Fig. S5 Alignment of PHYA and PHYB sequences from shade tolerant and shade intolerant species.

CLUSTAL 2.1 multiple sequence alignment – Phytochrome A

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Intol-Arabidopsis      ---------------------------------------------MSGSRPTQSSEGSR 14
Intol-Populus          ---------------------------------------------MSSSRPSHSSSNSA 14
Intol-Eucalyptus       ---------------------------------------------MSSSRPSQSSSNSA 14
Intol-Glycine max      ---------------------------------------------MSTSRPSQSSSNSR 14
Intol-Scots pine       ------------------------------------------------------------
Tol-Picea glauca       ----------------------------------------------------------GSSS 4
Tol-Norway spruce      MGTPCHKNDIINIKKKIDDYTNENLDVVFLITQHCDSMPTGALSITLHICRVTKWPGSSS 60

Intol-Arabidopsis      RSRHSARIIAQTTVDAKLHADFEESGSSFDYSTSVRVTGPVVENQPPRSDKVTTTYLHHI 74
Intol-Populus          RSRHSARIIAQTTVDAKLHADFEESGSSFDYSSSVRVTDSVGGDQPPRSDKVTTAYLHHI 74
Intol-Eucalyptus       RSRHSSRIIAQTTVDAKLHADFEESGSSFDYSSSVRVTGTPSGDQQPRSDKVTTAYLHQI 74
Intol-Glycine max      RSRHSAR-MAQATVDAKIHATFEESGSSFDYSSSVRVSGTADGVNQPRSDKVTTAYLR-- 71
Intol-Scots pine       ------------------------------------------------------------
Tol-Picea glauca       RQTHNARAMAQTTVDARIHAVFEESGHHFDYMKSIVDN----TDLEIVPSVAVSAYLQQI 60
Tol-Norway spruce      RQTHNARAMAQTTVDARIHAVFEESGHHFDYMKSIVDN----TDSEIVPSVAVSAYLQQI 116

Intol-Arabidopsis      QKGKLIQPFGCLLALDEK----TFKVIAYSENASELLTMASHAVPSVGEHPVLGIGTDIR 130
Intol-Populus          QKGKLIQPFGCLLALDEK----TFRVVAYSENAPELLTMVSHAVPSVGEHPVLGIGTDIR 130
Intol-Eucalyptus       QKGKTIQPFGCLIALDEK----TFKVIAYSENAPEMLTMVSHAVPSVGDQPVLRIGTDVR 130
Intol-Glicine max      --GKMIQPFGCLLAIDEKNHMQTCKVIAYSENEPEMLTMVSHAVPSVGDHPALGIGTDIK 129
Intol-Scots pine       ------------------------------------------------------------
Tol-Picea glauca       QRSKLLQPFGCMVAVNDK----TFEVIAYSENAPDMLQVSAHAVPSVEDQQILCIGSDAR 116
Tol-Norway spruce      QRSKLLQPFGCMVAVNEK----TFEVIAYSENAPDMLQVSAHAVPSVEDQQILCIGSDAR 172

Intol-Arabidopsis      SLFTAPSASALQKALGFGDVSLLNPILVHCRTSAKPFYAIIHRVTGSIIIDFEPVKPYEV 190
Intol-Populus          TIFTAPSASALQKAMGFGDVSLLNPILVHCKTSGKPFYAIVHRVTGSLIIDFEPVKPYEV 190
Intol-Eucalyptus       TIFTAPSASALHKVFGFADVSLLNPILVHCKTSGKPFYGIVHRVTGSIIIDFEPVKPYEV 190
Intol-Glycine max      TLFTAPSVSGLQKALGCADVSLLNPILVHCKTSGKPFYAIVHRVTGSLIVDFEPVKPYEV 189
Intol-Scots pine       ------------------------------------------------------------
Tol-Picea glauca       TLFTPSSTMALQKAAKFGELNLLNPILVHSKSSGKPFYAILHRIDVALVIDFEPISPSDA 176
Tol-Norway spruce      TLFTPSSTMALQKAAKFGELNLLNPILVHSKSSGKPFYAILHRIDVALVIDFEPISPSDV 232

                       PAS fold-2
                       70 - 185

Intol-Arabidopsis      PMTAAGALQSYKLAAKAITRLQSLPSGSMERLCDTMVQEVFELTGYDRVMAYKFHEDDHG 250
Intol-Populus          PMTAAGALQSYKLAAKAITRLQSLPSGSMERLCDTMVQEVFELTGYDRAMAYKFHDDDHG 250
Intol-Eucalyptus       PMTAAGALQSYKLAAKAIARLQSLPSGSIERLCDTMVQEVFELTGYDRAMAYKFHDDDHG 250
Intol-Glycine max      PMTAAGALQSYKLAAKAITRLQSLPSGNMERLCDTMVQEVFELTGYDRVMAYKFHEDDHG 249
Intol-Scots pine       ------------------------------------------------------------
Tol-Picea glauca       STSSMGALQSYKLAAKAISRLQSIPSGNIGLLCDMIVQEVRELLGYDRVMAYKFHHDEHG 236
Tol-Norway spruce      STSSMGALQSYKLAAKAISRLQSIPSGNIGLLCDMIVQEVRELLGYDRVMAYKFHHDEHG 292

Intol-Arabidopsis      EVVSEVTKPGLEPYLGLHYPATDIPQAARFLFMKNKVRMIVDCNAKHARVLQDEKLSFDL 310
Intol-Populus          EVVSEVTKPGMEPYLGLHYPATDIPQASRFLFMKNKVRMIVDCHAKHVKVLQDEKLPFDL 310
Intol-Eucalyptus       EVVSEITKPGLEPYLGLHYPATDIPQAARFLFMKNKVRLIVDCRAKHVNVLQDENLPFDL 310
Intol-Glycine max      EVIREITKPCLEPYLGLHYPATDIPQASRFLFRKNKVRMIVDCHAKHVRVLQDEKLQFDL 309
Intol-Scots pine       ----------------------DIPQASRFLFMRNRVRMICDCYAQPVAVIQDERSPRDL 38
Tol-Picea glauca       EVISEIRRSDLEPYLGLHYPATDIPQASRFLFLRNRVRMICDCCAPPVTVIQDKRLPRDL 296
Tol-Norway spruce      EVISEIRRSDLEPYLGLHYPATDIPQASRFLFLRNRVRMICDCCAPPVTVIQDKRLPRDL 352
                                        *****:**** :*:**:* ** *  . *:**:.   **
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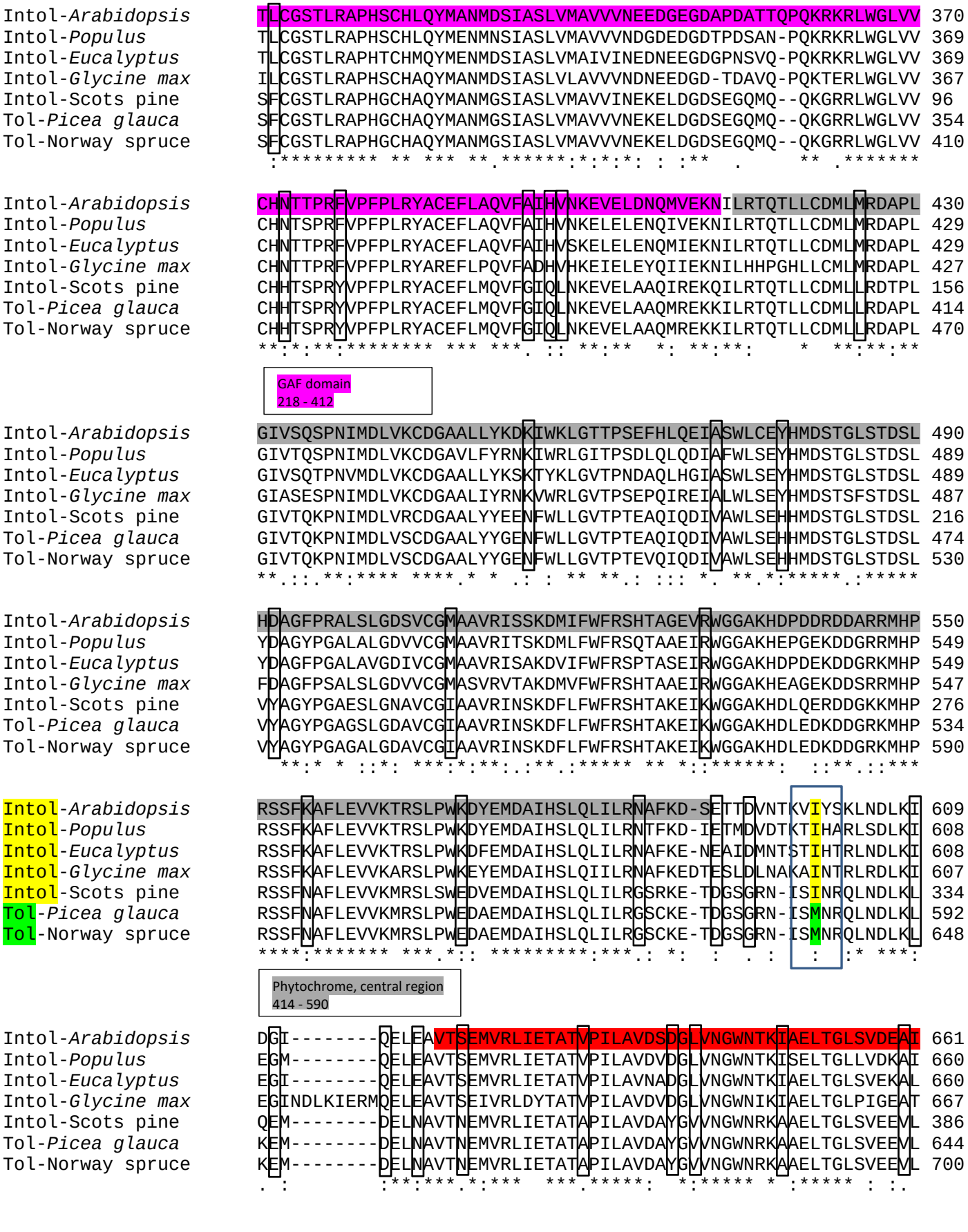
Intol-Arabidopsis TLCGSTLRAPHSCHLQYMANMDSIASLVMAVVVNEEDGEGDAPDATTQPQKRKRLWGLVV 370
Intol-Populus TLCGSTLRAPHSCHLQYMENMNSIASLVMAVVVNDGDEDGDTPDSAN-PQKRKRLWGLVV 369
Intol-Eucalyptus TLCGSTLRAPHTCHMQYMENMDSIASLVMAIVINEDNEEGDGPNSVQ-PQKRKRLWGLVV 369
Intol-Glycine max ILCGSTLRAPHSCHAQYMANMDSIASLVLAVVVNDNEEDGD-TDAVQ-PQKTERLWGLVV 367
Intol-Scots pine SFCGSTLRAPHGCHAQYMANMGSIASLVMAVVINEKELDGDSEGQMQ--QKGRRLWGLVV 96
Tol-Picea glauca SFCGSTLRAPHGCHAQYMANMGSIASLVMAVVVNEKELDGDSEGQMQ--QKGRRLWGLVV 354
Tol-Norway spruce SFCGSTLRAPHGCHAQYMANMGSIASLVMAVVVNEKELDGDSEGQMQ--QKGRRLWGLVV 410
Intol-Arabidopsis CHNTTPRFVPFPLRYACEFLAQVFAIHVNKEVELDNQMVEKNILRTQTLLCDMLMRDAPL 430
Intol-Populus CHNTSPRFVPFPLRYACEFLAQVFAIHVNKELELENQIVEKNILRTQTLLCDMLMRDAPL 429
Intol-Eucalyptus CHNTTPRFVPFPLRYACEFLAQVFAIHVSKELELENQMIEKNILRTQTLLCDMLMRDAPL 429
Intol-Glycine max CHNTTPRFVPFPLRYAREFLPQVFADHVHKEIELEYQIIEKNILHHPGHLLCMLMRDAPL 427
Intol-Scots pine CHHTSPRYVPFPLRYACEFLMQVFGIQLNKEVELAAQIREKQILRTQTLLCDMLLRDTPL 156
Tol-Picea glauca CHHTSPRYVPFPLRYACEFLMQVFGIQLNKEVELAAQMREKKILRTQTLLCDMLLRDAPL 414
Tol-Norway spruce CHHTSPRYVPFPLRYACEFLMQVFGIQLNKEVELAAQMREKKILRTQTLLCDMLLRDAPL 470
GAF domain
218 - 412
Intol-Arabidopsis GIVSQSPNIMDLVKCDGAALLYKDKIWKLGTTPSEFHLQEIASWLCEYHMDSTGLSTDSL 490
Intol-Populus GIVTQSPNIMDLVKCDGAVLFYRNKIWRLGITPSDLQLQDIAFWLSEYHMDSTGLSTDSL 489
Intol-Eucalyptus GIVSQTPNVMDLVKCDGAALLYKSKTYKLGVTPNDAQLHGIASWLSEYHMDSTGLSTDSL 489
Intol-Glycine max GIASESPNIMDLVKCDGAALIYRNKVWRLGVTPSEPQIREIALWLSEYHMDSTSFSTDSL 487
Intol-Scots pine GIVTQKPNIMDLVRCDGAALYYEENFWLLGVTPTEAQIQDIVAWLSEHHMDSTGLSTDSL 216
Tol-Picea glauca GIVTQKPNIMDLVSCDGAALYYGENFWLLGVTPTEAQIQDIVAWLSEHHMDSTGLSTDSL 474
Tol-Norway spruce GIVTQKPNIMDLVSCDGAALYYGENFWLLGVTPTEVQIQDIVAWLSEHHMDSTGLSTDSL 530
Intol-Arabidopsis HDAGFPRALSLGDSVCGMAAVRISSKDMIFWFRSHTAGEVRWGGAKHDPDDRDDARRMHP 550
Intol-Populus YDAGYPGALALGDVVCGMAAVRITSKDMLFWFRSQTAAEIRWGGAKHEPGEKDDGRRMHP 549
Intol-Eucalyptus YDAGFPGALAVGDIVCGMAAVRISAKDVIFWFRSPTASEIRWGGAKHDPDEKDDGRKMHP 549
Intol-Glycine max FDAGFPSALSLGDVVCGMASVRVTAKDMVFWFRSHTAAEIRWGGAKHEAGEKDDSRRMHP 547
Intol-Scots pine VYAGYPGAESLGNAVCGIAAVRINSKDFLFWFRSHTAKEIKWGGAKHDLQERDDGKKMHP 276
Tol-Picea glauca VYAGYPGAGSLGDAVCGIAAVRINSKDFLFWFRSHTAKEIKWGGAKHDLEDKDDGRKMHP 534
Tol-Norway spruce VYAGYPGAGALGDAVCGIAAVRINSKDFLFWFRSHTAKEIKWGGAKHDLEDKDDGRKMHP 590
Intol-Arabidopsis RSSFKAFLEVVKTRSLPWKDYEMDAIHSLQLILRNAFKD-SETTDVNTKVIYSKLNDLKI 609
Intol-Populus RSSFKAFLEVVKTRSLPWKDYEMDAIHSLQLILRNTFKD-IETMDVDTKTIHARLSDLKI 608
Intol-Eucalyptus RSSFKAFLEVVKTRSLPWKDFEMDAIHSLQLILRNAFKE-NEAIDMNTSTIHTRLNDLKI 608
Intol-Glycine max RSSFKAFLEVVKARSLPWKEYEMDAIHSLQIILRNAFKEDTESLDLNAKAINTRLRDLKI 607
Intol-Scots pine RSSFNAFLEVVKMRSLSWEDVEMDAIHSLQLILRGSRKE-TDGSGRN-ISINRQLNDLKL 334
Tol-Picea glauca RSSFNAFLEVVKMRSLPWEDAEMDAIHSLQLILRGSCKE-TDGSGRN-ISMNRQLNDLKL 592
Tol-Norway spruce RSSFNAFLEVVKMRSLPWEDAEMDAIHSLQLILRGSCKE-TDGSGRN-ISMNRQLNDLKL 648
Phytochrome, central region
414 - 590
Intol-Arabidopsis DGI--------QELEAVTSEMVRLIETATVPILAVDSDGLVNGWNTKIAELTGLSVDEAI 661
Intol-Populus EGM--------QELEAVTSEMVRLIETATVPILAVDVDGLVNGWNTKISELTGLLVDKAI 660
Intol-Eucalyptus EGI--------QELEAVTSEMVRLIETATVPILAVNADGLVNGWNTKIAELTGLSVEKAL 660
Intol-Glycine max EGINDLKIERMQELEAVTSEIVRLDYTATVPILAVDVDGLVNGWNIKIAELTGLPIGEAT 667
Intol-Scots pine QEM--------DELNAVTNEMVRLIETATAPILAVDAYGVVNGWNRKAAELTGLSVEEVL 386
Tol-Picea glauca KEM--------DELNAVTNEMVRLIETATAPILAVDAYGVVNGWNRKAAELTGLSVEEVL 644
Tol-Norway spruce KEM--------DELNAVTNEMVRLIETATAPILAVDAYGVVNGWNRKAAELTGLSVEEVL 700

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Intol-Arabidopsis      GKHFLTLVEDSSVEIVKRMLENALEGTEEQNVQFEIKTHLSRADAGPISLVVNACASRDL 721
Intol-Populus          GKHLLTLVEDSSVDIVKRMLFLALQGKEEQNIQFEIKTHGSKSECGPICLVVNACASRDL 720
Intol-Eucalyptus       GKHFLTLVEDSSVDIVKKMLHMALHGKEEKNIQFEIKTHDSRADSGPISLIANACASRDI 720
Intol-Glycine max      GKHLLTLVEDSSTDRVKKMLNLALLGEEEKNVQFEIKTLGSKMDSGPISLVVNRCASRDL 727
Intol-Scots pine       GEPLINLVEETSAENVKRMLHLALQGVEEQNVQIELKRHGSEEDKGPVVLLVNACSSRDL 446
Tol-Picea glauca       GEPLINLVEETSAENVERMLHLALEG-------------------------------- 670
Tol-Norway spruce      GEPLINLVEETSAENVERMLHLALEGVEEQNVQIELKRHGSQGDKGPVVLLVNACSSRDL 760
                       *: ::.***::*.: *::**  ** *

Intol-Arabidopsis      HENVVGVCFVAHDLTGQKTVMDKFTRIEGDYKAIIQNPNPLIPPIFGTDEFGWCTEWNPA 781
Intol-Populus          HENVVGVCFVGQDITGQKMVMDKFTRIEGDYKAIVQNRNPLIPPIFGTDEFGWCSEWNPA 780
Intol-Eucalyptus       QENVVGVCFVAQDITGQKMVMDKFTRIEGDYKAIVQNPNPLIPPIFGTDEFGWCSEWNPA 780
Intol-Glycine max      RDNVVGVCFVAHDITAQKNVMDKFIRIEGDYKAIVQNRNPLIPPIFGTDEFGWCCEWNPA 787
Intol-Scots pine       KENVVGVCFVAQDVTGQKIVMDKFTRIQGDYRAIVQNPSPLIPPIFGTDECGWCSEWNSA 506
Tol-Picea glauca       ------------------------------------------------------------
Tol-Norway spruce      KENIVGVCFVAQDVTGQKIVMDKFTRIQGDYRAIVQNPSPLIPPIFGTDECGWCSEWNSA 820

                       PAS-A domain
                       618 - 740

Intol-Arabidopsis      MSKLTGLKREEVIDKMLLGEVFGTQKSCCRLKNQEAFVNLGIVLNNAVTSQDPEKVSFAF 841
Intol-Populus          MTNLTGWKREEVLDKMLLGEVFGLNMACCRLKNQEAFVNLGVVLNTAMTGQESEKVSFGF 840
Intol-Eucalyptus       MAKLTGWKREEIIDKMLLGEVFGMHMACCRLKNQEAFVNLGVVLNGAMTGKELEKVQFGF 840
Intol-Glycine max      MMKLTGWKREEVMDKMLLGEIFGTQMAACRLKNQEAFVNLGVVLNKAMTGSETEKVPFGF 847
Intol-Scots pine       MEKLSGWKREEIIDKMLLGEVFGTRTACCRLKGQNALTQLRIILNSSMTGQETEKFPFGF 566
Tol-Picea glauca       ------------------------------------------------------------
Tol-Norway spruce      MEKLSGWKREEIIDKMLFGEVFGTRTSCCRLKGLNALTQLRIVLNSSMAGQETEKFPFGF 880

Intol-Arabidopsis      FTRGGKYVECLLCVSKKLDREGVVTGVFCFLQLASHELQQALHVQRLAERTAVKRLKALA 901
Intol-Populus          FARTGKYVECLLCVSKKLDREGAVTGVFCFLQLASQELQQALHVQRLSEQTALKRLKALA 900
Intol-Eucalyptus       FARGGKFVDCLLCVSKKLDGEGSVTGIFCFLQLASPELQQALHLQRLTEQTALKRLKQLA 900
Intol-Glycine max      FARNGKYVECLLSVSKKLDVEGLVTGVFCFLQLASPELQQALHIQRLSEQTASKRLNALS 907
Intol-Scots pine       FDRHGKYVETLLSANKKLDEEGKITGVFCFLHIASPELQQALYVQHMLEQAAMKRLKALT 626
Tol-Picea glauca       ------------------------------------------------------------
Tol-Norway spruce      FDRHGKYVEALLSANKKLDEEERITGVFCFLHLASPELQQALCVQHMLEQASMKRLKALT 940

                       PAS-B domain
                       748 - 873

Intol-Arabidopsis      YIKRQIRNPLSGIMFTRKMIEGTELGPEQRRILQTSALCQKQLSKILDDSDLESIIEGCL 961
Intol-Populus          YLKKQIWNPLSGIIFSGKMMEGTELGAEQKELLHTSAQCQCQLSKILDDSDLDSIIEGYL 960
Intol-Eucalyptus       YMKRQIRNPLSGIIFSRKLLEETELGLEQKLLLHTSAQCQSQLGKILDDSDLDSITDGYM 960
Intol-Glycine max      YMKRQIRNPLCGIVFSRKMLEGTDLGTEQKQLLRTSAQCQQQLSKILDDSDLDTIIDGYL 967
Intol-Scots pine       YLRLEIKNPLYGIMFTQKMMERTDLREDQRQLVETSALCQKQILKILDDMDLESIEDGYL 686
Tol-Picea glauca       ------------------------------------------------------------
Tol-Norway spruce      YLRMEIKNPLYGIMFTQTMMERTALREDQRQLVETSALCQKQILKILDDMDLESIEDGYL 1000

Intol-Arabidopsis      DLEMKEFTLNEVLTASTSQVMMKSNGKSVRITNETGEEVMSDTLYGDSIRLQQVLADFML 1021
Intol-Populus          DLEMVEFTLREVLVAATSQVMMKSNEKGIRIINDAAEEMMAETLYGDSIRLQQVLADFLL 1020
Intol-Eucalyptus       ELEMVEFTLHKVLVASMSQVMIKSNGKGVRIVNDVTEEAMTETLYGDALRLQQVLADFLS 1020
Intol-Glycine max      DLEMAEFTLHEVLVTSLSQVMEKSNGKSIRIVNDVAGHIMMETLYGDSLRLQQVLADFLL 1027
Intol-Scots pine       DLDTVEFTLGALLDAVISQGMIQSEEKGLEIGYDLPREITTTGLYGDQSRLQQILANFLV 746
Tol-Picea glauca       ------------------------------------------------------------
Tol-Norway spruce      DLDTVEFTLGALLDAVISQGMIQSEEKGLEIDYDLPREITTTGVYGDQSRLQQILANFLV 1060
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Intol-Arabidopsis       MAVNFTPSGGQLTVSASLRKDQLGRSVHLANLEIRLTHTGAGIPEFLLNQMFGTEEDVSE 1081
Intol-Populus           MSVNFTPSGGLLTVSASFSKDQLGQSVYLVHLELRIRHPGAGIPEALLDQMYGEDTGASV 1080
Intol-Eucalyptus        VSINYTPTGSQLVIAAHLTKDHLGESVQLAHLELRLTYAGGGISEALLNQMFENDGEISE 1080
Intol-Glycine max       ISINFTPNGGQVVVAGSLTKEQLGKSVHLVKLELSITHGGSGVPEVLLNQMFGNNGLESE 1087
Intol-Scots pine        TVIQFTPAEKWVRIKVSPTKRHLGGGVYVIRIEFRITHPGPGLPEKLVQQMFNFDPDMSQ 806
Tol-Picea glauca        ------------------------------------------------------------
Tol-Norway spruce       NVIQFTPAEKWVRIKVSSTKRHLGGGVYVIRVEFRITHPGPGLPEKLVQQMFNLDPDMSQ 1120

Intol-Arabidopsis       EGLSLMVSRKLVKLMNGDVQYLRQAGKSSFIITAELAAANK--------- 1122
Intol-Populus           EGISLVISRKLVKLMNGDVRYMREAGKSS---------------------- 1109
Intol-Eucalyptus        EGISLLISRKLVKLMNGDVQYLREAGKSTFIISVELAVANKSGSSLKGKN 1130
Intol-Glycine max       EGISLLIRAKLLKLMNGDVRYLREAGKSAFILSAELAAAHNLKA------ 1131
Intol-Scots pine        EGFGLLICRKLVRLMNGDVQYLRGGGTSSFVIVVELATGQNEEC------ 850
Tol-Picea glauca        -------------------------------------------------
Tol-Norway spruce       EGFGLFICRKLVRLMNGDVQYLRGGGTSSFIVVVELASGQTDEC------ 1164
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Histidine kinase domain
902 - 1,119

Details of the sequences used for alignment

- Intol-*Arabidopsis* ***Arabidopsis thaliana*** - AT1G09570.1
- Intol-*Populus* ***Populus tremula*** - gi|340007753|gb|AEK26583.1| phytochrome A, partial [*Populus tremula*]
- Intol-*Eucalyptus* ***Eucalyptus grandis*** - gi|702263244|ref|XP_010037943.1| PREDICTED: phytochrome A [*Eucalyptus grandis*]
- Intol-*Glycine max* ***Glycine max*** - gi|351722971|ref|NP_001238286.1| phytochrome A [*Glycine max*]
- Intol-Scots pine ***Pinus sylvestris*** - gi|410718340|gb|AFV79546.1| phytochrome N, partial [*Pinus sylvestris*]
- Tol-*Picea glauca* ***Picea glauca*** - Congenei - 167818246 670 bp
- Tol-Norway spruce ***Picea abies*** - Congenei - gi|543906193|gb|AGV77083.1| PHYN [*Picea abies*]

Arabidopsis-Shade Intolerant	Nucleotide	Spruce-Shade Tolerant	Nucleotide
E-Glutamate Acidic, Polar, Hydrophilic	GAA	K-Lysine Basic, Polar, Hydrophilic	AAG
I-Isoleucine Basic, Non-polar, Hydrophobic	ATT	M-Methionine Non-polar, Hydrophobic	ATG
K-Lysine Basic, Polar, Hydrophilic	AAA	E-Glutamic Acid Acidic, Polar, Hydrophilic	GAA
L-Leucine Basic, Non-polar, Hydrophobic	TTA	F-Phenylalanine Non-polar, hydrophobic	TTC
Q-Glutamine Neutral, Polar, Hydrophilic	CAA	L-Leucine Basic, Non-polar, Hydrophobic	CTG
T-Tyrosine Neutral, Polar, Hydrophilic	ACC	A-Alanine Non-polar, Hydrophobic	GCG
G-Glycine Neutral, Non-polar, Hydrophilic	GGT	E-Glutamic Acid Acidic, Polar, Hydrophilic	GAA
A-Alanine Non-polar, Hydrophobic	GCA	S-Serine Neutral, Polar, Hydrophilic	TCT
K-Lysine Basic, Polar, Hydrophilic	AAA	T-Threonine Neutral, Polar, Hydrophilic	ACA
L-Leucine Basic, Non-polar, Hydroph	TTG	V-Valine Non-polar, Hydrophobic	GTC

Shade Tolerant species

Picea abies (Niinemets, 2010)

Picea glauca (Durzan, 2010)

Shade Intolerant species

Pinus sylvestris (Niinemets, 2010)

Populus tremula (Niinemets *et al.*, 1998)

Eucalyptus grandis (Niinemets, 1997)

Glycine max (Sawada *et al.*, 2002)

Arabidopsis thaliana (Mullen *et al.*, 2006)

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CLUSTAL 2.1 multiple sequence alignment – Phytochrome B

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Tol-SprucePhyB          ------------------------------------------------------------MAQ 3
Tol-PsitchensisPhyp     MAS-------------------NSRHTQSQSTGSNNRRSS-----INTNTTTNKATAMAQ 36
Intol-Pparviflora       MAS-------------------RSRHTQSQSTGSNNRRSS-----TNTNTTTNKTMAMAQ 36
Intol-PineCon           MAS-------------------NSRHTQSQSTGSNNRRSS-----TNTNTTTNKATAMAQ 36
Intol-Ptaeda            MAS-------------------NSRYTQSQSTGSNNRRSS-----TNTNTTTNKATAMAQ 36
Tol-Pglauca             MAS-------------------NSRHTQSQSTGSNNRRSS-----INTNTTNNKATAMAQ 36
Intol-PineGenB          ------------------------------------------------------------
Intol-PopulusB1         MAS---------------QSQRQSNQ-RQHQNQAAQSSGT-SNMRQHHHATESVSKAIAQ 43
Intol-PopulusB2         MAS---------------QSQRQSNQ-PAHN--QAQSSGT-SNMRQHHHPTESVSKAIAQ 41
Intol-Eucalyptus        MAS---------------TSKAGSS--QPPAAGAGR---------GTHPATDSVSKAIAQ 34
Intol-Glycine-max       MAS---------------ASGAANSSVPPPQIHTSRTKLS-HHSSNNNNNIDSMSKAIAQ 44
Intol-Arabidopsis       MVSGVGGSGGGRGGGRGGEEEPSSSHTPNNRRGGEQAQSSGTKSLRPRSNTESMSKAIQQ 60

Tol-SprucePhyB          YNADARLLQVFEQSGESGKSFDYTRSIKSTTE--SVPEQQITAYLSRIQRGGRIQPFGCV 61
Tol-PsitchensisPhyp     YNADARLLQVFEQSGESGKSFDYTRSIKSTTE--SVPEQQITAYLSRIQRGGRIQPFGCV 94
Intol-Pparviflora       YNADARLLEVFEQSGESGKSFDYTRSIKSTTE--SVPEQQITAYLSRIQRGGIIQPFGCV 94
Intol-PineCon           YNSDARLLQVFEQSGESGKSFDYTRSIQVHNR--AVPEQQITAYLSRIQRGGRIQPFGCV 94
Intol-Ptaeda            YNADARLLQVFEQSGESGKSFDYTRSIKSTTE--SVPEQQITAYLSRIQRGGRIQPFGCV 94
Tol-Pglauca             YNADARLLQVFEQSGESGKSFDYTRSIKSTTE--SVPEQQITAYLSRIQRGGRIQPFGCV 94
Intol-PineGenB          --------------GESGKSFDYTRSIKSTTE--SVPEQQITAYLSRIQRGGRIQPFGCV 44
Intol-PopulusB1         YTVDAQLHAVFEQSGGSGKSFDYSQSVRTTSQ--SVPEEQITAYLSKIQRGGHIQPFGCM 101
Intol-PopulusB2         YTVDAQLHAVFEQSGGTGKSFDYSKSVRTPNQ--SVPEEQITAYLSKIQRGGHIQPFGCM 99
Intol-Eucalyptus        YTQDARLHAVFEQSGESGRSFDYSQSVRTTTQ--SVPEQQITAYLSKIQRGGHIQPFGCM 92
Intol-Glycine-max       YTEDARLHAVFEQSGESGRSFNYSESIRIASE--SVPEQQITAYLVKIQRGGFIQPFGSM 102
Intol-Arabidopsis       YTVDARLHAVFEQSGESGKSFDYSQSLKTTTYGSSVPEQQITAYLSRIQRGGYIQPFGCM 120
                                  * :*:**:*:.*::  .   :***:****** :***** *****.:

Tol-SprucePhyB          LAVEETTFRIIAYSENAVEMLDLAPQSVPSMEQPQLEVLTIGTDVRTLFTAASAHSLEKA 121
Tol-PsitchensisPhyp     LAVEETTFRIIAYSENAVEMLDLAPQSVPSMEQPQLEVLTIGTDVRTLFTAASAHSLEKA 154
Intol-Pparviflora       LAVEETTFRIIAYSENAVEMLDLAPQSVPSMEQSQLEVLTIGTDVRTLFTAASSHSLVKA 154
Intol-PineCon           LAVEETTFRIIAYSENE-EMLDLGAQSVPSMEKPQQDVLTIGTDVRTLFTAASAHSLEKA 153
Intol-Ptaeda            LAVEETTFRIIAYSENAVEMLDLAPQSVPSMEQPQQDVLTIGTDVRTLFTAASAHSLEKA 154
Tol-Pglauca             LAVEETTFRIIAYSENAVEMLDLAPQSVPSMEQPQLEVLTIGTDVRTLFTAASAHSLEKA 154
Intol-PineGenB          LAVEETTFRIIAYSENAVEMLDLAPQSVPSMEKPQQDVLTIGTDVRTLFTAASAHSLEKA 104
Intol-PopulusB1         IAVDEGSFRVIAYSENAKEMLGFTPQSVPSLD--KQEILSDGTDVRTLFRPSSSAMLEKA 159
Intol-PopulusB2         IAADEQSFRGIAYNENAKNMRGLTPQSVPSLE--KQEILFVGGDVRILFRPSSAVLLEKT 157
Intol-Eucalyptus        IAADESTFRILAYSENARDMLGLTPQSVPSLE--KPEVLGIGTDVRTLFTPSSGALLEKA 150
Intol-Glycine-max       IAVDEPSFRILGYSDNARDMLGITPQSVPSLDDKNDAAFALGTDVRALFTHSSALLLEKA 162
Intol-Arabidopsis       IAVDESSFRIIGYSENAREMLGIMPQSVPTLE--KPEILAMGTDVRSLFTSSSSILLERA 178
                        :*.:* :** :.*.:*  :* .: .****:::  :   :  * *** **  :*.  * ::

                        I143L: Associated with variation in red
                        light response (Filiault et al., 2008)

Tol-SprucePhyB          AVAQEISLMNPIWVHCKNSRKPFYAIVHRIDVGMVIDFEPLKTGDAFVSAAGAVQSQKLA 181
Tol-PsitchensisPhyp     AVAQEISLMNPIWVHCKNSRKPFYAIVHRIDVGMVIDFEPLKTGDAFVSAAGAVQSQ--- 211
Intol-Pparviflora       AVTQEISLMNPIWVHCKNSRKPFYAIVHRIDVGMVIDLEPLRTGDAFMSAAGAVQSQ--- 211
Intol-PineCon           AVAQEISLMNPIWVHCKNSRKPFYAIVHRIDVGMVIDLEPLRTGDAFMSAAGAVQSQ--- 210
Intol-Ptaeda            AVAQEISLMNPIWVHCKNSRKPFYAIVHRIDVGMVIDLEPLRTGDAFMSAAGAVQSQ--- 211
Tol-Pglauca             AVAQEISLMNPIWVHCKNSRKPFYAIVHRIDVGMVIDFEPLKTGDAFVSAAGAVQSQ--- 211
Intol-PineGenB          AVAQEISLMNPIWVHCKNSRKPFYAIVHRIDVGMVIDLEPLRTGDAFMSAAGAVQSQ--- 161
Intol-PopulusB1         FGAREITLLNPIWIHSKNSGKPFYAILHRIDVGIVIDLEPARTEDPALSIAGAVQSQ--- 216
Intol-PopulusB2         FGAREITLLNPIWIHSKNSGKPFYAILHRIDVGIVIDLEPARTEDPALSIAGAVQSQ--- 214
Intol-Eucalyptus        FGAREIMLLNPLWIHSKNSGKAFYAILHRIDVGIVIDLEPTRTEDPALSIAGAVQSQ--- 207
Intol-Glycine-max       FSAREISLMNPIWIHSRTSGKPFYGILHRIDVGIVIDLEPARTEDPALSIAGAVQSQ--- 219
Intol-Arabidopsis       FVAREITLLNPVWIHSKNTGKPFYAILHRIDVGVVIDLEPARTEDPALSIAGAVQSQ--- 235
                          ::** *:**:*:*.::: *.** .:******:***:** :* *. :* *******

                        PAS fold-2
                        103-219
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Tol-SprucePhyB          VRAISRLQSLPCGDIELLCDTVVENVRELTGYDRVMVYKFHSAAGAVQSQKLAVRAISRL 241
Tol-PsitchensisPhyp     ------------------------------------------------KLAVRAISRL 221
Intol-Pparviflora       ------------------------------------------------KLAVRAISRL 221
Intol-PineCon           ------------------------------------------------KLAVRAISRL 220
Intol-Ptaeda            ------------------------------------------------KLAVRAISRL 221
Tol-Pglauca             ------------------------------------------------KLAVRAISRL 221
Intol-PineGenB          ------------------------------------------------KLAVRAISRL 171
Intol-PopulusB1         ------------------------------------------------KLAVRSISQL 226
Intol-PopulusB2         ------------------------------------------------KLAVRAISQL 224
Intol-Eucalyptus        ------------------------------------------------KLAVRAISHL 217
Intol-Glycine-max       ------------------------------------------------KLAVRAISQL 229
Intol-Arabidopsis       ------------------------------------------------KLAVRAISQL 245
                                                                         *****:**:*

Tol-SprucePhyB          QSLPCGDIELLCDTVVENVRELTGYDRVMVYKFHEDEHGEVVAEIRRSDLEPYLGLHYPA 301
Tol-PsitchensisPhyp     QSLPCGDIELLCDSVVENVRELTGYDRVMVYKFHEDEHGEVVAEIRRSDLEPYLGLHYPA 281
Intol-Pparviflora       QSLPCGDIGLLCDTVVENVRELTGYDRVMVYKFHEDEHGEVVSEIRRSDLEPYLGLHYPA 281
Intol-PineCon           QSLPCGDVGLLCDTVVENVRELTGYDRVMVYKFHEDEHGEVVAEIRRSDLEPYLGLHYPA 280
Intol-Ptaeda            QSLPCGDVGLLCDTVVENVRELTGYDRVMVYKFHEDEHGEVVAEIRRSDLEPYLGLHYPA 281
Tol-Pglauca             QSLPCGDIELLCDTVVENVRELTGYDRVMVYKFHEDEHGEVVAEIRRSDLEPYLGLHYPA 281
Intol-PineGenB          QSLPCGDVGLLCDTVVENVRELTGYDRVMVYKFHEDEHGEVVAEIRRSDLEPYLGLHYPA 231
Intol-PopulusB1         QSLPGGDIKLLCDTVVESVRELTGYDRVMVYKFHEDEHGEVVAENKRADLEPYIGLHYPS 286
Intol-PopulusB2         QSLPGGDIKLLCDTVVDSVRELTGYDRVMVYKFHEDEHGEVVAENKRVDLEPYIGLHYPS 284
Intol-Eucalyptus        QSLPGGDIKLLCDTVVESVRELTGYDRVMVYKFHEDEHGEVVSESKRADLEPYIGLHYPA 277
Intol-Glycine-max       QSLPGGDVKLLCDTVVESVRELTGYDRVMVYKFHEDEHGEVVSESKRPDLEPYIGLHYPA 289
Intol-Arabidopsis       QALPGGDIKLLCDTVVESVRDLTGYDRVMVYKFHEDEHGEVVAESKRDDLEPYIGLHYPA 305
                        *:** **: ****:**:.**:**********************:* :* *****:*****:

Tol-SprucePhyB          TDIPQASRFLFMQNRVRMICDCMATPVQVIQSEELMQPLCLVGSTLRAPHGCHAQYMANM 361
Tol-PsitchensisPhyp     TDIPQASRFLFMQNRVRMICDCMATPVQVIQSEELMQPLCLVGSTLRAPHGCHAQYMANM 341
Intol-Pparviflora       TDIPQASRFLFMQNRVRMICDCMATPVKVIQSEELMQPLCLVGSTLRAPHGCHAQYMANM 341
Intol-PineCon           TDIPQASRFLFMQNRVRMICDCMATPVKVIQSEELMQPLCLVGSTPSAPHGCHAQYMANM 340
Intol-Ptaeda            TDIPQASRFLFMQNRVRMICDCMATPVKVIQSEELMQPLCLVGSTLRAPHGCHAQYMANM 341
Tol-Pglauca             TDIPQASRFLFMQNRVRMICDCMATPVQVIQSEELMQPLCLVGSTLRAPHGCHAQYMANM 341
Intol-PineGenB          TDIPQASRFLFMQNRVRMICDCMATPVKVIQSEELMQPLCLVGSTLRAPHGCHAQYMANM 291
Intol-PopulusB1         TDIPQASRFLFKQNRVRMIVDCHATPVRVIQDEALMQPLCLVGSTLRAPHGCHAQYMANM 346
Intol-PopulusB2         TDIPQASRFLFKQNRVRMIVDCHAIPVSVIQDEGLMQPLCLVGSTLRAPHGCHAQYMENM 344
Intol-Eucalyptus        TDIPQASRFLFKQNRVRMIADCHAMPVHVVQDESLMQPLCLVGSTLRAPHGCHAQYMANM 337
Intol-Glycine-max       TDIPQASRFLFKQNRVRMIVDCHASAVRVVQDEALVQPLCLVGSTLRAPHGCHAQYMANM 349
Intol-Arabidopsis       TDIPQASRFLFKQNRVRMIVDCNATPVLVVQDDRLTQSMCLVGSTLRAPHGCHSQYMANM 365
                        ********** ******* ** * .* *:*:: * *.:******  ******:*** **

Tol-SprucePhyB          GSIASLVMAVIINGNDDEGA--GSGRNSMKLWGLVVCHHTSPRAVPFPL---------- 408
Tol-PsitchensisPhyp     GSIASLVMAVIINGNDDEGA--GSGRNSMKLWGLVVCHHTSPRAVPFPLRYACEFMMQAF 399
Intol-Pparviflora       GSIASLVMAVIINGNDDEGG--GSGRNSMKLWGLVVCHHTSPRAVPFPLRYACEFLMQAF 399
Intol-PineCon           GSIRSLLMAVIINGNDDEGG--GSGRNSMKLWGLVVCHHTSPRAVPFPLRYACEFLMQAL 398
Intol-Ptaeda            GSIASLVMAVIINGNDEEGG--GSGRNSMKLWGLVVCHHTSPRAVPFPLRYACEFLMQAL 399
Tol-Pglauca             GSIASLVMAVIINGNDDEGA--GSGRNSMKLWGLVVCHHTSPRAVPFPLRYACEFMMQAF 399
Intol-PineGenB          GSIASLVMAVIINGNDDEGG--GSGRNSMKLWGLVVCHHTSPRAVPFPLRYACEFLMQAL 349
Intol-PopulusB1         GSIASMAMAVIINGNEEEA---IGGRNSTRLWGLVVCHHTSARCIPFPLRYACEFLMQAF 403
Intol-PopulusB2         GSIASLAMAVIIYGNDEEA---IGGRNSMRLWGLVVCHHTSARCIPFPLRYACEFLMQAF 401
Intol-Eucalyptus        GSIASLAMAVIINGNDEEA---VGGRNSMRLWGLVVCHHTSARCIPFPLRYACEFLMQAF 394
Intol-Glycine-max       GSIASLVMAVIINGNDEEG---VGGRSSMRLWGLVVCHHTSARCIPFPLRYACEFLMQAF 406
Intol-Arabidopsis       GSIASLAMAVIINGNEDDGSNVASGRSSMRLWGLVVCHHTSSRCIPFPLRYACEFLMQAF 425
                        *** *: ***** **:::.    .**.* :**********.*.:****
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GAF domain
252-443

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Tol-SprucePhyB          ---LNMELQLAAQLTEKHILRTQTLLCDMLLRDAPIGIVTQSPSIMDLVKCDGAALYYGG 465
Tol-PsitchensisPhyp     GLQLNMELQLAAQLTEKHILRTQTLLCDMLLRDAPIGIVTQSPSIMDLVKCDGAALYYGG 459
Intol-Pparviflora       GLQLNMELQLAAQLTEKHILRTQTLLCDMLLRHAPMGIVTQSPSIMDLVKCDGAALYYGG 459
Intol-PineCon           GLQLNMELQLAAQLTEKHILRTQTLLCDMLLRDAPMGIVTQSPSIKDLVKCDGAALYYGG 458
Intol-Ptaeda            GLQLNMELQLAAQLTEKHILKTQTLLCDMLLRDAPMGIVTQSPSIRDLVKCDGAALYYGG 459
Tol-Pglauca             GLQLNMELQLAAQLTEKHILRTQTLLCDMLLRDAPIGIVTQSPSIMDLVKCDGAALYYGG 459
Intol-PineGenB          GLQLNMELQLAAQLTEKHILRTQTLLCDMLLRDAPMGIVTQSPSIKDLVKCDGAALYYGG 409
Intol-PopulusB1         GLQLNMELQLASQLSEKHVLRTQTLLCDMLLRDSPTGIVTQSPSIMDLVKCDGAALYYQG 463
Intol-PopulusB2         GLQLNMELQLASQLLEKHVLRTQTLLCDMLLRDSPTGIVTQSPSIMDLVKCDGAALYYQG 461
Intol-Eucalyptus        GLQLNMELQLASQLSEKHVLRTQTLLCDMLLRDSPTGIVTQSPSIMDLVKCDGAALFYQG 454
Intol-Glycine-max       GLQLNMELQLAAQSLEKRVLRTQTLLCDMLLRDSPTGIVTQSPSIMDLVKCDGAALYFQG 466
Intol-Arabidopsis       GLQLNMELQLALQMSEKRVLRTQTLLCDMLLRDSPAGIVTQSPSIMDLVKCDGAAFLYHG 485
                           ******** *  **::*:***********.:* ********* *********: : *

Tol-SprucePhyB          MCWMLGVTPTEAQIKDIADWLLEHHGDSTGLSTDSLADAGYPGAASLGDAVCGMASARIT 525
Tol-PsitchensisPhyp     MCWMLGVTPTEAQIKDIADWLLEHHGDSTGLSTDSLADAGYPGAASLGDAVCGMASARIT 519
Intol-Pparviflora       KCWMLGVTPTEAQIKDIADWLLEHHGDSTGLSTDSLADAGYPGATSLGDAVCGMASARIT 519
Intol-PineCon           MCWMLGVTPTEAQIKDIADWLLEHHGDSTGLSTDSLADAGYPGAASLGDAVCGMASARIT 518
Intol-Ptaeda            MCWMLGVTPTEAQIKDIADWLLEHHGDSTGLSTDSLADAGYPGAASLGDAVCGMASARIT 519
Tol-Pglauca             MCWMLGVTPTEAQIKDIADWLLEHHGDSTGLSTDSLADAGYPGAASLGDAVCGMASAIIT 519
Intol-PineGenB          MCWMLGVTPTEAQIKDIADWLLEHHGDSTGLSTDSLADAGYPGAASLGDAVCGMASARIT 469
Intol-PopulusB1         QYYPSGVTPTEAQIKDIVEWLLALHGDSTGLSTDSLADAGYPGAASLGNAVCGMAVAYIT 523
Intol-PopulusB2         QYYPLGVTPTEAQIKDIVEWLLTLHGDPTGLSTDSLADAGYPGAAFLGDAVCGMAVAYIA 521
Intol-Eucalyptus        KYYPLGVTPTEAQIKDIVEWLLAFHGDSTGLSTDSLADAGYPGAASLGDAVCGMAVAYIT 514
Intol-Glycine-max       NYYPLGVTPTEAQIRDIIEWLLAFHGDSTGLSTDSLGDAGYPGAASLGDAVCGMAVAYIT 526
Intol-Arabidopsis       KYYPLGVAPSEVQIKDVVEWLLANHADSTGLSTDSLGDAGYPGAAALGDAVCGMAVAYIT 545
                          :  **:*:*.**:*: :***  *.*.********.*******: **:****** * *:

Tol-SprucePhyB          SKDFLFWFRSHTAKEMKWGGAKHHPDDKDDGRRMHPRSSFKAFLEVVKRRSLPWDNVEID 585
Tol-PsitchensisPhyp     SKDFLFWFRSHTAKEMKWGGAKHHPDDKDDGRRMHPRSSFKAFLEVVKRRSLPWDNVEID 579
Intol-Pparviflora       SKDFIFWFRSHTAKEMKWGGAKHHPDDKDDGRRMHPRSSFKAFLEVVKRRSLPWDNVEID 579
Intol-PineCon           SKDFLFWFRSHTAKEMKWGGAKHHPDDKDDARRMHPRSSFKAFLEVVKRRSLPWDNVEID 578
Intol-Ptaeda            SKDFLFWFRSHTAKEMKWGGAKHHPDDKDDARRMHPRSSFKAFLEVVKRRSLPWDNVEID 579
Tol-Pglauca             SKDFLFWFRSHTAKEMKWGGAKHHPDDKDDGRRMHPRSSFKAFLEVVKRRSLPWDNVEID 579
Intol-PineGenB          SKDFLFWFRSHTAKEMKWGGAKHHPDDKDDARRMHPRSSFKAFLEVVKRRSLPWDNVEID 529
Intol-PopulusB1         KRDFLFWFRSHTAKEIKWGGAKHHPEDKDDGQRMHPRSSFKAFLEVVKSRSLLWENAEMD 583
Intol-PopulusB2         ERDFLFWFRSHTAKEVKWGGAKHHPEDKDDGQRMHPRSSFKAFLEVVKSRSLPWENAEMD 581
Intol-Eucalyptus        KRDFLFWFRSHTAKEIKWGGAKHHPEDKDDGQRMHPRSSFKAFLEVVKSRSLPWENAEMD 574
Intol-Glycine-max       EKDFLFWFRSHTAKEIKWGGAKHHPEDKDDGQRMHPRSSFKAFLEVVKSRSLPWENAEMD 586
Intol-Arabidopsis       KRDFLFWFRSHTAKEIKWGGAKHHPEDKDDGQRMHPRSSFQAFLEVVKSRSQPWETAEMD 605
                        .:**:**********:*********:****.:********:******* **  *:..*:*

Tol-SprucePhyB          AIHSLQLILRGSFQDIDDSGGTKTMVHSRLN---DLR-LQGIDELSSVASEMVRLIETAT 641
Tol-PsitchensisPhyp     AIHSLQLILRGSFQDIDDSG-TKTMVHSRLN---DLR-LQGIDELSSVASEMVRLIETAT 634
Intol-Pparviflora       AIHSLQLILRGSFQDIDDSG-TKTMVHSQLN---DLR-LQGIDELSSVASEMVRLIETAT 634
Intol-PineCon           AIHSLQLILRCSFRDIDDSG-TKTMVHSRLN---YLR-LQGIDELSSVASEMVRLIETAT 633
Intol-Ptaeda            AIHSLQLILRGSFQDIDDSG-TKTMVHSRLN---DLR-LQGIDELSSVASEMVRLIETAT 634
Tol-Pglauca             AIHSLQLILRGSFQDIDDSG-TKTMVHSRLN---DLR-LQGIDELSSVASEMVRLIETAT 634
Intol-PineGenB          AIHSLQLILRGSFRDIDDSG-TKTMVHSRLN---DLR-LQGIDELSSVASEMVRLIETAT 584
Intol-PopulusB1         AIHSLQLILRDSFRDAEATN-SKAVVRTQLE---DTE-LQGMDELSSVAREMVRLIETAT 638
Intol-PopulusB2         AIHSLQLILRDSFRDAEATN-SKAVVHNQLK---DME-LQGMDELSSVAREMVRLIETAT 636
Intol-Eucalyptus        AIHSLQLILRDSFRDAERSN-SKAVINAPEV---DLE-LQGVDELSSVAREMVRLIETAT 629
Intol-Glycine-max       AIHSLQLILRDSFKDAEHRN-SKAVVDPHVS---EQE-LQGVDELSSVAREMVRLIETAT 641
Intol-Arabidopsis       AIHSLQLILRDSFKESEAAM-NSKVVDGVVQPCRDMAGEQGIDELGAVAREMVRLIETAT 664
                        ********** **:: :    .. ::            **:***.:** **********
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Phytochrome, central region
445 - 621

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Tol-SprucePhyB          APILAVDYNGLVNGWNAKVAELTGLPVGEAMGMSLVQDLVFEESVERVEKMLCNALK--- 698
Tol-PsitchensisPhyp     APILAVDYNGLVNVWNAKVAELTGLPVGEAMGMSLVQDLVFEESVERVKKMLCNAIR--- 691
Intol-Pparviflora       APILAVDYNGCVNGWNAKVAELTGLPVGEAMGMSLVQDLVFEESVESVEKMLYNALR--- 691
Intol-PineCon           APILAVDYNGLVNGWNAKVAELTGLPVGEAMGMSLVQDLVFEQSVERVEKMLHNALR--- 690
Intol-Ptaeda            APILAVDYNGLVNGWNAKVAELTGLPVGEAMGMSLVQDLVFEESVERVEKMLHNALR--- 691
Tol-Pglauca             APILAVDYNGLVNGWNAKVAELTGLPVGEAMGMSLVQDLVFEESVERVKKMLCNAIRGIP 694
Intol-PineGenB          APILAVDYNGLVNGWNAKVAELTGLPVGEAMGMSLVQDLVFEQSVERVEKMLHNALR--- 641
Intol-PopulusB1         APIFAVDVDGCINGWNAKVAELTGLSVERAMGKSLVHDLVYKEYEETVDKLLHRALR--- 695
Intol-PopulusB2         APIFAVDVDGCINGWNAKVAELTGLSVEEAMGKSLVHDLVYKEYEEIVDKLIHRAVK--- 693
Intol-Eucalyptus        APIFAVDVDGRINGWNGKMAELTGLSVEEAMGKSLLHDLVFKESKEIVDKLLQHALQ--- 686
Intol-Glycine-max       APIFAVDVDGHVNGWNAKVSELTGLPVEEAMGKSLVHDLVFKESEETMNKLLSRALK--- 698
Intol-Arabidopsis       VPIFAVDAGGCINGWNAKIAELTGLSVEEAMGKSLVSDLIYKENEATVNKLLSRALR--- 721
                        .**:*** .* :* **.*::*****.* .*** **: **::::    :.*:: .*::

Tol-SprucePhyB          ------------------------------------------------------------G 699
Tol-PsitchensisPhyp     ------------------------------------------------------------G 692
Intol-Pparviflora       ------------------------------------------------------------G 692
Intol-PineCon           ------------------------------------------------------------G 691
Intol-Ptaeda            ------------------------------------------------------------G 692
Tol-Pglauca             FSVGRLIILINQFNYAHIGTYKWFWADIMALTCMLVAIKFFKATPILLYWLTMPFVSFAG 754
Intol-PineGenB          ------------------------------------------------------------G 642
Intol-PopulusB1         ------------------------------------------------------------X 696
Intol-PopulusB2         ------------------------------------------------------------G 694
Intol-Eucalyptus        ------------------------------------------------------------G 687
Intol-Glycine-max       ------------------------------------------------------------G 699
Intol-Arabidopsis       ------------------------------------------------------------G 722

Tol-SprucePhyB          EEEKNVEMILRTFGPQKQKEAVFLVVNACSSRDFTNNIVGVCFVGQDVTGQKVVMDKFIR 759
Tol-PsitchensisPhyp     EEEKNVEMILRTFGPQKQKEAVFLVVNACSSRDFTNNIVGVCFVGQDVTGQKVVMDKFIR 752
Intol-Pparviflora       EEEKNVEMMLKTFGPQKEKKAVILVVNACSSRDFTDNIVGVCFVGQDVTSQKVVMDKFIR 752
Intol-PineCon           EEEKNVEMMLKTFGPQKEKEAVILVVNACSSRDFTDNIVGVCFVGQDVTSQKVVMDKFIR 751
Intol-Ptaeda            EEEKNVEMMLKTFGPQKEKEAVILVVNACSSRDFTDNIVGVCFVGQDVTSQKVVMDKFIR 752
Tol-Pglauca             EEEKNVEMILRTFGPQKQKEAVFLVVNACSSRDFTNNIVGVCFVGQDVTGQKVVMDKFIR 814
Intol-PineGenB          EEEKNVEMMLKTFGPQKEKEAVILVVNACSSRDFTDNIVGVCFVGQDVTSQKVVMDKFIR 702
Intol-PopulusB1         XXXXXXXIKLRTFDSEHQKKALFVVVNACSSKDYMNNIVGVCFVGQDVTGQKVVMDKYVH 756
Intol-PopulusB2         EEDKNVEIKLRTFCSEHQKKAVFVVVNACSSKDYMDNIVGVCFVGQDVTGQKVVMDKYVL 754
Intol-Eucalyptus        EEDKNVEIKLKTFGAEHHKKAIFVVVNACSSKDYMNNIVGVCFVGQDITGQKIVMDKFIH 747
Intol-Glycine-max       EEDKNVEIKMRTFGPEHQNKAVFLVVNACSSKDFTNNVVGVCFVGQDVTGQKIVMDKFIN 759
Intol-Arabidopsis       DEEKNVEVKLKTFSPELQGKAVFVVVNACSSKDYLNNIVGVCFVGQDVTSQKIVMDKFIN 782
                              : ::** .: . :*:::*******:*: :*:*********:*.**:****::

                        PAS-A domain
                        652 - 774

Tol-SprucePhyB          IQGDYRSIVQSPNPLIPPIFASDESACCSEWNAAMENVTGWARDEVIGKMLVGEIFGGCC 819
Tol-PsitchensisPhyp     IQGDYRSIVQNPNPLIPPIFASDESACCSEWNAAMENVTGWARDEVIGKMLVGEIFGGCC 812
Intol-Pparviflora       IQGDYSSIVQSPNPLIPPIFASDESACCSEWNAAMEKVTGWTRDEIIGKMLVGEIFGGCC 812
Intol-PineCon           IQGDYRSIVQSPNPLIPPIFASDEYACCSEWNAAMEKVTGWTHDEVIGKMLVGEIFGGCC 811
Intol-Ptaeda            IQGDYRSIVQSPNPLIPPIFASNEYACCSEWNAAMEKVTGWTHDEVIGKMLVGEIFGGCC 812
Tol-Pglauca             IQGDYKSIVQSPNPLIPPIFASDESACCSEWNAAMENVTGWARDEVIGKMLVGEIFGGCC 874
Intol-PineGenB          IQGDYRSIVQSPNPLIPPIFASDEYACCSEWNAAMEKVTGWTHDEVIGKMLVGEIFGGCC 762
Intol-PopulusB1         IQGDYKAIVHSPNPLIPPIFASDENTCCLEWNTAMEKFTGWSRGEVIGKMLVGEVFGSFC 816
Intol-PopulusB2         IQGDYKAIVHSPNPSIPPIFASDENTCCLEWNTAMEKLTGWSRGEVVGKMLVGEVFGSCC 814
Intol-Eucalyptus        IQGDYKAIVHSPNPLIPPIFACDDNTCCSEWNTAVENLTGWTRGEIMGKMLVGEVFGSCC 807
Intol-Glycine-max       IQGDYKAIVHSPNPLIPPIFASDDNTCCLEWNTAMEKLTGWGRVDVIGKMLVGEVFGSCC 819
Intol-Arabidopsis       IQGDYKAIVHSPNPLIPPIFAADENTCCLEWNMAMEKLTGWSRSEVIGKMIVGEVFGSCC 842
                        ***** :**:.*** ******.:: :** *** *:*:.*** : :::***:***:**. *

                        PAS-B domain
                        785-905
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Tol-SprucePhyB          RLKGQDAVTKFTIVLHSAIDGHEIEKFPFAFFDKQGKYVEALLTANKRTDADGRITGSFC 879
Tol-PsitchensisPhyp     RLKGQDAVTKFTIVLHSAIDGHEIEKFPFAFFDKQGKYVEALLTANKRTDADGRITGSFC 872
Intol-Pparviflora       RLKGQDAATKFTIVLHSAMDGQDIEKFPFAFFDKQGKYVESILTANKRTDADGRITGSFC 872
Intol-PineCon           RLKGQDAVTKFTIVLHQCNHGQEIEKFPFAFFDKQGKYVEALLTANKRTDADGRITGSFC 871
Intol-Ptaeda            RLKGQDAVTKFTIVLHSAIDGQEIEKFPFAFFDKQGKYVEALLTANKRTDADGRITGSFC 872
Tol-Pglauca             RLKGQDAVTKFTIVLHSAIDGHEIEKFPFAFFDKQGKYVEALLTANKRTDADGRITGSFC 934
Intol-PineGenB          RLKGQDAVTKFTIVLHSAIDGQEIEKFPFAFFDKQGKYVEALLTANKRTDADGRITGSFC 822
Intol-PopulusB1         QLKGSDALTKFMIALHNAIGGQDTDKLPFSFFDRNGKYVQALLTANKRVNMEGEIIGAFC 876
Intol-PopulusB2         KLKGPDALTKFMIALHNAIGGIDTDKLPFSFFDRNEKNVQTLLTANKRVNIN--IIGAFC 872
Intol-Eucalyptus        RLKGPDALTKFMIVLHNAIGGQDADKFPFSFFDRHGKYVQALLTANKRVSMDGKVIGAFC 867
Intol-Glycine-max       QLKGSDSITKFMIVLHNALGGQDTDKFPFSFLDRHGKYVQTFLTANKRVNMEGQIIGAFC 879
Intol-Arabidopsis       MLKGPDALTKFMIVLHNAIGGQDTDKFPFPFFDRNGKFVQALLTANKRVSLEGKVIGAFC 902
                          *** *: *** *.**..  * : :*:**.*:*:: * *:::****** .. :  : *:**

Tol-SprucePhyB          FLQIASSELRQALEVQRQQEKKCFARLKELAYIRQEIKNPLYGMMFTRKLLEETDLSDDQ 939
Tol-PsitchensisPhyp     FLQIASSELRQALEVQRQQEKKCFARLKELAYIRQEIKNPLYGMMFTRKLLEETDLSDDQ 932
Intol-Pparviflora       FLQIASSELLQALEVQRQQEKKCFARLKELAYIRQEIKNPLYGMMFTRKLLEETDLSDDQ 932
Intol-PineCon           FFRIASSELQHALEVQRQQEKKCFARLKELAYIRQEIKNPLYGMMFTRKLLEETDLSDDQ 931
Intol-Ptaeda            FLQIASSELQQALEVQRQQEKKCFARLKELAYIRQEIKNPLYGMMFTRKLLEETDLSDDQ 932
Tol-Pglauca             FLQIASSELRQALEVQRQQEKKCFARLKELAYIRQEIKNPLYGMMFTRKLLEETDLSDDQ 994
Intol-PineGenB          FLQIASSELQHALEVQRQQEKKCFARLKELAYIRQEIKNPLY------------------ 864
Intol-PopulusB1         FLQIASNELQQALKVQRQQEKKCSARMKELAYICQEIRNPLSGLRFTNSLLENTDLTEDQ 936
Intol-PopulusB2         FLQIASPELQPSLKVQKQQEKKSFARMKELAYICQEIKNPLSGIHFTNSLLENTDLTEDQ 932
Intol-Eucalyptus        FLQIASPELQQALKVQRQQDKKCFSRMKELAYMCQEIRNPLSGIRFTHSLLEATGLTEDQ 927
Intol-Glycine-max       FLQIMSPELQQALKAQRQQEKNSFGRMKELAYICQGVKNPLSGIRFTNSLLEATSLTNEQ 939
Intol-Arabidopsis       FLQIPSPELQQALAVQRRQDTECFTKAKELAYICQVIKNPLSGMRFANSLLEATDLNEDQ 962
                        *::* * **  :* .*::*:::.  : *****: * ::***

Tol-SprucePhyB          KQFVETSAVCERQMQKVIDDMDLDSLEDGYMELDTAEFILGTVIDAVVSQGMIVLREKGL 999
Tol-PsitchensisPhyp     KQFVETSAVCERQMQKVIDDMDLDSLEDGYMELDTAEFILGTVIDAVVSQGMIILREKGL 992
Intol-Pparviflora       KQFVETSAVCERQMQKVIDDTDLESLEDGYMELDTAEFILGTVIDAVVSQGMIVLREQGL 992
Intol-PineCon           KQFVETSAVCERQMQKVMDDMDLESLEDGYMELDTAEFILGTVIDAVVSQGMIVLREKGL 991
Intol-Ptaeda            KQFVETSAVCERQMQKVMDDMDLESLEDG------------------------------ 961
Tol-Pglauca             KQFVETSAVCERQMQKVIDDMDLDSLED------------------------------- 1022
Intol-PineGenB          ------------------------------------------------------------
Intol-PopulusB1         KQFLETSAACEKQILKITRDVDLXXXXXXLLELEKAEFLLGSVINAVVSQAMLLLRERNL 996
Intol-PopulusB2         QQFLETSAACEKQILKIIRDIDLESIENGSLELEKAEFLLGSVINAVVSQAMLLLRERNL 992
Intol-Eucalyptus        KQFLETSAACEKQMMRIINDADLRSIEDGSLELEKAEFFLGSVMNAVVSQVMILLRERGL 987
Intol-Glycine-max       KQFLETSVACEKQMLKIIRDVDLESIEDGSLELEKGEFLLGNVINAVVSQVMLLLRERNL 999
Intol-Arabidopsis       KQLLETSVSCEKQISRIVGDMDLESIEDGSFVLKREEFFLGSVINAIVSQAMFLLRDRGL 1022

Tol-SprucePhyB          QLIREIPGEVKTMHLYGDQVRLQQILADFLLNALRFTPSPEGWVAIKVLPTLKQLSGALH 1059
Tol-PsitchensisPhyp     QLIREIPGEVKTMHLYGDQVRLQQILADFLLNALRFTPSPEGWVAIKVLPTLKQLSGALH 1052
Intol-Pparviflora       QLIREIPGEVKTMRLYGDQVRLQQILADFLLNALRFTPSPEGWVAIKVLPTLKQLGGGLH 1052
Intol-PineCon           QLIREIPGEVKTMRLYGDEVKIQQILADFLLNVLRFTPSPEGWVAIKVFPTLKQLGGGLH 1051
Intol-Ptaeda            ------------------------------------------------------------
Tol-Pglauca             ------------------------------------------------------------
Intol-PineGenB          ------------------------------------------------------------
Intol-PopulusB1         QLLRDIPEEIKTLVVYGDQARIQQVLADFLLNMVRYAPSSAGWVEIHVCPTLKQISDGHT 1056
Intol-PopulusB2         QLLRDIPEEIKTLAVYGDQARIQQVLADFLLNMVRYAPSSAGWVEIHVCPTLKQISDGHT 1052
Intol-Eucalyptus        QLIRDIPDEIKTLAVCGDQLRIQQVLADFLLNMVRHAPSPEGWVEIHVRPSLKQTDGGLT 1047
Intol-Glycine-max       QLIRDIPEEIKTLAVYGDQLRIQQVLSDFLLNIVRYAPSPDGWVEIHVRPRIKQISDGLT 1059
Intol-Arabidopsis       QLIRDIPEEIKSIEVFGDQIRIQQLLAEFLLSIIRYAPSQE-WVEIHLSQLSKQMADGFA 1081
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Histidine kinase domain
934-1153

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Tol-SprucePhyB          VVLLEFRITHPGPG------------LPAELVQDLFDRSRWTTQEGVG-LSMCR-KLLK 1104
Tol-PsitchensisPhyp     VVLLEFRITHPGPG------------LPAELVQDLFDRSRWTTQEGVG-LSMCR-KLLK 1097
Intol-Pparviflora       VVHLEFRITHPGPG------------LPAELVQDLFDRSRWATQEGVG-LSMCR-KLLK 1097
Intol-PineCon           VVHLEFRITHPGLG------------LPAELVQDLFDRSQWATQEGVG-LSMCR-KLLK 1096
Intol-Ptaeda            ------------------------------------------------------------
Tol-Pglauca             ------------------------------------------------------------
Intol-PineGenB          ------------------------------------------------------------
Intol-PopulusB1         LVHMEFXXXXXXXXX-----------XLPPELVQDMFHSSRWVTQEGLG-LSMCR-KILK 1103
Intol-PopulusB2         LVHTEFRYLERVLQTRMLGLQHPLRSFLNCKLTLVMLHREGMVPKIQFQGLSVCQGRLIW 1112
Intol-Eucalyptus        LVHNEFRIVCPGEG------------LPPELVQDMFHSSRWMTEEGLG-LSMCR-KILR 1092
Intol-Glycine-max       LLHAEFRMVCPGEG------------LPPELIQDMFNNSRWGTQEGLG-LSMSR-KILK 1104
Intol-Arabidopsis       AIRTEFRMACPGEG------------LPPELVRDMFHSSRWTSPEGLG-LSVCR-KILK 1126

Tol-SprucePhyB          LMNGDVQYIRESGKCYFLVNVELPLAQREDASSMK---------- 1139
Tol-PsitchensisPhyp     LMNGDVQYVRESGKCYFLVNVELPLAQREDASSMK---------- 1132
Intol-Pparviflora       LMNGDVQYIRESGKCYFLVNVEFPFAQREDAASMK---------- 1132
Intol-PineCon           LMNGDVRYIRESGICYFLVNVEFPMAQREDAASIK---------- 1131
Intol-Ptaeda            ------------------------------------------
Tol-Pglauca             ------------------------------------------
Intol-PineGenB          ------------------------------------------
Intol-PopulusB1         LMNGEVQYIRESERCYFLVILEVPM-------------------- 1128
Intol-PopulusB2         LSFPENTTVALYPLTIWFLLLHRHQSRSITHT------------- 1144
Intol-Eucalyptus        LMSGEVQYIRESERCYFIITLELPMPQRSKDID------------ 1125
Intol-Glycine-max       LMNGEVQYIREAERCYFYVLLELPVTRRSSKKC------------ 1137
Intol-Arabidopsis       LMNGEVQYIRESERSYFLIILELPVPRKRPLSTASGSGDMMLMMPY 1172
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Details of the sequences used for alignment

- Tol-SprucePhyB ***Picea abies*** - Congenei - MA_10435530g0010, 1139 residues PhyB
- Tol-PsitchensisPhyp ***Picea sitchensis*** - Congenei - PUT-183a-*Picea_sitchensis*-8221 PlantGDB-assembled Unique Transcript-fragment derived from *Picea_sitchensis* mRNAs Apr_26_2011 (based on GenBank release 183).
- Intol-Pparviflora ***Pinus parviflora*** - gi|635149027|gb|AHZ63958.1| phytochrome [*Pinus parviflora*]
- Intol-PineCon ***Pinus sylvestris*** - Congenei - PUT-187a-*Pinus_sylvestris*-67937 PlantGDB-assembled Unique Transcript-fragment derived from *Pinus_sylvestris* mRNAs Feb_1_2012 (based on GenBank release 187)
- Intol-Ptaeda ***Pinus taeda*** - Congenei - PITA_000008046[961 residues]
- Tol-Pglauca ***Picea glauca*** - Congenei - Sequence maker-Seq167953850-snap-gene-0.12 class=Sequence position=167953850:12666..15909 (+ strand) *P.glauca* seq from congenei 1 ORF:1..2241 Frame +1 sequence got by joining 2 orfs
- Intol-PineGenB ***Pinus sylvestris*** - gi|158322002|gb|ABW33480.1| phytochrome P, partial [*Pinus sylvestris*]
- Intol-PopulusB1 ***Populus tremula*** - gi|340007755|gb|AEK26584.1| phytochrome B1, partial [*Populus tremula*]
- Intol-PopulusB2 ***Populus tremula*** - gi|78643950|emb|CAJ21338.1| phytochrome B2 [*Populus tremula*]
- Intol-Eucalyptus ***Eucalyptus grandis*** - XP_010065155.1 PREDICTED: phytochrome B [*Eucalyptus grandis*]
- Intol-Glycine-max ***Glycine max*** - NP_001240097.1 phytochrome B [*Glycine max*]
- Intol-Arabidopsis ***Arabidopsis thaliana*** - AT2G18790.1

Arabidopsis-Shade Intolerant	Nucleotide	Spruce-Shade Tolerant	Nucleotide
L-Leucine Non polar, Hydrophobic	TTA	F-Phenylalanine Non polar, Hydrophobic	TTT
R-Arginine Basic, Polar, Hydrophilic	AGA	K-Lysine Basic, Polar, Hydrophilic	AAG
L-Leucine Non polar, Hydrophobic	TTG	M-Methionine Non polar, Hydrophobic	ATG
Q-Glutamine Neutral, Polar, Hydrophilic	CAA	H-Histidine Basic, Polar, Hydrophilic	CAT
Q-Glutamine Neutral, Polar, Hydrophilic	CAG	R-Arginine Basic, Polar, Hydrophilic	CGG
G-Glycine Non polar, Hydrophilic	GGA	A-Alanine Non polar, Hydrophobic	GCT

Shade Tolerant species

Picea abies (Niinemets, 2010)

Picea sitchensis (Kennedy *et al.*, 2007)

Picea glauca (Durzan, 2010)

Shade Intolerant species

Pinus parviflora (Watano *et al.*, 2004)

Pinus sylvestris (Niinemets, 2010)

Pinus taeda (Ewers *et al.*, 2001)

Populus tremula (Niinemets *et al.*, 1998)

Eucalyptus grandis (Niinemets, 1997)

Glycine max (Sawada *et al.*, 2002)

Arabidopsis thaliana (Mullen *et al.*, 2006)

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