCCGCTGCA ATGAAACTTT TTTAATCTCA

       790        800        810        820        830        840
AATCAAAGCA AGCCTACGCT CTGAATACAT TAGCATGGGA TAGCGCGATA GGACTCTGGT
TTAGTTTCGT TCGGATGCGA GACTTATGTA ATCGTACCCT ATCGCGCTAT CCTGAGACCA

       850        860        870        880        890        900
CCTGTTGTGT TGGTCTTCGG GACCGGAGTA ATGATTAATA GGGACGGTTG GGGGCATTCG
GGACAACACA ACCAGAAGCC CTGGCCTCAT TACTAATTAT CCCTGCCAAC CCCCGTAAGC
```

```
       910        920        930        940        950        960
TATTTCATTG TCAGAGGTGA AATTCTTGGA TTTACGAAAG ACGAACTTCT GCGAAAGCAT
ATAAAGTAAC AGTCTCCACT TTAAGAACCT AAATGCTTTC TGCTTGAAGA CGCTTTCGTA

       970        980        990       1000       1010       1020
TTGCCAAGGA TGTTTTCATT AATCAAGAAC GAAAGTTGGG GGCTCGAAGA CGATCAGATA
AACGGTTCCT ACAAAAGTAA TTAGTTCTTG CTTTCAACCC CCGAGCTTCT GCTAGTCTAT

      1030       1040       1050       1060       1070       1080
CCGTCCTAGT CTCAACCGTA AACGATGCCG ACTAGGGATC GGCGGATGTT GAATCGATGA
GGCAGGATCA GAGTTGGCAT TTGCTACGGC TGATCCCTAG CCGCCTACAA CTTAGCTACT

      1090       1100       1110       1120       1130       1140
CTCCGCCGGC ACCTTATGAG AAATCAAAGT TTTTGGGTTC CGGGGGGAGT ATGGTCGCAA
GAGGCGGCCG TGGAATACTC TTTAGTTTCA AAAACCCAAG GCCCCCCTCA TACCAGCGTT

      1150       1160       1170       1180       1190       1200
GGCTGANNNN NNNNNNNNNN NNNNNNNNNN NNNCACCAGG AGTGGAGCCT GCGGCTTAAT
CCGACTNNNN NNNNNNNNNN NNNNNNNNNN NNNGTGGTCC TCACCTCGGA CGCCGAATTA

      1210       1220       1230       1240       1250       1260
TTGACTCAAC ACGGGGAAAC TCACCAGGTC CAGACATAGT GAGGATTGAC AGATTGAGAG
AACTGAGTTG TGCCCCTTTG AGTGGTCCAG GTCTGTATCA CTCCTAACTG TCTAACTCTC

      1270       1280       1290       1300       1310       1320
CTCTTTCTTG ATTCTATGGG TGGTGGTGCA TGGCCGTTCT TAGTTGGTGG AGTGATTTGT
GAGAAAGAAC TAAGATACCC ACCACCACGT ACCGGCAAGA ATCAACCACC TCACTAAACA

      1330       1340       1350       1360       1370       1380
CTGGTTAATT CCGTTAACGA ACGAGACCTC AGCCTGTTAA CTAGTCACGC GAAGGGTTCC
GACCAATTAA GGCAATTGCT TGCTCTGGAG TCGGACAATT GATCAGTGCG CTTCCCAAGG

      1390       1400       1410       1420       1430       1440
CCTTGGCGGG CGACTTCTTA GAGGGACTAT TGGCGTCTAG CCAATGGAAG TTTGAGGCAA
GGAACCGCCC GCTGAAGAAT CTCCCTGATA ACCGCAGATC GGTTACCTTC AAACTCCGTT

      1450       1460       1470       1480       1490       1500
TAACAGGTCT GTGATGCCCT TAGAATGTTC TGGGCCGCAC GCGCGCTACA CTGATGAATT
ATTGTCCAGA CACTACGGGA ATCTTACAAG ACCCGGCGTG CGCGCGATGT GACTACTTAA

      1510       1520       1530       1540       1550       1560
CAACGAGTTT ATAACCTGGG CCGACAGGCC CGGGTAATCT TTTGAAATTT CATCGTGATG
GTTGCTCAAA TATTGGACCC GGCTGTCCGG GCCCATTAGA AAACTTTAAA GTAGCACTAC

      1570       1580       1590       1600       1610       1620
GGGATAGATC ATTGCAATTA TTGATCTCCA ACGAGGAATT CCTAGTAAGC GCGAGTCATC
CCCTATCTAG TAACGTTAAT AACTAGAGGT TGCTCCTTAA GGATCATTCG CGCTCAGTAG

      1630       1640       1650       1660       1670       1680
AGCTCGCGTT GACTACGTCC CTGCCCTTTG TACACACCGC CCGTCGCTCC TACCGATTGA
TCGAGCGCAA CTGATGCAGG GACGGGAAAC ATGTGTGGCG GGCAGCGAGG ATGGCTAACT

      1690       1700       1710       1720       1730       1740
ATGGTCCGGT GAAGTTTTCG GATCGCGGCG ACGCCTGCGG TTCGCCGCCG GCGACGTTGT
TACCAGGCCA CTTCAAAAGC CTAGCGCCGC TGCGGACGCC AAGCGGCGGC CGCTGCAACA

      1750       1760       1770       1780       1790       1800
GAGAAGTTCA TCAAACCTTA TCATTTAGAG GAAGGAGAAG TCGTAACAAG GTTTCCGTAG
CTCTTCAAGT AGTTTGGAAT AGTAAATCTC CTTCCTCTTC AGCATTGTTC CAAAGGCATC

      1810       1820       1830       1840       1850       1860
GTGAACNNNN NNNNNNNNNN .......... .......... .......... ..........
CACTTGNNNN NNNNNNNNNN .......... .......... .......... ..........
```

Figure 10.

18S rDNA sequence data comparisons of *Physcomitrella patens.*

Homology alignment conducted with MacDNASIS sequence analysis software (Pro v3.6).
Physcomitrella patens 18S rDNA sequence data generated in this project is represented on the top line [labeled "Physcomitrella paten"]. *Physcomitrella patens* 18S rDNA sequence reported in GenBank accession # X80986 [labeled "P patens (Capesius)"]

```
                          10         20         30         40         50
Physcomitrel      1 NNNNNNNNNN NNNNNNNNNN NNNNNNNNNN NNNNNNNNAA AGATTAAGCC     50
P patens  (Ca     1 AACCTGGTTG ATCCTGCCAG TAGTCATATG CTTGTCTCAA AGATTAAGCC     50

                          60         70         80         90        100
Physcomitrel     51 ATGCATGTGT AAGTATAAAC TCTTTTGTAC TGTGAAACTG CGAATGGCTC    100
P patens  (Ca    51 ATGCATGTGT AAGTATAAAC TCTTTTGTAC TGTGAAACTG CGAATGGCTC    100

                         110        120        130        140        150
Physcomitrel    101 ATTAAATCAG TTATAGTTTC TTTGATGGTA CCTTGCTACT CGGATAACCG    150
P patens  (Ca   101 ATTAAATCAG TTATAGTTTC TTTGATGGTA CCTTGCTACT CGGATAACCG    150

                         160        170        180        190        200
Physcomitrel    151 TAGTAATTCT AGAGCTAATA CGTGCACAAA CTCCCGACTT TTTTGGAAGG    200
P patens  (Ca   151 TAGTAATTCT AGAGCTAATA CGTGCACAAA CTCCCGACTT TTTTGGAAGG    200

                         210        220        230        240        250
Physcomitrel    201 GACGTATTTA TTAGATAAAA GGCCGATGCG GGCTTGCCCG GTGTTGCGGT    250
P patens  (Ca   201 GACGTATTTA TTAGATAAAA GGCCGATGCG GGCTTGCCCG GTGTTGCGGT    250

                         260        270        280        290        300
Physcomitrel    251 GAATCATGAT AACTTTGTCG AATCGCACGG CCTTGGCGCT GGCGATGTTT    300
P patens  (Ca   251 GAATCATGAT AACTTTGTCG AATCGCACGG CCTTGGCGCT GGCGATGTTT    300

                         310        320        330        340        350
Physcomitrel    301 CATTCAAATT TCTGCCCTAT CAACTTTCGA TGGTAGGATA GAGGCCTACC    350
P patens  (Ca   301 CATTCAAATT TCTGCCCTAT CAACTTTCGA TGGTAGGATA GAGGCCTACC    350

                         360        370        380        390        400
Physcomitrel    351 ATGGTGGTAA CGGGTGACGG AGAATTAGGG TTCGATTCCG GAGAGGGAGC    400
P patens  (Ca   351 ATGGTGGTAA CGGGTGACGG AGAATTAGGG TTCGATTCCG GAGAGGGAGC    400

                         410        420        430        440        450
Physcomitrel    401 CTGAGAAACG GCTACCACAT CCAAGGAAGG CAGCAGGCGC GCAAATTACC    450
P patens  (Ca   401 CTGAGAAACG GCTACCACAT CCAAGGAAGG CAGCAGGCGC GCAAATTACC    450

                         460        470        480        490        500
Physcomitrel    451 CAATCCCGAC ACGGGGAGGT AGTGACAATA AATAACAATA CTGGGCTTTT    500
P patens  (Ca   451 CAATCCCGAC ACGGGGAGGT AGTGACAATA AATAACAATA CTGGGCTTTT    500

                         510        520        530        540        550
Physcomitrel    501 ACAAGTCTGG TAATTGGAAT GAGTACAATC TAAATCCCTT AACGAGGATC    550
P patens  (Ca   501 ACAAGTCTGG TAATTGGAAT GAGTACAATC TAAATCCCTT AACGAGGATC    550

                         560        570        580        590        600
Physcomitrel    551 CATTGGAGGN NNNNNNNNNN NNNNNNNNNN GCGGTAATTC CAGCTCCAAT    600
P patens  (Ca   551 CATTGGAGGG CAAGTCTGGT GCCAGCAGCC GCGGTAATTC CAGCTCCAAT    600

                         610        620        630        640        650
Physcomitrel    601 AGCGTATATT TAAGTTGTTG CAGTTAAAAA GCTCGTAGTT GGATCTTGGG    650
P patens  (Ca   601 AGCGTATATT TAAGTTGTTG CAGTTAAAAA GCTCGTAGTT GGATCTTGGG    650

                         660        670        680        690        700
Physcomitrel    651 TCGGGGGGAG CGGTCCGCCC CTTGTGGGTG TGCACTGGTC CACTCGGCCT    700
P patens  (Ca   651 TCGGGGGGAG CGGTCCGCCC CTTGTGGGTG TGCACTGGTC CACTCGGCCT    700

                         710        720        730        740        750
Physcomitrel    701 TCTTGCCGGG GACGCGCTCC TGGTTTTAAT TAATCGGGAC GCGGAGTCGG    750
P patens  (Ca   701 TCTTGCCGGG GACGCGCTCC TGGTTTTAAT TAATCGGGAC GCGGAGTCGG    750

                         760        770        780        790        800
Physcomitrel    751 CGATGTTACT TTGAAAAAAT TAGAGTGCTC AAAGCAAGCC TATGCTCTGA    800
P patens  (Ca   751 CGATGTTACT TTGAAAAAAT TAGAGTGCTC AAAGCAAGCC TATGCTCTGA    800
```

```
                        810         820         830         840         850
Physcomitrel     801 ATACATTAGC  ATGGAATAAC  GTGATAGGAC  TCTGGTCCTG  TTCGTGTTGG     850
P patens  (Ca    801 ATACATTAGC  ATGGAATAAC  GTGATAGGAC  TCTGGTCCTG  TTCGTGTTGG     850

                        860         870         880         890         900
Physcomitrel     851 TCTTCGGGAC  CGGAGTAATG  ATTAATAGGG  ACGGTTGGGG  GCATTCGTAT     900
P patens  (Ca    851 TCTTCGGGAC  CGGAGTAATG  ATTAATAGGG  ACGGTTGGGG  GCATTCGTAT     900

                        910         920         930         940         950
Physcomitrel     901 TTCATTGTCA  GAGGTGAAAT  TCTTGGATTT  ATGAAAGACG  AACTTCTGCG     950
P patens  (Ca    901 TTCATTGTCA  GAGGTGAAAT  TCTTGGATTT  ATGAAAGACG  AACTTCTGCG     950

                        960         970         980         990        1000
Physcomitrel     951 AAAGCATTTG  CCAAGGATGT  TTTCATTAAT  CAAGAACGAA  AGTTGGGGGC    1000
P patens  (Ca    951 AAAGCATTTG  CCAAGGATGT  TTTCATTAAT  CAAGAACGAA  AGTTGGGGGC    1000

                       1010        1020        1030        1040        1050
Physcomitrel    1001 TCGAAGACGA  TCAGATACCG  TCCTAGTCTC  AACCATAAAC  GATGCCGACT    1050
P patens  (Ca   1001 TCGAAGACGA  TCAGATACCG  TCCTAGTCTC  AACCATAAAC  GATGCCGACT    1050

                       1060        1070        1080        1090        1100
Physcomitrel    1051 AGGGATTGGC  GGATGTTACT  TTGATGACTC  CGCCAGCACC  TTATGAGAAA    1100
P patens  (Ca   1051 AGGGATTGGC  GGATGTTACT  TTGATGACTC  CGCCAGCACC  TTATGAGAAA    1100

                       1110        1120        1130        1140        1150
Physcomitrel    1101 TCAAAGTTTT  TNGGTTCCGG  GGNGAGTATG  NTCGCAAGNC  TGAANNNNNN    1150
P patens  (Ca   1101 TCAAAGTTTT  TGGGTTCCGG  GGGGAGTATG  GTCGCAAGGC  TGAAACTTAA    1150

                       1160        1170        1180        1190        1200
Physcomitrel    1151 NNNNNNNNNN  NNNNNNGCAC  NACCAGGAGT  GGAG-CTGCG  GCTTAATTTG    1200
P patens  (Ca   1151 AGGAATTGAC  GGAAGGGCAC  CACCAGGAGT  GGAGCCTGCG  GCTTAATTTG    1200

                       1210        1220        1230        1240        1250
Physcomitrel    1201 ACTCAACACG  GGGAAACTTA  CCAGGTCCAG  ACATAGTAAG  GATTGACAGA    1250
P patens  (Ca   1201 ACTCAACACG  GGGAAACTTA  CCAGGTCCAG  ACATAGTAAG  GATTGACAGA    1250

                       1260        1270        1280        1290        1300
Physcomitrel    1251 TTGAGAGCTC  TTTCTTGATT  CTATGGGTGG  TGGTGCATGG  CCGTTCTTAG    1300
P patens  (Ca   1251 TTGAGAGCTC  TTTCTTGATT  CTATGGGTGG  TGGTGCATGG  CCGTTCTTAG    1300

                       1310        1320        1330        1340        1350
Physcomitrel    1301 TTGGTGGAGT  GATTTGTCTG  GTTAATTCCG  TTAACGAACG  AGACCTCAGC    1350
P patens  (Ca   1301 TTGGTGGAGT  GATTTGTCTG  GTTAATTCCG  TTAACGAACG  AGACCTCAGC    1350

                       1360        1370        1380        1390        1400
Physcomitrel    1351 CTGCTAACTA  GTTACGCGAA  GGATTTTTTC  CTTTGCGGCC  AACTTCTTAG    1400
P patens  (Ca   1351 CTGCTAACTA  GTTACGCGAA  GGATTTTTTC  CTTTGCGGCC  AACTTCTTAG    1400

                       1410        1420        1430        1440        1450
Physcomitrel    1401 AGGGACTATC  GGCGTCTAGC  CGATGGAAGT  TTGAGGCAAT  AACAGGTCTG    1450
P patens  (Ca   1401 AGGGACTATC  GGCGTCTAGC  CGATGGAAGT  TTGAGGCAAT  AACAGGTCTG    1450

                       1460        1470        1480        1490        1500
Physcomitrel    1451 TGATGCCCTT  AGATGTTCTG  GGCCGCACGC  GCGCTACACT  GATGAATTCA    1500
P patens  (Ca   1451 TGATGCCCTT  AGATGTTCTG  GGCCGCACGC  GCGCTACACT  GATGAATTCA    1500

                       1510        1520        1530        1540        1550
Physcomitrel    1501 ACGAGTTTAT  AACCTGGACC  GATA-GGTCT  GGGTAATCTT  TTGAAATTTC    1550
P patens  (Ca   1501 ACGAGTTTAT  AACCTGGGCC  GATACGGT-T  GGGTAATCTT  TTGAAATTTC    1550

                       1560        1570        1580        1590        1600
Physcomitrel    1551 ATCGTGATGG  GGATAGATCA  TTGCAATTAT  TGATCTTCAA  CGAGGAATTC    1600
P patens  (Ca   1551 ATCGTGATGG  GGATAGATCA  TTGCAATTAT  TGATCTTCAA  CGAGGAATTC    1600
```

```
                             1610       1620       1630       1640       1650
Physcomitrel       1601 CTAGTAAGCG CGAGTCATCA GCTCGCGTTG ACTACGTCCC TGCCCTTTGT      1650
P patens (Ca       1601 CTAGTAAGCG CGAGTCATCA GCTCGCGTTG ACTACGTCCC TGCCCTTTGT      1650

                             1660       1670       1680       1690       1700
Physcomitrel       1651 ACACACCGCC CGTCGCTCCT ACCGATTGAA TGGTCCGGTG AAGTTTTCGG      1700
P patens (Ca       1651 ACACACCGCC CGTCGCTCCT ACCGATTGAA TGGTCCGGTG AAGTTTTCGG      1700

                             1710       1720       1730       1740       1750
Physcomitrel       1701 ATTGCGGCGA TGCCGGCGGT TCGCCGCCGG TGACGTTGGG AGAAGTTCAT      1750
P patens (Ca       1701 ATTGCGGCGA TGCCGGCGGT TCGCCGCCGG TGACGTTGGG AGAAGTTCAT      1750

                             1760       1770       1780       1790       1800
Physcomitrel       1751 TAAACCTTAT CATTTAGAGG AAGGAGAAGT CGTAACAAGG TTTCCGTAGG      1800
P patens (Ca       1751 TAAACCTTAT CATTTAGAGG AAGGAGAAGT CGTAACAAGG TTTCCGTAGG      1800

                             1810       1820       1830       1840       1850
Physcomitrel       1801 TNNNNNNNNN NNNNNNNNN. .......... .......... ..........      1850
P patens (Ca       1801 TGAACCTGCA GAAGGATCA. .......... .......... ..........      1850
```

APPENDIX B : Taxa

Table 2. Taxa list with classification.

Division Chlorophyta (Green Plants)
Subdivision Embryophytina (Embryophytes)

Class	Subclass	Genus species	Accession #
Bryophyta	Anthocerotopsida	*Anthoceros laevis*	U18491
		Anthoceros agrestis	X80984
		Megaceros aenigmaticus	
		Notophylas breutelu	
	Bryopsida	*Atrichum undulatum*	X85093
		Bryum argenteum	U18529
		Eurhynchium hians	U18501
		Funaria hygrometrica	X74114
		Leptobryum pyriforme	X80980
		Mnium hornum	X80985
		Physcomitrella patens	
		Physcomitrella patens 2	X80986
		Physcomitrium pyriforme	U18517
		Polytrichum formosum	X80982
	Sphagnopsida	*Sphagnum cuspidatum*	X80213
		Sphagnum palustre	
	Hepaticopsida	*Calypogeia arguta*	X78439
		Conocephalum conicum	X80987
		Fossombronia pusilla	X78341
		Marchantia polymorpha	X75521
		Reboulia hemisphaerica	U18521
		Riccia fluitans	X78441
		Scapania nemorea	X80983
		Sphaerocarpus donnelli	X85094
		Sphaerocarpus texanus	U18522
		Riccardia pinguis	X85095
		Pellia epiphylla	X80210

Table 2. Taxa list with classification (cont'd).

Division Chlorophyta (Green Plants)
Subdivision Embryophytina (Embryophytes)

Class	Subclass	Genus species	Accession #
Equisetophyta	Equisetophyta	*Equisetum robustum*	X78890
	Sphenopsida	*Equisetum hyemale*	U18500
Filicophyta		*Pteris vittata*	
	Filicopsida	*Adiantum raddianum*	X78889
		Adiantum raddianum 2	U18621
		Osmunda cinnamomea	U18516
		Salvinia natans	X90413
	Ophioglossopsida	*Ophioglossum petiolatum*	U18515
Lycopodiophyta	Isoetopsida	*Isoetes englemannii*	U18506
		Selaginella umbrosa	X75517
		Selaginella vogelii	X83520
	Lycopodiopsida	*Huperzia lucidulum*	U18505
		Lycopodiella inundatum	U18512
		Lycopodium phlegmaria	X81964
		Lycopodium taxifolium	X83522
		Lycopodium tristachyum	U18511
Magnoliophyta	Liliopsida	*Oryza sativa*	X00755
		Zea mays	K02202
	Magnoliopsida	*Arabidopsis thaliana*	X16077
		Glycine max	X02623
		Sinapis alba	X66325
Pinophyta	Cycadicae	*Zamia pumila*	M20017
	Pinicae	*Ginkgo biloba*	D16448
		Nageia nagi	D16447
		Pinus luchuensis	D38246
		Pinus wallichiana	X75080
		Taxus mairei	D16445
	Gneticae	*Gnetum leyboldii*	L24045
Psilotophyta	Psilotopsida	*Psilotum nudum*	X81963

Table 2. Taxa list with classification (cont'd).

Outgroups

Division Chlorophyta (Green Plants)
Subdivision Chlorophycophtina (Green Algae)

Class	Subclass	Genus species	Accession #
Charaphyta	Coleochaetales	*Coloeochaete scutata*	X68825
	Klebsormidiales	*Klebsormidium flaccidum*	X75520
	Charales	*Chara foetida*	X70704
		Nitella flexilis	U05261
		Nitella sp.	M95615
Chlorophyta	Chlorococcales	*Parietochloris pseudoalveolaris*	M63002
		Hydrodictyon reticulatum	M74497
	Volvocales	*Chlamydomonas reinhardtii*	M32703

Division	Class	Genus species	Accession #
Eumycota	Hemiascomycetes	*Saccharomyces cerevisiae*	J01353
	Archaeascomycetes	*Schizosaccharomyces pombe*	X58056
Myxomycota	Dictyosteliida	*Dictyostelium discoideum*	K02641

Table 3. Taxa set designations.

Taxa	Author	Accession	Error Status	Taxa Set A	Taxa Set B	Taxa Set C
Megaceros aenigmaticus	Ashton		*OK*	✓	✓	✓
Notophylas breutelu	Ashton		*OK*	✓	✓	✓
Physcomitrella patens	Ashton		*OK*	✓	✓	✓
Pteris vittata	Ashton		*OK*	✓	✓	✓
Sphagnum palustre	Ashton		*OK*	✓	✓	✓
Anthoceros agrestis	Capesius	X80984	N/A	✓	✓	✓
Atrichum undulatum	Capesius	X85093	OK	✓	✓	✓
Calypogeia arguta	Capesius	X78439	OK	✓	✓	✓
Conocephalum conicum	Capesius	X80987	OK	✓	✓	✓
Fossombronia pusilla	Capesius	X78341	OK	✓	✓	✓
Funaria hygrometrica	Capesius	X74114	OK	✓	✓	✓
Leptobryum pyriforme	Capesius	X80980	OK	✓	✓	✓
Mnium hornum	Capesius	X80985	OK	✓	✓	✓
Pellia epiphylla	Capesius	X80210	OK	✓	✓	✓
Physcomitrella patens 2	Capesius	X80986	OK		✓	✓
Polytrichum formosum	Capesius	X80982	OK	✓	✓	✓
Riccardia pinguis	Capesius	X85095	OK	✓	✓	✓
Riccia fluitans	Capesius	X78441	OK	✓	✓	✓
Scapania nemorea	Capesius	X80983	OK	✓	✓	✓
Sinapis alba	Capesius	X66325	OK	✓	✓	
Sphaerocarpos donnellii	Capesius	X85094	OK	✓	✓	✓
Sphagnum cuspidatum	Capesius	X80213	OK	✓	✓	✓
Anthoceros laevis	Chapman	U18491	N/A		✓	✓
Bryum argenteum	Chapman	U18529	OK		✓	✓
Equisetum hyemale	Chapman	U18500	OK		✓	✓
Eurhynchium hians	Chapman	U18501	OK		✓	✓
Huperzia lucidulum	Chapman	U18505	OK		✓	✓
Isoetes engelmannii	Chapman	U18506	OK		✓	✓
Lycopodiella inundatum	Chapman	U18512	OK		✓	✓
Lycopodium tristachyum	Chapman	U18511	OK		✓	✓
Ophioglossum petiolatum	Chapman	U18515	OK		✓	✓
Osmunda cinnamomea	Chapman	U18516	OK		✓	✓
Physcomitrium pyriforme	Chapman	U18517	OK		✓	✓
Reboulia hemisphaerica	Chapman	U18521	OK		✓	✓
Sphaerocarpus texanus	Chapman	U18522	OK		✓	✓
Ginkgo biloba	Chaw	D16448	OK	✓	✓	
Nageia nagi	Chaw	D16447	OK	✓	✓	
Pinus luchuensis	Chaw	D38246	OK	✓	✓	
Taxus mairei	Chaw	D16445	OK	✓	✓	
Schizosaccharomyces pombe	De Wachter	X58056	N/A		✓	
Glycine max	Eckenrode	X02623	OK	✓	✓	
Arabidopsis thaliana	Gruendler	X16077	OK	✓	✓	
Chlamydomonas reinhardtii	Gunderson	M32703	OK		✓	
Adiantum raddianum	Huss	X78889	OK	✓	✓	✓
Chara foetida	Huss	X70704	OK	✓	✓	
Coleochaete scutata	Huss	X68825	OK		✓	
Equisetum robustum	Huss	X78890	OK	✓	✓	✓
Klebsormidium flaccidum	Huss	X75520	OK		✓	
Lycopodium phlegmaria	Huss	X81964	OK	✓	✓	✓
Lycopodium taxifolium	Huss	X83522	OK	✓	✓	✓
Marchantia polymorpha	Huss	X75521	OK	✓	✓	✓
Psilotum nudum	Huss	X81963	OK	✓	✓	✓
Salvinia natans	Huss	X90413	OK	✓	✓	✓
Selginella umbrosa	Huss	X75517	OK	✓	✓	✓
Selginella vogelii	Huss	X83520	OK	✓	✓	✓
Parietochloris pseudoalveolaris	Lewis	M63002	OK		✓	
Saccharomyces cerevisiae	Mankin	J01353	N/A		✓	
Dictyostelium discoideum	McCarroll	K02641	N/A		✓	
Zea mays	Messing	K02202	OK	✓	✓	
Zamia pumila	Naire	M20017	OK	✓	✓	
Gnetum leyboldii	Nickrent	L24045	OK	✓	✓	
Nitella flexilis	Ragan	U05261	OK		✓	
Pinus wallichiana	Sensen	X75080	OK		✓	
Oryza sativa	Takaiwa	X00755	OK	✓	✓	
Hydrodictyon reticulatum	Wilcox	M74497	OK		✓	
Nitella sp.	Wilcox	M95615	OK		✓	
Adiantum raddianum 2	Wolf	U18621	OK		✓	

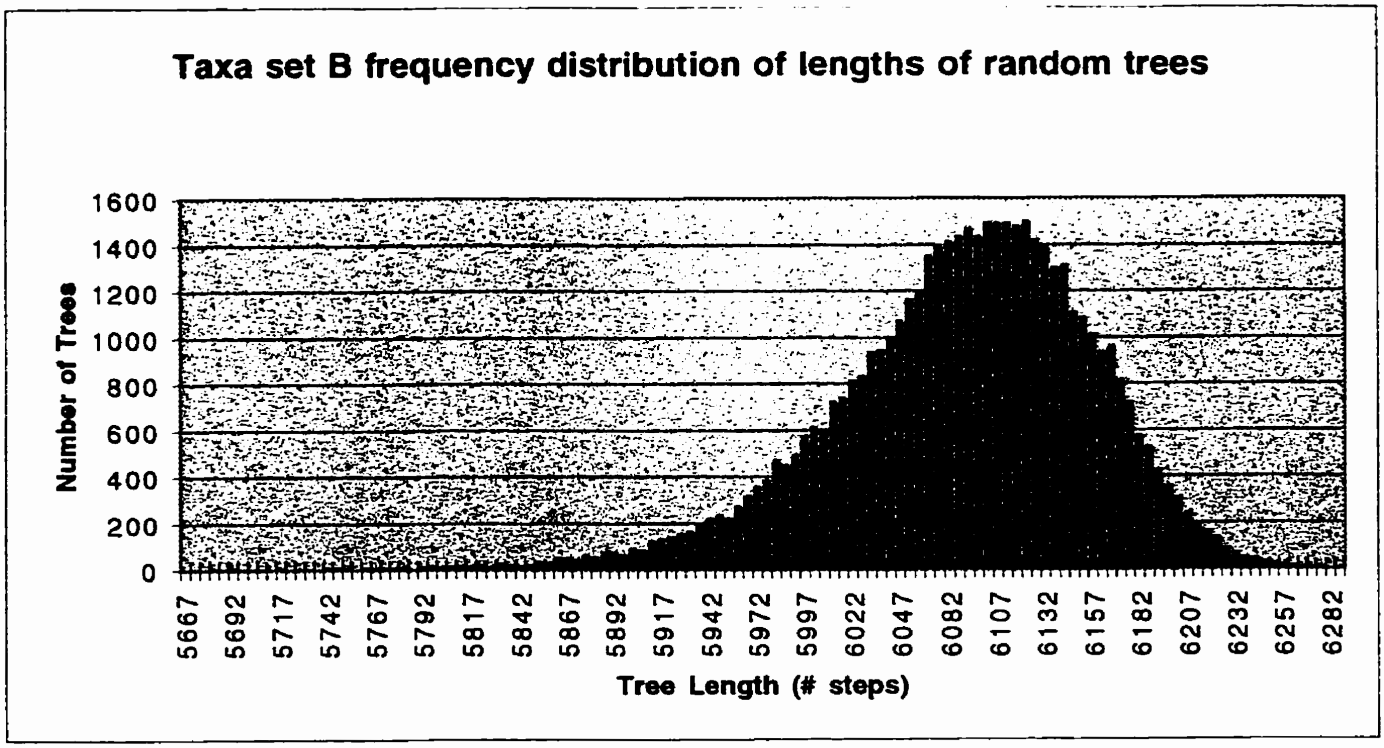
OK: determined by Hedderson (personal communication)
OK : determined by double-stranded sequencing
N/A: Not Available

APPENDIX C : Tree Length Distribution

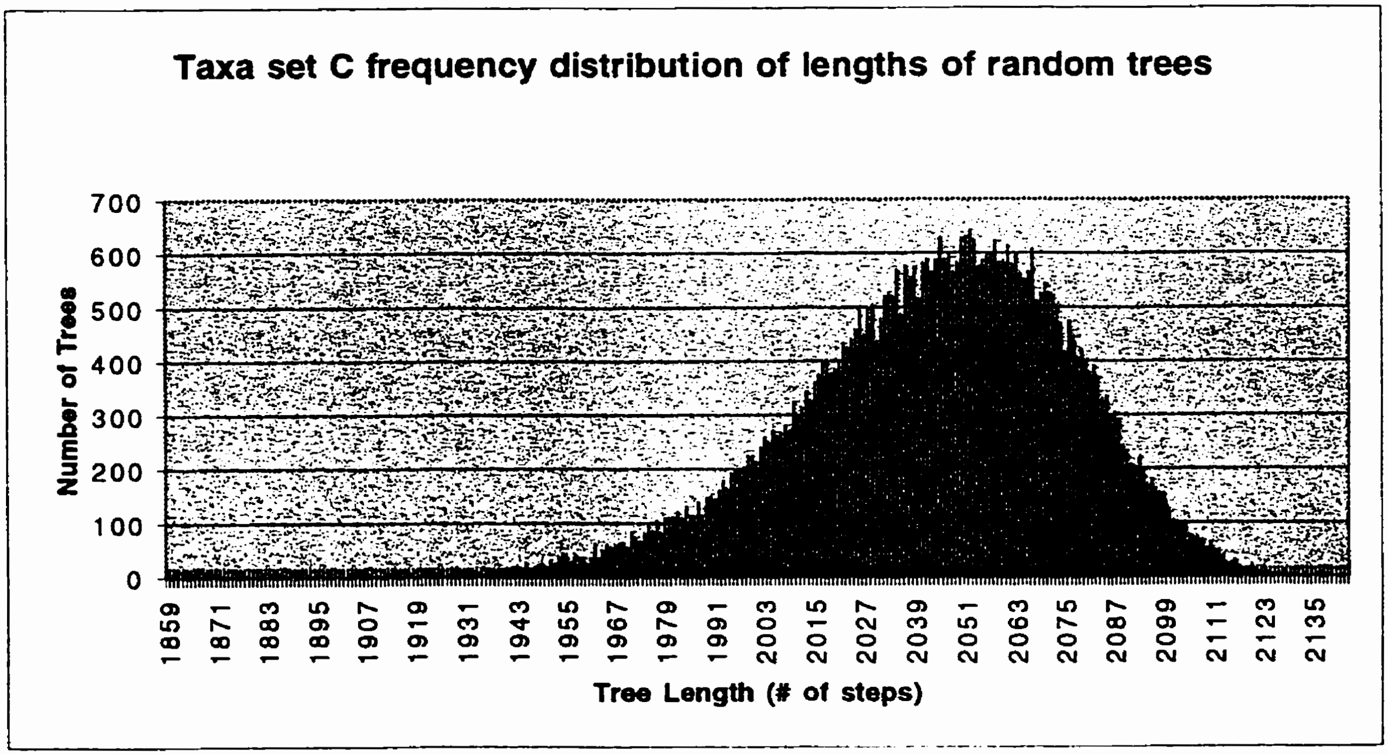
Figure 11.

Frequency distribution of lengths of random trees for taxa set B and C.

The g_1 statistic for tree length distribution skewness was determined for both taxa set B and C. The g_1 statistic based on the length distribution of 50,000 randomly sampled trees from a set of all possible trees.



mean	sd	g_1	g_2
6086.17	70.21	-0.6235	0.6492



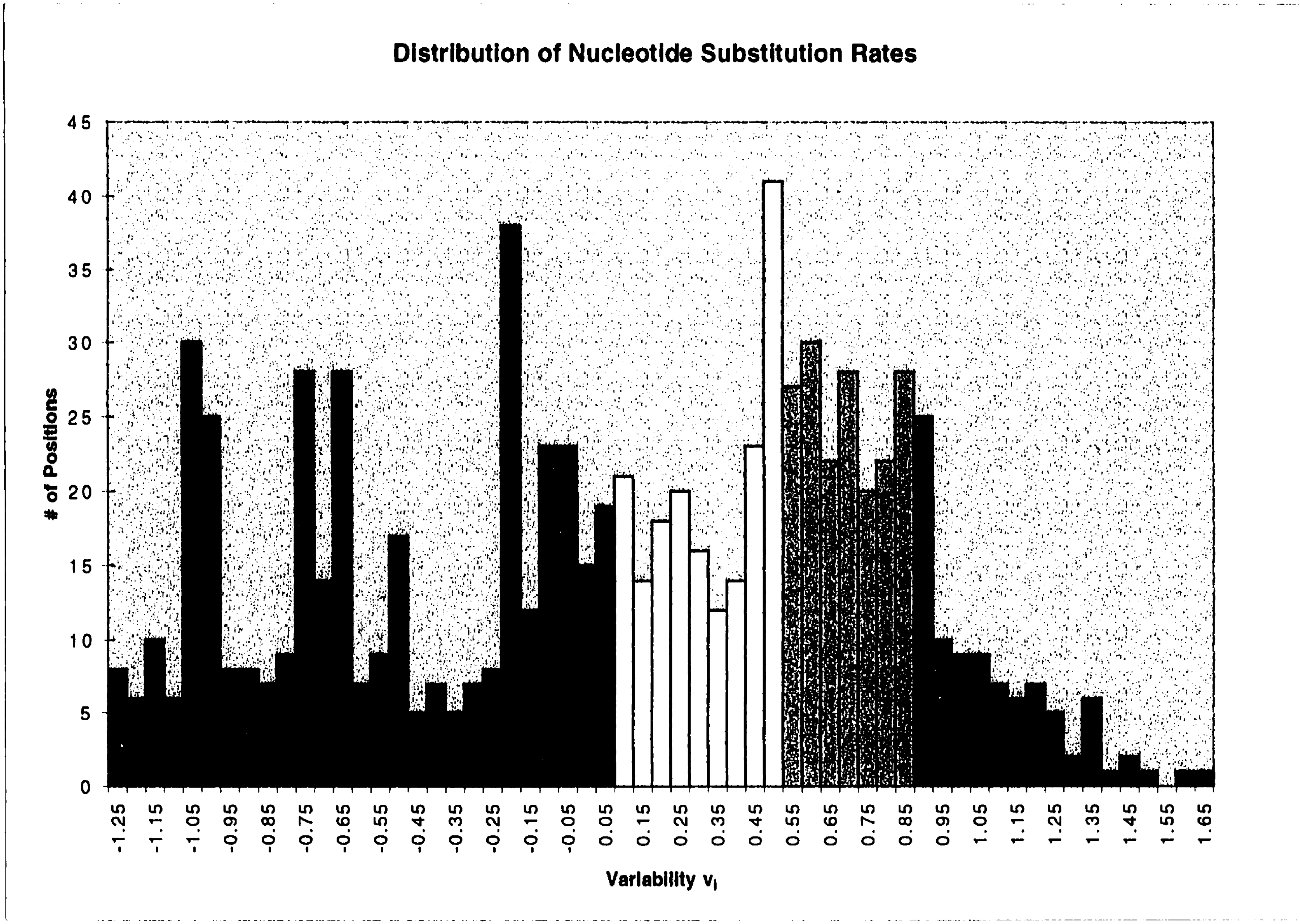
mean	sd	g_1	g_2
2043.27	33.62	-0.5330	0.3880

APPENDIX D : Substitution Rate Calculation

Figure 12.

Distribution of relative substitution rates, estimated from alignment of 18S rDNA of taxa set B.

Rates were estimated for each of the alignment positions not absolutely conserved and that contain a nucleotide in at least 25% of the aligned sequences. The colored areas in spectra define sets of nucleotides indicated in different categories used for phylogenetic analysis.



Distribution of Nucleotide Substitution Rates
# of Positions
0
5
10
15
20
25
30
35
40
45
-1.25
-1.15
-1.05
-0.95
-0.85
-0.75
-0.65
-0.55
-0.45
-0.35
-0.25
-0.15
-0.05
0.05
0.15
0.25
0.35
0.45
0.55
0.65
0.75
0.85
0.95
1.05
1.15
1.25
1.35
1.45
1.55
1.65
Variability v_i

Figure 13.

Distribution of relative substitution rates with respect to MacClade matrix, estimated from alignment of 18S rDNA of taxa set B.

Variability is the log of the values in the variability table for taxa set B (Table 4).

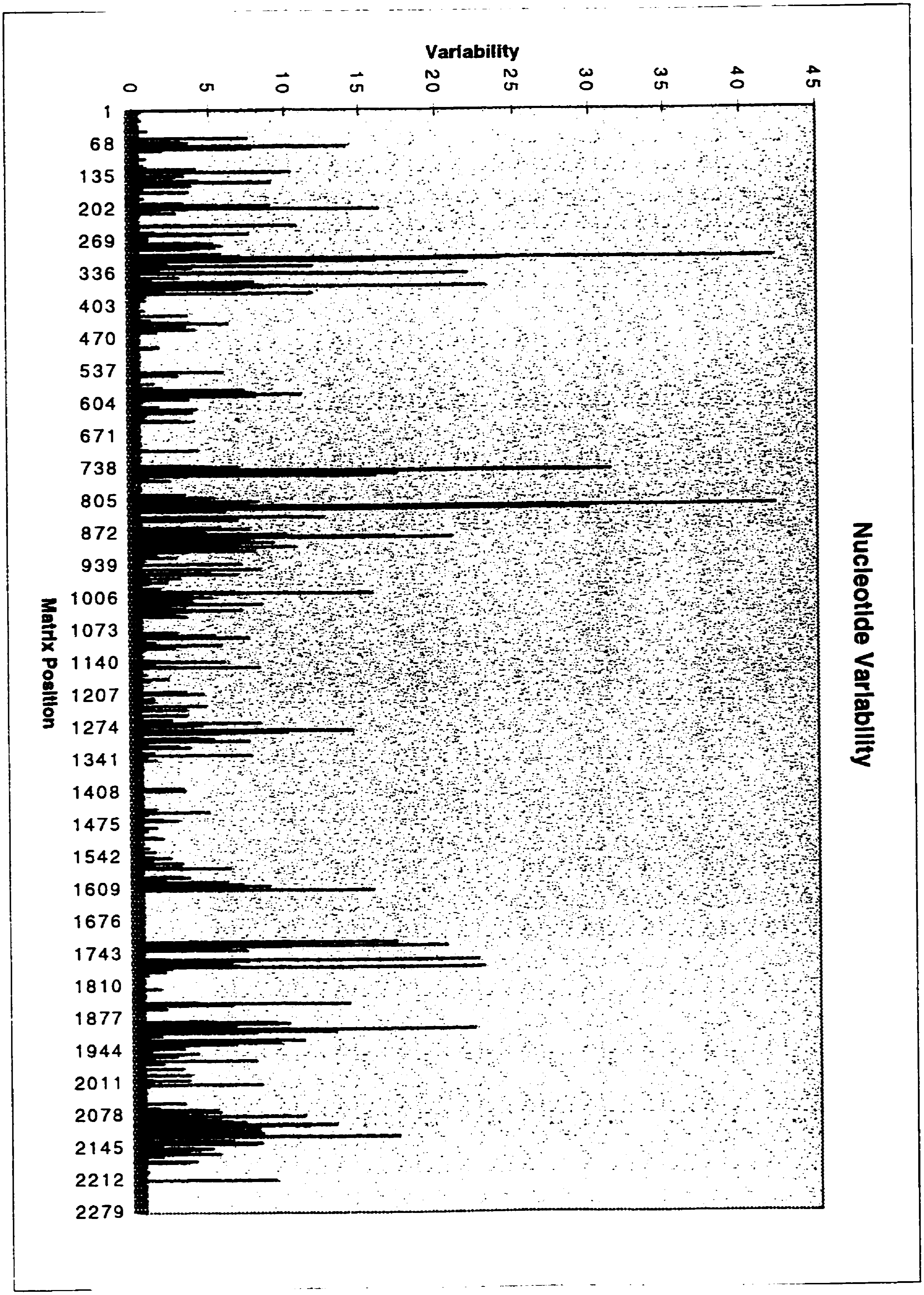

Nucleotide Variability
Variability
0 5 10 15 20 25 30 35 40 45
Matrix Position
1 68 135 202 269 336 403 470 537 604 671 738 805 872 939 1006 1073 1140 1207 1274 1341 1408 1475 1542 1609 1676 1743 1810 1877 1944 2011 2078 2145 2212 2279

Table 4.

Variability table for taxa set B.

The variabilities were calculated using taxa set B.

<u>Column Headings</u>

Site	:refers to matrix location of MacClade Matrix
Variability	:Score generated with 3 iterations of substition rate calculation.
Cat	:Variability category (shown in columns of MacClade Matrix)

Color Key

Cat #	Color
- 1	Grey
0	White
1	Red
2	Pink/Orange
3	Yellow
4	Green
5	Blue
6	Purple

Note: Nonvariable sites represented by purple are not included in table.

Table 4. Variability table for taxa set B.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
	-	-1		0.619	4	208	1.727746	3		0.856233	4	315	-	0
	9.269674	1		0.223341	5		0.170722	5		0.757058	4	317	-	0
	0.552329	4		0.767443	4	211	-	0		0.078532	5	318	2.160407	3
	0.529134	4		0.317833	4		0.182153	5		0.952773	4		0.651236	4
	0.148367	5		0.767447	4	214	2.739964	3		0.689048	4	320	-	0
	0.327716	4		3.282056	2		-	-1		0.929514	4		0.181397	5
	0.138438	5		1.078825	4		-	-1		0.917046	4	323	-	0
	0.90967	4		0.223339	5		-	-1		3.281521	2		11.752676	1
	0.446531	4	140	2.728873	3		-	-1		5.17309	2		3.810957	2
	7.509933	1	141	1.397547	3		-	-1	278	2.100022	3	330	-	0
	0.682403	4	142	1.496357	3		-	-1		0.687948	4	331	1.629031	3
	0.128236	5	145	-	0		-	-1	280	-	0		0.718257	4
	0.103599	5	146	-	0		-	-1	281	-	0		0.651259	4
	0.871057	4	147	-	0		-	-1		5.740174	2		0.920512	4
68	3.06303	3		4.286476	2		-	-1	283	2.145807	3		0.601508	4
	3.585126	2	149	1.890271	3		-	-1		5.2746	2		9.703156	1
72	-	0	150	-	0		-	-1		4.666056	2		14.84859	1
73	-	0		8.999743	1		-	-1		5.366636	2		21.933331	1
74	-	0		0.266337	5		-	-1		4.367602	2	340	-	0
75	3.011281	3		0.867829	4		-	-1	288	1.88005	3		0.319632	4
	14.107607	1	156	-	0		-	-1		3.845947	2	348	2.963082	3
	12.137928	1	157	1.657986	3		-	-1		-	-1		0.068799	5
78	1.663868	3		3.796199	2		-	-1		-	-1		0.419559	4
	0.344254	4		0.076108	5		-	-1		-	-1		0.476006	4
80	2.036346	3	161	-	0		-	-1		-	-1	353	1.156994	3
	7.768451	1		0.672955	4		-	-1		-	-1		0.09905	5
	6.805617	2	169	-	0		-	-1		-	-1	355	-	0
83	-	0		3.589689	2		-	-1		-	-1	356	-	0
86	1.905839	3	173	-	0		-	-1		-	-1		7.874473	1
87	-	0	178	-	0		3.289062	2		-	-1		0.323949	4
88	-	0		0.668554	4		10.726263	1		-	-1		0.777658	4
91	-	0		0.176978	5		5.156658	2		5.695101	2		0.631455	4
	0.084587	5	192	-	0	242	-	0	301	2.225938	3	361	-	0
	0.103866	5		0.068687	5	243	-	0		4.631436	2		0.596501	4
	0.343067	4		3.278543	2	244	-	0		4.675918	2		8.468694	1
	0.825009	4		0.176977	5	245	-	0		6.930992	2		3.206521	2
	0.619042	4		5.293993	2	246	-	0		4.692835	2		23.149639	1
	0.158184	5		8.955044	1		0.123009	5		42.043568	1		0.705765	4
	0.892272	4	200	-	0		0.323058	4	308	-	0		8.743754	1
	4.129072	2		4.639279	2	254	1.368369	3	309	-	0	368	-	0
	0.867849	4	202	1.137486	3	256	3.046788	3		24.016476	1		0.488794	4
	0.612641	4	203	1.58899	3		7.52297	1	311	1.855102	3		7.05522	2
127	-	0	204	-	0		5.17679	2		16.033964	1		0.943945	4
	0.650846	4		16.210125	1		0.255383	5		6.983452	2		0.076474	5
	10.379545	1		3.625143	2		0.920481	4	314	-	0	377	2.043571	3

Table 4. Variability table for taxa set B.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
	0.2255	5		0.380907	4	622	-	0		15.156329	1	802	-	0
379	-	0		0.103866	5	626	2.214879	3	753	-	0		5.207098	2
	11.742348	1		5.792713	2		3.791995	2		4.028542	2		0.826669	4
381	1.561765	3	544	1.734027	3	628	-	0		12.693307	1		3.440878	2
	0.317832	4	546	2.247888	3		0.788289	4		15.880737	1	807	1.243845	3
	0.085336	5	547	2.015177	3		0.651262	4		3.526304	2	808	3.050692	3
	0.646627	4	548	-	0		0.067634	5	758	-	0	809	-	0
	0.771534	4		0.515175	4		0.768031	4		0.715596	4	810	-	0
388	-	0	550	2.825728	3	634	-	0		0.825691	4		8.033676	1
	0.767469	4		0.103866	5		0.628	4	765	-	0		7.444651	1
	0.085667	5	567	1.256526	3		0.093563	5	766	1.450168	3	813	-	0
405	-	0		0.073112	5		0.160887	5	767	2.265764	3	814	-	0
	0.055434	5	575	1.805796	3	640	-	0	768	-	0	815	-	0
	0.103866	5	578	1.828991	3		0.810007	4	769	-	0	816	-	0
	0.666214	4		0.176978	5	643	2.917701	3	770	-	0	817	-	0
	0.123009	5		7.237089	1		3.864982	2	771	-	0	818	-	0
	0.089922	5		0.895812	4		0.160887	5	772	-	0		42.17226	1
	3.470867	2		0.627969	4		0.093563	5	773	-	0		16.798563	1
	1.082919	4		5.861557	2		0.108727	5	774	-	0		12.115381	1
	0.176977	5		7.878078	1		0.089327	5	775	-	0		5.566195	2
	3.5805	2		3.665234	2		0.110319	5		-	-1		10.407763	1
441	2.942682	3		0.39326	4		0.110319	5		-	-1	824	-	0
442	1.125725	3		11.017945	1		0.058113	5		-	-1		29.837286	1
	6.185495	2	590	1.367205	3		0.08572	5		-	-1		15.620416	1
	3.397484	2	591	-	0		0.223341	5		-	-1	827	3.118919	3
	0.093562	5		7.87618	1		0.874578	4		-	-1		4.957371	2
	3.97311	2		5.325319	2		0.757713	4		-	-1		5.009516	2
	0.093562	5		0.628004	4		4.149544	2		-	-1	830	2.072786	3
	1.004536	4	597	-	0		0.213441	5		-	-1		5.860284	2
460	1.485064	3	598	1.688656	3		0.104755	5		-	-1	832	-	0
	0.066862	5		3.542102	2		0.179315	5		-	-1	833	-	0
	0.223341	5		0.718146	4		0.22334	5		-	-1	834	-	0
	0.071828	5		0.476982	4		3.608802	2		-	-1	835	-	0
	0.123009	5		0.545833	4		4.396942	2		-	-1	836	-	0
	0.085336	5		0.093563	5		6.770321	2		-	-1	837	-	0
491	1.606322	3		0.103866	5		6.163895	2		-	-1	838	-	0
493	1.34938	3		0.093563	5		0.58855	4		-	-1	839	-	0
	0.084587	5		0.11128	5	743	1.77866	3	793	-	0	840	-	0
	0.176976	5		0.628063	4		31.307409	1	795	1.626606	3	841	-	0
	0.176976	5	614	1.569786	3	746	-	0		3.264218	2		12.496162	1
	0.055434	5		0.600258	4		29.58567	1		0.531552	4		5.20372	2
	0.159313	5		0.600123	4		4.048969	2	798	-	0		3.781062	2
	0.239817	5		0.651231	4		1.047038	4	799	-	0		6.75635	2
	0.251453	5		4.038343	2		3.501297	2		0.978878	4		3.219445	2
	0.223342	5		0.405938	4		17.272007	1	801	2.577457	3		0.176977	5

Table 4. Variability table for taxa set B.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
[redacted]	6.69502	2	908	2.942903	3	984	-	0	[redacted]	3.279169	2	[redacted]	0.073112	5
850	3.159932	3	909	2.401639	3	[redacted]	0.22334	5	[redacted]	0.366882	4	[redacted]	3.278544	2
851	-	0	[redacted]	3.559604	2	[redacted]	0.17698	5	[redacted]	0.099254	5	[redacted]	4.380527	2
[redacted]	0.939649	4	[redacted]	3.848646	2	990	1.578121	3	1081	2.670779	3	[redacted]	0.176977	5
[redacted]	5.553166	2	[redacted]	7.812299	1	[redacted]	0.223341	5	[redacted]	0.317833	4	[redacted]	0.176977	5
[redacted]	4.199852	2	[redacted]	3.441546	2	[redacted]	0.609693	4	[redacted]	0.149706	5	1213	-	0
[redacted]	7.43768	1	[redacted]	3.278681	2	[redacted]	0.190065	5	[redacted]	0.318916	4	[redacted]	0.085336	5
868	-	0	[redacted]	0.609673	4	[redacted]	3.278607	2	1087	2.711495	3	[redacted]	0.184502	5
[redacted]	3.184855	2	[redacted]	0.223341	5	[redacted]	6.50707	2	[redacted]	5.190529	2	[redacted]	0.085336	5
870	2.143478	3	919	1.400151	3	998	-	0	[redacted]	7.37346	1	1218	1.125726	3
871	-	0	[redacted]	0.609689	4	[redacted]	15.625661	1	[redacted]	0.067051	5	[redacted]	1.004646	4
[redacted]	3.849394	2	922	-	0	[redacted]	7.443014	1	[redacted]	0.600254	4	1223	1.125726	3
[redacted]	4.558035	2	925	1.556025	3	1002	1.239992	3	1101	1.125724	3	1225	1.125726	3
874	1.209866	3	926	2.695115	3	[redacted]	0.176979	5	1102	1.229711	3	[redacted]	4.509048	2
875	1.131517	3	[redacted]	0.600138	4	1007	2.709673	3	[redacted]	0.249082	5	[redacted]	0.176977	5
876	2.950408	3	933	-	0	[redacted]	3.856979	2	[redacted]	5.574201	2	[redacted]	3.278598	2
877	2.627478	3	938	-	0	[redacted]	5.012696	2	[redacted]	3.278647	2	[redacted]	0.190064	5
[redacted]	9.923486	1	[redacted]	0.085131	5	1011	-	0	1110	-	0	[redacted]	3.278607	2
[redacted]	0.433646	4	[redacted]	6.942472	2	[redacted]	3.676152	2	1111	1.490349	3	1262	2.319566	3
880	1.947697	3	942	-	0	1014	1.18634	3	[redacted]	0.83844	4	[redacted]	0.199949	5
[redacted]	0.322677	4	947	-	0	[redacted]	0.82716	4	1113	2.452124	3	[redacted]	0.176979	5
[redacted]	17.108433	1	[redacted]	0.223341	5	1016	3.03937	3	[redacted]	0.587425	4	[redacted]	8.144135	1
[redacted]	7.019657	2	[redacted]	8.182248	1	[redacted]	1.035093	4	[redacted]	0.185878	5	1270	1.196749	3
[redacted]	20.887762	1	[redacted]	0.223341	5	1019	-	0	[redacted]	0.895822	4	[redacted]	3.2786	2
885	3.144126	3	954	-	0	[redacted]	3.760838	2	[redacted]	0.711259	4	[redacted]	4.27888	2
886	-	0	955	-	0	[redacted]	0.142231	5	1140	1.711748	3	1274	1.778439	3
887	-	0	956	-	0	1022	2.032823	3	[redacted]	3.279149	2	[redacted]	3.766665	2
[redacted]	0.308956	5	957	-	0	[redacted]	8.269547	1	[redacted]	5.804338	2	[redacted]	0.651223	4
[redacted]	7.545074	1	[redacted]	4.916144	2	1024	2.510505	3	[redacted]	0.651224	4	1280	-	0
[redacted]	6.175605	2	[redacted]	4.032711	2	1025	-	0	1148	1.229711	3	1281	-	0
[redacted]	6.876983	2	[redacted]	4.33321	2	[redacted]	0.598423	4	[redacted]	0.353988	4	1282	-	0
892	1.125726	3	[redacted]	6.676934	2	1031	2.294927	3	1152	2.550627	3	[redacted]	13.920209	1
[redacted]	3.280788	2	962	-	0	[redacted]	3.276029	2	[redacted]	8.073201	1	[redacted]	14.335297	1
[redacted]	0.606773	4	963	-	0	1033	-	0	[redacted]	0.600253	4	1285	2.057786	3
[redacted]	9.101762	1	964	-	0	[redacted]	6.934744	2	[redacted]	0.067052	5	[redacted]	0.840473	4
897	-	0	[redacted]	0.085336	5	[redacted]	5.591353	2	[redacted]	0.085667	5	1287	-	0
[redacted]	3.656609	2	[redacted]	0.819166	4	[redacted]	3.487582	2	1176	-	0	[redacted]	9.944017	1
[redacted]	4.568418	2	969	2.942651	3	1039	-	0	1177	2.073606	3	[redacted]	6.991466	2
[redacted]	6.871687	2	[redacted]	0.88833	4	[redacted]	0.223338	5	[redacted]	0.870256	4	1290	1.699787	3
901	1.734086	3	[redacted]	0.952234	4	1042	2.550945	3	[redacted]	0.318915	4	[redacted]	5.278444	2
902	1.181077	3	973	-	0	1043	-	0	[redacted]	0.867922	4	1292	-	0
903	2.64297	3	976	2.073654	3	1044	-	0	[redacted]	0.099254	5	1295	-	0
[redacted]	10.580979	1	977	-	0	[redacted]	1.088647	4	[redacted]	0.318916	4	1296	-	0
[redacted]	6.437685	2	[redacted]	0.994332	4	1046	1.721671	3	[redacted]	0.085336	5	1297	-	0
906	-	0	[redacted]	0.767389	4	1047	2.945104	3	[redacted]	0.16287	5	1298	-	0

Table 4. Variability table for taxa set B.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
[illegible]	4.137196	2	[redacted]	0.342442	4	[redacted]	0.055434	5	1621	~	0	1691	~	0
1301	2.066523	3	1399	~	0	[redacted]	0.10037	5	1622	~	0	1692	~	0
[illegible]	5.050073	2	1400	~	0	[redacted]	1.004537	4	1623	~	0	1693	~	0
[illegible]	3.748783	2	1404	3.044568	3	1547	1.201387	3	1624	~	0	1694	~	0
[illegible]	4.030158	2	1406	~	0	1548	2.176435	3	1625	~	0	1695	~	0
[redacted]	1.032752	4	[redacted]	0.122122	5	[redacted]	1.004549	4	1626	~	0	1696	~	0
[redacted]	7.372039	1	1409	3.144292	3	[redacted]	1.004549	4	1627	~	0	1697	~	0
1308	1.208915	3	[redacted]	0.110174	5	[redacted]	1.004549	4	1628	~	0	1698	~	0
1309	~	0	[redacted]	0.110174	5	1559	2.942643	3	1629	~	0	1699	~	0
[redacted]	0.105014	5	1413	~	0	1560	~	0	1630	~	0	1700	~	0
[redacted]	0.897775	4	[redacted]	0.286228	5	[redacted]	0.777568	4	1631	~	0	1701	~	0
1316	2.788565	3	[redacted]	0.207483	5	[redacted]	1.004538	4	1632	~	0	1702	~	0
1317	~	0	[redacted]	0.282539	5	1567	2.942643	3	1633	~	0	1703	~	0
1318	~	0	[redacted]	0.197163	5	[illegible]	6.064565	2	1634	~	0	1704	~	0
[illegible]	3.521061	2	1421	~	0	[redacted]	0.055434	5	1635	~	0	1705	~	0
1322	~	0	[redacted]	0.249173	5	[redacted]	0.103866	5	1636	~	0	1706	~	0
[redacted]	0.223338	5	[redacted]	0.17698	5	[redacted]	0.055434	5	1637	~	0	1707	~	0
[redacted]	0.085335	5	[redacted]	0.103867	5	[redacted]	0.084587	5	1638	~	0	1708	~	0
1330	~	0	1447	1.217765	3	1587	2.942936	3	1639	~	0	1709	~	0
[redacted]	1.11505	4	[redacted]	0.194847	5	[redacted]	0.59067	4	1640	~	0	1710	~	0
[redacted]	0.176979	5	[redacted]	0.282144	5	[illegible]	3.39748	2	1641	~	0	1711	~	0
[redacted]	7.536263	1	[illegible]	4.684387	2	1593	1.802592	3	1642	~	0	1712	~	0
[redacted]	0.107145	5	[redacted]	0.618602	4	[redacted]	0.801753	4	1643	~	0	1713	~	0
[redacted]	0.317832	4	1468	1.61105	3	[illegible]	5.880794	2	1644	~	0	1714	~	0
[redacted]	0.651223	4	[redacted]	0.609042	4	[redacted]	0.718139	4	1645	~	0	1715	~	0
[redacted]	0.595197	4	1470	1.496837	3	1601	~	0	1646	~	0	1716	~	0
[redacted]	0.282144	5	1471	2.657177	3	[redacted]	0.845176	4	1647	~	0	[illegible]	~	-1
[redacted]	0.282812	5	[redacted]	0.473366	4	[illegible]	6.894108	2	1648	~	0	[illegible]	~	-1
1345	1.219445	3	[redacted]	0.138306	5	[illegible]	3.490597	2	1649	~	0	[illegible]	~	-1
[redacted]	0.224716	5	1485	1.243285	3	[illegible]	3.642759	2	1650	~	0	[illegible]	~	-1
[redacted]	0.223342	5	[redacted]	0.639934	4	[illegible]	5.469203	2	1651	~	0	[illegible]	~	-1
[redacted]	0.223342	5	[redacted]	0.103866	5	[redacted]	8.669055	1	1652	~	0	[redacted]	17.088163	1
[redacted]	0.223342	5	[redacted]	0.640092	4	1608	~	0	1653	~	0	[redacted]	11.813357	1
[redacted]	0.199227	5	[redacted]	0.093563	5	[illegible]	5.1464	2	1654	~	0	[redacted]	10.049682	1
[redacted]	0.223341	5	[redacted]	1.120804	4	[illegible]	6.075157	2	1655	~	0	[redacted]	8.316597	1
[redacted]	0.093563	5	1507	1.611039	3	[redacted]	7.233139	1	1656	~	0	[redacted]	11.036735	1
[redacted]	0.282811	5	1512	~	0	[illegible]	6.954473	2	1657	~	0	[illegible]	4.970957	2
[redacted]	0.20249	5	[redacted]	0.076474	5	[illegible]	4.510309	2	1658	~	0	[redacted]	7.209176	1
[redacted]	0.190807	5	[redacted]	0.066073	5	[redacted]	15.581428	1	1659	~	0	[illegible]	3.906911	2
[redacted]	0.194068	5	[redacted]	0.194847	5	1615	~	0	1685	~	0	[redacted]	20.366158	1
[redacted]	0.089327	5	[redacted]	0.194847	5	1616	~	0	1686	~	0	[illegible]	4.22669	2
[redacted]	0.122557	5	[redacted]	0.715707	4	1617	~	0	1687	~	0	[redacted]	9.901206	1
[redacted]	0.290471	5	1532	~	0	1618	~	0	1688	~	0	[illegible]	4.685752	2
1392	~	0	1535	1.125725	3	1619	~	0	1689	~	0	[illegible]	3.330656	2
[redacted]	0.294554	5	[redacted]	0.176979	5	1620	~	0	1690	~	0	1735	~	0

Table 4. Variability table for taxa set B.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
	5.540837	2		0.435026	4		7.689672	1		0.062285	5		4.300284	2
1737	2.858823	3		6.035917	2	1914	1.382366	3		0.594578	4	2110	-	0
	3.757946	2		6.102921	2	1917	1.464771	3		0.090382	5	2111	-	0
	7.08152	1	1856	1.524477	3		0.651237	4		0.078533	5		5.711187	2
1752	-	0		0.619124	4		0.441986	4	2039	-	0		5.251099	2
	0.103866	5		0.619124	4		10.916348	1		0.176977	5		7.885318	1
	0.103866	5	1861	1.816442	3	1927	1.984201	3		0.066072	5		6.253412	2
	0.103866	5	1862	-	0		5.979513	2		0.223341	5	2116	-	0
1756	-	0	1863	-	0		0.176994	5	2056	2.942847	3	2117	-	0
1757	1.68322	3	1864	-	0		0.317833	4	2057	1.125725	3	2118	-	0
	22.372915	1	1865	-	0		9.271133	1		0.079143	5		0.393321	4
1760	2.009835	3	1866	-	0		0.318912	4	2067	1.201386	3		8.07118	1
1761	-	0	1867	-	0		6.408242	2	2068	1.30576	3		5.272329	2
	7.231117	1	1868	-	0		3.925524	2		0.185877	5	2122	2.273361	3
1763	1.273527	3	1869	-	0	1938	-	0		3.794235	2		6.766105	2
	3.736887	2	1870	-	0	1943	2.942646	3		5.066354	2		6.587655	2
1765	2.161109	3	1871	-	0	1944	1.221869	3		3.278123	2		5.908135	2
	6.133319	2	1875	-	0		0.777568	4	2074	-	0		17.14352	1
	4.891889	2	1876	-	0		3.848276	2		5.309021	2		5.260294	2
1769	-	0	1877	-	0	1955	2.518901	3	2076	2.942675	3	2128	-	0
1770	-	0	1878	-	0	1956	1.41215	3		0.223971	5	2129	-	0
	0.140775	5	1879	-	0	1960	2.460857	3	2081	3.081217	3	2130	-	0
	6.563599	2	1883	-	0		0.882488	4		0.185878	5	2131	-	0
1773	1.802534	3	1884	-	0		0.886979	4		4.173811	2	2132	-	0
	22.762793	1	1885	-	0	1968	1.301808	3		10.869044	1	2133	-	0
	0.804438	4	1886	-	0		7.662072	1		0.159675	5		6.14751	2
1777	2.106157	3		4.897605	2		0.315614	5		3.982403	2		5.072736	2
	0.223338	5		4.530867	2	1974	1.579151	3		3.635116	2		4.278468	2
	0.089922	5		8.996841	1		0.066073	5		0.092489	5		4.554476	2
1784	1.739936	3	1890	3.117699	3	1985	2.826697	3		0.17479	5	2138	-	0
	0.22334	5		7.973341	1		0.055434	5		5.252111	2		7.962576	1
	0.609045	4		9.877855	1		0.23334	5	2093	1.839357	3		5.387676	2
	0.055434	5		6.367309	2		0.232166	5		6.056272	2		7.606258	1
	0.066073	5		0.101542	5		1.021165	4	2095	-	0		0.394096	4
	0.068799	5	1898	2.552688	3		3.281151	2		4.981063	2		0.249173	5
	0.09646	5	1899	1.201123	3		0.170739	5		6.971542	2		0.104422	5
	0.133313	5		0.140775	5		0.223339	5		6.634578	2		0.104422	5
1818	-	0		0.085336	5		0.803576	4		4.767314	2	2147	1.373574	3
1819	1.37357	3	1902	2.658007	3		3.280293	2		13.032255	1		0.210552	5
	0.098881	5		22.094467	1		0.240836	5		7.91533	1		1.063467	4
	0.133313	5	1905	-	0		0.106225	5		11.219984	1		3.437787	2
	0.09646	5		0.16286	5		0.873594	4		6.605432	2		4.73329	2
	0.09646	5		13.04104	1		0.093562	5		6.592031	2		4.137398	2
	3.844656	2	1909	-	0		7.980903	1	2106	1.247594	3		3.932129	2
	13.952195	1		3.297023	2		0.062285	5		7.838114	1		3.315608	2

Table 4. Variability table for taxa set B.

Site	Variability	Cat	Site	Variability	Cat
[redacted]	0.389642	4	2251	~	0
[redacted]	3.177977	2	2252	~	0
2159	~	0	2253	~	0
2160	1.27842	3	2254	~	0
[redacted]	3.17761	2	2255	~	0
[redacted]	5.208125	2	2256	~	0
2163	1.867603	3	2257	~	0
[redacted]	0.148508	5	2258	~	0
[redacted]	0.210897	5	2259	~	0
2166	1.278405	3	2260	~	0
2167	1.457551	3	2261	~	0
[redacted]	0.32395	4	2262	~	0
2176	1.520867	3	2263	~	0
[redacted]	3.70476	2	2264	~	0
[redacted]	3.17618	2	2265	~	0
2187	~	0	2266	~	0
2188	~	0	2267	~	0
2189	~	0	2268	~	0
[redacted]	0.166579	5	2269	~	0
[redacted]	0.512631	4	2270	~	0
[redacted]	0.230657	5	2271	~	0
[redacted]	8.887003	1	2272	~	0
[redacted]	0.471042	4	2273	~	0
[redacted]	~	-1	2274	~	0
[redacted]	~	-1	2275	~	0
[redacted]	~	-1	2276	~	0
[redacted]	~	-1	2277	~	0
[redacted]	~	-1	2278	~	0
2234	~	0	2279	~	0
2235	~	0	2280	~	0
2236	~	0	2281	~	0
2237	~	0	2282	~	0
2238	~	0	2283	~	0
2239	~	0			
2240	~	0			
2241	~	0			
2242	~	0			
2243	~	0			
2244	~	0			
2245	~	0			
2246	~	0			
2247	~	0			
2248	~	0			
2249	~	0			
2250	~	0			

APPENDIX E : Secondary Structure

Figure 14.

Secondary structure model for 18S rDNA of *Physcomitrella patens*.

The primary structure data was obtained from GenBank accession X80986. The sequence is written clockwise 5' → 3'. Helix numbering is according to Van de Peer *et al.* (1997).

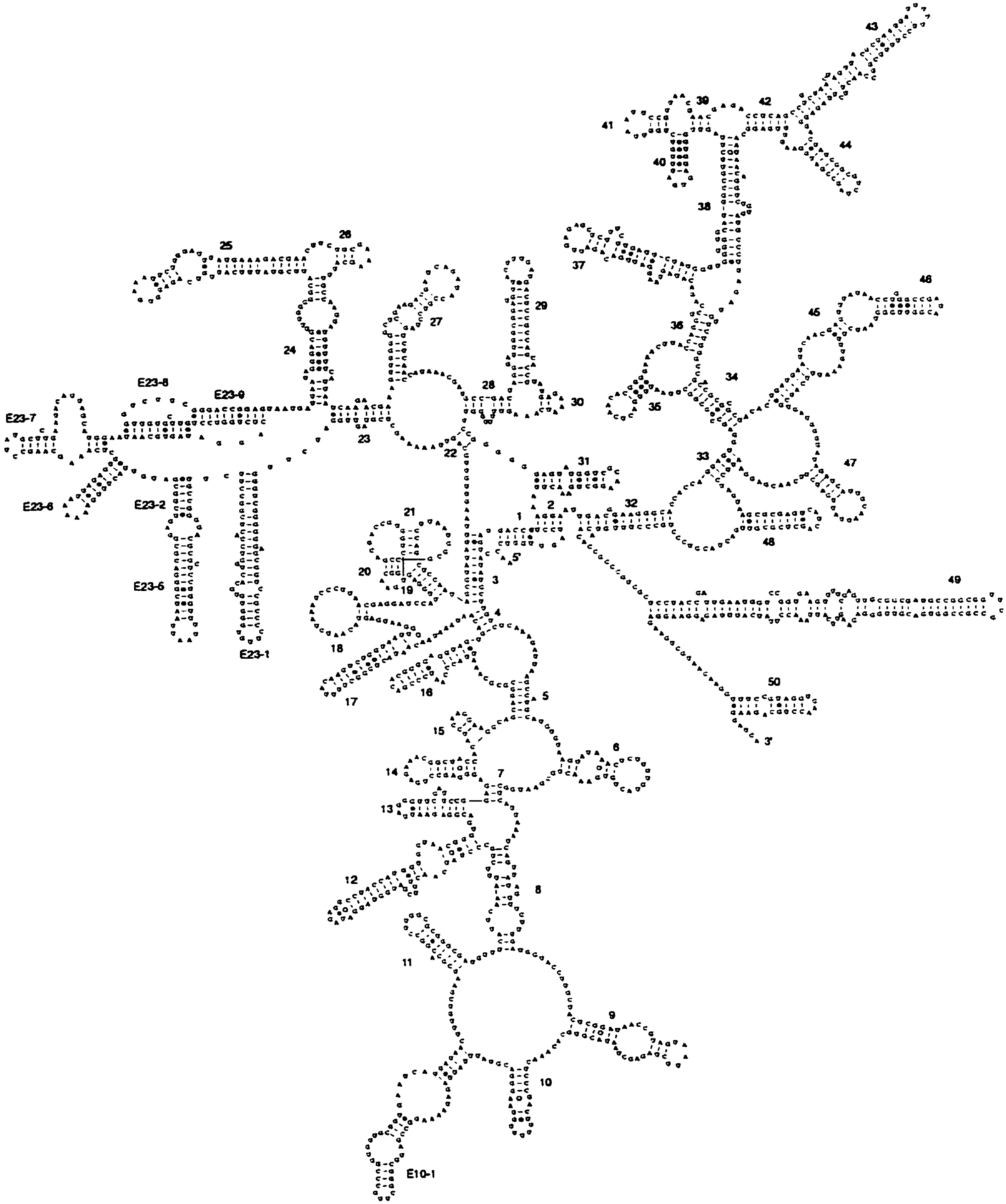
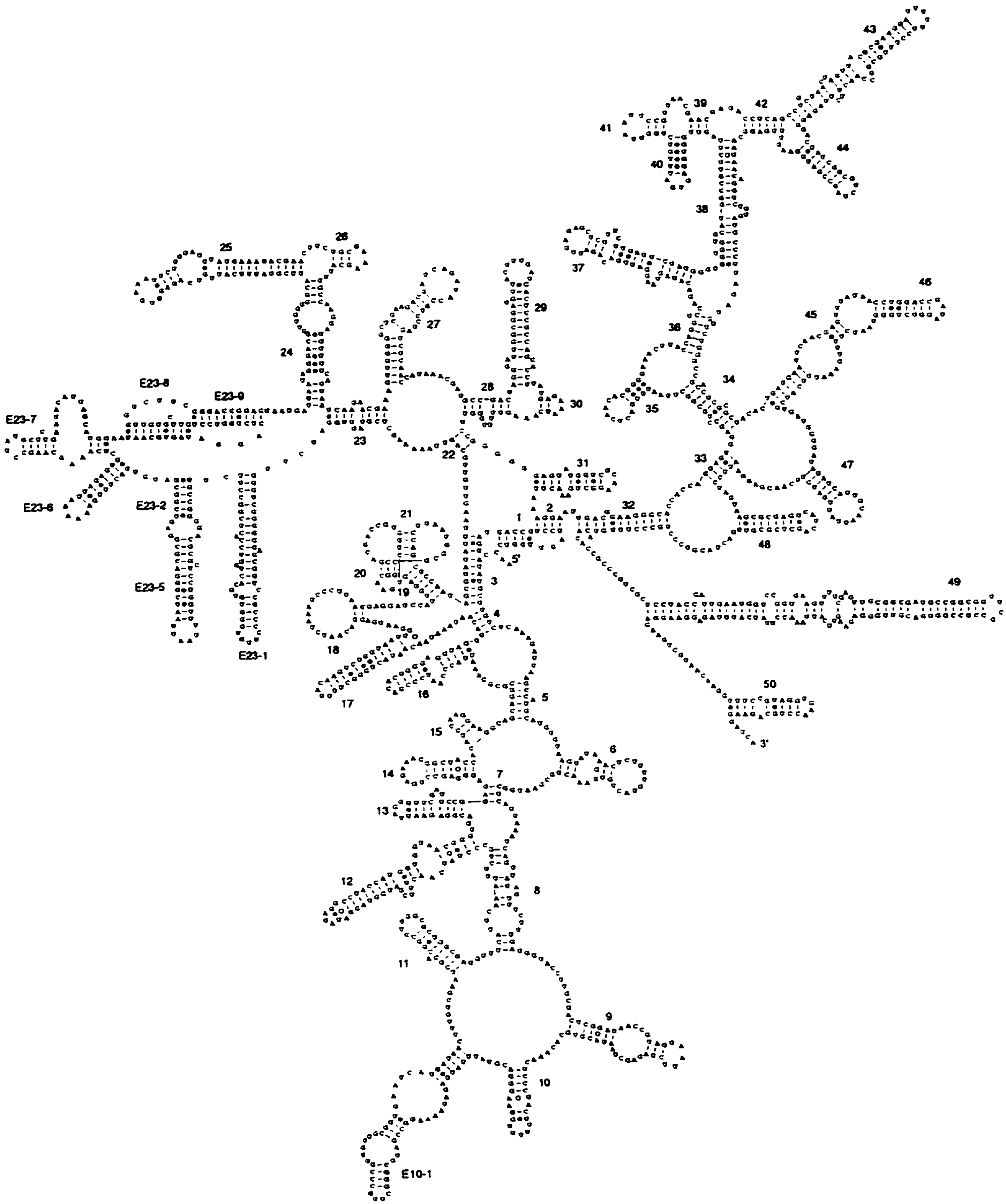

43
39
42
41
44
40
38
37
25
26
46
29
27
36
45
24
34
E23-8
28
30
E23-9
35
E23-7
23
22
33
47
31
E23-6
E23-2
32
21
1
2
48
5'
20
19
3
E23-5
49
4
18
E23-1
17
16
50
5
3'
15
6
14
7
13
12
8
11
9
10
E10-1

Figure 15.

Secondary structure model for 18S rDNA of *Physcomitrella patens* with primary and secondary structure corrections on helix 46.

The uncorrected primary structure data was obtained from Genbank accession X80986. The sequence is written clockwise 5' → 3'. Helix numbering is according to Van de Peer *et al.* (1997).

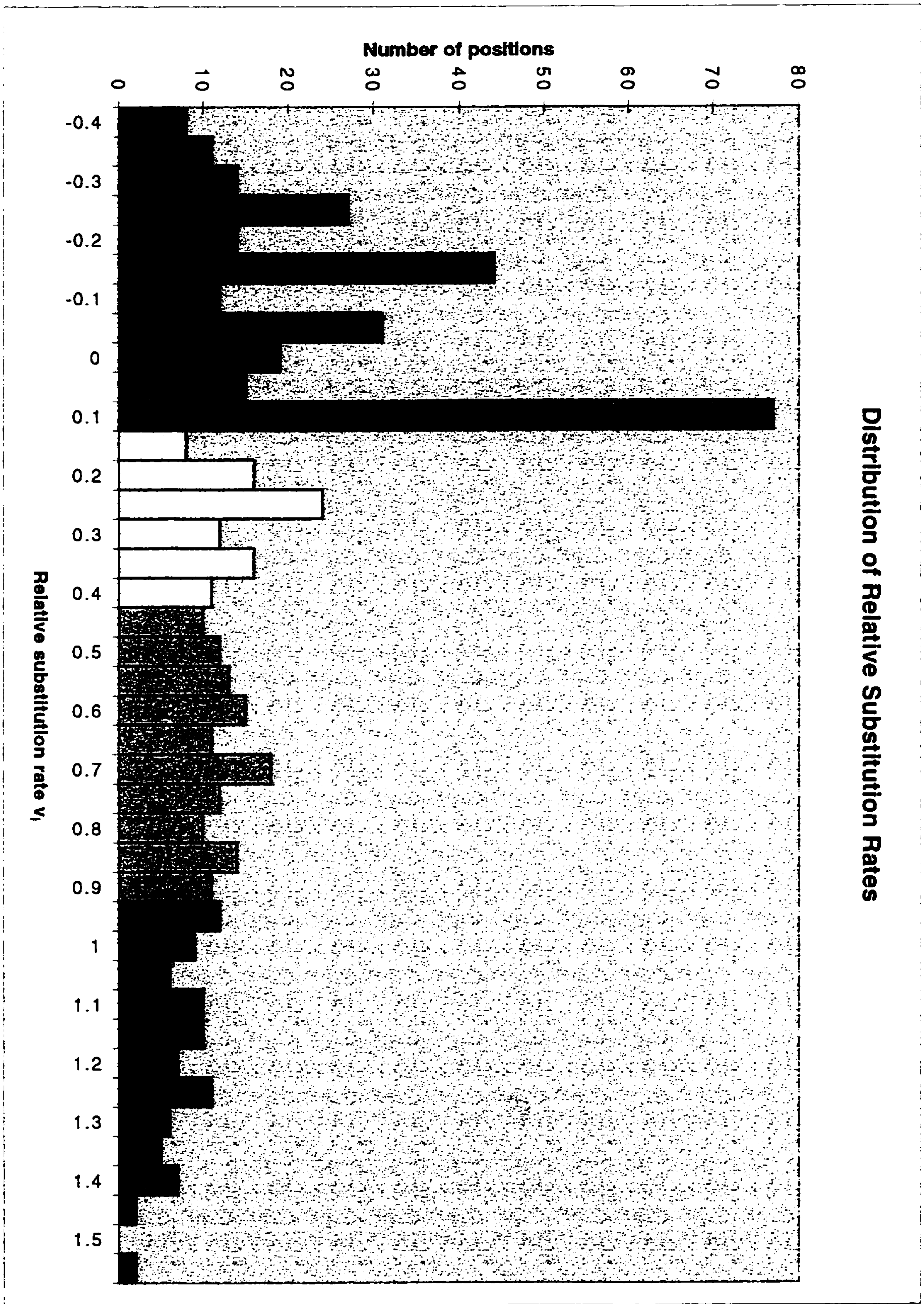


43
39
42
41
44
40
38
25
26
37
29
27
46
45
36
24
34
35
E23-8
E23-9
28
30
E23-7
23
22
31
33
47
E23-6
E23-2
1
2
32
21
5'
48
20
19
3
E23-5
49
4
18
E23-1
17
16
5
50
15
3'
6
14
7
13
12
8
11
9
10
E10-1

Figure 16.

Variability map of lower plants superimposed on the 18S rDNA secondary structure model of *Physcomitrella patens* shown in Figure 15.

Nucleotides are subdivided into five groups of increasing variability as described by Van de Peer *et al.* (1997). The most variable positions are in red (category 1) and, the most conserved in blue (category 5). Purple indicates the positions which are absolutely conserved, (category 6). Nucleotides present in *Physcomitrella patens* but absent in 75% of the lower plants considered are indicated in white. Grey indicates regions of undetermined variability due to ambiguous alignment.



Distribution of Relative Substitution Rates
Number of positions
0
10
20
30
40
50
60
70
80
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
Relative substitution rate v_i

Table 5.

Variability table for taxa set C.

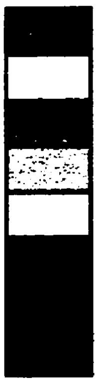
The variabilities were calculated using taxa set C.

<u>Column Headings</u>

Site	:refers to matrix location of MacClade Matrix
Variability	:Score generated with 3 iterations of substition rate calculation.
Cat	:Variability category (shown in columns of MacClade Matrix)

Color Key

Cat #	Color
- 1	Grey
0	White
1	Red
2	Pink/Orange
3	Yellow
4	Green
5	Blue
6	Purple



Note: Nonvariable sites represented by purple are not included in table.

Table 5. Variability table for taxa set C.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
[illegible]	-	-1	[illegible]	7.313498	2	[redacted]	-	-1	[illegible]	3.631387	2	379	-	0	[redacted]	0.875497	4
23	2.400065	3	156	-	0	[illegible]	-	-1	[redacted]	23.843922	1	[redacted]	12.590858	1	[illegible]	2.717394	2
[redacted]	1.003543	4	[redacted]	1.232586	4	[illegible]	-	-1	308	-	0	[redacted]	0.71236	5	590	2.505148	3
39	2.598499	3	158	1.852433	3	[illegible]	-	-1	309	-	0	[illegible]	4.848178	2	591	-	0
[redacted]	0.926294	4	[redacted]	0.585814	5	[illegible]	-	-1	[redacted]	22.692989	1	387	1.568456	3	[redacted]	0.896541	4
[redacted]	0.45451	5	161	-	0	[redacted]	11.689941	1	[redacted]	8.727041	1	388	-	0	597	-	0
[redacted]	0.606526	5	165	1.983505	3	[redacted]	16.944672	1	[redacted]	18.401386	1	[redacted]	1.232585	4	[redacted]	0.376893	5
[redacted]	1.160694	4	169	-	0	[redacted]	22.61495	1	[redacted]	8.233348	1	[redacted]	0.579161	5	599	2.20891	3
72	-	0	173	-	0	242	-	0	314	-	0	405	-	0	[redacted]	1.230248	4
73	-	0	178	-	0	243	-	0	315	-	0	[redacted]	0.976897	4	605	1.717242	3
74	-	0	[redacted]	1.230248	4	244	-	0	317	-	0	[illegible]	5.038437	2	[redacted]	0.896539	4
[illegible]	4.224235	2	192	-	0	245	-	0	320	-	0	426	2.645902	3	[redacted]	0.976897	4
[redacted]	12.306859	1	[redacted]	0.415194	5	246	-	0	321	1.34663	3	[illegible]	7.998219	2	[redacted]	0.896541	4
[redacted]	8.566137	1	[redacted]	1.230248	4	[illegible]	6.590549	2	323	-	0	[redacted]	1.230248	4	[redacted]	0.896541	4
[illegible]	7.440287	2	[redacted]	0.749565	4	[redacted]	10.867265	1	[redacted]	14.763712	1	[redacted]	12.991754	1	[redacted]	0.896541	4
[redacted]	1.232585	4	[illegible]	4.523172	2	[redacted]	9.573917	1	[redacted]	0.517846	5	[redacted]	0.896539	4	[illegible]	3.302628	2
[redacted]	0.79191	4	200	-	0	[redacted]	0.527933	5	330	-	0	[illegible]	3.853834	2	[redacted]	0.79191	4
83	-	0	[redacted]	9.901134	1	[redacted]	0.681978	5	[illegible]	3.460521	2	[redacted]	0.896539	4	[redacted]	1.230247	4
[illegible]	2.953751	2	[illegible]	4.949099	2	[redacted]	0.385379	5	[redacted]	1.230251	4	460	1.325305	3	[redacted]	0.585813	5
87	-	0	204	-	0	[redacted]	0.997563	4	[redacted]	0.415194	5	[redacted]	0.385349	5	622	-	0
88	-	0	[redacted]	14.679193	1	[illegible]	5.063408	2	[redacted]	15.974884	1	[redacted]	1.232585	4	[illegible]	2.964889	2
91	-	0	[illegible]	5.13748	2	[illegible]	3.559758	2	[redacted]	16.96855	1	[redacted]	0.445487	5	[redacted]	0.744925	4
[redacted]	0.897031	4	[redacted]	0.897031	4	[redacted]	9.07279	1	[redacted]	23.797117	1	[redacted]	0.71236	5	628	-	0
[redacted]	0.976897	4	210	1.602081	3	[redacted]	1.232587	4	340	-	0	[illegible]	3.049086	2	[redacted]	0.79191	4
100	2.324674	3	211	-	0	279	1.75157	3	348	1.320645	3	[redacted]	0.590929	5	634	-	0
[redacted]	0.71236	5	212	1.590599	3	280	-	0	[redacted]	0.744925	4	[redacted]	0.897031	4	[redacted]	0.896539	4
117	1.497844	3	[illegible]	7.277153	2	281	-	0	[redacted]	0.579161	5	[redacted]	1.230248	4	[redacted]	0.896539	4
121	2.452257	3	[illegible]	-	-1	[redacted]	0.944067	4	352	1.793893	3	[redacted]	1.230248	4	640	-	0
[redacted]	0.68883	5	[illegible]	-	-1	[illegible]	3.564573	2	[redacted]	0.579162	5	[redacted]	0.590929	5	[redacted]	0.43188	5
127	-	0	[illegible]	-	-1	[illegible]	5.754246	2	[redacted]	0.579162	5	514	1.33712	3	[redacted]	0.896539	4
[redacted]	0.85119	4	[illegible]	-	-1	[redacted]	0.579162	5	355	-	0	519	1.856973	3	[redacted]	0.842553	4
[illegible]	3.128895	2	[illegible]	-	-1	[redacted]	1.144802	4	356	-	0	520	1.901095	3	[redacted]	0.655874	5
[redacted]	0.71236	5	[illegible]	-	-1	[illegible]	3.371231	2	[illegible]	3.885621	2	[redacted]	1.232586	4	[redacted]	0.859801	4
[redacted]	1.232585	4	[illegible]	-	-1	[illegible]	-	-1	361	-	0	[redacted]	0.590929	5	[redacted]	0.859801	4
[redacted]	1.232585	4	[illegible]	-	-1	[illegible]	-	-1	362	1.712447	3	[redacted]	0.976897	4	[redacted]	0.625936	5
[redacted]	1.232585	4	[illegible]	-	-1	[illegible]	-	-1	[redacted]	13.417314	1	[redacted]	1.094154	4	[redacted]	0.896683	4
[illegible]	3.07286	2	[illegible]	-	-1	[illegible]	-	-1	[redacted]	12.757014	1	548	-	0	[redacted]	1.232586	4
[redacted]	1.232587	4	[illegible]	-	-1	[illegible]	-	-1	[redacted]	24.381956	1	[redacted]	0.976897	4	703	1.87433	3
[redacted]	0.897031	4	[illegible]	-	-1	[illegible]	-	-1	366	1.290763	3	[redacted]	0.517845	5	[illegible]	5.497921	2
[redacted]	0.681978	5	[illegible]	-	-1	[illegible]	-	-1	[illegible]	6.684884	2	575	1.717251	3	[illegible]	5.252469	2
[illegible]	2.868198	2	[illegible]	-	-1	[illegible]	-	-1	368	-	0	[redacted]	0.585814	5	[redacted]	0.90715	4
145	-	0	[illegible]	-	-1	[illegible]	-	-1	[redacted]	15.167713	1	[redacted]	1.230248	4	[redacted]	0.995272	4
146	-	0	[illegible]	-	-1	[illegible]	-	-1	[redacted]	0.590929	5	[illegible]	4.65137	2	[redacted]	1.239812	4
147	-	0	[illegible]	-	-1	300	1.558337	3	[redacted]	0.47586	5	[redacted]	0.906842	4	[redacted]	1.23259	4
[redacted]	0.831836	4	[illegible]	-	-1	[redacted]	0.79191	4	[redacted]	0.744925	4	[redacted]	0.896539	4	[redacted]	1.230249	4
150	-	0	[illegible]	-	-1	[redacted]	1.132634	4	378	1.276647	3	[redacted]	1.232586	4	[redacted]	14.297762	1

Table 5. Variability table for taxa set C.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
[redacted]	0.608078	5	799	-	0	[redacted]	1.230248	4	[redacted]	0.475859	5	[redacted]	1.230249	4	[redacted]	0.71236	5
[redacted]	26.794685	1	[redacted]	0.976897	4	849	1.844533	3	922	-	0	[redacted]	4.21441	2	1216	1.65957	3
746	-	0	801	2.59143	3	851	-	0	925	1.949421	3	1019	-	0	[redacted]	0.71236	5
[redacted]	34.862289	1	802	-	0	[redacted]	0.79191	4	[redacted]	0.79191	4	[redacted]	18.699017	1	[redacted]	1.230248	4
748	1.788468	3	803	2.378535	3	[redacted]	1.232595	4	933	-	0	1022	2.668656	3	[redacted]	1.064245	4
750	1.963703	3	806	2.620925	3	[redacted]	3.220134	2	938	-	0	[redacted]	5.175593	2	[redacted]	0.415192	5
[redacted]	13.608665	1	[redacted]	4.219388	2	[redacted]	4.82024	2	[redacted]	0.572653	5	[redacted]	8.259002	1	[redacted]	1.230248	4
[redacted]	20.423738	1	[redacted]	4.644421	2	868	-	0	[redacted]	0.571523	5	1025	-	0	[redacted]	9.787221	1
753	-	0	809	-	0	869	1.426172	3	942	-	0	[redacted]	0.694456	5	1270	2.138923	3
[redacted]	5.828836	2	810	-	0	870	1.572389	3	947	-	0	1033	-	0	[redacted]	1.100646	4
[redacted]	16.300552	1	[redacted]	9.427018	1	871	-	0	[redacted]	1.232585	4	[redacted]	6.062812	2	[redacted]	8.953848	1
[redacted]	11.987606	1	[redacted]	7.609166	2	[redacted]	5.294254	2	[redacted]	7.020597	2	1036	2.576682	3	1280	-	0
[redacted]	4.937298	2	813	-	0	873	2.430647	3	[redacted]	1.232586	4	1039	-	0	1281	-	0
758	-	0	814	-	0	[redacted]	1.230248	4	954	-	0	[redacted]	1.232587	4	1282	-	0
765	-	0	815	-	0	[redacted]	0.976897	4	955	-	0	[redacted]	5.817531	2	[redacted]	7.964884	2
766	1.463314	3	816	-	0	877	2.59143	3	956	-	0	1043	-	0	[redacted]	16.169518	1
[redacted]	5.38996	2	817	-	0	[redacted]	14.121339	1	957	-	0	1044	-	0	1285	1.583347	3
768	-	0	818	-	0	[redacted]	3.206238	2	[redacted]	8.899158	1	1045	2.301372	3	1287	-	0
769	-	0	[redacted]	23.75489	1	881	1.874331	3	[redacted]	6.581316	2	[redacted]	1.115244	4	[redacted]	21.747038	1
770	-	0	[redacted]	9.600008	1	[redacted]	20.268888	1	[redacted]	7.403722	2	[redacted]	0.385379	5	[redacted]	0.590929	5
771	-	0	[redacted]	17.612123	1	[redacted]	7.130877	2	[redacted]	7.041693	2	[redacted]	3.611351	2	1292	-	0
772	-	0	[redacted]	4.920897	2	[redacted]	17.795233	1	962	-	0	1085	1.522126	3	1295	-	0
773	-	0	[redacted]	19.445169	1	886	-	0	963	-	0	1087	1.832407	3	1296	-	0
774	-	0	824	-	0	887	-	0	964	-	0	[redacted]	6.514496	2	1297	-	0
775	-	0	[redacted]	37.154118	1	888	2.137763	3	[redacted]	0.71236	5	[redacted]	0.596708	5	1298	-	0
[redacted]	-	-1	[redacted]	16.188332	1	[redacted]	10.991977	1	973	-	0	[redacted]	3.81175	2	[redacted]	12.166841	1
[redacted]	-	-1	[redacted]	6.8196	2	[redacted]	11.666423	1	[redacted]	0.79191	4	1110	-	0	1301	1.833651	3
[redacted]	-	-1	[redacted]	7.968797	2	[redacted]	13.117917	1	977	-	0	[redacted]	6.093278	2	[redacted]	1.100648	4
[redacted]	-	-1	[redacted]	0.668578	5	[redacted]	1.232586	4	[redacted]	1.234016	4	[redacted]	2.764985	2	[redacted]	1.232587	4
[redacted]	-	-1	[redacted]	5.035216	2	[redacted]	5.570765	2	984	-	0	[redacted]	4.214374	2	1305	1.623335	3
[redacted]	-	-1	[redacted]	7.122333	2	897	-	0	[redacted]	1.230249	4	[redacted]	0.590928	5	[redacted]	8.358266	1
[redacted]	-	-1	832	-	0	[redacted]	0.528368	5	[redacted]	1.064245	4	[redacted]	2.998769	2	[redacted]	0.585814	5
[redacted]	-	-1	833	-	0	[redacted]	3.757417	2	[redacted]	0.475859	5	1139	1.649982	3	1309	-	0
[redacted]	-	-1	834	-	0	[redacted]	0.681978	5	[redacted]	1.064239	4	[redacted]	5.743462	2	[redacted]	0.452203	5
[redacted]	-	-1	835	-	0	[redacted]	0.791911	4	997	2.251053	3	[redacted]	3.596749	2	[redacted]	7.901381	2
[redacted]	-	-1	836	-	0	[redacted]	8.97216	1	998	-	0	[redacted]	0.596708	5	1316	2.341105	3
[redacted]	-	-1	837	-	0	[redacted]	0.681978	5	[redacted]	17.344212	1	1149	1.649981	3	1317	-	0
[redacted]	-	-1	838	-	0	906	-	0	[redacted]	5.807863	2	[redacted]	12.240114	1	1318	-	0
[redacted]	-	-1	839	-	0	[redacted]	9.565826	1	[redacted]	4.712387	2	[redacted]	0.579161	5	[redacted]	0.897033	4
[redacted]	-	-1	840	-	0	[redacted]	0.79191	4	[redacted]	1.230248	4	1176	-	0	1322	-	0
[redacted]	-	-1	841	-	0	911	2.072435	3	[redacted]	1.230248	4	[redacted]	0.385382	5	[redacted]	1.232586	4
[redacted]	-	-1	[redacted]	19.986122	1	[redacted]	0.681978	5	1008	1.886223	3	[redacted]	0.71236	5	[redacted]	0.71236	5
793	-	0	[redacted]	19.772421	1	[redacted]	3.976127	2	[redacted]	4.285595	2	[redacted]	0.517843	5	1330	-	0
[redacted]	1.232587	4	[redacted]	1.232585	4	[redacted]	0.475859	5	1011	-	0	[redacted]	1.230248	4	[redacted]	1.230248	4
[redacted]	1.230249	4	[redacted]	12.967735	1	[redacted]	1.232585	4	[redacted]	10.062966	1	[redacted]	1.230248	4	[redacted]	7.170249	2
798	-	0	[redacted]	0.681978	5	[redacted]	1.094154	4	[redacted]	1.230249	4	1213	-	0	[redacted]	0.450999	5

Table 5. Variability table for taxa set C.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
1342	2.179529	3	[redacted]	0.590929	5	1638	-	0	1709	-	0	[redacted]	0.517846	5	[illegible]	3.930546	2
1343	2.208907	3	[redacted]	1.094154	4	1639	-	0	1710	-	0	[illegible]	3.766107	2	[redacted]	0.451622	5
[redacted]	1.232586	4	1560	-	0	1640	-	0	1711	-	0	[redacted]	1.232584	4	[redacted]	0.71236	5
[redacted]	1.232586	4	[redacted]	0.590929	5	1641	-	0	1712	-	0	[redacted]	1.230249	4	[illegible]	5.529709	2
[redacted]	1.232586	4	[redacted]	0.976897	4	1642	-	0	1713	-	0	[redacted]	1.232584	4	[redacted]	23.22554	1
1358	1.321306	3	[redacted]	0.590929	5	1643	-	0	1714	-	0	[redacted]	0.590929	5	1905	-	0
[redacted]	1.232584	4	[redacted]	0.897031	4	1644	-	0	1715	-	0	[redacted]	0.694456	5	[redacted]	0.744925	4
[redacted]	0.896539	4	1593	1.281927	3	1645	-	0	1716	-	0	[redacted]	0.744925	4	[redacted]	14.152463	1
1365	2.208908	3	1594	1.89385	3	1646	-	0	[redacted]	-	-1	[redacted]	0.640894	5	1909	-	0
1372	1.293607	3	[redacted]	1.230248	4	1647	-	0	[redacted]	-	-1	[redacted]	0.745625	4	[redacted]	9.584916	1
1373	1.601586	3	1601	-	0	1648	-	0	[redacted]	-	-1	1818	-	0	[redacted]	13.889804	1
1374	1.651614	3	1602	2.325185	3	1649	-	0	[redacted]	-	-1	[redacted]	0.640894	5	[redacted]	0.681978	5
[redacted]	0.736933	5	[illegible]	6.72905	2	1650	-	0	[redacted]	-	-1	[redacted]	0.745625	4	[redacted]	1.232585	4
1379	1.286471	3	[illegible]	3.328416	2	1651	-	0	[redacted]	21.542904	1	[redacted]	0.640894	5	[illegible]	4.126468	2
1390	1.379363	3	1605	2.325188	3	1652	-	0	[redacted]	10.897581	1	[redacted]	0.640894	5	1928	1.952729	3
1392	-	0	1606	1.7309	3	1653	-	0	[redacted]	12.854319	1	[redacted]	8.114097	1	1930	1.424817	3
1393	1.491091	3	[redacted]	19.256275	1	1654	-	0	[redacted]	13.896381	1	[illegible]	4.267763	2	[redacted]	8.436602	1
1399	-	0	1608	-	0	1655	-	0	[redacted]	13.521935	1	[redacted]	0.71236	5	1938	-	0
1400	-	0	1609	1.919692	3	1656	-	0	[redacted]	0.897031	4	[redacted]	0.71236	5	[redacted]	1.232587	4
1406	-	0	[illegible]	3.223252	2	1657	-	0	[illegible]	5.125933	2	1862	-	0	1969	1.706745	3
[redacted]	1.036602	4	[illegible]	6.568538	2	1658	-	0	[illegible]	6.135058	2	1863	-	0	1973	1.783382	3
[redacted]	0.628137	5	[illegible]	3.374982	2	1659	-	0	[redacted]	26.879246	1	1864	-	0	1974	1.377244	3
[redacted]	0.628137	5	[redacted]	18.423962	1	1685	-	0	[redacted]	17.859688	1	1865	-	0	[redacted]	0.694456	5
1413	-	0	1615	-	0	1686	-	0	[redacted]	0.639935	5	1866	-	0	[redacted]	0.590929	5
[redacted]	0.513402	5	1616	-	0	1687	-	0	1735	-	0	1867	-	0	[redacted]	1.232585	4
[redacted]	1.130359	4	1617	-	0	1688	-	0	[illegible]	3.564716	2	1868	-	0	[redacted]	0.560479	5
[redacted]	1.26734	4	1618	-	0	1689	-	0	[redacted]	0.744925	4	1869	-	0	[redacted]	0.896539	4
1419	1.920922	3	1619	-	0	1690	-	0	1738	1.930106	3	1870	-	0	[illegible]	3.82684	2
1421	-	0	1620	-	0	1691	-	0	[redacted]	8.480633	1	1871	-	0	[redacted]	0.436233	5
[redacted]	1.211314	4	1621	-	0	1692	-	0	1752	-	0	1875	-	0	[redacted]	0.436233	5
[redacted]	1.230248	4	1622	-	0	1693	-	0	[redacted]	0.9769	4	1876	-	0	[redacted]	0.436233	5
[redacted]	0.976897	4	1623	-	0	1694	-	0	[redacted]	0.9769	4	1877	-	0	[redacted]	0.508977	5
1449	1.7309	3	1624	-	0	1695	-	0	[redacted]	0.9769	4	1878	-	0	[redacted]	0.681978	5
1450	2.179529	3	1625	-	0	1696	-	0	1756	-	0	1879	-	0	2039	-	0
1453	1.783381	3	1626	-	0	1697	-	0	[illegible]	4.327728	2	1883	-	0	[redacted]	1.230248	4
[redacted]	1.064241	4	1627	-	0	1698	-	0	[redacted]	26.128506	1	1884	-	0	[redacted]	0.694456	5
[redacted]	0.976897	4	1628	-	0	1699	-	0	[redacted]	9.143496	1	1885	-	0	[redacted]	1.232585	4
[redacted]	0.976897	4	1629	-	0	1700	-	0	1761	-	0	1886	-	0	[redacted]	0.68883	5
[redacted]	0.896541	4	1630	-	0	1701	-	0	[illegible]	7.401666	2	[illegible]	3.997552	2	[redacted]	1.232585	4
1512	-	0	1631	-	0	1702	-	0	[illegible]	3.642895	2	[illegible]	4.140663	2	[redacted]	0.79191	4
[redacted]	0.47586	5	1632	-	0	1703	-	0	[illegible]	3.766142	2	[illegible]	2.784576	2	2074	-	0
[redacted]	0.694456	5	1633	-	0	1704	-	0	1769	-	0	[illegible]	6.760604	2	[redacted]	1.230247	4
1520	1.7309	3	1634	-	0	1705	-	0	1770	-	0	[redacted]	16.033895	1	[redacted]	0.803386	4
1521	1.7309	3	1635	-	0	1706	-	0	[redacted]	9.037307	1	[illegible]	6.582469	2	[illegible]	5.125934	2
1532	-	0	1636	-	0	1707	-	0	[illegible]	7.610094	2	1896	1.809742	3	[redacted]	9.114459	1
[redacted]	1.230248	4	1637	-	0	1708	-	0	[redacted]	24.898895	1	[redacted]	1.094154	4	[redacted]	0.68883	5

Table 5. Variability table for taxa set C.

Site	Variability	Cat	Site	Variability	Cat	Site	Variability	Cat
[redacted]	10.471128	1	[redacted]	1.23911	4	2261	-	0
[redacted]	0.465398	5	[illegible]	5.718729	2	2262	-	0
[illegible]	3.220219	2	[redacted]	0.745625	4	2263	-	0
2095	-	0	2153	2.283268	3	2264	-	0
[illegible]	3.912166	2	2154	1.822172	3	2265	-	0
[illegible]	2.679604	2	2156	2.672781	3	2266	-	0
[redacted]	11.410489	1	2159	-	0	2267	-	0
[illegible]	6.03823	2	[illegible]	3.127488	2	2268	-	0
[illegible]	5.755039	2	[redacted]	0.485144	5	2269	-	0
[illegible]	3.362382	2	2187	-	0	2270	-	0
[illegible]	3.315792	2	2188	-	0	2271	-	0
2106	2.120934	3	2189	-	0	2272	-	0
[illegible]	5.2207	2	[redacted]	0.916255	4	2273	-	0
2108	1.862846	3	2201	1.658721	3	2274	-	0
2110	-	0	[illegible]	-	-1	2275	-	0
2111	-	0	[illegible]	-	-1	2276	-	0
[illegible]	4.871907	2	[illegible]	-	-1	2277	-	0
[illegible]	2.860922	2	[illegible]	-	-1	2278	-	0
[illegible]	3.509642	2	[illegible]	-	-1	2279	-	0
[illegible]	4.956572	2	2234	-	0	2280	-	0
2116	-	0	2235	-	0	2281	-	0
2117	-	0	2236	-	0	2282	-	0
2118	-	0	2237	-	0	2283	-	0
[redacted]	0.656031	5	2238	-	0			
[illegible]	4.686344	2	2239	-	0			
2121	1.587528	3	2240	-	0			
[illegible]	7.657166	2	2241	-	0			
[illegible]	4.619767	2	2242	-	0			
[redacted]	0.745625	4	2243	-	0			
[redacted]	15.034582	1	2244	-	0			
[redacted]	0.70407	5	2245	-	0			
2128	-	0	2246	-	0			
2129	-	0	2247	-	0			
2130	-	0	2248	-	0			
2131	-	0	2249	-	0			
2132	-	0	2250	-	0			
2133	-	0	2251	-	0			
2134	1.774515	3	2252	-	0			
[redacted]	0.745625	4	2253	-	0			
[redacted]	0.745625	4	2254	-	0			
2138	-	0	2255	-	0			
2141	2.345036	3	2256	-	0			
2142	2.004233	3	2257	-	0			
[redacted]	1.211314	4	2258	-	0			
[redacted]	0.541494	5	2259	-	0			
[redacted]	0.541494	5	2260	-	0			

APPENDIX F : Trees

Table 6. Character-Based phylogenetic trees; Parsimony

Figure	Data Set	Description	Page
Figure A	A	50% Majority-rule consensus tree	72
Figure B	A	50% Majority-rule bootstrap tree	73
Figure C	A	Strict consensus tree with decay indices	74
Figure D	B	50% Majority-rule consensus tree	75
Figure E	B	50% Majority-rule bootstrap tree	76

Table 7. Character-based phylogenetic trees; Maximum likelihood

Figure	Data Set	Description	Page
Figure F	A	Quartet puzzling (Heuristic maximum likelihood)	77
Figure G	B	Quartet puzzling (Heuristic maximum likelihood)	78
Figure H	A	Maximum likelihood	79
Figure I	A	Maximum likelihood bootstrap tree	80

Table 8. Distance-Based phylogenetic trees; Taxa set A.

Figure	Distance Calculation	Insertion & Deletions taken into account	Alignment Positions	Bootstrap	Evolution Model	Page
A1S	Jukes & Cantor (1969)	No	All	No	~	81
A1BS	"	No	All	100	~	83
A2S	"	Yes	All	No	~	85
A2BS	"	Yes	All	100	~	87
B1S	Tajima & Nei (1984)	No	All	No	~	89
B1BS	"	No	All	100	~	91
B2S	"	Yes	All	No	~	93
B2BS	"	Yes	All	100	~	95
C1S	Kimura (1980)	No	All	No	~	97
C1BS	"	No	All	100	~	99
C2S	"	Yes	All	No	~	101
C2BS	"	Yes	All	100	~	103
D1.1S	Jin & Nei (1990)	No	All	No	Jukes & Cantor	105
D1.1BS	"	No	All	100	Jukes & Cantor	107
D1.2S	"	Yes	All	No	Jukes & Cantor	109
D1.2BS	"	Yes	All	100	Jukes & Cantor	111
D2.1S	"	No	All	No	Kimura 2-p	113
D2.1BS	"	No	All	100	Kimura 2-p	115
D2.2S	"	Yes	All	No	Kimura 2-p	117
D2.2BS	"	Yes	All	100	Kimura 2-p	119
E1S	Transversions Only	No	All	No	~	121
E1BS	"	No	All	100	~	123
E2S	"	Yes	All	No	~	125
E2BS	"	Yes	All	100	~	127
F1S	No Correction	No	All	No	~	129
F1BS	"	No	All	100	~	131
F2S	"	Yes	All	No	~	133
F2BS	"	Yes	All	100	~	135
G1S	Van de Peer & De Wachter (1996)	No	All	No	~	137
G1BS	"	No	All	100	~	139
G2S	"	Yes	All	No	~	141
G2BS	"	Yes	All	100	~	143

Figure Label Key:

- A First letter: Distance Calculation (i.e. A= Jukes & Cantor)
- 1 Number: indel status (e.g. 1= not taken into account, 2= taken into account)
- B If B is present = 50% majority-rule bootstrap tree
- S Indicates taxa set A

Table 9. Distance-Based phylogenetic trees; Taxa set B.

Figure	Distance Calculation	Insertion & Deletions taken into account	Alignment Positions	Bootstrap	Evolution Model	Page
A1	Jukes & Cantor (1969)	No	All	No	~	145
A1B	"	No	All	100	~	147
A2	"	Yes	All	No	~	149
A2B	"	Yes	All	100	~	151
B1	Tajima & Nei (1984)	No	All	No	~	153
B1B	"	No	All	100	~	155
B2	"	Yes	All	No	~	157
B2B	"	Yes	All	100	~	159
C1	Kimura (1980)	No	All	No	~	161
C1B	"	No	All	100	~	163
C2	"	Yes	All	No	~	165
C2B	"	Yes	All	100	~	167
D1.1	Jin & Nei (1990)	No	All	No	Jukes & Cantor	169
D1.1B	"	No	All	100	Jukes & Cantor	171
D1.2	"	Yes	All	No	Jukes & Cantor	173
D1.2B	"	Yes	All	100	Jukes & Cantor	175
D2.1	"	No	All	No	Kimura 2-p	177
D2.1B	"	No	All	100	Kimura 2-p	179
D2.2	"	Yes	All	No	Kimura 2-p	181
D2.2B	"	Yes	All	100	Kimura 2-p	183
E1	Transversions Only	No	All	No	~	185
E1B	"	No	All	100	~	187
E2	"	Yes	All	No	~	189
E2B	"	Yes	All	100	~	191
F1	No Correction	No	All	No	~	193
F1B	"	No	All	100	~	195
F2	"	Yes	All	No	~	197
F2B	"	Yes	All	100	~	199
G1	Van de Peer & De Wachter (1996)	No	All	No	~	201
G1B	"	No	All	100	~	203
G2	"	Yes	All	No	~	205
G2B	"	Yes	All	100	~	207
H1B	No Correction	No	0,1,2,3,4	100	~	209
H2B	"	No	0,1,2	100	~	211
H3B	"	No	2,3,4,5,6	100	~	213

Figure Label Key:

- A First letter: Distance Calculation (i.e. A= Jukes & Cantor)
- 1 Number: indel status (e.g. 1= not taken into account, 2= taken into account)
- B If B is present = 50% majority-rule bootstrap tree

Table 10.

Consistent monophyletic clusters in distance-based analyses.

These monophyletic clusters constitute the triangles shown in the second tree of each pair for all distance-based analysis.

Taxa set A : Monophyletic Clusters

Pinophyta	*Pinus luchuensis* *Taxus mairei* *Nageia nagi* *Gnetum leyboldii*
Magnoliophyta	*Zea mays* *Oryza sativa* *Glycine max* *Sinapis alba* *Arabidopsis thaliana*
Isoetopsida	*Selaginella vogelii* *Selaginella umbrosa*
Lycopodiopsida	*Lycopodium taxifolium* *Lycopodium phlegmaria*
Bryopsida	*Physcomitrella patens* *Funaria hygrometrica* *Mnium hornum* *Leptobryum pyriforme*
Anthocerotopsida	*Anthoceros laevis* *Notophylas breutelu* *Megaceros aenigmaticus*
Hepaticopsida	*Riccia fluitans* *Conocephalum conicum* *Marchantia polymorpha* *Sphaerocarpos donnelli*

Taxa set B : Monophyletic Clusters

Pinophyta	*Pinus wallichiana* *Pinus luchuensis* *Taxus mairei* *Nageia nagi* *Gnetum leyboldii*
Magnoliophyta	*Zea mays* *Oryza sativa* *Glycine max* *Sinapis alba* *Arabidopsis thaliana*
Isoetopsida	*Selaginella vogelii* *Selaginella umbrosa* *Isoetes engelmannii*
Lycopodiopsida	*Lycopodium taxifolium* *Lycopodium phlegmaria* *Lycopodium tristachyum* *Huperzia lucidulum*
Bryopsida	*Physcomitrella patens* *Physcomitrella patens 2* *Funaria hygrometrica* *Physcomitrium pyriforme* *Mnium hornum* *Leptobryum pyriforme* *Eurhynchium hians* *Bryum argenteum*
Anthocerotopsida	*Anthoceros laevis* *Notophylas breutelu* *Megaceros aenigmaticus*
Hepaticopsida	*Riccia fluitans* *Conocephalum conicum* *Marchantia polymorpha* *Reboulia hemisphaerica* *Sphaerocarpus texanus* *Sphaerocarpos donnelli*
Charales	*Chara foetida* *Nitella sp.* *Nitella flexilis*
Chlorophyta	*Parietochloris pseudoalveolaris* *Hydrodictyon reticulatum* *Chlamydomonas reinhardtii*

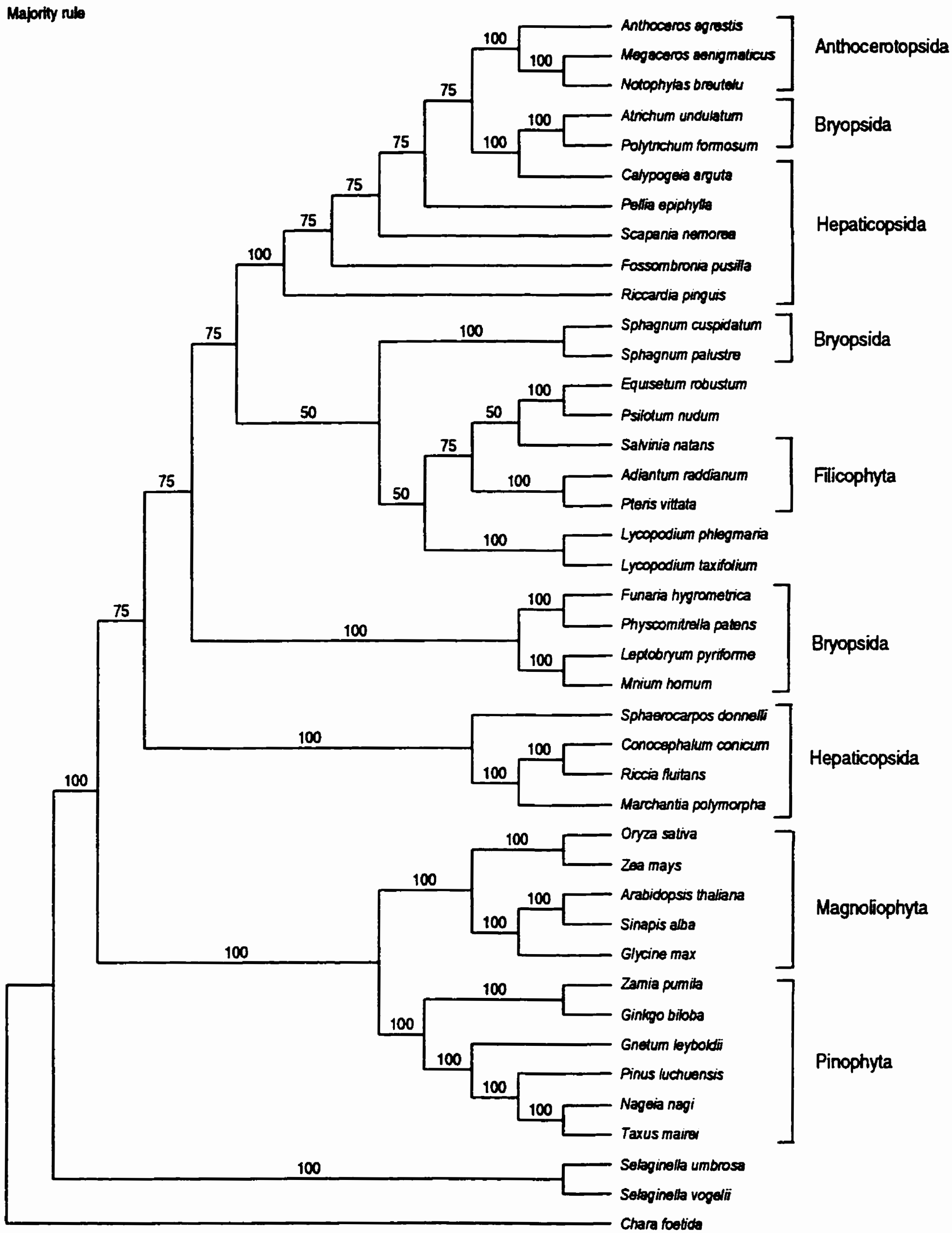


Figure A Parsimony; 50% Majority-Rule Consensus Tree of four most parsimonious trees (tree length = 1589) Taxa set A; informative sites only; Heuristic (100 replicates; random taxon addition; TBR)

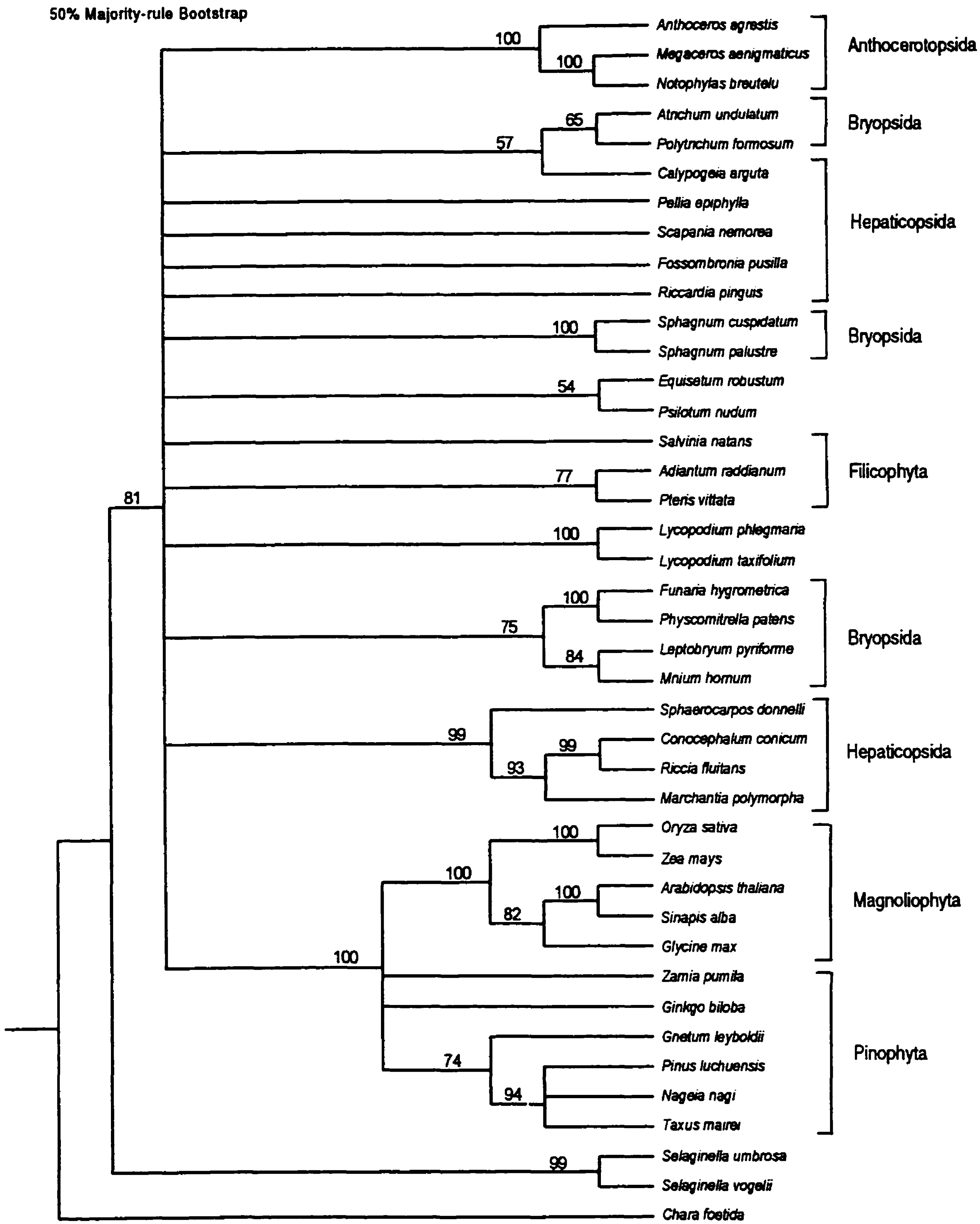


Figure B Parsimony; 50% Majority-Rule Bootstrap Tree
Taxa set A; informative sites only;
Heuristic (100 bootstrap replicates; each with 10 replicates of random taxon addition; TBR)

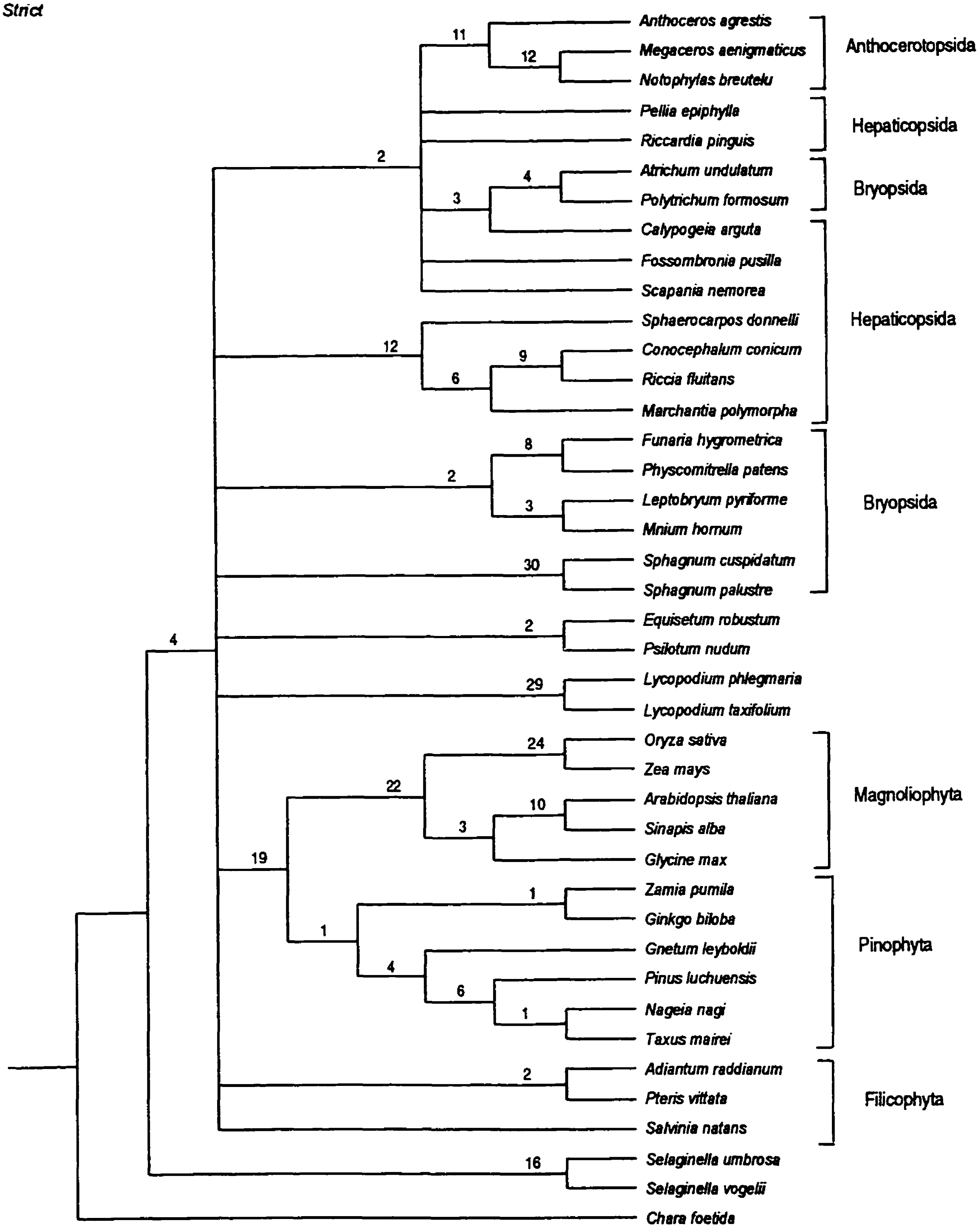


Figure C Parsimony; Strict Consensus Tree of four most parsimonious trees (tree length = 1589)
Taxa set A; informative sites only; Heuristic (100 replicates; random taxon addition; TBR)
Decay Indices are shown above each branch

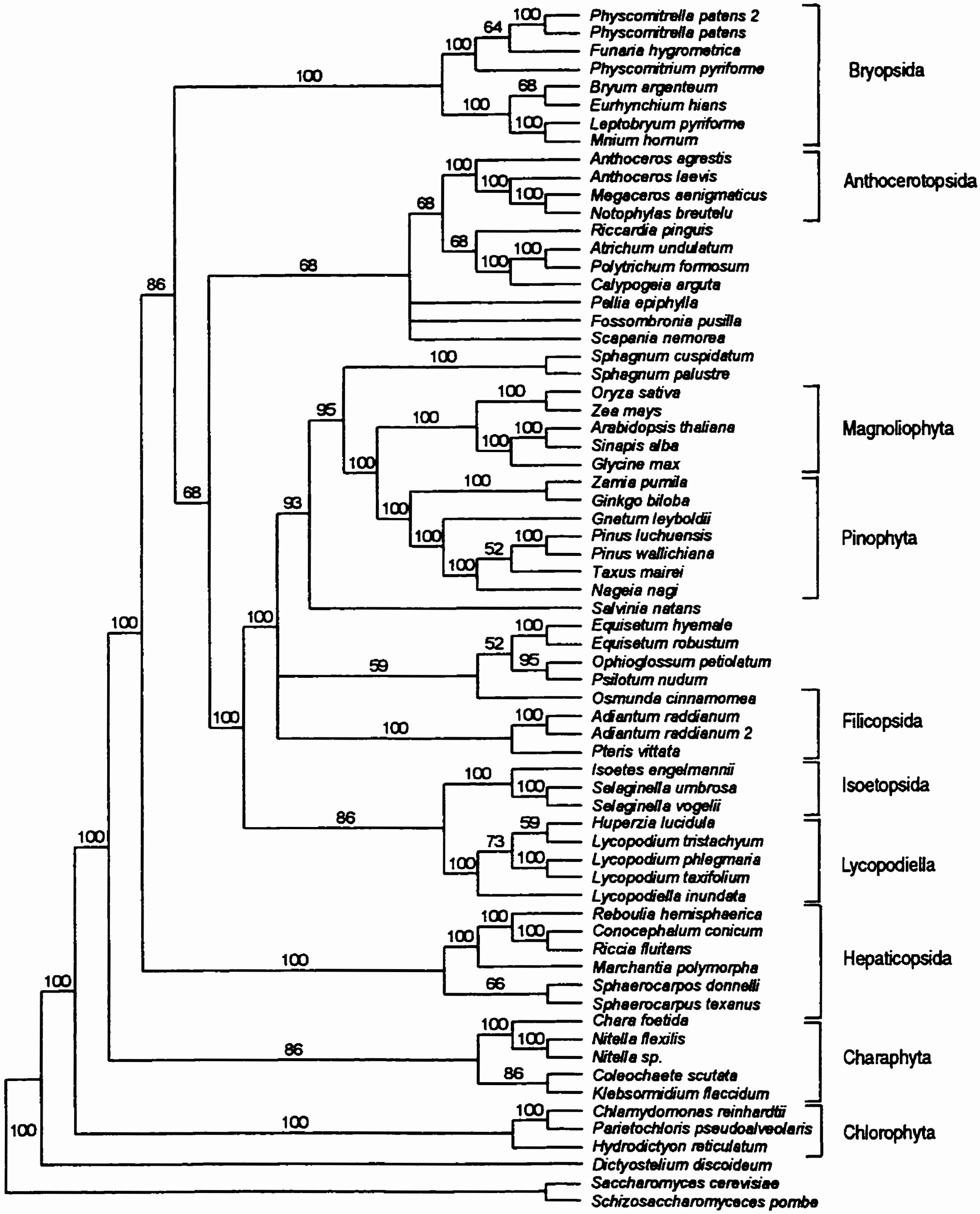


Figure D Parsimony; 50% Majority-Rule Consensus Tree of 88 most parsimonious trees (tree length = 3156) Taxa set B; informative sites only; Heuristic (100 replicates; random taxon addition; TBR)

50% Majority-rule Bootstrap

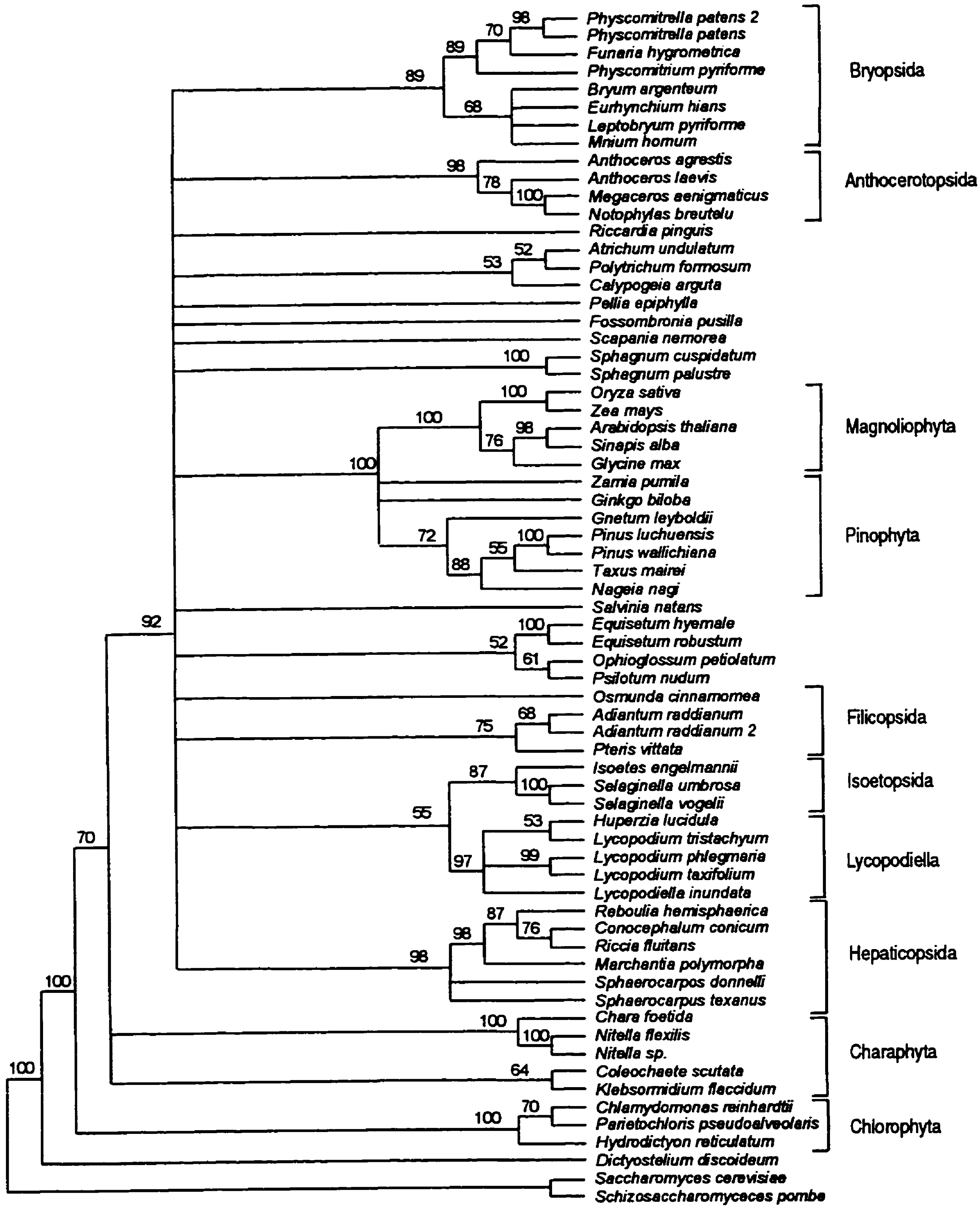


Figure E Parsimony; 50% Majority-Rule Bootstrap Tree
Taxa set B; informative sites only;
Heuristic (50 bootstrap replicates; each with 5 replicates of random taxon addition; TBR)

Puzzle

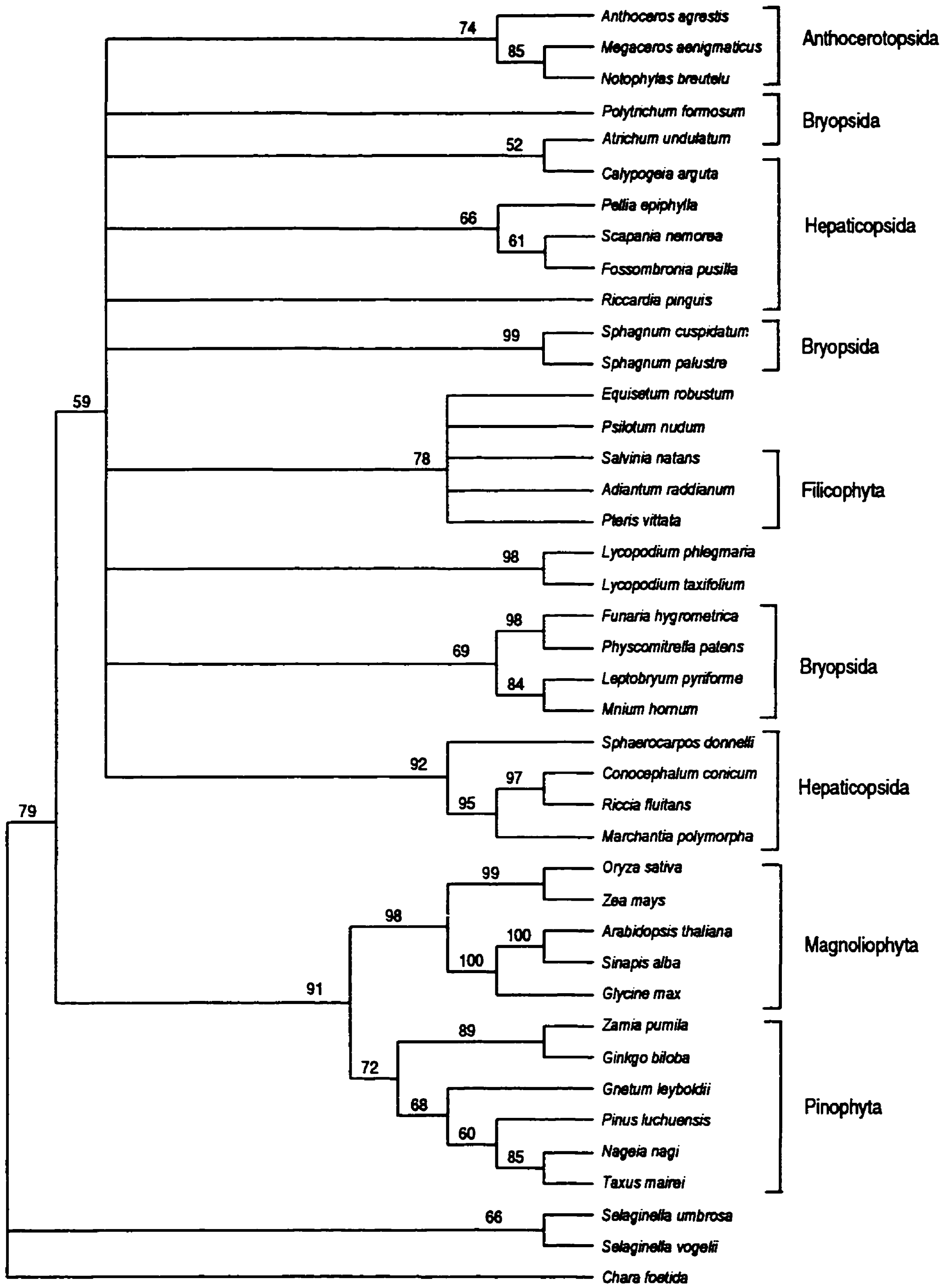


Figure F   Quartet puzzling; Taxa set A

Puzzle

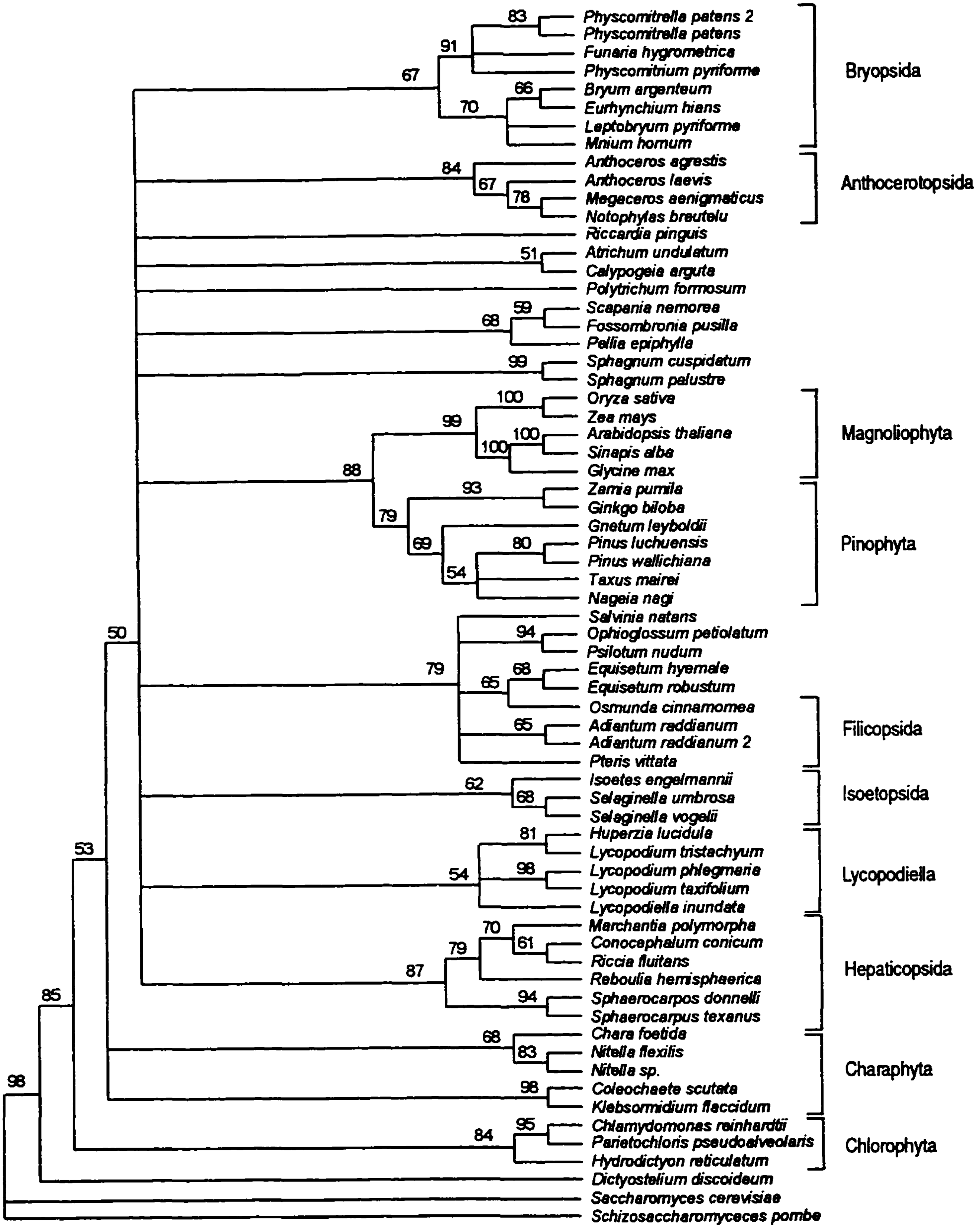


Figure G Quartet puzzling; Taxa set B

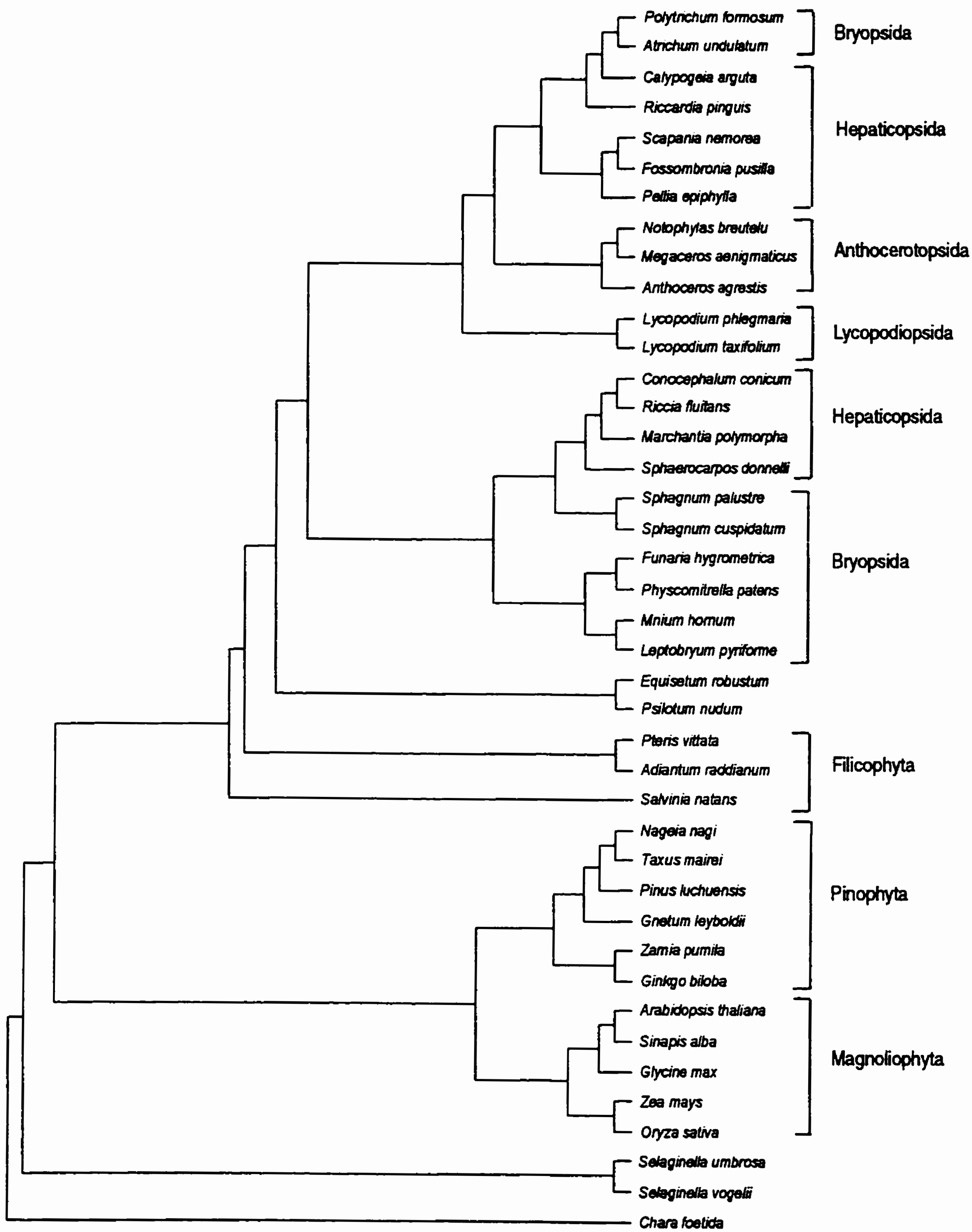


Figure H Maximum Likelihood; Taxa set A
Ln Likelihood= -13291.72141

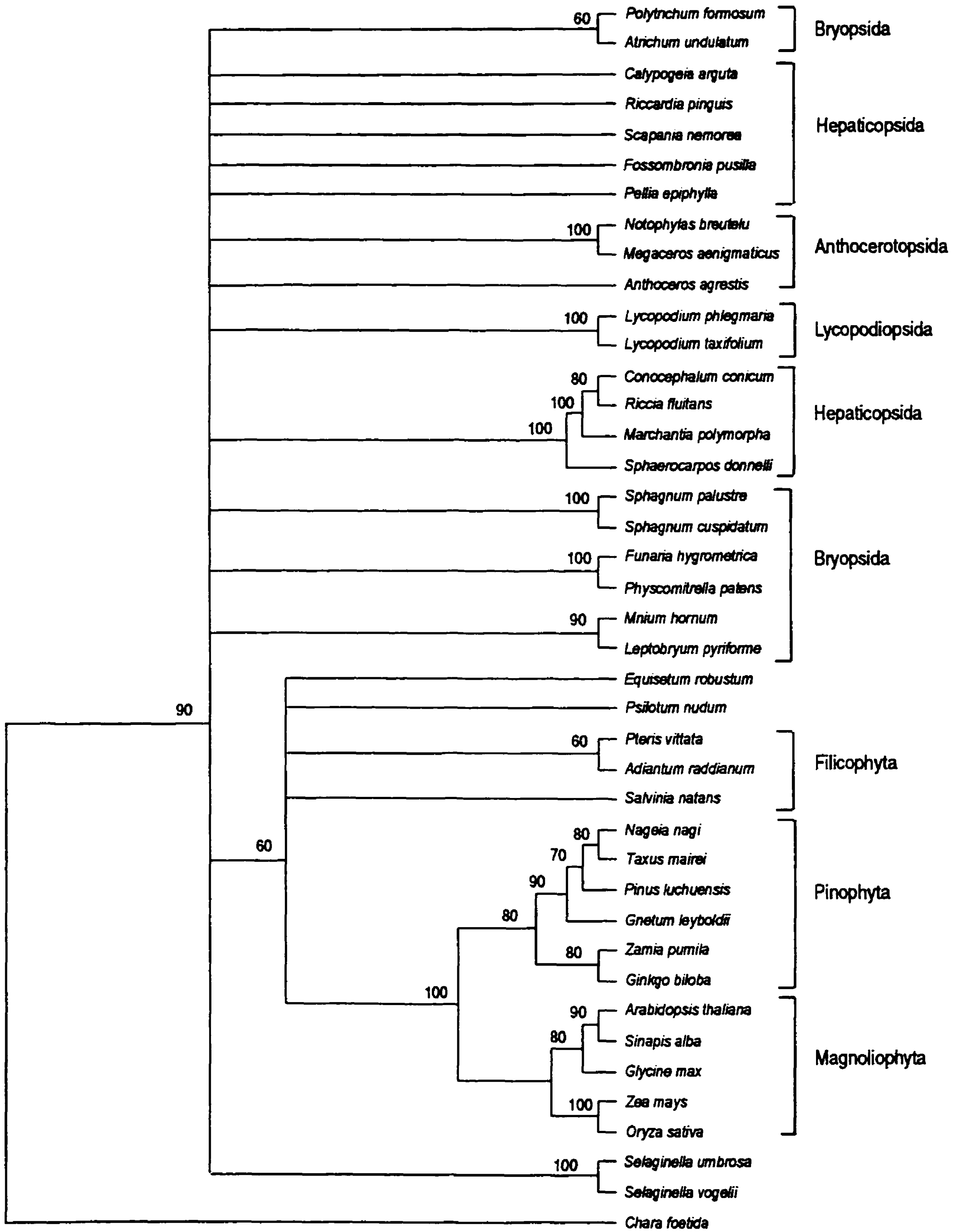


Figure I Maximum Likelihood; 50% Majority-Rule Bootstrap Tree; Taxa set A
10 Bootstraps

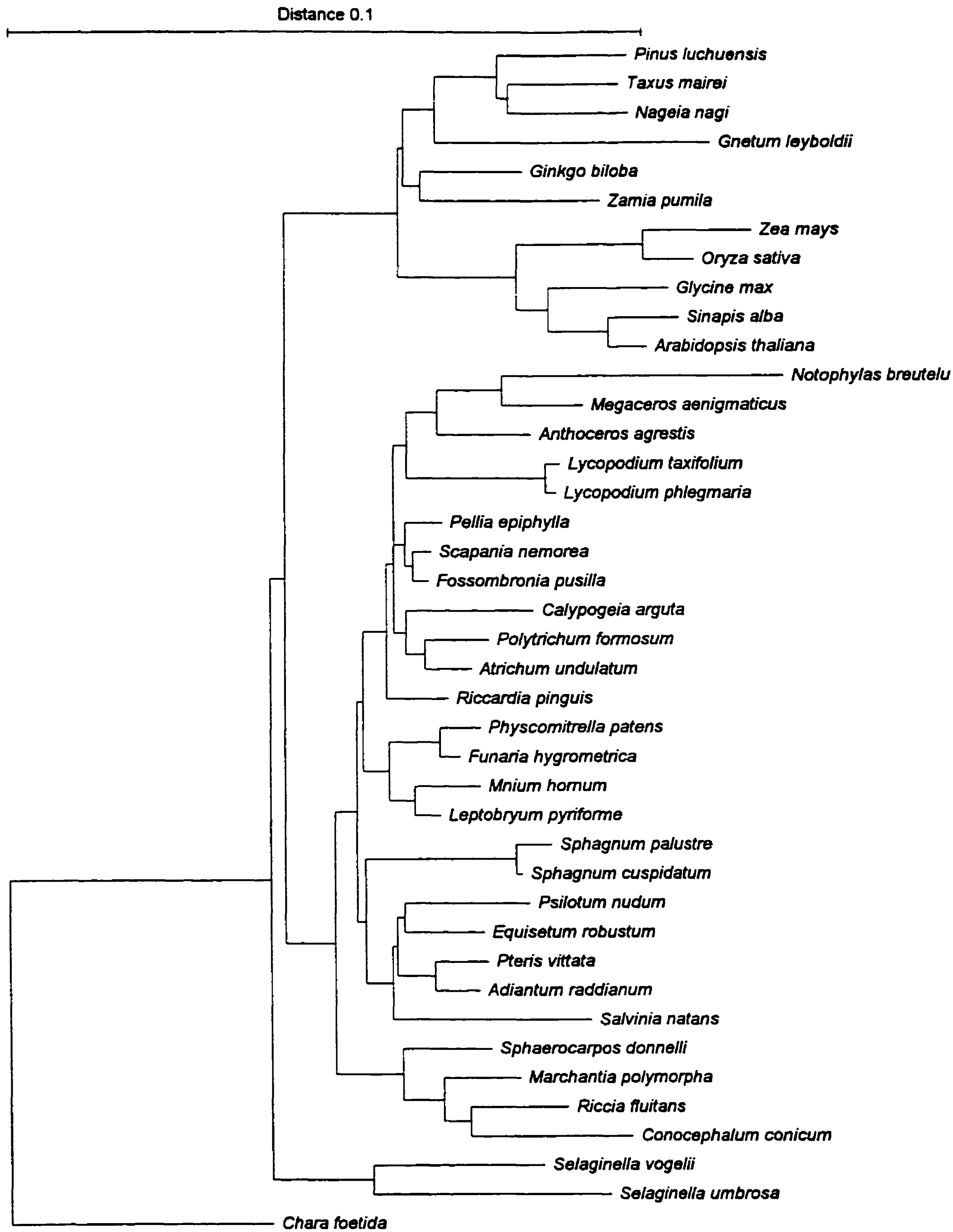


Figure A1S Jukes & Cantor; Neighbor-joining

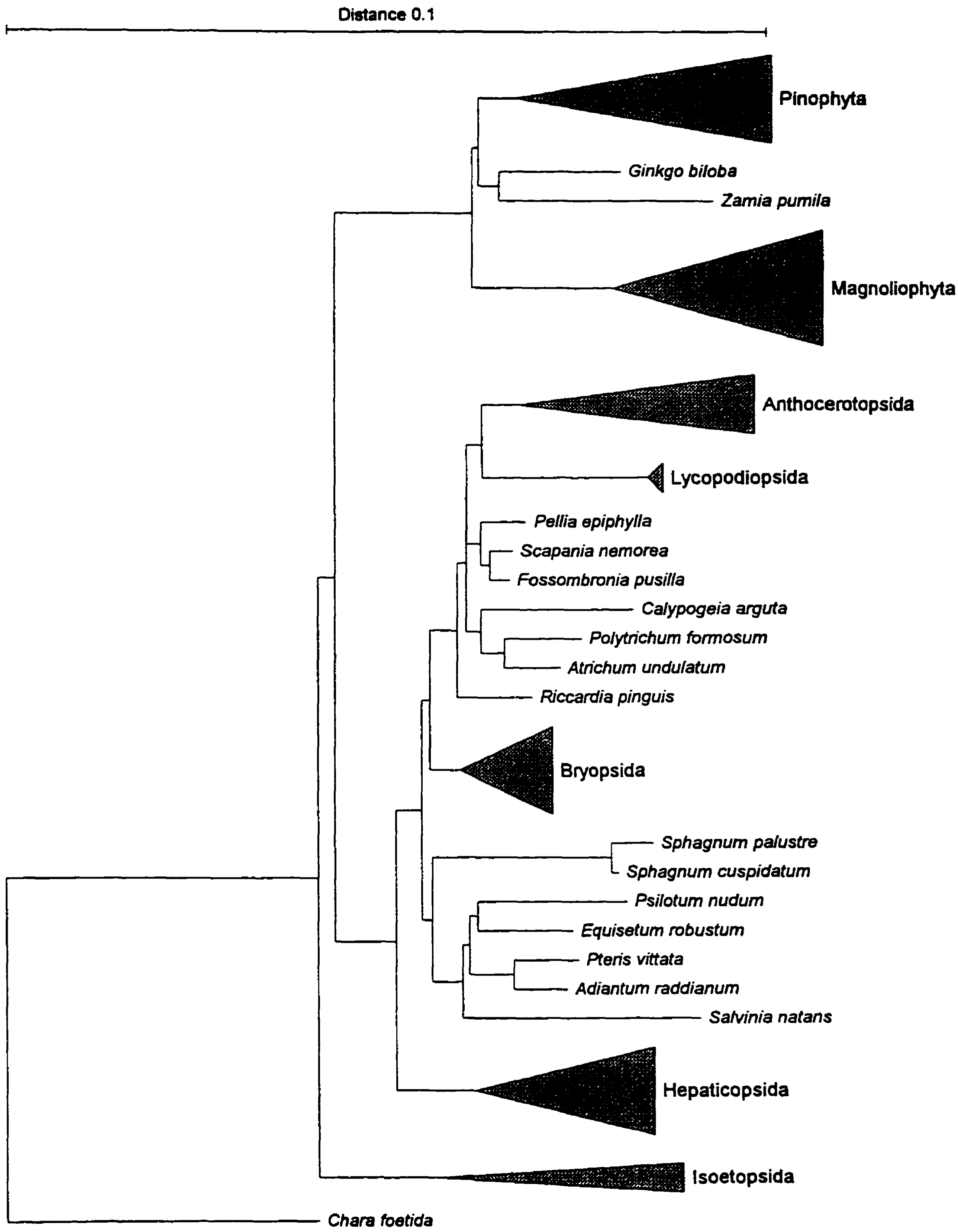


Figure A1S Jukes & Cantor; Neighbor-joining

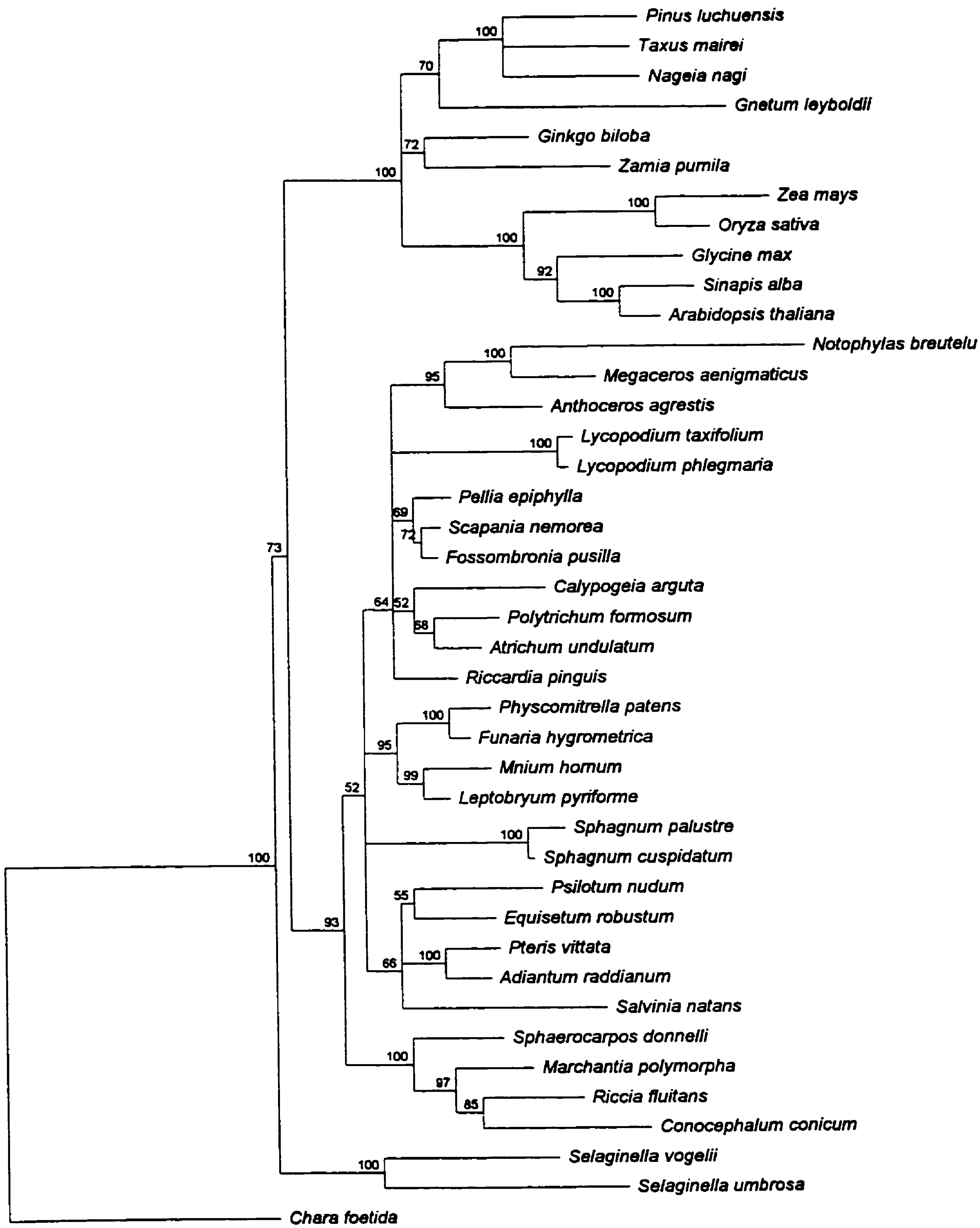


Figure A1SB *Jukes & Cantor; Neighbor-joining*
50% Majority-Rule Bootstrap Tree

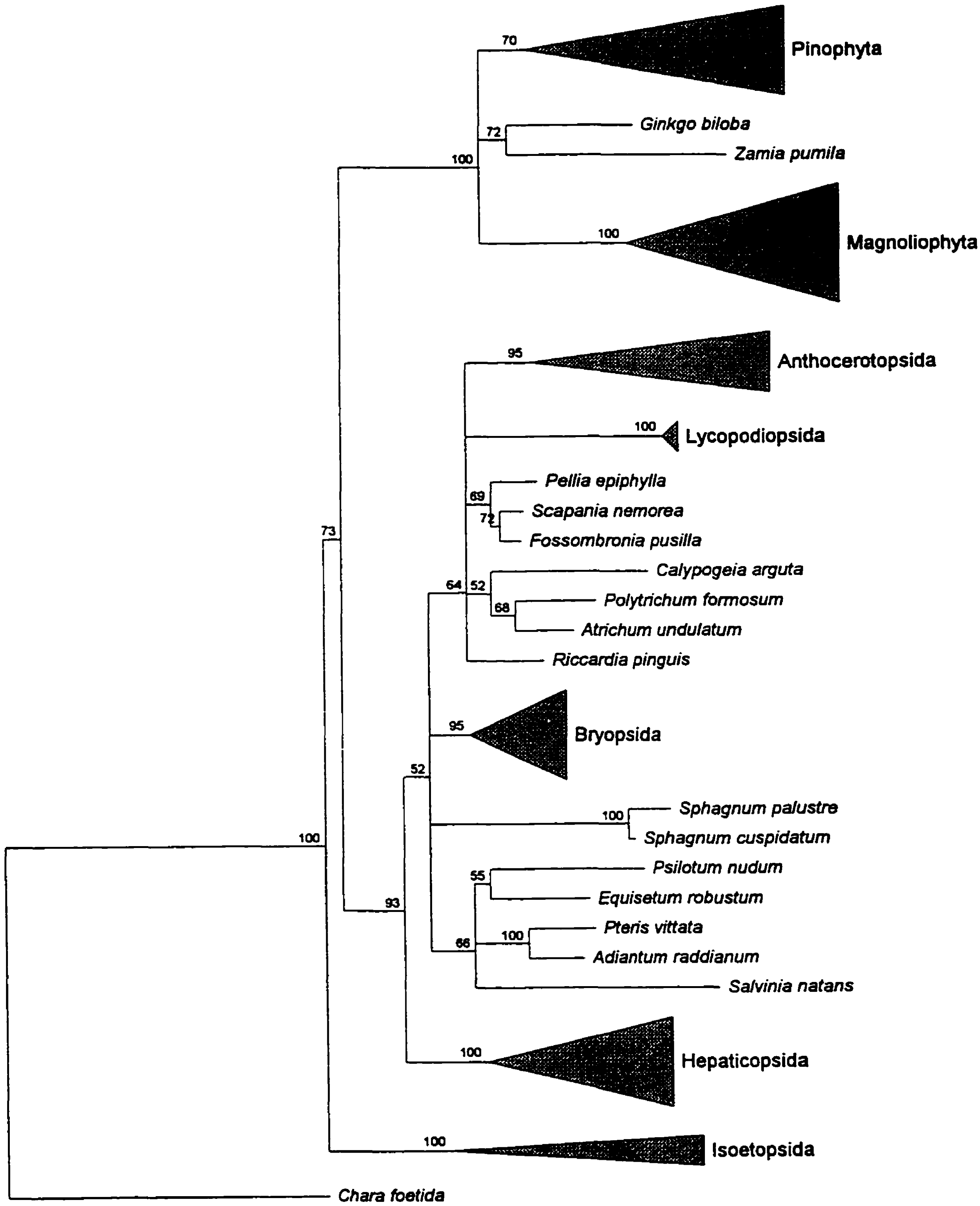


Figure A1SB Jukes & Cantor; Neighbor-joining
50% Majority-Rule Bootstrap Tree

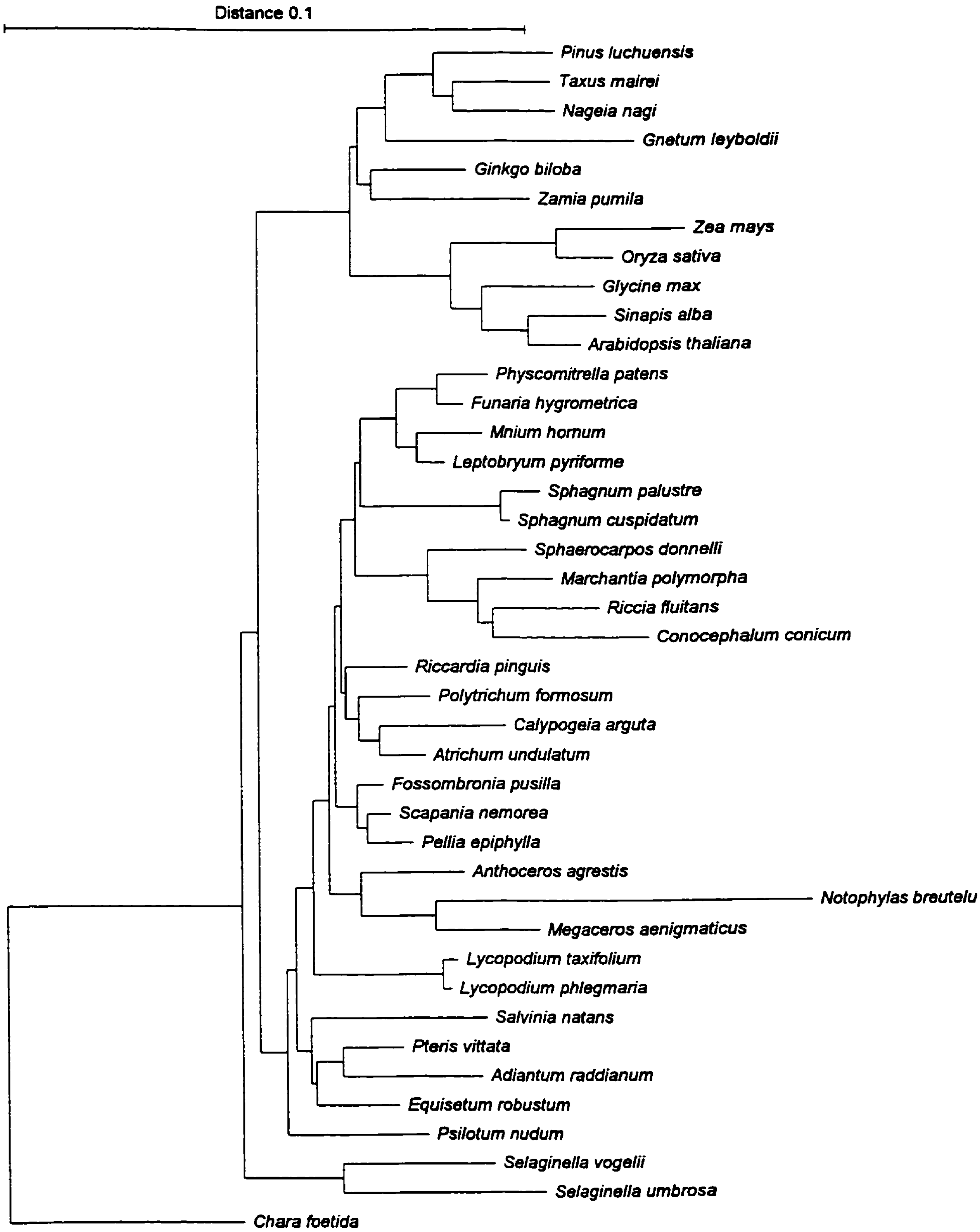


Figure A2S Jukes & Cantor
Insertions & Deletions taken into account

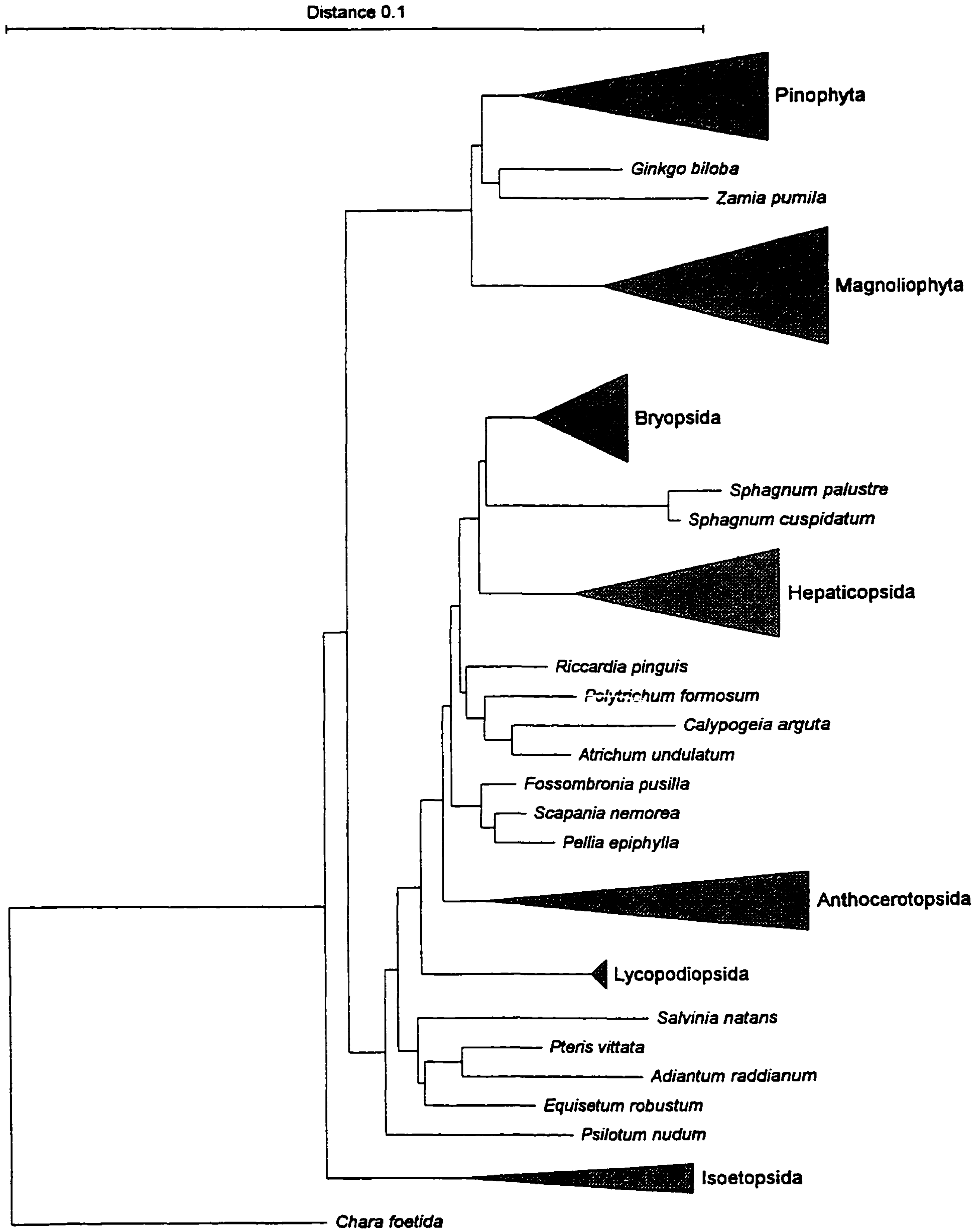


Figure A2S Jukes & Cantor
Insertions & Deletions taken into account

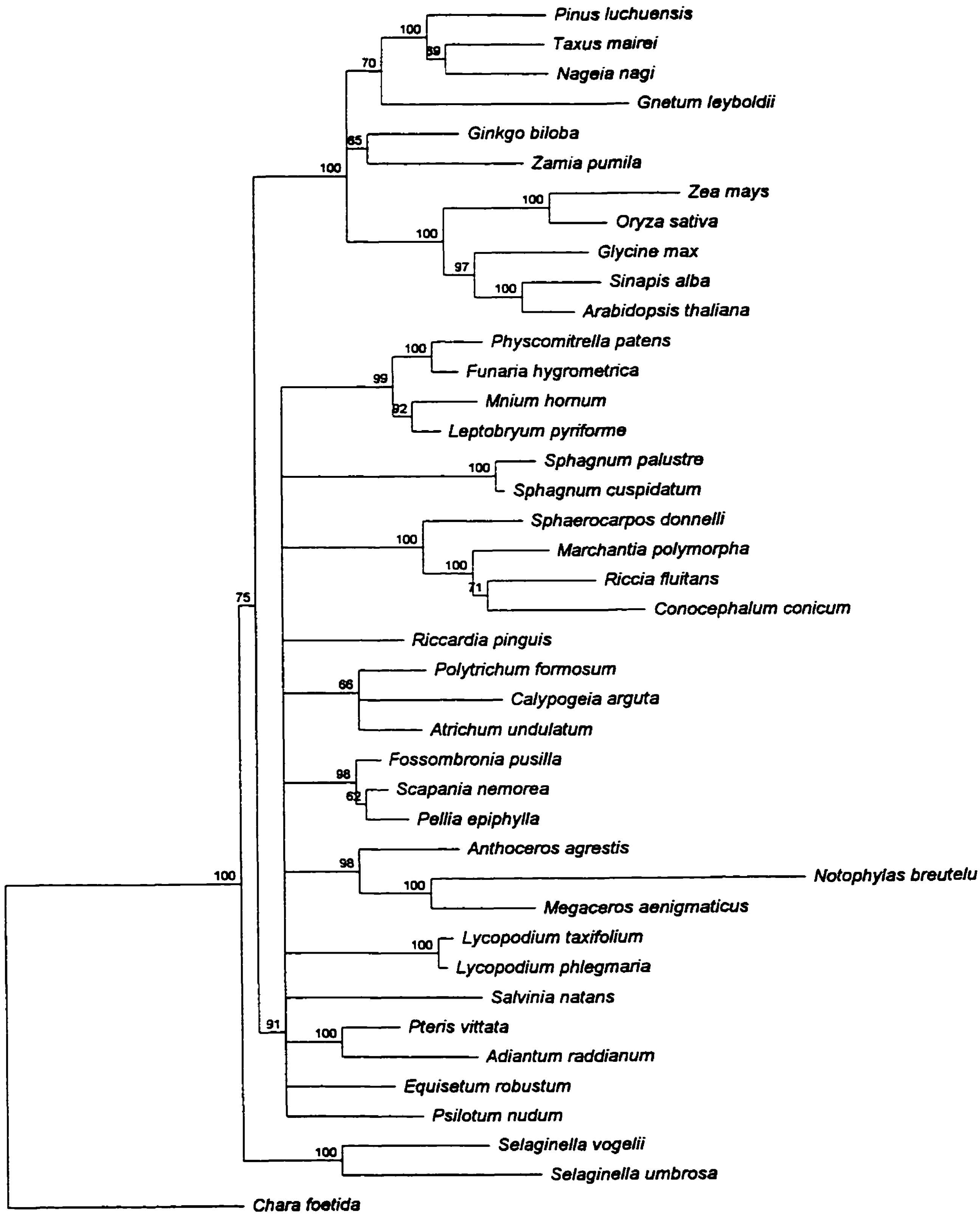


Figure A2SB Jukes & Cantor
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

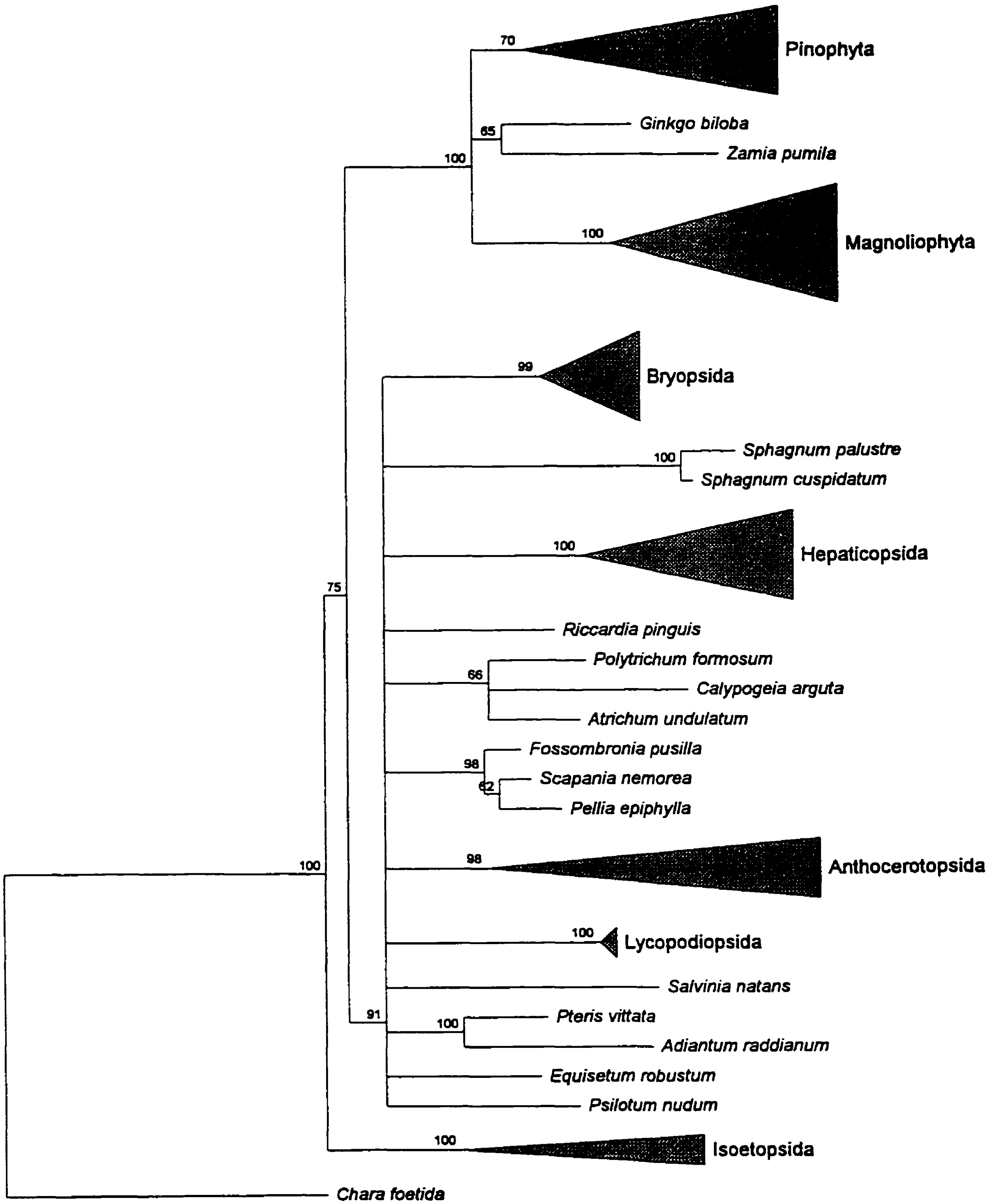


Figure A2SB Jukes & Cantor
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

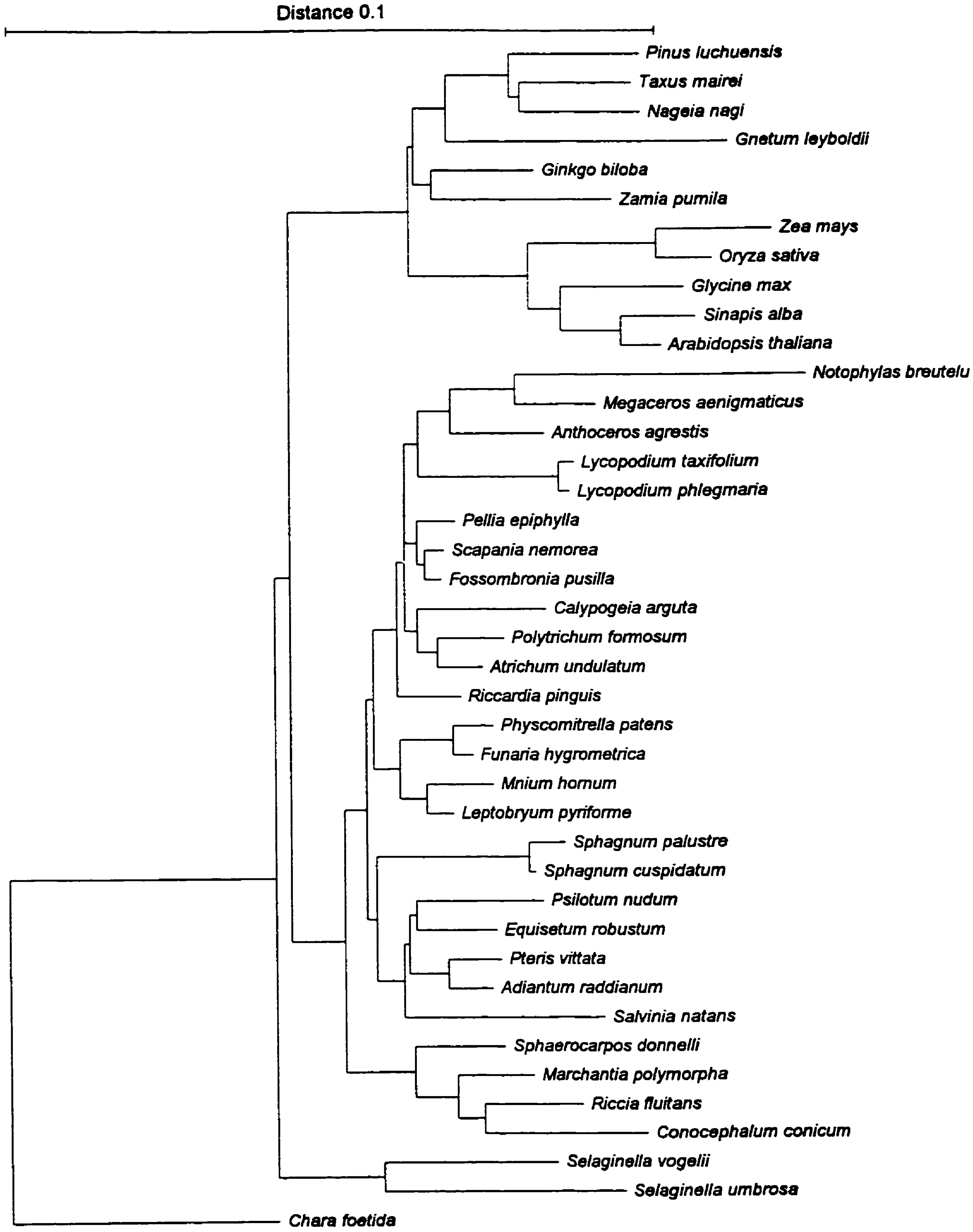


Figure B1S *Tajima & Nei; Neighbor-joining*

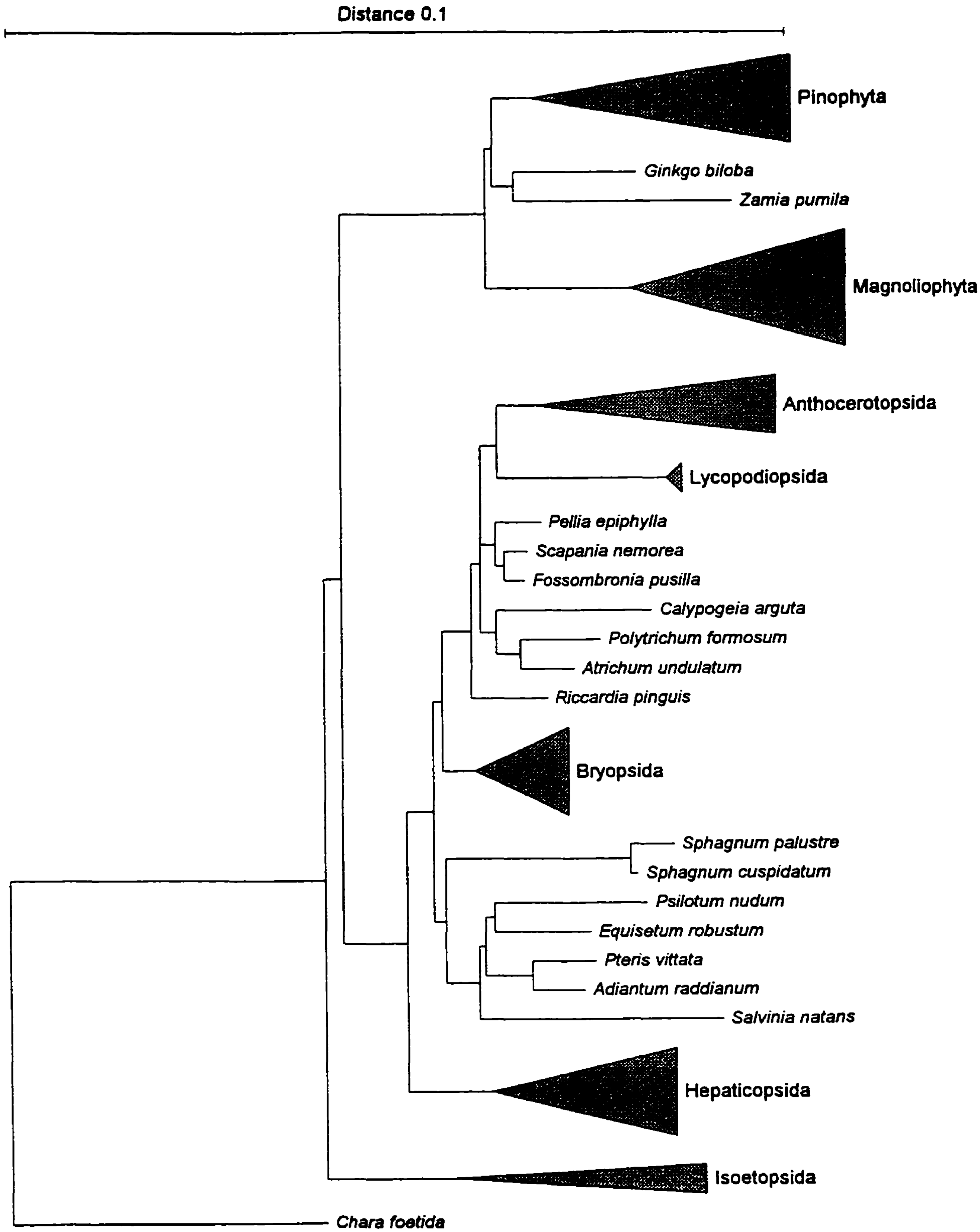


Figure B1S   Tajima & Nei; Neighbor-joining

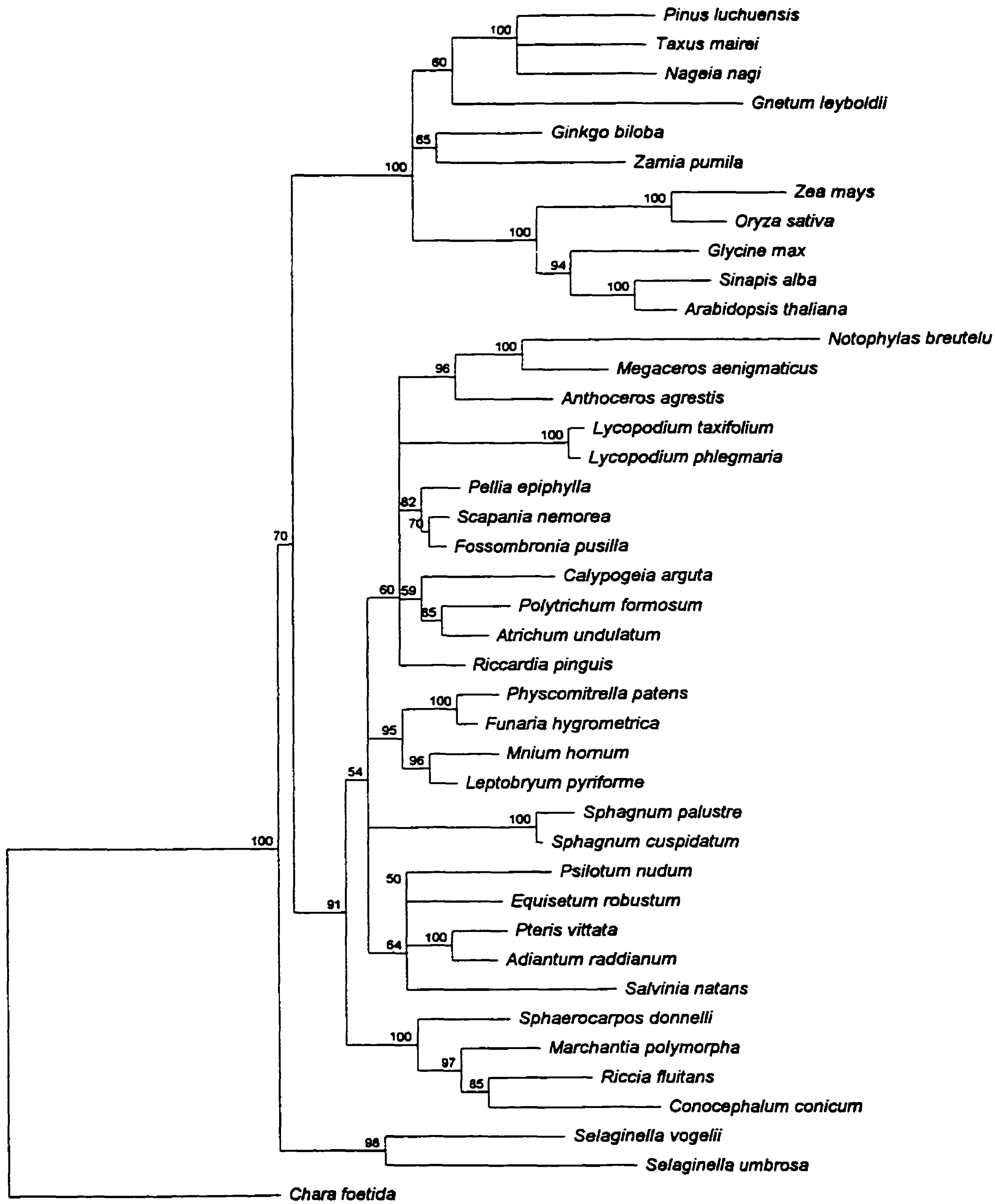


Figure B1SB Tajima & Nei; Neighbor-joining
50% Majority-Rule Bootstrap Tree

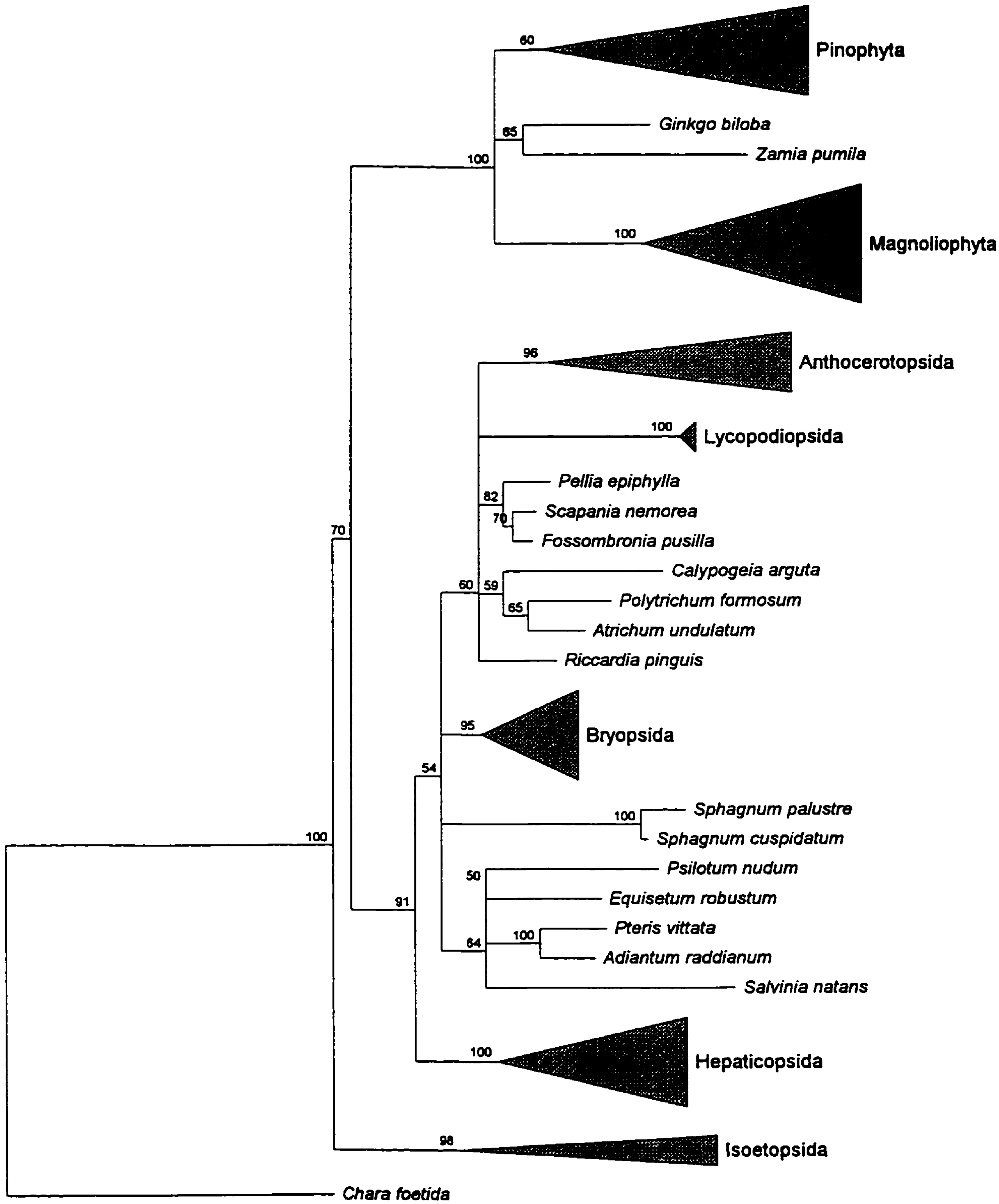


Figure B1SB Tajima & Nei; Neighbor-joining
50% Majority-Rule Bootstrap Tree

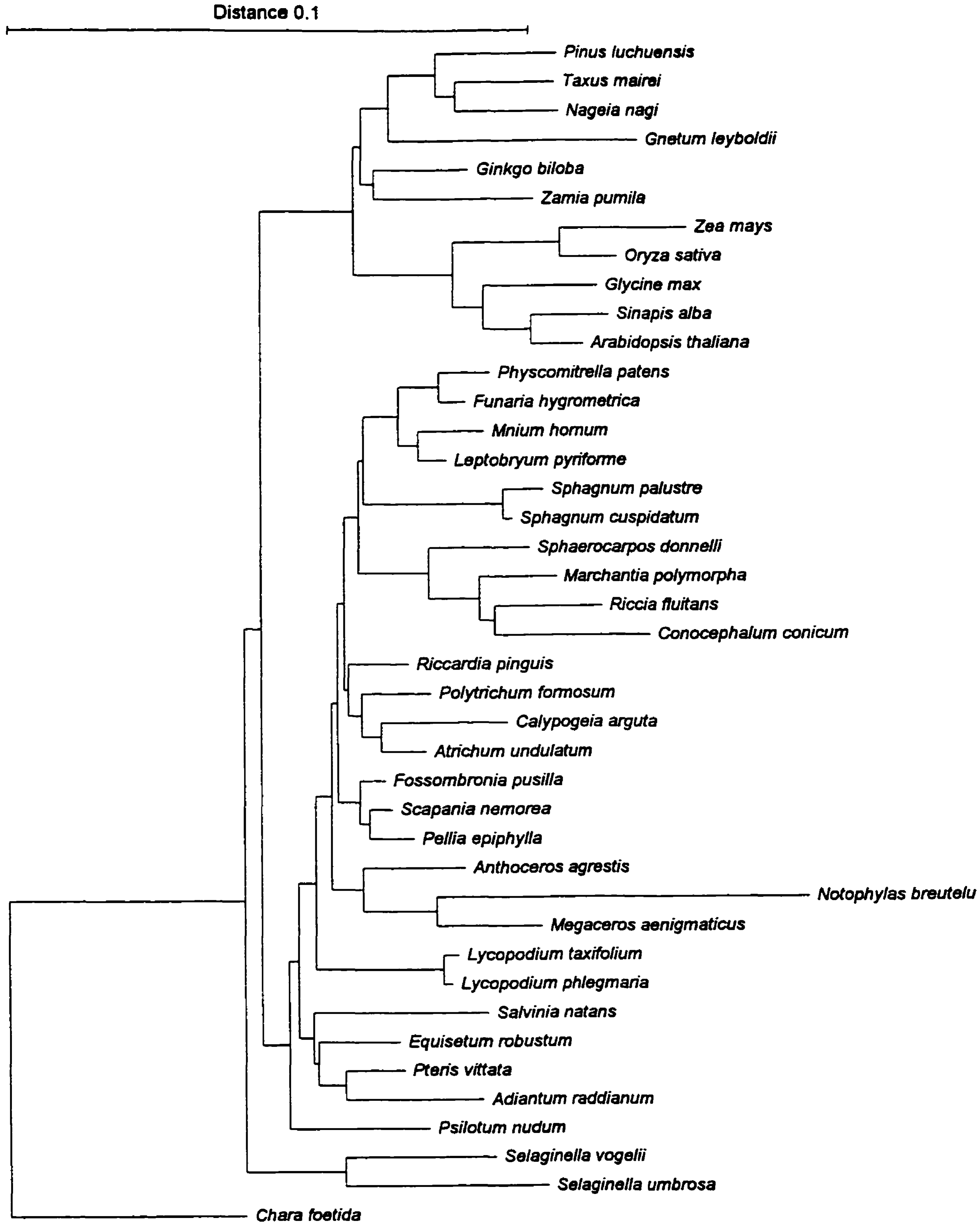


Figure B2S Tajima & Nei
Insertions & Deletions taken into account

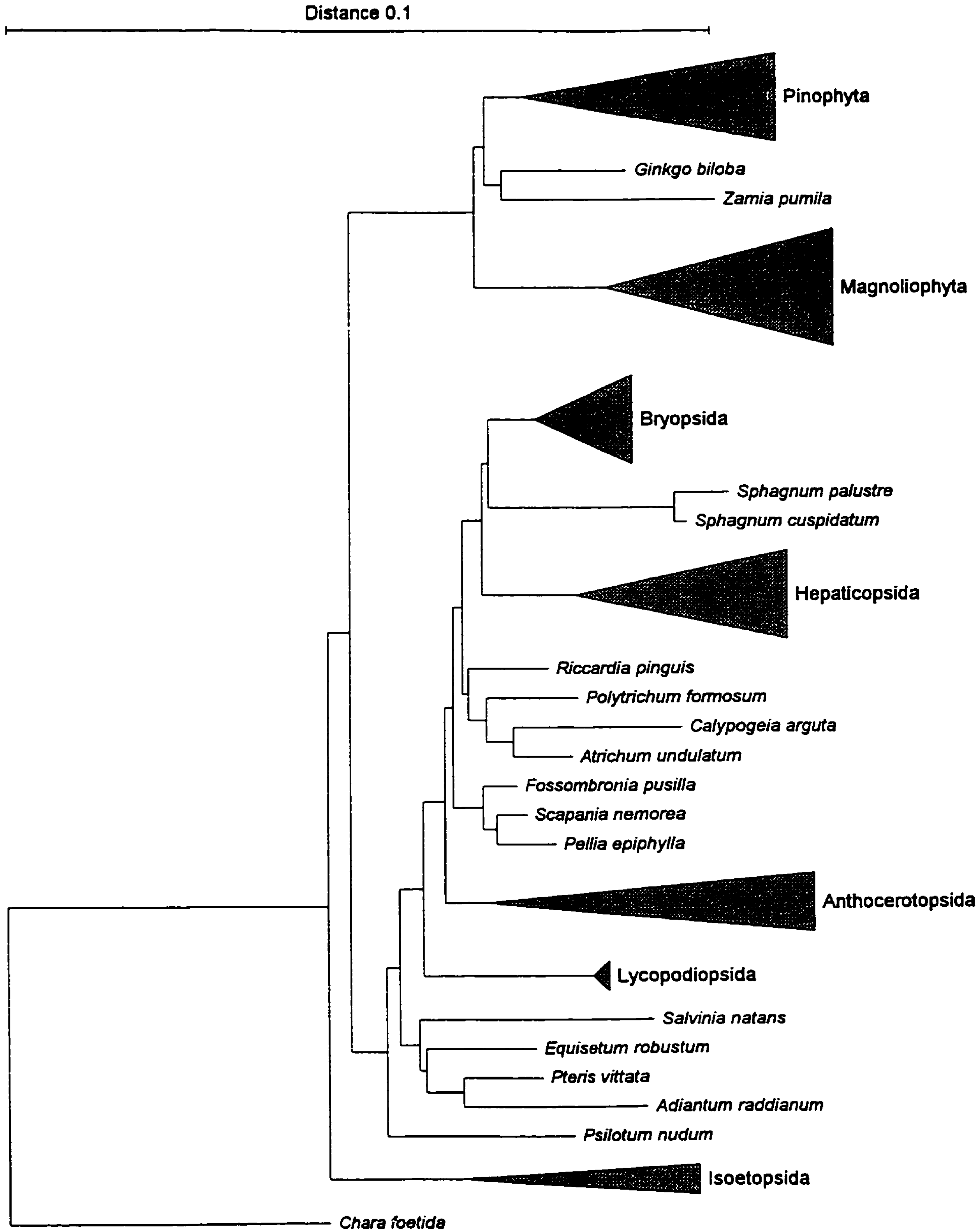


Figure B2S Tajima & Nei
Insertions & Deletions taken into account

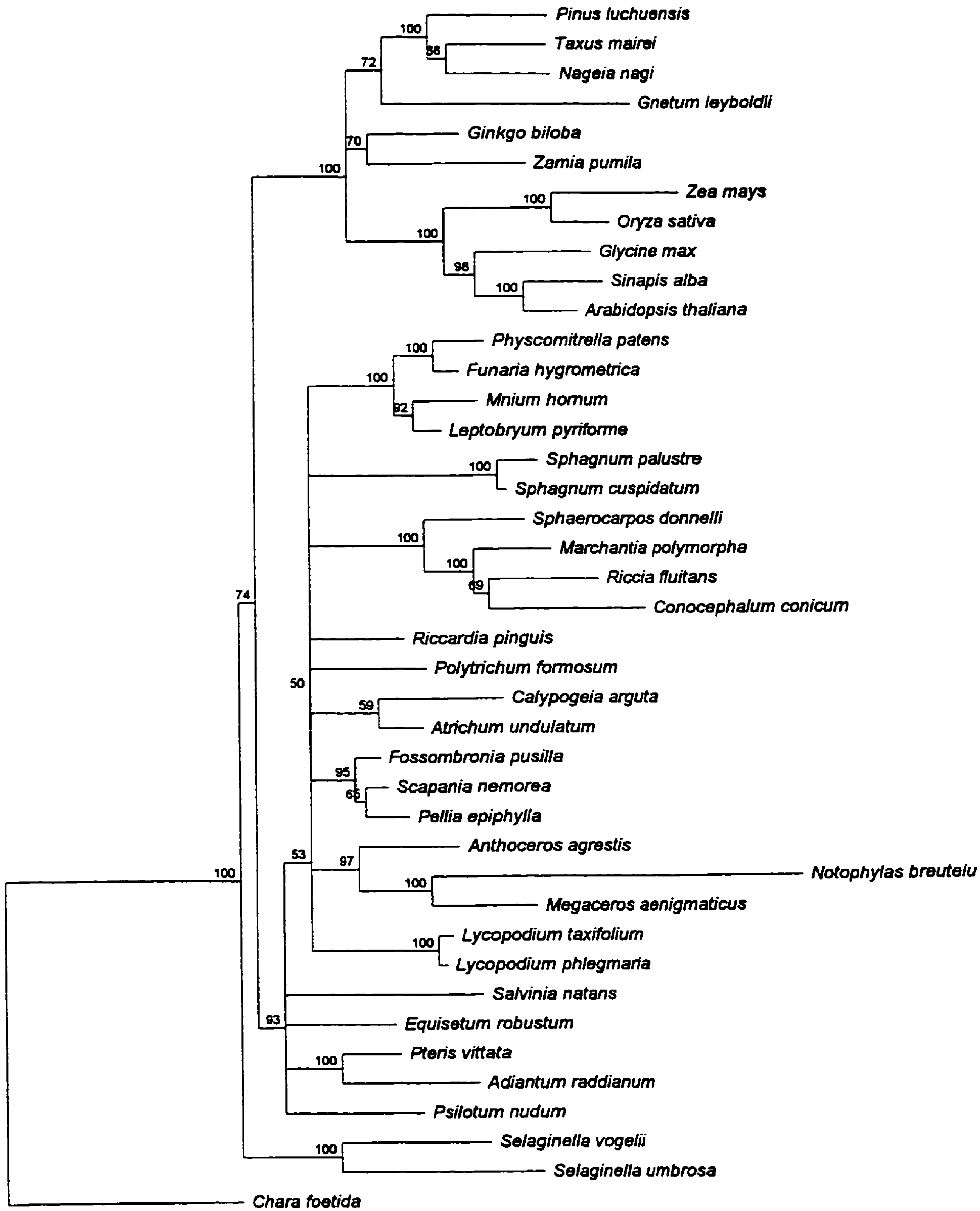


Figure B2SB Tajima & Nei

Insertions & Deletions taken into account

50% Majority-Rule Bootstrap Tree

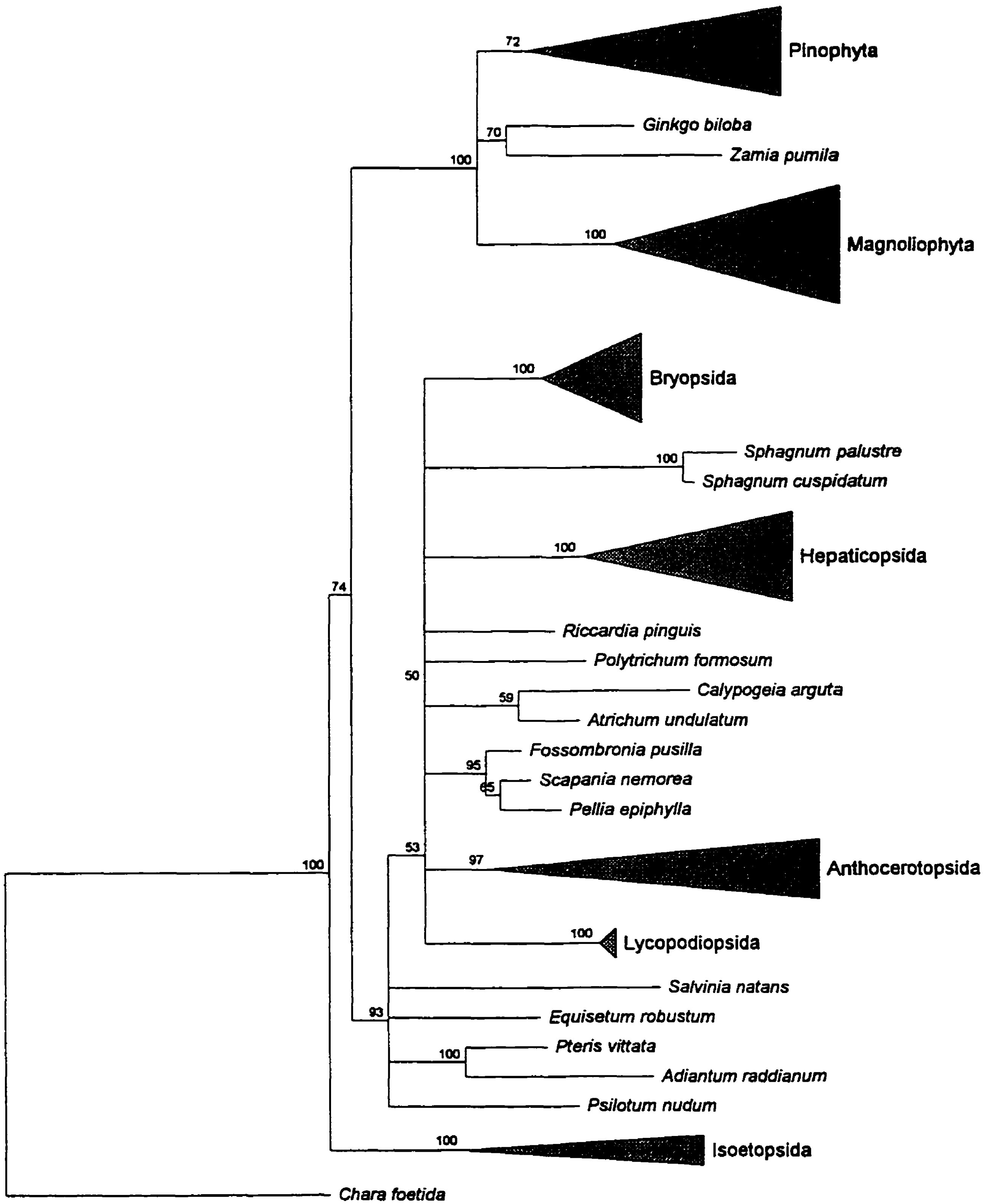


Figure B2SB Tajima & Nei
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

Figure C1S Kimura; Neighbor-joining

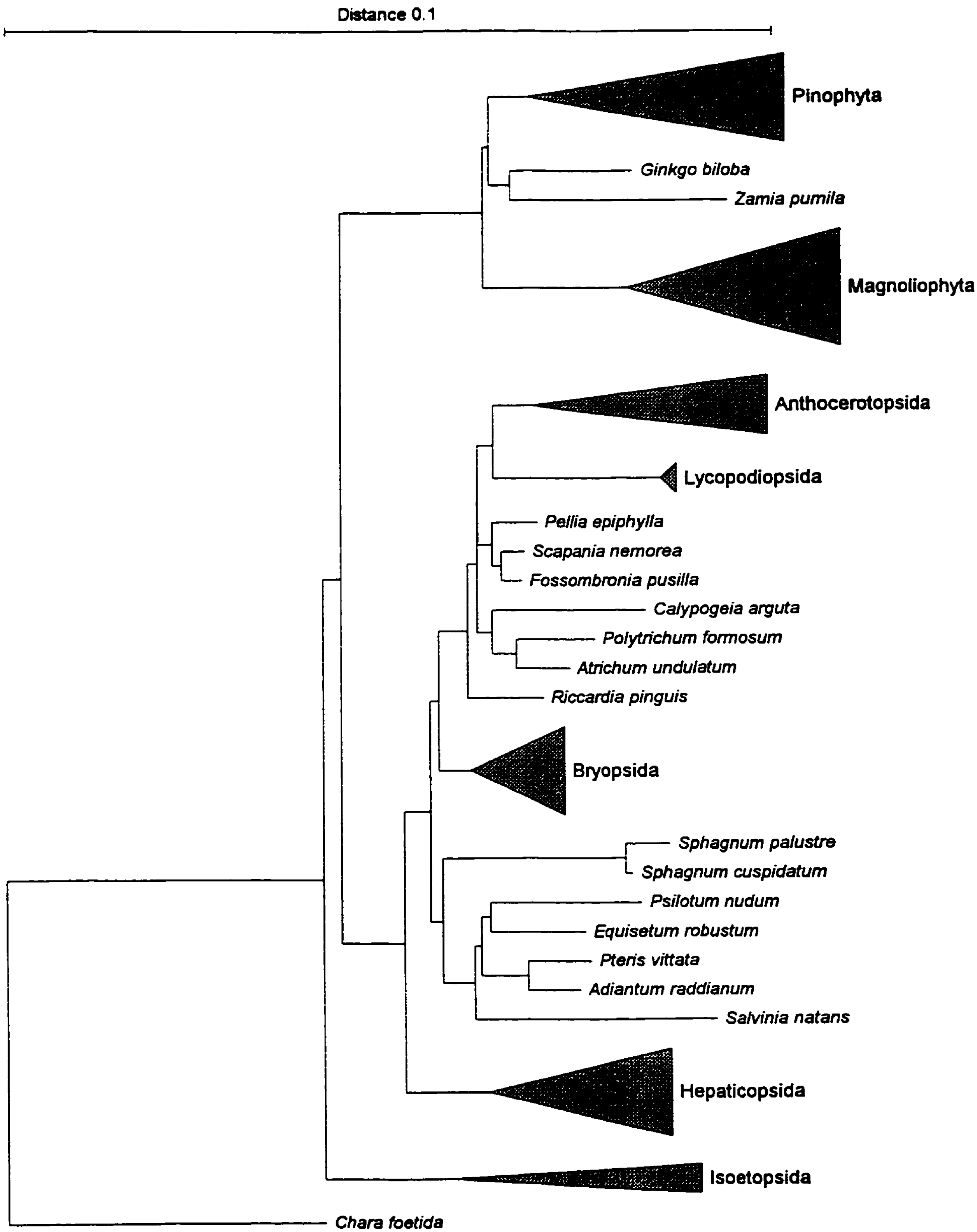


Figure C1S Kimura; Neighbor-joining

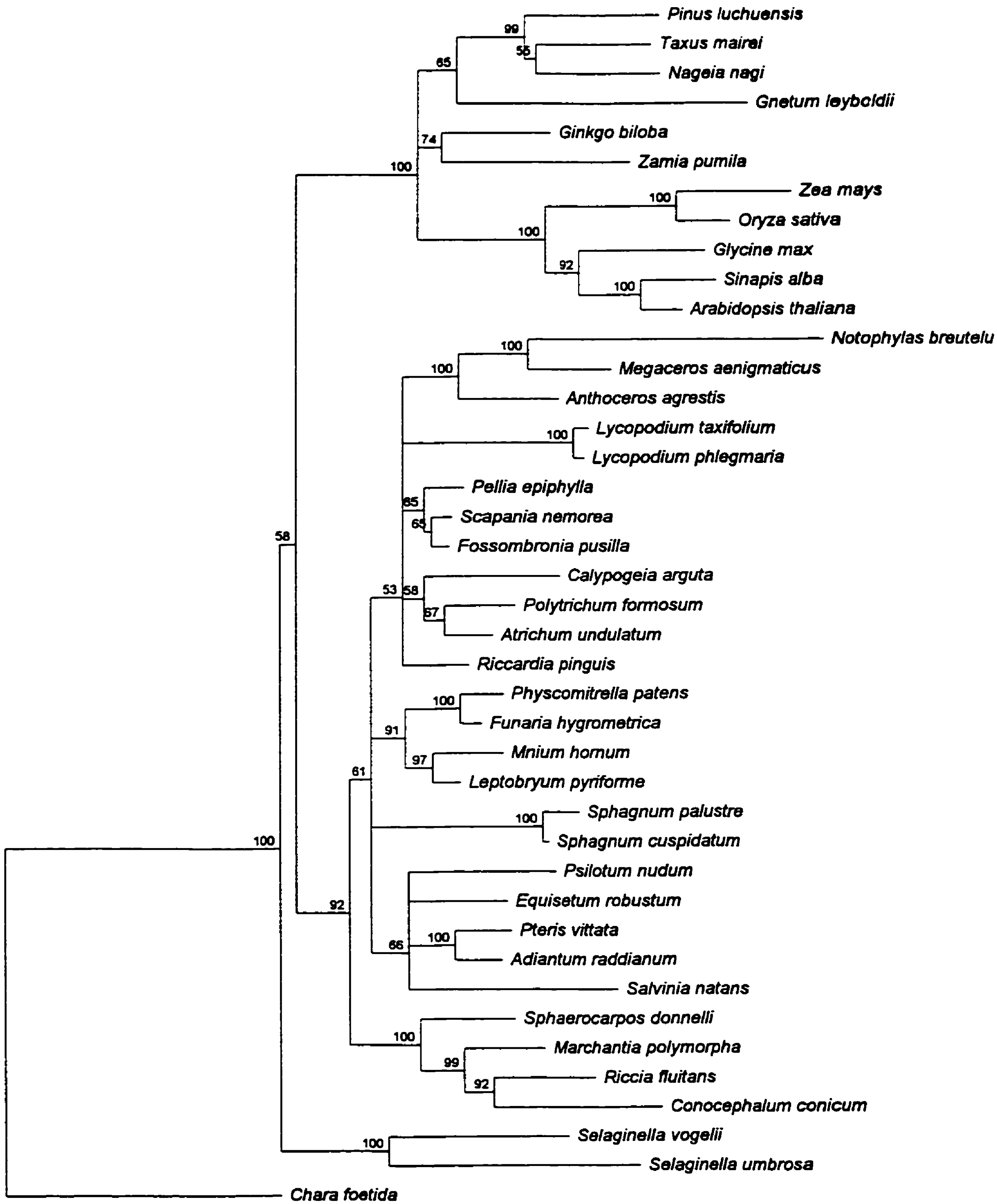


Figure C1SB Kimura; Neighbor-joining
50% Majority-Rule Bootstrap Tree

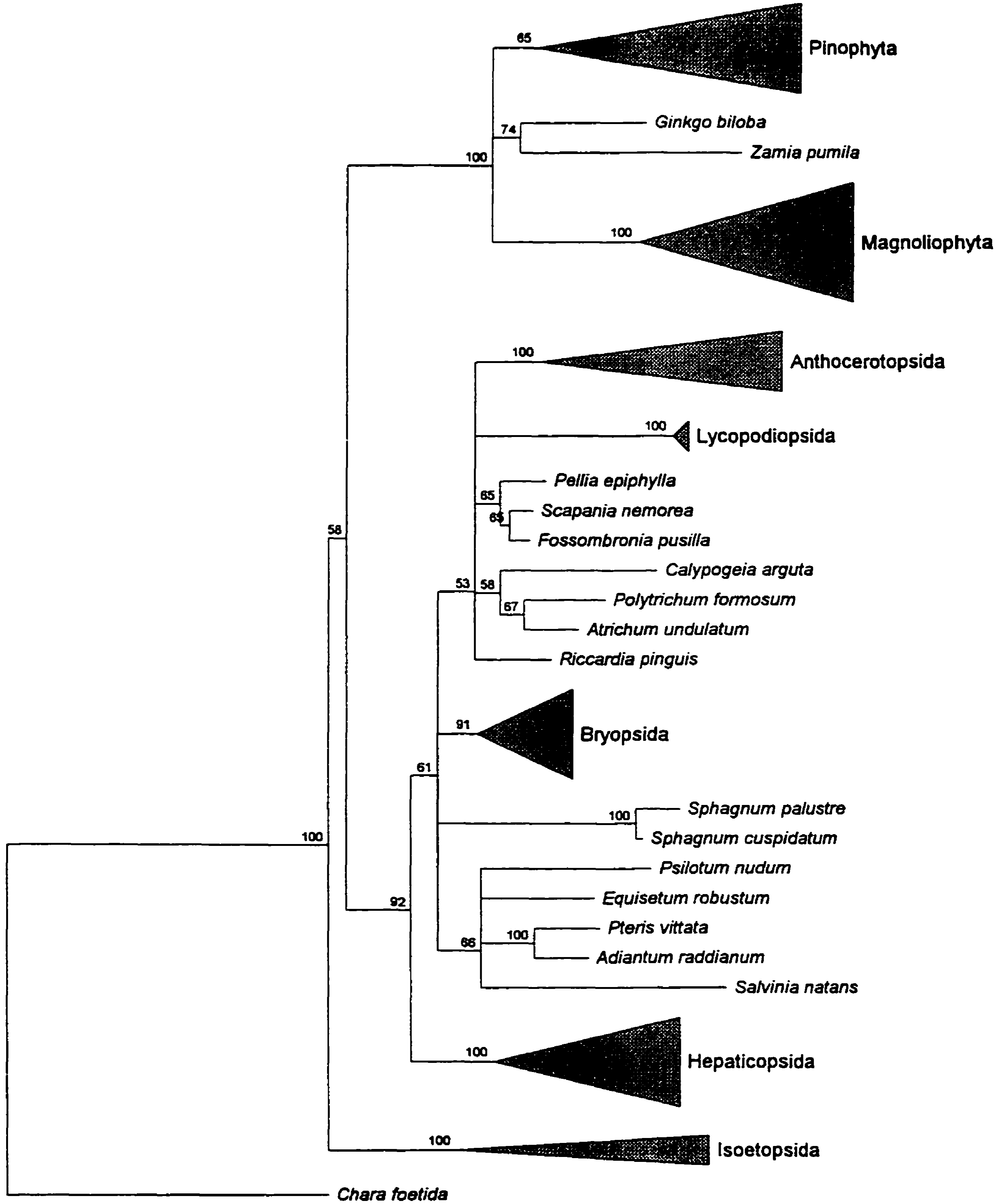


Figure C1SB Kimura; Neighbor-joining
50% Majority-Rule Bootstrap Tree

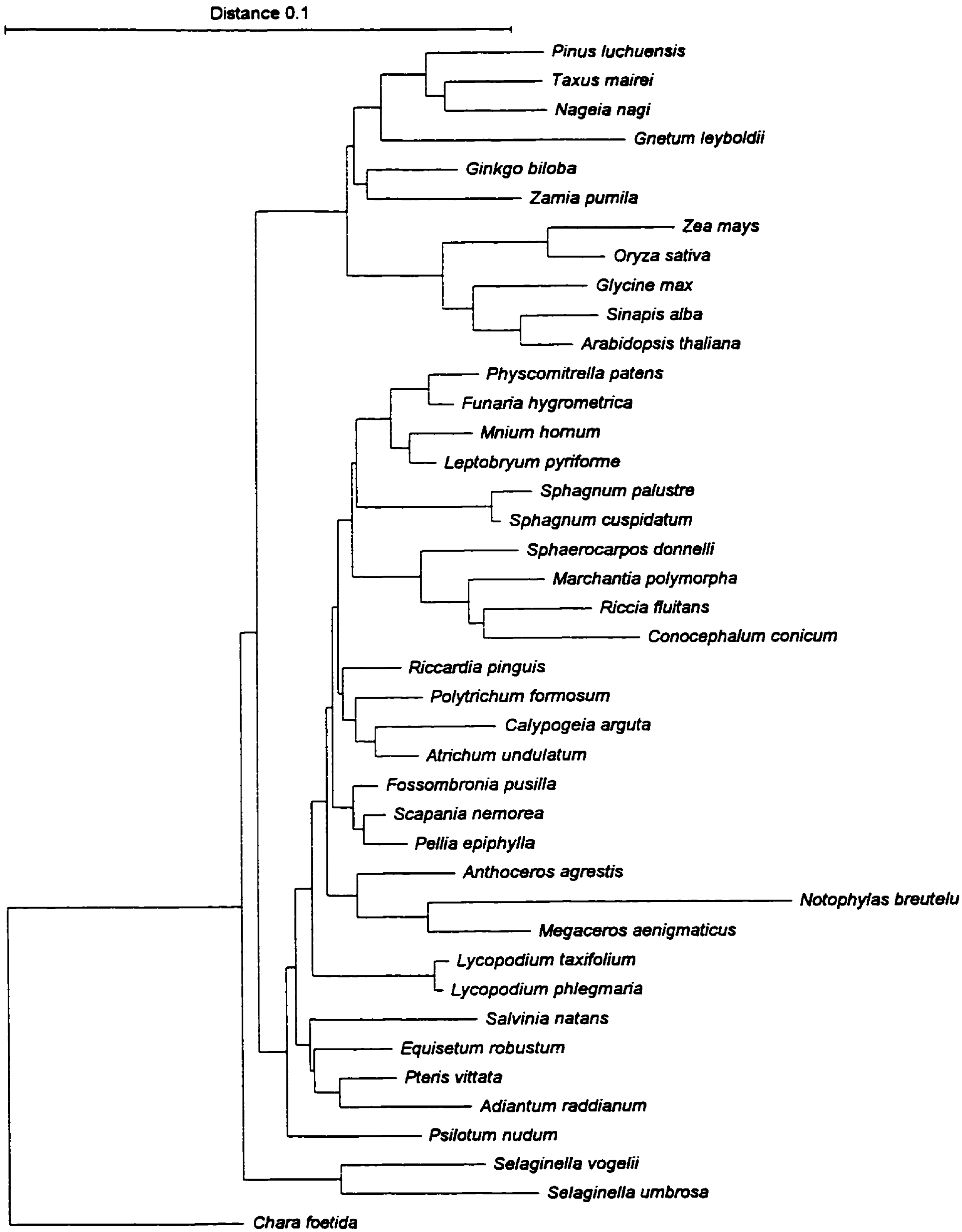


Figure C2S Kimura; (Insertions & Deletions taken into account)

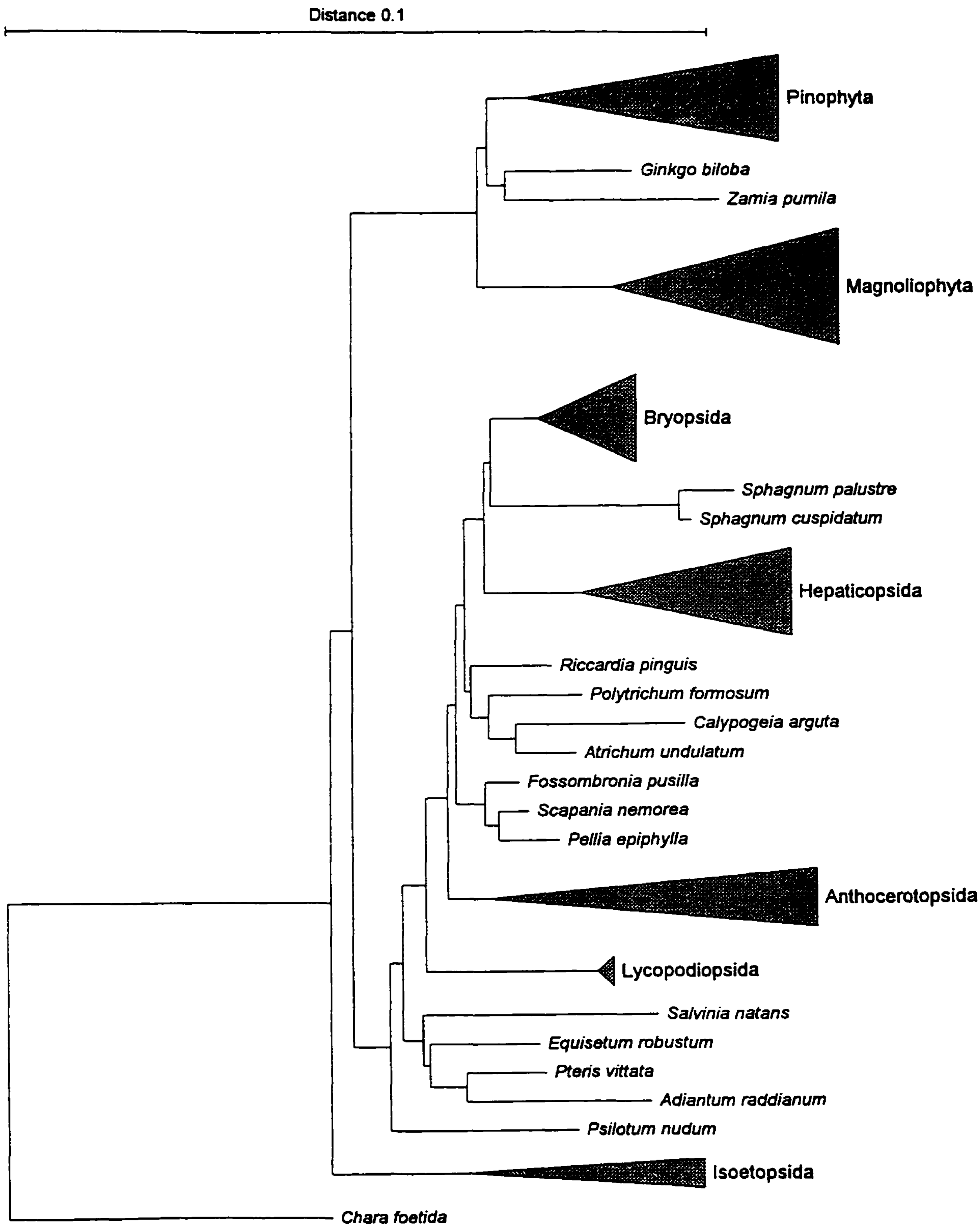


Figure C2S *Kimura; (Insertions & Deletions taken into account)*

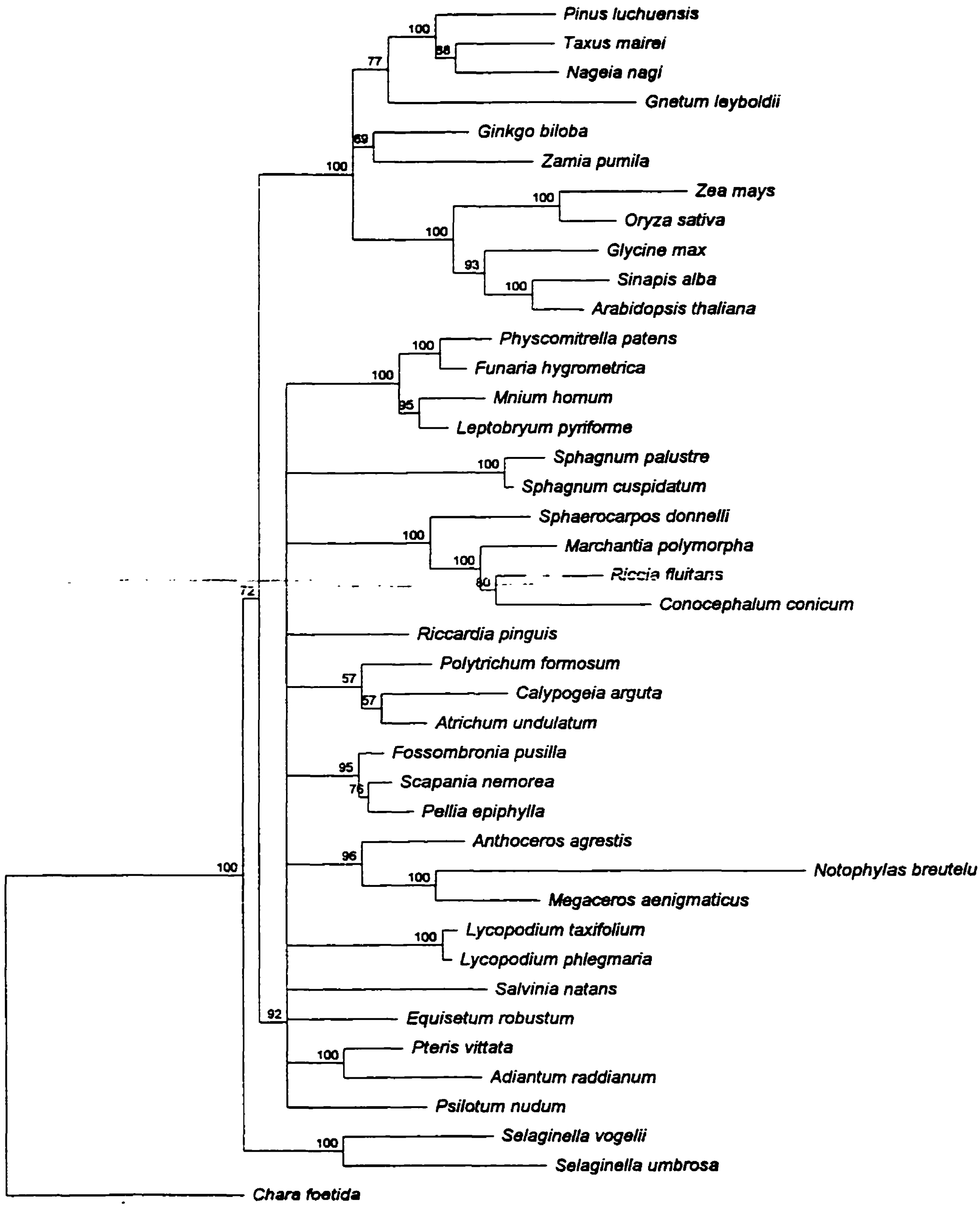


Figure C2SB Kimura; (Insertions & Deletions taken into account)
50% Majority-Rule Bootstrap Tree

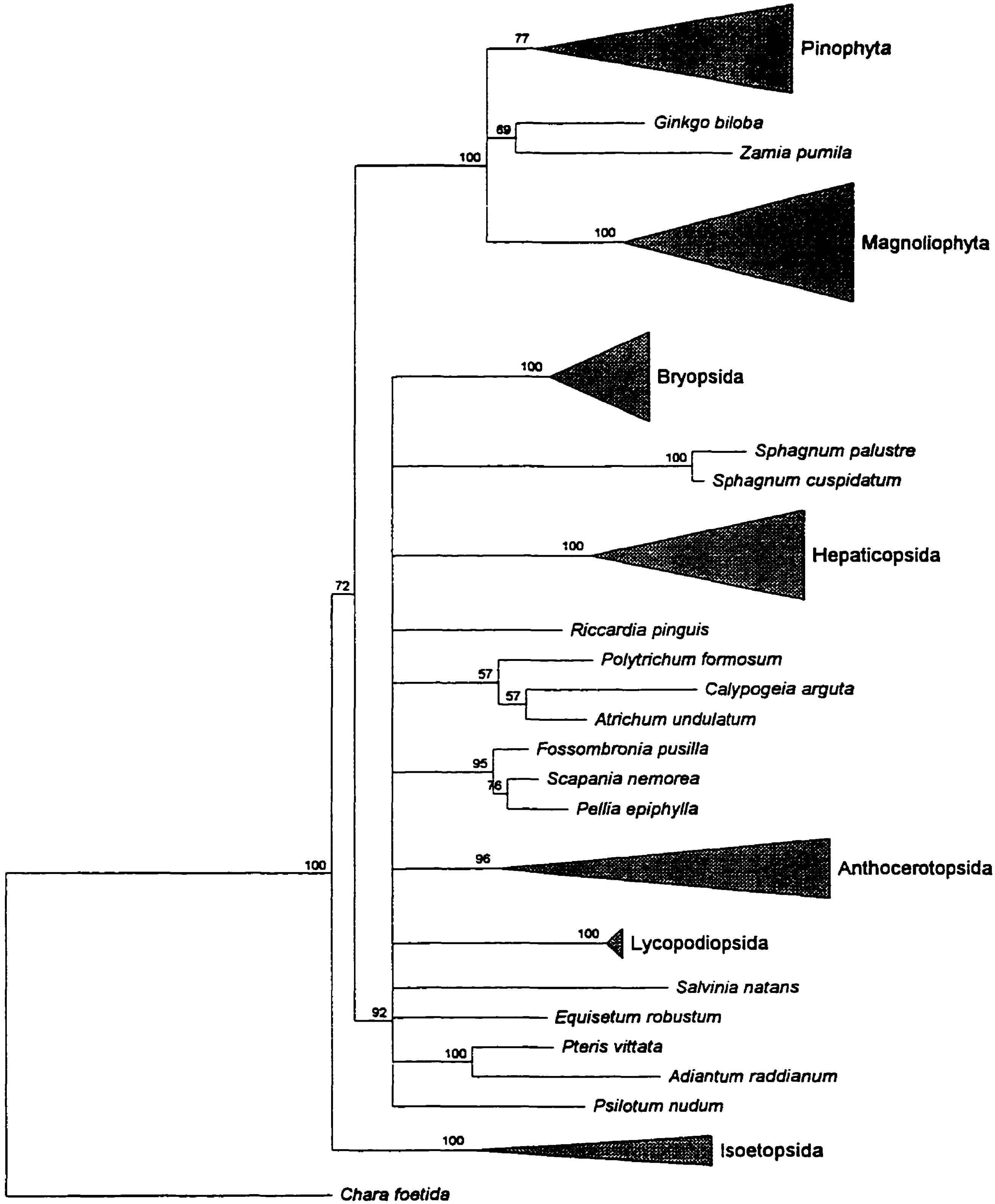


Figure C2SB Kimura; (Insertions & Deletions taken into account)
50% Majority-Rule Bootstrap Tree

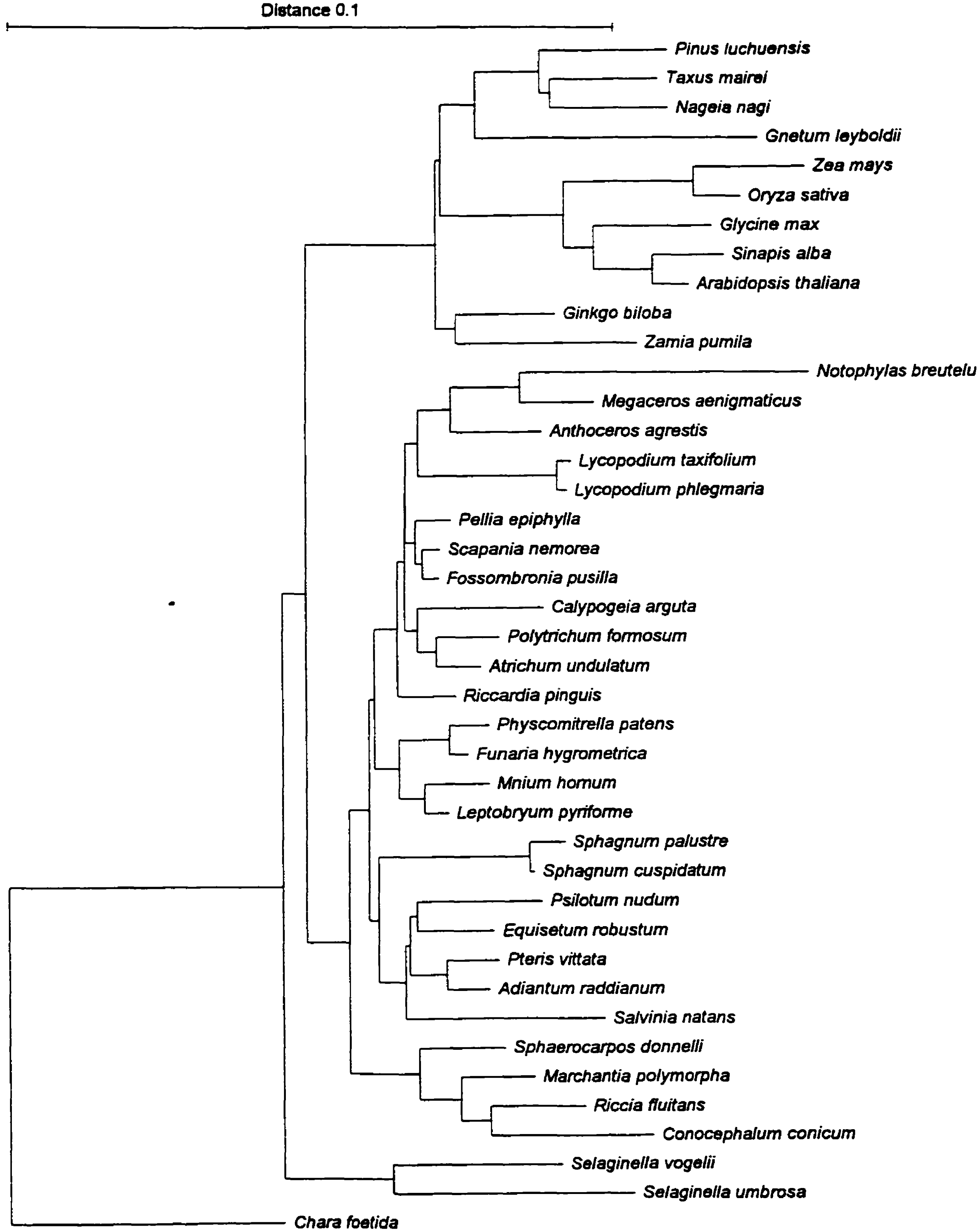


Figure D1.1S Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1

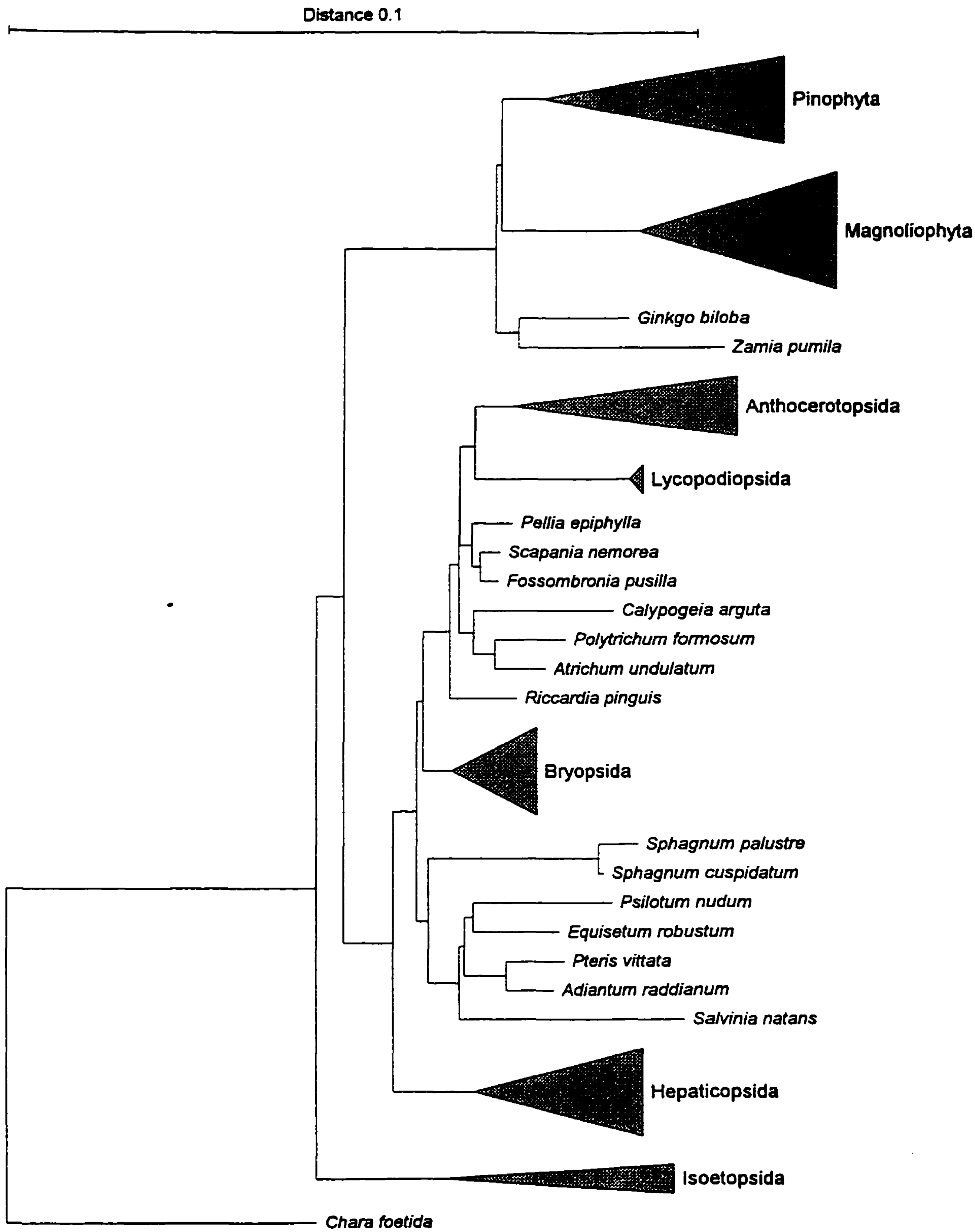


Figure D1.1S Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1

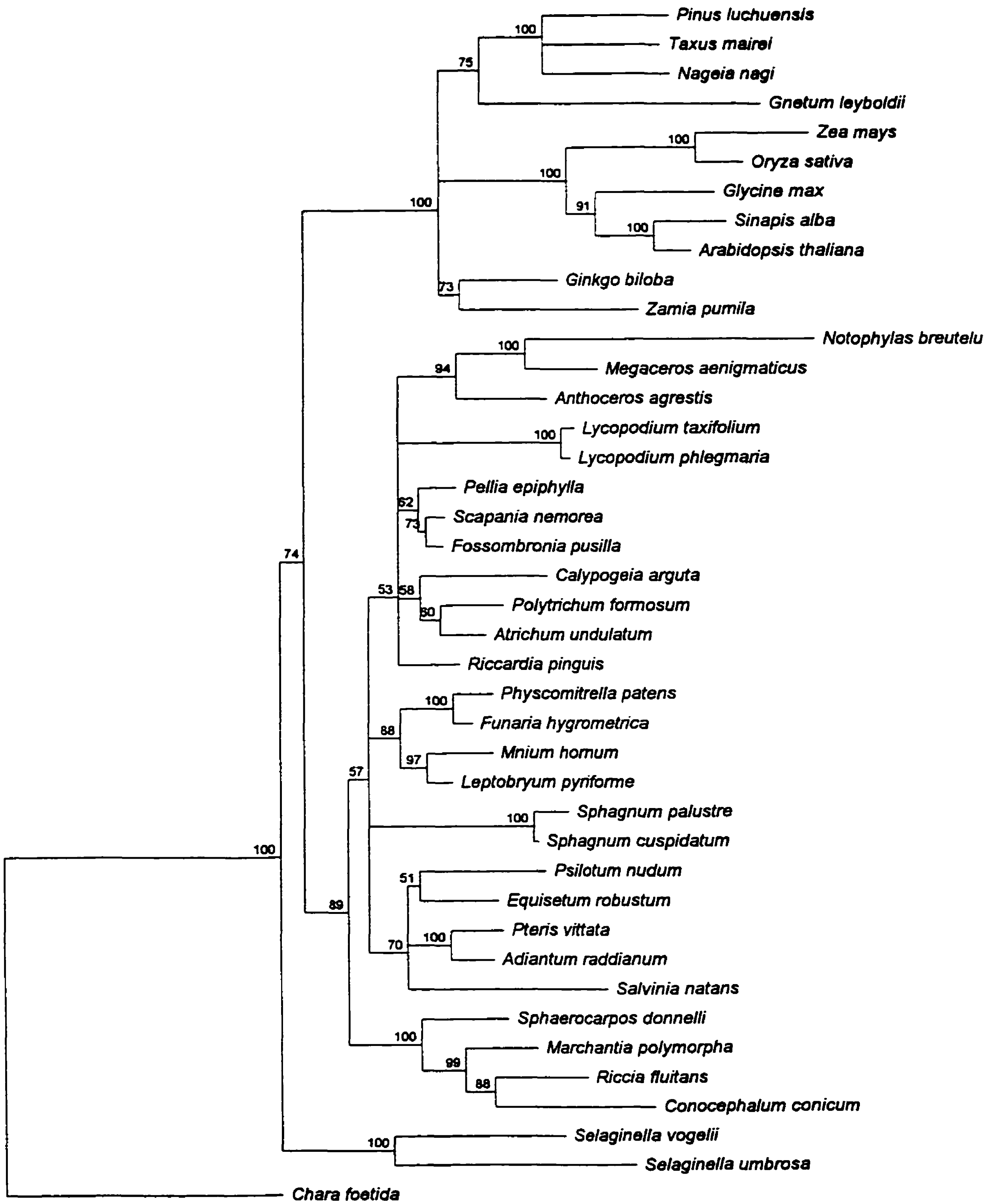


Figure D1.1SB *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*
50% Majority-Rule Bootstrap Tree

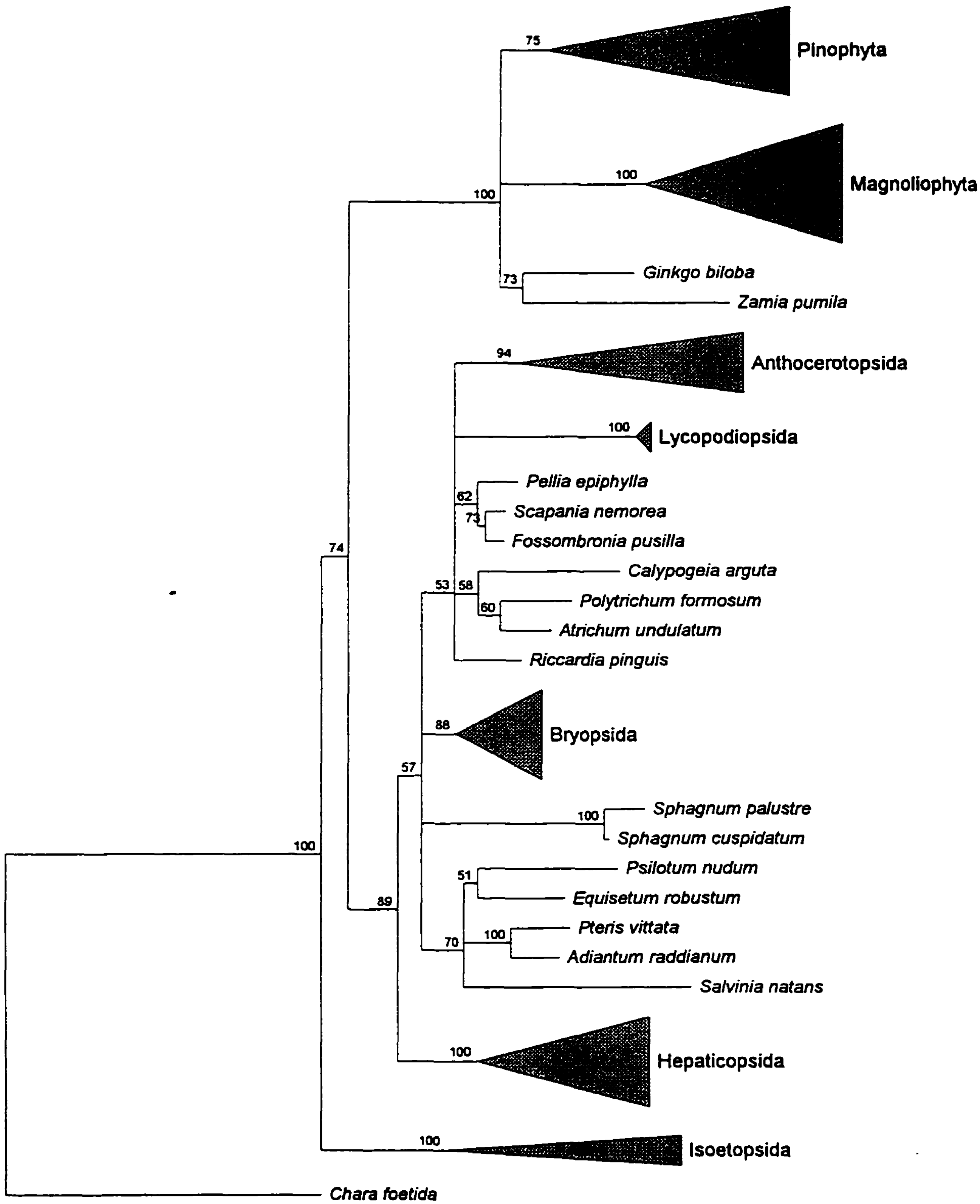


Figure D1.1SB Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model). Gamma distance = 1 50% Majority-Rule Bootstrap Tree

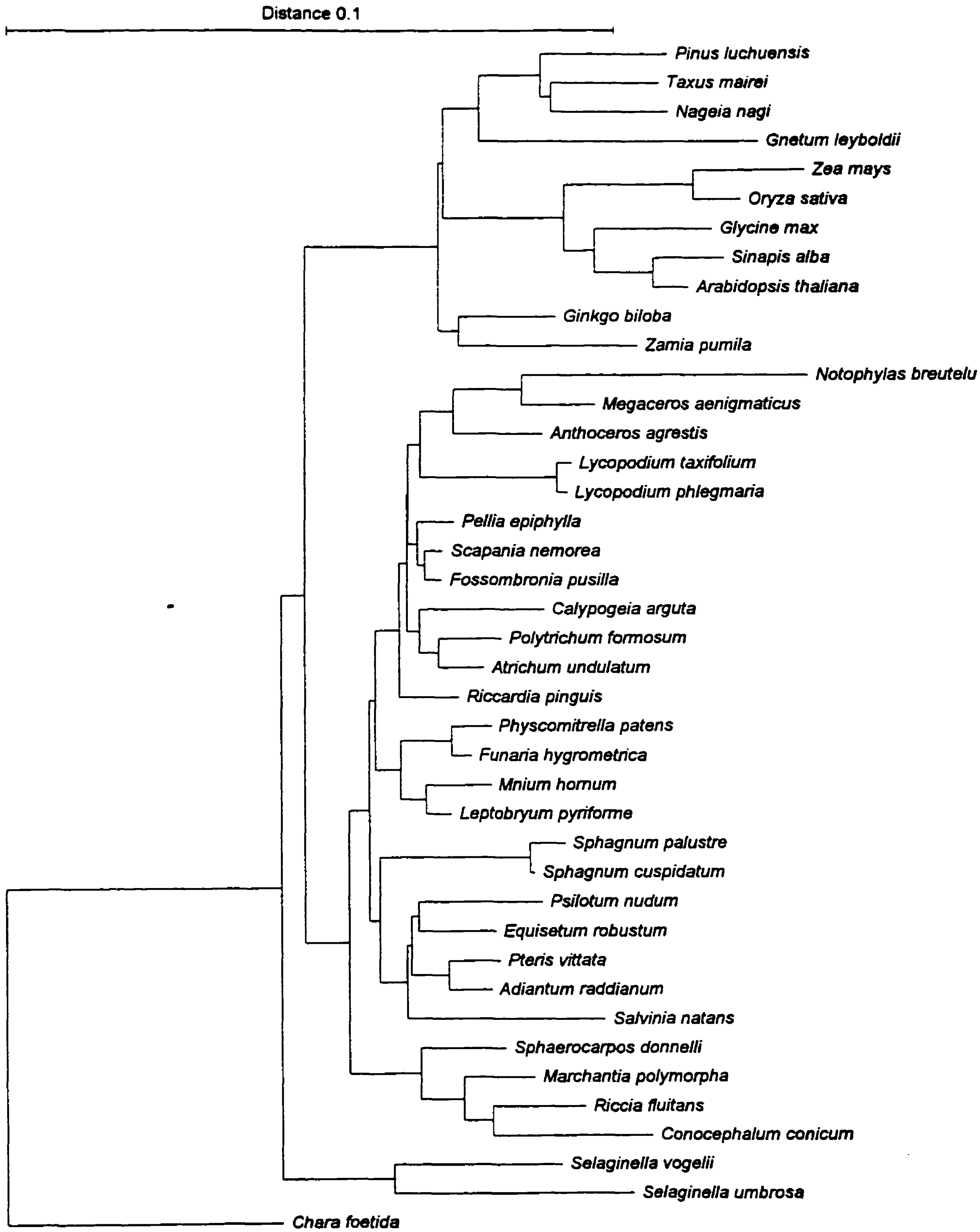


Figure D1.2S *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*
Insertions & Deletions taken into account

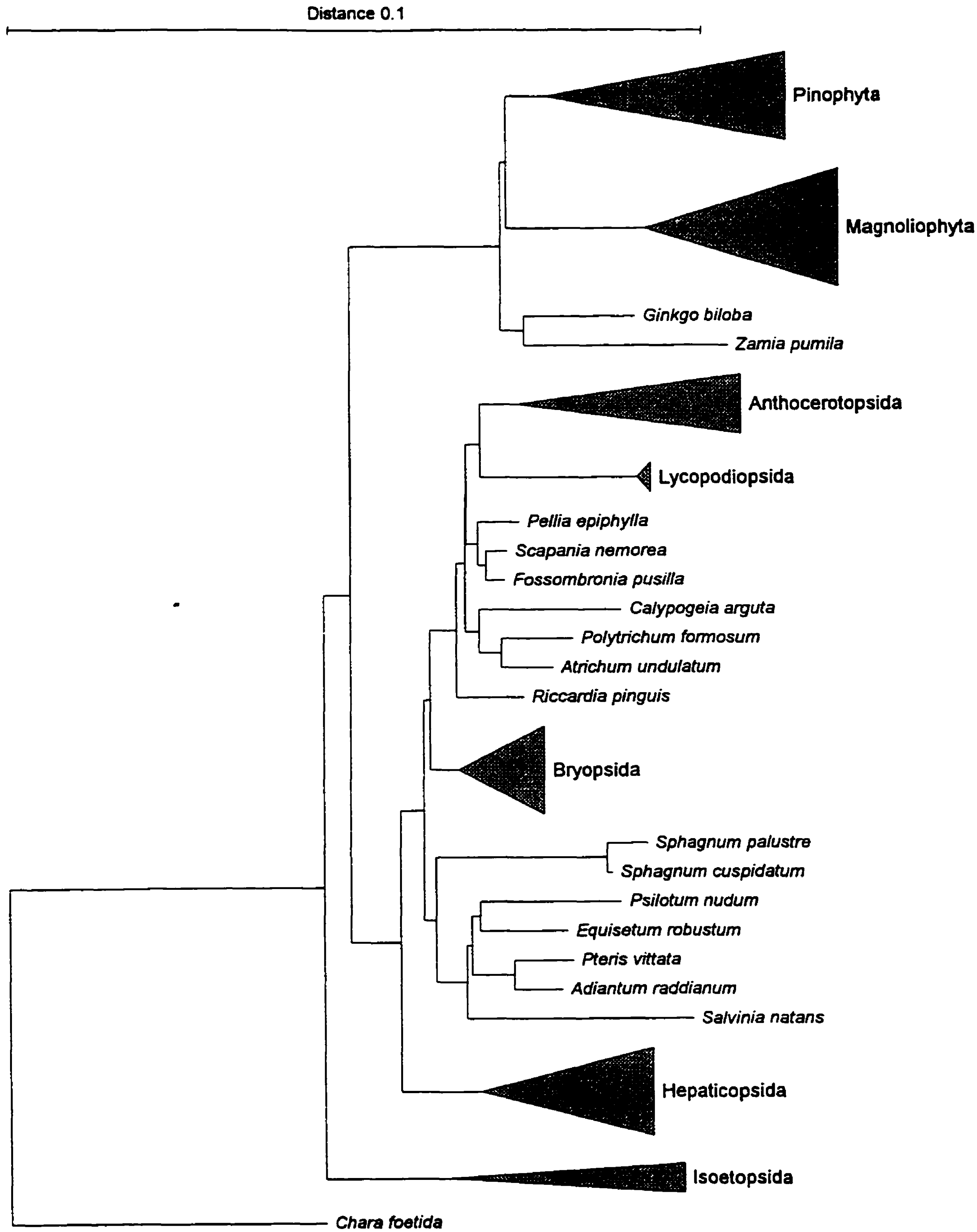


Figure D1.2S *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model). Gamma distance = 1*
Insertions & Deletions taken into account

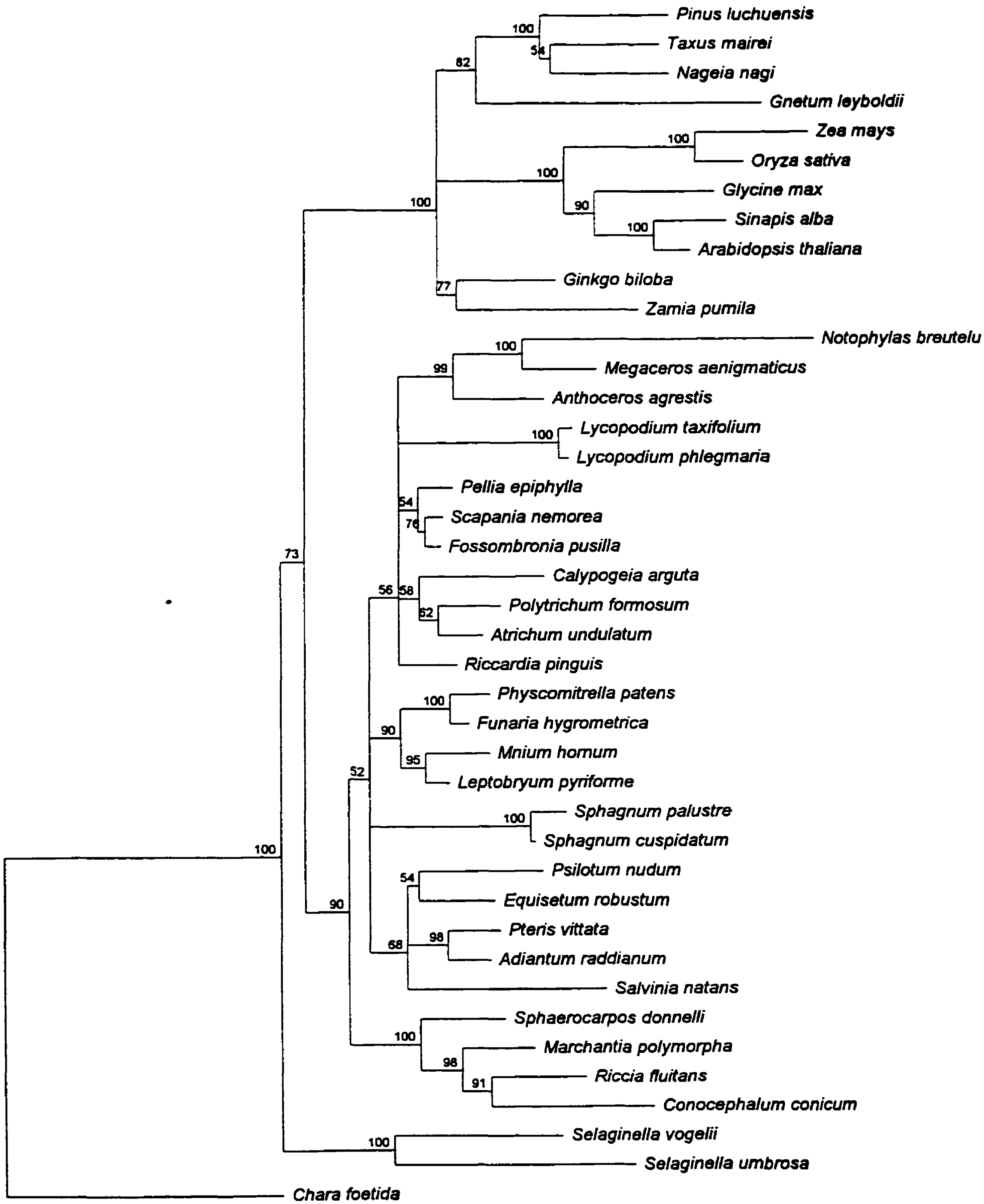


Figure D1.2SB *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

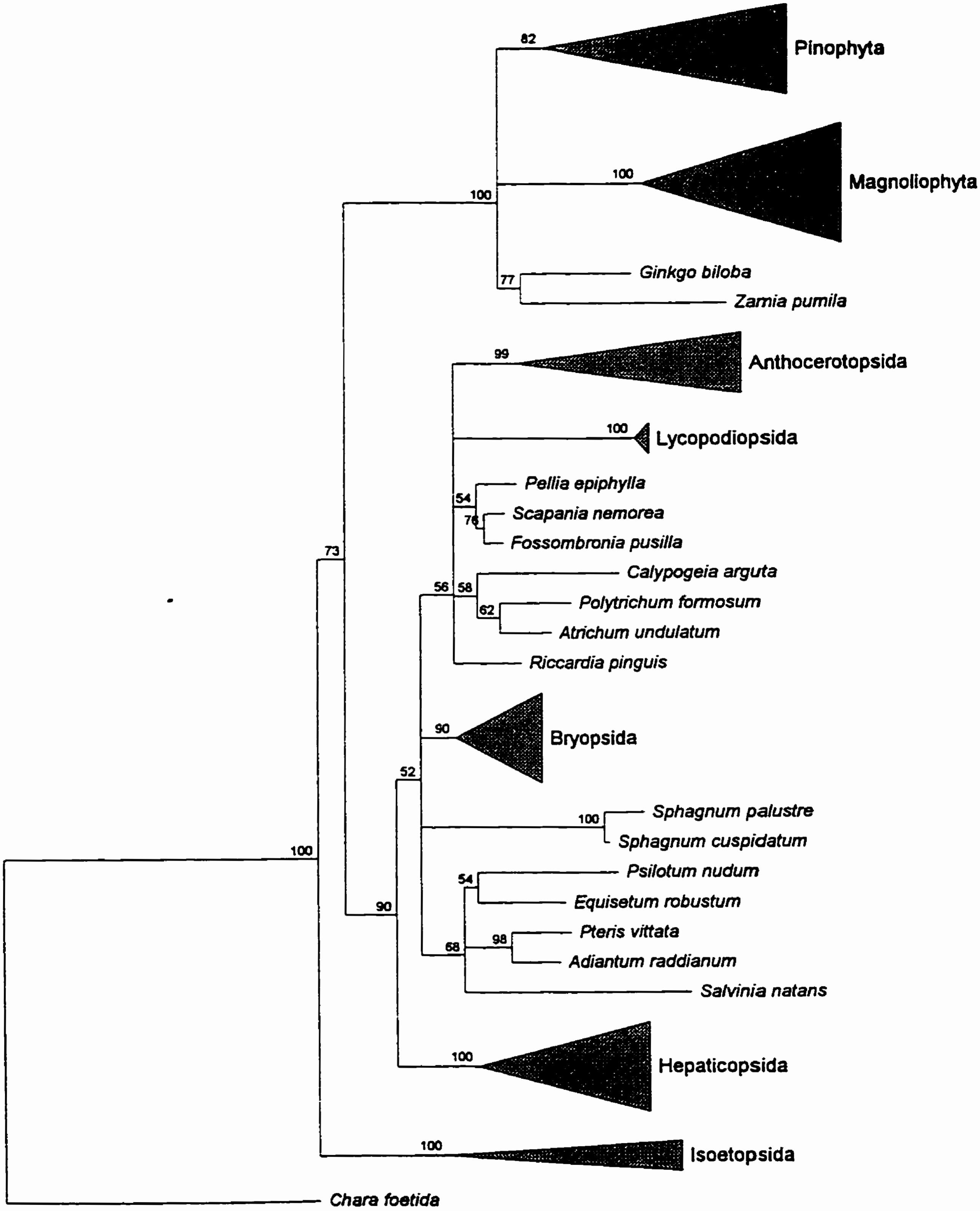


Figure D1.2SB *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model). Gamma distance = 1*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

Figure D2.1S Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1

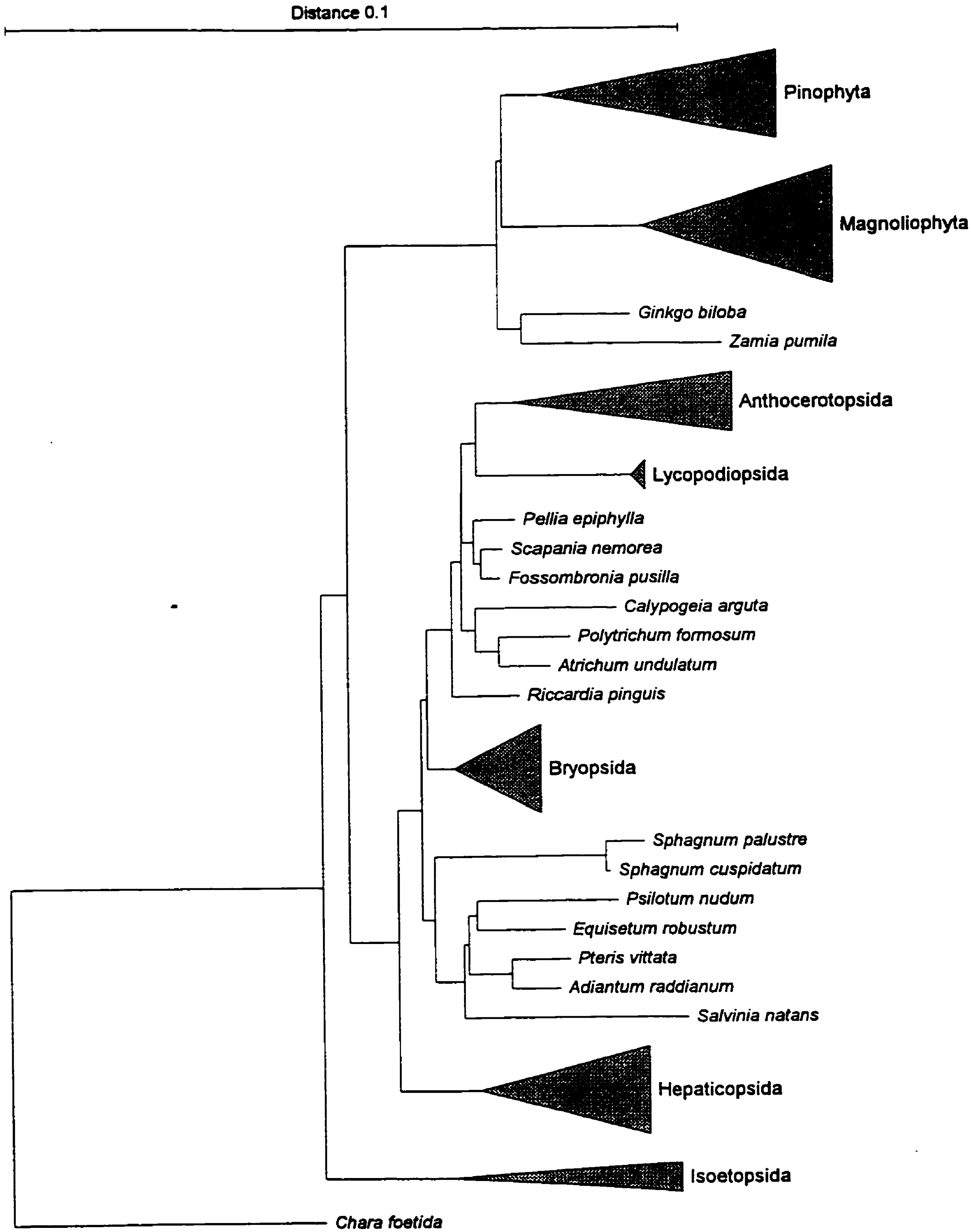


Figure D2.1S *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1*

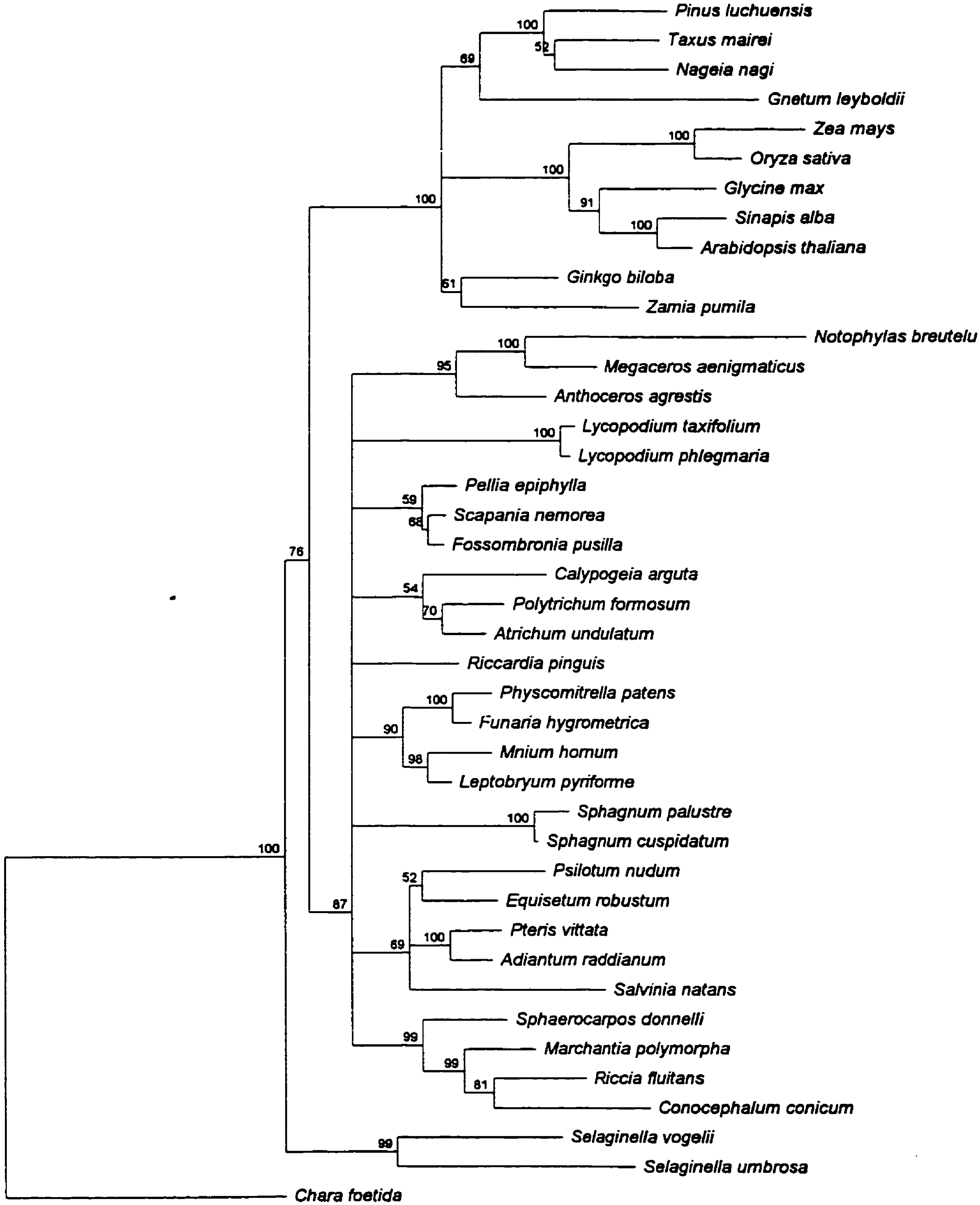


Figure D2.1SB *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1*
50% Majority-Rule Bootstrap Tree

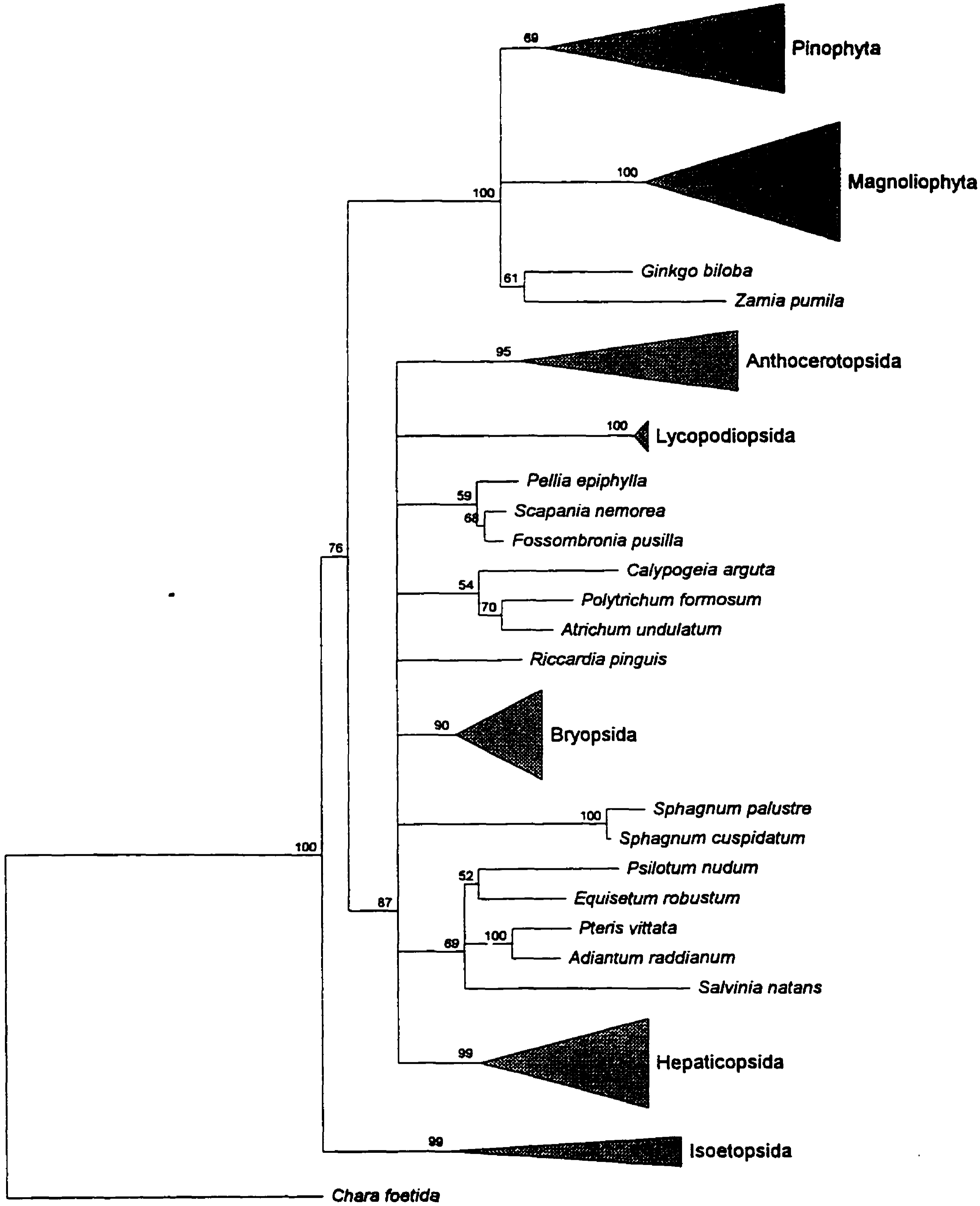


Figure D2.15B Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1 50% Majority-Rule Bootstrap Tree

Figure D2.2S Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1 Insertions & Deletions taken into account

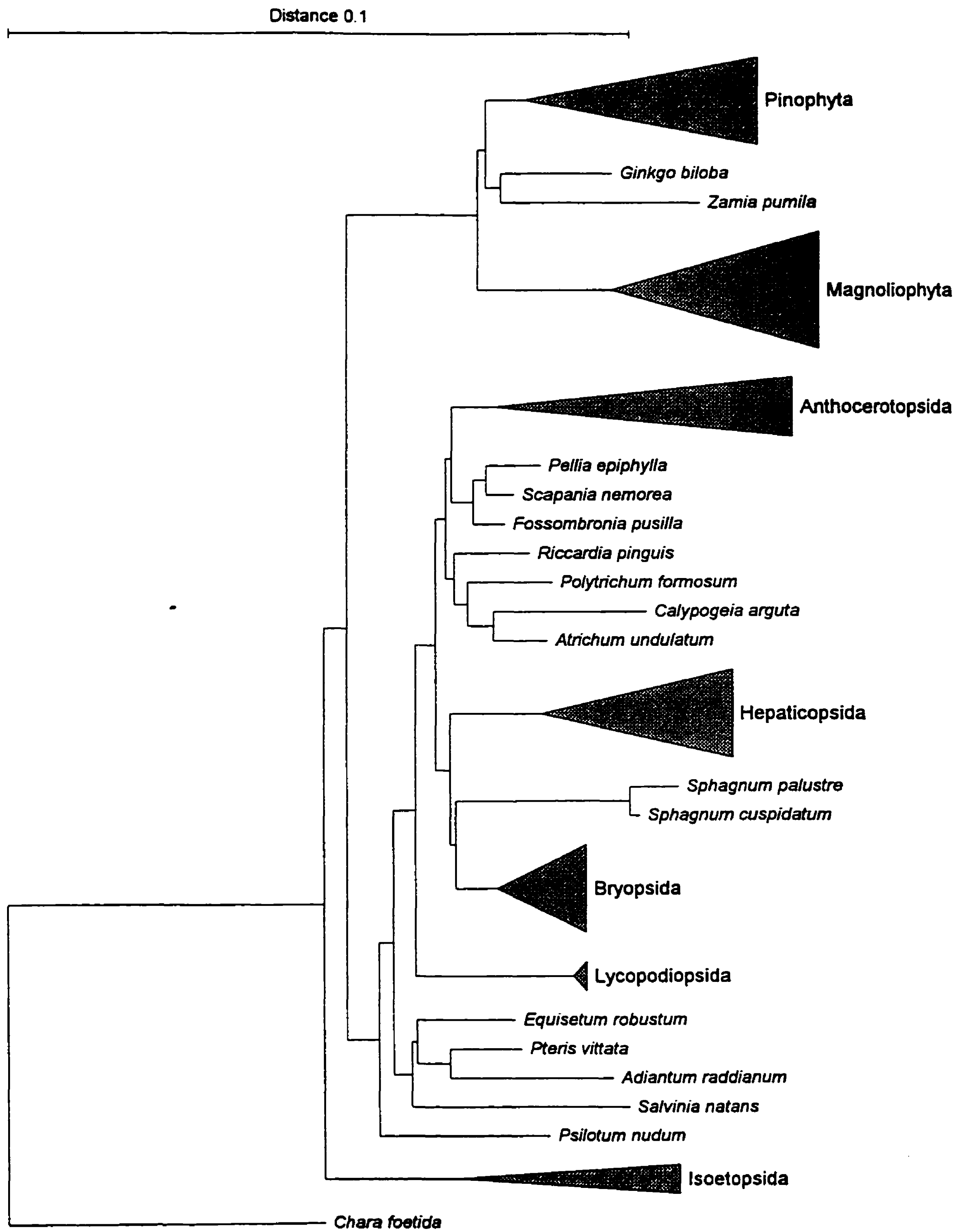


Figure D2.2S *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1 Insertions & Deletions taken into account*

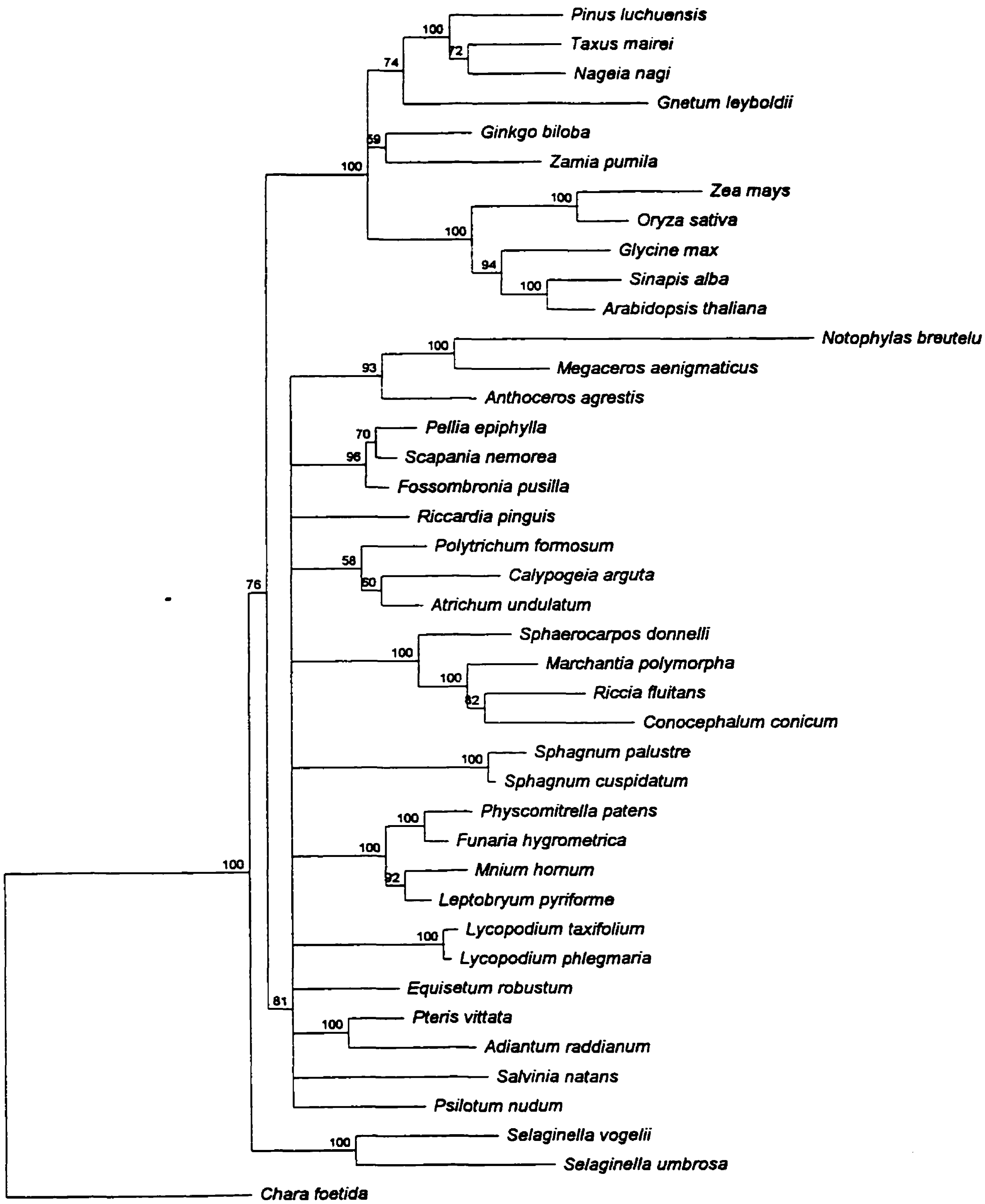


Figure D2.2SB *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

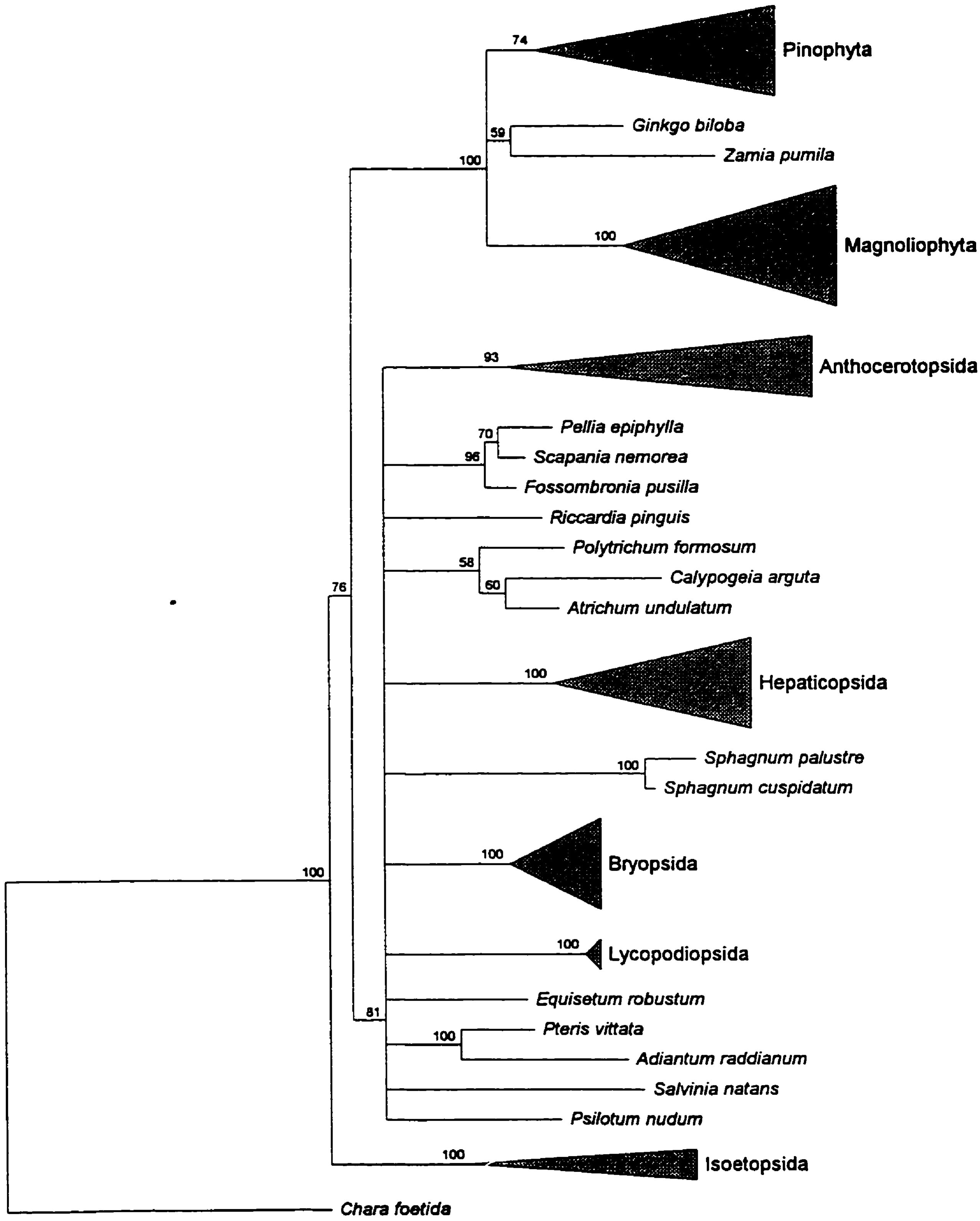


Figure D2.2SB *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

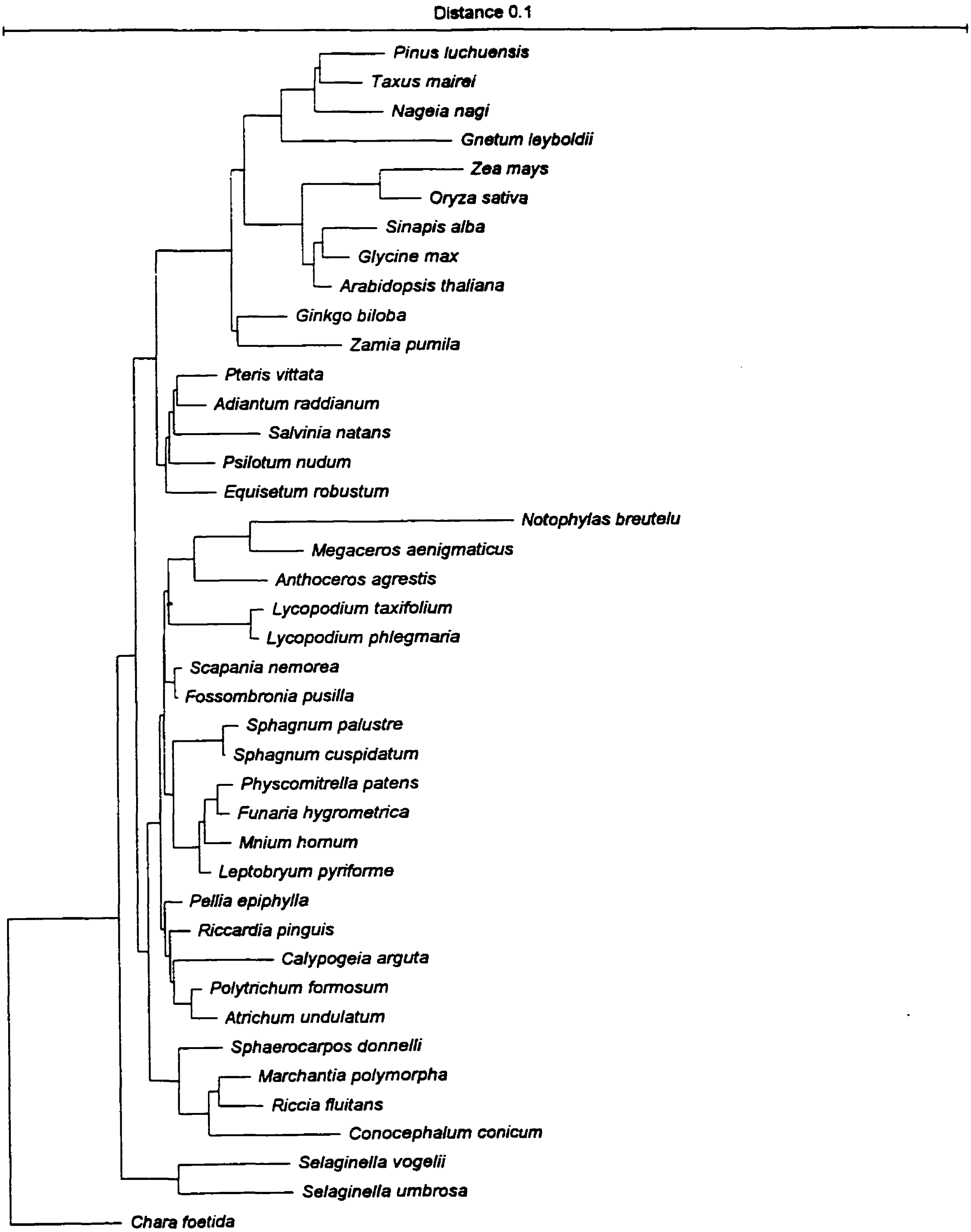


Figure E1S *Transversions Only; Neighbor-joining*

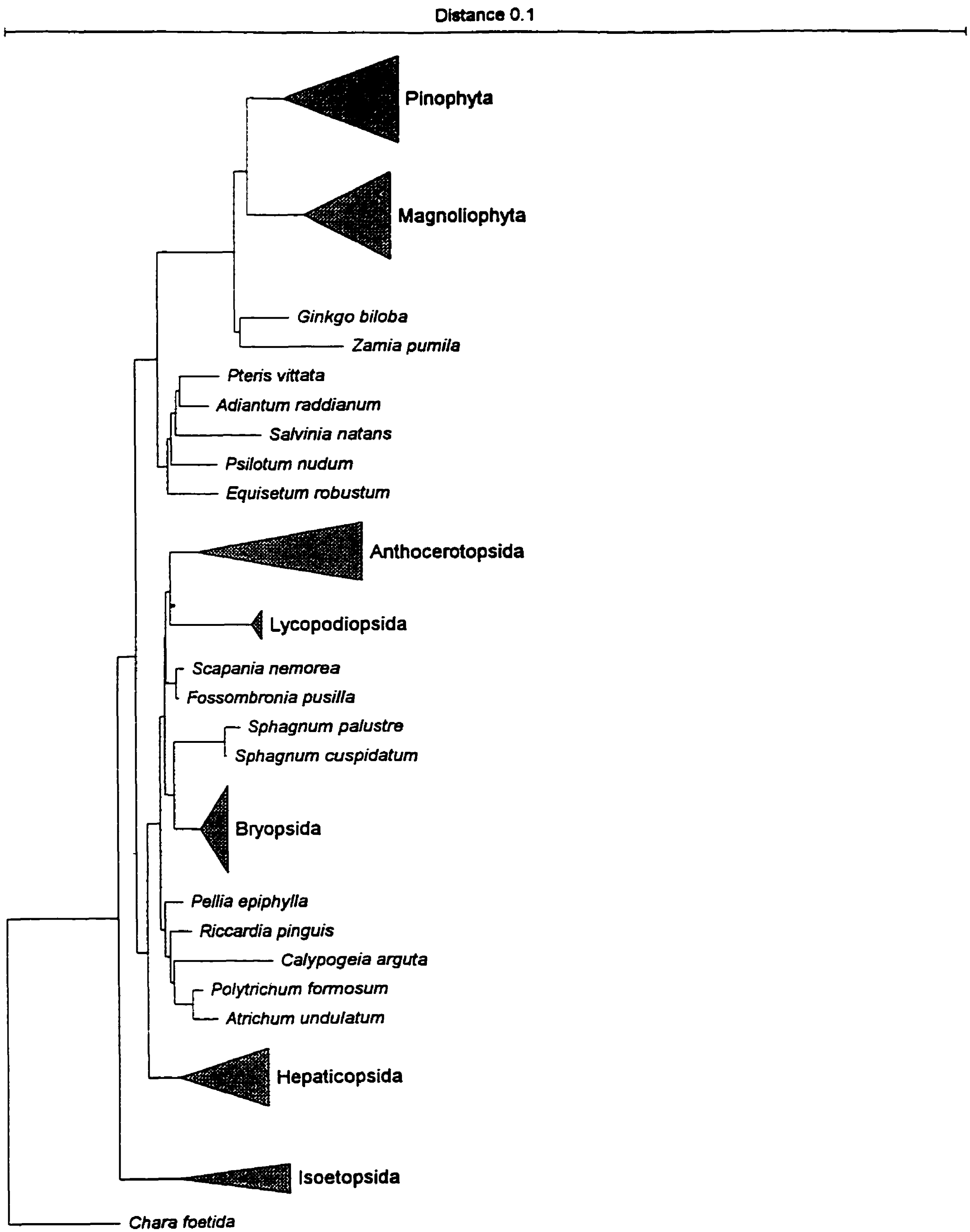


Figure E1S Transversions Only: Neighbor-joining

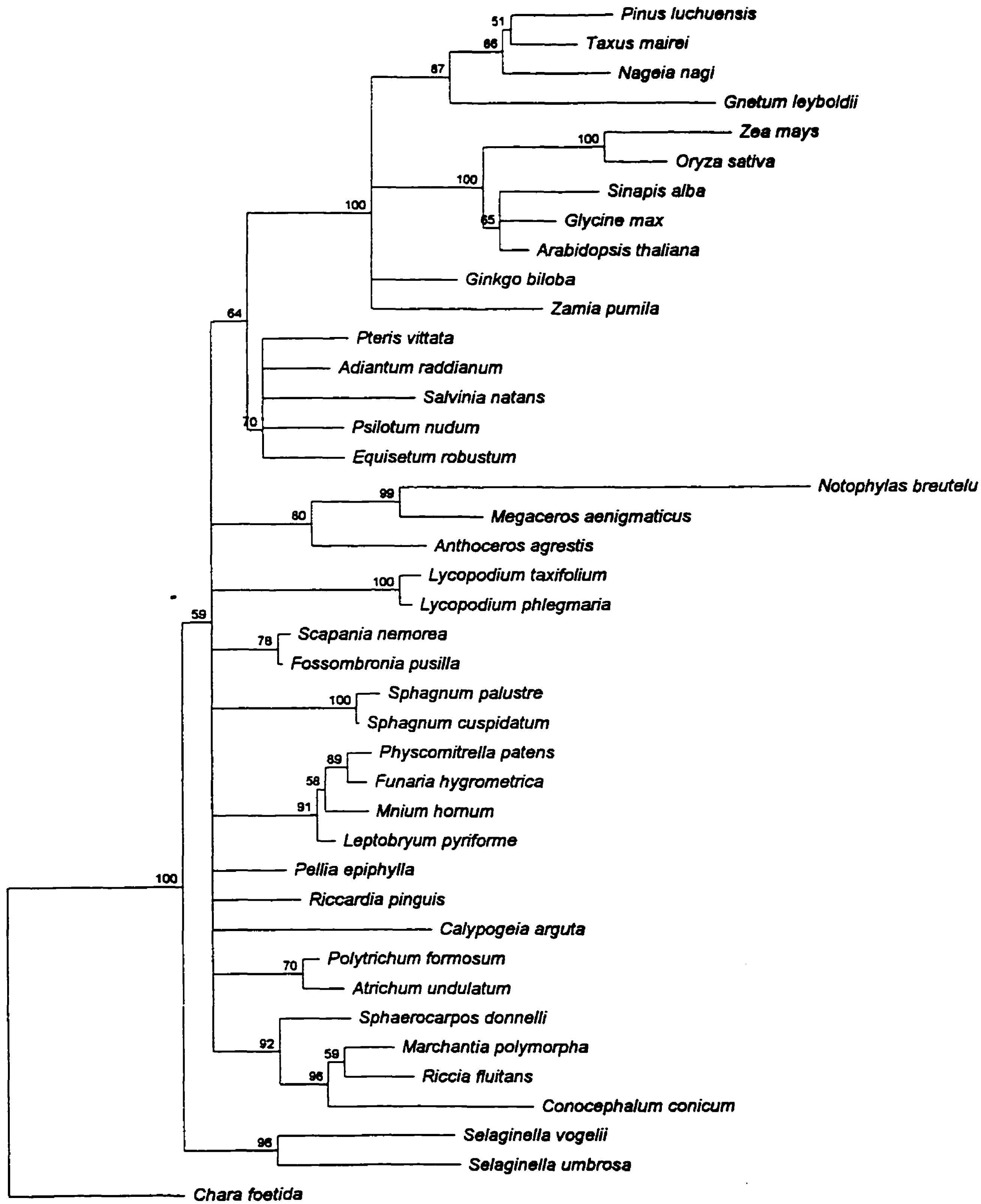


Figure E1SB Transversions Only; Neighbor-joining 50% Majority-Rule Bootstrap Tree

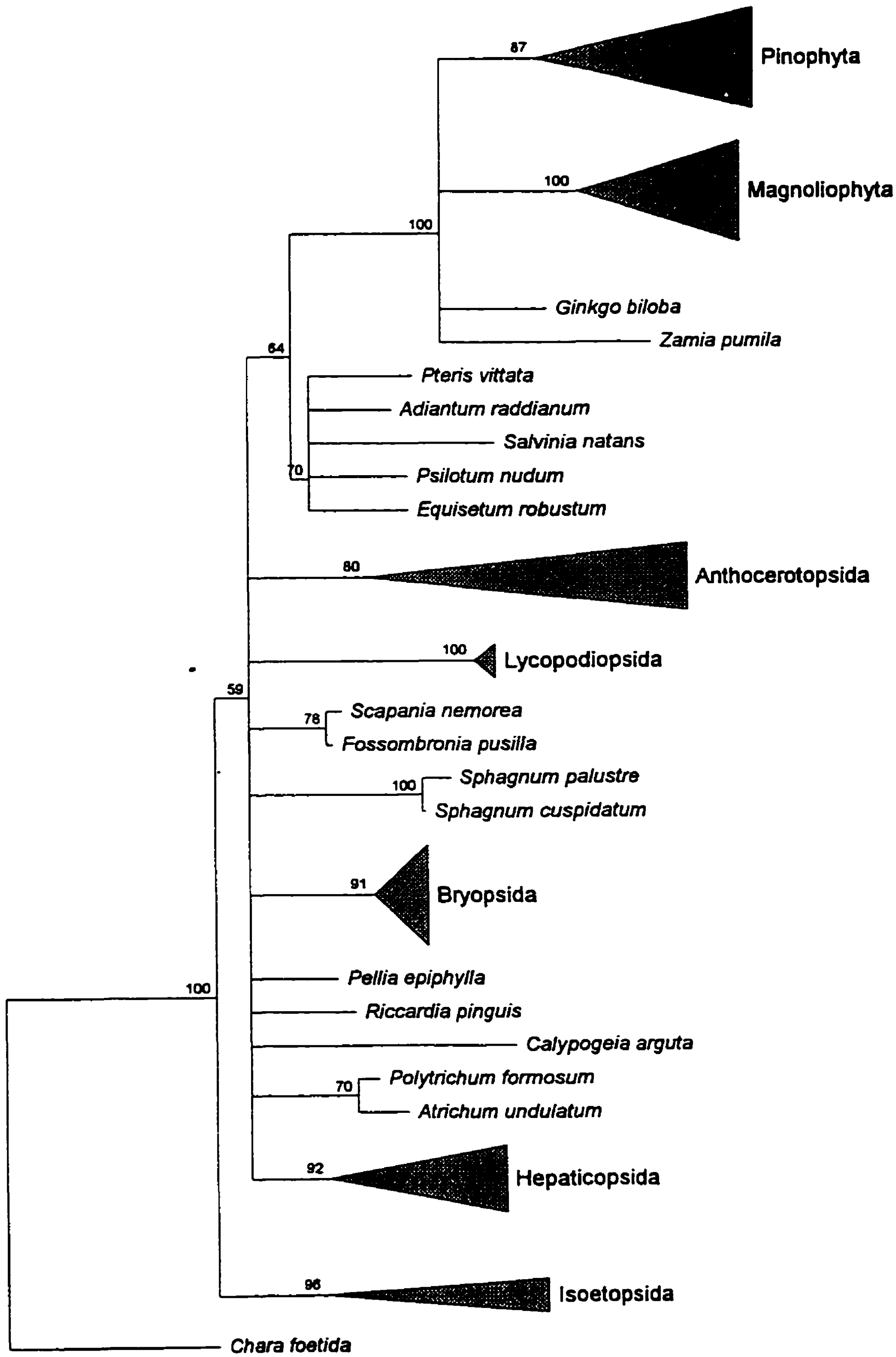


Figure E1SB Transversions Only; Neighbor-joining 50% Majority-Rule Bootstrap Tree

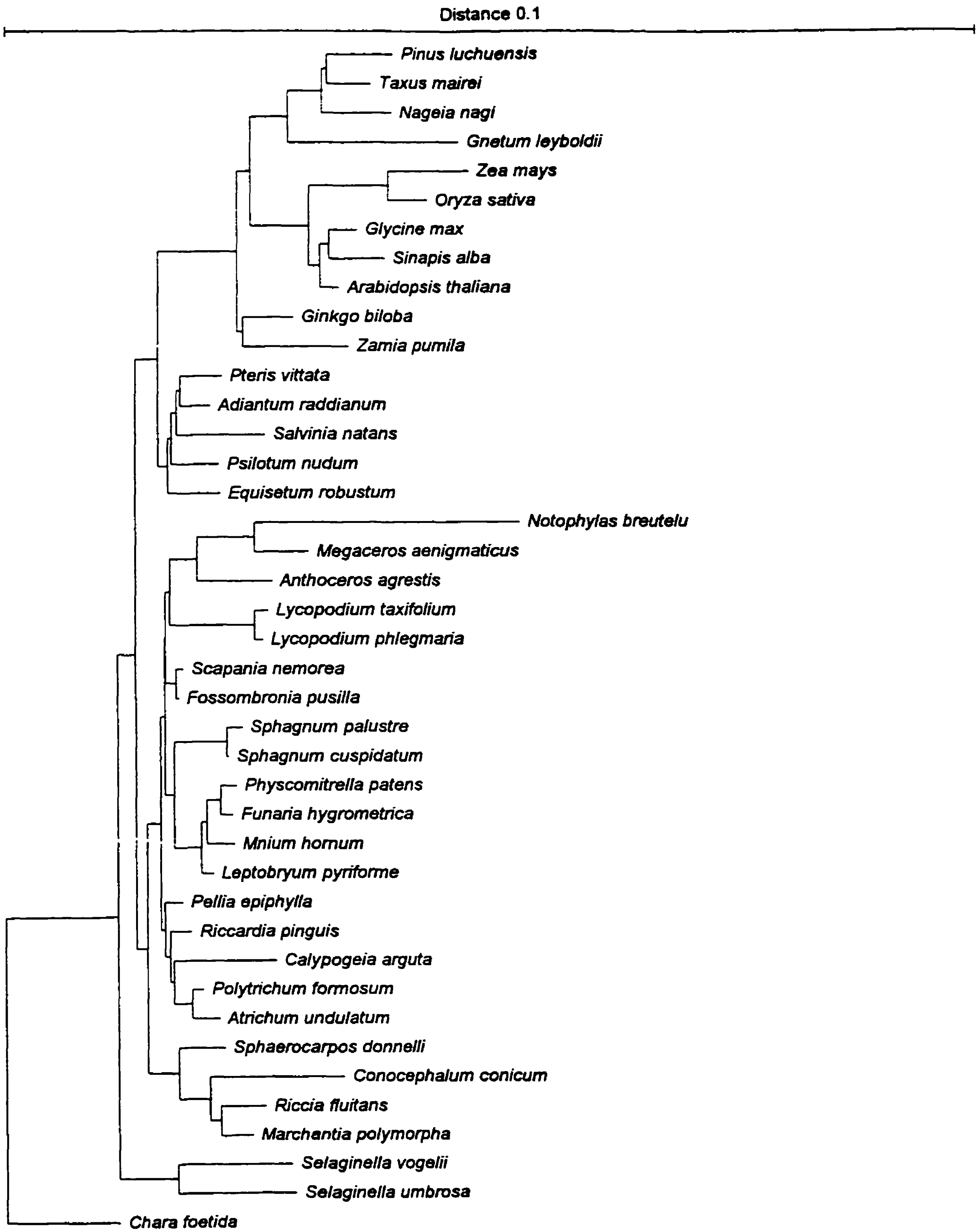


Figure E2S *Transversions Only; Insertions & Deletions taken into account*

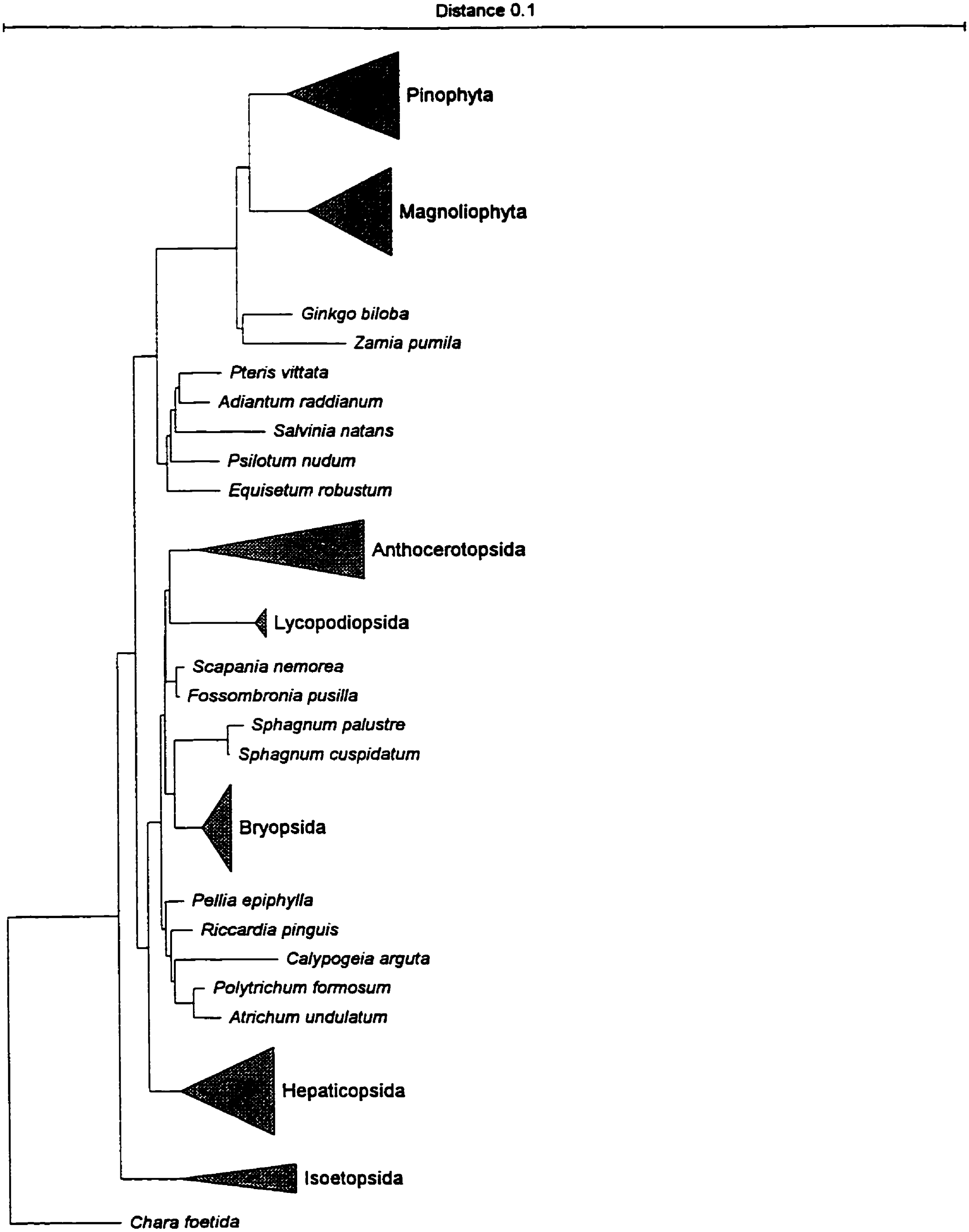


Figure E2S Transversions Only; Insertions & Deletions taken into account

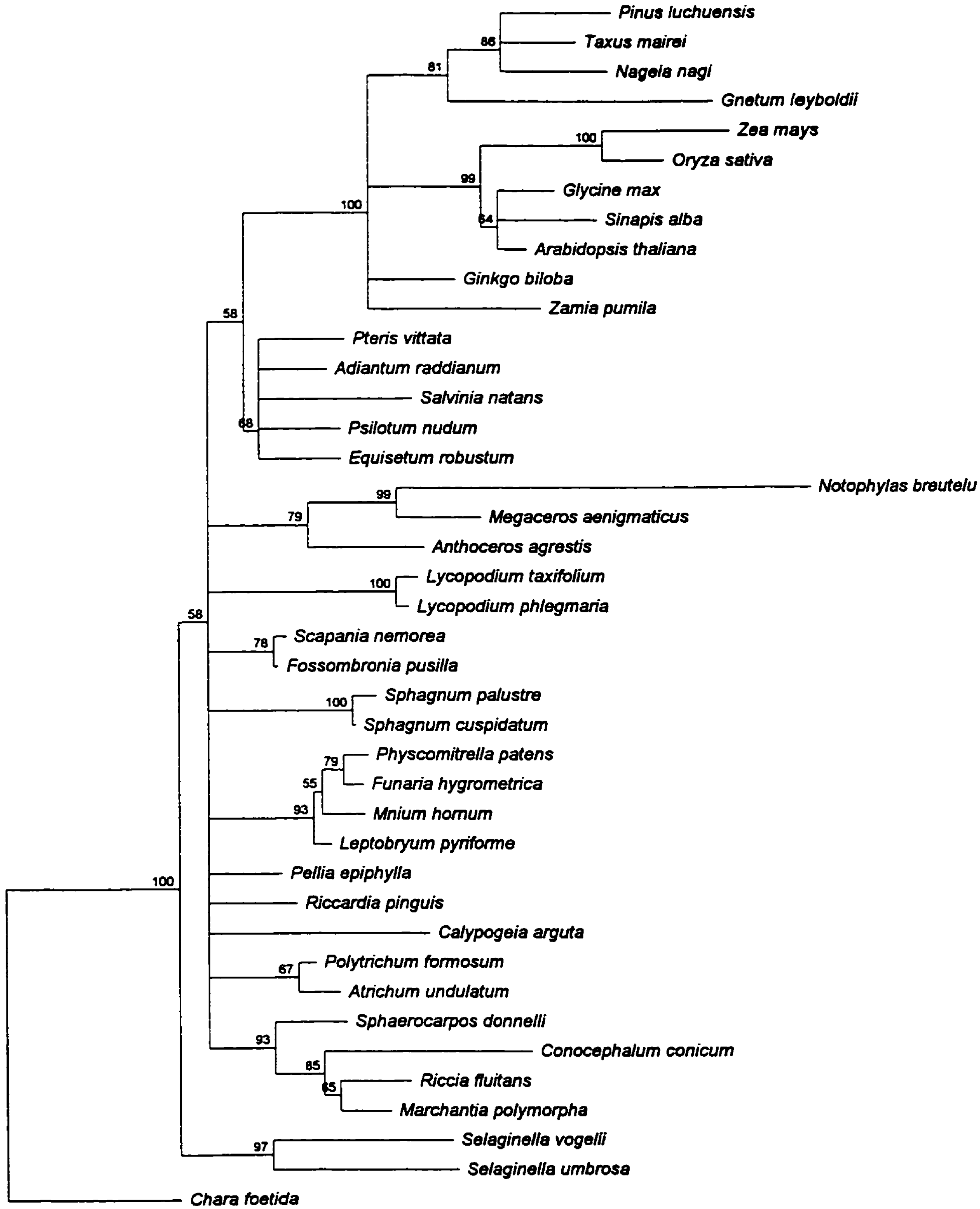


Figure E2SB *Transversions Only; Insertions & Deletions taken into account*
50% Majority-Rule Bootstrap Tree

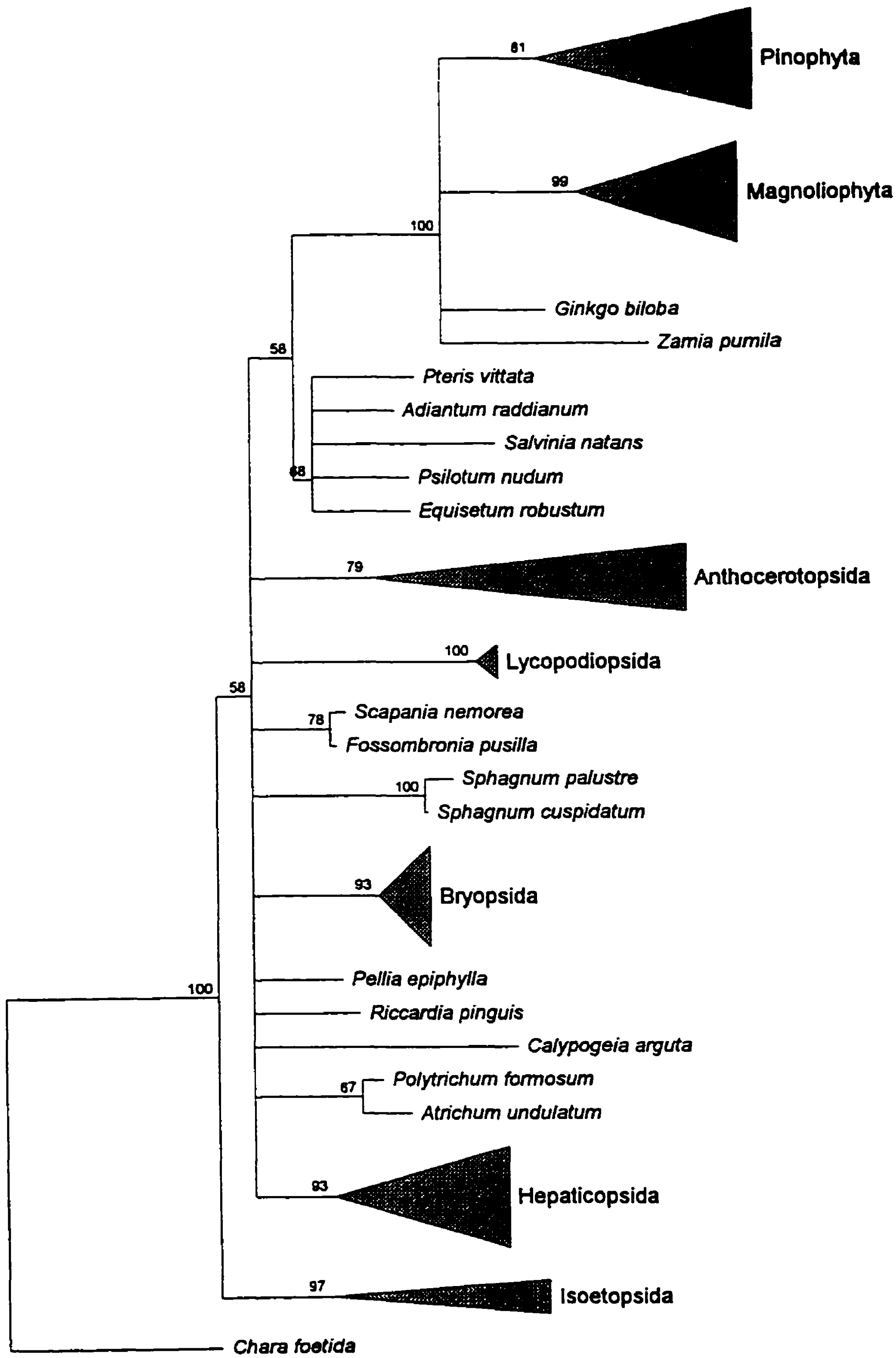


Figure E2SB *Transversions Only; Insertions & Deletions taken into account*
50% Majority-Rule Bootstrap Tree

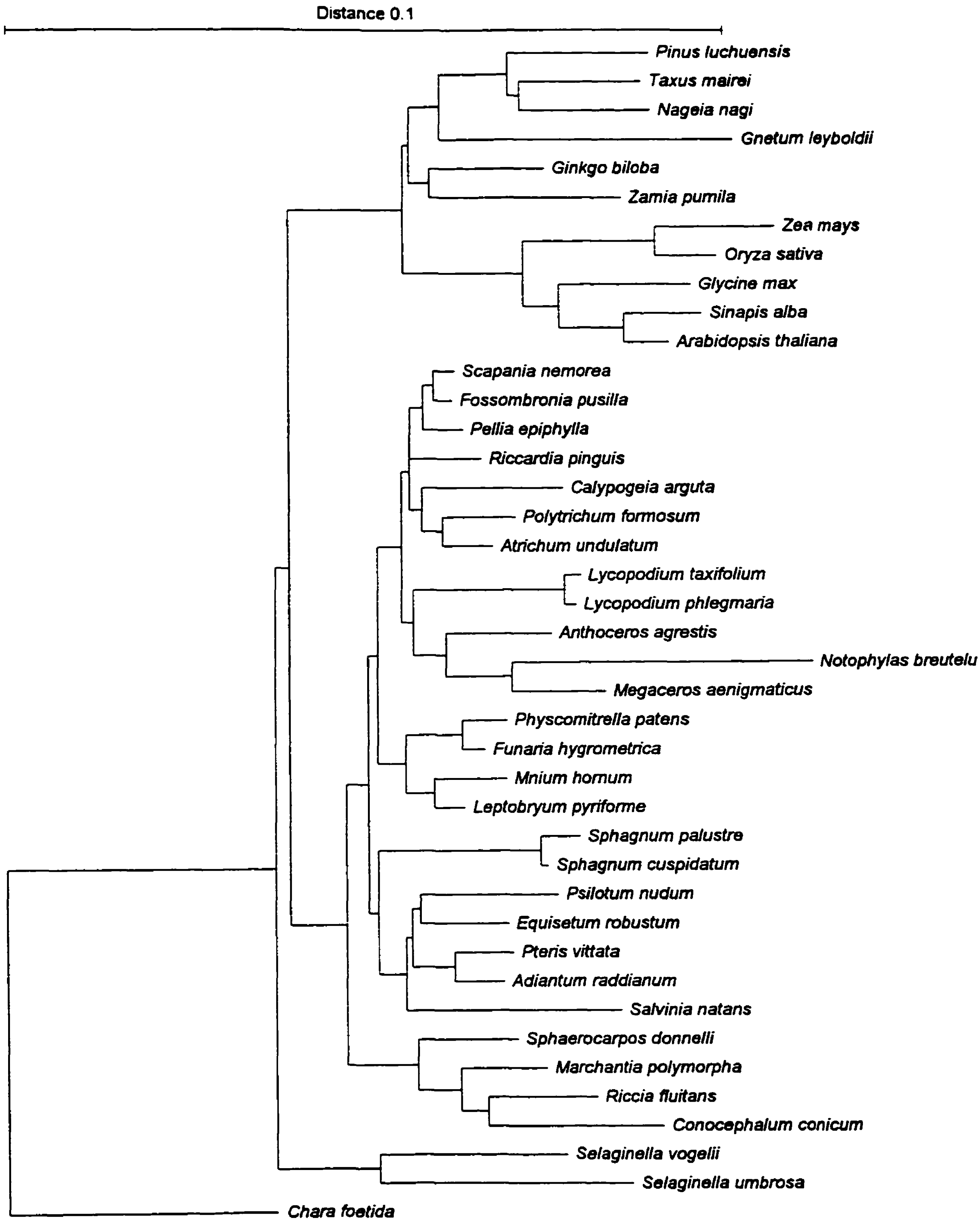


Figure F1S *No Correction; Neighbor-joining*

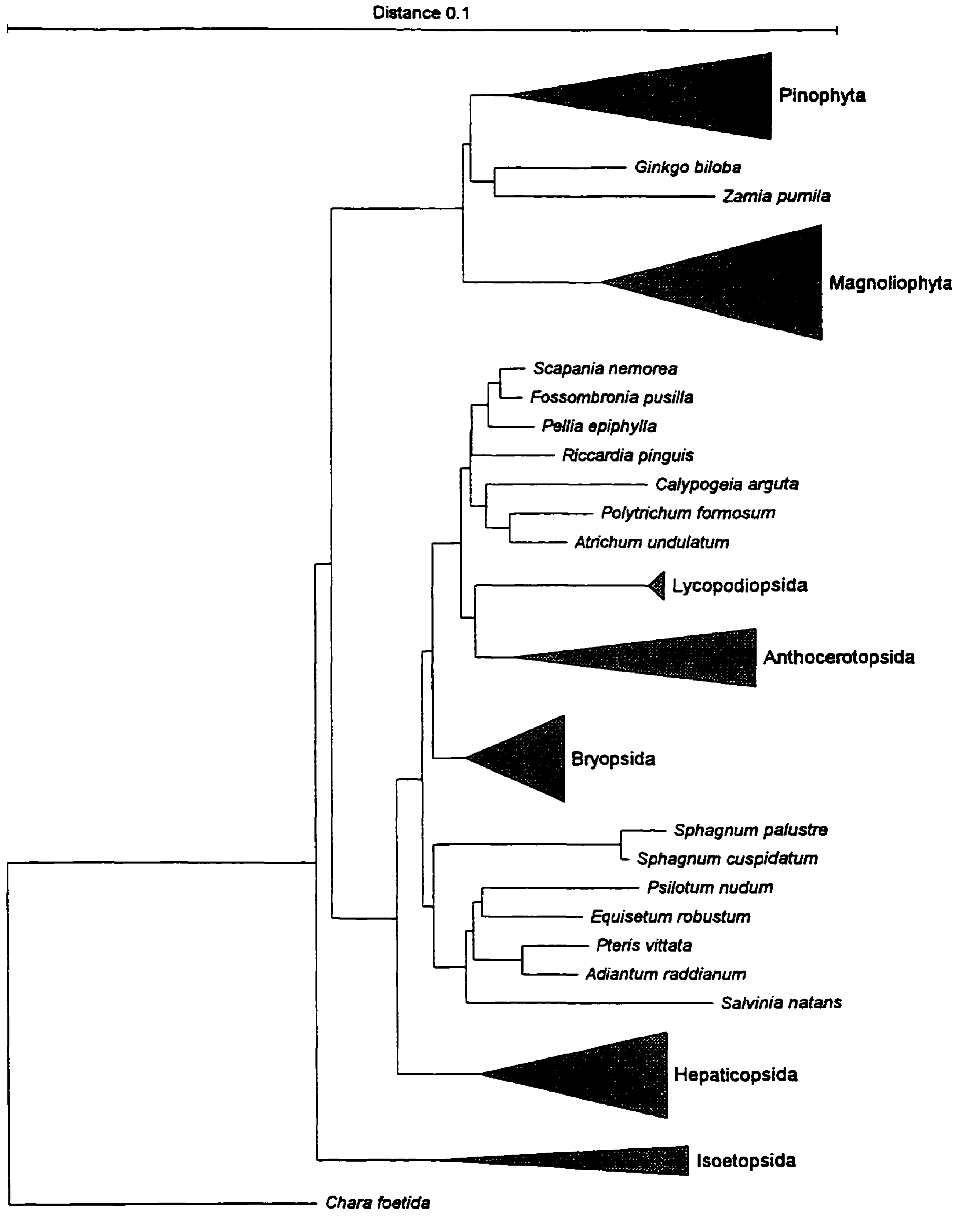


Figure F1S No Correction; Neighbor-joining

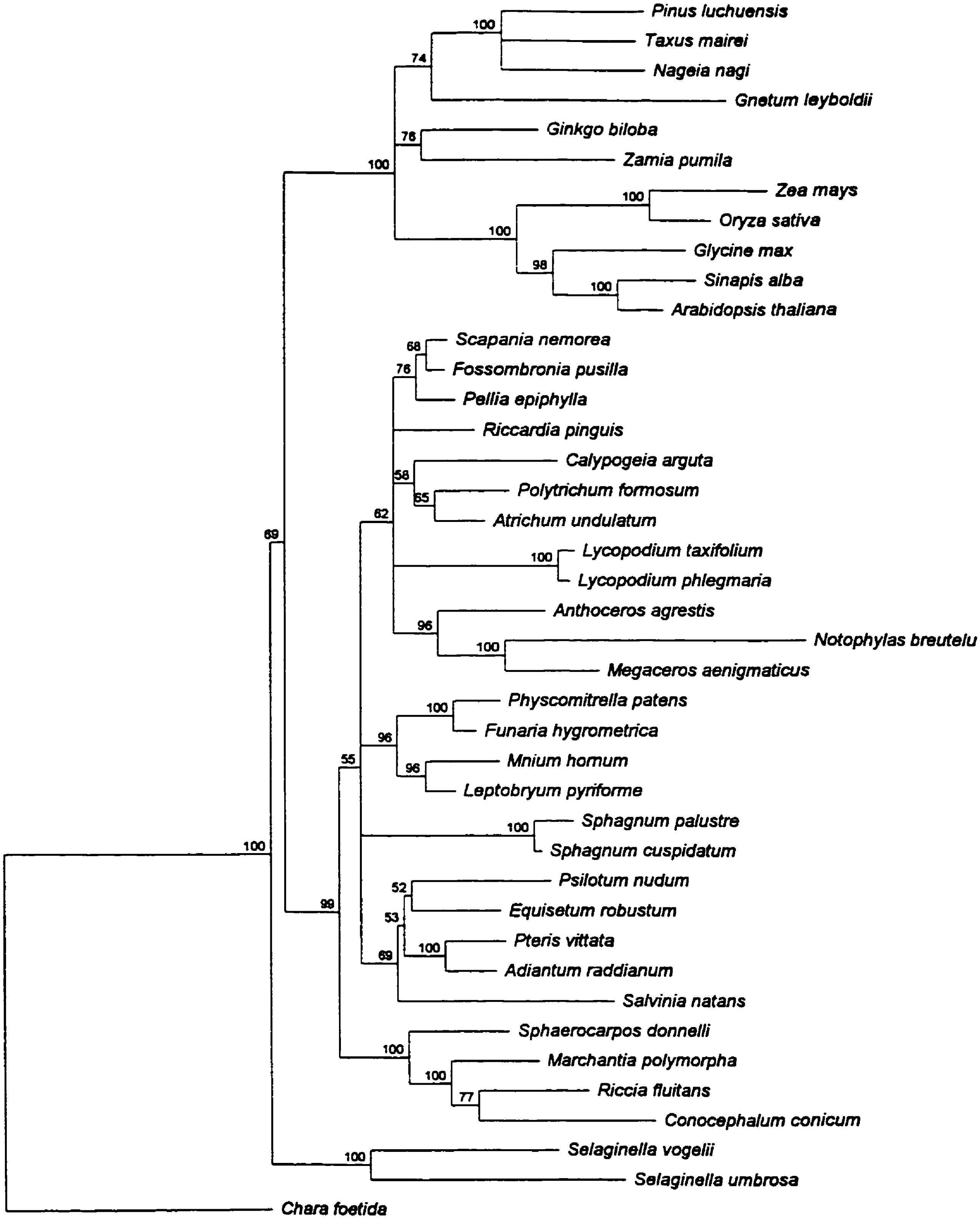


Figure F1SB No Correction; Neighbor-joining
50% Majority-Rule Bootstrap Tree

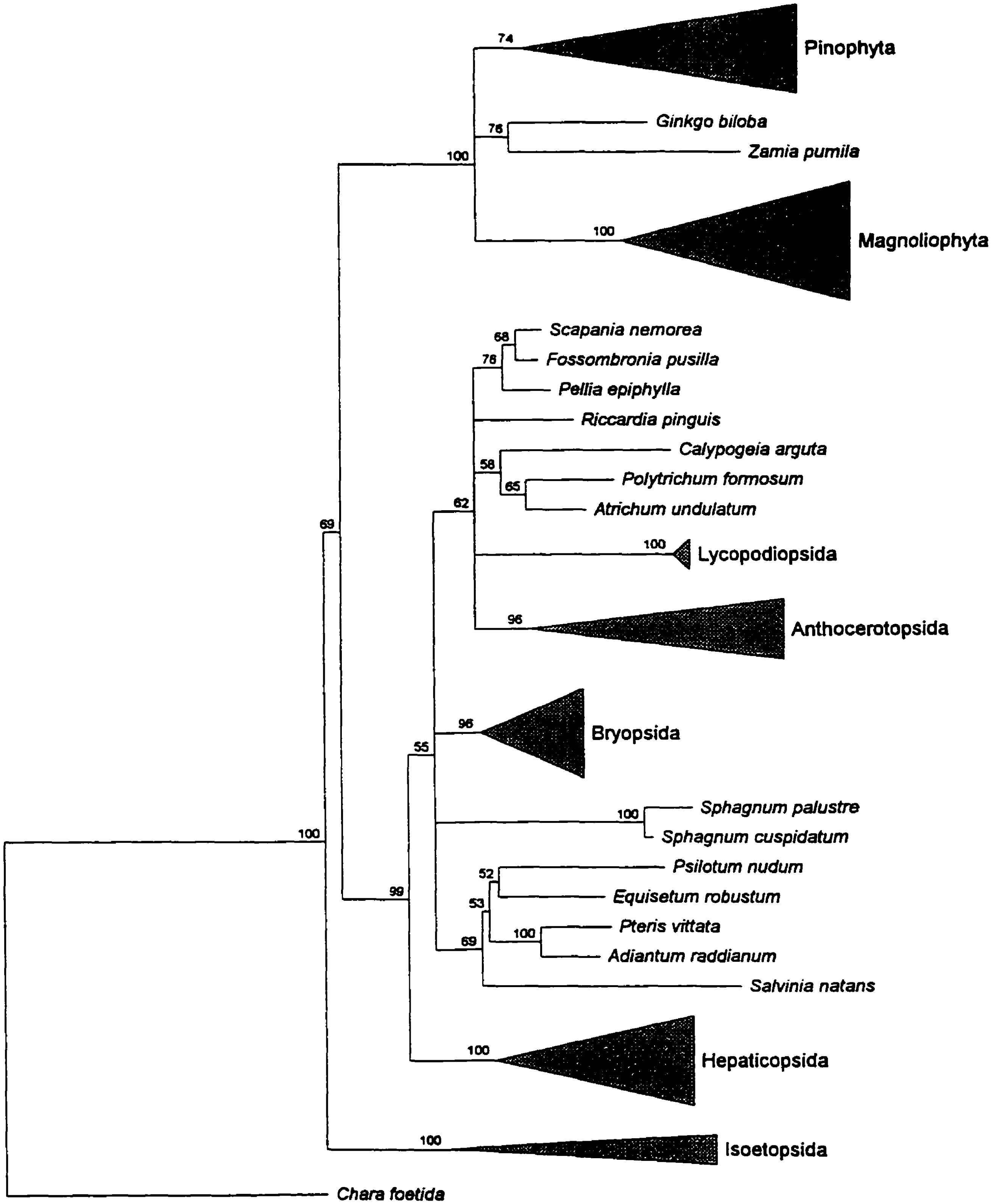


Figure F1SB No Correction; Neighbor-joining 50% Majority-Rule Bootstrap Tree

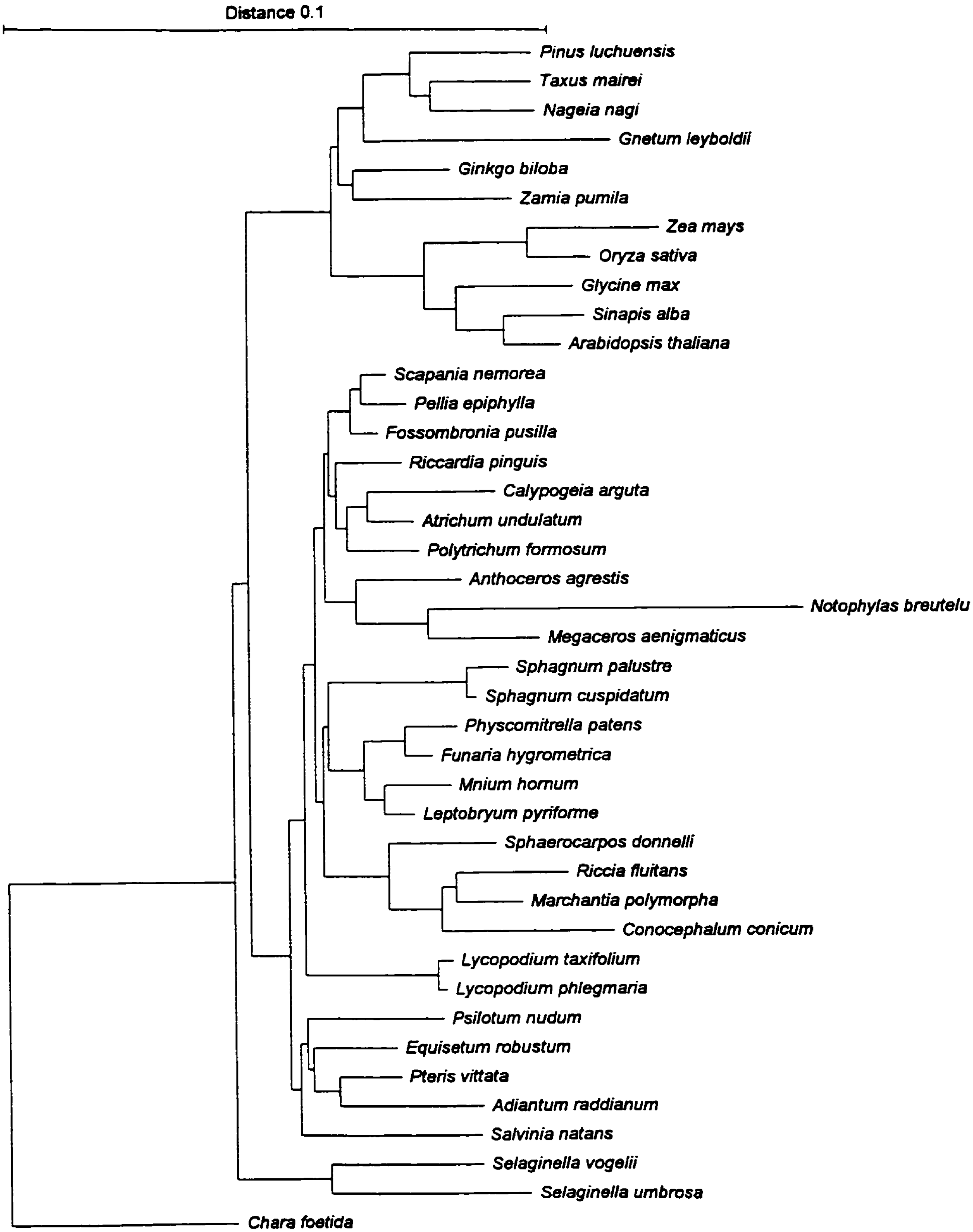


Figure F2S *No Correction; Insertions & Deletions taken into account*

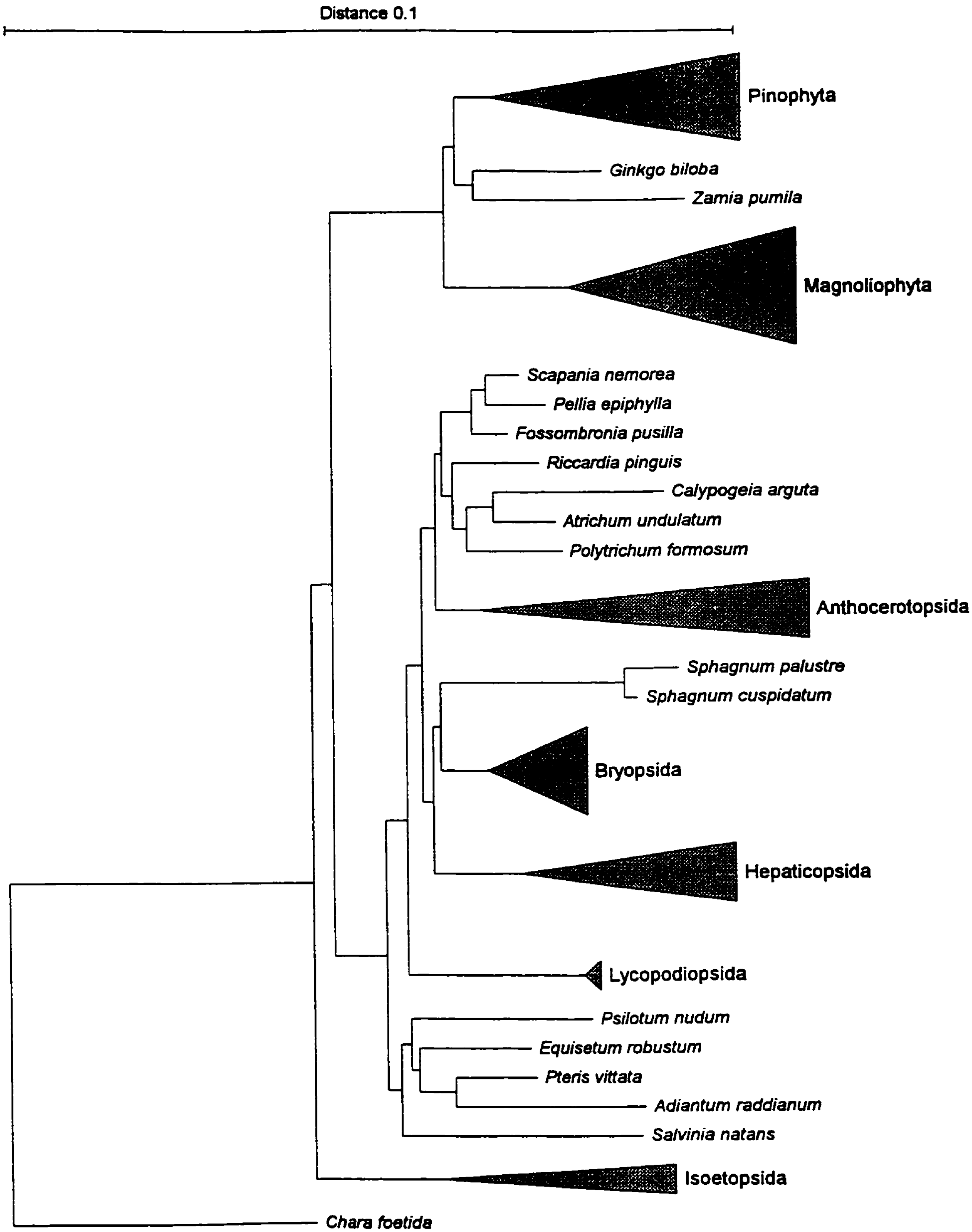


Figure F2S No Correction; Insertions & Deletions taken into account

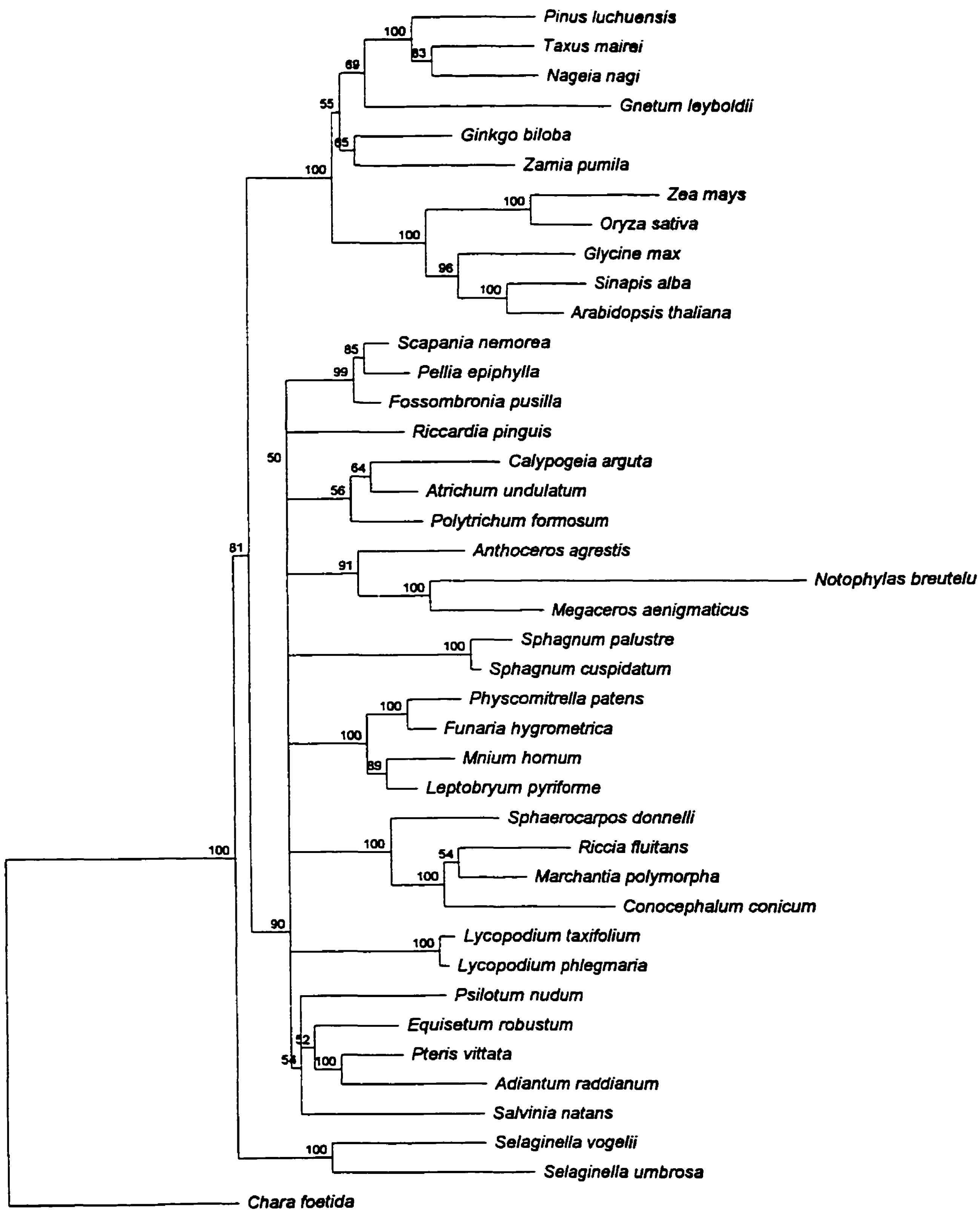


Figure F2SB *No Correction; Insertions & Deletions taken into account*
50% Majority-Rule Bootstrap Tree

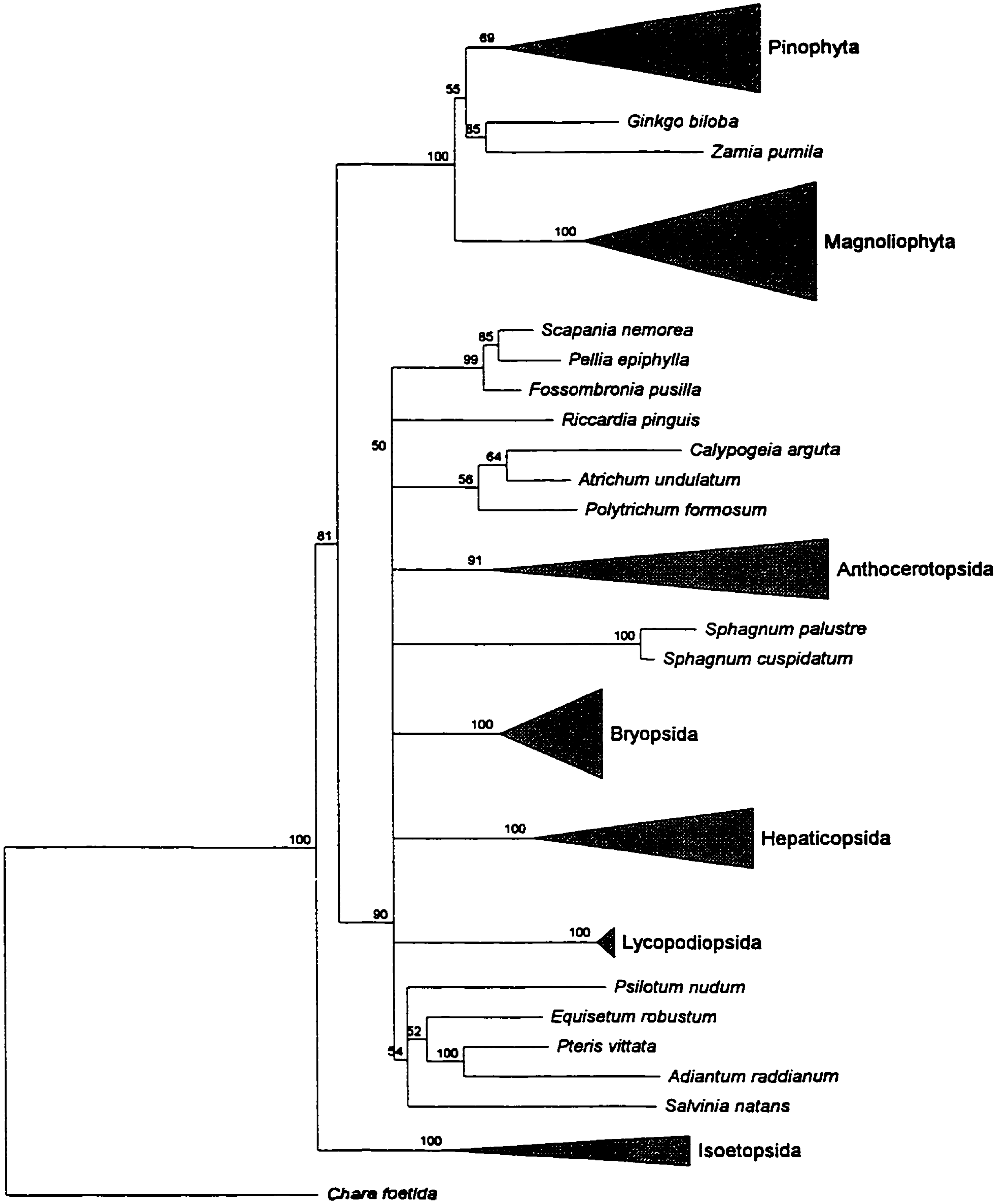


Figure F2SB No Correction; Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

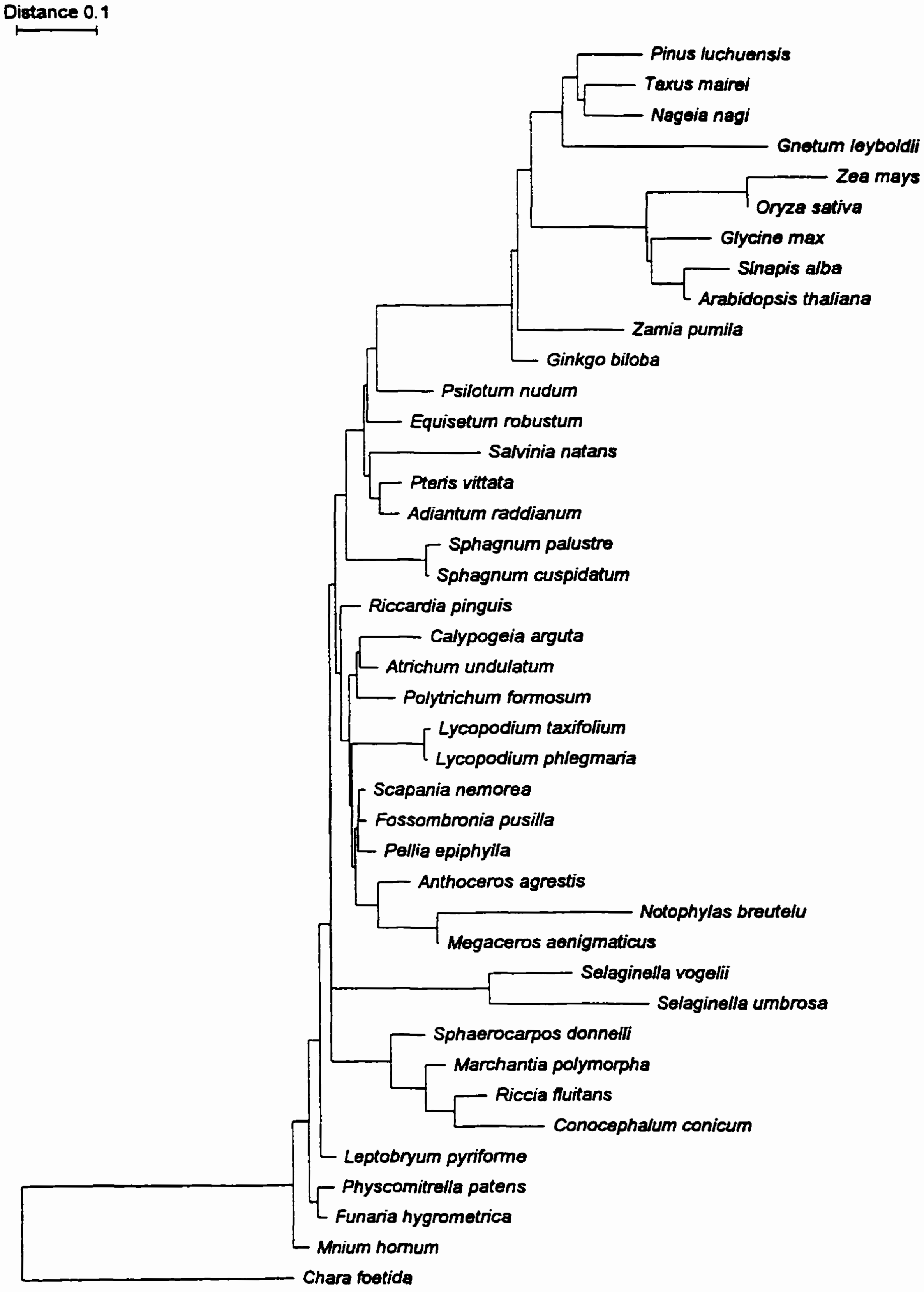


Figure G1S Van de Peer & De Wachter; Neighbor-joining

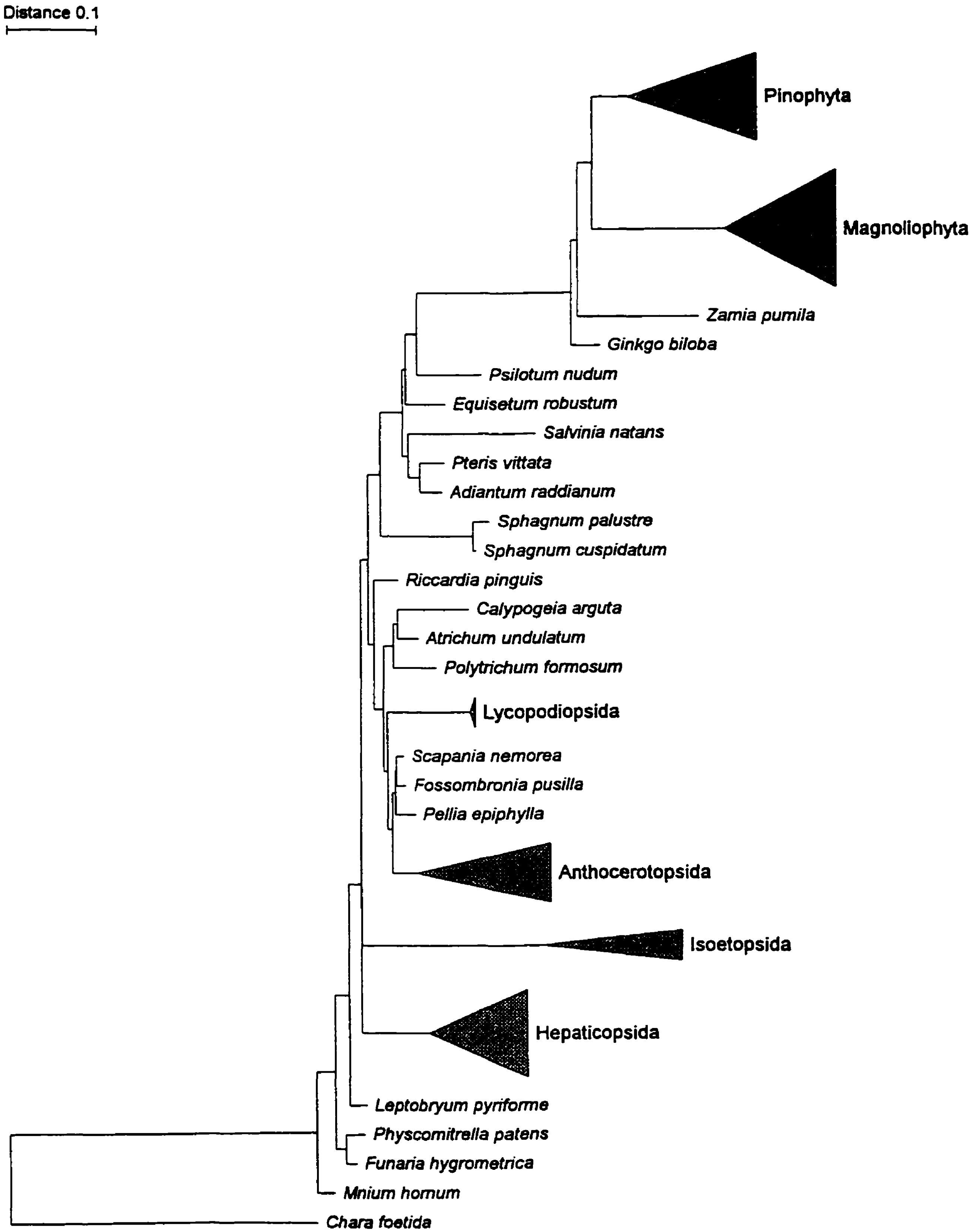


Figure G1S *Van de Peer & De Wachter; Neighbor-joining*

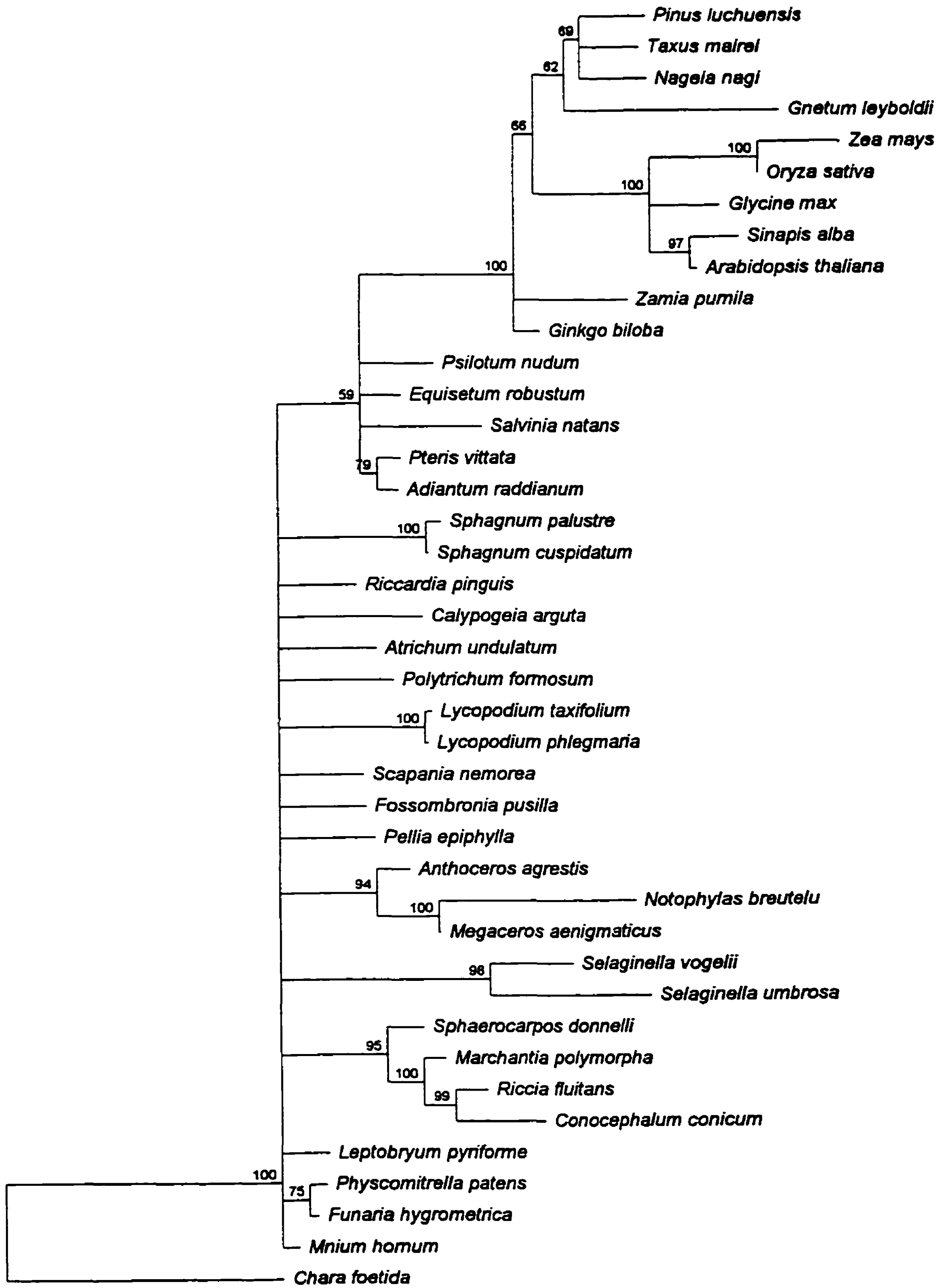


Figure G1SB *Van de Peer & De Wachter; Neighbor-joining 50% Majority-Rule Bootstrap Tree*

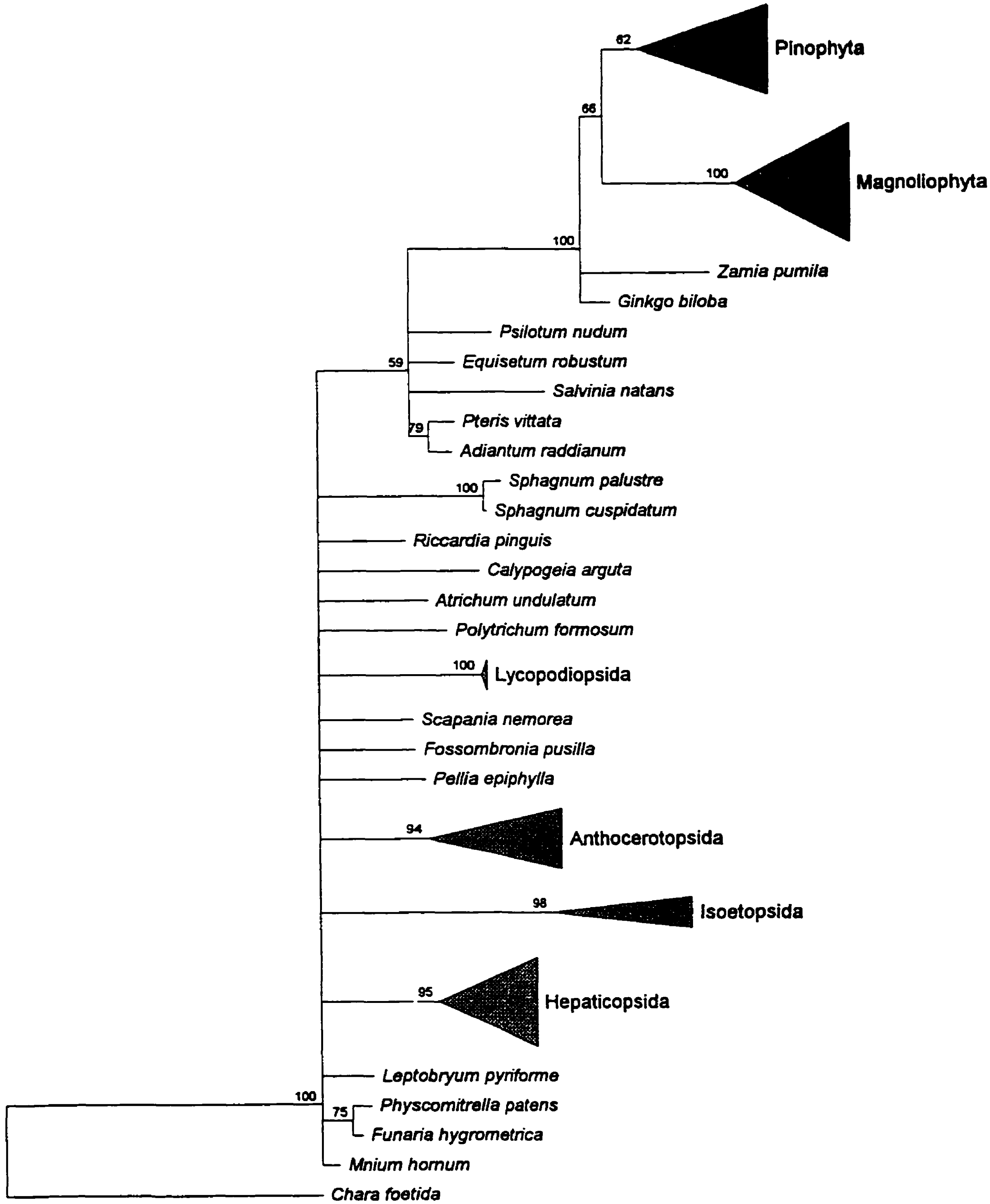


Figure G1SB Van de Peer & De Wachter; Neighbor-joining
50% Majority-Rule Bootstrap Tree

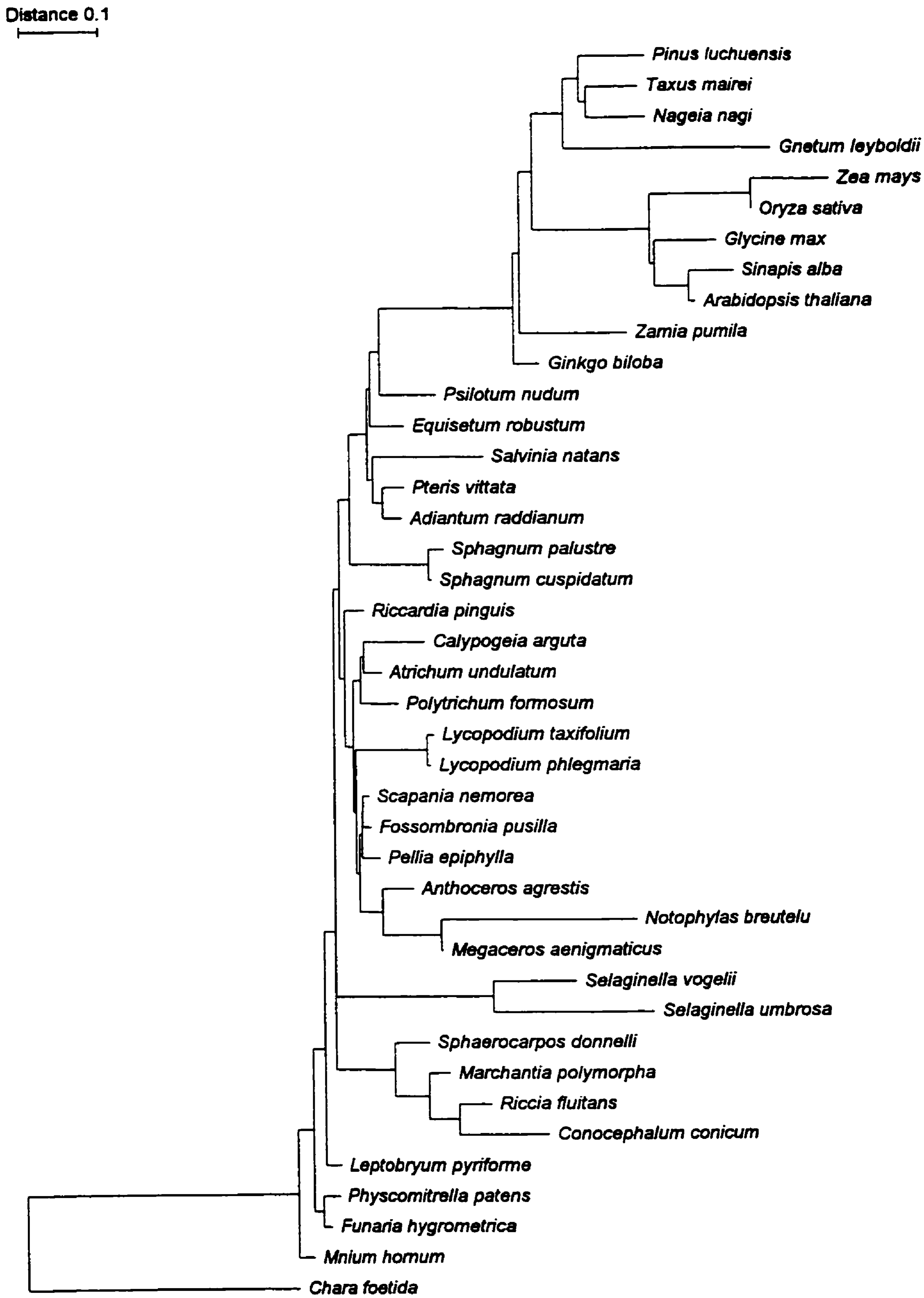


Figure G2S *Van de Peer & De Wachter, Insertions & Deletions taken into account*

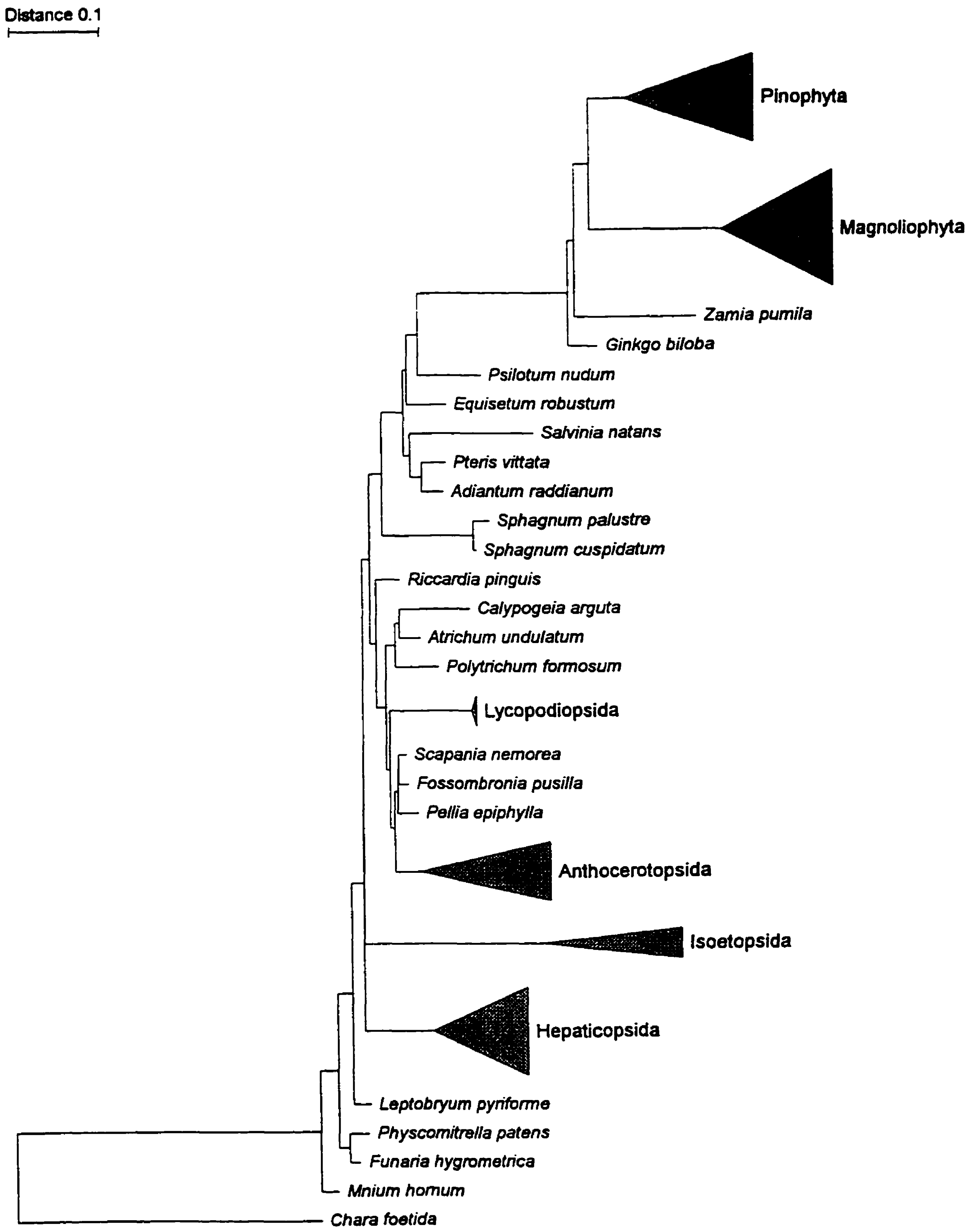


Figure G2S Van de Peer & De Wachter; Insertions & Deletions taken into account

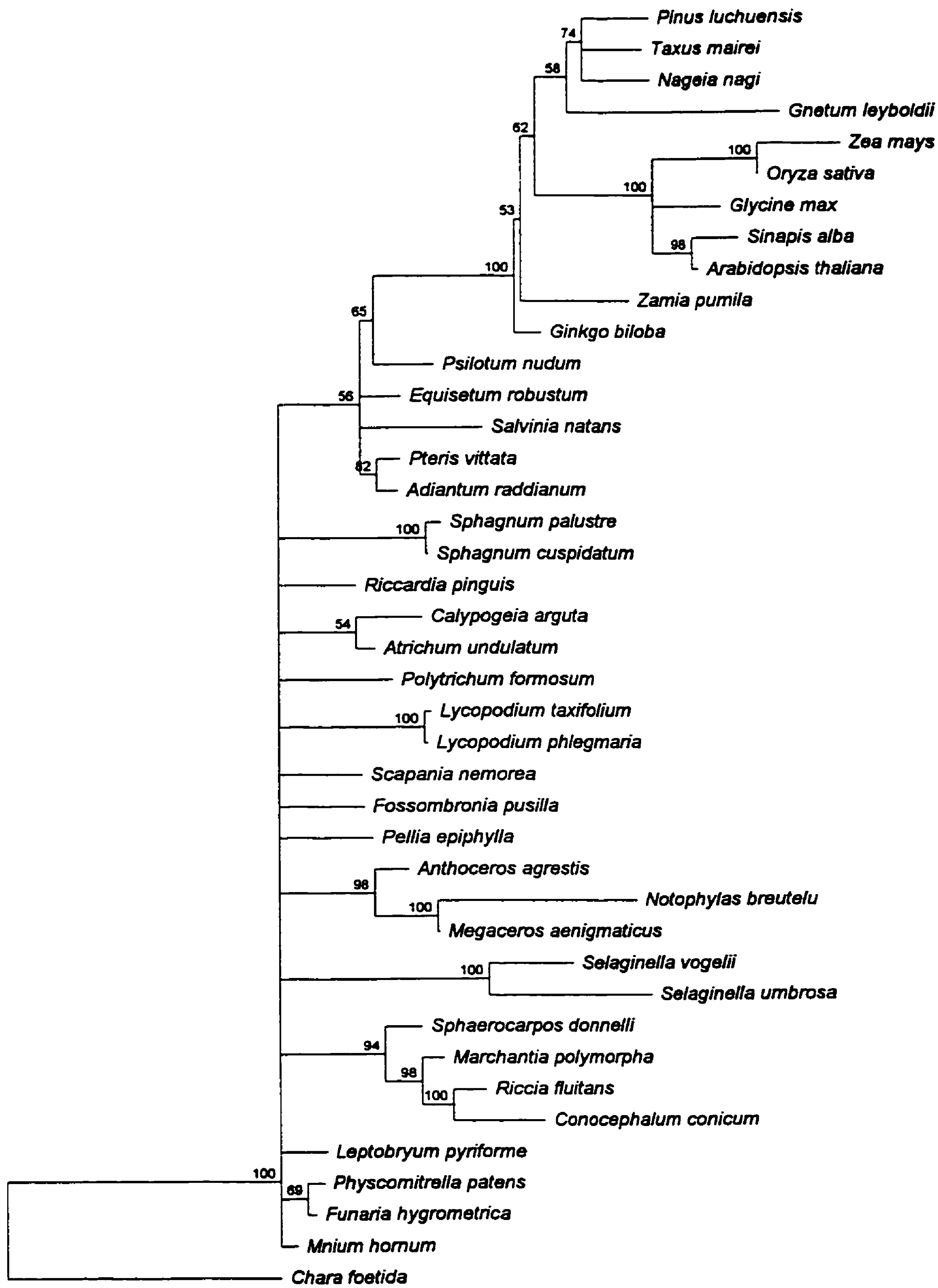


Figure G2SB *Van de Peer & De Wachter; Insertions & Deletions taken into account*
50% Majority-Rule Bootstrap Tree

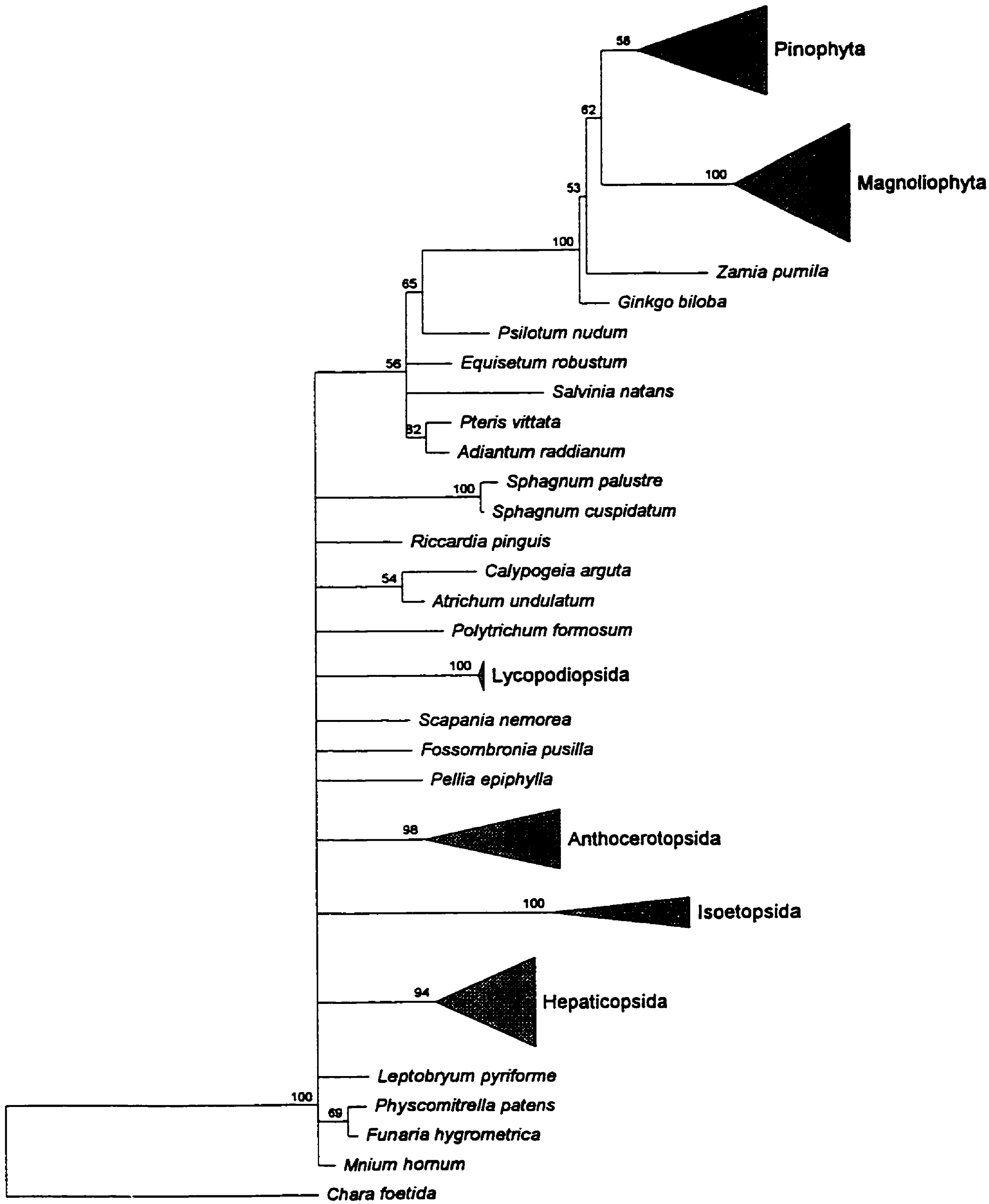


Figure G2SB Van de Peer & De Wachter; Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

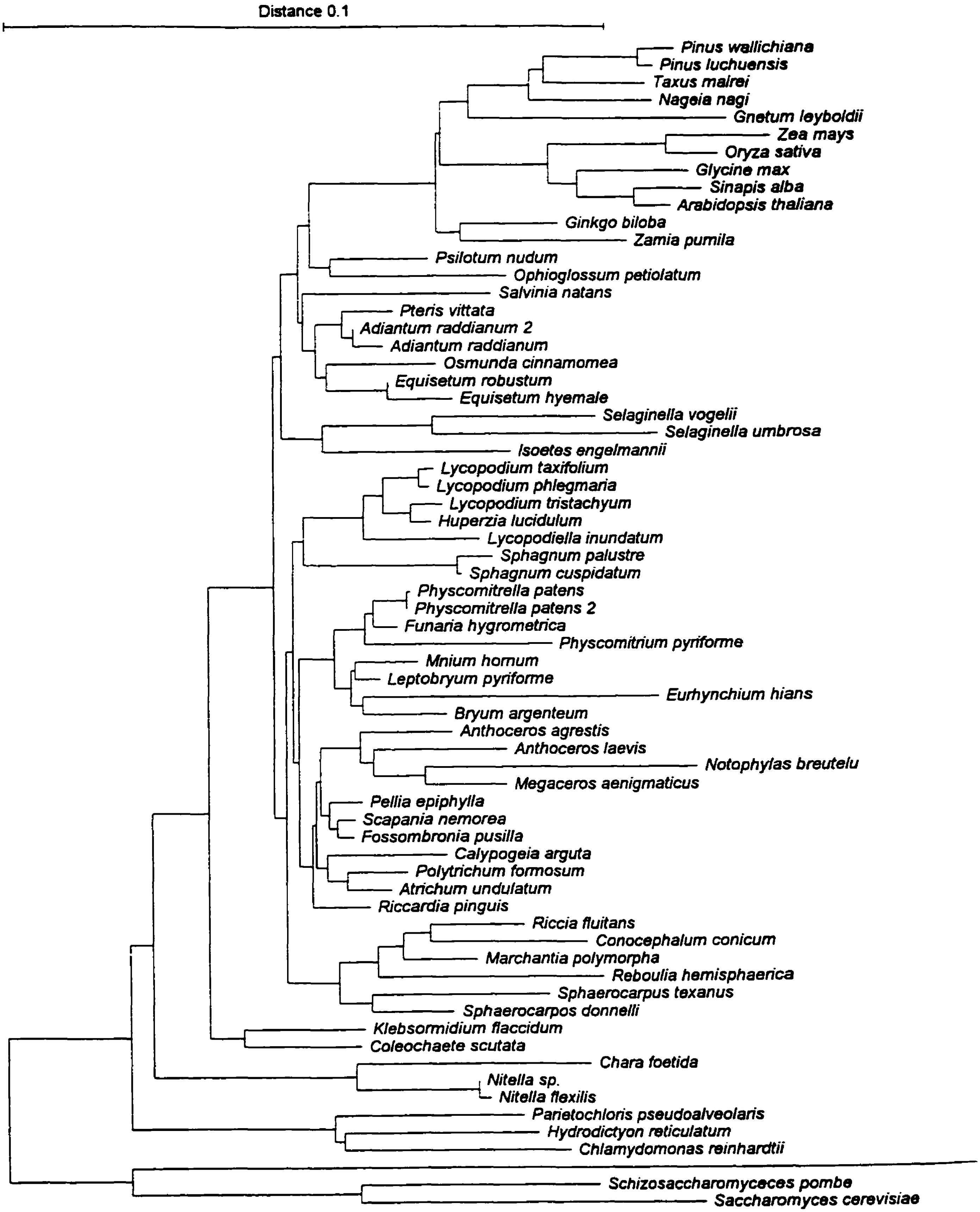


Figure A1 Jukes & Cantor; Neighbor-joining

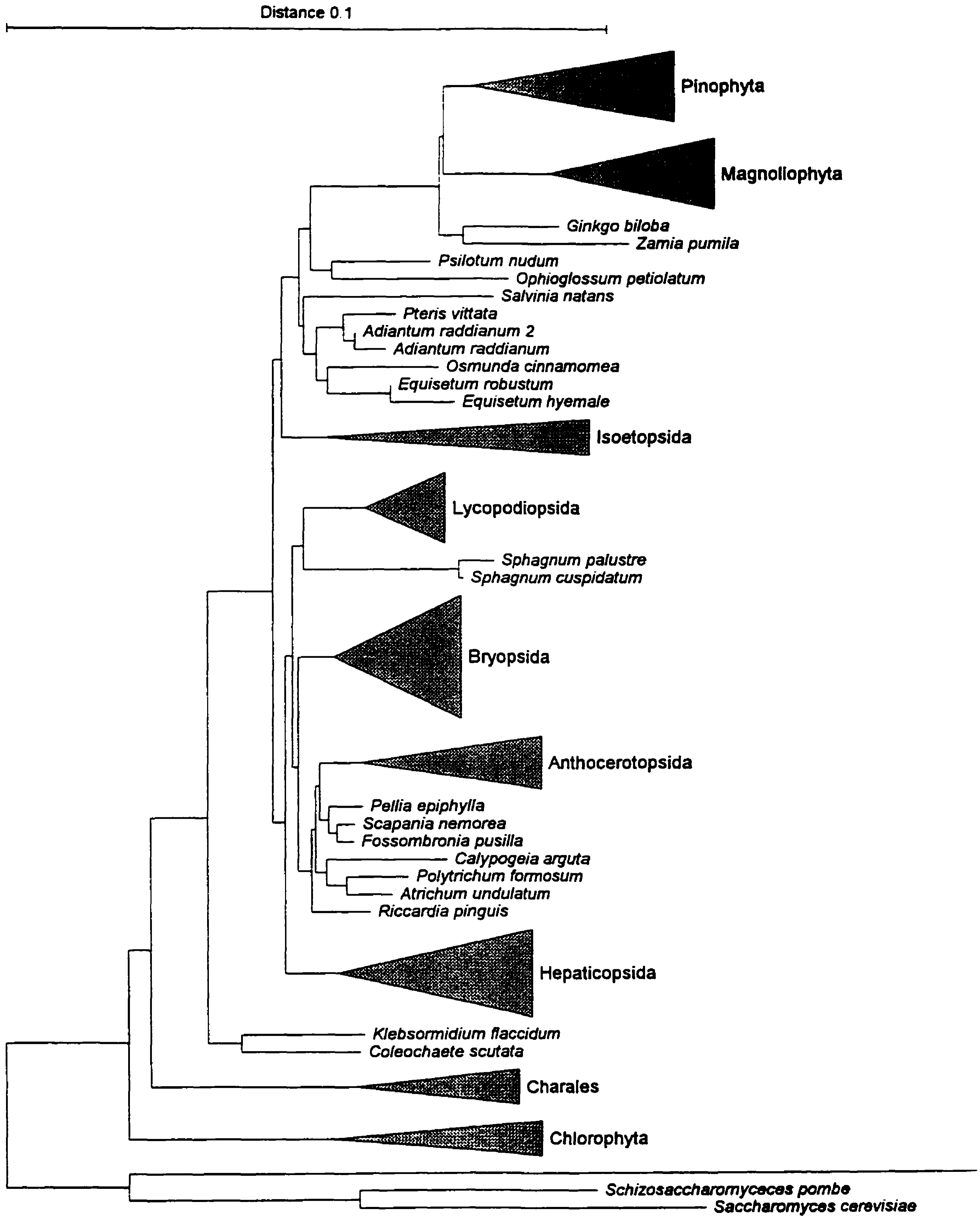


Figure A1 Jukes & Cantor; Neighbor-joining

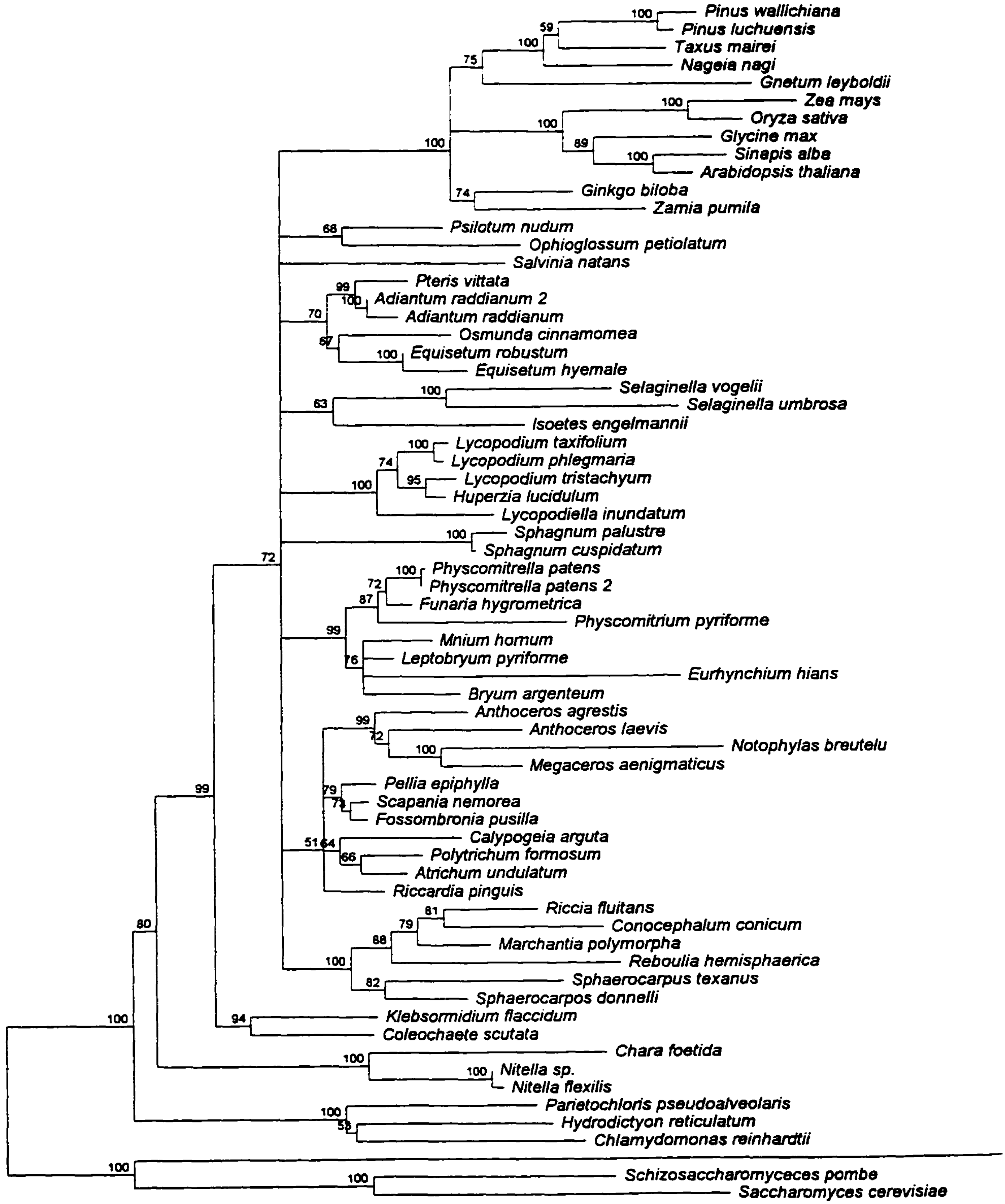


Figure A1B *Jukes & Cantor; 50% Majority-Rule Bootstrap Tree*

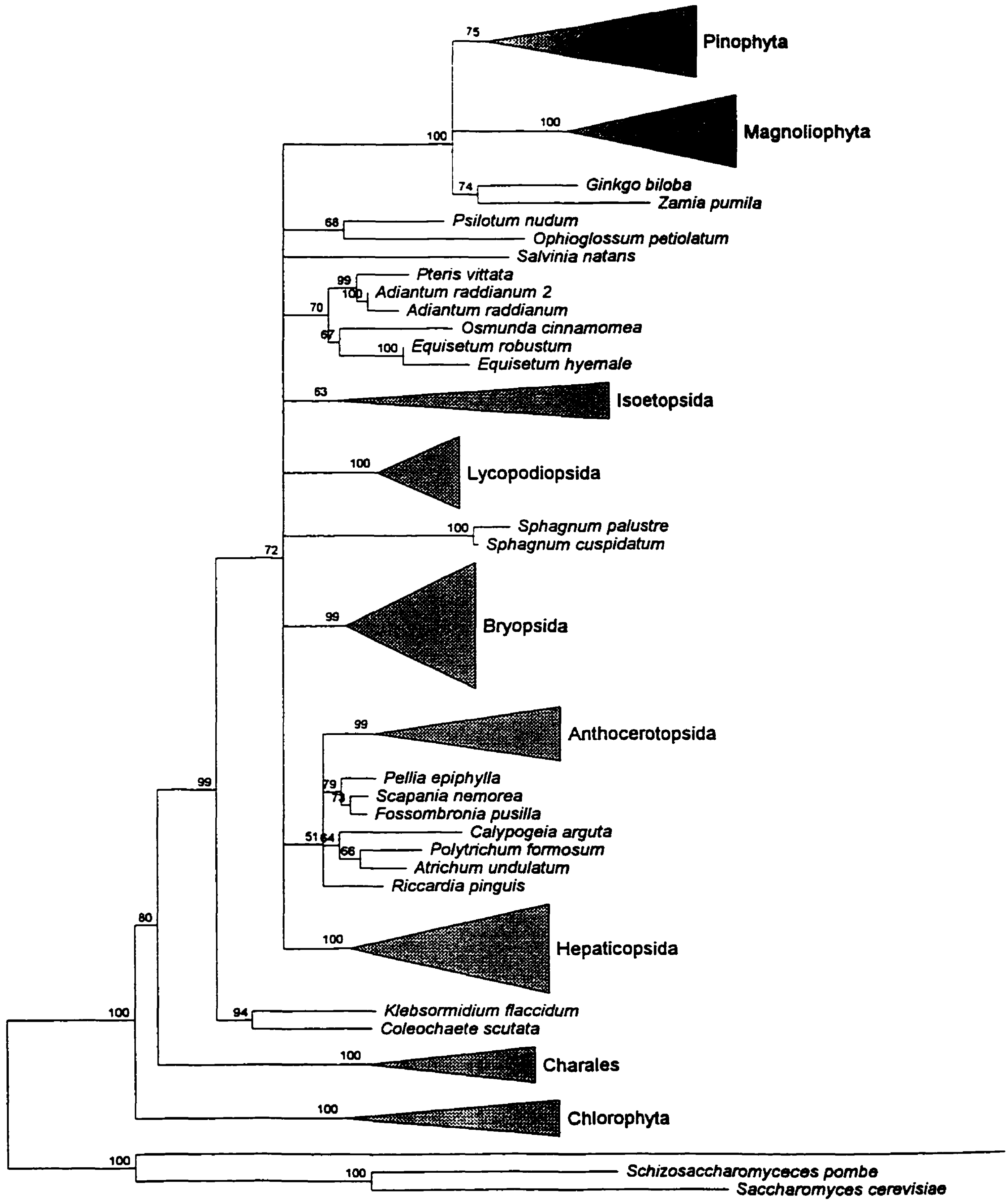


Figure A1B *Jukes & Cantor, 50% Majority-Rule Bootstrap Tree*

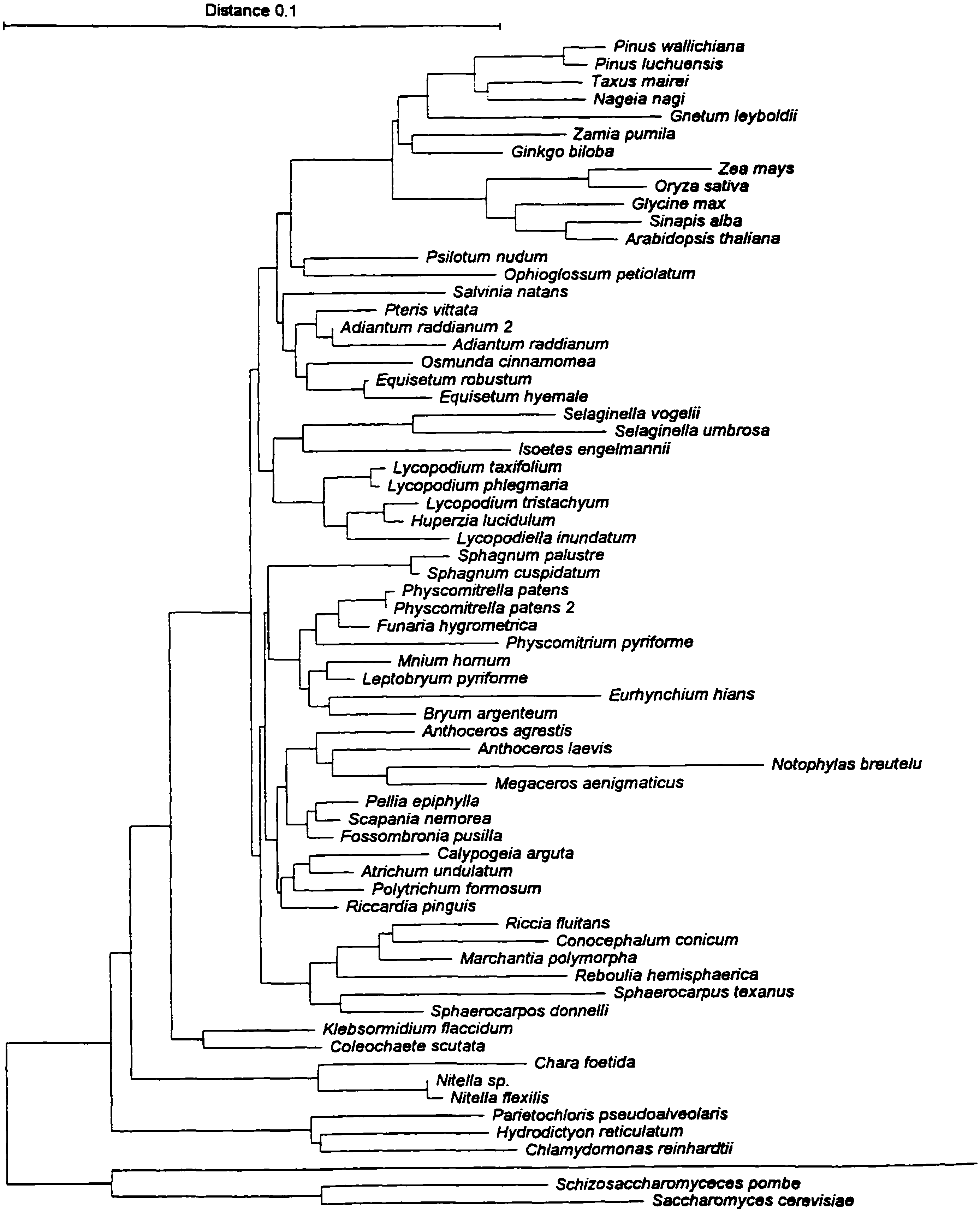


Figure A2 Jukes & Cantor; Neighbor-joining (Insertions & Deletions taken into account)

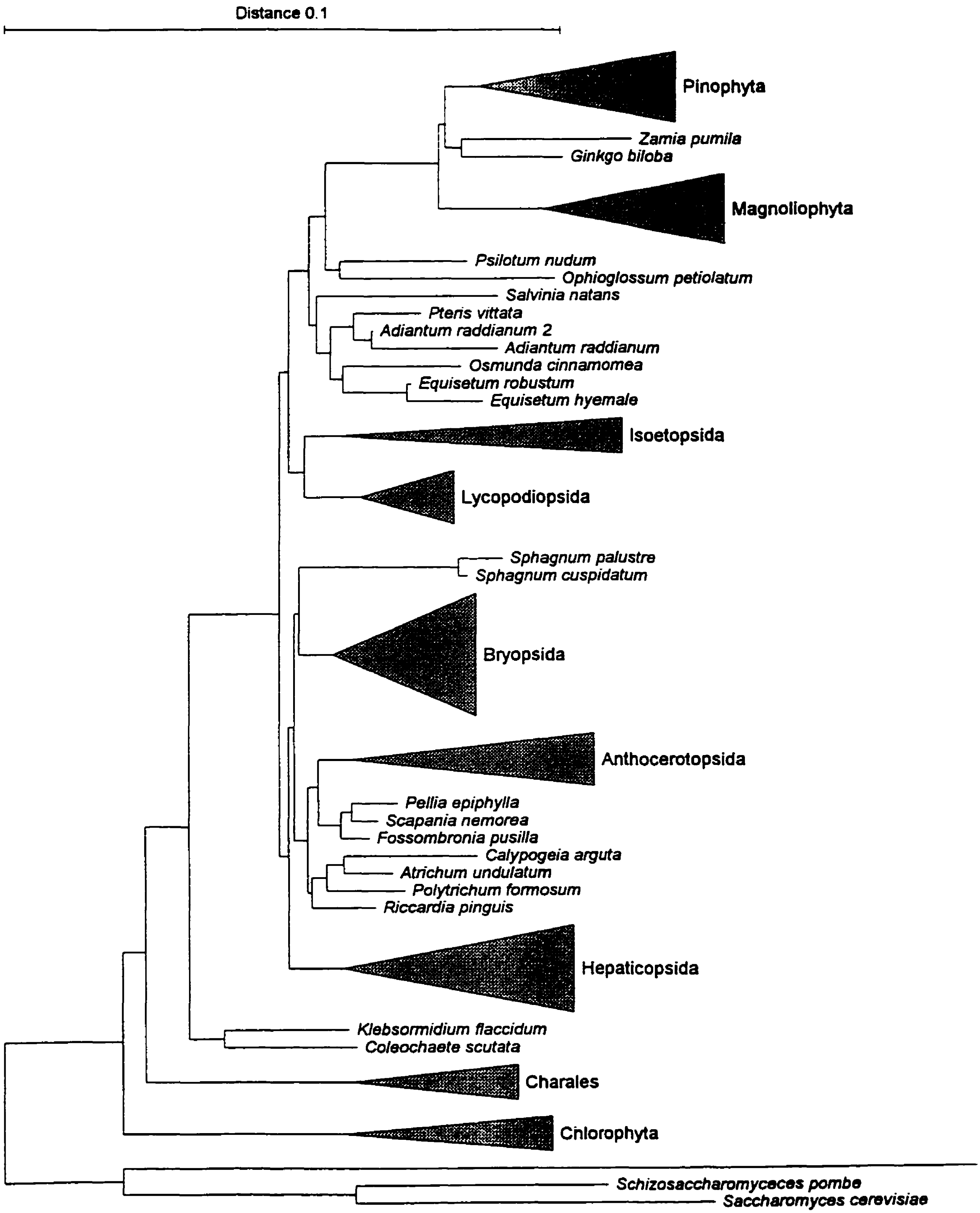


Figure A2 *Jukes & Cantor; Neighbor-joining (Insertions & Deletions taken into account)*

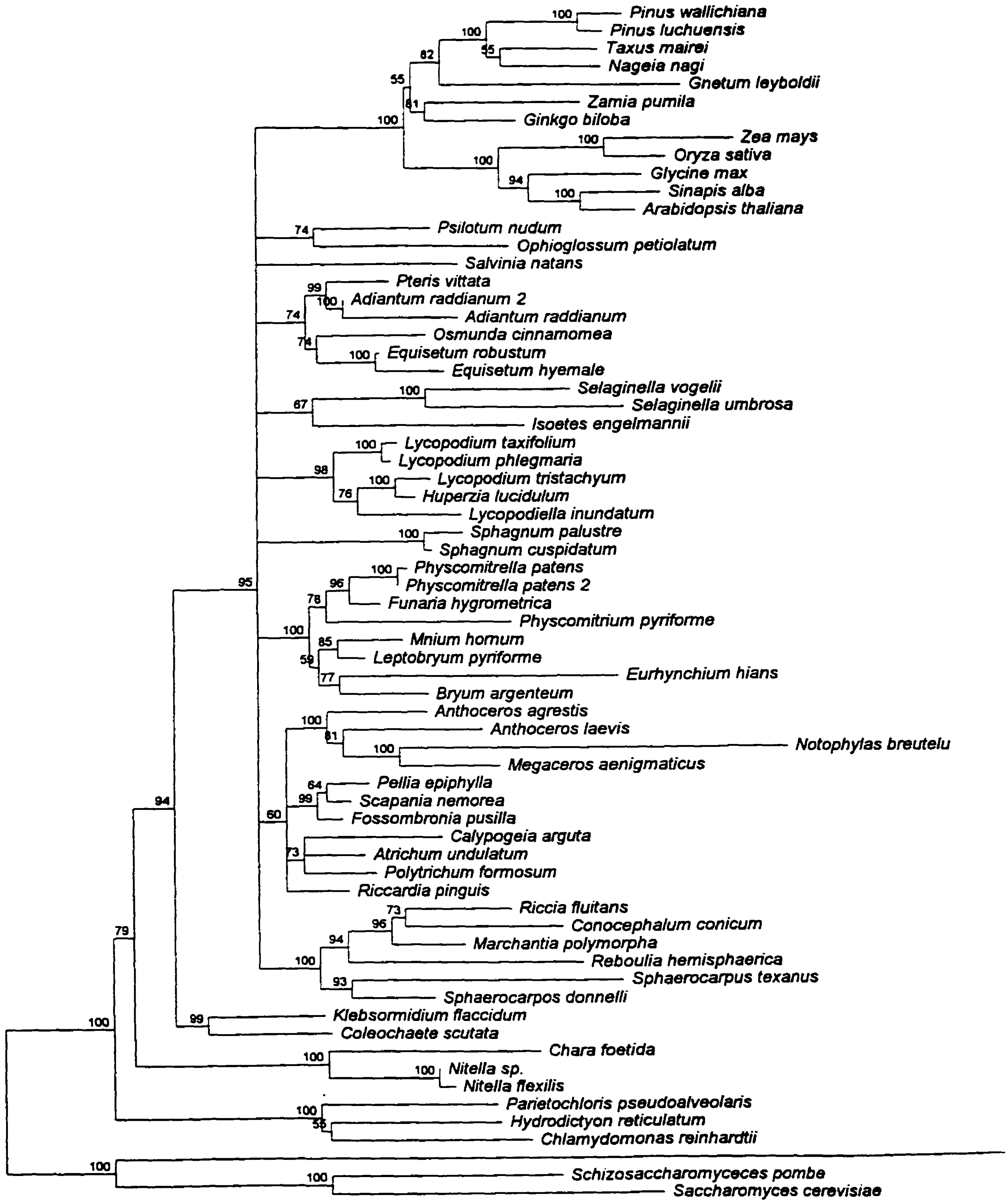


Figure A2B Jukes & Cantor; (Insertions & Deletions taken into account)
50% Majority-Rule Bootstrap Tree

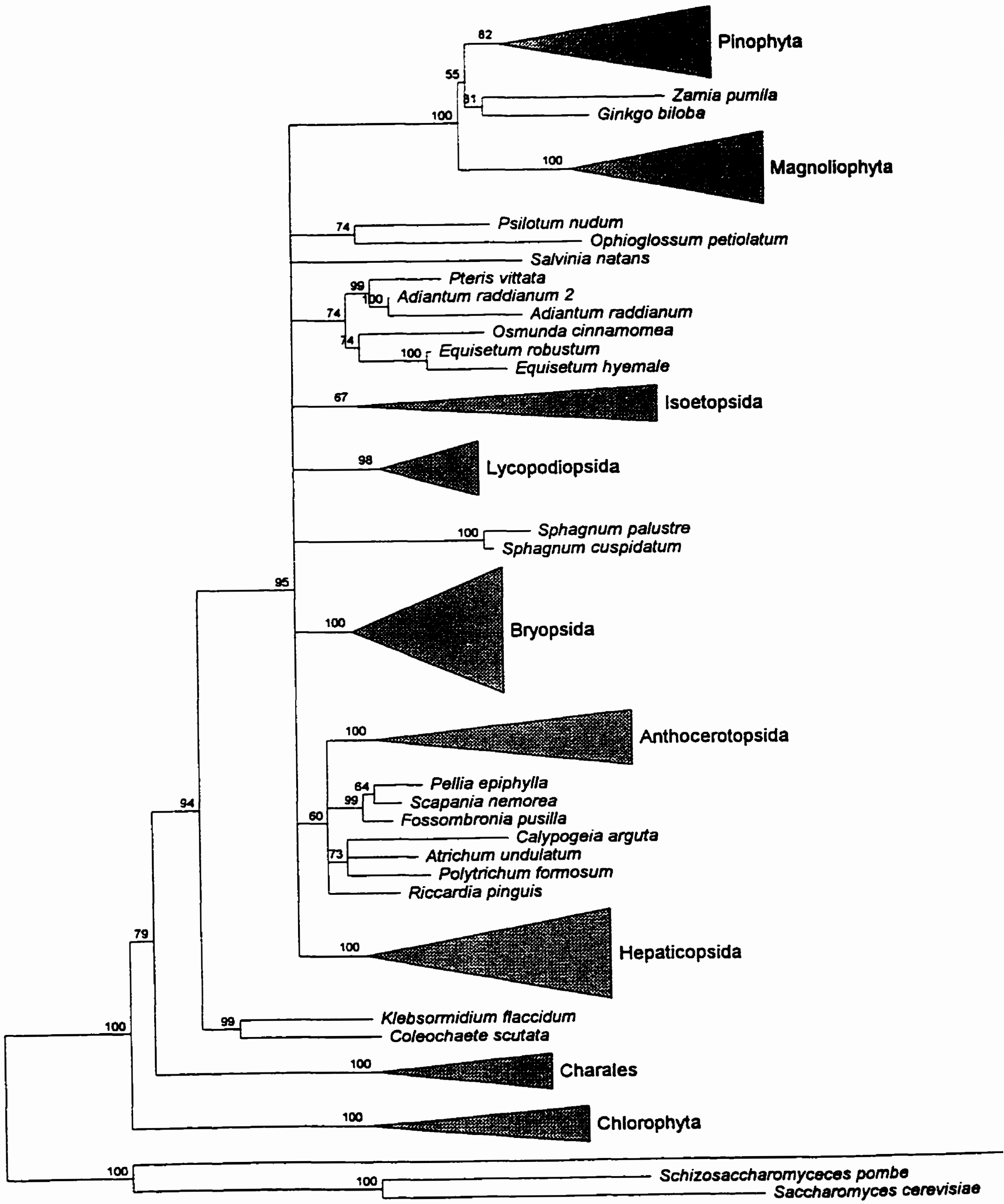


Figure A2B *Jukes & Cantor; (Insertions & Deletions taken into account)*
50% Majority-Rule Bootstrap Tree

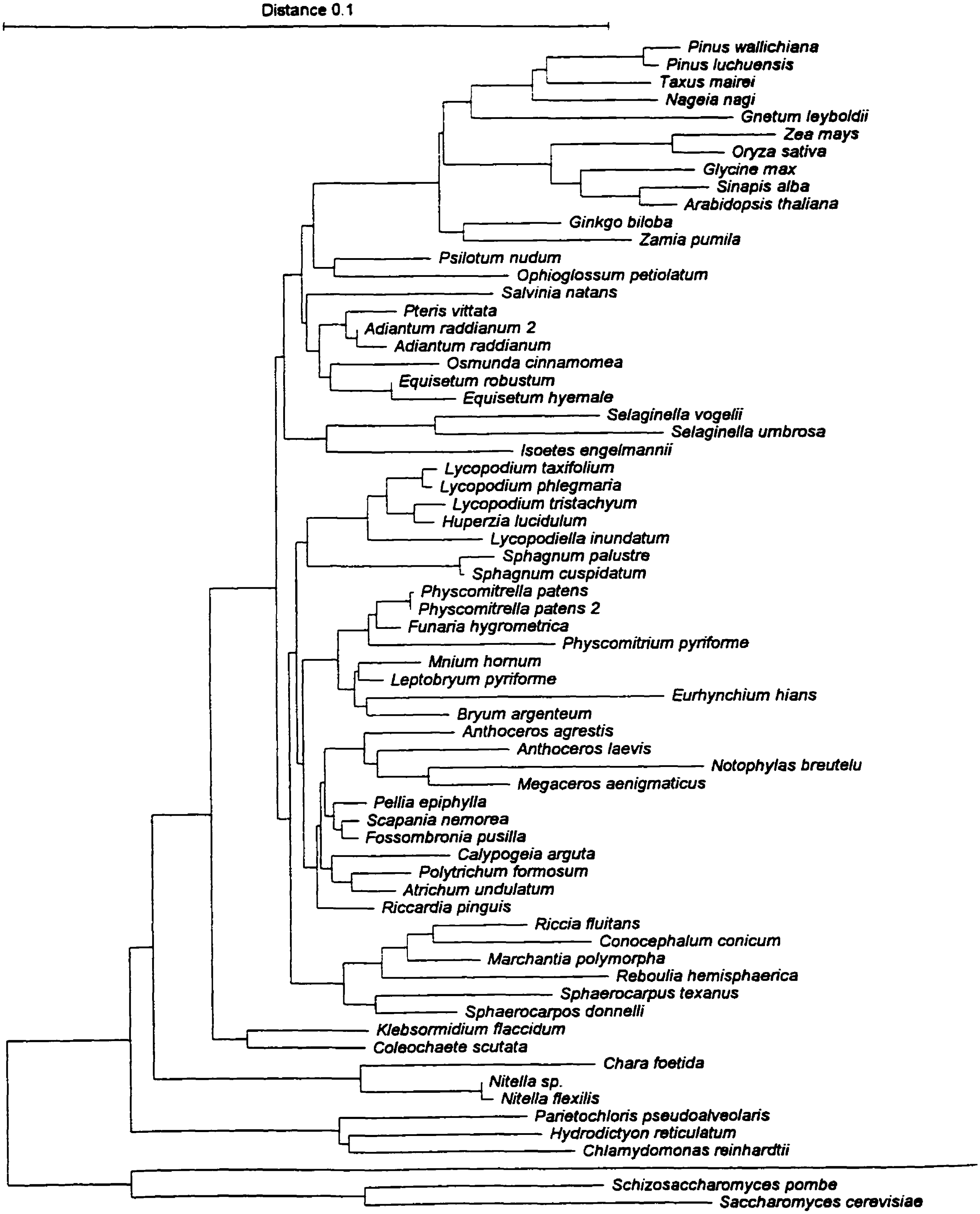


Figure B1 Tajima & Nei; Neighbor-joining

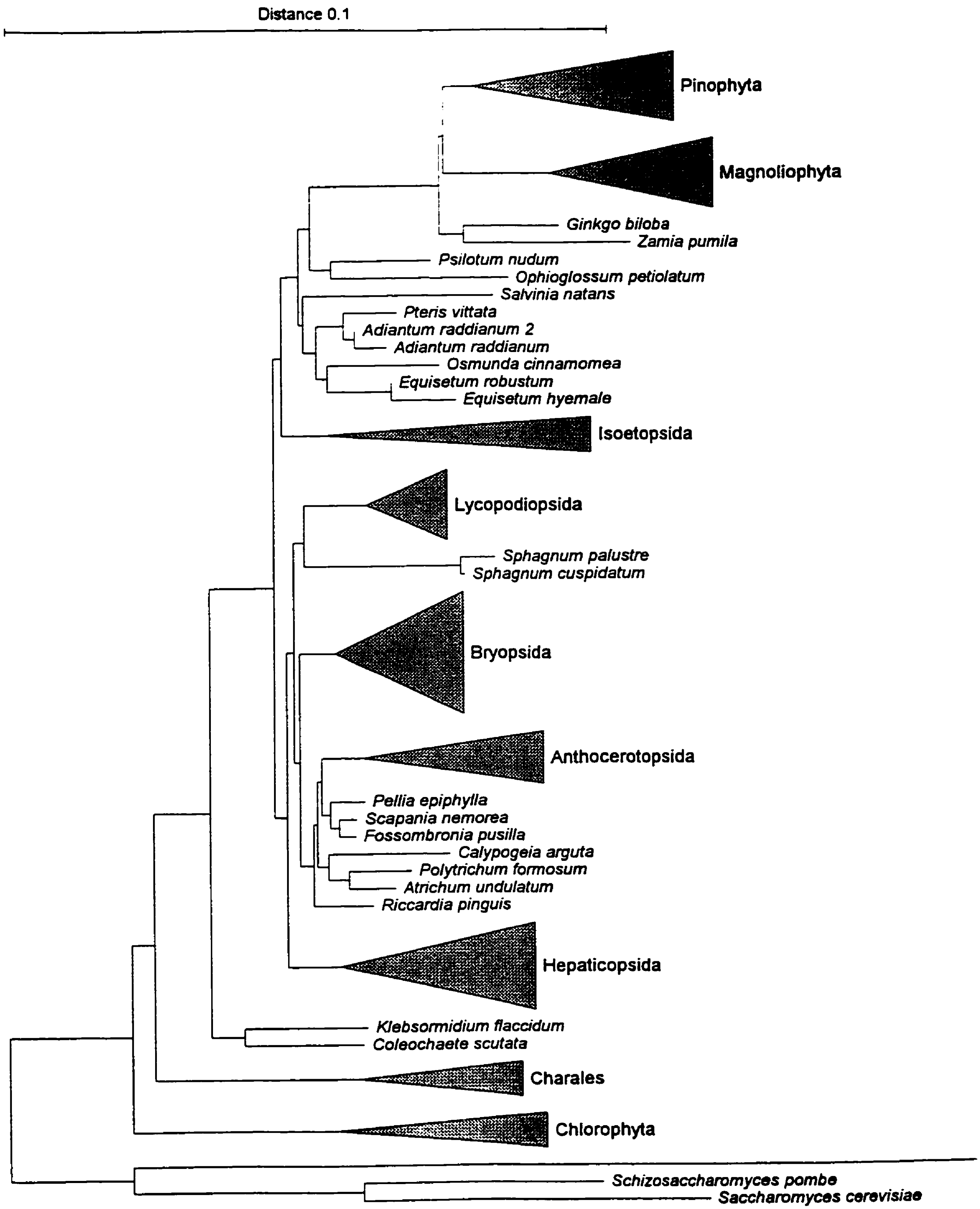


Figure B1 Tajima & Nei; Neighbor-joining

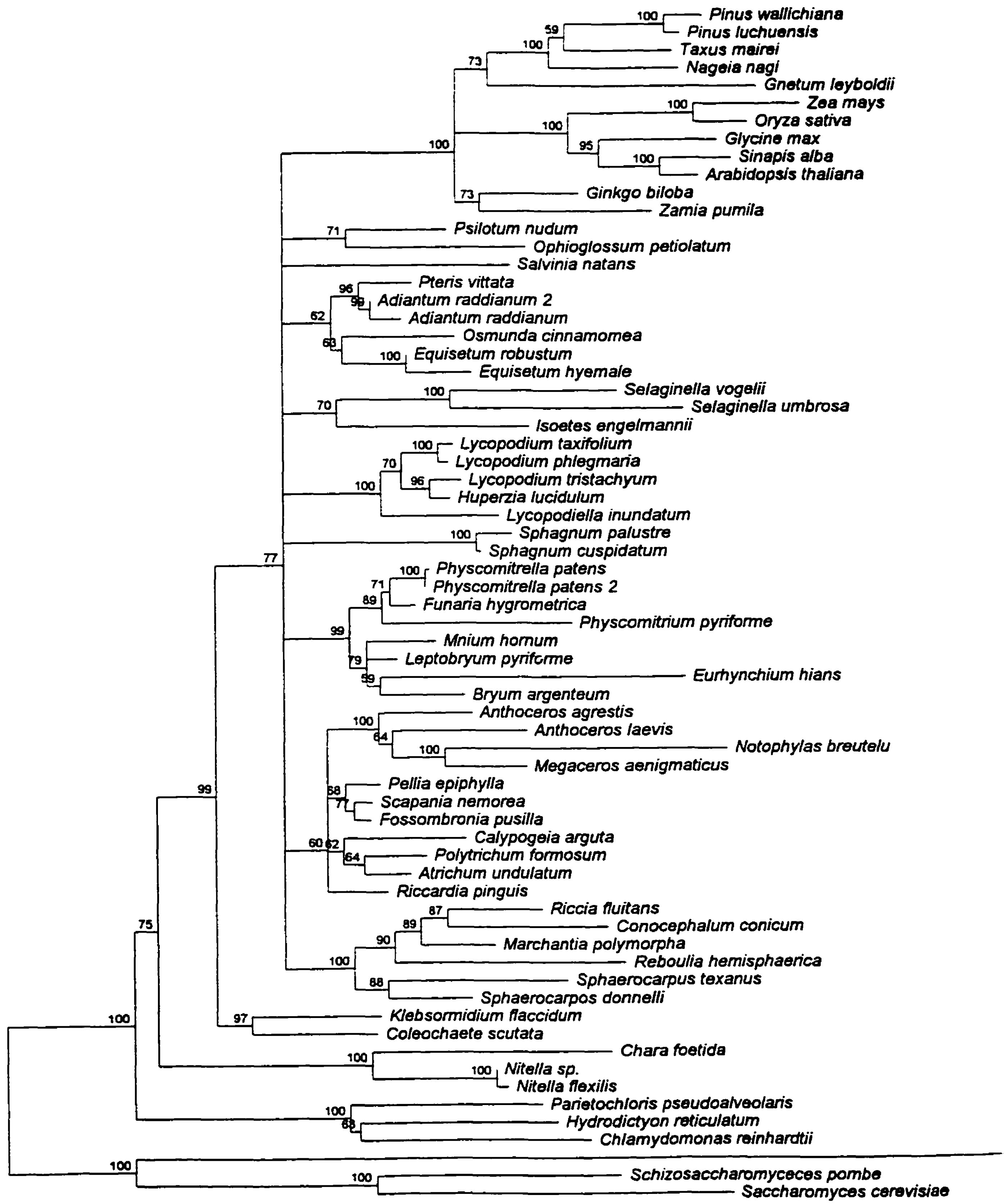


Figure B1B *Tajima & Nei; 50% Majority-Rule Bootstrap Tree*

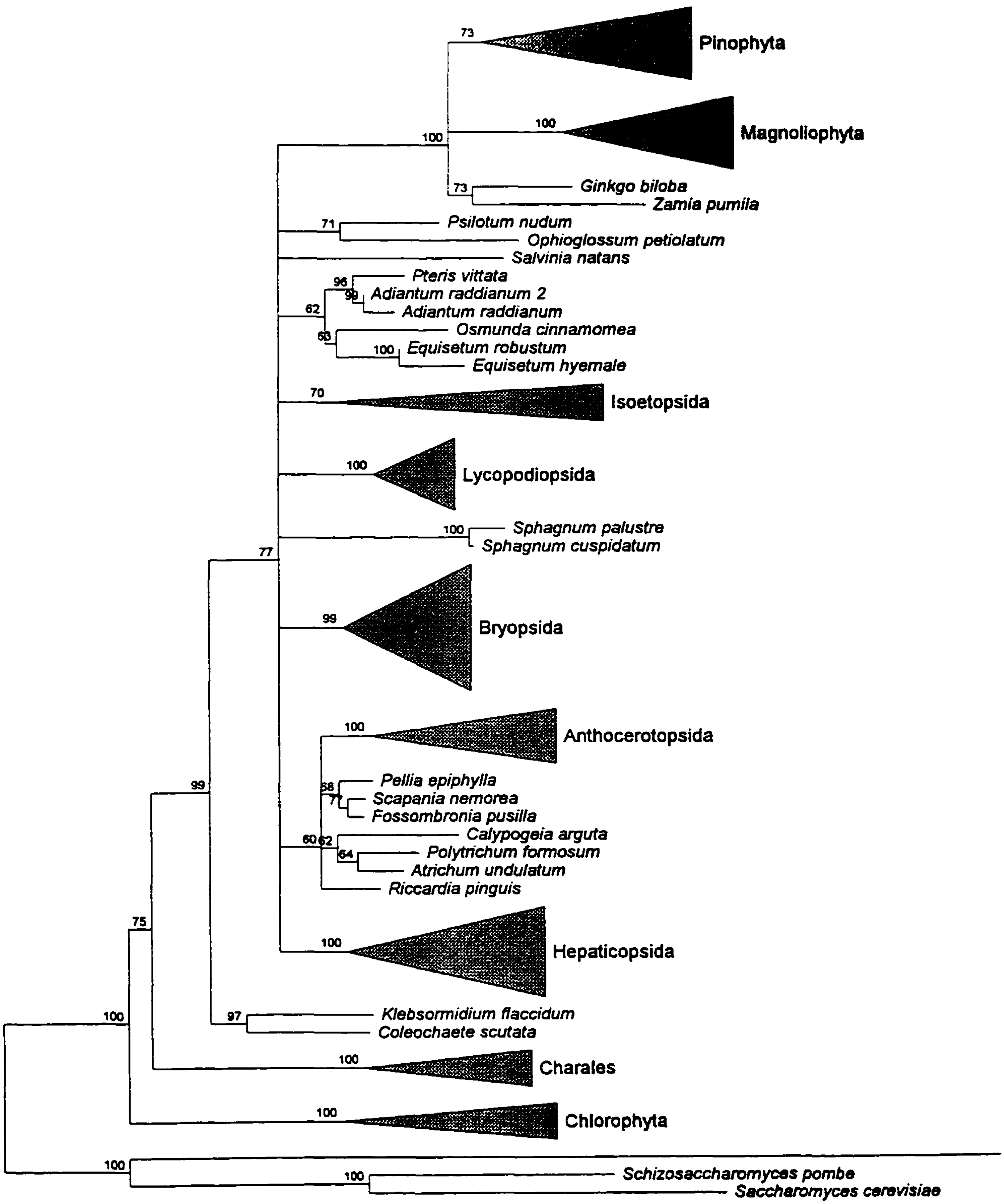


Figure B1B *Tajima & Nei; 50% Majority-Rule Bootstrap Tree*

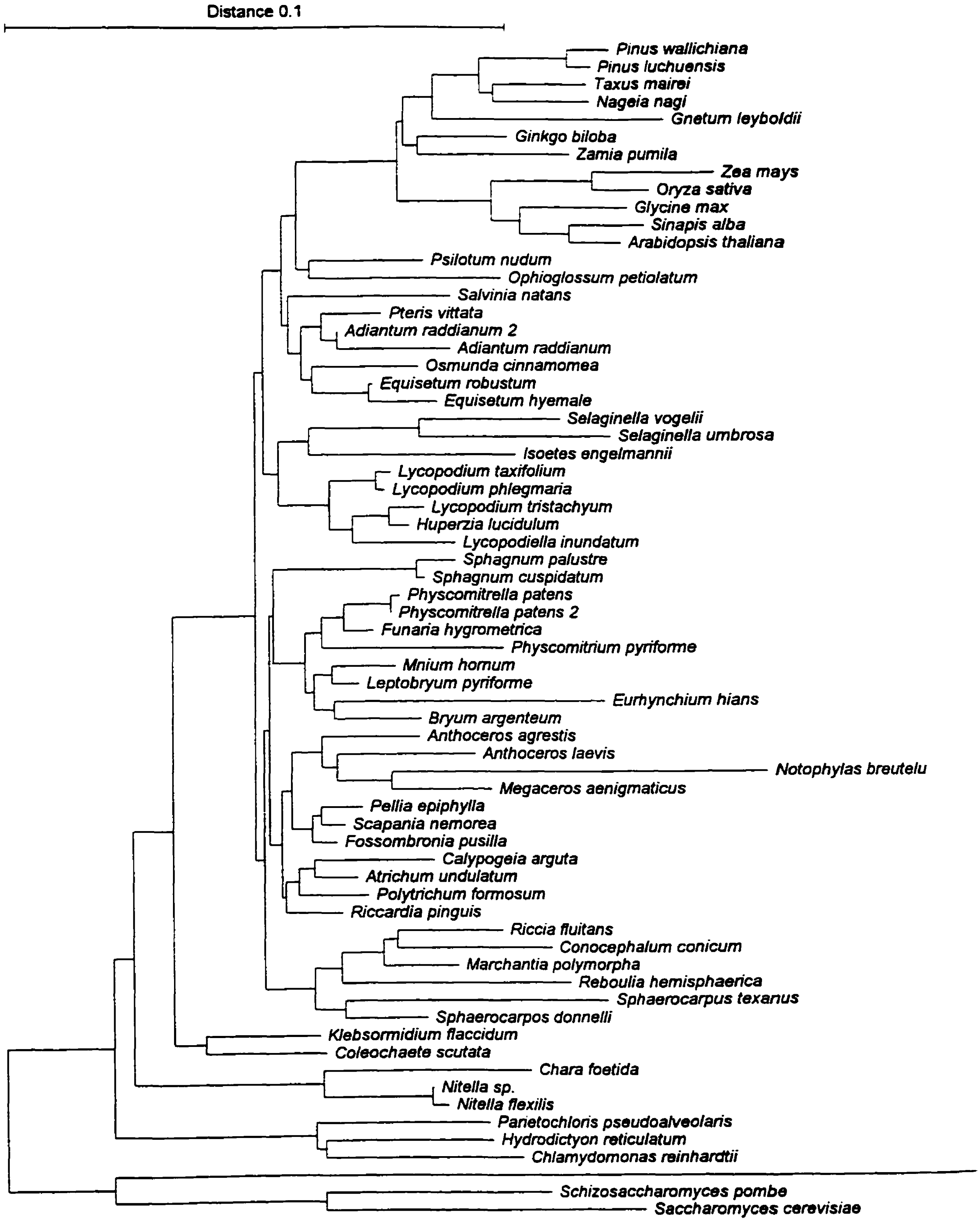


Figure B2 *Tajima & Nei; Neighbor-joining (Insertions & Deletions taken into account)*

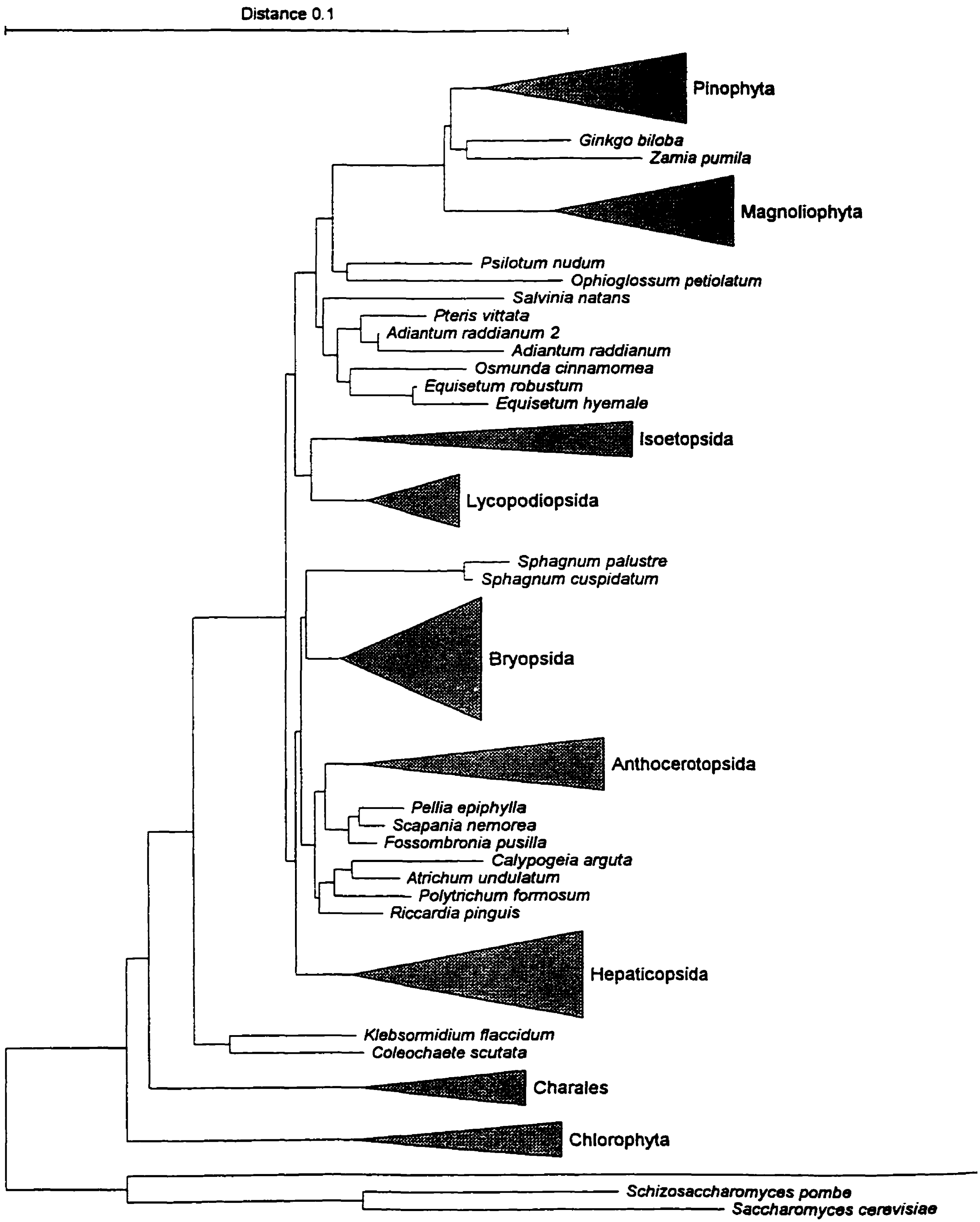


Figure B2 Tajima & Nei; Neighbor-joining (Insertions & Deletions taken into account)

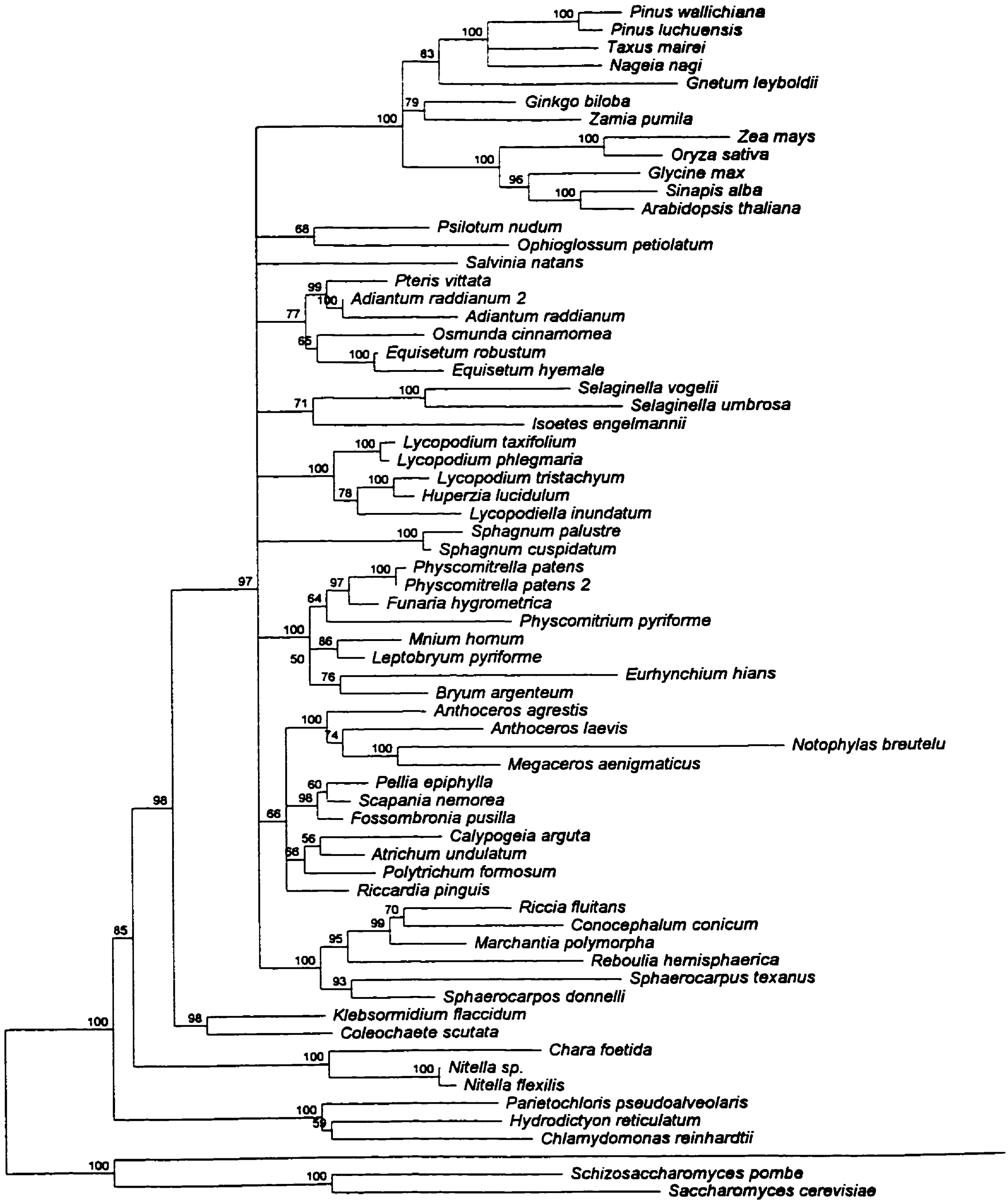


Figure B2B *Tajima & Nei; (Insertions and Deletions taken into account)*
50% Majority-Rule Bootstrap Tree

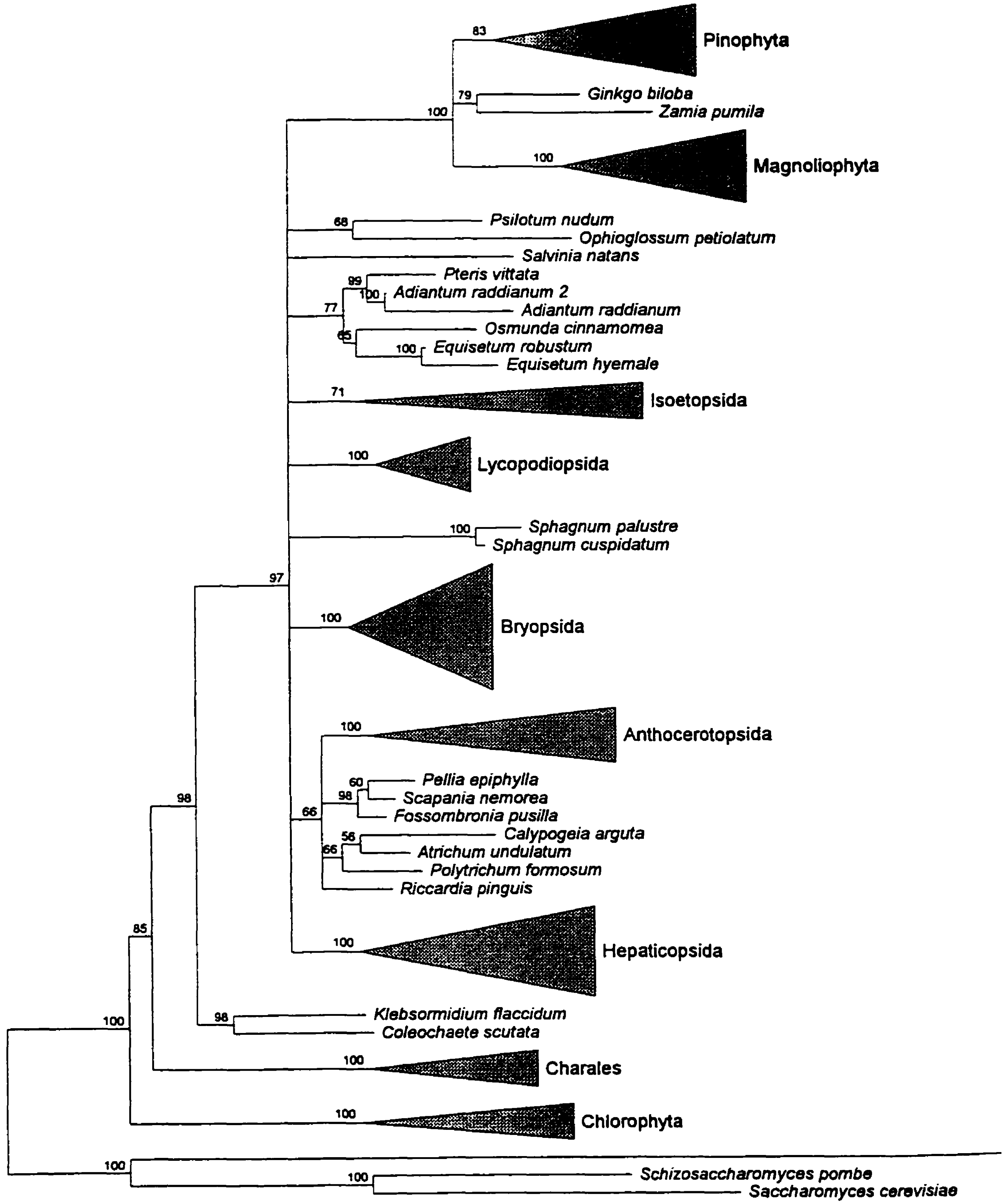


Figure B2B Tajima & Nei; (Insertions and Deletions taken into account)
50% Majority-Rule Bootstrap Tree

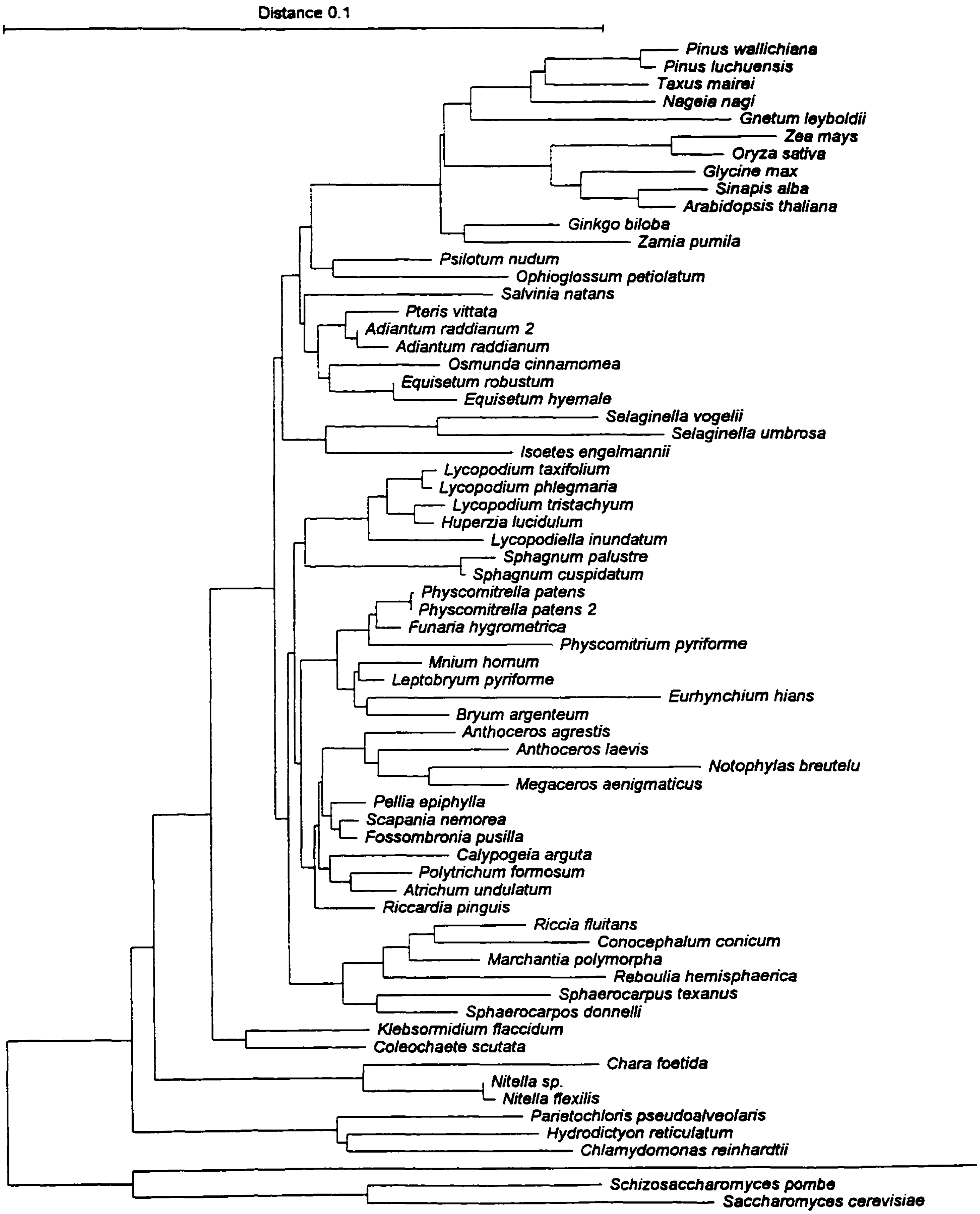


Figure C1 Kimura; Neighbor-joining

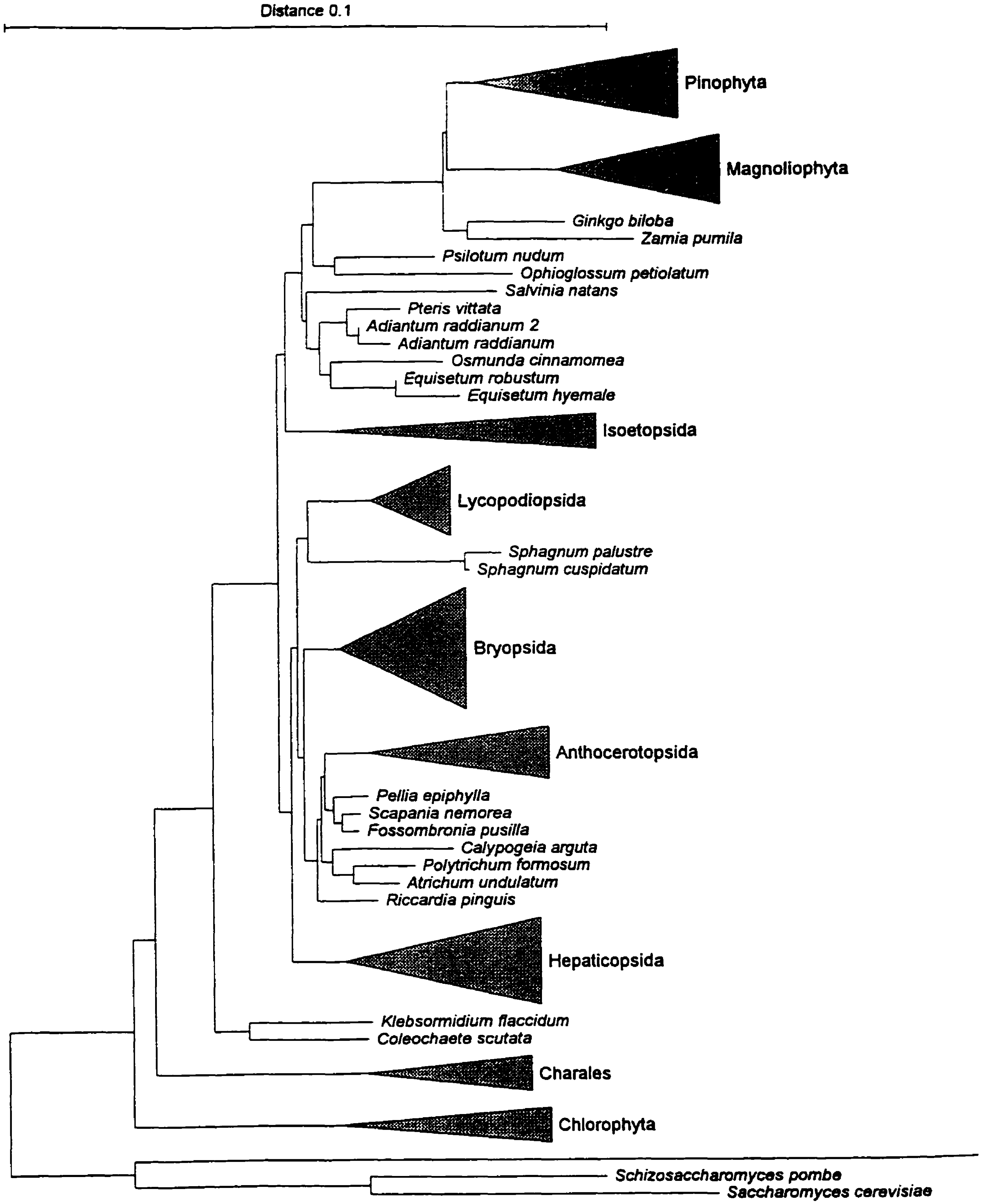


Figure C1   Kimura; Neighbor-joining

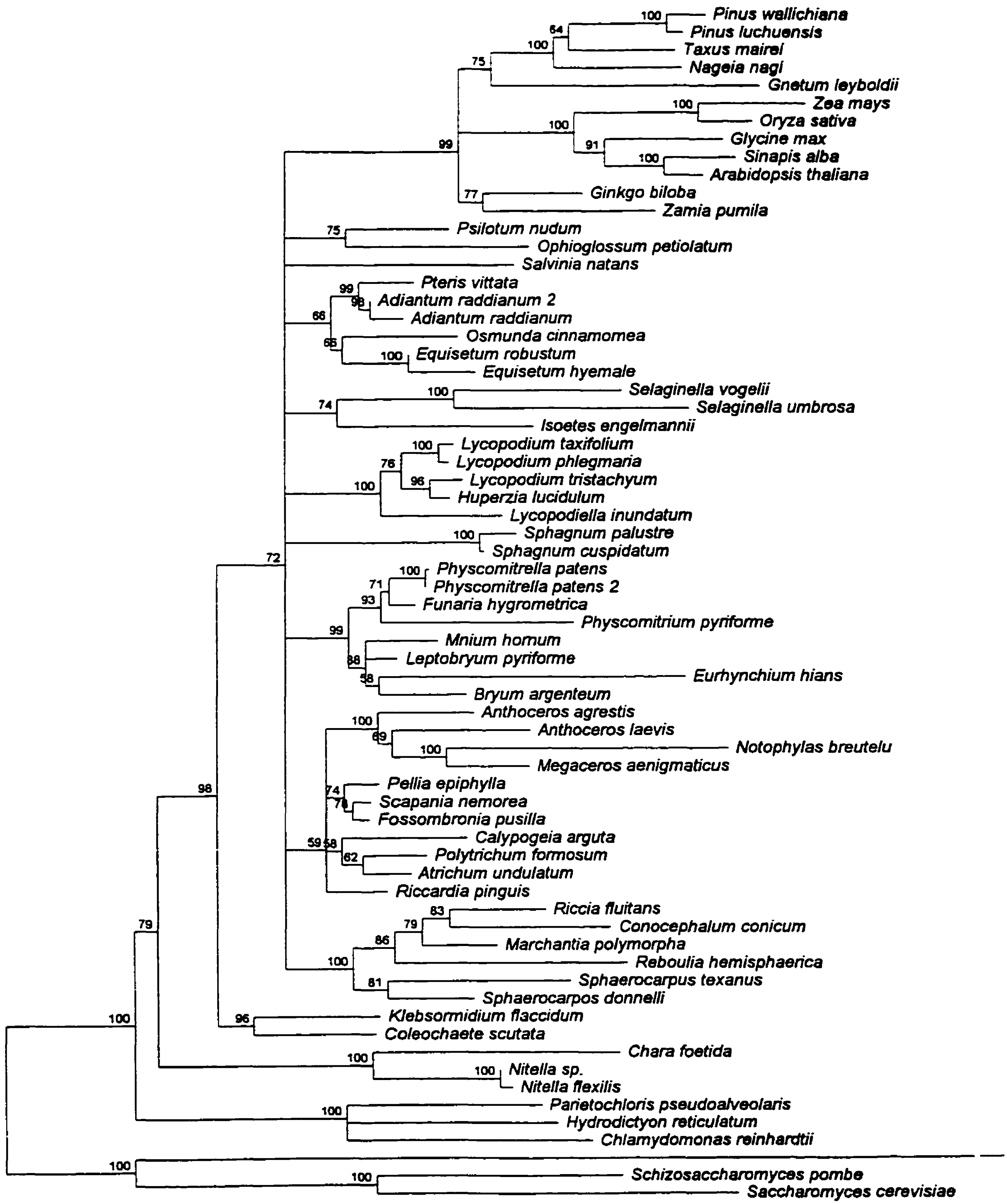


Figure C1B *Kimura; 50% Majority-Rule Bootstrap Tree*

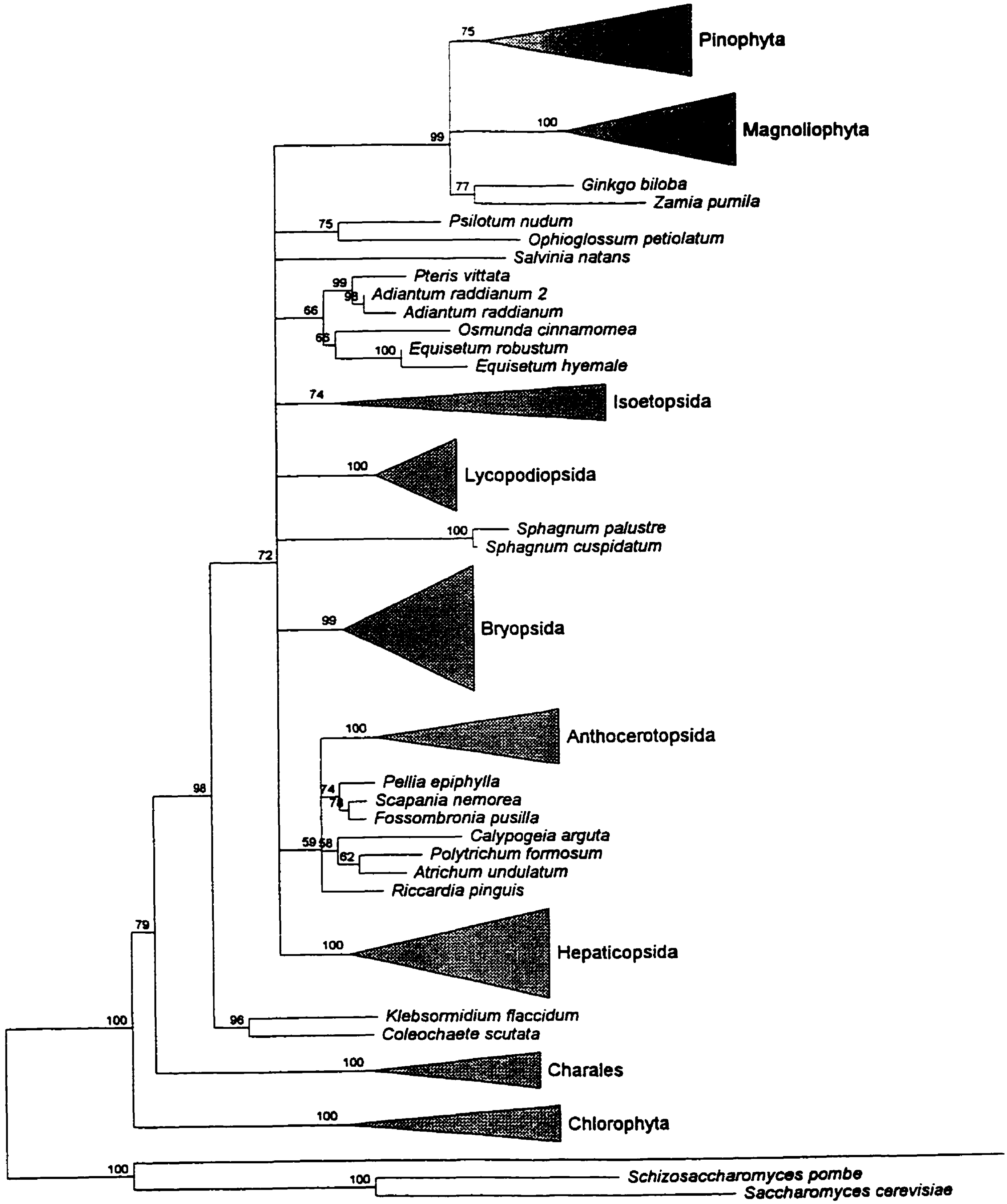


Figure C1B *Kimura; 50% Majority-Rule Bootstrap Tree*

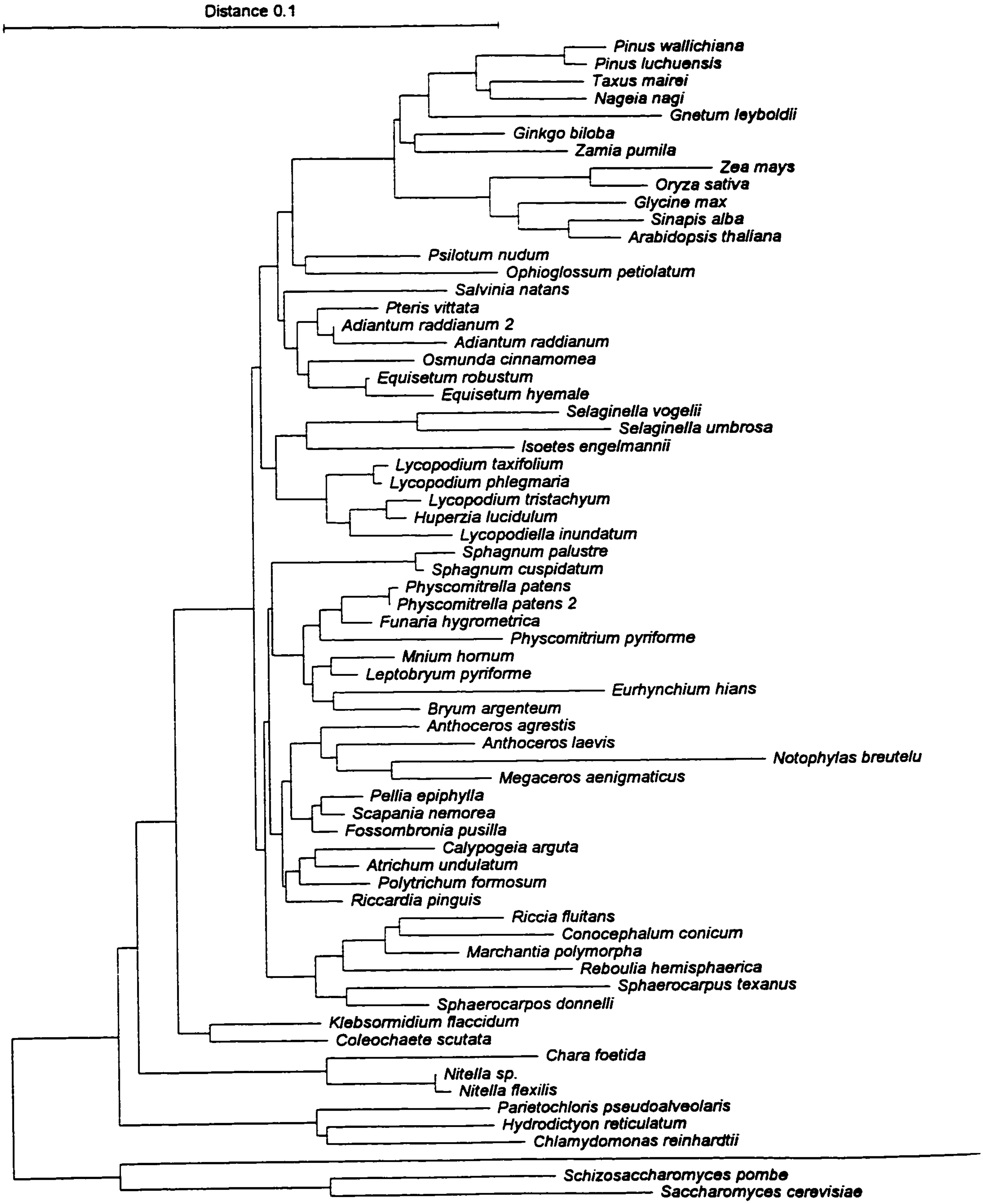


Figure C2 *Kimura; Neighbor-joining (Insertions & Deletions taken into account)*

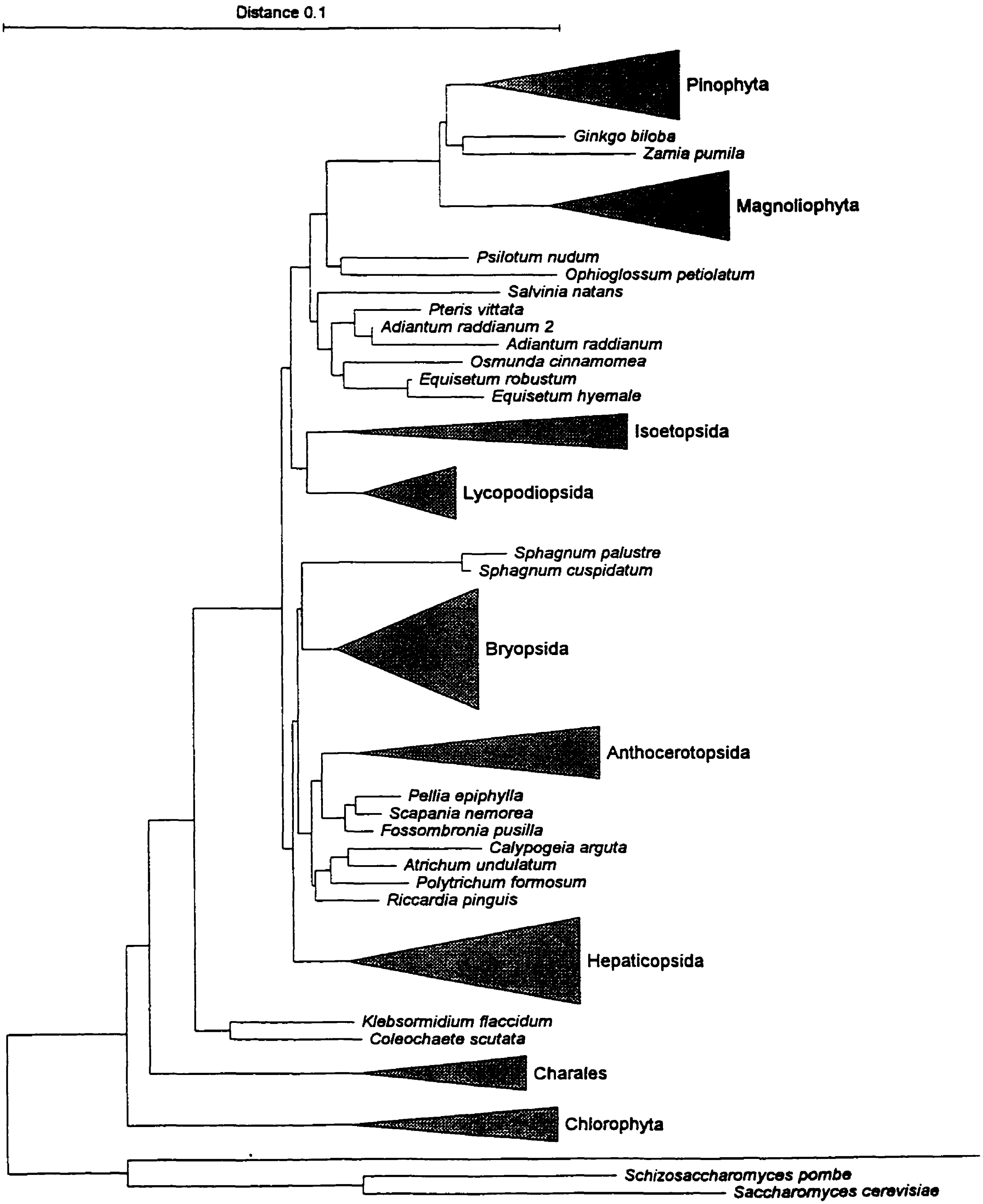


Figure C2 Kimura; Neighbor-joining (Insertions & Deletions taken into account)

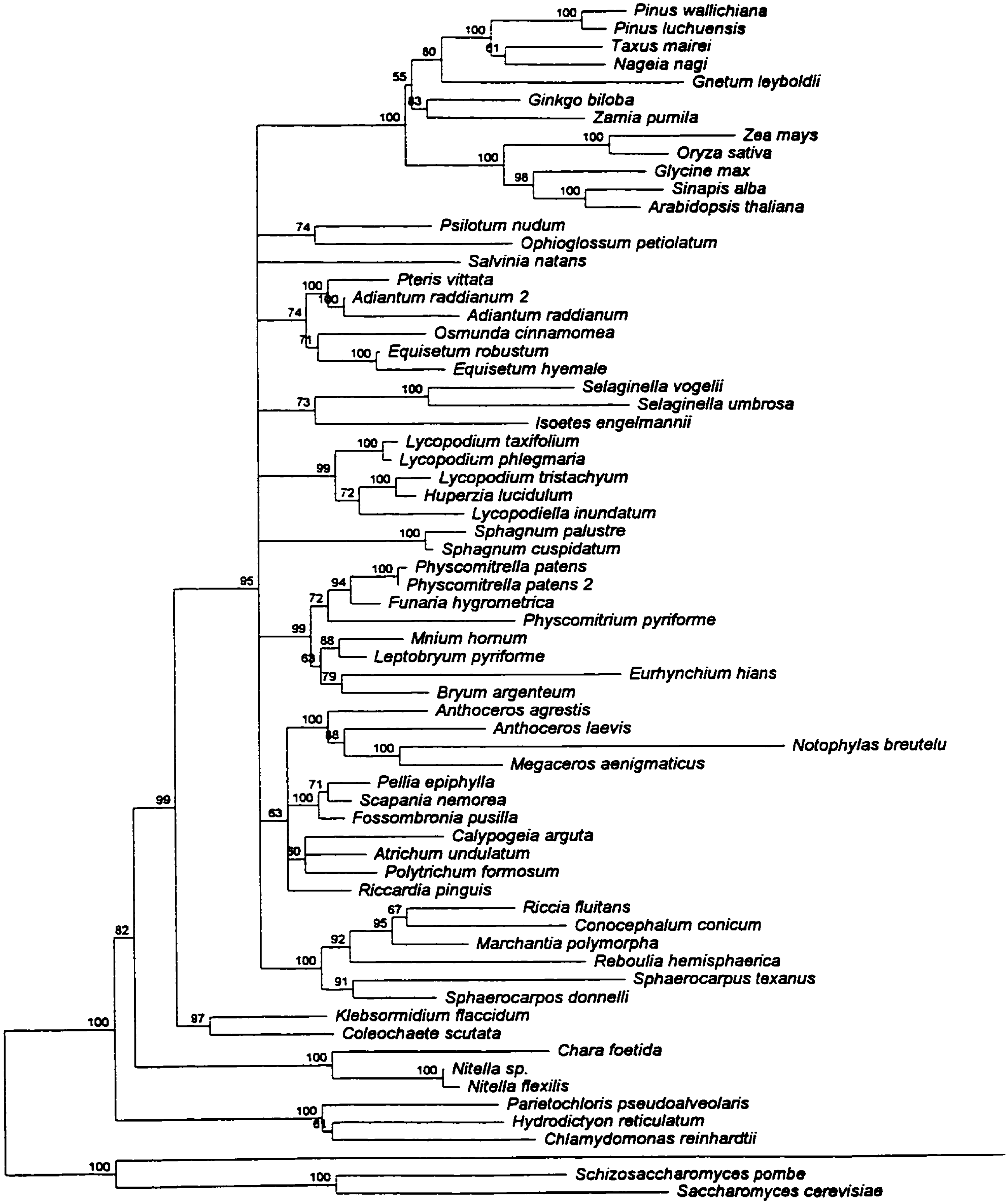


Figure C2B *Kimura; (Insertions & Deletions taken into account)*
50% Majority-Rule Bootstrap Tree

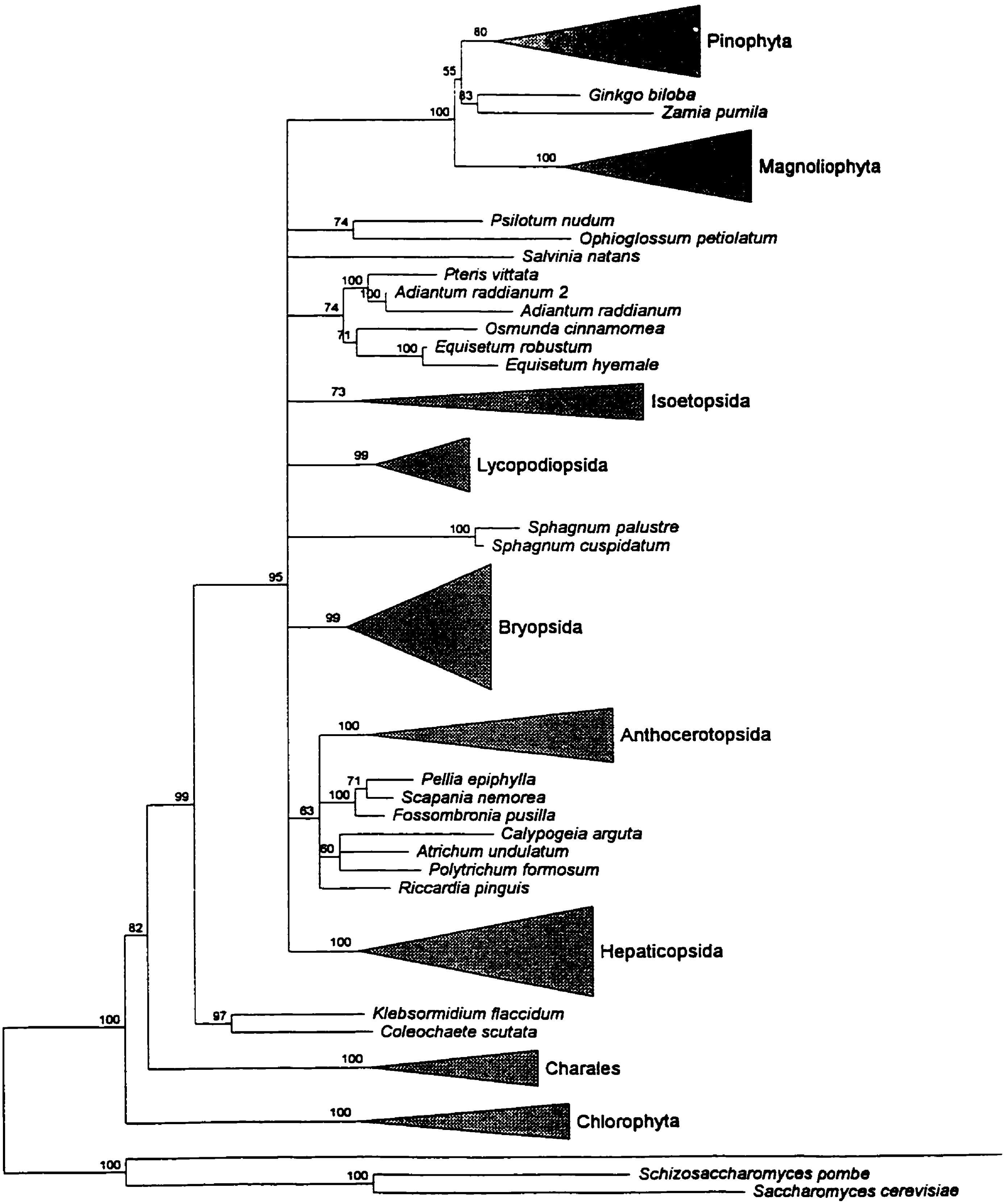


Figure C2B *Kimura; (Insertions & Deletions taken into account)*
50% Majority-Rule Bootstrap Tree

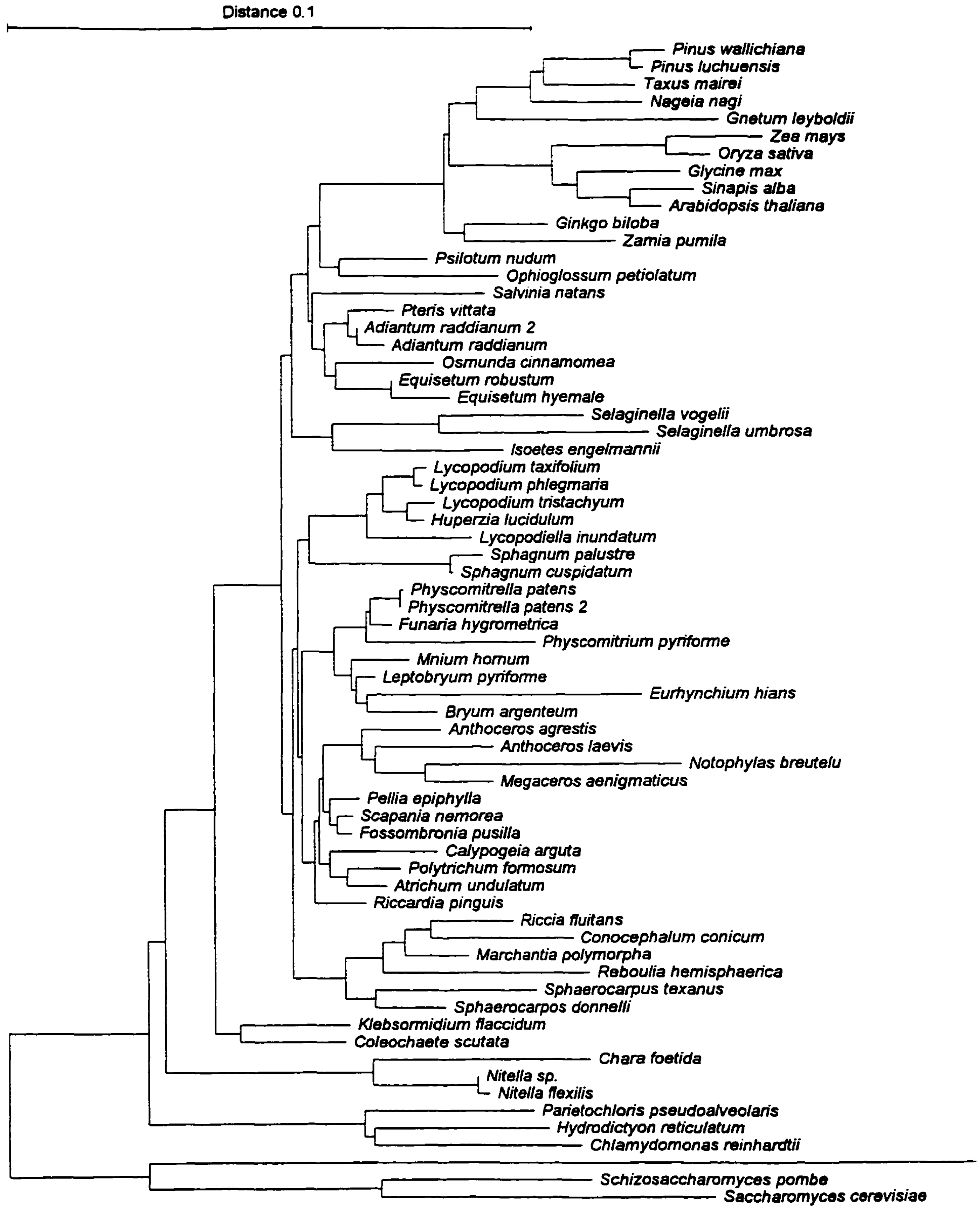


Figure D1.1 *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*

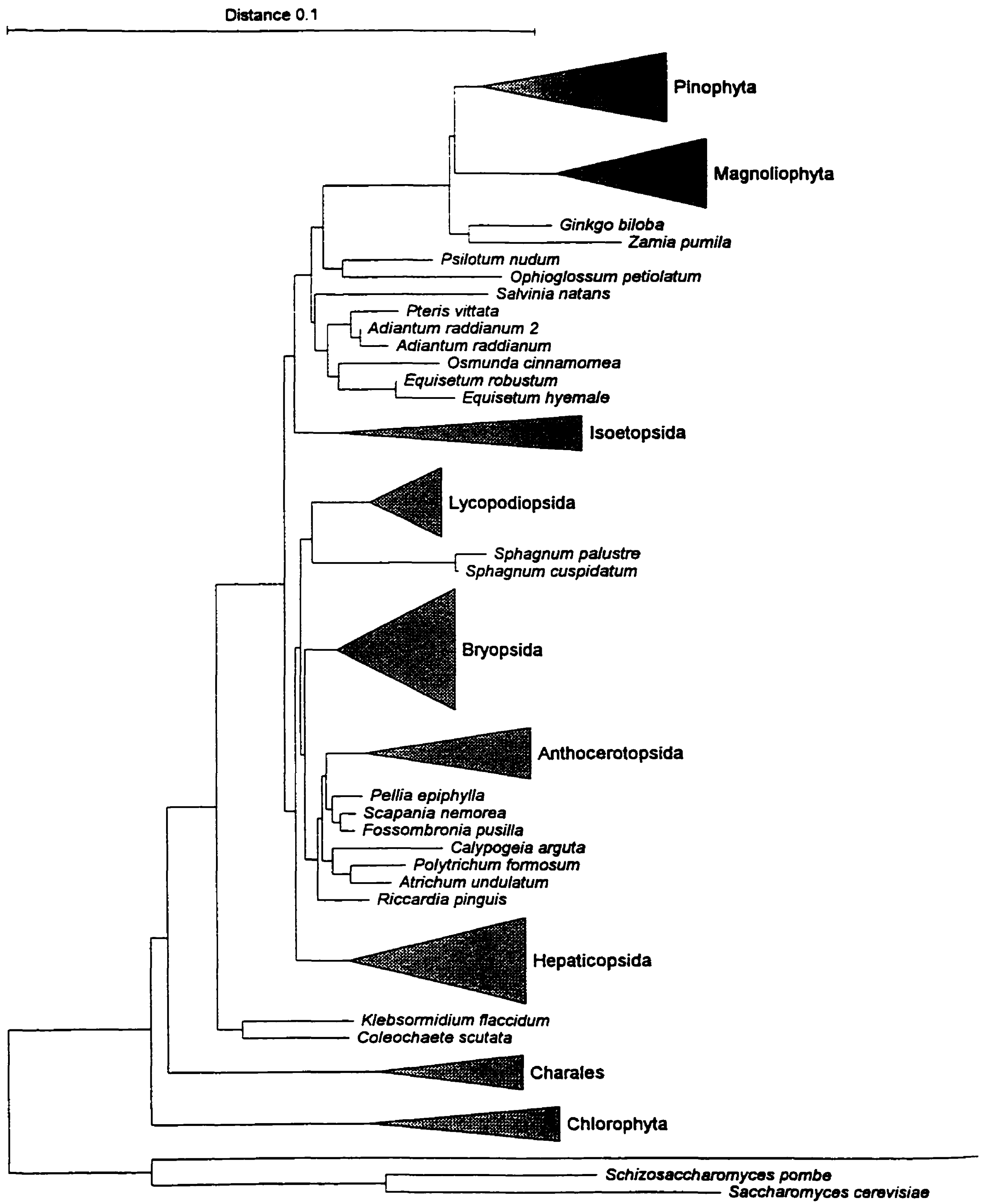


Figure D1.1 *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*

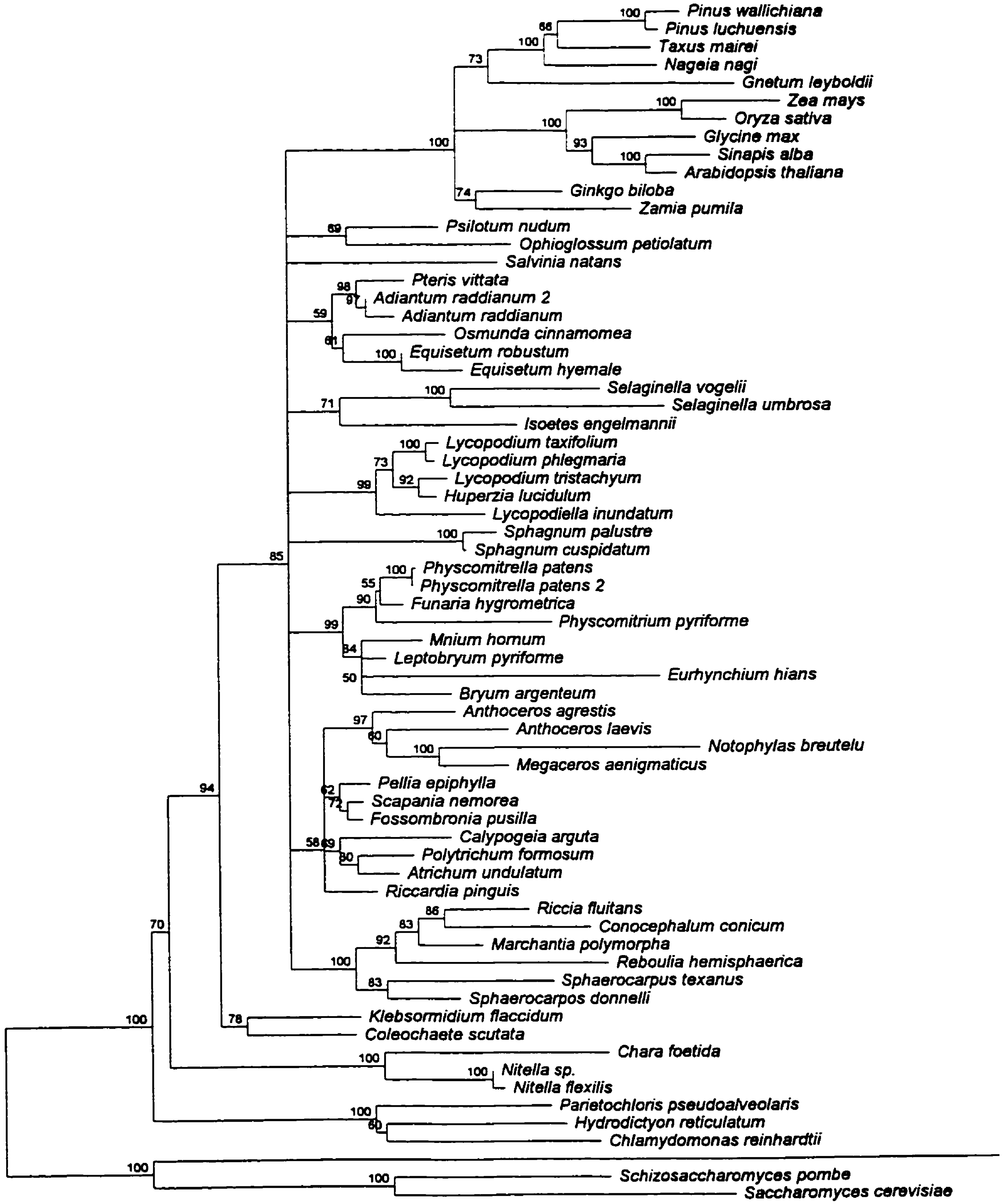


Figure D1.1B *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*
50% Majority-Rule Bootstrap Tree

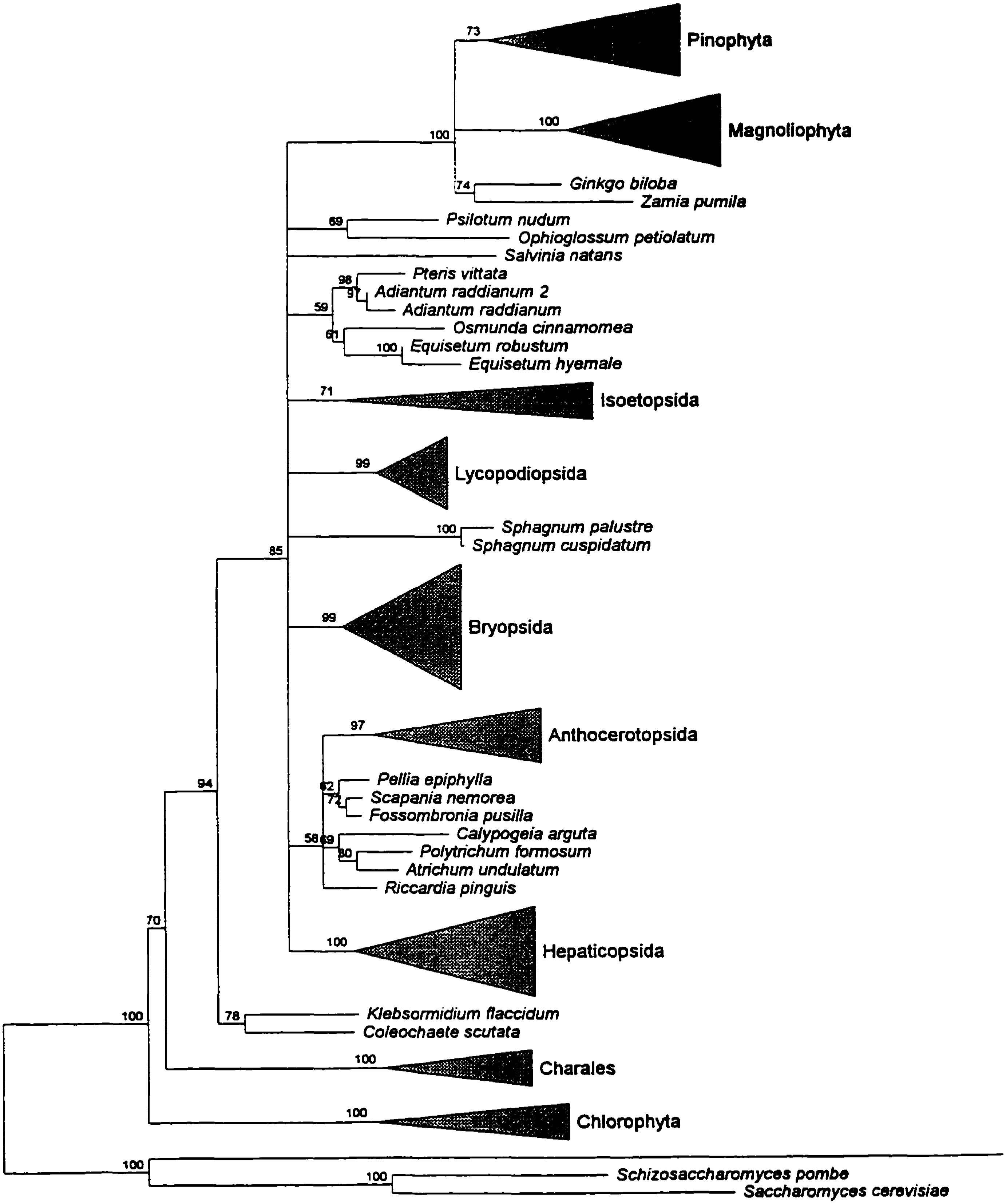


Figure D1.1B *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*
50% Majority-Rule Bootstrap Tree

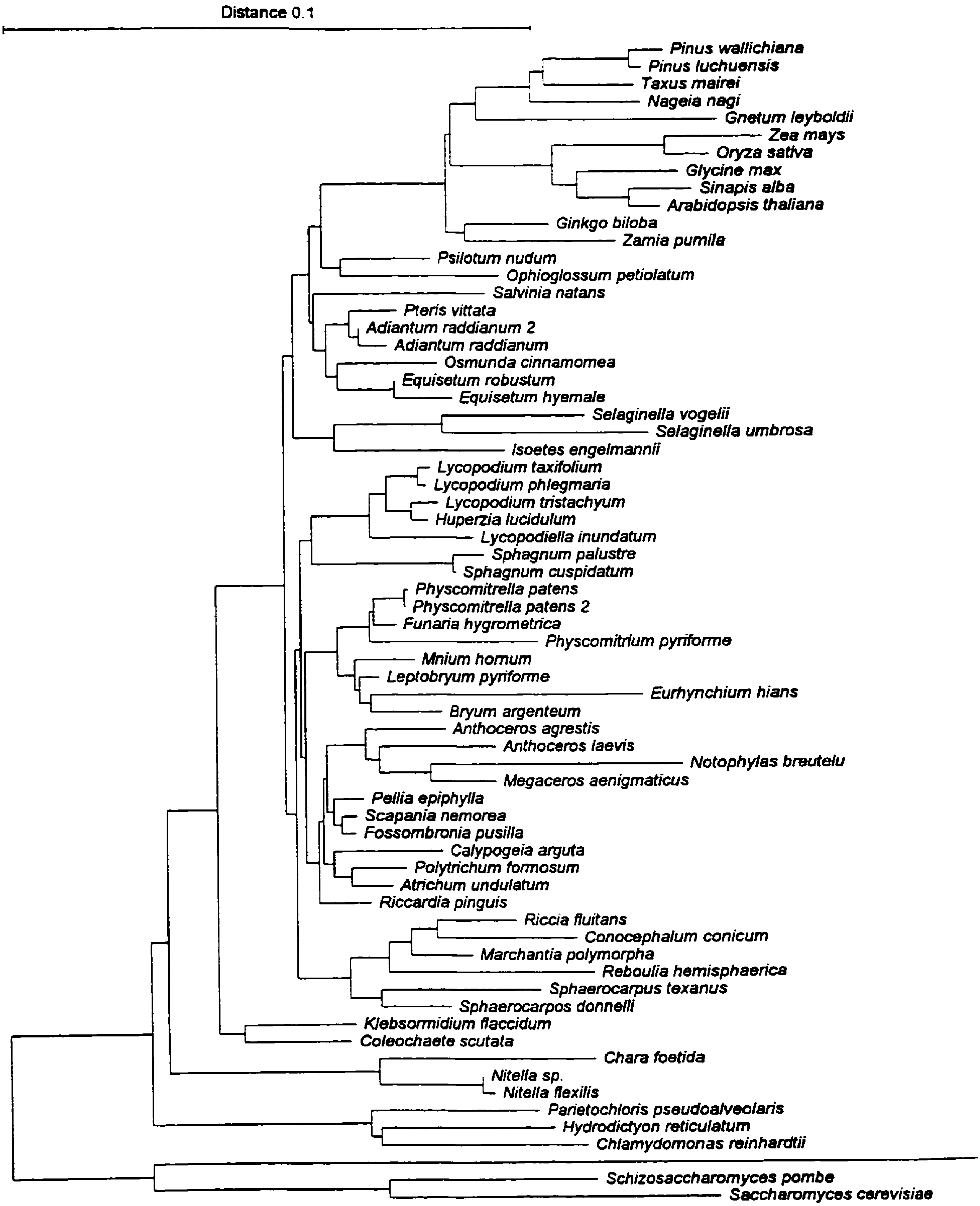


Figure D1.2 *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1 Insertions & Deletions taken into account*

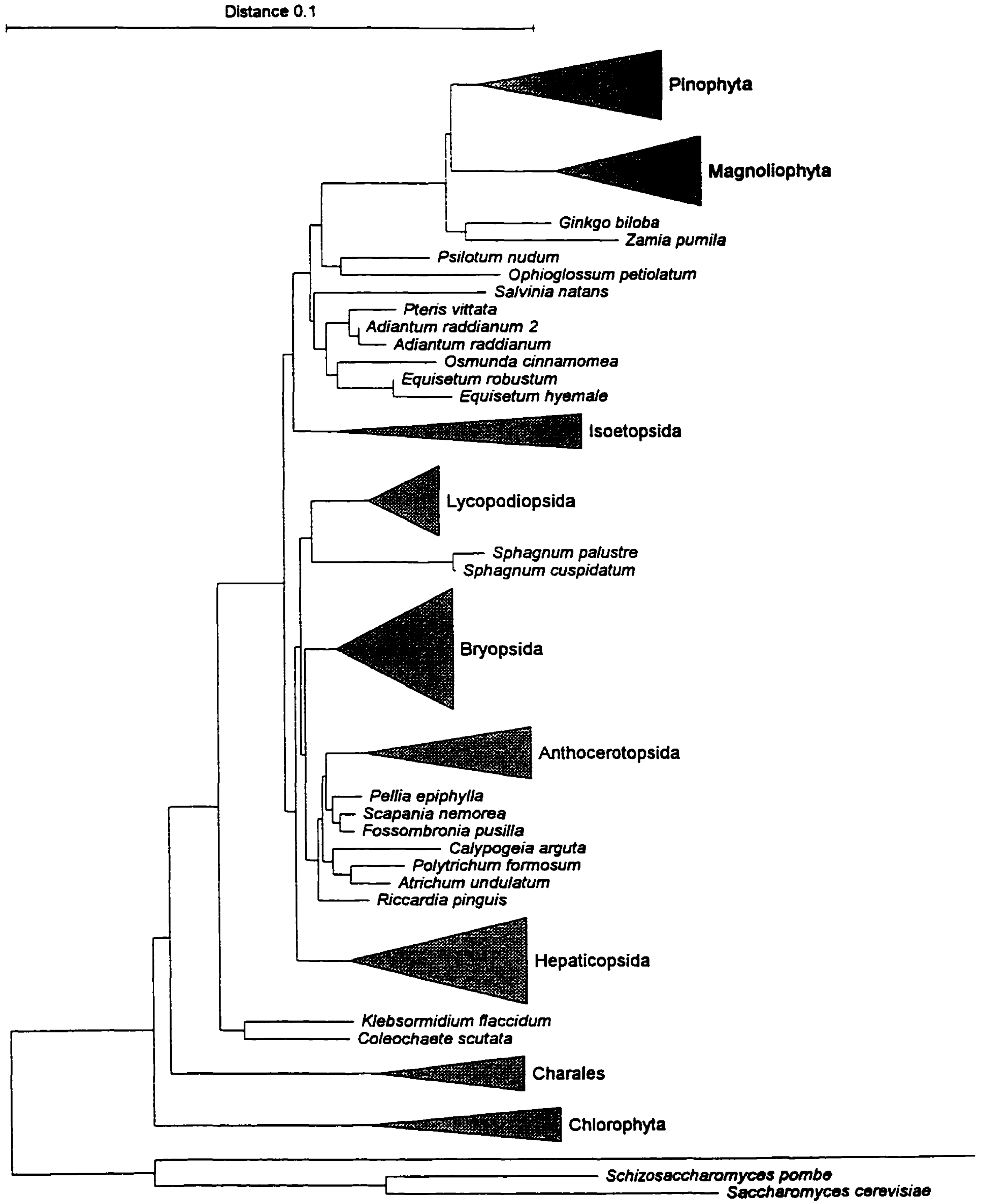


Figure D1.2 Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1
Insertions & Deletions taken into account

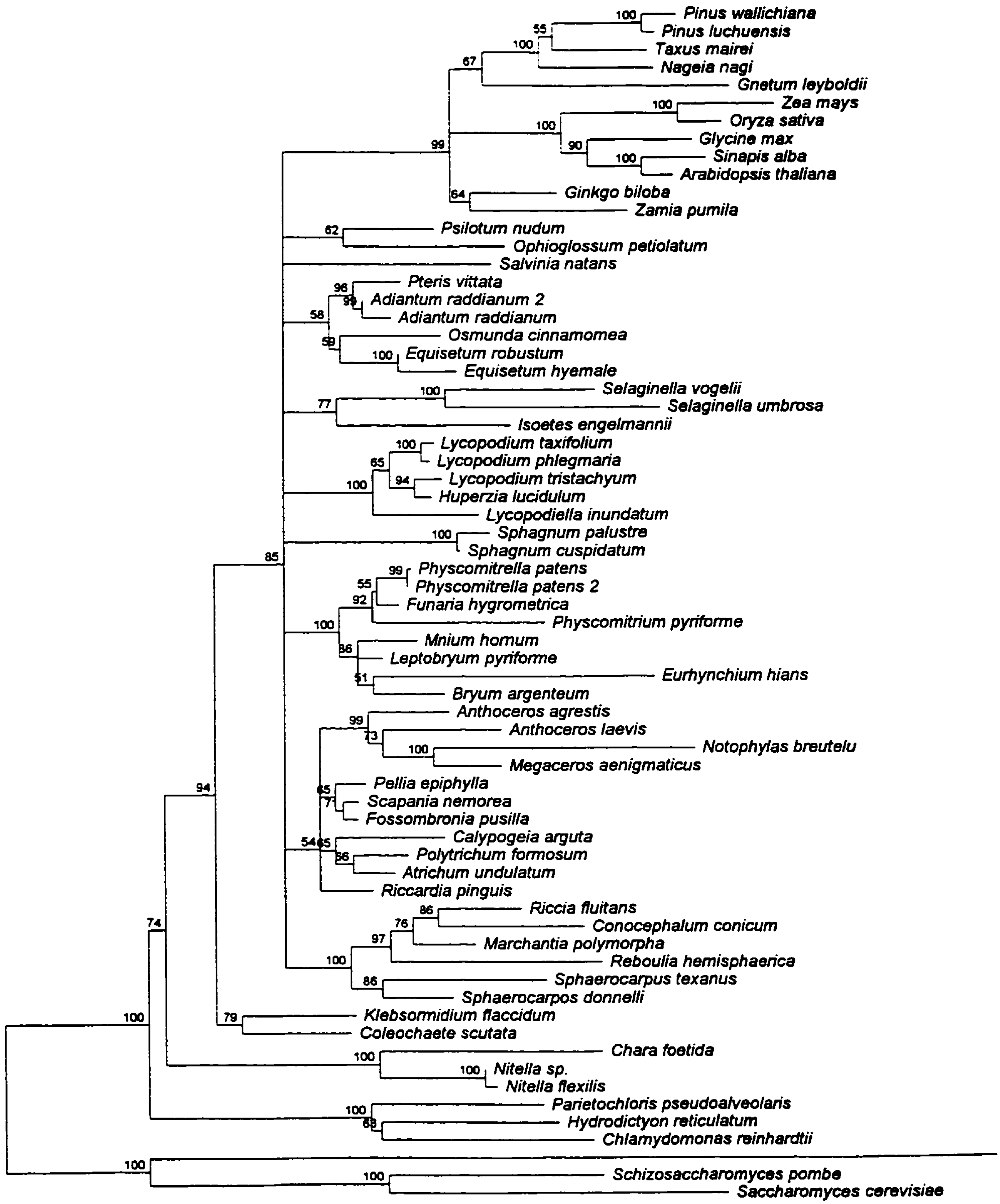


Figure D1.2B Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

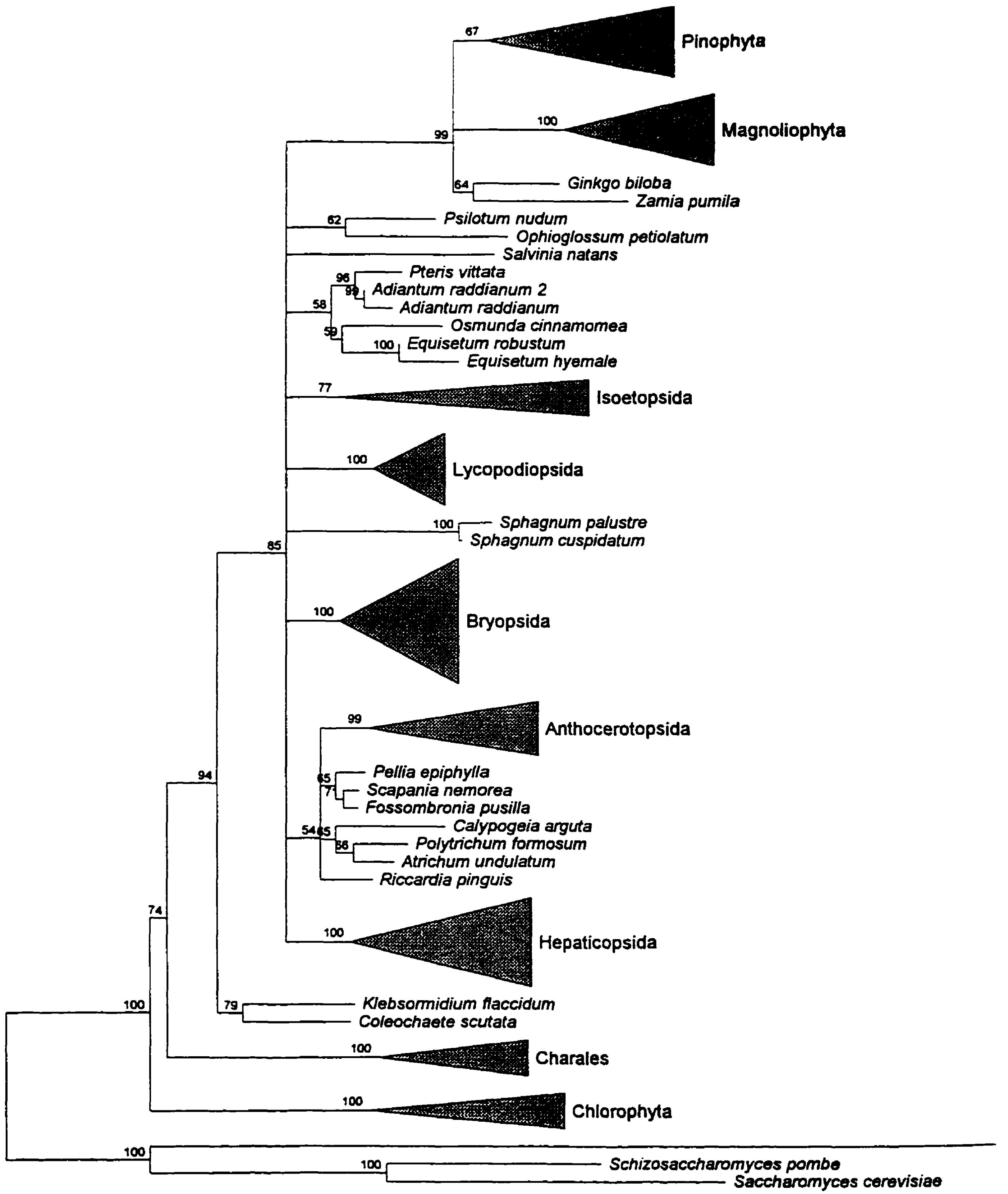


Figure D1.2B *Jin & Nei (Distance Calculation); Jukes & Cantor (Evolution Model), Gamma distance = 1*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

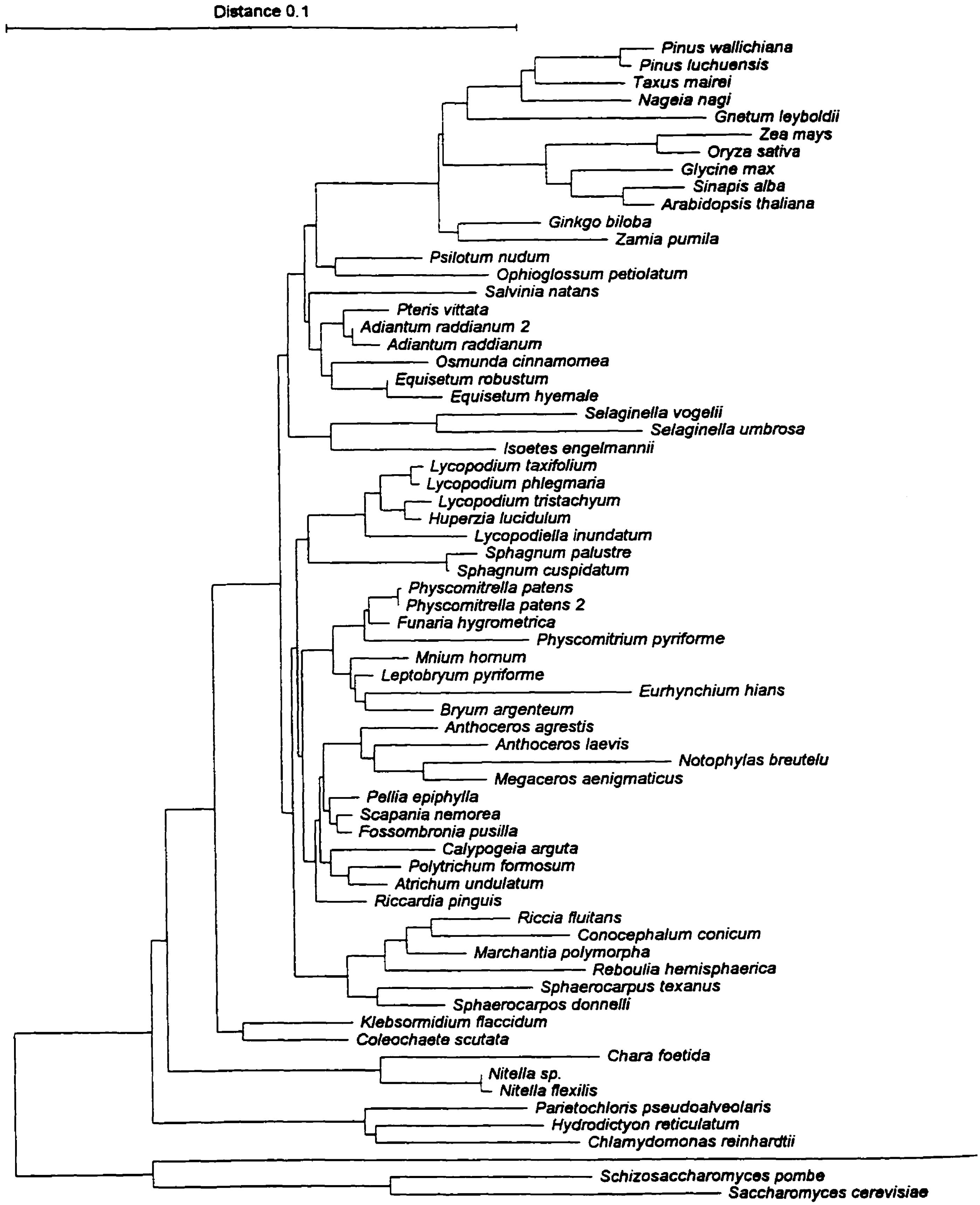


Figure D2.1 Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model). Gamma distance = 1

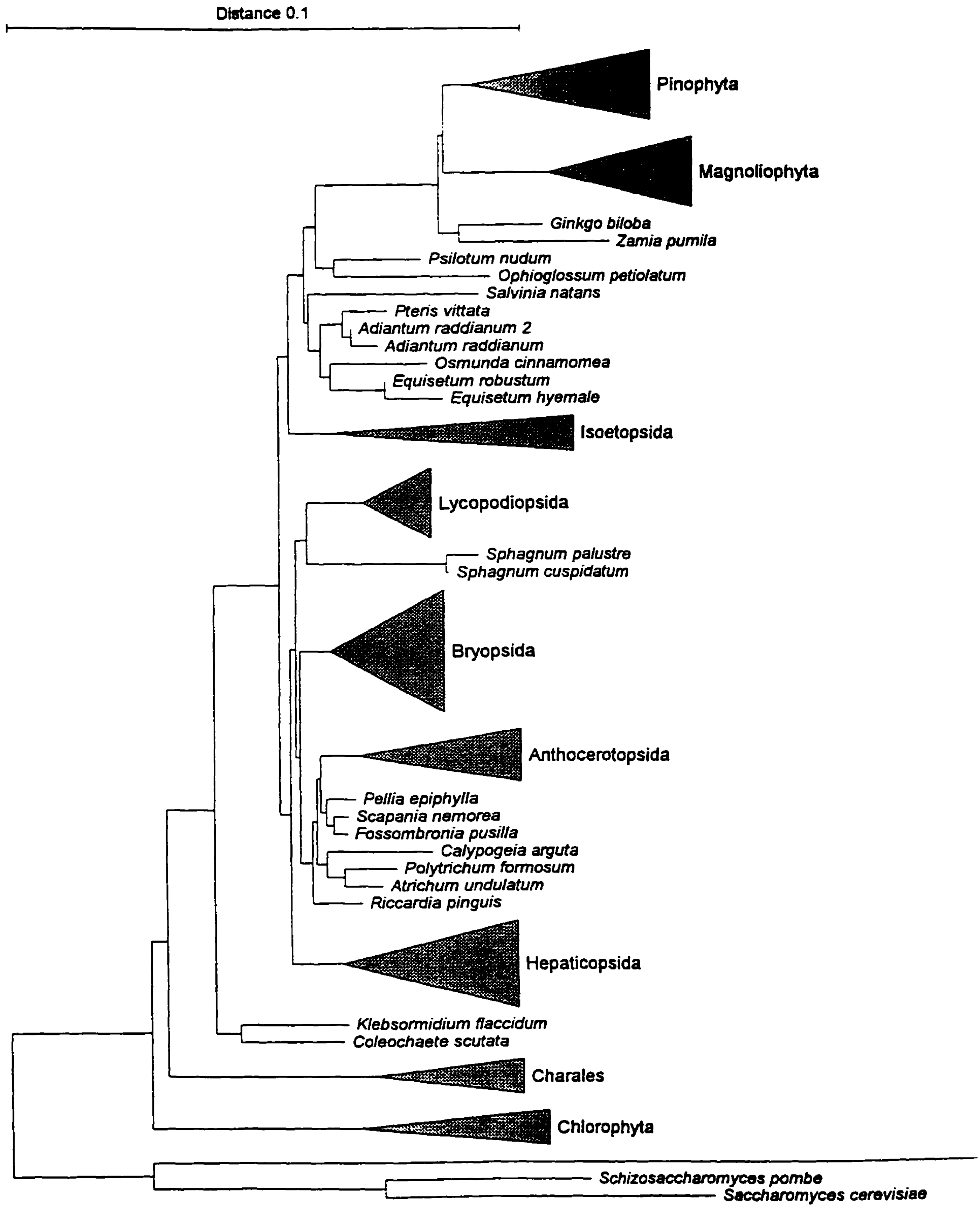


Figure D2.1 *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1*

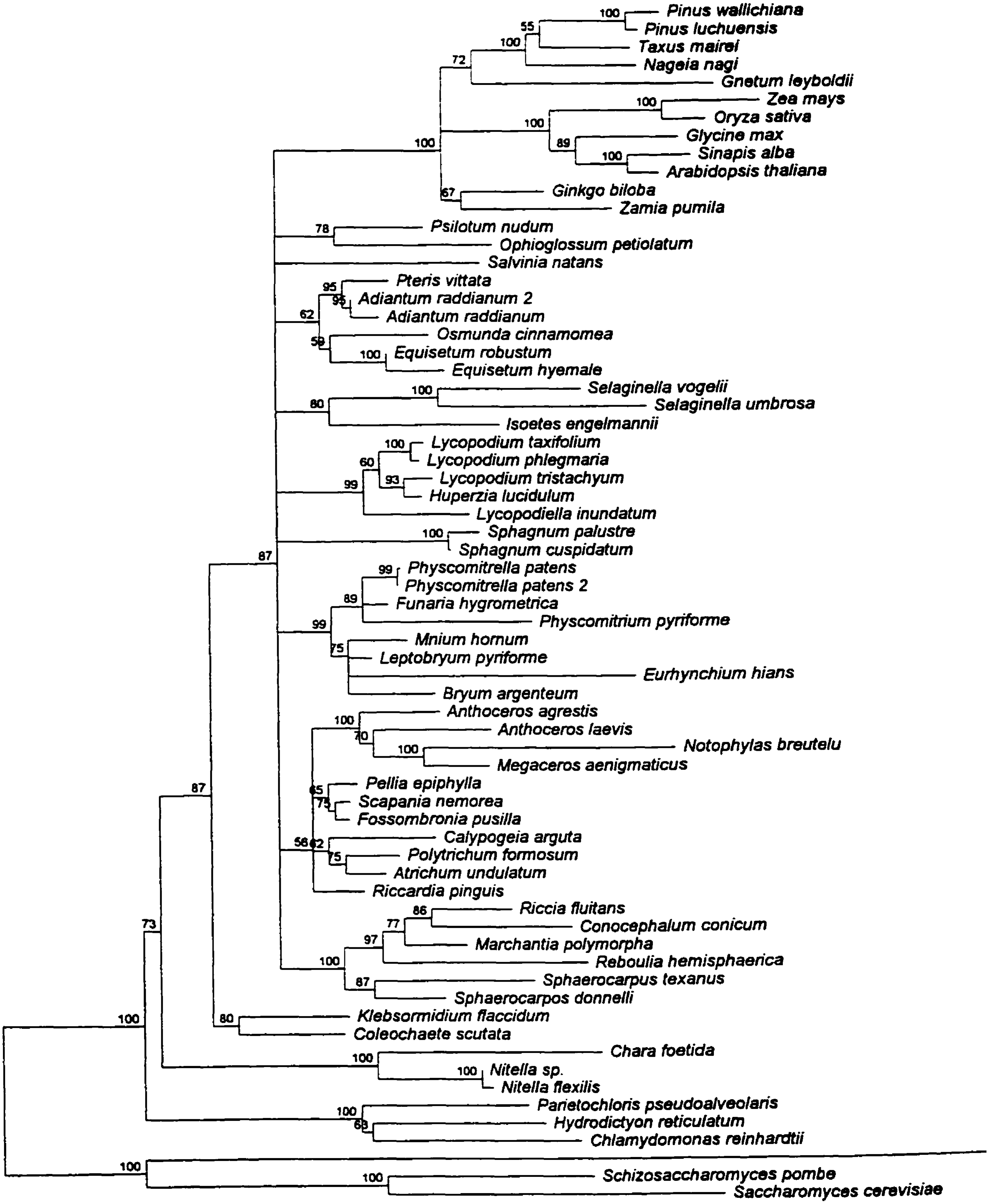


Figure D2.18 *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model). Gamma distance = 1*
50% Majority-Rule Bootstrap Tree

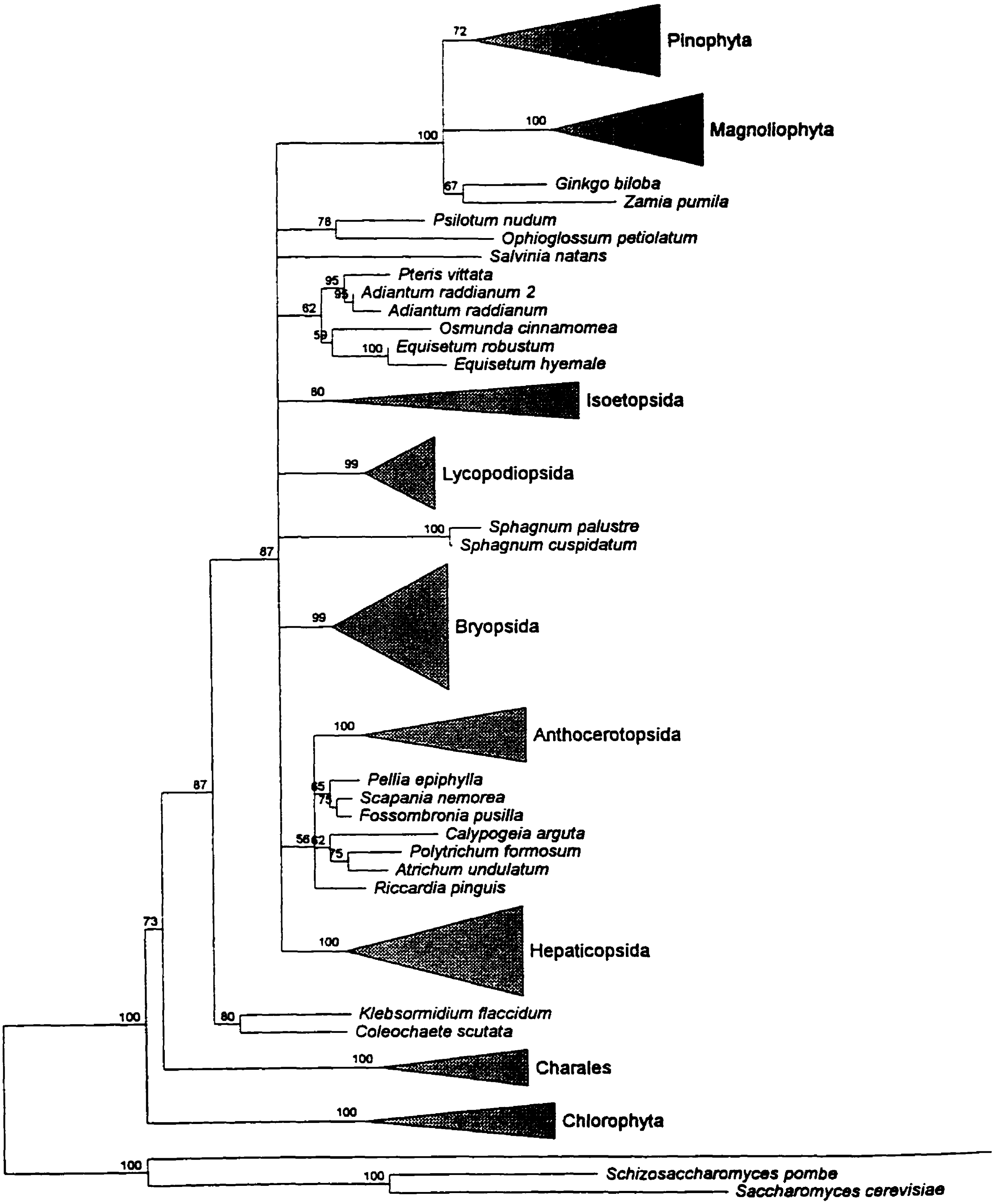


Figure D2.1B *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1*
50% Majority-Rule Bootstrap Tree

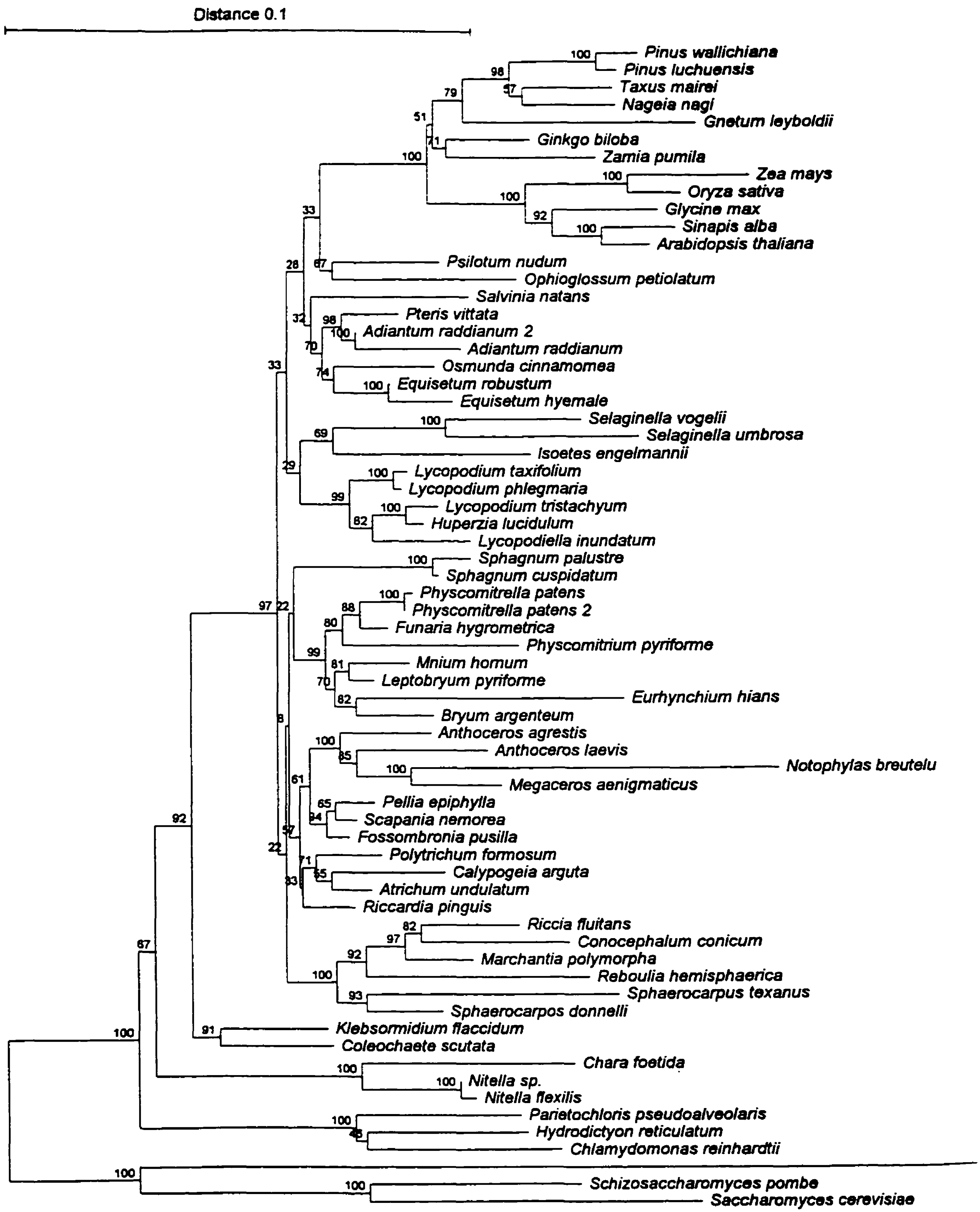


Figure D2.2 *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1 Insertions and Deletions taken into account*

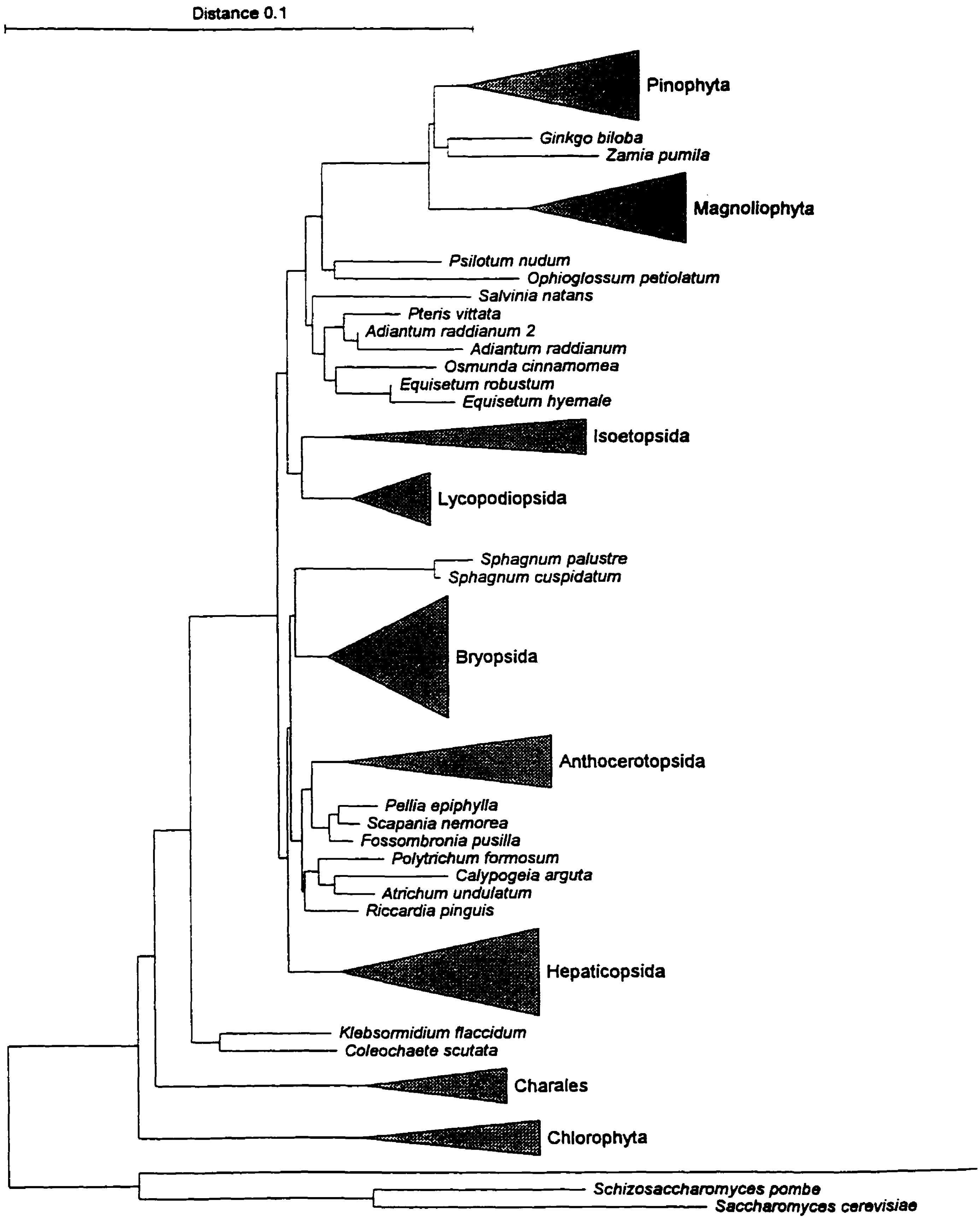


Figure D2.2 Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model). Gamma distance = 1 Insertions and Deletions taken into account

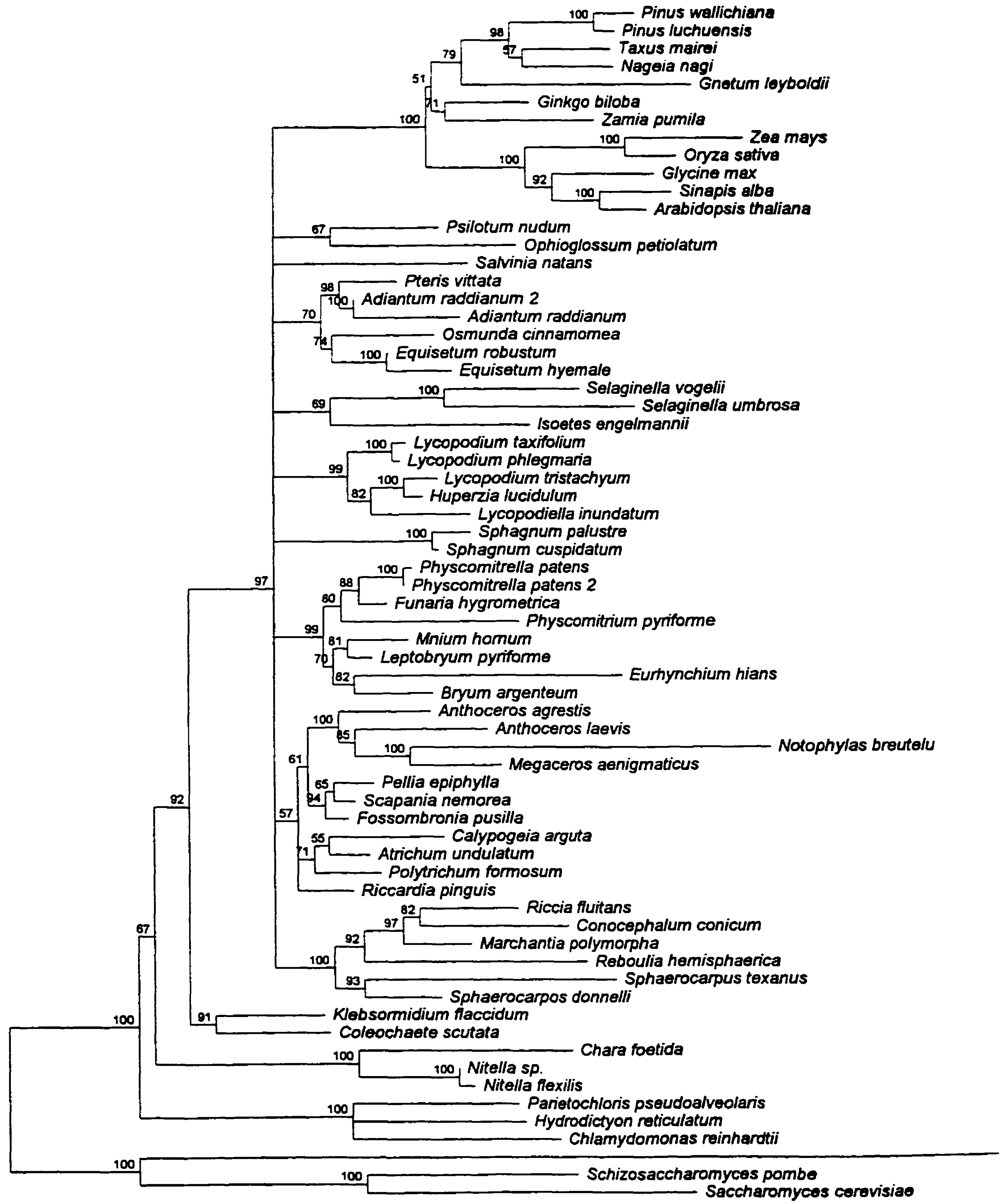


Figure D2.2B Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

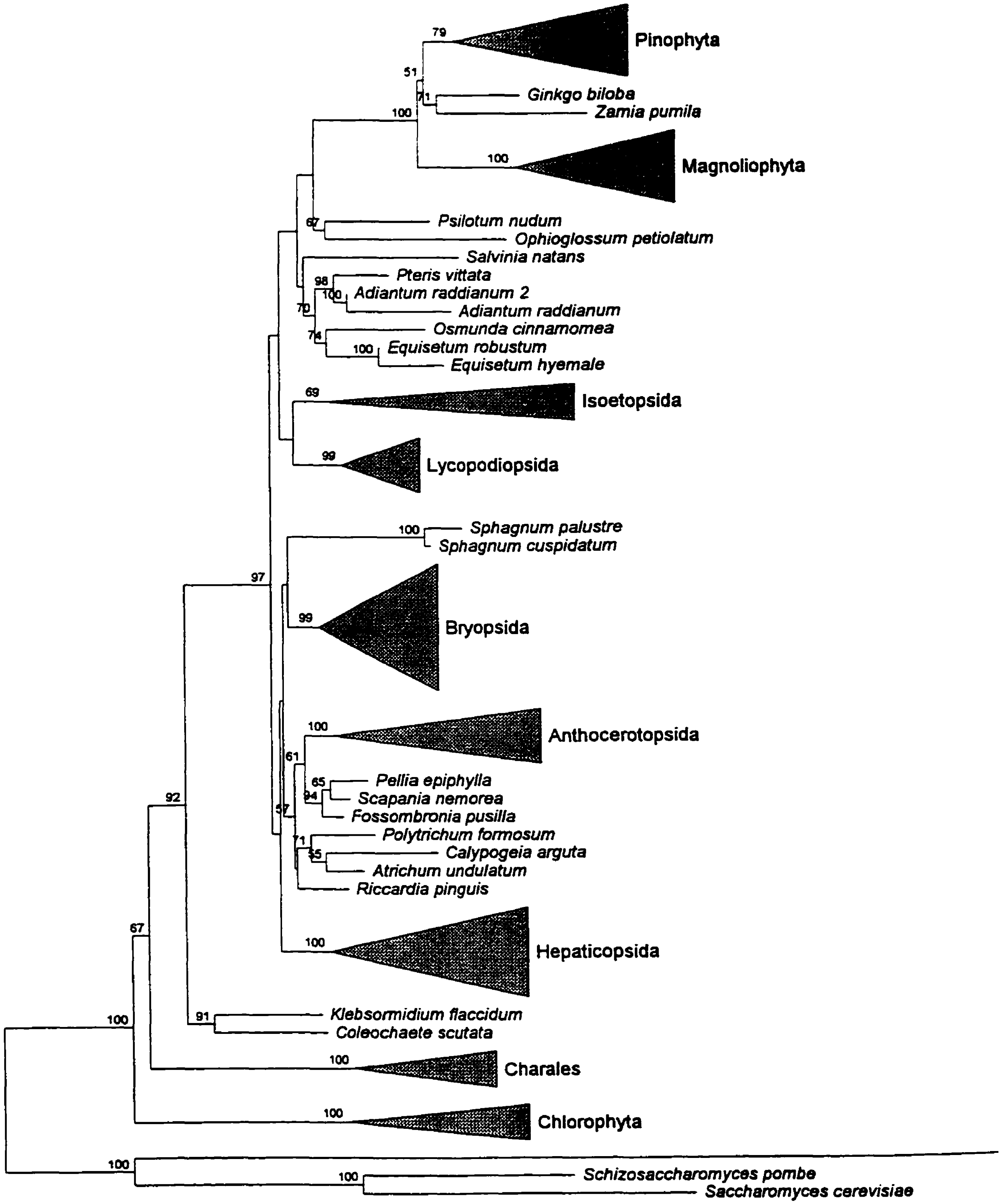


Figure D2.2B *Jin & Nei (Distance Calculation); Kimura 2-p (Evolution Model), Gamma distance = 1*
Insertions and Deletions taken into account
50% Marjority-Rule Bootstrap Tree

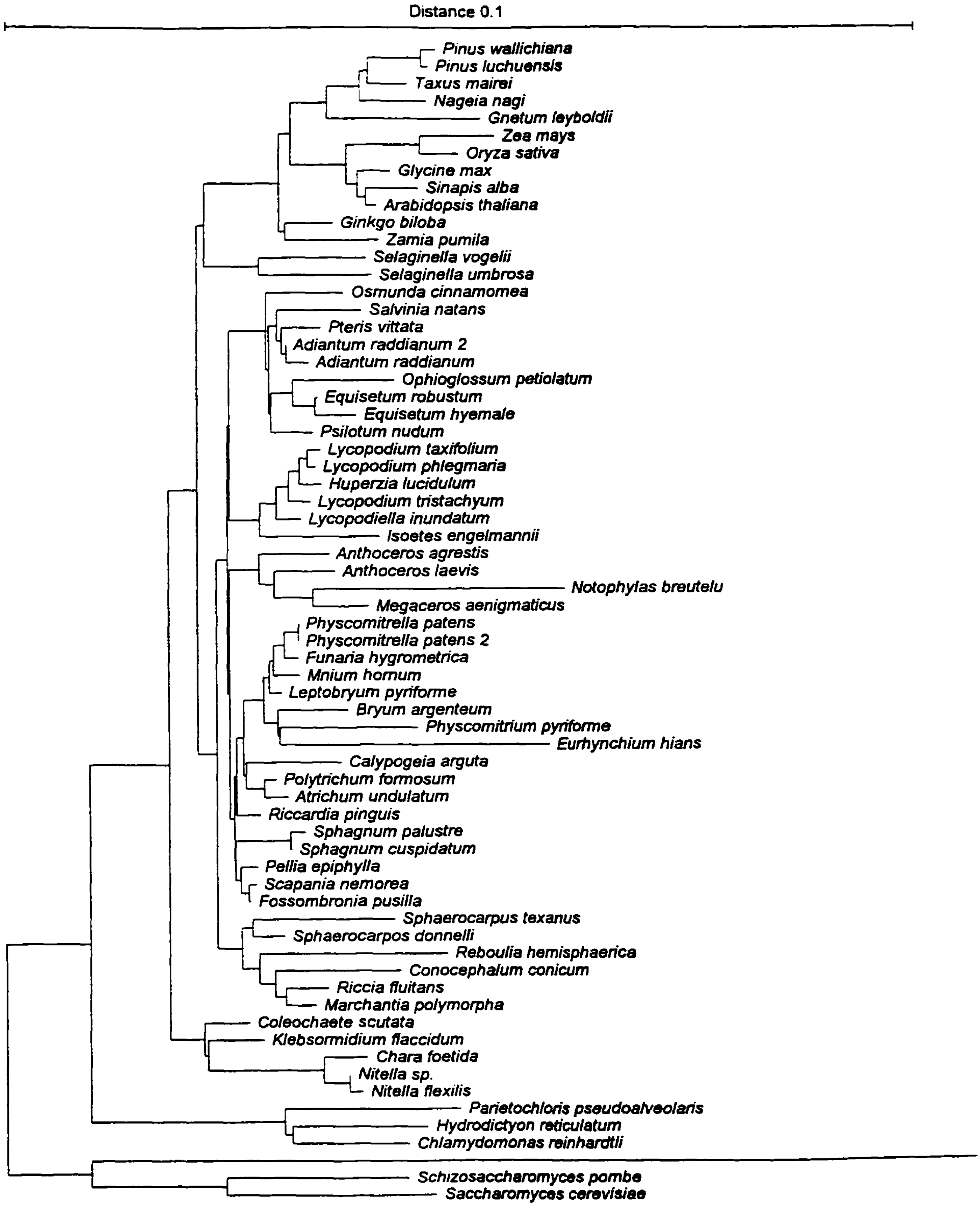


Figure E1 *Transversions Only; Neighbor-joining*

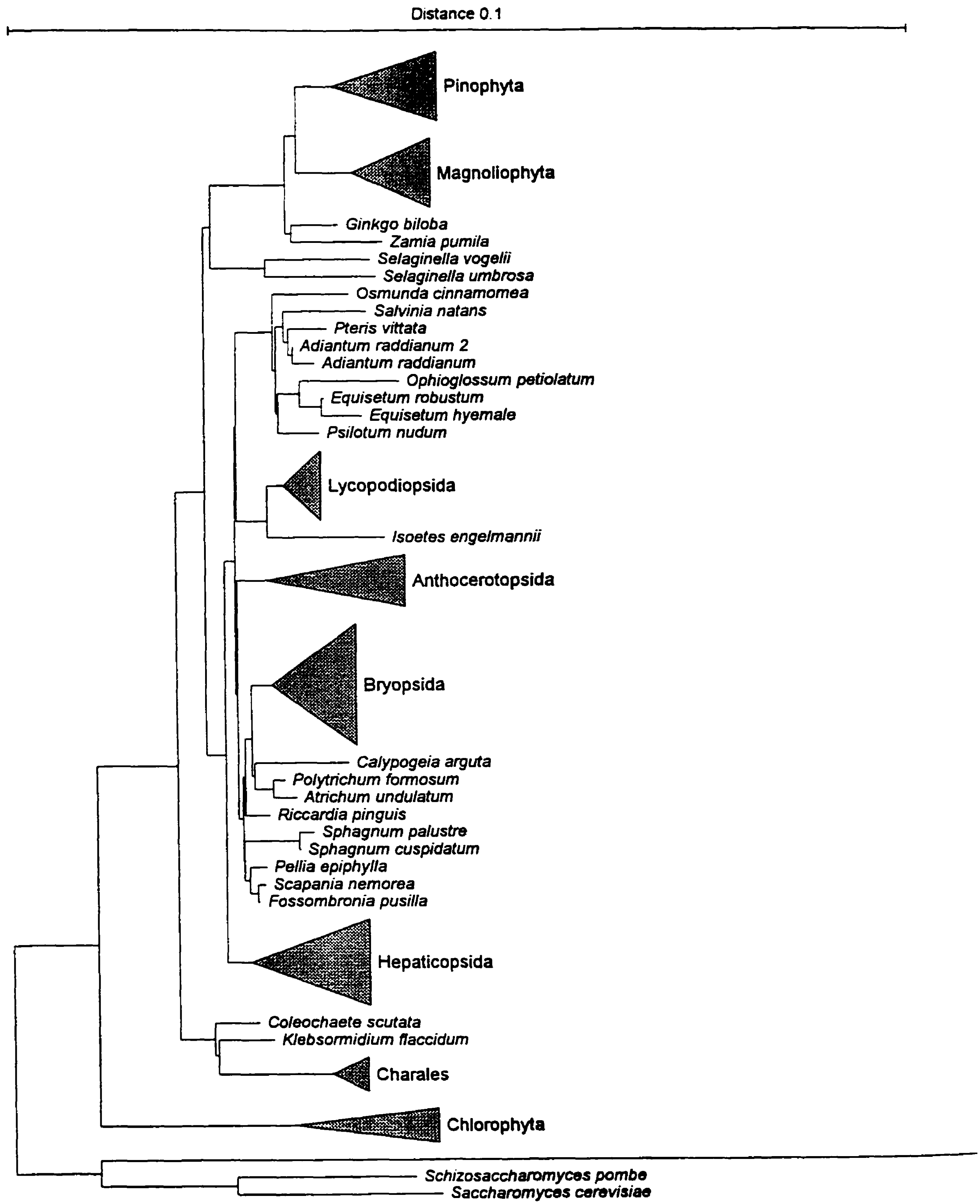


Figure E1 Transversions Only; Neighbor-joining

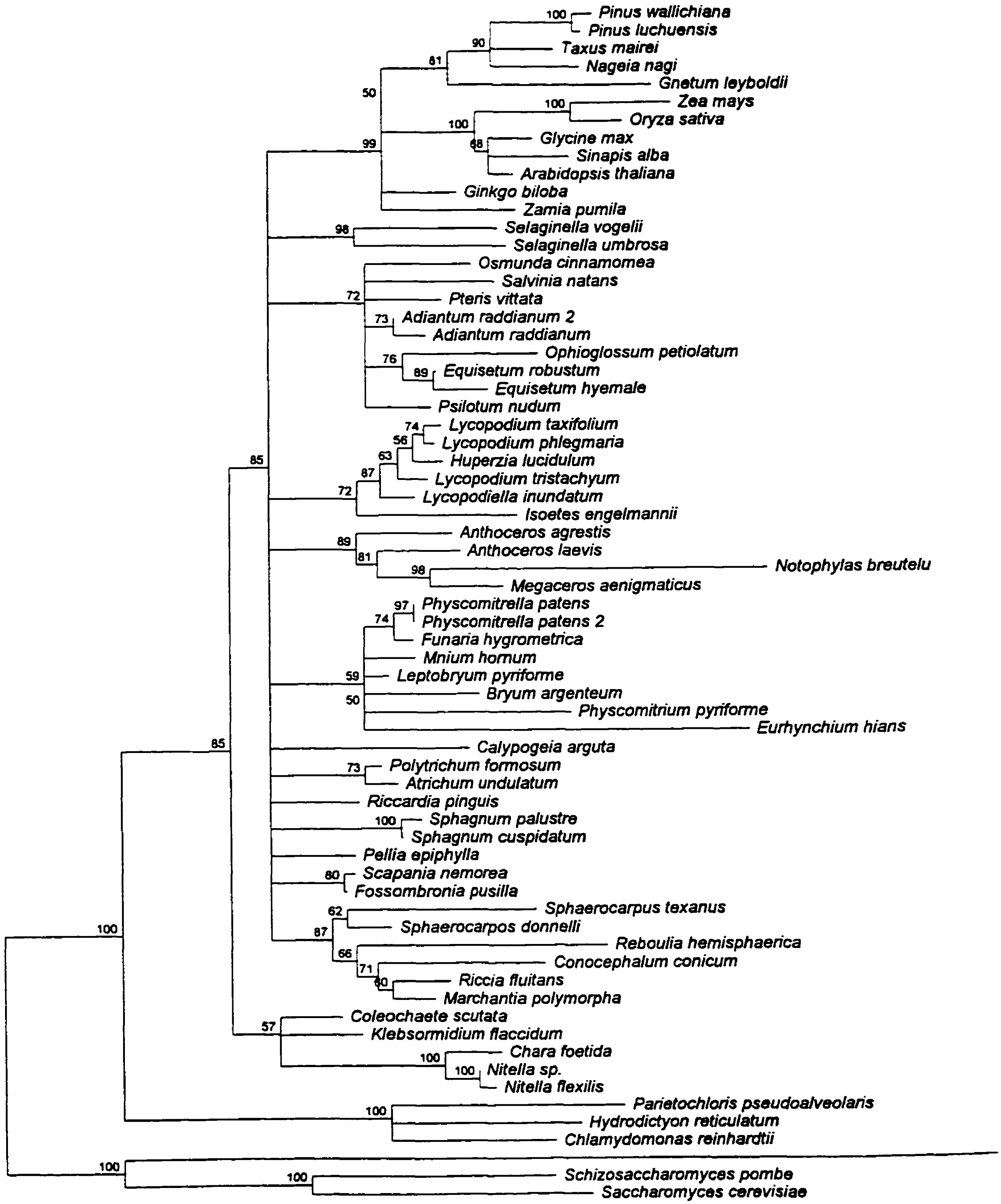


Figure E1B *Transversions Only; Neighbor-joining 50% Majority-Rule Bootstrap Tree*

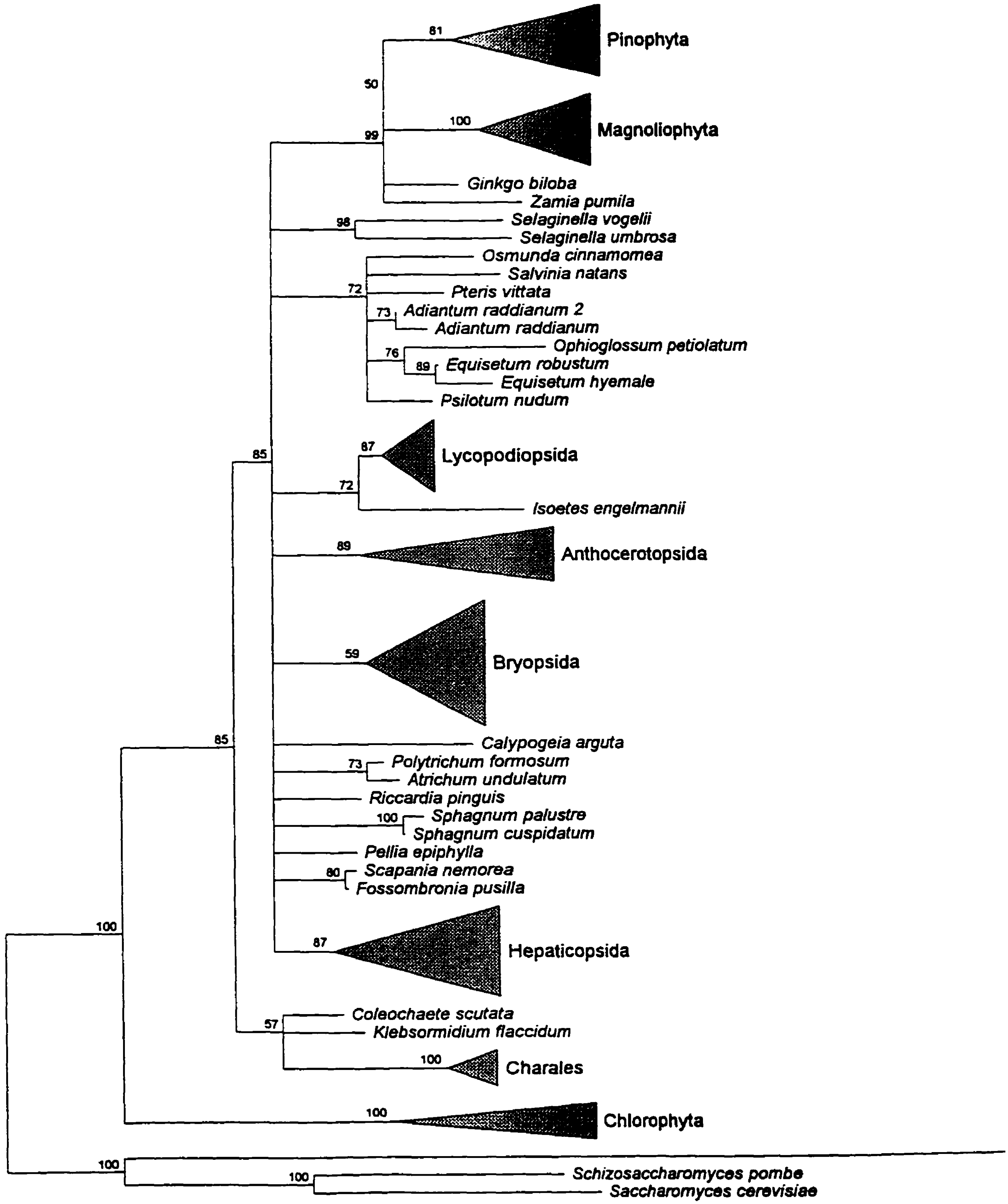


Figure E1B Transversions Only; Neighbor-joining 50% Majority-Rule Bootstrap Tree

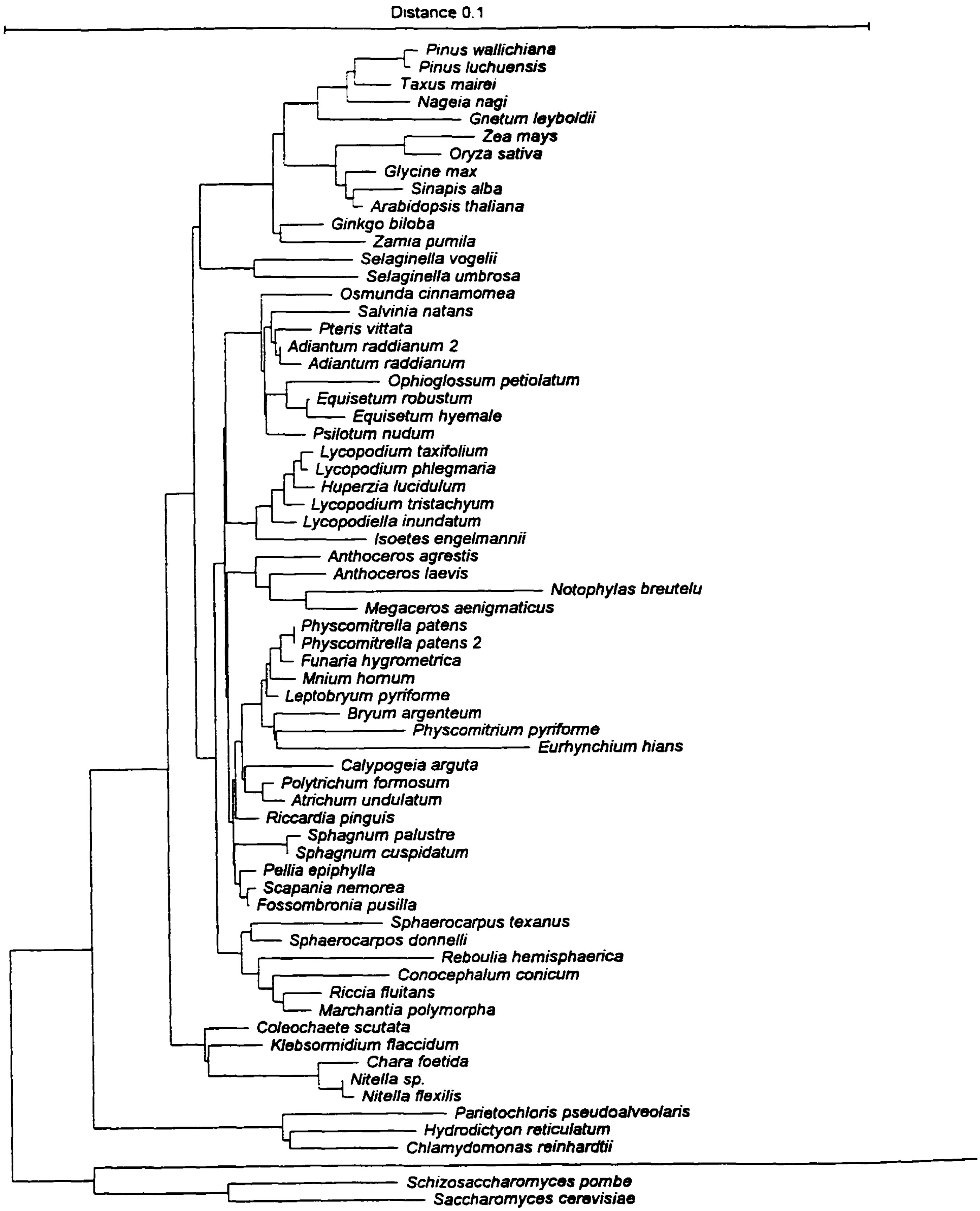


Figure E2 Transversions Only; Neighbor-joining Insertions & Deletions taken into account

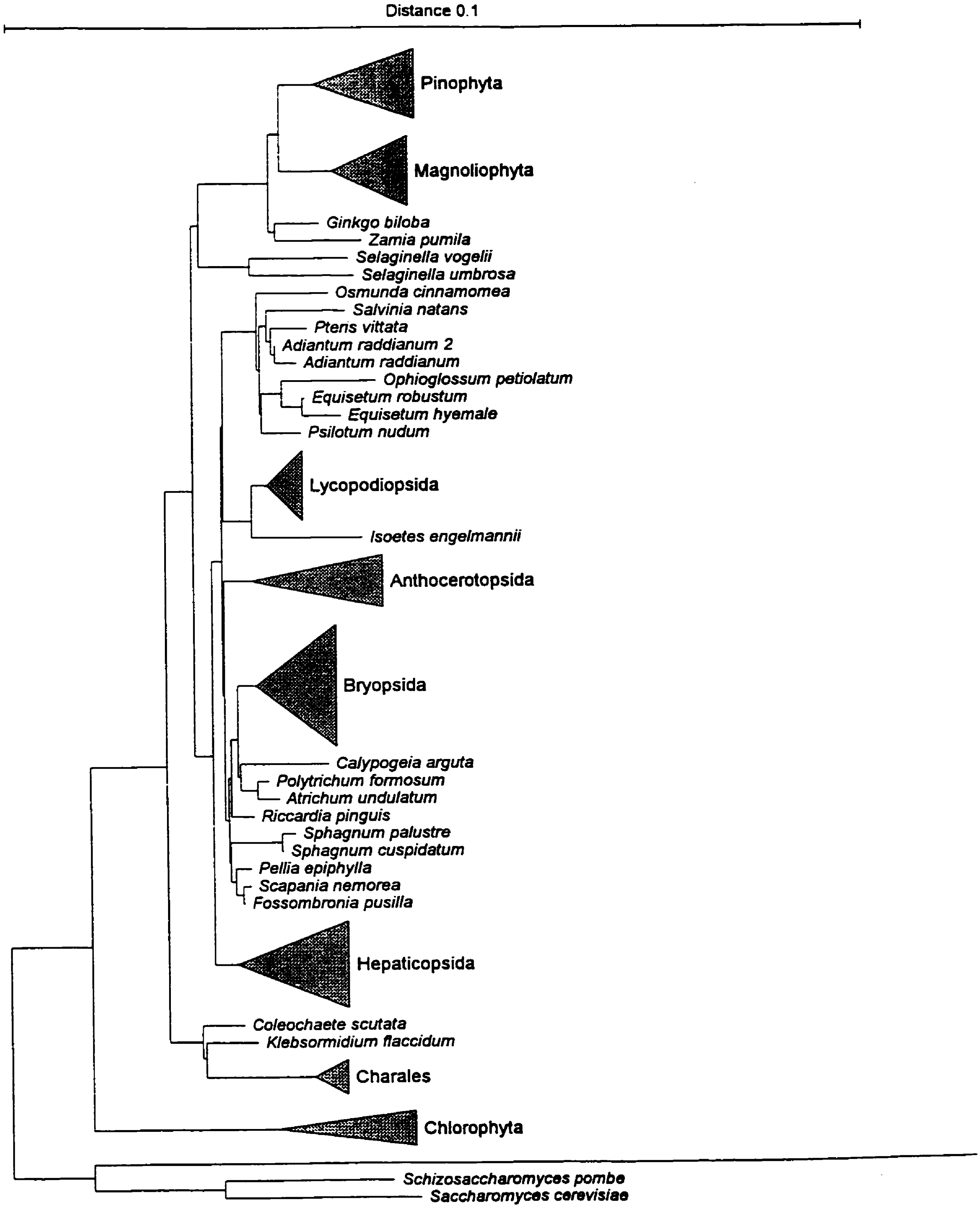


Figure E2 *Transversions Only; Neighbor-joining Insertions & Deletions taken into account*

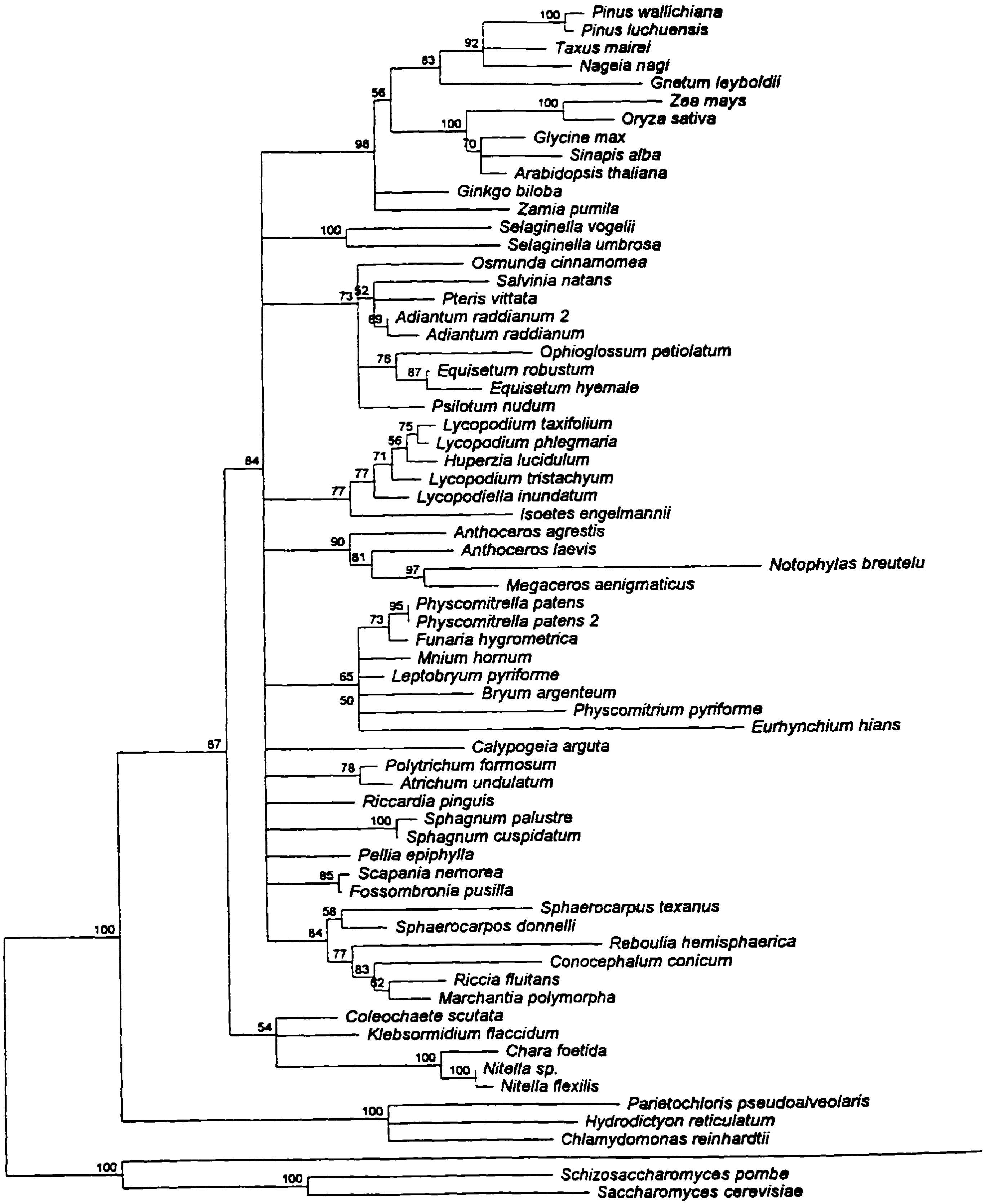


Figure E2B *Transversions Only; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

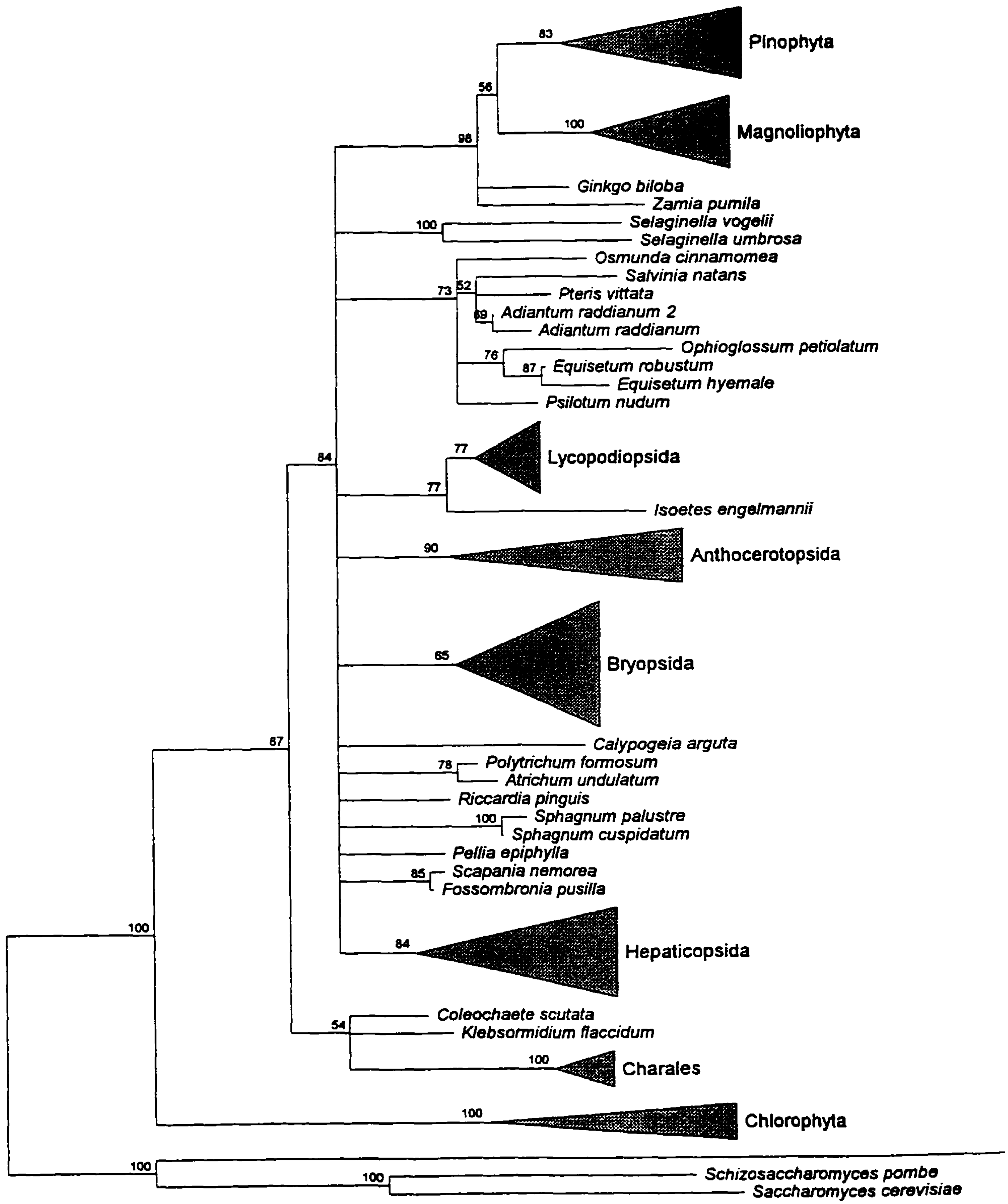


Figure E2B *Transversions Only; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

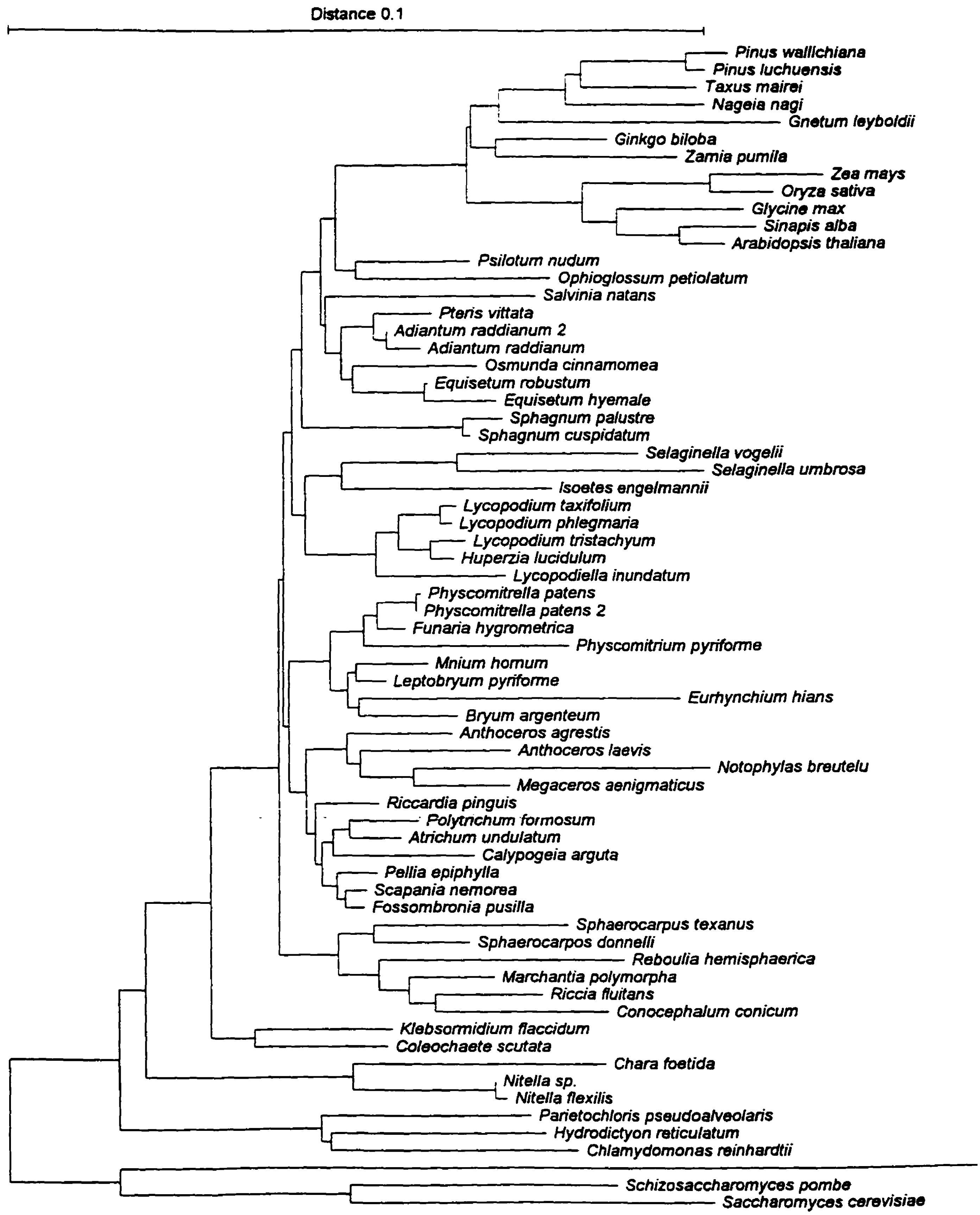


Figure F1   No Correction; Neighbor-joining

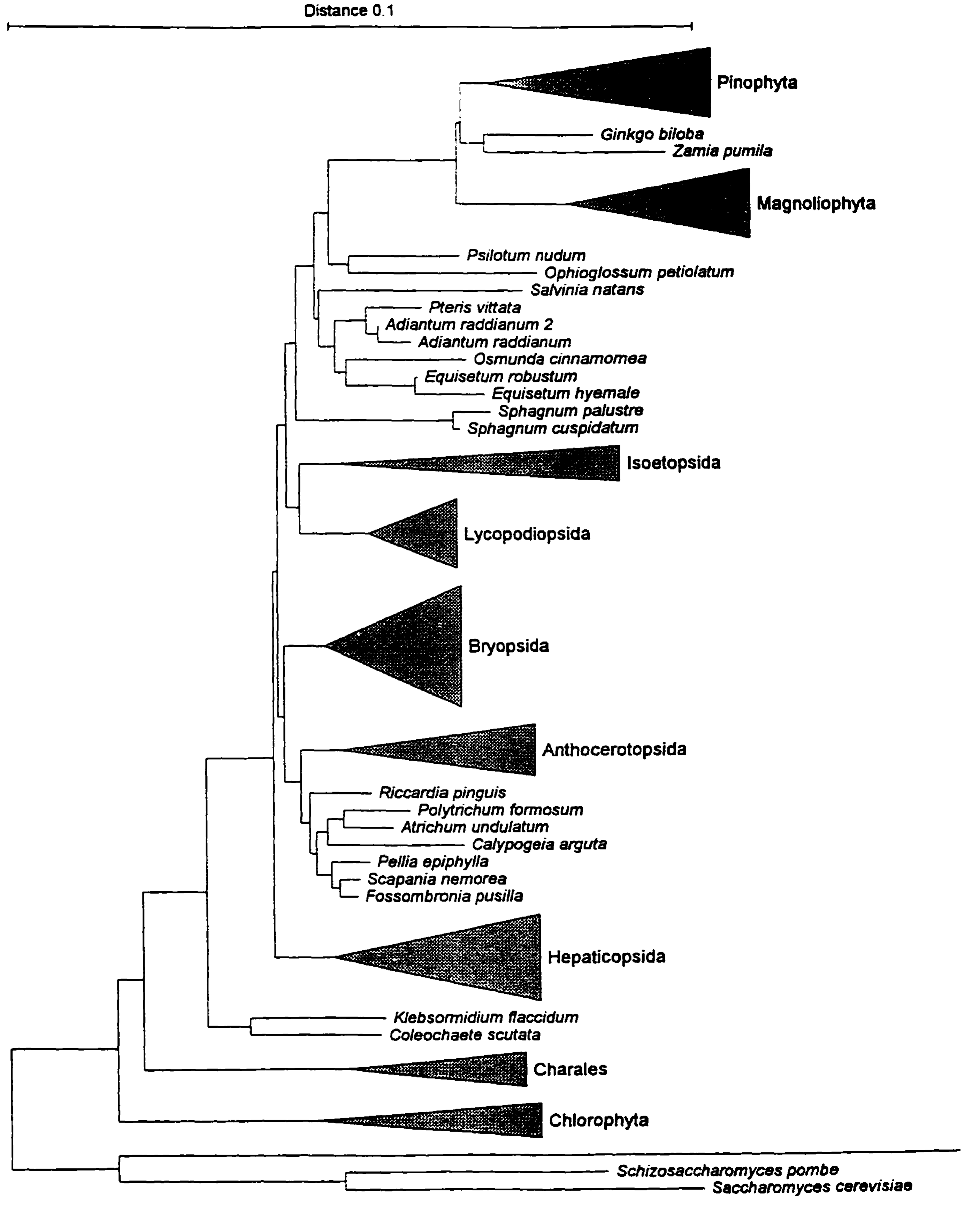


Figure F1 No Correction; Neighbor-joining

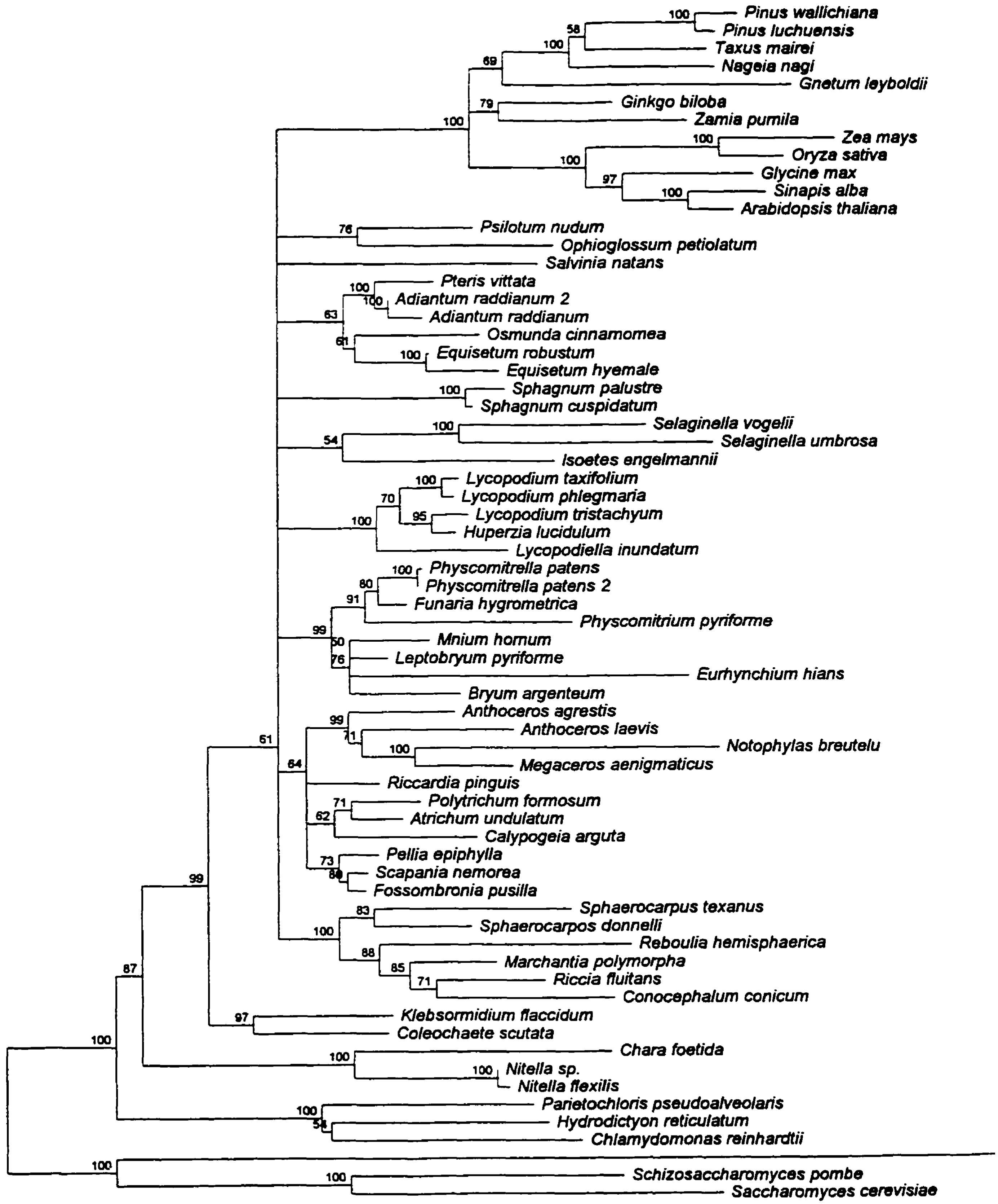


Figure F1B No Correction; Neighbor-joining
50% Majority-Rule Bootstrap Tree

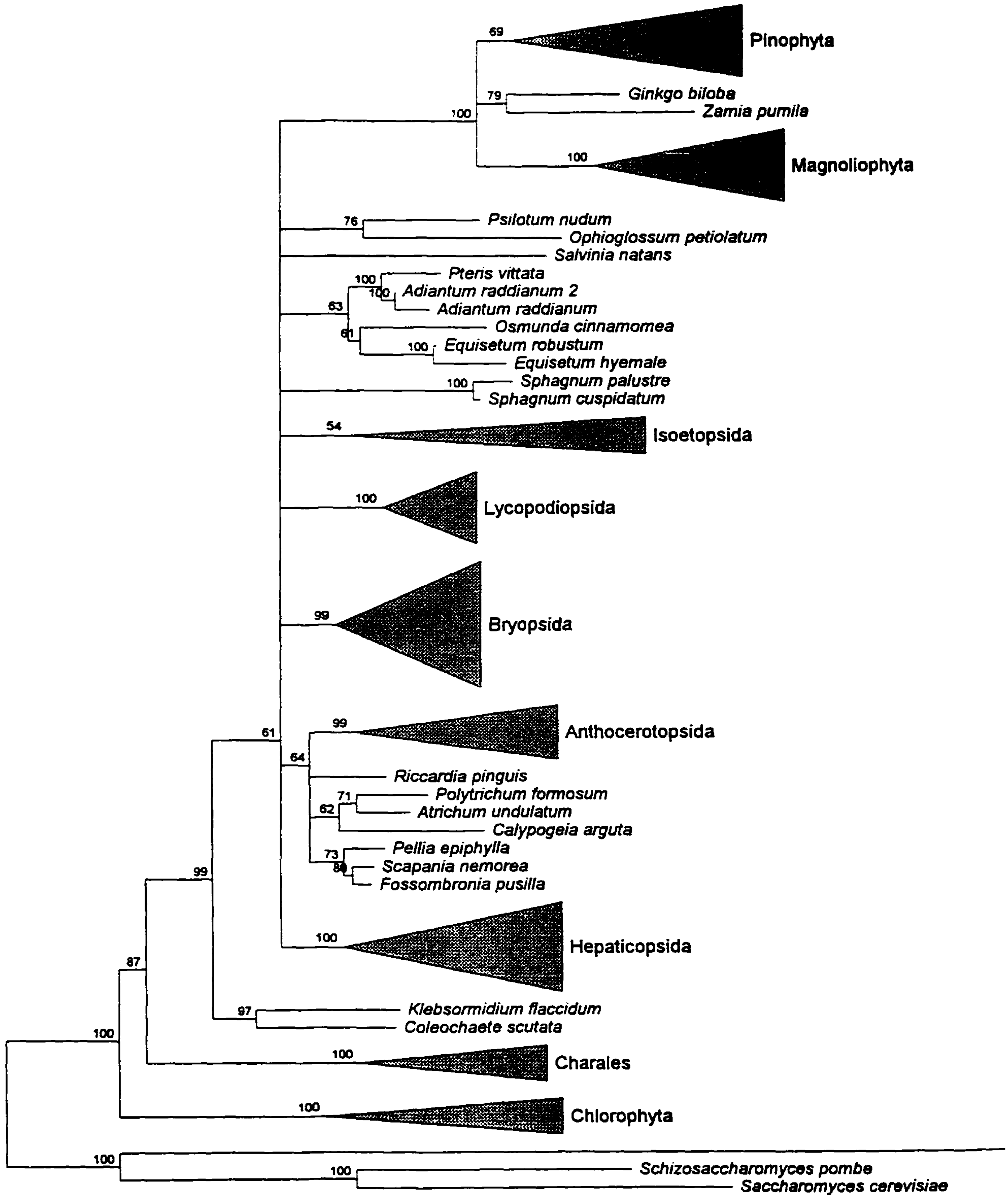


Figure F1B No Correction; Neighbor-joining 50% Majority-Rule Bootstrap Tree

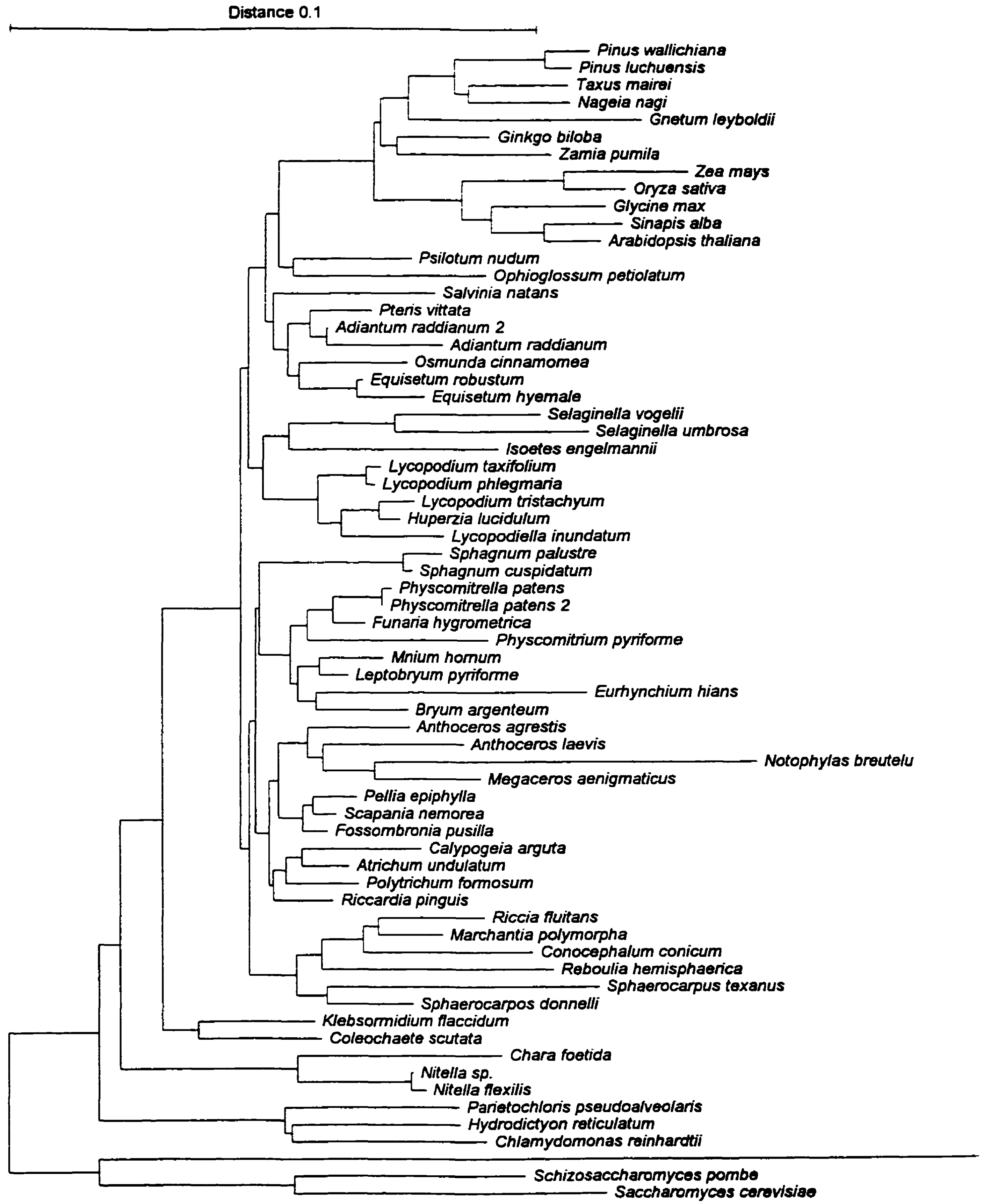


Figure F2 No Correction; Neighbor-joining
Insertions & Deletions taken into account

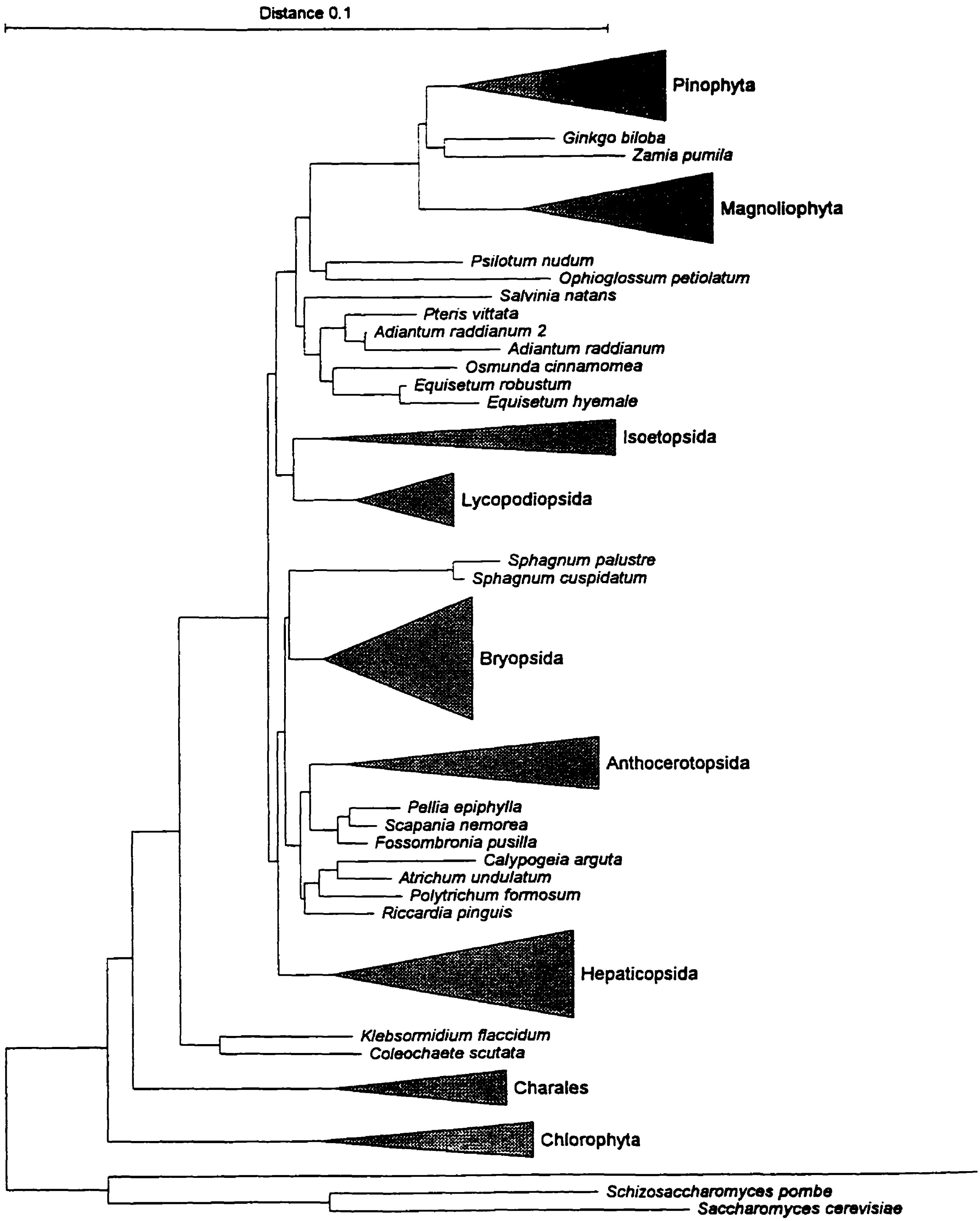


Figure F2 No Correction; Neighbor-joining
Insertions & Deletions taken into account

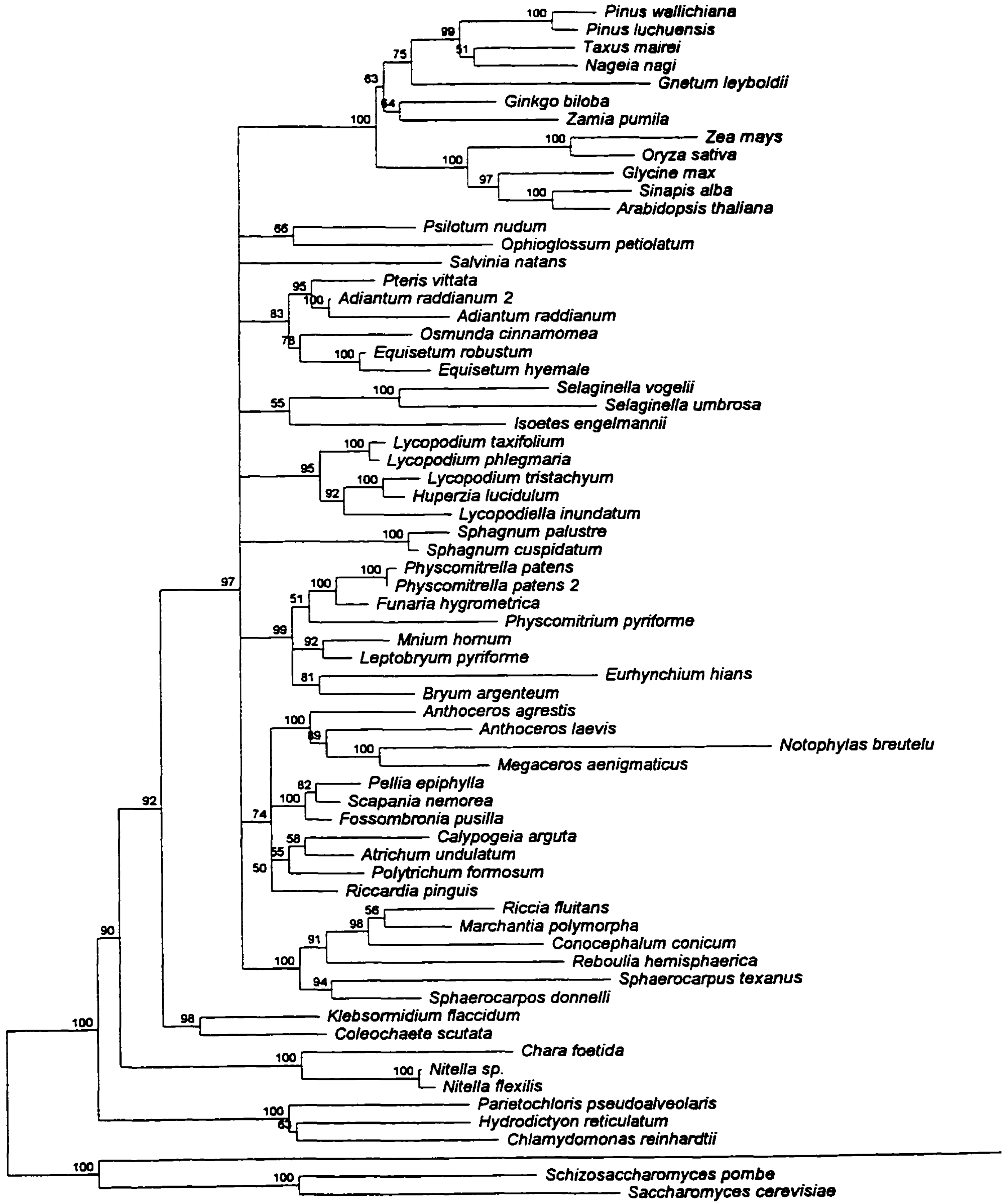


Figure F2B *No Correction; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

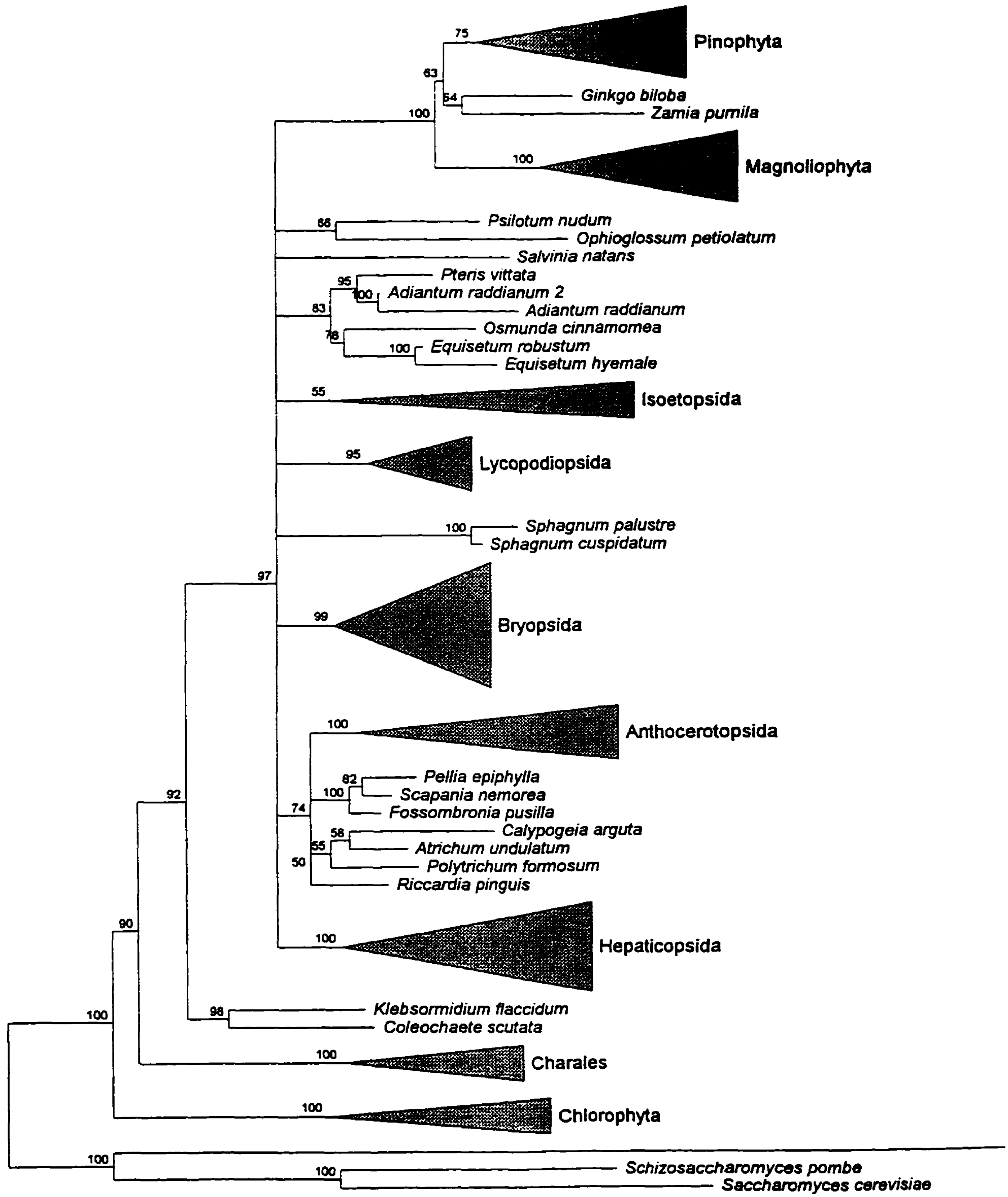


Figure F2B *No Correction; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

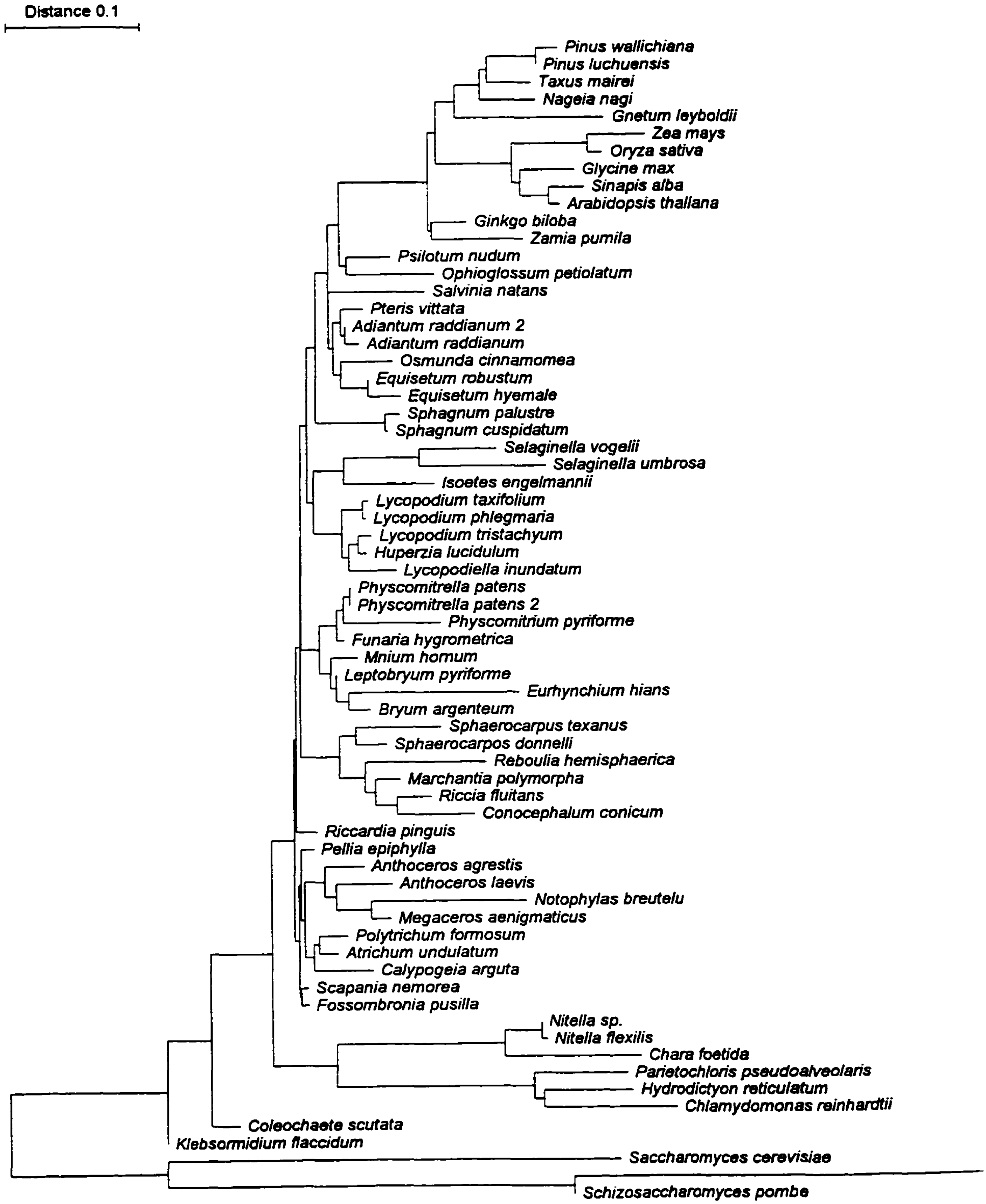


Figure G1 *Van de Peer & De Wachter; Neighbor-joining*

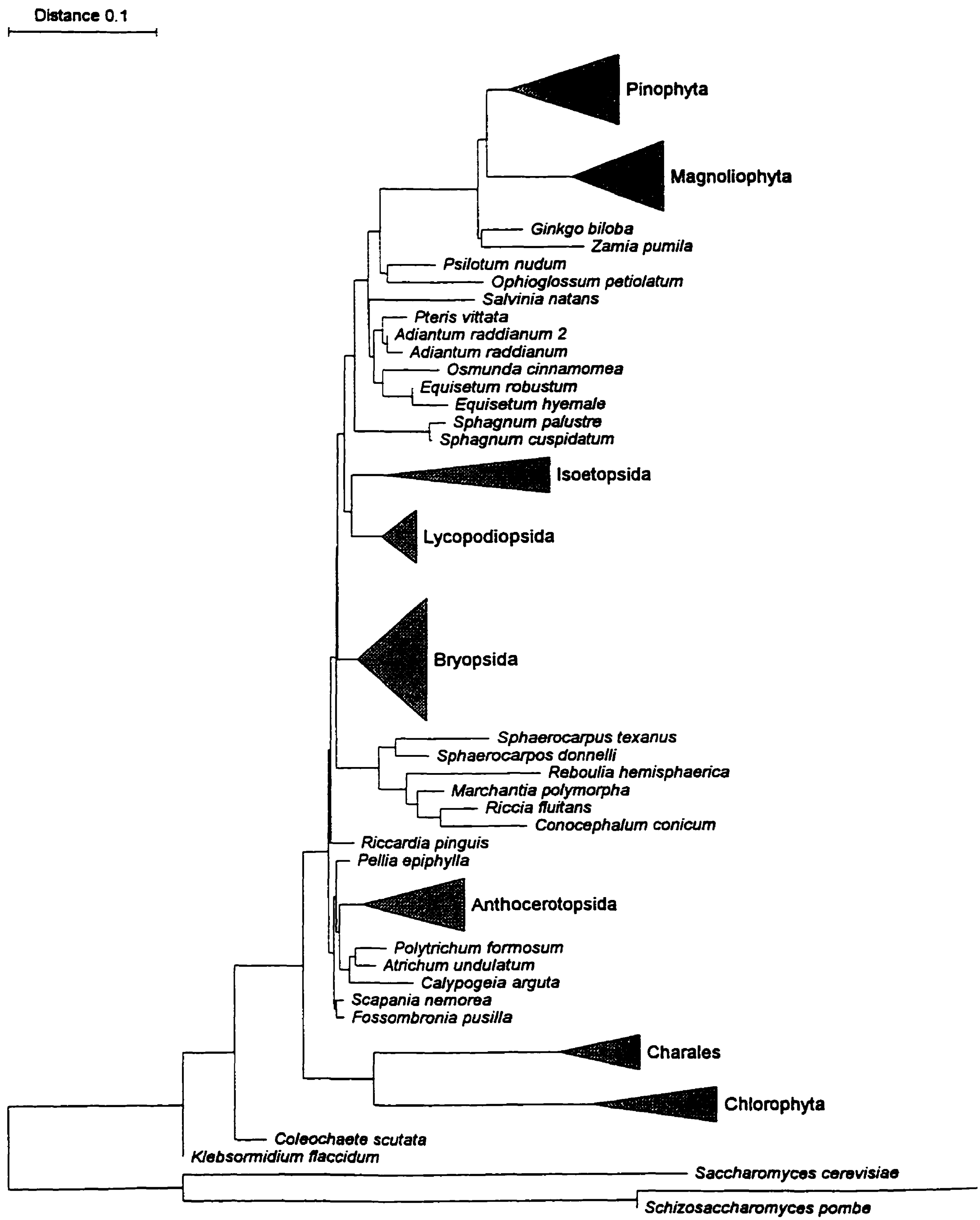


Figure G1 Van de Peer & De Wachter; Neighbor-joining

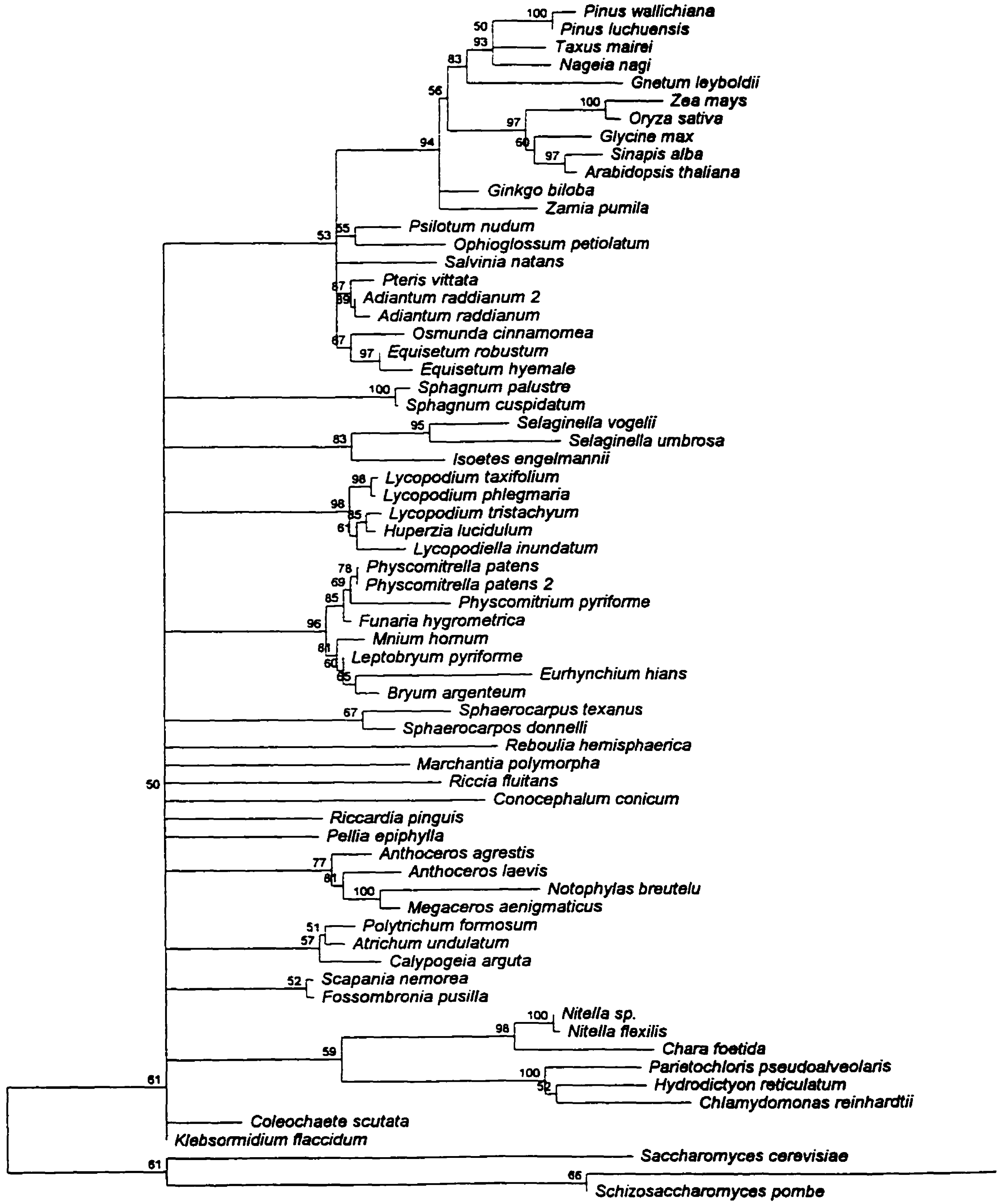


Figure G1B *Van de Peer & De Wachter: Neighbor-joining 50% Majority-Rule Bootstrap Tree*

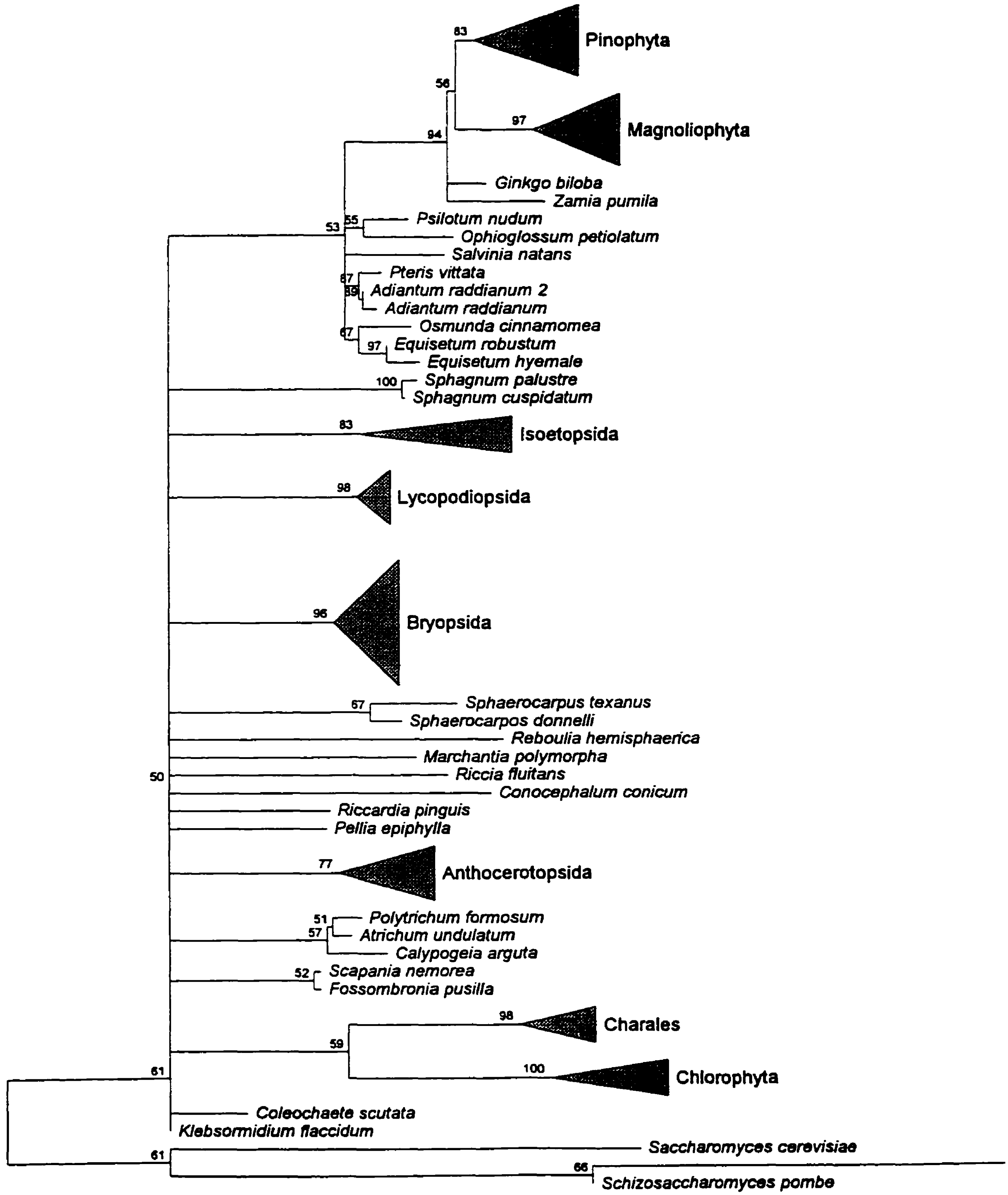


Figure G1B *Van de Peer & De Wachter; Neighbor-joining 50% Majority-Rule Bootstrap Tree*

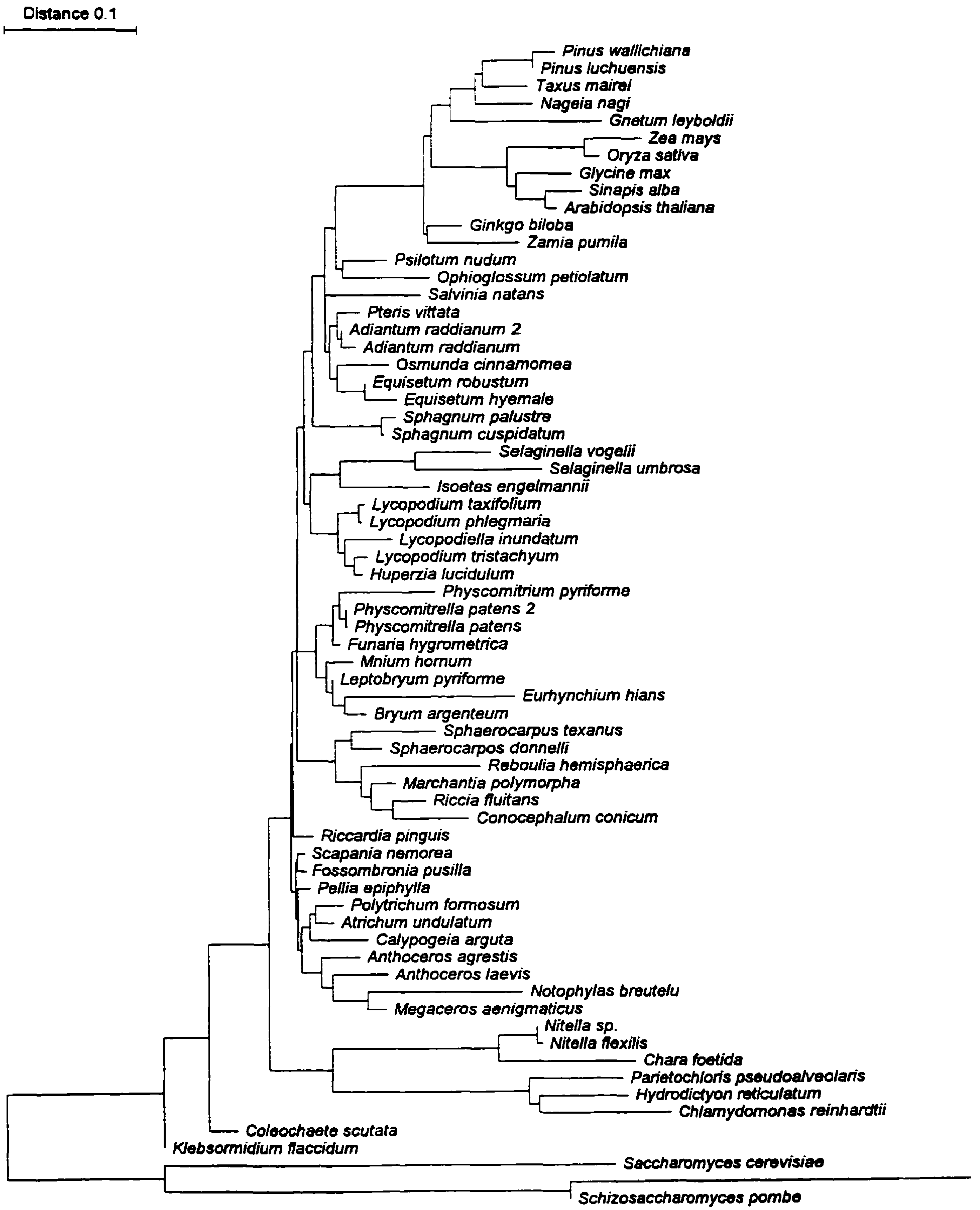


Figure G2 *Van de Peer & De Wachter*
Insertions & Deletions taken into account

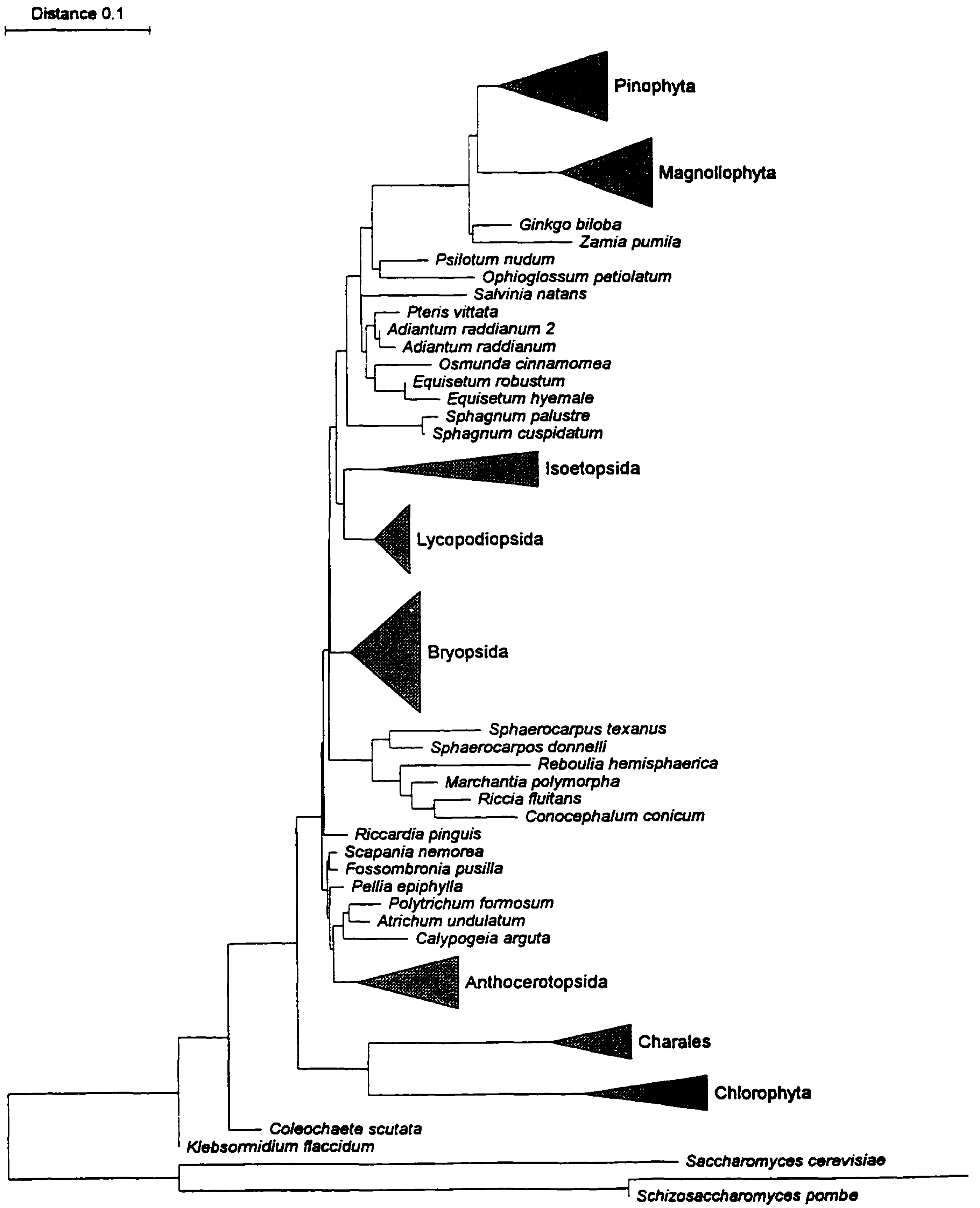


Figure G2 Van de Peer & De Wachter
Insertions & Deletions taken into account

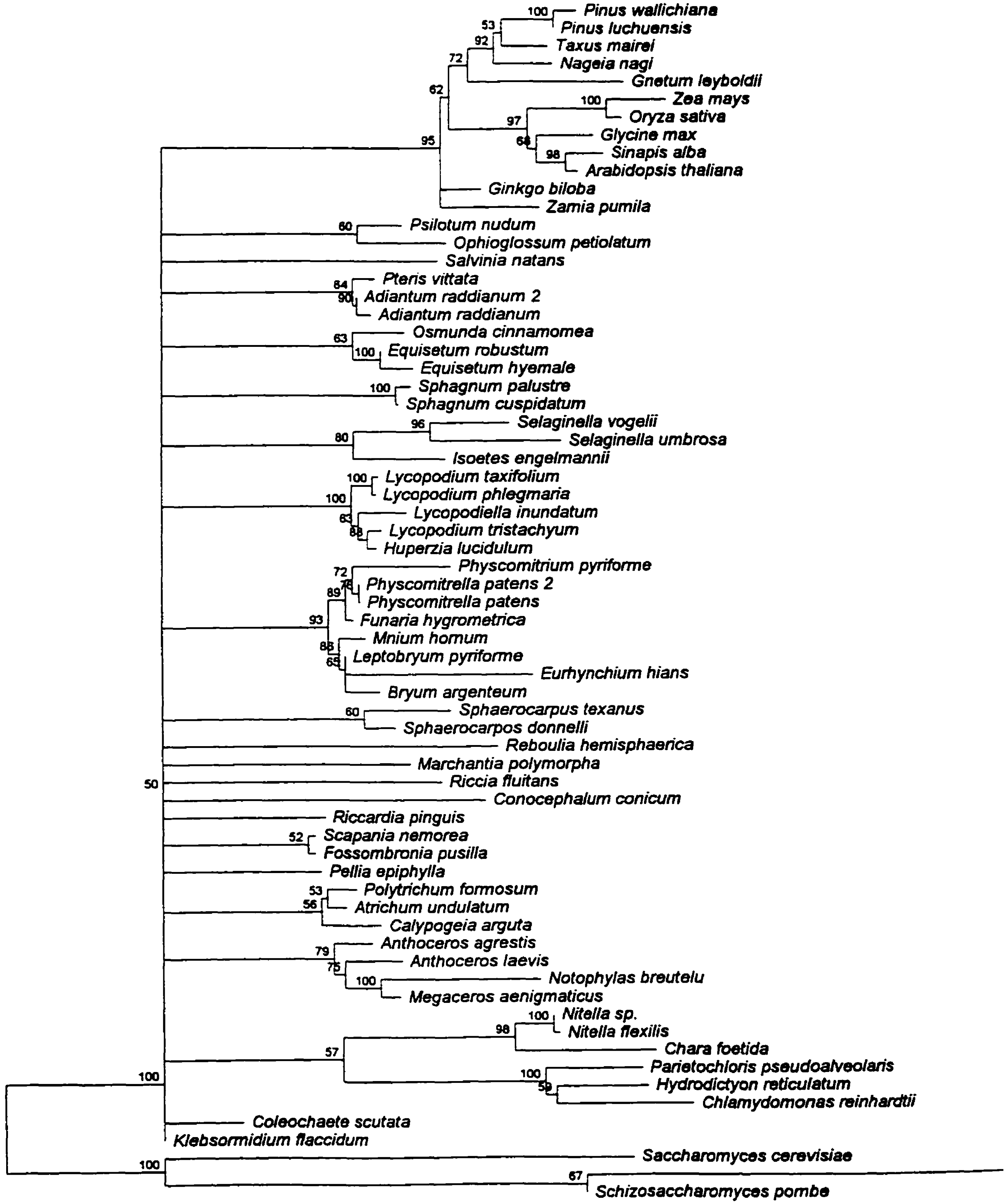


Figure G2B Van de Peer & De Wachter
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

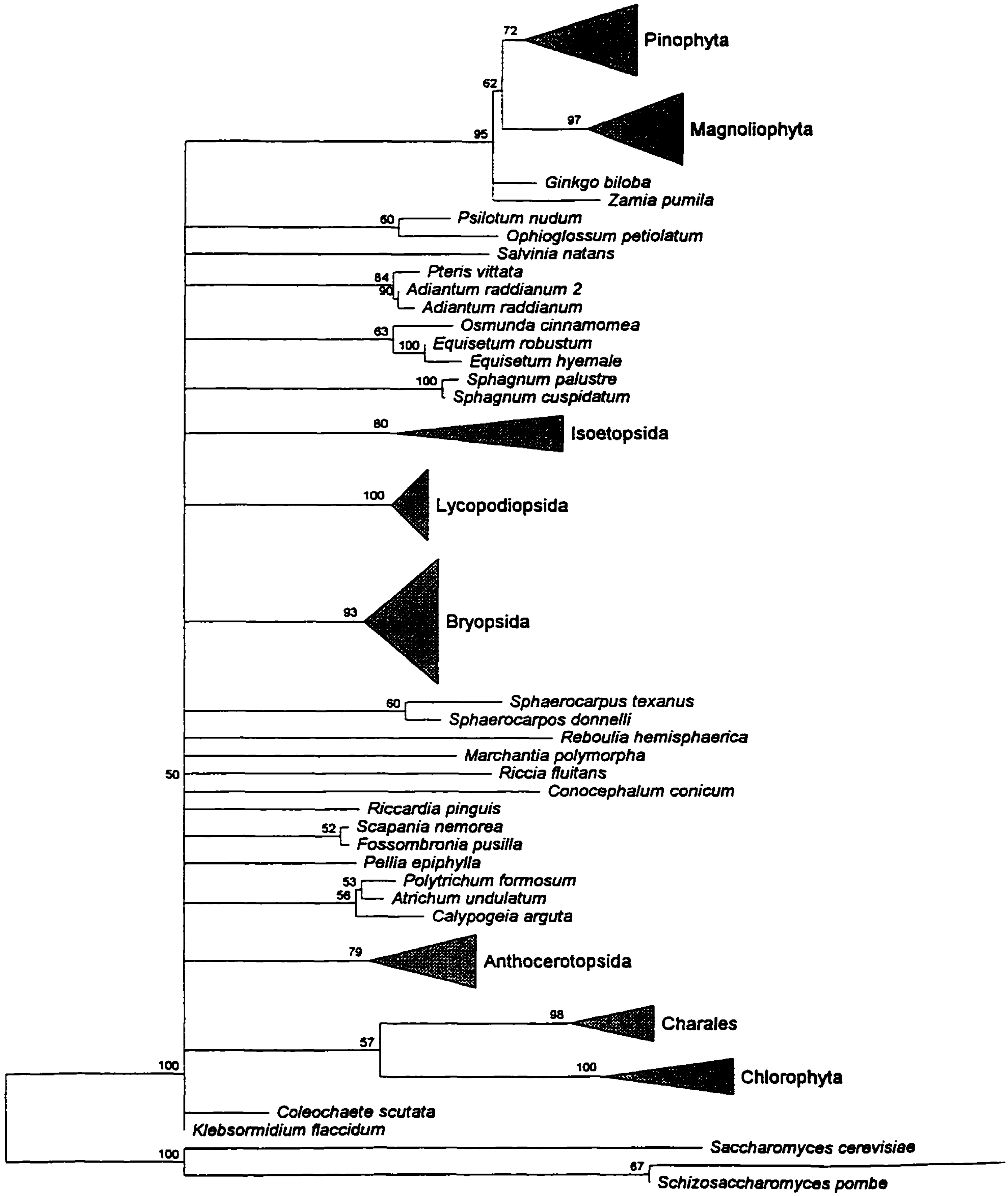


Figure G2B *Van de Peer & De Wachter*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree

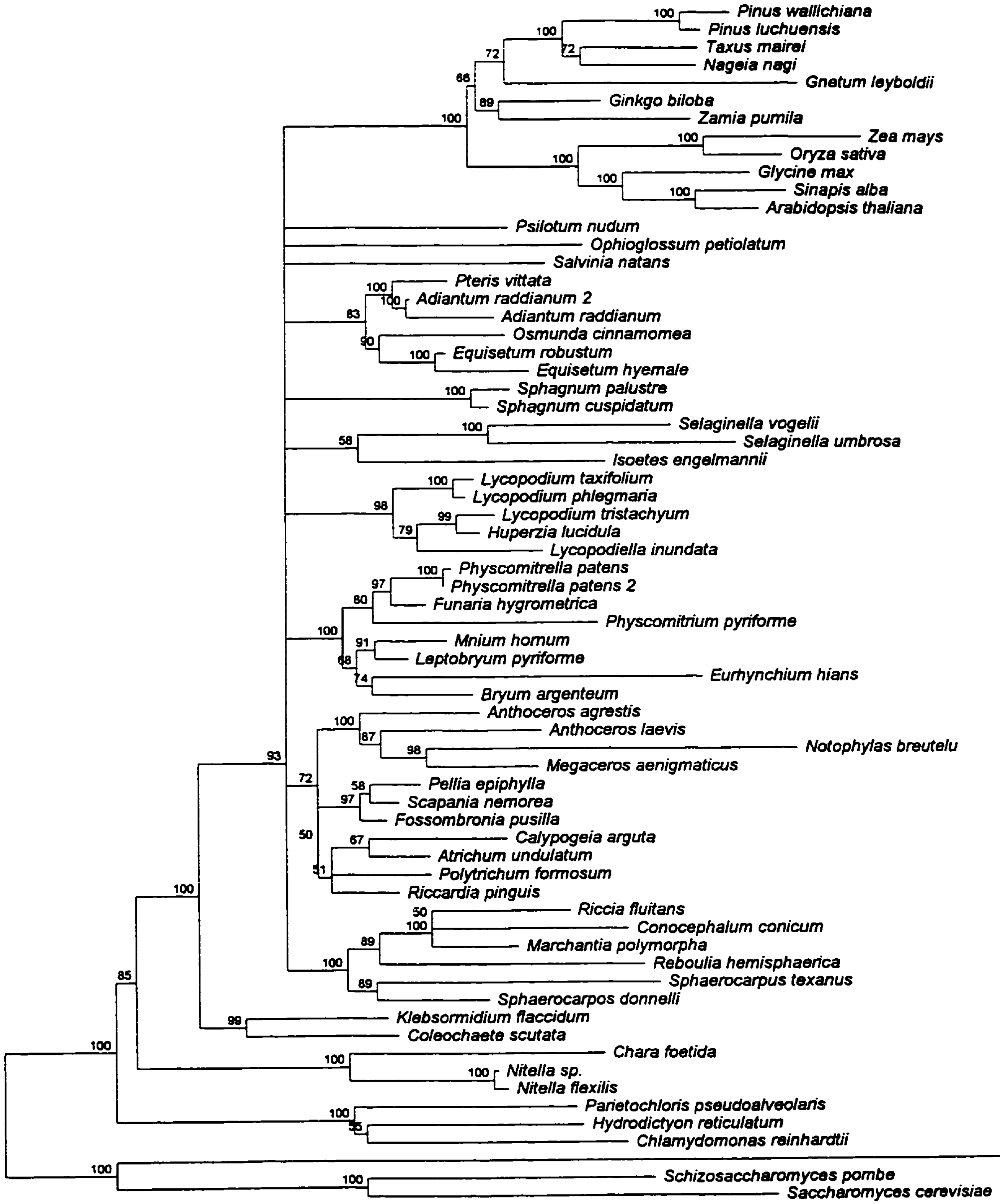


Figure H1B *No Correction; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree
Only Categories 0, 1, 2, 3, 4

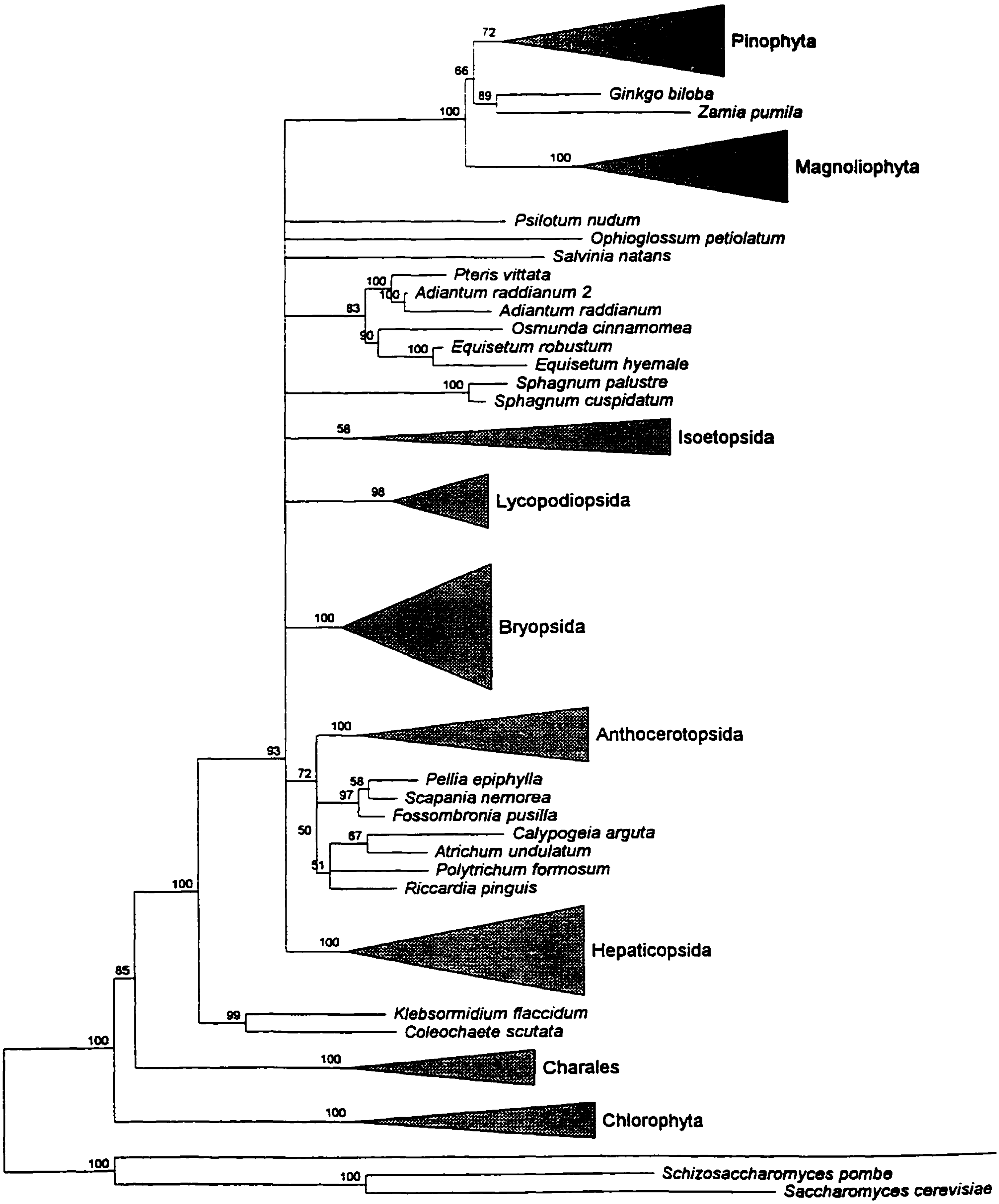


Figure H1B *No Correction; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree
Only Categories 0, 1, 2, 3, 4

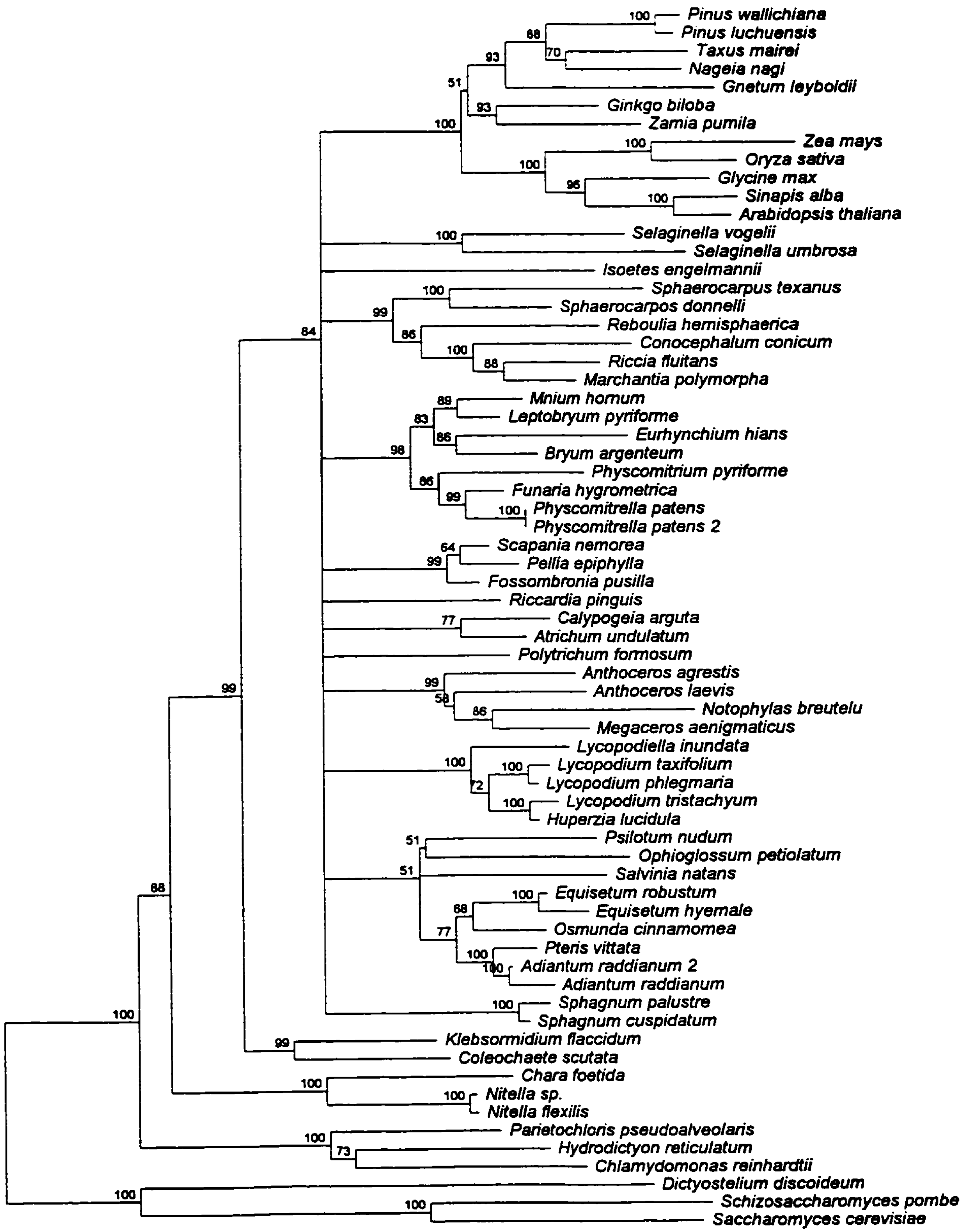


Figure H2B No Correction; Neighbor-joining
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree
Only Categories 0, 1, 2

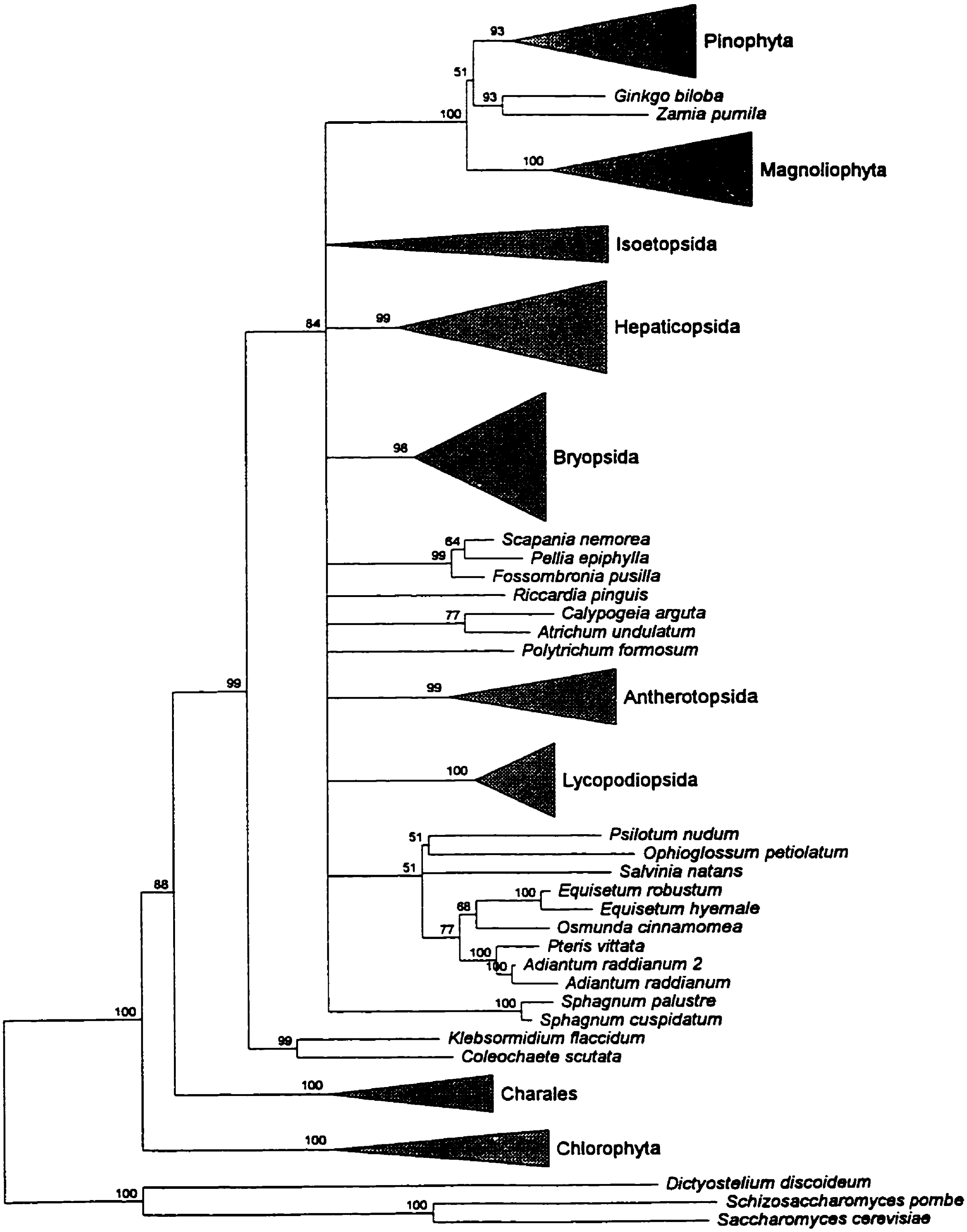


Figure H2B *No Correction; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree
Only Categories 0, 1, 2

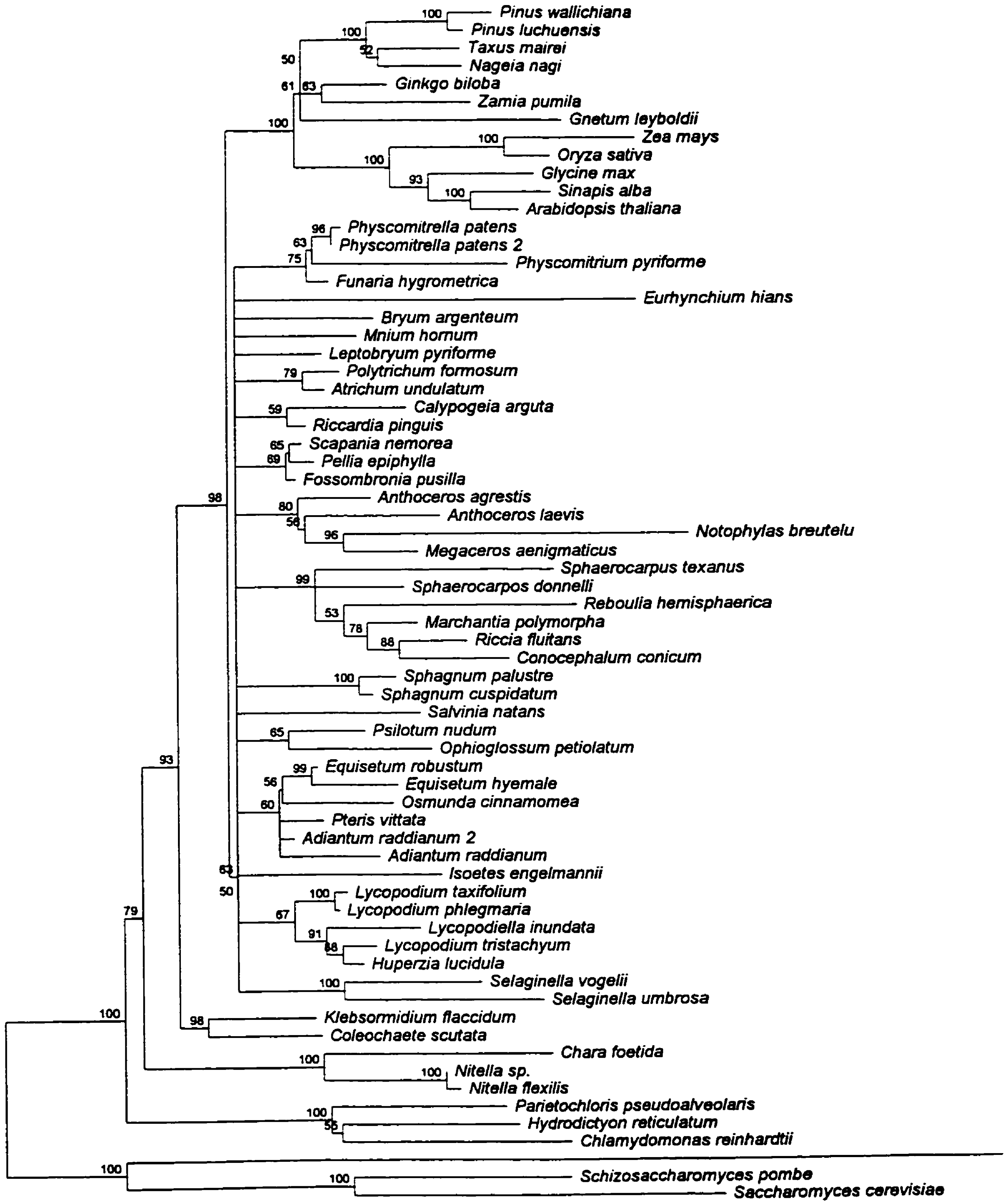


Figure H3B No Correction; Neighbor-joining
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree
Only Categories 2, 3, 4, 5, 6

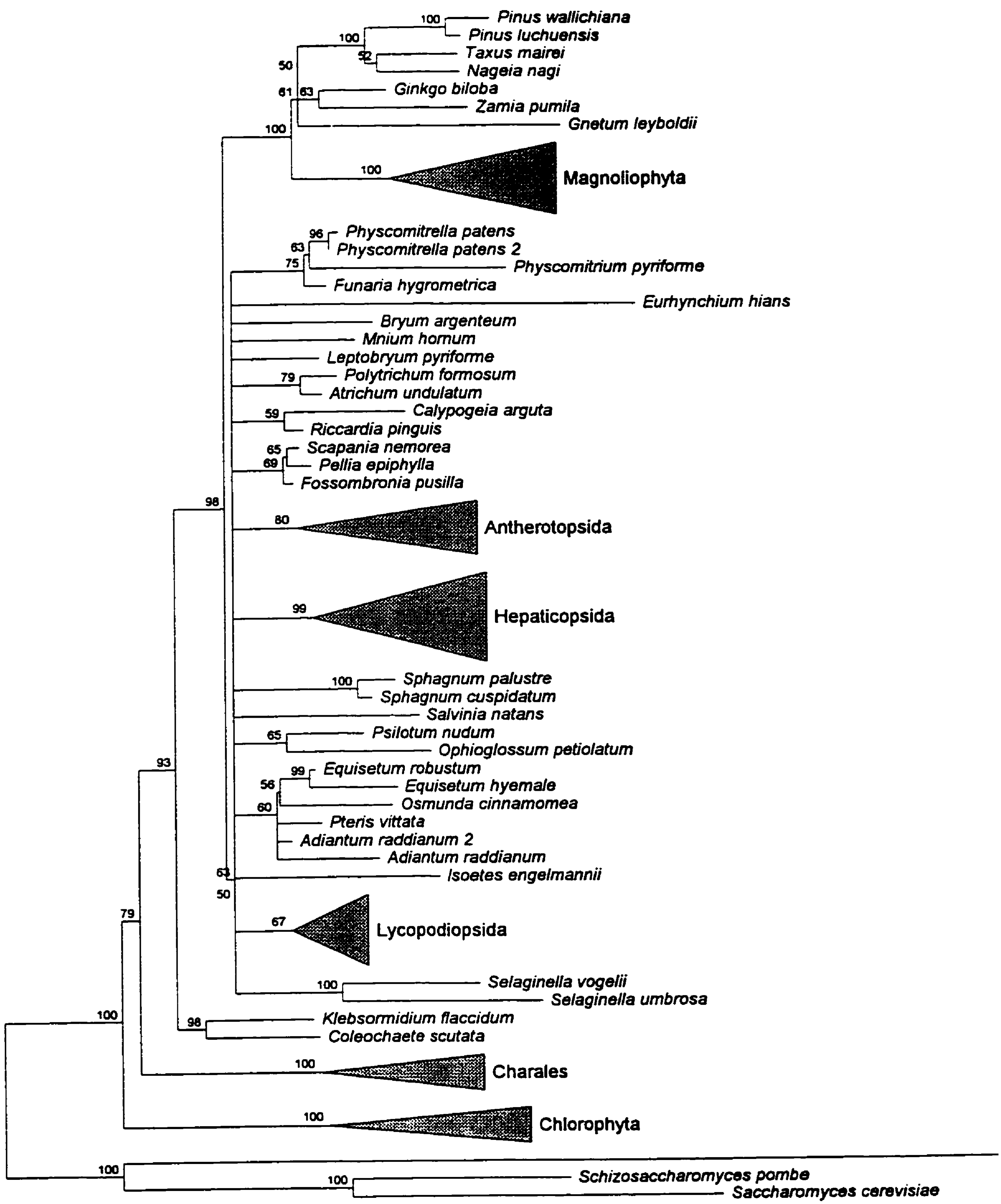


Figure H3B *No Correction; Neighbor-joining*
Insertions & Deletions taken into account
50% Majority-Rule Bootstrap Tree
Only Categories 2, 3, 4, 5, 6

Figure 18

Overall strict consensus tree; Taxa set A

The overall strict consensus tree represents absolute corroboration of clusters in the bootstrap trees which were generated from all tree construction methods. Dendrograms for taxa set A and B representing a strict overall consensus tree were constructed by visual inspection of all 50% majority-rule bootstrap trees. Only clusters which are maintained strictly in the bootstrap trees from all phylogenetic analyses are depicted. Any variation of taxa clustering among the phylogenetic approaches resulted in those affected taxa being displayed as polytomies.

Color Key

Magnoliophyta
Pinophyta
Equisetophyta
Psilotophyta
Filicophyta
Lycopodiophyta
Anthocerotopsida
Bryopsida
Hepaticopsida
Charaphyta

Overall Strict Consensus Tree

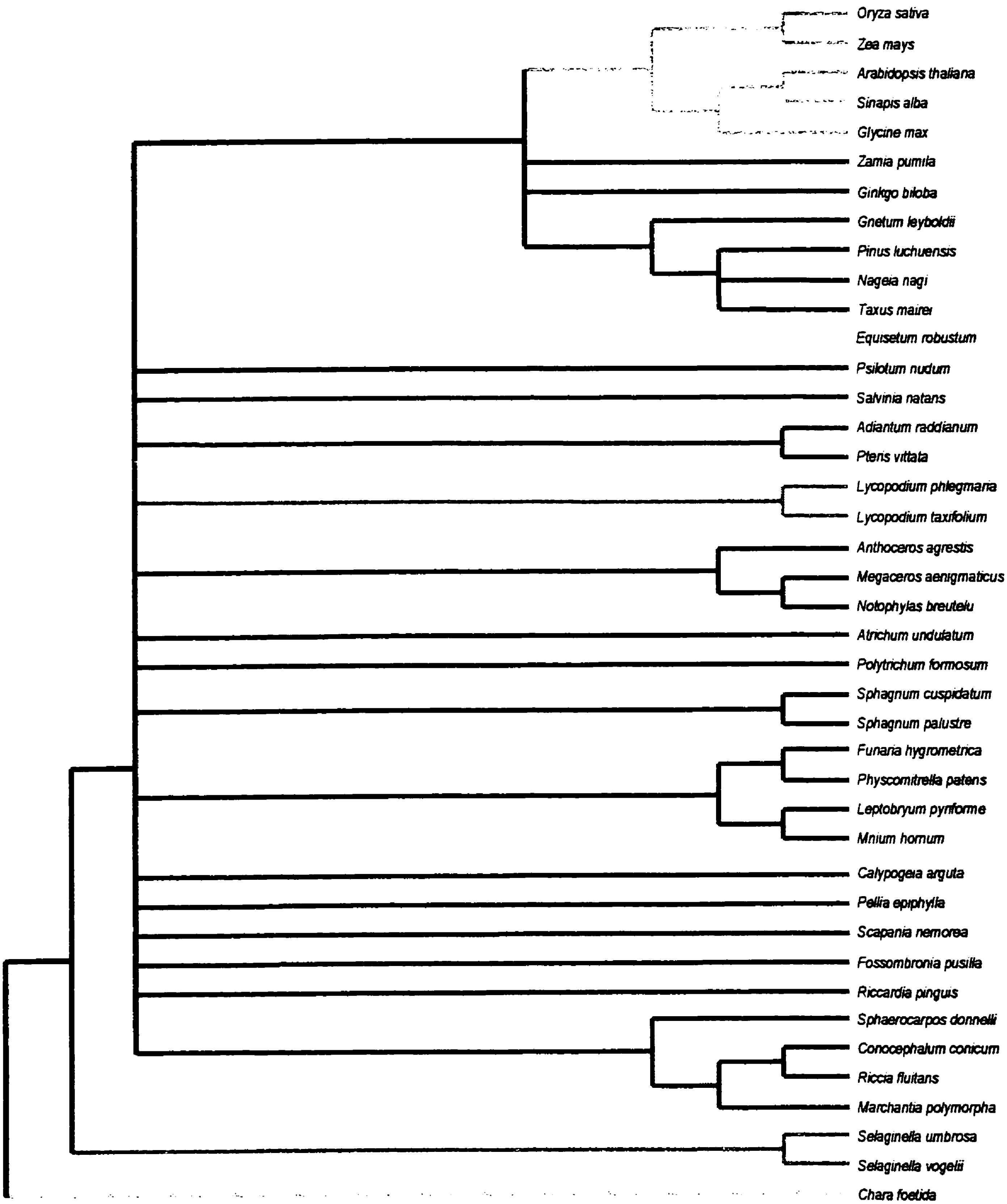


Figure 19

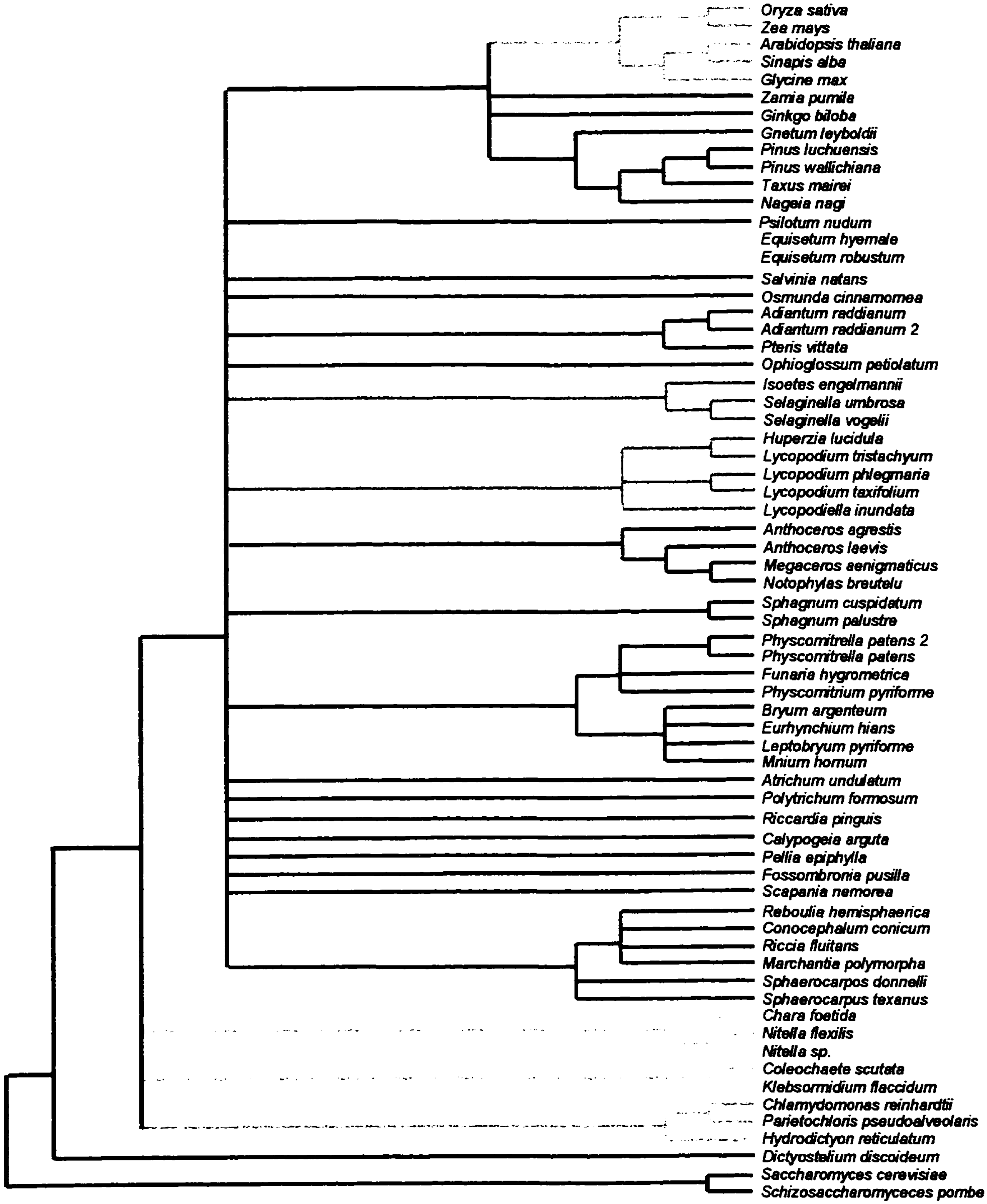
Overall strict consensus tree; Taxa set B

The overall strict consensus tree represents absolute corroboration of clusters in the bootstrap trees which were generated from all tree construction methods. Dendrograms for taxa set A and B representing a strict overall consensus tree were constructed by visual inspection of all 50% majority-rule bootstrap trees. Only clusters which are maintained strictly in the bootstrap trees from all phylogenetic analyses are depicted. Any variation of taxa clustering among the phylogenetic approaches resulted in those affected taxa being displayed as polytomies.

Color Key

Magnoliophyta
Pinophyta
Equisetophyta
Psilotophyta
Filicophyta
Lycopodiophyta
Anthocerotopsida
Bryopsida
Hepaticopsida
Charaphyta
Chlorophyta
Fungi

Overall Strict Consensus Tree



APPENDIX G : DCSE Alignment

Alignment matrix using Dedicated Comparative Sequence Editor (DCSE) containing secondary structure information.

The standard ambiguity codes are used to apply partial identity to unresolved nucleotides.

Code	Represented nucleotides
Y	U or C
R	A or G
M	A or C
K	U or G
W	U or A
S	C or G
B	U, C, or G
D	U, A, or G
H	U, C, or A
V	C, A, or G
N	U, C, A, or G

Additional Codes

N	:unidentified nucleotide, length of unidentified are probably known.
o	:unidentified nucleotide, length of unidentified area unknown. In this case, the symbol "o" is intercalated for the number of nucleotides from the most closely related species.
-	:denotes the presence of a gap at an alignment positions

Secondary Structure Symbols

[and]	:beginning and end of one strand of a helix.
^	: symbolizes][, a new helix starting immediately after a previous one.
{ and }	: beginning and end of an internal loop
(and)	; enclose a base forming part of a non-standard pair [any other pair other than G-C, A-U, or G-U].

DCSE Alignment

```
 1   2283

                  10                  20                  30                  40                  50
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
- U A U[C U G G U]U G A[U C C U^G C C A G^U A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C   1 Saccharomyces cerevisiae
- U A C[C U G G U]U G A[U C C U^G C C A G^U A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C   2 Schizosaccharomyces pombe
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C   3 Physcomitrella patens
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C   4 Anthoceros agrestis
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o G C U^U G U C]U C A A A G A U U A A[G C   5 Anthoceros laevis
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C   6 Pellia epiphylla
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o G U C]U C A A A G A U U A A[G C   7 Reboulia hemisphaerica 2
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C   8 Riccardia pinguis
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C   9 Sphaerocarpos donnellii
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o]o[o o o o]o o o o o o o o o o o o[o o  10 Sphaerocarpus texanus
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  11 Atrichum undulatum
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  12 Bryum argenteum
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o U G C U^U G U C]U C A A A G A U U A A[G C  13 Eurhynchium hians
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  14 Funaria hygrometrica
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  15 Leptobryum pyriforme
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  16 Mnium hornum
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  17 Physcomitrium pyriforme
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  18 Polytrichum formosum
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  19 Sphagnum cuspidatum
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  20 Calypogeia arguta
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U A A A A G A U U A A[G C  21 Conocephalum conicum
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  22 Fossombronia pusilla
- o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  23 Marchantia polymorpha
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G G U U A A[G C  24 Riccia fluitans
- A A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  25 Scapania nemorea
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o o o o o o o o o o o o[o C  26 Equisetum hyemale
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  27 Equisetum robustum
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o o o o o o o o o o o o[o o  28 Isoetes engelmannii
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o o o o o o o o o o o o[o o  29 Huperzia lucidula
o o o o[o o o o o]o o o[o o o o^o o o o o]o o[o o(o)o o o o o o o^o o o o]o o o o o o o o o o o o o[o o  30 Lycopodiella inundata
o o o o[o o o o o]o o o[o o o o^o o o o o]o U[G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  31 Lycopodium phlegmaria
o o o o[o o o o o]o o o[o o o o^o o o o o]o U[G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  32 Lycopodium taxifolium
o o o o[o o o o o]o o o[o o o o^o o o o o]o o[o o(o)o o o o o o o^o o o o]o o o o o o o o o o o o o[o o  33 Lycopodium tristachyum
o o o o[o o o o o]o o o[o o o o^o o o o o^o(A)G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  34 Selaginella galleottii
o o o o[o o o o o]o o o[o o o o^o o o o o^o(A)G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  35 Selaginella sp.
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  36 Oryza sativa
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  37 Zea mays
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  38 Arabidopsis thaliana
- U A C[U U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  39 Glycine max
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  40 Sinapis alba
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  41 Zamia pumila
o o o o[o o o o o]o G A[Y C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  42 Gnetum leyboldii
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]U C A A A G A U U A A[G C  43 Ginkgo biloba
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]U C A A A G A U U A A[G C  44 Pinus luchuensis
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  45 Pinus wallichiana
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]U C A A A G A U U A A[G C  46 Podocarpus nakaii
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]U C A A A G A U U A A[G C  47 Taxus mairei
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o o o o o o o o o o A[G C  48 Adiantum raddianum
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  49 Adiantum raddianum 2
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o o o o G A U U A A[G C  50 Ophioglossum petiolatum
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o]C[U G U C]U C A A A G A U U A A[G C  51 Osmunda cinnamomea
- o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  52 Salvinia natans
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  53 Psilotum nudum 2
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A C U A A[G C  54 Chara foetida
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  55 Coleochaete scutata
o o o o[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  56 Klebsormidium flaccidum
o o o o[o o o o o]o o o[o o o o^o o o o o]o[A G U(C)A U A U G C U^U G U C]U C A A A G A C U A A[G C  57 Nitella flexilis
o o o o[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A C U A A[G C  58 Nitella sp.
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  59 Chlamydomonas reinhardtii
- o o o[o o o o o]o o o[o o o o^o o o o o]o[o o U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  60 Hydrodictyon reticulatum
- U A C[C U G G U]U G A[U C C U^G C C A G]U[A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  61 Parietochloris pseudoalveolaris
- U A A[C U G G U]U G A[U C C U^G C C A G^U A G U(C)A U A U G C U^U G U C]U C A A A G A U U A A[G C  62 Dictyostelium discoideum
- - - - - - 1 - - - - - - - 2 - - - - - 1'- - - - - - - - -3- - - - - - - - - -4- - - - - - - - - - - - - -  63 Helix numbering 1
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o A A A G o U U A A[G C  64 Pteris vittata
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o o A A G A U o o A[G C  65 Megaceros aenigmaticus
o o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o A A A G A U o A A[G C  66 Notophylas breutelu
- o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o A A A G A U U A A[G C  67 Physcomitrella patens
- o o o[o o o o o]o o o[o o o o^o o o o o]o[o o o(o)o o o o o o o^o o o o]o o A A A G N N U N A[G C  68 Sphagnum palustre
```

```
                    60                  70                  80                  90                 100
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
C(A}U G C]A U G U C U A[A G U(A U A A}G C]A - - - - A U U U A U - A C - - A[G U(- G - A A}A C U]G C    1 Saccharomyces cerevisiae
C(A}U G C]A U G U C U A[A G U(A U A A}G C A]- - - - A U U U U G U A C - -[U G U(- G - A A}A C U]G C    2 Schizosaccharomyces pombe
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C    3 Physcomitrella patens
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - A C U U U U G U - A C U - -[G U(- G - A A}A C U]G C    4 Anthoceros agrestis
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U G U U U U G U - A C U - -[G U(- G - A A}A C U]G C    5 Anthoceros laevis
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C    6 Pellia epiphylla
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - - U C U U U G U - A C U - -[G U(- G - A A}A C U]C G    7 Reboulia hemisphaerica 2
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C    8 Riccardia pinguis
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C    9 Sphaerocarpos donnellii
o(o}o o o]o o o o o o A[A G U(A U A A}A C A]- - - - C U U U G U - A C - -[U G U(- G - A A}A C U]G C   10 Sphaerocarpus texanus
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   11 Atrichum undulatum
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   12 Bryum argenteum
C A U(G)C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   13 Eurhynchium hians
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   14 Funaria hygrometrica
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   15 Leptobryum pyriforme
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   16 Mnium hornum
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - - U C U U U G U - A C U - -[G U(- G - A A}A C U]G C   17 Physcomitrium pyriforme
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   18 Polytrichum formosum
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C C - -[G U(- G - A A}A C U]G C   19 Sphagnum cuspidatum
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   20 Calypogeia arguta
C(A}U G C]A U G U G U A[A G U(A U A A}A C A]- - C A U U U U G U - A C - -[U G U(- A - A A}A C U]G C   21 Conocephalum conicum
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   22 Fossombronia pusilla
C(A}U G C]A U G U G U A[A G U(A U A A}A C A]- - - C U U U U G U - A C - -[U G U(- G - A A}A C U]G C   23 Marchantia polymorpha
C(A}U G C]A U G U G U A[A G U(A U A A}A C A]- - - C U U U U G U - A C - -[U G U(- G - A A}A C U]G C   24 Riccia fluitans
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   25 Scapania nemorea
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C G U U U G U - A C U - -[G U(- G - A A}A C U]G C   26 Equisetum hyemale
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C G U U U G U - A C U - -[G U(- G - A A}A C U]G C   27 Equisetum robustum
o(o}o o o]o - o o o o o[A G U(A U A A}G C]- - U A U C C U U G U - A C U - -[G U(- G - A A}A C U]G C   28 Isoetes engelmannii
o(o}o o o]o - o o o o o[o o o(o o o A}A C]- - - U A U C U U G U - A C U - -[G U(- G - A A}A C U]G C   29 Huperzia lucidula
o(o}o o o]o - o o o o o[o o o(o o G A}A C]- - - U A U C U U G U - A C U - -[G U(- G - A A}A C U]G C   30 Lycopodiella inundata
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U A U C U U G U - A C G - -[G U(- G - A A}A C U]G C   31 Lycopodium phlegmaria
C(A}U G C]A U G U G U A U[G U(A U A A}A C]- - - U A U C U U G U - A C G - -[G U(- G - A A}A C]U G C   32 Lycopodium taxifolium
o(o}o o o]o - o o o o o[o o o(o o o A}A C]- - - U A U C U U G U - A C U - -[G U(- G - A A}A C U]G C   33 Lycopodium tristachyum
C(A}U G C]A U G U C U A[A G U(A U A A}A C]- - - U G C U U U G U - A C U - -[G U(- G - A A}A C U]G C   34 Selaginella galleottii
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U G C U U U G U - A C U - -[G U(- G - A A}A C U]G C   35 Selaginella sp.
C(A}U G C]A U G U G C A[A G U(A U G A}A C]- - - U A A U U C G A - A C U - -[G U(- G - A A}A C U]G C   36 Oryza sativa
C(A}U G C]A U G U G C A[A G U(A U G A}A C]- - - U A A U U C G A - A C U - -[G U(- G - A A}A C U]G C   37 Zea mays
C(A}U G C]A U G U G U A[A G U(A U G A}A C G]- - - A A U U C A G - A C - -[U G U(- G - A A}A C U]G C   38 Arabidopsis thaliana
C(A}U G C]A U G U G U A[A G U(A U G A}A C]- - - U A A U U C A G - A C U - -[G U(- G - A A}A C U]G C   39 Glycine max
C(A}U G C]A U G U G U A[A G U(A U G A}A C G]- - - A A U U C A G - A C - -[U G U(- G - A A}A C U]G C   40 Sinapis alba
C(A}U G C]A U G U G U C[A G U(A U G A}A C U]- - - A U U U U G G - A C - -[G G U(- G - A A}A C U]G C   41 Zamia pumila
C(A}U G C]A U G U C U A[A G U(A U G A}A C U]- - - A G U U C G A - A C - -[G G U(- G - A A}A C U]G C   42 Gnetum leyboldii
C(A}U G C]A U G U G U A[A G U(A U G A}A C]- - - U C U U U C A G - A C U - -[G U(- G - A A}A C U]G C   43 Ginkgo biloba
C(A}U G C]A U G U C U A[A G U(A U G A}A C A]- - - - U U U C A G - A C - -[U G U(- G - A A}A C U]G C   44 Pinus luchuensis
C(A}U G C]A U G U C U A[A G U(A U G A}A C]- - - U A A U U C A G - A C U - -[G U(- G - A A}A C U]G C   45 Pinus wallichiana
C(A}U G C]A U G U C U A[A G U(A U G A}A C]- - - U A U U U C G G - A C U - -[G U(- G - A A}A C U]G C   46 Podocarpus nakaii
C(A}U G C]A U G U C U A[A G U(A U G A}A C]- - - U A U U U C A G - A C U - -[G U(- G - A A}A C U]G C   47 Taxus mairei
C(A}U G C]A U o U G U A[A G U(A U A A}A C]- - - U C U C U U G U - A C U - -[G U(- G - A A}A C U]G C   48 Adiantum raddianum
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   49 Adiantum raddianum 2
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U C U U G U - A C U - -[G U(- G - A A}A C U]G C   50 Ophioglossum petiolatum
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U C U U G U - A C U - -[G U(- G - A A}A C U]G C   51 Osmunda cinnamomea
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U G U U A U - A C U - -[G U(- G - A A}A C U]G C   52 Salvinia natans
C(A}U G C]A U G U G U A[A G U(A U A A}G C A]- - - C C - U U G U - A C - -[U G U(- G - A A}A C U]G C   53 Psilotum nudum 2
C(A}U G C]A C G U C U A[A G U(G U G A}A C A]- - - - C U U U G C - A C - -[U G U(- G - A A}A C U]G C   54 Chara foetida
C(A}U G C]A U G U C U A[A G U(A U A A}A C(U)G]- - - A U C U A U - A - -[C(U)G U(- G - A A}A C U]G C   55 Coleochaete scutata
C(A}U G C]A U G U C U A[A G U(A U A A}A C]- - - U C U U U U A U - A C U - -[G U(- G - A A}A C U]G C   56 Klebsormidium flaccidum
C(A}U G C]A U G U C C A[A G U(G U A A}G C(U)G]- - U U U U U A C - A - -[C(U)G U(- G - A A}A C U]G C   57 Nitella flexilis
C(A}U G C]A U G U C N A[A G U(G U A A}G C(U)G]- - U U U U U A C - A - -[C(U)G U(- G - A A}A C U]G C   58 Nitella sp.
C(A}U G C]A U G U C U A[A G U(A U A A}A C(U)G]- - - C - U U A U - A - -[C(U)G U(- G - A A}A C U]G C   59 Chlamydomonas reinhardtii
C(A}U G C]A U G U C U A[A G U(A U A A}A C(U)G]- - - C - U U A U - A - -[C(U)G U(- G - A A}A C U]G C   60 Hydrodictyon reticulatum
C(A}U G C]A U G U C U A[A G U(A U A A}A C(U)G]- - - C - U U A U - A - -[C(U)G U(- G - A A}A C U]G C   61 Parietochloris pseudoalveolaris
C(A}U G C]A U G U C U A[A G U(A U A A}A U U]- - - - - C U U G U - A C - -[G A U(- G - A A}A C U]G C   62 Dictyostelium discoideum
- -5- - - - - - - - - - - - - - - -6- - - - - - - - - - - - - - - - - - - - - - - - - - - 6'- - - - - - -   63 Helix numbering 1
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   64 Pteris vittata
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - A C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   65 Megaceros aenigmaticus
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U A U G U - A C U - -[G -(A G - A A}A C U]G A   66 Notophylas breutelu
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C U - -[G U(- G - A A}A C U]G C   67 Physcomitrella patens
C(A}U G C]A U G U G U A[A G U(A U A A}A C]- - - U C U U U U G U - A C C - -[G U(- G - A A}A C U]G C   68 Sphagnum palustre
```

```
                    110                 120                 130                 140                 150
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(C G)U - U(U A U U)U G A]U A G U U C C - - - - U U U -    1 Saccharomyces cerevisiae
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(C G)U - U(U A U U)U G A]U A G U A C C - - - - U C A -    2 Schizosaccharomyces pombe
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    3 Physcomitrella patens
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U A -    4 Anthoceros agrestis
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U A U U)U G A]U G G U A C C - - - - - - U U -    5 Anthoceros laevis
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    6 Pellia epiphylla
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    7 Reboulia hemisphaerica 2
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    8 Riccardia pinguis
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    9 Sphaerocarpos donnellii
G A A U G G[C U C]A U U A A A C A(A G(U U)A U(A G)U(- C U - C U)U G A]U G G U A C C - - - - - - U U -    10 Sphaerocarpus texanus
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    11 Atrichum undulatum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    12 Bryum argenteum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    13 Eurhynchium hians
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    14 Funaria hygrometrica
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    15 Leptobryum pyriforme
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    16 Mnium hornum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    17 Physcomitrium pyriforme
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    18 Polytrichum formosum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    19 Sphagnum cuspidatum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    20 Calypogeia arguta
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U C C U - - - - - - U U -    21 Conocephalum conicum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    22 Fossombronia pusilla
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    23 Marchantia polymorpha
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G C -)U(U C U U)U G A]U G G U A C C - - - - - - U U -    24 Riccia fluitans
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U A -    25 Scapania nemorea
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    26 Equisetum hyemale
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    27 Equisetum robustum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A U C U - - - - - - U -    28 Isoetes engelmannii
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    29 Huperzia lucidula
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    30 Lycopodiella inundata
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    31 Lycopodium phlegmaria
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    32 Lycopodium taxifolium
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    33 Lycopodium tristachyum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U A U U)U G A]U G A U A C U - - - - - - U U -    34 Selaginella galleottii
G A A U G G[C U C]A U U A A A U[C A G(U A)A U(A G)U - U(U A U U)U G A]U G U U A C C - - - - - - U U -    35 Selaginella sp.
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U G U U)U G A U G]G U A C G - - - - - - - U -    36 Oryza sativa
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U G U U)U G A U G]G U A C G - - - - - - - U -    37 Zea mays
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U G U U)U G A U G]G U A A C - - - - - - - U -    38 Arabidopsis thaliana
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U G U U)U G A U G]G U A U C - - - - - - - U -    39 Glycine max
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U G U U)U G A U G]G U A A C - - - - - - - U -    40 Sinapis alba
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U C G U A C U - - - - - - C U -    41 Zamia pumila
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A U G]G U A C A - - - - - - U U -    42 Gnetum leyboldii
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    43 Ginkgo biloba
G G A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C U - - - - - - U U -    44 Pinus luchuensis
G G A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U U U U)U G A]U G G U A C C - - - - - - A U -    45 Pinus wallichiana
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - C(U A U U)U G A]U G G U A C C - - - - - - U U -    46 Podocarpus nakaii
G G A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - U U U -    47 Taxus mairei
G A A U G G[C U C]A U U A A A U[C A G(U U)A(- A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    48 Adiantum raddianum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    49 Adiantum raddianum 2
G A A U G G[C U C]A U U A A A U G(A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    50 Ophioglossum petiolatum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    51 Osmunda cinnamomea
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - U -    52 Salvinia natans
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    53 Psilotum nudum 2
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(C A)U - U(U A U U)U G G]U G G U C U C - - - - C U U -    54 Chara foetida
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U A U U)U G A]U G G U A C C - - - - - - - - -    55 Coleochaete scutata
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U A U U)U G A]U G G U A C C - - - - - - U U -    56 Klebsormidium flaccidum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(C G)U - U(U A U U)U G A]U G U U C C C - - - - - - C C A    57 Nitella flexilis
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(C G)U - U(U A U U)U G A]U G U U C C C - - - - - - C C A    58 Nitella sp.
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U A U U)U G A]U G G U A C C - - - - - - - U -    59 Chlamydomonas reinhardtii
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U A U U)U G A]U G G U A C C - - - - - - - U -    60 Hydrodictyon reticulatum
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U A U U)U G A]U G G U A C C - - - - - - - U -    61 Parietochloris pseudoalveolaris
A G A C G G[C U C]A U U A C A A(C A G U G A U(A A)A - C(U A A)U A G A]C U U U C G G G - - U U U U -    62 Dictyostelium discoideum
- - - - - - - 7 - - - - - - - - - - - - - - - - - - - - - - -8- - - - - - - - - - - - - - - - -E8_1 - - -E8_1'    63 Helix numbering 1
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C U - - - - - - o -    64 Pteris vittata
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    65 Megaceros aenigmaticus
G A A U G G[C U C]A U U A A A U[C A G(U G)A U(A G U A -(U C U G)A G A]G G G C A C C - - - - - - - U C    66 Notophylas breutelu
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    67 Physcomitrella patens
G A A U G G[C U C]A U U A A A U[C A G(U U)A U(A G)U - U(U C U U)U G A]U G G U A C C - - - - - - U U -    68 Sphagnum palustre
```

```
                    160                     170                     180                     190                     200
 . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . |
A C U A[C - A U G(G)U A U(A A C C G -)U G G]- U A A U - U[C U A(G A G C U A)A U A - C A U G]C U U -    1 Saccharomyces cerevisiae
A C U A[C -(U)U G(G)- A U(A A C C G -)U G G]- U A A U - U[C U A(G A G C U A)A U(A)- C A(U)G]C U A -    2 Schizosaccharomyces pombe
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -    3 Physcomitrella patens
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -    4 Anthoceros agrestis
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -    5 Anthoceros laevis
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -    6 Pellia epiphylla
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -    7 Reboulia hemisphaerica 2
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -    8 Riccardia pinguis
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -    9 Sphaerocarpos donnellii
G C U A[C -(U)C G(G)- A U(A A C - G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C - A -   10 Sphaerocarpus texanus
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   11 Atrichum undulatum
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)C(A)G(U)G]C A C -   12 Bryum argenteum
G C U A[C(- U G)G G - A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U C(A)C(G U)G]G A C -   13 Eurhynchium hians
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   14 Funaria hygrometrica
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   15 Leptobryum pyriforme
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   16 Mnium hornum
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   17 Physcomitrium pyriforme
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   18 Polytrichum formosum
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   19 Sphagnum cuspidatum
G C U A[C -(U)U G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   20 Calypogeia arguta
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   21 Conocephalum conicum
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   22 Fossombronia pusilla
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   23 Marchantia polymorpha
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   24 Riccia fluitans
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   25 Scapania nemorea
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   26 Equisetum hyemale
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   27 Equisetum robustum
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U U U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   28 Isoetes engelmannii
G C U A[C -(U)C G(G)- A U(A C C C G -)U A G]- U A A U C U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   29 Huperzia lucidula
A C U A[C(- U U)C G(G)A U(A C C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   30 Lycopodiella inundata
G C U A[C(- U)C G(G)- A U(A C C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   31 Lycopodium phlegmaria
G C U A[C(- U)C G(G)- A U(A C C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   32 Lycopodium taxifolium
G C U A[C -(U)C G(G)- A U(- A C C G -)U A G]- U A A U C U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   33 Lycopodium tristachyum
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   34 Selaginella galleottii
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   35 Selaginella sp.
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -   36 Oryza sativa
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -   37 Zea mays
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -   38 Arabidopsis thaliana
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -   39 Glycine max
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -   40 Sinapis alba
G C U A[C - A C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G U G]C A C -   41 Zamia pumila
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A G -   42 Gnetum leyboldii
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   43 Ginkgo biloba
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   44 Pinus luchuensis
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   45 Pinus wallichiana
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   46 Podocarpus nakaii
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   47 Taxus mairei
G C U A[C -(U)C G(G - A)U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A(- A -)C G(U)G]C A C -   48 Adiantum raddianum
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   49 Adiantum raddianum 2
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   50 Ophioglossum petiolatum
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   51 Osmunda cinnamomea
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C G A -   52 Salvinia natans
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   53 Psilotum nudum 2
A C C A[C -(U)C G(G)- A U(A A C C G -)U G G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A G -   54 Chara foetida
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   55 Coleochaete scutata
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   56 Klebsormidium flaccidum
A U U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G C G C U A)A U(A)- C G(U)G]C A G -   57 Nitella flexilis
A U U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A G -   58 Nitella sp.
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C G C -   59 Chlamydomonas reinhardtii
U C U A[C -(U)C G(G)- A U(A C C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C G U -   60 Hydrodictyon reticulatum
A C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C G C -   61 Parietochloris pseudoalveolaris
A C C U[U -(U)U G(G)- A U(A A C C G -)C(A)G]- U A A A - U[C - G(G G G C U A)A U(A)- C A(U)A]C A A G   62 Dictyostelium discoideum
'- - - - - - - - - - - - - 9 - - - - - - - - - - - - - - - - - - - - - - - - -9' - - - - - - - - - - -   63 Helix numbering 1
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   64 Pteris vittata
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -   65 Megaceros aenigmaticus
G C U A[C G(G)C G(G)- A U(A A C C G G)- A G]A U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A A -   66 Notophylas breutelu
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   67 Physcomitrella patens
G C U A[C -(U)C G(G)- A U(A A C C G -)U A G]- U A A U - U[C U A(G A G C U A)A U(A)- C G(U)G]C A C -   68 Sphagnum palustre
```

DCSE Alignment

```
                  210                 220                 230                 240                 250
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
- A A A[A U C U C[G - A]C C]- - - - - - - - - - - - - - - - - - - - - - - C U U U - - - - - - -[G G[     1 Saccharomyces cerevisiae
- A A A[A U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - U U U U U - - - - - -[G G[     2 Schizosaccharomyces pombe
A A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U U U U U - - - - -[G G[     3 Physcomitrella patens
C A A - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[     4 Anthoceros agrestis
C A A - C U[C C C[G - G]C U]- - - - - - - - - - - - - - - - - - - - - - - - U U U - - - - - - -[G G[     5 Anthoceros laevis
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C - U - - - - - -[G G[     6 Pellia epiphylla
C A A - C[G C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U U C G C U - - - -[G G[     7 Reboulia hemisphaerica 2
C A A -[G U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[     8 Riccardia pinguis
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U U U G U - - - -[G G[     9 Sphaerocarpos donnellii
C C A -[A(C)C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U U U U G U - - -[G G[    10 Sphaerocarpus texanus
A A A - C[U C C C[G - A]C]C - - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - - G[G[    11 Atrichum undulatum
A A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C C G - - - - - - -[G G[    12 Bryum argenteum
A A A - C[U C C C[G - A]C]C U U U - - - - - - - - - - - - - - - - - - - - - U U - - - - - - - - G[G[    13 Eurhynchium hians
A A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    14 Funaria hygrometrica
A A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C C U C C C G G - -[G G[    15 Leptobryum pyriforme
A A A - C[U C C C[G - A]C U]G G G C G C C U U C G C G G G U G C C U C G - U G A - - - - - - -[G G[    16 Mnium hornum
A A A - C[U C C C[G - A]C]U - - - - - - - - - - - - - - - - - - - - - - - - U U U - - - - - - - G[G[    17 Physcomitrium pyriforme
A A A - C[U C C C[G - A]C C]- - - - - - - - - - - - - - - - - - - - - - - - U U C U U - - - - -[G G[    18 Polytrichum formosum
C G A - C[U C C C[G - A]C C]C - - - - - - - - - - - - - - - - - - - - - - - C G C A A - - - - G[G G[    19 Sphagnum cuspidatum
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    20 Calypogeia arguta
C A A - G[G C U C[G - A]C U]G G A C G G U A U U C U G U A U C G - - - - - - U C C - - - - - - -[G G[    21 Conocephalum conicum
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    22 Fossombronia pusilla
C A A -[G G C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C A C - - - - - -[G G[    23 Marchantia polymorpha
C A A - C[G C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - U U C G C - - - - - -[G G[    24 Riccia fluitans
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C - U - - - - - -[G G[    25 Scapania nemorea
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    26 Equisetum hyemale
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    27 Equisetum robustum
C A A A[G U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C C C A U - - - - -[G G[    28 Isoetes engelmannii
C A A - A[U N C C[C G A]C U]- - - - - - - - - - - - - - - - - - - - - - - - G U A A A - - - - -[G G[    29 Huperzia lucidula
C A A - A[U C C C[G - A]C C]- - - - - - - - - - - - - - - - - - - - - - - - C U C G C - - - - -[G G[    30 Lycopodiella inundata
C G A - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - G U A A C - - - - -[G G[    31 Lycopodium phlegmaria
C G A - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - G U A A A - - - - -[G G[    32 Lycopodium taxifolium
C A A A[U(A)C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - G U A A A - - - - -[G G[    33 Lycopodium tristachyum
C A A - G[U C C C[G - A]C C]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    34 Selaginella galleottii
A A A - G[U C C C[U - U]C C]- - - - - - - - - - - - - - - - - - - - - - - - C C C - - - - - - -[G G[    35 Selaginella sp.
C A A - A[C C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C C - - - - - - -[G G[    36 Oryza sativa
C A A - A[C C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C C - - - - - - -[G G[    37 Zea mays
C A A - A C[C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U A U - - - - - - -[G G[    38 Arabidopsis thaliana
C A A -[A(C)C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    39 Glycine max
C A A -[A(C)C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    40 Sinapis alba
C A A - A[U C C C[G - A]C]U - - - - - - - - - - - - - - - - - - - - - - - - U U U - - - - - - - U[G[    41 Zamia pumila
C A A -[G U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U U - - - - - - -[G G[    42 Gnetum leyboldii
C A A - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    43 Ginkgo biloba
C A A -[A U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U U - - - - - - -[G G[    44 Pinus luchuensis
C A A -[G U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U U U - - - - - -[G G[    45 Pinus wallichiana
C A A -[A U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U C - - - - - - -[G G[    46 Podocarpus nakaii
A A A - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U U - - - - - - -[G G[    47 Taxus mairei
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    48 Adiantum raddianum
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    49 Adiantum raddianum 2
C G A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C C - - - - - - -[G G[    50 Ophioglossum peticlatum
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    51 Osmunda cinnamomea
C G A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - C U U - - - - - - -[G G[    52 Salvinia natans
C A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C C - - - - - - -[G G[    53 Psilotum nudum 2
C A U - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    54 Chara foetida
C G A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    55 Coleochaete scutata
C A A - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    56 Klebsormidium flaccidum
C A U - A[U C C C[G - A]C C]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    57 Nitella flexilis
C A U - A[U C C C[G - A]C C]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    58 Nitella sp.
- A C - A[A C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    59 Chlamydomonas reinhardtii
- A A - A[A C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    60 Hydrodictyon reticulatum
- A C - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    61 Parietochloris pseudoalveolaris
C G A -[U G G G U[G - A]C U G]- - - - - - - - - - - - - - - - - - - - - - - G C A A - - - - -[C G G[    62 Dictyostelium discoideum
- - - - - 10- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     63 Helix numbering 1
C A A - A[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - -[G G[    64 Pteris vittata
C A A - C U[C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U C U - - - - - - G[G G[    65 Megaceros aenigmaticus
A A A - C U[C C C[G - A]C U]C - - - - - - - - - - - - - - - - - - - - - - - U - U G G G - - G G[G G[    66 Notophylas breutelu
A A A - C[U C C C[G - A]C U]- - - - - - - - - - - - - - - - - - - - - - - - U U U U U - - - - -[G G[    67 Physcomitrella patens
C G A - C[U C C C[G - A]C C]C - - - - - - - - - - - - - - - - - - - - - - - C G C A A - - - G G[G G[    68 Sphagnum palustre
```

```
                    260                 270                 280                 290                 300
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
(A A)G A G A U]G U A U[U U A U U A(G A U A A A - A A)A U C - - A A(U)G U C]- - - - - U U C G - - - -    1 Saccharomyces cerevisiae
(A A)G G G A U]G U A U[U U A U U A(G A U A A A - A A)A C C - - A A(U)G C C]- - - - - U U C G - - - -    2 Schizosaccharomyces pombe
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U U G - - -(C    3 Physcomitrella patens
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C A G G C]- - U C U - - -[G C    4 Anthoceros agrestis
(A A)G G G]U C G U A U[U U A U U A(G A U A A A - A G)A C(G - - A A G A)C G G G]- - C U U G U - - -(C    5 Anthoceros laevis
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C - G G G]- - C U U G - -(C -    6 Pellia epiphylla
(A A)G G G C]U G U A U[U U A U U A(G A U A A A - A G)A C C - - G(A)G U C G G G]- - C U U G - - - C(C    7 Reboulia hemisphaerica 2
(A A)G G G A U]G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A)U G C G G G]- - - C U U - - - G(C    8 Riccardia pinguis
(A A)G G G A]U G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U)G C G G G]- - - C U U - - - G(C    9 Sphaerocarpos donnelli
(A A)G G G(A)U]G U A U[U U A U U A(G A U A A A - A G)G C C - - G A U G C G G G]- - - C U U - - - G(C   10 Sphaerocarpus texanus
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)A C C - - G(A)U G C G G G]- - - C U U - - - G(C   11 Atrichum undulatum
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)A C C - - G(A)U G C G G G]- - - C U U - - - G(C   12 Bryum argenteum
(A A)G G G A]C G U A U[U U(A)U U A(G A U A A A - A G)G C C - - G(A)U G C G G G]- - - C U U - - - G(C   13 Eurhynchium hians
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U U G - - -(C   14 Funaria hygrometrica
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U U G - - -(C   15 Leptobryum pyriforme
(A A)G G G A]C G U A U[U U A U U G(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U U G - - -(C   16 Mnium hornum
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A)U G C G G G]- - - C U U - - - G(C   17 Physcomitrium pyriforme
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)A C C - - G(A U G)C G G G]- - - C U U G - - -(C   18 Polytrichum formosum
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U C G - - -(C   19 Sphagnum cuspidatum
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U U G - - -(C   20 Calypogeia arguta
(A A)G G G C]U G U A U[U U A U U A(G A U A A A - A G)A C C - - G(A U G)C G G G G]- - C U U G - -(C U   21 Conocephalum conicum
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]C - - - U U - - - G(C   22 Fossombronia pusilla
(A A)G G G C U]G U A U[U U A U U A(G A U A A A - A G)A C C - - G(A U G)C G G G G]- - C U U G - -(C U   23 Marchantia polymorpha
(A A)G G G C]U G U A U[U U A U U A(G A U A A A - A G)A C C - - G(A U G)C G G G]- - G C U U G - - -(C   24 Riccia fluitans
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U U G - - -(C   25 Scapania nemorea
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- C U - U G - - - -(C   26 Equisetum hyemale
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- C U - U G - - - -(C   27 Equisetum robustum
(A A)G G G A U]G C A U[U U A U C A(G A U U A A - A G)G C C - - G(A U G)C A(U)G]C - - - U U - - - G(C(   28 Isoetes engelmannii
(A A)G G G A]C G U A U[U U A U U A(G A U G A A - A G)G C C - - G(A U G)C G(U)G]C - - - U U - - - G(C(   29 Huperzia lucidula
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - - G)A C C - - G(A U G)C G(U)G]C - - - U U - - - G(C(   30 Lycopodiella inundata
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]C - - - U U - - - G(C   31 Lycopodium phlegmaria
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]C - - - U U - - - G(C   32 Lycopodium taxifolium
(A A)G G G A]C G U A U[U U A U U A(G A C U A A - A G)G C C(- - A A U G)C G(U)G]C - - - U U - - - G(C(   33 Lycopodium tristachyum
(A A)G G G A]U G C A C[U U A C U A(G A U U C A - A G)G C C - - G(A C)A C G G G]C - - - U U - - - G(C   34 Selaginella galleottii
(A A)G G G A]U G C A C[U U A C U A(G A U U C A - A G)G C C - - G(A U)G C G G G]C - - - U C - - - G(C   35 Selaginella sp.
(G A)G G G G]C G C A U[U U A U U A(G A U A A A - A G)G(C)U - - G(A C)G C G G G C]- - U C C - - -[G C   36 Oryza sativa
(G A)G G G G]C G C A U[U U A U U A(G A U A A A - A G)G(C)U - - G(A C)G C G G G C]- - U C U - - -[G C   37 Zea mays
(A A)G G G]A C G C A U[U U A U U A(G A U A A A - A G)G U C - - G(A C)G C G G G C]- - U C U G - -[G C   38 Arabidopsis thaliana
(A A)G G G(A)U]G C A U[U U A U U A(G A U A A A - A G)G U C - - A(A C)A C A G G C]- - U C U - - -[G C   39 Glycine max
(A A)G G G(A)U]G C A U[U U A U U A(G A U A A A - A G)G U C - - G(A C)G C G(G)G]- - - C U C - - - -[U(   40 Sinapis alba
(A A)G G G A]C G C A U C[U A U U A(G A U A A A - A G)G C C - - G A(U G)C G G G C]- - U U U - - -[G C   41 Zamia pumila
(A A)G G G A U]G C A U[U U A U U A(G A U A A A - A G)G C C - - G A(Y)G A G]G C - - - - U U - - - G(C   42 Gnetum leyboldii
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G A(C)G C G G G]- - - C U C G - - -(C   43 Ginkgo biloba
(A A)G G G A U]G C A U[U U A U U A(G A U A A A - A G)G C C - - G G(C)G C G G G]C - - - U C - - - G(C   44 Pinus luchuensis
(A A)G G G A U]G C A U[U U(U)U U A(G A U A A A - A G)G C C - - G G(C)G C G G G]C - - - U U - - - G(C   45 Pinus wallichiana
(A A)G G G A U]G C A U[U U A U U A(G A U U A A - A G)G C C - - G G(C)G C G G G]U - - - U C - - - G(C   46 Podocarpus nakaii
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G G(C)G C G G G]C - - - U U - - - G(C   47 Taxus mairei
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C - - - G(A U G)C G G G]C - - - U U - - - G(C   48 Adiantum raddianum
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]C - - - U U - - - G(C   49 Adiantum raddianum 2
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)A C C - - G(A U G)C G G G]C - - - U U - - - G(C   50 Ophioglossum petiolatum
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G(A U A)C G G G]C - - - U U - - - G(C   51 Osmunda cinnamomea
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G(A U)C C G A G]- - - C U U G - - -(C   52 Salvinia natans
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]C - - - U U - - - G(C   53 Psilotum nudum 2
(A A)G G G A]U G U A U[U U A U U G(G A U A A A - A G)G C C - G(A U C)C G G G]- - - - C U U - - - - G[   54 Chara foetida
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)A C C(- A A U G)C G G G]- - - - C U C - - - - G[   55 Coleochaete scutata
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C(- A A U G)C G G]G - - - - C U U - - - - -    56 Klebsormidium flaccidum
(A A)G G G A]U G U A U[U U A U U A(G A U A A A - A G)G C C - A(A C U)C G A G]- - - - C U U - - - - G[   57 Nitella flexilis
(A A)G S G A]U G U A U[U U A U U A(G A U A A A - A G)G C C - A(A C U)C G A G]- - - - C U U - - - - G[   58 Nitella sp.
(A A)G G G U]C G U A U[U U A U U A(G A U A A A - A G)G C C(- - A G C)C G G G C]- - - U C U - - - -[G   59 Chlamydomonas reinhardtii
(A A)G G G U]C G U A U[A U A U U A(G A U A A A - A G)G C C - - G(A C)C G G A C]- - - U U U - - - -[G   60 Hydrodictyon reticulatum
(A A)G G G A]C G U A U[U U A U U A(G A U U A A - A G)G C C - - G(A C)C G G G C]- - - U C U - - - -[G   61 Parietochloris pseudoalveolaris
(A A)G C U C A]G C G -[A U U A U U(A G C A U U - C U)A C C - - A A(U)G C C]- - - - - U U C G - - - -    62 Dictyostelium discoideum
- - - - -10'- - - - - - - - - - - - - - - -E10_1- - - - - - - - - - - - - - - - - - - - - - - - - - -   63 Helix numbering 1
(A A)G G G A]C G C A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U C G - - -(C   64 Pteris vittata
(A o)G G G]G C G U A U[U U A U U A(G A U A U A - A G)G C(C - - G A U A)U G G G]- - U C U U G A U -(C   65 Megaceros aenigmaticus
(A A)G G G]U U - U - U[U U - U U A(G A U A - A - A G)A G(G A C G A U G)C G G G]- - - C U U G A - -(C   66 Notophylas breutelu
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U U G - - -(C   67 Physcomitrella patens
(A A)G G G A]C G U A U[U U A U U A(G A U A A A - A G)G C C - - G(A U G)C G G G]- - - C U C G - - -(C   68 Sphagnum palustre
```

```
                   310                 320                 330                 340                 350
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
-(G A C(- - U - - C U)U U - - G - A U(- G A - U U C A)U A - A U A A)C U U U U - - - - - - - C G A A(U   1 Saccharomyces cerevisiae
-(G G C(- - U U U U U)U U - - G - G U(- G A - G U C A)U A - A U A A)C U U U U - - - - - - - C G A A(U   2 Schizosaccharomyces pombe
C C G(G - U G - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U U G U - - - - - - C G A A(U   3 Physcomitrella patens
C U G(G - U A - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U   4 Anthoceros agrestis
C C G(G - U A - - U U A C - - G)- G U(- G A - A U C A)U G - A U A A)C U C C U - - - - - - - C G G A(U   5 Anthoceros laevis
C C G(G - - U - - U U G)C - - G - G U(- G A - C U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U   6 Pellia epiphylla
C C G G(- - U - - G A U)U C - G - G U(- - A - A U C A)U G - A U A A)C U C G A - - - - - - - C G N A(U   7 Reboulia hemisphaerica 2
C C G(G - - U - - G U)U G C - G - G U(- G A - C U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U   8 Riccardia pinguis
C C G(G - - U - - G U U)U C - G - G U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G A A(U   9 Sphaerocarpos donnelli
C C G U - - G - - -(U U)U C - G - G U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G A A(U  10 Sphaerocarpus texanus
C C G(G - - U - - A U)U G C - G - G U(- G A - C U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  11 Atrichum undulatum
C C G(G - - U - - G U)U G C - G - G U(- G A - A U C A)U G - A U A A)A U U U G U - - - - - - C G A A(U  12 Bryum argenteum
C C G(G - - U - - G U)U G C - G - G U(- U A - A U C A)U G - A(A)A A)C U U G U - - - - - - - C G A A(U  13 Eurhynchium hians
C C G(G - U G - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U U G U - - - - - - C G A A(U  14 Funaria hygrometrica
C C G(G - U A - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U G U - - - - - - - C G A A(U  15 Leptobryum pyriforme
C C G(G - U U - - U C G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U U G U - - - - - - C G A A(U  16 Mnium hornum
C C G(G - - U - - G U)U G C - G - G U(- G A - A U C A)U G - A U A A)C U U G U - - - - - - - C G A A(U  17 Physcomitrium pyriforme
C C G(G - U A - - U U G)C - - G - G U(- G A - C U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  18 Polytrichum formosum
C C G(G - U A - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  19 Sphagnum cuspidatum
C C G(G - U G - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  20 Calypogeia arguta
C C G(G - U G - - A U U)C - - G - G U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G A A(U  21 Conocephalum conicum
C C G(G - U G - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  22 Fossombronia pusilla
C C G(G - U G - - U U U)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G A - - - - - - - C G A A(U  23 Marchantia polymorpha
C C G(G - U G - - A U U)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G A - - - - - - - C G A A(U  24 Riccia fluitans
C C G(G - U G - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  25 Scapania nemorea
C C G(G - U A - - A C G)C - - G - G U(- G A - U U C A)U G - A U A A)C U U C C - - - - - - - C G A A(U  26 Equisetum hyemale
C C G(G - U A - - A C G)C - - G - G U(- G A - U U C A)U G - A U A A)C U U C C - - - - - - - C G A A(U  27 Equisetum robustum
(C)U G(G - U C - - A C G)C - - G - G U(U G A - C U C A)U G - A U A A)C U A G U - - - - - - - C G A A(U  28 Isoetes engelmannii
(C)C G(G - U A - - U U G)C - - G - G U(N G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  29 Huperzia lucidula
(C)C G(G - U - - - A U G)C - - G - G U(U G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  30 Lycopodiella inundata
 C C G(G - U A - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  31 Lycopodium phlegmaria
 C C G(G - U A - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  32 Lycopodium taxifolium
(C)C G(G - U A - - U U G C - -)G - G U(U G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  33 Lycopodium tristachyum
 C C G U(- U C - - U A U)C - - G - G U(- G A - U U C A)U G - G U A A)C U U G U - - - - - - - C G A A(U  34 Selaginella galleottii
 C C G U(- A C - - U C U)C - - G - G U(- G A - U U C A)U G - G U A A)C U U G U - - - - - - - C G A A(U  35 Selaginella sp.
 C C G C(- U G - - A U C)C - - G -(A)U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G G A(U  36 Oryza sativa
 C C G C(- C G - - A U C)C - - G -(A [illegible] A - U U C A)U G - A U A A)C U U G A - - - - - - - C G G A(U  37 Zea mays
 U U G C(- - - - - - U C)U - - G - A U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G G A(U  38 Arabidopsis thaliana
 C U G U(- U G - - C U U)U - - G - A U(- G A - U U C A)U G - A U A A)C U C G U - - - - - - - C G G A(U  39 Glycine max
(G)U G C(- U G - - C U C)U - - G - A U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G G A(U  40 Sinapis alba
 C C G(G - U C - - G U)U U - - G - G U(- G A - A U C A)U G - A U A)C C U U G A - - - - - - - U G G A(U  41 Zamia pumila
 U C(G - - U U - - G U)U C - - G - G U(- G A - A U C A)U G - A U A A)C U C G A - - - - - - - U G G A(U(  42 Gnetum leyboldii
 C C G C(- U G - - C U)U C - - G - G U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G G A(U  43 Ginkgo biloba
 C C G C(- U A - - U U)C C - - G - G U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G G A(U  44 Pinus luchuensis
 C C G C(- U U - - C U)C C - - G - G U(- G A - A U C A)U G - A(U)A A)C U C G A - - - - - - - C G G A(U  45 Pinus wallichiana
 C C G U(- U U - - C U)C C - - G - G U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G G A(U  46 Podocarpus nakaii
 C C G C(- U A - - C U)C C - - G - G U(- G A - U U C A)U G - A U A A)C U C G A - - - - - - - C G G A(U  47 Taxus mairei
 C C G(G - U A - - U U G)C -(- G)- G U(- G A - A U C A)U G - A U A A)C U U U C - - - - - - - C G A A(U  48 Adiantum raddianum
 C C G(G - U A - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U U C - - - - - - - C G A A(U  49 Adiantum raddianum 2
 C C G(G - U G - - A U G)C - - G - G U(- G A - C U C A)U G - A U A A)C U G U G - - - - - - - C G G A A   50 Ophioglossum petiolatum
 C C G(G - U A - - A C G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U C C - - - - - - - C G A A(U  51 Osmunda cinnamomea
 U C G G(- U U - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U C C - - - - - - - C G A A(U  52 Salvinia natans
 C C G(G - U U - - A U G)C - - G - G U(- G A - U U C A)U G - A U A A)C U C U G - - - - - - - C G A A(U  53 Psilotum nudum 2
(C C C G(U U G - - U U G)C - - G - G C(- G A - A U C A)U G - G U G A)C U U U G U - - - - - - C G A(A U  54 Chara foetida
(C C C G(G U A - - U U G C - -)G - G U(- G A - A U C A)U G - A U A A)C U C C U - - - - - - - C G A(A U  55 Coleochaete scutata
 G(C C G(G U A - - U U G C - -)G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A(A U  56 Klebsormidium flaccidum
(C U C G(G C G - - U U G)U - - G - G C(- G A - A U C A)U A - G U G A)C U U U U - - - - - - - C G A(A U  57 Nitella flexilis
(C U C G(G C G - - U U G)U - - G - G C(- G A - A U C A)U A - G U G A)C U U U U - - - - - - - C G A(A U  58 Nitella sp.
 C C C G(A C - - - C U G C - -)G - G U(- G A - A U C A)U G - A U A A)C U U C A - - - - - - - C G A(A U  59 Chlamydomonas reinhardtii
 U C C G(A C - - - C C G)C - - G - G U(- G A - A U C A)U G - A U A U)C U U C A - - - - - - - C G A(A U  60 Hydrodictyon reticulatum
 C C C G(A C - - - U C G)C - - G - G U(- G A - C U C A)U G - A U A A)C U U C A - - - - - - - C G A(A U  61 Parietochloris pseudoalveolaris
 - -(G G U(- - - - - U)U U - - G(G)G U(- G A U A C C G)A A - U A A U)A U U G - - - - - - - - C A G A(U  62 Dictyostelium discoideum
 - - - - - - - - - - - - - - - - -E10_1' - - - - - - - - - - - - - - - - - - - - -E10_?10_2' - - - - -   63 Helix numbering 1
 C C G(G - U A - - A U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U C C - - - - - - - C G A A U   64 Pteris vittata
 C C G(G - U A - - U U A C - - G)- G U(- G A - A U C A)U G - A U A A)C U C C U - - - - - - - C G A A(U  65 Megaceros aenigmaticus
 C C G(G - U A - - U U - C A C)G - G U(- G A - A U C A)U G G A U A A)C U C C U - - - - - - - C G A A(U  66 Notophylas breutelu
 C C G(G - U G - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U U U G U - - - - - - C G A A(U  67 Physcomitrella patens
 C C G(G - U A - - U U G)C - - G - G U(- G A - A U C A)U G - A U A A)C U C G U - - - - - - - C G A A(U  68 Sphagnum palustre
```

```
                    360                 370                 380                 390                 400
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
 C G C(A - -}U G G C]- - C U U G U -[G C U G G C G A]U G - G U[U C A(U U C -}A A A U(U U}C U G]C[C C    1 Saccharomyces cerevisiae
 C G C(A - -}U G G C]- - C U U G C -[G C C G G C G A]U G - G U[U C A(U U C -}A A A U(U U}C U G]C[C C    2 Schizosaccharomyces pombe
 C G C(A - -}C G G C]- C U U G G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C    3 Physcomitrella patens
 C G C(A - -}C G G C]- C C U G G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C    4 Anthoceros agrestis
(C)G C(A - -}C G G C]- C C C U G C -[G C C G G C(C)A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C    5 Anthoceros laevis
 C G C(A - -}C G G C]- C U U G G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C    6 Pellia epiphylla
 C G C(A - -}C G G C]- C U U A G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C    7 Reboulia hemisphaerica 2
 C G C(A - -}C G G C]- C C C G G C -[G C C G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C    8 Riccardia pinguis
 C G C(A - -}C G G C]C U A U U G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C    9 Sphaerocarpos donnelli
 C G C(A - -}C G G C]- C U U U U C -[G C U G G C G A]U - - G U[U U A(U U C - A}A A U(U U}C U]G C[C C   10 Sphaerocarpus texanus
 C G C(A - -}C G G C]- C U U A G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   11 Atrichum undulatum
 C G C(A - -}C G G C]- C U U A G C -[G C U G G C G A]U G - G U[U C A(A U C -}A A A U(U U}C U G]C[C C   12 Bryum argenteum
 C(C)C(A - -}C G G C]- C C C A G C -[G C U G G(C)G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   13 Eurhynchium hians
 C G C(A - -}C G G C]- C U U G G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   14 Funaria hygrometrica
 C G C(A - -}C G G C]- C C C A G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   15 Leptobryum pyriforme
 C G C(A - -}C G G C]- C U U G G C -[G C C G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   16 Mnium hornum
 C G C(A - -}C G G C]- C U U G G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   17 Physcomitrium pyriforme
 C G C(A - -}C G G C]- C U C A G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   18 Polytrichum formosum
 C G C(A - -}C G G C]- C C U G G C -[G C C G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   19 Sphagnum cuspidatum
 C G C(A - -}C G G C]- C U U A G A -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   20 Calypogeia arguta
 C G C(A - - G}G G C]C U U U U G C -[G C C(G}G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   21 Conocephalum conicum
 C G C(A - -}C G G C]- C C U A G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   22 Fossombronia pusilla
 C G C(A - -}C G G C]- C U U A G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   23 Marchantia polymorpha
 C G C(A - -}C G G C]- C U C C G C -[G C C G G C G A]U G - U U[U C A(U U C -}A(A)A U(U U}C U G]C[C C   24 Riccia fluitans
 C G C(A - -}C G G C]- C U U U G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   25 Scapania nemorea
 C G C(A - -}C G G C]- C U U G G C -[G C C G G C G A]U G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   26 Equisetum hyemale
 C G C(A - -}C G G C]- C U U G - C -[G C C G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   27 Equisetum robustum
 C G C(A - -}C G G C]- C U U A G N -[G C C G G C G A]U A - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   28 Isoetes engelmannii
 C G C(A - -}C G G C]- C U U U G C -[G C C G G C G A]U G - C U[U C A(N U U C}A A A U(U U}C U G]C[C C   29 Huperzia lucidula
 C G C(A - -}C G G C]- C U C A G C -[G C C G G C G A]U G - N U[U C A(C U U C}A A A U(U U}C U G]C[C C   30 Lycopodiella inundata
 C G C(A - - G}G G C]- C C U C G C -[G C C(G}G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   31 Lycopodium phlegmaria
 C G C(A - - G}G G C]- C C U C G C -[G C C(G}G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   32 Lycopodium taxifolium
 C G C(A - -}C G G C]- C U C A G U -[G C C G G C G A]U G - C U[U C A(C U U C}A A A U(U U}C U G]C[C C   33 Lycopodium tristachyum
 C G C(A - -}U A G U]- C U C U G U -[G C U G G C G A]U G - C U[U C A(A U C -}A A A U(U U}C U G]C[C C   34 Selaginella galleottii
 C G C(A - -}C G G C]- - C C A G A -[G C C G G C G A]U G - C U[U C A(A U C -}A A A U(U U}C U G]C[C C   35 Selaginella sp.
 C G C(A - -}C G G C]- C C U C G U -[G C C G G C G A]C G -[C A U C A(U U C -}A A A U(U U}C U G]C[C C   36 Oryza sativa
 C G C(A - -}C G G C]- C U U C G U -[G C C G G C G A]C G -[C A U C A(U U C -}A A A U(U U}C U G]C[C C   37 Zea mays
 C G C(A - -}U G G C]- C U C U G U -[G C U G G C G A]C G -[C A U C A(U U C -}A A A U(U U}C U G]C[C C   38 Arabidopsis thaliana
 C G C(A - -}C G G C]- C U U U G U -[G C C G G C G A]C G -[C A U C A(U U C -}A A A U(U U}C U G]C[C C   39 Glycine max
 C G C(A - -}U G G C]- C U U U G U -[G C U G G C G A]C G -[C A U C A(U U C -}A A A U(U U}C U G]C[C C   40 Sinapis alba
 U G C(A - -}U G G C]- C C U C G A -[G C C G G C G A]C G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   41 Zamia pumila
 G C G A - -}C G G C]- C U U U G U -[G C C G(G C G}A]C G -[C G U C A(U U C -}A A A U(U U}C U G]C[C C   42 Gnetum leyboldii
 C G C(A - -}C G G C]- C C U G G U -[G C C G G C G A]C G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   43 Ginkgo biloba
 C G C(A - -}C G G C]- C U U U G U -[G C U G G C G A]C G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   44 Pinus luchuensis
 C G C(A - -}C A G C]- C C U U G U -[G C U G G C G A]U G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   45 Pinus wallichiana
 C G C(A - -}C G G C]- C C U G G U -[G C C G G C G A]U G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   46 Podocarpus nakaii
 C G C(A - -}C G G C]- C U U U G U -[G C U G G C G A]C G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   47 Taxus mairei
 C G C(A - -}C - G C]- C U U G G C -[G C(C}G G C G A]U G - C U[U C A(U U C -}A A(A}U(U U}C U G]C[C C   48 Adiantum raddianum
 C G C(A - -}C G G C]- C U U G G C -[G C C G G C G A]U G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   49 Adiantum raddianum 2
[C G C(A - -}C G G C]- C U U - G C -[G C C G G C G]A C G - C U[U C A(U U C -}A A A U(U U}C U]G C[C C   50 Ophioglossum petiolatum
 C G(C A - - C G}G C]- C U U G G C -[G C(C G C}C G A]U G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   51 Osmunda cinnamomea
 C G C(A - -}C G G C]- C C U U G C -[G C C G G C G A]U G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   52 Salvinia natans
 C G C(A - -}C G G C]- C C C G G U -[G C C G G C G A]U G - C U[U C A(U U C -}A A A U(U U}C U G]C[C C   53 Psilotum nudum 2
 C G C(A - -}U G G C]- C U U U G A -[G C C G G C G A U]G - U U[C C A(U U C -}A A A U(U U}C U G]C[C C   54 Chara foetida
 C G C(A - -}C G G C]- - C C U G C -[G C C G G C G A U]G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   55 Coleochaete scutata
 C G C(A - -}C G G C]- C U U U G C -[G C U G G C G A U]G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   56 Klebsormidium flaccidum
 C G C(A - -}U G G C]- C U A U G C -[G C C G G C G A U]G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   57 Nitella flexilis
 C G C(A - -}U G G C]- C U U U G C -[G C C G G C G A U]G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   58 Nitella sp.
 C G U(A - -}U G G G]- - C U C G U -[C C C G A C G A U]G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   59 Chlamydomonas reinhardtii
 C G C(A - -}U G G C]- - C U U G C -[G C C G G C G A U]G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   60 Hydrodictyon reticulatum
 C G C(A - -}U G(C}C]- - U U C G U -[G(C)C G G C G A U]G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   61 Parietochloris pseudoalveolaris
 C G A - - - G G A]- - - U U U A - - -[U C U U C G A]C - A A G[U C U A(C U -}G U G U C A C U G]C[C C   62 Dictyostelium discoideum
11 - - - - - - - - - - - - - - - - - - - - - - -11'- - - - - - - - - - - - - - - - - - -8' - - - - - - - - -   63 Helix numbering 1
[C G C(A - -}C G G C]- C U U G G C -[G C C G G C G]A U G - C U[U C A(U U C -}A A A U(U U}C U]G C[C C   64 Pteris vittata
(G)C U(C A A}C G G C]- C U C U G G C[G C U G G C(G)A]U A - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   65 Megaceros aenigmaticus
(C)G C(A - -}C G G C]- C - C U G G C[G C U G G C(G)A]U G - U U[U C A(U U C -}A A A U(U C}C U G]C[C C   66 Notophylas breutelu
 C G C(A - -}C G G C]- C U U G G C -[G C U G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   67 Physcomitrella patens
 C G C(A - -}C G G C]- C C U G G C -[G C C G G C G A]U G - U U[U C A(U U C -}A A A U(U U}C U G]C[C C   68 Sphagnum palustre
```

```
                   410                 420                 430                 440                 450
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(U U C A)A(C)G G G]U A    1 Saccharomyces cerevisiae
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(U U U A)A(C)G G G]U A    2 Schizosaccharomyces pombe
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G    3 Physcomitrella patens
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G    4 Anthoceros agrestis
U(A)U(C - A)A C U(U U C G)A(U)G G U A G G(A)U]A G A[G(G)C C U A C C(U)U G G U(G G U A)A(C)G G G]U G    5 Anthoceros laevis
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G    6 Pellia epiphylla
U(A)U(C - A)A C U(U C C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U A)A(C)G G G]U G    7 Reboulia hemisphaerica 2
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G    8 Riccardia pinguis
U(A)U(C - A)A C U(U U C G)A C G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U A)A(C)G G G]U G    9 Sphaerocarpos donnellii
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U A)A - G G G]U G   10 Sphaerocarpus texanus
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   11 Atrichum undulatum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   12 Bryum argenteum
U(A)U(C - A)A(C)U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G(C)U(G G U A)A(C)G G G]U G   13 Eurhynchium hians
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   14 Funaria hygrometrica
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   15 Leptobryum pyriforme
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   16 Mnium hornum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   17 Physcomitrium pyriforme
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   18 Polytrichum formosum
U(A)U(C - A)A C U(U U C G)A C G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U G)A(C)G G G]U G   19 Sphagnum cuspidatum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   20 Calypogeia arguta
U(A)U(C - A)A C U(U U C G)A C G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U A)A(C)G G G]U G   21 Conocephalum conicum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   22 Fossombronia pusilla
U(A)U(C - A)A C U(U U C G)A C G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U A)A(C)G G G]U G   23 Marchantia polymorpha
U(A)U(C - A)A C U(U U C G)A C G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U A)A(C)G G G]U G   24 Riccia fluitans
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   25 Scapania nemorea
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   26 Equisetum hyemale
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   27 Equisetum robustum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   28 Isoetes engelmannii
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   29 Huperzia lucidula
U(A)U(C - A)A C U(U U C G)A C G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U G)A(C)G G G]U G   30 Lycopodiella inundata
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   31 Lycopodium phlegmaria
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   32 Lycopodium taxifolium
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   33 Lycopodium tristachyum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U A   34 Selaginella galleottii
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   35 Selaginella sp.
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G G[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   36 Oryza sativa
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G G[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   37 Zea mays
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   38 Arabidopsis thaliana
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   39 Glycine max
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   40 Sinapis alba
U(A)U(C - A)A C U(U U C G)A U G G(C)A G G(A)U]A G A[G(G)C C U(A)C C A U G G U(G G U G)A(C)G G G]U G   41 Zamia pumila
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G U[G(G)C C U A C C A U G G U(U G U G)A(C)G G G]U G   42 Gnetum leyboldii
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   43 Ginkgo biloba
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   44 Pinus luchuensis
U(A)U(C - A)A C U(U U C G)A U G G U A G G]A G A G A G G[C C U A C C A U G G U(G G U G)A(C)G G G]U G   45 Pinus wallichiana
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   46 Podocarpus nakaii
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   47 Taxus mairei
U(A)U(C - A)A C U(U U C G)A U G G U A G G - U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   48 Adiantum raddianum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   49 Adiantum raddianum 2
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   50 Ophioglossum petiolatum
U(A)U(C - A)A C U(A U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   51 Osmunda cinnamomea
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   52 Salvinia natans
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   53 Psilotum nudum 2
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   54 Chara foetida
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   55 Coleochaete scutata
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   56 Klebsormidium flaccidum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   57 Nitella flexilis
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   58 Nitella sp.
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   59 Chlamydomonas reinhardtii
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   60 Hydrodictyon reticulatum
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   61 Parietochloris pseudoalveolaris
U(A)U(C - A)A C U(U U C G)A U G G U A(C)G(G)U]A U U[G(G)C(C)U A C C A U G G U(U G U A)A(C)G G G]U A   62 Dictyostelium discoideum
- - - - - - - - - - - - - 12- - - - - - - - - - - - - - - - - - - - - - 12' - - - - - - - - - - - - - -   63 Helix numbering I
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U G)A(C)G G G]U G   64 Pteris vittata
U(A)U(A U A)A C U(U U C G)A(U)G G U A G G(A)U]A G A[G(G)C C U A C C(A)U G G U(G G U A)A(C)G G G]U G   65 Megaceros aenigmaticus
U(A)U(C - A)A C U(U U C G)A(U)G G U A G G(A)U]A G A[G(G)C C U A C C(A)U G G U(G G U A)A(C)G G G]U G   66 Notophylas breutelu
U(A)U(C - A)A C U(U U C G)A U G G U A G G(A)U]A G A[G(G)C C U A C C A U G G U(G G U A)A(C)G G G]U G   67 Physcomitrella patens
U(A)U(C - A)A C U(U U C G)A C G G U A G G(A)U]A G A[G(G)C C U A C C G U G G U(G G U G)A(C)G G G]U G   68 Sphagnum palustre
```

```
                        460                 470                 480                 490                 500
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
A[C G G G G A A U]A A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   1 Saccharomyces cerevisiae
A[C G G G G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   2 Schizosaccharomyces pombe
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   3 Physcomitrella patens
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   4 Anthoceros agrestis
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   5 Anthoceros laevis
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   6 Pellia epiphylla
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   7 Reboulia hemisphaerica 2
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   8 Riccardia pinguis
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]   9 Sphaerocarpos donnellii
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U C A G A A A C[G G C U(A)C C]  10 Sphaerocarpus texanus
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  11 Atrichum undulatum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  12 Bryum argenteum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G G(A)G C C]U G A G A G A C[G G C(A)U C C]  13 Eurhynchium hians
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  14 Funaria hygrometrica
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  15 Leptobryum pyriforme
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  16 Mnium hornum
A[C G(C)A(C)A A U]U A G G[G U U(C G A U]U(C)C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  17 Physcomitrium pyriforme
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  18 Polytrichum formosum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  19 Sphagnum cuspidatum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  20 Calypogeia arguta
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C]C U G A G A A A C A[G C U(A)C C]  21 Conocephalum conicum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  22 Fossombronia pusilla
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  23 Marchantia polymorpha
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  24 Riccia fluitans
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  25 Scapania nemorea
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  26 Equisetum hyemale
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  27 Equisetum robustum
A[C G G G G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A G A C[G G C U(A)C C]  28 Isoetes engelmannii
A[C G G A G A A U]C A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  29 Huperzia lucidula
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  30 Lycopodiella inundata
A[C G G A G A A U]C A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  31 Lycopodium phlegmaria
A[C G G A G A A U]C A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  32 Lycopodium taxifolium
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C U]U G A G A A A C[G G C U(A)C C]  33 Lycopodium tristachyum
A[C G G G G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  34 Selaginella galleottii
A[C G G G G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A C A C[G G C U(A)C C]  35 Selaginella sp.
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  36 Oryza sativa
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  37 Zea mays
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  38 Arabidopsis thaliana
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  39 Glycine max
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  40 Sinapis alba
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]C G A G A A A C[G G C U(A)C C]  41 Zamia pumila
A[C G G G G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  42 Gnetum leyboldii
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  43 Ginkgo biloba
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  44 Pinus luchuensis
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  45 Pinus wallichiana
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  46 Podocarpus nakaii
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  47 Taxus mairei
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G - G G C C]U G A G A A A C[G G C U(A)C C]  48 Adiantum raddianum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  49 Adiantum raddianum 2
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  50 Ophioglossum petiolatum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A U[G G C U(A)C U]  51 Osmunda cinnamomea
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  52 Salvinia natans
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  53 Psilotum nudum 2
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A G A U[G G C U(A)C C]  54 Chara foetida
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  55 Coleochaete scutata
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  56 Klebsormidium flaccidum
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A G A C[G G C U(A)C C]  57 Nitella flexilis
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A G A C[G G C U(A)C C]  58 Nitella sp.
A[C G G A G G A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A G A U[G G C U(A)C C]  59 Chlamydomonas reinhardtii
A[C G G A G G A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  60 Hydrodictyon reticulatum
A[C G G A G G A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  61 Parietochloris pseudoalveolaris
A[C G G G G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A U[G G C U(A)C C]  62 Dictyostelium discoideum
- - - - 13- - - - - - - - - - - - - - -13'- - - - - - - - 7'- - - - - -14 - - - - - - - - - - - - - - - - - - -14'-   63 Helix numbering 1
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  64 Pteris vittata
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  65 Megaceros aenigmaticus
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A A C C]U G A G A A A C[G G C U(A)C C]  66 Notophylas breutelu
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  67 Physcomitrella patens
A[C G G A G A A U]U A G G[G U U C[G A U]U C C G^G A G]A[G G(G)A G C C]U G A G A A A C[G G C U(A)C C]  68 Sphagnum palustre
```

```
                      510                 520                 530                 540                 550
. . . . | . . . . ! . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . :
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U]A A U U - C[A     1 Saccharomyces cerevisiae
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     2 Schizosaccharomyces pombe
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     3 Physcomitrella patens
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     4 Anthoceros agrestis
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C - G]A C A -[C(G)   5 Anthoceros laevis
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     6 Pellia epiphylla
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C U C G]A C A -[C G     7 Reboulia hemisphaerica 2
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     8 Riccardia pinguis
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     9 Sphaerocarpos donnellii
]A[C(A)U C]- A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     10 Sphaerocarpus texanus
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     11 Atrichum undulatum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     12 Bryum argenteum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G A U - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     13 Eurhynchium hians
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     14 Funaria hygrometrica
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     15 Leptobryum pyriforme
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     16 Mnium hornum
]A C A[U C]C A A G[G A]- A C G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     17 Physcomitrium pyriforme
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     18 Polytrichum formosum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     19 Sphagnum cuspidatum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     20 Calypogeia arguta
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     21 Conocephalum conicum
]A C A[U C]C A A G[G A]- A A G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     22 Fossombronia pusilla
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     23 Marchantia polymorpha
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     24 Riccia fluitans
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     25 Scapania nemorea
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C G - G G C]G C G C A A A[U U A C C[C A A)U C C - G]A C A -[C(G)   26 Equisetum hyemale
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     27 Equisetum robustum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     28 Isoetes engelmannii
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     29 Huperzia lucidula
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     30 Lycopodiella inundata
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     31 Lycopodium phlegmaria
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     32 Lycopodium taxifolium
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     33 Lycopodium tristachyum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     34 Selaginella gallecttii
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C]A A C A - C[G     35 Selaginella sp.
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     36 Oryza sativa
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     37 Zea mays
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     38 Arabidopsis thaliana
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     39 Glycine max
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     40 Sinapis alba
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     41 Zamia pumila
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     42 Gnetum leyboldii
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     43 Ginkgo biloba
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     44 Pinus luchuensis
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[U G     45 Pinus wallichiana
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     46 Podocarpus nakaii
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C G     47 Taxus mairei
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C - G]A C A -[C(G)   48 Adiantum raddianum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     49 Adiantum raddianum 2
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     50 Ophioglossum petiolatum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G U A - G G C]G C G U A A A[U U A C C[C A A)U C C C G]A C A -[C G     51 Osmunda cinnamomea
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     52 Salvinia natans
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     53 Psilotum nudum 2
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G U A A A[U U A C C[C A A)U C C U G]A C A -[U A     54 Chara foetida
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A U A -[C A     55 Coleochaete scutata
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A U A -[C A     56 Klebsormidium flaccidum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C A     57 Nitella flexilis
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C A     58 Nitella sp.
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     59 Chlamydomonas reinhardtii
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A U U -[C G     60 Hydrodictyon reticulatum
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C U G]A C A -[C A     61 Parietochloris pseudoalveolaris
]A[C U U C]U A C G[G A - A G]G C A[G C A - G G C]G C G C A A A[U U A C U[C A A)U C C - C]A A U A C[G     62 Dictyostelium discoideum
 - - 15- - - - - - - - 15' - - - - - - -5' - - - - - - - - - - - - - - - - - -16 - - - - - - - - - - - - - - -   63 Helix numbering 1
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     64 Pteris vittata
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C(G)   65 Megaceros aenigmaticus
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C C C A A A[U U A C C[C A A)U C C C G]A C A -[C(G)   66 Notophylas breutelu
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     67 Physcomitrella patens
]A[C(A)U C]C A A G[G A -(A)G]G C A[G C A - G G C]G C G C A A A[U U A C C[C A A)U C C C G]A C A -[C G     68 Sphagnum palustre
```

```
                    560                 570                 580                 590                 600
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C G A U A C A G G G C C C]A U U C -[G G G U C - U U G    1 Saccharomyces cerevisiae
 G G G(A -)G G U A G]U[G A C A]A G A A A U A A[C A A U G C A G G G C C C]U U U C -[G G G U C - U U G    2 Schizosaccharomyces pombe
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    3 Physcomitrella patens
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    4 Anthoceros agrestis
)G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    5 Anthoceros laevis
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    6 Pellia epiphylla
 A G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    7 Reboulia hemisphaerica 2
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    8 Riccardia pinguis
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    9 Sphaerocarpos donnellii
 G G G(A -)G G U A G]U[G A C A]A U A A - U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    10 Sphaerocarpus texanus
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    11 Atrichum undulatum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    12 Bryum argenteum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A U A G G G C U U]U U A C -[A A G U C - U U A    13 Eurhynchium hians
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    14 Funaria hygrometrica
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    15 Leptobryum pyriforme
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    16 Mnium hornum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A C(A A U A C(U C)G G G U U]U U A C -[A A C U C(- U C)G    17 Physcomitrium pyriforme
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - C G G    18 Polytrichum formosum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C G A U A C C G G G C U U]U U A C -[A A G U C - U G G    19 Sphagnum cuspidatum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    20 Calypogeia arguta
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    21 Conocephalum conicum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    22 Fossombronia pusilla
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    23 Marchantia polymorpha
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    24 Riccia fluitans
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    25 Scapania nemorea
)G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    26 Equisetum hyemale
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    27 Equisetum robustum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C - G G G C U U]C U A C -[A A G U C - U(G)G    28 Isoetes engelmannii
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    29 Huperzia lucidula
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C G A U G C U G G G C U U]U U A C -[A A G U C - U G G    30 Lycopodiella inundata
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    31 Lycopodium phlegmaria
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    32 Lycopodium taxifolium
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U - G G C U U]U U A C -[A A G U C(- U)G G    33 Lycopodium tristachyum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]- U A U -[G A G U C - U G G    34 Selaginella galleottii
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C U U]- U A C -[A A G U C - U G G    35 Selaginella sp.
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C G C]U U U A -[G U G U C - U G G    36 Oryza sativa
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C G C]G U U A -[G U G U C - U G G    37 Zea mays
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C U C]U U U C -[G A G U C - U G G    38 Arabidopsis thaliana
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C U C]A U U - -[G A G U C - U G G    39 Glycine max
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C U C]A U U - -[G A G U C - U G G    40 Sinapis alba
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]A U C - -[G A G U C - U G G    41 Zamia pumila
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C U C]- A U C -[G A G U C - U G G    42 Gnetum leyboldii
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]A U C - -[G A G U C - U G G    43 Ginkgo biloba
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]- A U C -[G A G U C - U G G    44 Pinus luchuensis
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]- A U C -[G A G U C - U G G    45 Pinus wallichiana
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]- U U A -[G A G U C - U G G    46 Podocarpus nakaii
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]- A U C -[G A G U C - U G G    47 Taxus mairei
)G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U U C -[A A G U C - U G G    48 Adiantum raddianum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U U C -[A A G U C - U G G    49 Adiantum raddianum 2
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C U U]U U A C -[A A G U C - U G G    50 Ophioglossum petiolatum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    51 Osmunda cinnamomea
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U C U -[A A G U C - U G G    52 Salvinia natans
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]- U U C A[A A G U C - U G G    53 Psilotum nudum 2
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]U U U C -[G A G U C - C G G    54 Chara foetida
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A U -[A A G U C - U G G    55 Coleochaete scutata
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U G C U G G G C U U]U U C A -[A A G U C - U G G    56 Klebsormidium flaccidum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]U U U C -[G A G U C - C G G    57 Nitella flexilis
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U C]U U U C -[G A G U C - C G G    58 Nitella sp.
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C C G G G C G C]- U U C -[G C G U C - U G G    59 Chlamydomonas reinhardtii
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C A C]U U C - -[G U G U C - U G G    60 Hydrodictyon reticulatum
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C U A U G C U U G G C U]C - U U C - G[A G U C - G G G    61 Parietochloris pseudoalveolaris
 G G G(A -)A G U A G]U[G A C A]A U A A A A U A U[C A A U(A C -)C U(A)U C C]U U U U U[G G A(G)G - G(- C    62 Dictyostelium discoideum
 - - - - 16' - - - - - - - - 4'- - - - - - - - - - - - - - -17 - - - - - - - - - - - - - - - - - - - - - -17'-    63 Helix numbering 1
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U U C -[A A G U C - U G G    64 Pteris vittata
)G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    65 Megaceros aenigmaticus
)G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C C U]U U A C -[A A G U C C U G G    66 Notophylas breutelu
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C A A U A C U G G G C U U]U U A C -[A A G U C - U G G    67 Physcomitrella patens
 G G G(A -)G G U A G]U[G A C A]A U A A A A U A A[C G A U A C C G G G C U U]U U A C -[A A G U C - U G G    68 Sphagnum palustre
```

```
                    610                 620                 630                 640                 650
. . . . | . . . . . | . . . . . | . . . . | . . . . | . . . . . | . . . . | . . . . . | . . . . | . . . . . |
U A[A]U U G]G A A U G A[G U]A C A A U G U - A A A U A - C C U U A -[A C]G A G - G A A C A A[U U G G    1 Saccharomyces cerevisiae
U A[A]U U G]G A A U G A[G U]A C A A U G U - A A A U A - C C U U A -[A C]G A G - G A A C A A[U U G G    2 Schizosaccharomyces pombe
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G    3 Physcomitrella patens
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C U A[U U G G    4 Anthoceros agrestis
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G    5 Anthoceros laevis
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G    6 Pellia epiphylla
U A[A]U U G]G U A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G    7 Reboulia hemisphaerica 2
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G    8 Riccardia pinguis
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G    9 Sphaerocarpos donnelli
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U - -[A C]G A G - G A U C C A[U U G G   10 Sphaerocarpus texanus
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   11 Atrichum undulatum
U A[A]U U G]G A A U G A G A A C A A U C U - A A A U C - C C U U A - A C G A G - G A U C C A[U U G G   12 Bryum argenteum
U A[A]U U G]G A A U G A[G U]A C A A U U U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   13 Eurhynchium hians
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   14 Funaria hygrometrica
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   15 Leptobryum pyriforme
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   16 Mnium hornum
U A[A]U U]C G A A U C G C U A C A A U C U - A A A U C - C C U U A - A C A C G - G A U C C A[U U G G   17 Physcomitrium pyriforme
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   18 Polytrichum formosum
U A[A]U C G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   19 Sphagnum cuspidatum
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   20 Calypogeia arguta
U A[A]U U G]G A A U G A G A A C A A U C U - A A A U C - C C U U A - A C G A G - G A U C C A[U U G G   21 Conocephalum conicum
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   22 Fossombronia pusilla
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   23 Marchantia polymorpha
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   24 Riccia fluitans
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   25 Scapania nemorea
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   26 Equisetum hyemale
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   27 Equisetum robustum
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   28 Isoetes engelmannii
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A C C - C C U U A -[A C]G A G - G A U C C A[U U G G   29 Huperzia lucidula
U A[A]U C G]G A A U G A[G U]A C A A U C C - A A A C C - N C U U A -[A C]G A G - G A U C C A[U U G G   30 Lycopodiella inundata
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   31 Lycopodium phlegmaria
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   32 Lycopodium taxifolium
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A C C - C C U U A -[A C]G A G - G A U C C A[U U G G   33 Lycopodium tristachyum
U A[A]U U G]G A A U G A G A A C A A U C U - A A A U C - U C U U A - A C G A G - G A U C C A[U U G G   34 Selaginella galleottii
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - U C U U A -[A C]G A G - G A U C C A[U U G G   35 Selaginella sp.
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   36 Oryza sativa
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   37 Zea mays
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   38 Arabidopsis thaliana
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A U G G A U C C A[U U G(A)   39 Glycine max
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   40 Sinapis alba
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   41 Zamia pumila
U A[A]U U G]G A A U G A[G U]A C A A U U U - A A A G C - C C U U A -[A C]G A G - G A U C C A[U U G G   42 Gnetum leyboldii
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   43 Ginkgo biloba
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   44 Pinus luchuensis
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   45 Pinus wallichiana
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A C C - C C U U A -[A C]G A G - G A U C C A[U U G G   46 Podocarpus nakaii
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   47 Taxus mairei
U A - U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   48 Adiantum raddianum
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   49 Adiantum raddianum 2
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A C A - C C U U A -[A C]G A G - G A U C C A[U U G G   50 Ophioglossum petiolatum
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   51 Osmunda cinnamomea
U A[A]U U G]G A A U G A[G U]A C G A U C U - A A A U C - C C C U A -[A C]G A G - G A U C C A[U U G G   52 Salvinia natans
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A C C - C C U U A -[A C]G A G - G A U C C A[U U G G   53 Psilotum nudum 2
U A[A]U U G]G A A U G A G A A C A G U C C U A A A C U C C U U C A - A C G A G - G A U C C A[U U G G   54 Chara foetida
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - U C U U A -[A C]G A G - G A U C C A[U U G G   55 Coleochaete scutata
C A[A]U U G]G A A U G A[G U]G C A A U C U - A A A U C - C C U C A -[A C]G A G - G A U C C A[U U G G   56 Klebsormidium flaccidum
U A[A]U U G]G A A U G A G A A C A G U C U - A A A C C C C U U A A - A C G A G - G A U C C A[U U G G   57 Nitella flexilis
U A[A]U U G]G A A U G A G A A C A G U C U - A A A C C C C U U A A - A C G A G - G A U C C A[U U G G   58 Nitella sp.
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   59 Chlamydomonas reinhardtii
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - U A U C C A[U U G G   60 Hydrodictyon reticulatum
C A[A]U A G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C A A[U U G G   61 Parietochloris pseudoalveolaris
- A]A U U G]A A A U G -[A A]C A C A A A U U A A A A C - U C U U A A[U U]A A - - C A - C A A[U U G R   62 Dictyostelium discoideum
- - - - - - - - - - - - 18- - - - - - - - - - - - - - - - - - - - - - - 18' - - - - - - - - - - - - - 19-   63 Helix numbering 1
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   64 Pteris vittata
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U o A -[A C]G A G - G A U C C A[U U G G   65 Megaceros aenigmaticus
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   66 Notophylas breutelu
U A[A]U U G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   67 Physcomitrella patens
U A[A]U C G]G A A U G A[G U]A C A A U C U - A A A U C - C C U U A -[A C]G A G - G A U C C A[U U G G   68 Sphagnum palustre
```

```
                    660                 670                 680                 690                 700
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    1 Saccharomyces cerevisiae
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    2 Schizosaccharomyces pombe
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    3 Physcomitrella patens
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    4 Anthoceros agrestis
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    5 Anthoceros laevis
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    6 Pellia epiphylla
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    7 Reboulia hemisphaerica 2
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    8 Riccardia pinguis
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A    9 Sphaerocarpos donnelli
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U -[G C G U A   10 Sphaerocarpus texanus
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   11 Atrichum undulatum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   12 Bryum argenteum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   13 Eurhynchium hians
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   14 Funaria hygrometrica
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   15 Leptobryum pyriforme
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   16 Mnium hornum
A]C[G G]G A A G U[C U G G]U G C C A C G A G[C C]G C G G U A A U U[C C A G]C[U C C A A]U[A G C G U A   17 Physcomitrium pyriforme
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   18 Polytrichum formosum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   19 Sphagnum cuspidatum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   20 Calypogeia arguta
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C G A]U[A G C G U A   21 Conocephalum conicum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   22 Fossombronia pusilla
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   23 Marchantia polymorpha
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   24 Riccia fluitans
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   25 Scapania nemorea
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   26 Equisetum hyemale
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   27 Equisetum robustum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   28 Isoetes engelmannii
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   29 Huperzia lucidula
A G^G G C]A A G U G[U G G]U G C C A G C A[G C C]G N G G U A A U U[C C A]G[C U C C A A]U[A G C G U A   30 Lycopodiella inundata
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   31 Lycopodium phlegmaria
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   32 Lycopodium taxifolium
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   33 Lycopodium tristachyum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   34 Selaginella galleottii
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   35 Selaginella sp.
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   36 Oryza sativa
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   37 Zea mays
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   38 Arabidopsis thaliana
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U(C)C A A]U[A G C G U A   39 Glycine max
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   40 Sinapis alba
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   41 Zamia pumila
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   42 Gnetum leyboldii
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   43 Ginkgo biloba
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   44 Pinus luchuensis
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   45 Pinus wallichiana
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   46 Podocarpus nakaii
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   47 Taxus mairei
A G^G G C]A A G U[C U G]- U G C C A G C A[G C C]G C - G U A A U U C[C A G^C U C C A A]U[A G C G U A   48 Adiantum raddianum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   49 Adiantum raddianum 2
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   50 Ophioglossum petiolatum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G U G G U A A U U[C C A G^C U C C A A]U A[G C G U A   51 Osmunda cinnamomea
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   52 Salvinia natans
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   53 Psilotum nudum 2
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   54 Chara foetida
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   55 Coleochaete scutata
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   56 Klebsormidium flaccidum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   57 Nitella flexilis
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   58 Nitella sp.
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   59 Chlamydomonas reinhardtii
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   60 Hydrodictyon reticulatum
A G^G G C]A A G U[C U G G]U G C C A G C A[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   61 Parietochloris pseudoalveolaris
A G^G G C]A A G U[C U G G]U G C C A G C R[G C C]G C G G U A A U U[C C A G^C U C C A A]U[A G C A U A   62 Dictyostelium discoideum
- - - 20- - - - - - - 21- - - - - - - - - - - - - 20' - - - - - - - - - - - - 21' - - - 19' - - - - - - - - -3'   63 Helix numbering 1
A G^G G C]A A N N[N N N N]N N N N N N N N[N N N]N N G G U A A U U[C C A G^C U C C A A]U[A G C G U A   64 Pteris vittata
A G^G o o]o o o o[o o o o]o o o o o o o o[o o o]G C G G U A A U U[C C A G^C U C C o A]U[A G C G o o   65 Megaceros aenigmaticus
A G^G o o]o o o o[o o o o]o o o o o o o o[o o o]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   66 Notophylas breutelu
A G^G N N]N N N N[N N N N]N N N N N N N N[N N N]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   67 Physcomitrella patens
A G^G N N]N N N N[N N N N]N N N N N N N N[N N N]G C G G U A A U U[C C A G^C U C C A A]U[A G C G U A   68 Sphagnum palustre
```

```
                    710                 720                 730                 740                 750
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
U A U U A]A A G U U G U U G[C A G]U U A A A A A G C[U C G U(A G)U U G A]A C U U U[G G G C - C C(G)G     1 Saccharomyces cerevisiae
U A U U A]A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G A]A C U U U[G A(G)C - C U G G     2 Schizosaccharomyces pombe
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G(U)- C(G)G G    3 Physcomitrella patens
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G G - U G G G    4 Anthoceros agrestis
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G - - U G G G    5 Anthoceros laevis
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A(U)G G G G(   6 Pellia epiphylla
U A U U]U A U G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G G - A G G G(  7 Reboulia hemisphaerica 2
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A - C G G G    8 Riccardia pinguis
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G G - A G G G    9 Sphaerocarpos donnelli
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U(G)G]A U C U U[G G G G(- A)G G G   10 Sphaerocarpus texanus
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A - U G G G   11 Atrichum undulatum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G U - C G G G(  12 Bryum argenteum
U A U U]U A A C U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U C[G G G(C -)U U G(C)  13 Eurhynchium hians
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G U - C G G G(  14 Funaria hygrometrica
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G U - C G G G(  15 Leptobryum pyriforme
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G U - C G G G(  16 Mnium hornum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G U - C G G G(  17 Physcomitrium pyriforme
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G A - C G G G   18 Polytrichum formosum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   19 Sphagnum cuspidatum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A - U G G G   20 Calypogeia arguta
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U G[G G G - A G G G   21 Conocephalum conicum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A U G G G G(  22 Fossombronia pusilla
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A G G G G G   23 Marchantia polymorpha
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G G A G G G U   24 Riccia fluitans
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G G U G G G G(  25 Scapania nemorea
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G(A -)C G G G(  26 Equisetum hyemale
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G(G -)C G G G(  27 Equisetum robustum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - U G G G   28 Isoetes engelmannii
U A U C]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A - U G G G   29 Huperzia lucidula
U A U]C U N N N U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - U G G G   30 Lycopodiella inundata
U A U]C U G A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - U G G G   31 Lycopodium phlegmaria
U A U]C U G A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - U G G G   32 Lycopodium taxifolium
U A U]C U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G A - U G G G   33 Lycopodium tristachyum
U A U(C)A]A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G U G G U G   34 Selaginella galleottii
U A U(C)A]A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G U G G G G   35 Selaginella sp.
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A C C U U G[G G(C -)G C G G(  36 Oryza sativa
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A C C U U[G G G(C - C)G G G(  37 Zea mays
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G A]A C C U U[G G G(A -)U G G G   38 Arabidopsis thaliana
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A C C U U[G G G(U -)U G G G   39 Glycine max
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G A]A C C U U[G G G(A -)U G G G   40 Sinapis alba
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G(A -)C G G(C   41 Zamia pumila
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G(A -)U G G G   42 Gnetum leyboldii
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G(C -)C G G G(  43 Ginkgo biloba
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A C C U U[G G G(A -)C G U(C)  44 Pinus luchuensis
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G(U -)C G(U)A   45 Pinus wallichiana
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G(U -)C G U G(  46 Podocarpus nakaii
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G(U -)C G U(C)  47 Taxus mairei
U A U U]U A A G U U G U U G[C(A)G]U U A A A A - G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   48 Adiantum raddianum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   49 Adiantum raddianum 2
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   50 Ophioglossum petiolatum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C U[G G G - U G G G   51 Osmunda cinnamomea
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   52 Salvinia natans
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   53 Psilotum nudum 2
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U U[G G G(U - G)G G A   54 Chara foetida
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U C[G G G(U)- U G G A   55 Coleochaete scutata
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U U[G G G(U)- U G G G(  56 Klebsormidium flaccidum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U U[G G G(U - G)G G A   57 Nitella flexilis
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U U[G G G(U - G)G G A   58 Nitella sp.
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U C[G G G U - G G G G   59 Chlamydomonas reinhardtii
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U C[G G G(U)- G G G U   60 Hydrodictyon reticulatum
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U U U C[G G G U - G G G U   61 Parietochloris pseudoalveolaris
U A C U A]A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G A]A G U U U A[A G G(- U U)U A   62 Dictyostelium discoideum
- - - - - - - - - - - - - - - - - - - 22- - - - - - - - - - - - - - - - - 23- - - - - - - - - - - - - - - - - - E23_   63 Helix numbering 1
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   64 Pteris vittata
U A A U]A A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - U G G G   65 Megaceros aenigmaticus
C A A U]A A A G U U G U U G[C(A)G]U U A A A A A G G[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   66 Notophylas breutelu
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U U[G G G(U)- C(G)G G   67 Physcomitrella patens
U A U U]U A A G U U G U U G[C(A)G]U U A A A A A G C[U C G U(A G)U U G G]A U C U C[G G G G - C G G G   68 Sphagnum palustre
```

```
                    760                 770                 780                 790                 800
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
U U G(- G)C C - G G U(C)C G - A]- - - - - - - - - - - - U U U U - - - - - - - - - - - - -(U C G(- - U    1 Saccharomyces cerevisiae
U C G(- A)C U - G G U(C)C G - C(C)G C]- - - - - - - - - - - A A G - - - - - - - - - -[G C G U G(- - U    2 Schizosaccharomyces pombe
G G G(A)G - C - G G U(C)C G - C C C]- - - - - - - - - - C U U G U - - - - - - - - - -[G G G U G(- - U    3 Physcomitrella patens
G U(G)- G C U - G G U(C)C G - C C U]- - - - - - - - - - C U U U - - - - - - - - - - -[G G G U G(- - U    4 Anthoceros agrestis
G(U G - G A)C - G G U(C)C G - C U]- - - - - - - - - - - C C U U U - - - - - - - - - -[G G U G(- - U    5 Anthoceros laevis
(C)- - G A(G)C - G G U(C)C G - C C]- - - - - - - - - - U C U U U U - - - - - - - - - -[G G U G(- - U    6 Pellia epiphylla
(U C - C G G)C - G G U(C)C G -(G)C]- - - - - - - - - - - - U A C U U G U - - - - - - -[G(G)U G(- - C    7 Reboulia hemisphaerica 2
G(C - G A G)C - G G U(C)C G - C C]- - - - - - - - - - - - U U U C C G - - - - - - - -[G G U G(- - U    8 Riccardia pinguis
U C - G G(G)C - G G U(C)C G - C U]- - - - - - - - - - - - U C U U U U - - - - - - - -[G G U G(- - U    9 Sphaerocarpos donnellii
U(C - G G G - -)G G U(C)C G - C C]- - - - - - - - - - - - U C U U U U - - - - - - - -[G G U G(- - U    10 Sphaerocarpus texanus
G(C - G A G)C - G G U(C)C G - C C]- - - - - - - - - - - - U C U U U U - - - - - - - -[G G U G(- - U    11 Atrichum undulatum
(G)G - G A(G)C - G G U(C)C G - C C]- - - - - - - - - - - - C C U U C G U G - - - - - -[G G U G(- - U    12 Bryum argenteum
)U G - G A(G U C)G G U(C C)G - C U]- - - - - - - - - - - - U C G U - - - - - - - - - -[G G U(C - - U    13 Eurhynchium hians
(G)G - G A(G)C - G G U(C)C G - C C C]- - - - - - - - - - C U U G U - - - - - - - - -[G G G U G(- - U    14 Funaria hygrometrica
(G)G - G A(G)C - G G U(C)C G - C C C]- - - - - - - - - - C U U G U - - - - - - - - -[G G G U G(- - U    15 Leptobryum pyriforme
(G)G - G A(G)C - G G U(C)C G - C C C]- - - - - - - - - - C U C G U - - - - - - - - -[G G G U G(- - U    16 Mnium hornum
(G G -)G A(G)C - G G U(C)C G - C C]- - - - - - - - - - - - C C U U G U G - - - - - - -[G G U G(- - U    17 Physcomitrium pyriforme
G A - G A(G)C - G G U(C)C G - C C]- - - - - - - - - - - - U C U U U U - - - - - - - -[G G U G(- - U    18 Polytrichum formosum
G(C -)G G(G)C - G G U(C)C G - U C]- - - - - - - - - - - - U U U G G G - - - - - - - -[G G U G(- - U    19 Sphagnum cuspidatum
G(C -)G(A)G C - G G U(C)C G - C C]- - - - - - - - - - - U C U U U U - - - - - - - - -[G G U G(- - U    20 Calypogeia arguta
C(U -)U(G)G C - G G U(C)C G - C U]- - - - - - - - - - - C U C C U U U C G U G G G G -[G G U G(- - U    21 Conocephalum conicum
(C)- - G A(G)C - G G U(C)C G - C C]- - - - - - - - - - U C U U U U - - - - - - - - - -[G G U G(- - U    22 Fossombronia pusilla
U - - C G(G)C - G G U(C)C G - C C]- - - - - - - - - - U C U U U U - - - - - - - - - -[G G U G(- - U    23 Marchantia polymorpha
C - - C G(G)C - G G U(C)C G - C U]- - - - - - - - - - C C U U G G U G G - - - - - - -[G G U G(- - U    24 Riccia fluitans
(C)- - G A(G)C - G G U(C)C G - C C]- - - - - - - - - - U C U U U U - - - - - - - - - -[G G U G(- - U    25 Scapania nemorea
(G C - G U G)C - G G U(C)C G - C C]- - - - - - - - - - - - C U C U C G - - - - - - - -[G G U G(- - U    26 Equisetum hyemale
(G C - G U G)C - G G U(C)C G - C C]- - - - - - - - - - - - C U C U C G - - - - - - - -[G G U G(- - U    27 Equisetum robustum
A U - G C(A)C - G G U(C)C G - C C C]- - - - - - - - - - - - U C G G - - - - - - - - -[G G G U G(- - U    28 Isoetes engelmannii
G C - G A(A C -)G G U(C)C G - C C]- - - - - - - - - - - - U C C U U U - - - - - - - -[G G U G(- - U    29 Huperzia lucidula
G C - G G(A)C - G G U(C)C G - C U U]- - - - - - - - - - - - U U U C - - - - - - - - -[G G G U G(- - U    30 Lycopodiella inundata
G C - G A(A C -)G G U(C)C G - C C]U - - - - - - - - - - - C C U U - - - - - - - - U[G G U G(- - U    31 Lycopodium phlegmaria
G C - G A(A C -)G G U(C)C G - C C]U - - - - - - - - - - - C C U U - - - - - - - - U[G G U G(- - U    32 Lycopodium taxifolium
G C - G A(A)C - G G U(C)C G - C C]- - - - - - - - - - - - U C C U U U - - - - - - - -[G G U G(- - U    33 Lycopodium tristachyum
G - - G(A)C U - G G U(C)C G - C C C]- - - - - - - - - - - U U G C - - - - - - - - - -[G G G U G(- - U    34 Selaginella galleottii
C - - G A(A)C - G G U(C)C G - C C C]- - - - - - - - - - - U C G C - - - - - - - - - -[G G G U G(- - U    35 Selaginella sp.
(C C G G G C)C - G G U(C C)G - C C]- - - - - - - - - - - - U C A C - - - - - - - - - -[G G C(A - - G    36 Oryza sativa
(C - - - - -)C - G G(G -)U G - C C]- - - - - - - - G C C G C C G U A C G - - - - - - -[G G C A(- - -    37 Zea mays
U C - G G C C - G G U(C)C G - C C]- - - - - - - - - - - - U U U - - - - - - - - - - -[G G U G(- - U    38 Arabidopsis thaliana
U C - G A U C - G G U(C)C G - C C]- - - - - - - - - - - - U C C - - - - - - - - - - -[G G U G(- - U    39 Glycine max
U C - G(C)C C - G G U(C)C G - C]- - - - - - - - - - - - G U U U G - - - - - - - - - - -[G U G(- - A    40 Sinapis alba
C)C - G G C C - G G U(C)C G - C U]- - - - - - - - - - - U U U U U G - - - - - - - - -[G G U G(- - U    41 Zamia pumila
G U - G G U C - G G U(C)C G - C C]- - - - - - - - - - - G A U C C - - - - - - - - - -[G G U G(- - U    42 Gnetum leyboldii
(U)C - G G C C - G G U(C)C G - C C]- - - - - - - - - - - U U U U C - - - - - - - - - -[G G U G(- - U    43 Ginkgo biloba
)A(C)- G G U C - G G U(C)C G - C C]- - - - - - - - - - - U U C U U - - - - - - - - - -[G G U G(- - U    44 Pinus luchuensis
A(A)- G G U(C)- G G U(C)C G - C C]- - - - - - - - - - - U A C U C - - - - - - - - - -[G G U G(- - U    45 Pinus wallichiana
(U C -)U G(U)C - G G U(C)C G - C C]- - - - - - - - - - G C A C C - - - - - - - - - - -[G G U G(- - U    46 Podocarpus nakaii
)A(C)- G G U U - G G U(C)U G - C C]- - - - - - - - - - - U A C U C - - - - - - - - - -[G G U G(- - U    47 Taxus mairei
G C - G A(G)C(- G)G U(C)C G - C C]- - - - - - - - - - - U U C U U U - - - - - - - - -[G G U G(- - U    48 Adiantum raddianum
G C - G A(G)C - G G U(C)C G - C C]- - - - - - - - - - - U U C U U U - - - - - - - - -[G G U G(- - U    49 Adiantum raddianum 2
G C - G(G)G C - G G U(C)C G - C C C]- - - - - - - - - - - - U C G U - - - - - - - - -[G G G U G(- - U    50 Ophioglossum petiolatum
G(C -)G A(G)C - G G U(C)C G - C U]- - - - - - - - - - - - - C U U C U - - - - - - - -[G G U G(- U U    51 Osmunda cinnamomea
G C - G G G C - G G U(C)C G - C C]- - - - - - - - - - - - U C C U C G - - - - - - - -[G G U G(- - U    52 Salvinia natans
G C - G A(G)C - G G U(C)C G - C C]- - - - - - - - - - U C C U C G - - - - - - - - - -[G G U G(- - U    53 Psilotum nudum 2
G G G - G U C - G G U(C)C G - C U C]- - - - - - - - - - - U U G C - - - - - - - - -[G G G C G(- - U    54 Chara foetida
G(C)G - A C C - G G U(C)C G - C C C]- - - - - - - - - - - U U U - - - - - - - - - -[G G G U G(- - U    55 Coleochaete scutata
(G)C G - G C C - G G U(C)C G - C C]- - - - - - - - - - - - U C A C - - - - - - - - - -[G G U G(- - U    56 Klebsormidium flaccidum
A G G -(A)C U - G G U(C)C G - C C]- - - - - - - - - - - U U C G C - - - - - - - - - -[G G C G(- - U    57 Nitella flexilis
A G G -(A)C U - G G U(C)C G - C C U]- - - - - - - - - - - U C G C - - - - - - - - -[G G G C G(- - U    58 Nitella sp.
U G G -(U)G C - G G U(C)C G - C C]- - - - - - - - - - - - U C U - - - - - - - - - - -[G G U G(- - U    59 Chlamydomonas reinhardtii
U(C)U - A G C - G G U(C)C G - C C]- - - - - - - - - - - - U A U - - - - - - - - - - -[G G U G(- - A    60 Hydrodictyon reticulatum
C G C - G C C - G G U(C)C G - C C G]- - - - - - - - - - - U U U - - - - - - - - - -[C G G U G(- - U    61 Parietochloris pseudoalveolaris
C C G - G G U - U U A(- U G U C A U U U)A C C A C]- - - - - U U C - - - - - - - - - -[G U G G U - -    62 Dictyostelium discoideum
_I - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    63 Helix numbering 1
G C - G(A)G C - G G U(C)C G - C C -]- - - - - - - - - - U C C U U U - - - - - - - -[- G G U G(- - U    64 Pteris vittata
G(U G - A C)U - G G U(C)C G - C C]- - - - - - - - - - - - U C U C A A - - - - - - - -[G G U G(- - U    65 Megaceros aenigmaticus
G(U - G A U)U - G G U(C)C G - C C]- - - - - - - - - - - - U C C N G A - - - - - - - -[G G G G(- - U    66 Notophylas breutelu
G G G(A)G - C - G G U(C)C G - C C C]- - - - - - - - - - C U U G U - - - - - - - - -[G G G U G(- - U    67 Physcomitrella patens
G(C -)G G(G)C - G G U(C)C G - C C]- - - - - - - - - C U C U U U G G G - - - - - - - -[G G U G(- - U    68 Sphagnum palustre
```

```
                    810                 820                 830                 840                 850
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
G - U)A C U G G(- A U U U C - - -)C A A C(G)G - G G C C U]U U C C - - - - - - - - - -[U U C U G G]C U    1 Saccharomyces cerevisiae
U - U)A C U G G(- - - U C A - - -)U G A C C G - G G(G)U C]G U U A A C - - - - - - - C[U U C U G G]C A    2 Schizosaccharomyces pombe
G - C)A C U(G)G - - U C - - - - - - C(A)C U C(G)- G(C)C U U]C U - - - - - - - - - - - - -[U G C C G G]G G    3 Physcomitrella patens
G - U)A C U G G - - U(G)- - - - - - A C C U C A - U C C C]U C U - - - - - - - - - - - - - G[G U C G G]G G    4 Anthoceros agrestis
G - C)A C U G(G - - U G - - - - - - A)C C U C A(- U)C C U]A C - - - - - - - - - - - - - C G[G U C G G]G G    5 Anthoceros laevis
G - C)A C U G(G)- - U C - - - - - - -(C)U U C C - U C U C]U U - - - - - - - - - - - U U G[G U C G G]G G    6 Pellia epiphylla
G - C)A C U G(G - - U C - - - - - C U U)C U C U - C C U U]- - - - - - - - - - - - - U C G[G U C G G]G G    7 Reboulia hemisphaerica 2
G - C)A C U G(G - - U C - - - - - - - U)C C C C G U C C U]U U - - - - - - - - - - - - C G[G U C G G]G G    8 Riccardia pinguis
G - C)A C U G(G)- - - C - - - - - - C G A C U C - U C U C U]U U U - - - - - - - - - -[U(G)G C C G G]G G    9 Sphaerocarpos donnelli
G - C)A C U(G G - - - C - - - C G G C)G C C U - C U C U]U U - - - - - - - - - - - - -[U(G)G C C G G]G G   10 Sphaerocarpus texanus
G - C)A C U G(G - - U C - - - - - - U)C U C C A - U C C U]U U - - - - - - - - - - - - -[U(G)G U C G G]G G   11 Atrichum undulatum
G - C)A C U G(G)- - U C - - - - - - C(A)C C C G - A C C U]U G U U U - - - - - - - - - C[U G C C G G]G G   12 Bryum argenteum
A - C)A C U(A G - -)U C - - - - - - C A(C C)C G - A - C C U]U U - - - - - - - - - - - - C U[G C C G]C G G   13 Eurhynchium hians
G - C)A C U G(G)- - U C - - - - - - C(A)C U - C - G G C C U]U C - - - - - - - - - - - - U[U G C C G G]G G   14 Funaria hygrometrica
G - C)A C U G(G)- - U C - - - - - - C(A)C C - C - G A C C U]U U - - - - - - - - - - - - C[U G C C G G]G G   15 Leptobryum pyriforme
G - C)A C U G(G)- - U C - - - - - - C(A)C C - C - G A C C U]U G - - - - - - U U U U C[U G C C G G]G G   16 Mnium hornum
G - C)A C U G(G)- - U C(- - - - - - C A)C U C G - G C C U]- - - - - - - - - - - - - - C[U U G C C G G]G G   17 Physcomitrium pyriforme
G - C)A C U G(A)- - U C - - - - - - U C U C C - - G U C C U]U U - - - - - - - - - - - - U G[G U C G G]G G   18 Polytrichum formosum
G - C)A C C G(G)- - C C(- - - - - U)C C C C - - G U C C U]U A - - - - - - - - - - - - G[U G C C G G]G G   19 Sphagnum cuspidatum
G - C)A C U G(G)- U(C)U - - - - - - - C U C C A - U C C U]U U - - - - - - - - - - - - -[U(G)G C C G G]G G   20 Calypogeia arguta
G - C)A C U G(A)- C(G)G - - - - - - - G U C U U - C U U]U U G U A U - - - - - - - - - A[U G C C G G]G G   21 Conocephalum conicum
G - C)A C U G(G)- - U C - - - - - - -(U)C U C C - A U C C U]U U - - - - - - - - - - - - U G[G U C G G]G G   22 Fossombronia pusilla
G - C)A C U G(G)- - C G - - - - - - - G C C C C - U U U C U]U U - - - - - - - - - - - U U G[G C C G G]G G   23 Marchantia polymorpha
G - C)A C U G(G)- - C G - - - - - - - G G C C U - U C U C U]U G U U - - - - - - - - - U C[U G C C G G]G G   24 Riccia fluitans
G - C)A C U G(G)- - U C - - - - - - -(U)C U C C - A C C C U]U - - - - - - - - - - - U U G[G U C G G]G G   25 Scapania nemorea
G - C)A C U G(U - - U C - - - - - - - G C)U C C - G U C C]U U U - - - - - - - - - - - - C[U G U C G G]G G   26 Equisetum hyemale
G - C)A C U G(U - - U C - - - - - - - G C)U C C - G U C C]U U U - - - - - - - - - - - - C[U G U C G G]G G   27 Equisetum robustum
G - C)A C U G(G)- - G C - - - - - - - A U U U C - A C C C U]U - - - - - - - - - - - - C[U(A)G U U G G]C G   28 Isoetes engelmannii
G - C)A C U(U G - -)U C - - - - - - - G C U C C - A U U C U]U U - - - - - - - - - - - -[U(G)G U C G G]G G   29 Huperzia lucidula
G - C)A C C G(G)- - C U - - - - - - - G C U C C - A C U C U]U U - - - - - - - - - - - -[U(G)G C C G G]G G   30 Lycopodiella inundata
G - C)A C U(U G - -)U C - - - - - - - G C U C C - A U C C U]U U - - - - - - - - - - - -[U(G)G U C G G]G G   31 Lycopodium phlegmaria
G - C)A C U(U G - -)U C - - - - - - - G C U C C - A U C C U]U U - - - - - - - - - - - -[U(G)G U C G G]G G   32 Lycopodium taxifolium
G - C)A C U G(G)- - U C - - - - - - - G C U C C - A U U C U]U U - - - - - - - - - - - -[U(G)G U C G G]G G   33 Lycopodium tristachyum
G - C)A C U G G - -(C)C - - - - - - - C C G U C - A C C C U]U U - - - - - - - - - - - -[U(A)G C C G G]G G   34 Selaginella galleottii
G - C)A C U G(G)- - U C - - - - - - - G C U C C - A U C C U]U U - - - - - - - - - - - - G A[G U C G G]U G   35 Selaginella sp.
G - C)A C C G(A - - - - - - - - - - - - C)C U G - C U C]G A C C C U U - - - - - - - - C[U G C C G G]C G   36 Oryza sativa
G - A A)C C G(A - - C C - - - - - - - G G)C U C(G A)C C C]U U - - - - - - - - - - - - C[U(G)C C G G]C G   37 Zea mays
G - C)A U U G G - - U C - - - - - - - G G C U U - G U C C]C U U - - - - - - - - - - - - C G[G U C G G]C G   38 Arabidopsis thaliana
G - C)A C C G G - - U C - - - - - - - G G C U C - G U C C]C U U - - - - - - - - - - - - C[U G C C G G]C G   39 Glycine max
G - C)A C C G G - -(U)C - - - - - - - G G C U U - G U C C]C U U - - - - - - - - - - - - C[U G U C G G]C G   40 Sinapis alba
G - C)A C C G G - - C C - - - - - - - G(U U)U C - G U C C]C U U - - - - - - - - - - - - U[U G U U G G]C G   41 Zamia pumila
G - C)A U C G A - - C C - - - - - - - G C U C C - G U U C]C U U - - - - - - - - - - - - C[U G U C G G]C G   42 Gnetum leyboldii
G - C)A C C G G - - C C - - - - - - - G(C)U C C - G U C C]C U U - - - - - - - - - - - - C[U G C C G G]C G   43 Ginkgo biloba
G - C)A C U G G - - C C - - - - - - -(C)U(C)A C - G U C U]C U U - - - - - - - - - - - - C[U G C C G G]C G   44 Pinus luchuensis
G - C)A C C(U)G - - C C - - - - - - -(C)U U(C)C - G U C C]C U U - - - - - - - - - - - - U[U G U C G G]C G   45 Pinus wallichiana
G - C)A C C G(C)- - C A(- - - - - - - C U)C G C - G U C C]C U U - - - - - - - - - - - - C[U G C C G G]C G   46 Podocarpus nakaii
G - C)A C U G G - - C C - - - - - - -(C)U(C)A C - G U C C]C U U - - - - - - - - - - - - C[U G C C G G]C G   47 Taxus mairei
G - C)A - U G(G)- - U C - - - - - - - G C U C C - G C C C U]U U - - - - - - - - - - - - C[U G U C G G]G G   48 Adiantum raddianum
G - C)A C U G(G)- - U C - - - - - - - G C U C C - G C C C U]U U - - - - - - - - - - - - C[U G U C G G]G G   49 Adiantum raddianum 2
G - C)A C U N C - -(G)C - - - - - - - G C U C C - G C C C U]U U - - - - - - - - - - - - C[U G C C G G]G G   50 Ophioglossum petiolatum
G - C)A C U G(G)- - U - - - - - - - - C C U C C - A U C C]U U U - - - - - - - - - - - - C[U G U C G G]G G   51 Osmunda cinnamomea
G - C)A C C G C - - U U - - - - - - - G C C U C - G C C C U]U U - - - - - - - - - - - - C U[G U C G G]G G   52 Salvinia natans
G - C)A C U G(G)- - U C G - - - - - - C U C - C - G U C C U]U C - - - - - - - - - - - - C[U G C C G G]G G   53 Psilotum nudum 2
G - U)A C U G G - - C C - - - - - - - C U U U C(- G C)C U U]U C - - - - - - - - - - - - U[U G C C G G]G G   54 Chara foetida
G - C)A C U G G - - U U - - - - - - -(U)C U C C - A(U)C C U]U C - - - - - - - - - - - - U[U G U C G G]G G   55 Coleochaete scutata
G - C)A C C G G - - C C - - - - - - - G(A)C C C - A(U)C C U]U C - - - - - - - - - - - - U[U G C C G G]G G   56 Klebsormidium flaccidum
G - C)A C C G G - -(C)C - - - - - - - C U U C C(- G C)C U C]U C - - - - - - - - - - - - U[U G C C G G]G G   57 Nitella flexilis
G - C)A C C G G - -(C)C - - - - - - - C U U C C(- G C)C U C]U C - - - - - - - - - - - - U[U G C C G G]G G   58 Nitella sp.
G - C)A C U G C - -(U)C - - - - - - - U G C U C - C A C C U]U C - - - - - - - - - - - - C[U G C C G G]G G   59 Chlamydomonas reinhardtii
G - U)A C U G C - - U A - - - - - - -(U)G G C C - C(U)C C U]U U - - - - - - - - - - - - C[U G C C G G]G G   60 Hydrodictyon reticulatum
G - C)A C U G G - - C G - - - - - - - U G G C C - C A C C U]U G - - - - - - - - - - - - C[U G C C G G]G G   61 Parietochloris pseudoalveolaris
- - - U A A A U(- - - C G A C - A)C C G G U A - - U C U]C U U U C U U A A - - - U A[G U U C A G]C U   62 Dictyostelium discoideum
- - - - - - - - - - - - - - - - - - - - - - - - - - - E23_1'- - - - - - - - - - - - - - - - - - E23_2 - - - -   63 Helix numbering 1
G - C)A C U G G - -(U)C - - - - - - G C U C C - - G C C C U]U U - - - - - - - - - - - - C[U G U C G G]G G   64 Pteris vittata
G G U)A C U G(G - G U G - - - - - - A)C U C C A(- o)U C C]U U - - - - - - - - - - - C U G[G U C G G]G G   65 Megaceros aenigmaticus
C - U)A C U A(G G - - G - - - - - - A)C C U C A(- C)C C C]U - - - - - - - - - - - - C U C[C U C G G]G -   66 Notophylas breutelu
G - C)A C U(G)G - - U C - - - - - - C(A)C U C(G)- G(C)C U U]C U - - - - - - - - - - - - -[U G C C G G]G G   67 Physcomitrella patens
G - C)A C C G(G)- - C C(- - - - - - U)C C - C C - G U C C U]U A - - - - - - - - - - - - G[U G C C G G]G G   68 Sphagnum palustre
```

```
                      860                 870                 880                 890                 900
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
- - - - - - - - - - - - - - - A A[C C(- U - - - U -)G A G U C]C U U G U - - -[G G C U C(U - - - - U)G G]     1 Saccharomyces cerevisiae
- - - - - - - - - - - - - - - A A[C U - A(C)U C A - U G U U C]U U U A U U - -[G A G C G U G G - - U A G]     2 Schizosaccharomyces pombe
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G U U]U U A A U U - -[A A U C G G G A - - C G C     3 Physcomitrella patens
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G(U)C]U U A A U U - -[G(C)C U G G G A - - C G C     4 Anthoceros agrestis
- - - - - - - - - - - - - - - A[C G C - G(- - U)U C U G G U C]U U A A C U - -[G G C C G G G(A - -)C G C     5 Anthoceros laevis
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G U C]U U A A U U - -[G G C U G G G A - - C G U     6 Pellia epiphylla
- - - - - - - - - - - - - - - A[C G C - G(C - C)C C U(U)G C U]U U A A C U - -[G G C(U)G G G(A - -)C G C     7 Reboulia hemisphaerica 2
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U G A C U - -[G G C U G G G A - - C G C     8 Riccardia pinguis
- - - - - - - - - - - - - - - A[C G C - G(C -)U U C U G G C C]U U C G U U - -[G G U C G G G A - - U G C     9 Sphaerocarpos donnelli
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C - G G C C]U U C G U U - -[G G C U(G)G G A - - C G C     10 Sphaerocarpus texanus
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G U C]U U A A C U - -[G G C U G G G A - - C G C     11 Atrichum undulatum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U C G C U - -[G G U C G G G A - - C G C     12 Bryum argenteum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C(A)U G(C)C C]U U C G C U - -[G G(U)C G(G)G A - - C G C     13 Eurhynchium hians
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G U U]U U A A C U - -[A A U C G G G A - - C G C     14 Funaria hygrometrica
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U C G C U - -[G G U C G G G A - - C G C     15 Leptobryum pyriforme
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U C G C U - -[G G U C G G G A - - C G C     16 Mnium hornum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G U U]U U A A U U - -[A A U C G G G A - - C G C     17 Physcomitrium pyriforme
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U G A U U - -[G G C U G G G A - - C G C     18 Polytrichum formosum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U G A C U - -[G G U C G G G A - - C G C     19 Sphagnum cuspidatum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A C U - -[G G C U G G G A - - C G C     20 Calypogeia arguta
- - - - - - - - - - - - - - - A[C G C - G(C -)G C C U G G C C]U U G A C U - -[G G U C G G G C - - C G C     21 Conocephalum conicum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C     22 Fossombronia pusilla
- - - - - - - - - - - - - - - A[C G C - G(C -)G U C U G G C C]U U G A C U - -[G G U C G G G C - - C G C     23 Marchantia polymorpha
- - - - - - - - - - - - - - - A[C G C - G(C - G)U C U G G C C]U U G A U U - -[G G U C G G G(A - -)C G C     24 Riccia fluitans
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G U C]U U A A C U - -[G G C U G G G A - - C G C     25 Scapania nemorea
- - - - - - - - - - - - - - - A[C G C -(A C -)U C C U G G(C)C]U U A A C U - -[G(U)C C G G G A(- - C)G C     26 Equisetum hyemale
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G(C)C]U U A A C U - -[G(U)C C G G G A - - C G C     27 Equisetum robustum
- - - - - - - - - - - - - - - A C[G U(- U)G - U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C]    28 Isoetes engelmannii
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C     29 Huperzia lucidula
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A C U - -[G G C U G G G A - - C G C     30 Lycopodiella inundata
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C     31 Lycopodium phlegmaria
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C     32 Lycopodium taxifolium
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C     33 Lycopodium tristachyum
- - - - - - - - - - - - - - - A[C A U - G - - U C C U G G(A)C]U U C A C U - -[G(A)C U G G G G - - C A U     34 Selaginella galleottii
- - - - - - - - - - - - - - - A[C G C(U)G - - C C C U G G(A)C]U U U A C U - -[G(G)C U G G G G - - C G C     35 Selaginella sp.
- - - - - - - - - - - - - - - A[U G C - G(C - U)C C U G G C C]U U A A C U - -[G G C C G G G(U - U)C G U     36 Oryza sativa
- - - - - - - - - - - - - - - A[U G C - G(C - U)C C U C G C C]U U A A C U - -[G G C C G G G(U - -)C G U     37 Zea mays
- - - - - - - - - - - - - - - A[U A C - G(C - U)C C U G G U C]U U A A U U - -[G G C C G G G(U - -)C G U     38 Arabidopsis thaliana
- - - - - - - - - - - - - - - A[U G C - G(C - U)C C U G(U)C C]U U A A C U - -[G G(C)C G G G(U - -)C G U     39 Glycine max
- - - - - - - - - - - - - - - A[U A C - G(C - U)C C U G G C C]U U A A U U - -[G G C C G G G(U - -)C G U     40 Sinapis alba
- - - - - - - - - - - - - - - G[C G C - G(C -)A C C U G G(C)C]U U A A C U - -[G(U)C U G G G U - - C G C     41 Zamia pumila
- - - - - - - - - - - - - - - A[C G C - G(G - U)C C U G G C C]U U A A U U - -[G G C U G G G(U - -)C G C     42 Gnetum leyboldii
- - - - - - - - - - - - - - - G[C G C - G(C - U)C C U G G C C]U U A A U U - -[G G C U G G G(U - -)C G C     43 Ginkgo biloba
- - - - - - - - - - - - - - - G[C G U - G(U - U)C C U G G C C]U U A A U U - -[G G C U G G G(U - -)C G C     44 Pinus luchuensis
- - - - - - - - - - - - - - - G[C G U - G(C - U)C C U G G C C]U U A A C U - -[G G C U G G G(U - -)C G C     45 Pinus wallichiana
- - - - - - - - - - - - - - - G C[G C - G(U - U)C C U G G C C]U U A A C U - -[G G U C G G G(U - -)C G C]    46 Podocarpus nakaii
- - - - - - - - - - - - - - - G[C G U - G(C - U)C C U G G(C)C]U U A A U U - -[G(U)C U G G G(U - -)C G C     47 Taxus mairei
- - - - - - - - - - - - - - - A[C(G)C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G -     48 Adiantum raddianum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C     49 Adiantum raddianum 2
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A G G U - -[G G C U G G G A - - C G C     50 Ophioglossum petiolatum
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G(C)C]U U A A C U - -[G(U)U C G G G A - - C G C     51 Osmunda cinnamomea
- - - - - - - - - - - - - - - C[C G C - G(C -)U C C U G G C C]U U C A U U - -[G G U C G G G A - - C G C     52 Salvinia natans
- - - - - - - - - - - - - - - A[C G C - G(G -)C C C U G G C C]U U C G C U - -[G G C U G G G G - - C G C     53 Psilotum nudum 2
- - - - - - - - - - - - - - - A[U G(U)- G(U -)U C C U(U)G C C]- U U U A C U -[G G C(C)G G G A - - U(C)C     54 Chara foetida
- - - - - - - - - - - - - - - A[C G C - G(C -)U U C U(U)G C C]- U U A A C U -[G G C(U)G G G A - - C G U     55 Coleochaete scutata
- - - - - - - - - - - - - - - A[C N C - G(C -)U C C U G G C C]- U U A A C U -[G G U C G G G A - - C G U     56 Klebsormidium flaccidum
- - - - - - - - - - - - - - - A[C G U - G(C -)U C C U(C)G C C]- U U C A U U -[G G C(C)G G G A - - C G C     57 Nitella flexilis
- - - - - - - - - - - - - - - A[C G U - G(C -)U C C U(C)G C C]- U U C A U U -[G G C(C)G G G A - - C G C     58 Nitella sp.
- - - - - - - - - - - - - - - A[C G G - G(C -)U C C U G G G C]- U U C A C U -[G U C U G G G A - - C U C     59 Chlamydomonas reinhardtii
- - - - - - - - - - - - - - - A[C G A - G(U -)U G C U G G G C]- U U C A C U -[G U C C G G U G - - C U U     60 Hydrodictyon reticulatum
- - - - - - - - - - - - - - - A[C G G - G(C -)U C C U G G G C]- U U C A C U -[G U C C G G G A - - C U C     61 Parietochloris pseudoalveolaris
U - - - - - - - - - - - - - - - - - - - - - - - -(G U A U U A U C]U U U - - - - - -[G A U A G U G C]- - - U U     62 Dictyostelium discoideum
- E23_3 E23_3'E23_4E23_4' - - - - - - - - - E23_5 - - - - - - - - - - - - - - - - - - - - - - E23_5'- - - -     63 Helix numbering 1
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U A A U U - -[G G C U G G G A - - C G C     64 Pteris vittata
- - - - - - - - - - - - - - - A[C G A U G(C - U)C C U G G A C]U A A A C U - -[G C C U G G G(A - -)C G C     65 Megaceros aenigmaticus
- - - - - - - - - - - - - - - A[G C A U G(C - U)C C U G U U C]U A - C C U U A[G C U U G G U(A - -)C G G     66 Notophylas breutelu
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G U U]U U A A U U - -[A A U C G G G A - - C G C     67 Physcomitrella patens
- - - - - - - - - - - - - - - A[C G C - G(C -)U C C U G G C C]U U G A C U - -[G G U C G G G A - - C G C     68 Sphagnum palustre
```

DCSE Alignment

```
                    910                 920                 930                 940                 950
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
]C G A - A[C - C A G G A]C U U U[U A C U U U - G A]A A A A A[U U A - G A G U - G]U[U C A(A A - G}C(A)    1 Saccharomyces cerevisiae
]G G A - A[C - C A G G A]C U U U[U A C(C)U U - G A]A A A A A[U U A - G(A)G U - G]U[U C A(A A - G}C(A)    2 Schizosaccharomyces pombe
 G]G A - G[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A     3 Physcomitrella patens
 G]G A - G[U - C G A C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A(    4 Anthoceros agrestis
 G]G A - G[U - C G G C]G A U G U[C A C U C U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A     5 Anthoceros laevis
 G]G A - G[U - C G A C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A     6 Pellia epiphylla
 G]G A - G[U - C G G C]G A U G U[U A C U U U - G A]G A A A A[U U A - G A G U - G]C[U C A(A A - G}C A(    7 Reboulia hemisphaerica 2
 G]G A - G[U - C G A C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A     8 Riccardia pinguis
 G]G A - G[U - C G G C(G)A]C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A     9 Sphaerocarpos donnelli
 G]G A - G[U - C G G C(G)A]U G U[U A C U U U - G A]G A A A A[U U A - G A G U - G]C[U C A(- A - G}C A(   10 Sphaerocarpus texanus
 G]G A - G[U - C G A C(G)A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    11 Atrichum undulatum
 G]G A - G[U - C G G C G]A C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    12 Bryum argenteum
 G]G A - G U -[C G G C]C A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    13 Eurhynchium hians
 G]G A - G[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    14 Funaria hygrometrica
 G]G A - G[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    15 Leptobryum pyriforme
 G]G A - G[U - C G G C G]A C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    16 Mnium hornum
 G]G A - G[U - C G G C G A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    17 Physcomitrium pyriforme
 G]G A - G[U - C G A C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    18 Polytrichum formosum
 G]G A - U[U - C G G C G]A C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    19 Sphagnum cuspidatum
 G]G A - G[U - C G G C(G)A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    20 Calypogeia arguta
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    21 Conocephalum conicum
 G]G A - G[U - C G A C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    22 Fossombronia pusilla
 G]G A - G[U - C G G C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    23 Marchantia polymorpha
 G]G A - G[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    24 Riccia fluitans
 G]G A - G[U - C G A C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    25 Scapania nemorea
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    26 Equisetum hyemale
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    27 Equisetum robustum
]C G A - G[C - C G G C G]C U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    28 Isoetes engelmannii
 G]G A - G[U - C G A C(G)A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    29 Huperzia lucidula
 G]G A - G[U - C G G C(G)A]C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    30 Lycopodiella inundata
 G]G A - G[U - C G A C(G)A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    31 Lycopodium phlegmaria
 G]G A - G[U - C G A C(G)A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    32 Lycopodium taxifolium
 G]G A - G[U - C G A C(G)A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    33 Lycopodium tristachyum
 G]G A G -[U - C G G C(G)A]U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    34 Selaginella galleottii
 G]G A G -[U - C G G C]G A U G U[U A C(C)U U - G A]A A A A A[U U A - G(A)G U - G]C[U C A(A A - G}C A    35 Selaginella sp.
 G]C C - U[C - C G G C G]C C G U[U A C U U U - G A]A G A A A[U U A - G A G U - G]C[U C A(A A - G}C A    36 Oryza sativa
 G]C C - U[C - C G G - G]C C G U[U A C U U U - G A]A G A A A[U U A - G A G U - G]C[U C A(A A - G}C A    37 Zea mays
 G]C C - U[C - C G G C]G C U G U[U A C U U U - G A]A G A A A[U U A - G A G U - G]C[U C A(A A - G}C A    38 Arabidopsis thaliana
 G]C C - U[C - C G G U G]C U G U[U A C U U U - G A]A G A A A[U U A - G A G U - G]C[U C A(A A - G}C A    39 Glycine max
 G]C C - U[C - C G G C G]C U G U[U A C U U U - G A]A G A A A[U U A - G A G U - G]C[U C A(A A - G}C A    40 Sinapis alba
 G]G U - U[C - C G A C G]C U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    41 Zamia pumila
 G]G C - U[U - C G A C G]C U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    42 Gnetum leyboldii
 G]G C - U[C - C G G C G]C C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    43 Ginkgo biloba
 G]G U - U[C - C G G C G]C C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    44 Pinus luchuensis
 G]G C - U[C - C G G C G]C U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    45 Pinus wallichiana
]G G U - U[C - C G G C G]C U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    46 Podocarpus nakaii
 G]G U - U[C - C G G C G]C C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    47 Taxus mairei
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G C}A    48 Adiantum raddianum
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    49 Adiantum raddianum 2
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]N N N A A[U U A - G A G U - G]C[U C A(A A - G}C A    50 Ophioglossum petiolatum
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    51 Osmunda cinnamomea
 G]U A - C[U - C G A U]U A U G U[U A C U U U - G A]A A A A A[U U G - G A G U - G]C[U C A(A A - G}C A    52 Salvinia natans
 G]G A - U[U - C G G C G]A C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    53 Psilotum nudum 2
 A]G A - G[C - C G G C G]C U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    54 Chara foetida
 G]G A - G[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    55 Coleochaete scutata
 G]G A - G[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    56 Klebsormidium flaccidum
 G]G A - G[C - C G G C G]C C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    57 Nitella flexilis
 G]G A - G[C - C G G C G]C C G U[U A C U U U - G A]A A A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    58 Nitella sp.
 G]G A - G[U - C G G C G]A G G U[U A C U U U - G A]G U A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    59 Chlamydomonas reinhardtii
 G]G A - G[U - C G G C G]U U G U[U A C U U U - G A]G U A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    60 Hydrodictyon reticulatum
 G]G A - G[U - C G G C G]A G G U[U A C U U U - G A]G U A A A[U U A - G A G U - G^U U C(A)A(A - G}C A    61 Parietochloris pseudoalveolaris
 G - - - U[U - U G G A C]A U U U[C A C U G U - G A]G A A A A[U U G - U G G U - G^U(U)U(A)A(A - G}C A    62 Dictyostelium discoideum
 - - - - - - - - E23_2'- - - - - - E23_6 - - - - - - - - - - - - - - - - E23_6 -'- - - - - - - E23_7 -    63 Helix numbering 1
 G]G A - U[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G]C A    64 Pteris vittata
 G]G A - G[U - C G A C]G A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    65 Megaceros aenigmaticus
 G]G A - G[U G C G A C]G A U G U[U U C U U U G G A]A A A A A[U U A G G A G U U -]C[U C A(A A G G]A A    66 Notophylas breutelu
 G]G A - G[U - C G G C G]A U G U[U A C U U U - G A]A A A A A[U U A - G A G U - G]C[U C A(A A - G}C A    67 Physcomitrella patens
 G]G A - U[U - C G G C G]A C G U[U A C U U U - G A]A A A A A[U U A - G A G U - A]A[U C A(A A - G}C A    68 Sphagnum palustre
```

```
                        960                 970                 980                 990                 1000
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
)G G C G]- - - - U A U - -(U G C U -(C)G(A A - U A U - A U U - A G - C A)U G G]A A -(U A A U A - G A    1 Saccharomyces cerevisiae
)G G C A A]- - - G U U -(U U G C U -(C)G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A U A - A A    2 Schizosaccharomyces pombe
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G    3 Physcomitrella patens
(U)G C]- - - C U U A U - - -(G C(U C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(G)G    4 Anthoceros agrestis
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U G A C G - U A    5 Anthoceros laevis
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G    6 Pellia epiphylla
(A)G C]- - - - C A U A C - -(G C(- C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G    7 Reboulia hemisphaerica 2
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G    8 Riccardia pinguis
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G    9 Sphaerocarpos donnellii
(A)G C]- - - - C U A C - - -(G U(- C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(C)G]  10 Sphaerocarpus texanus
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(A)G   11 Atrichum undulatum
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   12 Bryum argenteum
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G A]A A -(U A A C G - U G   13 Eurhynchium hians
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   14 Funaria hygrometrica
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   15 Leptobryum pyriforme
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G(- C)G   16 Mnium hornum
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   17 Physcomitrium pyriforme
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(C)G   18 Polytrichum formosum
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]G A -(U A G C G - C G   19 Sphagnum cuspidatum
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(U)G   20 Calypogeia arguta
 A G C]- - C A U U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   21 Conocephalum conicum
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   22 Fossombronia pusilla
 A G C]- - - C A U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   23 Marchantia polymorpha
 A G C]- - - C G U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   24 Riccia fluitans
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   25 Scapania nemorea
 A G C]- - - - C U G U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A(C)G(- U -)  26 Equisetum hyemale
 A G C]- - - - C U G U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   27 Equisetum robustum
 G G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(U)G   28 Isoetes engelmannii
 G G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   29 Huperzia lucidula
 G G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   30 Lycopodiella inundata
 G G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U(U)  31 Lycopodium phlegmaria
 G G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C A -(G)G   32 Lycopodium taxifolium
 G G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   33 Lycopodium tristachyum
 A G C]- - - - A A U U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C A - C(C)  34 Selaginella galleottii
 G G C]- - - - U C C U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C(U)  35 Selaginella sp.
 A G C]- - - - C A U C - - -(G C U(C)U G(G A - U A C - A U U - A G - C A)U G G]G A -(U A A C A - U(C)  36 Oryza sativa
 A G C]- - - - C A U C - - -(G C U(C)U G(G A - U A C - A U U - A G - C A)U G G]G A -(U A A C A - U(C)  37 Zea mays
 A G C]- - - - C U A C - - -(G C U(C)U G(G A - U A C - A U U - A G - C A)U G G]G A -(U A A C A - U(C)  38 Arabidopsis thaliana
 A G C]- - - - C U A C - - -(G C U(C)U G(U A - U A C - A U U - A G - C A)U G G]G A -(U A A C A - C(C)  39 Glycine max
 A G C]- - - - C U A C - - -(G C U(C)U G(U A - U A C - A U U - A G - C A)U G G]G A -(U A A C A - U(C)  40 Sinapis alba
 A G C]- - - - U U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G(- G U)  41 Zamia pumila
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   42 Gnetum leyboldii
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   43 Ginkgo biloba
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(C)G   44 Pinus luchuensis
 A G C]- - - - U U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G(  45 Pinus wallichiana
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(U)G   46 Podocarpus nakaii
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G -(U)G   47 Taxus mairei
 A G C]- - - - C U A U - - -(G C U(C)U(- A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   48 Adiantum raddianum
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - C G   49 Adiantum raddianum 2
 A G C]- - - - C U A C - - -(G C U(N)U G(A A - U A C - G U U - A G - C A)U G G]A A -(U A A C G(- A N)  50 Ophioglossum petiolatum
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   51 Osmunda cinnamomea
 A G C]- - - - C U G U - - -(G C U(C)U G(A A - C A C - A U U - A G - C A)U G G]A A -(U A A C G -(U)G   52 Salvinia natans
 A G C]- - - - C U G U - - -(G C U(C)U G(A A - U A C - G U U - A G - C A)U G G]A A -(U A A C G - U G   53 Psilotum nudum 2
 G G C]- - - - C U G U - - -(G C U(C)U G(A A - C A U - A U U - A G - C A)U(G)G A A]-(U A A C G -(C)G   54 Chara foetida
 G G C]- - - - A U A G - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U(G)G A A]-(U A A C A - U(U)  55 Coleochaete scutata
 G G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U(G)G A A]-(U A A C G - U G   56 Klebsormidium flaccidum
 G G C]- - - - C C A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U(G)G A A]-(U A A C G - C G   57 Nitella flexilis
 G G C]- - - - C C A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U(G)G A A]-(U A A C G - C G   58 Nitella sp.
 G G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U(G)G A A]-(U A A C A(- C)G   59 Chlamydomonas reinhardtii
 G G C]- - - - A U A C - - -(G C C(C)U G(A A - U A C - U U U - A G - C A)U(G)G A A]-(U A A C A -(C)G   60 Hydrodictyon reticulatum
 G G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U(G)G A A]-(U A A C A -(C)G   61 Parietochloris pseudoalveolaris
 G G C G]- - - - U C U - -(C G C C - U G(A U - C U U U U G C - A G - C A)U(G)G(U)A]-(U G A U G]- A A   62 Dictyostelium discoideum
 - - - - - - - - - - - - - - - - - - - - - - - - - E23_7'- - - - - - - - - - - - - - - - - - - - - E -23_8   63 Helix numbering 1
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G(- C G)  64 Pteris vittata
 A G C]- - - C U C A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   65 Megaceros aenigmaticus
 G C -]- - C A U C A U - - -(G C U(C)U -(A A U U A C - A U - A A G A - A)U G G]A - U(U A A C G A U U   66 Notophylas breutelu
 A G C]- - - - C U A U - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]A A -(U A A C G - U G   67 Physcomitrella patens
 A G C]- - - - C U A C - - -(G C U(C)U G(A A - U A C - A U U - A G - C A)U G G]G A -(U A G C G - C G   68 Sphagnum palustre
```

```
                    1010                1020                1030                1040                1050
 . . . . | . . . . ! . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
 A U]A G G A[C G(U - U)U G G U U C U]-[A U U U U - G U U G]G U U - U C U[A G - G A C - - C A(U)C G]U    1 Saccharomyces cerevisiae
 A U]A G G A[C G(U -)G U G G U U C U]-[A U U U U - G U U G]G U U - U C U[A G - G A C - - C G C C G]U    2 Schizosaccharomyces pombe
 A U]A G G A[C U C - - U G G U C C U]-[G U U(C)G U G U U G]G U C - U U C[G G - G A C - - C G G A G]U    3 Physcomitrella patens
 A U]A G G A[C U C - - U G G U C C U]-[A U U(G)U - G U U G]G U C - U U C[G G - G A U - - U G G A G]U    4 Anthoceros agrestis
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U    5 Anthoceros laevis
 A]U A G G A[C U C - - U G G U C C U]- A[U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U    6 Pellia epiphylla
 A]C A G G A[C U U - - C G G U C U U]- A[U U G C - G U U G]G U C - U U C[G G - G A C - - C G G A G]U    7 Reboulia hemisphaerica 2
 A U]A G G A[C U C - - C G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U    8 Riccardia pinguis
 A]C A G G A[C U C - - U G G U C U U]- U[U U G C - G U U G]G U C - U U C[G G - G A C - - C G G A G]U    9 Sphaerocarpos donnellii
]- C A G G A[C U C - - U G G U C C U]- A -[U(U)U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   10 Sphaerocarpus texanus
 A U]A G G A[C U C - - U G G U C C U]-[G U U(C)U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   11 Atrichum undulatum
 A]U A G G A[C U C - - U G G U C C U]- U[U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   12 Bryum argenteum
 A U]A G A A[U(A G - -)G G(C C)C C U]-[G U U G U - G U U G]G U C - U C C[G G - G(A)C - - C(G G A)G]U   13 Eurhynchium hians
 A]U A G G A[C U C - - U G G U C C U]G U[U C G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   14 Funaria hygrometrica
 A U]A G G A[C U C - - U G G U C C U]-[G U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   15 Leptobryum pyriforme
 A U]A G G A[C U C - - U G G U C C U]-[G U C(U C)U G U U G]G U C - U U C[G G - G A C - - C G G A G]U   16 Mnium hornum
 A U]A G G A[C U C - - U G G U C C U]-[G U C G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   17 Physcomitrium pyriforme
 A U]A G G A[C U C - - U G G U C C U]-[G U U(C)C - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   18 Polytrichum formosum
 A U]A G G A[C U C - - U G G U C C U]-[G U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   19 Sphagnum cuspidatum
 A U]A G G A[C U C - - U G G U C C U]-[A U U(U)U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   20 Calypogeia arguta
 A U]A G G A[C U U - - C G G U C U U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   21 Conocephalum conicum
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   22 Fossombronia pusilla
 A]C A G G A[C U C - - U G G U C U U]- A[U U G C - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   23 Marchantia polymorpha
 A]C A G G A[C U U - - C G G U C U U]- A[U U G C - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   24 Riccia fluitans
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   25 Scapania nemorea
)A U]A G G A[C U C - - U G G U C C U]-[A U(U G)U -(A)U U G]G U C - U U C[G G - G A C - - C G G A G]U   26 Equisetum hyemale
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   27 Equisetum robustum
 A]U A G G A[C(C)C - - C G G U C C U]- U[U U(C)C - G U U G]G U C - U U C[G G - G A C - - C G G(A)G]U   28 Isoetes engelmannii
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   29 Huperzia lucidula
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   30 Lycopodiella inundata
)A U]A G G A[C U C - - U G G U C C U]-[A U(U)G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   31 Lycopodium phlegmaria
 A U]A G G A[C U C - - U G G U C C U]-[A U U(G)U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   32 Lycopodium taxifolium
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   33 Lycopodium tristachyum
)A U]A G G A[C U C - - C G G U C C U]-[G U(U)G U - G U U G]G U C - U U U[G G - G A U - - U G G A G]U   34 Selaginella galleottii
)A U]A G G A[C U C - -(C)G G U C C U]-[G U(U)G U - G U U G]G U C - U C C[G G - G A U - - C(A)G A G]U   35 Selaginella sp.
)A U]A G G A[U U C - - C G G U C C U]-[A U(U)G U - G U U G]G C C - U U C[G G - G A U - - C G G A G]U   36 Oryza sativa
)A U]A G G A[U U C - - C G G U C C U]-[A U(U)G U - G U U G]G C C - U U C[G G - G A U - - C G G A G]U   37 Zea mays
)A U]A G G A[U U U - - C G A U C C U]-[A U(U)G U - G U U G]G C - - U U C[G G - G A U - - C G G A G]U   38 Arabidopsis thaliana
)A]C A G G A[U U C - - U G A U C C U]- A[U(U)G U - G U U G]G C C - U U C[G G - G A U - - C G G A G]U   39 Glycine max
)A U]A G G A[U U U - - C G G U C C U]-[A U(U)G U - G U U G]G C C - U U C[G G - G A U - - C G G A G]U   40 Sinapis alba
)A U]A G G A[U U C - - U G G U C C U]-[A U(U G)C - G U U G]G C C - U U C[G G - G A C - - C G G A G]U   41 Zamia pumila
 A U]A G G A[U U U - - C G A U C C U]-[G U U G U - G U U G]G C C - U U C[G G - G A U - - C G G A G]U   42 Gnetum leyboldii
 A U]A G G A G[U C - - U G G U C C U]-[A U U G U - G U U G]G C C - U U C[G G - G A C - - C G G A]G U   43 Ginkgo biloba
 A U]A G G A G[U C - - U G G U C C U]-[G U U(C)C - G U U G]G C C - U U C[G G - G A C - - C G G A]G U   44 Pinus luchuensis
(A)U]A G G A G[U C - - U G G U C C U]-[A(C)U G U - G U U G]G C C - U U C[G G - G A C - - C G G A]G U   45 Pinus wallichiana
 A U]A G G A G[U C - - C G G U C C U]-[A U U(C)C - G U U G]G C C - U U U[G G - G A C - - C G G A]G U   46 Podocarpus nakaii
 A U]A G G A G[U C - - U G G U C C U]-[G U U(C)C - G U U G]G C C - U U C[G G - G A C - - C G G A]G U   47 Taxus mairei
 A U]A G G A[C U C - - U G G U C C]U -[A U U G U - G U U G]G U C - U U C -[G - G A C - - C G G A G]U   48 Adiantum raddianum
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   49 Adiantum raddianum 2
)A]C A G G A[C U C - - U G G U C C U]- A[U(U G)U - G U U G]G U C U U C A[G G - G A C - - C G G A G]U   50 Ophioglossum petiolatum
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   51 Osmunda cinnamomea
 A U]A G G A[C U C - -(G)G G U C C]U -[G U C(U)U - G U U G]G U C - U C C G[G - G A C - - C(G)G A G]U   52 Salvinia natans
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C R G A G]U   53 Psilotum nudum 2
 A U]A G G A[C U C - - C G G U C C U]-[A U U(U)C - G U U G]G U C - U U C[G G - G A U - - U G G A G]U   54 Chara foetida
)A U]A G G A[C U C - - C G G U U C U]-[A U(U)G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   55 Coleochaete scutata
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   56 Klebsormidium flaccidum
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   57 Nitella flexilis
 A U]A G G A[C U C - - U G G U C C U]-[A U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   58 Nitella sp.
 A U]A G G A[C U C - - U G G - C C U]-[A U C - U - G U U G]G U C - U G U[G G - G(A)C - - C G G A G]U   59 Chlamydomonas reinhardtii
 A U]A G G A[C U C - - U G G - C C U]-[A U C(U)U - G U U G]G U C - U G U[A G - G(A)C - - C G G A G]U   60 Hydrodictyon reticulatum
 A U]A G G A[C U C - - U G G - C C U]-[A U C(U)U - G U U G]G U C - U G U[G G - G(A)C - - C G G A G]U   61 Parietochloris pseudoalveolaris
 A C A U G A[C A U - - U U U(A)C G C]- - - - -[U - A U U G]G U U - - - U[G C - G(U U U)A A A G U G]U   62 Dictyostelium discoideum
 - - - - - - - - - E23_9 - - - - - - - - - E23_8'- - - - - - - - - - - - - - - - - E23_9'- - - - - - -   63 Helix numbering 1
)A]U A G G A[C U C - - U G G U C C U]- A[U(U G)U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   64 Pteris vittata
 A U]A G G A[C U C - C U G G U C C U]-[A U U G U - G U U G]o U C - U A C[G G - G A U - - C G G A G]U   65 Megaceros aenigmaticus
 A U]A G G A[C U C - - U G G U C C U]-[A U U G G - G U U G]G U C - U C C[G G G C A U - - C G G A G]U   66 Notophylas breutelu
 A U]A G G A[C U C - - U G G U C C U]-[G U U(C)G U G U U G]G U C - U U C[G G - G A C - - C G G A G]U   67 Physcomitrella patens
 A U]A G G A[C U C - - U G G U C C U]-[G U U G U - G U U G]G U C - U U C[G G - G A C - - C G G A G]U   68 Sphagnum palustre
```

```
                    1060                1070                1080                1090                1100
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - C G G G)G G C A^U(    1 Saccharomyces cerevisiae
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A U A(G U - C G G G)G G C A^U     2 Schizosaccharomyces pombe
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     3 Physcomitrella patens
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     4 Anthoceros agrestis
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     5 Anthoceros laevis
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     6 Pellia epiphylla
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     7 Reboulia hemisphaerica 2
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     8 Riccardia pinguis
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     9 Sphaerocarpos donnellii
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     10 Sphaerocarpus texanus
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     11 Atrichum undulatum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     12 Bryum argenteum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A U A(G U - U G G G)G G C A^U     13 Eurhynchium hians
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     14 Funaria hygrometrica
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     15 Leptobryum pyriforme
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U G A(U A)G G G A C A(G U - U G G G)G G C A^U     16 Mnium hornum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     17 Physcomitrium pyriforme
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     18 Polytrichum formosum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     19 Sphagnum cuspidatum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     20 Calypogeia arguta
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     21 Conocephalum conicum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     22 Fossombronia pusilla
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     23 Marchantia polymorpha
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     24 Riccia fluitans
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     25 Scapania nemorea
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G);G G C A^U     26 Equisetum hyemale
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     27 Equisetum robustum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G(C)A C A(G U - U G G G)G G C A^U     28 Isoetes engelmannii
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     29 Huperzia lucidula
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     30 Lycopodiella inundata
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(C A)G G G A C A(G U - U G G G)G G C A^U     31 Lycopodium phlegmaria
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     32 Lycopodium taxifolium
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     33 Lycopodium tristachyum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(A A)G G G A C A(G U - U G G G)G G C A^U     34 Selaginella galleottii
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(G A)G G G A C A(G U - U G G G)G G C A^U     35 Selaginella sp.
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - C G G G)G G C A^U     36 Oryza sativa
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - C G G G)G G C A^U     37 Zea mays
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(C A)G G G A C A(G U - C G G G)G G C A^U     38 Arabidopsis thaliana
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(C A)G G G A C A(G U - C G G G)G G C A^U     39 Glycine max
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(C A)G G G A C A(G U - C G G G)G G C A^U     40 Sinapis alba
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(C A)G G G A C G(G U - C G G G)G G C A^U     41 Zamia pumila
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C(U G U - C G G G)G G C A^U     42 Gnetum leyboldii
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - C G G G)G G C A^U     43 Ginkgo biloba
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C(U G U - C G G G)G G C A^U     44 Pinus luchuensis
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U(C)A A(U A)G G G A C(U G U - C G G G)G G C A^U     45 Pinus wallichiana
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C(U G U - C G G G)G G C A^U     46 Podocarpus nakaii
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C(U G U - C G G G)G G C A^U     47 Taxus mairei
A - - - - - - - - - - - - - - - - - - - - - - A U G A U(U A A(U A)G G G A C A(G U - U G G G)G G C A^U     48 Adiantum raddianum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     49 Adiantum raddianum 2
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A U G(G U - U G G G)G G C A^U     50 Ophioglossum petiolatum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     51 Osmunda cinnamomea
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G A A C A(G U - U G G G)G G C A^U     52 Salvinia natans
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     53 Psilotum nudum 2
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A U(A)G A G A C G(G U - U G G G)G G C A^U     54 Chara foetida
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A U(A)G G G A C A(G U - U G G G)G G C A^U     55 Coleochaete scutata
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A U(A)G G G A C A(G U - U G G G)G A U A^U     56 Klebsormidium flaccidum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U(C)A A U(A)G G G A C A(G U - U G G G)G G C A^U     57 Nitella flexilis
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U(C)A A U(A)G G G A C A(G U - U G G G)G G C A^U     58 Nitella sp.
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(G A)G G G G U A(G U - C G G G)G G C A^U     59 Chlamydomonas reinhardtii
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(G A)G G G A C A(G U - C G G G)G G C A^U     60 Hydrodictyon reticulatum
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(G A)G G G A C A(G U - C G G G)G G C A^U     61 Parietochloris pseudoalveolaris
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A U(A)G G G A(U)G(G A - U G G G)G G U G^U     62 Dictyostelium discoideum
-E23_10 E23_11E23_11' E23_12E23_12' E23_10' - - - - - - - - - - - - - - - - - - - - 24- - - - - - - - -     63 Helix numbering 1
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     64 Pteris vittata
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     65 Megaceros aenigmaticus
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C A(G U - U G G G)G G C A^U     66 Notophylas breutelu
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     67 Physcomitrella patens
A - - - - - - - - - - - - - - - - - - - - - - A U G A(U U A A(U A)G G G A C G(G U - U G G G)G G C A^U     68 Sphagnum palustre
```

```
                    1110                1120                1130                1140                1150
. . . . | . . . . ! . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
(C)G G U(A)U U C A - A U(U)G(U C -)G A G]G U G - A A A[U U C(U U G G A U)U(U)A U U G A A(G)A C U(A)A]   1 Saccharomyces cerevisiae
 U C G U(A)U U C A - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U U G A A(G)A C G A A]   2 Schizosaccharomyces pombe
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]   3 Physcomitrella patens
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]   4 Anthoceros agrestis
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]   5 Anthoceros laevis
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]   6 Pellia epiphylla
 U C G U(A)U U U C - G(C)G G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U U(A)U G A A A(G)A C G A A]   7 Reboulia hemisphaerica 2
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]   8 Riccardia pinguis
 U C G U(A)U U U C - A U G G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U C A U G A A A(G)A C G A A]   9 Sphaerocarpos donnelli
 U C G U(A)U U U C - - U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A(U)G A A A(G)A C G A A]  10 Sphaerocarpus texanus
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  11 Atrichum undulatum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  12 Bryum argenteum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  13 Eurhynchium hians
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  14 Funaria hygrometrica
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  15 Leptobryum pyriforme
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  16 Mnium hornum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  17 Physcomitrium pyriforme
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  18 Polytrichum formosum
 U C G U(A)U U U C -(A)U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A(C)G A A A(G)A C G A A]  19 Sphagnum cuspidatum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  20 Calypogeia arguta
 U C G U(A)U U U C - G C G G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U C G C G A A A(G)A C G G A]  21 Conocephalum conicum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  22 Fossombronia pusilla
 U U G U(A)U U U C - A U G G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U C A U G A A A(G)A C A A A]  23 Marchantia polymorpha
 U C G U(A)U U U C - G C G G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U C G C G A A A(G)A C G G A]  24 Riccia fluitans
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  25 Scapania nemorea
 U C G U(A)U U(C)C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G(A)A A(G)A C G A A]  26 Equisetum hyemale
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  27 Equisetum robustum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  28 Isoetes engelmannii
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  29 Huperzia lucidula
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  30 Lycopodiella inundata
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  31 Lycopodium phlegmaria
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  32 Lycopodium taxifolium
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  33 Lycopodium tristachyum
 U C G U(A C)U C C - G U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A C G G A(A G)A C G A A]  34 Selaginella galleottii
 U C G U(A C)U C C - G U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A C G G A(A G)A C G A A]  35 Selaginella sp.
 U C G U(A)U U U C - A U A G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U U A U G A A A(G)A C G A A]  36 Oryza sativa
 U C G U(A)U U U C - A U A G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U U A U G A A A(G)A C G A A]  37 Zea mays
 U C G U(A)U U U C - A U A G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U U A U G A A A(G)A C G A A]  38 Arabidopsis thaliana
 U C G U(A)U U U C - A U A G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U U A U G A A A(G)A C G A A]  39 Glycine max
 U C G U(A)U U U C - A U A G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U U A U G A A A(G)A C G A A]  40 Sinapis alba
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  41 Zamia pumila
 U C G U(A)U U U C - A U A G(U C)A G G G]G U G - A A A[U U C U(U G G A U)U U A U G A A A G - C G A A]  42 Gnetum leyboldii
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  43 Ginkgo biloba
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G G A A(G)A C G A A]  44 Pinus luchuensis
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G G A]  45 Pinus wallichiana
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G G A A(G)A C G A A]  46 Podocarpus nakaii
 U C G U(A)U U U C -(A)U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A(C)G G A A(G)A C G A A]  47 Taxus mairei
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - - A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  48 Adiantum raddianum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  49 Adiantum raddianum 2
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  50 Ophioglossum petiolatum
 U C G U(A)U U U C - A U(U)G(U U)A G A G]G U G A - A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  51 Osmunda cinnamomea
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  52 Salvinia natans
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G G A A(G)A C G A A]  53 Psilotum nudum 2
 U C G U(A U)U C C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G G A(U G)A C G A A]  54 Chara foetida
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  55 Coleochaete scutata
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  56 Klebsormidium flaccidum
 U C G U(A U)U C C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G G A(U G)A C G A A]  57 Nitella flexilis
 U C G U(A U)U C C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G G A(U G)A C G A A]  58 Nitella sp.
 U C G U(A)U U C C - G U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A C G G A A(G)A C G A A]  59 Chlamydomonas reinhardtii
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  60 Hydrodictyon reticulatum
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  61 Parietochloris pseudoalveolaris
 U C A U(A)U U G G - U G G G(C G A)G A G]G U G - A A A[U U C(G U U G A C)C C U A U C A A(G)A U G A A]  62 Dictyostelium discoideum
 - - - - - - - - - - - - - - 25- - - - - - - - - - - - - - - - - - - - - - - 25' - - - - - - - - - - - - - -   63 Helix numbering 1
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  64 Pteris vittata
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  65 Megaceros aenigmaticus
 U C G U(A)U U U C G A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  66 Notophylas breutelu
 U C G U(A)U U U C - A U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A U G A A A(G)A C G A A]  67 Physcomitrella patens
 U C G U(A)U U U C -(A)U(U)G(U C)A G A G]G U G - A A A[U U C U(U G G A U)U(U)A(C)G A A A(G)A C G A A]  68 Sphagnum palustre
```

```
                   1160                1170                1180                1190                1200
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]C G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    1 Saccharomyces cerevisiae
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    2 Schizosaccharomyces pombe
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    3 Physcomitrella patens
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    4 Anthoceros agrestis
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    5 Anthoceros laevis
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    6 Pellia epiphylla
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    7 Reboulia hemisphaerica 2
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    8 Riccardia pinguis
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[    9 Sphaerocarpos donnellii
]C U U C[U G C]G A A A[G C A]U U[U G C C[- A G G A -]U G U U U U[C A]U U A A^U(G)A A[G A]A C G A]A A[   10 Sphaerocarpus texanus
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   11 Atrichum undulatum
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   12 Bryum argenteum
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   13 Eurhynchium hians
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   14 Funaria hygrometrica
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   15 Leptobryum pyriforme
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C G]U U A A^U C A A[G A]A C G A]A A[   16 Mnium hornum
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   17 Physcomitrium pyriforme
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   18 Polytrichum formosum
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   19 Sphagnum cuspidatum
]C U U C[U G U]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   20 Calypogeia arguta
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   21 Conocephalum conicum
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   22 Fossombronia pusilla
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   23 Marchantia polymorpha
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   24 Riccia fluitans
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   25 Scapania nemorea
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   26 Equisetum hyemale
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   27 Equisetum robustum
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U(U)U U[C A]U U A A^U C A A[G A]A C G A]A A[   28 Isoetes engelmannii
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   29 Huperzia lucidula
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   30 Lycopodiella inundata
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   31 Lycopodium phlegmaria
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   32 Lycopodium taxifolium
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   33 Lycopodium tristachyum
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   34 Selaginella galleottii
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   35 Selaginella sp.
]C A A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   36 Oryza sativa
]C A A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   37 Zea mays
]C A A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   38 Arabidopsis thaliana
]C A A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   39 Glycine max
]C A A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G G]A C G A]A A[   40 Sinapis alba
]C C A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   41 Zamia pumila
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A - U]G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   42 Gnetum leyboldii
]C C A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   43 Ginkgo biloba
]C C A C[U G C]G A A A[G C A]U U[U G C C[A A G G A - U]G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   44 Pinus luchuensis
]C C A C[U G C]G A A A[G C A]U U[U G C C[A A G G A - U]G U U U U[C A]U U(A)A^U C A A[G A]A C G A]A A[   45 Pinus wallichiana
]C C A C[U G C]G A A A[G C A]U U[U G C C[A A G G A - U]G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   46 Podocarpus nakaii
]C C A C[U G C]G A A A[G C A]U U[U G C C[A A G G A - U]G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   47 Taxus mairei
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A]-[U C A A[G A]A C G A]A A[   48 Adiantum raddianum
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   49 Adiantum raddianum 2
]C U A C[U(G)C]G A A A[G - A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   50 Ophioglossum peticlatum
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   51 Osmunda cinnamomea
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   52 Salvinia natans
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   53 Psilotum nudum 2
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]C G U(U)C U C A U U A A^U C A A[G A]A C G A]A A[   54 Chara foetida
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U(C)A U U A A^U C A A[G A]A C G A]A A[   55 Coleochaete scutata
]C U U C[U G C]G A A A[G C A]U U[U A U C[A A G G A -]U G U U U U(C)A U U A A^U C A A[G A]A C G A]A A[   56 Klebsormidium flaccidum
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U(C)A U U(A)A^U C A A[G A]A C G A]A A[   57 Nitella flexilis
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U(C)A U U(A)A^U C A A[G R]A C G A]A A[   58 Nitella sp.
]C A U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U A C U U U[C A]U U G A^U C A A[G A]A C G A]A A[   59 Chlamydomonas reinhardtii
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   60 Hydrodictyon reticulatum
]C U A C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   61 Parietochloris pseudoalveolaris
]C U U C[U G C]G A A A[G C A]U U[C A C C[A A A U A -]C(U)U C C C(C)A U U A A^U C A A[G A]A C G A]A A[   62 Dictyostelium discoideum
 - - - - - 26- - - - - 26' - - - - - - - - - - - - - - 24' - - - - - - - - - - - - - - - - 23' - - - - - -    63 Helix numbering 1
]C U A C[U(G)C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   64 Pteris vittata
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G C A]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   65 Megaceros aenigmaticus
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   66 Notophylas breutelu
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   67 Physcomitrella patens
]C U U C[U G C]G A A A[G C A]U U[U G C C[A A G G A -]U G U U U U[C A]U U A A^U C A A[G A]A C G A]A A[   68 Sphagnum palustre
```

```
                  1210                1220                1230                1240                1250
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
[G U U A G G G(G A U)C(G - A A)G A U G]A U C U G G U A C(C G U C(G U A)G U - C U U A A C]C A U A A A   1 Saccharomyces cerevisiae
[G U U A G G G(G A U)C(G - A A)G A C G]A U C A G A U A C(C G U C(G U A)G U - C U U A A C]C A U A A A   2 Schizosaccharomyces pombe
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   3 Physcomitrella patens
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   4 Anthoceros agrestis
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   5 Anthoceros laevis
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   6 Pellia epiphylla
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   7 Reboulia hemisphaerica 2
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   8 Riccardia pinguis
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   9 Sphaerocarpos donnellii
[G U U G G G G(G C U)C(G - G A U)G C G]A U C A G A U A C(C G U(C C - A)G U - C U C A A C]C A U A A A   10 Sphaerocarpus texanus
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   11 Atrichum undulatum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   12 Bryum argenteum
[G U U G G G(G G C U A)C(G A A)G A C G]A U C A G A U A C(C G U C(C U A)G(A -)C U C A A C]C A U A A A   13 Eurhynchium hians
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   14 Funaria hygrometrica
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   15 Leptobryum pyriforme
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   16 Mnium hornum
[G U U G G G G(G C U)C(G - A A A)A C G]A U C A G A U A C(C G U(C C U A)G U - C U C A A C]C A U A A A   17 Physcomitrium pyriforme
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   18 Polytrichum formosum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C G U A A A   19 Sphagnum cuspidatum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   20 Calypogeia arguta
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   21 Conocephalum conicum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   22 Fossombronia pusilla
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   23 Marchantia polymorpha
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   24 Riccia fluitans
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   25 Scapania nemorea
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   26 Equisetum hyemale
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   27 Equisetum robustum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   28 Isoetes engelmannii
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   29 Huperzia lucidula
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   30 Lycopodiella inundata
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   31 Lycopodium phlegmaria
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   32 Lycopodium taxifolium
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   33 Lycopodium tristachyum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   34 Selaginella galleottii
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   35 Selaginella sp.
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   36 Oryza sativa
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   37 Zea mays
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   38 Arabidopsis thaliana
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   39 Glycine max
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   40 Sinapis alba
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   41 Zamia pumila
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   42 Gnetum leyboldii
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   43 Ginkgo biloba
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   44 Pinus luchuensis
[G U U G G G G(G C U)C(G A A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   45 Pinus wallichiana
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   46 Podocarpus nakaii
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   47 Taxus mairei
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A - A A A   48 Adiantum raddianum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   49 Adiantum raddianum 2
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   50 Ophioglossum petiolatum
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   51 Osmunda cinnamomea
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   52 Salvinia natans
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   53 Psilotum nudum 2
[G U U G G G G(G A U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   54 Chara foetida
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   55 Coleochaete scutata
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(N G U C(C U A)G U - C U C A A C]C A U A A A   56 Klebsormidium flaccidum
[G U U G G G G(G A U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   57 Nitella flexilis
[G U U G G G G(G A U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   58 Nitella sp.
[G U U G G G G(G C U)C(G - A A)G A C G]A U U A G A U A C(C G U C(G U A)G U - C U C A A C]C A U A A A   59 Chlamydomonas reinhardtii
[G U U G G G G(G C U)C(G - A A)G A C G]A U U A G A U A C(C G U C(G U A)G U - C U C A A C]C A U A A A   60 Hydrodictyon reticulatum
[G U U G G G G(G C U)C(G - A A)G A C G]A U U A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   61 Parietochloris pseudoalveolaris
[G U U U G G G(G A U)C(G - A A)G A C G]A U C A G A U A C(C G U C(G U A)G U - C C A A A C]U A U A A A   62 Dictyostelium discoideum
 - - - - - - - - 27- - - - - - - - - - - - - - - - - - - - - - - - - - - - 27' - - - - - - - - - - -   63 Helix numbering 1
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   64 Pteris vittata
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   65 Megaceros aenigmaticus
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   66 Notophylas breutelu
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C A U A A A   67 Physcomitrella patens
[G U U G G G G(G C U)C(G - A A)G A C G]A U C A G A U A C(C G U C(C U A)G U - C U C A A C]C G U A A A   68 Sphagnum palustre
```

```
                1260            1270            1280            1290            1300
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
C U A U[G C C - G A C]U[A G(- - A)U C G G G U G G(U)G U U]- - - U U U U - U A A U -[G A - - - - C C     1 Saccharomyces cerevisiae
C U A U[G C C - G A C]U[A G G(G A)U C G G G C A A(U)G U U]- - - U C A U U U A U C -[G A - - - - C U     2 Schizosaccharomyces pombe
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - U G A U -[G A - - - - C U     3 Physcomitrella patens
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G G(A U)G U U]- - - A A U U - U G A U -[G A - - - - C(G)   4 Anthoceros agrestis
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - A G A U -[G A - - - - C U     5 Anthoceros laevis
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U     6 Pellia epiphylla
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - - G A U U - A G A U -[G A - - - - C U     7 Reboulia hemisphaerica 2
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U     8 Riccardia pinguis
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U     9 Sphaerocarpos donnelli
C G A U[G C C - G A C]U[A G G(G A)U U G(G)C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U    10 Sphaerocarpus texanus
C G A U[G C C(- G)A C]U[A G G(G A)U U U G C G G G(U)G U U]- - - A A U U - U G A U -[G A - - - - C C    11 Atrichum undulatum
C G A U[G C C - G A C]U[A G G(A A)U U G G C G G G(U)G U U]- - - G C U U - U G A U -[G A - - - - C C    12 Bryum argenteum
C G A U[G C C - G A]C U[A G G(G A)C U(U)G C G G(C U)G U U]- - - C A U U - U G A U -[G A - - - - C(C)   13 Eurhynchium hians
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - U G A U -[G A - - - - C U    14 Funaria hygrometrica
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G G(U)G U U]- - - G A U U - U G A U -[G A - - - - C C    15 Leptobryum pyriforme
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G G(U)G U U]- - - G A U U - C G A U -[G A - - - - C C    16 Mnium hornum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - U G A U -[G A - - - - C U    17 Physcomitrium pyriforme
C G A U[G C C(- G)A C]U[A G G(G A)U U C G C G G G(U)G U U]- - - A A U U - U G A U -[G A - - - - C C    18 Polytrichum formosum
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - - G A A U - C G A U -[G A - - - - C U    19 Sphagnum cuspidatum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U    20 Calypogeia arguta
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - - U C U U U U G A U -[G A - - - - C U    21 Conocephalum conicum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U    22 Fossombronia pusilla
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U    23 Marchantia polymorpha
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - U G A U U - A G A U -[G A - - - - C U    24 Riccia fluitans
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U    25 Scapania nemorea
C G A U[G C C - G A C]U[A G G(G A)U U G G C A G A(U)G U U]- - - A C U U - C G A U -[G A - - - - C U    26 Equisetum hyemale
C G A U[G C C - G A C]U[A G G(G A)U U G G C A G A(U)G U U]- - - A C U U - C G A U -[G A - - - - C U    27 Equisetum robustum
C G A U[G C C - G A C]U[A G G(G A)U(C)G G C G G A(U)G U U]- - - A C U U - C G A U -[G A - - - - C U    28 Isoetes engelmannii
C G A U[G C C - G A C]U[A G G(G A)U(C)G G C G G G(U)G U U]- - - A A U U - C G A U -[G A - - - - C C    29 Huperzia lucidula
C G A U[G C C - G A C]U[A G G(G A)U(C)G G C G G G(U)G U U]- - - N A U U - C G A U -[G A - - - - C C    30 Lycopodiella inundata
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G G(U)G U U]- - - A A U U - C G A U -[G A - - - - C C    31 Lycopodium phlegmaria
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G G(U)G U U]- - - A A U U - C G A U -[G A - - - - C C    32 Lycopodium taxifolium
C G A U[G C C - G A C]U[A G G(G A)U(C)G G C G G G(U)G U U]- - - A A U U - C G A U -[G A - - - - C C    33 Lycopodium tristachyum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A U U U - G G A U -[G A - - - - C U    34 Selaginella galleottii
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G G(A U)G U U]- - - A U U U - G G A U -[G A - - - - C(A)  35 Selaginella sp.
C G A U[G C C - G A C]C[A G G(G A)U C G G C G G A(U)G U U]- - - G C U U - A U A G -[G A - - - - C U    36 Oryza sativa
C G A U[G C C - G A C]C[A G G(G A)U C A G C G G(U)- G U U]- - - A C U A - A U A G -[G A - - - - C(C)  37 Zea mays
C G A U[G C C - G A C]C[A G G(G A)U C A G C G G A(U)G U U]- - - G C U U - A U A G -[G A - - - - C U    38 Arabidopsis thaliana
C G A U[G C C - G A C]C[A G G(G A)U C A G C G G A(U)G U U]- - - G C U U - U U A G -[G A - - - - C U    39 Glycine max
C G A U[G C C - G A C]C[A G G(G A)U C A G C G G A(U)G U U]- - - G C U U - U U A G -[G A - - - - C U    40 Sinapis alba
C G A U[G C C - G A C]C[A G G(G A)U C G G C G G A(U)G U U]- - - G C U C - U A A G -[G A - - - - C U    41 Zamia pumila
C G A U[G C C(- G)A C]C[A G G(G A)U C G G C G G A(U)G U U]- - - G C U U - U U A G -[G A - - - - C U    42 Gnetum leyboldii
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - - G C U U - U A A G -[G A - - - - C U    43 Ginkgo biloba
C G A U[G C C(- G)A C]C[A G G(G A)U(C)G G C G G A(U)G U U]- - - G C U C - U A A G -[G A - - - - C U    44 Pinus luchuensis
C G A U[G C C(- G)A C]C[A G G(A A)U(C)G G C G G A(U)G U U]- - - G C U C - U A A G -[G A - - - - C U    45 Pinus wallichiana
C G A U[G C C(- G)A C]C[A G G(G A)U C G G C G G A(U)G U U]- - - G C U C - U A A G -[G A - - - - C U    46 Podocarpus nakaii
C G A U[G C C(- G)A C]C[A G G(G A)U(C)G G C G G A(U)G U U]- - - G C U C - U A A G -[G A - - - - C U    47 Taxus mairei
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - U G A U -[G A - - - - C U    48 Adiantum raddianum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - U G A U -[G A - - - - C U    49 Adiantum raddianum 2
C G A U[G C C - G A C]U[A G G(G A)U(C)G G C G G A(U)G U U]- - - A C U U - C G A U -[G A - - - - C U    50 Ophioglossum petiolatum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - C A A U -[G A - - - - C U    51 Osmunda cinnamomea
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - C G A U -[G A - - - - C U    52 Salvinia natans
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - - A C C U - U G A U -[G A - - - - C U    53 Psilotum nudum 2
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U C]- - - U A U U - G G A U -[G A - - - - C U    54 Chara foetida
C G A U[G C C - G A C]U[A G G(G A)U(C)G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U    55 Coleochaete scutata
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - U G A U -[G A - - - - C U    56 Klebsormidium flaccidum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U C]- - - U A U U - U G A U -[G A - - - - C U    57 Nitella flexilis
C G A U[N C C - G A C]U[A G G(G A)U U G G C G G A(U)G U C]- - - U A U U - U G A U -[G A - - - - C U    58 Nitella sp.
C G A U[G C C - G A C]U[A G G(G A)U U G G C A G A(U)G U U]- - - C U U U - U G A U -[G A - - - - C U    59 Chlamydomonas reinhardtii
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - U U U U - U G A U -[G A - - - - C U    60 Hydrodictyon reticulatum
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - U U A U - C G A U -[G A - - - - C U    61 Parietochloris pseudoalveolaris
C U A U[G U C(- G)A C]C[A G G(G A)U C G G U U A A(A)A U U U U]- - - U U - C - - - - - - -[A A A A U U    62 Dictyostelium discoideum
- - - - - - - 28- - - - - - - - - - - - - 29- - - - - - - - - - - - - - - - - - - - - - - - - 29    63 Helix numbering 1
C G A U[G C C - G A C]U[A G G(G A)U(U)G G C G G A(U)G U U]- - - A C U U - U G A U -[G A - - - - C U    64 Pteris vittata
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A A U U - A G A U -[G A - - - - C U    65 Megaceros aenigmaticus
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G G(U)G U U]- - - A A U - A A G A U U[G A - - - - C C    66 Notophylas breutelu
C G A U[G C C - G A C]U[A G G(G A)U U G G C G G A(U)G U U]- - - A C U U - U G A U -[G A - - - - C U    67 Physcomitrella patens
C G A U[G C C - G A C]U[A G G(G A)U C G G C G G A(U)G U U]- - - G A A U - C G A U -[G A - - - - C U    68 Sphagnum palustre
```

```
                  1310                1320                1330                1340                1350
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
 C A C U C G G(U - A C -)C U]U A - - C[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C U G]G G G G    1 Saccharomyces cerevisiae
 U G C U C G G(C - A)C - C U]U A - - C[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G    2 Schizosaccharomyces pombe
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G    3 Physcomitrella patens
)U C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G    4 Anthoceros agrestis
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G    5 Anthoceros laevis
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G    6 Pellia epiphylla
 C C G C C G G(C - A)C - C U]C A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G    7 Reboulia hemisphaerica 2
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G    8 Riccardia pinguis
 C C G C C A G(C - A)C - C U]C A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G    9 Sphaerocarpos donnelli
 C C G - C A G(C - A)C - C U]U A - - U G A - G A A A U A A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   10 Sphaerocarpus texanus
 C C G C A A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U(A U U U G)G G U]U[C(C)G]G G G G   11 Atrichum undulatum
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   12 Bryum argenteum
)C C G C(C)A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A C[U U(U U U G)G G C]G[C - G]G G G G   13 Eurhynchium hians
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   14 Funaria hygrometrica
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   15 Leptobryum pyriforme
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   16 Mnium hornum
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G C]C[C(C)G]G G G G   17 Physcomitrium pyriforme
 C C G C G A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U(A U U U G)G G U]U[C(C)G]G G G G   18 Polytrichum formosum
 C C G C C G G(C - G)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   19 Sphagnum cuspidatum
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   20 Calypogeia arguta
 C C G C C G G(C - A)C - C U]C C G - A[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   21 Conocephalum conicum
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   22 Fossombronia pusilla
 C C G C C G G(C - A)C - C U]C C A - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   23 Marchantia polymorpha
 C C G C C G G(C - A)C - C U]C C A - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   24 Riccia fluitans
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   25 Scapania nemorea
 C U G C C G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   26 Equisetum hyemale
 C U G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   27 Equisetum robustum
 C C G C C(A)G(C - A)C - C U]C A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   28 Isoetes engelmannii
 C C G C C(N)G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   29 Huperzia lucidula
 C C G C C(A)G(U - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   30 Lycopodiella inundata
 C C G C C G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   31 Lycopodium phlegmaria
 C C G C C G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   32 Lycopodium taxifolium
 C C G C C(A)G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   33 Lycopodium tristachyum
 C C G C C A G(C - A)C - C U]C A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   34 Selaginella galleottii
)C C G C C A G(C - A)C - C U]C A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   35 Selaginella sp.
 C C G C C G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   36 Oryza sativa
)C C G C U G G(C C A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   37 Zea mays
 C C G C U G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   38 Arabidopsis thaliana
 C C G C U G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   39 Glycine max
 C C G C U G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   40 Sinapis alba
 C C G C C G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   41 Zamia pumila
 C C G U C G G(C - A)C - C U]U C - - C[G A]- G A A A[U C]A - G A[G U(G U U U G)G G U]U[C(C)G]G G G G   42 Gnetum leyboldii
 C C G C C G G(C - A)C - C U]U G - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   43 Ginkgo biloba
 C C G C C(A)G(C - A)C - C U]U C - - U[G A]- G A A A[U C]A - G A[G U(G U U U G)G G U]U[C(C)G]G G G G   44 Pinus luchuensis
 C C G C C(A)G(C - A)C - C U]U C - - U[G A]- G A A A[U C]A - G A[G U(G U U U G)G G U]U[C(C)G]G G G G   45 Pinus wallichiana
 C C G C C G G(C - A)C - C U]U C - - U[G A]- G A A A[U C]A - G A[G U(G U U U G)G G U]U[C(C)G]G G G G   46 Podocarpus nakaii
 C C G C C(A)G(C - A)C - C U]U C - - U[G A]- G A A A[U C]A - G A[G U(G U U U G)G G U]U[C(C)G]G G G G   47 Taxus mairei
 C C G C C A G(C - A)C - C U]U A - - U G - - G A A A U C A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   48 Adiantum raddianum
 C C G C C A G(C - A)C - C U]U A - - U G - A G A A A U C A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   49 Adiantum raddianum 2
 C C G C U(A)G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   50 Ophioglossum petiolatum
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   51 Osmunda cinnamomea
 U C G C C A G(C - A)C - C U]U A - - U[G A]G - A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   52 Salvinia natans
 C C G C C G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U C(U U U G)G G U]U[C(C)G]G G G G   53 Psilotum nudum 2
 C U G C C A G(C - A)C - C U]U G - - U[G A]- G A A A[U C]A - A A[G U U(U A C G)G G U]U[C(C)G]G G G G   54 Chara foetida
 C C G C C(A)G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(C U U G)G G U]U[C(C)G]G G G G   55 Coleochaete scutata
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   56 Klebsormidium flaccidum
 C C G U C A G(C - A)C - C U]U G - - U[G A]- G A A A[U C]A - A A[G U U(U U C G)G G U]U[C(C)G]G G G G   57 Nitella flexilis
 C C G U C A G(C - A)C - C U]U G - - U[G A]- G A A A[U C]A - A A[G U U(U U C G)G G U]U[C(C)G]G G G G   58 Nitella sp.
 C U G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   59 Chlamydomonas reinhardtii
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   60 Hydrodictyon reticulatum
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   61 Parietochloris pseudoalveolaris
 U A A U C G G(C - A)C - C U]U G - - U[G A]- G A A A[U C]A U G A[G U(G U U U A)G A U]U[C(C)G]G G G G   62 Dictyostelium discoideum
9' - - - - - - - - - - - - - - - - - - - - 30- - - - - - 30' - - - - - - - - - - 28' - - - - - 22' - - - -   63 Helix numbering 1
 C C G C C(A)G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G U U]U[C(C)G]G G G G   64 Pteris vittata
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G o U]U[C(C)G]G G G G   65 Megaceros aenigmaticus
 C C C C C G G(C C A)C C C U]U A - U U[G A]A G A A A[C C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   66 Notophylas breutelu
 C C G C C A G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U o)G G U]U[C(C)G]G G G o   67 Physcomitrella patens
 C C G C C G G(C - A)C - C U]U A - - U[G A]- G A A A[U C]A - A A[G U U(U U U G)G G U]U[C(C)G]G G G G   68 Sphagnum palustre
```

```
                    1360                1370                1380                1390                1400
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    1 Saccharomyces cerevisiae
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    2 Schizosaccharomyces pombe
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    3 Physcomitrella patens
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    4 Anthoceros agrestis
[G(A)G U(A)U G G U C]G C A A[G G C U G(A A)A U(C)C]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    5 Anthoceros laevis
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    6 Pellia epiphylla
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A A G A]A U[U G A C(G)G A A - G G G C A]C - -    7 Reboulia hemisphaerica 2
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    8 Riccardia pinguis
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -    9 Sphaerocarpos donnellii
[G(A)G U(A)U G G U C]G C A A[G G C U G(A -)A C(C)U]A A[A G G A]A U[U G A C(G)G A A - - G G C A]C - -   10 Sphaerocarpus texanus
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   11 Atrichum undulatum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   12 Bryum argenteum
[G A G(U A U)G(A)U]C G C A A C[G(C)U(- A A C)C U U]A A[A G G A]A U[U G A C(G)G(U)A -(C)G G C A]C - -   13 Eurhynchium hians
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   14 Funaria hygrometrica
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   15 Leptobryum pyriforme
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   16 Mnium hornum
[G A G U(A)U G G U]C G C G A A[G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   17 Physcomitrium pyriforme
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   18 Polytrichum formosum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   19 Sphagnum cuspidatum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   20 Calypogeia arguta
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   21 Conocephalum conicum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   22 Fossombronia pusilla
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   23 Marchantia polymorpha
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   24 Riccia fluitans
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   25 Scapania nemorea
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   26 Equisetum hyemale
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   27 Equisetum robustum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A -(G)G G C A]C - -   28 Isoetes engelmannii
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   29 Huperzia lucidula
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   30 Lycopodiella inundata
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   31 Lycopodium phlegmaria
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   32 Lycopodium taxifolium
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   33 Lycopodium tristachyum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   34 Selaginella galleottii
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   35 Selaginella sp.
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   36 Oryza sativa
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   37 Zea mays
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   38 Arabidopsis thaliana
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   39 Glycine max
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   40 Sinapis alba
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   41 Zamia pumila
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   42 Gnetum leyboldii
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   43 Ginkgo biloba
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   44 Pinus luchuensis
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   45 Pinus wallichiana
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   46 Podocarpus nakaii
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   47 Taxus mairei
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]- U[U G A C(G)G A A - G G G C A]C - -   48 Adiantum raddianum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   49 Adiantum raddianum 2
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[o o o o(o)o o o - o o o o o]o - -   50 Ophioglossum petiolatum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   51 Osmunda cinnamomea
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   52 Salvinia natans
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   53 Psilotum nudum 2
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   54 Chara foetida
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   55 Coleochaete scutata
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   56 Klebsormidium flaccidum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   57 Nitella flexilis
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   58 Nitella sp.
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   59 Chlamydomonas reinhardtii
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   60 Hydrodictyon reticulatum
[G A G U(A)U G G U C]G C A A[G G C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A(A)G G G C A]G G C   61 Parietochloris pseudoalveolaris
[G A G U(A)U G G(U)C]G C A A[G(U)C U G(A A)A C U U]A A[A G G A]A U[U G A C(G)G A A - G G G C A]C - -   62 Dictyostelium discoideum
- - - - - - 31- - - - - - - - - - - - 31' - - - - - - - - - - 2'- - - - - - - - - 32- - - - - - - - - -   63 Helix numbering 1
[G A G U(A)U G G U C]G C A A[G G C U G(A A)o o o o]o o[o o o o]o o[o o o o(o)o o o - o o o o o]o - -   64 Pteris vittata
[o(A)G U(A)U G o U C]G C A A[G o C U G(A A)o U(o o o o o o o o o o o[o o o o(o)o o o - o o G o A]o - -   65 Megaceros aenigmaticus
[A(U)A U(G)- - - U U]G C A A[G - C U G(A o)o o(o o o o o o o o o o o[o o o o(o)o o o - o o G o A]o - -   66 Notophylas breutelu
[G A G U(A)U G o U C]G C A A[G o C U G(A A)N N N N]N N[N N N N]N N[N N N N(N)N N N - N N G C A]C - -   67 Physcomitrella patens
[G A G U(A)U G G U C]G C A A[G G C U G(A N)N N N N]N N[N N N N]N N[N N N N(N)N N N - N N N N N]N - -   68 Sphagnum palustre
```

```
               1410              1420              1430              1440              1450
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
C A C U A -[G G A G U]G - G[A G C(C)U - - G C G G C]- U A A[U U U G]A C U C A A C A[C G G G]G A A A   1 Saccharomyces cerevisiae
C A C A A U[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   2 Schizosaccharomyces pombe
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   3 Physcomitrella patens
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   4 Anthoceros agrestis
C A C C A -[G G A G]C A G G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   5 Anthoceros laevis
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   6 Pellia epiphylla
C A C C A -[G G A G U]G G G[A G C - U - - G C G G C]U U A A[U C U G]A C U C A A C A[C G G G]G A C A   7 Reboulia hemisphaerica 2
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   8 Riccardia pinguis
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   9 Sphaerocarpos donnellii
C A C C A -[G G A G U]G - G[A G C - U - - G C G G C]U U A A[U U U G]A C U C A - C A[C G G G]G A C A   10 Sphaerocarpus texanus
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   11 Atrichum undulatum
C A C C A -[G G A G U]G - G[A - C - U - - - C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   12 Bryum argenteum
C A C C A -[G G A G U]G - G[A G C(C)U - - G C(A)G C]U C A A[U U U G]A C U C A A C A[C G G G]G A A C   13 Eurhynchium hians
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   14 Funaria hygrometrica
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   15 Leptobryum pyriforme
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   16 Mnium hornum
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A C   17 Physcomitrium pyriforme
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   18 Polytrichum formosum
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   19 Sphagnum cuspidatum
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   20 Calypogeia arguta
C A C C A -[G(U)A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   21 Conocephalum conicum
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   22 Fossombronia pusilla
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   23 Marchantia polymorpha
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   24 Riccia fluitans
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   25 Scapania nemorea
C A C C A -[G G A G U]G - G[A G C(C G - -]G C(G)G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   26 Equisetum hyemale
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   27 Equisetum robustum
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]- A A A   28 Isoetes engelmannii
C A C C A -[G G A G U]G - G[A G C(N)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G - A A   29 Huperzia lucidula
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G - A A   30 Lycopodiella inundata
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   31 Lycopodium phlegmaria
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   32 Lycopodium taxifolium
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G - A A   33 Lycopodium tristachyum
C A C C A -[G G U G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   34 Selaginella galleottii
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   35 Selaginella sp.
C A C C A -[G G C G U]G - G[G G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   36 Oryza sativa
C A C C A -[G G C G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   37 Zea mays
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   38 Arabidopsis thaliana
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]- U A A[U U U G]A C U C A A C A[C G G G]G A A A   39 Glycine max
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   40 Sinapis alba
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   41 Zamia pumila
C A C C A -[G G A G U]G - G[A G C(C)K - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]A A A A   42 Gnetum leyboldii
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   43 Ginkgo biloba
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   44 Pinus luchuensis
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   45 Pinus wallichiana
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   46 Podocarpus nakaii
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   47 Taxus mairei
C A C C A -[G G A G U]G - G C[A - U G - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]- A A A   48 Adiantum raddianum
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   49 Adiantum raddianum 2
o o o o o -[o o o o o]o - o[o o - o o - - o o o o C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   50 Ophioglossum peticlatum
C A C C A - G[G A G U]G - G A G - C C U -[G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   51 Osmunda cinnamomea
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   52 Salvinia natans
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   53 Psilotum nudum 2
C A C C A -[G G C G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   54 Chara foetida
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   55 Coleochaete scutata
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   56 Klebsormidium flaccidum
C A C C A -[G G C G U]G - G[A G C - U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   57 Nitella flexilis
C A C C A -[G G C G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   58 Nitella sp.
C A C C A -[G G C G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   59 Chlamydomonas reinhardtii
C A C C A -[G G C G U]G - G[A G C(N)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]A A A A   60 Hydrodictyon reticulatum
C A C C A -[G G C G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]A A A A   61 Parietochloris pseudoalveolaris
- A C A A U[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C U[C G G G]A A A A   62 Dictyostelium discoideum
- - - - - - - - -33 - - - - - - - - - - - - 34- - - - - - - - - - - 35- - - - - - - - - - - - 35' - - - - -   63 Helix numbering 1
C A C C A -[G G A G U]G - G[A G C C U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   64 Pteris vittata
C A C o A -[G G A G]U G - G[A G C(-)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C o G G]G A A A   65 Megaceros aenigmaticus
C A C o A -[G G A G]U G - G[A G C(-)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   66 Notophylas breutelu
o A C C A -[G G A G U]G - G[A G C(-)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   67 Physcomitrella patens
C A C C A -[G G A G U]G - G[A G C(C)U - - G C G G C]U U A A[U U U G]A C U C A A C A[C G G G]G A A A   68 Sphagnum palustre
```

DCSE Alignment

```
                  1460                1470                1480                1490               1500
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
C U C A[C C A G G(U)C]C A G A[C A C A A(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    1 Saccharomyces cerevisiae
C U C A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    2 Schizosaccharomyces pombe
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    3 Physcomitrella patens
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    4 Anthoceros agrestis
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    5 Anthoceros laevis
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    6 Pellia epiphylla
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A C G[U C U(U U C)U U    7 Reboulia hemisphaerica 2
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    8 Riccardia pinguis
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U    9 Sphaerocarpos donnellii
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U(G)A(C)A G A]U U G A G A G C[U C U(U U C)U -   10 Sphaerocarpus texanus
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   11 Atrichum undulatum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   12 Bryum argenteum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   13 Eurhynchium hians
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   14 Funaria hygrometrica
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   15 Leptobryum pyriforme
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   16 Mnium hornum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(C U C)U U   17 Physcomitrium pyriforme
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   18 Polytrichum formosum
C U U A[C C A G G(U)C]C A G A[C A U A G(U G A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   19 Sphagnum cuspidatum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   20 Calypogeia arguta
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   21 Conocephalum conicum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   22 Fossombronia pusilla
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   23 Marchantia polymorpha
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   24 Riccia fluitans
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   25 Scapania nemorea
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   26 Equisetum hyemale
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   27 Equisetum robustum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   28 Isoetes engelmannii
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   29 Huperzia lucidula
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   30 Lycopodiella inundata
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   31 Lycopodium phlegmaria
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   32 Lycopodium taxifolium
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   33 Lycopodium tristachyum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A U A G C[U C U(U U C)U U   34 Selaginella galleottii
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   35 Selaginella sp.
C U U A[C C A G G(U)C]C A G A[C A U A G(C A A G]G A U U G A(C)A G A]C U G A G A G C[U C U(U U C)U U   36 Oryza sativa
C U U A[C C A G G(U)C]C A G A[C A U A G(C A A G]G A U U G A(C)A G A]C U G A G A G C[U C U(U U C)U U   37 Zea mays
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]C U G A G A G C[U C U(U U C)U U   38 Arabidopsis thaliana
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A -]G G U U G A(C)A G A]C U G A G A G C[U C U(U U C)U U   39 Glycine max
C U U A[C C A(A)G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]C U G A G A G C[U C U(U U C)U U   40 Sinapis alba
C U U A[C C A G G(U)C]C A G A[C A U A G(C A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   41 Zamia pumila
C U U A[C C A G G(U)C]C A G A[C A U A G(C A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   42 Gnetum leyboldii
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   43 Ginkgo biloba
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   44 Pinus luchuensis
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   45 Pinus wallichiana
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   46 Podocarpus nakaii
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   47 Taxus mairei
C U U A[C C A G G(U)C]C A G A[C A U A(G U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   48 Adiantum raddianum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   49 Adiantum raddianum 2
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   50 Ophioglossum petiolatum
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   51 Osmunda cinnamomea
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   52 Salvinia natans
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   53 Psilotum nudum 2
C U C A[C C A G G(U)C]C A G A[C A U A G(C A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   54 Chara foetida
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   55 Coleochaete scutata
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   56 Klebsormidium flaccidum
C U C A[C C A G G(U)C]C A G A[C A U A G(C A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   57 Nitella flexilis
C U C A[C C A G G(U)C]C A G A[C A U A G(C A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   58 Nitella sp.
C U U A[C C A G G(U)C]C A G A[C A C G G(G A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   59 Chlamydomonas reinhardtii
C U U A[C C A G G(U)C]C A G A[C A U A G(U G A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   60 Hydrodictyon reticulatum
C U U A[C C A G G(U)C]C A G A[C A U G(U G A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   61 Parietochloris pseudoalveolaris
C U U A[C C A A G(C)U]A A G A(U A U A G(U A A G]G A U U G(A C)A G A]C U A A A A G A(U C U(U U C A)U   62 Dictyostelium discoideum
- - - - - - - 36- - - - - - - - - - 37- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   63 Helix numbering 1
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   64 Pteris vittata
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   65 Megaceros aenigmaticus
C U C A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   66 Notophylas breutelu
C U U A[C C A G G(U)C]C A G A[C A U A G(U A A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   67 Physcomitrella patens
C U C A[C C A G G(U)C]C A G A[C A U A G(U G A G]G A U U G A(C)A G A]U U G A G A G C[U C U(U U C)U U   68 Sphagnum palustre
```

```
                      1510                 1520                 1530                 1540                 1550
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . !
G A U U U U G U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U(U C)U]C A[G U - U^G G U G G A]G U G A[    1 Saccharomyces cerevisiae
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[    2 Schizosaccharomyces pombe
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[    3 Physcomitrella patens
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[    4 Anthoceros agrestis
G A U U C U A U G]G G U C[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[    5 Anthoceros laevis
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[    6 Pellia epiphylla
G A U U C U A U G]G G - U[G G(U)G G(U C G)A U G - G C C G U U -(C)U U]A G(U - U^G G U G G A]G U G A[    7 Reboulia hemisphaerica 2
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[    8 Riccardia pinguis
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[    9 Sphaerocarpos donnelli
G A U U C U A U G]G G - U[G G(U)G G(U C G)A U G(- G)C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   10 Sphaerocarpus texanus
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   11 Atrichum undulatum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   12 Bryum argenteum
G A U U C U A U G]G G U U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G A U G G A]G U G A[   13 Eurhynchium hians
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   14 Funaria hygrometrica
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   15 Leptobryum pyriforme
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   16 Mnium hornum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   17 Physcomitrium pyriforme
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   18 Polytrichum formosum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   19 Sphagnum cuspidatum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   20 Calypogeia arguta
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   21 Conocephalum conicum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   22 Fossombronia pusilla
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   23 Marchantia polymorpha
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   24 Riccia fluitans
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   25 Scapania nemorea
G A U U C U A U G]G G - U[G(G U A)G(U G)C A U(G -)G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   26 Equisetum hyemale
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   27 Equisetum robustum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   28 Isoetes engelmannii
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   29 Huperzia lucidula
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   30 Lycopodiella inundata
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   31 Lycopodium phlegmaria
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   32 Lycopodium taxifolium
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   33 Lycopodium tristachyum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]U U G A[   34 Selaginella galleottii
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G A A]G U G A[   35 Selaginella sp.
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   36 Oryza sativa
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G U C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   37 Zea mays
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   38 Arabidopsis thaliana
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   39 Glycine max
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   40 Sinapis alba
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   41 Zamia pumila
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   42 Gnetum leyboldii
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   43 Ginkgo biloba
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   44 Pinus luchuensis
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   45 Pinus wallichiana
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   46 Podocarpus nakaii
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   47 Taxus mairei
G A U U - U A U G]G G - U[G G(U)G G(U G)C A U G - G C(C)G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   48 Adiantum raddianum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   49 Adiantum raddianum 2
G A U U C U A U G]G G - U[G G(U)G(G U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   50 Ophioglossum petiolatum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G(A)G G A]G U G A[   51 Osmunda cinnamomea
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   52 Salvinia natans
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   53 Psilotum nudum 2
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   54 Chara foetida
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   55 Coleochaete scutata
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   56 Klebsormidium flaccidum
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   57 Nitella flexilis
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^R G U G G A]G U G A[   58 Nitella sp.
G A U U C U G U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G G]U U G C[   59 Chlamydomonas reinhardtii
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G G]U U G C[   60 Hydrodictyon reticulatum
G A U U(C)U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G G]U U G C[   61 Parietochloris pseudoalveolaris
G A U U C U A U A]A G - U[G G(U)G G(U G)C A U G - G U C G U U -(C)U U]A[G U - U^G G U G G A]G C G A[   62 Dictyostelium discoideum
- - - - - 37' - - - - - - - - - - - - - - - - - - 38- - - - - - - - - - - - - - - 39- - - 40- - - - - - -   63 Helix numbering 1
G A U U C U A U G]G G - U[G G(U)G(G U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   64 Pteris vittata
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   65 Megaceros aenigmaticus
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   66 Notophylas breutelu
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   67 Physcomitrella patens
G A U U C U A U G]G G - U[G G(U)G G(U G)C A U G - G C C G U U -(C)U U]A[G U - U^G G U G G A]G U G A[   68 Sphagnum palustre
```

```
                 1560          1570          1580          1590          1600
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
[U U U G U C^U G C]- U U A A U U[G C G]A U A A C G[A A - C]G A G A[C C U U A A^C C U(A)C U A A(A U)A    1 Saccharomyces cerevisiae
[U U U G U C^U G C]- U U A A U U[G C G]A U A A C G[A A - C]G A G A[C C U U A A^C C U(G)C U A A(A U)A    2 Schizosaccharomyces pombe
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    3 Physcomitrella patens
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    4 Anthoceros agrestis
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    5 Anthoceros laevis
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    6 Pellia epiphylla
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A]- G G A G A[C(C)U C A G^C C U(G)C U A A(C U)A    7 Reboulia hemisphaerica 2
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    8 Riccardia pinguis
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(A)U U A A(C U)A    9 Sphaerocarpos donnellii
[U U U G U C^U G G]- U U A A U -[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(A)U U A A(C U)A    10 Sphaerocarpus texanus
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    11 Atrichum undulatum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    12 Bryum argenteum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A]G[C C U(G)C U A A(C C)A    13 Eurhynchium hians
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    14 Funaria hygrometrica
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    15 Leptobryum pyriforme
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    16 Mnium hornum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    17 Physcomitrium pyriforme
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    18 Polytrichum formosum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    19 Sphagnum cuspidatum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    20 Calypogeia arguta
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A A[C U C A G^C C U(G)C U A A(C U)A(   21 Conocephalum conicum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    22 Fossombronia pusilla
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    23 Marchantia polymorpha
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    24 Riccia fluitans
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    25 Scapania nemorea
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    26 Equisetum hyemale
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    27 Equisetum robustum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    28 Isoetes engelmannii
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    29 Huperzia lucidula
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    30 Lycopodiella inundata
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    31 Lycopodium phlegmaria
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    32 Lycopodium taxifolium
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    33 Lycopodium tristachyum
[U U U G U C^U G G]- U U A A U U[C C G]A U A A C G[A A - C]G A G A[C C U C A A^C C U(G)C U A A(C U)A    34 Selaginella galleottii
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    35 Selaginella sp.
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    36 Oryza sativa
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    37 Zea mays
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    38 Arabidopsis thaliana
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(A U)A    39 Glycine max
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    40 Sinapis alba
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C G G^C C U(G)C U A A(C U)A    41 Zamia pumila
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    42 Gnetum leyboldii
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    43 Ginkgo biloba
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    44 Pinus luchuensis
[U U U G U C^U G G]- U U A A U U[C C G]A U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    45 Pinus wallichiana
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    46 Podocarpus nakaii
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    47 Taxus mairei
[U U U G U C]U[G G]- U U A A U U[C C]- U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    48 Adiantum raddianum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    49 Adiantum raddianum 2
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    50 Ophioglossum petiolatum
[U U U(G)U C^U G G]- U U A A U U[C C G]U U U A C G[A A - C]G A U A[C C U C A G^C C U(G)C U A A(C U)A    51 Osmunda cinnamomea
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    52 Salvinia natans
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    53 Psilotum nudum 2
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(A U)A    54 Chara foetida
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    55 Coleochaete scutata
[U U U G U C^U G G]- U U A A U U[C C G]A U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    56 Klebsormidium flaccidum
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    57 Nitella flexilis
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    58 Nitella sp.
[C U U G U C]A[G G]- U U G A U U[C C]G G U A A C G[A A - C]G A G A[C C U C A]G[C C U(G)C U A A(A U)A    59 Chlamydomonas reinhardtii
[C U U G U C]A[G G]- U U G A U U[C C]G G U A A C G[A A - C]G A G A[C C U C A]G[C C U(G)C U A A(A U)A    60 Hydrodictyon reticulatum
[C U U G U C]A[G G]U U C G A U U[C C]G G U A A C G[A A - C]G A G A[C C U C A]G[C C U(G)C U A A(A U)A    61 Parietochloris pseudoalveolaris
[U U U G U C^U G G]- U C A A U U[C C G]A U A A C G[G A - C]G A G A[C C U C G]A -[C C U(G)C U A A(C U    62 Dictyostelium discoideum
 - 40' - - - - 41- - - - - - - - - 41' - - - - - - - 39' - - - - - - 42- - - - - - - - - - - - - - -    63 Helix numbering 1
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    64 Pteris vittata
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    65 Megaceros aenigmaticus
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    66 Notophylas breutelu
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)C U A A(C U)A    67 Physcomitrella patens
[U U U G U C^U G G]- U U A A U U[C C G]U U A A C G[A A - C]G A G A[C C U C A G^C C U(G)U U A A(C U)A    68 Sphagnum palustre
```

DCSE Alignment

```
                    1610                1620                1630                1640                1650
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
- G U G G(U)G - C U A G C)A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     1 Saccharomyces cerevisiae
- G C U G G A - U C A G C C A)U U - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     2 Schizosaccharomyces pombe
- G U U(A)C G - C G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     3 Physcomitrella patens
- G U U(A)C A - C G A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     4 Anthoceros agrestis
- G U U(A)C A - C G A A G]A A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     5 Anthoceros laevis
- G U U(A)C A - C G A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     6 Pellia epiphylla
- C U(A)C G C - G G G G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     7 Reboulia hemisphaerica 2
- G U U(A)C G - C(G)A A G A]A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     8 Riccardia pinguis
- G C U(A)C G - C G A - G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     9 Sphaerocarpos donnelli
- G C U(A G)C G C G A G G]C A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     10 Sphaerocarpus texanus
- G U U(A)C A - C G A A G A]A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     11 Atrichum undulatum
- G U U(A)C G - C G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     12 Bryum argenteum
-(C)U U G C G - C(C)A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     13 Eurhynchium hians
- G U U(A)C G - C G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     14 Funaria hygrometrica
- G U U(A)C G - C G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     15 Leptobryum pyriforme
- G U U(A)C G - C G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     16 Mnium hornum
- G U U(A)C(A)- U G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     17 Physcomitrium pyriforme
- G U U(A)C G - C G A A G A]A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     18 Polytrichum formosum
- G U C(A)C G - C(G)A A G G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     19 Sphagnum cuspidatum
- G U U(A)C A - C G A A G A]A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     20 Calypogeia arguta
(C)G C U(A)C G - C G G(A)G U C]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     21 Conocephalum conicum
- G U U(A)C A - C G A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     22 Fossombronia pusilla
- G C U(A)C G - C G G G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     23 Marchantia polymorpha
- G C U(A)C G - C G G G G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     24 Riccia fluitans
- G U U(A)C A - C G A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     25 Scapania nemorea
- G U U(A)C G - C G A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     26 Equisetum hyemale
- G U U(A)C G - C G A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     27 Equisetum robustum
- G U(- A)C G(A)C G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     28 Isoetes engelmannii
- G U U(A)C A - C(G)A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     29 Huperzia lucidula
- G U U(A)C A - C(G)A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     30 Lycopodiella inundata
- G U U(A)C A - C(G)A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     31 Lycopodium phlegmaria
- G U U(A)C A - C(G)A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     32 Lycopodium taxifolium
- G U U(A)C A - C(G)A A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     33 Lycopodium tristachyum
- G C U(A)C G - C A G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     34 Selaginella galleottii
- G C U(A)C U - C G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     35 Selaginella sp.
- G C U A U G - C G G A G]C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     36 Oryza sativa
- G C U A U G - C G G A G]C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     37 Zea mays
- G C U(A)C G - U G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     38 Arabidopsis thaliana
- G C U(A)U G - U G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     39 Glycine max
- G C U(A)C G - U G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     40 Sinapis alba
- G C U(A)C G - C G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     41 Zamia pumila
- G C U(A)C G - U G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     42 Gnetum leyboldii
- G C U(A)U G - C G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     43 Ginkgo biloba
- G C U(A)C G - C G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     44 Pinus luchuensis
- G C U(A)C G - C G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     45 Pinus wallichiana
- G C U(A)C A - C G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     46 Podocarpus nakaii
- G C U(A)C G - C G G A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     47 Taxus mairei
- G U U(A)C(A - C)G(A)A G]G - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     48 Adiantum raddianum
- G U U(A)C(A - C)G(A)A G]G - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     49 Adiantum raddianum 2
- G U U(A)C G - C G A A G]C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     50 Ophioglossum petiolatum
- G U U A C(A - C)G(A)A G]A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     51 Osmunda cinnamomea
- G U C(A)C G - C G A A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     52 Salvinia natans
- G U U(A)C G - C G A A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     53 Psilotum nudum 2
- G C U(A)C G - C G G G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     54 Chara foetida
- G U U(A)C A - C A A A G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     55 Coleochaete scutata
- G U U(A)C A - C G(A)A G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     56 Klebsormidium flaccidum
- G C U(A)C G - C G A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     57 Nitella flexilis
- G C U(A)C G - C G A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     58 Nitella sp.
- G U C(A)G C - A U C G C]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     59 Chlamydomonas reinhardtii
- G U C(A)C G - G U C G C]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     60 Hydrodictyon reticulatum
- G U C(A)C G - G U U G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     61 Parietochloris pseudoalveolaris
-)A G U(A)G U - A U U U A U U A G U C(G A U A U)A G A C(G)A U A G C U U U U(C)U G G G G U(U U)G G A     62 Dictyostelium discoideum
- 43- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -E43_1- - - - - - - - - - - - - - -     63 Helix numbering 1
- G U U(A)C A - C G A A G]G - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     64 Pteris vittata
- G U U(A)C A - C G A A G]A A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     65 Megaceros aenigmaticus
- G U U(A)C A - C G A A G]A A - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     66 Notophylas breutelu
- G U U(A)C G - C G A A G G A]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     67 Physcomitrella patens
- G U C(A)C G - C(G)A A G G G]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -     68 Sphagnum palustre
```

```
                1660                1670                1680                1690                1700
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   1 Saccharomyces cerevisiae
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   2 Schizosaccharomyces pombe
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   3 Physcomitrella patens
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   4 Anthoceros agrestis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   5 Anthoceros laevis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   6 Pellia epiphylla
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   7 Reboulia hemisphaerica 2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   8 Riccardia pinguis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   9 Sphaerocarpos donnellii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  10 Sphaerocarpus texanus
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  11 Atrichum undulatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  12 Bryum argenteum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  13 Eurhynchium hians
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  14 Funaria hygrometrica
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  15 Leptobryum pyriforme
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  16 Mnium hornum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  17 Physcomitrium pyriforme
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  18 Polytrichum formosum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  19 Sphagnum cuspidatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  20 Calypogeia arguta
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  21 Conocephalum conicum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  22 Fossombronia pusilla
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  23 Marchantia polymorpha
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  24 Riccia fluitans
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  25 Scapania nemorea
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  26 Equisetum hyemale
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  27 Equisetum robustum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  28 Isoetes engelmannii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  29 Huperzia lucidula
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  30 Lycopodiella inundata
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  31 Lycopodium phlegmaria
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  32 Lycopodium taxifolium
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  33 Lycopodium tristachyum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  34 Selaginella galleottii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  35 Selaginella sp.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  36 Oryza sativa
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  37 Zea mays
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  38 Arabidopsis thaliana
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  39 Glycine max
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  40 Sinapis alba
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  41 Zamia pumila
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  42 Gnetum leyboldii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  43 Ginkgo biloba
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  44 Pinus luchuensis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  45 Pinus wallichiana
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  46 Podocarpus nakaii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  47 Taxus mairei
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  48 Adiantum raddianum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  49 Adiantum raddianum 2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  50 Ophioglossum petiolatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  51 Osmunda cinnamomea
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  52 Salvinia natans
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  53 Psilotum nudum 2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  54 Chara foetida
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  55 Coleochaete scutata
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  56 Klebsormidium flaccidum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  57 Nitella flexilis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  58 Nitella sp.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  59 Chlamydomonas reinhardtii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  60 Hydrodictyon reticulatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  61 Parietochloris pseudoalveolaris
A U G A U]U U C G - - - - - - - - - - - - - - - - - - - - - - - - - - -[G U C A U(C)U C C(U}G C U U C A  62 Dictyostelium discoideum
- - - -E43_1' - -E43_?43_3E43_4 E43_4'E43_5 E43_5'E43_3'E43_6 E43_6'- - - - - - - - - E43_2'- - -  63 Helix numbering 1
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  64 Pteris vittata
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  65 Megaceros aenigmaticus
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  66 Notophylas breutelu
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  67 Physcomitrella patens
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  68 Sphagnum palustre
```

```
                    1710                1720                1730                1740                1750
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
- - - - - - - - - - - - - - - - - - - - - - - U U U(G C U G G U U(A - U C)C A C U(U C)U U A G A G G]   1 Saccharomyces cerevisiae
- - - - - - - - - - - - - - - - - - - - - - - U(U G G C U G A U C(A - U)U A G C U(U C)U U A G A G G]   2 Schizosaccharomyces pombe
- - - - - - - - - - - - - - - - - - - U U U U U(U C C U U U G C G(G - C C)A A C U(U C)U U A G A G G]   3 Physcomitrella patens
- - - - - - - - - - - - - - - - - - - - - A C C U(U C U U C G U G(G - C C)A A C U(U C)U U A G A G G]   4 Anthoceros agrestis
- - - - - - - - - - - - - - - - - - - - - - C C U U(C U U C G U G(G - C C)A A C U(U C)U U A G A G G]   5 Anthoceros laevis
- - - - - - - - - - - - - - - - - - - - A U C - U(U C U U U G U G(G - C C)A A C U(U C)U U A G A G G]   6 Pellia epiphylla
- - - - - - - - - - - - - - - - - - - - - U U C(U C C C C U G C G(G - C C)A G(C)U(U C)U U A G A G G]   7 Reboulia hemisphaerica 2
- - - - - - - - - - - - - - - - - - - - - - U C U(U C U U(G)G C G(G - C C)A A C U(U C)U U A G A G G]   8 Riccardia pinguis
- - - - - - - - - - - - - - - - - - - - - C U U G(U C C U U G U G(G - C C)A G C U(U C)U U A G A G G]   9 Sphaerocarpos donnelli
- - - - - - - - - - - - - - - - - - - - - C U U G U(C C U U G U G(- - C C)A G C U(U C)U U A G A G G]  10 Sphaerocarpus texanus
- - - - - - - - - - - - - - - - - - - - - - U C U(U C U U U G U G(G - C C)A A C U(U C)U U A G A G G]  11 Atrichum undulatum
- - - - - - - - - - - - - - - - - - - U U U C C(U C C U U U G C G(G - C C)A A C U(U C)U U A G A G G]  12 Bryum argenteum
- - - - - - - - - - - - - - - - - - - U U U C C(U C C U U(U)G C G(- - C)C A A(C)U(U C)U U A G A G G]  13 Eurhynchium hians
- - - - - - - - - - - - - - - - - - - U U U U U(U C C U U U G C G(G - C C)A A C U(U C)U U A G A G G]  14 Funaria hygrometrica
- - - - - - - - - - - - - - - - - - - U U U C C(U C C U U U G C G(G - C C)A A C U(U C)U U A G A G G]  15 Leptobryum pyriforme
- - - - - - - - - - - - - - - - - - - U U U C C(U C C U U U G C G(G - C C)A A C U(U C)U U A G A G G]  16 Mnium hornum
- - - - - - - - - - - - - - - - - - - U U U C C(U C C U U U G(C)G(G - C C)A A C U(U C)U U A G A G G]  17 Physcomitrium pyriforme
- - - - - - - - - - - - - - - - - - - - - - U C U(U C U U C G C G(G - C C)A A C U(U C)U U A G A G G]  18 Polytrichum formosum
- - - - - - - - - - - - - - - - - - - - - U U C(C C C U U(G)G C G(G - C C)G A C U(U C)U U A G A G G]  19 Sphagnum cuspidatum
- - - - - - - - - - - - - - - - - - - - - - U C U(U C U U U G U G(G - C C)A A C U(U C)U U A G A G G]  20 Calypogeia arguta
- - - - - - - - - - - - - - - - C A U U U U U U(G G U(C)C U G C G(G - U C)A G C U(U C)U U A G A G G]  21 Conocephalum conicum
- - - - - - - - - - - - - - - - - - - - - A U C U(U C U U U G U G(G - C C)A A C U(U C)U U A G A G G]  22 Fossombronia pusilla
- - - - - - - - - - - - - - - - - - - - C U U G U(U C C C U G U G(G - A C)A G C U(U C)U U A G A G G]  23 Marchantia polymorpha
- - - - - - - - - - - - - - - - - U U C U U U U U(C C C C U G C G(G - C C)A G C U(U C)U U A G A G G]  24 Riccia fluitans
- - - - - - - - - - - - - - - - - - - - - A U C U(U C U U U G U G(G - C C)A A C U(U C)U U A G A G G]  25 Scapania nemorea
- - - - - - - - - - - - - - - - - - - - - C U U G(U C U U C G U G(G - C C)A A C U(U C)U U A G A G G]  26 Equisetum hyemale
- - - - - - - - - - - - - - - - - - - - - C U U G(U C U U C G U G(G - C C)A A C U(U C)U U A G A G G]  27 Equisetum robustum
- - - - - - - - - - - - - - - - - - - - A U C U(U C C U U U G C G(G - C C A)G C U(U C)U U A G A G G]  28 Isoetes engelmannii
- - - - - - - - - - - - - - - - - - - - - A U C U(U C U U(G)G U G(G - C C)A A C U(U C)U U A G A G G]  29 Huperzia lucidula
- - - - - - - - - - - - - - - - - - - - - A U C U(U C U U(G)G U G(G - C C)A A C U(U C)U U A G A G G]  30 Lycopodiella inundata
- - - - - - - - - - - - - - - - - - - - - A U C U(U C U U(G)G U G(G - C C)A A C U(U C)U U A G A G G]  31 Lycopodium phlegmaria
- - - - - - - - - - - - - - - - - - - - - A U C U(U C U U(G)G U G(G - C C)A A C U(U C)U U A G A G G]  32 Lycopodium taxifolium
- - - - - - - - - - - - - - - - - - - - - A U C U(U C U U(G)G U G(G - C C)A A C U(U C)U U A G A G G]  33 Lycopodium tristachyum
- - - - - - - - - - - - - - - - - - - - - A C U U(C C U U U G C G(G - C C)A G C U(U C)U U A G A G G]  34 Selaginella galleottii
- - - - - - - - - - - - - - - - - - - - - - U U C(C C U C C G A G(G - C C)A G C U(U C)U U A G A G G]  35 Selaginella sp.
- - - - - - - - - - - - - - - - - - - - - C A U C C(C U C C G C A(G - C)U A G C U(U C)U U A G A G G]  36 Oryza sativa
- - - - - - - - - - - - - - - - - - - - - C A U C C(C U C C G U A(G - U)U A G C U(U C)U U A G A G G]  37 Zea mays
- - - - - - - - - - - - - - - - - - - - - C A U C(C C U U C A C G(G - C C)G G C U(U C)U U A G A G G]  38 Arabidopsis thaliana
- - - - - - - - - - - - - - - - - - - - - U A A C(C C U C C A C G(G - C C)A G C U(U C)U U A G A G G]  39 Glycine max
- - - - - - - - - - - - - - - - - - - - - C A U C(C C U U C A C G(G - C C)G G C U(U C)U U A G A G G]  40 Sinapis alba
- - - - - - - - - - - - - - - - - - - - - G U U U(C U U U C G U G(G - C C)A G C U(U C)U U A G A G G]  41 Zamia pumila
- - - - - - - - - - - - - - - - - - - - - U A G C(C C U U C G C G(G - A C)A G C U(U C)U U A G A G G]  42 Gnetum leyboldii
- - - - - - - - - - - - - - - - - - - - - U U C G(C C U U C G U G(G - C C)A G C U(U C)U U A G A G G]  43 Ginkgo biloba
- - - - - - - - - - - - - - - - - - - - - U U C C(C C U U C G C G(G - C C)A G C U(U C)U U A G A G G]  44 Pinus luchuensis
- - - - - - - - - - - - - - - - - - - - - U U C C(C C U U C G C G(G - C C)A G C U(U C)U U A G A G G]  45 Pinus wallichiana
- - - - - - - - - - - - - - - - - - - - - U U C C(C C U U C G U G(G - C C)A G C U(U C)U U A G A G G]  46 Podocarpus nakaii
- - - - - - - - - - - - - - - - - - - - - U U U C(C C U U C G U G(G - C C)A G C U(U C)U U A G A G G]  47 Taxus mairei
- - - - - - - - - - - - - - - - - - - - - A U C(C U(C)U(U C)G(U G - - C C)A A C U(U C)U U A G A G G]  48 Adiantum raddianum
- - - - - - - - - - - - - - - - - - - - - A U C(C U(C)U(U C)G(U G G - C C)A A C U(U C)U U A G A G G]  49 Adiantum raddianum 2
- - - - - - - - - - - - - - - - - - - - - U C A G C(C U U C G C G(G - C G)A A C U(U C)U U A G A G G]  50 Ophioglossum petiolatum
- - - - - - - - - - - - - - - - - - - - - A U C(C U(C)U(U C)G U(G U - C C)A A C U(U C)U U A G A G G]  51 Osmunda cinnamomea
- - - - - - - - - - - - - - - - - - - - - A U C C(U C U U C G C G(G - C C)G A C U(U C)U U A G A G G]  52 Salvinia natans
- - - - - - - - - - - - - - - - - - - - - A U C C(U C U U C G U G(G - C C)A A C U(U C)U U A G A G G]  53 Psilotum nudum 2
- - - - - - - - - - - - - - - - - - - - - C C U U(U C C U C G U G(G - C C)A G C U(U C)U U A G A G G]  54 Chara foetida
- - - - - - - - - - - - - - - - - - - - - U U C U(C C U U U G U G(G - U C)A A C U(U C)U U A G A G G]  55 Coleochaete scutata
- - - - - - - - - - - - - - - - - - - - - U U C U(U C U(C)C G U G(G - C C)A A C U(U C)U U A G A G G]  56 Klebsormidium flaccidum
- - - - - - - - - - - - - - - - - - - - - U C U U(U C C U C G U G(G - C C)A G C U(U C)U U A G A G G]  57 Nitella flexilis
- - - - - - - - - - - - - - - - - - - - - U C U U(U C C U C G U G(G - C C)A G C U(U C)U U A G A G G]  58 Nitella sp.
- - - - - - - - - - - - - - - - - - - - - - A C C U(G C G G U G C(G - C C)G A C U(U C)U U A G A G G]  59 Chlamydomonas reinhardtii
- - - - - - - - - - - - - - - - - - - - - U U U U U(G C G G C C G(G - U U)G A C U(U C)U U A G A G G]  60 Hydrodictyon reticulatum
- - - - - - - - - - - - - - - - - - - - - U C C U U(C C A G C C G(G - C C)G A C U(U C)U U A G A G G]  61 Parietochloris pseudoalveolaris
A G G A G U(G)U G U(A)G U C U G A C U(C)G A U A G G U A C(G A A U - U A A A)A C U(U C)U U A G A G G]  62 Dictyostelium discoideum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -43'- - - - - - - - - - - - - - - - -  63 Helix numbering 1
- - - - - - - - - - - - - - - - - - - - - A U C C U(C U U C G U G(G - C C)A A C U(U C)U U A G A G G]  64 Pteris vittata
- - - - - - - - - - - - - - - - - - - - - - U C U U(C U U C G U G(G - C C)A A C U(U C)U U A G A G G]  65 Megaceros aenigmaticus
- - - - - - - - - - - - - - - - - - - - - - C C U U(C U G C G G G(G - U C)A A C U(U C)U U A G A G G]  66 Notophylas breutelu
- - - - - - - - - - - - - - - - - - - U U U U U(U C C U U U G C G(G - C C)A A C U(U C)U U A G A G G]  67 Physcomitrella patens
- - - - - - - - - - - - - - - - - - - - - U U C(C C C U U(G)G C G(G - G C)G A C U(U C)U U A G A G G]  68 Sphagnum palustre
```

```
                  1760                 1770                 1780                 1790                 1800
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . !
]G - A[C U - A U C G - G U]U U C A A - -[G C C G - A U G G]A A G U[U U G A G G]C A[A(U)A A C(A)G G U   1 Saccharomyces cerevisiae
]G - A[C U - A U U G - G C]A U A A A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   2 Schizosaccharomyces pombe
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   3 Physcomitrella patens
]G - A[C U - A U(C)G - G C]G U C U A - -[G C C(A)- A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   4 Anthoceros agrestis
]G - A[C U - A U U U - G C]G U C U A - -[G C G A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   5 Anthoceros laevis
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   6 Pellia epiphylla
]G A C A[C U G U C - - G C]G U C U A - -[G C(C)G - A C G G]A A G U[U U G A - G]C[A A(U)A A C(A)G G U   7 Reboulia hemisphaerica 2
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   8 Riccardia pinguis
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   9 Sphaerocarpos donnellii
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G -   10 Sphaerocarpus texanus
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   11 Atrichum undulatum
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   12 Bryum argenteum
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U A[U G A G G]C[A A(U)A A C(A)G G U   13 Eurhynchium hians
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   14 Funaria hygrometrica
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   15 Leptobryum pyriforme
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   16 Mnium hornum
]G - A[C U - A U(C)G - G C]G U C U A - -[G C C(A)- A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   17 Physcomitrium pyriforme
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   18 Polytrichum formosum
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   19 Sphagnum cuspidatum
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   20 Calypogeia arguta
]G - A[C U - G U C G - G C]G U C U A - -[G C C G - A C G G]A A G U[U U G A G]G C[A A(U)A A C(A)G G U   21 Conocephalum conicum
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   22 Fossombronia pusilla
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   23 Marchantia polymorpha
]G - A[C U - G U C G - G C]G U C U A - -[G C C G - A C G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   24 Riccia fluitans
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   25 Scapania nemorea
]G - A[C U - A U G G - C C]G U C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U(   26 Equisetum hyemale
]G - A[C U - A U G G - C C]G U C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   27 Equisetum robustum
]G - A[C U - A U U C - G C]G U C U A - -[G C G G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   28 Isoetes engelmannii
]G - A[C U - A U U C - G C]G U C C A - -[G C G G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   29 Huperzia lucidula
]G - A[C U - A U U C - G C]G U C C A - -[G C G G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   30 Lycopodiella inundata
]G - A[C U - A U U C - G C]G U C C A - -[G C G G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   31 Lycopodium phlegmaria
]G - A[C U - A U U C - G C]G U C C A - -[G C G G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   32 Lycopodium taxifolium
]G - A[C U - A U U C - G C]G U C C A - -[G C G G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   33 Lycopodium tristachyum
]G - A[C U - A U C G - C U]- A C U - - -[A G C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   34 Selaginella galleottii
]G - A[C U - A U U C - G C]U C C C A - -[G C G G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   35 Selaginella sp.
]G - A[C U -(A)U G G - C C]G U U U A - -[G G C C - A(C)G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   36 Oryza sativa
]G - A C[U -(A)U G G - C C]G U U U A - -[G G C C - G(C)G]- A A G U[U U G A G G]C[A A(U)A A C(A)G G U   37 Zea mays
]G - A[C U -(A)U G G - C C]G U U U A - -[G G C C - A(A)G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   38 Arabidopsis thaliana
]G - A[C U -(A)U G G - C C]G C U U A - -[G G C C - A(C)G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   39 Glycine max
]G - A[C U -(A)U G G - C C]G U U U A - -[G G C C - A(A)G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   40 Sinapis alba
]G - A[C U - A U G G - C C]G U U U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   41 Zamia pumila
]G - A[C U - A U G G - C C]G C U C A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   42 Gnetum leyboldii
]G - A[C U - A U G G - C C]C U U C A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   43 Ginkgo biloba
]G - A[C U - A U G G - C C]U C C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   44 Pinus luchuensis
]G - A[C U - A U G G - C C]G U U U A - -[G G C C - A U G G]A G G U[U U G A G G]C[A A(U)A A C(A)G G U   45 Pinus wallichiana
]G - A[C U - A U G G - C C]G U U U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   46 Podocarpus nakaii
]G - A[C U - A U G G - C C]G U U U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   47 Taxus mairei
]G - A[C U - A U G G - C C]G U C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)- G U   48 Adiantum raddianum
]G - A[C U - A U G G - C C]G U C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   49 Adiantum raddianum 2
]G - A[C U(- G)U G G - C C]G U C U A - -[G G C C - A - G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   50 Ophioglossum petiolatum
]G - A[C U - A U G G - C C]G U C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A U(A)G G U   51 Osmunda cinnamomea
]G - A[C U - G U G G - C C]G U C U A - -[G G C C - A C G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   52 Salvinia natans
]G - A[C U - A U G G - C C]R C C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   53 Psilotum nudum 2
]G - A[C U - G U U G G(A)C]G A C U A - -[G C C A - A C G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   54 Chara foetida
]G - A[C U - A U C G - G C]U U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   55 Coleochaete scutata
]G - A[C U - A U U(U)G G C]G U C U A C A[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   56 Klebsormidium flaccidum
]G - A[C U - G U U G G(A)C]G A C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   57 Nitella flexilis
]G - A[C U - G U U G G(A)C]G A C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   58 Nitella sp.
]G - A[C U - A U U G - G C]G U U U A - -[G C C A - A U G G]A A G U A[U G A G G]C[G A(U)A A C(A)G G U   59 Chlamydomonas reinhardtii
]G - A[C U - A U U G - G C]G U U U A - -[G U C A - A U G G]A A G U A[U G A G G]C[A A(U)A A C(A)G G U   60 Hydrodictyon reticulatum
]G - A[C U -(C)U C G - G C]G A C U A - -[G C C G - A(U)G G]A A G U G[U G A G G]C[G A(U)A A C(A)G G U   61 Parietochloris pseudoalveolaris
]G - A[C U -(A)C C U - G C]C U C A A - -[G C A G - G(C)G G]A A G U C[C G A G G]C[A A(U)A A C(A)G G U   62 Dictyostelium discoideum
- - - - - - - - 44- - - - - - - - - - - - - - - - 44' - - - - - - - - - - - - - - 42' - - - - - - - - - - - -   63 Helix numbering 1
]G - A[C U(- A)U G G - C C]G U C U A - -[G G C C - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   64 Pteris vittata
]G - A[C U - A U U U - G C]G U C U A - -[G C G A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   65 Megaceros aenigmaticus
]G - A[C U - A U U U - G C]G U C U A - -[G U G A - A U A G]A A G U[U U G A G G]A[A A(U)A A C(A)G G U   66 Notophylas breutelu
]G - A[C U - A U C G - G C]G U C U A - -[G C C G - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   67 Physcomitrella patens
]G - A[C U - A U U G - G C]G U C U A - -[G C C A - A U G G]A A G U[U U G A G G]C[A A(U)A A C(A)G G U   68 Sphagnum palustre
```

```
                 1810                1820                1830                1840                1850
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
C(- U G U G)A U G C C C U]U A G A A C[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A C G G   1 Saccharomyces cerevisiae
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A C G G   2 Schizosaccharomyces pombe
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A   3 Physcomitrella patens
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A   4 Anthoceros agrestis
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A   5 Anthoceros laevis
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A   6 Pellia epiphylla
C(- U G U G)A U(G)C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G   7 Reboulia hemisphaerica 2
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A   8 Riccardia pinguis
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G   9 Sphaerocarpos donnellii
C(- U G U G)A U(G)C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  10 Sphaerocarpus texanus
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  11 Atrichum undulatum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G(C)G(C)G(C)U]A C A C[U G A U G G  12 Bryum argenteum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A C)G C G(C)G C U]A C A C[U G A U G G  13 Eurhynchium hians
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  14 Funaria hygrometrica
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G  15 Leptobryum pyriforme
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G  16 Mnium hornum
C(- U G U G)A U G C C C U]C A G A - U[G(U)U C U G G]G C C[G C(G)C G C G(C)G C U]A C A C[U G A U G A  17 Physcomitrium pyriforme
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  18 Polytrichum formosum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  19 Sphagnum cuspidatum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  20 Calypogeia arguta
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G  21 Conocephalum conicum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  22 Fossombronia pusilla
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G  23 Marchantia polymorpha
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G  24 Riccia fluitans
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  25 Scapania nemorea
(G - U G U G)A U G C(C G)U]U A G A - U[G(U)U C U G G]G C G[G C(A G)G C(G C)G C U]A G A C[U G A U G A  26 Equisetum hyemale
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  27 Equisetum robustum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  28 Isoetes engelmannii
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  29 Huperzia lucidula
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  30 Lycopodiella inundata
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  31 Lycopodium phlegmaria
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  32 Lycopodium taxifolium
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  33 Lycopodium tristachyum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  34 Selaginella galleottii
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  35 Selaginella sp.
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C -[G C(A)C G C G(C)G C U]A C A C[U G A U G(U)  36 Oryza sativa
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G(U)  37 Zea mays
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G(U)  38 Arabidopsis thaliana
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G(U)  39 Glycine max
C(- U G U G)A U G C C C U]U A G A - U[G(U)U(C)U G G]G C -[G C(A)C G C G(C)G C U]A C A C[U G A U G(U)  40 Sinapis alba
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G(U)  41 Zamia pumila
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G C    42 Gnetum leyboldii
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G(U)  43 Ginkgo biloba
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G C    44 Pinus luchuensis
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G C    45 Pinus wallichiana
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G C    46 Podocarpus nakaii
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G C    47 Taxus mairei
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C(G)C G(C)U]A C A C[U G A U G A  48 Adiantum raddianum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  49 Adiantum raddianum 2
C(- U G U G)A U G(G)o o o]o o o o - o[o(o)o o o o o]o o o[o o(o)o o o o o(o)o o]o o o o o[o o o o o o  50 Ophioglossum peticlatum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C]G C G C U A C A C[U G A U G A  51 Osmunda cinnamomea
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  52 Salvinia natans
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  53 Psilotum nudum 2
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G G  54 Chara foetida
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  55 Coleochaete scutata
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  56 Klebsormidium flaccidum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  57 Nitella flexilis
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  58 Nitella sp.
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A C G C  59 Chlamydomonas reinhardtii
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G C  60 Hydrodictyon reticulatum
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G C  61 Parietochloris pseudoalveolaris
C(- U G U G)A U G C C C U]U A G A - U[A(C)C U U G G]G C C[G C(A)C G C G(C)G C U]A C A[A U G U A G G  62 Dictyostelium discoideum
38' - - - - - - - - - - - - - - - - - - - - - 36' - - - - - - - - - - 34' - - - - - - - - - - - - - - 45-  63 Helix numbering 1
C(- U G U G)A U G(C)C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G C(G)C U]A C A C[U G A U G A  64 Pteris vittata
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  65 Megaceros aenigmaticus
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  66 Notophylas breutelu
C(- U G U G)A U G C C C U]U A G A - U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  67 Physcomitrella patens
C(- U G U G)A U G C C C U]U A G A A U[G(U)U C U G G]G C C[G C(A)C G C G(C)G C U]A C A C[U G A U G A  68 Sphagnum palustre
```

```
                    1860                1870                1880                1890                1900
. . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
A G(: C A G C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - - - C U A A[C C(U U)G G C C]     1 Saccharomyces cerevisiae
A G(C C A A C)G A G]U U G(A A A A A A(A)U]- - - C U U U U - - -[G(A)U U U U U U]A U[C C U(U)G G C C]     2 Schizosaccharomyces pombe
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U(G)G G C C      3 Physcomitrella patens
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U C A[C C U(U G)U C C]     4 Anthoceros agrestis
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U(U)G G C C]     5 Anthoceros laevis
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     6 Pellia epiphylla
A(C U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     7 Reboulia hemisphaerica 2
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     8 Riccardia pinguis
A(C U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     9 Sphaerocarpos donnellii
A(U U C A A U)A A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - - U A U A G[C C U G G G C C]     10 Sphaerocarpus texanus
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     11 Atrichum undulatum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     12 Bryum argenteum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     13 Eurhynchium hians
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     14 Funaria hygrometrica
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     15 Leptobryum pyriforme
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     16 Mnium hornum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G(A)C C]     17 Physcomitrium pyriforme
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     18 Polytrichum formosum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     19 Sphagnum cuspidatum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     20 Calypogeia arguta
A(G U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     21 Conocephalum conicum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     22 Fossombronia pusilla
A(C U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     23 Marchantia polymorpha
A(C U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     24 Riccia fluitans
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     25 Scapania nemorea
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A A G A[C C U G G G C C]     26 Equisetum hyemale
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A A C A[C C U G G G C C]     27 Equisetum robustum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U G C[C C U G G G C C]     28 Isoetes engelmannii
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U G A[C C U G G G C C]     29 Huperzia lucidula
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U G A[C C U G G G C C]     30 Lycopodiella inundata
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A C G A[C C U G G G C C]     31 Lycopodium phlegmaria
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U C A C G A[C C U G G(G)C C]     32 Lycopodium taxifolium
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U G A[C C U G G G C C]     33 Lycopodium tristachyum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - G C A U - G[C C U G G U C U]     34 Selaginella galleottii
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - G C U U - G[C C U G(U)G C C]     35 Selaginella sp.
)A(U C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - A U A U A G[C C U G G(U)C C]    36 Oryza sativa
)A(U C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - A U A U A G[C C(U U)G G C C]    37 Zea mays
)A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U C A C A -[C C U(U -)G C C]    38 Arabidopsis thaliana
)A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - C U A U A G[C C U(U)G G C C]    39 Glycine max
)A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - - U C A C A[C C U(U)G G U C]    40 Sinapis alba
)A(U U C A A C G)A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - C U A U A A[C C U G G G C C]    41 Zamia pumila
A(U U C A G C)G A G]C - - - - - - - - - - - - - - - - - - - - - - - - - U U C C U U C[C C U G G U C C]     42 Gnetum leyboldii
)A(U U C A A C G)A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - C U A U A A[C C U G G G C C]    43 Ginkgo biloba
A(A C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - U U C U C U C[C C U G G(C)C C]     44 Pinus luchuensis
A(G C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - U U U U C U U[C C U G G U(U)C]     45 Pinus wallichiana
A(A U C A G C)G A G]C - - - - - - - - - - - - - - - - - - - - - - - - - U U U U U C G[C C U G G U C C]     46 Podocarpus nakaii
A(A C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - U U U U C U C[C C U G G(U)C C]     47 Taxus mairei
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A C C A[C C U G G G C C]     48 Adiantum raddianum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A C C A[C C U G G G C C]     49 Adiantum raddianum 2
o(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - C C G C C G[C C U G G G(C)C]     50 Ophioglossum peticlatum
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A A A A[C C U G G G C C]     51 Osmunda cinnamomea
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U C U U G[C C U(C)G G C C]     52 Salvinia natans
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - U C U A C C C[C C U G G G U C]     53 Psilotum nudum 2
A(U C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U G C U U G[C C U G G G U C]     54 Chara foetida
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G A C C]     55 Coleochaete scutata
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     56 Klebsormidium flaccidum
A(U C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - C G U G C A[C C U G G G U C]     57 Nitella flexilis
A(U C C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - C G U G C A[C C U G G G U C]     58 Nitella sp.
G(A C C A A C)G A G]C - - - - - - - - - - - - - - - - - - - - - - - - - - - - C U A U[C C U(U)G G C C]     59 Chlamydomonas reinhardtii
A(U U C A A C)G A G]C - - - - - - - - - - - - - - - - - - - - - - - - - - - - C U A U[C C U(U)G A C C]     60 Hydrodictyon reticulatum
A(U U C A A C)G A G]C - - - - - - - - - - - - - - - - - - - - - - - - - - - - C U A G[C C U(U)G G C C]     61 Parietochloris pseudoalveolaris
A A A C A A A]A A G G - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - C U[C C U G G U C C]     62 Dictyostelium discoideum
- - - - - - - - - - - - - - - - - - - - E45_1 - - - - - E45_1'- - - - - - - - - - - - - - 46- - - - -     63 Helix numbering 1
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A C C A[C C U G G G(C)C]     64 Pteris vittata
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U(G)G G C C]     65 Megaceros aenigmaticus
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U(G)G G C C]     66 Notophylas breutelu
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G A C C]     67 Physcomitrella patens
A(U U C A A C)G A G]U - - - - - - - - - - - - - - - - - - - - - - - - - - U U A U A A[C C U G G G C C]     68 Sphagnum palustre
```

```
                   1910                1920                1930                1940                1950
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
]G A G A -[G G U - C(U - - U}G G]U A A U[C U U(- - G U G A A A)C U C C G U - C G]U G C U G G G G A U    1 Saccharomyces cerevisiae
]G G A A -[G G U - C(U)- - G G G]U A A U[C U U(- - G U U A A A)C U C C G U - C G]U G C U G G G G A U    2 Schizosaccharomyces pombe
 G]A U A[C G G U - U - - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U    3 Physcomitrella patens
]G A G A -[G G A(- A C - -}G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U    4 Anthoceros agrestis
]G A G A -[G G U - C(U)- - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U    5 Anthoceros laevis
]G A G A -[G G U - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U    6 Pellia epiphylla
]G G A A -[G G U - C U - - G G G]U A A U[C U U(- - U U G A U A A}U U C A U - C G]U G A U G G G G A U    7 Reboulia hemisphaerica 2
]G A G A -[G G U - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U    8 Riccardia pinguis
]G A A A -[G G C - U C - - G G G]U A A U[C U U(- - U U C A A A C}U U C A U - C G]U G A U G G G G A U    9 Sphaerocarpos donnelli
]C A A A -[G G C - U C - - G G G]U A A U[C U U(- - U U C A A A C}U U C A U - C G]U G A U G G G G A U   10 Sphaerocarpus texanus
]G A G A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   11 Atrichum undulatum
]G G U A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A U A U}U U C A U - C G]U G A U G G G G A U   12 Bryum argenteum
]G A U A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   13 Eurhynchium hians
]G A U A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   14 Funaria hygrometrica
]G A C A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   15 Leptobryum pyriforme
]G A C A -[G G C - C U - - G G G]U A A U[C U U(- - C U G A A A U}U U C A U - C G]U G A U G G G G A U   16 Mnium hornum
]G A U A -[G G(C)- C U - - G G G]U A A U[C U U(- - C U G A A A U}U U C A U - C G]U G A U G G G G A U   17 Physcomitrium pyriforme
]G A G A -[G G C - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   18 Polytrichum formosum
]G A C A -[G G C - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   19 Sphagnum cuspidatum
]G A G A -[G G U - C U - - G G G]U A A U[C U U(- - U U C A A A U}U U C A U - C G]U G A U G G G G A U   20 Calypogeia arguta
]G U G A -[G G C - U C - - G G G]U A A U[C U U(- - U U G A A A A}U U C A U - C G]U G A U G G G G A U   21 Conocephalum conicum
]G A G A -[G G U - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   22 Fossombronia pusilla
]G A A A -[G G U - U C - - G G G]U A A U[C U U(- - U U G A A A A}U U C A U - C G]U G A U G G G G A U   23 Marchantia polymorpha
]G G A A -[G G U - U C - - G G G]U A A U[C U U(- - U U G A A A A}U U C A U - C G]U G A U G G G G A U   24 Riccia fluitans
]G A G A -[G G U - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   25 Scapania nemorea
]G A G A -[G G U - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   26 Equisetum hyemale
]G A G A -[G G U - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   27 Equisetum robustum
]G A U A -[G G U - C U - - G G G]C A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   28 Isoetes engelmannii
]G A U A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   29 Huperzia lucidula
]G A U A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   30 Lycopodiella inundata
]G A C A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   31 Lycopodium phlegmaria
]G A C A -[G G - - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   32 Lycopodium taxifolium
]G A U A -[G G C - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   33 Lycopodium tristachyum
]G U C A -[G G A - U C - - G G G]U A A U[C U U(- - U U G A A A C}U U C A U - C G]U G A U G G G G A U   34 Selaginella galleottii
]G A A A -[G G C -(U)C - - G G G]U A A U[C U U(- - C U G A A A A}U U C A U - C G]U G A U G G G G A U   35 Selaginella sp.
]G A C A -[G G(C)- C C - - G G G]U A A U[C U U(- - G G G A A A U}U(U)C A U - C G]U G A U G G G G A U   36 Oryza sativa
]G A C A -[G G C - C - - - - G G]U A A U[C U U(- - G G G A A A U}U(U)C A U{G}C G]U G A U G G G G A U   37 Zea mays
]G A C A -[G G C(- C C - -}G G G]U A A U[C U U(- - U - G A A A U}U(U)C A U - C G]U G A U G G G G A U   38 Arabidopsis thaliana
]G A C A -[G G U - C(C)- - G G G]U A A U[C U U(- - U - G A A A U}U(U)C A U - C G]U G A U G G G G A U   39 Glycine max
]G A C A -[G G C - C(C)- - G G G]U A A U[C U U(- - U - G A A A U}U(U)C A U - C G]U G A U G G G G A U   40 Sinapis alba
]G G G A -[G G U - C C - - G G G]A A A U[C U(G - - G C G A A A U}U(U)C A U - C G]U G A U G G G G A U   41 Zamia pumila
]G A G A -[G G A - U C - - G G G]A A A U[C U U(- - G U G A A A A}U G C A U - C G]U G A U G G G G A U   42 Gnetum leyboldii
]G A G A -[G G C - C C - - G G G]A A A U[C U(G - - C C G A A A U}U(U)C A U - C G]U G A U G G G G A U   43 Ginkgo biloba
]G A A A -[G G(U)- U U - - G G G]A A A U[C U U(- - G C C A A A U}U G C A U - C G]U G A U G G G G A U   44 Pinus luchuensis
]G A G A -[G(C)A - U C - - G G G]A A A U[C U U(- - C U C A A A U}U G C A U - C G]U G A U G G G G A U   45 Pinus wallichiana
]G A G A -[G G G - U C - - G G G]A A A U[C U U(- - G C C A A A U}U G C A U - C G]U G A U G G G G A U   46 Podocarpus nakaii
]G A A A -[G G(U)- U C - - G G G]A A A U[C U U(- - G C C A A A U}U G C A U - C G]U G A U G G G G A U   47 Taxus mairei
]G A C A -[G G C - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   48 Adiantum raddianum
]G A C A -[G G C - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   49 Adiantum raddianum 2
]G A G A -[G(A)C - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   50 Ophioglossum petiolatum
]G A G A -[G G C - C C - - G G G]U A A U[C U U(- - U U U A A A U}U U C A U - C G]U G A U G G G G A U   51 Osmunda cinnamomea
]G A C A -[G G C - C(U)- - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   52 Salvinia natans
]G A G A -[G G C - C C - - G G G]U A A U[C U U(- - G U G A A A U}U U C A U - C G]U G A U G G G G A U   53 Psilotum nudum 2
]G A A A -[G G C - C U - - G G G]U A A C[C U U(- - C U C A A G G}U U C A U - C G]U G A C G G G G A U   54 Chara foetida
]G A A A -[G G U - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   55 Coleochaete scutata
]G A A A -[N G U - C U - - G G G]U A A U[C U U(- - G U G A A A U}U U C A U - C G]U G A U G G G G A U   56 Klebsormidium flaccidum
]G A A A -[G G C - U C - - G G G]C A A C[C U U(- - C U C A A A C}U U C A U - C G]U G A C G G G G A U   57 Nitella flexilis
]G A A A -[G G C - U C - - G G G]C A A C[C U U(- - C U C A A A C}U Y C A U - C G]U G A C G G G G A U   58 Nitella sp.
]G A G A -[G G C - C(C)- - G G G]U A A U[C U U(- - - G U A A A C}C G C G U - C G]U G A U G G G G A U   59 Chlamydomonas reinhardtii
]G A G A -[G G U - C(C)- - G G G]U A A U[C U U(- - - U G A A A C}U G C A U - C G]U G A U G G G G A U   60 Hydrodictyon reticulatum
]G A C A -[G G C - C(C)- - G G G]U A A U[C U U(- - - G C A A A C}U G C A U - C G]U G A U G G G G C U   61 Parietochloris pseudoalveolaris
]G G A A -[G G A - U U - - G G G]U A A U C A(U - - - U U G(A A)U U U C C U A C G U]A A C U G G G C U   62 Dictyostelium discoideum
 - - - - - - - - - - - - 46' - - - - - - - - - - - - - - - - - - - - - - 45' - - - - - - - - - - - - -   63 Helix numbering 1
]G A C A -[G(G)C - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   64 Pteris vittata
]G A G A -[G G U - U(U)- - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   65 Megaceros aenigmaticus
]G A G A -[G G U - C(U)- - G G G]U A A U[C U -(G C - U G A A A U}U U C A U - C G]U G A U G G G G A U   66 Notophylas breutelu
]G A U A -[G G U - C U - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   67 Physcomitrella patens
]G A C A -[G G C - C C - - G G G]U A A U[C U U(- - U U G A A A U}U U C A U - C G]U G A U G G G G A U   68 Sphagnum palustre
```

```
                    1960                1970                1980                1990                2000
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
[A G A G C A]U U G U A A U U A U[U G C U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C A A G     1 Saccharomyces cerevisiae
[A G A G C A]U U G C A A U U A U[U G C U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C A A G     2 Schizosaccharomyces pombe
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G     3 Physcomitrella patens
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G     4 Anthoceros agrestis
[A G A U C A]U U G C A A U U A U[U G A U C U]U G A A C G A G G A A[U U C C]U A G U A[A G C G C G A G     5 Anthoceros laevis
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G     6 Pellia epiphylla
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G     7 Reboulia hemisphaerica 2
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G     8 Riccardia pinguis
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G     9 Sphaerocarpos donnellii
[A G A - C A]U U G C A A U U A U[U G(A)U C U]U C A A C G A G G A[A U U C C]U A G U A[A(G)C G C G A G    10 Sphaerocarpus texanus
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    11 Atrichum undulatum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    12 Bryum argenteum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    13 Eurhynchium hians
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    14 Funaria hygrometrica
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    15 Leptobryum pyriforme
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    16 Mnium hornum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A A[G C G C G A G    17 Physcomitrium pyriforme
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    18 Polytrichum formosum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    19 Sphagnum cuspidatum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    20 Calypogeia arguta
[A G A U C A]U U G C A A U U A U[U G A U C U]U G A A C G A G G A[A U U(C)C]U A G U A[A G C G C G A G    21 Conocephalum conicum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    22 Fossombronia pusilla
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    23 Marchantia polymorpha
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    24 Riccia fluitans
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    25 Scapania nemorea
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C U A G G A[A U U C C]U A G U A[A G - G C G A G    26 Equisetum hyemale
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    27 Equisetum robustum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    28 Isoetes engelmannii
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    29 Huperzia lucidula
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    30 Lycopodiella inundata
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    31 Lycopodium phlegmaria
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    32 Lycopodium taxifolium
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    33 Lycopodium tristachyum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U A C C]U A G U A[A G C G C G A G    34 Selaginella galleottii
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    35 Selaginella sp.
[A G A U C A]U U G C A A U U G U[U G G U C U]U C A A C G A G G A[A U G C C]U A G U A[A G C G C G A G    36 Oryza sativa
[A G A U C A]U U G C A A U U G U[U G G U C U]U C A A C G A G G A[A U G C C]U A G U A[A G C G C G A G    37 Zea mays
[A G A U C A]U U G C A A U U G U[U G G U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    38 Arabidopsis thaliana
[A G A U C A]U U G C A A U U G U[U G G U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    39 Glycine max
[A G A U C A]U U G C A A U U G U[U G G U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    40 Sinapis alba
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    41 Zamia pumila
[A G A U C]U U U G C A A U U A U C[G G U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G U G A G    42 Gnetum leyboldii
[A G A U C A]U U G C A A U U A U[U G A U C U]U A A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    43 Ginkgo biloba
[A G A(C)C A]U U G C A A U U A U[U G(A)U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    44 Pinus luchuensis
[A G A C C A]U U G C A A U U A U[U G G U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G(U)G    45 Pinus wallichiana
[A G A(C)C A]U U G C A A U U A U[U G(A)U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    46 Podocarpus nakaii
[A G A(C)C A]U U G C A A U U A U[U G(A)U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    47 Taxus mairei
 -[G A U C A]U U G C A A U U A U[U G A U C]U U C A A C G A G G A[A U U C C]U A G U A[A G C G C(G)A G    48 Adiantum raddianum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    49 Adiantum raddianum 2
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G(C)G C G A G    50 Ophioglossum petiolatum
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C]G U A G U A[A G C G C G A G    51 Osmunda cinnamomea
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    52 Salvinia natans
[A G A U C A]U U G C A A U U A U[U G G U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    53 Psilotum nudum 2
[A G A U U G]U U G U A A U U A U[C G A U C U]U G A A C G A G G A[A U G C C]U A G U A[A G C G U G A G    54 Chara foetida
[A G A U U A]U U G C A A U U A U[U A A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    55 Coleochaete scutata
[A G A U U A]U U G C A A U U A U[U A A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    56 Klebsormidium flaccidum
[A G A U U G]U U G C A A U U A U[C G A U C U]U G A A C G A G G A[A U G C C]U A G U A[A G C G C G A G    57 Nitella flexilis
[A G A U U G]U U G C A A U U A U[C G A U C U]U G A A C G A G G A[A U G C C]U A G U A[A G C G C G A G    58 Nitella sp.
[A G A U U A]U U G C A A U U A U[U A G U C U]U C A A C G A G G A[A U G C C]U A G U A[A G C G C G A G    59 Chlamydomonas reinhardtii
[A G A U U A]U U G C A A U U A U[U A G U C U]U C A A C G A G G A[A U G C C]U A G U A[A G C G C G A G    60 Hydrodictyon reticulatum
[A G A U U A]U U G C A A U U A U[U A A U C U]U C A A C G A G G A[A U G C C]U A G U A[A G(G C)C G A G    61 Parietochloris pseudoalveolaris
[U G A U C]U U U G U A A U U A U U[G A U C A]U A A A C G A G G A[A U U C C]U U G U A[A G C G U A A G]    62 Dictyostelium discoideum
 - 47- - - - - - - - - - - - - - - - - 47' - - - - - - - - - - - - - - - 33' - - - - - - - - - 48- - - -    63 Helix numbering 1
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G(C)G C G A G    64 Pteris vittata
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A A[U U C C]U A G U A[A G C G C G A G    65 Megaceros aenigmaticus
[A G A U C A]U U G A A A U U A U[U G C U C U]C C A A C G A G G A A[U U C C]U A G U A[A G C G C G A A    66 Notophylas breutelu
[A G A U C A]U U G C A A U U A U[U G A U C U]U C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    67 Physcomitrella patens
[A G A U C A]U U G C A A U U A U[U G A U C U]C C A A C G A G G A[A U U C C]U A G U A[A G C G C G A G    68 Sphagnum palustre
```

DCSE Alignment

```
                  2010                2020                2030                2040                2050
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
U]C A U C A[G C U U G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    1 Saccharomyces cerevisiae
U]C A U C A[G C U U G C G U U]G A A U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    2 Schizosaccharomyces pombe
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    3 Physcomitrella patens
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    4 Anthoceros agrestis
U]C A U C A[G C U C G N G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    5 Anthoceros laevis
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    6 Pellia epiphylla
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    7 Reboulia hemisphaerica 2
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    8 Riccardia pinguis
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G    9 Sphaerocarpos donnellii
U]C A U C A[G C U C G C G - U]G A C U A C G U C C C[U G C C(C)U U - U G U[A -]C A]C A C C G C C - G   10 Sphaerocarpus texanus
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   11 Atrichum undulatum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   12 Bryum argenteum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C(C)U(U)- U G U[A -]C A]C A A C G C C C G   13 Eurhynchium hians
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   14 Funaria hygrometrica
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   15 Leptobryum pyriforme
U]C A U C A[G C U C G C G U U]G A C U A C G C C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   16 Mnium hornum
U]C A U C A[G C U C G C G U]C G - C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   17 Physcomitrium pyriforme
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   18 Polytrichum formosum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   19 Sphagnum cuspidatum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   20 Calypogeia arguta
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   21 Conocephalum conicum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   22 Fossombronia pusilla
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   23 Marchantia polymorpha
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   24 Riccia fluitans
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   25 Scapania nemorea
U]C A U C A[G C U C G C(G)U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C U G C C C G   26 Equisetum hyemale
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   27 Equisetum robustum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C(G)U U - U G U[A -]C A]C A C C G C C C G   28 Isoetes engelmannii
U]C A U C A[G C U C N N N U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   29 Huperzia lucidula
U]C A U C A[G C U C G C G N U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   30 Lycopodiella inundata
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   31 Lycopodium phlegmaria
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   32 Lycopodium taxifolium
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   33 Lycopodium tristachyum
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   34 Selaginella galleottii
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   35 Selaginella sp.
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   36 Oryza sativa
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   37 Zea mays
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   38 Arabidopsis thaliana
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   39 Glycine max
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   40 Sinapis alba
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   41 Zamia pumila
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   42 Gnetum leyboldii
U]C A U C A[A C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   43 Ginkgo biloba
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   44 Pinus luchuensis
U]C A U C A[A C(U)C G U G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   45 Pinus wallichiana
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   46 Podocarpus nakaii
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   47 Taxus mairei
U]C A U C A[G C U - G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   48 Adiantum raddianum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   49 Adiantum raddianum 2
U]C A U C A[G C U C G C - U U]G A C U A C G - C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   50 Ophioglossum petiolatum
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   51 Osmunda cinnamomea
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   52 Salvinia natans
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   53 Psilotum nudum 2
U]C A U C A[G C U C G C G C U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   54 Chara foetida
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   55 Coleochaete scutata
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   56 Klebsormidium flaccidum
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   57 Nitella flexilis
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   58 Nitella sp.
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   59 Chlamydomonas reinhardtii
U]C A U C A[G C U C G C G U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   60 Hydrodictyon reticulatum
U]C A U C A[G C U C G(C G)U U]G A U U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   61 Parietochloris pseudoalveolaris
]U C A U U A C[C U U A U G C U]G A A U A U G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   62 Dictyostelium discoideum
- - - - - - - - - - - 48' - - - - - - - - - - - - - - - - - - - - - - 32' - - - - - - - - - - - - - - - - -   63 Helix numbering 1
U]C A U C A[G C U C G C G U U]G A C A C G G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   64 Pteris vittata
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   65 Megaceros aenigmaticus
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A A]C A]C A C C G C C C G   66 Notophylas breutelu
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   67 Physcomitrella patens
U]C A U C A[G C U C G C G U U]G A C U A C G U C C C[U G C C C C U U - U G U[A -]C A]C A C C G C C C G   68 Sphagnum palustre
```

```
                    2060                2070                2080                2090                2100
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
U C G C(U A G U(A)C C(G A)U U G A A U G G C U -(U)A G U(G A)G(G)C C(U C)A(G G A)U C U G - C U U -(A)   1 Saccharomyces cerevisiae
U C G C(U A C U(A)C C(G A)U U G A A U G G C U -(U)A G U(G A)G(G)C C(U C)U(G G A)U U G G - C(U)U - G    2 Schizosaccharomyces pombe
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U(G)C - G G C G(A)   3 Physcomitrella patens
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)   4 Anthoceros agrestis
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U U(U U)C(G G A)U U G C - G G C(G A    5 Anthoceros laevis
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)   6 Pellia epiphylla
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G A G(U U)C(G G A)U C G C - G G C G(A)   7 Reboulia hemisphaerica 2
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)   8 Riccardia pinguis
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G A G(U U)C(G G A)U U G C - G G C G(A)   9 Sphaerocarpos donnellii
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G -(G A)A G(A G U U)C(G G A)U U G C - G G C G(A)  10 Sphaerocarpus texanus
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U C G C - G G C G(A)  11 Atrichum undulatum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)G G U(U U U)C(G G A)U U G C - G G C G(A)  12 Bryum argenteum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C)- G G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G A   13 Eurhynchium hians
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)G G U(U U U)C(G G A)U U(G)C - G G C G(A)  14 Funaria hygrometrica
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  15 Leptobryum pyriforme
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U C G C - G G C G(A)  16 Mnium hornum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A A)G U(U U U)C(G G A)U(U G)C - G G(C G A   17 Physcomitrium pyriforme
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U C G C - G G C G(A)  18 Polytrichum formosum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U(C)C - G G C G(A)  19 Sphagnum cuspidatum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  20 Calypogeia arguta
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G A(G U U)C(G G A)U C G C - G G C G(A)  21 Conocephalum conicum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  22 Fossombronia pusilla
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G A(G U U)C(G G A)U U G C - G G C G(A)  23 Marchantia polymorpha
U C G C(U C C U(A)C C(C A)U U G A A U G G U(C - C)G G U(G A)A G A(G U C)C(G G A)U C G C - G G C G(A)  24 Riccia fluitans
U C G C(U C(C)U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  25 Scapania nemorea
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U - C - G G C G(A)  26 Equisetum hyemale
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  27 Equisetum robustum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U G(U U)C(G G A)U U G C -(U)G C G(A)  28 Isoetes engelmannii
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  29 Huperzia lucidula
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  30 Lycopodiella inundata
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  31 Lycopodium phlegmaria
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  32 Lycopodium taxifolium
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A)  33 Lycopodium tristachyum
U C G C(U C C U(A)C C(G A)U U G G A U G G U(C - C)G G U(G A)A G U(G U U)C(G G A)U C G U - A A C G(A)  34 Selaginella galleottii
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(G U U)C(G G A)U U G C - A G C G(A)  35 Selaginella sp.
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U G(U U)C(G G A)U C G C - G G C G(A)  36 Oryza sativa
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U G(U U)C(G G A G)C U C - G G C(- -   37 Zea mays
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U G(U U)C(G G A)U C G C - G G C G(A)  38 Arabidopsis thaliana
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U G(U U)C(G G A)U U G C - G G C G(A)  39 Glycine max
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G(U)A(C U)C(G G A)U C G C - G G C G(A)  40 Sinapis alba
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U G(U U)C(G G A)U C G U - G(C)C G(A)  41 Zamia pumila
U C G C(U C C U(A)C C(G A)U U G A A C G A U(C - C)G G U(G A)A A U G(U U)C(G G A)U U A C - G G C G(A)  42 Gnetum leyboldii
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U G(U U)C(G G A)U C G C - G(C)C G(A)  43 Ginkgo biloba
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U G(U U)C(G G A)U C G C - G(C)C G(A)  44 Pinus luchuensis
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U G(U U)C(G G A)U U G C - G(U)C G(A)  45 Pinus wallichiana
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U G(U U)C(C G A)U C G C - G A C G(A)  46 Podocarpus nakaii
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U G(U U)C(G G A)U C G C - G A C G(A)  47 Taxus mairei
U C G C(U C C U(A)C C(G A)U U G A A U G G -(C - C)G G U(G A)A G U(U U U)C(G G A)U C G C(- G)G C G(A)  48 Adiantum raddianum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U C G C - G G C G(A)  49 Adiantum raddianum 2
U C G C(U C C U(A)C C(G A)U U G A A U G G(U C - C)G G U(G A)A G U(N N U)C(G G A)U C G C - G G C G(A)  50 Ophioglossum petiolatum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C(- A)  51 Osmunda cinnamomea
U C G C(U C C U(A)C C(G A)U U G A A U G G -(U C C)G G U(G A)A G U(G U U)C(G G A)U C G C - G G C G(A)  52 Salvinia natans
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C G(A   53 Psilotum nudum 2
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U G(U C)U(G G A)U C G C - G G U - G(  54 Chara foetida
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U(U U U)C(G G A)U U G C - G G C - G(  55 Coleochaete scutata
U C G C(U C C U(A)C C(G A)U U G A A U G A U(C - C)G G U(G A)A G U(U U U)C(G G A)U C G C - G G C - U(  56 Klebsormidium flaccidum
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U G(U U)C(G G A)U U G C - G G U - G(  57 Nitella flexilis
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U G(U U)C(G G A)U U G C - G G U - G(  58 Nitella sp.
U C G C(U C C U(A)C C(G A)U U G G G U G(U)G(C - U)G G U(G A)A G U G(U U)C(G G A)U U G A - G C(U - U)  59 Chlamydomonas reinhardtii
U C G C(U C C U(A)C C(G A)U U G G G U G(U)G(C - U)G G U(G A)A G U G(U U)C(G G A)U U G G - C A G -(A)  60 Hydrodictyon reticulatum
U C G C(U(C)C U(A C C G A)U U G G G U G(U)G(C - U)G G U(G A)A G U G(U U)C(G G A)U U G G - C(G)G - C   61 Parietochloris pseudoalveolaris
U C G C(U C C U(A)C C(G A)U(C)G A A U G A U(A - C)G G U(A A)A G(U)U A A C(G G A)U(C)G U - U U U A U   62 Dictyostelium discoideum
- - - - - - - - - - - - - - - - - - - - - - - - 49- - - - - - - - - - - - - - - - - - - - - - - - -   63 Helix numbering 1
U C G C(U C C U(A)C C(G A)U U G A A U G G(U C - C)G G U(G A)A G U(U U U)C(G G A)U C G C - G A C G(A)  64 Pteris vittata
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U U(U U)C(G G A)U U G C - G G C(G A   65 Megaceros aenigmaticus
U C G U(U C C U(A)C C(G A)U U G A U U G G U(C - C)G G G(G A)A G U U(U U)C(G G A)U U G G U G G C(G A   66 Notophylas breutelu
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U U(G)C - G G C G(A)  67 Physcomitrella patens
U C G C(U C C U(A)C C(G A)U U G A A U G G U(C - C)G G U(G A)A G U(U U U)C(G G A)U C(G)C - G G C G(A)  68 Sphagnum palustre
```

```
                 2110                2120                2130                2140                2150
. . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . |
)G A G A(A)G G G G]- - G C A A - - -[C U C C(A)U C U C - - - - - - -(A)- G A - G C G G A(G A A)U(U U)G     1 Saccharomyces cerevisiae
 U U U C U G C U G]- - G C A A - - -[C G G C G G A A A - - - - - - - C - A(U U)G C C G A(G A A)G(U U)G     2 Schizosaccharomyces pombe
)U G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G(G)G A(G A A)G(U U C)    3 Physcomitrella patens
)C G C C G G C G G]- - G A A A - - -[C C G C C G G C G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)    4 Anthoceros agrestis
 C A - - -)G C G G]- - G U G A - - -[C C G C(C G G C G - - - - - - - A C)G U - U G U G A G(A A)G(U U C)    5 Anthoceros laevis
)C G C C G(A)U G G]- - U U C G - - -[C C G(C)C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)    6 Pellia epiphylla
)C G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U)C     7 Reboulia hemisphaerica 2
)C G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)    8 Riccardia pinguis
)U G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U C)C     9 Sphaerocarpos donnellii
)U G C C G G C G]- - - G U U - - - -[C G C C G(C)G U G - - - - - - -(A)C G U - U G U G A(G A A)G(- U C    10 Sphaerocarpus texanus
)U G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   11 Atrichum undulatum
)U(C G)C G G C G G]- - U U C G - - -[C C G C C G(G U)G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   12 Bryum argenteum
 U(U U)C C G G C G G]- U U C G - - -[C C G C C G G(U)G - - - - - - - U C G U - U G U A G(G A A)G(U U C)   13 Eurhynchium hians
)U G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G(G)G A(G A A)G(U U C)   14 Funaria hygrometrica
)C G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   15 Leptobryum pyriforme
)C G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   16 Mnium hornum
 U)G G C(G)G)C G G - - N N G G - - - - A A(C(G)G U U(- - - - - - - - A G C)U - U G(G U)A(G A A)G(U U C)   17 Physcomitrium pyriforme
)C G C C G G C G G]- - U U C G - - -[C C G C C G G C G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   18 Polytrichum formosum
)C G C C(U)G C G G]- - U U C G - - -[C C G C(C)G G C G - - - - - - -(A)C G U - U G(U)G A(G A A)G(U U C)   19 Sphagnum cuspidatum
)C G C C G G U G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   20 Calypogeia arguta
)C G C C G G U G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   21 Conocephalum conicum
)C G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   22 Fossombronia pusilla
)U G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U C C)   23 Marchantia polymorpha
)U G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   24 Riccia fluitans
)C G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   25 Scapania nemorea
)C G C U G G)C G G - - U U C G - - - - - - -[C C G G C G - - - - - - -(A)C G U - U G(U)G A(G A A)G(U U C)   26 Equisetum hyemale
)C G C U G G C G G]- - U U C G - - -[C C G C C G G C G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   27 Equisetum robustum
)C G C - G(G)C G)G - - U U C G - - - -[C G C G U G - - - - - - - - - -(A)C G U -(U)G U G A(G A A)G(U U)C    28 Isoetes engelmannii
)C G C - G(G)C G)G - - U U C G - - - -[C G C G U G - - - - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   29 Huperzia lucidula
)C G U - G(G)C G)G - - U U C G - - - -[C G C G U G - - - - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   30 Lycopodiella inundata
)C G C C G G C G G]- - U U C G - - -[C C G C U G G C G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   31 Lycopodium phlegmaria
)C G C C G G C G G]- - U U C G - - -[C C G C U G G C G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   32 Lycopodium taxifolium
)C G C - G(G)C G)G - - U U C G - - - -[C G C G U G - - - - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   33 Lycopodium tristachyum
)U G C C G G C G G]- - U U C G - - -[C U G C U G G C G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   34 Selaginella galleottii
)U G C C G A C G G]- - U U C G - - -[C C G U C G G C G - - - - - - -(A)C G C - U G U G A(G A A)G(U U C)   35 Selaginella sp.
)C G G G G G C G G]- - U U C G - - -[C C G C C C C C G - - - - - - -(A)C G U - C G C G A(G A A)G(U C)C    36 Oryza sativa
 - C G C A C)C G G]- - U U C G - - -[C C G(C C C C C G - - - A C C G U C C -)G C C G A G(A A)G(U C)C    37 Zea mays
)C G U G G G U G G]- - U U C G - - -[C C G C C C G C G - - - - - - -(A)C G U - C G C G A(G A A)G(U C)C    38 Arabidopsis thaliana
)C G U G(A)G C G G]- - U U C G - - -[C U G C(C)C G C G - - - - - - -(A)C G U - U G U G A(G A A)G(U C)C    39 Glycine max
)C G U G G G U G G]- - U U C G - - -[C C G U C C G C G - - - - - - -(A)C G U - C G C G A(G A A)G(U U)U(   40 Sinapis alba
)C G(A)C G(G)C G G]- - U U C G - - -[C U G(G G)C G C G - - - - - - -(A)C G(U)- C G C G A(G A A)G(U U)C    41 Zamia pumila
)C G(A)U G A U G G]- U U U C G C C - A(U C G U C G C G - - - - - - -(A)C G U - C G U G A(G A A)G(C U)C    42 Gnetum leyboldii
)C G(A)C G G C G G]- - U U C G - - -[C C G C C G(G)C G - - - - - - -(A)C G(U)- C G C G A(G A A)G(U U)C    43 Ginkgo biloba
)C G(A)C G G C G G]- - U U C - - - -[C U G U C G(G)C G - - - - - - -(A)C G(U)- C G C G A(G A A)G(U U)C    44 Pinus luchuensis
)C G A C G G U G G]- - U U C G - - -[C C G C U G U C G - - - - - - -(A)C G(U)- C G U G A(G A A)G(U U)C    45 Pinus wallichiana
)C G U U G G C G G]- - U U G U - - -[C U G C C G A C G - - - - - - -(A)C G U - U G C G A(G A A)G(U U)C    46 Podocarpus nakaii
)C G G C G G U G G]- - U U U - - - -[C C G U C G C C G - - - - - - -(A)U G U - U G C G A(G A A)G(U U)C    47 Taxus mairei
)C(C G)U G G C G)G - - U U C G - - - -[C G C C G(G U)G - - - - - - -(A)C G U - - G U G A(G A A)G(U U C)   48 Adiantum raddianum
)C G C U G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   49 Adiantum raddianum 2
)C A G C C G G C G G]- U C C G - -[C C o o o o o o o o o - - - - - - -(o)o o o - o o o o o(o o o)o(o o o)   50 Ophioglossum petiolatum
)C G C C G G C G G]- - A U C G - - -[C U G C C G G U G(- - - - - - - A C)G U - U G U G A(G A A)G(U U C)   51 Osmunda cinnamomea
)C G(G)C G G C G G]- - U A C C - - -[C C G C C G(G)C G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   52 Salvinia natans
 C G C C G)G C G G]- - U C C G - - -[C C G C(C G G C C - - - - - - - A)C G U - U G U G A(G A A)G(U U C)   53 Psilotum nudum 2
(A)U C U C G G C G G]- U U U G - -[C C G C U - G G G G - - - - - - -(G)U G C - U G U G A(G A A)G(U U)C    54 Chara foetida
(A)C(C)C U G G C G G]- U U C G - -[C C G C C - G G(U)G - - - - - - -(A)C G C - U G U G A(G A A)G(U U C)   55 Coleochaete scutata
(A)C U(C)C G G C u G]- U C N G - -[C N G C C - G(A)A G - - - - - - -(A)A G C - U G U G A(G A A)G(U U C)   56 Klebsormidium flaccidum
(A)C C C C G G C G G]- U U C G - -[C C G C U - G G G G - - - - - - -(G)C G C - U G U G A(G A A)G(U U)C    57 Nitella flexilis
(A)C C C C G G C G G]- U U C G - -[C C G C U - G G G G - - - - - - -(G)C G C - U G U G A(G A A)G(U U)C    58 Nitella sp.
)G G C U G G G]- - - - G C A A - - - - -[C C - U G G C - - - - - - - C(U U)G - C U U G A(G A A)G(U U)C    59 Chlamydomonas reinhardtii
)A G(C)G G G U G]- - - G C A A - - - -[C A C - C U(A)C - - - - - - - U(A)C U - G C C G A(G A A)G(U U)C    60 Hydrodictyon reticulatum
 A G U C G C G G]- - - U U U - - - - - -[C C G(C)U G A C - - - - - - - U G C(A)- G C C G A(G A A)G(U U)C    61 Parietochloris pseudoalveolaris
 C U G U]- - - - - - G G C A - - - - - - - -(A C A(C U)G A U A(- - - U)A - - - A A U(U)A(A A A)G U U A(    62 Dictyostelium discoideum
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    63 Helix numbering 1
)C G C U G G C G G o]- U U C U - - -[C C G C C G G U G - - - - - - -(A)C G U - U G U G A(G A A)G(U U C)   64 Pteris vittata
 C A C C G)G C G G]- - G U A A - - -[C U G C(C G G C G - - - - - - - A C)G U - U G U G A G(A A)G(U U C)   65 Megaceros aenigmaticus
 C A C C G)G G G G]- - G U C A - - -[C C G C(C G G C G - - - - - - - A C)G U - U G U G A G(A A)G(U U C)   66 Notophylas breutelu
)U G C C G G C G G]- - U U C G - - -[C C G C C G G U G - - - - - - -(A)C G U - U G(G)G A(G A A)G(U U C)   67 Physcomitrella patens
)C G C C(U)G C G G]- - U U C G - - -[C C G C(C)G G C G - - - - - - -(A)C G U - U G(U)G A(G A A)G(U U C)   68 Sphagnum palustre
```

```
                2160                2170                2180                2190                2200
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . . |
 G(A)C(A A)A C U -(U)G G U C A U U U A G(A)G G(A)A C U A]A A A G U C G U - - - A A C A A G G[U U U C      1 Saccharomyces cerevisiae
 G(A)C(A A)A C U -(U)G G U C A U U U A G(A)G G(A)A G U A]A A A G U C G U - - - A A C A A G G[U U U C(     2 Schizosaccharomyces pombe
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     3 Physcomitrella patens
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     4 Anthoceros agrestis
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o      5 Anthoceros laevis
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     6 Pellia epiphylla
 U U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A o o o]o o o o o o o o - - - o o o o o o o[o o o o(     7 Reboulia hemisphaerica 2
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     8 Riccardia pinguis
 U U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     9 Sphaerocarpos donnelli
 C)U U(A A A)C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o(     10 Sphaerocarpus texanus
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     11 Atrichum undulatum
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o(     12 Bryum argenteum
}A U U(A A)A C C - U(U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o(     13 Eurhynchium hians
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      14 Funaria hygrometrica
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     15 Leptobryum pyriforme
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     16 Mnium hornum
}A C(C A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o(     17 Physcomitrium pyriforme
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     18 Polytrichum formosum
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     19 Sphagnum cuspidatum
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     20 Calypogeia arguta
}U U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      21 Conocephalum conicum
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     22 Fossombronia pusilla
}U U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     23 Marchantia polymorpha
}U U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     24 Riccia fluitans
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A(A)G A]G A A G U C G U - - - A A C A A G G[U U U C(     25 Scapania nemorea
}A U U(G A)A C C(- U U)A C C A U U U A G(A)G o(o)o o o o]o o o o o o o o - - - o o o o o o o[o o o o(     26 Equisetum hyemale
}A U U(A A)A C C(- U U)A C C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     27 Equisetum robustum
 A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o      28 Isoetes engelmannii
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o      29 Huperzia lucidula
}A U U(A A)A C C(- U U)A C C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o(     30 Lycopodiella inundata
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     31 Lycopodium phlegmaria
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     32 Lycopodium taxifolium
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G o o o o o o o - - - o o o o o o o[o o o o(     33 Lycopodium tristachyum
}A U U(G A)A C C(- U U)A C U A U C U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     34 Selaginella galleottii
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     35 Selaginella sp.
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      36 Oryza sativa
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      37 Zea mays
 A C U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      38 Arabidopsis thaliana
 A C U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      39 Glycine max
(U)C U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      40 Sinapis alba
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      41 Zamia pumila
 A U U(G A)A C C(- U U)A U C G U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U A C      42 Gnetum leyboldii
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G o o o o - - - o o o o o o o[o o o o      43 Ginkgo biloba
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G o o o o - - - o o o o o o o[o o o o      44 Pinus luchuensis
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U A C      45 Pinus wallichiana
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G o o o o - - - o o o o o o o[o o o o      46 Podocarpus nakaii
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G o o o o - - - o o o o o o o[o o o o      47 Taxus mairei
}A U U(A A)G C C(- U U A)U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G o[o o o o(     48 Adiantum raddianum
}A U U(A A)G C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     49 Adiantum raddianum 2
}o o o(o o)o o o(- o o -)o o o o o o o o(o)o o(o)o o o o]o o o o o o o o - - - o o o o o o o[o o o o      50 Ophioglossum petiolatum
}A U U(A A)G C C(- U U)A U C A U U U A G(A)G o(o)o o o o]o o o o o o o o - - - o o o o o o o[o o o o      51 Osmunda cinnamomea
}A U U(A A)G C C(- U U A)U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      52 Salvinia natans
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     53 Psilotum nudum 2
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     54 Chara foetida
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     55 Coleochaete scutata
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     56 Klebsormidium flaccidum
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     57 Nitella flexilis
 A U U(G A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     58 Nitella sp.
 A U U(A A)A C C(- C U)C(C)C A C C U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      59 Chlamydomonas reinhardtii
 A U U(A A)A C C(- C U)C(C)C A C C U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      60 Hydrodictyon reticulatum
 A U U(A A)A C C(- C U)C(C)C A C C U A G(A G U A)A G(C)A]G A A G U C G U - - - A A C A A G G[U U U C      61 Parietochloris pseudoalveolaris
(U)U U(A A)A U C(- U C)A U U G U U U(A)G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U A U C      62 Dictyostelium discoideum
 - - - - - - - - - - - 49' - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -      63 Helix numbering 1
}A U U(A -)A C C(- U U A)U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A o C A G o o[o o o o      64 Pteris vittata
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C      65 Megaceros aenigmaticus
}A U C(A -)A C C(C U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U C G U A A C A A G G[U U U C      66 Notophylas breutelu
}A U U(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     67 Physcomitrella patens
}A U C(A A)A C C(- U U)A U C A U U U A G(A)G G(A)A G G A]G A A G U C G U - - - A A C A A G G[U U U C(     68 Sphagnum palustre
```

```
                2210                 2220                 2230                 2240                 2250
 . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . . |
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U A - - - - - - - - - - - - - - - - - - - - - -   1 Saccharomyces cerevisiae
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A U U A - - - - - - - - - - - - - - - - - - - - - -   2 Schizosaccharomyces pombe
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -   3 Physcomitrella patens
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -   4 Anthoceros agrestis
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -   5 Anthoceros laevis
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -   6 Pellia epiphylla
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -   7 Reboulia hemisphaerica 2
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C o o o o - - - - - - - - - - - - - - - - - - - - - -   8 Riccardia pinguis
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -   9 Sphaerocarpos donnellii
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  10 Sphaerocarpus texanus
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  11 Atrichum undulatum
(o)o o o o o]o o o o[o o o o o(o)o o o o]o c o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  12 Bryum argenteum
(o)o o o o o]o o o o[o o o o o(o)o o o c]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  13 Eurhynchium hians
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G C A C A C A C A C A A A A A A A A A A C U G  14 Funaria hygrometrica
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A C U G G G C C G - - - - - - - - - - - - - - - - -  15 Leptobryum pyriforme
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  16 Mnium hornum
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  17 Physcomitrium pyriforme
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  18 Polytrichum formosum
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  19 Sphagnum cuspidatum
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  20 Calypogeia arguta
 U G U A G G]U G A A[C C U G C A G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  21 Conocephalum conicum
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  22 Fossombronia pusilla
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  23 Marchantia polymorpha
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  24 Riccia fluitans
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  25 Scapania nemorea
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  26 Equisetum hyemale
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  27 Equisetum robustum
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  28 Isoetes engelmannii
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  29 Huperzia lucidula
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  30 Lycopodiella inundata
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  31 Lycopodium phlegmaria
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  32 Lycopodium taxifolium
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  33 Lycopodium tristachyum
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  34 Selaginella galleottii
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  35 Selaginella sp.
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  36 Oryza sativa
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  37 Zea mays
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  38 Arabidopsis thaliana
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  39 Glycine max
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  40 Sinapis alba
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  41 Zamia pumila
 C G U A G G]U G A A[C C U G C G G U A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  42 Gnetum leyboldii
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  43 Ginkgo biloba
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  44 Pinus luchuensis
 C o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  45 Pinus wallichiana
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  46 Podocarpus nakaii
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  47 Taxus mairei
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  48 Adiantum raddianum
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  49 Adiantum raddianum 2
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  50 Ophioglossum petiolatum
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  51 Osmunda cinnamomea
 C o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  52 Salvinia natans
(C)o o o o o]o o o o[o o o o o(o)o o o c]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  53 Psilotum nudum 2
(o)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  54 Chara foetida
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  55 Coleochaete scutata
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  56 Klebsormidium flaccidum
(C)o o o o o]o o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  57 Nitella flexilis
(C)G U A G G]U G A A[C C U G C(A)G A A G]G A U C A o o o - - - - - - - - - - - - - - - - - - - - - -  58 Nitella sp.
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  59 Chlamydomonas reinhardtii
 C G U A G o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  60 Hydrodictyon reticulatum
 C G U A G G]U G A A[C C U G C G G A A G]G A U C A U U G - - - - - - - - - - - - - - - - - - - - - -  61 Parietochloris pseudoalveolaris
 C G U A G G]U G A A[C C U G C G G A U G]G A U C A U U U U - - - - - - - - - - - - - - - - - - - - -  62 Dictyostelium discoideum
 - -50 - - - - - - - - - - - 50' - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  63 Helix numbering 1
 o o o o o o]o o o o[o o o o o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  64 Pteris vittata
 C G U A G G]U G A o[o C U G o o o o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  65 Megaceros aenigmaticus
 C G U A G G]U G A -[C - - - - - - - - - -]- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  66 Notophylas breutelu
(C)G U A G G]U o o o[o o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  67 Physcomitrella patens
(C)G U A G G]U G A A[C o o o o(o)o o o o]o o o o o o o o o - - - - - - - - - - - - - - - - - - - - - -  68 Sphagnum palustre
```

```
                2260                2270                2280
. . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . .
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   1 Saccharomyces cerevisiae
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   2 Schizosaccharomyces pombe
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   3 Physcomitrella patens
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   4 Anthoceros agrestis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   5 Anthoceros laevis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   6 Pellia epiphylla
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   7 Reboulia hemisphaerica 2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   8 Riccardia pinguis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   9 Sphaerocarpos donnelli
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   10 Sphaerocarpus texanus
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   11 Atrichum undulatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   12 Bryum argenteum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   13 Eurhynchium hians
C A A A C A A C C C C U U U U A U G A A U U U G U G A A U G U A C   14 Funaria hygrometrica
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   15 Leptobryum pyriforme
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   16 Mnium hornum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   17 Physcomitrium pyriforme
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   18 Polytrichum formosum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   19 Sphagnum cuspidatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   20 Calypogeia arguta
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   21 Conocephalum conicum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   22 Fossombronia pusilla
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   23 Marchantia polymorpha
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   24 Riccia fluitans
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   25 Scapania nemorea
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   26 Equisetum hyemale
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   27 Equisetum robustum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   28 Isoetes engelmannii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   29 Huperzia lucidula
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   30 Lycopodiella inundata
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   31 Lycopodium phlegmaria
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   32 Lycopodium taxifolium
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   33 Lycopodium tristachyum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   34 Selaginella galleottii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   35 Selaginella sp.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   36 Oryza sativa
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   37 Zea mays
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   38 Arabidopsis thaliana
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   39 Glycine max
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   40 Sinapis alba
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   41 Zamia pumila
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   42 Gnetum leyboldii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   43 Ginkgo biloba
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   44 Pinus luchuensis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   45 Pinus wallichiana
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   46 Podocarpus nakaii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   47 Taxus mairei
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   48 Adiantum raddianum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   49 Adiantum raddianum 2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   50 Ophioglossum petiolatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   51 Osmunda cinnamomea
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   52 Salvinia natans
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   53 Psilotum nudum 2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   54 Chara foetida
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   55 Coleochaete scutata
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   56 Klebsormidium flaccidum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   57 Nitella flexilis
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   58 Nitella sp.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   59 Chlamydomonas reinhardtii
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   60 Hydrodictyon reticulatum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   61 Parietochloris pseudoalveolaris
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   62 Dictyostelium discoideum
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   63 Helix numbering 1
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   64 Pteris vittata
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   65 Megaceros aenigmaticus
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   66 Notophylas breutelu
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   67 Physcomitrella patens
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   68 Sphagnum palustre
```

APPENDIX H : MacClade Matrix

Variability categories are assigned to each alignment position, or column. The categories were transcribed to this matrix from Table 4 (Page 44).

Taxa with Variability Info	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	-1	1.	0	6.	4.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6	4.	6.	6.	0	6	6	5	0
1 Saccharomyces cerevisiae	.	T	A	T	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
2 Schizosaccharomyces pombe	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
3 Physcomitrella patens 2	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
4 Anthoceros agrestis	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
5 Anthoceros laevis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
6 Pellia epiphylla	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
7 Reboulia hemisphaerica	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
8 Riccardia pinguis	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
9 Sphaerocarpos donnellii	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
10 Sphaerocarpus texanus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
11 Atrichum undulatum	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
12 Bryum argenteum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
13 Eurhynchium hians	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	T
14 Funaria hygrometrica	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
15 Leptobryum pyriforme	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
16 Mnium hornum	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
17 Physcomitrium pyriforme	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
18 Polytrichum formosum	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
19 Sphagnum cuspidatum	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
20 Calypogeia arguta	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
21 Conocephalum conicum	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
22 Fossombronia pusilla	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
23 Marchantia polymorpha	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
24 Riccia fluitans	.	A	A	C	C	T	G	G	T	T	G	A	T	C	G	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
25 Scapania nemorosa	.	A	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
26 Equisetum hyemale	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
27 Equisetum robustum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
28 Isoetes engelmanii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
29 Huperzia lucidulum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
30 Lycopodiella inundatum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
31 Lycopodium phlegmaria	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	T	G	T	C	A	T	A	T
32 Lycopodium taxifolium	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	T	G	T	C	A	T	A	T
33 Lycopodium tristachyum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
34 Selaginella umbrosa	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
35 Selaginella vogelii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
36 Oryza sativa	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
37 Zea mays	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
38 Arabidopsis thaliana	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
39 Glycine max	.	T	A	C	T	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
40 Sinapis alba	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
41 Zamia pumila	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
42 Gnetum leyboldii	?	?	?	?	?	?	?	?	?	?	G	A	C/T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
43 Ginkgo biloba	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
44 Pinus luchuensis	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
45 Pinus wallichiana	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
46 Nageia nagi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
47 Taxus mairei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
48 Adiantum raddianum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
49 Adiantum raddianum 2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
50 Ophioglossum petiolatum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
51 Osmunda cinnamomea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
52 Salvinia natans	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
53 Psilotum nudum	?	?	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
54 Chara foetida	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
55 Coleochaete scutata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
56 Klebsormidium flaccidum	?	?	?	?	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
57 Nitella flexilis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	T	C	A	T	A	T
58 Nitella sp.	?	?	?	?	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
59 Chlamydomonas reinhardtii	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
60 Hydrodictyon reticulatum	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	T	C	A	T	A	T
61 Parietochloris pseudoalveolaris	.	T	A	C	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
62 Dictyostelium discoideum	.	?	A	A	C	T	G	G	T	T	G	A	T	C	C	T	G	C	C	A	G	T	A	G	T	C	A	T	A	T
63 Pteris vittata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
64 Megaceros aenigmaticus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
65 Notothylas breutelii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
66 Physcomitrella patens	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
67 Sphagnum palustre	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

Taxa with Variability Info 2		31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
		6	6.	5.	6.	6.	6.	6.	6.	4.	6.	6.	6.	6.	5.	4.	6.	6.	6.	6.	6.	6.	6	6	6	6.	6	4.	6	6.	1
1	Saccharomyces cerevisiae	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
2	Schizosaccharomyces pombe	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
3	Physcomitrella patens 2	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
4	Anthoceros agrestis	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
5	Anthoceros laevis	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
6	Pellia epiphylla	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
7	Reboulia hemisphaerica	?	?	?	?	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
8	Riccardia pinguis	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
9	Sphaerocarpos donnellii	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
10	Sphaerocarpus texanus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
11	Atrichum undulatum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
12	Bryum argenteum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
13	Eurhynchium hians	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
14	Funaria hygrometrica	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
15	Leptobryum pyriforme	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
16	Mnium hornum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
17	Physcomitrium pyriforme	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
18	Polytrichum formosum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
19	Sphagnum cuspidatum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
20	Calypogeia arguta	?	?	?	?	?	T	C	T	G	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
21	Conocephalum conicum	G	C	T	T	G	T	C	T	A	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
22	Fossombronia pusilla	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
23	Marchantia polymorpha	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
24	Riccia fluitans	G	C	T	T	G	T	C	T	C	A	A	A	G	G	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
25	Scapania nemorea	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
26	Equisetum hyemale	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	C	C	A	T	G	C	A	T	G	T	G
27	Equisetum robustum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
28	Isoetes engelmannii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	?	?	?
29	Huperzia lucidulum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	?	?	?
30	Lycopodiella inundatum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	?	?	?
31	Lycopodium phlegmaria	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
32	Lycopodium taxifolium	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
33	Lycopodium tristachyum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	?	?	?
34	Selaginella umbrosa	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
35	Selaginella vogelii	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
36	Oryza sativa	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
37	Zea mays	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
38	Arabidopsis thaliana	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
39	Glycine max	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
40	Sinapis alba	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
41	Zamia pumila	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
42	Gnetum leyboldii	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
43	Ginkgo biloba	?	?	?	?	?	?	?	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
44	Pinus luchuensis	?	?	?	?	?	?	?	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
45	Pinus wallichiana	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
46	Nageia nagi	?	?	?	?	?	?	?	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
47	Taxus mairei	?	?	?	?	?	?	?	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
48	Adiantum raddianum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	A	G	C	C	A	T	G	C	A	T	?	T	G
49	Adiantum raddianum 2	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
50	Ophioglossum petiolatum	?	?	?	?	?	?	?	?	?	?	?	?	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
51	Osmunda cinnamomea	?	?	C	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
52	Salvinia natans	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
53	Psilotum nudum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
54	Chara foetida	G	C	T	T	G	T	C	T	C	A	A	A	G	A	C	T	A	A	G	C	C	A	T	G	C	A	C	G	T	C
55	Coleochaete scutata	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
56	Klebsormidium flaccidum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
57	Nitella flexilis	G	C	T	T	G	T	C	T	C	A	A	A	G	A	C	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
58	Nitella sp.	G	C	T	T	G	T	C	T	C	A	A	A	G	A	C	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
59	Chlamydomonas reinhardtii	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
60	Hydrodictyon reticulatum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
61	Parietochloris pseudoalveolaris	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
62	Dictyostelium discoideum	G	C	T	T	G	T	C	T	C	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	C
63	Pteris vittata	?	?	?	?	?	?	?	?	?	A	A	A	G	?	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
64	Megaceros aenigmaticus	?	?	?	?	?	?	?	?	?	?	A	A	G	A	T	?	?	A	G	C	C	A	T	G	C	A	T	G	T	G
65	Notothylas breutelii	?	?	?	?	?	?	?	?	?	A	A	A	G	A	T	?	A	A	G	C	C	A	T	G	C	A	T	G	T	G
66	Physcomitrella patens	?	?	?	?	?	?	?	?	?	A	A	A	G	A	T	T	A	A	G	C	C	A	T	G	C	A	T	G	T	G
67	Sphagnum palustre	?	?	?	?	?	?	?	?	?	A	A	A	G	?	?	T	?	A	G	C	C	A	T	G	C	A	T	G	T	G

Taxa with Variability Info	3	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
		4.	5.	5.	6.	6.	4.	6.	3.	6.	2.	6.	0.	0.	0.	3.	1.	1.	3.	4.	3.	1.	2.	0	6	6	3.	0	0	6	6
1	Saccharomyces cerevisiae	T	A	A	G	T	A	T	A	A	G	C	A	.	.	.	.	A	T	T	T	A	T	.	A	C	.	.	A	G	T
2	Schizosaccharomyces pombe	T	A	A	G	T	A	T	A	A	G	C	A	.	.	.	.	A	T	T	T	T	G	T	A	C	.	.	T	G	T
3	Physcomitrella patens 2	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
4	Anthoceros agrestis	T	A	A	G	T	A	T	A	A	A	C	.	.	.	A	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
5	Anthoceros laevis	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	G	T	T	T	T	G	T	.	A	C	T	.	.	G	T
6	Pellia epiphylla	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
7	Reboulia hemisphaerica	T	A	A	G	T	A	T	A	A	A	C	.	.	.	.	T	C	T	T	T	G	T	.	A	C	T	.	.	G	T
8	Riccardia pinguis	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
9	Sphaerocarpos donnellii	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
10	Sphaerocarpus texanus	?	A	A	G	T	A	T	A	A	A	C	A	.	.	.	.	C	T	T	T	G	T	.	A	C	.	.	T	G	T
11	Atrichum undulatum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
12	Bryum argenteum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
13	Eurhynchium hians	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
14	Funaria hygrometrica	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
15	Leptobryum pyriforme	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
16	Mnium hornum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
17	Physcomitrium pyriforme	T	A	A	G	T	A	T	A	A	A	C	.	.	.	.	T	C	T	T	T	G	T	.	A	C	T	.	.	G	T
18	Polytrichum formosum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
19	Sphagnum cuspidatum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	C	.	.	G	T
20	Calypogeia arguta	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
21	Conocephalum conicum	T	A	A	G	T	A	T	A	A	A	C	A	.	.	C	A	T	T	T	T	G	T	.	A	C	.	.	T	G	T
22	Fossombronia pusilla	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
23	Marchantia polymorpha	T	A	A	G	T	A	T	A	A	A	C	A	.	.	.	C	T	T	T	T	G	T	.	A	C	.	.	T	G	T
24	Riccia fluitans	T	A	A	G	T	A	T	A	A	A	C	A	.	.	.	C	T	T	T	T	G	T	.	A	C	.	.	T	G	T
25	Scapania nemorea	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
26	Equisetum hyemale	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	G	T	T	T	G	T	.	A	C	T	.	.	G	T
27	Equisetum robustum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	G	T	T	T	G	T	.	A	C	T	.	.	G	T
28	Isoetes engelmannii	?	?	A	G	T	A	T	A	A	G	C	.	.	T	A	T	C	C	T	T	G	T	.	A	C	T	.	.	G	T
29	Huperzia lucidulum	?	?	?	?	?	?	?	?	A	A	C	.	.	.	T	A	T	C	T	T	G	T	.	A	C	T	.	.	G	T
30	Lycopodiella inundatum	?	?	?	?	?	?	?	G	A	A	C	.	.	.	T	A	T	C	T	T	G	T	.	A	C	T	.	.	G	T
31	Lycopodium phlegmaria	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	A	T	C	T	T	G	T	.	A	C	G	.	.	G	T
32	Lycopodium taxifolium	T	A	T	G	T	A	T	A	A	A	C	.	.	.	T	A	T	C	T	T	G	T	.	A	C	G	.	.	G	T
33	Lycopodium tristachyum	?	?	?	?	?	?	?	?	A	A	C	.	.	.	T	A	T	C	T	T	G	T	.	A	C	T	.	.	G	T
34	Selaginella umbrosa	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	G	C	T	T	T	G	T	.	A	C	T	.	.	G	T
35	Selaginella vogelii	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	G	C	T	T	T	G	T	.	A	C	T	.	.	G	T
36	Oryza sativa	C	A	A	G	T	A	T	G	A	A	C	.	.	.	T	A	A	T	T	C	G	A	.	A	C	T	.	.	G	T
37	Zea mays	C	A	A	G	T	A	T	G	A	A	C	.	.	.	T	A	A	T	T	C	G	A	.	A	C	T	.	.	G	T
38	Arabidopsis thaliana	T	A	A	G	T	A	T	G	A	A	C	G	.	.	.	A	A	T	T	C	A	G	.	A	C	.	.	T	G	T
39	Glycine max	T	A	A	G	T	A	T	G	A	A	C	.	.	.	T	A	A	T	T	C	A	G	.	A	C	T	.	.	G	T
40	Sinapis alba	T	A	A	G	T	A	T	G	A	A	C	G	.	.	.	A	A	T	T	C	A	G	.	A	C	.	.	T	G	T
41	Zamia pumila	T	C	A	G	T	A	T	G	A	A	C	T	.	.	.	A	T	T	T	T	G	G	.	A	C	.	.	G	G	T
42	Gnetum leyboldii	T	A	A	G	T	A	T	G	A	A	C	T	.	.	.	A	G	T	T	C	G	A	.	A	C	.	.	G	G	T
43	Ginkgo biloba	T	A	A	G	T	A	T	G	A	A	C	.	.	.	T	C	T	T	T	C	A	G	.	A	C	T	.	.	G	T
44	Pinus luchuensis	T	A	A	G	T	A	T	G	A	A	C	.	.	.	T	A	A	T	T	C	A	G	.	A	C	T	.	.	G	T
45	Pinus wallichiana	T	A	A	G	T	A	T	G	A	A	C	.	.	.	T	A	A	T	T	C	A	G	.	A	C	T	.	.	G	T
46	Nageia nagi	T	A	A	G	T	A	T	G	A	A	C	.	.	.	T	A	T	T	T	C	G	G	.	A	C	T	.	.	G	T
47	Taxus mairei	T	A	A	G	T	A	T	G	A	A	C	.	.	.	T	A	T	T	T	C	A	G	.	A	C	T	.	.	G	T
48	Adiantum raddianum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	C	T	T	G	T	.	A	C	T	.	.	G	T
49	Adiantum raddianum 2	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
50	Ophioglossum petiolatum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	C	T	T	G	T	.	A	C	T	.	.	G	T
51	Osmunda cinnamomea	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	C	T	T	G	T	.	A	C	T	.	.	G	T
52	Salvinia natans	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	G	T	T	A	T	.	A	C	T	.	.	G	T
53	Psilotum nudum	T	A	A	G	T	A	T	A	A	G	C	A	.	.	.	C	C	.	T	T	G	T	.	A	C	.	.	T	G	T
54	Chara foetida	T	A	A	G	T	G	T	G	A	A	C	A	.	.	.	.	C	T	T	T	G	C	.	A	C	.	.	T	G	T
55	Coleochaete scutata	T	A	A	G	T	A	T	A	A	A	C	T	G	.	.	.	A	T	C	T	A	T	.	A	.	.	C	T	G	T
56	Klebsormidium flaccidum	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	A	T	.	A	C	T	.	.	G	T
57	Nitella flexilis	C	A	A	G	T	G	T	A	A	G	C	T	G	.	.	T	T	T	T	T	A	C	.	A	.	.	C	T	G	T
58	Nitella sp.	?	A	A	G	T	G	T	A	A	G	C	T	G	.	.	T	T	T	T	T	A	C	.	A	.	.	C	T	G	T
59	Chlamydomonas reinhardtii	T	A	A	G	T	A	T	A	A	A	C	T	G	.	.	.	C	.	T	T	A	T	.	A	.	.	C	T	G	T
60	Hydrodictyon reticulatum	T	A	A	G	T	A	T	A	A	A	C	T	G	.	.	.	C	.	T	T	A	T	.	A	.	.	C	T	G	T
61	Parietochloris pseudoalveolaris	T	A	A	G	T	A	T	A	A	A	C	T	G	.	.	.	C	.	T	T	A	T	.	A	.	.	C	T	G	T
62	Dictyostelium discoideum	T	A	A	G	T	A	T	A	A	A	T	T	.	.	.	.	.	C	T	T	G	T	.	A	C	.	.	G	A	T
63	Pteris vittata	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
64	Megaceros aenigmaticus	T	A	A	G	T	A	T	A	A	A	C	.	.	.	A	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
65	Notothylas breutelii	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	A	T	G	T	.	A	C	T	.	.	G	.
66	Physcomitrella patens	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	T	.	.	G	T
67	Sphagnum palustre	T	A	A	G	T	A	T	A	A	A	C	.	.	.	T	C	T	T	T	T	G	T	.	A	C	C	.	.	G	T

Taxa with Variability Info	4	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
		0.	5.		6.	6.	6.	6.	6.	5.	4.	6.	4.	6.	6.	6.	6.	6.	6.	6.	5.	6.	6.	6.	6	6	4.	5.	6	6	6
1	Saccharomyces cerevisiae	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
2	Schizosaccharomyces pombe	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
3	Physcomitrella patens 2	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
4	Anthoceros agrestis	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
5	Anthoceros laevis	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
6	Pellia epiphylla	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
7	Reboulia hemisphaerica	.	G	.	A	A	A	C	T	C	G	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
8	Riccardia pinguis	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
9	Sphaerocarpos donnellii	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
10	Sphaerocarpus texanus	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	C	A	A	G	T
11	Atrichum undulatum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
12	Bryum argenteum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
13	Eurhynchium hians	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
14	Funaria hygrometrica	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
15	Leptobryum pyriforme	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
16	Mnium hornum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
17	Physcomitrium pyriforme	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
18	Polytrichum formosum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
19	Sphagnum cuspidatum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
20	Calypogeia arguta	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
21	Conocephalum conicum	.	A	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
22	Fossombronia pusilla	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
23	Marchantia polymorpha	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
24	Riccia fluitans	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
25	Scapania nemorea	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
26	Equisetum hyemale	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
27	Equisetum robustum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
28	Isoetes engelmannii	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
29	Huperzia lucidulum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
30	Lycopodiella inundatum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
31	Lycopodium phlegmaria	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
32	Lycopodium taxifolium	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
33	Lycopodium tristachyum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
34	Selaginella umbrosa	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
35	Selaginella vogelii	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
36	Oryza sativa	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
37	Zea mays	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
38	Arabidopsis thaliana	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
39	Glycine max	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
40	Sinapis alba	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
41	Zamia pumila	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
42	Gnetum leyboldii	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
43	Ginkgo biloba	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
44	Pinus luchuensis	.	G	.	A	A	A	C	T	G	C	G	G	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
45	Pinus wallichiana	.	G	.	A	A	A	C	T	G	C	G	G	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
46	Nageia nagi	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
47	Taxus mairei	.	G	.	A	A	A	C	T	G	C	G	G	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
48	Adiantum raddianum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
49	Adiantum raddianum 2	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
50	Ophioglossum petiolatum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	G	A	G	T
51	Osmunda cinnamomea	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
52	Salvinia natans	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
53	Psilotum nudum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
54	Chara foetida	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
55	Coleochaete scutata	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
56	Klebsormidium flaccidum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
57	Nitella flexilis	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
58	Nitella sp	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
59	Chlamydomonas reinhardtii	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
60	Hydrodictyon reticulatum	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
61	Parietochloris pseudoalveolaris	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
62	Dictyostelium discoideum	.	G	.	A	A	A	C	T	G	C	A	G	A	C	G	G	C	T	C	A	T	T	A	C	A	A	C	A	G	T
63	Pteris vittata	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
64	Megaceros aenigmaticus	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
65	Notothylas breutelii	A	G	.	A	A	A	C	T	G	A	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
66	Physcomitrella patens	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T
67	Sphagnum palustre	.	G	.	A	A	A	C	T	G	C	G	A	A	T	G	G	C	T	C	A	T	T	A	A	A	T	C	A	G	T

	Taxa with Variability Info 5	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
		4	6.	6.	2.	4.	4.	0.	4.	6.	1.	4.	5.	4.	6.	4.	4.	2.	4.	5.	3.	3.	3.			0.	0	0	2	3	0
1	Saccharomyces cerevisiae	T	A	T	C	G	T	.	T	T	A	T	T	T	G	A	T	A	G	T	T	C	C	.	.	.	.	T	T	T	.
2	Schizosaccharomyces pombe	T	A	T	C	G	T	.	T	T	A	T	T	T	G	A	T	A	G	T	A	C	C	.	.	.	.	T	C	A	.
3	Physcomitrella patens 2	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
4	Anthoceros agrestis	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	A	.
5	Anthoceros laevis	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
6	Pellia epiphylla	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
7	Reboulia hemisphaerica	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
8	Riccardia pinguis	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
9	Sphaerocarpos donnelli	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
10	Sphaerocarpus texanus	T	A	T	A	G	T	.	C	T	.	C	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
11	Atrichum undulatum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
12	Bryum argenteum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
13	Eurhynchium hians	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
14	Funaria hygrometrica	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
15	Leptobryum pyriforme	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
16	Mnium hornum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
17	Physcomitrium pyriforme	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
18	Polytrichum formosum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
19	Sphagnum cuspidatum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
20	Calypogeia arguta	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	C	C	T	.	.	.	.	.	T	T	.
21	Conocephalum conicum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
22	Fossombronia pusilla	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
23	Marchantia polymorpha	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
24	Riccia fluitans	T	A	T	A	G	C	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
25	Scapania nemorea	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	A	.
26	Equisetum hyemale	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
27	Equisetum robustum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
28	Isoetes engelmannii	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	T	C	.	.	T	.	.	.	T	.
29	Huperzia lucidulum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
30	Lycopodiella inundatum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
31	Lycopodium phlegmaria	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
32	Lycopodium taxifolium	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
33	Lycopodium tristachyum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
34	Selaginella umbrosa	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	A	T	A	C	T	.	.	.	.	.	T	T	.
35	Selaginella vogelii	A	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	T	T	A	C	C	.	.	.	.	.	T	T	.
36	Oryza sativa	T	A	T	A	G	T	.	T	T	G	T	T	T	G	A	T	G	G	T	A	C	G	.	.	.	.	.	.	T	.
37	Zea mays	T	A	T	A	G	T	.	T	T	G	T	T	T	G	A	T	G	G	T	A	C	G	.	.	.	.	.	.	T	.
38	Arabidopsis thaliana	T	A	T	A	G	T	.	T	T	G	T	T	T	G	A	T	G	G	T	A	A	C	.	.	.	.	.	.	T	.
39	Glycine max	T	A	T	A	G	T	.	T	T	G	T	T	T	G	A	T	G	G	T	A	T	C	.	.	.	.	.	.	T	.
40	Sinapis alba	T	A	T	A	G	T	.	T	T	G	T	T	T	G	A	T	G	G	T	A	A	C	.	.	.	.	.	.	T	.
41	Zamia pumila	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	T	.	.	.	.	.	C	T	.
42	Gnetum leyboldii	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	A	.	.	.	.	.	T	T	.
43	Ginkgo biloba	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
44	Pinus luchuensis	T	A	T	A	G	T	.	T	T	T	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	A	T	.
45	Pinus wallichiana	T	A	T	A	G	T	.	T	T	T	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	A	T	.
46	Nageia nagi	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
47	Taxus mairei	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	T	T	T	.
48	Adiantum raddianum	T	A	.	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
49	Adiantum raddianum 2	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
50	Ophioglossum petiolatum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
51	Osmunda cinnamomea	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
52	Salvinia natans	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	T	.
53	Psilotum nudum	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
54	Chara foetida	T	A	T	C	A	T	.	T	T	A	T	T	T	G	G	T	G	G	T	C	T	C	.	.	.	.	C	T	T	.
55	Coleochaete scutata	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	.	.	.
56	Klebsormidium flaccidum	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
57	Nitella flexilis	T	A	T	C	G	T	.	T	T	A	T	T	T	G	A	T	G	T	T	C	C	C	.	.	.	.	.	C	C	A
58	Nitella sp	T	A	T	C	G	T	.	T	T	A	T	T	T	G	A	T	G	T	T	C	C	C	.	.	.	.	.	C	C	A
59	Chlamydomonas reinhardtii	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	.	T	.
60	Hydrodictyon reticulatum	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	.	T	.
61	Parietochloris pseudoalveolaris	T	A	T	A	G	T	.	T	T	A	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	.	T	.
62	Dictyostelium discoideum	G	A	T	A	A	A	.	C	T	A	A	T	A	G	A	C	T	T	T	C	G	G	.	.	G	T	T	T	T	.
63	Pteris vittata	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	T	.	.	.	?	.
64	Megaceros aenigmaticus	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
65	Notothylas breutelu	G	A	T	A	G	T	A	.	T	C	T	G	A	G	A	G	G	G	C	A	C	C	.	.	.	.	.	.	T	C
66	Physcomitrella patens	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.
67	Sphagnum palustre	T	A	T	A	G	T	.	T	T	C	T	T	T	G	A	T	G	G	T	A	C	C	.	.	.	.	.	T	T	.

Taxa with Variability Info		151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
	6	1.	5.	4.	6.	6.	0.	3.	2.	5.	6.	0.	6.	6.	6.	4.	6.	6.	6.	0.	6.	2.	6.	0	6	6.	6.	6.	0	6.	6.
1	Saccharomyces cerevisiae	A	C	T	A	C	.	A	T	G	G	T	A	T	A	A	C	C	G	.	T	G	G	.	T	A	A	T	.	T	C
2	Schizosaccharomyces pombe	A	C	T	A	C	.	T	T	G	G	.	A	T	A	A	C	C	G	.	T	G	G	.	T	A	A	T	.	T	C
3	Physcomitrella patens 2	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
4	Anthoceros agrestis	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
5	Anthoceros laevis	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
6	Pellia epiphylla	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
7	Reboulia hemisphaerica	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
8	Riccardia pinguis	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
9	Sphaerocarpos donnelli	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
10	Sphaerocarpus texanus	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	-	G	.	T	A	G	.	T	A	A	T	.	T	C
11	Atrichum undulatum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
12	Bryum argenteum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
13	Eurhynchium hians	G	C	T	A	C	.	T	G	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
14	Funaria hygrometrica	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
15	Leptobryum pyriforme	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
16	Mnium hornum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
17	Physcomitrium pyriforme	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
18	Polytrichum formosum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
19	Sphagnum cuspidatum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
20	Calypogeia arguta	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
21	Conocephalum conicum	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
22	Fossombronia pusilla	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
23	Marchantia polymorpha	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
24	Riccia fluitans	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
25	Scapania nemorosa	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
26	Equisetum hyemale	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
27	Equisetum robustum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
28	Isoetes engelmannii	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	T	T	C
29	Huperzia lucidulum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	C	C	C	G	.	T	A	G	.	T	A	A	T	C	T	C
30	Lycopodiella inundatum	A	C	T	A	C	.	T	T	C	G	G	A	T	A	C	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
31	Lycopodium phlegmaria	G	C	T	A	C	.	T	C	G	G	.	A	T	A	C	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
32	Lycopodium taxifolium	G	C	T	A	C	.	T	C	G	G	.	A	T	A	C	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
33	Lycopodium tristachyum	G	C	T	A	C	.	T	C	G	G	.	A	T	.	A	C	C	G	.	T	A	G	.	T	A	A	T	C	T	C
34	Selaginella umbrosa	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
35	Selaginella vogelii	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
36	Oryza sativa	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
37	Zea mays	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
38	Arabidopsis thaliana	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
39	Glycine max	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
40	Sinapis alba	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
41	Zamia pumila	G	C	T	A	C	.	A	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
42	Gnetum leyboldii	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
43	Ginkgo biloba	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
44	Pinus luchuensis	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
45	Pinus wallichiana	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
46	Nageia nagi	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
47	Taxus mairei	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
48	Adiantum raddianum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
49	Adiantum raddianum 2	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
50	Ophioglossum petiolatum	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
51	Osmunda cinnamomea	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
52	Salvinia natans	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
53	Psilotum nudum	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
54	Chara foetida	A	C	C	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	G	G	.	T	A	A	T	.	T	C
55	Coleochaete scutata	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
56	Klebsormidium flaccidum	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
57	Nitella flexilis	A	T	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
58	Nitella sp.	A	T	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
59	Chlamydomonas reinhardtii	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
60	Hydrodictyon reticulatum	T	C	T	A	C	.	T	C	G	G	.	A	T	A	C	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
61	Parietochloris pseudoalveolaris	A	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
62	Dictyostelium discoideum	A	C	C	T	T	.	T	T	G	G	.	A	T	A	A	C	C	G	.	C	A	G	.	T	A	A	A	.	T	C
63	Pteris vittata	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
64	Megaceros aenigmaticus	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
65	Notothylas breutelii	G	C	T	A	C	G	G	C	G	G	.	A	T	A	A	C	C	G	G	.	A	G	A	T	A	A	T	.	T	C
66	Physcomitrella patens	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C
67	Sphagnum palustre	G	C	T	A	C	.	T	C	G	G	.	A	T	A	A	C	C	G	.	T	A	G	.	T	A	A	T	.	T	C

	Taxa with Variability info 7	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
		8.	8.	8.	4.	8.	8.	9	8.	6.	6.	5.	0.	5.	2.	6.	6.	5.	2.	1.	0.	2.	3.	3.	0	1.	2.	6.	3	8	5.
1	Saccharomyces cerevisiae	T	A	G	A	G	C	T	A	A	T	A	.	C	A	T	G	C	T	T	.	.	A	A	A	A	T	C	T	C	G
2	Schizosaccharomyces pombe	T	A	G	A	G	C	T	A	A	T	A	.	C	A	T	G	C	T	A	.	.	A	A	A	A	T	C	C	C	G
3	Physcomitrella patens 2	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
4	Anthoceros agrestis	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	A	T	C	C	C	G
5	Anthoceros laevis	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	C	T	C	C	C	G
6	Pellia epiphylla	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
7	Reboulia hemisphaerica	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	G	C	C	C	G
8	Riccardia pinguis	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	G	T	C	C	C	G
9	Sphaerocarpos donnelli	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
10	Sphaerocarpus texanus	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	.	A	.	C	C	A	.	A	C	C	C	C	G
11	Atrichum undulatum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
12	Bryum argenteum	T	A	G	A	G	C	T	A	A	T	A	C	A	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
13	Eurhynchium hians	T	A	G	A	G	C	T	A	A	T	C	A	C	G	T	G	G	A	C	.	A	A	A	.	C	T	C	C	C	G
14	Funaria hygrometrica	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
15	Leptobryum pyriforme	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
16	Mnium hornum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
17	Physcomitrium pyriforme	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
18	Polytrichum formosum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
19	Sphagnum cuspidatum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	G	A	.	C	T	C	C	C	G
20	Calypogeia arguta	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
21	Conocephalum conicum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	G	G	C	T	C	G
22	Fossombronia pusilla	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
23	Marchantia polymorpha	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	G	G	C	C	C	G
24	Riccia fluitans	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	G	C	C	C	G
25	Scapania nemorea	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
26	Equisetum hyemale	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
27	Equisetum robustum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	A	G	T	C	C	C	G
28	Isoetes engelmanni	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	?	C	C	C
29	Huperzia lucidulum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	C	C	C	G
30	Lycopodiella inundatum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	C	C	C	G
31	Lycopodium phlegmaria	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	G	A	.	A	T	C	C	C	G
32	Lycopodium taxifolium	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	G	A	.	A	T	C	C	C	G
33	Lycopodium tristachyum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	A	T	A	C	C	C	G
34	Selaginella umbrosa	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	G	T	C	C	C	G
35	Selaginella vogelii	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	G	T	C	C	C	T
36	Oryza sativa	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	A	C	C	C	C	G
37	Zea mays	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	A	C	C	C	C	G
38	Arabidopsis thaliana	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	A	C	C	C	C	G
39	Glycine max	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	A	C	C	C	C	G
40	Sinapis alba	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	A	C	C	C	C	G
41	Zamia pumila	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	C	C	C	G
42	Gnetum leyboldi	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	G	.	C	A	A	.	G	T	C	C	C	G
43	Ginkgo biloba	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	C	C	C	G
44	Pinus luchuensis	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	G	T	C	C	C	G
45	Pinus wallichiana	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	G	T	C	C	C	G
46	Nageia nagi	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	C	C	C	G
47	Taxus mairei	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	A	T	C	C	C	G
48	Adiantum raddianum	T	A	G	A	G	C	T	A	A	.	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
49	Adiantum raddianum 2	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
50	Ophioglossum petiolatum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	G	A	.	C	T	C	C	C	G
51	Osmunda cinnamomea	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
52	Salvinia natans	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	G	A	.	C	G	A	.	C	T	C	C	C	G
53	Psilotum nudum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	C	T	C	C	C	G
54	Chara foetida	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	G	.	C	A	T	.	A	T	C	C	C	G
55	Coleochaete scutata	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	G	A	.	C	T	C	C	C	G
56	Klebsormidium flaccidum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	C	C	C	G
57	Nitella flexilis	T	A	G	C	G	C	T	A	A	T	A	.	C	G	T	G	C	A	G	.	C	A	T	.	A	T	C	C	C	G
58	Nitella sp.	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	G	.	C	A	T	.	A	T	C	C	C	G
59	Chlamydomonas reinhardtii	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	G	C	.	.	A	C	.	A	A	C	C	C	G
60	Hydrodictyon reticulatum	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	G	T	.	.	A	A	.	A	A	C	C	C	G
61	Parietochloris pseudoalveolaris	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	G	C	.	.	A	C	.	A	T	C	C	C	G
62	Dictyostelium discoideum	.	G	G	G	G	C	T	A	A	T	A	.	C	A	T	A	C	A	A	G	C	G	A	.	T	G	G	G	T	G
63	Pteris vittata	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	A	A	.	A	T	C	C	C	G
64	Megaceros aenigmaticus	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	C	A	A	.	C	T	C	C	C	G
65	Notothylas breutelii	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	A	.	A	A	A	.	C	T	C	C	C	G
66	Physcomitrella patens	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	A	A	A	.	C	T	C	C	C	G
67	Sphagnum palustre	T	A	G	A	G	C	T	A	A	T	A	.	C	G	T	G	C	A	C	.	C	G	A	.	C	T	C	C	C	G

Taxa with Variability Info 8	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
	0	8.	8.	3.	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2	1.
1 Saccharomyces cerevisiae	.	A	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T	T
2 Schizosaccharomyces pombe	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	T
3 Physcomitrella patens 2	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
4 Anthoceros agrestis	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
5 Anthoceros laevis	.	G	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
6 Pellia epiphylla	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
7 Reboulia hemisphaerica	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
8 Riccardia pinguis	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
9 Sphaerocarpos donnellii	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
10 Sphaerocarpus texanus	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
11 Atrichum undulatum	.	A	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
12 Bryum argenteum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	C
13 Eurhynchium hians	.	A	C	C	T	T	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
14 Funaria hygrometrica	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
15 Leptobryum pyriforme	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	C
16 Mnium hornum	.	A	C	T	G	G	G	G	C	G	C	C	T	T	C	G	C	G	G	G	T	G	C	C	T	C	G	.	T	G
17 Physcomitrium pyriforme	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
18 Polytrichum formosum	.	A	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
19 Sphagnum cuspidatum	.	A	C	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	G
20 Calypogeia arguta	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
21 Conocephalum conicum	.	A	C	T	G	G	A	C	G	G	T	A	T	T	C	T	G	T	A	T	C	G	.	.	.	.	.	.	T	C
22 Fossombronia pusilla	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
23 Marchantia polymorpha	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
24 Riccia fluitans	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	C
25 Bazzania nemorosa	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
26 Equisetum hyemale	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
27 Equisetum robustum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
28 Isoetes engelmannii	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	C
29 Huperzia lucidulum	G	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	G	T
30 Lycopodiella inundatum	.	A	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
31 Lycopodium phlegmaria	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	G	T
32 Lycopodium taxifolium	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	G	T
33 Lycopodium tristachyum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	G	T
34 Selaginella umbrosa	.	A	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
35 Selaginella vogelii	.	T	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	C
36 Oryza sativa	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
37 Zea mays	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
38 Arabidopsis thaliana	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	A
39 Glycine max	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
40 Sinapis alba	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
41 Zamia pumila	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
42 Gnetum leyboldii	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
43 Ginkgo biloba	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
44 Pinus luchuensis	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
45 Pinus wallichiana	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
46 Nageia nagi	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
47 Taxus mairei	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
48 Adiantum raddianum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
49 Adiantum raddianum 2	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
50 Ophioglossum petiolatum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
51 Osmunda cinnamomea	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
52 Salvinia natans	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
53 Psilotum nudum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
54 Chara foetida	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
55 Coleochaete scutata	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
56 Klebsormidium flaccidum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
57 Nitella flexilis	.	A	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
58 Nitella sp.	.	A	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
59 Chlamydomonas reinhardtii	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
60 Hydrodictyon reticulatum	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
61 Parietochloris pseudoalveolaris	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
62 Dictyostelium discoideum	.	A	C	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	G	C
63 Pteris vittata	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
64 Megaceros aenigmaticus	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C
65 Notothylas breutelii	.	A	C	T	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	.
66 Physcomitrella patens	.	A	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T
67 Sphagnum palustre	.	A	C	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	G

#	Taxa with Variability Info	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
		2.	0.	0.	0.	-1	-1	-1	-1	5.	6.	4.	6.	6.	3.	6.	3.	1.	6.	2.	6.	5.	4.	6.	4.	4.	5.	4.	6.	6	4
1	Saccharomyces cerevisiae	T	.	.	.	.	.	.	.	G	G	A	A	G	A	G	A	T	G	T	A	T	T	T	A	T	T	A	G	A	T
2	Schizosaccharomyces pombe	T	T	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	T	A	T	T	T	A	T	T	A	G	A	T
3	Physcomitrella patens 2	T	T	T	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
4	Anthoceros agrestis	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
5	Anthoceros laevis	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	T	C	G	T	A	T	T	T	A	T	T	A	G	A	T
6	Pellia epiphylla	.	T	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
7	Reboulia hemisphaerica	C	G	C	T	.	.	.	.	G	G	A	A	G	G	G	C	T	G	T	A	T	T	T	A	T	T	A	G	A	T
8	Riccardia pinguis	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	T	A	T	T	T	A	T	T	A	G	A	T
9	Sphaerocarpos donnellii	T	T	G	T	.	.	.	.	G	G	A	A	G	G	G	A	T	G	T	A	T	T	T	A	T	T	A	G	A	T
10	Sphaerocarpus texanus	T	T	T	G	T	.	.	.	G	G	A	A	G	G	G	A	T	G	T	A	T	T	T	A	T	T	A	G	A	T
11	Atrichum undulatum	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
12	Bryum argenteum	G	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
13	Eurhynchium hians	.	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
14	Funaria hygrometrica	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
15	Leptobryum pyriforme	T	C	C	C	G	G	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
16	Mnium hornum	A	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	G	G	A	T
17	Physcomitrium pyriforme	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
18	Polytrichum formosum	C	T	T	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
19	Sphagnum cuspidatum	C	A	A	.	.	.	.	G	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
20	Calypogeia arguta	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	G	T	T	A	G	A	G
21	Conocephalum conicum	C	.	.	.	.	.	.	.	G	G	A	A	G	G	G	C	T	G	T	A	T	T	T	A	T	T	A	G	A	T
22	Fossombronia pusilla	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
23	Marchantia polymorpha	A	C	.	.	.	.	.	.	G	G	A	A	G	G	G	C	T	G	T	A	T	T	T	A	T	T	A	G	A	T
24	Riccia fluitans	G	C	.	.	.	.	.	.	G	G	A	A	G	G	G	C	T	G	T	A	T	T	T	A	T	T	A	G	A	T
25	Scapania nemorea	.	T	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
26	Equisetum hyemale	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
27	Equisetum robustum	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
28	Isoetes engelmannii	C	A	T	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	T	T	T	A	T	C	A	G	A	T
29	Huperzia lucidulum	A	A	A	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
30	Lycopodiella inundatum	C	G	C	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
31	Lycopodium phlegmaria	A	A	C	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
32	Lycopodium taxifolium	A	A	A	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
33	Lycopodium tristachyum	A	A	A	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	C
34	Selaginella umbrosa	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	C	T	T	A	C	T	A	G	A	T
35	Selaginella vogelii	C	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	C	T	T	A	C	T	A	G	A	T
36	Oryza sativa	C	.	.	.	.	.	.	.	G	G	G	A	G	G	G	G	C	G	C	A	T	T	T	A	T	T	A	G	A	T
37	Zea mays	C	.	.	.	.	.	.	.	G	G	G	A	G	G	G	G	C	G	C	A	T	T	T	A	T	T	A	G	A	T
38	Arabidopsis thaliana	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
39	Glycine max	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	T	T	T	A	T	T	A	G	A	T
40	Sinapis alba	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	T	T	T	A	T	T	A	G	A	T
41	Zamia pumila	T	.	.	.	.	.	.	.	T	G	A	A	G	G	G	A	C	G	C	A	T	C	T	A	T	T	A	G	A	T
42	Gnetum leyboldii	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	T	T	T	A	T	T	A	G	A	T
43	Ginkgo biloba	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
44	Pinus luchuensis	T	T	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	T	T	T	T	T	T	A	G	A	T
45	Pinus wallichiana	T	T	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	T	T	T	T	T	T	A	G	A	T
46	Nageia nagi	C	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	C	A	T	T	T	A	T	T	A	G	A	T
47	Taxus mairei	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
48	Adiantum raddianum	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
49	Adiantum raddianum 2	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
50	Ophioglossum petiolatum	C	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
51	Osmunda cinnamomea	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
52	Salvinia natans	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
53	Psilotum nudum	C	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
54	Chara foetida	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	T	A	T	T	T	A	T	T	G	G	A	T
55	Coleochaete scutata	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
56	Klebsormidium flaccidum	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
57	Nitella flexilis	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	T	G	T	A	T	T	T	A	T	T	A	G	A	T
58	Nitella sp	T	.	.	.	.	.	.	.	G	G	A	A	G	C/G	G	A	T	G	T	A	T	T	T	A	T	T	A	G	A	T
59	Chlamydomonas reinhardtii	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	T	C	G	T	A	T	T	T	A	T	T	A	G	A	T
60	Hydrodictyon reticulatum	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	T	C	G	T	A	T	A	T	A	T	T	A	G	A	T
61	Parietochloris pseudoalveolaris	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
62	Dictyostelium discoideum	A	A	.	.	.	.	.	C	G	G	A	A	G	C	T	C	A	G	C	G	.	A	T	T	A	T	T	A	G	C
63	Pteris vittata	T	.	.	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	C	A	T	T	T	A	T	T	A	G	A	T
64	Megaceros aenigmaticus	T	.	.	.	.	.	.	G	G	G	A	?	G	G	G	G	C	G	T	A	T	T	T	A	T	T	A	G	A	T
65	Notothylas breutelii	T	G	G	G	.	.	G	G	G	G	A	A	G	G	G	T	T	.	T	.	T	T	T	.	T	T	A	G	A	T
66	Physcomitrella patens	T	T	T	.	.	.	.	.	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T
67	Sphagnum palustre	C	A	A	.	.	.	G	G	G	G	A	A	G	G	G	A	C	G	T	A	T	T	T	A	T	T	A	G	A	T

Taxa with Variability Info	10	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
		4.	4.	6		6.	2.	2.	3.	4.	0.	0.	2.	3.	2.	2.	2.	2.	3.	2.	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2
1	Saccharomyces cerevisiae	A	A	A	.	A	A	A	T	C	.	.	A	A	T	G	T	C	.	.	.	.	.	T	T	C	G	.	.	.	.
2	Schizosaccharomyces pombe	A	A	A	.	A	A	A	C	C	.	.	A	A	T	G	C	C	.	.	.	.	.	T	T	C	G	.	.	.	.
3	Physcomitrella patens 2	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
4	Anthoceros agrestis	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	A	G	G	C	.	.	T	C	T	.	.	.	G	C
5	Anthoceros laevis	A	A	A	.	A	G	A	C	G	.	.	A	A	G	A	C	G	G	G	.	.	C	T	T	G	T	.	.	.	C
6	Pellia epiphylla	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	.	G	G	G	.	.	C	T	T	G	.	.	C	.
7	Reboulia hemisphaerica	A	A	A	.	A	G	A	C	C	.	.	G	A	G	T	C	G	G	G	.	.	C	T	T	G	.	.	.	C	C
8	Riccardia pinguis	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
9	Sphaerocarpos donnellii	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
10	Sphaerocarpus texanus	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
11	Atrichum undulatum	A	A	A	.	A	G	A	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
12	Bryum argenteum	A	A	A	.	A	G	A	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
13	Eurhynchium hians	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
14	Funaria hygrometrica	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
15	Leptobryum pyriforme	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
16	Mnium hornum	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
17	Physcomitrium pyriforme	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
18	Polytrichum formosum	A	A	A	.	A	G	A	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
19	Sphagnum cuspidatum	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	C	G	.	.	.	C
20	Calypogeia arguta	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	.	.	.	G	C
21	Conocephalum conicum	A	A	A	.	A	G	A	C	C	.	.	G	A	T	G	C	G	G	G	G	.	.	C	T	T	G	.	.	C	T
22	Fossombronia pusilla	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
23	Marchantia polymorpha	A	A	A	.	A	G	A	C	C	.	.	G	A	T	G	C	G	G	G	G	.	.	C	T	T	G	.	.	C	T
24	Riccia fluitans	A	A	A	.	A	G	A	C	C	.	.	G	A	T	G	C	G	G	G	.	.	G	C	T	T	G	.	.	.	C
25	Scaparia nemorea	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
26	Equisetum hyemale	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	C	T	.	T	G	.	.	.	.	C
27	Equisetum robustum	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	C	T	.	T	G	.	.	.	.	C
28	Isoetes engelmannii	T	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	A	T	G	C	.	.	.	T	T	.	.	.	G	C
29	Huperzia lucidulum	G	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	T	G	C	.	.	.	T	T	.	.	.	G	C
30	Lycopodiella inundatum	A	A	A	.	.	G	A	C	C	.	.	G	A	T	G	C	G	T	G	C	.	.	.	T	T	.	.	.	G	C
31	Lycopodium phlegmaria	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
32	Lycopodium taxifolium	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
33	Lycopodium bristachyum	T	A	A	.	A	G	G	C	C	.	.	A	A	T	G	C	G	T	G	C	.	.	.	T	T	.	.	.	G	C
34	Selaginella umbrosa	T	C	A	.	A	G	G	C	C	.	.	G	A	C	A	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
35	Selaginella vogelii	T	C	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	C	.	.	.	G	C
36	Oryza sativa	A	A	A	.	A	G	G	C	T	.	.	G	A	C	G	C	G	G	G	C	.	.	T	C	C	.	.	.	G	C
37	Zea mays	A	A	A	.	A	G	G	C	T	.	.	G	A	C	G	C	G	G	G	C	.	.	T	C	T	.	.	.	G	C
38	Arabidopsis thaliana	A	A	A	.	A	G	G	T	C	.	.	G	A	C	G	C	G	G	G	C	.	.	T	C	T	G	.	.	G	C
39	Glycine max	A	A	A	.	A	G	G	T	C	.	.	A	A	C	A	C	A	G	G	C	.	.	T	C	T	.	.	.	G	C
40	Sinapis alba	A	A	A	.	A	G	G	T	C	.	.	G	A	C	G	C	G	G	G	.	.	.	C	T	C	.	.	.	.	T
41	Zamia pumila	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	T	T	T	.	.	.	G	C
42	Gnetum leyboldii	A	A	A	.	A	G	G	C	C	.	.	G	A	C/T	G	A	G	G	C	.	.	.	.	T	T	.	.	.	G	C
43	Ginkgo biloba	A	A	A	.	A	G	G	C	C	.	.	G	A	C	G	C	G	G	G	.	.	.	C	T	C	G	.	.	.	C
44	Pinus luchuensis	A	A	A	.	A	G	G	C	C	.	.	G	G	C	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
45	Pinus wallichiana	A	A	A	.	A	G	G	C	C	.	.	G	G	C	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
46	Nageia nagi	T	A	A	.	A	G	G	C	C	.	.	G	G	C	G	C	G	G	G	T	.	.	.	T	C	.	.	.	G	C
47	Taxus mairei	A	A	A	.	A	G	G	C	C	.	.	G	G	C	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
48	Adiantum raddianum	A	A	A	.	A	G	G	C	.	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
49	Adiantum raddianum 2	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
50	Ophioglossum petiolatum	A	A	A	.	A	G	A	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
51	Osmunda cinnamomea	A	A	A	.	A	G	G	C	C	.	.	G	A	T	A	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
52	Salvinia natans	A	A	A	.	A	G	G	C	C	.	.	G	A	T	C	C	G	A	G	.	.	.	C	T	T	G	.	.	.	C
53	Psilotum nudum	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	C	.	.	.	T	T	.	.	.	G	C
54	Chara foetida	A	A	A	.	A	G	G	C	C	.	G	A	T	C	C	G	G	G	.	.	.	.	C	T	T	.	.	.	.	G
55	Coleochaete scutata	A	A	A	.	A	G	A	C	C	.	A	A	T	G	C	G	G	G	.	.	.	.	C	T	C	.	.	.	.	G
56	Klebsormidium flaccidum	A	A	A	.	A	G	G	C	C	.	A	A	T	G	C	G	G	G	.	.	.	.	C	T	T	.	.	.	.	.
57	Nitella flexilis	A	A	A	.	A	G	G	C	C	.	A	A	C	T	C	G	A	G	.	.	.	.	C	T	T	.	.	.	.	G
58	Nitella sp.	A	A	A	.	A	G	G	C	C	.	A	A	C	T	C	G	A	G	.	.	.	.	C	T	T	.	.	.	.	G
59	Chlamydomonas reinhardtii	A	A	A	.	A	G	G	C	C	.	.	A	G	C	C	G	G	G	C	.	.	.	T	C	T	.	.	.	.	G
60	Hydrodictyon reticulatum	A	A	A	.	A	G	G	C	C	.	.	G	A	C	C	G	G	A	C	.	.	.	T	T	T	.	.	.	.	G
61	Parietochloris pseudoalveolaris	T	A	A	.	A	G	G	C	C	.	.	G	A	C	C	G	G	G	C	.	.	.	T	C	T	.	.	.	.	G
62	Dictyostelium discoideum	A	T	T	.	C	T	A	C	C	.	.	A	A	T	G	C	C	.	.	.	.	.	T	T	C	G	.	.	.	.
63	Pteris vittata	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	C	G	.	.	.	C
64	Megaceros aenigmaticus	A	T	A	.	A	G	G	C	C	.	.	G	A	T	A	T	G	G	G	.	.	T	C	T	T	G	A	T	.	C
65	Notophylas breutelu	A	.	A	.	A	G	A	G	G	A	C	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	A	.	.	C
66	Physcomitrella patens	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	T	G	.	.	.	C
67	Sphagnum palustre	A	A	A	.	A	G	G	C	C	.	.	G	A	T	G	C	G	G	G	.	.	.	C	T	C	G	.	.	.	C

	Taxa with Variability Info 11	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
		3.	2.	2.	2.	2.	2	1.	0.	0.	1.	3.	1.	2.	0.	0.	6.	0.	3.	4.	0.	5.	6	0.	1.	6.	6	6	6	2	0
1	Saccharomyces cerevisiae	.	G	A	C	.	.	T	.	.	C	T	T	T	.	.	G	.	A	T	.	G	A	.	T	T	C	A	T	A	.
2	Schizosaccharomyces pombe	.	G	G	C	.	.	T	T	T	T	T	T	T	.	.	G	.	G	T	.	G	A	.	G	T	C	A	T	A	.
3	Physcomitrella patens 2	C	C	G	G	.	T	G	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
4	Anthoceros agrestis	C	T	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
5	Anthoceros laevis	C	C	G	G	.	T	A	.	.	T	T	A	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
6	Pellia epiphylla	C	C	G	G	.	.	T	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	C	T	C	A	T	G	.
7	Reboulia hemisphaerica	C	C	G	G	.	.	T	.	.	G	A	T	T	C	.	G	.	G	T	.	.	A	.	A	T	C	A	T	G	.
8	Riccardia pinguis	C	C	G	G	.	.	T	.	.	G	T	T	G	C	.	G	.	G	T	.	G	A	.	C	T	C	A	T	G	.
9	Sphaerocarpos donnellii	C	C	G	G	.	.	T	.	.	G	T	T	T	C	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
10	Sphaerocarpus texanus	C	C	G	T	.	.	G	.	.	.	T	T	T	C	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
11	Atrichum undulatum	C	C	G	G	.	.	T	.	.	A	T	T	G	C	.	G	.	G	T	.	G	A	.	C	T	C	A	T	G	.
12	Bryum argenteum	C	C	G	G	.	.	T	.	.	G	T	T	G	C	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
13	Eurhynchium hians	C	C	G	G	.	.	T	.	.	G	T	T	G	C	.	G	.	G	T	.	T	A	.	A	T	C	A	T	G	.
14	Funaria hygrometrica	C	C	G	G	.	T	G	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
15	Leptobryum pyriforme	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
16	Mnium hornum	C	C	G	G	.	T	T	.	.	T	C	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
17	Physcomitrium pyriforme	C	C	G	G	.	.	T	.	.	G	T	T	G	C	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
18	Polytrichum formosum	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	C	T	C	A	T	G	.
19	Sphagnum cuspidatum	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
20	Calypogeia arguta	C	C	G	G	.	.	T	.	.	A	A	C	G	C	.	G	.	G	T	.	G	A	.	A	T	C	A	T	A	.
21	Conocephalum conicum	C	C	G	G	.	T	G	.	.	A	T	T	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
22	Fossombronia pusilla	C	C	G	G	.	T	G	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
23	Marchantia polymorpha	C	C	G	G	.	T	G	.	.	T	T	T	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
24	Riccia fluitans	C	C	G	G	.	T	G	.	.	A	T	T	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
25	Scapania nemorosa	C	C	G	G	.	T	G	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
26	Equisetum hyemale	C	C	G	G	.	T	A	.	.	A	C	G	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
27	Equisetum robustum	C	C	G	G	.	T	A	.	.	A	C	G	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
28	Isoetes engelmannii	C	T	G	G	.	T	C	.	.	A	C	G	C	.	.	G	.	G	T	T	G	A	.	C	T	C	A	T	G	.
29	Huperzia lucidulum	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	?	G	A	.	A	T	C	A	T	G	.
30	Lycopodiella inundatum	C	C	G	G	.	T	.	.	.	A	T	G	C	.	.	G	.	G	T	T	G	A	.	A	T	C	A	T	G	.
31	Lycopodium phlegmaria	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
32	Lycopodium lucidulum	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
33	Lycopodium tristachyum	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	T	G	A	.	A	T	C	A	T	G	.
34	Selaginella umbrosa	C	C	G	T	.	T	C	.	.	T	A	T	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
35	Selaginella vogelii	C	C	G	T	.	A	C	.	.	T	C	T	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
36	Oryza sativa	C	C	G	C	.	T	G	.	.	A	T	C	C	.	.	G	.	A	T	.	G	A	.	T	T	C	A	T	G	.
37	Zea mays	C	C	G	C	.	C	G	.	.	A	T	C	C	.	.	G	.	A	T	.	G	A	.	T	T	C	A	T	G	.
38	Arabidopsis thaliana	T	T	G	C	.	.	.	.	.	.	T	C	T	.	.	G	.	A	T	.	G	A	.	T	T	C	A	T	G	.
39	Glycine max	C	T	G	T	.	T	G	.	.	C	T	T	T	.	.	G	.	A	T	.	G	A	.	T	T	C	A	T	G	.
40	Sinapis alba	G	T	G	C	.	T	G	.	.	C	T	C	T	.	.	G	.	A	T	.	G	A	.	T	T	C	A	T	G	.
41	Zamia pumila	C	C	G	G	.	T	C	.	.	G	T	T	T	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
42	Gnetum leyboldii	T	C	G	.	.	T	T	.	.	G	T	T	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
43	Ginkgo biloba	C	C	G	C	.	T	G	.	.	C	T	T	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
44	Pinus luchuensis	C	C	G	C	.	T	T	.	.	C	T	C	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
45	Pinus wallichiana	C	C	G	C	.	T	T	.	.	C	T	C	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
46	Nageia nagi	C	C	G	T	.	T	T	.	.	C	T	C	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
47	Taxus mairei	C	C	G	C	.	T	A	.	.	C	T	C	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
48	Adiantum raddianum	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
49	Adiantum raddianum 2	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
50	Ophioglossum petiolatum	C	C	G	G	.	T	G	.	.	A	T	G	C	.	.	G	.	G	T	.	G	A	.	C	T	C	A	T	G	.
51	Osmunda cinnamomea	C	C	G	G	.	T	A	.	.	A	C	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
52	Salvinia natans	T	C	G	G	.	T	T	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
53	Psilotum nudum	C	C	G	G	.	T	T	.	.	A	T	G	C	.	.	G	.	G	T	.	G	A	.	T	T	C	A	T	G	.
54	Chara foetida	C	C	C	G	T	T	G	.	.	T	T	G	C	.	.	G	.	G	C	.	G	A	.	A	T	C	A	T	G	.
55	Coleochaete scutata	C	C	C	G	G	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
56	Klebsormidium flaccidum	G	C	C	G	G	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
57	Nitella flexilis	C	T	C	G	G	C	G	.	.	T	T	G	T	.	.	G	.	G	C	.	G	A	.	A	T	C	A	T	A	.
58	Nitella sp.	C	T	C	G	G	C	G	.	.	T	T	G	T	.	.	G	.	G	C	.	G	A	.	A	T	C	A	T	A	.
59	Chlamydomonas reinhardtii	C	C	C	G	A	C	.	.	.	C	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
60	Hydrodictyon reticulatum	T	C	C	G	A	C	.	.	.	C	C	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
61	Parietochloris pseudoalveolaris	C	C	C	G	A	C	.	.	.	T	C	G	C	.	.	G	.	G	T	.	G	A	.	C	T	C	A	T	G	.
62	Dictyostelium discoideum	.	.	G	G	T	.	.	.	.	.	T	T	T	.	.	G	G	G	T	.	G	A	T	A	C	C	G	A	A	.
63	Pteris vittata	C	C	G	G	.	T	A	.	.	A	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
64	Megaceros aenigmaticus	C	C	G	G	.	T	A	.	.	T	T	A	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
65	Notothylas breutelii	C	C	G	G	.	T	A	.	.	T	T	.	C	A	C	G	.	G	T	.	G	A	.	A	T	C	A	T	G	G
66	Physcomitrella patens	C	C	G	G	.	T	G	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.
67	Sphagnum palustre	C	C	G	G	.	T	A	.	.	T	T	G	C	.	.	G	.	G	T	.	G	A	.	A	T	C	A	T	G	.

	Taxa with Variability Info 12	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
		3	4.	4.	4.	4.	6.	1.	1.	1.	0.						4.	6.	3.	6.	5.	4.	4.	3	5.	0.	0.	1	4	4	4
1	Saccharomyces cerevisiae	A	T	A	A	C	T	T	T	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	G	G	C
2	Schizosaccharomyces pombe	A	T	A	A	C	T	T	T	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	G	G	C
3	Physcomitrella patens 2	A	T	A	A	C	T	T	T	G	T	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
4	Anthoceros agrestis	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
5	Anthoceros laevis	A	T	A	A	C	T	C	C	T	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	G	G	C
6	Pellia epiphylla	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
7	Reboulia hemisphaerica	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	?	A	T	C	G	C	A	.	.	C	G	G	C
8	Riccardia pinguis	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
9	Sphaerocarpos donnellii	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
10	Sphaerocarpus texanus	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
11	Atrichum undulatum	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
12	Bryum argenteum	A	T	A	A	A	T	T	T	G	T	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
13	Eurhynchium hians	A	A	A	A	C	T	T	G	T	.	.	.	.	.	.	C	G	A	A	T	C	C	C	A	.	.	C	G	G	C
14	Funaria hygrometrica	A	T	A	A	C	T	T	T	G	T	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
15	Leptobryum pyriforme	A	T	A	A	C	T	T	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
16	Mnium hornum	A	T	A	A	C	T	T	T	G	T	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
17	Physcomitrium pyriforme	A	T	A	A	C	T	T	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
18	Polytrichum formosum	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
19	Sphagnum cuspidatum	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
20	Calypogeia arguta	G	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
21	Conocephalum conicum	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	G	G	G	C
22	Fossombronia pusilla	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
23	Marchantia polymorpha	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
24	Riccia fluitans	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
25	Scapania nemorosa	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
26	Equisetum hyemale	A	T	A	A	C	T	T	C	C	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
27	Equisetum robustum	A	T	A	A	C	T	T	C	C	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
28	Isoetes engelmannii	A	T	A	A	C	T	A	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
29	Huperzia lucidulum	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
30	Lycopodiella inundatum	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	G	G	G	C
31	Lycopodium phlegmaria	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	G	G	G	C
32	Lycopodium taxifolium	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
33	Lycopodium tristachyum	A	T	A	A	C	T	T	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	A	G	T
34	Selaginella umbrosa	G	T	A	A	C	T	T	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
35	Selaginella vogelii	G	T	A	A	C	T	T	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
36	Oryza sativa	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	G	G	C
37	Zea mays	A	T	A	A	C	T	T	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	T	G	G	C
38	Arabidopsis thaliana	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	G	G	C
39	Glycine max	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	T	G	G	C
40	Sinapis alba	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	T	G	G	A	T	T	G	C	A	.	.	T	G	G	C
41	Zamia pumila	A	T	A	C	C	T	T	G	A	.	.	.	.	.	.	T	G	G	A	T	G	C	G	A	.	.	C	G	G	C
42	Gnetum leyboldii	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	G	G	C
43	Ginkgo biloba	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	A	G	C
44	Pinus luchuensis	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	A	G	C
45	Pinus wallichiana	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	G	G	C
46	Nageia nagi	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	G	A	T	C	G	C	A	.	.	C	G	G	C
47	Taxus mairei	A	T	A	A	C	T	C	G	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	.	G	C
48	Adiantum raddianum	A	T	A	A	C	T	T	T	C	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
49	Adiantum raddianum 2	A	T	A	A	C	T	T	T	C	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
50	Ophioglossum petiolatum	A	T	A	A	C	T	G	T	G	.	.	.	.	.	.	C	G	G	A	A	C	G	C	A	.	.	C	G	G	C
51	Osmunda cinnamomea	A	T	A	A	C	T	T	C	C	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
52	Salvinia natans	A	T	A	A	C	T	T	C	C	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
53	Psilotum nudum	A	T	A	A	C	T	C	T	G	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	G	G	C
54	Chara foetida	G	T	G	A	C	T	T	T	G	T	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
55	Coleochaete scutata	A	T	A	A	C	T	C	C	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
56	Klebsormidium flaccidum	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	G	G	C
57	Nitella flexilis	G	T	G	A	C	T	T	T	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	G	G	C
58	Nitella sp.	G	T	G	A	C	T	T	T	T	.	.	.	.	.	.	C	G	A	A	T	C	G	T	A	.	.	T	G	G	G
59	Chlamydomonas reinhardtii	A	T	A	A	C	T	T	C	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	G	G	C
60	Hydrodictyon reticulatum	A	T	A	T	C	T	T	C	A	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	T	G	C	C
61	Parietochloris pseudoalveolaris	A	T	A	A	C	T	T	C	A	.	.	.	.	.	.	C	G	A	A	T	C	G	A	.	.	.	G	G	A	.
62	Dictyostelium discoideum	T	A	A	T	A	T	T	G	.	.	.	.	.	.	.	C	A	G	A	T	C	G	C	A	.	.	C	G	G	C
63	Pteris vittata	A	T	A	A	C	T	T	C	C	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
64	Megaceros aenigmaticus	A	T	A	A	C	T	C	C	T	.	.	.	.	.	.	C	G	A	A	T	G	C	T	C	A	A	C	G	G	C
65	Notothylas breutelii	A	T	A	A	C	T	C	C	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
66	Physcomitrella patens	A	T	A	A	C	T	T	T	G	T	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C
67	Sphagnum palustre	A	T	A	A	C	T	C	G	T	.	.	.	.	.	.	C	G	A	A	T	C	G	C	A	.	.	C	G	G	C

Taxa with Variability Info	13	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390
		0	4	1	2.	1.	4.	1.	0.	4.	6.	2.	6.	4.	6.	5.	6.	3.	5.	0.	1.	3.	4	5	6.	4.	6.	4.	0	6	6
1	Saccharomyces cerevisiae	.	.	C	T	T	G	T	.	G	C	T	G	G	C	G	A	T	G	.	G	T	T	C	A	T	T	C	.	A	A
2	Schizosaccharomyces pombe	.	.	C	T	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	G	T	T	C	A	T	T	C	.	A	A
3	Physcomitrella patens 2	.	C	T	T	G	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
4	Anthoceros agrestis	.	C	C	T	G	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
5	Anthoceros laevis	.	C	C	C	T	G	C	.	G	C	C	G	G	C	C	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
6	Pellia epiphylla	.	C	T	T	G	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
7	Reboulia hemisphaerica	.	C	T	T	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
8	Riccardia pinguis	.	C	C	C	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
9	Sphaerocarpos donnellii	C	T	A	T	T	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
10	Sphaerocarpus texanus	.	C	T	T	T	T	C	.	G	C	T	G	G	C	G	A	T	G	.	.	T	T	T	A	T	T	C	.	A	A
11	Atrichum undulatum	.	C	T	T	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
12	Bryum argenteum	.	C	T	T	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	G	T	T	C	A	A	T	C	.	A	A
13	Eurhynchium hians	.	C	C	C	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
14	Funaria hygrometrica	.	C	T	T	G	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
15	Leptobryum pyriforme	.	C	C	C	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
16	Mnium hornum	.	C	T	T	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
17	Physcomitrium pyriforme	.	C	T	T	G	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
18	Polytrichum formosum	.	C	T	C	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
19	Sphagnum cuspidatum	.	C	C	T	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
20	Calypogeia arguta	.	.	C	C	C	A	G	C	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
21	Conocephalum conicum	C	T	T	T	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
22	Fossombronia pusilla	.	C	C	T	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
23	Marchantia polymorpha	.	C	T	T	A	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
24	Riccia fluitans	.	C	T	C	C	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
25	Scapania nemorea	.	C	T	T	T	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
26	Equisetum hyemale	.	C	T	T	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
27	Equisetum robustum	.	C	T	T	G	.	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
28	Isoetes engelmannii	.	C	T	T	A	G	?	.	G	C	C	G	G	C	G	A	T	A	.	C	T	T	C	A	T	T	C	.	A	A
29	Huperzia lucidulum	.	C	T	T	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	?	T	T	C	A	A
30	Lycopodiella inundatum	.	C	T	C	A	G	C	.	G	C	C	G	G	C	G	A	T	G	.	?	T	T	C	A	C	T	T	C	A	A
31	Lycopodium phlegmaria	.	C	C	T	C	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
32	Lycopodium taxifolium	.	C	C	T	C	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
33	Lycopodium tristachyum	.	C	T	C	A	G	T	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	C	T	T	C	A	A
34	Selaginella umbrosa	.	C	T	C	T	G	T	.	G	C	T	G	G	C	G	A	T	G	.	C	T	T	C	A	A	T	C	.	A	A
35	Selaginella vogelii	.	.	C	C	A	G	A	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	A	T	C	.	A	A
36	Oryza sativa	.	C	C	T	C	G	T	.	G	C	C	G	G	C	G	A	C	G	.	C	A	T	C	A	T	T	C	.	A	A
37	Zea mays	.	C	T	T	C	G	T	.	G	C	C	G	G	C	G	A	C	G	.	C	A	T	C	A	T	T	C	.	A	A
38	Arabidopsis thaliana	.	C	T	C	T	G	T	.	G	C	T	G	G	C	G	A	C	G	.	C	A	T	C	A	T	T	C	.	A	A
39	Glycine max	.	C	T	T	T	G	T	.	G	C	C	G	G	C	G	A	C	G	.	C	A	T	C	A	T	T	C	.	A	A
40	Sinapis alba	.	C	T	T	T	G	T	.	G	C	T	G	G	C	G	A	C	G	.	C	A	T	C	A	T	T	C	.	A	A
41	Zamia pumila	.	C	C	T	C	G	A	.	G	C	C	G	G	C	G	A	C	G	.	C	T	T	C	A	T	T	C	.	A	A
42	Gnetum leyboldii	.	C	T	T	T	G	T	.	G	C	C	G	G	C	G	A	C	G	.	C	G	T	C	A	T	T	C	.	A	A
43	Ginkgo biloba	.	C	C	T	G	G	T	.	G	C	C	G	G	C	G	A	C	G	.	C	T	T	C	A	T	T	C	.	A	A
44	Pinus luchuensis	.	C	C	T	T	G	T	.	G	C	T	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
45	Pinus wallichiana	.	C	C	T	T	G	T	.	G	C	T	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
46	Nageia nagi	.	C	C	T	G	G	T	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
47	Taxus mairei	.	C	T	T	T	G	T	.	G	C	T	G	G	C	G	A	C	G	.	C	T	T	C	A	T	T	C	.	A	A
48	Adiantum raddianum	.	C	T	T	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
49	Adiantum raddianum 2	.	C	T	T	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
50	Ophioglossum petiolatum	.	C	T	T	.	G	C	.	G	C	C	G	G	C	G	A	C	G	.	C	T	T	C	A	T	T	C	.	A	A
51	Osmunda cinnamomea	.	C	T	T	G	G	C	.	G	C	C	G	C	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
52	Salvinia natans	.	C	C	T	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
53	Psilotum nudum	.	C	C	C	G	G	T	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
54	Chara foetida	.	C	T	T	T	G	A	.	G	C	C	G	G	C	G	A	T	G	.	T	T	C	C	A	T	T	C	.	A	A
55	Coleochaete scutata	.	.	C	C	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
56	Klebsormidium flaccidum	.	C	T	T	T	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
57	Nitella flexilis	.	C	T	A	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
58	Nitella sp.	.	C	T	T	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
59	Chlamydomonas reinhardtii	.	.	C	T	C	G	T	.	C	C	C	G	A	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
60	Hydrodictyon reticulatum	.	.	C	T	T	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
61	Parietochloris pseudoalveolaris	.	.	T	T	C	G	T	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
62	Dictyostelium discoideum	.	.	T	T	T	A	.	.	.	T	C	T	T	C	G	A	C	.	A	A	G	T	C	T	A	C	T	.	G	T
63	Pteris vittata	.	C	T	T	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	C	T	T	C	A	T	T	C	.	A	A
64	Megaceros aenigmaticus	.	C	T	C	T	G	G	C	G	C	T	G	G	C	G	A	T	A	.	T	T	T	C	A	T	T	C	.	A	A
65	Notothylas breutelii	.	C	.	C	T	G	G	C	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
66	Physcomitrella patens	.	C	T	T	G	G	C	.	G	C	T	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A
67	Sphagnum palustre	.	C	C	T	G	G	C	.	G	C	C	G	G	C	G	A	T	G	.	T	T	T	C	A	T	T	C	.	A	A

Taxa with Variability Info	14	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
		6	0.	6	4.	6	0.	0.	0.	0.	6.	6.	0.	0.	5.	0.	0.	6.	6.	6.	5.	5.	6.	6.	6.	4.	6.	6	5	6	6
1	Saccharomyces cerevisiae	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
2	Schizosaccharomyces pombe	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
3	Physcomitrella patens 2	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
4	Anthoceros agrestis	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
5	Anthoceros laevis	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
6	Pellia epiphylla	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
7	Reboulia hemisphaerica	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	C	C	G	A	T	G	G	T	A	G
8	Riccardia pinguis	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
9	Sphaerocarpos donnellii	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	C	G	G	T	A	G
10	Sphaerocarpus texanus	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
11	Atrichum undulatum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
12	Bryum argenteum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
13	Eurhynchium hians	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
14	Funaria hygrometrica	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
15	Leptobryum pyriforme	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
16	Mnium hornum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
17	Physcomitrium pyriforme	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
18	Polytrichum formosum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
19	Sphagnum cuspidatum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	C	G	G	T	A	G
20	Calypogeia arguta	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
21	Conocephalum conicum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	C	G	G	T	A	G
22	Fossombronia pusilla	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
23	Marchantia polymorpha	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	C	G	G	T	A	G
24	Riccia fluitans	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	C	G	G	T	A	G
25	Scapania nemorea	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
26	Equisetum hyemale	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
27	Equisetum robustum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
28	Isoetes engelmannii	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
29	Huperzia lucidulum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
30	Lycopodiella inundatum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	C	G	G	T	A	G
31	Lycopodium phlegmaria	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
32	Lycopodium taxifolium	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
33	Lycopodium tristachyum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
34	Selaginella umbrosa	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
35	Selaginella vogelii	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
36	Oryza sativa	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
37	Zea mays	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
38	Arabidopsis thaliana	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
39	Glycine max	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
40	Sinapis alba	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
41	Zamia pumila	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	C	A	G
42	Gnetum leyboldii	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
43	Ginkgo biloba	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
44	Pinus luchuensis	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
45	Pinus wallichiana	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
46	Nageia nagi	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
47	Taxus mairei	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
48	Adiantum raddianum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
49	Adiantum raddianum 2	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
50	Ophioglossum petiolatum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
51	Osmunda cinnamomea	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	A	T	C	G	A	T	G	G	T	A	G
52	Salvinia natans	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
53	Psilotum nudum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
54	Chara foetida	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
55	Coleochaete scutata	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
56	Klebsormidium flaccidum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
57	Nitella flexilis	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
58	Nitella sp.	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
59	Chlamydomonas reinhardtii	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
60	Hydrodictyon reticulatum	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
61	Parietochloris pseudoalveolaris	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
62	Dictyostelium discoideum	G	T	C	A	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	C
63	Pteris vittata	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
64	Megaceros aenigmaticus	A	T	T	T	C	T	G	C	C	C	T	A	T	A	T	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
65	Notothylas breutelii	A	T	T	C	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
66	Physcomitrella patens	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	T	G	G	T	A	G
67	Sphagnum palustre	A	T	T	T	C	T	G	C	C	C	T	A	T	C	.	A	A	C	T	T	T	C	G	A	C	G	G	T	A	G

Taxa with Variability Info	15	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
		6	6.	5.	6.	6.	2.	6.	6.	6.	6.	6.	6.	6.	6.	4.	6.	6.	5.	6.	2.	3.	3.	2.	6.	6.	6.	6	6	6	2
1	Saccharomyces cerevisiae	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	T	T	C	A	A	C	G	G	G	T	A
2	Schizosaccharomyces pombe	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	T	T	T	A	A	C	G	G	G	T	A
3	Physcomitrella patens 2	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
4	Anthoceros agrestis	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
5	Anthoceros laevis	G	A	T	A	G	A	G	G	C	C	T	A	C	C	T	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
6	Pellia epiphylla	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
7	Reboulia hemisphaerica	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
8	Riccardia pinguis	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
9	Sphaerocarpos donnellii	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
10	Sphaerocarpus texanus	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	A	A	.	G	G	G	T	G
11	Atrichum undulatum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
12	Bryum argenteum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
13	Eurhynchium hians	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	C	T	G	G	T	A	A	C	G	G	G	T	G
14	Funaria hygrometrica	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
15	Leptobryum pyriforme	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
16	Mnium hornum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
17	Physcomitrium pyriforme	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
18	Polytrichum formosum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
19	Sphagnum cuspidatum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
20	Calypogeia arguta	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
21	Conocephalum conicum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
22	Fossombronia pusilla	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
23	Marchantia polymorpha	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
24	Riccia fluitans	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
25	Scapania nemorea	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
26	Equisetum hyemale	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
27	Equisetum robustum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
28	Isoetes engelmannii	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
29	Huperzia lucidulum	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
30	Lycopodiella inundatum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
31	Lycopodium phlegmaria	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
32	Lycopodium taxifolium	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
33	Lycopodium tristachyum	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
34	Selaginella umbrosa	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	A
35	Selaginella vogelii	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
36	Oryza sativa	G	A	T	A	G	G	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
37	Zea mays	G	A	T	A	G	G	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
38	Arabidopsis thaliana	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
39	Glycine max	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
40	Sinapis alba	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
41	Zamia pumila	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
42	Gnetum leyboldii	G	A	T	A	G	T	G	G	C	C	T	A	C	C	A	T	G	G	T	T	G	T	G	A	C	G	G	G	T	G
43	Ginkgo biloba	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
44	Pinus luchuensis	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
45	Pinus wallichiana	G	A	G	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
46	Nageia nagi	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
47	Taxus mairei	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
48	Adiantum raddianum	G	.	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
49	Adiantum raddianum 2	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
50	Ophioglossum petiolatum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
51	Osmunda cinnamomea	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
52	Salvinia natans	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
53	Psilotum nudum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
54	Chara foetida	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
55	Coleochaete scutata	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
56	Klebsormidium flaccidum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
57	Nitella flexilis	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
58	Nitella sp.	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
59	Chlamydomonas reinhardtii	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
60	Hydrodictyon reticulatum	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
61	Parietochloris pseudoalveolaris	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
62	Dictyostelium discoideum	G	G	T	A	T	T	G	G	C	C	T	A	C	C	A	T	G	G	T	T	G	T	A	A	C	G	G	G	T	A
63	Pteris vittata	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G
64	Megaceros aenigmaticus	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
65	Notothylas breutelii	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
66	Physcomitrella patens	G	A	T	A	G	A	G	G	C	C	T	A	C	C	A	T	G	G	T	G	G	T	A	A	C	G	G	G	T	G
67	Sphagnum palustre	G	A	T	A	G	A	G	G	C	C	T	A	C	C	G	T	G	G	T	G	G	T	G	A	C	G	G	G	T	G

Taxa with Variability Info	10	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
		0	0.	0.	5.	2	5.	4	0.	0.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0	0	0	0.	0	0	0	0
1	Saccharomyces cerevisiae	A	C	G	G	G	G	A	A	T	A	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
2	Schizosaccharomyces pombe	A	C	G	G	G	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
3	Physcomitrella patens 2	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
4	Anthoceros agrestis	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
5	Anthoceros laevis	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
6	Pellia epiphylla	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
7	Reboulia hemisphaerica	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
8	Riccardia pinguis	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
9	Sphaerocarpos donnellii	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
10	Sphaerocarpus texanus	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
11	Atrichum undulatum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
12	Bryum argenteum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
13	Eurhynchium hians	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
14	Funaria hygrometrica	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
15	Leptobryum pyriforme	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
16	Mnium hornum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
17	Physcomitrium pyriforme	A	C	G	C	A	C	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
18	Polytrichum formosum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
19	Sphagnum cuspidatum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
20	Calypogeia arguta	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
21	Conocephalum conicum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
22	Fossombronia pusilla	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
23	Marchantia polymorpha	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
24	Riccia fluitans	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
25	Scapania nemorea	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
26	Equisetum hyemale	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
27	Equisetum robustum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
28	Isoetes engelmannii	A	C	G	G	G	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
29	Huperzia lucidulum	A	C	G	G	A	G	A	A	T	C	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
30	Lycopodiella inundatum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
31	Lycopodium phlegmaria	A	C	G	G	A	G	A	A	T	C	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
32	Lycopodium taxifolium	A	C	G	G	A	G	A	A	T	C	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
33	Lycopodium tristachyum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
34	Selaginella umbrosa	A	C	G	G	G	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
35	Selaginella vogelii	A	C	G	G	G	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
36	Oryza sativa	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
37	Zea mays	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
38	Arabidopsis thaliana	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
39	Glycine max	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
40	Sinapis alba	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
41	Zamia pumila	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
42	Gnetum leyboldii	A	C	G	G	G	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
43	Ginkgo biloba	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
44	Pinus luchuensis	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
45	Pinus wallichiana	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
46	Nageia nagi	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
47	Taxus mairei	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
48	Adiantum raddianum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
49	Adiantum raddianum 2	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
50	Ophioglossum petiolatum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
51	Osmunda cinnamomea	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
52	Salvinia natans	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
53	Psilotum nudum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
54	Chara foetida	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
55	Coleochaete scutata	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
56	Klebsormidium flaccidum	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
57	Nitella flexilis	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
58	Nitella sp.	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
59	Chlamydomonas reinhardtii	A	C	G	G	A	G	G	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
60	Hydrodictyon reticulatum	A	C	G	G	A	G	G	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
61	Parietochloris pseudoalveolaris	A	C	G	G	A	G	G	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
62	Dictyostelium discoideum	A	C	G	G	G	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
63	Pteris vittata	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
64	Megaceros aenigmaticus	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
65	Notophylas breutelu	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
66	Physcomitrella patens	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G
67	Sphagnum palustre	A	C	G	G	A	G	A	A	T	T	A	G	G	G	T	T	C	G	A	T	T	C	C	G	G	A	G	A	G	G

	Taxa with Variability Info 17	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510
		6	5	5	6.	5.	5.	5.	6.	6.	6.	3.	6	3.	5.	6.	6.	5.	5.	6.	5.	6.	6.	6.	6	6.	6	6	6	6	6.
1	Saccharomyces cerevisiae	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
2	Schizosaccharomyces pombe	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
3	Physcomitrella patens 2	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
4	Anthoceros agrestis	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
5	Anthoceros laevis	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
6	Pellia epiphylla	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
7	Reboulia hemisphaerica	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
8	Riccardia pinguis	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
9	Sphaerocarpos donnelli	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
10	Sphaerocarpus texanus	G	A	G	C	C	T	C	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	.	A	A	G	G
11	Atrichum undulatum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
12	Bryum argenteum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
13	Eurhynchium hians	G	A	G	C	C	T	G	A	G	A	G	A	C	G	G	C	A	T	C	C	A	C	A	T	C	C	A	A	G	G
14	Funaria hygrometrica	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
15	Leptobryum pyriforme	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
16	Mnium hornum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
17	Physcomitrium pyriforme	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
18	Polytrichum formosum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
19	Sphagnum cuspidatum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
20	Calypogeia arguta	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
21	Conocephalum conicum	G	A	G	C	C	T	G	A	G	A	A	A	C	A	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
22	Fossombronia pusilla	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
23	Marchantia polymorpha	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
24	Riccia fluitans	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
25	Scapania nemorosa	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
26	Equisetum hyemale	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
27	Equisetum robustum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
28	Isoetes engelmannii	G	A	G	C	C	T	G	A	G	A	G	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
29	Huperzia lucidulum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
30	Lycopodiella inundatum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
31	Lycopodium phlegmaria	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
32	Lycopodium taxifolium	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
33	Lycopodium tristachyum	G	A	G	C	T	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
34	Selaginella umbrosa	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
35	Selaginella vogelii	G	A	G	C	C	T	G	A	G	A	C	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
36	Oryza sativa	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
37	Zea mays	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
38	Arabidopsis thaliana	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
39	Glycine max	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
40	Sinapis alba	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
41	Zamia pumila	G	A	G	C	C	C	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
42	Gnetum leyboldii	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
43	Ginkgo biloba	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
44	Pinus luchuensis	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
45	Pinus wallichiana	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
46	Nageia nagi	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
47	Taxus mairei	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
48	Adiantum raddianum	.	G	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
49	Adiantum raddianum 2	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
50	Ophioglossum petiolatum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
51	Osmunda cinnamomea	G	A	G	C	C	T	G	A	G	A	A	A	T	G	G	C	T	A	C	T	A	C	A	T	C	C	A	A	G	G
52	Salvinia natans	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
53	Psilotum nudum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
54	Chara foetida	G	A	G	C	C	T	G	A	G	A	G	A	T	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
55	Coleochaete scutata	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
56	Klebsormidium flaccidum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
57	Nitella flexilis	G	A	G	C	C	T	G	A	G	A	G	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
58	Nitella sp.	G	A	G	C	C	T	G	A	G	A	G	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
59	Chlamydomonas reinhardtii	G	A	G	C	C	T	G	A	G	A	G	A	T	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
60	Hydrodictyon reticulatum	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
61	Parietochloris pseudoalveolaris	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
62	Dictyostelium discoideum	G	A	G	C	C	T	G	A	G	A	A	A	T	G	G	C	T	A	C	C	A	C	T	T	C	T	A	C	G	G
63	Pteris vittata	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
64	Megaceros aenigmaticus	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
65	Notothylas breutelii	G	A	A	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
66	Physcomitrella patens	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G
67	Sphagnum palustre	G	A	G	C	C	T	G	A	G	A	A	A	C	G	G	C	T	A	C	C	A	C	A	T	C	C	A	A	G	G

Taxa with Variability Info	10	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540
		6		6.	5.	6.	6.	6.	6.	5.	5.		6.	6.	6.	6.	6.	5.	4.	6.	6.	6.	6	6	6.	6.	6.	6.	6.	6	6.
1	Saccharomyces cerevisiae	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
2	Schizosaccharomyces pombe	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
3	Physcomitrella patens 2	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
4	Anthoceros agrestis	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
5	Anthoceros laevis	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
6	Pellia epiphylla	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
7	Reboulia hemisphaerica	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
8	Riccardia pinguis	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
9	Sphaerocarpos donnellii	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
10	Sphaerocarpus texanus	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
11	Atrichum undulatum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
12	Bryum argenteum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
13	Eurhynchium hians	A	.	A	G	G	C	A	G	A	T	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
14	Funaria hygrometrica	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
15	Leptobryum pyriforme	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
16	Mnium hornum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
17	Physcomitrium pyriforme	A	.	A	C	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
18	Polytrichum formosum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
19	Sphagnum cuspidatum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
20	Calypogeia arguta	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
21	Conocephalum conicum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
22	Fossombronia pusilla	A	.	A	A	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
23	Marchantia polymorpha	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
24	Riccia fluitans	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
25	Scapania nemorea	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
26	Equisetum hyemale	A	.	A	G	G	C	A	G	C	G	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
27	Equisetum robustum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
28	Isoetes engelmannii	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
29	Huperzia lucidulum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
30	Lycopodiella inundatum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
31	Lycopodium phlegmaria	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
32	Lycopodium taxifolium	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
33	Lycopodium tristachyum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
34	Selaginella umbrosa	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
35	Selaginella vogelii	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
36	Oryza sativa	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
37	Zea mays	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
38	Arabidopsis thaliana	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
39	Glycine max	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
40	Sinapis alba	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
41	Zamia pumila	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
42	Gnetum leyboldii	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
43	Ginkgo biloba	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
44	Pinus luchuensis	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
45	Pinus wallichiana	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
46	Nageia nagi	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
47	Taxus mairei	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
48	Adiantum raddianum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
49	Adiantum raddianum 2	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
50	Ophioglossum petiolatum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
51	Osmunda cinnamomea	A	.	A	G	G	C	A	G	T	A	.	G	G	C	G	C	G	T	A	A	A	T	T	A	C	C	C	A	A	T
52	Salvinia natans	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
53	Psilotum nudum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
54	Chara foetida	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	T	A	A	A	T	T	A	C	C	C	A	A	T
55	Coleochaete scutata	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
56	Klebsormidium flaccidum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
57	Nitella flexilis	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
58	Nitella sp	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
59	Chlamydomonas reinhardtii	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
60	Hydrodictyon reticulatum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
61	Parietochloris pseudoalveolaris	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
62	Dictyostelium discoideum	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	T	C	A	A	T
63	Pteris vittata	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
64	Megaceros aenigmaticus	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
65	Notothylas breutelii	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	C	C	A	A	A	T	T	A	C	C	C	A	A	T
66	Physcomitrella patens	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T
67	Sphagnum palustre	A	.	A	G	G	C	A	G	C	A	.	G	G	C	G	C	G	C	A	A	A	T	T	A	C	C	C	A	A	T

Taxa with Variability Info	19	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570
		6	5	2	3	6.	3.	3.	0.	4.	3.	5.	6.	6.	6.		6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	3	6	5	6
1	Saccharomyces cerevisiae	C	C	T	A	A	T	T	.	C	A	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
2	Schizosaccharomyces pombe	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	G	A	A	A
3	Physcomitrella patens 2	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
4	Anthoceros agrestis	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
5	Anthoceros laevis	C	C	.	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
6	Pellia epiphylla	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
7	Reboulia hemisphaerica	C	T	C	G	A	C	A	.	C	G	A	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
8	Riccardia pinguis	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
9	Sphaerocarpos donnelli	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
10	Sphaerocarpus texanus	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	.
11	Atrichum undulatum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
12	Bryum argenteum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
13	Eurhynchium hians	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
14	Funaria hygrometrica	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
15	Leptobryum pyriforme	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
16	Mnium hornum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
17	Physcomitrium pyriforme	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
18	Polytrichum formosum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
19	Sphagnum cuspidatum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
20	Calypogeia arguta	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	C	A
21	Conocephalum conicum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
22	Fossombronia pusilla	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
23	Marchantia polymorpha	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
24	Riccia fluitans	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
25	Scapania nemorea	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
26	Equisetum hyemale	C	C	.	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
27	Equisetum robustum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
28	Isoetes engelmannii	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
29	Huperzia lucidulum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
30	Lycopodiella inundatum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
31	Lycopodium phlegmaria	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
32	Lycopodium taxifolium	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
33	Lycopodium tristachyum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
34	Selaginella umbrosa	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
35	Selaginella vogelii	C	C	C	A	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
36	Oryza sativa	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
37	Zea mays	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
38	Arabidopsis thaliana	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
39	Glycine max	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
40	Sinapis alba	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
41	Zamia pumila	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
42	Gnetum leyboldii	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
43	Ginkgo biloba	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
44	Pinus luchuensis	C	C	T	G	A	C	A	.	T	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
45	Pinus wallichiana	C	C	T	G	A	C	A	.	T	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
46	Nageia nagi	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
47	Taxus mairei	C	C	T	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
48	Adiantum raddianum	C	C	.	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
49	Adiantum raddianum 2	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
50	Ophioglossum petiolatum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
51	Osmunda cinnamomea	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
52	Salvinia natans	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
53	Psilotum nudum	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
54	Chara foetida	C	C	T	G	A	C	A	.	T	A	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
55	Coleochaete scutata	C	C	T	G	A	T	A	.	C	A	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
56	Klebsormidium flaccidum	C	C	T	G	A	T	A	.	C	A	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
57	Nitella flexilis	C	C	T	G	A	C	A	.	C	A	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
58	Nitella sp.	C	C	T	G	A	C	A	.	C	A	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
59	Chlamydomonas reinhardtii	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
60	Hydrodictyon reticulatum	C	C	T	G	A	T	T	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
61	Parietochloris pseudoalveolaris	C	C	T	G	A	C	A	.	C	A	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
62	Dictyostelium discoideum	C	C	.	C	A	A	T	A	C	G	G	G	G	A	.	A	G	T	A	G	T	G	A	C	A	A	T	A	A	A
63	Pteris vittata	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
64	Megaceros aenigmaticus	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
65	Notothylas breutelu	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
66	Physcomitrella patens	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A
67	Sphagnum palustre	C	C	C	G	A	C	A	.	C	G	G	G	G	A	.	G	G	T	A	G	T	G	A	C	A	A	T	A	A	A

	Taxa with Variability Info 20	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900
		6.	6.	6.	6.	3.	6.	6.	3.	5.	1.	4.	6.	6.	4.	2.	1.	2.	4.	1.	3.	0.	1.	2	4.	6.	6.	0.	3.	2	4
1	Saccharomyces cerevisiae	T	A	A	C	G	A	T	A	C	A	G	G	G	C	C	C	A	T	T	C	.	G	G	G	T	C	.	T	T	G
2	Schizosaccharomyces pombe	T	A	A	C	A	A	T	G	C	A	G	G	G	C	C	C	T	T	T	C	.	G	G	G	T	C	.	T	T	G
3	Physcomitrella patens 2	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
4	Anthoceros agrestis	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
5	Anthoceros laevis	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
6	Pellia epiphylla	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
7	Reboulia hemisphaerica	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
8	Riccardia pinguis	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
9	Sphaerocarpos donnellii	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
10	Sphaerocarpus texanus	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
11	Atrichum undulatum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
12	Bryum argenteum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
13	Eurhynchium hians	T	A	A	C	A	A	T	A	T	A	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	T	A
14	Funaria hygrometrica	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
15	Leptobryum pyriforme	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
16	Mnium hornum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
17	Physcomitrium pyriforme	T	A	A	C	A	A	T	A	C	T	C	G	G	G	T	T	T	T	A	C	.	A	A	C	T	C	.	T	C	G
18	Polytrichum formosum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	C	G	G
19	Sphagnum cuspidatum	T	A	A	C	G	A	T	A	C	C	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
20	Calypogeia arguta	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
21	Conocephalum conicum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
22	Fossombronia pusilla	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
23	Marchantia polymorpha	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
24	Riccia fluitans	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
25	Scapania nemorosa	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
26	Equisetum hyemale	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
27	Equisetum robustum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
28	Isoetes engelmannii	T	A	A	C	A	A	T	A	C	.	G	G	G	C	T	T	C	T	A	C	.	A	A	G	T	C	.	T	G	G
29	Huperzia lucidulum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
30	Lycopodiella inundatum	T	A	A	C	G	A	T	G	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
31	Lycopodium phlegmaria	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
32	Lycopodium taxifolium	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
33	Lycopodium tristachyum	T	A	A	C	A	A	T	A	C	T	.	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
34	Selaginella umbrosa	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	.	T	A	T	.	G	A	G	T	C	.	T	G	G
35	Selaginella vogelii	T	A	A	C	A	A	T	A	C	C	G	G	G	C	T	T	.	T	A	C	.	A	A	G	T	C	.	T	G	G
36	Oryza sativa	T	A	A	C	A	A	T	A	C	C	G	G	G	C	G	C	T	T	T	A	.	G	T	G	T	C	.	T	G	G
37	Zea mays	T	A	A	C	A	A	T	A	C	C	G	G	G	C	G	C	G	T	T	A	.	G	T	G	T	C	.	T	G	G
38	Arabidopsis thaliana	T	A	A	C	A	A	T	A	C	C	G	G	G	C	T	C	T	T	T	C	.	G	A	G	T	C	.	T	G	G
39	Glycine max	T	A	A	C	A	A	T	A	C	C	G	G	G	C	T	C	A	T	T	.	.	G	A	G	T	C	.	T	G	G
40	Sinapis alba	T	A	A	C	A	A	T	A	C	C	G	G	G	C	T	C	A	T	T	.	.	G	A	G	T	C	.	T	G	G
41	Zamia pumila	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	A	T	C	.	.	G	A	G	T	C	.	T	G	G
42	Gnetum leyboldii	T	A	A	C	A	A	T	A	C	C	G	G	G	C	T	C	.	A	T	C	.	G	A	G	T	C	.	T	G	G
43	Ginkgo biloba	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	A	T	C	.	.	G	A	G	T	C	.	T	G	G
44	Pinus luchuensis	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	A	T	C	.	.	G	A	G	T	C	.	T	G	G
45	Pinus wallichiana	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	.	A	T	C	.	G	A	G	T	C	.	T	G	G
46	Nageia nagi	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	.	T	T	A	.	G	A	G	T	C	.	T	G	G
47	Taxus mairei	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	.	A	T	C	.	G	A	G	T	C	.	T	G	G
48	Adiantum raddianum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	T	C	.	A	A	G	T	C	.	T	G	G
49	Adiantum raddianum 2	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	T	C	.	A	A	G	T	C	.	T	G	G
50	Ophioglossum petiolatum	T	A	A	C	A	A	T	A	C	C	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
51	Osmunda cinnamomea	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
52	Salvinia natans	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	C	T	.	A	A	G	T	C	.	T	G	G
53	Psilotum nudum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	.	T	T	C	A	A	A	G	T	C	.	T	G	G
54	Chara foetida	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	T	T	T	C	.	G	A	G	T	C	.	C	G	G
55	Coleochaete scutata	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	T	.	A	A	G	T	C	.	T	G	G
56	Klebsormidium flaccidum	T	A	A	C	A	A	T	G	C	T	G	G	G	C	T	T	T	T	C	A	.	A	A	G	T	C	.	T	G	G
57	Nitella flexilis	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	T	T	T	C	.	G	A	G	T	C	.	C	G	G
58	Nitella sp.	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	C	T	T	T	C	.	G	A	G	T	C	.	C	G	G
59	Chlamydomonas reinhardtii	T	A	A	C	A	A	T	A	C	C	G	G	G	C	G	C	.	T	T	C	.	G	C	G	T	C	.	T	G	G
60	Hydrodictyon reticulatum	T	A	A	C	A	A	T	A	C	T	G	G	G	C	A	C	T	T	C	.	.	G	T	G	T	C	.	T	G	G
61	Parietochloris pseudoalveolaris	T	A	A	C	T	A	T	G	C	T	T	G	G	C	T	C	.	T	T	C	.	G	A	G	T	C	.	G	G	G
62	Dictyostelium discoideum	T	A	T	C	A	A	T	A	C	.	C	T	A	T	C	C	T	T	T	T	T	G	G	A	G	G	.	G	.	C
63	Pteris vittata	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	T	C	.	A	A	G	T	C	.	T	G	G
64	Megaceros aenigmaticus	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
65	Notothylas breutelii	T	A	A	C	A	A	T	A	C	T	G	G	G	C	C	T	T	T	A	C	.	A	A	G	T	C	C	T	G	G
66	Physcomitrella patens	T	A	A	C	A	A	T	A	C	T	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G
67	Sphagnum palustre	T	A	A	C	G	A	T	A	C	C	G	G	G	C	T	T	T	T	A	C	.	A	A	G	T	C	.	T	G	G

Taxa with Variability Info	21	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030
		4	6.	6	6.	4	5.	6.	5.	6.	6.	5.	5.	4.	3.	4.	6.	4.	4.	6.	2.	4.	0.	6.	6	6.	3	2.	0	4	4
1	Saccharomyces cerevisiae	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	G	T	.	A	A	A	T	A	.	C	C
2	Schizosaccharomyces pombe	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	G	T	.	A	A	A	T	A	.	C	C
3	Physcomitrella patens 2	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
4	Anthoceros agrestis	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
5	Anthoceros laevis	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
6	Pellia epiphylla	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
7	Reboulia hemisphaerica	T	A	A	T	T	G	G	T	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
8	Riccardia pinguis	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
9	Sphaerocarpos donnellii	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
10	Sphaerocarpus texanus	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
11	Atrichum undulatum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
12	Bryum argenteum	T	A	A	T	T	G	G	A	A	T	G	A	G	A	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
13	Eurhynchium hians	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	T	T	.	A	A	A	T	C	.	C	C
14	Funaria hygrometrica	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
15	Leptobryum pyriforme	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
16	Mnium hornum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
17	Physcomitrium pyriforme	T	A	A	T	T	C	G	A	A	T	C	G	C	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
18	Polytrichum formosum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
19	Sphagnum cuspidatum	T	A	A	T	C	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
20	Calypogeia arguta	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
21	Conocephalum conicum	T	A	A	T	T	G	G	A	A	T	G	A	G	A	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
22	Fossombronia pusilla	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
23	Marchantia polymorpha	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
24	Riccia fluitans	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
25	Scapania nemorea	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
26	Equisetum hyemale	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
27	Equisetum robustum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
28	Isoetes engelmannii	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
29	Huperzia lucidulum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	C	C	.	C	C
30	Lycopodiella inundatum	T	A	A	T	C	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	C	.	A	A	A	C	C	.	?	C
31	Lycopodium phlegmaria	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
32	Lycopodium taxifolium	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
33	Lycopodium tristachyum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	C	C	.	C	C
34	Selaginella umbrosa	T	A	A	T	T	G	G	A	A	T	G	A	G	A	A	C	A	A	T	C	T	.	A	A	A	T	C	.	T	C
35	Selaginella vogelii	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	T	C
36	Oryza sativa	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
37	Zea mays	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
38	Arabidopsis thaliana	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
39	Glycine max	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
40	Sinapis alba	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
41	Zamia pumila	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
42	Gnetum leyboldii	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	T	T	.	A	A	A	G	C	.	C	C
43	Ginkgo biloba	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
44	Pinus luchuensis	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
45	Pinus wallichiana	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
46	Nageia nagi	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	C	C	.	C	C
47	Taxus mairei	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
48	Adiantum raddianum	T	A	.	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
49	Adiantum raddianum 2	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
50	Ophioglossum petiolatum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	C	A	.	C	C
51	Osmunda cinnamomea	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
52	Salvinia natans	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	G	A	T	C	T	.	A	A	A	T	C	.	C	C
53	Psilotum nudum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	C	C	.	C	C
54	Chara foetida	T	A	A	T	T	G	G	A	A	T	G	A	G	A	A	C	A	G	T	C	C	T	A	A	A	C	T	C	C	T
55	Coleochaete scutata	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	T	C
56	Klebsormidium flaccidum	C	A	A	T	T	G	G	A	A	T	G	A	G	T	G	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
57	Nitella flexilis	T	A	A	T	T	G	G	A	A	T	G	A	G	A	A	C	A	G	T	C	T	.	A	A	A	C	C	C	C	T
58	Nitella sp	T	A	A	T	T	G	G	A	A	T	G	A	G	A	A	C	A	G	T	C	T	.	A	A	A	C	C	C	C	T
59	Chlamydomonas reinhardtii	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
60	Hydrodictyon reticulatum	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
61	Parietochloris pseudoalveolaris	C	A	A	T	A	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
62	Dictyostelium discoideum	.	A	A	T	T	G	A	A	A	T	G	.	A	A	C	A	C	A	A	A	T	T	A	A	A	A	C	.	T	C
63	Pteris vittata	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
64	Megaceros aenigmaticus	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
65	Notothylas breutelii	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
66	Physcomitrella patens	T	A	A	T	T	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C
67	Sphagnum palustre	T	A	A	T	C	G	G	A	A	T	G	A	G	T	A	C	A	A	T	C	T	.	A	A	A	T	C	.	C	C

Taxa with Variability Info	22	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660
		5	4.	6.	0.	6.	6.	4.	5.	5.	0.	4.	6.	3.	6.	2.	6.	6.	6.	6.	5.	6.	5	6	6	5.	6.	6	6	6	5.
1	Saccharomyces cerevisiae	T	T	A	·	A	C	G	A	G	·	G	A	A	C	A	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
2	Schizosaccharomyces pombe	T	T	A	·	A	C	G	A	G	·	G	A	A	C	A	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
3	Physcomitrella patens 2	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
4	Anthoceros agrestis	T	T	A	·	A	C	G	A	G	·	G	A	T	C	T	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
5	Anthoceros laevis	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
6	Pellia epiphylla	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
7	Reboulia hemisphaerica	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
8	Riccardia pinguis	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
9	Sphaerocarpos donnellii	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
10	Sphaerocarpus texanus	T	T	·	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
11	Atrichum undulatum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
12	Bryum argenteum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
13	Eurhynchium hians	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
14	Funaria hygrometrica	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
15	Leptobryum pyriforme	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
16	Mnium hornum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
17	Physcomitrium pyriforme	T	T	A	·	A	C	A	C	G	·	G	A	T	C	C	A	T	T	G	G	A	C	G	G	G	A	A	G	T	C
18	Polytrichum formosum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
19	Sphagnum cuspidatum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
20	Calypogeia arguta	T	T	?	A	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
21	Conocephalum conicum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
22	Fossombronia pusilla	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
23	Marchantia polymorpha	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
24	Riccia fluitans	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
25	Scapania nemorosa	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
26	Equisetum hyemale	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
27	Equisetum robustum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
28	Isoetes engelmannii	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
29	Huperzia lucidulum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
30	Lycopodiella inundatum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	G
31	Lycopodium phlegmaria	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
32	Lycopodium taxifolium	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
33	Lycopodium tristachyum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
34	Selaginella umbrosa	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
35	Selaginella vogelii	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
36	Oryza sativa	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
37	Zea mays	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
38	Arabidopsis thaliana	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
39	Glycine max	T	T	A	·	A	C	G	A	T	G	G	A	T	C	C	A	T	T	G	A	A	G	G	G	C	A	A	G	T	C
40	Sinapis alba	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
41	Zamia pumila	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
42	Gnetum leyboldii	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
43	Ginkgo biloba	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
44	Pinus luchuensis	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
45	Pinus wallichiana	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
46	Nageia nagi	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
47	Taxus mairei	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
48	Adiantum raddianum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
49	Adiantum raddianum 2	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
50	Ophioglossum petiolatum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
51	Osmunda cinnamomea	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
52	Salvinia natans	C	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
53	Psilotum nudum	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
54	Chara foetida	T	C	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
55	Coleochaete scutata	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
56	Klebsormidium flaccidum	T	C	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
57	Nitella flexilis	T	A	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
58	Nitella sp.	T	A	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
59	Chlamydomonas reinhardtii	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
60	Hydrodictyon reticulatum	T	T	A	·	A	C	G	A	G	·	T	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
61	Parietochloris pseudoalveolaris	T	T	A	·	A	C	G	A	G	·	G	A	T	C	A	A	T	T	G	G	A	G	G	G	C	A	A	G	T	C
62	Dictyostelium discoideum	T	T	A	A	T	T	A	A	·	·	C	A	·	C	A	A	T	T	G	A/G	A	G	G	G	C	A	A	G	T	C
63	Pteris vittata	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	G	C	A	A	?	?	?
64	Megaceros aenigmaticus	T	?	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	?	?	?	?	?	?	?
65	Notothylas breutelii	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	?	?	?	?	?	?	?
66	Physcomitrella patens	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	?	?	?	?	?	?	?
67	Sphagnum palustre	T	T	A	·	A	C	G	A	G	·	G	A	T	C	C	A	T	T	G	G	A	G	G	?	?	?	?	?	?	?

Taxa with Variability Info	23	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690
		6.	6.	6.	6.	6.	6.	6.	6.	5.	5.	6.	6.	6.	6.	6.	5.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6	6	6	6.
1	Saccharomyces cerevisiae	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
2	Schizosaccharomyces pombe	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
3	Physcomitrella patens 2	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
4	Anthoceros agrestis	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
5	Anthoceros laevis	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
6	Pellia epiphylla	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
7	Reboulia hemisphaerica	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
8	Riccardia pinguis	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
9	Sphaerocarpos donnellii	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
10	Sphaerocarpus texanus	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
11	Atrichum undulatum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
12	Bryum argenteum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
13	Eurhynchium hians	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
14	Funaria hygrometrica	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
15	Leptobryum pyriforme	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
16	Mnium hornum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
17	Physcomitrium pyriforme	T	G	G	T	G	C	C	A	C	G	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
18	Polytrichum formosum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
19	Sphagnum cuspidatum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
20	Calypogeia arguta	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
21	Conocephalum conicum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
22	Fossombronia pusilla	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
23	Marchantia polymorpha	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
24	Riccia fluitans	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
25	Scapania nemorea	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
26	Equisetum hyemale	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
27	Equisetum robustum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
28	Isoetes engelmannii	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
29	Huperzia lucidulum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
30	Lycopodiella inundatum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	?	G	G	T	A	A	T	T	C	C	A	G	C	T	C
31	Lycopodium phlegmaria	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
32	Lycopodium lucidulum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
33	Lycopodium tristachyum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
34	Selaginella umbrosa	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
35	Selaginella vogelii	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
36	Oryza sativa	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
37	Zea mays	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
38	Arabidopsis thaliana	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
39	Glycine max	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
40	Sinapis alba	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
41	Zamia pumila	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
42	Gnetum leyboldii	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
43	Ginkgo biloba	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
44	Pinus luchuensis	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
45	Pinus wallichiana	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
46	Nageia nagi	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
47	Taxus mairei	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
48	Adiantum raddianum	T	G	.	T	G	C	C	A	G	C	A	G	C	C	G	C	.	G	T	A	A	T	T	C	C	A	G	C	T	C
49	Adiantum raddianum 2	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
50	Ophioglossum petiolatum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
51	Osmunda cinnamomea	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	T	G	G	T	A	A	T	T	C	C	A	G	C	T	C
52	Salvinia natans	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
53	Psilotum nudum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
54	Chara foetida	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
55	Coleochaete scutata	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
56	Klebsormidium flaccidum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
57	Nitella flexilis	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
58	Nitella sp.	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
59	Chlamydomonas reinhardtii	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
60	Hydrodictyon reticulatum	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
61	Parietochloris pseudoalveolaris	T	G	G	T	G	C	C	A	G	C	A	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
62	Dictyostelium discoideum	T	G	G	T	G	C	C	A	G	C	A/G	G	C	C	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
63	Pteris vittata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	G	G	T	A	A	T	T	C	C	A	G	C	T	C
64	Megaceros aenigmaticus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
65	Notothylas breutelii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
66	Physcomitrella patens	?	?	?	?	?	?	?	?	?	?	?	?	?	?	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C
67	Sphagnum palustre	?	?	?	?	?	?	?	?	?	?	?	?	?	?	G	C	G	G	T	A	A	T	T	C	C	A	G	C	T	C

	Taxa with Variability Info 24	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720
		6.	5.	6.	6.	6.	6.	6.	6.	6.	6.	5.	6.	4.	4.	2.	5.	5.	6.	6.	6.	6.	6.	6	6	6.	6.	6.	6	6	6
1	Saccharomyces cerevisiae	C	A	A	T	A	G	C	G	T	A	T	A	T	T	A	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
2	Schizosaccharomyces pombe	C	A	A	T	A	G	C	G	T	A	T	A	T	T	A	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
3	Physcomitrella patens 2	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
4	Anthoceros agrestis	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
5	Anthoceros laevis	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
6	Pellia epiphylla	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
7	Reboulia hemisphaerica	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	T	G	T	T	G	T	T	G	C	A	G	T	T	A
8	Riccardia pinguis	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
9	Sphaerocarpos donnellii	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
10	Sphaerocarpus texanus	C	A	A	T	.	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
11	Atrichum undulatum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
12	Bryum argenteum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
13	Eurhynchium hians	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	C	T	T	G	T	T	G	C	A	G	T	T	A
14	Funaria hygrometrica	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
15	Leptobryum pyriforme	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
16	Mnium hornum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
17	Physcomitrium pyriforme	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
18	Polytrichum formosum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
19	Sphagnum cuspidatum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
20	Calypogeia arguta	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
21	Conocephalum conicum	C	G	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
22	Fossombronia pusilla	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
23	Marchantia polymorpha	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
24	Riccia fluitans	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
25	Scapania nemorea	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
26	Equisetum hyemale	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
27	Equisetum robustum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
28	Isoetes engelmannii	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
29	Huperzia lucidulum	C	A	A	T	A	G	C	G	T	A	T	A	T	C	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
30	Lycopodiella inundatum	C	A	A	T	A	G	C	G	T	A	T	A	T	C	T	?	?	?	T	T	G	T	T	G	C	A	G	T	T	A
31	Lycopodium phlegmaria	C	A	A	T	A	G	C	G	T	A	T	A	T	C	T	G	A	G	T	T	G	T	T	G	C	A	G	T	T	A
32	Lycopodium taxifolium	C	A	A	T	A	G	C	G	T	A	T	A	T	C	T	G	A	G	T	T	G	T	T	G	C	A	G	T	T	A
33	Lycopodium tristachyum	C	A	A	T	A	G	C	G	T	A	T	A	T	C	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
34	Selaginella umbrosa	C	A	A	T	A	G	C	G	T	A	T	A	T	C	A	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
35	Selaginella vogelii	C	A	A	T	A	G	C	G	T	A	T	A	T	C	A	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
36	Oryza sativa	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
37	Zea mays	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
38	Arabidopsis thaliana	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
39	Glycine max	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
40	Sinapis alba	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
41	Zamia pumila	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
42	Gnetum leyboldii	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
43	Ginkgo biloba	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
44	Pinus luchuensis	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
45	Pinus wallichiana	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
46	Nageia nagi	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
47	Taxus mairei	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
48	Adiantum raddianum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
49	Adiantum raddianum 2	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
50	Ophioglossum petiolatum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
51	Osmunda cinnamomea	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
52	Salvinia natans	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
53	Psilotum nudum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
54	Chara foetida	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
55	Coleochaete scutata	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
56	Klebsormidium flaccidum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
57	Nitella flexilis	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
58	Nitella sp	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
59	Chlamydomonas reinhardtii	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
60	Hydrodictyon reticulatum	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
61	Parietochloris pseudoalveolaris	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
62	Dictyostelium discoideum	C	A	A	T	A	G	C	A	T	A	T	A	C	T	A	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
63	Pteris vittata	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
64	Megaceros aenigmaticus	C	?	A	T	A	G	C	G	?	?	T	A	A	T	A	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
65	Notothylas breutelii	C	A	A	T	A	G	C	G	T	A	C	A	A	T	A	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
66	Physcomitrella patens	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A
67	Sphagnum palustre	C	A	A	T	A	G	C	G	T	A	T	A	T	T	T	A	A	G	T	T	G	T	T	G	C	A	G	T	T	A

Taxa with Variability Info	25	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750
		0	0.	0.	0.	0	5.	6.	6.	6.	6.	6.	6.	6.	6.	6.	2.	6.	2.	2.	6.	2.	4.	3.	0	1.	0	1	2.	4	2
1	Saccharomyces cerevisiae	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	A	A	C	T	T	T	G	G	G	C	.	C	C	G	G
2	Schizosaccharomyces pombe	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	A	A	C	T	T	T	G	A	G	C	.	C	T	G	G
3	Physcomitrella patens 2	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	G	G
4	Anthoceros agrestis	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	G	.	T	G	G	G
5	Anthoceros laevis	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	.	.	T	G	G	G
6	Pellia epiphylla	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	T	G	G	G	G
7	Reboulia hemisphaerica	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	G	.	A	G	G	G
8	Riccardia pinguis	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	.	C	G	G	G
9	Sphaerocarpos donnellii	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	G	.	A	G	G	G
10	Sphaerocarpus texanus	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	G	.	A	G	G	G
11	Atrichum undulatum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	.	T	G	G	G
12	Bryum argenteum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	G	G
13	Eurhynchium hians	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	C	G	G	G	C	.	T	T	G	C
14	Funaria hygrometrica	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	G	G
15	Leptobryum pyriforme	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	T	.	C	G	G	G
16	Mnium hornum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	G	G
17	Physcomitrium pyriforme	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	G	G
18	Polytrichum formosum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	A	.	C	G	G	G
19	Sphagnum cuspidatum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
20	Calypogeia arguta	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	.	G	G	A	.	.	T	G	G
21	Conocephalum conicum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	G	.	A	G	G	G
22	Fossombronia pusilla	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	T	G	G	G	G
23	Marchantia polymorpha	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	G	G	G	G	G
24	Riccia fluitans	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	G	A	G	G	G	T
25	Scapania nemorosa	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	G	T	G	G	G	G
26	Equisetum hyemale	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	A	.	C	G	G	G
27	Equisetum robustum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
28	Isoetes engelmannii	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	T	G	G	G
29	Huperzia lucidulum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	.	T	G	G	G
30	Lycopodiella inundatum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	T	G	G	G
31	Lycopodium phlegmaria	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	T	G	G	G
32	Lycopodium taxifolium	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	T	G	G	G
33	Lycopodium tristachyum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	.	T	G	G	G
34	Selaginella umbrosa	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	T	G	G	T	G
35	Selaginella vogelii	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	T	G	G	G	G
36	Oryza sativa	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	C	C	T	T	G	G	G	C	.	G	C	G	G
37	Zea mays	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	C	C	T	T	G	G	G	C	.	C	G	G	G
38	Arabidopsis thaliana	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	A	A	C	C	T	T	G	G	G	A	.	T	G	G	G
39	Glycine max	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	C	C	T	T	G	G	G	T	.	T	G	G	G
40	Sinapis alba	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	A	A	C	C	T	T	G	G	G	A	.	T	G	G	G
41	Zamia pumila	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	.	C	G	G	C
42	Gnetum leyboldii	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	A	.	T	G	G	G
43	Ginkgo biloba	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	C	.	C	G	G	G
44	Pinus luchuensis	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	T	A
45	Pinus wallichiana	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	T	A
46	Nageia nagi	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	T	.	C	G	T	G
47	Taxus mairei	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	T	C
48	Adiantum raddianum	A	A	A	.	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
49	Adiantum raddianum 2	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
50	Ophioglossum petiolatum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
51	Osmunda cinnamomea	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	T	G	G	G	.	T	G	G	G
52	Salvinia natans	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
53	Psilotum nudum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
54	Chara foetida	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	T	G	G	G	T	.	G	G	G	A
55	Coleochaete scutata	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	C	G	G	G	T	.	T	G	G	A
56	Klebsormidium flaccidum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	T	G	G	G	T	.	T	G	G	G
57	Nitella flexilis	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	T	G	G	G	T	.	G	G	G	A
58	Nitella sp	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	T	G	G	G	T	.	G	G	G	A
59	Chlamydomonas reinhardtii	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	C	G	G	G	T	.	G	G	G	G
60	Hydrodictyon reticulatum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	C	G	G	G	T	.	G	G	G	T
61	Parietochloris pseudoalveolaris	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	T	T	C	G	G	G	T	.	G	G	G	T
62	Dictyostelium discoideum	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	A	A	G	T	T	T	A	A	G	G	.	T	T	T	A
63	Pteris vittata	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
64	Megaceros aenigmaticus	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	T	G	G	G
65	Notothylas breutelii	A	A	A	A	G	G	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G
66	Physcomitrella patens	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	T	G	G	G	T	.	C	G	G	G
67	Sphagnum palustre	A	A	A	A	G	C	T	C	G	T	A	G	T	T	G	G	A	T	C	T	C	G	G	G	G	.	C	G	G	G

Taxa with Variability Info	28	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780
		1.	1.	0.	2.	1.	1.	2.	0.	6.	6.	4.	6.	4.	6.	0.	3.	3.	0.	0.	0.	0.	0.	0	0	0	-1	-1	-1	-1	-1
1	Saccharomyces cerevisiae	T	T	G	.	G	C	C	.	G	G	T	C	C	G	.	A	.	.	.	.	.	.	.	.	.	.	.	.	T	T
2	Schizosaccharomyces pombe	T	C	G	.	A	C	T	.	G	G	T	C	C	G	.	C	C	G	C	.	.	.	.	.	.	.	.	.	.	.
3	Physcomitrella patens 2	G	G	G	A	G	.	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	C	T
4	Anthoceros agrestis	G	T	G	.	G	C	T	.	G	G	T	C	C	G	.	C	C	T	.	.	.	.	.	.	.	.	.	.	C	T
5	Anthoceros laevis	G	T	G	.	G	A	C	.	G	G	T	C	C	G	.	C	T	.	.	.	.	.	.	.	.	.	.	.	C	C
6	Pellia epiphylla	C	.	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	T	C	T
7	Reboulia hemisphaerica	T	C	.	C	G	G	C	.	G	G	T	C	C	G	.	G	C	.	.	.	.	.	.	.	.	.	.	.	.	T
8	Riccardia pinguis	G	C	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
9	Sphaerocarpos donnellii	T	C	.	G	G	G	C	.	G	G	T	C	C	G	.	C	T	.	.	.	.	.	.	.	.	.	.	.	.	T
10	Sphaerocarpus texanus	T	C	.	G	G	G	.	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
11	Atrichum undulatum	G	C	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
12	Bryum argenteum	G	G	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	C
13	Eurhynchium hians	T	G	.	G	A	G	T	C	G	G	T	C	C	G	.	C	T	.	.	.	.	.	.	.	.	.	.	.	.	T
14	Funaria hygrometrica	G	G	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	C	T
15	Leptobryum pyriforme	G	G	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	C	T
16	Mnium hornum	G	G	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	C	T
17	Physcomitrium pyriforme	G	G	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	C
18	Polytrichum formosum	G	A	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
19	Sphagnum cuspidatum	G	C	.	G	G	G	C	.	G	G	T	C	C	G	.	T	C	.	.	.	.	.	.	.	.	.	.	.	.	T
20	Calypogeia arguta	G	A	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
21	Conocephalum conicum	C	T	.	T	G	G	C	.	G	G	T	C	C	G	.	C	T	.	.	.	.	.	.	.	.	.	.	.	C	T
22	Fossombronia pusilla	C	.	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	T	C	T
23	Marchantia polymorpha	T	.	.	C	G	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	T	C	T
24	Riccia fluitans	C	.	.	C	G	G	C	.	G	G	T	C	C	G	.	C	T	.	.	.	.	.	.	.	.	.	.	C	C	T
25	Scapania nemorea	C	.	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	T	C	T
26	Equisetum hyemale	G	C	.	G	T	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	C
27	Equisetum robustum	G	C	.	G	T	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	C
28	Isoetes engelmannii	A	T	.	G	C	A	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	.	.
29	Huperzia lucidulum	G	C	.	G	A	A	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
30	Lycopodiella inundatum	G	C	.	G	G	A	C	.	G	G	T	C	C	G	.	C	T	T	.	.	.	.	.	.	.	.	.	.	.	.
31	Lycopodium phlegmaria	G	C	.	G	A	A	C	.	G	G	T	C	C	G	.	C	C	T	.	.	.	.	.	.	.	.	.	.	.	.
32	Lycopodium taxifolium	G	C	.	G	A	A	C	.	G	G	T	C	C	G	.	C	C	T	.	.	.	.	.	.	.	.	.	.	.	.
33	Lycopodium tristachyum	G	C	.	G	A	A	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
34	Selaginella umbrosa	G	.	.	G	A	C	T	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	.	T
35	Selaginella vogelii	C	.	.	G	A	A	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	.	T
36	Oryza sativa	C	C	G	G	G	C	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
37	Zea mays	C	.	.	.	.	.	C	.	G	G	G	.	T	G	.	C	C	.	.	.	.	.	.	.	.	G	C	C	G	C
38	Arabidopsis thaliana	T	C	.	G	G	C	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
39	Glycine max	T	C	.	G	A	T	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
40	Sinapis alba	T	C	.	G	C	C	C	.	G	G	T	C	C	G	.	C	.	.	.	.	.	.	.	.	.	.	.	.	G	T
41	Zamia pumila	C	C	.	G	G	C	C	.	G	G	T	C	C	G	.	C	T	.	.	.	.	.	.	.	.	.	.	.	T	T
42	Gnetum leyboldii	G	T	.	G	G	T	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	G	A
43	Ginkgo biloba	T	C	.	G	G	C	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	T
44	Pinus luchuensis	A	G	.	G	G	T	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	A
45	Pinus wallichiana	A	A	.	G	G	T	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	A
46	Nageia nagi	T	C	.	T	G	T	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	G	C	A
47	Taxus mairei	A	C	.	G	G	T	T	.	G	G	T	C	T	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	A
48	Adiantum raddianum	G	C	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	T
49	Adiantum raddianum 2	G	C	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	T
50	Ophioglossum petiolatum	G	C	.	G	G	G	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	.	.
51	Osmunda cinnamomea	G	C	.	G	A	G	C	.	G	G	T	C	C	G	.	C	T	.	.	.	.	.	.	.	.	.	.	.	.	.
52	Salvinia natans	G	C	.	G	G	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
53	Psilotum nudum	G	C	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	T	C	C
54	Chara foetida	G	G	G	.	G	T	C	.	G	G	T	C	C	G	.	C	T	C	.	.	.	.	.	.	.	.	.	.	.	T
55	Coleochaete scutata	G	C	G	.	A	C	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	.	T
56	Klebsormidium flaccidum	G	C	G	.	G	C	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
57	Nitella flexilis	A	G	G	.	A	C	T	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	T
58	Nitella sp.	A	G	G	.	A	C	T	.	G	G	T	C	C	G	.	C	C	T	.	.	.	.	.	.	.	.	.	.	.	T
59	Chlamydomonas reinhardtii	T	G	G	.	T	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
60	Hydrodictyon reticulatum	T	C	T	.	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
61	Parietochloris pseudoalveolaris	C	G	C	.	G	C	C	.	G	G	T	C	C	G	.	C	C	G	.	.	.	.	.	.	.	.	.	.	.	T
62	Dictyostelium discoideum	C	C	G	.	G	G	T	.	T	T	A	.	T	G	T	C	A	T	T	T	A	C	C	A	C	.	.	.	.	.
63	Pteris vittata	G	C	.	G	A	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	T	C
64	Megaceros aenigmaticus	G	T	G	.	A	C	T	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
65	Notothylas breutelii	G	T	.	G	A	T	T	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	.	.	.	T
66	Physcomitrella patens	G	G	G	A	G	.	C	.	G	G	T	C	C	G	.	C	C	C	.	.	.	.	.	.	.	.	.	.	C	T
67	Sphagnum palustre	G	C	.	G	G	G	C	.	G	G	T	C	C	G	.	C	C	.	.	.	.	.	.	.	.	.	C	T	C	T

Taxa with Variability Info	27	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810
		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0.	6.	3.	2.	4.	0.	0.	4.	3.	0	2.	6.	4	2	3	3	0	0
1	Saccharomyces cerevisiae	T	T	T	.	.	.	.	.	.	.	.	.	.	.	T	C	G	.	.	T	G	.	T	A	C	T	G	G	.	A
2	Schizosaccharomyces pombe	A	A	G	.	.	.	.	.	.	.	.	.	G	C	G	T	G	.	.	T	T	.	T	A	C	T	G	G	.	.
3	Physcomitrella patens 2	T	G	T	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
4	Anthoceros agrestis	T	T	.	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	T	A	C	T	G	G	.	.
5	Anthoceros laevis	T	T	T	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
6	Pellia epiphylla	T	T	T	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
7	Reboulia hemisphaerica	A	C	T	T	G	T	.	.	.	.	.	.	.	G	G	T	G	.	.	C	G	.	C	A	C	T	G	G	.	.
8	Riccardia pinguis	T	T	C	C	G	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
9	Sphaerocarpos donnelii	C	T	T	T	T	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
10	Sphaerocarpus texanus	C	T	T	T	T	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
11	Atrichum undulatum	C	T	T	T	T	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
12	Bryum argenteum	C	T	T	C	G	T	G	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
13	Eurhynchium hians	C	G	T	.	.	.	.	.	.	.	.	.	.	G	G	T	C	.	.	T	A	.	C	A	C	T	A	G	.	.
14	Funaria hygrometrica	T	G	T	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
15	Leptobryum pyriforme	T	G	T	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
16	Mnium hornum	C	G	T	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
17	Physcomitrium pyriforme	C	T	T	G	T	G	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
18	Polytrichum formosum	C	T	T	T	T	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	A	.	.
19	Sphagnum cuspidatum	T	T	G	G	G	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	G	.	.
20	Calypogeia arguta	C	T	T	T	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
21	Conocephalum conicum	C	C	T	T	T	C	G	T	G	G	G	G	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	A	.	C
22	Fossombronia pusilla	T	T	T	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
23	Marchantia polymorpha	T	T	T	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
24	Riccia fluitans	T	G	G	T	G	G	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
25	Scapania nemorea	T	T	T	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
26	Equisetum hyemale	T	C	T	C	G	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	T	.	.
27	Equisetum robustum	T	C	T	C	G	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	T	.	.
28	Isoetes engelmannii	T	C	G	G	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
29	Huperzia lucidulum	C	C	T	T	T	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	T	G	.	.
30	Lycopodiella inundatum	T	T	T	C	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	C	G	G	.	.
31	Lycopodium phlegmaria	C	C	T	T	.	.	.	.	.	.	.	.	T	G	G	T	G	.	.	T	G	.	C	A	C	T	T	G	.	.
32	Lycopodium taxifolium	C	C	T	T	.	.	.	.	.	.	.	.	T	G	G	T	G	.	.	T	G	.	C	A	C	T	T	G	.	.
33	Lycopodium tristachyum	C	C	T	T	T	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
34	Selaginella umbrosa	T	G	C	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
35	Selaginella vogelii	C	G	C	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
36	Oryza sativa	C	A	C	.	.	.	.	.	.	.	.	.	.	G	G	C	A	.	.	G	G	.	C	A	C	C	G	A	.	.
37	Zea mays	C	G	T	A	C	G	.	.	.	.	.	.	.	G	G	C	A	.	.	.	G	.	A	A	C	C	G	A	.	.
38	Arabidopsis thaliana	T	T	.	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	T	T	G	G	.	.
39	Glycine max	C	C	.	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	G	.	.
40	Sinapis alba	T	T	G	.	.	.	.	.	.	.	.	.	.	.	G	T	G	.	.	A	G	.	C	A	C	C	G	G	.	.
41	Zamia pumila	T	T	T	G	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	G	.	.
42	Gnetum leyboldii	T	C	C	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	T	C	G	A	.	.
43	Ginkgo biloba	T	T	C	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	G	.	.
44	Pinus luchuensis	C	T	C	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	T	G	.	.
45	Pinus wallichiana	C	T	C	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	T	G	.	.
46	Nageia nagi	C	C	.	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	C	.	.
47	Taxus mairei	C	T	C	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
48	Adiantum raddianum	C	T	T	T	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	.	T	G	G	.	.
49	Adiantum raddianum 2	C	T	T	T	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
50	Ophioglossum petiolatum	T	C	G	T	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	?	C	.	.
51	Osmunda cinnamomea	C	T	T	C	T	.	.	.	.	.	.	.	.	G	G	T	G	.	T	T	G	.	C	A	C	T	G	G	.	.
52	Salvinia natans	C	C	T	C	G	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	C	.	.
53	Psilotum nudum	T	C	G	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
54	Chara foetida	T	G	C	.	.	.	.	.	.	.	.	.	G	G	G	C	G	.	.	T	G	.	T	A	C	T	G	G	.	.
55	Coleochaete scutata	T	T	.	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
56	Klebsormidium flaccidum	C	A	C	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	G	.	.
57	Nitella flexilis	C	G	C	.	.	.	.	.	.	.	.	.	.	G	G	C	G	.	.	T	G	.	C	A	C	C	G	G	.	.
58	Nitella sp.	C	G	C	.	.	.	.	.	.	.	.	.	G	G	G	C	G	.	.	T	G	.	C	A	C	C	G	G	.	.
59	Chlamydomonas reinhardtii	C	T	.	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	C	.	.
60	Hydrodictyon reticulatum	A	T	.	.	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	A	G	.	T	A	C	T	G	C	.	.
61	Parietochloris pseudoalveolaris	T	T	.	.	.	.	.	.	.	.	.	.	C	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
62	Dictyostelium discoideum	T	T	C	.	.	.	.	.	.	.	.	.	.	G	T	G	G	T	.	.	.	.	.	T	A	A	A	T	.	.
63	Pteris vittata	C	T	T	T	.	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
64	Megaceros aenigmaticus	C	T	C	A	A	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	G	T	A	C	T	G	G	.	G
65	Notothylas breutelii	C	C	?	G	A	.	.	.	.	.	.	.	.	G	G	G	G	.	.	T	C	.	T	A	C	T	A	G	G	.
66	Physcomitrella patens	T	G	T	.	.	.	.	.	.	.	.	.	G	G	G	T	G	.	.	T	G	.	C	A	C	T	G	G	.	.
67	Sphagnum palustre	T	T	G	G	G	.	.	.	.	.	.	.	.	G	G	T	G	.	.	T	G	.	C	A	C	C	G	G	.	.

294

#	Taxa with Variability Info 28	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840
		1	1.	0	0.	0.	0.	0.	0.	1.	1.	1.	2.	1.	0.	1.	1.	3.	2.	2.	3.	2.	0.	0.	0	0.	0.	0.	0	0	0
1	Saccharomyces cerevisiae	T	T	T	C	.	.	.	C	A	A	C	G	G	.	G	G	C	C	T	T	T	C	C	.	.	.	.	.	.	.
2	Schizosaccharomyces pombe	.	T	C	A	.	.	.	T	G	A	C	C	G	.	G	G	G	T	C	G	T	T	A	A	C	.	.	.	.	.
3	Physcomitrella patens 2	T	C	.	.	.	.	.	C	A	C	T	C	G	.	G	C	C	T	T	C	T	.	.	.	.	.	.	.	.	.
4	Anthoceros agrestis	T	G	.	.	.	.	.	A	C	C	T	C	A	.	T	C	C	C	T	C	T	.	.	.	.	.	.	.	.	.
5	Anthoceros laevis	T	G	.	.	.	.	.	A	C	C	T	C	A	.	T	C	C	T	A	C	.	.	.	.	.	.	.	.	.	.
6	Pellia epiphylla	T	C	.	.	.	.	.	.	C	T	T	C	C	.	T	C	T	C	T	T	.	.	.	.	.	.	.	.	.	.
7	Reboulia hemisphaerica	T	C	.	.	.	.	C	T	T	C	T	C	T	.	C	C	T	T	.	.	.	.	.	.	.	.	.	.	.	.
8	Riccardia pinguis	T	C	.	.	.	.	.	.	T	C	C	C	C	G	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.	.
9	Sphaerocarpos donnellii	.	C	.	.	.	.	.	C	G	A	C	T	C	.	T	C	T	C	T	T	T	T	.	.	.	.	.	.	.	.
10	Sphaerocarpus texanus	.	C	.	.	.	C	G	G	C	G	C	C	T	.	C	T	C	T	T	T	.	.	.	.	.	.	.	.	.	.
11	Atrichum undulatum	T	C	.	.	.	.	.	T	C	T	C	C	A	.	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.	.
12	Bryum argenteum	T	C	.	.	.	.	.	C	A	C	C	C	G	.	A	C	C	T	T	G	T	T	T	.	.	.	.	.	.	.
13	Eurhynchium hians	T	C	.	.	.	.	.	C	A	C	C	C	G	.	A	.	C	C	T	T	T	.	.	.	.	.	.	.	.	.
14	Funaria hygrometrica	T	C	.	.	.	.	.	C	A	C	T	.	C	.	G	G	C	C	T	T	C	.	.	.	.	.	.	.	.	.
15	Leptobryum pyriforme	T	C	.	.	.	.	.	C	A	C	C	.	C	.	G	A	C	C	T	T	T	.	.	.	.	.	.	.	.	.
16	Mnium hornum	T	C	.	.	.	.	.	C	A	C	C	.	C	.	G	A	C	C	T	T	G	.	.	.	.	.	.	T	T	T
17	Physcomitrium pyriforme	T	C	.	.	.	.	.	C	A	C	T	C	G	.	G	C	C	T	.	.	.	.	.	.	.	.	.	.	.	.
18	Polytrichum formosum	T	C	.	.	.	.	.	T	C	T	C	C	.	.	G	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
19	Sphagnum cuspidatum	C	C	.	.	.	.	.	T	C	C	C	C	.	.	G	T	C	C	T	T	A	.	.	.	.	.	.	.	.	.
20	Calypogeia arguta	T	C	.	.	.	.	.	T	C	T	C	C	A	.	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.	.
21	Conocephalum conicum	G	G	.	.	.	.	.	.	G	T	C	T	T	.	C	T	T	T	T	G	T	A	T	.	.	.	.	.	.	.
22	Fossombronia pusilla	T	C	.	.	.	.	.	.	T	C	T	C	C	.	A	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
23	Marchantia polymorpha	C	G	.	.	.	.	.	.	G	C	C	C	C	.	T	T	T	C	T	T	T	.	.	.	.	.	.	.	.	.
24	Riccia fluitans	C	G	.	.	.	.	.	.	G	G	C	C	T	.	T	C	T	C	T	T	G	T	T	.	.	.	.	.	.	.
25	Scapania nemorea	T	C	.	.	.	.	.	.	T	C	T	C	C	.	A	C	C	C	T	T	.	.	.	.	.	.	.	.	.	.
26	Equisetum hyemale	T	C	.	.	.	.	.	.	G	C	T	C	C	.	G	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
27	Equisetum robustum	T	C	.	.	.	.	.	.	G	C	T	C	C	.	G	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
28	Isoetes engelmannii	G	C	.	.	.	.	.	.	A	T	T	T	C	.	A	C	C	C	T	T	.	.	.	.	.	.	.	.	.	.
29	Huperzia lucidulum	T	C	.	.	.	.	.	.	G	C	T	C	C	.	A	T	T	C	T	T	T	.	.	.	.	.	.	.	.	.
30	Lycopodiella inundatum	C	T	.	.	.	.	.	.	G	C	T	C	C	.	A	C	T	C	T	T	T	.	.	.	.	.	.	.	.	.
31	Lycopodium phlegmaria	T	C	.	.	.	.	.	.	G	C	T	C	C	.	A	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
32	Lycopodium taxifolium	T	C	.	.	.	.	.	.	G	C	T	C	C	.	A	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
33	Lycopodium tristachyum	T	C	.	.	.	.	.	.	G	C	T	C	C	.	A	T	T	C	T	T	T	.	.	.	.	.	.	.	.	.
34	Selaginella umbrosa	C	C	.	.	.	.	.	.	C	C	G	T	C	.	A	C	C	C	T	T	T	.	.	.	.	.	.	.	.	.
35	Selaginella vogelii	T	C	.	.	.	.	.	.	G	C	T	C	C	.	A	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
36	Oryza sativa	.	.	.	.	.	.	.	.	.	C	C	T	G	.	C	T	C	G	A	C	C	C	T	T	.	.	.	.	.	.
37	Zea mays	C	C	.	.	.	.	.	.	G	G	C	T	C	G	A	C	C	C	T	T	.	.	.	.	.	.	.	.	.	.
38	Arabidopsis thaliana	T	C	.	.	.	.	.	.	G	G	C	T	T	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
39	Glycine max	T	C	.	.	.	.	.	.	G	G	C	T	C	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
40	Sinapis alba	T	C	.	.	.	.	.	.	G	G	C	T	T	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
41	Zamia pumila	C	C	.	.	.	.	.	.	G	T	T	T	C	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
42	Gnetum leyboldii	C	C	.	.	.	.	.	.	G	C	T	C	C	.	G	T	T	C	C	T	T	.	.	.	.	.	.	.	.	.
43	Ginkgo biloba	C	C	.	.	.	.	.	.	G	C	T	C	C	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
44	Pinus luchuensis	C	C	.	.	.	.	.	.	C	T	T	C	C	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
45	Pinus wallichiana	C	C	.	.	.	.	.	.	C	T	T	C	C	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
46	Nageia nagi	C	A	.	.	.	.	.	.	C	T	C	G	C	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
47	Taxus mairei	C	C	.	.	.	.	.	.	C	T	C	A	C	.	G	T	C	C	C	T	T	.	.	.	.	.	.	.	.	.
48	Adiantum raddianum	T	C	.	.	.	.	.	.	G	C	T	C	C	.	G	C	C	C	T	T	T	.	.	.	.	.	.	.	.	.
49	Adiantum raddianum 2	T	C	.	.	.	.	.	.	G	C	T	C	C	.	G	C	C	C	T	T	T	.	.	.	.	.	.	.	.	.
50	Ophioglossum petiolatum	G	C	.	.	.	.	.	.	G	C	T	C	C	.	G	C	C	C	T	T	T	.	.	.	.	.	.	.	.	.
51	Osmunda cinnamomea	T	.	.	.	.	.	.	.	C	C	T	G	C	.	A	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
52	Salvinia natans	T	T	.	.	.	.	.	.	G	C	C	T	C	.	G	C	C	C	T	T	T	.	.	.	.	.	.	.	.	.
53	Psilotum nudum	T	C	G	.	.	.	.	.	C	T	C	.	C	.	G	T	C	C	T	T	C	.	.	.	.	.	.	.	.	.
54	Chara foetida	C	C	.	.	.	.	.	.	C	T	T	T	C	.	G	C	C	T	T	T	C	.	.	.	.	.	.	.	.	.
55	Coleochaete scutata	T	T	.	.	.	.	.	.	T	C	T	C	C	.	A	T	C	C	T	T	C	.	.	.	.	.	.	.	.	.
56	Klebsormidium flaccidum	C	C	.	.	.	.	.	.	G	A	C	C	C	.	A	T	C	C	T	T	C	.	.	.	.	.	.	.	.	.
57	Nitella flexilis	C	C	.	.	.	.	.	.	C	T	T	C	C	.	G	C	C	T	C	T	C	.	.	.	.	.	.	.	.	.
58	Nitella sp.	C	C	.	.	.	.	.	.	C	T	T	C	C	.	G	C	C	T	C	T	C	.	.	.	.	.	.	.	.	.
59	Chlamydomonas reinhardtii	T	C	.	.	.	.	.	.	T	G	C	T	C	.	C	A	C	C	T	T	C	.	.	.	.	.	.	.	.	.
60	Hydrodictyon reticulatum	T	A	.	.	.	.	.	.	T	G	G	C	C	.	C	T	C	C	T	T	T	.	.	.	.	.	.	.	.	.
61	Parietochloris pseudoalveolaris	C	G	.	.	.	.	.	.	T	G	G	C	C	.	C	A	C	C	T	T	G	.	.	.	.	.	.	.	.	.
62	Dictyostelium discoideum	.	C	G	A	C	.	A	C	C	G	G	T	A	.	.	T	C	T	C	T	T	T	C	T	T	A	A	.	.	.
63	Pteris vittata	T	C	.	.	.	.	.	G	C	T	C	C	.	.	G	C	C	C	T	T	T	.	.	.	.	.	.	.	.	.
64	Megaceros aenigmaticus	T	G	.	.	.	.	.	A	C	T	C	C	A	.	?	T	C	C	T	T	.	.	.	.	.	.	.	.	.	.
65	Notothylas breutelii	.	G	.	.	.	.	.	A	C	C	T	C	A	.	C	C	C	C	T	.	.	.	.	.	.	.	.	.	.	.
66	Physcomitrella patens	T	C	.	.	.	.	.	C	A	C	T	C	G	.	G	C	C	T	T	C	T	.	.	.	.	.	.	.	.	.
67	Sphagnum palustre	C	C	.	.	.	.	.	T	C	C	.	C	C	.	G	T	C	C	T	T	A	.	.	.	.	.	.	.	.	.

Positions 841–855

	Taxa with Variability Info 20	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855
		0.	1.	2.	2.	2	2.	6.	6.	2.	3.	0.				
1	Saccharomyces cerevisiae	.	.	T	T	C	T	G	G	C	T	.	.	.	.	.
2	Schizosaccharomyces pombe	.	C	T	T	C	T	G	G	C	A	.	.	.	.	.
3	Physcomitrella patens 2	.	.	T	G	C	C	G	G	G	G	.	.	.	.	.
4	Anthoceros agrestis	.	.	G	G	T	C	G	G	G	G	.	.	.	.	.
5	Anthoceros laevis	.	C	G	G	T	C	G	G	G	G	.	.	.	.	.
6	Pellia epiphylla	T	T	G	G	T	C	G	G	G	G	.	.	.	.	.
7	Reboulia hemisphaerica	T	C	G	G	T	C	G	G	G	G	.	.	.	.	.
8	Riccardia pinguis	.	C	G	G	T	C	G	G	G	G	.	.	.	.	.
9	Sphaerocarpos donnellii	.	T	G	G	C	C	G	G	G	G	.	.	.	.	.
10	Sphaerocarpus texanus	.	T	G	G	C	C	G	G	G	G	.	.	.	.	.
11	Atrichum undulatum	.	T	G	G	T	C	G	G	G	G	.	.	.	.	.
12	Bryum argenteum	.	C	T	G	C	C	G	G	G	G	.	.	.	.	.
13	Eurhynchium hians	.	C	T	G	C	C	G	C	G	G	.	.	.	.	.
14	Funaria hygrometrica	.	T	T	G	C	C	G	G	G	G	.	.	.	.	.
15	Leptobryum pyriforme	.	C	T	G	C	C	G	G	G	G	.	.	.	.	.
16	Mnium hornum	T	C	T	G	C	C	G	G	G	G	.	.	.	.	.
17	Physcomitrium pyriforme	C	T	T	G	C	C	G	G	G	G	.	.	.	.	.
18	Polytrichum formosum	.	T	G	G	T	C	G	G	G	G	.	.	.	.	.
19	Sphagnum cuspidatum	.	G	T	G	C	C	G	G	G	G	.	.	.	.	.
20	Calypogeia arguta	.	T	G	G	T	C	G	G	G	G	.	.	.	.	.
21	Conocephalum conicum	.	A	T	G	C	C	G	G	G	G	.	.	.	.	.
22	Fossombronia pusilla	.	T	G	G	T	C	G	[illegible]	G	G	.	.	.	.	.
23	Marchantia polymorpha	T	T	G	G	C	C	G	G	G	G	.	.	.	.	.
24	Riccia fluitans	T	C	T	G	C	C	G	G	G	G	.	.	.	.	.
25	Scapania nemorea	T	T	G	G	T	C	G	G	G	G	.	.	.	.	.
26	Equisetum hyemale	.	C	T	G	T	C	G	G	G	G	.	.	.	.	.
27	Equisetum robustum	.	C	T	G	T	C	G	G	G	G	.	.	.	.	.
28	Isoetes engelmannii	C	T	A	G	T	T	G	G	C	G	.	.	.	.	.
29	Huperzia lucidula	.	T	G	G	T	C	G	G	G	G	.	.	.	.	.
30	Lycopodiella inundatum	.	T	G	G	C	C	G	G	G	G	.	.	.	.	.
31	Lycopodium phlegmaria	.	T	G	G	T	C	G	G	G	G	.	.	.	.	.
32	Lycopodium taxifolium	.	T	G	G	T	C	G	G	G	G	.	.	.	.	.
33	Lycopodium tristachyum	.	T	G	G	T	C	G	G	G	G	.	.	.	.	.
34	Selaginella umbrosa	.	T	A	G	C	C	G	G	G	G	.	.	.	.	.
35	Selaginella vogelii	.	G	A	G	T	C	G	G	T	G	.	.	.	.	.
36	Oryza sativa	.	C	T	G	C	C	G	G	C	G	.	.	.	.	.
37	Zea mays	.	C	T	G	C	C	G	G	C	G	.	.	.	.	.
38	Arabidopsis thaliana	.	C	G	G	T	C	G	G	C	G	.	.	.	.	.
39	Glycine max	.	C	T	G	C	C	G	G	C	G	.	.	.	.	.
40	Sinapis alba	.	C	T	G	T	C	G	G	C	G	.	.	.	.	.
41	Zamia pumila	.	T	T	G	T	T	G	G	C	G	.	.	.	.	.
42	Gnetum leyboldii	.	C	T	G	T	C	G	G	C	G	.	.	.	.	.
43	Ginkgo biloba	.	C	T	G	C	C	G	G	C	G	.	.	.	.	.
44	Pinus luchuensis	.	T	T	G	T	C	G	G	C	G	.	.	.	.	.
45	Pinus wallichiana	.	T	T	G	T	C	G	G	C	G	.	.	.	.	.
46	Nageia nagi	.	C	T	G	C	C	G	G	C	G	.	.	.	.	.
47	Taxus mairei	.	C	T	G	C	C	G	G	C	G	.	.	.	.	.
48	Adiantum raddianum	.	C	T	G	T	C	G	G	G	G	.	.	.	.	.
49	Adiantum raddianum 2	.	C	T	G	T	C	G	G	G	G	.	.	.	.	.
50	Ophioglossum petiolatum	.	C	T	G	C	C	G	G	G	G	.	.	.	.	.
51	Osmunda cinnamomea	.	C	T	G	T	C	G	G	G	G	.	.	.	.	.
52	Salvinia natans	.	C	T	G	T	C	G	G	G	G	.	.	.	.	.
53	Psilotum nudum	.	C	T	G	C	C	G	G	G	G	.	.	.	.	.
54	Chara foetida	.	T	T	G	C	C	G	G	G	G	.	.	.	.	.
55	Coleochaete scutata	.	T	T	G	T	C	G	G	G	G	.	.	.	.	.
56	Klebsormidium flaccidum	.	T	T	G	C	C	G	G	G	G	.	.	.	.	.
57	Nitella flexilis	.	T	T	G	C	C	G	G	G	G	.	.	.	.	.
58	Nitella sp.	.	T	T	G	C	C	G	G	G	G	.	.	.	.	.
59	Chlamydomonas reinhardtii	.	C	T	G	C	C	G	G	G	G	.	.	.	.	.
60	Hydrodictyon reticulatum	.	C	T	G	C	C	G	G	G	G	.	.	.	.	.
61	Paristochloris pseudoalveolaris	.	C	T	G	C	C	G	G	G	G	.	.	.	.	.
62	Dictyostelium discoideum	T	A	G	T	T	C	A	G	C	T	T	.	.	.	.
63	Pteris vittata	.	C	T	G	T	C	G	G	G	G	.	.	.	.	.
64	Megaceros aenigmaticus	C	T	G	G	T	C	G	G	G	G	.	.	.	.	.
65	Notothylas breutelii	C	T	C	C	T	C	G	G	G	.	.	.	.	.	.
66	Physcomitrella patens	.	.	T	G	C	C	G	G	G	G	.	.	.	.	.
67	Sphagnum palustre	.	G	T	G	C	C	G	G	G	G	.	.	.	.	.

Positions 856–870

	Taxa with Variability Info 20	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870
										4.	2.	2.	1.	0	2	3.
1	Saccharomyces cerevisiae	.	.	.	.	.	.	.	.	A	A	C	C	.	T	.
2	Schizosaccharomyces pombe	.	.	.	.	.	.	.	.	A	A	C	T	.	A	C
3	Physcomitrella patens 2	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
4	Anthoceros agrestis	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
5	Anthoceros laevis	.	.	.	.	.	.	.	.	A	C	G	C	.	G	.
6	Pellia epiphylla	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
7	Reboulia hemisphaerica	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
8	Riccardia pinguis	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
9	Sphaerocarpos donnellii	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
10	Sphaerocarpus texanus	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
11	Atrichum undulatum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
12	Bryum argenteum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
13	Eurhynchium hians	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
14	Funaria hygrometrica	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
15	Leptobryum pyriforme	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
16	Mnium hornum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
17	Physcomitrium pyriforme	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
18	Polytrichum formosum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
19	Sphagnum cuspidatum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
20	Calypogeia arguta	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
21	Conocephalum conicum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
22	Fossombronia pusilla	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
23	Marchantia polymorpha	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
24	Riccia fluitans	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
25	Scapania nemorea	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
26	Equisetum hyemale	.	.	.	.	.	.	.	.	A	C	G	C	.	A	C
27	Equisetum robustum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
28	Isoetes engelmannii	.	.	.	.	.	.	.	.	A	C	G	T	.	T	G
29	Huperzia lucidula	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
30	Lycopodiella inundatum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
31	Lycopodium phlegmaria	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
32	Lycopodium taxifolium	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
33	Lycopodium tristachyum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
34	Selaginella umbrosa	.	.	.	.	.	.	.	.	A	C	G	T	.	G	.
35	Selaginella vogelii	.	.	.	.	.	.	.	.	A	C	G	C	T	G	.
36	Oryza sativa	.	.	.	.	.	.	.	.	A	T	G	C	.	G	C
37	Zea mays	.	.	.	.	.	.	.	.	A	T	G	C	.	G	C
38	Arabidopsis thaliana	.	.	.	.	.	.	.	.	A	T	A	C	.	G	C
39	Glycine max	.	.	.	.	.	.	.	.	A	T	G	C	.	G	C
40	Sinapis alba	.	.	.	.	.	.	.	.	A	T	A	C	.	G	C
41	Zamia pumila	.	.	.	.	.	.	.	.	G	C	G	C	.	G	C
42	Gnetum leyboldii	.	.	.	.	.	.	.	.	A	C	G	C	.	G	G
43	Ginkgo biloba	.	.	.	.	.	.	.	.	G	C	G	C	.	G	C
44	Pinus luchuensis	.	.	.	.	.	.	.	.	G	C	G	T	.	G	C
45	Pinus wallichiana	.	.	.	.	.	.	.	.	G	C	G	T	.	G	C
46	Nageia nagi	.	.	.	.	.	.	.	.	G	C	G	C	.	G	T
47	Taxus mairei	.	.	.	.	.	.	.	.	G	C	G	T	.	G	C
48	Adiantum raddianum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
49	Adiantum raddianum 2	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
50	Ophioglossum petiolatum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
51	Osmunda cinnamomea	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
52	Salvinia natans	.	.	.	.	.	.	.	.	C	C	G	C	.	G	C
53	Psilotum nudum	.	.	.	.	.	.	.	.	A	C	G	C	.	G	G
54	Chara foetida	.	.	.	.	.	.	.	.	A	T	G	T	.	G	T
55	Coleochaete scutata	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
56	Klebsormidium flaccidum	.	.	.	.	.	.	.	.	A	C	?	C	.	G	C
57	Nitella flexilis	.	.	.	.	.	.	.	.	A	C	G	T	.	G	C
58	Nitella sp.	.	.	.	.	.	.	.	.	A	C	G	T	.	G	C
59	Chlamydomonas reinhardtii	.	.	.	.	.	.	.	.	A	C	G	G	.	G	C
60	Hydrodictyon reticulatum	.	.	.	.	.	.	.	.	A	C	G	A	.	G	T
61	Paristochloris pseudoalveolaris	.	.	.	.	.	.	.	.	A	C	G	G	.	G	C
62	Dictyostelium discoideum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
63	Pteris vittata	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
64	Megaceros aenigmaticus	.	.	.	.	.	.	.	.	A	C	G	A	T	G	C
65	Notothylas breutelii	.	.	.	.	.	.	.	.	A	G	C	A	T	G	C
66	Physcomitrella patens	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C
67	Sphagnum palustre	.	.	.	.	.	.	.	.	A	C	G	C	.	G	C

Taxa with Variability Info	30	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900
		0.	2.	2.	3.	3	3.	3	1.	4.	3.	4.	1.	2.	1.	3.	0.	0.	5.	1.	2.	2.	3.	2.	4.	1.		0.	2	2	2
1	Saccharomyces cerevisiae	.	.	T	.	G	A	G	T	C	C	T	T	G	T	.	.	.	G	G	C	T	C	T	.	.	.	.	T	G	G
2	Schizosaccharomyces pombe	T	C	A	.	T	G	T	T	C	T	T	T	A	T	T	.	.	G	A	G	C	G	T	G	G	.	.	T	A	G
3	Physcomitrella patens 2	.	T	C	C	T	G	G	T	T	T	T	A	A	T	T	.	.	A	A	T	C	G	G	G	A	.	.	C	G	C
4	Anthoceros agrestis	.	T	C	C	T	G	G	T	C	T	T	A	A	T	T	.	.	G	C	C	T	G	G	G	A	.	.	C	G	C
5	Anthoceros laevis	.	T	T	C	T	G	G	T	C	T	T	A	A	C	T	.	.	G	G	C	C	G	G	G	A	.	.	C	G	C
6	Pellia epiphylla	.	T	C	C	T	G	G	T	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	T
7	Reboulia hemisphaerica	.	C	C	C	T	T	G	C	T	T	T	A	A	C	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
8	Riccardia pinguis	.	T	C	C	T	G	G	C	C	T	T	G	A	C	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
9	Sphaerocarpos donnellii	.	T	T	C	T	G	G	C	C	T	T	C	G	T	T	.	.	G	G	T	C	G	G	G	A	.	.	T	G	C
10	Sphaerocarpus texanus	.	T	C	C	.	G	G	C	C	T	T	C	G	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
11	Atrichum undulatum	.	T	C	C	T	G	G	T	C	T	T	A	A	C	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
12	Bryum argenteum	.	T	C	C	T	G	G	C	C	T	T	C	G	C	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C
13	Eurhynchium hians	.	T	C	A	T	G	C	C	C	T	T	C	G	C	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C
14	Funaria hygrometrica	.	T	C	C	T	G	G	T	T	T	T	A	A	C	T	.	.	A	A	T	C	G	G	G	A	.	.	C	G	C
15	Leptobryum pyriforme	.	T	C	C	T	G	G	C	C	T	T	C	G	C	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C
16	Mnium hornum	.	T	C	C	T	G	G	C	C	T	T	C	G	C	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C
17	Physcomitrium pyriforme	.	T	C	C	T	G	G	T	T	T	T	A	A	T	T	.	.	A	A	T	C	G	G	G	A	.	.	C	G	C
18	Polytrichum formosum	.	T	C	C	T	G	G	C	C	T	T	G	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
19	Sphagnum cuspidatum	.	T	C	C	T	G	G	C	C	T	T	G	A	C	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C
20	Calypogeia arguta	.	T	C	C	T	G	G	T	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
21	Conocephalum conicum	.	G	C	C	T	G	G	C	C	T	T	G	A	C	T	.	.	G	G	T	C	G	G	G	C	.	.	C	G	C
22	Fossombronia pusilla	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
23	Marchantia polymorpha	.	G	T	C	T	G	G	C	C	T	T	G	A	C	T	.	.	G	G	T	C	G	G	G	C	.	.	C	G	C
24	Riccia fluitans	.	G	T	C	T	G	G	C	C	T	T	G	A	T	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C
25	Scapania nemorea	.	T	C	C	T	G	G	T	C	T	T	A	A	C	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
26	Equisetum hyemale	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	T	C	C	G	G	G	A	.	.	C	G	C
27	Equisetum robustum	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	T	C	C	G	G	G	A	.	.	C	G	C
28	Isoetes engelmannii	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
29	Huperzia lucidulum	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
30	Lycopodiella inundatum	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
31	Lycopodium phlegmaria	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
32	Lycopodium taxifolium	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
33	Lycopodium tristachyum	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
34	Selaginella umbrosa	.	T	C	C	T	G	G	A	C	T	T	C	A	C	T	.	.	G	A	C	T	G	G	G	G	.	.	C	A	T
35	Selaginella vogelii	.	C	C	C	T	G	G	A	C	T	T	T	A	C	T	.	.	G	G	C	T	G	G	G	G	.	.	C	G	C
36	Oryza sativa	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	G	C	C	G	G	G	T	.	T	C	G	T
37	Zea mays	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	G	C	C	G	G	G	T	.	.	C	G	T
38	Arabidopsis thaliana	.	T	C	C	T	G	G	T	C	T	T	A	A	T	T	.	.	G	G	C	C	G	G	G	T	.	.	C	G	T
39	Glycine max	.	T	C	C	T	G	T	C	C	T	T	A	A	C	T	.	.	G	G	C	C	G	G	G	T	.	.	C	G	T
40	Sinapis alba	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	C	G	G	G	T	.	.	C	G	T
41	Zamia pumila	.	A	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	T	C	T	G	G	G	T	.	.	C	G	C
42	Gnetum leyboldii	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	T	.	.	C	G	C
43	Ginkgo biloba	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	T	.	.	C	G	C
44	Pinus luchuensis	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	T	.	.	C	G	C
45	Pinus wallichiana	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	G	C	T	G	G	G	T	.	.	C	G	C
46	Nageia nagi	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	G	T	C	G	G	G	T	.	.	C	G	C
47	Taxus mairei	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	T	C	T	G	G	G	T	.	.	C	G	C
48	Adiantum raddianum	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	.
49	Adiantum raddianum 2	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
50	Ophioglossum petiolatum	.	T	C	C	T	G	G	C	C	T	T	A	G	G	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
51	Osmunda cinnamomea	.	T	C	C	T	G	G	C	C	T	T	A	A	C	T	.	.	G	T	T	C	G	G	G	A	.	.	C	G	C
52	Salvinia natans	.	T	C	C	T	G	G	C	C	T	T	C	A	T	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C
53	Psilotum nudum	.	C	C	C	T	G	G	C	C	T	T	C	G	C	T	.	.	G	G	C	T	G	G	G	G	.	.	C	G	C
54	Chara foetida	.	T	C	C	T	T	G	C	C	.	T	T	T	A	C	T	.	G	G	C	C	G	G	G	A	.	.	T	C	C
55	Coleochaete scutata	.	T	T	C	T	T	G	C	C	.	T	T	A	A	C	T	.	G	G	C	T	G	G	G	A	.	.	C	G	T
56	Klebsormidium flaccidum	.	T	C	C	T	G	G	C	C	.	T	T	A	A	C	T	.	G	G	T	C	G	G	G	A	.	.	C	G	T
57	Nitella flexilis	.	T	C	C	T	C	G	C	C	.	T	T	C	A	T	T	.	G	G	C	C	G	G	G	A	.	.	C	G	C
58	Nitella sp.	.	T	C	C	T	C	G	C	C	.	T	T	C	A	T	T	.	G	G	C	C	G	G	G	A	.	.	C	G	C
59	Chlamydomonas reinhardtii	.	T	C	C	T	G	G	G	C	.	T	T	C	A	C	T	.	G	T	C	T	G	G	G	A	.	.	C	T	C
60	Hydrodictyon reticulatum	.	T	G	C	T	G	G	G	C	.	T	T	C	A	C	T	.	G	T	C	C	G	G	T	G	.	.	C	T	T
61	Parietochloris pseudoalveolaris	.	T	C	C	T	G	G	G	C	.	T	T	C	A	C	T	.	G	T	C	C	G	G	G	A	.	.	C	T	C
62	Dictyostelium discoideum	.	G	T	A	T	T	A	T	C	T	T	T	.	.	.	.	.	G	A	T	A	G	T	G	C	.	.	.	T	T
63	Pteris vittata	.	T	C	C	T	G	G	C	C	T	T	A	A	T	T	.	.	G	G	C	T	G	G	G	A	.	.	C	G	C
64	Megaceros aenigmaticus	.	T	C	C	T	G	G	A	C	T	A	A	A	C	T	.	.	G	C	C	T	G	G	G	A	.	.	C	G	C
65	Notothylas breutelii	.	T	C	C	T	G	T	T	C	T	A	.	C	C	T	T	A	G	C	T	T	G	G	T	A	.	.	C	G	G
66	Physcomitrella patens	.	T	C	C	T	G	G	T	T	T	T	A	A	T	T	.	.	A	A	T	C	G	G	G	A	.	.	C	G	C
67	Sphagnum palustre	.	T	C	C	T	G	G	C	C	T	T	G	A	C	T	.	.	G	G	T	C	G	G	G	A	.	.	C	G	C

	Taxa with Variability Info 31	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030
		3	3.	3	1.	2	0.	6.	3.	3.	2.	2.	1.	2.	2.	6.	4.	5.	6.	3.	4.	6.	0	6.	6.	3.	3	6.	6	6	6.
1	Saccharomyces cerevisiae	C	G	A	A	C	.	C	A	G	G	A	C	T	T	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
2	Schizosaccharomyces pombe	G	G	A	A	C	.	C	A	G	G	A	C	T	T	T	T	A	C	C	T	T	.	G	A	A	A	A	A	A	T
3	Physcomitrella patens 2	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
4	Anthoceros agrestis	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
5	Anthoceros laevis	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	C	A	C	T	C	T	.	G	A	A	A	A	A	A	T
6	Pellia epiphylla	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
7	Reboulia hemisphaerica	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	G	A	A	A	A	T
8	Riccardia pinguis	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
9	Sphaerocarpos donnellii	G	G	A	G	T	.	C	G	G	C	G	A	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
10	Sphaerocarpus texanus	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	G	A	A	A	A	T
11	Atrichum undulatum	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
12	Bryum argenteum	G	G	A	G	T	.	C	G	G	C	G	A	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
13	Eurhynchium hians	G	G	A	G	T	.	C	G	G	C	C	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
14	Funaria hygrometrica	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
15	Leptobryum pyriforme	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
16	Mnium hornum	G	G	A	G	T	.	C	G	G	C	G	A	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
17	Physcomitrium pyriforme	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
18	Polytrichum formosum	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
19	Sphagnum cuspidatum	G	G	A	T	T	.	C	G	G	C	G	A	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
20	Calypogeia arguta	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
21	Conocephalum conicum	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
22	Fossombronia pusilla	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
23	Marchantia polymorpha	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
24	Riccia fluitans	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
25	Scapania nemorea	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
26	Equisetum hyemale	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
27	Equisetum robustum	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
28	Isoetes engelmannii	C	G	A	G	C	.	C	G	G	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
29	Huperzia lucidulum	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
30	Lycopodiella inundatum	G	G	A	G	T	.	C	G	G	C	G	A	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
31	Lycopodium phlegmaria	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
32	Lycopodium taxifolium	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
33	Lycopodium tristachyum	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
34	Selaginella umbrosa	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
35	Selaginella vogelii	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	C	T	T	.	G	A	A	A	A	A	A	T
36	Oryza sativa	G	C	C	T	C	.	C	G	G	C	G	C	C	G	T	T	A	C	T	T	T	.	G	A	A	G	A	A	A	T
37	Zea mays	G	C	C	T	C	.	C	G	G	.	G	C	C	G	T	T	A	C	T	T	T	.	G	A	A	G	A	A	A	T
38	Arabidopsis thaliana	G	C	C	T	C	.	C	G	G	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	G	A	A	A	T
39	Glycine max	G	C	C	T	C	.	C	G	G	T	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	G	A	A	A	T
40	Sinapis alba	G	C	C	T	C	.	C	G	G	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	G	A	A	A	T
41	Zamia pumila	G	G	T	T	C	.	C	G	A	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
42	Gnetum leyboldii	G	G	C	T	T	.	C	G	A	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
43	Ginkgo biloba	G	G	C	T	C	.	C	G	G	C	G	C	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
44	Pinus luchuensis	G	G	T	T	C	.	C	G	G	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
45	Pinus wallichiana	G	G	C	T	C	.	C	G	G	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
46	Nageia nagi	G	G	T	T	C	.	C	G	G	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
47	Taxus mairei	G	G	T	T	C	.	C	G	G	C	G	C	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
48	Adiantum raddianum	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
49	Adiantum raddianum 2	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
50	Ophioglossum petiolatum	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	?	?	?	A	A	T
51	Osmunda cinnamomea	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
52	Salvinia natans	G	T	A	C	T	.	C	G	A	T	T	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
53	Psilotum nudum	G	G	A	T	T	.	C	G	G	C	G	A	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
54	Chara foetida	A	G	A	G	C	.	C	G	G	C	G	C	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
55	Coleochaete scutata	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
56	Klebsormidium flaccidum	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
57	Nitella flexilis	G	G	A	G	C	.	C	G	G	C	G	C	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
58	Nitella sp.	G	G	A	G	C	.	C	G	G	C	G	C	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
59	Chlamydomonas reinhardtii	G	G	A	G	T	.	C	G	G	C	G	A	G	G	T	T	A	C	T	T	T	.	G	A	G	T	A	A	A	T
60	Hydrodictyon reticulatum	G	G	A	G	T	.	C	G	G	C	G	T	T	G	T	T	A	C	T	T	T	.	G	A	G	T	A	A	A	T
61	Parietochloris pseudoalveolaris	G	G	A	G	T	.	C	G	G	C	G	A	G	G	T	T	A	C	T	T	T	.	G	A	G	T	A	A	A	T
62	Dictyostelium discoideum	G	.	.	T	T	.	T	G	G	A	C	A	T	T	T	C	A	C	T	G	T	.	G	A	G	A	A	A	A	T
63	Pteris vittata	G	G	A	T	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
64	Megaceros aenigmaticus	G	G	A	G	T	.	C	G	A	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
65	Notothylas breutelii	G	G	A	G	T	G	C	G	A	C	G	A	T	G	T	T	T	C	T	T	T	G	G	A	A	A	A	A	A	T
66	Physcomitrella patens	G	G	A	G	T	.	C	G	G	C	G	A	T	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T
67	Sphagnum palustre	G	G	A	T	T	.	C	G	G	C	G	A	C	G	T	T	A	C	T	T	T	.	G	A	A	A	A	A	A	T

Taxa with Variability Info	32	031	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047	048	049	050	051	052	053	054	055	056	057	058	059	060
		8.	4.	0.	8.	6.	6.	6.	0.	5.	2.	8.	0.	8.	8.	6.	8.	0.	8.	5.	8.	1.	5.	8.	0	0.	0.	0	2	2	2
1	Saccharomyces cerevisiae	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	G	.	.	.	.	T	A
2	Schizosaccharomyces pombe	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	A	A	.	.	.	G	T
3	Physcomitrella patens 2	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
4	Anthoceros agrestis	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	T	G	C	.	.	.	C	T	T	A
5	Anthoceros laevis	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
6	Pellia epiphylla	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
7	Rebouila hemisphaerica	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	A	T
8	Riccardia pinguis	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
9	Sphaerocarpos donnelli	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
10	Sphaerocarpus texanus	T	A	.	G	A	G	T	.	G	C	T	.	C	A	.	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
11	Atrichum undulatum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
12	Bryum argenteum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
13	Eurhynchium hians	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
14	Funaria hygrometrica	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
15	Leptobryum pyriforme	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
16	Mnium hornum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
17	Physcomitrium pyriforme	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
18	Polytrichum formosum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
19	Sphagnum cuspidatum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
20	Calypogeia arguta	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
21	Conocephalum conicum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	C	A	T	T	A
22	Fossombronia pusilla	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
23	Marchantia polymorpha	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	C	A	T	A
24	Riccia fluitans	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	C	G	T	A
25	Scapania nemorea	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
26	Equisetum hyemale	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	G
27	Equisetum robustum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	G
28	Isoetes engelmannii	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
29	Huperzia lucidulum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
30	Lycopodiella inundatum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
31	Lycopodium phlegmaria	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
32	Lycopodium taxifolium	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
33	Lycopodium tristachyum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
34	Selaginella umbrosa	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	A	A	T
35	Selaginella vogelii	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	T	C	C
36	Oryza sativa	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	A	T
37	Zea mays	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	A	T
38	Arabidopsis thaliana	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
39	Glycine max	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
40	Sinapis alba	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
41	Zamia pumila	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	T	T	A
42	Gnetum leyboldi	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
43	Ginkgo biloba	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
44	Pinus luchuensis	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	T	T	A
45	Pinus wallichiana	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	T	T	A
46	Nageia nagi	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
47	Taxus mairei	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
48	Adiantum raddianum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
49	Adiantum raddianum 2	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
50	Ophioglossum petiolatum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
51	Osmunda cinnamomea	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
52	Salvinia natans	T	G	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	G
53	Psilotum nudum	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	G
54	Chara foetida	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	G
55	Coleochaete scutata	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	A	T	A
56	Klebsormidium flaccidum	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
57	Nitella flexilis	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	C	A
58	Nitella sp.	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	C	A
59	Chlamydomonas reinhardtii	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
60	Hydrodictyon reticulatum	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	A	T	A
61	Parietochloris pseudoalveolaris	T	A	.	G	A	G	T	.	G	T	T	.	C	A	A	A	.	G	C	A	G	G	C	.	.	.	.	C	T	A
62	Dictyostelium discoideum	T	G	.	T	G	G	T	.	G	T	T	T	.	A	A	A	.	G	C	A	G	G	C	G	.	.	.	.	T	C
63	Pteris vittata	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
64	Megaceros aenigmaticus	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	C	T	C	A
65	Notothylas breutelu	T	A	G	G	A	G	T	T	.	C	T	.	C	A	A	A	G	G	A	A	G	C	.	.	.	C	A	T	C	A
66	Physcomitrella patens	T	A	.	G	A	G	T	.	G	C	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A
67	Sphagnum palustre	T	A	.	G	A	G	T	.	A	A	T	.	C	A	A	A	.	G	C	A	A	G	C	.	.	.	.	C	T	A

	Taxa with Variability Info 33	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990
		2	0.	0.	0.	6	5.	4.	8.	3.	6.	4.	4.	0.	6.	6.	3.	0.	4.	8.	4.		6.	6.	0.	5.	6	8.	6	5	3.
1	Saccharomyces cerevisiae	T	.	.	T	G	C	T	.	C	G	A	A	.	T	A	T	.	A	T	T	.	A	G	.	C	A	T	G	G	A
2	Schizosaccharomyces pombe	T	.	T	T	G	C	T	.	C	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
3	Physcomitrella patens 2	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
4	Anthoceros agrestis	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
5	Anthoceros laevis	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
6	Pellia epiphylla	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
7	Reboulia hemisphaerica	A	C	.	.	G	C	.	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
8	Riccardia pinguis	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
9	Sphaerocarpos donnellii	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
10	Sphaerocarpus texanus	C	.	.	.	G	T	.	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
11	Atrichum undulatum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
12	Bryum argenteum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
13	Eurhynchium hians	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	A	A
14	Funaria hygrometrica	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
15	Leptobryum pyriforme	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
16	Mnium hornum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
17	Physcomitrium pyriforme	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
18	Polytrichum formosum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
19	Sphagnum cuspidatum	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	G
20	Calypogeia arguta	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
21	Conocephalum conicum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
22	Fossombronia pusilla	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
23	Marchantia polymorpha	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
24	Riccia fluitans	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
25	Scapania nemorosa	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
26	Equisetum hyemale	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
27	Equisetum robustum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
28	Isoetes engelmannii	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
29	Huperzia lucidulum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
30	Lycopodiella inundatum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
31	Lycopodium phlegmaria	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
32	Lycopodium taxifolium	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
33	Lycopodium tristachyum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
34	Selaginella umbrosa	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
35	Selaginella vogelii	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
36	Oryza sativa	C	.	.	.	G	C	T	C	T	G	G	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	G
37	Zea mays	C	.	.	.	G	C	T	C	T	G	G	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	G
38	Arabidopsis thaliana	C	.	.	.	G	C	T	C	T	G	G	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	G
39	Glycine max	C	.	.	.	G	C	T	C	T	G	T	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	G
40	Sinapis alba	C	.	.	.	G	C	T	C	T	G	T	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	G
41	Zamia pumila	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
42	Gnetum leyboldii	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
43	Ginkgo biloba	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
44	Pinus luchuensis	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
45	Pinus wallichiana	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
46	Nageia nagi	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
47	Taxus mairei	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
48	Adiantum raddianum	T	.	.	.	G	C	T	C	T	.	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
49	Adiantum raddianum 2	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
50	Ophioglossum petiolatum	C	.	.	.	G	C	T	?	T	G	A	A	.	T	A	C	.	G	T	T	.	A	G	.	C	A	T	G	G	A
51	Osmunda cinnamomea	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
52	Salvinia natans	T	.	.	.	G	C	T	C	T	G	A	A	.	C	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
53	Psilotum nudum	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	G	T	T	.	A	G	.	C	A	T	G	G	A
54	Chara foetida	T	.	.	.	G	C	T	C	T	G	A	A	.	C	A	T	.	A	T	T	.	A	G	.	C	A	T	G	G	A
55	Coleochaete scutata	G	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
56	Klebsormidium flaccidum	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
57	Nitella flexilis	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
58	Nitella sp.	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
59	Chlamydomonas reinhardtii	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
60	Hydrodictyon reticulatum	C	.	.	.	G	C	C	C	T	G	A	A	.	T	A	C	.	T	T	T	.	A	G	.	C	A	T	G	G	A
61	Parietochloris pseudoalveolaris	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
62	Dictyostelium discoideum	T	C	.	.	G	C	C	.	T	G	A	T	.	C	T	T	T	T	G	C	.	A	G	.	C	A	T	G	G	T
63	Pteris vittata	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
64	Megaceros aenigmaticus	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
65	Notothylas breutelii	T	.	.	.	G	C	T	C	T	.	A	A	T	T	A	C	.	A	T	.	A	A	G	A	.	A	T	G	G	A
66	Physcomitrella patens	T	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	A
67	Sphagnum palustre	C	.	.	.	G	C	T	C	T	G	A	A	.	T	A	C	.	A	T	T	.	A	G	.	C	A	T	G	G	G

Taxa with Variability Info	34	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020
		5		6.	4.	5.	2.	2.	0.	1.	1.	6.	3.	6.	6.	5.	6.	3.	2.	2.		0.	2.	8.	3.	4.	3.	4.	8	0	2
1	Saccharomyces cerevisiae	A	.	T	A	A	T	A	.	G	A	A	T	A	G	G	A	C	G	T	.	T	T	G	G	T	T	C	T	.	A
2	Schizosaccharomyces pombe	A	.	T	A	A	T	A	.	A	A	A	T	A	G	G	A	C	G	T	.	G	T	G	G	T	T	C	T	.	A
3	Physcomitrella patens 2	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
4	Anthoceros agrestis	A	.	T	A	A	C	G	.	G	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
5	Anthoceros laevis	A	.	T	G	A	C	G	.	T	A	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
6	Pellia epiphylla	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
7	Reboulia hemisphaerica	A	.	T	A	A	C	G	.	C	G	A	C	A	G	G	A	C	T	T	.	.	C	G	G	T	C	T	T	.	A
8	Riccardia pinguis	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	C	G	G	T	C	C	T	.	A
9	Sphaerocarpos donnellii	A	.	T	A	A	C	G	.	C	G	A	C	A	G	G	A	C	T	C	.	.	T	G	G	T	C	T	T	.	T
10	Sphaerocarpus texanus	A	.	T	A	A	C	G	.	C	G	.	C	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
11	Atrichum undulatum	A	.	T	A	A	C	G	.	A	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
12	Bryum argenteum	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	T
13	Eurhynchium hians	A	.	T	A	A	C	G	.	T	G	A	T	A	G	A	A	T	A	G	.	.	G	G	C	C	C	C	T	.	G
14	Funaria hygrometrica	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	G	T
15	Leptobryum pyriforme	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
16	Mnium hornum	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
17	Physcomitrium pyriforme	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
18	Polytrichum formosum	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
19	Sphagnum cuspidatum	A	.	T	A	G	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
20	Calypogeia arguta	A	.	T	A	A	C	G	.	T	T	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
21	Conocephalum conicum	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	T	.	.	C	G	G	T	C	T	T	.	A
22	Fossombronia pusilla	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
23	Marchantia polymorpha	A	.	T	A	A	C	G	.	C	G	A	C	A	G	G	A	C	T	C	.	.	T	G	G	T	C	T	T	.	A
24	Riccia fluitans	A	.	T	A	A	C	G	.	C	G	A	C	A	G	G	A	C	T	T	.	.	C	G	G	T	C	T	T	.	A
25	Scapania nemorosa	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
26	Equisetum hyemale	A	.	T	A	A	C	G	.	T	.	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
27	Equisetum robustum	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
28	Isoetes engelmannii	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	C	C	.	.	C	G	G	T	C	C	T	.	T
29	Huperzia lucidulum	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
30	Lycopodiella inundatum	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
31	Lycopodium phlegmaria	A	.	T	A	A	C	G	.	T	T	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
32	Lycopodium taxifolium	A	.	T	A	A	C	A	.	G	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
33	Lycopodium tristachyum	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
34	Selaginella umbrosa	A	.	T	A	A	C	A	.	C	C	A	T	A	G	G	A	C	T	C	.	.	C	G	G	T	C	C	T	.	G
35	Selaginella vogelii	A	.	T	A	A	C	G	.	C	T	A	T	A	G	G	A	C	T	C	.	.	C	G	G	T	C	C	T	.	G
36	Oryza sativa	A	.	T	A	A	C	A	.	T	C	A	T	A	G	G	A	T	T	C	.	.	C	G	G	T	C	C	T	.	A
37	Zea mays	A	.	T	A	A	C	A	.	T	C	A	T	A	G	G	A	T	T	C	.	.	C	G	G	T	C	C	T	.	A
38	Arabidopsis thaliana	A	.	T	A	A	C	A	.	T	C	A	T	A	G	G	A	T	T	T	.	.	C	G	A	T	C	C	T	.	A
39	Glycine max	A	.	T	A	A	C	A	.	C	C	A	C	A	G	G	A	T	T	C	.	.	T	G	A	T	C	C	T	.	A
40	Sinapis alba	A	.	T	A	A	C	A	.	T	C	A	T	A	G	G	A	T	T	T	.	.	C	G	G	T	C	C	T	.	A
41	Zamia pumila	A	.	T	A	A	C	G	.	G	T	A	T	A	G	G	A	T	T	C	.	.	T	G	G	T	C	C	T	.	A
42	Gnetum leyboldii	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	T	T	T	.	.	C	G	A	T	C	C	T	.	G
43	Ginkgo biloba	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	G	T	C	.	.	T	G	G	T	C	C	T	.	A
44	Pinus luchuensis	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	G	T	C	.	.	T	G	G	T	C	C	T	.	A
45	Pinus wallichiana	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	G	T	C	.	.	T	G	G	T	C	C	T	.	A
46	Nageia nagi	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	G	T	C	.	.	C	G	G	T	C	C	T	.	A
47	Taxus mairei	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	G	T	C	.	.	T	G	G	T	C	C	T	.	G
48	Adiantum raddianum	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
49	Adiantum raddianum 2	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
50	Ophioglossum petiolatum	A	.	T	A	A	C	G	.	A	?	A	C	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
51	Osmunda cinnamomea	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
52	Salvinia natans	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	G	G	G	T	C	C	T	.	G
53	Psilotum nudum	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
54	Chara foetida	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	C	G	G	T	C	C	T	.	A
55	Coleochaete scutata	A	.	T	A	A	C	A	.	T	T	A	T	A	G	G	A	C	T	C	.	.	C	G	G	T	T	C	T	.	A
56	Klebsormidium flaccidum	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
57	Nitella flexilis	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
58	Nitella sp.	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
59	Chlamydomonas reinhardtii	A	.	T	A	A	C	A	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	.	C	C	T	.	A
60	Hydrodictyon reticulatum	A	.	T	A	A	C	A	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	.	C	C	T	.	A
61	Parietochloris pseudoalveolaris	A	.	T	A	A	C	A	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	.	C	C	T	.	A
62	Dictyostelium discoideum	A	.	T	G	A	T	G	.	A	A	A	C	A	T	G	A	C	A	T	.	.	T	T	T	A	C	G	C	.	.
63	Pteris vittata	A	.	T	A	A	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
64	Megaceros aenigmaticus	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	C	T	G	G	T	C	C	T	.	A
65	Notothylas breutelii	.	T	T	A	A	C	G	A	T	T	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	A
66	Physcomitrella patens	A	.	T	A	A	C	G	.	T	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G
67	Sphagnum palustre	A	.	T	A	G	C	G	.	C	G	A	T	A	G	G	A	C	T	C	.	.	T	G	G	T	C	C	T	.	G

Taxa with Variability Info	35	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050
		5	3	1.	3.	0.	4.	6.	6.	6.	6.	3.	2.	0.	6.	2.	2.	2.	6.	0.	5.	6.	3.	0.	0.	4.	3	3	2	6	6
1	Saccharomyces cerevisiae	T	T	T	T	.	G	T	T	G	G	T	T	.	T	C	T	A	G	.	G	A	C	.	.	C	A	T	C	G	T
2	Schizosaccharomyces pombe	T	T	T	T	.	G	T	T	G	G	T	T	.	T	C	T	A	G	.	G	A	C	.	.	C	G	C	C	G	T
3	Physcomitrella patens 2	T	T	C	G	T	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
4	Anthoceros agrestis	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	T	.	.	T	G	G	A	G	T
5	Anthoceros laevis	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
6	Pellia epiphylla	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
7	Reboulia hemisphaerica	T	T	G	C	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
8	Riccardia pinguis	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
9	Sphaerocarpos donnellii	T	T	G	C	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
10	Sphaerocarpus texanus	.	T	T	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
11	Atrichum undulatum	T	T	C	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
12	Bryum argenteum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
13	Eurhynchium hians	T	T	G	T	.	G	T	T	G	G	T	C	.	T	C	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
14	Funaria hygrometrica	T	C	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
15	Leptobryum pyriforme	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
16	Mnium hornum	T	C	T	C	T	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
17	Physcomitrium pyriforme	T	C	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
18	Polytrichum formosum	T	T	C	C	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
19	Sphagnum cuspidatum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
20	Calypogeia arguta	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
21	Conocephalum conicum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
22	Fossombronia pusilla	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
23	Marchantia polymorpha	T	T	G	C	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
24	Riccia fluitans	T	T	G	C	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
25	Scapania nemorosa	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
26	Equisetum hyemale	T	T	G	T	.	A	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
27	Equisetum robustum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
28	Isoetes engelmannii	T	T	C	C	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
29	Huperzia lucidulum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
30	Lycopodiella inundatum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
31	Lycopodium phlegmaria	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
32	Lycopodium taxifolium	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
33	Lycopodium tristachyum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
34	Selaginella umbrosa	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	T	G	G	.	G	A	T	.	.	T	G	G	A	G	T
35	Selaginella vogelii	T	T	G	T	.	G	T	T	G	G	T	C	.	T	C	C	G	G	.	G	A	T	.	.	C	A	G	A	G	T
36	Oryza sativa	T	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	T	.	.	C	G	G	A	G	T
37	Zea mays	T	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	T	.	.	C	G	G	A	G	T
38	Arabidopsis thaliana	T	T	G	T	.	G	T	T	G	G	C	.	.	T	T	C	G	G	.	G	A	T	.	.	C	G	G	A	G	T
39	Glycine max	T	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	T	.	.	C	G	G	A	G	T
40	Sinapis alba	T	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	T	.	.	C	G	G	A	G	T
41	Zamia pumila	T	T	G	C	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
42	Gnetum leyboldii	T	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	T	.	.	C	G	G	A	G	T
43	Ginkgo biloba	T	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
44	Pinus luchuensis	T	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
45	Pinus wallichiana	C	T	G	T	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
46	Nageia nagi	T	T	C	C	.	G	T	T	G	G	C	C	.	T	T	T	G	G	.	G	A	C	.	.	C	G	G	A	G	T
47	Taxus mairei	T	T	C	C	.	G	T	T	G	G	C	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
48	Adiantum raddianum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	.	G	.	G	A	C	.	.	C	G	G	A	G	T
49	Adiantum raddianum 2	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
50	Ophioglossum petiolatum	T	T	G	T	.	G	T	T	G	G	T	C	T	T	C	A	G	G	.	G	A	C	.	.	C	G	G	A	G	T
51	Osmunda cinnamomea	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
52	Salvinia natans	T	C	T	T	.	G	T	T	G	G	T	C	.	T	C	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
53	Psilotum nudum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	A/G	G	A	G	T
54	Chara foetida	T	T	T	C	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	T	.	.	T	G	G	A	G	T
55	Coleochaete scutata	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
56	Klebsormidium flaccidum	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
57	Nitella flexilis	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
58	Nitella sp.	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
59	Chlamydomonas reinhardtii	T	C	.	T	.	G	T	T	G	G	T	C	.	T	G	T	G	G	.	G	A	C	.	.	C	G	G	A	G	T
60	Hydrodictyon reticulatum	T	C	T	T	.	G	T	T	G	G	T	C	.	T	G	T	A	G	.	G	A	C	.	.	C	G	G	A	G	T
61	Parietochloris pseudoalveolaris	T	C	T	T	.	G	T	T	G	G	T	C	.	T	G	T	G	G	.	G	A	C	.	.	C	G	G	A	G	T
62	Dictyostelium discoideum	.	.	.	T	.	A	T	T	G	G	T	T	.	.	.	T	G	C	.	G	T	T	T	A	A	A	G	T	G	T
63	Pteris vittata	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
64	Megaceros aenigmaticus	T	T	G	T	.	G	T	T	G	?	T	C	.	T	A	C	G	G	.	G	A	T	.	.	C	G	G	A	G	T
65	Notothylas breutelii	T	T	G	G	.	G	T	T	G	G	T	C	.	T	C	C	G	G	G	C	A	T	.	.	C	G	G	A	G	T
66	Physcomitrella patens	T	T	C	G	T	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T
67	Sphagnum palustre	T	T	G	T	.	G	T	T	G	G	T	C	.	T	T	C	G	G	.	G	A	C	.	.	C	G	G	A	G	T

Taxa with Variability Info	38	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080
		6																						6	6.	6.	6	6.	4	5	6
1	Saccharomyces cerevisiae	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
2	Schizosaccharomyces pombe	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
3	Physcomitrella patens 2	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
4	Anthoceros agrestis	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
5	Anthoceros laevis	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
6	Pellia epiphylla	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
7	Reboulia hemisphaerica	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
8	Riccardia pinguis	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
9	Sphaerocarpos donnellii	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
10	Sphaerocarpus texanus	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
11	Atrichum undulatum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
12	Bryum argenteum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
13	Eurhynchium hians	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
14	Funaria hygrometrica	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
15	Leptobryum pyriforme	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
16	Mnium hornum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	G	A
17	Physcomitrium pyriforme	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
18	Polytrichum formosum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
19	Sphagnum cuspidatum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
20	Calypogeia arguta	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
21	Conocephalum conicum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
22	Fossombronia pusilla	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
23	Marchantia polymorpha	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
24	Riccia fluitans	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
25	Scapania nemorea	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
26	Equisetum hyemale	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
27	Equisetum robustum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
28	Isoetes engelmannii	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
29	Huperzia lucidulum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
30	Lycopodiella inundatum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
31	Lycopodium phlegmaria	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
32	Lycopodium taxifolium	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
33	Lycopodium tristachyum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
34	Selaginella umbrosa	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
35	Selaginella vogelii	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
36	Oryza sativa	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
37	Zea mays	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
38	Arabidopsis thaliana	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
39	Glycine max	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
40	Sinapis alba	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
41	Zamia pumila	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
42	Gnetum leyboldii	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
43	Ginkgo biloba	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
44	Pinus luchuensis	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
45	Pinus wallichiana	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	C	A	A
46	Nageia nagi	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
47	Taxus mairei	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
48	Adiantum raddianum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
49	Adiantum raddianum 2	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
50	Ophioglossum petiolatum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
51	Osmunda cinnamomea	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
52	Salvinia natans	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
53	Psilotum nudum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
54	Chara foetida	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
55	Coleochaete scutata	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
56	Klebsormidium flaccidum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
57	Nitella flexilis	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	C	A	A
58	Nitella sp.	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	C	A	A
59	Chlamydomonas reinhardtii	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
60	Hydrodictyon reticulatum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
61	Parietochloris pseudoalveolaris	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
62	Dictyostelium discoideum	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
63	Pteris vittata	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
64	Megaceros aenigmaticus	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
65	Notothylas breutelii	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
66	Physcomitrella patens	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A
67	Sphagnum palustre	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	G	A	T	T	A	A

Taxa with Variability Info	37	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110
		3	6.	6	4.	5	4	3.	2.	6.	6.		1.	6.	6.	6.	6.	5.	4.	6.	6.	3.	3.	6.	6.	6.	5.	6	2	2	0
1	Saccharomyces cerevisiae	T	A	G	G	G	A	C	G	G	T	.	C	G	G	G	G	G	C	A	T	C	G	G	T	A	T	T	C	A	.
2	Schizosaccharomyces pombe	T	A	G	G	G	A	T	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	C	A	.
3	Physcomitrella patens 2	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
4	Anthoceros agrestis	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
5	Anthoceros laevis	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
6	Pellia epiphylla	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
7	Reboulia hemisphaerica	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
8	Riccardia pinguis	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
9	Sphaerocarpos donnellii	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
10	Sphaerocarpus texanus	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
11	Atrichum undulatum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
12	Bryum argenteum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
13	Eurhynchium hians	T	A	G	G	G	A	T	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
14	Funaria hygrometrica	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
15	Leptobryum pyriforme	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
16	Mnium hornum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
17	Physcomitrium pyriforme	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
18	Polytrichum formosum	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
19	Sphagnum cuspidatum	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
20	Calypogeia arguta	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
21	Conocephalum conicum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
22	Fossombronia pusilla	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
23	Marchantia polymorpha	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	T	G	T	A	T	T	T	C	.
24	Riccia fluitans	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
25	Scapania nemorosa	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
26	Equisetum hyemale	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	C	C	.
27	Equisetum robustum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
28	Isoetes engelmannii	T	A	G	G	C	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
29	Huperzia lucidulum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
30	Lycopodiella inundatum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
31	Lycopodium phlegmaria	C	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
32	Lycopodium taxifolium	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
33	Lycopodium tristachyum	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
34	Selaginella umbrosa	A	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	C	T	C	C	.
35	Selaginella vogelii	G	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	C	T	C	C	.
36	Oryza sativa	T	A	G	G	G	A	C	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
37	Zea mays	T	A	G	G	G	A	C	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
38	Arabidopsis thaliana	C	A	G	G	G	A	C	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
39	Glycine max	C	A	G	G	G	A	C	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
40	Sinapis alba	C	A	G	G	G	A	C	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
41	Zamia pumila	C	A	G	G	G	A	C	G	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
42	Gnetum leyboldii	T	A	G	G	G	A	C	T	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
43	Ginkgo biloba	T	A	G	G	G	A	C	G	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
44	Pinus luchuensis	T	A	G	G	G	A	C	T	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
45	Pinus wallichiana	T	A	G	G	G	A	C	T	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
46	Nageia nagi	T	A	G	G	G	A	C	T	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
47	Taxus mairei	T	A	G	G	G	A	C	T	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
48	Adiantum raddianum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
49	Adiantum raddianum 2	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
50	Ophioglossum petiolatum	T	A	G	G	G	A	T	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
51	Osmunda cinnamomea	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
52	Salvinia natans	T	A	G	G	A	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
53	Psilotum nudum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
54	Chara foetida	T	A	G	A	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	C	C	.
55	Coleochaete scutata	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
56	Klebsormidium flaccidum	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	A	T	A	T	T	C	G	T	A	T	T	T	C	.
57	Nitella flexilis	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	C	C	.
58	Nitella sp.	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	C	C	.
59	Chlamydomonas reinhardtii	G	A	G	G	G	G	T	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	C	C	.
60	Hydrodictyon reticulatum	G	A	G	G	G	A	C	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
61	Parietochloris pseudoalveolaris	G	A	G	G	G	A	C	A	G	T	.	C	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
62	Dictyostelium discoideum	T	A	G	G	G	A	T	G	G	A	.	T	G	G	G	G	G	T	G	T	T	C	A	T	A	T	T	G	G	.
63	Pteris vittata	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
64	Megaceros aenigmaticus	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
65	Notothylas breutelii	T	A	G	G	G	A	C	A	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	G
66	Physcomitrella patens	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.
67	Sphagnum palustre	T	A	G	G	G	A	C	G	G	T	.	T	G	G	G	G	G	C	A	T	T	C	G	T	A	T	T	T	C	.

Taxa with Variability Info	38	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140
		3.	4.	3.	6.	6.	4.	6.	6.	5.	6.	6.	6.	6.		6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6	6.	6	4.	4	3
1	Saccharomyces cerevisiae	A	T	T	G	T	C	.	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
2	Schizosaccharomyces pombe	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
3	Physcomitrella patens 2	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
4	Anthoceros agrestis	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
5	Anthoceros laevis	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
6	Pellia epiphylla	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
7	Reboulia hemisphaerica	G	C	G	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
8	Riccardia pinguis	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
9	Sphaerocarpos donnellii	A	T	G	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	C	A	T
10	Sphaerocarpus texanus	.	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
11	Atrichum undulatum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
12	Bryum argenteum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
13	Eurhynchium hians	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
14	Funaria hygrometrica	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
15	Leptobryum pyriforme	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
16	Mnium hornum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
17	Physcomitrium pyriforme	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
18	Polytrichum formosum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
19	Sphagnum cuspidatum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	C
20	Calypogeia arguta	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
21	Conocephalum conicum	G	C	G	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	C	G	C
22	Fossombronia pusilla	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
23	Marchantia polymorpha	A	T	G	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	C	A	T
24	Riccia fluitans	G	C	G	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	C	G	C
25	Bazzania nemorosa	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
26	Equisetum hyemale	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
27	Equisetum robustum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
28	Isoetes engelmannii	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
29	Huperzia lucidulum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
30	Lycopodiella inundatum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
31	Lycopodium phlegmaria	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
32	Lycopodium taxifolium	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
33	Lycopodium tristachyum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
34	Selaginella umbrosa	G	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	C
35	Selaginella vogelii	G	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	C
36	Oryza sativa	A	T	A	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
37	Zea mays	A	T	A	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
38	Arabidopsis thaliana	A	T	A	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
39	Glycine max	A	T	A	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
40	Sinapis alba	A	T	A	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
41	Zamia pumila	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
42	Gnetum leyboldii	A	T	A	G	T	C	A	G	G	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
43	Ginkgo biloba	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
44	Pinus luchuensis	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
45	Pinus wallichiana	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
46	Nageia nagi	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
47	Taxus mairei	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	C
48	Adiantum raddianum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	.	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
49	Adiantum raddianum 2	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
50	Ophioglossum petiolatum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
51	Osmunda cinnamomea	A	T	T	G	T	T	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
52	Salvinia natans	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
53	Psilotum nudum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
54	Chara foetida	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
55	Coleochaete scutata	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
56	Klebsormidium flaccidum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
57	Nitella flexilis	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
58	Nitella sp.	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
59	Chlamydomonas reinhardtii	G	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	C
60	Hydrodictyon reticulatum	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
61	Parietochloris pseudoalveolaris	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
62	Dictyostelium discoideum	T	G	G	G	C	G	A	G	A	G	G	T	G	.	A	A	A	T	T	C	G	T	T	G	A	C	C	C	T	A
63	Pteris vittata	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
64	Megaceros aenigmaticus	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
65	Notothylas breutelii	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
66	Physcomitrella patens	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	T
67	Sphagnum palustre	A	T	T	G	T	C	A	G	A	G	G	T	G	.	A	A	A	T	T	C	T	T	G	G	A	T	T	T	A	C

Taxa with Variability Info	39	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170
		2	2.	0.	4	0.	0.	0.	3.	4.	0.	0.	3.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0	0.	4	5	0
1	Saccharomyces cerevisiae	T	G	A	A	G	A	C	T	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
2	Schizosaccharomyces pombe	T	G	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
3	Physcomitrella patens 2	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
4	Anthoceros agrestis	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
5	Anthoceros laevis	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
6	Pellia epiphylla	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
7	Reboulia hemisphaerica	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
8	Riccardia pinguis	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
9	Sphaerocarpos donnellii	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
10	Sphaerocarpus texanus	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
11	Atrichum undulatum	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
12	Bryum argenteum	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
13	Eurhynchium hians	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
14	Funaria hygrometrica	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
15	Leptobryum pyriforme	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
16	Mnium hornum	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
17	Physcomitrium pyriforme	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
18	Polytrichum formosum	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
19	Sphagnum cuspidatum	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
20	Calypogeia arguta	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
21	Conocephalum conicum	G	A	A	A	G	A	C	G	G	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
22	Fossombronia pusilla	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
23	Marchantia polymorpha	G	A	A	A	G	A	C	A	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
24	Riccia fluitans	G	A	A	A	G	A	C	G	G	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
25	Scapania nemorosa	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
26	Equisetum hyemale	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
27	Equisetum robustum	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
28	Isoetes engelmannii	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
29	Huperzia lucidulum	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
30	Lycopodiella inundatum	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
31	Lycopodium phlegmaria	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
32	Lycopodium taxifolium	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
33	Lycopodium tristachyum	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
34	Selaginella umbrosa	G	G	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
35	Selaginella vogelii	G	G	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
36	Oryza sativa	G	A	A	A	G	A	C	G	A	A	C	A	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
37	Zea mays	G	A	A	A	G	A	C	G	A	A	C	A	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
38	Arabidopsis thaliana	G	A	A	A	G	A	C	G	A	A	C	A	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
39	Glycine max	G	A	A	A	G	A	C	G	A	A	C	A	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
40	Sinapis alba	G	A	A	A	G	A	C	G	A	A	C	A	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
41	Zamia pumila	G	A	A	A	G	A	C	G	A	A	C	C	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
42	Gnetum leyboldii	G	A	A	A	G	·	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
43	Ginkgo biloba	G	A	A	A	G	A	C	G	A	A	C	C	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
44	Pinus luchuensis	G	A	A	A	G	A	C	G	G	A	C	C	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
45	Pinus wallichiana	G	A	A	A	G	A	C	G	G	A	C	C	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
46	Nageia nagi	G	G	A	A	G	A	C	G	A	A	C	C	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
47	Taxus mairei	G	G	A	A	G	A	C	G	A	A	C	C	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
48	Adiantum raddianum	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
49	Adiantum raddianum 2	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
50	Ophioglossum petiolatum	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	·	A	T	T	T	G	C	C
51	Osmunda cinnamomea	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
52	Salvinia natans	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
53	Psilotum nudum	G	G	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
54	Chara foetida	G	G	A	T	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
55	Coleochaete scutata	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
56	Klebsormidium flaccidum	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	A	T	C
57	Nitella flexilis	G	G	A	T	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
58	Nitella sp.	G	G	A	T	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
59	Chlamydomonas reinhardtii	G	G	A	A	G	A	C	G	A	A	C	A	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
60	Hydrodictyon reticulatum	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
61	Parietochloris pseudoalveolaris	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
62	Dictyostelium discoideum	T	C	A	A	G	A	T	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	C	A	C	C
63	Pteris vittata	G	A	A	A	G	A	C	G	A	A	C	T	A	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
64	Megaceros aenigmaticus	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
65	Notothylas breutelii	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
66	Physcomitrella patens	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C
67	Sphagnum palustre	G	A	A	A	G	A	C	G	A	A	C	T	T	C	T	G	C	G	A	A	A	G	C	A	T	T	T	G	C	C

	Taxa with Variability Info 40	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200
		6	6.	6	6	5.	0.	3.	4.	4.	6.	4.	6	6.	5.	6.	6.	4.	6.	6.	5.	6.	6.	6.	5	6.	5.	6	6	6	6.
1	Saccharomyces cerevisiae	A	A	G	G	A	.	C	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
2	Schizosaccharomyces pombe	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
3	Physcomitrella patens 2	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
4	Anthoceros agrestis	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
5	Anthoceros laevis	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
6	Pellia epiphylla	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
7	Reboulia hemisphaerica	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
8	Riccardia pinguis	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
9	Sphaerocarpos donnelli	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
10	Sphaerocarpus texanus	-	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	G	A	A	G	A	A	C	G	A	A	A
11	Atrichum undulatum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
12	Bryum argenteum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
13	Eurhynchium hians	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
14	Funaria hygrometrica	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
15	Leptobryum pyriforme	A	A	G	G	A	.	T	G	T	T	T	T	C	G	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
16	Mnium hornum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
17	Physcomitrium pyriforme	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
18	Polytrichum formosum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
19	Sphagnum cuspidatum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	T	G	A	A	A
20	Calypogeia arguta	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
21	Conocephalum conicum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
22	Fossombronia pusilla	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
23	Marchantia polymorpha	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
24	Riccia fluitans	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
25	Scapania nemorea	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
26	Equisetum hyemale	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
27	Equisetum robustum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
28	Isoetes engelmannii	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
29	Huperzia lucidulum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
30	Lycopodiella inundatum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
31	Lycopodium phlegmaria	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
32	Lycopodium taxifolium	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
33	Lycopodium tristachyum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
34	Selaginella umbrosa	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
35	Selaginella vogelii	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
36	Oryza sativa	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
37	Zea mays	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
38	Arabidopsis thaliana	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
39	Glycine max	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	G	A	C	G	A	A	A
40	Sinapis alba	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
41	Zamia pumila	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
42	Gnetum leyboldii	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
43	Ginkgo biloba	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
44	Pinus luchuensis	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
45	Pinus wallichiana	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
46	Nageia nagi	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
47	Taxus mairei	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	.	T	C	A	A	G	A	A	C	G	A	A	A
48	Adiantum raddianum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
49	Adiantum raddianum 2	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
50	Ophioglossum petiolatum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
51	Osmunda cinnamomea	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
52	Salvinia natans	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
53	Psilotum nudum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
54	Chara foetida	A	A	G	G	A	.	C	G	T	T	C	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
55	Coleochaete scutata	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
56	Klebsormidium flaccidum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
57	Nitella flexilis	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A/G	A	C	G	A	A	A
58	Nitella sp.	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
59	Chlamydomonas reinhardtii	A	A	G	G	A	.	T	A	C	T	T	T	C	A	T	T	G	A	T	C	A	A	G	A	A	C	G	A	A	A
60	Hydrodictyon reticulatum	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
61	Parietochloris pseudoalveolaris	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
62	Dictyostelium discoideum	A	A	A	T	A	.	C	T	T	C	C	C	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
63	Pteris vittata	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
64	Megaceros aenigmaticus	A	A	G	G	C	A	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
65	Notothylas breutelii	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
66	Physcomitrella patens	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A
67	Sphagnum palustre	A	A	G	G	A	.	T	G	T	T	T	T	C	A	T	T	A	A	T	C	A	A	G	A	A	C	G	A	A	A

Taxa with Variability Info 41		1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230
		6.	6.	6.	2.	6.	6.	6.	6.	2.	6.	5.	6.	0.	5.	6.	5.	5.	3.	6.	6.	6.	4.	3.	6.	3.	6.	6	6	6	6
1	Saccharomyces cerevisiae	G	T	T	A	G	G	G	G	A	T	C	G	.	A	A	G	A	T	G	A	T	C	T	G	G	T	A	C	C	G
2	Schizosaccharomyces pombe	G	T	T	A	G	G	G	G	A	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
3	Physcomitrella patens 2	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
4	Anthoceros agrestis	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
5	Anthoceros laevis	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
6	Pellia epiphylla	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
7	Reboulia hemisphaerica	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
8	Riccardia pinguis	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
9	Sphaerocarpos donnellii	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
10	Sphaerocarpus texanus	G	T	T	G	G	G	G	G	C	T	C	G	.	G	A	T	G	C	G	A	T	C	A	G	A	T	A	C	C	G
11	Atrichum undulatum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
12	Bryum argenteum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
13	Eurhynchium hians	G	T	T	G	G	G	G	G	C	T	A	C	G	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
14	Funaria hygrometrica	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
15	Leptobryum pyriforme	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
16	Mnium hornum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
17	Physcomitrium pyriforme	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	A	A	C	G	A	T	C	A	G	A	T	A	C	C	G
18	Polytrichum formosum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
19	Sphagnum cuspidatum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
20	Calypogeia arguta	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
21	Conocephalum conicum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
22	Fossombronia pusilla	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
23	Marchantia polymorpha	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
24	Riccia fluitans	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
25	Scapania nemorea	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
26	Equisetum hyemale	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
27	Equisetum robustum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
28	Isoetes engelmannii	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
29	Huperzia lucidulum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
30	Lycopodiella inundatum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
31	Lycopodium phlegmaria	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
32	Lycopodium lucidulum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
33	Lycopodium tristachyum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
34	Selaginella umbrosa	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
35	Selaginella vogelii	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
36	Oryza sativa	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
37	Zea mays	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
38	Arabidopsis thaliana	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
39	Glycine max	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
40	Sinapis alba	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
41	Zamia pumila	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
42	Gnetum leyboldii	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
43	Ginkgo biloba	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
44	Pinus luchuensis	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
45	Pinus wallichiana	G	T	T	G	G	G	G	G	C	T	C	G	A	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
46	Nageia nagi	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
47	Taxus mairei	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
48	Adiantum raddianum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
49	Adiantum raddianum 2	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
50	Ophioglossum petiolatum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
51	Osmunda cinnamomea	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
52	Salvinia natans	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
53	Psilotum nudum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
54	Chara foetida	G	T	T	G	G	G	G	G	A	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
55	Coleochaete scutata	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
56	Klebsormidium flaccidum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	?	G
57	Nitella flexilis	G	T	T	G	G	G	G	G	A	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
58	Nitella sp	G	T	T	G	G	G	G	G	A	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
59	Chlamydomonas reinhardtii	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	T	A	G	A	T	A	C	C	G
60	Hydrodictyon reticulatum	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	T	A	G	A	T	A	C	C	G
61	Parietochloris pseudoalveolaris	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	T	A	G	A	T	A	C	C	G
62	Dictyostelium discoideum	G	T	T	T	G	G	G	G	A	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
63	Pteris vittata	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
64	Megaceros aenigmaticus	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
65	Notothylas breutelii	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
66	Physcomitrella patens	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G
67	Sphagnum palustre	G	T	T	G	G	G	G	G	C	T	C	G	.	A	A	G	A	C	G	A	T	C	A	G	A	T	A	C	C	G

Taxa with Variability Info	42	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260
		0	0.	2	0	0	0	5.		0.	0.	2.	0.	0.	0.	0.	5.	0.	0.	0.	0.	0.	2.	0.	0.	0.	0.	0		0	0
1	Saccharomyces cerevisiae	T	C	G	T	A	G	T	.	C	T	T	A	A	C	C	A	T	A	A	A	C	T	A	T	G	C	C	.	G	A
2	Schizosaccharomyces pombe	T	C	G	T	A	G	T	.	C	T	T	A	A	C	C	A	T	A	A	A	C	T	A	T	G	C	C	.	G	A
3	Physcomitrella patens 2	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
4	Anthoceros agrestis	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
5	Anthoceros laevis	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
6	Pellia epiphylla	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
7	Reboulia hemisphaerica	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
8	Riccardia pinguis	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
9	Sphaerocarpos donnelli	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
10	Sphaerocarpus texanus	T	C	C	.	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
11	Atrichum undulatum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
12	Bryum argenteum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
13	Eurhynchium hians	T	C	C	T	A	G	A	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
14	Funaria hygrometrica	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
15	Leptobryum pyriforme	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
16	Mnium hornum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
17	Physcomitrium pyriforme	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
18	Polytrichum formosum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
19	Sphagnum cuspidatum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	G	T	A	A	A	C	G	A	T	G	C	C	.	G	A
20	Calypogeia arguta	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
21	Conocephalum conicum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
22	Fossombronia pusilla	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
23	Marchantia polymorpha	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
24	Riccia fluitans	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
25	Scapania nemorea	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
26	Equisetum hyemale	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
27	Equisetum robustum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
28	Isoetes engelmannii	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
29	Huperzia lucidulum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
30	Lycopodiella inundatum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
31	Lycopodium phlegmaria	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
32	Lycopodium taxifolium	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
33	Lycopodium tristachyum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
34	Selaginella umbrosa	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
35	Selaginella vogelii	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
36	Oryza sativa	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
37	Zea mays	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
38	Arabidopsis thaliana	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
39	Glycine max	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
40	Sinapis alba	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
41	Zamia pumila	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
42	Gnetum leyboldii	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
43	Ginkgo biloba	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
44	Pinus luchuensis	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
45	Pinus wallichiana	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
46	Nageia nagi	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
47	Taxus mairei	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
48	Adiantum raddianum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	.	A	A	A	C	G	A	T	G	C	C	.	G	A
49	Adiantum raddianum 2	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
50	Ophioglossum petiolatum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
51	Osmunda cinnamomea	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
52	Salvinia natans	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
53	Psilotum nudum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
54	Chara foetida	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
55	Coleochaete scutata	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
56	Klebsormidium flaccidum	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
57	Nitella flexilis	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
58	Nitella sp.	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	?	C	C	.	G	A
59	Chlamydomonas reinhardtii	T	C	G	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
60	Hydrodictyon reticulatum	T	C	G	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
61	Parietochloris pseudoalveolaris	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
62	Dictyostelium discoideum	T	C	G	T	A	G	T	.	C	C	A	A	A	C	T	A	T	A	A	A	C	T	A	T	G	T	C	.	G	A
63	Pteris vittata	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
64	Megaceros aenigmaticus	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
65	Notothylas breutelii	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
66	Physcomitrella patens	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	A	T	A	A	A	C	G	A	T	G	C	C	.	G	A
67	Sphagnum palustre	T	C	C	T	A	G	T	.	C	T	C	A	A	C	C	G	T	A	A	A	C	G	A	T	G	C	C	.	G	A

#	Taxa with Variability Info 43	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290
		8.	3.	8.	8.	6.	5.	6.	5.	1.	3.	6.	2.	2.	3.	2.	8.	6.	6.	4.	0.	O	0	1.	1.	3.	4.	0.	1	2	3.
1	Saccharomyces cerevisiae	C	T	A	G	.	.	A	T	C	G	G	G	T	G	G	T	G	T	T	.	.	.	T	T	T	T	.	T	A	A
2	Schizosaccharomyces pombe	C	T	A	G	G	G	A	T	C	G	G	G	C	A	A	T	G	T	T	.	.	.	T	C	A	T	T	T	A	T
3	Physcomitrella patens 2	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	T	G	A
4	Anthoceros agrestis	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
5	Anthoceros laevis	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	A	G	A
6	Pellia epiphylla	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
7	Reboulia hemisphaerica	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	A	T	T	.	A	G	A
8	Riccardia pinguis	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
9	Sphaerocarpos donnellii	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
10	Sphaerocarpus texanus	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
11	Atrichum undulatum	C	T	A	G	G	G	A	T	T	T	G	C	G	G	G	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
12	Bryum argenteum	C	T	A	G	G	A	A	T	T	G	G	C	G	G	G	T	G	T	T	.	.	.	G	C	T	T	.	T	G	A
13	Eurhynchium hians	C	T	A	G	G	G	A	C	T	T	G	C	G	G	C	T	G	T	T	.	.	.	C	A	T	T	.	T	G	A
14	Funaria hygrometrica	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	T	G	A
15	Leptobryum pyriforme	C	T	A	G	G	G	A	T	T	G	G	C	G	G	G	T	G	T	T	.	.	.	G	A	T	T	.	T	G	A
16	Mnium hornum	C	T	A	G	G	G	A	T	T	G	G	C	G	G	G	T	G	T	T	.	.	.	G	A	T	T	.	C	G	A
17	Physcomitrium pyriforme	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	T	G	A
18	Polytrichum formosum	C	T	A	G	G	G	A	T	T	C	G	C	G	G	G	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
19	Sphagnum cuspidatum	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	A	A	T	.	C	G	A
20	Calypogeia arguta	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
21	Conocephalum conicum	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	T	C	T	T	T	T	G	A
22	Fossombronia pusilla	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
23	Marchantia polymorpha	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
24	Riccia fluitans	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	T	G	A	T	T	.	A	G	A
25	Scapania nemorosa	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
26	Equisetum hyemale	C	T	A	G	G	G	A	T	T	G	G	C	A	G	A	T	G	T	T	.	.	.	A	C	T	T	.	C	G	A
27	Equisetum robustum	C	T	A	G	G	G	A	T	T	G	G	C	A	G	A	T	G	T	T	.	.	.	A	C	T	T	.	C	G	A
28	Isoetes engelmannii	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	C	G	A
29	Huperzia lucidulum	C	T	A	G	G	G	A	T	C	G	G	C	G	G	G	T	G	T	T	.	.	.	A	A	T	T	.	C	G	A
30	Lycopodiella inundatum	C	T	A	G	G	G	A	T	C	G	G	C	G	G	G	T	G	T	T	.	.	.	?	A	T	T	.	C	G	A
31	Lycopodium phlegmaria	C	T	A	G	G	G	A	T	C	G	G	C	G	G	G	T	G	T	T	.	.	.	A	A	T	T	.	C	G	A
32	Lycopodium taxifolium	C	T	A	G	G	G	A	T	C	G	G	C	G	G	G	T	G	T	T	.	.	.	A	A	T	T	.	C	G	A
33	Lycopodium tristachyum	C	T	A	G	G	G	A	T	C	G	G	C	G	G	G	T	G	T	T	.	.	.	A	A	T	T	.	C	G	A
34	Selaginella umbrosa	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	T	T	T	.	G	G	A
35	Selaginella vogelii	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	T	T	T	.	G	G	A
36	Oryza sativa	C	C	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	T	.	A	T	A
37	Zea mays	C	C	A	G	G	G	A	T	C	A	G	C	G	G	T	.	G	T	T	.	.	.	A	C	T	A	.	A	T	A
38	Arabidopsis thaliana	C	C	A	G	G	G	A	T	C	A	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	T	.	A	T	A
39	Glycine max	C	C	A	G	G	G	A	T	C	A	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	T	.	T	T	A
40	Sinapis alba	C	C	A	G	G	G	A	T	C	A	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	T	.	T	T	A
41	Zamia pumila	C	C	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	C	.	T	A	A
42	Gnetum leyboldii	C	C	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	T	.	T	T	A
43	Ginkgo biloba	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	T	.	T	A	A
44	Pinus luchuensis	C	C	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	C	.	T	A	A
45	Pinus wallichiana	C	C	A	G	G	A	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	C	.	T	A	A
46	Nageia nagi	C	C	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	C	.	T	A	A
47	Taxus mairei	C	C	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	C	T	C	.	T	A	A
48	Adiantum raddianum	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	T	G	A
49	Adiantum raddianum 2	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	T	G	A
50	Ophioglossum petiolatum	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	C	G	A
51	Osmunda cinnamomea	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	C	A	A
52	Salvinia natans	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	C	G	A
53	Psilotum nudum	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	C	T	.	T	G	A
54	Chara foetida	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	C	.	.	.	T	A	T	T	.	G	G	A
55	Coleochaete scutata	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
56	Klebsormidium flaccidum	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	T	G	A
57	Nitella flexilis	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	C	.	.	.	T	A	T	T	.	T	G	A
58	Nitella sp	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	C	.	.	.	T	A	T	T	.	T	G	A
59	Chlamydomonas reinhardtii	C	T	A	G	G	G	A	T	T	G	G	C	A	G	A	T	G	T	T	.	.	.	C	T	T	T	.	T	G	A
60	Hydrodictyon reticulatum	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	T	T	T	T	.	T	G	A
61	Parietochloris pseudoalveolaris	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	T	T	A	T	.	C	G	A
62	Dictyostelium discoideum	C	C	A	G	G	G	A	T	C	G	G	T	T	A	A	A	A	T	T	T	T	.	.	.	T	T	.	C	.	.
63	Pteris vittata	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	T	G	A
64	Megaceros aenigmaticus	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	A	T	T	.	A	G	A
65	Notothylas breutelii	C	T	A	G	G	G	A	T	T	G	G	C	G	G	G	T	G	T	T	.	.	.	A	A	T	.	A	A	G	A
66	Physcomitrella patens	C	T	A	G	G	G	A	T	T	G	G	C	G	G	A	T	G	T	T	.	.	.	A	C	T	T	.	T	G	A
67	Sphagnum palustre	C	T	A	G	G	G	A	T	C	G	G	C	G	G	A	T	G	T	T	.	.	.	G	A	A	T	.	C	G	A

Taxa with Variability Info	44	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320
		2	0	6	6	0	0.	0.	0.	6.	2.	3.	2.	2.	2.	4.	1.	6.	3.	0.	5.	6.	6.	6	6	4.	3	0	0	2	6
1	Saccharomyces cerevisiae	T	.	G	A	.	.	.	.	C	C	C	A	C	T	C	G	G	T	.	A	C	.	C	T	T	A	.	.	C	G
2	Schizosaccharomyces pombe	C	.	G	A	.	.	.	.	C	T	T	G	C	T	C	G	G	C	.	A	C	.	C	T	T	A	.	.	C	G
3	Physcomitrella patens 2	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
4	Anthoceros agrestis	T	.	G	A	.	.	.	.	C	G	T	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
5	Anthoceros laevis	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
6	Pellia epiphylla	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
7	Reboulia hemisphaerica	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	C	A	.	.	T	G
8	Riccardia pinguis	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
9	Sphaerocarpos donnellii	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	C	A	.	.	T	G
10	Sphaerocarpus texanus	T	.	G	A	.	.	.	.	C	T	C	C	G	.	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
11	Atrichum undulatum	T	.	G	A	.	.	.	.	C	C	C	C	G	C	A	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
12	Bryum argenteum	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
13	Eurhynchium hians	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
14	Funaria hygrometrica	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
15	Leptobryum pyriforme	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
16	Mnium hornum	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
17	Physcomitrium pyriforme	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
18	Polytrichum formosum	T	.	G	A	.	.	.	.	C	C	C	C	G	C	G	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
19	Sphagnum cuspidatum	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	G	C	.	C	T	T	A	.	.	T	G
20	Calypogeia arguta	T	.	G	A	.	.	.	.	C	T	T	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
21	Conocephalum conicum	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	C	C	G	.	A	G
22	Fossombronia pusilla	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
23	Marchantia polymorpha	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	C	C	A	.	T	G
24	Riccia fluitans	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	C	C	A	.	T	G
25	Scapania nemorea	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
26	Equisetum hyemale	T	.	G	A	.	.	.	.	C	T	C	T	G	C	C	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
27	Equisetum robustum	T	.	G	A	.	.	.	.	C	T	C	T	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
28	Isoetes engelmannii	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	C	A	.	.	T	G
29	Huperzia lucidulum	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	?	G	C	.	A	C	.	C	T	T	A	.	.	T	G
30	Lycopodiella inundatum	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	A	G	T	.	A	C	.	C	T	T	A	.	.	T	G
31	Lycopodium phlegmaria	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
32	Lycopodium taxifolium	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
33	Lycopodium tristachyum	T	.	G	A	.	.	.	.	C	C	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
34	Selaginella umbrosa	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	C	A	.	.	T	G
35	Selaginella vogelii	T	.	G	A	.	.	.	.	C	A	C	C	G	C	C	A	G	C	.	A	C	.	C	T	C	A	.	.	T	G
36	Oryza sativa	G	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
37	Zea mays	G	.	G	A	.	.	.	.	C	C	C	C	G	C	T	G	G	C	C	A	C	.	C	T	T	A	.	.	T	G
38	Arabidopsis thaliana	G	.	G	A	.	.	.	.	C	T	C	C	G	C	T	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
39	Glycine max	G	.	G	A	.	.	.	.	C	T	C	C	G	C	T	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
40	Sinapis alba	G	.	G	A	.	.	.	.	C	T	C	C	G	C	T	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
41	Zamia pumila	G	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
42	Gnetum leyboldii	G	.	G	A	.	.	.	.	C	T	C	C	G	T	C	G	G	C	.	A	C	.	C	T	T	C	.	.	C	G
43	Ginkgo biloba	G	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	G	.	.	T	G
44	Pinus luchuensis	G	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	C	.	.	T	G
45	Pinus wallichiana	G	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	C	.	.	T	G
46	Nageia nagi	G	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	C	.	.	T	G
47	Taxus mairei	G	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	C	.	.	T	G
48	Adiantum raddianum	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
49	Adiantum raddianum 2	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
50	Ophioglossum petiolatum	T	.	G	A	.	.	.	.	C	T	C	C	G	C	T	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
51	Osmunda cinnamomea	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
52	Salvinia natans	T	.	G	A	.	.	.	.	C	T	T	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
53	Psilotum nudum	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G
54	Chara foetida	T	.	G	A	.	.	.	.	C	T	C	T	G	C	C	A	G	C	.	A	C	.	C	T	T	G	.	.	T	G
55	Coleochaete scutata	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
56	Klebsormidium flaccidum	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
57	Nitella flexilis	T	.	G	A	.	.	.	.	C	T	C	C	G	T	C	A	G	C	.	A	C	.	C	T	T	G	.	.	T	G
58	Nitella sp.	T	.	G	A	.	.	.	.	C	T	C	C	G	T	C	A	G	C	.	A	C	.	C	T	T	G	.	.	T	G
59	Chlamydomonas reinhardtii	T	.	G	A	.	.	.	.	C	T	C	T	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
60	Hydrodictyon reticulatum	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
61	Parietochloris pseudoalveolaris	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
62	Dictyostelium discoideum	.	.	.	.	A	A	A	A	T	T	T	A	A	T	C	G	G	C	.	A	C	.	C	T	T	G	.	.	T	G
63	Pteris vittata	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
64	Megaceros aenigmaticus	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
65	Notothylas breutelii	T	T	G	A	.	.	.	.	C	C	C	C	C	C	C	G	G	C	C	A	C	C	C	T	T	A	.	T	T	G
66	Physcomitrella patens	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	A	G	C	.	A	C	.	C	T	T	A	.	.	T	G
67	Sphagnum palustre	T	.	G	A	.	.	.	.	C	T	C	C	G	C	C	G	G	C	.	A	C	.	C	T	T	A	.	.	T	G

Taxa with Variability Info	45	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350
		6.	0.	6	6	6	6.	5.	5.	6.	0.	4.	6.	5.	6.	1.	5.	4.	4.	6.	6.	4.	5.	5	6.	3.	6	6.	6	6	6
1	Saccharomyces cerevisiae	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	T	G	G	G	G	G
2	Schizosaccharomyces pombe	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
3	Physcomitrella patens 2	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
4	Anthoceros agrestis	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
5	Anthoceros laevis	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
6	Pellia epiphylla	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
7	Reboulia hemisphaerica	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
8	Riccardia pinguis	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
9	Sphaerocarpos donnellii	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
10	Sphaerocarpus texanus	A	.	G	A	A	A	T	A	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
11	Atrichum undulatum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	A	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
12	Bryum argenteum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
13	Eurhynchium hians	A	.	G	A	A	A	T	C	A	.	A	A	C	T	T	T	T	T	G	G	G	C	G	C	.	G	G	G	G	G
14	Funaria hygrometrica	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
15	Leptobryum pyriforme	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
16	Mnium hornum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
17	Physcomitrium pyriforme	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	C	C	C	C	G	G	G	G	G
18	Polytrichum formosum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	A	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
19	Sphagnum cuspidatum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
20	Calypogeia arguta	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
21	Conocephalum conicum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
22	Fossombronia pusilla	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
23	Marchantia polymorpha	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
24	Riccia fluitans	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
25	Scapania nemorea	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
26	Equisetum hyemale	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
27	Equisetum robustum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
28	Isoetes engelmannii	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
29	Huperzia lucidulum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
30	Lycopodiella inundatum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
31	Lycopodium phlegmaria	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
32	Lycopodium taxifolium	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
33	Lycopodium tristachyum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
34	Selaginella umbrosa	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
35	Selaginella vogelii	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
36	Oryza sativa	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
37	Zea mays	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
38	Arabidopsis thaliana	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
39	Glycine max	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
40	Sinapis alba	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
41	Zamia pumila	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
42	Gnetum leyboldii	A	.	G	A	A	A	T	C	A	.	G	A	G	T	G	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
43	Ginkgo biloba	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
44	Pinus luchuensis	A	.	G	A	A	A	T	C	A	.	G	A	G	T	G	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
45	Pinus wallichiana	A	.	G	A	A	A	T	C	A	.	G	A	G	T	G	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
46	Nageia nagi	A	.	G	A	A	A	T	C	A	.	G	A	G	T	G	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
47	Taxus mairei	A	.	G	A	A	A	T	C	A	.	G	A	G	T	G	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
48	Adiantum raddianum	.	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
49	Adiantum raddianum 2	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
50	Ophioglossum petiolatum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
51	Osmunda cinnamomea	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
52	Salvinia natans	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
53	Psilotum nudum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	C	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
54	Chara foetida	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	A	C	G	G	G	T	T	C	C	G	G	G	G	G
55	Coleochaete scutata	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	C	T	T	G	G	G	T	T	C	C	G	G	G	G	G
56	Klebsormidium flaccidum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
57	Nitella flexilis	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	C	G	G	G	T	T	C	C	G	G	G	G	G
58	Nitella sp.	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	C	G	G	G	T	T	C	C	G	G	G	G	G
59	Chlamydomonas reinhardtii	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
60	Hydrodictyon reticulatum	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
61	Parietochloris pseudoalveolaris	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
62	Dictyostelium discoideum	A	.	G	A	A	A	T	C	A	T	G	A	G	T	G	T	T	T	A	G	A	T	T	C	C	G	G	G	G	G
63	Pteris vittata	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	T	T	T	C	C	G	G	G	G	G
64	Megaceros aenigmaticus	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	?	T	T	C	C	G	G	G	G	G
65	Notothylas breutelii	A	A	G	A	A	A	C	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G
66	Physcomitrella patens	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	?	G	G	T	T	C	C	G	G	G	G	?
67	Sphagnum palustre	A	.	G	A	A	A	T	C	A	.	A	A	G	T	T	T	T	T	G	G	G	T	T	C	C	G	G	G	G	G

Taxa with Variability Info	40	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380
		5	5.	5	6.	5.	6	6.	5.	6	5.	6.	6	5.	6.	5.	6.	6.	6.	6.	6.	6.	5.	5.	5	5.	6.	6	6	5	6
1	Saccharomyces cerevisiae	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
2	Schizosaccharomyces pombe	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
3	Physcomitrella patens 2	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
4	Anthoceros agrestis	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
5	Anthoceros laevis	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	T	C	C	A	A	A	G	G
6	Pellia epiphylla	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
7	Reboulia hemisphaerica	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	A	G
8	Riccardia pinguis	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
9	Sphaerocarpos donnellii	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
10	Sphaerocarpus texanus	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	.	A	C	C	T	A	A	A	G	G
11	Atrichum undulatum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
12	Bryum argenteum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
13	Eurhynchium hians	G	A	G	T	A	T	G	A	T	C	G	C	A	A	C	G	C	T	.	A	A	C	C	T	T	A	A	A	G	G
14	Funaria hygrometrica	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
15	Leptobryum pyriforme	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
16	Mnium hornum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
17	Physcomitrium pyriforme	G	A	G	T	A	T	G	G	T	C	G	C	G	A	A	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
18	Polytrichum formosum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
19	Sphagnum cuspidatum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
20	Calypogeia arguta	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
21	Conocephalum conicum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
22	Fossombronia pusilla	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
23	Marchantia polymorpha	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
24	Riccia fluitans	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
25	Scapania nemorosa	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
26	Equisetum hyemale	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
27	Equisetum robustum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
28	Isoetes engelmannii	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
29	Huperzia lucidulum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
30	Lycopodiella inundatum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
31	Lycopodium phlegmaria	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
32	Lycopodium taxifolium	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
33	Lycopodium tristachyum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
34	Selaginella umbrosa	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
35	Selaginella vogelii	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
36	Oryza sativa	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
37	Zea mays	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
38	Arabidopsis thaliana	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
39	Glycine max	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
40	Sinapis alba	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
41	Zamia pumila	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
42	Gnetum leyboldii	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
43	Ginkgo biloba	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
44	Pinus luchuensis	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
45	Pinus wallichiana	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
46	Nageia nagi	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
47	Taxus mairei	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
48	Adiantum raddianum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
49	Adiantum raddianum 2	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
50	Ophioglossum petiolatum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
51	Osmunda cinnamomea	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
52	Salvinia natans	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
53	Psilotum nudum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
54	Chara foetida	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
55	Coleochaete scutata	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
56	Klebsormidium flaccidum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
57	Nitella flexilis	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
58	Nitella sp	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
59	Chlamydomonas reinhardtii	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
60	Hydrodictyon reticulatum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
61	Parietochloris pseudoalveolaris	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	A	C	T	T	A	A	A	G	G
62	Dictyostelium discoideum	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	T	C	T	G	A	A	A	C	T	T	A	A	A	G	G
63	Pteris vittata	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	A	?	?	?	?	?	?	?	?	?
64	Megaceros aenigmaticus	?	A	G	T	A	T	G	?	T	C	G	C	A	A	G	?	C	T	G	A	A	?	T	?	?	?	?	?	?	?
65	Notothylas breutelii	A	T	A	T	G	.	.	.	T	T	G	C	A	A	G	.	C	T	G	A	?	?	?	?	?	?	?	?	?	?
66	Physcomitrella patens	G	A	G	T	A	T	G	?	T	C	G	C	A	A	G	?	C	T	G	A	A	?	?	?	?	?	?	?	?	?
67	Sphagnum palustre	G	A	G	T	A	T	G	G	T	C	G	C	A	A	G	G	C	T	G	A	?	?	?	?	?	?	?	?	?	?

	Taxa with Variability Info 47	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410
		6	6	6	6	6	6.	6.	6.	6.	5.	6.	0.	5.	6.	6.	6.	6.	4.	0.	0.	6.	6.	6.	3.	6.	0.	6.	5	3	6
1	Saccharomyces cerevisiae	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	T	A	.	G	G	A	G
2	Schizosaccharomyces pombe	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	A	A	T	G	G	A	G
3	Physcomitrella patens 2	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
4	Anthoceros agrestis	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
5	Anthoceros laevis	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
6	Pellia epiphylla	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
7	Reboulia hemisphaerica	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
8	Riccardia pinguis	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
9	Sphaerocarpos donnellii	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
10	Sphaerocarpus texanus	A	A	T	T	G	A	C	G	G	A	A	.	.	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
11	Atrichum undulatum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
12	Bryum argenteum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
13	Eurhynchium hians	A	A	T	T	G	A	C	G	G	T	A	.	C	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
14	Funaria hygrometrica	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
15	Leptobryum pyriforme	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
16	Mnium hornum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
17	Physcomitrium pyriforme	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
18	Polytrichum formosum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
19	Sphagnum cuspidatum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
20	Calypogeia arguta	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
21	Conocephalum conicum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	T	A	G
22	Fossombronia pusilla	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
23	Marchantia polymorpha	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
24	Riccia fluitans	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
25	Scapania nemorosa	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
26	Equisetum hyemale	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
27	Equisetum robustum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
28	Isoetes engelmannii	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
29	Huperzia lucidulum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
30	Lycopodiella inundatum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
31	Lycopodium phlegmaria	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
32	Lycopodium taxifolium	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
33	Lycopodium tristachyum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
34	Selaginella umbrosa	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	T	G
35	Selaginella vogelii	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
36	Oryza sativa	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	C	G
37	Zea mays	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	C	G
38	Arabidopsis thaliana	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
39	Glycine max	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
40	Sinapis alba	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
41	Zamia pumila	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
42	Gnetum leyboldii	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
43	Ginkgo biloba	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
44	Pinus luchuensis	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
45	Pinus wallichiana	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
46	Nageia nagi	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
47	Taxus mairei	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
48	Adiantum raddianum	A	.	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
49	Adiantum raddianum 2	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
50	Ophioglossum petiolatum	A	A	T	?	?	?	?	?	?	?	?	.	?	?	?	?	?	?	.	.	?	?	?	?	?	.	?	?	?	?
51	Osmunda cinnamomea	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
52	Salvinia natans	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
53	Psilotum nudum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
54	Chara foetida	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	C	G
55	Coleochaete scutata	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
56	Klebsormidium flaccidum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	A	G
57	Nitella flexilis	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	C	G
58	Nitella sp.	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	C	G
59	Chlamydomonas reinhardtii	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	C	G
60	Hydrodictyon reticulatum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	C	A	C	C	A	.	G	G	C	G
61	Parietochloris pseudoalveolaris	A	A	T	T	G	A	C	G	G	A	A	A	G	G	G	C	A	G	G	C	C	A	C	C	A	.	G	G	C	G
62	Dictyostelium discoideum	A	A	T	T	G	A	C	G	G	A	A	.	G	G	G	C	A	C	.	.	.	A	C	A	A	T	G	G	A	G
63	Pteris vittata	?	?	?	?	?	?	?	?	?	?	?	.	?	?	?	?	?	?	.	.	C	A	C	C	A	.	G	G	A	G
64	Megaceros aenigmaticus	?	?	?	?	?	?	?	?	?	?	?	.	?	?	G	?	A	?	.	.	C	A	C	?	A	.	G	G	A	G
65	Notothylas breutelii	?	?	?	?	?	?	?	?	?	?	?	.	?	?	G	?	A	?	.	.	C	A	C	?	A	.	G	G	A	G
66	Physcomitrella patens	?	?	?	?	?	?	?	?	?	?	?	.	?	?	G	C	A	C	.	.	?	A	C	C	A	.	G	G	A	G
67	Sphagnum palustre	?	?	?	?	?	?	?	?	?	?	?	.	?	?	?	?	?	?	.	.	C	A	C	C	A	.	G	G	A	G

Taxa with Variability Info	48	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440
		5	5.	0	6	5.	5	6.	5.	5	0.		6.	6.	5.	6.	6.	6.	6.	6.	6.	6.	5.	6.	6.	6	6	6	6	6	6
1	Saccharomyces cerevisiae	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	.	T	A	A	T	T	T	G	A	C	T	C	A	A
2	Schizosaccharomyces pombe	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
3	Physcomitrella patens 2	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
4	Anthoceros agrestis	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
5	Anthoceros laevis	C	A	G	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
6	Pellia epiphylla	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
7	Reboulia hemisphaerica	T	G	G	G	A	G	C	.	T	.	.	G	C	G	G	C	T	T	A	A	T	C	T	G	A	C	T	C	A	A
8	Riccardia pinguis	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
9	Sphaerocarpos donnellii	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
10	Sphaerocarpus texanus	T	G	.	G	A	G	C	.	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	.
11	Atrichum undulatum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
12	Bryum argenteum	T	G	.	G	A	.	C	.	T	.	.	.	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
13	Eurhynchium hians	T	G	.	G	A	G	C	C	T	.	.	G	C	A	G	C	T	C	A	A	T	T	T	G	A	C	T	C	A	A
14	Funaria hygrometrica	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
15	Leptobryum pyriforme	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
16	Mnium hornum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
17	Physcomitrium pyriforme	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
18	Polytrichum formosum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
19	Sphagnum cuspidatum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
20	Calypogeia arguta	T	G	.	G	A	C	C	G	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
21	Conocephalum conicum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
22	Fossombronia pusilla	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
23	Marchantia polymorpha	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
24	Riccia fluitans	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
25	Scapania nemorosa	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
26	Equisetum hyemale	T	G	.	G	A	G	C	C	G	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
27	Equisetum robustum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
28	Isoetes engelmannii	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
29	Huperzia lucidulum	T	G	.	G	A	G	C	?	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
30	Lycopodiella inundatum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
31	Lycopodium phlegmaria	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
32	Lycopodium taxifolium	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
33	Lycopodium tristachyum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
34	Selaginella umbrosa	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
35	Selaginella vogelii	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
36	Oryza sativa	T	G	.	G	G	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
37	Zea mays	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
38	Arabidopsis thaliana	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
39	Glycine max	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	.	T	A	A	T	T	T	G	A	C	T	C	A	A
40	Sinapis alba	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
41	Zamia pumila	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
42	Gnetum leyboldii	T	G	.	G	A	G	C	C	G/T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
43	Ginkgo biloba	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
44	Pinus luchuensis	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
45	Pinus wallichiana	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
46	Nageia nagi	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
47	Taxus mairei	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
48	Adiantum raddianum	T	G	.	G	C	A	.	T	G	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
49	Adiantum raddianum 2	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
50	Ophioglossum petiolatum	?	?	.	?	?	?	.	?	?	.	.	?	?	?	?	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
51	Osmunda cinnamomea	T	G	.	G	A	G	.	C	C	T	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
52	Salvinia natans	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
53	Psilotum nudum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
54	Chara foetida	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
55	Coleochaete scutata	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
56	Klebsormidium flaccidum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
57	Nitella flexilis	T	G	.	G	A	G	C	.	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
58	Nitella sp.	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
59	Chlamydomonas reinhardtii	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
60	Hydrodictyon reticulatum	T	G	.	G	A	G	C	?	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
61	Parietochloris pseudoalveolaris	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
62	Dictyostelium discoideum	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
63	Pteris vittata	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
64	Megaceros aenigmaticus	T	G	.	G	A	G	C	.	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
65	Notothylas breutelii	T	G	.	G	A	G	C	.	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
66	Physcomitrella patens	T	G	.	G	A	G	C	.	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A
67	Sphagnum palustre	T	G	.	G	A	G	C	C	T	.	.	G	C	G	G	C	T	T	A	A	T	T	T	G	A	C	T	C	A	A

Taxa with Variability Info 40	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470
	6	6.	6	6.	6	6.	3.	6.	5.	5.	6.	6.	2.	6.	6.	6.	6.	4.	6.	6.	6.	6.	6.	6.	6	6	6	3	4	3
1 Saccharomyces cerevisiae	C	A	C	G	G	G	G	A	A	A	C	T	C	A	C	C	A	G	G	T	C	C	A	G	A	C	A	C	A	A
2 Schizosaccharomyces pombe	C	A	C	G	G	G	G	A	A	A	C	T	C	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
3 Physcomitrella patens 2	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
4 Anthoceros agrestis	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
5 Anthoceros laevis	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
6 Pellia epiphylla	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
7 Reboulia hemisphaerica	C	A	C	G	G	G	G	A	C	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
8 Riccardia pinguis	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
9 Sphaerocarpos donnellii	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
10 Sphaerocarpus texanus	C	A	C	G	G	G	G	A	C	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
11 Atrichum undulatum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
12 Bryum argenteum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
13 Eurhynchium hians	C	A	C	G	G	G	G	A	A	C	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
14 Funaria hygrometrica	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
15 Leptobryum pyriforme	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
16 Mnium hornum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
17 Physcomitrium pyriforme	C	A	C	G	G	G	G	A	A	C	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
18 Polytrichum formosum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
19 Sphagnum cuspidatum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
20 Calypogeia arguta	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
21 Conocephalum conicum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
22 Fossombronia pusilla	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
23 Marchantia polymorpha	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
24 Riccia fluitans	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
25 Scapania nemorea	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
26 Equisetum hyemale	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
27 Equisetum robustum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
28 Isoetes engelmannii	C	A	C	G	G	G	·	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
29 Huperzia lucidula	C	A	C	G	G	G	G	·	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
30 Lycopodiella inundatum	C	A	C	G	G	G	G	·	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
31 Lycopodium phlegmaria	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
32 Lycopodium taxifolium	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
33 Lycopodium tristachyum	C	A	C	G	G	G	G	·	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
34 Selaginella umbrosa	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
35 Selaginella vogelii	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
36 Oryza sativa	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
37 Zea mays	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
38 Arabidopsis thaliana	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
39 Glycine max	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
40 Sinapis alba	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	A	G	T	C	C	A	G	A	C	A	T	A	G
41 Zamia pumila	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
42 Gnetum leyboldii	C	A	C	G	G	G	A	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
43 Ginkgo biloba	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
44 Pinus luchuensis	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
45 Pinus wallichiana	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
46 Nageia nagi	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
47 Taxus mairei	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
48 Adiantum raddianum	C	A	C	G	G	G	·	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
49 Adiantum raddianum 2	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
50 Ophioglossum petiolatum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
51 Osmunda cinnamomea	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
52 Salvinia natans	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
53 Psilotum nudum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
54 Chara foetida	C	A	C	G	G	G	G	A	A	A	C	T	C	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
55 Coleochaete scutata	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
56 Klebsormidium flaccidum	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
57 Nitella flexilis	C	A	C	G	G	G	G	A	A	A	C	T	C	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
58 Nitella sp.	C	A	C	G	G	G	G	A	A	A	C	T	C	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
59 Chlamydomonas reinhardtii	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	C	G	G
60 Hydrodictyon reticulatum	C	A	C	G	G	G	A	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
61 Parietochloris pseudoalveolaris	C	A	C	G	G	G	A	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	G	T
62 Dictyostelium discoideum	C	T	C	G	G	G	A	A	A	A	C	T	T	A	C	C	A	A	G	C	T	A	A	G	A	T	A	T	A	G
63 Pteris vittata	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
64 Megaceros aenigmaticus	C	A	C	?	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
65 Notothylas breutelii	C	A	C	G	G	G	G	A	A	A	C	T	C	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
66 Physcomitrella patens	C	A	C	G	G	G	G	A	A	A	C	T	T	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G
67 Sphagnum palustre	C	A	C	G	G	G	G	A	A	A	C	T	C	A	C	C	A	G	G	T	C	C	A	G	A	C	A	T	A	G

Taxa with Variability Info	50	1471	1472	1473	1474	1475	1476	1477	1478	1479	1480	1481	1482	1483	1484	1485	1486	1487	1488	1489	1490	1491	1492	1493	1494	1495	1496	1497	1498	1499	1500
		3	4.	6	6	6.	5.	6.	6.	6.	6	6.	6.	6.	6.	3.	6.	6.	6.	4.	6.	5.	4.	6	6	6	5.	6.	6	6	6
1	Saccharomyces cerevisiae	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
2	Schizosaccharomyces pombe	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
3	Physcomitrella patens 2	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
4	Anthoceros agrestis	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
5	Anthoceros laevis	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
6	Pellia epiphylla	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
7	Reboulia hemisphaerica	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	C	G	T	C	T	T	T	C	T	T
8	Riccardia pinguis	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
9	Sphaerocarpos donnellii	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
10	Sphaerocarpus texanus	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	.
11	Atrichum undulatum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
12	Bryum argenteum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
13	Eurhynchium hians	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
14	Funaria hygrometrica	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
15	Leptobryum pyriforme	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
16	Mnium hornum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
17	Physcomitrium pyriforme	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	C	T	C	T	T
18	Polytrichum formosum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
19	Sphagnum cuspidatum	T	G	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
20	Calypogeia arguta	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
21	Conocephalum conicum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
22	Fossombronia pusilla	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
23	Marchantia polymorpha	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
24	Riccia fluitans	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
25	Scapania nemorosa	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
26	Equisetum hyemale	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
27	Equisetum robustum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
28	Isoetes engelmannii	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
29	Huperzia lucidulum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
30	Lycopodiella inundatum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
31	Lycopodium phlegmaria	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
32	Lycopodium taxifolium	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
33	Lycopodium tristachyum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
34	Selaginella umbrosa	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	T	A	G	C	T	C	T	T	T	C	T	T
35	Selaginella vogelii	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
36	Oryza sativa	C	A	A	G	G	A	T	T	G	A	C	A	G	A	C	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
37	Zea mays	C	A	A	G	G	A	T	T	G	A	C	A	G	A	C	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
38	Arabidopsis thaliana	T	A	A	G	G	A	T	T	G	A	C	A	G	A	C	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
39	Glycine max	T	A	A	.	G	G	T	T	G	A	C	A	G	A	C	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
40	Sinapis alba	T	A	A	G	G	A	T	T	G	A	C	A	G	A	C	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
41	Zamia pumila	C	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
42	Gnetum leyboldii	C	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
43	Ginkgo biloba	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
44	Pinus luchuensis	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
45	Pinus wallichiana	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
46	Nageia nagi	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
47	Taxus mairei	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
48	Adiantum raddianum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
49	Adiantum raddianum 2	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
50	Ophioglossum petiolatum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
51	Osmunda cinnamomea	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
52	Salvinia natans	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
53	Psilotum nudum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
54	Chara foetida	C	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
55	Coleochaete scutata	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
56	Klebsormidium flaccidum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
57	Nitella flexilis	C	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
58	Nitella sp.	C	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
59	Chlamydomonas reinhardtii	G	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
60	Hydrodictyon reticulatum	T	G	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
61	Parietochloris pseudoalveolaris	G	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
62	Dictyostelium discoideum	T	A	A	G	G	A	T	T	G	A	C	A	G	A	C	T	A	A	A	A	G	A	T	C	T	T	T	C	A	T
63	Pteris vittata	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
64	Megaceros aenigmaticus	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
65	Notothylas breutelii	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
66	Physcomitrella patens	T	A	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T
67	Sphagnum palustre	T	G	A	G	G	A	T	T	G	A	C	A	G	A	T	T	G	A	G	A	G	C	T	C	T	T	T	C	T	T

Taxa with Variability Info 51		1801	1802	1803	1804	1805	1806	1807	1808	1809	1810	1811	1812	1813	1814	1815	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825	1826	1827	1828	1829	1830
		6	6	6.	6	4.	6.	3.	6.	6.	6.	6.	0.	5.	6.	6.	6.	5.	6.	6.	5.	5.	6.	6	6		6.	4	6	6	6
1	Saccharomyces cerevisiae	G	A	T	T	T	T	G	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
2	Schizosaccharomyces pombe	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
3	Physcomitrella patens 2	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
4	Anthoceros agrestis	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
5	Anthoceros laevis	G	A	T	T	C	T	A	T	G	G	G	T	C	C	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
6	Pellia epiphylla	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
7	Reboulia hemisphaerica	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	C	G	A	T	G	.	G	C	C	G	T
8	Riccardia pinguis	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
9	Sphaerocarpos donnelli	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
10	Sphaerocarpus texanus	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	C	G	A	T	G	.	G	C	C	G	T
11	Atrichum undulatum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
12	Bryum argenteum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
13	Eurhynchium hians	G	A	T	T	C	T	A	T	G	G	G	T	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
14	Funaria hygrometrica	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
15	Leptobryum pyriforme	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
16	Mnium hornum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
17	Physcomitrium pyriforme	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
18	Polytrichum formosum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
19	Sphagnum cuspidatum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
20	Calypogeia arguta	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
21	Conocephalum conicum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
22	Fossombronia pusilla	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
23	Marchantia polymorpha	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
24	Riccia fluitans	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
25	Scapania nemorosa	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
26	Equisetum hyemale	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	A	G	T	G	C	A	T	G	.	G	C	C	G	T
27	Equisetum robustum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
28	Isoetes engelmannii	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
29	Huperzia lucidulum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
30	Lycopodiella inundatum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
31	Lycopodium phlegmaria	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
32	Lycopodium taxifolium	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
33	Lycopodium tristachyum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
34	Selaginella umbrosa	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
35	Selaginella vogelii	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
36	Oryza sativa	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
37	Zea mays	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	T	C	G	T
38	Arabidopsis thaliana	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
39	Glycine max	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
40	Sinapis alba	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
41	Zamia pumila	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
42	Gnetum leyboldii	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
43	Ginkgo biloba	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
44	Pinus luchuensis	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
45	Pinus wallichiana	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
46	Nageia nagi	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
47	Taxus mairei	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
48	Adiantum raddianum	G	A	T	T	.	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
49	Adiantum raddianum 2	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
50	Ophioglossum petiolatum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
51	Osmunda cinnamomea	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
52	Salvinia natans	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
53	Psilotum nudum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
54	Chara foetida	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
55	Coleochaete scutata	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
56	Klebsormidium flaccidum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
57	Nitella flexilis	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
58	Nitella sp	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
59	Chlamydomonas reinhardtii	G	A	T	T	C	T	G	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
60	Hydrodictyon reticulatum	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
61	Parietochloris pseudoalveolaris	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
62	Dictyostelium discoideum	G	A	T	T	C	T	A	T	A	A	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	T	C	G	T
63	Pteris vittata	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
64	Megaceros aenigmaticus	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
65	Notothylas breutelii	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
66	Physcomitrella patens	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T
67	Sphagnum palustre	G	A	T	T	C	T	A	T	G	G	G	.	T	G	G	T	G	G	T	G	C	A	T	G	.	G	C	C	G	T

Taxa with Variability Info	52	1831	1832	1833	1834	1835	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860
		6.	0.	8.	8.	3.	6	6.	6.		6.	6.	5.	5.	6.	5.	4.	3.	3.	6.	4.	4.	6.	6.	6	6.	6	4.	6	3	0.
1	Saccharomyces cerevisiae	T	T	C	T	C	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	C	.
2	Schizosaccharomyces pombe	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	C	.
3	Physcomitrella patens 2	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
4	Anthoceros agrestis	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
5	Anthoceros laevis	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
6	Pellia epiphylla	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
7	Reboulia hemisphaerica	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
8	Riccardia pinguis	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
9	Sphaerocarpos donnellii	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
10	Sphaerocarpus texanus	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
11	Atrichum undulatum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
12	Bryum argenteum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
13	Eurhynchium hians	T	.	C	T	T	A	G	T	.	T	G	A	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
14	Funaria hygrometrica	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
15	Leptobryum pyriforme	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
16	Mnium hornum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
17	Physcomitrium pyriforme	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
18	Polytrichum formosum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
19	Sphagnum cuspidatum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
20	Calypogeia arguta	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
21	Conocephalum conicum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
22	Fossombronia pusilla	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
23	Marchantia polymorpha	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
24	Riccia fluitans	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
25	Scapania nemorea	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
26	Equisetum hyemale	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
27	Equisetum robustum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
28	Isoetes engelmannii	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
29	Huperzia lucidulum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
30	Lycopodiella inundatum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
31	Lycopodium phlegmaria	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
32	Lycopodium taxifolium	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
33	Lycopodium tristachyum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
34	Selaginella umbrosa	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	T	T	G	A	T	T	T	G	T	C	T	G	G	.
35	Selaginella vogelii	T	.	C	T	T	A	G	T	.	T	G	G	T	G	A	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
36	Oryza sativa	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
37	Zea mays	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
38	Arabidopsis thaliana	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
39	Glycine max	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
40	Sinapis alba	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
41	Zamia pumila	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
42	Gnetum leyboldii	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
43	Ginkgo biloba	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
44	Pinus luchuensis	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
45	Pinus wallichiana	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
46	Nageia nagi	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
47	Taxus mairei	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
48	Adiantum raddianum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
49	Adiantum raddianum 2	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
50	Ophioglossum petiolatum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
51	Osmunda cinnamomea	T	.	C	T	T	A	G	T	.	T	G	G	A	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
52	Salvinia natans	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
53	Psilotum nudum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
54	Chara foetida	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
55	Coleochaete scutata	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
56	Klebsormidium flaccidum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
57	Nitella flexilis	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
58	Nitella sp.	T	.	C	T	T	A	G	T	.	T	A/G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
59	Chlamydomonas reinhardtii	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	G	T	T	G	C	C	T	T	G	T	C	A	G	G	.
60	Hydrodictyon reticulatum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	G	T	T	G	C	C	T	T	G	T	C	A	G	G	.
61	Parietochloris pseudoalveolaris	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	G	T	T	G	C	C	T	T	G	T	C	A	G	G	T
62	Dictyostelium discoideum	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	C	G	A	T	T	T	G	T	C	T	G	G	.
63	Pteris vittata	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
64	Megaceros aenigmaticus	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
65	Notothylas breutelii	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
66	Physcomitrella patens	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.
67	Sphagnum palustre	T	.	C	T	T	A	G	T	.	T	G	G	T	G	G	A	G	T	G	A	T	T	T	G	T	C	T	G	G	.

No.	Taxa with Variability Info 53	1661	1662	1663	1664	1665	1666	1667	1668	1669	1670	1671	1672	1673	1674	1675	1676	1677	1678	1679	1680	1681	1682	1683	1684	1685	1686	1687	1688	1689	1690
		6.	4.	4.	6.	6.	6.	3.	6.	6.	2.	6.	5.	6.	6.	6.	6.	6.		5.	6.	6.	5.	6.	5	6.	6.	3.	4	2	6
1	Saccharomyces cerevisiae	T	T	A	A	T	T	G	C	G	A	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	T	A	A	C
2	Schizosaccharomyces pombe	T	T	A	A	T	T	G	C	G	A	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	T	A	A	C
3	Physcomitrella patens 2	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
4	Anthoceros agrestis	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
5	Anthoceros laevis	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
6	Pellia epiphylla	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	G	G	A	G	A	C	C	T	C	A	G	C
7	Reboulia hemisphaerica	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
8	Riccardia pinguis	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
9	Sphaerocarpos donnellii	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
10	Sphaerocarpus texanus	T	T	A	A	T	.	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
11	Atrichum undulatum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
12	Bryum argenteum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
13	Eurhynchium hians	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
14	Funaria hygrometrica	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
15	Leptobryum pyriforme	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
16	Mnium hornum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
17	Physcomitrium pyriforme	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
18	Polytrichum formosum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
19	Sphagnum cuspidatum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
20	Calypogeia arguta	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	A	C	T	C	A	G	C
21	Conocephalum conicum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
22	Fossombronia pusilla	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
23	Marchantia polymorpha	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
24	Riccia fluitans	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
25	Scapania nemorosa	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
26	Equisetum hyemale	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
27	Equisetum robustum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
28	Isoetes engelmannii	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
29	Huperzia lucidula	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
30	Lycopodiella inundatum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
31	Lycopodium phlegmaria	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
32	Lycopodium taxifolium	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
33	Lycopodium tristachyum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	A	C
34	Selaginella umbrosa	T	T	A	A	T	T	C	C	G	A	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
35	Selaginella vogelii	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
36	Oryza sativa	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
37	Zea mays	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
38	Arabidopsis thaliana	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
39	Glycine max	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
40	Sinapis alba	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	G	G	C
41	Zamia pumila	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
42	Gnetum leyboldii	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
43	Ginkgo biloba	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
44	Pinus luchuensis	T	T	A	A	T	T	C	C	G	A	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
45	Pinus wallichiana	T	T	A	A	T	T	C	C	G	A	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
46	Nageia nagi	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
47	Taxus mairei	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
48	Adiantum raddianum	T	T	A	A	T	T	C	C	.	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
49	Adiantum raddianum 2	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
50	Ophioglossum petiolatum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
51	Osmunda cinnamomea	T	T	A	A	T	T	C	C	G	T	T	T	A	C	G	A	A	.	C	G	A	T	A	C	C	T	C	A	G	C
52	Salvinia natans	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
53	Psilotum nudum	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
54	Chara foetida	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
55	Coleochaete scutata	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
56	Klebsormidium flaccidum	T	T	A	A	T	T	C	C	G	A	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
57	Nitella flexilis	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
58	Nitella sp.	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
59	Chlamydomonas reinhardtii	T	T	G	A	T	T	C	C	G	G	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
60	Hydrodictyon reticulatum	T	T	G	A	T	T	C	C	G	G	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
61	Parietochloris pseudoalveolaris	T	C	G	A	T	T	C	C	G	G	T	A	A	C	G	G	A	.	C	G	A	G	A	C	C	T	C	G	A	.
62	Dictyostelium discoideum	T	C	A	A	T	T	C	C	G	A	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
63	Pteris vittata	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
64	Megaceros aenigmaticus	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
65	Notothylas breutelii	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
66	Physcomitrella patens	T	T	A	A	T	T	C	C	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C
67	Sphagnum palustre	T	T	A	A	T	T	C	G	G	T	T	A	A	C	G	A	A	.	C	G	A	G	A	C	C	T	C	A	G	C

Taxa with Variability Info	54	1591	1592	1593	1594	1595	1596	1597	1598	1599	1600	1601	1602	1603	1604	1605	1606	1607	1608	1609	1610	1611	1612	1613	1614	1615	1616	1617	1618	1619	1620
		8.	6.	3.	4.	6	6.	6.	2.	4.	6.	0.	4.	2.	2.	2.	2.	1.	0.	2.	2.	1.	2.	2.	1	0.	0.	0.	0	0	0
1	Saccharomyces cerevisiae	C	T	A	C	T	A	A	A	T	A	.	G	T	G	G	T	G	.	C	T	A	G	C	A	.	.	.	.	.	.
2	Schizosaccharomyces pombe	C	T	G	C	T	A	A	A	T	A	.	G	C	T	G	G	A	.	T	C	A	G	C	C	A	T	T	.	.	.
3	Physcomitrella patens 2	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	G	A	.	.	.	.	.
4	Anthoceros agrestis	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
5	Anthoceros laevis	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	A	.	.	.	.	.
6	Pellia epiphylla	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
7	Reboulia hemisphaerica	C	T	G	C	T	A	A	C	T	A	.	C	T	A	C	G	C	.	G	G	G	G	G	A	.	.	.	.	.	.
8	Riccardia pinguis	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	A	A	.	.	.	.	.
9	Sphaerocarpos donnellii	C	T	A	T	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	A	.	G	G	A	.	.	.	.	.
10	Sphaerocarpus texanus	C	T	A	T	T	A	A	C	T	A	.	G	C	T	A	G	C	G	C	G	A	G	G	C	A	.	.	.	.	.
11	Atrichum undulatum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	A	.	.	.	.	.
12	Bryum argenteum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	G	A	.	.	.	.	.
13	Eurhynchium hians	C	T	G	C	T	A	A	C	C	A	.	C	T	T	G	C	G	.	C	C	A	A	G	G	A	.	.	.	.	.
14	Funaria hygrometrica	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	G	A	.	.	.	.	.
15	Leptobryum pyriforme	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	G	A	.	.	.	.	.
16	Mnium hornum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	G	A	.	.	.	.	.
17	Physcomitrium pyriforme	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	T	G	A	A	G	G	A	.	.	.	.	.
18	Polytrichum formosum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	A	A	.	.	.	.	.
19	Sphagnum cuspidatum	C	T	G	C	T	A	A	C	T	A	.	G	T	C	A	C	G	.	C	G	A	A	G	G	G	.	.	.	.	.
20	Calypogeia arguta	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	A	.	.	.	.	.
21	Conocephalum conicum	C	T	G	C	T	A	A	C	T	A	C	G	C	T	A	C	G	.	C	G	G	A	G	T	C	.	.	.	.	.
22	Fossombronia pusilla	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
23	Marchantia polymorpha	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	G	G	G	A	.	.	.	.	.	.
24	Riccia fluitans	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	G	G	G	G	.	.	.	.	.	.
25	Scapania nemorosa	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
26	Equisetum hyemale	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	A	.	.	.	.	.	.
27	Equisetum robustum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	A	.	.	.	.	.	.
28	Isoetes engelmannii	C	T	G	C	T	A	A	C	T	A	.	G	T	.	A	C	G	A	C	G	A	A	G	G	A	.	.	.	.	.
29	Huperzia lucidulum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
30	Lycopodiella inundatum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
31	Lycopodium phlegmaria	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
32	Lycopodium taxifolium	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
33	Lycopodium tristachyum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
34	Selaginella umbrosa	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	A	G	A	G	G	.	.	.	.	.	.
35	Selaginella vogelii	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	T	.	C	G	G	A	G	G	.	.	.	.	.	.
36	Oryza sativa	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	T	G	.	C	G	G	A	G	C	.	.	.	.	.	.
37	Zea mays	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	T	G	.	C	G	G	A	G	C	.	.	.	.	.	.
38	Arabidopsis thaliana	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	T	G	G	A	G	G	.	.	.	.	.	.
39	Glycine max	C	T	G	C	T	A	A	A	T	A	.	G	C	T	A	T	G	.	T	G	G	A	G	G	.	.	.	.	.	.
40	Sinapis alba	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	T	G	G	A	G	G	.	.	.	.	.	.
41	Zamia pumila	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	G	A	G	G	.	.	.	.	.	.
42	Gnetum leyboldii	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	T	G	G	A	G	G	.	.	.	.	.	.
43	Ginkgo biloba	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	T	G	.	C	G	G	A	G	G	.	.	.	.	.	.
44	Pinus luchuensis	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	G	A	G	G	.	.	.	.	.	.
45	Pinus wallichiana	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	G	A	G	G	.	.	.	.	.	.
46	Nageia nagi	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	A	.	C	G	G	A	G	G	.	.	.	.	.	.
47	Taxus mairei	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	G	A	G	G	.	.	.	.	.	.
48	Adiantum raddianum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	G	.	.	.	.	.	.
49	Adiantum raddianum 2	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	G	.	.	.	.	.	.
50	Ophioglossum petiolatum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	C	.	.	.	.	.	.
51	Osmunda cinnamomea	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
52	Salvinia natans	C	T	G	C	T	A	A	C	T	A	.	G	T	C	A	C	G	.	C	G	A	A	G	G	.	.	.	.	.	.
53	Psilotum nudum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	G	.	.	.	.	.	.
54	Chara foetida	C	T	G	C	T	A	A	A	T	A	.	G	C	T	A	C	G	.	C	G	G	G	G	A	.	.	.	.	.	.
55	Coleochaete scutata	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	A	A	A	G	G	.	.	.	.	.	.
56	Klebsormidium flaccidum	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	.	.	.	.	.	.
57	Nitella flexilis	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	A	G	G	A	.	.	.	.	.	.
58	Nitella sp.	C	T	G	C	T	A	A	C	T	A	.	G	C	T	A	C	G	.	C	G	A	G	G	A	.	.	.	.	.	.
59	Chlamydomonas reinhardtii	C	T	G	C	T	A	A	A	T	A	.	G	T	C	A	G	C	.	A	T	C	G	C	.	.	.	.	.	.	.
60	Hydrodictyon reticulatum	C	T	G	C	T	A	A	A	T	A	.	G	T	C	A	C	G	.	G	T	C	G	C	.	.	.	.	.	.	.
61	Parietochloris pseudoalveolaris	C	T	G	C	T	A	A	A	T	A	.	G	T	C	A	C	G	.	G	T	T	G	G	.	.	.	.	.	.	.
62	Dictyostelium discoideum	C	C	T	G	C	T	A	A	C	T	.	A	G	T	A	G	T	.	A	T	T	T	A	T	T	A	G	T	C	G
63	Pteris vittata	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	G	.	.	.	.	.	.
64	Megaceros aenigmaticus	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	A	.	.	.	.	.
65	Notothylas breutelii	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	A	.	C	G	A	A	G	A	A	.	.	.	.	.
66	Physcomitrella patens	C	T	G	C	T	A	A	C	T	A	.	G	T	T	A	C	G	.	C	G	A	A	G	G	A	.	.	.	.	.
67	Sphagnum palustre	C	T	G	T	T	A	A	C	T	A	.	G	T	C	A	C	G	.	C	G	A	A	G	G	G	.	.	.	.	.

Taxa with Variability Info	55	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050
		0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0	0	0	0
1	Saccharomyces cerevisiae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	Schizosaccharomyces pombe	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	Physcomitrella patens 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	Anthoceros agrestis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	Anthoceros laevis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	Pellia epiphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	Reboulia hemisphaerica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	Riccardia pinguis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	Sphaerocarpos donnellii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	Sphaerocarpus texanus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	Atrichum undulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	Bryum argenteum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	Eurhynchium hians	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	Funaria hygrometrica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	Leptobryum pyriforme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	Mnium hornum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	Physcomitrium pyriforme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	Polytrichum formosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	Sphagnum cuspidatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	Calypogeia arguta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	Conocephalum conicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	Fossombronia pusilla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	Marchantia polymorpha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	Riccia fluitans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	Scapania nemorea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	Equisetum hyemale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	Equisetum robustum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	Isoetes engelmannii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	Huperzia lucidulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	Lycopodiella inundatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	Lycopodium phlegmaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	Lycopodium tuxifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	Lycopodium tristachyum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	Selaginella umbrosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	Selaginella vogelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	Oryza sativa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	Zea mays	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	Glycine max	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40	Sinapis alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	Zamia pumila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	Gnetum leyboldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	Ginkgo biloba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	Pinus luchuensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	Pinus wallichiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46	Nageia nagi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47	Taxus mairei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48	Adiantum raddianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	Adiantum raddianum 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	Ophioglossum petiolatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51	Osmunda cinnamomea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52	Salvinia natans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53	Psilotum nudum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54	Chara foetida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55	Coleochaete scutata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56	Klebsormidium flaccidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
57	Nitella flexilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	Nitella sp	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59	Chlamydomonas reinhardtii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	Hydrodictyon reticulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
61	Parietochloris pseudoalveolaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62	Dictyostelium discoideum	A	T	A	T	A	G	A	C	G	A	T	A	G	C	T	T	T	T	C	T	G	G	G	G	T	T	T	G	G	A
63	Pteris vittata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64	Megaceros aenigmaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65	Notothylas breutelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
66	Physcomitrella patens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	Sphagnum palustre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Taxa with Variability Info	59	1651	1652	1653	1654	1655	1656	1657	1658	1659	1660	1661	1662	1663	1664	1665	1666	1667	1668	1669	1670	1671	1672	1673	1674	1675	1676	1677	1678	1679	1680
		0.	0.	0.	0.	0.	0.	0.	0.	0.																				.	
1	Saccharomyces cerevisiae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	Schizosaccharomyces pombe	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	Physcomitrella patens 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	Anthoceros agrestis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	Anthoceros laevis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	Pellia epiphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	Reboulia hemisphaerica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	Riccardia pinguis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	Sphaerocarpos donnellii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	Sphaerocarpus texanus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	Atrichum undulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	Bryum argenteum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	Eurhynchium hians	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	Funaria hygrometrica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	Leptobryum pyriforme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	Mnium hornum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	Physcomitrium pyriforme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	Polytrichum formosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	Sphagnum cuspidatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	Calypogeia arguta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	Conocephalum conicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	Fossombronia pusilla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	Marchantia polymorpha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	Riccia fluitans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	Scapania nemorea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	Equisetum hyemale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	Equisetum robustum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	Isoetes engelmannii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	Huperzia lucidulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	Lycopodiella inundatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	Lycopodium phlegmaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	Lycopodium taxifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	Lycopodium tristachyum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	Selaginella umbrosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	Selaginella vogelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	Oryza sativa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	Zea mays	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	Glycine max	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40	Sinapis alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	Zamia pumila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	Gnetum leyboldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	Ginkgo biloba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	Pinus luchuensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	Pinus wallichiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46	Nageia nagi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47	Taxus mairei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48	Adiantum raddianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	Adiantum raddianum 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	Ophioglossum petiolatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51	Osmunda cinnamomea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52	Salvinia natans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53	Psilotum nudum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54	Chara foetida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55	Coleochaete scutata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56	Klebsormidium flaccidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
57	Nitella flexilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	Nitella sp	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59	Chlamydomonas reinhardtii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	Hydrodictyon reticulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
61	Parietochloris pseudoalveolaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62	Dictyostelium discoideum	A	T	G	A	T	T	T	C	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
63	Pteris vittata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64	Megaceros aenigmaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65	Notothylas breutelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
66	Physcomitrella patens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	Sphagnum palustre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

	Taxa with Variability Info 57	1681	1682	1683	1684	1685	1686	1687	1688	1689	1690	1691	1692	1693	1694	1695	1696	1697	1698	1699	1700	1701	1702	1703	1704	1705	1706	1707	1708	1709	1710
						0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0	0	0	0
1	Saccharomyces cerevisiae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	Schizosaccharomyces pombe	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	Physcomitrella patens 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	Anthoceros agrestis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	Anthoceros laevis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	Pellia epiphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	Reboulia hemisphaerica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	Riccardia pinguis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	Sphaerocarpos donnellii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	Sphaerocarpus texanus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	Atrichum undulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	Bryum argenteum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	Eurhynchium hians	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	Funaria hygrometrica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	Leptobryum pyriforme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	Mnium hornum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	Physcomitrium pyriforme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	Polytrichum formosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	Sphagnum cuspidatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	Calypogeia arguta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	Conocephalum conicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	Fossombronia pusilla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	Marchantia polymorpha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	Riccia fluitans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	Scapania nemorosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	Equisetum hyemale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	Equisetum robustum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	Isoetes engelmannii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	Huperzia lucidula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	Lycopodiella inundatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	Lycopodium phlegmaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	Lycopodium taxifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	Lycopodium tristachyum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	Selaginella umbrosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	Selaginella vogelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	Oryza sativa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	Zea mays	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	Glycine max	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40	Sinapis alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	Zamia pumila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	Gnetum leyboldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	Ginkgo biloba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	Pinus luchuensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	Pinus wallichiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46	Nageia nagi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47	Taxus mairei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48	Adiantum raddianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	Adiantum raddianum 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	Ophioglossum petiolatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51	Osmunda cinnamomea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52	Salvinia natans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53	Psilotum nudum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54	Chara foetida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55	Coleochaete scutata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56	Klebsormidium flaccidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
57	Nitella flexilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	Nitella sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59	Chlamydomonas reinhardtii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	Hydrodictyon reticulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
61	Parietochloris pseudoalveolaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62	Dictyostelium discoideum	.	.	.	.	G	T	C	A	T	C	T	C	C	T	G	C	T	T	C	A	A	G	G	A	G	T	G	T	G	T
63	Pteris vittata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64	Megaceros aenigmaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65	Notothylas breutelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
66	Physcomitrella patens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	Sphagnum palustre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

	Taxa with Variability Info 58	1711	1712	1713	1714	1715	1716	1717	1718	1719	1720	1721	1722	1723	1724	1725	1726	1727	1728	1729	1730	1731	1732	1733	1734	1735	1736	1737	1738	1739	1740
		0	0.	0.	0.	0.	0	-1	-1	-1	-1	-1	1.	1.	1.	1.	1.	2.	1.	2.	1.	2.	1.	2.	2.	0.	2.	3.	2	1	6
1	Saccharomyces cerevisiae	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	T	G	C	T	G	G	T	T	A	.	T	C	C	A	C
2	Schizosaccharomyces pombe	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	G	G	C	T	G	A	T	C	A	.	T	T	A	G	C
3	Physcomitrella patens 2	.	.	.	.	.	.	.	.	.	T	T	T	T	T	T	C	C	T	T	T	G	C	G	G	.	C	C	A	A	C
4	Anthoceros agrestis	.	.	.	.	.	.	.	.	.	.	.	A	C	C	T	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
5	Anthoceros laevis	.	.	.	.	.	.	.	.	.	.	.	.	C	C	T	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
6	Pellia epiphylla	.	.	.	.	.	.	.	.	.	.	A	T	C	.	T	T	C	T	T	T	G	T	G	G	.	C	C	A	A	C
7	Reboulia hemisphaerica	.	.	.	.	.	.	.	.	.	.	.	T	T	C	T	C	C	C	C	T	G	C	G	G	.	C	C	A	G	C
8	Riccardia pinguis	.	.	.	.	.	.	.	.	.	.	.	.	T	C	T	T	C	T	T	G	G	C	G	G	.	C	C	A	A	C
9	Sphaerocarpos donnellii	.	.	.	.	.	.	.	.	.	.	.	C	T	T	G	T	C	C	T	T	G	T	G	G	.	C	C	A	G	C
10	Sphaerocarpus texanus	.	.	.	.	.	.	.	.	.	.	.	C	T	T	G	T	C	C	T	T	G	T	G	.	.	C	C	A	G	C
11	Atrichum undulatum	.	.	.	.	.	.	.	.	.	.	.	.	T	C	T	T	C	T	T	T	G	T	G	G	.	C	C	A	A	C
12	Bryum argenteum	.	.	.	.	.	.	.	.	.	T	T	T	C	C	T	C	C	T	T	T	G	C	G	G	.	C	C	A	A	C
13	Eurhynchium hians	.	.	.	.	.	.	.	.	.	T	T	T	C	C	T	C	C	T	T	T	G	C	G	.	.	C	C	A	A	C
14	Funaria hygrometrica	.	.	.	.	.	.	.	.	.	T	T	T	T	T	T	C	C	T	T	T	G	C	G	G	.	C	C	A	A	C
15	Leptobryum pyriforme	.	.	.	.	.	.	.	.	.	T	T	T	C	C	T	C	C	T	T	T	G	C	G	G	.	C	C	A	A	C
16	Mnium hornum	.	.	.	.	.	.	.	.	.	T	T	T	C	C	T	C	C	T	T	T	G	C	G	G	.	C	C	A	A	C
17	Physcomitrium pyriforme	.	.	.	.	.	.	.	.	.	T	T	T	C	C	T	C	C	T	T	T	G	C	G	G	.	C	C	A	A	C
18	Polytrichum formosum	.	.	.	.	.	.	.	.	.	.	.	.	T	C	T	T	C	T	T	C	G	C	G	G	.	C	C	A	A	C
19	Sphagnum cuspidatum	.	.	.	.	.	.	.	.	.	.	.	T	T	C	C	C	C	T	T	G	G	C	G	G	.	C	C	G	A	C
20	Calypogeia arguta	.	.	.	.	.	.	.	.	.	.	.	.	T	C	T	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
21	Conocephalum conicum	.	.	.	.	.	.	C	A	T	T	T	T	T	T	G	G	T	C	C	T	G	C	G	G	.	T	C	A	G	C
22	Fossombronia pusilla	.	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	T	T	T	G	T	G	G	.	C	C	A	A	C
23	Marchantia polymorpha	.	.	.	.	.	.	.	.	.	.	C	T	T	G	T	T	C	C	C	T	G	T	G	G	.	A	C	A	G	C
24	Riccia fluitans	.	.	.	.	.	.	.	T	T	C	T	T	T	T	T	C	C	C	C	T	G	C	G	G	.	C	C	A	G	C
25	Scapania nemorosa	.	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	T	T	T	G	T	G	G	.	C	C	A	A	C
26	Equisetum hyemale	.	.	.	.	.	.	.	.	.	.	.	C	T	T	G	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
27	Equisetum robustum	.	.	.	.	.	.	.	.	.	.	.	C	T	T	G	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
28	Isoetes engelmannii	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	C	T	T	T	G	C	G	G	.	C	C	A	G	C
29	Huperzia lucidulum	.	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	T	T	G	G	T	G	G	.	C	C	A	A	C
30	Lycopodiella inundatum	.	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	T	T	G	G	T	G	G	.	C	C	A	A	C
31	Lycopodium phlegmaria	.	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	T	T	G	G	T	G	G	.	C	C	A	A	C
32	Lycopodium taxifolium	.	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	T	T	G	G	T	G	G	.	C	C	A	A	C
33	Lycopodium tristachyum	.	.	.	.	.	.	.	.	.	.	.	A	T	C	T	T	C	T	T	G	G	T	G	G	.	C	C	A	A	C
34	Selaginella umbrosa	.	.	.	.	.	.	.	.	.	.	.	A	C	T	T	C	C	T	T	T	G	C	G	G	.	C	C	A	G	C
35	Selaginella vogelii	.	.	.	.	.	.	.	.	.	.	.	.	T	T	C	C	C	T	C	C	G	A	G	G	.	C	C	A	G	C
36	Oryza sativa	.	.	.	.	.	.	.	.	.	.	.	C	A	T	C	C	C	T	C	C	G	C	A	G	.	C	T	A	G	C
37	Zea mays	.	.	.	.	.	.	.	.	.	.	.	C	A	T	C	C	C	T	C	C	G	T	A	G	.	T	T	A	G	C
38	Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	.	.	C	A	T	C	C	C	T	T	C	A	C	G	G	.	C	C	G	G	C
39	Glycine max	.	.	.	.	.	.	.	.	.	.	.	T	A	A	C	C	C	T	C	C	A	C	G	G	.	C	C	A	G	C
40	Sinapis alba	.	.	.	.	.	.	.	.	.	.	.	C	A	T	C	C	C	T	T	C	A	C	G	G	.	C	C	G	G	C
41	Zamia pumila	.	.	.	.	.	.	.	.	.	.	.	G	T	T	T	C	T	T	T	C	G	T	G	G	.	C	C	A	G	C
42	Gnetum leyboldii	.	.	.	.	.	.	.	.	.	.	.	T	A	G	C	C	C	T	T	C	G	C	G	G	.	A	C	A	G	C
43	Ginkgo biloba	.	.	.	.	.	.	.	.	.	.	.	T	T	C	G	C	C	T	T	C	G	T	G	G	.	C	C	A	G	C
44	Pinus luchuensis	.	.	.	.	.	.	.	.	.	.	.	T	T	C	C	C	C	T	T	C	G	C	G	G	.	C	C	A	G	C
45	Pinus wallichiana	.	.	.	.	.	.	.	.	.	.	.	T	T	C	C	C	C	T	T	C	G	C	G	G	.	C	C	A	G	C
46	Nageia nagi	.	.	.	.	.	.	.	.	.	.	.	T	T	C	C	C	C	T	T	C	G	T	G	G	.	C	C	A	G	C
47	Taxus mairei	.	.	.	.	.	.	.	.	.	.	.	T	T	T	C	C	C	T	T	C	G	T	G	G	.	C	C	A	G	C
48	Adiantum raddianum	.	.	.	.	.	.	.	.	.	.	.	A	T	C	C	T	C	T	T	C	G	T	G	.	.	C	C	A	A	C
49	Adiantum raddianum 2	.	.	.	.	.	.	.	.	.	.	.	A	T	C	C	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
50	Ophioglossum petiolatum	.	.	.	.	.	.	.	.	.	.	.	T	C	A	G	C	C	T	T	C	G	C	G	G	.	C	G	A	A	C
51	Osmunda cinnamomea	.	.	.	.	.	.	.	.	.	.	.	A	T	C	C	T	C	T	T	C	G	T	G	T	.	C	C	A	A	C
52	Salvinia natans	.	.	.	.	.	.	.	.	.	.	.	A	T	C	C	T	C	T	T	C	G	C	G	G	.	C	C	G	A	C
53	Psilotum nudum	.	.	.	.	.	.	.	.	.	.	.	A	T	C	C	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
54	Chara foetida	.	.	.	.	.	.	.	.	.	.	.	C	C	T	T	T	C	C	T	C	G	T	G	G	.	C	C	A	G	C
55	Coleochaete scutata	.	.	.	.	.	.	.	.	.	.	.	T	T	C	T	C	C	T	T	T	G	T	G	G	.	T	C	A	A	C
56	Klebsormidium flaccidum	.	.	.	.	.	.	.	.	.	.	.	T	T	C	T	T	C	T	C	C	G	T	G	G	.	C	C	A	A	C
57	Nitella flexilis	.	.	.	.	.	.	.	.	.	.	.	T	C	T	T	T	C	C	T	C	G	T	G	G	.	C	C	A	G	C
58	Nitella sp.	.	.	.	.	.	.	.	.	.	.	.	T	C	T	T	T	C	C	T	C	G	T	G	G	.	C	C	A	G	C
59	Chlamydomonas reinhardtii	.	.	.	.	.	.	.	.	.	.	.	.	A	C	C	T	G	C	G	G	T	G	C	G	.	C	C	G	A	C
60	Hydrodictyon reticulatum	.	.	.	.	.	.	.	.	.	.	.	T	T	T	T	T	G	C	G	G	C	C	G	G	.	T	T	G	A	C
61	Parietochloris pseudoalveolaris	.	.	.	.	.	.	.	.	.	.	.	T	C	C	T	T	C	C	A	G	C	C	G	G	.	C	C	G	A	C
62	Dictyostelium discoideum	A	G	T	C	T	G	A	C	T	C	G	A	T	A	G	G	T	A	C	G	A	A	T	.	T	A	A	A	A	C
63	Pteris vittata	.	.	.	.	.	.	.	.	.	.	.	A	T	C	C	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
64	Megaceros aenigmaticus	.	.	.	.	.	.	.	.	.	.	.	.	T	C	T	T	C	T	T	C	G	T	G	G	.	C	C	A	A	C
65	Notothylas breutelii	.	.	.	.	.	.	.	.	.	.	.	.	C	C	T	T	C	T	G	C	G	G	G	G	.	T	C	A	A	C
66	Physcomitrella patens	.	.	.	.	.	.	.	.	.	T	T	T	T	T	T	C	C	T	T	T	G	C	G	G	.	C	C	A	A	C
67	Sphagnum palustre	.	.	.	.	.	.	.	.	.	.	.	T	T	C	C	C	C	T	T	G	G	C	G	G	.	G	C	G	A	C

Taxa with Variability Info	50	1741	1742	1743	1744	1745	1746	1747	1748	1749	1750	1751	1752	1753	1754	1755	1756	1757	1758	1759	1760	1761	1762	1763	1764	1765	1766	1767	1768	1769	1770
		8	6.	6.	8	6.	5.	6.	6.	6.	6.	6.	0.	5.	5.	5.	0.	3.	6.	1.	3.	0.	1.	3.	2	3.	2	2.	8	0.	0
1	Saccharomyces cerevisiae	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	T	T	T	C	A	A	.	.
2	Schizosaccharomyces pombe	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	A	T	A	A	A	.	.
3	Physcomitrella patens 2	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
4	Anthoceros agrestis	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
5	Anthoceros laevis	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	T	.	G	C	G	T	C	T	A	.	.
6	Pellia epiphylla	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.
7	Reboulia hemisphaerica	T	T	C	T	T	A	G	A	G	G	G	A	C	A	C	T	G	T	C	.	.	G	C	G	T	C	T	A	.	.
8	Riccardia pinguis	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.
9	Sphaerocarpos donnellii	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
10	Sphaerocarpus texanus	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
11	Atrichum undulatum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.
12	Bryum argenteum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
13	Eurhynchium hians	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
14	Funaria hygrometrica	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
15	Leptobryum pyriforme	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
16	Mnium hornum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
17	Physcomitrium pyriforme	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
18	Polytrichum formosum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
19	Sphagnum cuspidatum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.
20	Calypogeia arguta	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.
21	Conocephalum conicum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	G	T	C	G	.	G	C	G	T	C	T	A	.	.
22	Fossombronia pusilla	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.
23	Marchantia polymorpha	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
24	Riccia fluitans	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	G	T	C	G	.	G	C	G	T	C	T	A	.	.
25	Scapania nemorosa	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.
26	Equisetum hyemale	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	C	T	A	.	.
27	Equisetum robustum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	C	T	A	.	.
28	Isoetes engelmannii	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	C	.	G	C	G	T	C	T	A	.	.
29	Huperzia lucidulum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	C	.	G	C	G	T	C	C	A	.	.
30	Lycopodiella inundatum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	C	.	G	C	G	T	C	C	A	.	.
31	Lycopodium phlegmaria	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	C	.	G	C	G	T	C	C	A	.	.
32	Lycopodium taxifolium	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	C	.	G	C	G	T	C	C	A	.	.
33	Lycopodium tristachyum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	C	.	G	C	G	T	C	C	A	.	.
34	Selaginella umbrosa	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	C	T	.	A	C	T	.	.	.
35	Selaginella vogelii	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	C	.	G	C	T	C	C	C	A	.	.
36	Oryza sativa	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
37	Zea mays	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
38	Arabidopsis thaliana	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	C	T	T	A	.	.
39	Glycine max	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
40	Sinapis alba	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
41	Zamia pumila	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	C	T	C	A	.	.
42	Gnetum leyboldii	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	C	T	T	C	A	.	.
43	Ginkgo biloba	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
44	Pinus luchuensis	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
45	Pinus wallichiana	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
46	Nageia nagi	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	T	T	A	.	.
47	Taxus mairei	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	C	T	A	.	.
48	Adiantum raddianum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	C	T	A	.	.
49	Adiantum raddianum 2	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	C	T	A	.	.
50	Ophioglossum petiolatum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	G	T	G	G	.	C	C	G	T	C	T	A	.	.
51	Osmunda cinnamomea	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	C	T	A	.	.
52	Salvinia natans	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	G	T	G	G	.	C	C	G	T	C	T	A	.	.
53	Psilotum nudum	T	T	C	T	T	A	G	A	G	G	G	.	A.	C	T	.	A	T	G	G	.	C	C	A/G	C	C	T	A	.	.
54	Chara foetida	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	G	T	T	G	G	A	C	G	A	C	T	A	.	.
55	Coleochaete scutata	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	T	T	C	T	A	.	.
56	Klebsormidium flaccidum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	T	G	G	C	G	T	C	T	A	C	A
57	Nitella flexilis	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	G	T	T	G	G	A	C	G	A	C	T	A	.	.
58	Nitella sp.	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	G	T	T	G	G	A	C	G	A	C	T	A	.	.
59	Chlamydomonas reinhardtii	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	T	T	A	.	.
60	Hydrodictyon reticulatum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	T	T	A	.	.
61	Parietochloris pseudoalveolaris	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	C	T	C	G	.	G	C	G	A	C	T	A	.	.
62	Dictyostelium discoideum	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	C	C	T	.	G	C	C	T	C	A	A	.	.
63	Pteris vittata	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	G	G	.	C	C	G	T	C	T	A	.	.
64	Megaceros aenigmaticus	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	T	.	G	C	G	T	C	T	A	.	.
65	Notothylas breutelii	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	T	.	G	C	G	T	C	T	A	.	.
66	Physcomitrella patens	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	C	G	.	G	C	G	T	C	T	A	.	.
67	Sphagnum palustre	T	T	C	T	T	A	G	A	G	G	G	.	A	C	T	.	A	T	T	G	.	G	C	G	T	C	T	A	.	.

Taxa with Variability Info	60	1771	1772	1773	1774	1775	1776	1777	1778	1779	1780	1781	1782	1783	1784	1785	1786	1787	1788	1789	1790	1791	1792	1793	1794	1795	1796	1797	1798	1799	1800
		5.	2	3.	1.		4.	3.	5.	6.	6.	5.	6.	6.	3.	6.	6.	6.	6.	6.	5.	4.	6.	6	6	6.	5	6.	6	6	6
1	Saccharomyces cerevisiae	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
2	Schizosaccharomyces pombe	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
3	Physcomitrella patens 2	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
4	Anthoceros agrestis	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
5	Anthoceros laevis	G	C	G	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
6	Pellia epiphylla	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
7	Reboulia hemisphaerica	G	C	C	G	.	A	C	G	G	A	A	G	T	T	T	G	A	.	G	C	A	A	T	A	A	C	A	G	G	T
8	Riccardia pinguis	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
9	Sphaerocarpos donnellii	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
10	Sphaerocarpus texanus	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	.
11	Atrichum undulatum	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
12	Bryum argenteum	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
13	Eurhynchium hians	G	C	C	G	.	A	T	G	G	A	A	G	T	A	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
14	Funaria hygrometrica	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
15	Leptobryum pyriforme	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
16	Mnium hornum	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
17	Physcomitrium pyriforme	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
18	Polytrichum formosum	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
19	Sphagnum cuspidatum	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
20	Calypogeia arguta	G	C	C	A	.	T	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
21	Conocephalum conicum	G	C	C	G	.	A	C	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
22	Fossombronia pusilla	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
23	Marchantia polymorpha	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
24	Riccia fluitans	G	C	C	G	.	A	C	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
25	Scapania nemorosa	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
26	Equisetum hyemale	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
27	Equisetum robustum	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
28	Isoetes engelmannii	G	C	G	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
29	Huperzia lucidulum	G	C	G	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
30	Lycopodiella inundatum	G	C	G	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
31	Lycopodium phlegmaria	G	C	G	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
32	Lycopodium taxifolium	G	C	G	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
33	Lycopodium tristachyum	G	C	G	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
34	Selaginella umbrosa	A	G	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
35	Selaginella vogelii	G	C	G	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
36	Oryza sativa	G	G	C	C	.	A	C	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
37	Zea mays	G	G	C	C	.	G	C	G	.	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
38	Arabidopsis thaliana	G	G	C	C	.	A	A	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
39	Glycine max	G	G	C	C	.	A	C	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
40	Sinapis alba	G	G	C	C	.	A	A	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
41	Zamia pumila	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
42	Gnetum leyboldii	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
43	Ginkgo biloba	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
44	Pinus luchuensis	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
45	Pinus wallichiana	G	G	C	C	.	A	T	G	G	A	G	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
46	Nageia nagi	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
47	Taxus mairei	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
48	Adiantum raddianum	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	.	G	T
49	Adiantum raddianum 2	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
50	Ophioglossum petiolatum	G	G	C	C	.	A	.	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
51	Osmunda cinnamomea	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	T	A	G	G	T
52	Salvinia natans	G	G	C	C	.	A	C	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
53	Psilotum nudum	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
54	Chara foetida	G	C	C	A	.	A	C	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
55	Coleochaete scutata	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
56	Klebsormidium flaccidum	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
57	Nitella flexilis	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
58	Nitella sp.	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
59	Chlamydomonas reinhardtii	G	C	C	A	.	A	T	G	G	A	A	G	T	A	T	G	A	G	G	C	G	A	T	A	A	C	A	G	G	T
60	Hydrodictyon reticulatum	G	T	C	A	.	A	T	G	G	A	A	G	T	A	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
61	Parietochloris pseudoalveolaris	G	C	C	G	.	A	T	G	G	A	A	G	T	G	T	G	A	G	G	C	G	A	T	A	A	C	A	G	G	T
62	Dictyostelium discoideum	G	C	A	G	.	G	C	G	G	A	A	G	T	C	C	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
63	Pteris vittata	G	G	C	C	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
64	Megaceros aenigmaticus	G	C	G	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
65	Notothylas breutelii	G	T	G	A	.	A	T	A	G	A	A	G	T	T	T	G	A	G	G	A	A	A	T	A	A	C	A	G	G	T
66	Physcomitrella patens	G	C	C	G	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T
67	Sphagnum palustre	G	C	C	A	.	A	T	G	G	A	A	G	T	T	T	G	A	G	G	C	A	A	T	A	A	C	A	G	G	T

Taxa with Variability Info 61	1601	1602	1603	1604	1605	1606	1607	1608	1609	1610	1611	1612	1613	1614	1615	1616	1617	1618	1619	1620	1621	1622	1623	1624	1625	1626	1627	1628	1629	1630
	5		6.	6.	6.	6.	6.	6.	6.	5.	6.	5.	6.	5.	6.	6.	6.	0.	3.	6.	6.	6.	6.	6	6	6	6	6	5	6
1 Saccharomyces cerevisiae	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	A	C	G	T	T	C	T	G	G	G	C	C	G
2 Schizosaccharomyces pombe	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
3 Physcomitrella patens 2	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
4 Anthoceros agrestis	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
5 Anthoceros laevis	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
6 Pellia epiphylla	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
7 Reboulia hemisphaerica	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
8 Riccardia pinguis	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
9 Sphaerocarpos donnellii	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
10 Sphaerocarpus texanus	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
11 Atrichum undulatum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
12 Bryum argenteum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
13 Eurhynchium hians	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
14 Funaria hygrometrica	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
15 Leptobryum pyriforme	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
16 Mnium hornum	C	.	T	G	T	.G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
17 Physcomitrium pyriforme	C	.	T	G	T	G	A	T	G	C	C	C	T	C	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
18 Polytrichum formosum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
19 Sphagnum cuspidatum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
20 Calypogeia arguta	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
21 Conocephalum conicum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
22 Fossombronia pusilla	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
23 Marchantia polymorpha	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
24 Riccia fluitans	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
25 Scapania nemorosa	G	.	T	G	T	G	A	T	G	C	C	G	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	G	G
26 Equisetum hyemale	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
27 Equisetum robustum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
28 Isoetes engelmannii	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
29 Huperzia lucidulum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
30 Lycopodiella inundatum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
31 Lycopodium phlegmaria	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
32 Lycopodium taxifolium	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
33 Lycopodium tristachyum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
34 Selaginella umbrosa	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
35 Selaginella vogelii	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	.	G
36 Oryza sativa	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
37 Zea mays	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
38 Arabidopsis thaliana	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
39 Glycine max	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	.	G
40 Sinapis alba	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
41 Zamia pumila	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
42 Gnetum leyboldii	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
43 Ginkgo biloba	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
44 Pinus luchuensis	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
45 Pinus wallichiana	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
46 Nageia nagi	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
47 Taxus mairei	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
48 Adiantum raddianum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
49 Adiantum raddianum 2	C	.	T	G	T	G	A	T	G	G	?	?	?	?	?	?	?	.	?	?	?	?	?	?	?	?	?	?	?	?
50 Ophioglossum petiolatum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
51 Osmunda cinnamomea	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
52 Salvinia natans	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
53 Psilotum nudum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
54 Chara foetida	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
55 Coleochaete scutata	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
56 Klebsormidium flaccidum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
57 Nitella flexilis	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
58 Nitella sp.	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
59 Chlamydomonas reinhardtii	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
60 Hydrodictyon reticulatum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
61 Parietochloris pseudoalveolaris	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	A	C	C	T	T	G	G	G	C	C	G
62 Dictyostelium discoideum	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
63 Pteris vittata	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
64 Megaceros aenigmaticus	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
65 Notothylas breutelii	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
66 Physcomitrella patens	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	.	T	G	T	T	C	T	G	G	G	C	C	G
67 Sphagnum palustre	C	.	T	G	T	G	A	T	G	C	C	C	T	T	A	G	A	A	T	G	T	T	C	T	G	G	G	C	C	G

Taxa with Variability Info	82	1831	1832	1833	1834	1835	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860
		8	5.	5	6	8.	6.	6.	6.	8.	6.	6.	5.	6.	6.	6.	8.	6.	2.	8.	1.	4.	2.	2	6	6	3	4	4	6	6
1	Saccharomyces cerevisiae	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	C	G	G	A	G	C	C	A	G	C	G	A	G
2	Schizosaccharomyces pombe	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	C	G	G	A	G	C	C	A	A	C	G	A	G
3	Physcomitrella patens 2	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
4	Anthoceros agrestis	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
5	Anthoceros laevis	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
6	Pellia epiphylla	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
7	Reboulia hemisphaerica	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	C	T	C	A	A	C	G	A	G
8	Riccardia pinguis	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
9	Sphaerocarpos donnellii	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	C	T	C	A	A	C	G	A	G
10	Sphaerocarpus texanus	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	T	A	A	G
11	Atrichum undulatum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
12	Bryum argenteum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	T	T	C	A	A	C	G	A	G
13	Eurhynchium hians	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	T	T	C	A	A	C	G	A	G
14	Funaria hygrometrica	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
15	Leptobryum pyriforme	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	T	T	C	A	A	C	G	A	G
16	Mnium hornum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	T	T	C	A	A	C	G	A	G
17	Physcomitrium pyriforme	C	G	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
18	Polytrichum formosum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
19	Sphagnum cuspidatum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
20	Calypogeia arguta	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
21	Conocephalum conicum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	G	T	C	A	A	C	G	A	G
22	Fossombronia pusilla	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
23	Marchantia polymorpha	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	C	T	C	A	A	C	G	A	G
24	Riccia fluitans	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	C	T	C	A	A	C	G	A	G
25	Scapania nemorosa	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
26	Equisetum hyemale	C	A	G	G	C	G	C	G	C	T	A	G	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
27	Equisetum robustum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
28	Isoetes engelmannii	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
29	Huperzia lucidulum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
30	Lycopodiella inundatum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
31	Lycopodium phlegmaria	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
32	Lycopodium taxifolium	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
33	Lycopodium tristachyum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
34	Selaginella umbrosa	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
35	Selaginella vogelii	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
36	Oryza sativa	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	T	A	T	C	C	A	A	C	G	A	G
37	Zea mays	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	T	A	T	C	C	A	A	C	G	A	G
38	Arabidopsis thaliana	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	T	A	T	T	C	A	A	C	G	A	G
39	Glycine max	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	T	A	T	T	C	A	A	C	G	A	G
40	Sinapis alba	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	T	A	T	T	C	A	A	C	G	A	G
41	Zamia pumila	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	T	A	T	T	C	A	A	C	G	A	G
42	Gnetum leyboldii	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	C	A	T	T	C	A	G	C	G	A	G
43	Ginkgo biloba	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	T	A	T	T	C	A	A	C	G	A	G
44	Pinus luchuensis	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	C	A	G	C	C	A	A	C	G	A	G
45	Pinus wallichiana	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	C	A	G	C	C	A	A	C	G	A	G
46	Nageia nagi	C	A	C	G	C	G	C	G	C	T	A	C	A	[illegible]	T	G	A	T	G	C	A	A	T	C	A	G	C	G	A	G
47	Taxus mairei	C	A	C	G	C	G	C	G	C	T	A	C	A	[illegible]	T	G	A	T	G	C	A	A	C	C	A	A	C	G	A	G
48	Adiantum raddianum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
49	Adiantum raddianum 2	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
50	Ophioglossum petiolatum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	T	T	C	A	A	C	G	A	G
51	Osmunda cinnamomea	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
52	Salvinia natans	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
53	Psilotum nudum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
54	Chara foetida	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	G	A	T	C	C	A	A	C	G	A	G
55	Coleochaete scutata	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
56	Klebsormidium flaccidum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
57	Nitella flexilis	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	C	C	A	A	C	G	A	G
58	Nitella sp.	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	C	C	A	A	C	G	A	G
59	Chlamydomonas reinhardtii	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	C	G	C	G	A	C	C	A	A	C	G	A	G
60	Hydrodictyon reticulatum	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	C	A	T	T	C	A	A	C	G	A	G
61	Parietochloris pseudoalveolaris	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	C	A	T	T	C	A	A	C	G	A	G
62	Dictyostelium discoideum	C	A	C	G	C	G	C	G	C	T	A	C	A	A	T	G	T	A	G	G	A	A	A	C	A	A	A	A	A	G
63	Pteris vittata	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
64	Megaceros aenigmaticus	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
65	Notothylas breutelii	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
66	Physcomitrella patens	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G
67	Sphagnum palustre	C	A	C	G	C	G	C	G	C	T	A	C	A	C	T	G	A	T	G	A	A	T	T	C	A	A	C	G	A	G

	Taxa with Variability Info 63	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
		3	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				0.	0.	0.	0.	0.				0.	0.	0.	0.	2	2	1.	3
1	Saccharomyces cerevisiae	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
2	Schizosaccharomyces pombe	T	T	G	A	A	A	A	A	A	A	T	.	.	.	C	T	T	T	T	.	.	.	G	A	T	T	T	T	T	T
3	Physcomitrella patens 2	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
4	Anthoceros agrestis	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
5	Anthoceros laevis	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
6	Pellia epiphylla	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
7	Reboulia hemisphaerica	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
8	Riccardia pinguis	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
9	Sphaerocarpos donnellii	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
10	Sphaerocarpus texanus	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	A	T
11	Atrichum undulatum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
12	Bryum argenteum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
13	Eurhynchium hians	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
14	Funaria hygrometrica	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
15	Leptobryum pyriforme	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
16	Mnium hornum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
17	Physcomitrium pyriforme	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
18	Polytrichum formosum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
19	Sphagnum cuspidatum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
20	Calypogeia arguta	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
21	Conocephalum conicum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
22	Fossombronia pusilla	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
23	Marchantia polymorpha	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
24	Riccia fluitans	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
25	Scapania nemorea	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
26	Equisetum hyemale	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	A
27	Equisetum robustum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	A
28	Isoetes engelmannii	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
29	Huperzia lucidulum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
30	Lycopodiella inundatum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	C
31	Lycopodium phlegmaria	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	C
32	Lycopodium taxifolium	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C	A	C
33	Lycopodium tristachyum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
34	Selaginella umbrosa	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	G	C	A	T
35	Selaginella vogelii	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	G	C	T	T
36	Oryza sativa	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	A	T
37	Zea mays	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A	T	A	T
38	Arabidopsis thaliana	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C	A	C
39	Glycine max	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T	A	T
40	Sinapis alba	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C	A
41	Zamia pumila	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T	A	T
42	Gnetum leyboldii	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	C	C	T
43	Ginkgo biloba	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T	A	T
44	Pinus luchuensis	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	T	T	A
45	Pinus wallichiana	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	T	T	C
46	Nageia nagi	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	T	T	T
47	Taxus mairei	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	T	T	C
48	Adiantum raddianum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	C
49	Adiantum raddianum 2	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	C
50	Ophioglossum petiolatum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	C	G	C
51	Osmunda cinnamomea	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	A
52	Salvinia natans	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	C	T
53	Psilotum nudum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C	T	A	C
54	Chara foetida	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	G	C	T
55	Coleochaete scutata	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
56	Klebsormidium flaccidum	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
57	Nitella flexilis	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	G	T	G
58	Nitella sp.	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	G	T	G
59	Chlamydomonas reinhardtii	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
60	Hydrodictyon reticulatum	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
61	Parietochloris pseudoalveolaris	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	T
62	Dictyostelium discoideum	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
63	Pteris vittata	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	C
64	Megaceros aenigmaticus	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
65	Notothylas breutelii	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
66	Physcomitrella patens	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T
67	Sphagnum palustre	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	T	A	T

#	Taxa with Variability Info 84	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
		1	1.	8	8	8	2.	5.	3.	3.	5.	5.	3.	1.	6.	0.	6.	5.	1.	0.	2.	1.			3.	6	6	3	6	6	4.
1	Saccharomyces cerevisiae	A	A	C	C	T	T	G	G	C	C	G	A	G	A	.	G	G	T	.	C	T	.	.	T	G	G	T	A	A	T
2	Schizosaccharomyces pombe	A	T	C	C	T	T	G	G	C	C	G	G	A	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
3	Physcomitrella patens 2	A	A	C	C	T	G	G	G	C	C	G	A	T	A	C	G	G	T	.	T	.	.	.	G	G	G	T	A	A	T
4	Anthoceros agrestis	C	A	C	C	T	T	G	T	C	C	G	A	G	A	.	G	G	A	.	A	C	.	.	G	G	G	T	A	A	T
5	Anthoceros laevis	A	A	C	C	T	T	G	G	C	C	G	A	G	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
6	Pellia epiphylla	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
7	Reboulia hemisphaerica	A	A	C	C	T	G	G	G	C	C	G	G	A	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
8	Riccardia pinguis	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	C	C	.	.	G	G	G	T	A	A	T
9	Sphaerocarpos donnellii	A	A	C	C	T	G	G	G	C	C	G	A	A	A	.	G	G	C	.	T	C	.	.	G	G	G	T	A	A	T
10	Sphaerocarpus texanus	A	G	C	C	T	G	G	G	C	C	C	A	A	A	.	G	G	C	.	T	C	.	.	G	G	G	T	A	A	T
11	Atrichum undulatum	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
12	Bryum argenteum	A	A	C	C	T	G	G	G	C	C	G	G	T	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
13	Eurhynchium hians	A	A	C	C	T	G	G	G	C	C	G	A	T	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
14	Funaria hygrometrica	A	A	C	C	T	G	G	G	C	C	G	A	T	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
15	Leptobryum pyriforme	A	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
16	Mnium hornum	A	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
17	Physcomitrium pyriforme	A	A	C	C	T	G	G	A	C	C	G	A	T	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
18	Polytrichum formosum	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
19	Sphagnum cuspidatum	A	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
20	Calypogeia arguta	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
21	Conocephalum conicum	A	A	C	C	T	G	G	G	C	C	G	T	G	A	.	G	G	C	.	T	C	.	.	G	G	G	T	A	A	T
22	Fossombronia pusilla	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
23	Marchantia polymorpha	A	A	C	C	T	G	G	G	C	C	G	A	A	A	.	G	G	T	.	T	C	.	.	G	G	G	T	A	A	T
24	Riccia fluitans	A	A	C	C	T	G	G	G	C	C	G	G	A	A	.	G	G	T	.	T	C	.	.	G	G	G	T	A	A	T
25	Scapania nemorosa	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
26	Equisetum hyemale	G	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	C	C	.	.	G	G	G	T	A	A	T
27	Equisetum robustum	C	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	C	C	.	.	G	G	G	T	A	A	T
28	Isoetes engelmannii	G	C	C	C	T	G	G	G	C	C	G	A	T	A	.	G	G	T	.	C	T	.	.	G	G	G	C	A	A	T
29	Huperzia lucidulum	G	A	C	C	T	G	G	G	C	C	G	A	T	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
30	Lycopodiella inundatum	G	A	C	C	T	G	G	G	C	C	G	A	T	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
31	Lycopodium phlegmaria	G	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
32	Lycopodium taxifolium	G	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	.	.	C	T	.	.	G	G	G	T	A	A	T
33	Lycopodium tristachyum	G	A	C	C	T	G	G	G	C	C	G	A	T	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
34	Selaginella umbrosa	.	G	C	C	T	G	G	T	C	T	G	T	C	A	.	G	G	A	.	T	C	.	.	G	G	G	T	A	A	T
35	Selaginella vogelii	.	G	C	C	T	G	T	G	C	C	G	A	A	A	.	G	G	C	.	T	C	.	.	G	G	G	T	A	A	T
36	Oryza sativa	A	G	C	C	T	G	G	T	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
37	Zea mays	A	G	C	C	T	T	G	G	C	C	G	A	C	A	.	G	G	C	.	C	.	.	.	.	G	G	T	A	A	T
38	Arabidopsis thaliana	A	.	C	C	T	T	.	G	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
39	Glycine max	A	G	C	C	T	T	G	G	C	C	G	A	C	A	.	G	G	T	.	C	C	.	.	G	G	G	T	A	A	T
40	Sinapis alba	C	A	C	C	T	T	G	G	T	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
41	Zamia pumila	A	A	C	C	T	G	G	G	C	C	G	G	G	A	.	G	G	T	.	C	C	.	.	G	G	G	A	A	A	T
42	Gnetum leyboldii	T	C	C	C	T	G	G	T	C	C	G	A	G	A	.	G	G	A	.	T	C	.	.	G	G	G	A	A	A	T
43	Ginkgo biloba	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	C	.	C	C	.	.	G	G	G	A	A	A	T
44	Pinus luchuensis	T	T	C	C	T	G	G	T	T	C	G	A	G	A	.	G	G	A	.	T	C	.	.	G	G	G	A	A	A	T
45	Pinus wallichiana	T	T	C	C	T	G	G	T	T	C	G	A	G	A	.	G	C	A	.	T	C	.	.	G	G	G	A	A	A	T
46	Nageia nagi	C	G	C	C	T	G	G	T	C	C	G	A	G	A	.	G	G	G	.	T	C	.	.	G	G	G	A	A	A	T
47	Taxus mairei	T	C	C	C	T	G	G	T	C	C	G	A	A	A	.	G	G	T	.	T	C	.	.	G	G	G	A	A	A	T
48	Adiantum raddianum	C	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
49	Adiantum raddianum 2	C	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
50	Ophioglossum petiolatum	C	G	C	C	T	G	G	G	C	C	G	A	G	A	.	G	A	C	.	C	C	.	.	G	G	G	T	A	A	T
51	Osmunda cinnamomea	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
52	Salvinia natans	T	G	C	C	T	C	G	G	C	C	G	A	C	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	T
53	Psilotum nudum	C	C	C	C	T	G	G	G	T	C	G	A	G	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
54	Chara foetida	T	G	C	C	T	G	G	G	T	C	G	A	A	A	.	G	G	C	.	C	T	.	.	G	G	G	T	A	A	C
55	Coleochaete scutata	A	A	C	C	T	G	G	A	C	C	G	A	A	A	.	G	G	T	.	C	C	.	.	G	G	G	T	A	A	T
56	Klebsormidium flaccidum	A	A	C	C	T	G	G	G	C	C	G	A	A	A	.	?	G	T	.	C	T	.	.	G	G	G	T	A	A	T
57	Nitella flexilis	C	A	C	C	T	G	G	G	T	C	G	A	A	A	.	G	G	C	.	T	C	.	.	G	G	G	C	A	A	C
58	Nitella sp.	C	A	C	C	T	G	G	G	T	C	G	A	A	A	.	G	G	C	.	T	C	.	.	G	G	G	C	A	A	C
59	Chlamydomonas reinhardtii	A	T	C	C	T	T	G	G	C	C	G	A	G	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
60	Hydrodictyon reticulatum	A	T	C	C	T	T	G	A	C	C	G	A	G	A	.	G	G	T	.	C	C	.	.	G	G	G	T	A	A	T
61	Parietochloris pseudoalveolaris	A	G	C	C	T	T	G	G	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
62	Dictyostelium discoideum	C	T	C	C	T	G	G	T	C	C	G	G	A	A	.	G	G	A	.	T	T	.	.	G	G	G	T	A	A	T
63	Pteris vittata	C	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T
64	Megaceros aenigmaticus	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	T	T	.	.	G	G	G	T	A	A	T
65	Notothylas breutelii	A	A	C	C	T	G	G	G	C	C	G	A	G	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
66	Physcomitrella patens	A	A	C	C	T	G	G	A	C	C	G	A	T	A	.	G	G	T	.	C	T	.	.	G	G	G	T	A	A	T
67	Sphagnum palustre	A	A	C	C	T	G	G	G	C	C	G	A	C	A	.	G	G	C	.	C	C	.	.	G	G	G	T	A	A	T

#	Taxa with Variability Info 65	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
		6	6	4.			1.	3.	2.	6.	5.	4.	1.	4.	2.	6.	2.	6.	0.	6.	6.	6.	6.	3	3	6.	6.	6.	6	4	6
1	Saccharomyces cerevisiae	C	T	T	.	.	G	T	G	A	A	A	C	T	C	C	G	T	.	C	G	T	G	C	T	G	G	G	G	A	T
2	Schizosaccharomyces pombe	C	T	T	.	.	G	T	T	A	A	A	C	T	C	C	G	T	.	C	G	T	G	C	T	G	G	G	G	A	T
3	Physcomitrella patens 2	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
4	Anthoceros agrestis	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
5	Anthoceros laevis	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
6	Pellia epiphylla	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
7	Reboulia hemisphaerica	C	T	T	.	.	T	T	G	A	T	A	A	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
8	Riccardia pinguis	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
9	Sphaerocarpos donnellii	C	T	T	.	.	T	T	C	A	A	A	C	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
10	Sphaerocarpus texanus	C	T	T	.	.	T	T	C	A	A	A	C	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
11	Atrichum undulatum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
12	Bryum argenteum	C	T	T	.	.	T	T	G	A	T	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
13	Eurhynchium hians	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
14	Funaria hygrometrica	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
15	Leptobryum pyriforme	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
16	Mnium hornum	C	T	T	.	.	C	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
17	Physcomitrium pyriforme	C	T	T	.	.	C	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
18	Polytrichum formosum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
19	Sphagnum cuspidatum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
20	Calypogeia arguta	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
21	Conocephalum conicum	C	T	T	.	.	T	T	G	A	A	A	A	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
22	Fossombronia pusilla	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
23	Marchantia polymorpha	C	T	T	.	.	T	T	G	A	A	A	A	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
24	Riccia fluitans	C	T	T	.	.	T	T	G	A	A	A	A	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
25	Scapania nemorea	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
26	Equisetum hyemale	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
27	Equisetum robustum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
28	Isoetes engelmannii	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
29	Huperzia lucidulum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
30	Lycopodiella inundatum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
31	Lycopodium phlegmaria	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
32	Lycopodium taxifolium	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
33	Lycopodium tristachyum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
34	Selaginella umbrosa	C	T	T	.	.	T	T	G	A	A	A	C	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
35	Selaginella vogelii	C	T	T	.	.	C	T	G	A	A	A	A	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
36	Oryza sativa	C	T	T	.	.	G	G	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
37	Zea mays	C	T	T	.	.	G	G	G	A	A	A	T	T	T	C	A	T	G	C	G	T	G	A	T	G	G	G	G	A	T
38	Arabidopsis thaliana	C	T	T	.	.	T	.	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
39	Glycine max	C	T	T	.	.	T	.	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
40	Sinapis alba	C	T	T	.	.	T	.	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
41	Zamia pumila	C	T	G	.	.	G	C	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
42	Gnetum leyboldii	C	T	T	.	.	G	T	G	A	A	A	A	T	G	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
43	Ginkgo biloba	C	T	G	.	.	C	C	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
44	Pinus luchuensis	C	T	T	.	.	C	T	C	A	A	A	T	T	G	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
45	Pinus wallichiana	C	T	T	.	.	C	T	C	A	A	A	T	T	G	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
46	Nageia nagi	C	T	T	.	.	G	C	C	A	A	A	T	T	G	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
47	Taxus mairei	C	T	T	.	.	G	C	C	A	A	A	T	T	G	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
48	Adiantum raddianum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
49	Adiantum raddianum 2	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
50	Ophioglossum petiolatum	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
51	Osmunda cinnamomea	C	T	T	.	.	T	T	T	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
52	Salvinia natans	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
53	Psilotum nudum	C	T	T	.	.	G	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
54	Chara foetida	C	T	T	.	.	C	T	C	A	A	G	G	T	T	C	A	T	.	C	G	T	G	A	C	G	G	G	G	A	T
55	Coleochaete scutata	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
56	Klebsormidium flaccidum	C	T	T	.	.	G	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
57	Nitella flexilis	C	T	T	.	.	C	T	C	A	A	A	C	T	T	C	A	T	.	C	G	T	G	A	C	G	G	G	G	A	T
58	Nitella sp	C	T	T	.	.	C	T	C	A	A	A	C	T	C/T	C	A	T	.	C	G	T	G	A	C	G	G	G	G	A	T
59	Chlamydomonas reinhardtii	C	T	T	.	.	.	G	T	A	A	A	C	C	G	C	G	T	.	C	G	T	G	A	T	G	G	G	G	A	T
60	Hydrodictyon reticulatum	C	T	T	.	.	.	T	G	A	A	A	C	T	G	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
61	Parietochloris pseudoalveolaris	C	T	T	.	.	.	G	C	A	A	A	C	T	G	C	A	T	.	C	G	T	G	A	T	G	G	G	G	C	T
62	Dictyostelium discoideum	C	A	T	.			T	T	G	A	A	T	T	T	C	C	T	A	C	G	T	A	A	C	T	G	G	G	C	T
63	Pteris vittata	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
64	Megaceros aenigmaticus	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
65	Notothylas breutelii	C	T	G	.	.	C	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
66	Physcomitrella patens	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T
67	Sphagnum palustre	C	T	T	.	.	T	T	G	A	A	A	T	T	T	C	A	T	.	C	G	T	G	A	T	G	G	G	G	A	T

Taxa with Variability Info	66	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
		6	6.	6.	2.	3.	3.	8.	8.	6.	3.	6.	8.	6.	8.	4.	6.	4.	3.	1.	8.	8.	6.	5.	3.	8.	8	6	5	6	6
1	Saccharomyces cerevisiae	A	G	A	G	C	A	T	T	G	T	A	A	T	T	A	T	T	G	C	T	C	T	T	C	A	A	C	G	A	G
2	Schizosaccharomyces pombe	A	G	A	G	C	A	T	T	G	C	A	A	T	T	A	T	T	G	C	T	C	T	T	C	A	A	C	G	A	G
3	Physcomitrella patens 2	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
4	Anthoceros agrestis	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
5	Anthoceros laevis	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	G	A	A	C	G	A	G
6	Pellia epiphylla	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
7	Reboulia hemisphaerica	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
8	Riccardia pinguis	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
9	Sphaerocarpos donnellii	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
10	Sphaerocarpus texanus	A	G	A	.	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
11	Atrichum undulatum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
12	Bryum argenteum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
13	Eurhynchium hians	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
14	Funaria hygrometrica	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
15	Leptobryum pyriforme	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
16	Mnium hornum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
17	Physcomitrium pyriforme	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
18	Polytrichum formosum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
19	Sphagnum cuspidatum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
20	Calypogeia arguta	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
21	Conocephalum conicum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	G	A	A	C	G	A	G
22	Fossombronia pusilla	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
23	Marchantia polymorpha	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
24	Riccia fluitans	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
25	Scapania nemorosa	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
26	Equisetum hyemale	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	T	A	G
27	Equisetum robustum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
28	Isoetes engelmannii	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
29	Huperzia lucidulum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
30	Lycopodiella inundatum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
31	Lycopodium phlegmaria	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
32	Lycopodium taxifolium	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
33	Lycopodium tristachyum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
34	Selaginella umbrosa	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
35	Selaginella vogelii	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
36	Oryza sativa	A	G	A	T	C	A	T	T	G	C	A	A	T	T	G	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
37	Zea mays	A	G	A	T	C	A	T	T	G	C	A	A	T	T	G	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
38	Arabidopsis thaliana	A	G	A	T	C	A	T	T	G	C	A	A	T	T	G	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
39	Glycine max	A	G	A	T	C	A	T	T	G	C	A	A	T	T	G	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
40	Sinapis alba	A	G	A	T	C	A	T	T	G	C	A	A	T	T	G	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
41	Zamia pumila	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
42	Gnetum leyboldii	A	G	A	T	C	T	T	T	G	C	A	A	T	T	A	T	C	G	G	T	C	T	T	A	A	A	C	G	A	G
43	Ginkgo biloba	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
44	Pinus luchuensis	A	G	A	C	C	A	T	T	G	C	A	A	T	T	A	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
45	Pinus wallichiana	A	G	A	C	C	A	T	T	G	C	A	A	T	T	A	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
46	Nageia nagi	A	G	A	C	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
47	Taxus mairei	A	G	A	C	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
48	Adiantum raddianum	.	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
49	Adiantum raddianum 2	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
50	Ophioglossum petiolatum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
51	Osmunda cinnamomea	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
52	Salvinia natans	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
53	Psilotum nudum	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	G	T	C	T	T	C	A	A	C	G	A	G
54	Chara foetida	A	G	A	T	T	G	T	T	G	T	A	A	T	T	A	T	C	G	A	T	C	T	T	G	A	A	C	G	A	G
55	Coleochaete scutata	A	G	A	T	T	A	T	T	G	C	A	A	T	T	A	T	T	A	A	T	C	T	T	C	A	A	C	G	A	G
56	Klebsormidium flaccidum	A	G	A	T	T	A	T	T	G	C	A	A	T	T	A	T	T	A	A	T	C	T	T	C	A	A	C	G	A	G
57	Nitella flexilis	A	G	A	T	T	G	T	T	G	C	A	A	T	T	A	T	C	G	A	T	C	T	T	G	A	A	C	G	A	G
58	Nitella sp.	A	G	A	T	T	G	T	T	G	C	A	A	T	T	A	T	C	G	A	T	C	T	T	G	A	A	C	G	A	G
59	Chlamydomonas reinhardtii	A	G	A	T	T	A	T	T	G	C	A	A	T	T	A	T	T	A	G	T	C	T	T	C	A	A	C	G	A	G
60	Hydrodictyon reticulatum	A	G	A	T	T	A	T	T	G	C	A	A	T	T	A	T	T	A	G	T	C	T	T	C	A	A	C	G	A	G
61	Parietochloris pseudoalveolaris	A	G	A	T	T	A	T	T	G	C	A	A	T	T	A	T	T	A	A	T	C	T	T	C	A	A	C	G	A	G
62	Dictyostelium discoideum	T	G	A	T	C	T	T	T	G	T	A	A	T	T	A	T	T	G	A	T	C	A	T	A	A	A	C	G	A	G
63	Pteris vittata	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
64	Megaceros aenigmaticus	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
65	Notothylas breutelii	A	G	A	T	C	A	T	T	G	A	A	A	T	T	A	T	T	G	C	T	C	T	C	C	A	A	C	G	A	G
66	Physcomitrella patens	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	T	C	A	A	C	G	A	G
67	Sphagnum palustre	A	G	A	T	C	A	T	T	G	C	A	A	T	T	A	T	T	G	A	T	C	T	C	C	A	A	C	G	A	G

Taxa with Variability Info	67	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		6	6	6.	6.	3.	6.	5.	6.	6.	6.	6.	6.	6.	6.	5.	5.	4.	2.	5.	5.	6.	6.	6	6	6.	6	4	6	6	2
1	Saccharomyces cerevisiae	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	A	A	G	T	C	A	T	C	A	G	C	T	T
2	Schizosaccharomyces pombe	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	A	A	G	T	C	A	T	C	A	G	C	T	T
3	Physcomitrella patens 2	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
4	Anthoceros agrestis	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
5	Anthoceros laevis	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
6	Pellia epiphylla	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
7	Reboulia hemisphaerica	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
8	Riccardia pinguis	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
9	Sphaerocarpos donnellii	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
10	Sphaerocarpus texanus	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
11	Atrichum undulatum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
12	Bryum argenteum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
13	Eurhynchium hians	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
14	Funaria hygrometrica	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
15	Leptobryum pyriforme	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
16	Mnium hornum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
17	Physcomitrium pyriforme	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
18	Polytrichum formosum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
19	Sphagnum cuspidatum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
20	Calypogeia arguta	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
21	Conocephalum conicum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
22	Fossombronia pusilla	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
23	Marchantia polymorpha	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
24	Riccia fluitans	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
25	Scapania nemorosa	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
26	Equisetum hyemale	G	A	A	T	T	C	C	T	A	G	T	A	A	G	.	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
27	Equisetum robustum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
28	Isoetes engelmannii	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
29	Huperzia lucidulum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
30	Lycopodiella inundatum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
31	Lycopodium phlegmaria	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
32	Lycopodium taxifolium	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
33	Lycopodium tristachyum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
34	Selaginella umbrosa	G	A	A	T	A	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
35	Selaginella vogelii	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
36	Oryza sativa	G	A	A	T	G	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
37	Zea mays	G	A	A	T	G	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
38	Arabidopsis thaliana	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
39	Glycine max	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
40	Sinapis alba	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
41	Zamia pumila	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	T	G	A	G	T	C	A	T	C	A	G	C	T	C
42	Gnetum leyboldii	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	A	C	T	C
43	Ginkgo biloba	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	T	G	T	C	A	T	C	A	A	C	T	C
44	Pinus luchuensis	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	T	G	T	C	A	T	C	A	A	C	T	C
45	Pinus wallichiana	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
46	Nageia nagi	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
47	Taxus mairei	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	.
48	Adiantum raddianum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
49	Adiantum raddianum 2	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
50	Ophioglossum petiolatum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
51	Osmunda cinnamomea	G	A	A	T	T	C	G	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
52	Salvinia natans	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
53	Psilotum nudum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	T	G	A	G	T	C	A	T	C	A	G	C	T	C
54	Chara foetida	G	A	A	T	G	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
55	Coleochaete scutata	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
56	Klebsormidium flaccidum	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
57	Nitella flexilis	G	A	A	T	G	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
58	Nitella sp	G	A	A	T	G	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
59	Chlamydomonas reinhardtii	G	A	A	T	G	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
60	Hydrodictyon reticulatum	G	A	A	T	G	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
61	Parietochloris pseudoalveolaris	G	A	A	T	G	C	C	T	A	G	T	A	A	G	G	C	C	G	A	G	T	C	A	T	T	A	C	C	T	T
62	Dictyostelium discoideum	G	A	A	T	T	C	C	T	T	G	T	A	A	G	C	G	T	A	A	G	T	C	A	T	C	A	G	C	T	C
63	Pteris vittata	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
64	Megaceros aenigmaticus	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
65	Notothylas breutelii	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	A	T	C	A	T	C	A	G	C	T	C
66	Physcomitrella patens	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C
67	Sphagnum palustre	G	A	A	T	T	C	C	T	A	G	T	A	A	G	C	G	C	G	A	G	T	C	A	T	C	A	G	C	T	C

	Taxa with Variability Info 66	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
		6.	5	5.	4.	5	6	6.	1.	5.	5.	4.	6.	5.	6.	6.	6.	6.	6.	6.	6.	5.	6	6.		6	6	6.	6	0.	6.
1	Saccharomyces cerevisiae	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
2	Schizosaccharomyces pombe	G	C	G	T	T	G	A	A	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
3	Physcomitrella patens 2	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
4	Anthoceros agrestis	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
5	Anthoceros laevis	G	?	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
6	Pellia epiphylla	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
7	Reboulia hemisphaerica	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
8	Riccardia pinguis	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
9	Sphaerocarpos donnellii	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
10	Sphaerocarpus texanus	G	C	G	.	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
11	Atrichum undulatum	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
12	Bryum argenteum	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
13	Eurhynchium hians	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
14	Funaria hygrometrica	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
15	Leptobryum pyriforme	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
16	Mnium hornum	G	C	G	T	T	G	A	C	T	A	C	G	C	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
17	Physcomitrium pyriforme	G	C	G	T	C	G	.	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
18	Polytrichum formosum	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
19	Sphagnum cuspidatum	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
20	Calypogeia arguta	G	C	A	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
21	Conocephalum conicum	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
22	Fossombronia pusilla	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
23	Marchantia polymorpha	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
24	Riccia fluitans	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
25	Scapania nemorosa	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
26	Equisetum hyemale	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
27	Equisetum robustum	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
28	Isoetes engelmannii	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	G	T	T	.	T	G	T	A	.	C
29	Huperzia lucidulum	?	?	?	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
30	Lycopodiella inundatum	G	C	G	?	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
31	Lycopodium phlegmaria	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
32	Lycopodium taxifolium	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
33	Lycopodium tristachyum	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
34	Selaginella umbrosa	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
35	Selaginella vogelii	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
36	Oryza sativa	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
37	Zea mays	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
38	Arabidopsis thaliana	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
39	Glycine max	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
40	Sinapis alba	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
41	Zamia pumila	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
42	Gnetum leyboldii	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
43	Ginkgo biloba	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
44	Pinus luchuensis	G	T	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
45	Pinus wallichiana	G	T	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
46	Nageia nagi	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
47	Taxus mairei	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
48	Adiantum raddianum	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
49	Adiantum raddianum 2	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
50	Ophioglossum petiolatum	G	C	.	T	T	G	A	C	T	A	C	G	.	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
51	Osmunda cinnamomea	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
52	Salvinia natans	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
53	Psilotum nudum	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
54	Chara foetida	G	C	G	C	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
55	Coleochaete scutata	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
56	Klebsormidium flaccidum	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
57	Nitella flexilis	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
58	Nitella sp.	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
59	Chlamydomonas reinhardtii	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
60	Hydrodictyon reticulatum	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
61	Parietochloris pseudoalveolaris	G	C	G	T	T	G	A	T	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
62	Dictyostelium discoideum	A	T	G	C	T	G	A	A	T	A	T	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
63	Pteris vittata	G	C	G	T	T	G	A	C	A	C	G	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
64	Megaceros aenigmaticus	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
65	Notothylas breutelii	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	A	C
66	Physcomitrella patens	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C
67	Sphagnum palustre	G	C	G	T	T	G	A	C	T	A	C	G	T	C	C	C	T	G	C	C	C	T	T	.	T	G	T	A	.	C

Taxa with Variability Info	00	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070
		6	6.	6.	5.	5.	6.	6.	6.	6	6.	6.	6.	6.	5.	6.	3.	3.	6.	6.	6.	6.	5.	6.	6	6	6.	3	3	5	6
1	Saccharomyces cerevisiae	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	A	G	T	A	C	C	G	A	T	T	G	A	A	T	G
2	Schizosaccharomyces pombe	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	A	C	T	A	C	C	G	A	T	T	G	A	A	T	G
3	Physcomitrella patens 2	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
4	Anthoceros agrestis	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
5	Anthoceros laevis	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
6	Pellia epiphylla	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
7	Reboulia hemisphaerica	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
8	Riccardia pinguis	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
9	Sphaerocarpos donnellii	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
10	Sphaerocarpus texanus	A	C	A	C	C	G	C	C	.	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
11	Atrichum undulatum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
12	Bryum argenteum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
13	Eurhynchium hians	A	C	A	A	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
14	Funaria hygrometrica	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
15	Leptobryum pyriforme	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
16	Mnium hornum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
17	Physcomitrium pyriforme	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
18	Polytrichum formosum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
19	Sphagnum cuspidatum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
20	Calypogeia arguta	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
21	Conocephalum conicum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
22	Fossombronia pusilla	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
23	Marchantia polymorpha	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
24	Riccia fluitans	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	C	A	T	T	G	A	A	T	G
25	Scapania nemorea	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
26	Equisetum hyemale	A	C	A	C	T	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
27	Equisetum robustum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
28	Isoetes engelmannii	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
29	Huperzia lucidulum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
30	Lycopodiella inundatum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
31	Lycopodium phlegmaria	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
32	Lycopodium taxifolium	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
33	Lycopodium tristachyum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
34	Selaginella umbrosa	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	G	A	T	G
35	Selaginella vogelii	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
36	Oryza sativa	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
37	Zea mays	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
38	Arabidopsis thaliana	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
39	Glycine max	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
40	Sinapis alba	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
41	Zamia pumila	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	C	G
42	Gnetum leyboldii	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
43	Ginkgo biloba	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
44	Pinus luchuensis	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
45	Pinus wallichiana	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
46	Nageia nagi	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
47	Taxus mairei	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
48	Adiantum raddianum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
49	Adiantum raddianum 2	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
50	Ophioglossum petiolatum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
51	Osmunda cinnamomea	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
52	Salvinia natans	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
53	Psilotum nudum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
54	Chara foetida	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
55	Coleochaete scutata	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
56	Klebsormidium flaccidum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
57	Nitella flexilis	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
58	Nitella sp	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
59	Chlamydomonas reinhardtii	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	G	G	T	G
60	Hydrodictyon reticulatum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	G	G	T	G
61	Parietochloris pseudoalveolaris	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	G	G	T	G
62	Dictyostelium discoideum	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	C	G	A	A	T	G
63	Pteris vittata	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
64	Megaceros aenigmaticus	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
65	Notothylas breutelii	A	C	A	C	C	G	C	C	C	G	T	C	G	T	T	C	C	T	A	C	C	G	A	T	T	G	A	T	T	G
66	Physcomitrella patens	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G
67	Sphagnum palustre	A	C	A	C	C	G	C	C	C	G	T	C	G	C	T	C	C	T	A	C	C	G	A	T	T	G	A	A	T	G

21	Conocephalum conicum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	Fossombronia pusilla	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
23	Marchantia polymorpha	G	T	C	.	C	G	G	T	G	A	A	G	A	G	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
24	Riccia fluitans	G	T	C	.	C	G	G	T	G	A	A	G	A	G	T	C	C	G	G	A	T	C	G	C	.	G	G	C	G	A
25	Scapania nemorosa	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
26	Equisetum hyemale	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	.	C	.	G	G	C	G	A
27	Equisetum robustum	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
28	Isoetes engelmannii	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	C	.	T	G	C	G	A
29	Huperzia lucidulum	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
30	Lycopodiella inundatum	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
31	Lycopodium phlegmaria	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
32	Lycopodium taxifolium	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
33	Lycopodium tristachyum	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
34	Selaginella umbrosa	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	C	G	T	.	A	A	C	G	A
35	Selaginella vogelii	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	C	.	A	G	C	G	A
36	Oryza sativa	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A
37	Zea mays	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	G	C	T	C	.	G	G	C	.	.
38	Arabidopsis thaliana	A	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A
39	Glycine max	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
40	Sinapis alba	A	T	C	.	C	G	G	T	G	A	A	G	T	A	C	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A
41	Zamia pumila	A	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	C	G	T	.	G	C	C	G	A
42	Gnetum leyboldii	A	T	C	.	C	G	G	T	G	A	A	A	T	G	T	T	C	G	G	A	T	T	A	C	.	G	G	C	G	A
43	Ginkgo biloba	A	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	C	G	C	.	G	C	C	G	A
44	Pinus luchuensis	A	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	C	.	G	T	C	G	A
45	Pinus wallichiana	A	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	C	.	G	T	C	G	A
46	Nageia nagi	A	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	C	G	A	T	C	G	C	.	G	A	C	G	A
47	Taxus mairei	A	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	C	G	C	.	G	A	C	G	A
48	Adiantum raddianum	G	.	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A
49	Adiantum raddianum 2	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A
50	Ophioglossum petiolatum	G	T	C	.	C	G	G	T	G	A	A	G	T	?	?	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A
51	Osmunda cinnamomea	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	.	A
52	Salvinia natans	G	.	T	C	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A
53	Psilotum nudum	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
54	Chara foetida	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	C	T	G	G	A	T	C	G	C	.	G	G	T	.	G
55	Coleochaete scutata	A	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	.	G
56	Klebsormidium flaccidum	A	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	C	G	C	.	G	G	C	.	T
57	Nitella flexilis	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	C	.	G	G	T	.	G
58	Nitella sp.	G	T	C	.	C	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	C	.	G	G	T	.	G
59	Chlamydomonas reinhardtii	T	G	C	.	T	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	A	.	G	C	T	.	T
60	Hydrodictyon reticulatum	T	G	C	.	T	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	G	.	C	A	G	.	A
61	Parietochloris pseudoalveolaris	T	G	C	.	T	G	G	T	G	A	A	G	T	G	T	T	C	G	G	A	T	T	G	G	.	C	G	G	.	C
62	Dictyostelium discoideum	A	T	A	.	C	G	G	T	A	A	A	G	T	T	A	A	C	G	G	A	T	C	G	T	.	T	T	T	A	T
63	Pteris vittata	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	C	G	C	.	G	A	C	G	A
64	Megaceros aenigmaticus	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
65	Notothylas breutelii	G	T	C	.	C	G	G	G	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	G	T	G	G	C	G	A
66	Physcomitrella patens	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	T	G	C	.	G	G	C	G	A
67	Sphagnum palustre	G	T	C	.	C	G	G	T	G	A	A	G	T	T	T	T	C	G	G	A	T	C	G	C	.	G	G	C	G	A

	Taxa with Variability Info 71	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130
		1	1.	1	2.	2.	3.	1.	2.	6.	0.	0.	2.	2.	1.	2.	0.	0.	0.	4.	1.	2.	3.	2	2.	2.	1.	2	0	0	0
1	Saccharomyces cerevisiae	G	A	G	A	A	G	G	G	G	.	.	G	C	A	A	.	.	.	C	T	C	C	A	T	C	T	C	.	.	.
2	Schizosaccharomyces pombe	T	T	T	C	T	G	C	T	G	.	.	G	C	A	A	.	.	.	C	G	G	C	G	G	A	A	A	.	.	.
3	Physcomitrella patens 2	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
4	Anthoceros agrestis	C	G	C	C	G	G	C	G	G	.	.	G	A	A	A	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
5	Anthoceros laevis	C	A	.	.	.	G	C	G	G	.	.	G	T	G	A	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
6	Pellia epiphylla	C	G	C	C	G	A	T	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
7	Reboulia hemisphaerica	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
8	Riccardia pinguis	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
9	Sphaerocarpos donnellii	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
10	Sphaerocarpus texanus	T	G	C	C	G	G	C	G	.	.	.	G	T	T	.	.	.	.	C	G	C	C	G	C	G	T	G	.	.	.
11	Atrichum undulatum	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
12	Bryum argenteum	T	C	G	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
13	Eurhynchium hians	T	T	T	C	C	G	G	C	G	G	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
14	Funaria hygrometrica	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
15	Leptobryum pyriforme	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
16	Mnium hornum	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
17	Physcomitrium pyriforme	T	G	G	C	G	G	C	G	G	.	.	?	?	G	G	.	.	.	.	A	A	C	G	G	T	T	.	.	.	.
18	Polytrichum formosum	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
19	Sphagnum cuspidatum	C	G	C	C	T	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
20	Calypogeia arguta	C	G	C	C	G	C	.	.	.	.	.	T	T	C	G	.	.	.	T	C	G	C	C	C	G	G	G	.	.	.
21	Conocephalum conicum	C	G	C	C	G	G	T	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
22	Fossombronia pusilla	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
23	Marchantia polymorpha	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
24	Riccia fluitans	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
25	Scapania nemorosa	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
26	Equisetum hyemale	C	G	C	T	G	G	C	G	G	.	.	T	T	C	G	.	.	.	.	.	.	C	C	G	G	C	G	.	.	.
27	Equisetum robustum	C	G	C	T	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
28	Isoetes engelmannii	C	G	C	.	G	G	C	G	G	.	.	T	T	C	G	.	.	.	.	C	G	C	G	T	G	.	.	.	.	.
29	Huperzia lucidulum	C	G	C	.	G	G	C	G	G	.	.	T	T	C	G	.	.	.	.	C	G	C	G	T	G	.	.	.	.	.
30	Lycopodiella inundatum	C	G	T	.	G	G	C	G	G	.	.	T	T	C	G	.	.	.	.	C	G	C	G	T	G	.	.	.	.	.
31	Lycopodium phlegmaria	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	T	G	G	C	G	.	.	.
32	Lycopodium taxifolium	C	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	T	G	G	C	G	.	.	.
33	Lycopodium tristachyum	C	G	C	.	G	G	C	G	G	.	.	T	T	C	G	.	.	.	.	C	G	C	G	T	G	.	.	.	.	.
34	Selaginella umbrosa	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	T	G	C	T	G	G	C	G	.	.	.
35	Selaginella vogelii	T	G	C	C	G	A	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	T	C	G	G	C	G	.	.	.
36	Oryza sativa	C	G	G	G	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	C	C	C	G	.	.	.
37	Zea mays	.	C	G	C	A	C	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	C	C	C	G	.	.	.
38	Arabidopsis thaliana	C	G	T	G	G	G	T	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	C	G	C	G	.	.	.
39	Glycine max	C	G	T	G	A	G	C	G	G	.	.	T	T	C	G	.	.	.	C	T	G	C	C	C	G	C	G	.	.	.
40	Sinapis alba	C	G	T	G	G	G	T	G	G	.	.	T	T	C	G	.	.	.	C	C	G	T	C	C	G	C	G	.	.	.
41	Zamia pumila	C	G	A	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	T	G	G	G	C	G	C	G	.	.	.
42	Gnetum leyboldii	C	G	A	T	G	A	T	G	G	.	T	T	T	C	G	C	C	.	A	T	C	G	T	C	G	C	G	.	.	.
43	Ginkgo biloba	C	G	A	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
44	Pinus luchuensis	C	G	A	T	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	T	C	G	.	.	.
45	Pinus wallichiana	C	G	A	C	G	G	T	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	T	G	T	C	G	.	.	.
46	Nageia nagi	C	G	T	T	G	G	C	G	G	.	.	T	T	G	T	.	.	.	C	T	G	C	C	G	A	C	G	.	.	.
47	Taxus mairei	C	G	G	C	G	G	T	G	G	.	.	T	T	T	.	.	.	.	C	C	G	T	C	G	C	C	G	.	.	.
48	Adiantum raddianum	C	C	G	T	G	G	C	G	G	.	.	T	T	C	G	.	.	.	.	C	G	C	C	G	G	T	G	.	.	.
49	Adiantum raddianum 2	C	G	C	T	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
50	Ophioglossum petiolatum	C	A	G	C	C	G	G	C	G	G	.	T	C	C	G	.	.	C	C	?	?	?	?	?	?	?	?	.	.	.
51	Osmunda cinnamomea	C	G	C	C	G	G	C	G	G	.	.	A	T	C	G	.	.	.	C	T	G	C	C	G	G	T	G	.	.	.
52	Salvinia natans	C	G	G	C	G	G	C	G	G	.	.	T	A	C	C	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
53	Psilotum nudum	C	G	C	C	G	G	C	G	G	.	.	T	C	C	G	.	.	.	C	C	G	C	C	G	G	C	C	.	.	.
54	Chara foetida	A	T	C	T	C	G	G	C	G	G	.	T	T	T	G	.	.	C	C	G	C	T	.	G	G	G	G	.	.	.
55	Coleochaete scutata	A	C	C	C	T	G	G	C	G	G	.	T	T	C	G	.	.	C	C	G	C	C	.	G	G	T	G	.	.	.
56	Klebsormidium flaccidum	A	C	T	C	C	G	G	C	G	G	.	T	C	?	G	.	.	C	?	G	C	C	.	G	A	A	G	.	.	.
57	Nitella flexilis	A	C	C	C	C	G	G	C	G	G	.	T	T	C	G	.	.	C	C	G	C	T	.	G	G	G	G	.	.	.
58	Nitella sp.	A	C	C	C	C	G	G	C	G	G	.	T	T	C	G	.	.	C	C	G	C	T	.	G	G	G	G	.	.	.
59	Chlamydomonas reinhardtii	G	G	C	T	G	G	G	.	.	.	.	G	C	A	A	.	.	.	.	.	C	C	.	T	G	G	C	.	.	.
60	Hydrodictyon reticulatum	A	G	C	G	G	G	T	G	.	.	.	G	C	A	A	.	.	.	.	C	A	C	.	C	T	A	C	.	.	.
61	Parietochloris pseudoalveolaris	A	G	T	C	G	C	G	G	.	.	.	T	T	T	.	.	.	.	.	C	C	G	C	T	G	A	C	.	.	.
62	Dictyostelium discoideum	C	T	G	T	.	.	.	.	.	.	G	G	C	A	.	.	.	.	.	.	.	A	C	A	C	T	G	A	T	A
63	Pteris vittata	C	G	C	T	G	G	C	G	G	?	.	T	T	C	T	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
64	Megaceros aenigmaticus	C	A	C	C	G	G	C	G	G	.	.	G	T	A	A	.	.	.	C	T	G	C	C	G	G	C	G	.	.	.
65	Notothylas breutelu	C	A	C	C	G	G	G	G	G	.	.	G	T	C	A	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.
66	Physcomitrella patens	T	G	C	C	G	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	T	G	.	.	.
67	Sphagnum palustre	C	G	C	C	T	G	C	G	G	.	.	T	T	C	G	.	.	.	C	C	G	C	C	G	G	C	G	.	.	.

#	Taxa with Variability Info 72	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160
		0	0.	0	2.	2.	2	2.	0.	1.	2.	1.	4.	5.	5.	5.	6.	3.	5.	4.	2.	2.	2	2	2	6	4	6	2	0	3
1	Saccharomyces cerevisiae	.	.	.	A	.	G	A	.	G	C	G	G	A	G	A	A	T	T	T	G	G	A	C	A	A	A	C	T	.	T
2	Schizosaccharomyces pombe	.	.	.	C	.	A	T	T	G	C	C	G	A	G	A	A	G	T	T	G	G	A	C	A	A	A	C	T	.	T
3	Physcomitrella patens 2	.	.	.	A	C	G	T	.	T	G	G	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
4	Anthoceros agrestis	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
5	Anthoceros laevis	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
6	Pellia epiphylla	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
7	Reboulia hemisphaerica	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	T	T	T	A	A	A	C	C	.	T
8	Riccardia pinguis	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
9	Sphaerocarpos donnellii	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	C	C	T	T	T	A	A	A	C	C	.	T
10	Sphaerocarpus texanus	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	.	T	C	C	T	T	A	A	A	C	C	.	T
11	Atrichum undulatum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
12	Bryum argenteum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
13	Eurhynchium hians	.	.	.	T	C	G	T	.	T	G	T	A	G	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
14	Funaria hygrometrica	.	.	.	A	C	G	T	.	T	G	G	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
15	Leptobryum pyriforme	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
16	Mnium hornum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
17	Physcomitrium pyriforme	.	.	.	A	G	C	T	.	T	G	G	T	A	G	A	A	G	T	T	C	A	C	C	A	A	A	C	C	.	T
18	Polytrichum formosum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
19	Sphagnum cuspidatum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
20	Calypogeia arguta	.	.	.	T	C	G	T	.	T	G	T	G	A	A	G	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
21	Conocephalum conicum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	T	T	T	A	A	A	C	C	.	T
22	Fossombronia pusilla	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
23	Marchantia polymorpha	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	C	C	T	T	T	A	A	A	C	C	.	T
24	Riccia fluitans	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	T	T	T	A	A	A	C	C	.	T
25	Scapania nemorosa	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
26	Equisetum hyemale	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
27	Equisetum robustum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
28	Isoetes engelmannii	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
29	Huperzia lucidula	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
30	Lycopodiella inundatum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
31	Lycopodium phlegmaria	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
32	Lycopodium taxifolium	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
33	Lycopodium tristachyum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
34	Selaginella umbrosa	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
35	Selaginella vogelii	.	.	.	A	C	G	C	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
36	Oryza sativa	.	.	.	A	C	G	T	.	C	G	C	G	A	G	A	A	G	T	C	C	A	T	T	G	A	A	C	C	.	T
37	Zea mays	A	C	C	G	T	C	C	.	G	C	C	G	A	G	A	A	G	T	C	C	A	T	T	G	A	A	C	C	.	T
38	Arabidopsis thaliana	.	.	.	A	C	G	T	.	C	G	C	G	A	G	A	A	G	T	C	C	A	C	T	A	A	A	C	C	.	T
39	Glycine max	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	[illegible]	C	A	C	T	G	A	A	C	C	.	T
40	Sinapis alba	.	.	.	A	C	G	T	.	C	G	C	G	A	G	A	A	G	T	T	T	T	C	T	A	A	A	C	C	.	T
41	Zamia pumila	.	.	.	A	C	G	T	.	C	G	C	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
42	Gnetum leyboldii	.	.	.	A	C	G	T	.	C	G	T	G	A	G	A	A	G	C	T	C	A	T	T	G	A	A	C	C	.	T
43	Ginkgo biloba	.	.	.	A	C	G	T	.	C	G	C	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
44	Pinus luchuensis	.	.	.	A	C	G	T	.	C	G	T	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
45	Pinus wallichiana	.	.	.	A	C	G	T	.	C	G	T	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
46	Nageia nagi	.	.	.	A	C	G	T	.	T	G	C	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
47	Taxus mairei	.	.	.	A	T	G	T	.	T	G	C	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
48	Adiantum raddianum	.	.	.	A	C	G	T	.	.	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	G	C	C	.	T
49	Adiantum raddianum 2	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	G	C	C	.	T
50	Ophioglossum petiolatum	.	.	.	?	?	?	?	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	?
51	Osmunda cinnamomea	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	G	C	C	.	T
52	Salvinia natans	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	G	C	C	.	T
53	Psilotum nudum	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
54	Chara foetida	.	.	.	G	T	G	C	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
55	Coleochaete scutata	.	.	.	A	C	G	C	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
56	Klebsormidium flaccidum	.	.	.	A	A	G	C	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
57	Nitella flexilis	.	.	.	G	C	G	C	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
58	Nitella sp.	.	.	.	G	C	G	C	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	G	A	A	C	C	.	T
59	Chlamydomonas reinhardtii	.	.	.	C	T	T	G	.	C	T	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	C
60	Hydrodictyon reticulatum	.	.	.	T	A	C	T	.	G	C	C	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	C
61	Parietochloris pseudoalveolaris	.	.	.	T	G	C	A	.	G	C	C	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	C
62	Dictyostelium discoideum	.	.	.	T	A	.	.	.	A	A	T	T	A	A	A	A	G	T	T	A	T	T	T	A	A	A	T	C	.	T
63	Pteris vittata	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	.	A	C	C	.	T
64	Megaceros aenigmaticus	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
65	Notothylas breutelii	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	C	A	.	A	C	C	C	T
66	Physcomitrella patens	.	.	.	A	C	G	T	.	T	G	G	G	A	G	A	A	G	T	T	C	A	T	T	A	A	A	C	C	.	T
67	Sphagnum palustre	.	.	.	A	C	G	T	.	T	G	T	G	A	G	A	A	G	T	T	C	A	T	C	A	A	A	C	C	.	T

5	Anthoceros laevis	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G											
6	Pellia epiphylla	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
7	Reboulia hemisphaerica	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	?	?	?	?	?	?	?	?	?	?	?	.	.	.	?
8	Riccardia pinguis	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
9	Sphaerocarpos donnellii	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
10	Sphaerocarpus texanus	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
11	Atrichum undulatum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
12	Bryum argenteum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
13	Eurhynchium hians	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
14	Funaria hygrometrica	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
15	Leptobryum pyriforme	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
16	Mnium hornum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
17	Physcomitrium pyriforme	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
18	Polytrichum formosum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
19	Sphagnum cuspidatum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
20	Calypogeia arguta	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
21	Conocephalum conicum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
22	Fossombronia pusilla	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
23	Marchantia polymorpha	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
24	Riccia fluitans	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
25	Scapania nemorosa	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	A	G	A	G	A	A	G	T	C	G	T	.	.	.	A
26	Equisetum hyemale	T	A	C	C	A	T	T	T	A	G	A	G	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	.	.	?
27	Equisetum robustum	T	A	C	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
28	Isoetes engelmannii	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
29	Huperzia lucidulum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
30	Lycopodiella inundatum	T	A	C	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
31	Lycopodium phlegmaria	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
32	Lycopodium taxifolium	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
33	Lycopodium tristachyum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	?	?	?	?	?	?	?	.	.	.	?
34	Selaginella umbrosa	T	A	C	T	A	T	C	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
35	Selaginella vogelii	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
36	Oryza sativa	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
37	Zea mays	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
38	Arabidopsis thaliana	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
39	Glycine max	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
40	Sinapis alba	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
41	Zamia pumila	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
42	Gnetum leyboldii	T	A	T	C	G	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
43	Ginkgo biloba	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	?	?	?	?	.	.	.	?
44	Pinus luchuensis	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	?	?	?	?	.	.	.	?
45	Pinus wallichiana	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
46	Nageia nagi	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	?	?	?	?	.	.	.	?
47	Taxus mairei	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	?	?	?	?	.	.	.	?
48	Adiantum raddianum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
49	Adiantum raddianum 2	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
50	Ophioglossum petiolatum	?	.	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	.	.	?
51	Osmunda cinnamomea	T	A	T	C	A	T	T	T	A	G	A	G	?	?	?	?	?	?	?	?	?	?	?	?	?	?	.	.	.	?
52	Salvinia natans	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
53	Psilotum nudum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
54	Chara foetida	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
55	Coleochaete scutata	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
56	Klebsormidium flaccidum	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
57	Nitella flexilis	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
58	Nitella sp.	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
59	Chlamydomonas reinhardtii	T	C	C	C	A	C	C	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
60	Hydrodictyon reticulatum	T	C	C	C	A	C	C	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
61	Parietochloris pseudoalveolaris	T	C	C	C	A	C	C	T	A	G	A	G	T	A	A	G	C	A	G	A	A	G	T	C	G	T	.	.	.	A
62	Dictyostelium discoideum	C	A	T	T	G	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
63	Pteris vittata	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
64	Megaceros aenigmaticus	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
65	Notothylas breutelii	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	C	G	T	A
66	Physcomitrella patens	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A
67	Sphagnum palustre	T	A	T	C	A	T	T	T	A	G	A	G	G	A	A	G	G	A	G	A	A	G	T	C	G	T	.	.	.	A

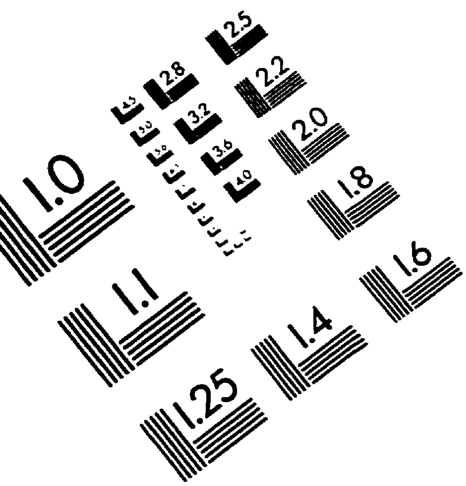
Taxa with Variability Info	74	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220
		6	6	6	5.	6.	6.	6.	6.	4.	6.	5.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6	6	6.	6	1	6	4	6.	6.
1	Saccharomyces cerevisiae	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
2	Schizosaccharomyces pombe	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
3	Physcomitrella patens 2	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
4	Anthoceros agrestis	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
5	Anthoceros laevis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
6	Pellia epiphylla	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
7	Reboulia hemisphaerica	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
8	Riccardia pinguis	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
9	Sphaerocarpos donnellii	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
10	Sphaerocarpus texanus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
11	Atrichum undulatum	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
12	Bryum argenteum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
13	Eurhynchium hians	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
14	Funaria hygrometrica	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
15	Leptobryum pyriforme	A	C	A	A	G	G	T	T	T	C	C	G	1	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
16	Mnium hornum	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
17	Physcomitrium pyriforme	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
18	Polytrichum formosum	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
19	Sphagnum cuspidatum	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
20	Calypogeia arguta	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
21	Conocephalum conicum	A	C	A	A	G	G	T	T	T	C	T	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
22	Fossombronia pusilla	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
23	Marchantia polymorpha	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
24	Riccia fluitans	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
25	Scapania nemorosa	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
26	Equisetum hyemale	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
27	Equisetum robustum	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
28	Isoetes engelmannii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
29	Huperzia lucidula	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
30	Lycopodiella inundatum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
31	Lycopodium phlegmaria	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
32	Lycopodium taxifolium	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
33	Lycopodium tristachyum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
34	Selaginella umbrosa	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
35	Selaginella vogelii	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
36	Oryza sativa	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
37	Zea mays	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
38	Arabidopsis thaliana	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
39	Glycine max	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
40	Sinapis alba	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
41	Zamia pumila	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
42	Gnetum leyboldii	A	C	A	A	G	G	T	T	A	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	T	A	G
43	Ginkgo biloba	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
44	Pinus luchuensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
45	Pinus wallichiana	A	C	A	A	G	G	T	T	A	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
46	Nageia nagi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
47	Taxus mairei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
48	Adiantum raddianum	A	C	A	A	G	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
49	Adiantum raddianum 2	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
50	Ophioglossum petiolatum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
51	Osmunda cinnamomea	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
52	Salvinia natans	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
53	Psilotum nudum	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
54	Chara foetida	A	C	A	A	G	G	T	T	T	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
55	Coleochaete scutata	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
56	Klebsormidium flaccidum	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
57	Nitella flexilis	A	C	A	A	G	G	T	T	T	C	C	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
58	Nitella sp	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	A	G	A	A	G
59	Chlamydomonas reinhardtii	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
60	Hydrodictyon reticulatum	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
61	Parietochloris pseudoalveolaris	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	A	G
62	Dictyostelium discoideum	A	C	A	A	G	G	T	A	T	C	C	G	T	A	G	G	T	G	A	A	C	C	T	G	C	G	G	A	T	G
63	Pteris vittata	?	C	A	G	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
64	Megaceros aenigmaticus	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	?	?	C	T	G	?	?	?	?	?	?
65	Notothylas breutelii	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	.	C	.	.	.	.	.	.	.	.	.
66	Physcomitrella patens	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	?	?	?	?	?	?	?	?	?	?	?	?	?
67	Sphagnum palustre	A	C	A	A	G	G	T	T	T	C	C	G	T	A	G	G	T	G	A	A	C	?	?	?	?	?	?	?	?	?

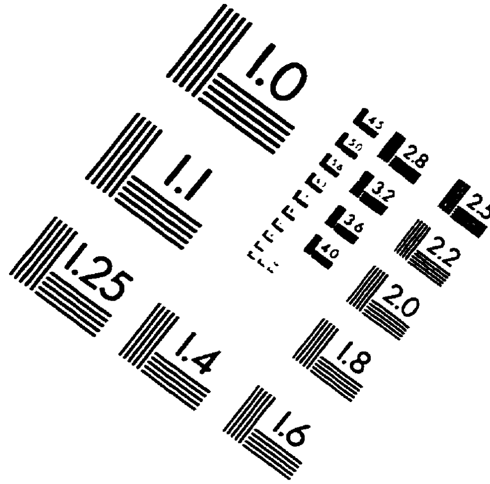
Taxa with Variability Info	75	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250
		6.	6.	6.	6.	6.	6.	6.	6.	-1	-1	-1	-1	-1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1	Saccharomyces cerevisiae	G	A	T	C	A	T	T	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	Schizosaccharomyces pombe	G	A	T	C	A	T	T	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	Physcomitrella patens 2	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	Anthoceros agrestis	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	Anthoceros laevis	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	Pellia epiphylla	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	Reboulia hemisphaerica	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	Riccardia pinguis	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	Sphaerocarpos donnellii	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	Sphaerocarpus texanus	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	Atrichum undulatum	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	Bryum argenteum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	Eurhynchium hians	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	Funaria hygrometrica	G	A	T	C	A	T	T	G	C	A	C	A	C	A	C	A	C	A	A	A	A	A	A	A	A	A	A	C	T	G
15	Leptobryum pyriforme	G	A	T	C	A	C	T	G	G	G	C	C	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	Mnium hornum	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	Physcomitrium pyriforme	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	Polytrichum formosum	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	Sphagnum cuspidatum	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	Calypogeia arguta	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	Conocephalum conicum	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	Fossombronia pusilla	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	Marchantia polymorpha	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	Riccia fluitans	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	Scapania nemorosa	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	Equisetum hyemale	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	Equisetum robustum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	Isoetes engelmannii	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	Huperzia lucidulum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	Lycopodiella inundatum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	Lycopodium phlegmaria	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	Lycopodium taxifolium	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	Lycopodium tristachyum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	Selaginella umbrosa	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	Selaginella vogelii	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	Oryza sativa	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	Zea mays	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	Arabidopsis thaliana	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	Glycine max	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40	Sinapis alba	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	Zamia pumila	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	Gnetum leyboldii	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	Ginkgo biloba	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	Pinus luchuensis	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	Pinus wallichiana	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46	Nageia nagi	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47	Taxus mairei	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48	Adiantum raddianum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	Adiantum raddianum 2	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	Ophioglossum petiolatum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51	Osmunda cinnamomea	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52	Salvinia natans	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53	Psilotum nudum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54	Chara foetida	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55	Coleochaete scutata	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56	Klebsormidium flaccidum	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
57	Nitella flexilis	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	Nitella sp.	G	A	T	C	A	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59	Chlamydomonas reinhardtii	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	Hydrodictyon reticulatum	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
61	Parietochloris pseudoalveolaris	G	A	T	C	A	T	T	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62	Dictyostelium discoideum	G	A	T	C	A	T	T	T	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
63	Pteris vittata	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64	Megaceros aenigmaticus	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65	Notothylas breutelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
66	Physcomitrella patens	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	Sphagnum palustre	?	?	?	?	?	?	?	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

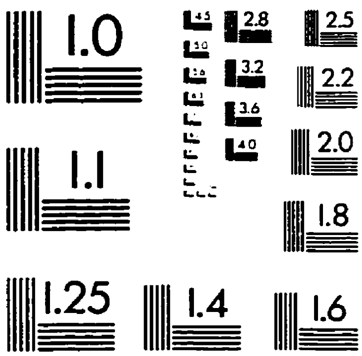
21	Conocephalum conicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	Fossombronia pusilla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23	Marchantia polymorpha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	Riccia fluitans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	Scapania nemorea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	Equisetum hyemale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27	Equisetum robustum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28	Isoetes engelmannii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	Huperzia lucidulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30	Lycopodiella inundatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	Lycopodium phlegmaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	Lycopodium taxifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	Lycopodium tristachyum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	Selaginella umbrosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	Selaginella vogelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36	Oryza sativa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37	Zea mays	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	Arabidopsis thaliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	Glycine max	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40	Sinapis alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	Zamia pumila	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	Gnetum leyboldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	Ginkgo biloba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	Pinus luchuensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	Pinus wallichiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46	Nageia nagi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47	Taxus mairei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48	Adiantum raddianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	Adiantum raddianum 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	Ophioglossum petiolatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51	Osmunda cinnamomea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52	Salvinia natans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53	Psilotum nudum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54	Chara foetida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55	Coleochaete scutata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56	Klebsormidium flaccidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
57	Nitella flexilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	Nitella sp	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59	Chlamydomonas reinhardtii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	Hydrodictyon reticulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
61	Parietochloris pseudoalveolaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62	Dictyostelium discoideum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
63	Pteris vittata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64	Megaceros aenigmaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65	Notothylas breutelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
66	Physcomitrella patens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	Sphagnum palustre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

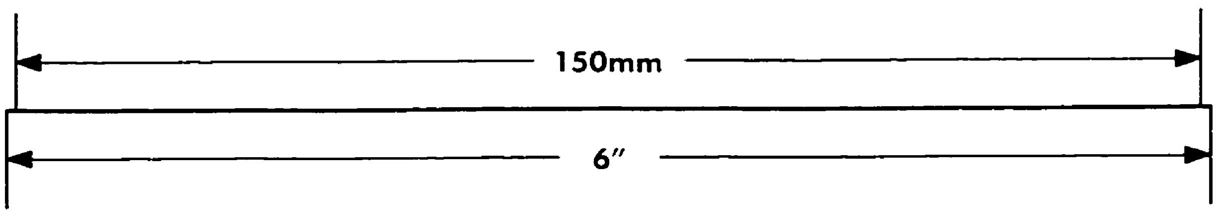
Taxa with Variability Info	77	2281	2282	2283
		0.	0.	0.
1	Saccharomyces cerevisiae	.	.	.
2	Schizosaccharomyces pombe	.	.	.
3	Physcomitrella patens 2	.	.	.
4	Anthoceros agrestis	.	.	.
5	Anthoceros laevis	.	.	.
6	Pellia epiphylla	.	.	.
7	Reboulia hemisphaerica	.	.	.
8	Riccardia pinguis	.	.	.
9	Sphaerocarpos donnellii	.	.	.
10	Sphaerocarpus texanus	.	.	.
11	Atrichum undulatum	.	.	.
12	Bryum argenteum	.	.	.
13	Eurhynchium hians	.	.	.
14	Funaria hygrometrica	T	A	C
15	Leptobryum pyriforme	.	.	.
16	Mnium hornum	.	.	.
17	Physcomitrium pyriforme	.	.	.
18	Polytrichum formosum	.	.	.
19	Sphagnum cuspidatum	.	.	.
20	Calypogeia arguta	.	.	.
21	Conocephalum conicum	.	.	.
22	Fossombronia pusilla	.	.	.
23	Marchantia polymorpha	.	.	.
24	Riccia fluitans	.	.	.
25	Scapania nemorea	.	.	.
26	Equisetum hyemale	.	.	.
27	Equisetum robustum	.	.	.
28	Isoetes engelmannii	.	.	.
29	Huperzia lucidulum	.	.	.
30	Lycopodiella inundatum	.	.	.
31	Lycopodium phlegmaria	.	.	.
32	Lycopodium taxifolium	.	.	.
33	Lycopodium tristachyum	.	.	.
34	Selaginella umbrosa	.	.	.
35	Selaginella vogelii	.	.	.
36	Oryza sativa	.	.	.
37	Zea mays	.	.	.
38	Arabidopsis thaliana	.	.	.
39	Glycine max	.	.	.
40	Sinapis alba	.	.	.
41	Zamia pumila	.	.	.
42	Gnetum leyboldii	.	.	.
43	Ginkgo biloba	.	.	.
44	Pinus luchuensis	.	.	.
45	Pinus wallichiana	.	.	.
46	Nageia nagi	.	.	.
47	Taxus mairei	.	.	.
48	Adiantum raddianum	.	.	.
49	Adiantum raddianum 2	.	.	.
50	Ophioglossum petiolatum	.	.	.
51	Osmunda cinnamomea	.	.	.
52	Salvinia natans	.	.	.
53	Psilotum nudum	.	.	.
54	Chara foetida	.	.	.
55	Coleochaete scutata	.	.	.
56	Klebsormidium flaccidum	.	.	.
57	Nitella flexilis	.	.	.
58	Nitella sp.	.	.	.
59	Chlamydomonas reinhardtii	.	.	.
60	Hydrodictyon reticulatum	.	.	.
61	Parietochloris pseudoalveolaris	.	.	.
62	Dictyostelium discoideum	.	.	.
63	Pteris vittata	.	.	.
64	Megaceros aenigmaticus	.	.	.
65	Notothylas breutelii	.	.	.
66	Physcomitrella patens	.	.	.
67	Sphagnum palustre	.	.	.

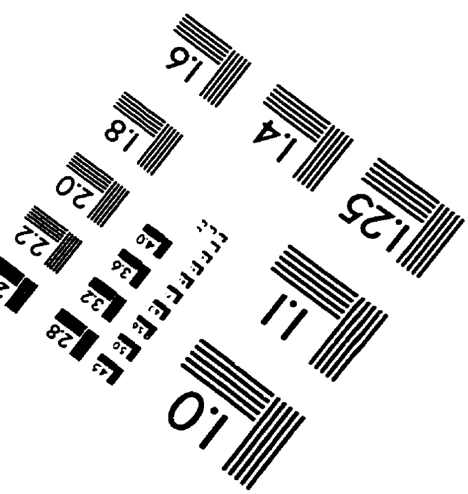
IMAGE EVALUATION TEST TARGET (QA-3)











APPLIED IMAGE . Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989