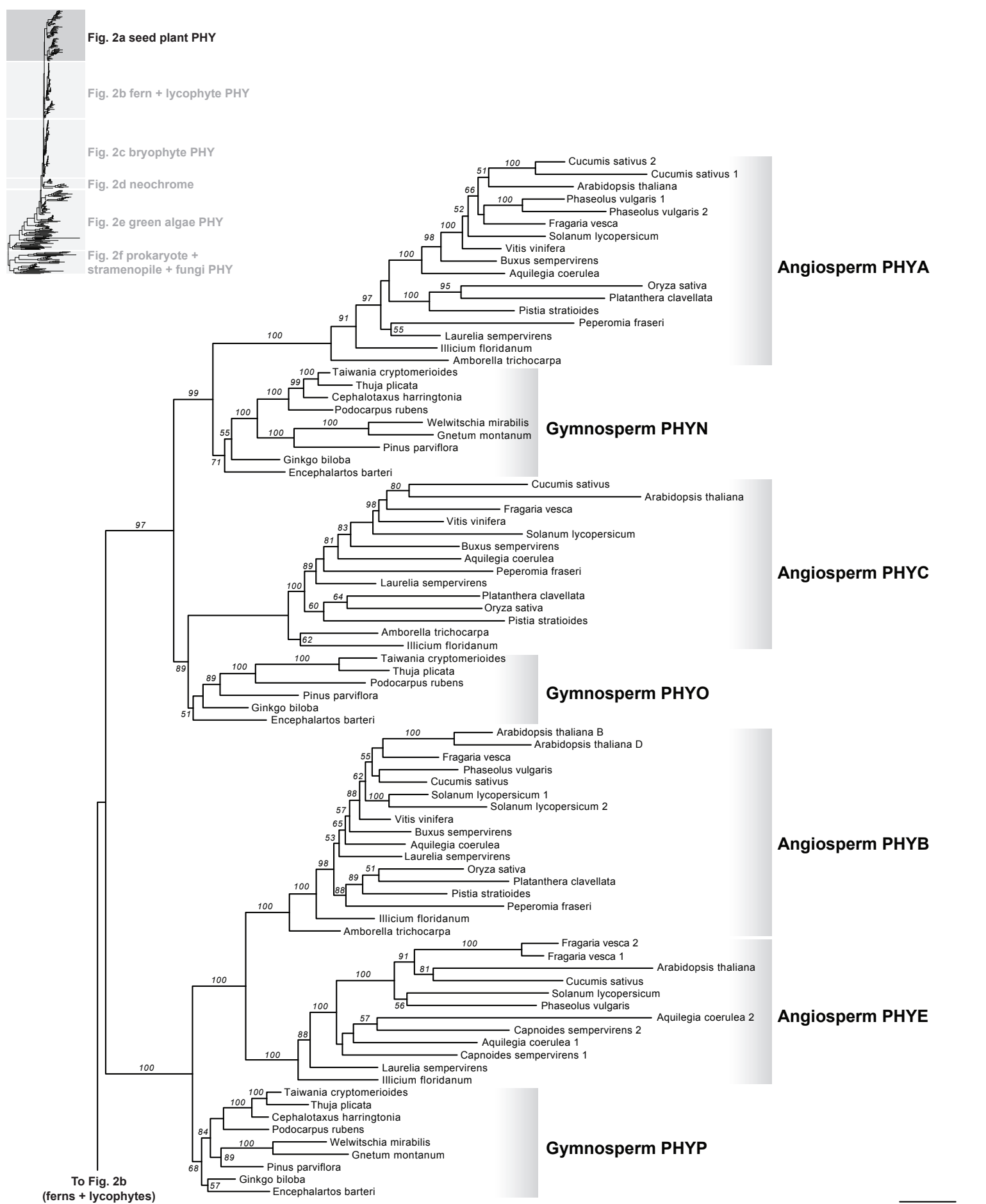


Supplementary Figure 1. The organismal lineages screened for phytochrome homologs. Phytochromes were not detected in lineages indicated in grey. *Traditional Archaeplastida does not include cryptophytes.



Supplementary Figure 2. The phylogeny of phytochromes reconstructed from 423 protein sequences. Topology derived from the best maximum likelihood tree. The values associated with branches are maximum likelihood bootstrap support. For better visualization, the complete tree is broken down into six subtrees (a-f) and scaled differently. The inset at the top-left corner shows the map to each subtree. **(a)** The seed plant phytochrome subtree. Phylogeny continues in Supplementary Fig. 2b.



Fig. 2a seed plant PHY

Fig. 2b fern + lycophyte PHY

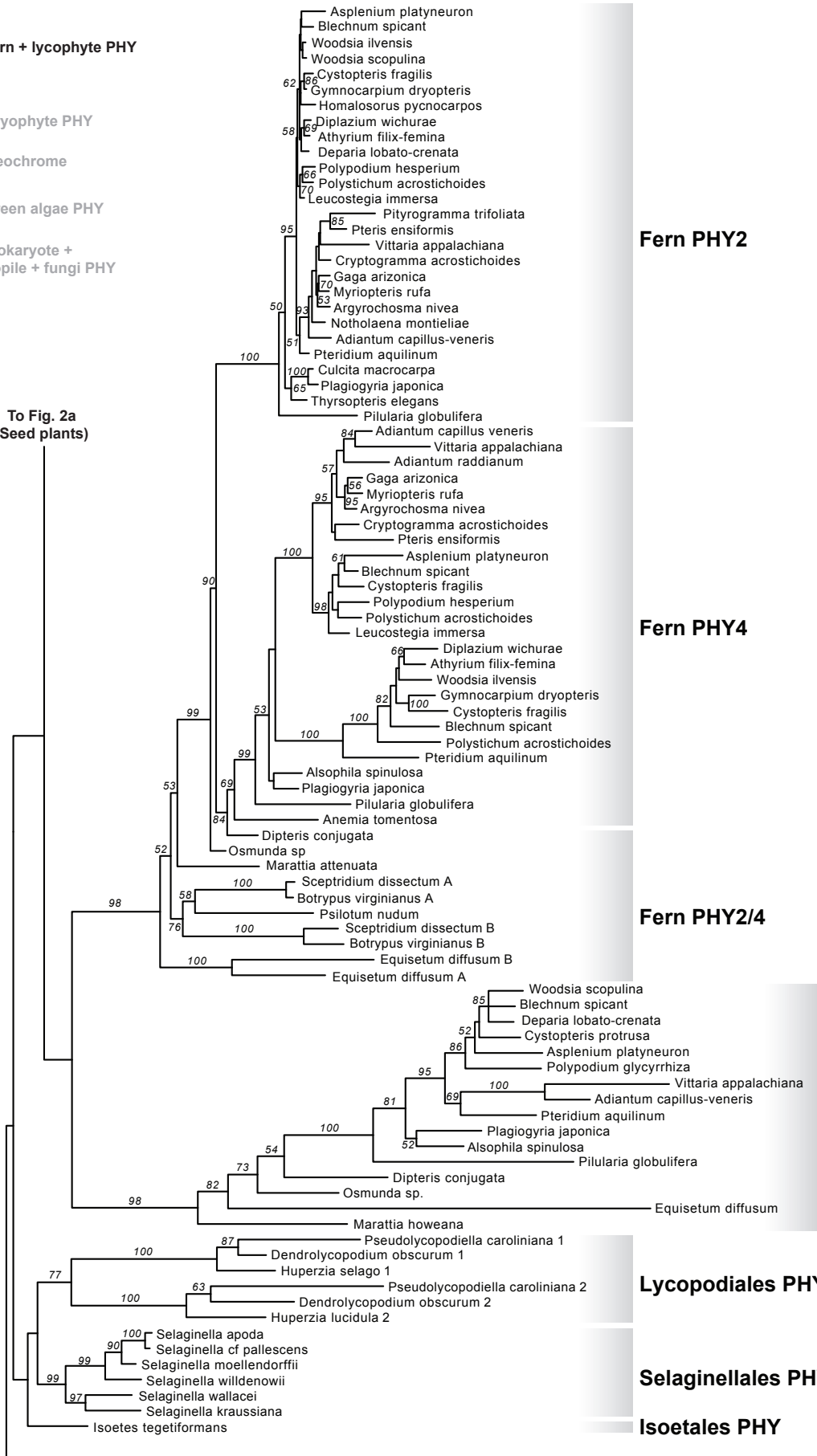
Fig. 2c bryophyte PHY

Fig. 2d neochrome

Fig. 2e green algae PHY

Fig. 2f prokaryote + stramenopile + fungi PHY

To Fig. 2a
(Seed plants)



To Fig. 1c
(bryophytes)

0.1 substitutions/site

Supplementary Figure 2. (b) The fern and lycophyte phytochrome subtree. Phylogeny continues in Supplementary Fig. 2a,c. See Fig. 5 for a more extensively sampled and higher resolution phylogeny that was reconstructed from nucleotide dataset.



Fig. 2a seed plant PHY

Fig. 2b fern + lycophyte PHY

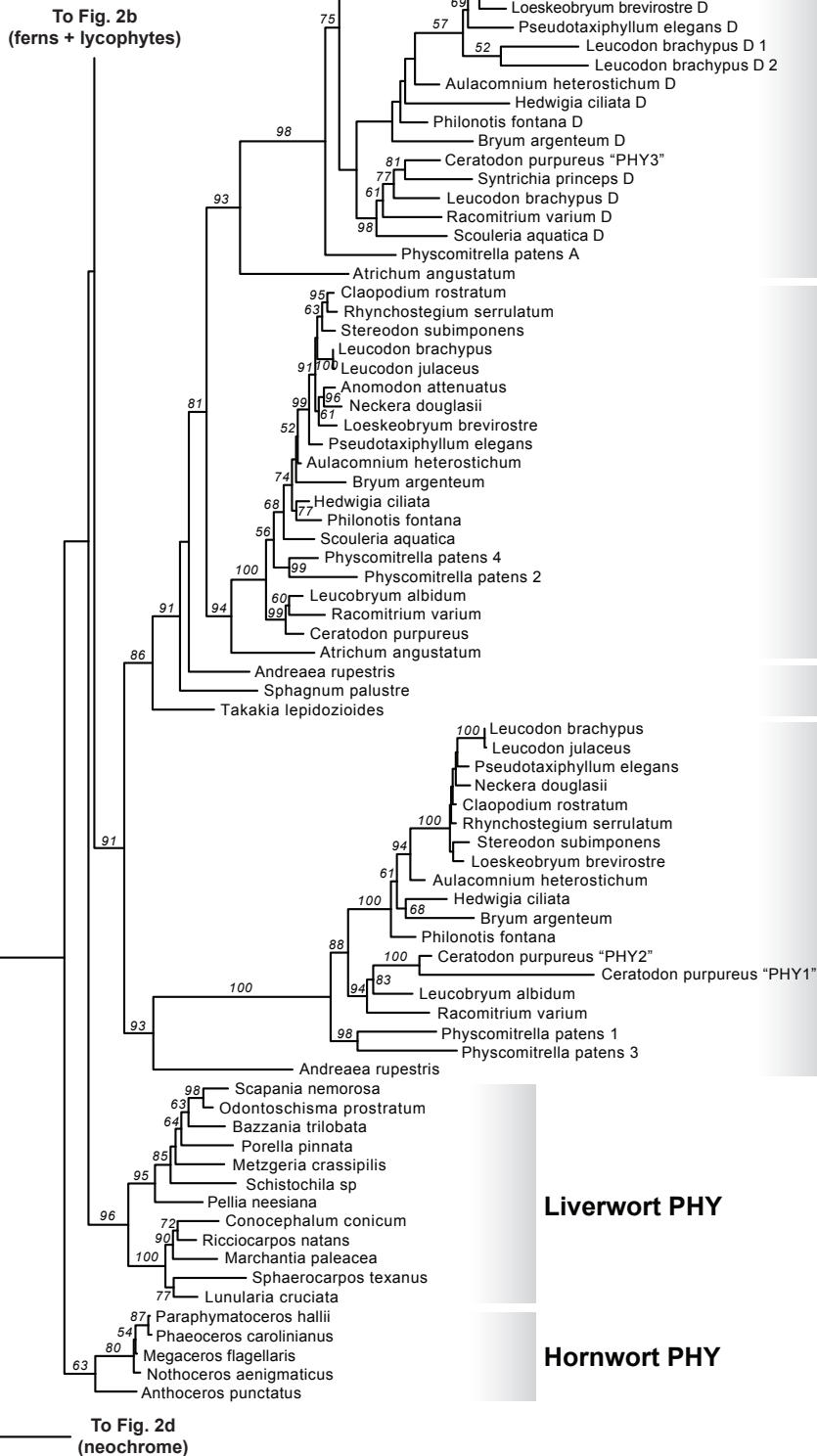
Fig. 2c bryophyte PHY

Fig. 2d neochrome

Fig. 2e green algae PHY

Fig. 2f prokaryote + stramenopile + fungi PHY

To Fig. 2b
(ferns + lycophytes)



Moss PHY5

Moss PHY2_4

Moss PHY2_4/5

Moss PHY1_3

Liverwort PHY

Hornwort PHY

To Fig. 2d
(neochrome)

To Fig. 2e
(green algae)

0.1 substitutions/site

Supplementary Figure 2. (c) The bryophyte phytochrome subtree. Phylogeny continues in Supplementary Fig. 2b,d,e. See Fig. 4 for a more extensively sampled and higher resolution phylogeny that was reconstructed from nucleotide dataset.

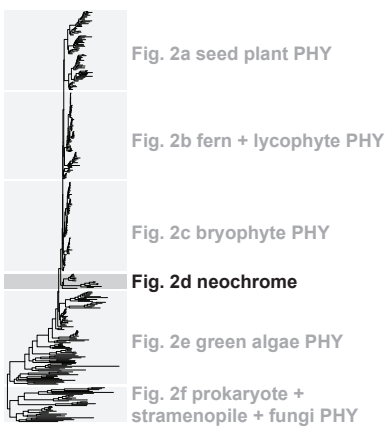


Fig. 2a seed plant PHY

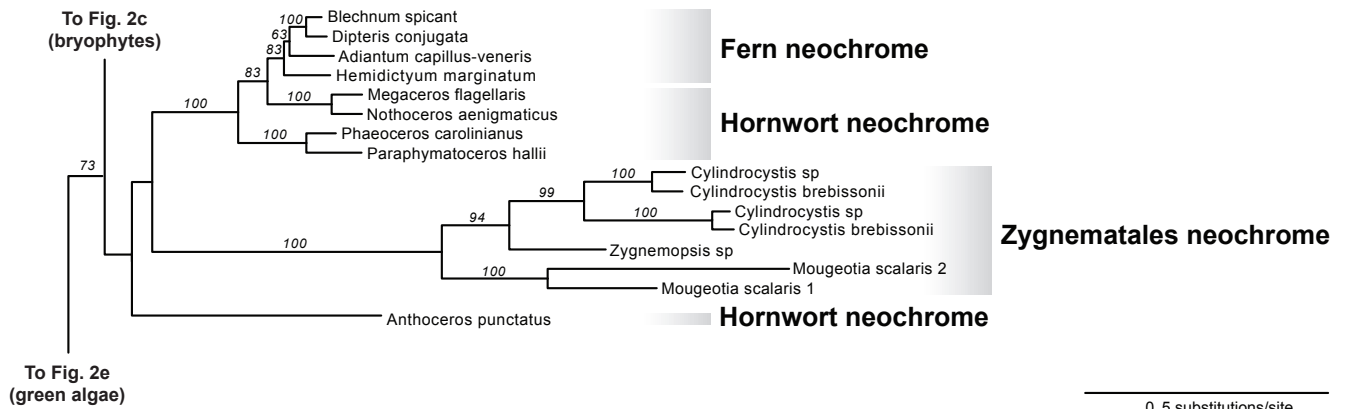
Fig. 2b fern + lycophyte PHY

Fig. 2c bryophyte PHY

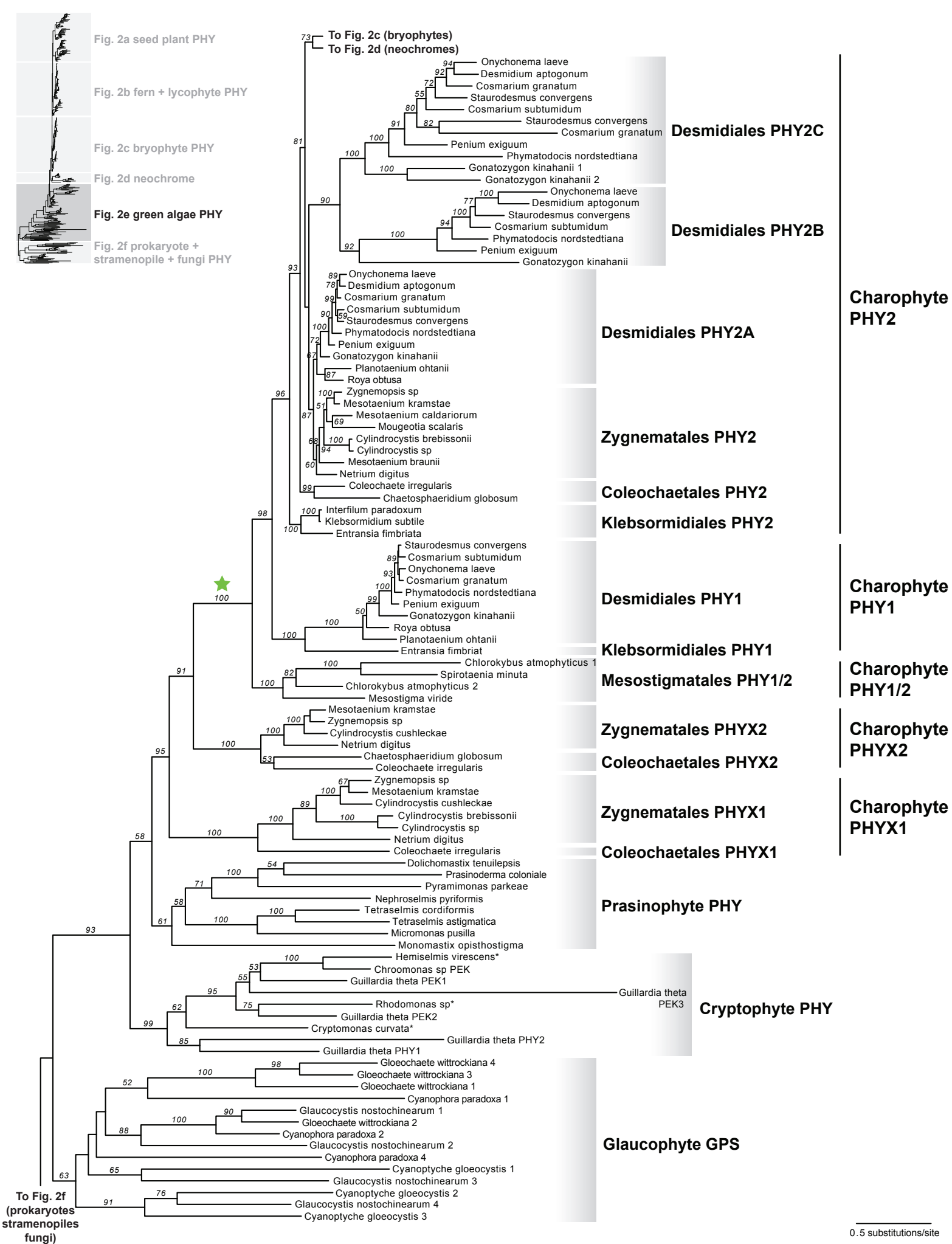
Fig. 2d neochrome

Fig. 2e green algae PHY

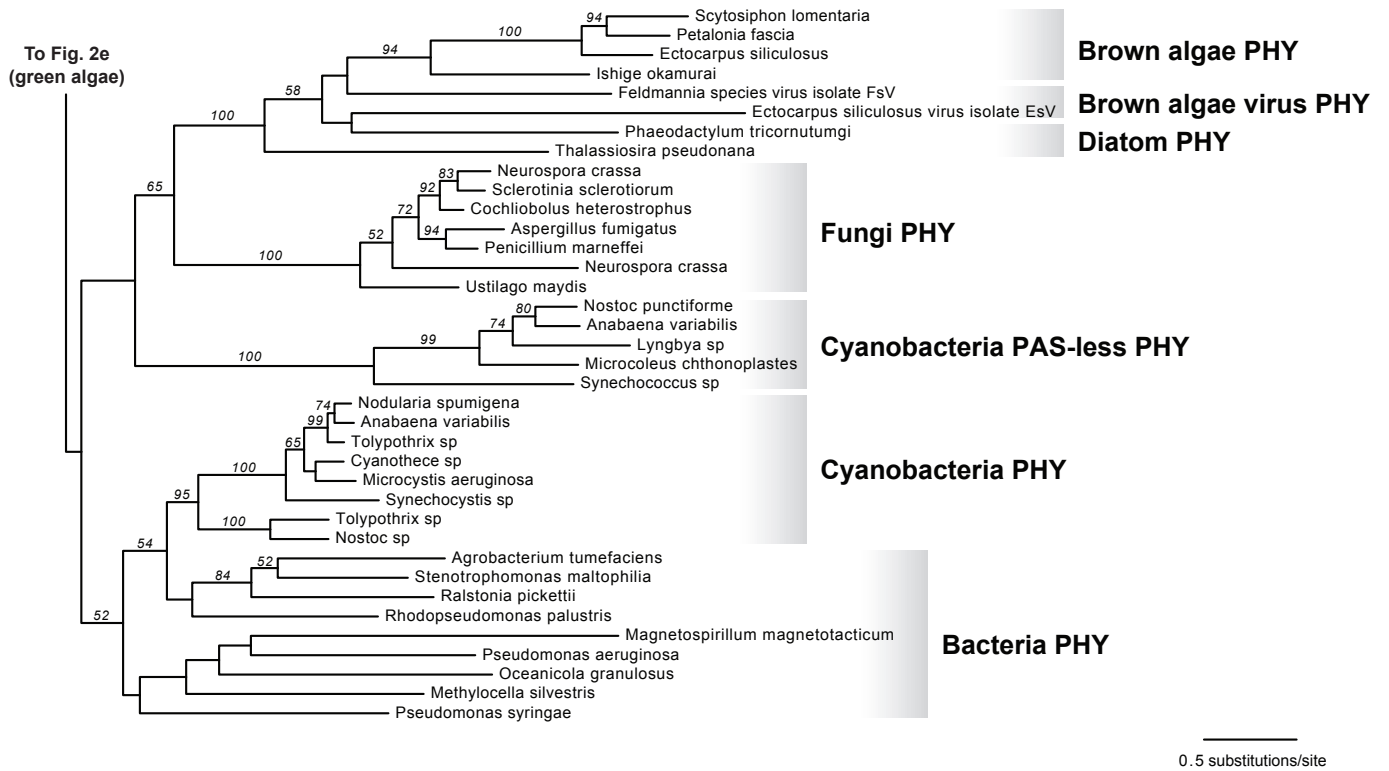
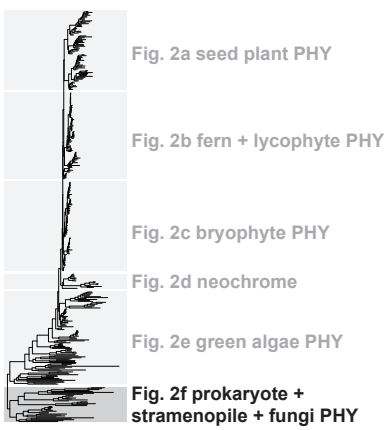
Fig. 2f prokaryote + stramenopile + fungi PHY



Supplementary Figure 2. (d) The neochrome subtree. Phylogeny continues in Supplementary Fig. 2c,e. See Fig. 3 for a more extensively sampled and higher resolution phylogeny.



Supplementary Figure 2. (e) The green algae phytochrome subtree. Green star marks the origin of canonical plant phytochrome. Phylogeny continues in Supplementary Fig. 2c,d,f. “*” marks the cryptophyte phytochromes that have incomplete C-terminal end, so that they cannot be determined as PEK or not.



Supplementary Figure 2. (f) The prokaryote + stramenopile + fungi phytochrome subtree. Phylogeny continues in Supplementary Fig. 2e.

Supplementary Table 1. List of transcriptomes and genomes screened for phytochrome homologs. "-": not applicable.

Taxa	Source	1KP ³ identifier
Angiosperm		
<i>Amborella trichocarpa</i>	Genome, Amborella Genome Project ¹	-
<i>Aquilegia coerulea</i>	Genome, Phytozome ²	-
<i>Arabidopsis thaliana</i>	Genome, Phytozome	-
<i>Buxus sempervirens</i>	Transcriptome, 1KP ³	IWMW
<i>Capnoides sempervirens</i>	Transcriptome, 1KP	AUGV
<i>Cucumis sativus</i>	Genome, Phytozome	-
<i>Fragaria vesca</i>	Genome, Phytozome	-
<i>Illicium floridanum</i>	Transcriptome, 1KP	VZCI
<i>Laurelia sempervirens</i>	Transcriptome, 1KP	WAIL
<i>Oryza sativa</i>	Genome, Phytozome	-
<i>Peperomia fraseri</i>	Transcriptome, 1KP	XSZI
<i>Phaseolus vulgaris</i>	Genome, Phytozome	-
<i>Pistia stratioides</i>	Transcriptome, 1KP	MFIN
<i>Platanthera clavellata</i>	Transcriptome, 1KP	MTHW
<i>Solanum lycopersicum</i>	Genome, Phytozome	-
<i>Vitis vinifera</i>	Genome, Phytozome	-
Gymnosperm		
<i>Cephalotaxus harringtonia</i>	Transcriptome, 1KP	WYAJ
<i>Encephalartos barteri</i>	Transcriptome, 1KP	GNQG
<i>Ginkgo biloba</i>	Transcriptome, 1KP	SGTW
<i>Gnetum montanum</i>	Transcriptome, 1KP	GTHK
<i>Pinus parviflora</i>	Transcriptome, 1KP	IIOL
<i>Podocarpus rubens</i>	Transcriptome, 1KP	XLGK
<i>Taiwania cryptomerioides</i>	Transcriptome, 1KP	QSNJ
<i>Thuja plicata</i>	Transcriptome, 1KP	VFYZ
<i>Welwitschia mirabilis</i>	Transcriptome, 1KP	TOXE
Fern		
<i>Adiantum tenerum</i>	Transcriptome, 1KP	BMJR
<i>Anemia tomentosa</i>	Transcriptome, 1KP	CQPW
<i>Argyroschisma nivea</i>	Transcriptome, 1KP	XDDT
<i>Asplenium platyneuron</i>	Transcriptome, 1KP	KJZG
<i>Athyrium filix-femina</i>	Transcriptome, 1KP	AFPO
<i>Azolla caroliniana</i>	Transcriptome, 1KP	CVEG
<i>Azolla filiculoides</i>	Transcriptome, Brouwer et al. ⁴	-
<i>Blechnum spicant</i>	Transcriptome, 1KP	VITX
<i>Botrypus virginianus</i>	Transcriptome, 1KP	BEGM
<i>Ceratopteris thalictroides</i>	Transcriptome, 1KP	PIVW
<i>Gaga arizonica</i>	Transcriptome, 1KP	DCDT

<i>Cryptogramma acrostichoides</i>	Transcriptome, 1KP	WQML
<i>Culcita macrocarpa</i>	Transcriptome, 1KP	PNZO
<i>Alsophila spinulosa</i>	Transcriptome, 1KP	GANB
<i>Cystopteris fragilis</i>	Transcriptome, 1KP	LHLE
<i>Cystopteris protrusa</i>	Transcriptome, 1KP	YOWV
<i>Danaea nodosa</i>	Transcriptome, 1KP	DFHO
<i>Deparia lobato-crenata</i>	Transcriptome, 1KP	FCHS
<i>Diplazium wichurae</i>	Transcriptome, 1KP	UFJN
<i>Dipteris conjugata</i>	Transcriptome, 1KP	MEKP
<i>Equisetum diffusum</i>	Transcriptome, 1KP	CAPN
<i>Gymnocarpium dryopteris</i>	Transcriptome, 1KP	HEGQ
<i>Homalosorus pycnocarpus</i>	Transcriptome, 1KP	OCZL
<i>Leucostegia immersa</i>	Transcriptome, 1KP	WGTU
<i>Lindsaea microphylla</i>	Transcriptome, 1KP	YIXP
<i>Lonchitis hirsuta</i>	Transcriptome, 1KP	VVRN
<i>Lygodium japonicum</i>	Transcriptome, 1KP	PBUU
<i>Marattia attenuata</i>	Transcriptome, 1KP	UGNK
<i>Myriopteris rufa</i>	Transcriptome, 1KP	GSXD
<i>Notholaena montieliae</i>	Transcriptome, 1KP	YCKE
<i>Osmunda javanica</i>	Transcriptome, 1KP	VIBO
<i>Osmunda sp</i>	Transcriptome, 1KP	UOMY
<i>Osmundastrum cinnamomeum</i>	Transcriptome, 1KP	RFMZ
<i>Pilularia globulifera</i>	Transcriptome, 1KP	KIIX
<i>Pityrogramma trifoliata</i>	Transcriptome, 1KP	UJTT
<i>Plagiogyria japonica</i>	Transcriptome, 1KP	UWOD
<i>Polypodium glycyrrhiza</i>	Transcriptome, 1KP	CJNT
<i>Polypodium hesperium</i>	Transcriptome, 1KP	GYFU
<i>Polystichum acrostichoides</i>	Transcriptome, 1KP	FQGQ
<i>Pteridium aquilinum</i>	Transcriptome, Der et al. ⁵	-
<i>Pteris ensiformis</i>	Transcriptome, 1KP	FLTD
<i>Sceptridium dissectum</i>	Transcriptome, 1KP	EEAQ
<i>Thyrsopteris elegans</i>	Transcriptome, 1KP	EWXK
<i>Vittaria appalachiana</i>	Transcriptome, 1KP	NDUV
<i>Woodsia ilvensis</i>	Transcriptome, 1KP	YQEC
<i>Woodsia scopulina</i>	Transcriptome, 1KP	YJJY
Isoetopsida		
<i>Selaginella cf pallescens</i>	Transcriptome, 1KP	ABIJ
<i>Selaginella moellendorffii</i>	Genome, Phytozome	-
<i>Selaginella willdenowii</i>	Transcriptome, 1KP	KJYC
<i>Selaginella kraussiana</i>	Transcriptome, 1KP	ZFGK
<i>Selaginella wallacei</i>	Transcriptome, 1KP	JKAA
<i>Selaginella apoda</i>	Transcriptome, 1KP	LGDQ

Isoetes tegetiformans	Transcriptome, 1KP	PKOX
Lycopodiales		
Dendrolycopodium obscurum	Transcriptome, 1KP	XNXF
Huperzia selago	Transcriptome, 1KP	GTUO
Huperzia lucidula	Transcriptome, 1KP	GKAG
Pseudolycopodiella caroliniana	Transcriptome, 1KP	UPMJ
Moss		
Andreaea rupestris	Transcriptome, 1KP	WOGB
Anomodon attenuatus	Transcriptome, 1KP	QMWB
Claopodium rostratum	Transcriptome, 1KP	VBMM
Atrichum angustatum	Transcriptome, 1KP	ZTHV
Aulacomnium heterostichum	Transcriptome, 1KP	WNGH
Bryum argenteum	Transcriptome, 1KP	JMXW
Ceratodon purpureus	Transcriptome, 1KP	FFPD
Hedwigia ciliata	Transcriptome, 1KP	YWNF
Stereodon subimponens	Transcriptome, 1KP	LNSF
Leucobryum albidum	Transcriptome, 1KP	VMXJ
Leucodon brachypus	Transcriptome, 1KP	ZACW
Neckera douglasii	Transcriptome, 1KP	TMAJ
Philonotis fontana	Transcriptome, 1KP	ORKS
Physcomitrella patens	Genome, Phytozome	-
Pseudotaxiphyllum elegans	Transcriptome, 1KP	QKQO
Racomitrium varium	Transcriptome, 1KP	RDOO
Rhynchostegium serrulatum	Transcriptome, 1KP	JADL
Loeskeobryum brevirostre	Transcriptome, 1KP	WSPM
Leucodon julaceus	Transcriptome, 1KP	IGUH
Scouleria aquatica	Transcriptome, 1KP	BPSG
Sphagnum palustre	Transcriptome, 1KP	RCBT
Syntrichia princeps	Transcriptome, 1KP	GRKU
Takakia lepidozoides	Transcriptome, 1KP	SKQD
Liverwort		
Scapania nemorosa	Transcriptome, 1KP	IRBN
Porella pinnata	Transcriptome, 1KP	UUHD
Schistochila sp	Transcriptome, 1KP	LGOW
Metzgeria crassipilis	Transcriptome, 1KP	NRWZ
Pellia neesiana	Transcriptome, 1KP	JHFI
Odontoschisma prostratum	Transcriptome, 1KP	YBQN
Conocephalum conicum	Transcriptome, 1KP	ILBQ
Lunularia cruciata	Transcriptome, 1KP	TXVB
Sphaerocarpos texanus	Transcriptome, 1KP	HERT
Ricciocarpos natans	Transcriptome, 1KP	WJLO
Bazzania trilobata	Transcriptome, 1KP	WZYK

Hornwort

Nothoceros aenigmaticus	Transcriptome, 1KP	DXOU
Megaceros flagellaris	Transcriptome, 1KP	UCRN
Paraphymatoceros hallii	Transcriptome, 1KP	FAJB
Phaeoceros carolinianus	Transcriptome, 1KP	WCZB
Anthoceros punctatus	Genome, Li et al. ⁶	-
Phaeomegaceros coriaceus	Transcriptome, 1KP	AKXB
Leiosporoceros dussii	Transcriptome, 1KP	ANON

Desmidiiales

Cosmarium granatum	Transcriptome, 1KP	MNNM
Cosmarium subtumidum	Transcriptome, 1KP	WDGV
Desmidium aptogonum	Transcriptome, 1KP	DFDS
Gonatozygon kinahanii	Transcriptome, 1KP	KEYW
Onychonema laeve	Transcriptome, 1KP	GGWH
Penium exiguum	Transcriptome, 1KP	YSQT
Phymatodocis nordstedtiana	Transcriptome, 1KP	RPQV
Planotaenium ohtanii	Transcriptome, 1KP	SNOX
Roya obtusa	Transcriptome, 1KP	XRTZ
Staurodesmus convergens	Transcriptome, 1KP	WCQU

Zygnematales

Cylindrocystis brebissonii	Transcriptome, 1KP	YOXI
Cylindrocystis cushleckae	Transcriptome, 1KP	JOJQ
Cylindrocystis sp	Transcriptome, 1KP	VAZE
Mesotaenium braunii	Transcriptome, 1KP	WSJO
Mesotaenium kramstae	Transcriptome, 1KP	NBYP
Netrium digitus	Transcriptome, 1KP	FFGR
Zygnemopsis sp	Transcriptome, 1KP	MFZO

Coleochaetales

Coleochaete irregularis	Transcriptome, 1KP	QPDY
Chaetosphaeridium globosum	Transcriptome, 1KP	DRGY

Klebsormidiales

Interfilum paradoxum	Transcriptome, 1KP	FPCO
Klebsormidium subtile	Transcriptome, 1KP	FQLP
Entransia fimbriata	Transcriptome, 1KP	BFIK

Mesostigmatales

Chlorokybus atmophyticus	Transcriptome, 1KP	AZZW
Mesostigma viride	Transcriptome, 1KP	KYIO
Spirotaenia minuta	Transcriptome, 1KP	NNHQ

Charales

Chara vulgaris	Transcriptome, 1KP	MWXT
----------------	--------------------	------

Trebouxiophyceae

Botryococcus braunii	Transcriptome, 1KP	ETGN
----------------------	--------------------	------

<i>Botryococcus terribilis</i>	Transcriptome, 1KP	QYXY
<i>Coccomyxa pringsheimii</i>	Transcriptome, 1KP	GXBM
<i>Eremosphaera viridis</i>	Transcriptome, 1KP	MNCB
<i>Geminella</i> sp.	Transcriptome, 1KP	PFUD
<i>Leptosira obovata</i>	Transcriptome, 1KP	ZNUM
<i>Microthamnion kuetzigianum</i>	Transcriptome, 1KP	DXNY
<i>Nannochloris atomus</i>	Transcriptome, 1KP	MFYC
<i>Neochloris oleoabundans</i>	Transcriptome, 1KP	EEJO
<i>Parachlorella kessleri</i>	Transcriptome, 1KP	AKCR
<i>Prasiola crispa</i>	Transcriptome, 1KP	WCLV
<i>Prototheca wickerhamii</i>	Transcriptome, 1KP	BILC
<i>Stichococcus bacillaris</i>	Transcriptome, 1KP	WXRI
<i>Trebouxia arboricola</i>	Transcriptome, 1KP	NKXU

Ulvophyceae

<i>Acrosiphonia</i> sp.	Transcriptome, 1KP	JIWJ
<i>Blastophysa</i> cf. <i>rhizopus</i>	Transcriptome, 1KP	VHIJ
<i>Bolbocoleon piliferum</i>	Transcriptome, 1KP	LSHT
<i>Bryopsis plumosa</i>	Transcriptome, 1KP	JTIG
<i>Cephaleuros virescens</i>	Transcriptome, 1KP	YDCQ
<i>Cladophora glomerata</i>	Transcriptome, 1KP	VBLH
<i>Codium fragile</i>	Transcriptome, 1KP	GYBH
<i>Desmochloris halophila</i>	Transcriptome, 1KP	KSFK
<i>Entocladia endozoica</i>	Transcriptome, 1KP	OQON
<i>Halochlorococcum marinum</i>	Transcriptome, 1KP	ALZF
<i>Helicodictyon planctonicum</i>	Transcriptome, 1KP	AJAU
<i>Ignatius tetrasporus</i>	Transcriptome, 1KP	KADG
<i>Ochlochaete</i> sp.	Transcriptome, 1KP	CQQP
<i>Oltmannsiellopsis viridis</i>	Transcriptome, 1KP	PZBH
<i>Oltmannsiellopsis viridis</i>	Transcriptome, 1KP	QJYX
<i>Percursaria percursa</i>	Transcriptome, 1KP	OAEZ
<i>Planophila laetevirens</i>	Transcriptome, 1KP	CBNG
<i>Planophila</i> sp.	Transcriptome, 1KP	LETF
<i>Pirula salina</i>	Transcriptome, 1KP	NQYP
<i>Pseudoneochloris marina</i>	Transcriptome, 1KP	GJIY
<i>Trentepohlia annulata</i>	Transcriptome, 1KP	NATT

Chlorophyceae

<i>Ankistrodesmus</i> sp.	Transcriptome, 1KP	OTQG
<i>Aphanochaete repens</i>	Transcriptome, 1KP	IJMT
<i>Asteromonas gracilis</i>	Transcriptome, 1KP	NTLE
<i>Botryosphaerella sudetica</i>	Transcriptome, 1KP	VJDZ
<i>Brachiomonas submarina</i>	Transcriptome, 1KP	GUBD
<i>Carteria crucifera</i>	Transcriptome, 1KP	VIAU

<i>Carteria obtusa</i>	Transcriptome, 1KP	RUIF
<i>Chaetopeltis orbicularis</i>	Transcriptome, 1KP	BAZF
<i>Chlamydomonas reinhardtii</i>	Genome, Phytozome	-
<i>Chlamydomonas bilatus</i>	Transcriptome, 1KP	MULF
<i>Chlamydomonas cribrum</i>	Transcriptome, 1KP	BCYF
<i>Chlamydomonas moewusii</i>	Transcriptome, 1KP	JRGZ
<i>Chlamydomonas noctigama</i>	Transcriptome, 1KP	VALZ
<i>Chlamydomonas sp.</i>	Transcriptome, 1KP	TSBQ
<i>Chlamydomonas sp.</i>	Transcriptome, 1KP	AOUJ
<i>Chlorella variabilis</i>	Genome, Blanc et al. ⁷	-
<i>Chloromonas oogama</i>	Transcriptome, 1KP	IHOI
<i>Chloromonas perforata</i>	Transcriptome, 1KP	QRTH
<i>Chloromonas reticulata</i>	Transcriptome, 1KP	LBRP
<i>Chloromonas rosae</i>	Transcriptome, 1KP	AJUW
<i>Chloromonas subdivisa</i>	Transcriptome, 1KP	GFUR
<i>Chloromonas tughillensis</i>	Transcriptome, 1KP	UTRE
<i>Cylindrocapsa geminella</i>	Transcriptome, 1KP	DZPJ
<i>Dunaliella salina</i>	Transcriptome, 1KP	RHVC
<i>Dunaliella tertiolecta</i>	Transcriptome, 1KP	ZDIZ
<i>Eudorina elegans</i>	Transcriptome, 1KP	RNAT
<i>Fritschiella tuberosa</i>	Transcriptome, 1KP	VFIV
<i>Golenkinia longispicula</i>	Transcriptome, 1KP	BZSH
<i>Gonium pectorale</i>	Transcriptome, 1KP	KUJU
<i>Haematococcus pluvialis</i>	Transcriptome, 1KP	ODXI
<i>Haematococcus pluvialis</i>	Transcriptome, 1KP	AGIO
<i>Hafniomonas reticulata</i>	Transcriptome, 1KP	FXHG
<i>Heterochlamydomonas inaequalis</i>	Transcriptome, 1KP	IRYH
<i>Lobochlamys segnis</i>	Transcriptome, 1KP	OFUE
<i>Lobomonas rostrata</i>	Transcriptome, 1KP	JKKI
<i>Microspora cf. tumidula</i>	Transcriptome, 1KP	FOYQ
<i>Neodesmus pupukensis</i>	Transcriptome, 1KP	MWAN
<i>Neochlorosarcina sp.</i>	Transcriptome, 1KP	USIX
<i>Oedogonium cardiacum</i>	Transcriptome, 1KP	DVYE
<i>Oedogonium foveolatum</i>	Transcriptome, 1KP	SDPC
<i>Oogamochlamys gigantea</i>	Transcriptome, 1KP	XDLL
<i>Pandorina morum</i>	Transcriptome, 1KP	RYJX
<i>Pediastrum duplex</i>	Transcriptome, 1KP	XKWQ
<i>Pediastrum duplex</i>	Transcriptome, 1KP	XTON
<i>Phacotus lenticularis</i>	Transcriptome, 1KP	ZIVZ
<i>Pleurastrum insigne</i>	Transcriptome, 1KP	PRIQ
<i>Pteromonas angulosa</i>	Transcriptome, 1KP	LNIL
<i>Pteromonas sp.</i>	Transcriptome, 1KP	ACRY

Scenedesmus dimorphus	Transcriptome, 1KP	PZIF
Spermatozopsis exsultans	Transcriptome, 1KP	MXDS
Spermatozopsis similis	Transcriptome, 1KP	ENAU
Stephanosphaera pluvialis	Transcriptome, 1KP	ZLQE
Stigeoclonium helveticum	Transcriptome, 1KP	JMUI
Uronema sp.	Transcriptome, 1KP	ISGT
Uronema belkae	Transcriptome, 1KP	RAWF
Vitreochlamys sp.	Transcriptome, 1KP	QWRA
Volvox carteri	Genome, Phytozome	-
Volvox aureus	Transcriptome, 1KP	JWGT
Volvox aureus	Transcriptome, 1KP	WRSL
Volvox globator	Transcriptome, 1KP	ISPU
Pedinophyceae		
Pedinomonas minor	Transcriptome, 1KP	RRSV
Pedinomonas tuberculata	Transcriptome, 1KP	PUAN
Red Algae		
Betaphycus gelatinae	Transcriptome, 1KP	BWVJ
Ceramium kondoi	Transcriptome, 1KP	VZWX
Chondrus crispus	Genome, Collen et al. ⁸	-
Chondrus crispus	Transcriptome, 1KP	UGPM
Chroodactylon ornatum	Transcriptome, 1KP	LLXJ
Cyanidioschyzon merolae	Genome, Matsuzaki et al. ⁹	-
Dumontia simplex	Transcriptome, 1KP	IEHF
Eucheuma denticulatum	Transcriptome, 1KP	JEBK
Galdieria sulphuraria	Genome, Barbier et al. ¹⁰	-
Glaucosphaera vacuolata	Transcriptome, 1KP	RSOF
Gloeopeltis furcata	Transcriptome, 1KP	SBLT
Gracilaria asiatica	Transcriptome, 1KP	VNAL
Gracilaria blodgettii	Transcriptome, 1KP	LJPN
Gracilaria chouae	Transcriptome, 1KP	FTRP
Gracilaria lemaneiformi	Transcriptome, 1KP	IKWM
Grateloupia filicina	Transcriptome, 1KP	ZJOJ
Grateloupia livida	Transcriptome, 1KP	IKIZ
Grateloupia turuturu	Transcriptome, 1KP	URSB
Grateloupia chiangii	Transcriptome, 1KP	PWKQ
Gymnogongrus ftabelliformis	Transcriptome, 1KP	CKXF
Heterosiphonia pulchra	Transcriptome, 1KP	YSBD
Kappaphycus alvarezii	Transcriptome, 1KP	IHJY
Mazzaella japonica	Transcriptome, 1KP	WEJN
Polysiphonia japonica	Transcriptome, 1KP	XAXW
Pyropia yezoensis	Genome, Nakamura et al. ¹¹	-
Porphyra yezoensis	Transcriptome, 1KP	ZULJ

Porphyridium cruentum	Transcriptome, 1KP	OBUY
Porphyridium purpureum	Genome, Bhattacharya et al. ¹²	-
Porphyridium purpureum	Transcriptome, 1KP	PVGP
Rhodella violacea	Transcriptome, 1KP	RTLK
Rhodochaete parvula	Transcriptome, 1KP	JJZR
Sinotubimorpha guangdongensis	Transcriptome, 1KP	PYDB
Symphocladia latiuscula	Transcriptome, 1KP	UYFR
Prasinophyte		
Monomastix opisthostigma	Transcriptome, 1KP	BTFM
Pyramimonas parkeae	Transcriptome, 1KP	TNAW
Tetraselmis cordiformis	Transcriptome, 1KP	DUMA
Cryptophyte		
Chroomonas sp	Transcriptome, 1KP	ROZZ
Cryptomonas curvata	Transcriptome, 1KP	BAKF
Guillardia theta	Genome, Curtis et al. ¹³	-
Hemiselmis virescens	Transcriptome, 1KP	MJMQ
Rhodomonas sp	Transcriptome, 1KP	IAYV
Glaucophyte		
Cyanophora paradoxa	Genome, Price et al. ¹⁴	-
Cyanoptyche gloeocystis	Transcriptome, 1KP	JKHA
Glaucocystis nostochinearum	Transcriptome, 1KP	POOW
Haptophytes		
Isochrysis sp.	Transcriptome, 1KP	BAJW
Pavlova lutheri	Transcriptome, 1KP	NMAK
Prymnesium parvum	Transcriptome, 1KP	LXRN
Stramenopiles - Chrysophytes		
Mallomonas sp.	Transcriptome, 1KP	BOGT
Ochromonas sp.	Transcriptome, 1KP	EBWI
Synura petersenii	Transcriptome, 1KP	DBYD
Synura sp.	Transcriptome, 1KP	VKVG
Stramenopiles - Brown algae		
Ishige okamurae	Transcriptome, 1KP	APTP
Petalonia fascia	Transcriptome, 1KP	VRGZ
Scytosiphon lomentaria	Transcriptome, 1KP	JCXF

Supplementary Table 2. GenBank accessions of the phytochromes used in phylogenetic analyses. "-": not applicable.

Phytochrome	Source	1KP ³ identifier	GenBank accession
Angiosperm PHYA			
<i>Arabidopsis thaliana</i>	Genome, Phytozome ²	-	-
<i>Fragaria vesca</i>	Genome, Phytozome	-	-
<i>Phaseolus vulgaris</i> 1	Genome, Phytozome	-	-
<i>Phaseolus vulgaris</i> 2	Genome, Phytozome	-	-
<i>Cucumis sativus</i> 1	Genome, Phytozome	-	-
<i>Cucumis sativus</i> 2	Genome, Phytozome	-	-
<i>Vitis vinifera</i>	Genome, Phytozome	-	-
<i>Solanum lycopersicum</i>	Genome, Phytozome	-	-
<i>Buxus sempervirens</i>	Transcriptome, 1KP ²	IWMW	KT071960
<i>Aquilegia coerulea</i>	Genome, Phytozome	-	-
<i>Oryza sativa</i>	Genome, Phytozome	-	-
<i>Platanthera clavellata</i>	Transcriptome, 1KP	MTHW	KT071961
<i>Pistia stratioides</i>	Transcriptome, 1KP	MFIN	KT071962
<i>Laurelia sempervirens</i>	Transcriptome, 1KP	WAIL	KT071963
<i>Peperomia fraseri</i>	Transcriptome, 1KP	XSZI	KT071964
<i>Illicium floridanum</i>	Transcriptome, 1KP	VZCI	KT071965
<i>Amborella trichocarpa</i>	Genome, Amborella Genome Project ¹	-	-
Gymnosperm PHYN			
<i>Cephalotaxus harringtonia</i>	Transcriptome, 1KP	WYAJ	KT071966
<i>Podocarpus rubens</i>	Transcriptome, 1KP	XLGK	KJ195161
<i>Thuja plicata</i>	Transcriptome, 1KP	VFYZ	KT071967
<i>Taiwania cryptomerioides</i>	Transcriptome, 1KP	QSNJ	KJ195162
<i>Pinus parviflora</i>	Transcriptome, 1KP	IIOL	KJ195163
<i>Welwitschia mirabilis</i>	Transcriptome, 1KP	TOXE	KJ195164
<i>Gnetum montanum</i>	Transcriptome, 1KP	GTHK	KJ195165
<i>Ginkgo biloba</i>	Transcriptome, 1KP	SGTW	KT071968
<i>Encephalartos barteri</i>	Transcriptome, 1KP	GNQG	KJ195166
Angiosperm PHYC			
<i>Arabidopsis thaliana</i>	Genome, Phytozome	-	-
<i>Fragaria vesca</i>	Genome, Phytozome	-	-
<i>Cucumis sativus</i>	Genome, Phytozome	-	-
<i>Vitis vinifera</i>	Genome, Phytozome	-	-
<i>Solanum lycopersicum</i>	Genome, Phytozome	-	-
<i>Buxus sempervirens</i>	Transcriptome, 1KP	IWMW	KT071969
<i>Aquilegia coerulea</i>	Genome, Phytozome	-	-
<i>Oryza sativa</i>	Genome, Phytozome	-	-
<i>Platanthera clavellata</i>	Transcriptome, 1KP	MTHW	KT071970
<i>Pistia stratioides</i>	Transcriptome, 1KP	MFIN	KT071971
<i>Laurelia sempervirens</i>	Transcriptome, 1KP	WAIL	KT071972
<i>Peperomia fraseri</i>	Transcriptome, 1KP	XSZI	KT071973
<i>Illicium floridanum</i>	Transcriptome, 1KP	VZCI	KT071974
<i>Amborella trichocarpa</i>	Genome, Amborella Genome Project	-	-
Gymnosperm PHYO			
<i>Podocarpus rubens</i>	Transcriptome, 1KP	XLGK	KJ195167
<i>Thuja plicata</i>	Transcriptome, 1KP	VFYZ	KT071975
<i>Taiwania cryptomerioides</i>	Transcriptome, 1KP	QSNJ	KJ195168
<i>Pinus parviflora</i>	Transcriptome, 1KP	IIOL	KJ195169
<i>Ginkgo biloba</i>	Transcriptome, 1KP	SGTW	KT071976
<i>Encephalartos barteri</i>	Transcriptome, 1KP	GNQG	KJ195170

Angiosperm PHYB

<i>Arabidopsis thaliana</i> D	Genome, Phytozome	-	-
<i>Arabidopsis thaliana</i> B	Genome, Phytozome	-	-
<i>Fragaria vesca</i>	Genome, Phytozome	-	-
<i>Phaseolus vulgaris</i>	Genome, Phytozome	-	-
<i>Cucumis sativus</i>	Genome, Phytozome	-	-
<i>Vitis vinifera</i>	Genome, Phytozome	-	-
<i>Solanum lycopersicum</i> 1	Genome, Phytozome	-	-
<i>Solanum lycopersicum</i> 2	Genome, Phytozome	-	-
<i>Buxus sempervirens</i>	Transcriptome, 1KP	IWMW	KT071977
<i>Aquilegia coerulea</i>	Genome, Phytozome	-	-
<i>Oryza sativa</i>	Genome, Phytozome	-	-
<i>Platanthera clavellata</i>	Transcriptome, 1KP	MTHW	KT071978
<i>Pistia stratioides</i>	Transcriptome, 1KP	MFIN	KT071979
<i>Laurelia sempervirens</i>	Transcriptome, 1KP	WAIL	KT071980
<i>Peperomia fraseri</i>	Transcriptome, 1KP	XSZI	KT071981
<i>Illicium floridanum</i>	Transcriptome, 1KP	VZCI	KT071982
<i>Amborella trichocarpa</i>	Genome, Amborella Genome Project	-	-

Angiosperm PHYE

<i>Arabidopsis thaliana</i>	Genome, Phytozome	-	-
<i>Fragaria vesca</i> 1	Genome, Phytozome	-	-
<i>Fragaria vesca</i> 2	Genome, Phytozome	-	-
<i>Phaseolus vulgaris</i>	Genome, Phytozome	-	-
<i>Cucumis sativus</i>	Genome, Phytozome	-	-
<i>Solanum lycopersicum</i>	Genome, Phytozome	-	-
<i>Capnoides sempervirens</i> 1	Transcriptome, 1KP	AUGV	KT071983
<i>Aquilegia coerulea</i> 1	Genome, Phytozome	-	-
<i>Capnoides sempervirens</i> 2	Transcriptome, 1KP	AUGV	KT071984
<i>Aquilegia coerulea</i> 2	Genome, Phytozome	-	-
<i>Laurelia sempervirens</i>	Transcriptome, 1KP	WAIL	KT071985
<i>Illicium floridanum</i>	Transcriptome, 1KP	VZCI	KT071986

Gymnosperm PHYP

<i>Thuja plicata</i>	Transcriptome, 1KP	VFYZ	KT071987
<i>Taiwania cryptomerioides</i>	Transcriptome, 1KP	QSNJ	KJ195155
<i>Cephalotaxus harringtonia</i>	Transcriptome, 1KP	WYAJ	KT071988
<i>Podocarpus rubens</i>	Transcriptome, 1KP	XLGK	KJ195156
<i>Pinus parviflora</i>	Transcriptome, 1KP	IIOL	KJ195157
<i>Gnetum montanum</i>	Transcriptome, 1KP	GTHK	KJ195158
<i>Welwitschia mirabilis</i>	Transcriptome, 1KP	TOXE	KJ195159
<i>Ginkgo biloba</i>	Transcriptome, 1KP	SGTW	KT071989
<i>Encephalartos barteri</i>	Transcriptome, 1KP	GNQG	KJ195160

Fern PHY1

<i>Equisetum diffusum</i>	Transcriptome, 1KP	CAPN	KT071819
<i>Marattia howeana</i>	Cloning, this study	-	KP872700
<i>Osmunda</i> sp	Transcriptome, 1KP	UOMY	KJ195150
<i>Dipteris conjugata</i>	Transcriptome, 1KP	MEKP	KT071820
<i>Pilularia globulifera</i>	Transcriptome, 1KP	KIIX	KJ195151
<i>Plagiogyria japonica</i>	Transcriptome, 1KP	UWOD	KJ195152
<i>Adiantum capillus-veneris</i>	GenBank	-	AB016151
<i>Pteridium aquilinum</i>	Transcriptome, Der et al. ⁵	-	SRX423244
<i>Cystopteris protrusa</i>	Transcriptome, 1KP	YOWV	KT071821
<i>Blechnum spicant</i>	Transcriptome, 1KP	VITX	KJ195153
<i>Polypodium glycyrrhiza</i>	Transcriptome, 1KP	CJNT	KJ195154

<i>Asplenium platyneuron</i>	Transcriptome, 1KP	KJZG	KT071822
<i>Alsophila spinulosa</i>	Transcriptome, 1KP	GANB	KT071823
<i>Woodsia scopulina</i>	Transcriptome, 1KP	YJJY	KT071824
<i>Deparia lobato-crenata</i>	Transcriptome, 1KP	FCHS	KT071825
<i>Vittaria appalachiana</i>	Transcriptome, 1KP	NDUV	KT071826
<i>Danaea nodosa</i>	Transcriptome, 1KP	DFHO	KT071827
<i>Azolla filiculoides</i>	Transcriptome, Brouwer et al. ⁴	-	-
<i>Thyrsopteris elegans</i>	Transcriptome, 1KP	EWXK	KT071828
<i>Ceratopteris thalictroides</i>	Transcriptome, 1KP	PIVW	KT071829
<i>Lonchitis hirsuta</i>	Transcriptome, 1KP	VVRN	KT071830
Fern PHY2/4			
<i>Equisetum diffusum</i> A	Transcriptome, 1KP	CAPN	KJ195136
<i>Equisetum diffusum</i> B	Transcriptome, 1KP	CAPN	KT071831
<i>Botrypus virginianus</i> A	Transcriptome, 1KP	BEGM	KJ195137
<i>Sceptridium dissectum</i> A	Transcriptome, 1KP	EFAQ	KT071832
<i>Botrypus virginianus</i> B	Transcriptome, 1KP	BEGM	KT071833
<i>Sceptridium dissectum</i> B	Transcriptome, 1KP	EFAQ	KT071834
<i>Psilotum nudum</i>	GenBank	QVMR	X74930
<i>Marattia attenuata</i>	Transcriptome, 1KP	UGNK	KT071835
<i>Osmunda</i> sp A	Transcriptome, 1KP	UOMY	KJ195138
<i>Dipteris conjugata</i>	Transcriptome, 1KP	MEKP	KJ195139
<i>Danaea nodosa</i>	Transcriptome, 1KP	DFHO	KT071836
<i>Osmundastrum cinnamomeum</i> A	Transcriptome, 1KP	RFMZ	KT071837
<i>Osmunda javanica</i> A	Transcriptome, 1KP	VIBO	KT071838
<i>Osmundastrum cinnamomeum</i> B	Transcriptome, 1KP	RFMZ	KT071839
<i>Osmunda javanica</i> B	Transcriptome, 1KP	VIBO	KT071840
Fern PHY2			
<i>Anemia tomentosa</i>	Transcriptome, 1KP	CQPW	KJ195140
<i>Pilularia globulifera</i>	Transcriptome, 1KP	KIIX	KJ195142
<i>Plagiogyria japonica</i>	Transcriptome, 1KP	UWOD	KJ195141
<i>Adiantum capillus-veneris</i>	GenBank	-	AB016232
<i>Pteridium aquilinum</i>	Transcriptome, Der et al.	-	SRX423244
<i>Polystichum acrostichoides</i>	Transcriptome, 1KP	FQGQ	KT071841
<i>Cystopteris fragilis</i>	Transcriptome, 1KP	LHLE	KT071842
<i>Blechnum spicant</i>	Transcriptome, 1KP	VITX	KJ195143
<i>Leucostegia immersa</i>	Transcriptome, 1KP	WGTV	KT071843
<i>Polypodium hesperium</i>	Transcriptome, 1KP	GYFU	KJ195144
<i>Gymnocarpium dryopteris</i>	Transcriptome, 1KP	HEGQ	KT071844
<i>Homalosorus pycnocarpus</i>	Transcriptome, 1KP	OCZL	KT071845
<i>Athyrium filix-femina</i>	Transcriptome, 1KP	AFPO	KT071846
<i>Diplazium wichurae</i>	Transcriptome, 1KP	UFJN	KT071847
<i>Deparia lobato-crenata</i>	Transcriptome, 1KP	FCHS	KT071848
<i>Asplenium platyneuron</i>	Transcriptome, 1KP	KJZG	KT071849
<i>Woodsia scopulina</i>	Transcriptome, 1KP	YJJY	KT071850
<i>Woodsia ilvensis</i>	Transcriptome, 1KP	YQEC	KT071851
<i>Vittaria appalachiana</i>	Transcriptome, 1KP	NDUV	KT071852
<i>Pityrogramma trifoliata</i>	Transcriptome, 1KP	UJTT	KT071853
<i>Pteris ensiformis</i>	Transcriptome, 1KP	FLTD	KT071854
<i>Myriopteris rufa</i>	Transcriptome, 1KP	GSXD	KT071855
<i>Gaga arizonica</i>	Transcriptome, 1KP	DCDT	KT071856
<i>Argyrochosma nivea</i>	Transcriptome, 1KP	XDDT	KT071857
<i>Notholaena montieliae</i>	Transcriptome, 1KP	YCKE	KT071858
<i>Cryptogramma acrostichoides</i>	Transcriptome, 1KP	WQML	KT071859

<i>Thyrsopteris elegans</i>	Transcriptome, 1KP	EWXK	KT071860
<i>Culcita macrocarpa</i>	Transcriptome, 1KP	PNZO	KT071861
<i>Lindsaea microphylla</i>	Transcriptome, 1KP	YIXP	KT071862
<i>Lonchitis hirsuta</i>	Transcriptome, 1KP	VVRN	KT071863
<i>Ceratopteris thalictroides</i>	Transcriptome, 1KP	PIVW	KT071864
Fern PHY4A			
<i>Plagiogyria japonica</i>	Transcriptome, 1KP	UWOD	KJ195145
<i>Pilularia globulifera</i>	Transcriptome, 1KP	KIIX	KJ195146
<i>Adiantum tenerum</i>	Transcriptome, 1KP	BMJR	KJ195147
<i>Polystichum acrostichoides</i>	Transcriptome, 1KP	FQGQ	KT071865
<i>Cystopteris fragilis</i>	Transcriptome, 1KP	LHLE	KT071866
<i>Blechnum spicant</i>	Transcriptome, 1KP	VITX	KJ195148
<i>Leucostegia immersa</i>	Transcriptome, 1KP	WGTV	KT071867
<i>Polypodium hesperium</i>	Transcriptome, 1KP	GYFU	KJ195149
<i>Adiantum capillus-veneris</i>	GenBank	-	AB003364
<i>Asplenium platyneuron</i>	Transcriptome, 1KP	KJZG	KT071868
<i>Gaga arizonica</i>	Transcriptome, 1KP	DCDT	KT071869
<i>Myriopteris rufa</i>	Transcriptome, 1KP	GSXD	KT071870
<i>Argyrochosma nivea</i>	Transcriptome, 1KP	XDDT	KT071871
<i>Vittaria appalachiana</i>	Transcriptome, 1KP	NDUV	KT071872
<i>Pteris ensiformis</i>	Transcriptome, 1KP	FLTD	KT071873
<i>Cryptogramma acrostichoides</i>	Transcriptome, 1KP	WQML	KT071874
<i>Alsophila spinulosa</i>	Transcriptome, 1KP	GANB	KT071875
<i>Azolla caroliniana</i>	Transcriptome, 1KP	CVEG	KT071876
<i>Lonchitis hirsuta</i>	Transcriptome, 1KP	VVRN	KT071877
<i>Ceratopteris thalictroides</i>	Transcriptome, 1KP	PIVW	KT071878
<i>Anemia tomentosa A</i>	Transcriptome, 1KP	CQPW	KT071879
<i>Anemia tomentosa B</i>	Transcriptome, 1KP	CQPW	KT071880
<i>Lindsaea microphylla</i>	Transcriptome, 1KP	YIXP	KT071881
<i>Lygodium japonicum</i>	Transcriptome, 1KP	PBUU	KT071882
<i>Thyrsopteris elegans</i>	Transcriptome, 1KP	EWXK	KT071883
Fern PHY4B			
<i>Pteridium aquilinum</i>	Transcriptome, Der et al.	-	SRX423244
<i>Cystopteris fragilis</i>	Transcriptome, 1KP	LHLE	KT071884
<i>Blechnum spicant</i>	Transcriptome, 1KP	VITX	KT071885
<i>Polystichum acrostichoides</i>	Transcriptome, 1KP	FQGQ	KT071886
<i>Gymnocarpium dryopteris</i>	Transcriptome, 1KP	HEGQ	KT071887
<i>Woodsia ilvensis</i>	Transcriptome, 1KP	YQEC	KT071888
<i>Athyrium filix-femina</i>	Transcriptome, 1KP	AFPO	KT071889
<i>Diplazium wichuriae</i>	Transcriptome, 1KP	UFJN	KT071890
Isoetopsida PHY			
<i>Selaginella cf pallescens</i>	Transcriptome, 1KP	ABIJ	KT071891
<i>Selaginella moellendorffii</i>	Genome, Phytozome	-	XM_002991595
<i>Selaginella willdenowii</i>	Transcriptome, 1KP	KJYC	KT071892
<i>Selaginella kraussiana</i>	Transcriptome, 1KP	ZFGK	KT071893
<i>Selaginella wallacei</i>	Transcriptome, 1KP	JKAA	KJ195172
<i>Selaginella apoda</i>	Transcriptome, 1KP	LGDQ	KT071894
<i>Isoetes tegetiformans</i>	Transcriptome, 1KP	PKOX	KJ195171
Lycopodiales PHY1			
<i>Dendrolycopodium obscurum</i>	Transcriptome, 1KP	XNXF	KJ195173
<i>Huperzia selago</i>	Transcriptome, 1KP	GTUO	KJ195174
<i>Pseudolycopodiella caroliniana</i>	Transcriptome, 1KP	UPMJ	KT071895
Lycopodiales PHY2			

<i>Dendrolycopodium obscurum</i>	Transcriptome, 1KP	XNXF	KJ195175
<i>Huperzia lucidula</i>	Transcriptome, 1KP	GKAG	KJ195176
<i>Pseudolycopodiella caroliniana</i>	Transcriptome, 1KP	UPMJ	KT071896
Moss PHY1_3			
<i>Andreaea rupestris</i>	Transcriptome, 1KP	WOGB	KT071897
<i>Rhynchostegium serrulatum</i>	Transcriptome, 1KP	JADL	KT071898
<i>Aulacomnium heterostichum</i>	Transcriptome, 1KP	WNGH	KT071899
<i>Hedwigia ciliata</i>	Transcriptome, 1KP	YWNF	KJ195194
<i>Philonotis fontana</i>	Transcriptome, 1KP	ORKS	KT071900
<i>Ceratodon purpureus</i> A	GenBank	-	U72993
<i>Ceratodon purpureus</i> B	GenBank	-	U87632
<i>Leucobryum albidum</i>	Transcriptome, 1KP	VMXJ	KT071901
<i>Physcomitrella patens</i> 1	Genome, Phytozome	-	XM_001765983
<i>Physcomitrella patens</i> 3	Genome, Phytozome	-	XM_001778103
<i>Racomitrium varium</i>	Transcriptome, 1KP	RDOO	KT071902
<i>Leucodon julaceus</i>	Transcriptome, 1KP	IGUH	KT071903
<i>Leucodon brachypus</i>	Transcriptome, 1KP	ZACW	KT071904
<i>Pseudotaxiphyllum elegans</i>	Transcriptome, 1KP	QKQO	KT071905
<i>Neckera douglasii</i>	Transcriptome, 1KP	TMAJ	KT071906
<i>Stereodon subimponens</i>	Transcriptome, 1KP	LNSF	KT071907
<i>Loeskeobryum brevirostre</i>	Transcriptome, 1KP	WSPM	KT071908
<i>Cladopodium rostratum</i>	Transcriptome, 1KP	VBMM	KJ195193
<i>Bryum argenteum</i>	Transcriptome, 1KP	JMXW	KJ195195
Moss PHY2_4/5			
<i>Andreaea rupestris</i>	Transcriptome, 1KP	WOGB	KT071909
<i>Sphagnum palustre</i>	Transcriptome, 1KP	RCBT	KT071910
<i>Takakia lepidozoides</i>	Transcriptome, 1KP	SKQD	KT071911
Moss PHY2_4			
<i>Atrichum angustatum</i>	Transcriptome, 1KP	ZTHV	KT071912
<i>Physcomitrella patens</i> 4	Genome, Phytozome	-	XM_001773498
<i>Physcomitrella patens</i> 2	Genome, Phytozome	-	XM_001782287
<i>Rhynchostegium serrulatum</i>	Transcriptome, 1KP	JADL	KT071913
<i>Aulacomnium heterostichum</i>	Transcriptome, 1KP	WNGH	KT071914
<i>Hedwigia ciliata</i>	Transcriptome, 1KP	YWNF	KJ195190
<i>Philonotis fontana</i>	Transcriptome, 1KP	ORKS	KT071915
<i>Ceratodon purpureus</i>	Transcriptome, 1KP	FFPD	KT071916
<i>Leucobryum albidum</i>	Transcriptome, 1KP	VMXJ	KT071917
<i>Racomitrium varium</i>	Transcriptome, 1KP	RDOO	KT071918
<i>Scouleria aquatica</i>	Transcriptome, 1KP	BPSG	KT071919
<i>Bryum argenteum</i>	Transcriptome, 1KP	JMXW	KJ195191
<i>Loeskeobryum brevirostre</i>	Transcriptome, 1KP	WSPM	KT071920
<i>Neckera douglasii</i>	Transcriptome, 1KP	TMAJ	KT071921
<i>Cladopodium rostratum</i>	Transcriptome, 1KP	VBMM	KJ195189
<i>Leucodon brachypus</i>	Transcriptome, 1KP	ZACW	KT071922
<i>Leucodon julaceus</i>	Transcriptome, 1KP	IGUH	KT071923
<i>Pseudotaxiphyllum elegans</i>	Transcriptome, 1KP	QKQO	KT071924
<i>Anomodon attenuatus</i>	Transcriptome, 1KP	QMWB	KT071925
<i>Stereodon subimponens</i>	Transcriptome, 1KP	LNSF	KT071926
Moss PHYS			
<i>Atrichum angustatum</i>	Transcriptome, 1KP	ZTHV	KT071927
<i>Physcomitrella patens</i> A	Genome, Phytozome	-	XM_001761093
<i>Physcomitrella patens</i> B	Genome, Phytozome	-	XM_001767172
<i>Physcomitrella patens</i> C	Genome, Phytozome	-	XM_001754314

Rhynchostegium serrulatum D	Transcriptome, 1KP	JADL	KT071928
Aulacomnium heterostichum D	Transcriptome, 1KP	WNGH	KT071929
Hedwigia ciliata D	Transcriptome, 1KP	YWNF	KT071930
Philonotis fontana D	Transcriptome, 1KP	ORKS	KT071931
Leucobryum albidum D	Transcriptome, 1KP	VMXJ	KT071932
Ceratodon purpureus D	GenBank	-	AY123149
Scouleria aquatica D	Transcriptome, 1KP	BPSG	KT071933
Racomitrium varium D	Transcriptome, 1KP	RDOO	KT071934
Syntrichia princeps D	Transcriptome, 1KP	GRKU	KT071935
Bryum argenteum D	Transcriptome, 1KP	JMXW	KJ195187
Leucodon brachypus D	Transcriptome, 1KP	ZACW	KT071936
Anomodon attenuatus D	Transcriptome, 1KP	QMWB	KT071937
Cladopodium rostratum D	Transcriptome, 1KP	VBMM	KJ195185
Loeskeobryum brevirostre D	Transcriptome, 1KP	WSPM	KT071938
Pseudotaxiphyllum elegans D	Transcriptome, 1KP	QKQO	KT071939
Racomitrium varium E	Transcriptome, 1KP	RDOO	KT071940
Scouleria aquatica E	Transcriptome, 1KP	BPSG	KT071941
Syntrichia princeps E	Transcriptome, 1KP	GRKU	KT071942
Hedwigia ciliata E	Transcriptome, 1KP	YWNF	KJ195186
Philonotis fontana E	Transcriptome, 1KP	ORKS	KT071943
Leucobryum albidum E	Transcriptome, 1KP	VMXJ	KT071944
Ceratodon purpureus E	GenBank	-	EU122393
Rhynchostegium serrulatum E	Transcriptome, 1KP	JADL	KT071945
Aulacomnium heterostichum E 1	Transcriptome, 1KP	WNGH	KT071946
Aulacomnium heterostichum E 2	Transcriptome, 1KP	WNGH	KT071947
Anomodon attenuatus E	Transcriptome, 1KP	QMWB	KT071948
Neckera douglasii E	Transcriptome, 1KP	TMAJ	KT071949
Pseudotaxiphyllum elegans E	Transcriptome, 1KP	QKQO	KT071950
Cladopodium rostratum E	Transcriptome, 1KP	VBMM	KJ195184
Loeskeobryum brevirostre E	Transcriptome, 1KP	WSPM	KT071951
Leucodon julaceus E	Transcriptome, 1KP	IGUH	KT071952
Leucodon brachypus E	Transcriptome, 1KP	ZACW	KT071953
Liverwort PHY			
Scapania nemorosa	Transcriptome, 1KP	IRBN	KJ195177
Porella pinnata	Transcriptome, 1KP	UUHD	KJ195178
Schistochila sp	Transcriptome, 1KP	LGOW	KJ195179
Metzgeria crassipilis	Transcriptome, 1KP	NRWZ	KJ195180
Pellia neesiana	Transcriptome, 1KP	JHFI	KJ195181
Odontoschisma prostratum	Transcriptome, 1KP	YBQN	KT071954
Marchantia paleacea	GenBank	-	AB022917
Conocephalum conicum	Transcriptome, 1KP	ILBQ	KJ195182
Lunularia cruciata	Transcriptome, 1KP	TXVB	KT071955
Sphaerocarpos texanus	Transcriptome, 1KP	HERT	KJ195183
Ricciocarpos natans	Transcriptome, 1KP	WJLO	KT071956
Bazzania trilobata	Transcriptome, 1KP	WZYK	KT071957
Hornwort PHY			
Nothoceros aenigmaticus	Cloning, Li et al. ⁶	DXOU	KJ128384
Megaceros flagellaris	Transcriptome, 1KP	UCRN	KJ195197
Paraphymatoceros hallii	Transcriptome, 1KP	FAJB	KJ195198
Phaeoceros carolinianus	Transcriptome, 1KP	WCZB	KJ195199
Anthoceros punctatus	Genome, Li et al. ⁶	-	KJ195038
Phaeomegaceros coriaceus	Transcriptome, 1KP	AKXB	KT071958
Leiosporoceros dussii	Transcriptome, 1KP	ANON	KT071959

Hornwort NEO

Nothoceros aenigmaticus	Transcriptome, 1KP	DXOU	KJ128382
Megaceros flagellaris	Transcriptome, 1KP	UCRN	KJ195132
Paraphymatoceros hallii	Transcriptome, 1KP	FAJB	KJ194999
Phaeoceros carolinianus	Transcriptome, 1KP	WCZB	KJ194998
Anthoceros punctatus	Cloning, Li et al.	-	KJ194997

Fern NEO

Adiantum capillus-veneris	GenBank	-	AB012082
Dipteris conjugata	Cloning, Li et al.	-	KJ195011
Blechnum spicant	Cloning, Li et al.	-	KJ195007
Hemidictyum marginatum	Cloning, Li et al.	-	KJ195037

Zygnematales NEO

Mougeotia scalaris 1	GenBank	-	AB206961
Mougeotia scalaris 2	GenBank	-	AB206962
Cylindrocystis brebissonii 1	Transcriptome, 1KP	YOXI	KJ195042
Cylindrocystis sp 1	Transcriptome, 1KP	VAZE	KJ195043
Cylindrocystis brebissonii 2	Transcriptome, 1KP	YOXI	KJ195044
Cylindrocystis sp 2	Transcriptome, 1KP	VAZE	KJ195041
Zygnemopsis sp	Transcriptome, 1KP	MFZO	KJ195039

Desmidiales PHY2C

Desmidium aptogonum	Transcriptome, 1KP	DFDS	KT071990
Onychonema laeve	Transcriptome, 1KP	GGWH	KT071991
Cosmarium granatum 1	Transcriptome, 1KP	MNNM	KT071992
Stauroidesmus convergens 1	Transcriptome, 1KP	WCQU	KT071993
Cosmarium subtumidum	Transcriptome, 1KP	WDGV	KT071994
Stauroidesmus convergens 2	Transcriptome, 1KP	WCQU	KT071995
Cosmarium granatum 2	Transcriptome, 1KP	MNNM	KT071996
Phymatodocis nordstedtiana	Transcriptome, 1KP	RPQV	KT071997
Penium exiguum	Transcriptome, 1KP	YSQT	KT071998
Gonatozygon kinahanii 1	Transcriptome, 1KP	KEYW	KT071999
Gonatozygon kinahanii 2	Transcriptome, 1KP	KEYW	KT072000

Desmidiales PHY2B

Desmidium aptogonum	Transcriptome, 1KP	DFDS	KT072001
Onychonema laeve	Transcriptome, 1KP	GGWH	KT072002
Cosmarium subtumidum	Transcriptome, 1KP	WDGV	KT072003
Stauroidesmus convergens	Transcriptome, 1KP	WCQU	KT072004
Phymatodocis nordstedtiana	Transcriptome, 1KP	RPQV	KT072005
Penium exiguum	Transcriptome, 1KP	YSQT	KT072006
Gonatozygon kinahanii	Transcriptome, 1KP	KEYW	KT072007

Desmidiales PHY2A

Desmidium aptogonum	Transcriptome, 1KP	DFDS	KT072008
Cosmarium subtumidum	Transcriptome, 1KP	WDGV	KT072009
Cosmarium granatum	Transcriptome, 1KP	MNNM	KT072010
Onychonema laeve	Transcriptome, 1KP	GGWH	KT072011
Stauroidesmus convergens	Transcriptome, 1KP	WCQU	KT072012
Phymatodocis nordstedtiana	Transcriptome, 1KP	RPQV	KT072013
Penium exiguum	Transcriptome, 1KP	YSQT	KT072014
Gonatozygon kinahanii	Transcriptome, 1KP	KEYW	KT072015
Roya obtusa	Transcriptome, 1KP	XRTZ	KJ195200
Planotaenium ohtanii	Transcriptome, 1KP	SNOX	KJ195201

Zygnematales PHY2

Mougeotia scalaris	Genbank	-	AB206965
Mesotaenium kramstae	Transcriptome, 1KP	NBYP	KT072016

Mesotaenium caldariorum	Genbank	-	U31283
Zygnemopsis sp	Transcriptome, 1KP	MFZO	KJ195202
Cylindrocystis sp	Transcriptome, 1KP	VAZE	KJ195203
Cylindrocystis brebissonii	Transcriptome, 1KP	YOXI	KJ195204
Mesotaenium braunii	Transcriptome, 1KP	WSJO	KJ195205
Netrium digitus	Transcriptome, 1KP	FFGR	KT072017
Coleochaetales PHY2			
Coleochaete irregularis	Transcriptome, 1KP	QPDY	KJ195206
Chaetosphaeridium globosum	Transcriptome, 1KP	DRGY	KJ195207
Klebsormidiales PHY2			
Interfilum paradoxum	Transcriptome, 1KP	FPCO	KJ195208
Klebsormidium subtile	Transcriptome, 1KP	FQLP	KJ195209
Entransia fimbriata	Transcriptome, 1KP	BFIK	KJ195210
Desmidiales PHY1			
Cosmarium granatum	Transcriptome, 1KP	MNNM	KT072018
Cosmarium subtumidum	Transcriptome, 1KP	WDGV	KT072019
Staurodesmus convergens	Transcriptome, 1KP	WCQU	KT072020
Onychonema laeve	Transcriptome, 1KP	GGWH	KT072021
Phymatodocis nordstedtiana	Transcriptome, 1KP	RPQV	KT072022
Penium exiguum	Transcriptome, 1KP	YSQT	KT072023
Gonatozygon kinahanii	Transcriptome, 1KP	KEYW	KT072024
Roya obtusa	Transcriptome, 1KP	XRTZ	KT072025
Planotaenium ohtanii	Transcriptome, 1KP	SNOX	KT072026
Klebsormidiales PHY1			
Entransia fimbriata	Transcriptome, 1KP	BFIK	KT072027
Mesostigmatales PHY1/2			
Mesostigma viride	Transcriptome, 1KP	KYIO	KT072028
Chlorokybus atmophyticus 1	Transcriptome, 1KP	AZZW	KT072029
Chlorokybus atmophyticus 2	Transcriptome, 1KP	AZZW	KT072030
Spirotaenia minuta	Transcriptome, 1KP	NNHQ	KT072031
Zygnematales PHYX2			
Zygnemopsis sp	Transcriptome, 1KP	MFZO	KT072032
Cylindrocystis cushleckae	Transcriptome, 1KP	JOJQ	KT072033
Mesotaenium kramstae	Transcriptome, 1KP	NBYP	KT072034
Netrium digitus	Transcriptome, 1KP	FFGR	KT072035
Coleochaetales PHYX2			
Coleochaete irregularis	Transcriptome, 1KP	QPDY	KT072036
Chaetosphaeridium globosum	Transcriptome, 1KP	DRGY	KT072037
Zygnematales PHYX1			
Zygnemopsis sp	Transcriptome, 1KP	MFZO	KT072038
Mesotaenium kramstae	Transcriptome, 1KP	NBYP	KT072039
Cylindrocystis cushleckae	Transcriptome, 1KP	JOJQ	KT072040
Cylindrocystis brebissonii	Transcriptome, 1KP	YOXI	KT072041
Cylindrocystis sp	Transcriptome, 1KP	VAZE	KT072042
Netrium digitus	Transcriptome, 1KP	FFGR	KT072043
Coleochaetales PHYX1			
Coleochaete irregularis	Transcriptome, 1KP	QPDY	KT072044
Prasinophyte PHY			
Monomastix opisthostigma	Transcriptome, 1KP	BTFM	-
Pyramimonas parkeae	Transcriptome, 1KP	TNAW	-
Tetraselmis cordiformis	Transcriptome, 1KP	DUMA	-
Dolichomastix tenuilepsis	GenBank	-	KF876183
Tetraselmis astigmatica	GenBank	-	KF876182

Prasinoderma coloniale	GenBank	-	KF876180
Nephroselmis pyriformis	GenBank	-	KF876181
Micromonas pusilla	GenBank	-	KF754357
Cryptophyte PHY			
Hemiselmis virescens	Transcriptome, 1KP	MJMQ	KT013280
Cryptomonas curvata	Transcriptome, 1KP	BAKF	KT013281
Rhodomonas sp	Transcriptome, 1KP	IAYV	KT013282
Guillardia theta 1	Genome, Curtis et al. ¹³	-	-
Guillardia theta 2	Genome, Curtis et al.	-	-
Chroomonas sp	Transcriptome, 1KP	ROZZ	KT013283
Guillardia theta PEK1	Genome, Curtis et al.	-	-
Guillardia theta PEK2	Genome, Curtis et al.	-	-
Guillardia theta PEK3	Genome, Curtis et al.	-	-
Glaucophyte PHY			
Cyanophora paradoxa 1	Genome, Price et al. ¹⁴	-	KF597305
Cyanophora paradoxa 2	Genome, Price et al.	-	KF615870
Cyanophora paradoxa 4	Genome, Price et al.	-	-
Gloeochaete wittrockiana GPS2	Transcriptome, Duanmu et al. ¹⁵	-	-
Gloeochaete wittrockiana GPS4	Transcriptome, Duanmu et al.	-	-
Gloeochaete wittrockiana GPS3	Transcriptome, Duanmu et al.	-	-
Gloeochaete wittrockiana GPS1	Transcriptome, Rockwell et al. ¹⁶	-	KF894953
Cyanoptychae gloeocystis 1	Transcriptome, 1KP	JKHA	KT013284
Cyanoptychae gloeocystis 2	Transcriptome, 1KP	JKHA	KT013285
Cyanoptychae gloeocystis 3	Transcriptome, 1KP	JKHA	KT013286
Glaucozystis nostochinearum 1	Transcriptome, 1KP	POOW	KT013287
Glaucozystis nostochinearum 2	Transcriptome, 1KP	POOW	KT013288
Glaucozystis nostochinearum 3	Transcriptome, 1KP	POOW	KT013289
Glaucozystis nostochinearum 4	Transcriptome, 1KP	POOW	KT013290
Diatom PHY			
Thalassiosira pseudonana	GenBank	-	XM_002290775
Phaeodactylum tricornutum	GenBank	-	XM_002179026
Brown algae PHY			
Petalonia fascia	Transcriptome, 1KP	VRGZ	KT003814
Scytosiphon lomentaria	Transcriptome, 1KP	JCXF	KT003815
Ishige okamurai	Transcriptome, 1KP	APTP	KT003816
Ectocarpus siliculosus	GenBank	-	FN649030
Feldmannia species virus isolate FsV	GenBank	-	EU916176
Ectocarpus siliculosus virus isolate EsV	GenBank	-	AF204951
Fungi PHY			
Aspergillus fumigatus	GenBank	-	DS499603
Ustilago maydis	GenBank	-	AACP01000210
Cochliobolus heterostrophus	GenBank	-	AY456024
Neurospora crassa 1	GenBank	-	BK004087
Neurospora crassa 2	GenBank	-	DQ128077
Penicillium marneffeii	GenBank	-	XM_002144684
Cyanobacteria PHY			
Microcystis aeruginosa	GenBank	-	AP009552
Nodularia spumigena	GenBank	-	AAVW01000039
Synechocystis sp	GenBank	-	BA000022
Anabaena variabilis	GenBank	-	NC_007413
Cyanothece sp	GenBank	-	ABVE01000001
Nostoc sp	GenBank	-	BA000019
Tolypothrix sp 1	GenBank	-	AF309559

Tolypothrix sp 2	GenBank	-	AF309560
Cyanobacteria PAS-less PHY			
Microcoleus chthonoplastes	GenBank	-	DS989848
Lyngbya sp	GenBank	-	AAVU01000002
Nostoc punctiforme	GenBank	-	CP001037
Anabaena variabilis	GenBank	-	CP000117
Synechococcus sp	GenBank	-	ABD00881
Bacteria PHY			
Agrobacterium tumefaciens	GenBank	-	C58AE007869
Pseudomonas aeruginosa	GenBank	-	CH482383
Pseudomonas syringae	GenBank	-	AE016853
Ralstonia pickettii	GenBank	-	CP001068
Stenotrophomonas maltophilia	GenBank	-	AM743169
Rhodopseudomonas palustris	GenBank	-	BX572602
Oceanicola granulosus	GenBank	-	AAOT01000028
Methylocella silvestris	GenBank	-	CP001280
Sclerotinia sclerotiorum	GenBank	-	CH476645
Magnetospirillum magnetotacticum	GenBank	-	AAAP01003476

Supplementary references

- ¹Amborella Genome Project. The *Amborella* genome and the evolution of flowering plants. *Science* **342**, 1241089 (2013).
- ²Goodstein, D. M. *et al.* Phytozome: a comparative platform for green plant genomics. *Nucleic Acids Res.* **40**, D1178–86 (2012).
- ³Matasci, N. *et al.* Data access for the 1,000 Plants (1KP) project. *GigaScience* **3**, 17 (2014).
- ⁴Brouwer, P. *et al.* *Azolla* domestication towards a biobased economy? *New Phytol* **202**, 1069–1082 (2014).
- ⁵Der, J. P., Barker, M. S., Wickett, N. J., Depamphilis, C. W. & Wolf P. G. De novo characterization of the gametophyte transcriptome in bracken fern, *Pteridium aquilinum*. *BMC Genomics* **12**, 99 (2011).
- ⁶Li, F.-W. *et al.* Horizontal transfer of an adaptive chimeric photoreceptor from bryophytes to ferns. *Proc. Natl. Acad. Sci. USA* **111**, 6672–6677 (2014).
- ⁷Blanc, G. *et al.* The *Chlorella variabilis* NC64A genome reveals adaptation to photosymbiosis, coevolution with viruses, and cryptic sex. *Plant Cell* **22**, 2943–2955 (2010).
- ⁸Collen, J. *et al.* Genome structure and metabolic features in the red seaweed *Chondrus crispus* shed light on evolution of the Archaeplastida. *Proc. Natl. Acad. Sci. USA* **110**, 5247–5252 (2013).
- ⁹Matsuzaki, M. *et al.* Genome sequence of the ultrasmall unicellular red alga *Cyanidioschyzon merolae* 10D. *Nature* **428**, 653–657 (2004).
- ¹⁰Barbier, G. *et al.* Comparative genomics of two closely related unicellular thermo-acidophilic red algae, *Galdieria sulphuraria* and *Cyanidioschyzon merolae*, reveals the molecular basis of the metabolic flexibility of *Galdieria sulphuraria* and significant differences in carbohydrate metabolism of both algae. *Plant Physiology* **137**, 460–474 (2005).
- ¹¹Nakamura, Y. *et al.* The first symbiont-free genome sequence of marine red alga, *Susabi-nori* (*Pyropia yezoensis*). *PLoS ONE* **8**, e57122 (2013).
- ¹²Bhattacharya, D. *et al.* Genome of the red alga *Porphyridium purpureum*. *Nat Comms* **4**, 1941 (2013).
- ¹³Curtis, B. A. *et al.* Algal genomes reveal evolutionary mosaicism and the fate of nucleomorphs. *Nature* **492**, 59–65 (2012).
- ¹⁴Price, D. C. *et al.* *Cyanophora paradoxa* genome elucidates origin of photosynthesis in algae and plants. *Science* **335**, 843–847 (2012).
- ¹⁵Duanmu, D. *et al.* Marine algae and land plants share conserved phytochrome signaling systems. *Proc. Natl. Acad. Sci. USA* **111**, 15827–15832 (2014).
- ¹⁶Rockwell, N. C. *et al.* Eukaryotic algal phytochromes span the visible spectrum. *Proc. Natl. Acad. Sci. USA* **111**, 3871–3876 (2014).