Supplemental Data

Supplemental Figure S1. Schematic view of a plant F-box kelch protein.

- **Supplemental Figure S2**. Alignment of F-box associated domains and individual kelch repeats from *A. thaliana* proteins.
- **Supplemental Figure S3.** Rooted NJ trees including FBKs and FBAs of V. vinifera, P. trichocarpa, O. sativa, S. bicolor and S. moellendorffii.
- Supplemental Figure S4. NJ tree generated using full-length FBK protein sequences of *A. thaliana*, *P. trichocarpa*, *V. vinifera*, *O. sativa*, *S. bicolor*, *S. moellendorffii* and *P. patens*.
- Supplemental Figure S5. Representative phylogenetic trees.
- Supplemental Figure S6. Protein sequence alignment of 43 representative FBKs.
- Supplemental Figure S7. NJ tree of A. thaliana and A. lyrata FBKs.
- Supplemental Figure S8. Density plot of the permutation test.
- Supplemental Figure S9. Relative transcript level of closely related FBKs.
- **Supplemental Table S1**. Identifiers of F-box kelch proteins in *A. thaliana*, *P. trichocarpa*, *V. vinifera*, *O. sativa*, *S. bicolor*, *S. moellendorffii* and *P. patens*.
- Supplemental Table S2. Number of F-box kelch proteins in non-plant model species.
- **Supplemental Table S3**. Identifiers of F-box proteins with F-box associated domains in *A*. *thaliana*, *P. trichocarpa*, *V. vinifera*, *O. sativa*, *S. bicolor*, *S. moellendorffii* and *P. patens*.
- **Supplemental Table S4**. Comparison of three tree topologies obtained with NJ, ML and Bayesian Algorithms.
- **Supplemental Table S5.** Absolute numbers of unstable, stable, ancient and superstable FBKs in plant genomes.
- Supplemental Table S6. Sequences of q-RT PCR primers.
- **Supplemental Dataset S1.** Tissue-specific expression data of *A. thaliana* FBKs extracted from ATGenExpress_Plus extended tissue series.



Supplemental Figure S1. Schematic view of a plant FBK protein. Consensus sequences of the F-box domain and kelch repeats are depicted below. In general, amino acids that share at least 30% homology between all sequences of an alignment are given in the one letter amino acid code, whereas amino acids with less than 30% homology are depicted as an "X". Exceptionally, in the case of the kelch 5 repeat amino acids with less than 50% homology are depicted as an "X". Gaps occuring in the alignment were deleted if more than 50% of the aligned sequences contained a gap at the same position. The positions of each domain within the alignment were determined using Pfam (Sonnhammer et al., 1997). n = number of sequences that underly the respective consensus sequence.

AT1G27420(K4) YSYTVVR-NKVY-FMD RNMPGR-LGV FD PEE-NS AT5G57360(K4) SRLGHTLSVYG GRKILMFGGLAKSGPLKFR SDVFTMDLSEEEC WSSVF AT1G32430 SYPEDDKRLVICSCD GRKILMFGGLAKSGPLKFR SDVFTMDLSEEEC WSVF AT1G62270 SELVDEENKVIVC CDE EGRANTYVGGNKLVSKTQLD DVQRSYRFRFSYVPS LVOF AT2G27520 RTFEBEDKKVIVC CDDRWKENMTYVGGNKLVSKTQLD DSNLWKLPFFFSVVPS LVOF AT3G17880 IFFIDEEKKVVVFD CDDRWKENMTYIVGENGFKKLSYEK DRSNLWKLPFFFSVVPS VGLY AT3G17280 SFLUDEENKVAVCSDAV-CSDTDTEDEDRRRTYIVGEOVEFVDEV SESF-VVRCSVVPS VGLY AT3G17540 SFLUDEENKVAVC SDVDTKDGLRSRIYIVGEVDFKD TRGSDNWPLLLGVPS LVGSVPS AT3G20710 NFFIDEEKKVAVVFEKDSSNSWMYNPNYNKAYIGENGYFKSVNLL KSVFKSVNLL KGAHFNNELLSYPS LVGSVPS AT4605080 NFFIDEEKKVAVVFEKDSSNSWMYNPNYNKAYIGENGFKKNSG SVFR TRGSDNWPLLLGVPS LVGSVPS	celch repeats	AT1G61540 (K3) AT2G18910 (K3) AT3G08810 (K2) AT5G39560 (K2) AT2G29770 (K1) AT4G39240 (K1) AT1G51550 (K5) AT2G18910 (K5)	HDIGYRCEVSLG 	$ \begin{array}{c} - \ LDG - \ KIYMFGSEFVVYNFEE \\ - \ GT - \ KLIVSGGCADSGAL \\ - \ - \ GT - \ KLIVSGGCADSGAL \\ - \ - \ OGGHGYSDSR \\ - \ - \ OGGHGYSDSR \\ - \ - \ OGGREMODSSDMF \\ - \ - \ MSIVAIDSE - \ YVLGGCLELVSTG \\ - \ - \ MSIVAIDSE - \ YVLGGEDSYRHRKDD \\ - \ - \ GGR - \ IL \ YGGSVAGDS \\ - \ - \ GGR - \ IL \ YGGSVAGDS \\ - \ - \ GGR - \ IL \ YGGSVAGDS \\ - \ - \ GGR - \ IL \ YGGSVAGDS \\ - \ - \ - \ GGR - \ IL \ MSGSVAGDS \\ - \ - \ - \ - \ - \ - \ - \ - \ - \ -$		
AT1G62270SELVDEENKVIVCCDEE-EDDINDTVYIGENEWMRKEDIVQRSVRRMFSVPSKVGH AT2G27520RIFIEEDKKVIVVDCDERWKENMTYIVGKNGFKLSYEKDRSNLWRLPFFSVVPSKVGH AT3G16880IFFIDEEKKVVVVFDKDKEMRNRITAYIIGENGYFRKUDLGDGESF-FVCSVVPSSVEIK AT3G17280SFLLDEENKVAVCSDAV-CSDTDTEDEDRERTYIVGEGVDEFVYDEVSTETSHNWFLVSVPNLVHLE AT3G17530SFLLDEENKVAVCSDVDTKDGLRSRIYIVGKDFVKEVKDTKG5DNNWFLLCVVPSLVSIC AT3G17540SFLLDEENKVAVCCDRHIDDEDKTRIYIVGVDLYKEVKDTKG5DNNWFLLCVVPSLVSIC AT3G20710NFFIDEEKKVAVVFEKDSSSWSMYNPNYNKAYIAGENGYFKSVNLLKSPNTLQLG-HLVCS		AT1G27420(K4) AT5G57360(K4) AT1G32430	-YSYTVVR-NKVY-FMD SRLGHTLSVYG -SYFIDDKRLVICSCD	RNMPGRLGV 		WSSVFVPP WRCVTGSG
AT3G17540SFLLDEENKVAVCDRHIDDEDKTRIYIVGVDLYKEVYKETKGDANNULLCYVPS	omains	AT1G62270 AT2G27520 AT3G16880 AT3G17280	SFLVDEENKVIVC RIFIBEDKKVIVV IFFIDEEKKVVVVFD SFLIDEEKKVAVCSDAV	CDEE - EDDINDTVYIGENEWRKE	DIVQRSYRPRMFSYVPS DRSNLWRLPFFFSVVPS LGD - SESF PVRCSVVPS STETSHNWPFLVSYVPN STETSHNWPFLVSVVPN	LVQI LVGLY SVEIK LVHIE
AT4G35290GREIDERMAK-MALGFDEEF-GRATFALIGEDGYFREFDRITFAILEEAGERAGVACGSIVCSIVCSIVCSIVCSIVCSIVCSIVCSIVCSIVCSIVC	FBAd	AT3G1/530 AT3G17540 AT3G20710 AT4G05080 AT4G33290	- SFLIDEENKVAVC - SFLIDEENKVAVC - NFFIDEEKKVAVVFEKD - NFFIDEEKKLAVVIDKV - GFFIDEEKKK-VALG	- SDVDIKDGLKSKITIVGKDFNKEVFKD - CDRHIDDEDKRITIVGKDFNKEVFKER SSSWSWMYNPNYNKAYIAGENGYFKSVNLL ESEDCKRSNSHIN - SVIIGDDGYLKKMNSLG FDEF-GRKTFNHIGEDGYFREFDRITFNII	TRGSDNNWPLLICTYPS 	

Supplemental Figure S2. Alignment of F-box associated domains and individual kelch repeats (K1-K5) from randomly chosen *A. thaliana* proteins obtained with ClustalX.



Supplemental Figure S3. FBKs and FBAs are closely related to each other. Rooted NJ trees including FBKs and FBAs of A: *V. vinifera*, **B**: *P. trichocarpa*, **C**: *O. sativa*, **D**: *S. bicolor* and **E**: *S. moellendorffii*. Alignment of full-length protein sequences and construction of the NJ trees was performed in MEGA, using a bootstrap value of 1000. Trees were rooted with leucine-rich repeat containing F-box proteins (LRRs) of the respective species identified by BlastP search with AtTIR1. FBK/FBA proteins are characterized by overlapping positions of the F-box associated domain and individual kelch repeats.



Arabidopsis thaliana

- Populus trichocarpa
 Vitio viniforo
- Vitis vinifera
 Oryza sativa
- Sorghum bicolor
- Selaginella moellendorffii
- Physcomitrella patens
- Homo sapiens
 Chlamydomonas rheinhardtii

Supplemental Figure S4. NJ tree generated using full-length FBK protein sequences of *A. thaliana*, *P. trichocarpa, V. vinifera, O. sativa, S. bicolor, S. moellendorffii* and *P. patens*. Numbers at branches indicate bootstrap values >50. Color code indicates species background of the FBKs. The NJ tree was devided in 40 ortholog clades according to the bootstrap support and phylogenetic distances, respectively. Ortholog clades were categorized in (i) unstable: lineage-specific clades, (ii) stable: clades including orthologs in at least two species, (iii) ancient: clades including orthologs in at least one lower land plant, one monocot and one eudicot species, (iv) superstable: clades with orthologs in all analyzed land plant species.

Α Maximum Likelihood



В Bayesian



С Neighbor-joining



Supplemental Figure S5. Representative phylogenetic trees. **A**: Maximum likelihood (ML), **B**: Bayesian and **C**: Neighbor-Joining (NJ) trees from 43 representative FBK protein sequences. At least one sequence from each of the clades of the NJ tree from Supplementary Figure 4 was randomly sampled. The number of the clade from which the sequence was sampled is displayed after the bracket. Single sequences not belonging to a group of orthologs are labeled as clade #a. The Bayesian and NJ trees display numbers at the nodes that have bootstrap values >45%; the ML tree displays nodes with bootstrap values of 100%. Sequence names are abbreviated as in Supplemental Fig. S6.

F-Box

Kelch-1

igi Chlre3	ON DRIDSNIL VSIDIS FUTPREVVTASI TIMOLAAAA KADVING		ASSE
Sel_417121	PIWSQUELEUQLHUNFUELPALCRGKSVCKAWKSAIQGLGYSK	AHRFSNGQW-MIMKDNSVFYRPQNIMCNELD	LSSLVKIEPPEGSEP
Sel_65366	ELIPGLEFDVALHOLVRVEHTSHPOMORVCREWESTIASPDFYA	TERKKCATTRSAIVVAQAHKSEALPPFGDSLYYPS	SRSTERICPICELGD
Sel_87207	TLIPGLRDSLALQOLAR VPRAYYPAL RRVSRMWQGTILGRQLFK	IRKDIGLOFPWIMVPFSSSSTCSSWEAYDPV	ENVERDIGTIESTNP
Sel 402181	-ITPGLERGVAQSOLARVERGLIPRERLVSROWNOAL REDUITS	MOSETSASRSSELLCTOERVSCVYNES	LDGCHEVEVPRIILP
Sel_403983	DLIPGLPDHLVIOVLSRISWWDFSSAIRVSRGWLAAIO-ETA	KN-ATASLRRPRCYPFFMISIOAPH	SSGREIDESIEGLSC
Sel_83069	KLIPGLPNDLAILCIARLPEGMFPLLELVSSAWKRAVSSETFRI	MEHQGEFLQGWINVLVESATGAAFRAFDED	ANRYYNMSPVEANIS
Sb04g02051	DLIPGLPEDLAKICLALVPRTHFPVMGAVSKRWMSFLESKELIA	VRKEVGKLPEWVYVLTPDAGAKGSHRETHECS	GOKOSPILERMEGLTK
Sb05g02375	EILIGVIGREIMISOLLRIPRSYYYDVAOVNRSFYSIVRSGELYF	URREAGIVEONIMCSCNVLEMEGFDEC	ROR FSIESMEIECF
SDU6G03335	SELECTION OF THE DEFAUSSES DYSKETACT NEW FRONT COOPERATION	I ERRIEV TEHEVET ACT MPERRENEE	PORMANDERMECTEC
GSV2685500	PITIOGLPDD TAL I OLARWPRKYHTLIKOVSRWRDI V SSEEWHA	YEOKHKLDEEW IMALCEDK FERVCCYVIDE YST	RRS KLIEGE PRSL
GSV3232300	ELIPGIPEE IAELOLIHVEYPYQALARSVSSSWNKA I TDPSFLI	SKKIDSLSOPYDFVFASSKSTSRIQEQADD	SGRUFVILEPMECSAA
GSV3233300	EMFQ-USDEVLSHIDSRLTPRDIASVASVCKRLYQUTKNEDUWF	UVCQ-NAWGCMNDTFVLDL-NAT	NPENOHVKVSSPPPG
GSV3240400	DUNGDULERVISWIPTSVFFRUTSVCKRWKSIADSATFOI	ACSOIPSRDWFFMVDPHLNOWVVFDSA	ERN ² KTUNHPULLOL
GSV0228/00	P-HIKLEUDILHIIFSILELKUIIIOKSVOKFFIUIDIAPAPME STHEN DDUVAAVHICITTEDDOSDEDATSDAMDIEISAATHII	EPSIDI DOHLI CI EDIDOSI ASDIII DEAA	SNU VRFELSFLPFR
Os02g21110	RTIPTIPDEUSFOLLARI PELYYLKIKI WSOAWKAATTSSEUSO	UBREUGLTPEWIAVLTKLEPNKLDCYMIDDL	FRKZORIE PM SEVS
Os07q47650	STILLALPDDLATHCVALIPPRAAHP STALVSRAFHTITTRDPGTLA	ARRURLSDHVILSLRPPASASPLFFILLP	HPGWPPILE-LISPPV
Os08g13360	EAVARUGCDOVLSTUHLUPAESVLSFAAAORAFHAWASSDAUWE	ALCRRDWGARATAALARRRRCALSARRVVKGASER	PRASHSINLVAGWLV
Os10g25210	GFTGGLDDEMVLETLVRLPARSVLRORAVCTAWRRUTSDPAFLF	AHHHRORDLELIMFRGGSDRVGAIDL	HAAQLREVVDH
Pop174433	YSAEQUSDELENLIUAR VERSEYWK FPNVNKRILSUVKSGELFK	IRREIGVRPSSVFIFATGDKSWWMFDRQ	FCSRRKULDLL ADCC
Pop177961 Pop274431	STWAMI DEDITI NETT VDVDD EM I EDI DSVCKDWNSTHODSSELK	IENSOVDSHODOUT TEWKNDHTDOOS VESUDT	
Pop548662	ENTERINE DIENETIVE VEFTATI ALKSVOR WAS TEODS STEP	RATCTGOKLVVMAORVNPEVSPVYFTULEPD	TGDVCEUPPTEGESN
Pop780375	TILPGLPDHUSONOLTSUPPSILFSVSHAWRRUTYSS-UFA	PFFSUYALL ASSSDNOVDIIR-IELMSFDEI	SSLERSVESICKDPP
Pop800124	EIWKEFPEDLFEAVIARLPIATFFRFRSVOQKWNSLLDSQSFSC	HCAQVPQANPWFYTITĤENV	
Pop783326	PKIEKUPSEIISEIISRUPVKCLVRFKCVSKTWRSLISHPEFVK	NHIKRTKEDTNAHYKIFLSTDEHLSIDPD	DNLTTOLKFPV
AT1G14330	SUINDIGRONSISCIIRCSRSGYGSIASLNRSFRSFVKTGEIYF	NRRONOIVEHWVMFSCOLLEWVMFNEF	ERRYMNIE TM SFMC
A12G4413U	DTESSI DDDIVI NOTADVSERUVDTI SI VOVGDOSI I DSDRIVA		
AT3G63220	GULDG TPEA VAL ROLAH VELHLHPNI ELVSRSWRAAT RSHELFF	WEKEURSSPHLICVCAFDPENI WOVYSPN	CDRULTIPLLSRIR
AT5G43190	NIWSNUPNHULEHTUSLUPFKTLLTURSISRHLRSUILSPSFIS	DHSFSLPS-FLULSHPOGLLCFSUSPSSVSSLL	TRSSRSIK-L CYPF
Phypa11831	GITTE AL PDD VAMQOLLEVQPQSHAQLQQVSRRWNELVNSPWYYQ	ERKRSETSEKLICIMOVVEPKHSPMFGINVLNVQ	QRTWERESPIEDFPE
Phypa13924	FSUSALPDDVLLDOLARMPRAALQTAMMVOOKWRSTLKSTEFYF	MRKQNCRVENLEFVFGAGTGAVYCKSSGMAGELCSGRSI-A	ENDM LNGYHN
Phypa16375	GINEAN POLITARIO AR VERAQUALLI SAVORSWRLDI OSRVIJYI		SNR7 FALLAI NEOR
Phypal6675	ALWSNIFEHLHDILLAFIELPSFFREROVOKKWNEIVNSKNFLS		SURTHMIN SYFL
Phypa18968	PTIPELSDNTALVILALTELSYHOPIKRVCKKVOROUTTNEVL	MEK FORVKIPTEV FLLASAROOROOWRMFDEV	YNR ROLLOG CDYT
Phypa16912	- IWSN OPER VARILLAR OPLSSLIHTRLWSKSWDREI YSGRVMO	DGSVHENPRSWIFLFENGGPENPHKLHAFDPL	RNDVOTFTTICHFAT
Phypa63719	DIWGDLOKYILEMVYEKLPLOSFFLIREVCKSWNSIAC	ERRGFKDLIERPY-FVLMPFKPKLLAYNISRG	EWINKRIVERKTPLK
JFK-Hs	RSMSELPEEVLEYIIISFILPYQEHKTAALVCKQWYRIIKGVAH	IQCYH-GFMKA-VQEGNIQRES	RTYPYEGTPI
	1		
	Koloh 1	Koloh 2	
	Kelch-1	Kelch-2	
· · ·		Kelch-2	
jgi_Chlreg	Kelch-1		VID-LALTVDRSPRF
jgi_Chlre3 Sel_417121 Sel_65366	Kelch-1 GRDSMILF-GCGSGIRDYEYE-W-ELPLSGA-DPG TIV	Keich-2	VID-LTLTVDRSERF VYDSRVHKWVSSCRV RVLVREDRWEAMEDM
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207	Keich-1 ERDSMILF-EEGSEIRDYEYE-W-ELPLSGA-DPG TIVFWAI-OS HGGIPLFSGIAV-ESKUFIVEEWNQAMRSVFVFEFSRGATSRG GEVLK-CFAMMHI-KERLFIITEGKIYTSRKWRALNTHIGKESQC	Keich-2 ARyhsticasedgRifyfeg IarrsttriS Solveg IktthygarRifyaggRify Solveg RyffaccavddSifyaggTghergiRScd	VID-LULTVDRSERF VYDSRVHKUVSSCRV RYLVREDRUEAMEDM AVVPAQNAUIPLPAM
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540	Kelch-1 ERDSMILF-GEGSEIRDYEYE-W-ULPLSGA-DPG TIV	Keich-2	VID-LULTVDRSERF VYDSRVHKRVSSCRV RYLVREDREAMEDM XYVPADNALFURAM VYCSGAGRWRALEPM
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181	Kelch-1 GRDSMILF-GGGSGIRDYEYE-W-ULPLSGA-DPG HGGIPLFSGIAAV-ESKIFIVGEWNQAMRSVFVFDFSRGANSRG GEVLK-CFAMHI-KERIFIIGCKIYTSRKVRALNTHGKUSQC NDKECFVA-GRBLUVGFSFRMHPVINFXRADREEVSA2 IDIPPVTVVASGELLAECSTLFVCNPFUKVLRAN	Keich-2	VID-LULTVDRSERF VYDSRVHKVVSSCRV RYLVREDREAMEDM AVVPAQNAA IFFFAM VYCSGAGRERALFPM
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sel_40283 Sel_403983	Keich-1 GRDSMILF-GCGSGIRDYEYE-W-ELPLSGA-DPG TIVFYAI-OS HGGIPLFSGIAAV-ESKIFIVGGWNQAMRSVFVFDFSRGATSKG GEVLK-CFANYHI-KERIFIIGGKIYTSRKVRALNTIIGKWSOG NDKECFYAGRDILVVGPSFRMHPVTWRYRADRNEWSAA IDIPVTVVASGLABCSTLFVCNFHKVLREN GAPLSGROVCV-DSKIFVLGGRDEFLPDVFVLDLGRRTVOR SETWIGE ADVL	Keich-2	VID-LELTVDRSERF VYDSRVHKYVSSCRV RYLVREDREAMPDM AYVPAONAN IPEPAM VYCSGAGRWRALPPM IVDVCANRGEPIEDL IVDVCANRGEPIEDL
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_403983 Sel_403983 Sel_83069 Sel_402051	Kelch-1 CRDSMILF-CCGSCIRDYEYE-W-ULPLSGA-DPC TIV	Keich-2	VIE-LELTVDRSERF VYDSRVHK VSSCRV RYL VREDREAM9DT AV PAONAW IPIPAM VYCSGACRWRALPPM IVI VCANRGERIADPM IVI VCANRGEPI9DL VLD VRERRHOM9SM VLD VRERRHOM9SM
jgi_Chlreg Sel_417121 Sel_65366 Sel_87207 Sel_3540 Sel_402181 Sel_403983 Sel_83069 Sb05g02375	Kelch-1 CRDSMILF-CEGSCIRDYEYE-W-LIPLSGA-DPC HGGIPLFSGIAN-ESKIFIYCEWNQAMRSVFYFFFSRGATSRC GEVLK-CFANWHI-KERIFIYCEWNQAMRSVFYFFFSRGATSRC GEVLK-CFANWHI-KERIFIYCEWNQAMRSVFYFFFKVRA DIPFUYVASCELAECSTLFVCNFFFKVLRE GAPLSCRQCV-DSKIFYLCERDEFLPUYFYLDLGRRTTVR SETWOCF-ACVAL-DSKIFILGCRDEFLPUYFYLDLGRRTTVR ACF-GVVI-GEKIFIIACYSCVSDEVYCVDSCINRUTVI TLADKESLAV-CTNILWFCR-VEAHVLSYSLUNSWUTVE	Keich-2	VIE-LELTVDRSERF VYDSRVHKUVSSCRV RYLVREDREAMEDM AVVPAONAMIPTEAM VYCSGACRRALEPM
jgi_Chlreg Sel_417121 Sel_65366 Sel_87207 Sel_3540 Sel_402181 Sel_403983 Sel_83069 Sb04g02051 Sb05g02375 Sb05g02335	Keich-1 GRDSMILF-GGGSGIRDYEYE-W-ULPLSGA-DPG TIVFVAI-OS HGGIPLFSGIAAV-ESKIFIVGEWNQAMRSVFVFDFSRGATSRG GEVLK-CFAMHI-KERIFIIGCKIYTSRKVRALNTHGKWSQC NDKECFVAGRBLUVGFSFRMHPVIWRADRNEUSAF GAPLSGRCVCV-DSKIFVLGCRDEFLPDVFVLDLCRRTWQR SETWOGF-ACVAL-DSKIFVLGCAREVCGVFTVDAFNKVQRG AGF-GVVI-GEKIFIIACYSCVSDEVYQVDSCLNRTVT TLADKESLAV-GTNLLMFGRR-VEAHVVLSVSLLINSWTT	Keich-2	VID-LELTVDRSERF VYDSRVKGVSSCRV RYLVREDREAMEDM AYVPAQNAAITPEPAM VYCSGAGRWRALPPA IYDVCANREPPEPL VYDVCANREPPEPL VYDLEONKGTLIEGI LYDSEMRTWTTLESM AAETLENTRDFENF
jgi_Chlrea Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sel_403983 Sel_83069 Sb04g02051 Sb05g02375 Sb05g02375 Sb05g02375	Keich-1 CRDSMILF-CCGSCIRDYEYE-W-ULPLSGA-DPC TIV	Keich-2 	VIE-LELTVDRSERF VYDSRVHKIVSSCRV RYLVREDREAMEDT AVVPAONAGIPTEAM VYCSGAGRWRAIEPM VYCSGAGRWRAIEPM VIDYREKRHOMSSG VIDYREKRHOMSSG VIDYREKRHOMSSG VIDSEMRUTTIESE IYDSEMRUTTIESE IYDSEMRUTTIESE IYDSEMRUTTIESE IYDSEMRUTTIESE IYDSEMRUTTIESE IYDSEMRUTTIESE IYDSEMRUTTIESE IYDSEMRUTTIESE
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jgi_Chlrea Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_403983 Sel_83069 Sb04g02051 Sb05g02375 Sb05g02375 GSV1396300 GSV2685500 GSV2282500	Keich-1 GRDSMILF-GGGSGIRDYEYE-W-LIPLSGA-DPG HGGIPLFSGIAAV-ESKIFIVGEWNOAMRSVFVFDFSRGAVSRG GEVLK-CFAMHI-KERIFIIGGKIYTSRKVRALNTHIGKVSOC NDKCFADLUVGFSFRMHPVIDERRDNEWSAA IDIPFVTYVASGELAECSTLFVCNPFUKVLREM GAPLSGRCVA-DSKIFVLGGLAECSTLFVCNPFUKVLREM SETWOGF-ACVAL-DSKIFVLGGRAEVCGDVFTVDAFNKVOR ACF-GVVI-GGKIFIIACYSCVSDEVYCVDSCLNRUTVI TLADKESLAV-GTNILVFGR-VEAHVLSSLLINSVTTG FTYESLAV-GTNILVFGR	Keich-2 A	VIE-LELTVDRSERF VYDSRVKWVSSCRV RYLVREDREAMEDM AVVPAQNAXIPLEAM VYCSGAGRALEPM VYCSGAGRALEPM VYDVCANREPA9DL VYDVCANREPA9DL VYDLEQNKKTLIEGL AAETLENTRRDFENF LYNSELGTWOTLEDM RYDPVSDTKAAVAKM TVPPVSDTKAAVAKM
jgi_Chlrsi Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sb04502051 Sb05902375 Sb06500335 Sb0650035 Sb0650035 Sb0650035 Sb0650035 Sb0650035 Sb065005 Sb065	Keich-1 CRDSMILF-GCGSCIRDYEYE-W-LIPLSGA-DPC TIV	Keich-2 EYHSMCASEDGRLEYFGEIARRSTTRIS- SVGDNRFWECVVCVGEIARRSTTRIR- SDLPGARSFEACCAVDDSHEVAGGH-DESKNAIRSCD DET TIPECCPASASFGGMAXVAGGACFGSTPIRDAE DET TIPECCPASASFGGMAXVAGGACFGSTPI	VID-LULTVDRSERF VYDSRVHKYVSSCRV RYL VREDREAMEDD VYCSGAGR RAIEPM VYCSGAGR RAIEPM VYCSGAGR RAIEPM VYCSGARR RAIEPM VID LOKKTLIEGI VYD LEOKKTLIEGI VYD LEOKKTLIEGI VYCLEVKELEVK
jgi_Chlrea Sel_417121 Sel_65366 Sel_87207 Sel_3540 Sel_402181 Sel_403983 Sel_83069 Sb05g02375 Sb05g0232300 Sb05g2232300 Sb05g2232370 Sb05g22370 Sb05g02375 Sb05g025 Sb05g025 Sb05g025 Sb05g025 Sb05g025 Sb05g025	Keich-1 CRDSMILF-GCGSCIRDYEYE-W-ULPLSGA-DPG TIV	Keich-2 	VID-LELTVDRSERF VYDSRVHKVSSCRV RYL VREDREAMEDM AYVPAONAWIPTEAM VYCSGACREALEPM VLOYAORREPH9DL VIDYREKREHOMESG VYDLEONKWTLIEGI LYDSEMRTWTTESM AAETLENTRRDFENF TYNPHINSKKSHLDP MYDPYDGXAVAKU
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jgi_Chlrei Sel_417121 Sel_65366 Sel_87207 Sel_403983 Sel_403983 Sel_403983 Sel_403983 Sel_403983 Sel_403983 Sel_40398300 GSV32323300 GSV32323300 GSV32323300 GSV32340400 GSV3240400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV32400 SSV34000 SSV34000 SSV34000 SS	Kelch-1 CRDSMILF-GCGSCIRDYEYE-W-ULPLSGA-DPG HGGIPLFSGIAV-ESKIFIYGGWNQAMRSVFYFDFSRGATSRG GEVLK-CFAWHI-KERFFIZGKIYTSKVRALNTHGK SOC NDKECFAV-GREILVGGKIYTSKVRALNTHGK SOC NDKCCAGREILVGFSKIYTSKVRALNTHGK SOC NDKCYAGREILVGFSKIYTSKVRALNTHGK SOC SETWCF-ACAL-DSKIFILGGKIYTSKVRALNTKGKKVOR ACG-GVVI-GCKIFILGGKIYTSKVRALNTKGKK SETWCF-ACAL-DSKIFILGGCDEFLPDVFVIDCRTTOKKVRA SETWCF-ACAL-DSKIFILGGCSDEFLPDVFVIDCKITKVRAL GAPLSGR-CVCA-DSKIFILGGCSDEFLPDVFVIDCKTR GRNYLHF-EVF0I	Kelch-2	VID -LULTVDRSERF VYD SRVHKY VSSCRV RYL VREDR EAMEDN VYD SRVHKY VSSCRV RYL VREDR EAMEDN VYC SGAGR RATEPM
jgi_Chlrsi Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_403983 Sel	Kelch-1 CRDSMILF-GCGSCIRDYEYE-W-ULPLSGA-DPG HGGIPLFSGTAX-ESKFIYGGWNOAMRSVEVFEFSRGATSRG GEVLK-CFAYHI-KERFFIYGGKIYTSKURAINTUGKSOG NDKECFYA-GRBLUYGFSFRHHYIWRFRADREESAA IDIPYTVVASGELLARCSTEVCNPFURVLRR GAPLSGR-CVCV-DSKHILGGCDEFLPUVVLLGRKTVORG SETWGF-ACYL-DSKIILMGGAREVCGUVFIYLAFRNKVOR ACFGVVI-GCKIFILGSCSURVYCYDSCLNRWTVI TLADKESLAY-GTNILWFGR-VEAHVVLSSLLINSUTT GMNYLHFEVFOI	Keich-2	VIE -LELTVDRSERF VYDSRVHKYVSSCRV RYL VREDREAM9DN AVYPAONA IFFBAM VYCSGAGR RAHPPM TOTALSAN IFFBAM VYCSGAGR RAHPPM TOTALSAN IFFBAM VICSGAGR RAHPPM TOTALSAN IFFBAM VICSGAR IFFBAM VICSGAR IFFBAM AAETLINTRDFPH AAETLINTRDFPH TYDFHINSKSHLDP TYNFHINSKSHLDP
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sel_403983 Sel_403983 Sel_83069 Sb05g02375 Sb05g02375 Sb06g03335 Sb05g02375 Sb05	Kelch-1 CRDSMILF-GCGSCIRDYEYE-W-ULPLSGA-DPG HGGIPLFSGTAV-ESKPFIVGEWNOAMRSVEVFEFSRGATSRG GEVLK-CFAMYHI-KERFFIVGEWNOAMRSVEVFEFSRGATSRG GEVLK-CFAMYHI-KERFFIVGEWNOAMRSVEVFEFSRGATSRG GEVLK-CFAMYHI-KERFFIVGEWITSRKVRALNTHIGKKSOT NDKECIVA-GRADINGERSTUREVSAU TDIPFVIVVASGELLACSTLFVCNPFIKVLREN GAPLSGR-CVCU-DSKNFVLGERDETLPUVFVLLGRRTTORR SETWOCF-ACVL-DSKNFVLGERDETLPUVFVLLGRRTTORR SETWOCF-ACVL-DSKNFVLGERDETLPUVFVLLGRRTTORR SETWOCF-ACVL-DSKNFVLGERDETLPUVFVLLGRRTTORR SETWOCF-ACVL-DSKNFVLGERSEVGAVGVSTLVAFKKORG ACF-GVVI-GCKNFVLGYSCVSDEVYGVDSCLNRVTVT TLADKESIAV-GTNILVFGER-VEAHVVLSYSLLINSUTTC GMNYHF-EVFOI	Keich-2	VIE -LELTVURSERF VVDSRVHRVSSCRV RYLVREDREAM9DT AVPAONAN IPPEAM VYCSGAGREALPPA VICSGAGREALPPA VICSGAGREALPPA VIDYREKERHOM9SS VIDYREKERHOM9SS VIDYSERRTHTTPSS AAETLINTRRDFPNF VIDYSERTTTPSS AAETLINTRRDFPNF VYDPSSKSTROTPIL VYDSETTCTEDI TYNPHINSSKSHLDP VIDSTROTPIG VIDYSETTCTEDI VIDYSETTCTTEDI VIDYSETTCTTEDI VIDYSETTCTTEDI VIDYSETTCTTEDI VIDYSETTCTTEDI VIDYSETTCTTEDI VIDYSETTCTTEDI VIDYSETTCTST
jgi_Chlrei Sel_417121 Sel_65366 Sel_87207 Sel_402181 Sel_83069 Sb04g02051 Sb05g02375 Sb06g02375 Sb06g02375 Sv1396300 GSV2685500 GSV32323300 GSV3240400 GSV2287100 OS02g36520 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS07g47650 OS17g40 S1360 S160 S160 S160 S160 S160 S160 S160 S1	Kelch-1 CRDSMILF-GCGSCIRDYEYE-W-ULPLSGA-DPG HGGIPLFSGTAV-ESKFFIVGEWNOAMRSVEVFDFSRGATSR GEVLK-CFANVHI-KERFFIVGEWNOAMRSVEVFDFSRGATSR GEVLK-CFANVHI-KERFFIVGEKIYTSKVRALNTHGK SOO NDKCCAI-GRBILVGFSTMTVVINGRADRSESAA IDIPFVTVVASGELLAECSTLFVCNPFIKVLREM GAPLSGR-CVCI-DSKIFULGCRDEFLPDVFVIDCRTTOKV GAPLSGR-CVCI-DSKIFULGGRDEFLPDVFVIDCRTTOK GAPLSGR-CVCI-DSKIFULGGRDEFLPDVFVIDCTNTUTKVREM GAPLSGR-CVCI-DSKIFULGGRDEFLPDVFVIDCTNTUTKVREM GAPLSGR-CVCI-DSKIFULGGRDEFLPDVFVIDCTNTUTKVREM GAPLSGR-CVCI-DSKIFULGGCGDATDEVYSVDASTRVSTT GANYLHF-EVF0I	Keich-2	VID -LULTVDRSERF VYD SRVHKY VSSCRV RYL VREDR EAMSDN VYD SRVHKY VSSCRV RYL VREDR EAMSDN VYC SGAGR RATEPM
jgi_Chlrsi Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_403983 Sel	Kelch-1 CRDSMILF-GCGSCIRDYEYE-W-ULPLSGA-DPG HGGIPLFSGTAV-ESKIFIYGGWNOAMRSVEYFEFSRGATSRG GEVLK-CFAYHI-KREFFIIGGKIYTSKURAINTIGKSOO NDKECFYA-GRBILVYGFSFRHPYIWRWAADRSESAA IDIPYTVYASGELLABCSTEVCNPFHYVRWRAADRESAA IDIPYTVYASGELLABCSTEVCNPFHYVRWRAADRESAA IDIPYTVYASGELLABCSTEVCNPFHYVRWRAADRESAA IDIPYTVYASGELLABCSTEVCNPFHYVRWRAADRESAA GAPLSGROCC-DSKIFULGGRDEFLPUVFULGRRTVORG SETWGF-ACVI-DSKIFULGGRDEFLPUVFULGTRRTVORG AGF-GGVVI-GGKIFIIGCYSCYBOYOVDSCIN RTVT ILANKESLAV-GTNILVFGR-VEAHVVLSJSLLINSUTT GMNYLHF-EVFOI	Keich-2	VID -LULTVDRSERF VYD SRVHKY VSSCRV RYL VREDR EAMEDD VYD SRVHKY VSSCRV RYL VREDR EAMEDD VYCSGAGR RAIEPM
jgi_Chlred Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sbl4502051 Sb05902375 Sb06902375 Sb0690335 Sb05902375 Sb05	Kelch-1 CRDSMILF-GCGSCIRDYEYE-W-ULPLSGA-DPG HGGIPLFSGTAV-ESKPFIYGEWNOAMRSVEYFEFSRGATSRG GEVLK-CFAMYH-KERFFIIGEK IYTSRKVRAINTIGKKSOG GEVLK-CFAMYH-KERFFIIGEK IYTSRKVRAINTIGKSOG GAPLSGR-OCCO-DSKNFVLGERDELPUFYULDKRTTORK SETWOCF-ACYL-DSKIILWGESPERHPVIWRTRADRESAA IDIPFYIYVASGELLARCSTLFVCNPFIKVLRE GAPLSGR-OCCO-DSKNFVLGERDELPUFYULDKRTTORK SETWOCF-ACYL-DSKIILWGEREVGDVFIYDAFRKVORG ACF-GVVI-GCKIFIILGYSCYSDEVYOTDSCINRTVIT TLADKESLAY-GTNILWFGER-VEAHVULSYSLLINSSTTT GMNYHF-EVFOI	Keich-2 ABYHSMCASEDG RLEYEGG IARRSTTRI SVGG IKTTHVGAR HLC SDL PGARSHFACCAVDD SILVAGG H. DESKNAR PET TDPCCFASASFG MAVYAGG AGFGSTSTPL PET TDPCGFASASFG MAVAGG AGFASASFGE SELTTPCGFASASFG MAVAGG AGFASTSTPL PET TDPCGFASASFG MAVAGG AGFASTSTPL SELTTPCGFASASFG MAVAGG AGFASTSTPL SELTTPCGTASASFGA MAVGG CARSSTDFF SELTTPCGTASASFGA MAVGG CARSSTDFF SELTTPCAGTASASCGA SUNTIL SELTTPCAGSTSTTFAGSTDF MAVHGG CARSSTLITL	VIE -LULTVDRSERF VVDSRVHKVSSCRV RYLVREDREAMSDN AVPAONATIPDEAM VYCSGAGRWAIEPM VICSGAGRWAIEPM VICSGAGRWAIEPM VIDSGAGRWAIEPM VIDSGAGRWAIESG VID VCANRGEPIEDI VID VCANRGEPIEDI VID VSCARGEPIEDI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VSCHVIDSKEEPPR VFILSNIG SELEPM VFILSNIG SELEPM VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VID VSCHKKVLEGI VSCHKKVLEGI VID VSCHKKVLEGI VSCHKKKVLEGI VSCHKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK

Kelch-3

Kelch-4

jgi_Chlre3	-GCSLFCLWVV	GGN <mark>C</mark> D-	LAR			SGVD		DVWTL	-DEKSWE
Sel_417121	EIAOTSFRDAN	DMLLREC-K	LYFITATWTSLP	MGLHOPTYDE	PCL	YNNTSLVY	CAGKLVLAL	DAKTL	-GFVYLDEA
501_65366 501_87207	NTADYKINGVEVT		TGWVSGIGSDSQ-G	EFSRSADFLIDEAT	GRUSRAE				
Sel 33540	HTARKEOSCEV	MD@C	FYVICGTDGR-D	OPVTAGER FOR RT	RRETVI	PGLMAPPLVM	WGDVIWAW	HPNG	
Sel_402181	ELKPATAMTAM	VEEGK	WELSH	GAGL	GTNTEVNAVEM	CREFRTPLVC	SGVGDUVCV	TSHLSP	-KALVFDVS
Sel_403983	NVPRTECNEGY	IG <u>e</u> -F	ICVVGGYSS	-VEKSOPLDDDQS	TFW		VSSA	DAISIG-	
Se1_83069	HCVRSSORETV		FWYIANYGDHPO	RASAL FFNLAS	KSTTLI	PEMASHKVAL	ARFONILVV	HOS	-KIMRMDPE
Sb04g02051	NRADOMOSCEE	FESMDD_0	FYVIC-GRAFFH-N	EVISCASERITEN			VILGEN FUI	EWKNUR-	-SPAIRNPA
Sb06g03335	OHSAV		LYVLCORS	LSDAKYOIIK	PVD	DMG		OTHHS	-NITYMGRSO
GSV1396300	NLP_KLOSCFF	MDC-B	FYVIGGMSSHTD	-CLTCG EMNIET	RIMRRIEMPGS	NIGTSPPLVM	WVNNOLMSA	DÕATN	-EVKKYDKŠ
GSV2685500	NIVPDIEDSIV	LDE- <mark>K</mark>	I <u>YI</u> RCGTSGL	.TSHVYAVVYNESH	IGT QHAD-ADM	VLGW-QGPAV	VVDGTLYVL	DORLGT-	-RIMMWOKE
GSV3232300	RSGLARYDAA	VGN- <u>k</u>	LYVTEGWTWP-F	SFSPRGGVYDGDR	DTWOEMS-LGM	REGM-TGISV	VLRNRI FVL	SEYGDC	-RMKVMVPD
GSV3233300	PPONOST HATA	MNS	FST			SESVIGGERI	LMFGGMAKS	GELSSL	TERIMOLS
GSV0228700	PPEMFR FOES	S-R	FKWFC		AGN	RVCF		SAKRVG	-REALWEYS
Os02g21110	PRORAGEVEEV	AGAGDGREE	FWVMCVALGLWS		GKMREIGDM	WEEWRLGPV	VISAEVFML	DGH	DIFRINFS
Os02g36520	PFMKAQVLPTA	LADVLKIATMASYKC-K	LYVPO-SLYSWP-F	FFDIGGEIYDPEL	NSTETMA-DGL	GDGWGTKLGI	VVNEELYTL	EPSSSLI	DQIKRYDSE
Os07g47650	FREKWMHGSAS			DRGGLAMDEAT	EAMAPVS-PIL	DMG <u>M</u> -KGRAA	WVGG <u>III YSY</u>	DYLG	-OVKGYDPD
Ostsg13360	PLSESGHTLTW		MVLFCGRGSEF		IDV₩ 95Т0АСКНОП1	PT DM	<u>-u</u> u	<u>DIN</u>	<u>ERM</u> -PK
Pop174433	ROREKLIGSECF	MDN-8	FYVIC-GRNEEG	NVLTCAPANDEDK	KANDLIPMEDT	PIATSPPLIM	WVNNEDWAL	EPSSN	OKVMLKR
Pop177961	STAMVPFICVV	YDE-	WFLKC-LGSHR	EVMSEAYDEET	STOTPIS-DGM	VAGE-RNPSI	SLDGHLMAL	CRDGC-	KURVYDEA
Pop274431	AVNLCSSKMAY	CDS-F	LILEALSP	LGLMMMRLDT	GYNEHIP-AKF	PRSEDGYLV	GTOKREFLV	GRI	-GYSWELD
Pop548662	ARE DECKAIF	RHC-N	ILHVIGGYSTEMQ-G	RFERTA VFEIAS	WO KNVLDLED.	AMCP-KTCVC	GSDGELMMC	RGG	
Pop780375	KDGRFSREPIG		CLYMVNG	NAPKEGL VYD VEE	NOWNDMP-RGM		TMNEDIMVV	NEVTG	
Pop783326	PCSVI	NI_LNC	DINILWV	CCDGEINVIN SLK	GTIANG		SLOGI	RSDPE-	SCAMARTS
AT1G14330	NKPEKMESEVF	MDC-R	FWIEGIGGNDS	KVLTCGDEFDLET	KKTEIPMPPR	SREMARPLV	WVNNE MAA	DH-ADM-	-EVRKYDKE
AT2G44130	TEGRDECOCFA	VGMGF	FOVLSGYGTESO-G	RFRSDGEINDEAT	DSSRI	DNVWPRGRTA	GDFRSSSTL	WCFTDT	-DEQSWETN
AT3G46050	TLDLTVOMSVV	P e -S	LVMSC	KV <u>YD</u> M	NGL	KLNF-KNICL	VEIENMMCQ	TKVCEG-	-VIVWCEPE
AT3G63220	OTHNSACSELV	VNE-B	VHNLH	-KGLSTVQVLESVK	LGCDVK	DYG <mark>0</mark> -QGPMV	VEDVINVM	SHG	LVFKQE
AT5G43190	PDIVERKFT	SVCYHN-Y	EHNYCLWH	ORCOCHEWENECA		YNWP		NCZ	MEUDERVE
Phypa11031	PRROYGELCAA	VNC_V	FYVVCLGLTTOP-Y	AYVASMDAFDTKI.	NOTRV-LPM	GGCVTACT	VVGRATYME	TSHAV-	FUSFWKYD
Phypa16375	KISMELYDSAV	LDN-G	FYVVNS-S	SENLVGLVYDEKO	DE VYMA-HGL	NTGE-OSKT	AMNGKUYAV	GDSHSLI	EEISVUNGK
Phypa16675	PSRVALITETA	FINC-Y	LYSMSF	GATTGVLAFDVNŘ	GT <mark>W</mark> DQVK-VKM	PLAL			
Phypa16942	GMRLDTODAAL	DNC-L	LICTALVGTDAL	VAFDIHR	GVVSEV	ANEFROTPLV	CGGRIVMAV	APVDD-I	DCFYALNAV
Phypa18968	HVSKWeSECI	LDN-K	FFVICGOGSEKO	-ALTSGOYNDESE		ENMARPLVA	<u>WVKDOLMAA</u>	DASTM	<u>-ELNAMHKGI</u>
Phypa16912 Phypa63719	SCREPPHI TTC			RETHIPMANDIKI					TITINATO
JFK-Hs	PSPKAGATLVV	YKD-L	LVLFCGWTRPOE	RFFDEIHTMSESK	NWENCI	VTTHAGHSSC	MIDDKMIVF	GGSLGS-	-ROMS
			30	250		. 270	.280	290.	
	Kelch-4		Kel	ch-5					
	Kelch-4		Kel	ch-5					
jgi_Chlre3	Kelch-4	LMF	Kel	ch-5 NLDVGACPAPWGHP	VLGAPPGKRMA	ISRTDLLV	FGG		YS e
jgi_Chlre3 Sel_417121	Keich-4	LMF	- <mark>€€</mark> SEEL-CNHITW	ch-5 vldvgacpapwghp nmhqwslv	VLGAPPGKRMA VA	ISRTDLLV GGGAEI-	FGG01 TLFLSH		YS FKGL
jgi_Chlre3 Sel_417121 Sel_65366	Kelch-4	LMF BREIMPAELRY-LRLQA	_ <mark>GC</mark> STEL_CNHITW R	ch-5 NLDVGACPAPWGHP nmhqwslv	VLGAPPGKRMA 	ISRTDLLV GGGAEI-	FGGWI TLFLSH]	FKGLC
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540	Keich-4	LMF		Ch-5 WLDVGACPAPWGHP NMHQWSLV 	VLGAPPGKRMA 	ISRTDLLV GGGAEI- SSGINE- RPARSG-	FGGMI TLFLSH GVL/ZRRV		FKGLC
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181	Keich-4	LMF PREIMPAELRY-LRLQA 	ECCESTEL ENHITW	Ch-5 NLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV	VLGAPPGKRMA -VA	ISRTDLLV GGGAEI- SSGINE- RPARSG-	FGGMI TLFLSH GVLMRRV	 	FKGLG FKGLG PVGDNFVYN KRNFHLLGF
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sel_402181	Keich-4	LMF	Kel <u>CES</u> EEL- <u>C</u> NHITW R	Ch-5 wldvgacpapwghp nmhqwslv gvgeevwlieldv filqsvhrsv	VLGAPPGKRMA -VA	ISRTDLLV GGGAEI- SSGINE- RPARSG-	FGGEI TLFLSH GVLERRV SNOERT	AEAS1	FKGUS FKGLG PVGDNFVYN KRNFHLLGF
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sel_403983 Sel_83069	Keich-4	LMF	EGESTEL-GNHITW R	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV JILOSVHRSV WONRNRSSIIAEV	VLGAPPGKRMA -VA	ISRTDLLV GGGAEI- SSGINE- RPARSG- NSK	FGGMI TLFLSH GVLERRV SNOTRT FTRMSV	AEAS	FKGUS FKGLC PVGDNFVYN KRNFHLLGF SSGIILASA
jgi_Chlre3 Sel_417121 Sel_5366 Sel_87207 Sel_33540 Sel_402181 Sel_402983 Sel_83069 Sb04g02051 Sb0502275	Keich-4 	LMF	ECSPEL-CNHITW R	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV VGUSVHRSV WQONRNRSSITAEV VGCCGV	VLGAPPGKRMA VA	ISRTDLLV GGGAEI- SSGINE- RPARSG- RPARSG- NSK DPAAPM-	FGGTI TLFLSH GVLTRRV SNOTRT FTRNSV GSETCT GSETCT	AEAS	FKGLC FKGLC PVGDNFVYN KRNFHLLGF SSGIILASA PSGSCLCSV
jgi_Chlre3 Sel_417121 Sel_6366 Sel_87207 Sel_33540 Sel_402181 Sel_403983 Sel_83069 Sb04902051 Sb05g02375 Sb05g02375	Kelch-4 	LMF	Kel -GESEL-ENHITW R	Ch-5 WLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV SILQSVHRSV SWQNRNRSSITAEV GGGGGVYQTL GGGGGVYQTL	VLGAPPGKRMA -VA -PF-IDAC -LGGLLNRCS- -CH-LGTAS MY IEICS-	ISRTDLLV GGGAEI- SSGINE- RPARSG- NSK DPAAPM- IDESYG-	FGGW I TLFLSH GVLWRR SNOTR FTRWNSV GSEW CT WVP	AEASI IDGK ADMKD-S SKLKI NNEPPDI	FKGLG FKGLG PVGDNFVYN KRNFHLLGF SSGIILASA PSGSCLCSV RSGSFVYNG VAKH
jgi_Chlre3 Sel_417121 Sel_63366 Sel_87207 Sel_402181 Sel_403983 Sel_83069 Sb04g02051 Sb05g02375 Sb05g02375 Sb05g03335	Keich-4 	LMF	Kel R-GESTEL-CNHITW R-WGLGFK S-WGLGFKIRS SWEIQSG ICDKI WIGGKIRS HEDKOLLFPLEEEP C-CNMLVIGARSP HPCLVYI GCDSJUVIGGHRGP	Ch-5 WLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV HILQSVHRSV WQNRNRSSITAEV GGGGV	VIGAPPGKRMA -VA	ISRTDLLV GGGAEI RPARSG- NSK DPAAPM- DPAAPM DESYG- EDGNAG	FGGUI TLFLSH GVLURRV SNOTRT FTR'NSV GSEVC GSEVC KMKCP KMKC	AEASI AEASI DGK ADMKD-S SKLKI NNEPPDI NNEPPDI	FKGL FKGL PVGDNFVYN KRNFHLLGF SSGILLASA SSGSILASA RSGSFVYNC VAKH
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_3540 Sel_402181 Sel_403983 Sel_83069 Sb05g02375 Sb05g02375 Sb06g03335 GSV1396300 GSV2685500	Keich-4 	LMFFALAG GRRANAESHG ERDPLFPK STGGLYNGSYRFALEC LTGSSSTRFSFGV EBRYTSVHGGG-IMFRS 	ECSPELCNHITW R	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV GUGESVHRSV WQNRNRSSITAEV GGGGV YGGGV YGGGV YGFU	VLGAPPGKRMA -VA	ISRTDLLV- GGGAEI- SSGINE- RPARSG- NSK DPAAPM- LDESYG DUGNAG- -NVGNMG-	FGGT I TLFLSH GVLTRRV SNOTRT FTR NSV GSEVCT VV GPDZN GPDZN GYUVSS-S	AEAS	FKGL FKGL FVGDNFVYN KRNFHLGF SSGIILASA PSGSCLCSV RGSFVYNG
jgi_Chlre3 Sel_417121 Sel_65366 Sel_87207 Sel_33540 Sel_402181 Sel_402181 Sel_402051 Sb05g02375 Sb05g02375 Sb05g03335 GSV1396300 GSV2685500 GSV22323300	Keich-4 	LMF EREIMPAELRY-LRLQA ERDELFPK GTPGLPGY STGGLYNRSSYRFALEC LTGSSSTRFSFGV EBYTSVHGWG-IMFRS 	ECSPEL-CNHITW R	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV VGUSVHRSV WONRNSSITAEV CG	VLGAPPGKRMA VA	ISRTDLLV- GGGAEI SSGINE RPARSG- NSK 	FGGN I TL FL SH GVLERR V SNOR R V SNOR R V SNOR R V GSEN C T GSEN CT GSEN C GPD GPD GVM VSSS WVER V	AEASI ADKC ADMKD-S SKLKI NNEPPD VLSVREI IPKL7 MAAPIA	FKGL FKGL PVGDNFVYN KKNFHLLGF SSGIILASA PSGSCLCSV RSGSFVYNC SSGSFVYNC
jgi_Chlre3 Sel_417121 Sel_6366 Sel_87207 Sel_3540 Sel_402181 Sel_403983 Sel_403983 Sel_83069 Sb04g02051 Sb05g02375 Sb05g02375 Sb05g02375 Sb05g03335 Sb04g02051 Sb05g02375 Sb05g025 Sb05g	Keich-4 	LMF	Kel 	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV ILQSVHRSV WQNRNRSSITAEV GGGGV YEGEV	VIGAPPGKRMA -VA -PF-IDAC -LGGLLNRCS- -CHLGTAS- -MY -IG -IVLHSWEP -IG -IVLHSWEP -IG -IVLHSWEP -IG -IT	ISRTDLLV- 	FGGUI TIFLSH GVLURRV SNOTRT FTRUNSV GSEUCT FTRUNS GVMVS GVMVSSS GVMVSSS FTV TRAIVLGGQ	AEAS DGK ADMKD SKLKI NNEPPDI VLSVREI IPKL MAAPIAI TGEEW-1	FKGLC FKGLC PVGDNFVYN KRNFHLLGF SSGILASA SSGSTVYNG RSGSFVYNG RSGSFVYNG TSDDDVIS FSDFSPCNC MLSELHELS SSCSTVYG
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jgi_Chlre3 Sel_417121 Sel_65366 Sel_3540 Sel_402181 Sel_402181 Sel_403983 Sel_83069 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05903335 GSV1396300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV322370 C90274550 Os08913365220 Os10925210 Pop174433 Pop548662 Pop780375 F09800124 F09780375 F09800124 AT3G63220 AT3G63220 AT3G63220 AT3G4190 Phypa11831	Keich-4	LMF	Kel -GESTEL-CNHITW R -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGCSTVICGHRGP -C -WGCSTVICGHRGP -C -C -C -C -C -C -C -C -C -C	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV GUGEGVHRSV WQNRNRSSITAEV GGGGV VEGEV	VLGAPPGKRMA -VA	ISRTDLLV	FGGUI TLFLSH GVLERRV GVLERRV GVLERRV GVLGRT FTRUNSV GSEUCT FTRUNSV GVMVSS-S GVMVSS-S GVMVSS-S GVMVSS-S GVMVSS-S GVMVSS-S GVMVSSN GVMVSSN GVMVSSN NVKUSRN NIL COLRP NIK KILHCD NIK KILHCD 	AEAS	PVGDNFVYN FKGL PVGDNFVYN KRNFHLLGF SSGIILASA PSGSCLCSV SSSGILSSV FSDFSPCNC FSDFSPCNC FSDFSPCNC FSDFSPCNC FSDFSPCNC FSDFSPCNC FSDFSPCNC SSSGTVYSG GACUVSG GACUVSG SSSGTVSG SSSGTVSG SSSGTVSG SSSGTVSG SSSGTVSG SSSGT SSSSGT SSSGT SSSGT SSSSGT
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jgi_Chlre3 Sel_417121 Sel_63366 Sel_37207 Sel_33540 Sel_402181 Sel_402181 Sel_403983 Sel_83069 Sb04g02051 Sb05g02375 Sb06g03335 Sb05g02375 Sb06g03335 GSV1396300 GSV3223300 GSV3223300 GSV3223300 GSV322370 GSV3233300 GSV3228700 Os02g21110 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g36520 Os02g376520 S079760 S079760 F0p274431 F0p274431 F0p274431 F0p274431 F0p2783266 AT1G14330 AT3G46050 AT3G43220 AT3G43190 Fhypa1831 Fhypa16375 F1ypa16675	Keich-4 CAEL 	LMF	Kel 	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV SWONRNRSSITAEV GGGGV VEGEV VEGEV VEGEV VEGEV VEGEV VETSSPWKQLEFQ NLQVMQAV-LQNN SKGKAKGKGTKAE SKQSSP VETSSPWKQLEFQ NLQVMQAV-LQNN SKGKAKGKGTKAE SKGY GKGGY GKGGY GKGGY SEGEGEGGG VSYSGLGANCAP VSYSGGMATCRP SEGEGEGGG SEGEGEGGG SEGEGEGGG SEELG PRIGANRAAVSKTE 	VIGAPPGKRMA -VA -PF-IDAC -IGGLLNRCS- -CH-LGTAS- -MY -IG- -IG- -IG- -IG- -IG- -IG- -IG- -IG	ISRTDLLV- 	FGGUI TIFLSH GVLURRV SNOTRT FTRUNSV GSEUC FTRUNSV GSEUC GVMVSSS GVMVSSS GVMVSS GVMVSS TRAIVLGGO FL TIVCSR LGQR PPLOSC TIVCSR CONSC TIVCSR CONSC TIVCSR CONSC CONSC CONSC CONSC FLCSSR PPLOSC	AEAS	FKG
jgi_Chlre3 Sel_417121 Sel_65366 Sel_3540 Sel_402181 Sel_402181 Sel_403983 Sel_83069 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05903335 GSV1396300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV32233300 GSV322310 CSV228700 OS02925210 F09780375 F09800124 F09780375 F09800124 F09780375 F09800124 F09783266 AT1G14330 AT3663220 AT3663220 AT3663220 AT3663220 AT366320 F09P4018375 F0980124 F0978326 AT366320 AT366320 F09980124 F0978336 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09980124 F0978326 AT366320 F09986 F09986 AT366320 F09986 AT366320 AT366320 F09986 AT366320 AT366320 AT366320 F09986 AT36655 AT36555 AT36555 AT36555 AT365555 AT365555 AT3655555 AT36555555555555555555555555555555555555	Keich-4 	LMF	Kel -GESTEL-CNHITW R -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGLGFK -WGCSTVICGHROP -CC -WGLVICGGRGST -CC -WGCSTVICGGRGST -CC -WGCSTVICGGRGST -CC -CC -CC -CC -CC -CC -CC -C	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV GVGEEVWLIELDV GUGGGV	VLGAPPGKRMA -VA	ISRTDLLV	FGGC I TLFLSH GVLERRV GVLERRV GVLERRV GVLC FTRENSV GSEWCT FTRENSV GSEWCT GVMVSS-S GVMVSSS WVECE GVMVSSS WVECE GVMVSSS WVECE GVMVSSS WVECE GVMVSSS GVMVSSS TLICGO COLRP TLIVVVDV TLICKEVDR PPLVT TLIVVVDV TLICKEVDR FSE	ABASSAC	PVGDNFVYN KRNFHLLGF SSGIILASA PSGSCLCSV RSGSFVYNG RSGSFVYNG FSDFSPCNC FSDFSPCNC FSDFYCAR PIDFRTAAL FGSAELVSG PGSAELVSG FGSAELVSG GACUOTSGC GACUOTSGC CALOSYNG GACUOTSGC SSNFVIN GCALOSYNG SCALOSYNG SSNFVIN SLPFSHA SLSDFFLNS
jgi_Chlre3 Sel_417121 Sel_45366 Sel_87207 Sel_3540 Sel_402181 Sel_403983 Sel_600335 Sb04902051 Sb05902375 Sb0690335 Sb05902375 Sb0690335 Sb05902375 Sb0690335 Sb05902375 Sb0690335 Sb05902375 Sb0690333300 GSV3240400 GSV3240400 GSV3240400 GSV324700 Os02921110 Os02936520 Os07947650 Os07947650 Os07947650 Os089336 Pop174433 Pop177961 Pop27431 Pop548662 Pop780375 Pop800124 Pop783326 AT13G43190 Phypa1831 Phypa1831 Phypa16375 Phypa16942 Phypa18944	Keich-4 	LMF	Kel 	Ch-5 NLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV SUQNRNRSSTAEV SWQNRNRSSTAEV GGGGVYQTL GGGGVYQTL GGGGV	VLGAPPGKRMA -VA	ISRTDLLV- GGGAEI 	FGGUI TLFLSH GVLURRV SNOCRT FTRUS GVLURRV SNOCRT FTRUS GVLURR GVLURR GVLURS GVLUSS GVLUSS TRAIVLGGQ FRI TRAIVLGGQ FRI HULCR NYKUS NYKUS HULCR TLLCKEVDR LGDULC FILLGEVDR TLLCKEVDR TLLCKEVDR TLLCKEVDR TLLCKEVDR TLLCKEVDR TLLCKEVDR FRI GFRUSS		FKGLG FKGLG FKGLG FKGLG FKGLG FKGLG FKGLG FSDFVNC FSDFVNC FSDFVNC FSDFVNC FSDFVNC FSDFVNC FKGFVFCAR F
jgi_Chlre3 Sel_417121 Sel_63366 Sel_87207 Sel_33540 Sel_402181 Sel_403983 Sel_403983 Sel_83069 Sb04g02051 Sb05g02375 Sb06g033355 Sb06g033355 Sb06g033355 GSV1396300 GSV3223300 GSV3223700 GSV3223700 GSV32240400 GSV3224700 Os02g21110 Os02g36520 Os02g376520 Os07g47650 Pop174433 Pop177961 Pop274431 Pop783326 ATIG14330 AT366220 AT5643190 Phypa16675 Phypa16675 Phypa16942 Phypa16942 Phypa169129	Keich-4	LMF	Kel 	Ch-5 NLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV GUGSU	VIGAPPGKRMA -VA -PF-IDAC -IGGLLNRCS- -CH-LGTAS -MY -IEICS -IV-LHSWEP -IG -IV-LHSWEP -IG -VY -IS -UQ-FES	ISRTDLLV- 	FGGUI TIFLSH GVLURRV SNOTRT FTRUNS GVLURRV SNOTR FTRUNS GVLURR FTRUNS GVLUR GVLUR FTRUNS FU GVLUR FU COLON 	ALASSA ADMKD- SKLK1 NNEPPDD VLSVRE IPKL MAAPIA TGEEW-1 VLTHPI ILASKNI VSSP MARP MPNI VSSP LECGKNI VSSP	FKG
jgi_Chlre3 Sel_417121 Sel_65366 Sel_3540 Sel_402181 Sel_402181 Sel_403983 Sel_83069 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb05902375 Sb0592375 Sb0592375 Sb0592375 Sb0592375 Sb05925210 Sb059252	Keich-4	LMF	Kel -GESTEL-CNHITW R 	Ch-5 VLDVGACPAPWGHP NMHQWSLV GVGEEVWLIELDV GVGEEVWLIELDV GUGGGV	VLGAPPGKRMA -VA -PFIDAC -LGGLLNRCS- -CHLGTAS -MY -IGGLLNRCS- -IV-LHSWEP -IG -IV-LHSWEP -IG -VY -IG -VY -IC -VY -IC -IC - - - - - - - - - - - - - - - -	ISRTDLLV	FGGUI TIFLSH GVLERRV SNOTRT FTRUNSV GVLCRT FTRUNS-V GVLCR FTRUNS GVMVSSS GVMVSS TRATVLGGO FL TRATVLGGO FL TRATVLGGO FL	ABASSAC	PVGDNFVYN FKGLC PVGDNFVYN KRNFHLLGF SSGIILASA PSGSCLCSV SSGFVYNC FSDFSCNC FSDFSCNC FSDFSCNC FSDFSCNC FSGFVYNC FSGFVYNC FSGFVYNC FSGFVYNC FSGFVYNC FSGSAELVSC PKGSAELVSC FSGSAELVSC FSGFVSC SSSFVYNC GCALQSYNC GCALQSYNC GCALQSYNC GCALQSYNC GCALQSYNC GCALQSYNC GCALQSYNC GCALQSYNC GCALQSYNC FSTLFFSHA SLSDFFLNS

Supplemental Figure S6. Protein sequence alignment created with hmmalign of 43 representatives of the FBKs, where at least one sequence was sampled from each of the clades of the gene tree in Supplemental Fig. S4. Positions of F-box domain and kelch repeats are indicated with black bars on top of the alignment, except for kelch repeat 4 and 5, which are enclosed in a box inside the alignment. Sequence names are abbreviated for visualization purposes. Abbreviations are: Chlre= *Chlamydomonas reinhardtii* jgi#; Phypa= *Physcomitrella patens* #=jgi number; Selmo= *Selaginella moellendorffii* #=jgi number; Os# = *Oryza sativa* LOC_OS#, where # stands for locus number given at MSU (TIGR); Sb#= *Sorghum bicolor* (jgi); Pop_#= *Populus trichocarpa* #=jgi number; GSV #=Genoscope number first 7 digits; ATI code (TAIR) is used for *Arabidopsis thaliana*; JFK-Hs = *Homo sapiens* FBX42 (AAH43410.1).



Supplemental Figure S7. NJ tree generated using partial FBK protein sequences (joined F-box and kelch domain) of *A. thaliana* and *A. lyrata*. Numbers at branches indicate bootstrap values (1000 replicates). AL numbers represent *A. lyrata* protein IDs according to Joint Genome Institute (genome.jgi-psf.org/Araly1). Boxed sequences designate proteins used for Ka/Ks ratios in Figure 5: yellow = superstable, green = unstable.



Supplemental Figure S8. Density plot of the test statistic d generated from the permutation test (one million repeats). D-statistic is defined as difference of the average means between the similarity of all kelch repeats within a protein and the similarity of kelch repeats between different proteins. Genetic distances among different kelch repeats were estimated using protdist from the PHYLIP suite (Felsenstein, 1989). The red line shows the d-statistic value for the observed arrangement of kelch repeats. The gray shaded area corresponds to the critical region (α =0.05), with a critical value of d as 0.1923.



Supplemental Figure S9. Relative transcript level of a subset of closely related FBKs. Plant organs were harvested from 6-week-old *A. thaliana* Col-0 plants cultivated under long day conditions at 20°C. Seed-lings were cultivated for 7 days on ATS medium under long day conditions at 20°C. Three biological replicates were measured, each in two technical replicates. Error bars represent SE. Transcript level of genes labeled with asterisks were under the detection limit in the analyzed plant organs.

Supplemental Table S1. Identifiers of F-box kelch proteins in A. thaliana, P. trichocarpa, V. vinifera, O. sativa, S. bicolor, S. moellendorffii and P. patens.

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT1G14330	Pop 174433	GSV00121001	Os01g33490	Sb01g013220	Selm 115581	jgi Phypa1_1 101961
AT1G15670	Pop 177961	GSV02287001	Os01g47050	Sb01g013240	Selm 121243	jgi Phypa1_1 104453
AT1G16250	Pop 230616	GSV02498001	Os01g50840	Sb01g022240	Selm 14013	jgi Phypa1_1 108027
AT1G19460	Pop 244788	GSV02750001	Os01g69940	Sb01g022460	Selm 174189	jgi Phypa1_1 114815
AT1G19470	Pop 265449	GSV02843001	Os02g02350	Sb01g045700	Selm 23216	jgi Phypa1_1 118316
AT1G19930	Pop 267446	GSV02903001	Os02g05700	Sb01g046015	Selm 272238	jgi Phypa1_1 126823
AT1G22040	Pop 274431	GSV07630001	Os02g10850	Sb02g001990	Selm 33540	jgi Phypa1_1 131411
AT1G23390	Pop 283960	GSV13963001	Os02g11790	Sb02g002025	Selm 33948	jgi Phypa1_1 137266
AT1G26930	Pop 287991	GSV15284001	Os02g15950	Sb02g003160	Selm 402181	jgi Phypa1_1 139248
AT1G27420	Pop 298158	GSV16869001	Os02g21110	Sb02g005040	Selm 403983	jgi Phypa1_1 14114
AT1G30090	Pop 420602	GSV17315001	Os02g30210	Sb02g005880	Selm 404324	jgi Phypa1_1 153643
AT1G31350	Pop 547623	GSV19396001	Os02g35530	Sb02g025486	Selm 404826	jgi Phypa1_1 156376
AT1G51550	Pop 547631	GSV24520001	Os02g36520	Sb02g032340	Selm 405137	jgi Phypa1_1 158495
AT1G55270	Pop 548662	GSV24761001	Os02g51350	Sb02g042690	Selm 405262	jgi Phypa1_1 159848
AT1G60570	Pop 548664	GSV25445001	Os03g07160	Sb03g030090	Selm 406718	jgi Phypa1_1 159974
AT1G61540	Pop 549362	GSV26849001	Os03g07530	Sb03g041500	Selm 407049	jgi Phypa1_1 159978
AT1G67480	Pop 551335	GSV26855001	Os03g30160	Sb03g041730	Selm 409427	jgi Phypa1_1 160103
AT1G68050	Pop 552235	GSV26967001	Os04g31120	Sb04g001090	Selm 411128	jgi Phypa1_1 160232
AT1G74510	Pop 553842	GSV28309001	Os04g52830	Sb04g003660	Selm 411144	jgi Phypa1_1 161137
AT1G76920	Pop 555218	GSV29589001	Os04g57290	Sb04g007310	Selm 412518	jgi Phypa1_1 162266
AT1G80440	Pop 558147	GSV30594001	Os06g39370	Sb04g009700	Selm 417121	jgi Phypa1_1 162989
AT2G02870	Pop 559358	GSV31346001	Os06g44500	Sb04g009920	Selm 421271	jgi Phypa1_1 163528
AT2G18915	Pop 559574	GSV31580001	Os06g47890	Sb04g020510	Selm 421284	jgi Phypa1_1 163752
AT2G20380	Pop 561211	GSV32323001	Os06g49750	Sb04g023200	Selm 422132	jgi Phypa1_1 164205
AT2G21680	Pop 561242	GSV32333001	Os07g02910	Sb04g023750	Selm 422192	jgi Phypa1_1 164284
AT2G21950	Pop 563452	GSV32404001	Os07g03100	Sb04g027910	Selm 424145	jgi Phypa1_1 166753
AT2G22030	Pop 564672	GSV33280001	Os07g05880	Sb05g002260	Selm 426714	jgi Phypa1_1 166966
AT2G22050	Pop 565042	GSV33282001	Os07g47650	Sb05g006950	Selm 429669	jgi Phypa1_1 167883
AT2G24540	Pop 566051	GSV33571001	Os08g13360	Sb05g006960	Selm 429850	jgi Phypa1_1 168336
AT2G29600	Pop 572245	GSV34447001	Os09g38300	Sb05g021030	Selm 431561	jgi Phypa1_1 169046

	Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
-	AT2G29770	Pop 572337	GSV34454001	Os10g04890	Sb05g023750	Selm 438121	jgi Phypa1_1 169120
	AT2G29780	Pop 583883	GSV34587001	Os10g21930	Sb06g012290	Selm 441635	jgi Phypa1_1 169426
	AT2G29800	Pop 589736	GSV34781001	Os10g24900	Sb06g025030	Selm 448225	jgi Phypa1_1 169940
	AT2G29810	Pop 592319	GSV37006001	Os10g25210	Sb06g028820	Selm 55890	jgi Phypa1_1 171546
	AT2G29820	Pop 597156	GSV37841001	Os10g26990	Sb06g032150	Selm 65366	jgi Phypa1_1 172502
	AT2G29830	Pop 649911	GSV38104001	Os11g04330	Sb06g033350	Selm 75526	jgi Phypa1_1 172546
	AT2G29860	Pop 651336		Os11g14140	Sb06g033750	Selm 766041	jgi Phypa1_1 172882
	AT2G41360	Pop 658140		Os11g34460	Sb07g002320	Selm 78419	jgi Phypa1_1 180856
	AT2G44030	Pop 708739		Os12g04130	Sb07g006910	Selm 79476	jgi Phypa1_1 181624
	AT2G44130	Pop 754910			Sb10g023140	Selm 83069	jgi Phypa1_1 188742
	AT2G44630	Pop 756767			Sb10g026080	Selm 85806	jgi Phypa1_1 188796
	AT2G44700	Pop 758312			Sb10g026580	Selm 87207	jgi Phypa1_1 189687
	AT3G06570	Pop 758319			Sb10g028340	Selm 88328	jgi Phypa1_1 201289
	AT3G08810	Pop 762216			Sb10g029710	Selm 92558	jgi Phypa1_1 202273
	AT3G10510	Pop 763659				Selm 92689	jgi Phypa1_1 229126
	AT3G24610	Pop 764261				Selm 92722	jgi Phypa1_1 229344
	AT3G24760	Pop 768560					jgi Phypa1_1 231395
	AT3G27150	Pop 771222					jgi Phypa1_1 233086
	AT3G27910	Pop 780347					jgi Phypa1_1 233535
	AT3G43710	Pop 780375					jgi Phypa1_1 233728
	AT3G46050	Pop 783326					jgi Phypa1_1 233823
	AT3G59940	Pop 798553					jgi Phypa1_1 234202
	AT3G61350	Pop 800124					jgi Phypa1_1 234490
	AT3G61590	Pop 801458					jgi Phypa1_1 234671
	AT3G63220	Pop 805659					jgi Phypa1_1 23672
	AT4G02310	Pop 807034					jgi Phypa1_1 23835
	AT4G03030	Pop 807217					jgi Phypa1_1 44026
	AT4G11750	Pop 809263					jgi Phypa1_1 44304
	AT4G11770	Pop 811754					jgi Phypa1_1 45289
	AT4G14905	Pop 822050					jgi Phypa1_1 45319
	AT4G19330	Pop 825819					jgi Phypa1_1 5127
	AT4G19865	Pop 830083					jgi Phypa1_1 63719

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT4G19870	PtI002296					jgi Phypa1_1 63738
AT4G23580	PtVII000004					jgi Phypa1_1 68326
AT4G25710	PtX002172					jgi Phypa1_1 70860
AT4G29370	Pt170000007					jgi Phypa1_1 90500
AT4G33900	PtVIII000539					jgi Phypa1_1 91322
AT4G34170	Pt129000020					jgi Phypa1_1 96028
AT4G35120						jgi Phypa1_1 96502
AT4G38940						jgi Phypa1_1 97006
AT4G39240						jgi Phypa1_1 98858
AT4G39290						
AT4G39550						
AT4G39560						
AT4G39570						
AT4G39580						
AT4G39590						
AT4G39600						
AT4G39753						
AT4G39756						
AT4G39760						
AT5G02980						
AT5G02990						
AT5G03000						
AT5G03020						
AT5G07610						
AT5G15710						
AT5G26960						
AT5G28160						
AT5G28180						
AT5G38670						
AT5G38680						
AT5G39560						
AT5G40680						

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT5G42350						
AT5G42360						
AT5G43190						
AT5G48980						
AT5G48990						
AT5G49000						
AT5G51250						
AT5G57360						
AT5G60570						

Supplemental Table S2. Number of F-box kelch proteins in non-

Species	Number of FBKs	Number of kelch repeats (Pfam)	Protein ID
Bacteria	-	-	-
Saccharomyces cerevisae	-	-	-
Chlamydomonas reinhardtii	1	3	EDP09183 ^a
Caenorhabditis elegans	1	3	Q9N3K6 ^b
Drosophila melanogaster	1	3	Q9W281 ^b
Mus Musculus	1	3	Q6PDJ6 ^b
Homo sapiens	1	3	Q6P3S6 [⊳]
^a GenBank ID; ^b Swiss Prot ID			

Supplemental Table S3: Identifiers of F-box proteins with F-box associated domains in *A. thaliana*, *P. trichocarpa*, *V. vinifera*, *O. sativa*, *S. bicolor*, *S. moellendorffii* and *P. patens*.

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT1G09650	Pop 241644	GSV02287001*	Os02g10600	Sb01g003460	Selm 428410	jgi Phypa1_1 163116
AT1G10890	Pop 246916	GSV26022001	Os02g33840	Sb01g013220*	Selm 413145	jgi Phypa1_1 164205*
AT1G11620	Pop 547750	GSV26967001*	Os02g35560	Sb01g013240*	Selm 33948*	jgi Phypa1_1 234287
AT1G11810	Pop 548688	GSV33571001	Os03g25640	Sb01g018980		jgi Phypa1_1 234728
AT1G12170	Pop 548689	GSV33582001	Os03g46690	Sb01g031390		jgi Phypa1_1 65071
AT1G12190	Pop 549801		Os04g11450	Sb01g034970		jgi Phypa1_1 90500*
AT1G12870	Pop 560159		Os04g11660	Sb01g037880		jgi Phypa1_1 91913
AT1G13200	Pop 563457		Os04g11790	Sb02g001040		
AT1G24793	Pop 565298		Os04g50200	Sb02g002025*		
AT1G24880	Pop 568920		Os05g02570	Sb02g005870		
AT1G25141	Pop 569113		Os05g08010	Sb02g005880*		
AT1G30780	Pop 569545		Os05g08350	Sb02g005890		
AT1G30790	Pop 569549		Os05g08440	Sb02g008113		
AT1G30920	Pop 570279		Os05g08460	Sb02g023440		
AT1G30925	Pop 571268		Os06g07380	Sb02g027685		
AT1G30930	Pop 571296		Os06g07390	Sb03g044080		
AT1G30935	Pop 574752		Os06g07460	Sb04g000800		
AT1G31000	Pop 575938		Os07g08570	Sb04g003010		
AT1G31080	Pop 579428		Os07g09710	Sb04g006790		
AT1G31090	Pop 581757		Os07g09814	Sb04g009700*		
AT1G32140	Pop 581764		Os07g09870	Sb04g025085		
AT1G32420	Pop 585979		Os07g13870	Sb04g026045		
AT1G32430	Pop 587549		Os07g13890	Sb05g020470		
AT1G32660	Pop 590131		Os07g16420	Sb05g025730		
AT1G33010	Pop 590133		Os07g16800	Sb05g025750		
AT1G33020	Pop 590935		Os07g35050	Sb06g027040		
AT1G33530	Pop 592321		Os07g35060	Sb08g003880		
AT1G46840	Pop 597059		Os08g10340	Sb08g015610		
AT1G46984	Pop 666139		Os08g36960	Sb08g021860		
AT1G47340	Pop 241644		Os09g20650	Sb08g021900		

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT1G47390	Pop 752836		Os09g27570	Sb09g027720		
AT1G47730	Pop 753649		Os09g30180	Sb09g030410		
AT1G47765	Pop 754910*		Os09g34200	Sb10g010900		
AT1G47790	Pop 756767*		Os10g04850	Sb10g024600		
AT1G47800	Pop 761635		Os10g25210*			
AT1G47810	Pop 761790		Os10g25660			
AT1G48060	Pop 763809		Os12g03440			
AT1G50870	Pop 764347		Os12g06740			
AT1G50880	Pop 764712		Os06g0170866			
AT1G51290	Pop 765277					
AT1G51320	Pop 766270					
AT1G52490	Pop 770387					
AT1G53370	Pop 771222*					
AT1G53550	Pop 775680					
AT1G53790	Pop 783326					
AT1G54550	Pop 786330					
AT1G55070	Pop 787092					
AT1G58090	Pop 799299					
AT1G59680	Pop 801694					
AT1G60370	Pop 805278					
AT1G61060	Pop 807217*					
AT1G62270	Pop 808297					
AT1G65990						
AT1G66490						
AT1G67130						
AT1G67450						
AT1G67455						
AT1G70380						
AT1G70390						
AT1G70960						

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT1G70970						
AT1G71320						
AT1G76830						
AT1G77650						
AT2G02890						
AT2G04920						
AT2G07140						
AT2G13130						
AT2G14710						
AT2G15640						
AT2G16220						
AT2G16450						
AT2G16810						
AT2G17310						
AT2G17830						
AT2G18780						
AT2G19630						
AT2G21930						
AT2G23160						
AT2G27520						
AT2G31470						
AT2G33655						
AT2G34280						
AT2G38590						
AT2G40910						
AT2G40920						
AT2G40925						
AT2G43260						
AT2G43440						
AT3G04660						

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT3G06240						
AT3G07870						
AT3G08750						
AT3G10240						
AT3G10430						
AT3G10790						
AT3G13680						
AT3G13820						
AT3G13830						
AT3G16210						
AT3G16555						
AT3G16580						
AT3G16590						
AT3G16740						
AT3G16820						
AT3G16880						
AT3G17265						
AT3G17280						
AT3G17320						
AT3G17480						
AT3G17490						
AT3G17500						
AT3G17530						
AT3G17540						
AT3G17560						
AT3G17570						
AT3G17620						
AT3G17710						
AT3G18320						
AT3G18330						

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT3G18340						
AT3G18910						
AT3G18980						
AT3G19410						
AT3G19470						
AT3G19560						
AT3G19880						
AT3G19890						
AT3G20030						
AT3G20690						
AT3G20710						
AT3G21120						
AT3G21130						
AT3G21170						
AT3G21410						
AT3G22350						
AT3G22421						
AT3G22650						
AT3G22700						
AT3G22710						
AT3G22720						
AT3G22730						
AT3G22870						
AT3G22940						
AT3G23260						
AT3G23420						
AT3G23880						
AT3G23960						
AT3G24580						
AT3G25460						

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT3G44120						
AT3G44130						
AT3G47020						
AT3G47030						
AT3G47150						
AT3G49450						
AT3G49510						
AT3G49520						
AT3G49980						
AT3G52320						
AT3G57580						
AT3G57590						
AT3G59610						
AT3G61340						
AT4G04690						
AT4G05080						
AT4G09190						
AT4G09790						
AT4G09870						
AT4G10740						
AT4G11590						
AT4G12560						
AT4G17200						
AT4G17780						
AT4G19930						
AT4G19940						
AT4G21240						
AT4G29970						
AT4G33160						
AT4G33290						

Arabidopsis	Populus	Vitis	Oryza	Sorghum	Selaginella	Physcomitrella
AT4G38870						
AT5G07610*						
AT5G10340						
AT5G15660						
AT5G15670						
AT5G18160						
AT5G36200						
AT5G36730/						
AT5G36820						
AT5G37040						
AT5G38810						
AT5G41490						
AT5G41500						
AT5G41510						
AT5G42430						
AT5G42460						
AT5G47300						
AT5G50220						
AT5G51000						
A15G52610						
AT5G52620						
AT5G60560						
AT5G62060						
AT5G62510						
AT5G62660						
A15G65850						

* F-box proteins with F-box associated domain and kelch repeats.

Supplemental Table S4: Comparison of three tree topologies obtained with three different algorithms (NJ=Neighbor-Joining, Bayesian and ML=Maximum Likelihood) using Shimodaira-Hasegawa (Shimodaira and Hasegawa, 1999) and one-sided Kishino-Hasegawa (1sKH, Kishino and Hasegawa, 1989) tests, implemented in Treepuzzle (Schmidt and von Haeseler, 2007). In addition, a Chi-square test was performed to compare the likelihoods (I) of the three trees to the best tree (in this case the ML tree). The ML and NJ trees have the same likelihood.

Tree		ΔI	S.E.	p1-skh	p-SH	2ΔI	Chi-square	p-value
NJ	-30957.15	0	0.0024	1	0.737	0	0	0
Bayesian	-31069.27	112.12	22.7059	0	0	224.24	0.406	0.03
ML	-30957.15	0	best tree	1	1	0	0	0

Schmidt HA, von Haeseler A (2007) Maximum-likelihood analysis using TREE-PUZZLE. Curr Prot Bioinformatics Chapter 6: Unit 6.6

Supplemental '	Table S5.	Number	of unstable,	stable,	ancient a	and supersta	ble FBK	s in A.	thaliana,	V.	vinifera,
P. trichocarpa,	O. sativa, s	S. bicoloi	r, S.moellend	<i>dorffii</i> ar	nd P. pate	ens.					

Species	Number of unstable FBKs	Number of stable FBKs	Number of ancient FBKs	Number of superstable FBKs	Total number of FBKs
Arabidopsis thaliana	66	14	12	11	103
Vitis vinifera	0	15	9	12	36
Populus trichocarpa	0	21	30	17	68
Oryza sativa	0	11	15	13	39
Sorghum bicolor	0	18	16	10	44
Selaginella moellendorffii	5	16	11	14	46
Physcomitrella patens	19	20	5	27	71

Primer	Sequence
AT1G14330_F	5' ACTGAGATACCGGAAATGTCGC 3'
AT1G14330_R	5' TCAGCATGATCAGCAGCATACA 3'
AT1G26930_F	5' AGAGATTGCGGTTTTAGCGG 3'
AT1G26930_R	5' CATCCATAAACACACCGGAACA 3'
AT1G74510_F	5' AGCTTTATGCTGCGAATTACGC 3'
AT1G74510_R	5' CACTAACTGATCCCCACAAGCC 3'
AT2G02870_F	5' TGATCACGCCGATATGGAAGT 3'
AT2G02870_R	5' AGCAAGTCCCCATCCGTTTAC 3'
AT3G27150_F	5' CGTGTTGGACGATGTTTGACA 3'
AT3G27150_R	5' CGCAAAGCGATTCTTTATCTCC 3'
AT5G40680_F	5' CGTATTGTGGTGTGGCGATA 3'
AT5G40680_R	5' CTTGATTCCTCCAGCGAAAA 3'
AT5G60570_F	5' ATGGTGGACTCGTCAAACGGT 3'
AT5G60570_R	5' CAAGAATTCACCACAATGCCCT 3'

Supplemental Table S6. Sequences of q-RT PCR primers