

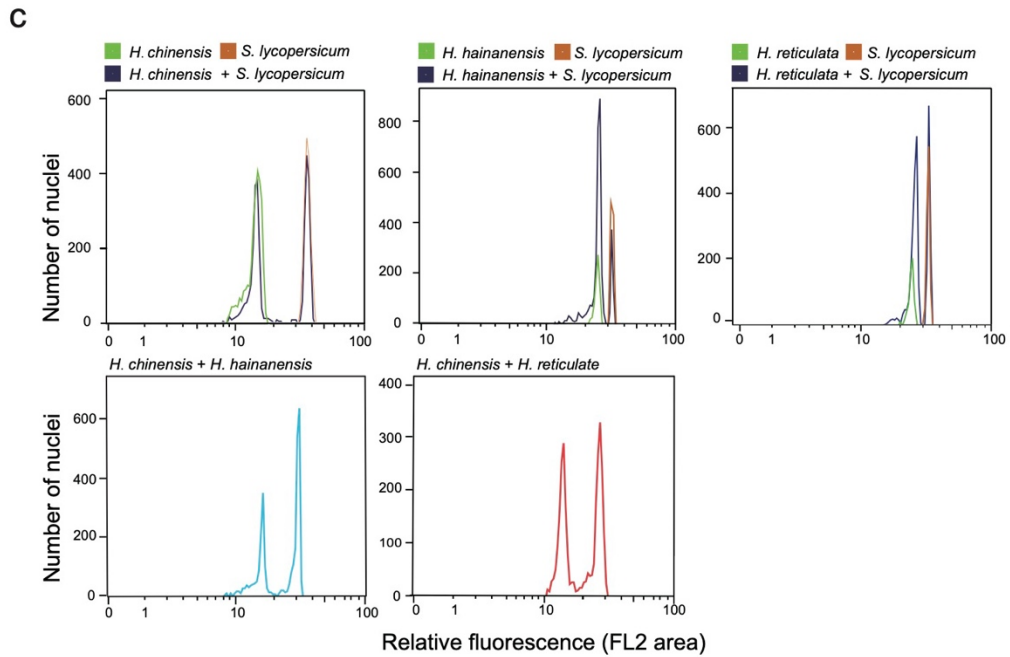
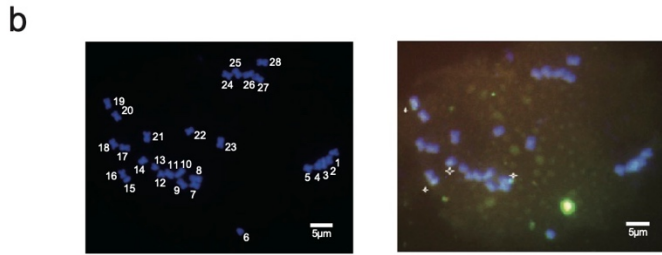
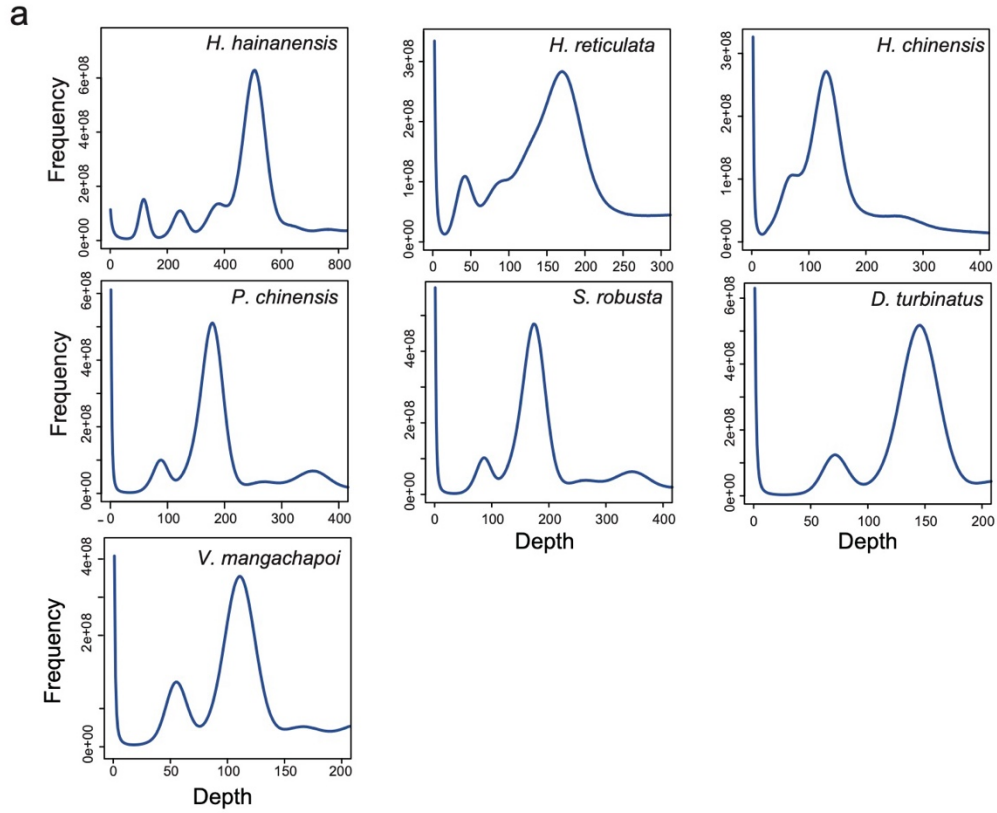
Supplemental information

Title:

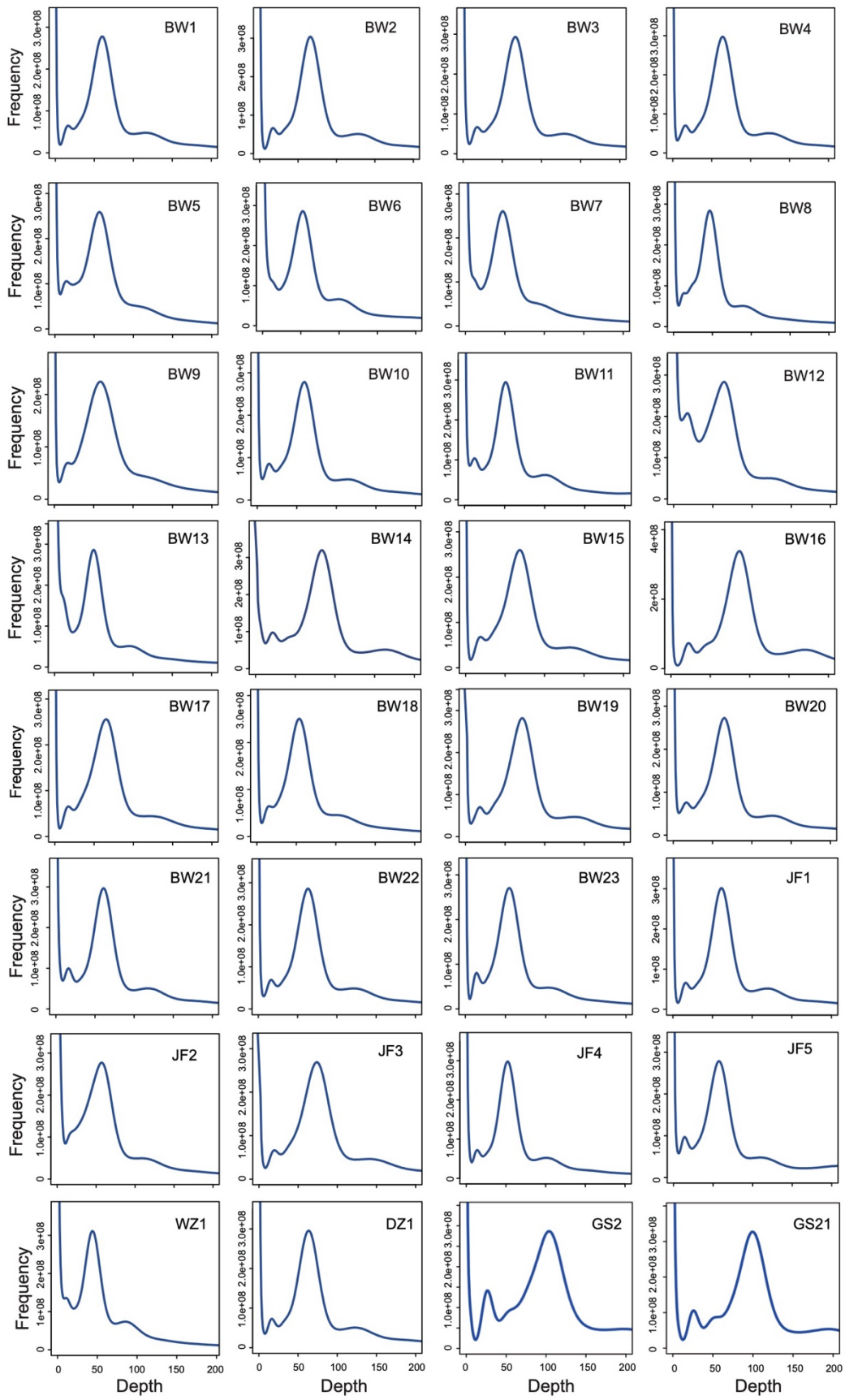
Dipterocarpaceae genomics reveal their demography and adaptations to Asian rainforests

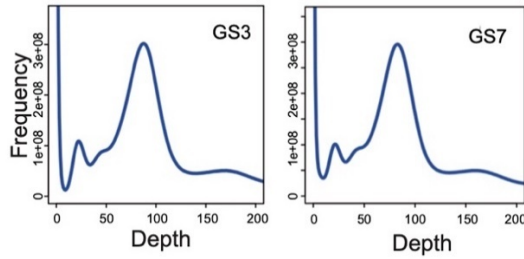
Author list:

Rong Wang, Chao-Nan Liu, Simon T Segar, Yu-Ting Jiang, Kai-Jian Zhang, Kai Jiang, Gang Wang, Jing Cai, Lu-Fan Chen, Shan Chen, Jing Cheng, Stephen G Compton, Jun-Yin Deng, Yuan-Yuan Ding, Fang K. Du, Xiao-Di Hu, Xing-Hua Hu, Ling Kang, Dong-Hai Li, Ling Lu, Yuan-Yuan Li, Liang Tang, Xin Tong, Zheng-Shi Wang, Wei-Wei Xu, Yang Yang, Run-Guo Zang, Zhuo-Xin Zu, Yuan-Ye Zhang & Xiao-Yong Chen

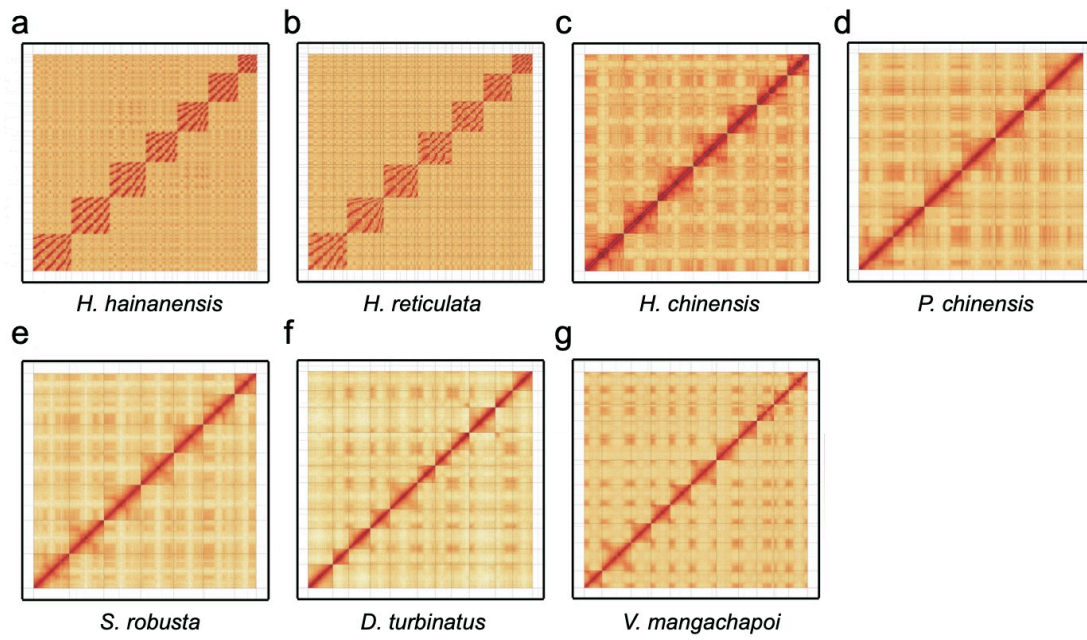


d

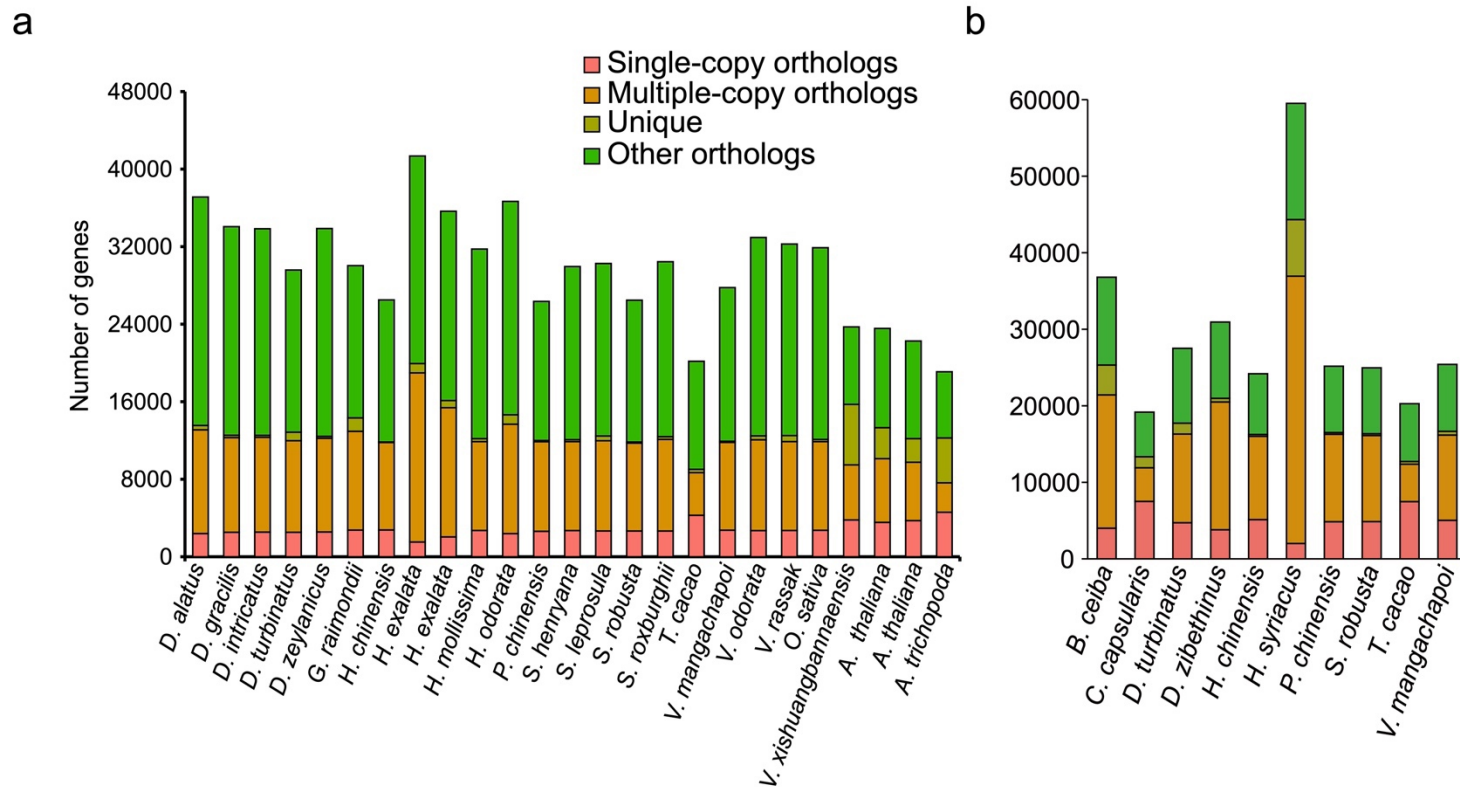




Supplementary Figure 1. *k*-mer distributions of the 7 Dipteroocarpoideae genomes (a), the results of karyotype analysis of *H. hainanensis* using fluorescence *in situ* hybridization (b), the results of flow cytometry (c), and *k*-mer distributions of all sampled trees of *H. hainanensis* (n=30) and the selected four *H. reticulata* trees (d). In the *k*-mer analysis, the ploidy of a species is assessed via the ratio of the depth of the leftmost peak to that of the rightmost peak, and the results suggest that *H. hainanensis* and *H. reticulata* are tetraploid species and the other species are diploids. The details of Illumina sequencing data used for the *k*-mer analysis are shown in Supplementary Tables 2 and 16. The chromosome number of *H. hainanensis* was identified as 28, which was four times as the basic chromosome number in genus *Hopea* (n=7)¹. The green fluorescence signal (highlighted by crosses in Supplementary Fig. 1b) were detected in all the four chromosomes using *in situ* hybridization with the probe of 18SrDNA (this experiment was performed for one time), further confirming that there are four copies of basic chromosomes in *H. hainanensis*, i.e., autotetraploidy. When estimating the genome size for *H. Chinesis*, *H. hainanensis* and *H. reticulata*, we used the genome of *Solanum lycopersicum* (2C = 2.12) as the reference for flow cytometry experiments. When estimating genome size, we ran individual sample for each of the three *Hopea* species (*H. Chinesis*, *H. hainanensis* and *H. reticulata*) and *S. lycopersicum* separately, and ran samples combining each *Hopea* species with *S. lycopersicum* (Supplementary Fig 1c (the upper panel) and Supplementary Table 1). *H. Chinesis* was chosen as the reference diploid species for the estimation of ploidy of *H. hainanensis* and *H. reticulata*. Each treatment of flow cytometry experiments were repeated for three times with similar results.

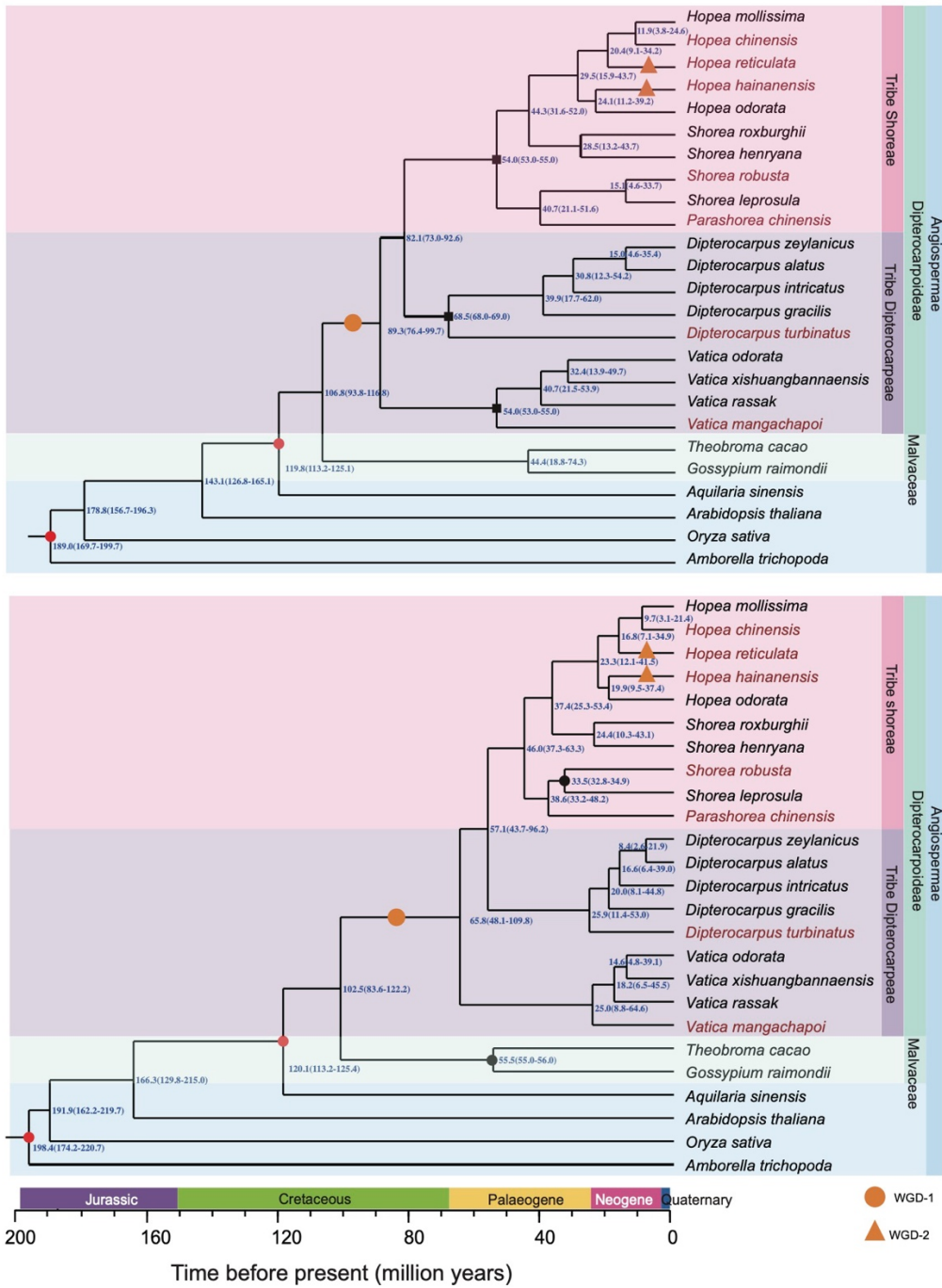


Supplementary Figure 2. Heat maps of interaction intensity between the pseudo-chromosomes clustered by Hi-C reads for the 7 Dipteroidea species.

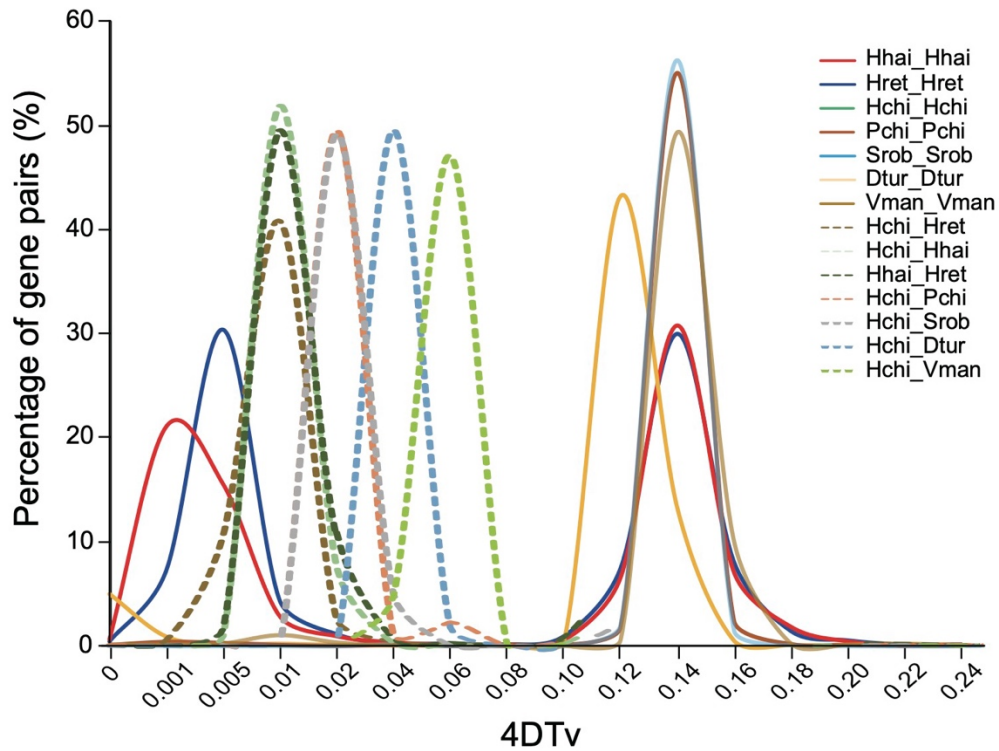


Supplementary Figure 3. Results of gene family clustering based on the genomes of our focal 7 Dipterocarpoideae species, other 12 Dipterocarpoideae species and four species from other plant taxa (a) and those of the 5 diploid Dipterocarpoideae species and 5 temperate tree species (b). Full names of each species and the references reported the assembled genomes are listed in Supplementary Table 9. Source data are provided as a Source Data file.

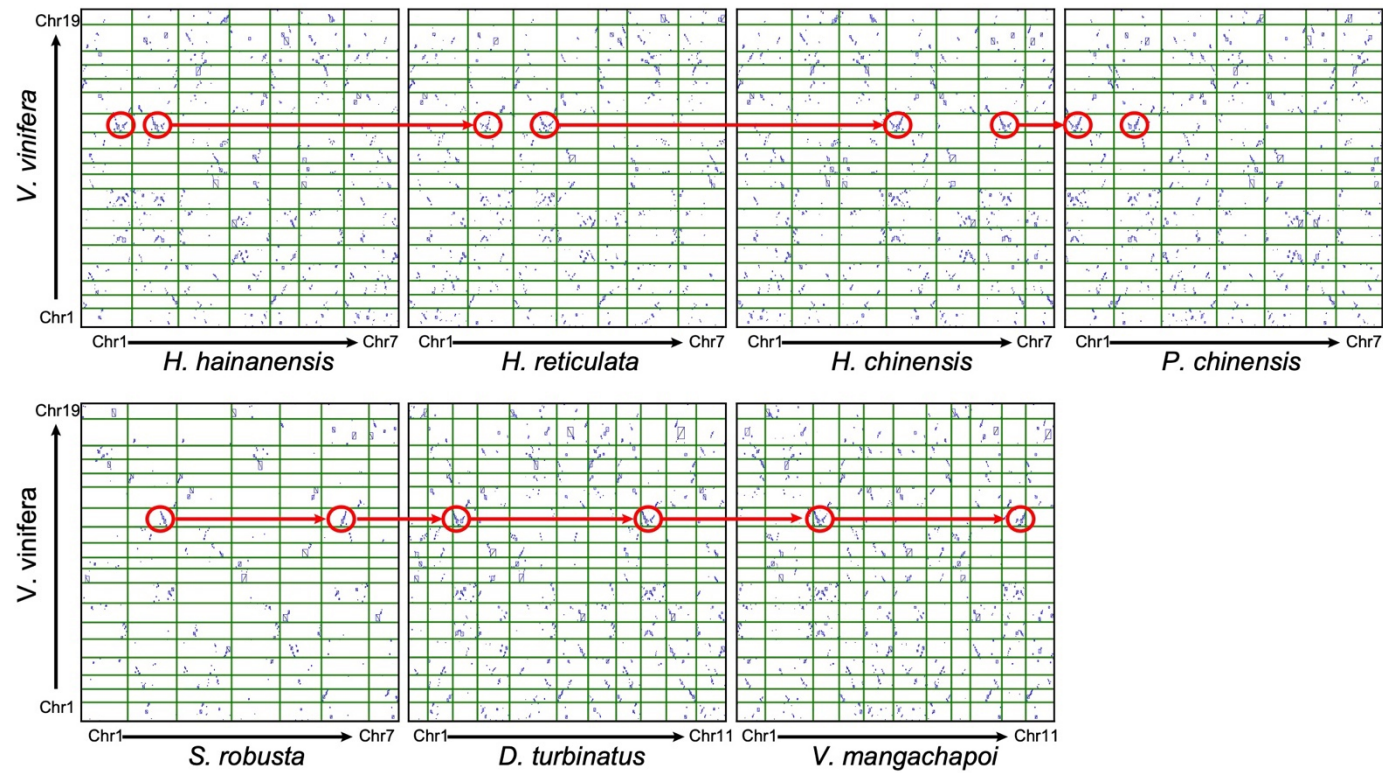
a



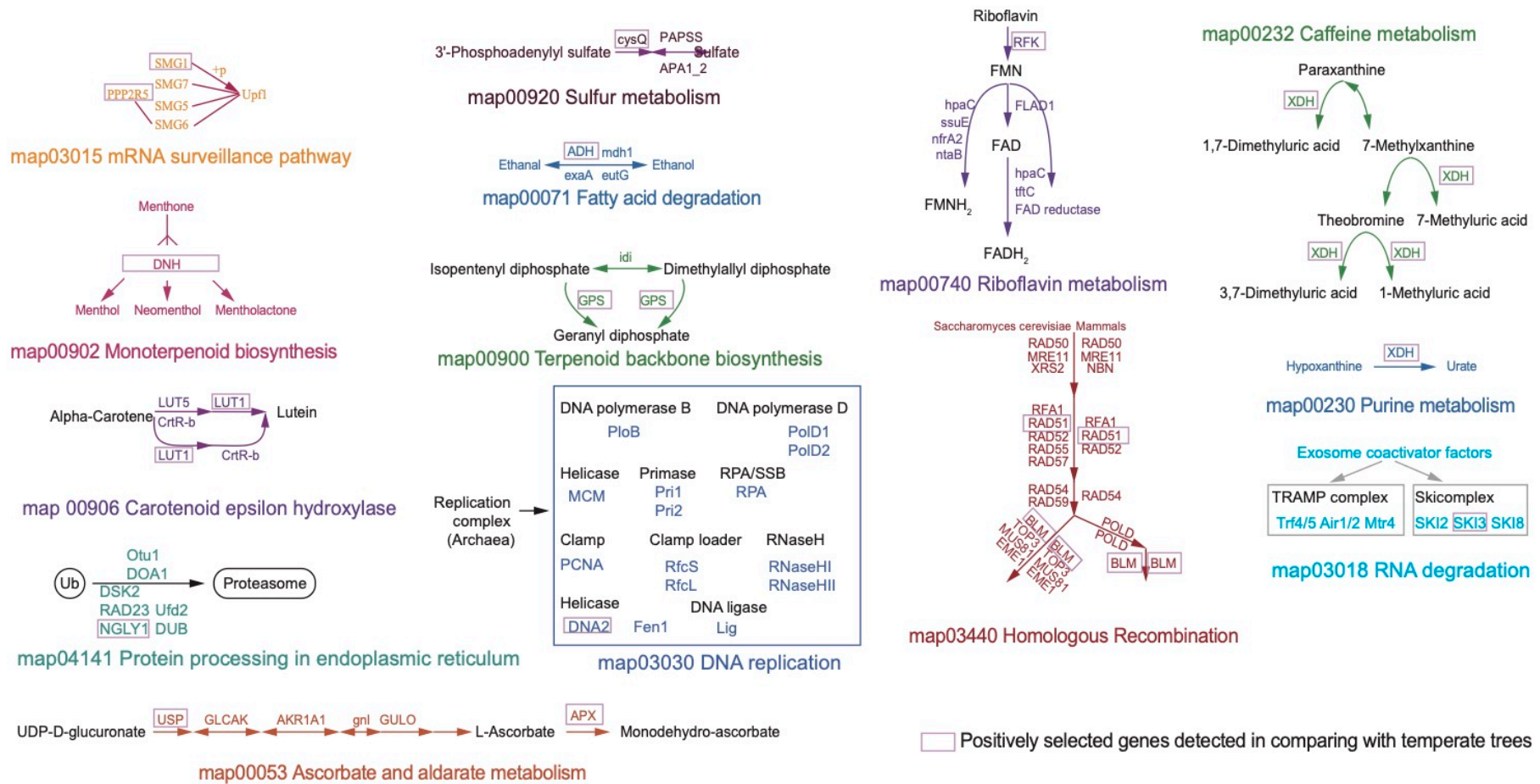
b



Supplementary Figure 4. Results of phylogenomic analysis using calibrations from Bell et al.² and Vega et al.³ (red dots), Bansal et al.⁴ (black squares) and Ng et al.⁵ (black dots) (a), and the distribution of transversion rate of four-fold degenerate sites (4DTv) for homologous genes within each genome and between two genomes (b). The genomes assembled in this study are highlighted by red. Abbreviations of species are shown in Supplementary Table 2.



Supplementary Figure 5. Comparison of the homologous regions between the genome of each focal Dipterocarpoideae species and the genome of *Vitis vinifera*. Results show that most homologous regions detected in the genome of *Vitis vinifera* are doubled in the genomes of our focal species.



Supplementary Figure 6. Positively selected genes (16) involved in the KEGG pathways relevant to plants' response to environmental stresses. Purple frames are used to highlight the positively selected genes supported by the comparison with the genomes of five temperate tree species. The function of each gene is shown in Supplementary Data 2.

RAD51D

<i>S. robusta</i>	.....	A	S	G	K	A	A	S	F	V	I	P	S	D	S	D	H	K	G	E	P	G	M	K	R	I	V	.....													
<i>P. chinensis</i>	.....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.....
<i>H. chinensis</i>	.....	A	S	G	K	A	S	R	F	V	I	P	P	D	S	D	H	K	G	E	P	G	M	K	R	T	V	.....													
<i>D. turbinatus</i>	.....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.....
<i>V. mangachapoi</i>	.....	A	S	G	K	A	A	R	F	M	I	P	P	D	S	R	.	.	.	.	.	.	.	.	.	.	.....				
<i>B. ceiba</i>	.....	A	S	G	K	A	A	S	F	V	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.....
<i>H. syriacus</i>	.....	A	S	G	K	A	A	R	F	L	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.....
<i>D. zibethinus</i>	.....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.....
<i>T. cacao</i>	Y	L	C	P	F	Y	I	R	L	L	G	R	L	Q	G	L	L	F	R	T	C	P	Y	R	F	A	G	D	E	K	N	I	E	K	M	E	L	F	H	E	.
<i>T. cacao</i>	D	T	T	A	T	A	I	E	W	A	L	A	E	L	I	N	N	P	A	V	L	E	K	A	R	Q	V	M	E	K	V	V	G	N
<i>C. capsularis</i>	.....	A	S	G	K	A	A	R	F	V	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.....

<i>S. robusta</i>	.....
<i>P. chinensis</i>	.....
<i>H. chinensis</i>	.....
<i>D. turbinatus</i>	.....
<i>V. mangachapoi</i>	.....
<i>B. ceiba</i>	.....
<i>H. syriacus</i>	.....
<i>D. zibethinus</i>	.....
<i>T. cacao</i>	NRIVQESDTANLPYIQAI
<i>C. capsularis</i>	.....

b SMC5

<i>S. robusta</i>	ME	EP	RR	KR	PK	IE	ER	G	ADDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	H	H	L	I	C	K	P	G	T	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>P. chinensis</i>	ME	EP	RR	KR	PK	IE	ER	G	ADDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	H	H	L	I	C	K	P	G	T	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>H. chinensis</i>	ME	EP	RP	KR	PK	IE	ER	G	ADDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	H	H	L	I	C	K	P	G	T	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>D. turbinatus</i>	ME	EP	RP	KR	PK	IE	ER	G	ADDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	H	H	L	I	C	K	P	G	T	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>V. mangachapoi</i>	ME	EP	RV	KR	PK	IS	SR	G	VDDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	N	H	L	V	C	K	P	G	P	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>B. ceiba</i>	ME	EP	RV	KR	PK	IS	SR	G	VDDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	N	H	L	V	C	K	P	G	P	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>H. syriacus</i>	ME	EP	RV	KR	PK	IS	SR	G	VDDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	N	H	L	V	C	K	P	G	P	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>D. zibethinus</i>	ME	EP	RV	KR	PK	IS	SR	G	VDDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	N	H	L	V	C	K	P	G	P	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>T. cacao</i>	ME	EP	RV	KR	LK	IS	SR	G	VDDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	N	H	L	V	C	K	P	G	S	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V
<i>C. capsularis</i>	ME	EP	RV	KR	PK	IS	SR	G	VDDY	LP	GNI	T	E	I	E	L	N	N	F	M	T	F	N	H	L	V	C	K	P	G	S	R	L	N	L	V	I	G	P	N	G	S	G	K	S	S	L	V

<i>S. robusta</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	S	V	G	A	Y	V	K	R	G	E	H	A	G	F	I	K	I	S	L	R	G	H	A	E	G	E	R	I	T	I	M	R	K	I	D	T	Q	N	K	S	E	W
<i>P. chinensis</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	S	V	G	A	Y	V	K	R	G	E	H	A	G	F	I	K	I	S	L	R	G	H	A	E	G	E	R	I	T	I	M	R	K	I	D	T	Q	N	K	S	E	W
<i>H. chinensis</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	S	V	G	A	Y	V	K	R	G	E	H	A	G	F	I	R	I	S	L	R	G	H	A	E	G	E	R	I	T	I	M	R	K	I	D	T	Q	N	K	S	E	W
<i>D. turbinatus</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	S	V	G	A	Y	V	K	R	G	E	H	A	G	F	I	K	I	S	L	R	G	H	A	E	G	E	R	I	T	I	M	R	K	I	D	T	Q	N	K	S	E	W
<i>V. mangachapoi</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	S	V	G	A	Y	V	K	R	G	E	H	A	G	F	I	K	I	S	L	R	G	R	A	E	G	E	R	I	T	I	M	R	K	I	D	T	Q	N	K	S	E	W
<i>B. ceiba</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	S	I	G	S	Y	V	K	R	G	E	D	S	G	Y	I	K	I	C	L	R	C	Y	S	K	E	E	E	I	T	I	V	R	K	I	N	H	N	K	S	E	W	
<i>H. syriacus</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	S	I	G	A	Y	V	K	R	G	E	D	A	G	V	V	K	I	S	L	R	C	Y	T	K	E	E	Q	I	T	I	V	R	K	I	D	I	R	N	K	S	E	W
<i>D. zibethinus</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	N	I	G	A	Y	V	K	R	G	E	S	C	Y	I	K	I	T	L	R	C	Y	T	K	E	E	Q	I	T	I	V	R	K	I	D	I	R	N	K	S	E	W	
<i>T. cacao</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	T	N	I	G	A	Y	V	K	R	G	E	S	C	Y	I	K	I	S	L	R	C	Y	T	E	E	Q	S	T	I	V	R	K	I	N	H	N	K	S	E	W			
<i>C. capsularis</i>	CA	IA	L	C	L	G	G	E	P	Q	L	L	G	R	A	H	I	G	A	F	V	K	R	G	E	T	A	G	Y	I	K	I	S	L	R	C	Y	T	K	E	E	R	I	T	I	A	R	K	I	D	I	E	N	K	S	E	W	

<i>S. robusta</i>	L	Y	N	G	K	V	V	P	K	K	E	V	L	A	V	I	Q	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	V	Q	L	L	E	E	T	E	K	A	V	G	D	P	K	L	P
<i>P. chinensis</i>	L	Y	N	G	K	V	V	P	K	K	E	V	L	A	V	I	Q	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	V	Q	L	L	E	E	T	E	K	A	V	G	D	P	K	L	P
<i>H. chinensis</i>	L	Y	N	G	K	V	V	P	K	K	E	V	L	A	V	I	Q	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	V	Q	L	L	E	E	T	E	K	A	V	G	D	P	K	L	P
<i>D. turbinatus</i>	L	H	N	G	K	V	V	P	K	K	E	V	L	A	V	I	Q	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	V	Q	L	L	E	E	T	E	K	A	V	G	D	P	K	L	P
<i>V. mangachapoi</i>	L	Y	N	G	K	V	V	S	K	K	E	V	L	A	V	I	Q	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	V	Q	L	L	E	E	T	E	K	A	V	G	D	P	K	L	P
<i>B. ceiba</i>	L	Y	N	G	K	S	V	P	K	R	E	I	L	D	V	I	R	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	I	Q	L	L	E	E	T	E	K	A	V	G	D	P	O	L	P
<i>H. syriacus</i>	L	Y	N	G	K	S	V	P	K	R	E	I	L	D	V	I	R	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	I	Q	L	L	E	E	T	E	K	A	V	G	D	P	O	L	P
<i>D. zibethinus</i>	L	Y	N	G	K	S	V	P	K	R	E	I	L	D	V	I	R	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	I	Q	L	L	E	E	T	E	K	A	V	G	D	P	O	L	P
<i>T. cacao</i>	L	Y	N	G	K	S	V	P	K	R	E	I	L	D	V	I	R	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	I	Q	L	L	E	E	T	E	K	A	V	G	D	P	O	L	P
<i>C. capsularis</i>	S	Y	N	G	K	S	V	P	K	R	E	I	L	D	V	I	R	K	F	N	I	Q	V	N	N	L	T	Q	F	L	P	Q	D	R	V	C	E	F	A	K	L	T	P	I	Q	L	L	E	E	T	E	K	A	V	G	D	P	O	L	P

<i>S. robusta</i>	V	Q	H	A	L	V	D	K	S	R	E	L	K	K	Y	Q	Q	A	V	E	R	N	G	V	T	L	K	Q	L	D	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	E	L	L	A	K	V	E	S	M	K	K	K	K
<i>P. chinensis</i>	V	Q	H	A	L	V	D	K	S	R	E	L	K	K	Y	Q	Q	A	V	E	R	N	G	V	T	L	K	Q	L	D	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	E	L	L	A	K	V	E	S	M	K	K	K	K
<i>H. chinensis</i>	V	Q	H	A	L	V	D	K	S	R	E	L	K	K	Y	Q	Q	A	V	E	R	N	G	V	T	L	K	Q	L	D	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	E	L	L	A	K	V	E	S	M	K	K	K	
<i>D. turbinatus</i>	V	Q	H	A	L	V	D	K	S	R	E	L	K	K	Y	Q	Q	A	V	E	R	N	G	V	T	L	K	Q	L	D	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	E	L	L	A	K	V	E	S	M	K	K	K	
<i>V. mangachapoi</i>	L	Q	H	A	L	V	D	K	S	R	E	L	K	K	Y	Q	Q	A	V	E	R	N	G	V	T	L	K	Q	L	D	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	E	L	L	A	K	V	E	S	M	K	K	K	
<i>B. ceiba</i>	V	Q	H	C	L	V	E	K	S	R	E	L	K	K	Y	Q	K	A	V	D	T	M	G	E	S	L	K	Q	L	I	A	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	L	L	E	K	V	D	S	M	K	K	K	
<i>H. syriacus</i>	V	Q	H	C	L	V	E	K	S	R	E	L	K	K	Y	Q	K	A	V	D	T	M	G	E	S	L	K	Q	L	I	A	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	L	L	E	K	V	D	S	M	K	K	K	
<i>D. zibethinus</i>	V	Q	H	C	L	V	E	K	S	R	E	L	K	K	Y	Q	K	A	V	D	T	M	G	E	S	L	K	Q	L	I	A	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	L	L	E	K	V	D	S	M	K	K	K	
<i>T. cacao</i>	V	Q	H	C	L	V	E	K	S	R	E	L	K	K	Y	Q	K	A	V	E	T	M	G	E	S	L	K	Q	L	I	A	L	N	A	E	Q	E	K	D	V	E	R	V	R	Q	R	E	L	L	E	K	V	N	Y	M	K	K	K	
<i>C. capsularis</i>	V	Q	H	S	T	L	I	E	K	S	R	E	L	K	K	Y	Q	K	A	V	E	T	M	G	E	S	L	K	Q	L	V	A	L	N	A	E	L	E	K	D	V	E	R	V	R	Q	R	N	E	L	L	E	K	V	D	Y	M	K	

SMC5

S. robusta LPEFEHPKDELGRINGQIRELVRVQSNKRLLOKSEMEKLLYQRQLNLRQCIDRLKDMEN
P. chinensis LPEFEHPKDELGRINGQIRELVRVQSNKRLLOKSEMEKLLYQRQSNLRQCIDRLKDMEN
H. chinensis LPEFEHPKDELGRINGQIRELVRVQSNKRLLOKSEMEKLLYQRQLNLRQCIDRLKDMEN
D. turbinatus LPKFEHPKDELGRINGQIRELVRVQSNKRLLOKSEMEKLLYQRQLNLRQCIDRLKDMEN
V. mangachapoi LPAYEPPKAEIERLKSQIVELTSSAHQLMQQKKEKESLGMKKAALRNQVDRKDMEN
B. ceiba LPVYEPPKEEIERLKSQIVELTSSAQMMQKKEKESLGMKKTALRNQVDRKDMEN
H. syriacus LPAYEPPKEEIERLKSQIVELTSSAHQKMQKKEKESLGMKKTALRNQVDRKDMEN
D. zibethinus LPAYEPPKEEIERLKSQIVELTSSAHQKMQKKEKESLGMKKTALRNQVDRKDMEN
T. cacao LPAYEPPKEEIERLKSQIVELTSSAHQKMQKKEKESLGMKKTALRNQVDRKDMEN
C. capsularis LRSYKPPKEEIESLISQIALKETSAREKRRQKEMKEKHLGQLKSAALRNQVNSLTDLENK

S. robusta NKRLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
P. chinensis NKRLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
H. chinensis NKRLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
D. turbinatus NKRLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
V. mangachapoi NKRLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
B. ceiba TKLLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
H. syriacus SKCLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
D. zibethinus NKLLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
T. cacao TKLLRALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI
C. capsularis TKLLHALKNSGAEIVQAYQWLQQRHLLNKEVFGPVLLEVNVSDQHANYLEGHVPPFYI

S. robusta WKSFITQDDGDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
P. chinensis WKSFITQDDGDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
H. chinensis WKSFITQDDADRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
D. turbinatus WKSFITQDDADRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
V. mangachapoi WKSFITQDDGDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
B. ceiba WRSFITQDDGDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
H. syriacus WKSFITQDDGDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
D. zibethinus WRSFITQDDGDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
T. cacao WKSFITQDDGDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF
C. capsularis WKSFITQDDSRDRDFVAKNLKPFVFPVLYVVRDGNLQKSRPEVS.EEMRVLGIYTRLDQVF

S. robusta DAPDVVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
P. chinensis DAPDVVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
H. chinensis DAPDVVKEALTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
D. turbinatus DAPDVVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
V. mangachapoi DAPDVVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
B. ceiba DAPTAVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
H. syriacus DAPTAVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
D. zibethinus DAPTAVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
T. cacao DAPTAVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW
C. capsularis DAPTAVKEVLTSQFGLDNS.....YIGTKETDKKADDVKE.LGISDLWTFPNHYRW

S. robusta VCSRY.DNHVSARVEAVDRSRLLFGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
P. chinensis VCSRY.DNHVSARVEAVDRSRLLFGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
H. chinensis VRSRY.DNHVSARVEAVDRSRLLFGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
D. turbinatus VCSRY.DKHVSARVEAVDRSRLLFGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
V. mangachapoi VCSRY.DNHVSARVEAVDRSRLLFGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
B. ceiba SVSRYGDNEMSAQVEPVHDSRLLLCGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
H. syriacus SVSRYGDNEMSAQVEPVHDSRLLLCGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
D. zibethinus SVSRYGDNEMSAQVEPVHDSRLLLCGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
T. cacao SVSRY.DNHISGTVESVDRSRLLFGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ
C. capsularis SVSRYDNNAI SATVEPVHDSRLLLCGLDGGETEKLRSRRTSELEKSIITDIQQELKSLQTEQ

S. robusta RILEDEAAQLQKQEEIVNTVRNEKRRKQELNRIEQRKRKVESLEKEDDLDTVMAKLVLD
P. chinensis RILEDEAAQLQKQEEIVNTVRNEKRRKQELNRIEQRKRKVESLEKEDDLDTVMAKLVLD
H. chinensis RILEDEAAKQLQKQEEIVNTVRNEKRRKQELNRIEQRKRKVESLEKEDDLDTVMAKLVLD
D. turbinatus RILEDEAAQLQKQEEIVNTVRNEKRRKQELNRIEQRKRKVESLEKEDDLDTVMAKLVLD
V. mangachapoi RILEDEAAQLQKQEEIVNTVRNEKRRKQELNRIEQRKRKVESLEKEDDLDTVMAKLVLD
B. ceiba RVAEDEAAKQLQKQREEMVNTGRRMCKRKELESCEVEQRKRKLVSELEKGGVETAMAKLID
H. syriacus RLVEDEAAKQLQKQREEMVNTGRRMCKRKELESCEVEQRKRKLVSELEKGGVETAMAKLID
D. zibethinus RLVEDEAAKQLQKQREEMVNTGRRMCKRKELESCEVEQRKRKLVSELEKGGVETAMAKLID
T. cacao RLVEDEAAKQLQKQREEMVNTGRRMCKRKELESCEVEQRKRKLVSELEKGGVETAMAKLID
C. capsularis RQLEDESAKIEKQREDMVLTSRRMIQKQKNMENYVAQLKSTL.SLEESDLETAVAKLID

SMC5

S. robusta QVARRHNTNRRFEDMIKIKDILLVDAVSLKWNLAENKLVSTIYDAKIRELEANFKHQEKFAQQ
P. chinensis QVARRHNSNRRFEDMIKIKDILLVDAVSLKWNLAENKLVSTIYDAKIRELEANLKHQEKFAQQ
H. chinensis QVARRHNTNRRFEDMIKIKDILLVDAVSLKWNLAENKLVSTIYDAKIRELEANLKHQEKFAQQ
D. turbinatus QVARRHNTSQFEDVIKIKDILLVDAVSLKWNLAENKLVSTIYDAKIRELEANLKHQEKFAQQ
V. mangachapoi QVARRHNTNRRFEDVIKIKDILLVDAVSLKWNLAENKLVSTIYDAKIRELEANLKHQEKFAQQ
B. ceiba QATRSNVERFKHAIKIKDILLVEAVSCKWVFAEKHMVSTIYDAKIRDSEANLKEHEKFAHQ
H. syriacus QATRSNVERFKHAIKIKDILLVEAVSCKWVFAEKHMVSTIYDAKIRDSEANLKEHEKFAHQ
D. zibethinus QATRSNVERFKHAIKIKDILLVEAVSCKWVFAEKHMVSTIYDAKIRDSEANLKEHEKFAHQ
T. cacao QATRSNVERFKHAIKIKDILLVEAVSCKWVFAEKHMVSTIYDAKIRDSEANLKEHEKFAHQ
C. capsularis RAKRISNVERFNHAIKIKDILLVEAVAWKWSFAEKHMVSTIYDAKIRDSEANLKEHEKFAHQ

S. robusta ALQQFEYCKKEVEDCRQOLYAAKTSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
P. chinensis ALQQFEYCKKEVEDCRQOLSAAKTSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
H. chinensis ALQQLEFYCKKEVEDCRQOLSAAKRSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
D. turbinatus ALQQLEFYCKKEVEDCRQOLSAAKRSAESIAVITSELEKAFLEMPPTTIEELEAAIEDNISQ
V. mangachapoi ALQQFEYCKKEVEDCRQOLSAAKRSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
B. ceiba ASLDLQICEKNVEDHSQOLLAAKRHAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
H. syriacus ASMNLEICQEVKDYRQOLSAAKRSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
D. zibethinus ASLNLQFCENDVKGYSQOLSAAKRSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
T. cacao ASLHLEFYCKKEVEDCRQOLSAAKRSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ
C. capsularis ASLDLQCKKEDVEDYLOOLSAAKRSAESIAVITPELEKAFLEMPPTTIEELEAAIEDNISQ

S. robusta ANSILFLN.QNILQEYEHRRQHRIEDISTKLEADKKELEERCLAETNALKESWLPTLRNLVA
P. chinensis ANSILFLN.QNILQEYEHRRQHRIEDISTKLEADKKELEERCLAETNALKESWLPTLRNLVA
H. chinensis ANSILFLN.QNILQEYEHRRQHRIEDVSTKLEADKKELEERCWAEINALKESWLPTLRNLVA
D. turbinatus ANSILFLN.QNILQEYEHRRQHRIEISTKLEADKKELEERCLTEMNALKESWLPTLRNLVA
V. mangachapoi ANSILFLN.QNILQEYEHRRQHRIEDISTKLEADKKELEERCLAETNALKESWLPTLRNLVA
B. ceiba ANSIVFLN.RNILQEYEDRRHQIEAISAKLDADNKELEORCLAEIDALKNWLPKLRNLVS
H. syriacus ANSIVFLN.QNILQEYQDRERQIEAISAKLDADNKELEORCLAEIDALKNWLPKLRNLVS
D. zibethinus ANSIVFLN.RNILQEYEDRRHQIEAISAKLDADNKELEORCLAEIDALKNWLPKLRNLVS
T. cacao ANSIVFLN.RNILQEYEDRRHQIEAISAKLDADNKELEORCLAEIDALKNWLPKLRNLVS
C. capsularis ANSIFCLNGNNILLEYEDRRQIEAISAKLEADNKELEORCLAEIDALKNWLPKLRNLVN

S. robusta QINETFSHKFFQEMAVAGEVLLD.....
P. chinensis QINETFSRKKFFQEMAVAGEVLLD.....
H. chinensis QINETFSHKFFQEMAVAGEVLLGITM.....
D. turbinatus QINETFSRKKFFQEMAVAGEVLLD.....
V. mangachapoi QINETFSRKKFFQEMAVAGEVLLD.....
B. ceiba QINETFSRNFQEMAVAGEVSLD.....
H. syriacus QINETFSRNFQEMAVAGEVSLD.....
D. zibethinus QINETFSRNFQEMAVAGEVSLD.....
T. cacao QINETFSRNFQEMAVAGEVSLD.....
C. capsularis QINETFSRNFQEMAVAGEVSLD.....

S. robustaEHGTDFFDQFGILIKVKFR.....
P. chinensisEHGTDFFDQFGILIKVKFR.....
H. chinensisNMELIFDQFGILIKVKFR.....
D. turbinatusEHGTDFFDQFGILIKVKFR.....
V. mangachapoiERGSDFDQFGILIKVKFR.....
B. ceibaEHDTFDQFGILIKVKFR.....
H. syriacusEHDNDFDQFGILIKVKFR.....
D. zibethinusEHDMDFDQFGVLIKVKFR.....
T. cacaoEHDTFDQFGILIKVKFR.....
C. capsularisEHDADFQFGIFIKVKFR.....

S. robustaQSGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
P. chinensisQSGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
H. chinensisQSGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
D. turbinatusQSGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
V. mangachapoiQSGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
B. ceibaQAGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
H. syriacusQAGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
D. zibethinusQAGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
T. cacaoQTGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG
C. capsularisQAGQLQVLSAHHQSGGERSVSTILYLVSLQDLTNCPFRVVEINQG

C LUT1

<i>S. robusta</i>	MRSSSLIS.SFSFPTAPPRRSAT.....SLHS.....LSVKSSVEKTF.TTKTQ..
<i>P. chinensis</i>	MQSSLLIS.SFSFPTAPPPHRSAT.....SLHS.....LSIKSSVEKTF.TNKKPQ..
<i>H. chinensis</i>	MQSSLLIS.SFSFPTAPPPRRFST.....SLHS.....LSIKSSVEKTF.NTKPQ..
<i>D. turbinatus</i>	MQSSLSIS.SFSFPTAPPPRSATS.....LHS.....LSVKSSVDKIK....PQ..
<i>V. mangachapoi</i>	MQSSFSIS.SFSFPAAPPPRTS.....LRS.....LSIKSSVEKTS.TTKSQ..
<i>B. pendula</i>	MQSCVNLSPRPLSFISLPCQKPINP.....LP LQS.....FSVKSSVDKTP.TSKPKHL
<i>O. rehderiana</i>	MQSCLTPSSLSFLVSIPPRKPIN.....P LQP.....FSIKSSVDKTP.TTKPK..
<i>Q. robur</i>	MQSCVTLG.SLSFLSLPSQRPPNN.....IPLQS.....FSVKSYIGKTP.TAKRK..
<i>F. sylvatica</i>	MRSVCVAFS.SITFPSLPPRRLTIN.....IPLQS.....FSVKSSIEKTF.TTKPK..
<i>F. excelsior</i>	MKSCVTL.SLSFSLPQRATIN.....IPLQS.....FSIKSSIEKTF.STKPK..

<i>S. robusta</i>	.PTNASPRKPA SWVSPNWLTSLSRSL.TVGRGDDSGIPIASAE.LDDVSDLLGGALFLPLF
<i>P. chinensis</i>	.PTNASFPKPA SWVSPNWLTSLSRSL.TIGRGDDSGIPLASAE.LDDVSDLLGGALFLPLF
<i>H. chinensis</i>	.PTNATPKPA SWVSPNWLTSLSRSL.TVGRGDDSGIPIASAE.LDDVSDLLGGALFLPLF
<i>D. turbinatus</i>	.PTNATTRKPA SWVSPNWLTSLSRSL.TVGRGDDSGIPIASAKLDDVSDLLGGALFLPLF
<i>V. mangachapoi</i>	.PTNATTPKPA SWVSPNWLTSLSRSL.TIGRGDDSGIPIASAO.LDDVSDLLGGALFLPLF
<i>B. pendula</i>	ATSATPSK KAT SWVSPNWLTSLSRSL.TIGSNDDSGIPIASAO.LDDVSDLLGGALFLPLF
<i>O. rehderiana</i>	.PAP.APSKTT SWVSPNWLTSLSRSL.TIGANDDSGIPVANA.O.LDDVSDLLGGALFLPLF
<i>Q. robur</i>	.PT..IPS KPN SWVSPNWLTSLSRSL.TIGFNDDSGIPIASAO.LDDVSDLLGGALFLPLF
<i>F. sylvatica</i>	.PT..SPSKST SWVSPNWLTSLSRSL.TIGSNDDSRIPIASAO.LDDVSDLLGGALFLPLF
<i>F. excelsior</i>	.PA..SPSNST SWVSPNWLTSLSRSL.TIGSNDDSGIPIASAO.LDDVSDLLGGALFLPLF

<i>S. robusta</i>	FLQHLNFELLPDQNISMTTGATIHTTNGLFMKLSQRQSNLTFASSTSR.....
<i>P. chinensis</i>	FLQHLNFELLPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSTSR.....
<i>H. chinensis</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSTSR.....
<i>D. turbinatus</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKFSQRQSNLAFASSTSR.....
<i>V. mangachapoi</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSTSR.....
<i>B. pendula</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSERRPDIS..SPTSK.....
<i>O. rehderiana</i>	FLQHLNFELVPDQNI RFVHEA.....QPTPK.....
<i>Q. robur</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSERKPNFAFSSSTSK.....
<i>F. sylvatica</i>	FLQHLNFELVPDQDISMTTGATIHTTNGLYMKLSERRSKFDISSPTSK.....
<i>F. excelsior</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLYMKLSERKSNFDNSPTPSK.....

<i>S. robusta</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCADRLVEKLVQPF
<i>P. chinensis</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCADRLVEKLVQPF
<i>H. chinensis</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCADRLVEKLVQPF
<i>D. turbinatus</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCAERLVEKLVQPF
<i>V. mangachapoi</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCAERLVEKLVQAL
<i>B. pendula</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCAERLVEKLVQPF
<i>O. rehderiana</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCAERLVEKLVQPF
<i>Q. robur</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCAERLVEKLVQPF
<i>F. sylvatica</i>	GS LW.....TVRRKAVVPSLHKKRYLSVMVDRVFCKCAERLVQKLVQPF
<i>F. excelsior</i>	GIVFR IETPCRLIAGPISFVKLVRRKAVVPSLHKKRYLSVMVDRVFCKCAERLVONLQPF

<i>S. robusta</i>	ALNGNAVNLEEKFSQLTLDVIGLALFNYNFDSLTA DSPVIDAVYTALKEAELRSTDI LPY
<i>P. chinensis</i>	ALNGNAVNMEENFSQLTLDVIGLALFNYNFDSLTA DSPVIDAVYTALKEAELRSTDI LPY
<i>H. chinensis</i>	ALNGNAVNMEEEKFSQLTLDVIGLALFNYNFDSLTA DSPVIDAVYTALKEAELRSTDI LPY
<i>D. turbinatus</i>	ALNGNAVNMEEEKFSQLTLDVIGLALFNYNFDSLTA DSPVIDAVYTALKEAELRSTDI LPY
<i>V. mangachapoi</i>	ALNGSAVNMEEEKFSQLTLDVIGLALFNYNFDSLTA DSPVIDAVYTALKEAELRSTDI LPY
<i>B. pendula</i>	ALDGTAVNMEEEKFSQLTLDVIGLSIFNYNFDSLTS DSPVIEA IYTALKEAELRSTDI LPY
<i>O. rehderiana</i>	ALDGTAVNMEEEKFSQLTLDVIGLSIFNYNFDSLTS DSPVIDAVYTALKEAELRSTDI LPY
<i>Q. robur</i>	ALDGTAVNMEEEKFSQLTLDVIGLSIFNYNFDSLTS DSPVIDAVYTALKEAELRSTDI LPY
<i>F. sylvatica</i>	A FDGTAVNMEEEKFSQLTLDVIGLSVFNYNFDSLTS DSPVIDAVYTALKEAELRSTDI LPY
<i>F. excelsior</i>	ALDGM PVNMEAKFSQLTLDVIGLSVFNYNFDSLTS DSPVIDAVYTALKEAELRSTDI LPY

<i>S. robusta</i>	WKIKPLCKIIPROIKAEKAVTIIRTTVEELIKQCKEIVS EGERINEEYVNETDPSILR
<i>P. chinensis</i>	WKIKPLCKIIPROIKAEKAVTIIRTTVEELIKQCKEIVS EGERINEEYVNETDPSVLR
<i>H. chinensis</i>	WKIKPLCKIIPROIKAEKAVTIIRTTVEELIKQCKEIVS EGERINEEYVNETDPSILR
<i>D. turbinatus</i>	WKIKPLCKIIPROIKAEKAVTIIRTTVEELIKQCKEIVS EGERINEEYVNETDPSILR
<i>V. mangachapoi</i>	WKIKPLCKIIPROIKAEKAVTIIRKTVEELIKQCKEIVS EGERINEEYVNETDPSILR
<i>B. pendula</i>	WK.AVLCRIVPROIKAEKAVTIIRTTVEELIKQCKEIVN EGERINEEYVNETDPSILR
<i>O. rehderiana</i>	.IGVLCRIMVPROIKAEKAVTIIRKTVEELIKQCKEIVK EGERINEEYVNETDPSILR
<i>Q. robur</i>	WKIRTLCKIIPROIKAEKAVTIIRTTVEELIKQCKEIVN EGERINEEYVNETDPSILR
<i>F. sylvatica</i>	WKIRALCKIIPROIKAEKAVTIIRTTVEELIKQCKEIVR EGERINEEYVNETDPSILR
<i>F. excelsior</i>	WKISALCKIIPROIKAEKAVTIIRKAVEELIKQCKEIVK EGERINEEYVNETDPSILR

LUT1

<i>S. robusta</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTLYLLSKDSTSLRAQEEVDRVLOG
<i>P. chinensis</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTLYLLSKDSTSLRAQEEVDRVLOG
<i>H. chinensis</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTLYLLSKDSTSLRVQEEVDRVLOG
<i>D. turbinatus</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTLYLLSKDSSSLRAQEEVDRVLOG
<i>V. mangachapoi</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTLYLLSKDSSSLRAQEEVDRVLOG
<i>B. pendula</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTFYLLSKDSASLLKAQEEVDRVLEG
<i>O. rehderiana</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTLYLLSKDPSSLPKAAQEEVDRVLEG
<i>Q. robur</i>	FLASREEVSSLQLRDDLLSMLVAGHETTGSVLTWTLYLLSKDSSSLKAQEEVDRVLEG
<i>F. sylvatica</i>	FLASREEVSSMLRDDLLSMLVAGHETTGSVLTWTLYLLSKDSSSLKAREEVDRLVLEG
<i>F. excelsior</i>	FLASREEVSSMLRDDLLSMLVAGHETTGSVLTWTLYLLSKDPSSLLKAREEVDRLVLOG

<i>S. robusta</i>	FLQHLNFELLPDQNISMTTGATIHTTNGLFMKLSQRQSNLTFASSTSR.....
<i>P. chinensis</i>	FLQHLNFELLPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSILR.....
<i>H. chinensis</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSTSR.....
<i>D. turbinatus</i>	FLQHLKFELVPDQNISMTTGATIHTTNGLFMKFSQRQSNLAFASSTSR.....
<i>V. mangachapoi</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSTSR.....
<i>B. pendula</i>	FLQRLNFELVPDQNISMTTGATIHTTDGLYMKLSERRPDIS..SPTSK.....
<i>O. rehderiana</i>	FLQRLNFELVPDQNIREFVHEA.....QPTPK.....
<i>Q. robur</i>	FLQRLNFELVPDQNISMTTGATIHTTDGLYMKLCERKPNFAFSSPTSK.....
<i>F. sylvatica</i>	FLQRLNFELVPDQDISMTTGATIHTTNGMYMKLSERRSKFDISSPTSK.....
<i>F. excelsior</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLYMKLSERRKSNFDNSPTPSK.....

<i>S. robusta</i>	HHSAQVWERANEFVPERFDLEGPINPESNTDFRFIPFSGGPRKCVGDQFAMLEAIVALAI
<i>P. chinensis</i>	HHSAQVWERANEFVPERFDLEGPINPESNTDFRFIPFSGGPRKCVGDQFAMLEAIVALAI
<i>H. chinensis</i>	HHSAQVWERANEFVPERFDLEGPMPNESNTDFRFIPFSGGPRKCVGDQFAMLEAIVALAI
<i>D. turbinatus</i>	HHSAQVWERADEFVPERFDLDDPINPESNTDFRFIPFSGGPRKCVGDQFAMLEAIVALAI
<i>V. mangachapoi</i>	HHSAQVWERADEFVPERFDLEGPINPESNTDFRFIPFSGGPRKCVGDQFAMLEAIVALAI
<i>B. pendula</i>	HHSQVWERAEFVPERFDLESPIPNETNTDYRFIPFSGGPRKCVGDQFALLEAIVALAI
<i>O. rehderiana</i>	HHSQVWERAEFVPERFDESSVPNETNTDYRFIPFSGGPRKCVGDQFALLEAIVALAI
<i>Q. robur</i>	HHSQVWERAEFVPERFDLESVPNETNTDYRFIPFSGGPRKCVGDQFALLEAIVALAI
<i>F. sylvatica</i>	HHSQVWERAEFVPERFDLESVPNETNTDYRFIPFSGGPRKCVGDQFALLEAIVALAI
<i>F. excelsior</i>	HHSQVWDRAEFVPERFDLASAIPNETNTDYRFIPFSGGPRKCVGDQFALLEAIVALAV

<i>S. robusta</i>	FLQHLNFELLPDQNISMTTGATIHTTNGLFMKLSQRQSNLTFASSTSR.....
<i>P. chinensis</i>	FLQHLNFELLPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSILR.....
<i>H. chinensis</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSTSR.....
<i>D. turbinatus</i>	FLQHLKFELVPDQNISMTTGATIHTTNGLFMKFSQRQSNLAFASSTSR.....
<i>V. mangachapoi</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLFMKLSQRQSNLAFASSTSR.....
<i>B. pendula</i>	FLQRLNFELVPDQNISMTTGATIHTTDGLYMKLSERRPDIS..SPTSK.....
<i>O. rehderiana</i>	FLQRLNFELVPDQNIREFVHEA.....QPTPK.....
<i>Q. robur</i>	FLQRLNFELVPDQNISMTTGATIHTTDGLYMKLCERKPNFAFSSPTSK.....
<i>F. sylvatica</i>	FLQRLNFELVPDQDISMTTGATIHTTNGMYMKLSERRSKFDISSPTSK.....
<i>F. excelsior</i>	FLQHLNFELVPDQNISMTTGATIHTTNGLYMKLSERRKSNFDNSPTPSK.....

DNA2

S. robusta HPDILLISGTRVAA SFNCPRRTVLDERLTSSEYSTAALTGTLLEHIFQAGLKEIPSLNFI
P. chinensis HPDILLISGTRVAA SFNCPRRTVLDERLTSSEYSTAALTGTLLEHIFQAGLKEIPSLNFI
H. chinensis YPDILLISGTRVAA SFNCPRRTVLDERLTSSEYSTAALTGTLLEHIFQAGLKEIPSLNFI
D. turbinatus HPDILLISGTRVAA SFNCPRRTVLDERLTSSEHSTAALTGTLLEHIFQAGLKEIPSLNFI
V. mangachapoi HPDILLISGTRVAA SFNCPRRTVLDERLTSSEHSTAALTGTLLEHIFQAGLKEIPSLNFI
B. pendula HPDILLISGTRVAG SFSCPRRTVLDERLKSSEYSTAALTGTLLEHIFQAGLKEIPSLNFI
O. rehdieriana HPDILLISGTRVAG SFSCPRRTVLDERLKSSEYSTAALTGTLLEHIFQAGLKEIPSLNFI
Q. robur HPDILLISGTRVAG SFSCPRRTVLDERLKSSEYSTAALTGTLLEHIFQAGLKEIPSLNFI
F. sylvatica HPDILLISGTRVAG SFSCPRRAVLDERLKSSEYSTAALTGTLLEHIFQAGLKEIPSLNFI
F. excelsior HPDILLISGTRM. VLELR. RNQQQEAALMGTLLEHIFQAGLKEIPSLNFI

S. robusta EEARLVVLQKNLESLEYACGVKENDMYKTLIEAIPKILNWI FLFKDSQNSKAPTIDFGSDN
P. chinensis EEARLVVLQKNLESLEYACGVKENDMYKTLIEAIPKILNWI FLFKDSQNSKAPTIDFGSDN
H. chinensis EEARLVVLQKNLESLEYACGVNENDMYKTLIEAIPKILNWI FLFKDSQNSKAPTIDFGSDN
D. turbinatus EEARLVVLQKNLESLEYACGVNESDMYKTLIEAIPKILNWI FLFKDSQNSKAPTIDFGSDN
V. mangachapoi EEARLVVLQKNLESLEYACGVNENDMYKTLIEAIPKILNWI FLFKDSQNSKAPTIDFGSDN
B. pendula EEARLVVLQKNLESLEYACGVNENDMYKTLIEAVPKMLNWI ITFKDSQ.
O. rehdieriana EEARLVVLQKNLESLEYACGVNENDMYKTLIEAVPKILNWI ITFKDSQSKAPSVDFGSDN
Q. robur EEARLVVLQKSIESLEYACGVNENDMYKTLIEAIPKILNWI ITFKDSQSKAPSVDFGSDN
F. sylvatica EEARLV.
F. excelsior EEARLVVLQKNLENLYACGVDEIDTQKTLIEAIPKILNWI ITFKDSQSKAPSVDFGSDN

S. robusta GLKKLNISEVIDIEEMAWAPKYGLKGMIDASVRVQVESSGNEAYEKILPLEFKTGKAPNG
P. chinensis GLKKLNISEVIDIEEMAWAPKYGLKGMIDASVRVQVESSGNEAYEKILPLEFKTGKAPNG
H. chinensis GLKKFNISEVIDIEEMAWAPKYGLKGMIDASVRVQVESSGNEAYEKILPLEFKTGKAPNG
D. turbinatus GLKKVKISEVIDIEEMAWAPKYGLKGMIDASVRVQVESSGNEAYEKILPLEFKTGKAPNG
V. mangachapoi GLKKVNISEVIDIEEMAWAPKYGLKGMIDASVRVQVESSGNEAYEKILPLEFKTGKAPNG
B. pendula VIDIEEMAWAPKYGLKGMIDASVR.
O. rehdieriana GLKKVNISEVIDIEEMAWAPKYGLKGMIDASVRVSI TSNKNQAN EKIMPLEFKTGKAPNG
Q. robur GLKK. VIDIEEMAWAPKYGLKGMIDASVRANVITSNKNEAHEKIMPLEFKTGKAPNG
F. sylvatica VIDIEEMAWAPKYGLKGMIDASVRVNVKSNKNEAQQKIMPLEFKTGK.
F. excelsior GLKKIKINEVIDIEEMAWAPKYGLKGMIDASVQVRIESTLHEAHEKIMPLEFKTGKAPNG

S. robusta Q. AMEHCAQVILYTLMSERYLKPIDSGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
P. chinensis Q. SVEHCAQVILYTLMSERYLKPIDSGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
H. chinensis Q. AMEHCAQVILYTLMSERYLKPIDSGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
D. turbinatus Q. AMEHCAQVILYTLMSERYLKPIDSGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
V. mangachapoi Q. SVEHCAQVILYTLMSERYLKPIDSGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
B. pendula Q. SMEHCAQVIFYTLLMSERYLKHIDRGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
O. rehdieriana Q. SMEHCAQVIFYTLLMSERYLKHIDRGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
Q. robur Q. ASL. W. YQKHIDRGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
F. sylvatica Q. SMEHSAQVILYTLMSERYLKHIDRGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN
F. excelsior Q. TMEHSAQVILYTLMSERYLKHIDRGLLYYLOSDHTQGIIVRRSDLVGLIMRRNELAN

S. robusta DIVKASTTQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
P. chinensis DIVKASTTQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
H. chinensis DVVKASTTQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
D. turbinatus DIVKASTTQQLPMLRVPTMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
V. mangachapoi DMVKASTSQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
B. pendula DILKASTMQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
O. rehdieriana DILKASTVQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
Q. robur DILKASTIQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
F. sylvatica DILKASTTQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS
F. excelsior DLLKALTAQQLPMLRVPSMCKGCRHLDVCTIYHKALGGDAETSGLGAMYDSLHVHLSNS

S. robusta HCSFLRHWDRLIDLEAKEMQLVKREIWHSHTVKRDSSSCFCSTIAL. . . DELPERKSDS
P. chinensis HCSFLRHWDRLIDLEAKEMQLVKREIWHSHTVKRDSSSCFCSTIAL. . . DELPEQKSDG
H. chinensis QSSFLRHWDRLIDLEAKEMQLVKREIWHSHNTKDRSSSCFCSTIAL. . . DELPEWKSDG
D. turbinatus HCSFLRHWDRLIDLEAKEMQLVKREIWHSHTVKRDSSSCFCSTIAL. . . DELPQRKSDG
V. mangachapoi QCSFLRHWDRLIDLEAKEMQLVKREIWHSHTVKRDSSSCFCSTIAL. . . DELPEQKSDG
B. pendula HCTFLRHWDRLIDLEAREIELVKKIWRSHSLKHDNSTSFLSSVLVDASDELPHQNSLQE
O. rehdieriana HCTFLRHWDRLIDLEAREIELVKKIWRSHSLKHDNSTSFLSSVLVDASDELPHQNSLQE
Q. robur HSIFLRHWDRLIDLEAKEIELVKKIWRSHSLKHDNSTSFLSSVLVDASDELPHQNSLQE
F. sylvatica HCSFLRHWDRLIDLEAKEIELVKKIWRSHSLKHDNSTSFLSSVLVDASDELPHQNSLQE
F. excelsior HCTFLRHWDRLIDLEAKALEVKKIWRSHSLKHDNSTSFLSSVLVDASDELPHQNSLQE

DNA2

S. robusta NRRFYRFRVQRSPDSEVVEGSAIDPVTAAFSLTNDLGS TLKSGDYVMLSTESGCNPIASGV
P. chinensis NRRFYRFRVQRSPDGNVEGSAIDPLTAASSLTNDLGS TLKSGDYVMLSTESGRNPIASGV
H. chinensis NRRFYRFRVQRSPDGNVEGSAIDPLTAASSLTNDLGS TLKSGDYVMLSTESGRNPIASGI
D. turbinatus NRRFYRFRVQRSPDGNVEGSAIDPLTAASSLTNDLGS TLKSGDYVMLSTESGRNPIASGV
V. mangachapoi NRRFYRFRVQRSPDGNVEGSAIDPLTAASSLTNDLGS TLKSGDYVMLSTESGRNPIASGV
B. pendula NRRFYRFRVYRDLLSVNVKASDGDSSFTVVSPTSDMDC TLKSGDYVILSTESGHLTIASGV
O. rehderiana NRRFYRFRVYRDLLSVNVKASDGDSSFTVVSPTSDMDC TLKSGDYVILSTESGHLTIASGV
Q. robur NRRFYRFRVYRDLLSVNVKASDGDSSFTVVSPTSDMDC TLKSGDYVILSTESGHLTIASGV
F. sylvatica NRRFYRFRVYRDLLSVNVKASDGDSSFTVVSPTSDMDC TLKSGDYVILSTESGHLTIASGV
F. excelsior NRRFYRFRVYRDLLSVNVKASDGDSSFTVVSPTSDMDC TLKSGDYVILSTESGHLTIASGV

S. robusta ITDISPIHVSVSFSKRLRLPRSNASSEAEDFIREVWRIDKDNMTSFSVMRFNLVOLFLQ
P. chinensis ITDISPIHVSVSFSKRLRLPRSNASSEAEDFIREVWRIDKDNMTSFSVMRFNLVOLFLQ
H. chinensis ITDISPIHVSVSFSKRLRLPRSNASSEAEDFIREVWRIDKDNMTSFSVMRFNLVOLFLQ
D. turbinatus ITDISPIHVSVSFSKRLRLPRSNASSEAEDFIREVWRIDKDNMTSFSVMRFNLVOLFLQ
V. mangachapoi ITDISPIHVSVSFSKRLRLPRSNASSEAEDFIREVWRIDKDNMTSFSVMRFNLVOLFLQ
B. pendula IKEISRFRHISVSFSKRLRLPRSNASSEAEHDLFIREVWRIDKDEFMTSFAVMRFNLVOLFLR
O. rehderiana ITEISRFRHISVSFSKRLRLPRSNASSEAEHDLFIREVWRIDKDEFMTSFAVMRFNLVOLFLR
Q. robur ITEISRFRHISVSFSKRLRLPRSNASSEAEHDLFIREVWRIDKDEFMTSFAVMRFNLVOLFLR
F. sylvatica ITEISRFRHISVSFSKRLRLPRSNASSEAEHDLFIREVWRIDKDEFMTSFAVMRFNLVOLFLR
F. excelsior ITDVGNSHVSVSFTKRLRLPRSNASSEAEHDLFIREVWRIDKDEFMTSFAVMRFNLVOLFLR

S. robusta NAEESHLLRKMIVDLEAPRFDKECVSSODPAISYLRSEKSLNDDQRRAILKILAAKDYALI
P. chinensis NAEESHLLRKMIVDLEAPRFDKECVSSODPAISYLRSEKSLNDDQRRAILKILAAKDYALI
H. chinensis NAEESHLLRKMIVDLEAPRFDKECVSSODPAISYLRSEKSLNDDQRRAILKILAAKDYALI
D. turbinatus NAEESHLLRKMIVDLEAPRFDKECVSSODPAISYLRSEKSLNDDQRRAILKILAAKDYALI
V. mangachapoi NAEESHLLRKMIVDLEAPRFDKECVSSODPAISYLRSEKSLNDDQRRAILKILAAKDYALI
B. pendula SVQSTQLRRIKIVDLEAPRFDKSGCIFSDQPAISYVWSEKSLNDDQRRAILKILAAKDYALI
O. rehderiana SVQSTQLRRIKIVDLEAPRFDKSGCIFSDQPAISYVWSEKSLNDDQRRAILKILAAKDYALI
Q. robur SVQSTQLRRIKIVDLEAPRFDKSGCIFSDQPAISYVWSEKSLNDDQRRAILKILAAKDYALI
F. sylvatica SVQSTQLRRIKIVDLEAPRFDKSGCIFSDQPAISYVWSEKSLNDDQRRAILKILAAKDYALI
F. excelsior NERSHLLRKMIVDLEMPRFDKSGCIFSDQPAISYVWSEKSLNDDQRRAILKILAAKDYALI

S. robusta LGMPGTGKTTMVHAVIALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
P. chinensis LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
H. chinensis LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
D. turbinatus LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
V. mangachapoi LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
B. pendula LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
O. rehderiana LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
Q. robur LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
F. sylvatica LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH
F. excelsior LGMPGTGKTTMVHAVKALLLRGASILLTSYNSAVDNLLIKLKAQDIDFVIRGRHEAVH

S. robusta EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
P. chinensis EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
H. chinensis EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
D. turbinatus EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
V. mangachapoi EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
B. pendula EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
O. rehderiana EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
Q. robur EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
F. sylvatica EEVRGHCFSAMNHSVNDIKIRLSQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP
F. excelsior TVEGNCISAMKMESTQEIKKIKLDQVKKVAVTCLGITSPLLSGKRFDVDCIMDEAGQITLP

S. robusta VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
P. chinensis VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
H. chinensis VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
D. turbinatus VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
V. mangachapoi VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
B. pendula VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
O. rehderiana VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
Q. robur VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
F. sylvatica VSLGPLMFASMFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM
F. excelsior VSLGPLMLASKFVLVGDHYQLPPLVQSTEARENGMGISLFCRLSEAHPOAISALCSQYRM

e cysQ

S. robusta MEACLVKCP.GNVLQRALKP.....LRCS..SSMATNS.GKFSVKTAYDAVLL
P. chinensis ..MTRC CW.....TLEVPSY
H. chinensis MEACLMKCP.GNALRRVLKP.....LRCS..SSMAIHS.GKISVKTAYDAVLL
D. turbinatus MEACLVKCP.GNALRRVLKP.....FRSS..SSMAIHS.GKISVKTAYDAVLL
V. mangachapoi MEACLVKCP.GNALRRVLKP.....LRCS..SSMAINS.GKISVKTAYDAVLL
B. pendula METCLMRC SHGGSTLFRALKP..PLSMKLPNSLCC..SFMAIHTDGGRSVKTAYDALLL
O. rehdieriana METCLMRC SHGGSTLFRVLKP..PLSMKLPNSL...SFMAIHTDGGRSIKRAYDALLL
Q. robur METCLMKC SH.GRALFRALKP..LSLKLPSIHC...SSMAIHTDGGRWTKRAYDTLLL
F. sylvatica METCLMKC SH.GSALFRALKP..P.SLKLPSIRC...SSMAIHTGGSCAKRAYDALLL
F. excelsior MEAC.....TLFKPLKPSNLNFKISIPSRFSSNFSSSTRIHAGGDRMTKRAYDGILL

S. robusta DAGCTLLQLTRPVEETYASIGAKYGLKATPSDIKKG.....
P. chinensis NWQCLWKR L TSFI.....GAKYGLNATPSDIKKG.....
H. chinensis DAGCTLLQLARPVEETYASIGAEYGLKATPSDIKKG.....
D. turbinatus DAGCTLLQLARPVEQTYASIGAKYGLKATPSDIKKG.....
V. mangachapoi DAGCTLLQLASPVEETYASIGAKYGLKATPSDIKKG.....
B. pendula DAGCTLLQLAKPVEETYATIGSKYGLSATSAEIKQG.....
O. rehdieriana DAGCTLLQLAKPVEETYATIGSKYGLSATSAEIKQG.....
Q. robur DAGCTLLQLAKPVEEYATIGCKYGLSATSAEIKQGFRRFAAPWPEKLRVQVCLSATSA
F. sylvatica DAGCTLLQLAKPVEEYATIGSKYGLSATSAEIKQG.....
F. excelsior DAGCTLLQLAKPVEEYTLTIGQKYGLKATVADIKQG.....

S. robustaFKSAFSAAPWPEKLRVQGDGRPFWKLVSEATSCANEDYFEEVYQ.....
P. chinensisFKRAFSAAPWPKLRVQGDGRPFWKLVSEATGCANDDYFEEVYQ.....
H. chinensisFRRAFPAPWPEKLRVQGDGRPFWKLVSEATGCANDDYFEEVYQ.....
D. turbinatusFKRAFSAAPWPEKLRVQGDGRPFWKLVSEATGCANDDYFEEVYE.....
V. mangachapoiFKRAFSAAPWPKLRVQGDGRPFWKLVSEATGCANDDYFEEVYE.....
B. pendulaFKRAFSAAPWPEKLRVQGDGRPFWKLVSEATGCANDDYFEEVYE.....
O. rehdierianaFKRAFSAAPWPKLRVQGDGRPFWKLVSEATGCANDDYFEEVYE.....
Q. robur EIKQGFRRFAAPWPEKLRVQGDGRPFWKLVSEATGCANDDYFEEVYE.....
F. sylvaticaFRRFAAPWPEKLRVQGDGRPFWKLVSEATGCADGDYFEEVYEVIFLKNKLPKL
F. excelsiorFKRAFSAAPWPEKLRVQDGRPFWRLLVSEATGCDS DNYFEEVYK.....

S. robustaYYANGDAWHLPDGAHQTIILLKDAGVKMAVVSNFDTLRKLLKDLNVLDLFDVAV
P. chinensisYYANGDAWHLPDGAHQTIILLKDAGVKMAVVSNFDTLRKLLKDLNAILDFDAV
H. chinensisYYANGDAWHLPDGAHQTIILLKNAGVKMAVVSNFDTLRKLLKDLNVLDLFDVAV
D. turbinatusYYANGDAWHLPDGAHQTIILLKDVGVKMAVVSNFDTLRKLLKDLNVLDLFDVAV
V. mangachapoiYYANGDAWHLPDGAHQTIILLKDAGVKMAVVSNFDTLRKLLKDLNVLDLFDVAV
B. pendulaYYAKGDAWRLLPDGAYETIALLKDAGVKVAVVSNFDTLRKLLKDLNVLDLFDVAV
O. rehdierianaYYAKGDAWHLPDGAJETIALLKDAGVKVAVVSNFDTLRKLLKDLNVLDLFDVAV
Q. roburYYAKGDAWRLLPDGAYETITLLRDAG.....DLFDVAV
F. sylvatica LVLSPLYYAKGDAWHLPDGAJETITLLKDAGVKIAVVSNFDTLRKLLKDLNVLDLFDVAV
F. excelsiorYYANGDAWHLPDGAJETITLLKDSGVKLAVVSNFDTLRKLLKDLNVLDLFDVAV

S. robusta IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
P. chinensis IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
H. chinensis IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
D. turbinatus IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
V. mangachapoi IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
B. pendula IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
O. rehdieriana IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
Q. robur IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
F. sylvatica IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW
F. excelsior IISSEVGYEKPDARIFKKAAL.....DQVGVEAGRSVHIGDDEKADKMGANAVGIDCWLW

S. robusta GRDVKTFSDIQKRIFILDA
P. chinensis GRDVKTFSDIQKRIFISDA
H. chinensis RSDVKTFSDIQKRIFISDA
D. turbinatus GRDVKTFSDIQKRIFILDE
V. mangachapoi GRDVKTFSDIQKRIFISDE
B. pendula GTDIKTFSDIGSRILISES
O. rehdieriana GIDIKTFSGISRILISES
Q. roburGT.....
F. sylvatica GIDVKTFSDIGNRILISEP
F. excelsior GVDVKTFSDIQNRILLPBP

f BLM

<i>S. robusta</i>	ANHVQEMKDMLIAVSNELLDNAANLS	SPQQIEKLRQDRLOLNKQIQOLERYLN...	DAER
<i>P. chinensis</i>	ANHVQEMKDMLIAVSNELLDNAADNLS	SPQQIEKLRQDRLOLNKQIQOLERYLN...	DAER
<i>H. chinensis</i>	ANHVQEMKDMLIAVSNELLDNAANLS	SPQQIEKLRQDRLOLNKQIQOLERYLN...	DAER
<i>D. turbinatus</i>	ANHVQEMKDMLIAVSNELLDNAANLS	SPQQIEKLRQDRLOLNKQIQOLERYLN...	DAER
<i>V. mangachapoi</i>	ANHVQEMKDMLIAVSNELLDNAANLS	PHQIEKLHQDRLOLNKQIQOLERYLN...	DAER
<i>B. pendula</i>	.....	.....LLLNKQIQOLDGYLHANSVDEER	
<i>O. rehderiana</i>	AAHLQEMKDMLIVISNELLDNVNE	LSLEQIEFLRRDRLOLNKQIQOLDGYLRANSVDEER	
<i>Q. robur</i>	TTHLQEMKDMLIVISNELLDNVNE	LSSEHIEKLRQDRLOLNKQIQOLDGYLRANSVDEER	
<i>F. sylvatica</i>	ATHLQEMKDMLIVISNELLDNVNE	LSLEHIEKLRQDRLOLNKQIQOLDGYLRANSVDEER	
<i>F. excelsior</i>	.....NA	DNLSDFEKLROERQOLNKQIRHLEKYLHSTSVNBER	

<i>S. robusta</i>	QKSHFAAST	ASRTFQYETPQATASWIEPSKFTQVHLHNDSS	MCRNWD	TASASFP	SFNN
<i>P. chinensis</i>	QKSHFAAST	ASRSFQYEMPQATASWIEPSKFTQVHLRNDSS	MCRNWD	TASVSFP	SFNN
<i>H. chinensis</i>	QKSHFVAST	TSRTFQYETPQATASWIEPSKFTQVHLRNDSS	MCRNWD	TASVSFP	SFNN
<i>D. turbinatus</i>	QKSHFAAST	ASRTFQYETPQATASWIDPSKFTQVHLHNDSS	MCRNWD	TASVSFP	SFNN
<i>V. mangachapoi</i>	KKSHFAAST	ASHTFRHETPQATASRIDPSKFTQVHLHNDSS	VCWNNS	SPSVSFP	SFNN
<i>B. pendula</i>	QRSHYCIHG	.....SYQLIYKNEAGYERWNS	SPSVS	SFSDVR	
<i>O. rehderiana</i>	QSSHYSTATA	ATRPFQYETPEAATLRT.SMRCDAHVNLHNEAGYERWNS	TVS	SFSDVR	
<i>Q. robur</i>	QKSHYSTST	AIRSFQYETPQAATAFKT.PMRFEAQVNLNELG	SNERWN	...SF	SSDVR
<i>F. sylvatica</i>	QRSHYSTST	AATRSFQYETPQADAFKT.SMRFEAQVNLNELG	SYERWN	...SF	SSDVR
<i>F. excelsior</i>	KMSQFSST	.LSTPMTFQTPPAVPRIDSTRLDRFQINTESS	FDRWGS	SPSFP	SYSTDR

<i>S. robusta</i>	FDVSSAVG	REPYIPKI	IEVNYIEGSND	QQRW	SRDFSWTKKLEANNKKVFGNHSFRPNQR
<i>P. chinensis</i>	LDISSAPV	GREPYIPKI	IEVNYIEGSND	QQRW	SRDFSWTKKLEANNKKVFGNHSFRPNQR
<i>H. chinensis</i>	FDVSSAPV	GREPYIPKI	IEVNYIEGSND	QQRW	SRDFSWTKKLEANNKKVFGNHSFRPNQR
<i>D. turbinatus</i>	FDVSSAPV	GREPYIPKI	IEVNYIEGSND	QQRW	SRDFSWTKKLEANNKKVFGNHSFRPNQR
<i>V. mangachapoi</i>	FDVSSAPV	GREPYIPKI	IEVNYIEGSND	QQRW	SRDFSWTKKLEANNKKVFGNHSFRPNQR
<i>B. pendula</i>	FGVSSGPM	EREPYIPKY	VEVNYIEGSND	KKCS	SGNFPWTKKMEAINKKVFGNHSFRPNQR
<i>O. rehderiana</i>	FGVSSGPV	EREPYIPKY	AEVNYIEGSND	KKWS	SGNFPWAKKLEANNKKVFGNHSFRPNQR
<i>Q. robur</i>	FDVSSVPLE	REPYVPKY	VEVNYIEGSND	KKWS	QNFPPWAKKLEANNKKVFGNHSFRPNQR
<i>F. sylvatica</i>	FDVLSGPLE	REPYIPKY	VEVNYIEGSND	KKWS	ENFPWTKKLEANNKKVFGNHSFRPNQR
<i>F. excelsior</i>	FGVSTAPLE	REPYVPKY	IEVNYIEGSND	KKWS	GWDFPWTKKLEANNKKVFGNHSFRPNQR

<i>S. robusta</i>	EVINATMSGH	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	....
<i>P. chinensis</i>	EVINATMTGH	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>H. chinensis</i>	EVINATMSGH	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>D. turbinatus</i>	EVINATMSGH	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>V. mangachapoi</i>	EVINATMSGH	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>B. pendula</i>	EAINAAMSGY	DVFLMPTGR	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>O. rehderiana</i>	EVINATMSGC	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>Q. robur</i>	EVINATMSGC	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>F. sylvatica</i>	EVINATMSGY	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP
<i>F. excelsior</i>	EVINATMSGY	DVFLMPTGG	GKSLTYQLPALICPGITL	VISPLVSLIQDQIMHLLQ	ANIP

9 LRPPRC

S. robusta MEKAWLFFYWAS KIKGFKHDQFTYTTMLDIFGEAGRIS SMKYVFQOMOEKGTIDAVTYT
P. chinensis MEKAWLFFYWAS KIKGFKHDQFTYTTMLDIFGEARRIS SMKYVFQOMOEKGTIDAVTYT
H. chinensis MEKAWLFFNWS KIKGFKHDQFTYTTMLDIFGEAGRIS SVKYVFQOMOEKGTIDAVTYT
D. turbinatus MEKAWLFFNWS KIKGFKHDQFTYTTMLDIFGEAGRIS SMKHVFQOMOEKGTIDAVTYT
V. mangachapoi MEKAWLFFNWS KIKGFKHDQFTYTTMLDIFGEAGRIS SMKYVFQOMOEKGTIDAVTYT
B. pendula MEKAWLFFNWS RLKGFKHDQFTYTTMLDIFGEAGRIP SMKHVFQOMOEKGLKIDAVTYT
O. reheriana MEKAWLFFNWS RLKGFKHDQFTYTTMVGIFGEAGRIS SMNYVFE LMRKGLKIDAVTYT
Q. robur MEKAWLFFNWS KIKGFKHDQFTYTTMLDIFGEAGRVA SMKHVFEOMOEKGLKIDAVTYT
F. sylvatica MEKAWLFFNWS RLKGFKHDQFTYTTMLDIFGEAGRIS SMKHVFEOMOEKGLKIDAVTYT
F. excelsior MEKAWLFFNWS GRKNFKHDQFTYTTMLDIFGEARRIS SMKYVFQOMOEKGLKIDVVTYT

S. robusta SVMHWVSRG GDVDGAVEVWEEMREKGC EPTVVSYTAYMKILFDNKR VKEATDIFYKEMLOS
P. chinensis SVMHWVSRG GDVDGAVEVWEEMREKGC EPTVVSYTAYMKILFDNKR VKEATDIFYMEMLOS
H. chinensis SVMHWVSRG GDVDGAVEVWEEMREKGC EPTVVSYTAYMKILFDNKR VKEATDIFYKEMLOS
D. turbinatus SVMHWVSRG GDVDGAVEVWEEMREKGC EPTVVSYTAYMKILFDNKR VKEATDIFYKEMLOS
V. mangachapoi SVMHWVSRG GDVDGAVEVWEEMREKGC EPTVVSYTAYMKILFDNKR VKEATDIFYKEMLOS
B. pendula SLMHWLSSS GDVDGAVKVVWEEMKNGC YPTVVSYTAYMKVLFDN SRAKEATDIFYREMLRS
O. reheriana SLMHWLSSS GDVDRAVKVVWEEMKANGC FLTVVSYTAYMKVLFDN SRAKEATDIFYREMLRS
Q. robur SLMHWLSSS GNVGAIKVVWEEMKNGC FPTVVSYTAYMKILFDN NRAKEATEVYKEMLRS
F. sylvatica SLMHWLSSS GDVDGAMKVVWEEMKNGC FLTVVSYTAYMKILFDN GRASEATDAYKEMLRS
F. excelsior SLLHWMSND GDVDGAVKLVWEEMKLGCR PTVVSYTAFMKILFDH KRVKEATEVYKEMLOS

S. robusta GISPNCHTYT VLMEHLIGAGKYNEALDIFNMQEAEVK PDKAACNVL IEKCKARETGAI
P. chinensis GISPNCHTYT VLMEHLIDAGKYNEALDIFNMQEAGVK PDKAACNVL IEKCKARETGAI
H. chinensis GISPNCYTYT VLMEHLIDAGKYNEALDIFNMQEAGVK PDKAACNVL IEKCKVRETGAI
D. turbinatus GITPNGHYTYT VLMEHLMGAGKYNEALDIFNMQEAGVK PDKAACNVL IEKCKTRATGAI
V. mangachapoi GISPNCHTYT VLMEHLIGAGKYDEALDIFNMQEAGVK PDKAACNVL IEKCKARETGAI
B. pendula GCAPNCHTYT VLMEYLVGSGKYKEALEMFCMQEAGAQ PDKAACNVL IEKCKARETGAI
O. reheriana GCTPNCHTYT VLMEYLVGSGKYKEALEMFCMQEAGTQ PDKAACNVL IEKCKMAGETKAF
Q. robur GFSPTCHTYT VLMEYLVGSGKYEEALEIFSKMQEAGIQ PDKAACNVL IEKCKAGETRAL
F. sylvatica GCAPTCHTYT VLMEYLVGSGECNTVF.....LVEG.VMIAACGKV
F. excelsior GLSPNCYTYT VLMEHLACSGKFD EALEVFNMQEAGVQ PDKATCNL IVEIC CRTGETWAM

S. robusta TQILQYMKHF LVLRYPIFLETLKTLN AAGESD LLLRQVHPHISPECVSDEKEVELIRNG
P. chinensis TQILQYMKHF LVLRYPIFLEALKILN AAGESD LFLRQVHPHISVEHVSDEKEVELIRNG
H. chinensis TQILQYMKENFLVLRYPFLEALKTLN AAGESD LLLRQVHPHISVERVSDEKEVELIRNA
D. turbinatus TQILQYMKENFLVLRYPFLEALKSLN AAGESD LLLRQVHPHISVECVSDKKEVELIGNA
V. mangachapoi TLLILQYMKENFLVLRYPFLEALKTLN AAGESD LLLRQVHPHISAEVVTDEKEVEPIRNA
B. pendula TLLILQYMKESRLVLRYPVFLKALKIAGES SALLMQVNP HFS TICVSEEEAVDLRPTA
O. reheriana TLLILQYMKQNLVLRYPVFLKALKIAGES SALLMQVNP HFS TICVSEEEAGDLRATG
Q. robur TLLILQYMKESRLVLRYPVFLKALKIAGES SALLMQVNP HFS TICVSEEEAVDLRPTA
F. sylvatica SVWAGTVTCS MWPLRWG.....DALVSSI.....
F. excelsior MKILQYMKENL LVLRYPVYQKALETFK MAGESYELLRQVNRHFVIEHFKEEKTDFKGFETA

S. robusta SEVTL SLERELVLL LKKQNL LAVDHL LAALGDKNKQLDPAIISTIEANGNHCRLD GAL
P. chinensis SEVTF SLERELVLL LKKQNL LAVDHL LAALGDKNKQLDPAIISTIEANSNHCR LAGAL
H. chinensis SEVNL SLERELVLL LKKQNL LAVDHL LAALGDKNKQLDPAIISTIEANSNH LQ.....
D. turbinatus SEVTL SLERELVSL LKKQNL LAIDHL LAALGDRNKR LDP AIISTIEANGNHCRLD GAL
V. mangachapoi SEVTL SLERELVLL LKKQNL LAVDHL LAALGDENKQLDPAIIT TIEANGNHCRLD GAL
B. pendula ADVPF SIDRGLLIFLKKRN LVAIDRLTGTIDKNIRLDSAIIS IIVEANCDCRRS GAL
O. reheriana ADVPF SIDRGLLIFLKKRN LVAIDRLTGTIDKNIRLDSAIIS IIVEANCDCRRS GAL
Q. robur SDTSY GIDRGLLIFLKKRN LVAIDRLTGTIDKNMQLDSAIISAI IKENCGHRRS GAL
F. sylvaticaLVSHLGGDGRS WNVKFLRDFHDWELESA.....
F. excelsior RVNCF NVDSGF VLNLINKQNFVAIDY LADMDKGVRLDSKIISTIEELNS TNGRWNSAL

S. robusta SAFNYSVKMS IILERTAF LALIGLIRSNAFISVVS IVEEMVRAGYSLGVYLGSLLIYRL
P. chinensis SAFNYSVKMS IILERTAF LSLIGLIRSNFTISVVS IVEEMVRAGYSPGVYLGSLLIYRL
H. chinensisARWC IIGLQL.....
D. turbinatus LAFNYSVKMS IILERTYLA LIGLIRSNFTICVVS IVEEMVRAGYSLGVYLGSLLIYRL
V. mangachapoi SAFNYSVKMS IILERTYLA LIGLIRSNFTISVVS IVEEMVRAGYSLGVYLGSLLIYRL
B. pendula LAFKYSVRMG IITERNAYLS LIGLIMRSNSFSKVVE IVEAMIRIGQSLGTYQSALLIYRL
O. reheriana LAFKYSVRMG IITERNAYLS LIGLIMRSNSFSKVVE IVEAMIRIGQSLGTYQSALLIYRL
Q. robur LAFKYSVRMG IITERNAYLS LIGLIRSNYSFAKVVKVVEAMIGAGHSLGTYQSALLIYRL
F. sylvaticaTSFLELI.....
F. excelsior FAF EYGVKFG LNIDRIAYIAL IGLSIRTNSFSKAVE IVEEMVREHSLGTQQSALLIYHL

h LSD1

<i>S. robusta</i>	.....	MAQIPNLDNSPINKSK
<i>P. chinensis</i>	.....LLDASHRNL.RSLPRSFRRSSADS	MAQIPNLDNSPINKSK
<i>H. chinensis</i>	.....ISRRSSADS	MAQIPNLDNSPINKSK
<i>D. turbinatus</i>	.....LLQASHRKLKSGSLPRSFRRSSADS	MAQIPNLDNSPINKSK
<i>V. mangachapoi</i>	.....	MAQIPNLDNSPINKSK
<i>B. pendula</i>	.....	MAQIPNLDNAPLNFT
<i>O. rehderiana</i>	.....	MAQIPNLDNAPLNFT
<i>Q. robur</i>	.....	MAQIPNLDNAPLNFT
<i>F. sylvatica</i>	MKVRGTERQREACKSIGVMEVKEIKRESQKREIPSLYNTERHFAP	MAQIPNLDNAPLNFT
<i>F. excelsior</i>	.....	MAQIPNLDNAPLNFT

<i>S. robusta</i>	SMRDQSQRDLLKILK	IRGKKCLVIEPKLGGSLSLIIQTSILKEHGVLELRHLSPEPVO
<i>P. chinensis</i>	SIREQSQRDLLKILK	IRGKKCLVIEPKLGGSLSLIIQTSLLKEHGVLELRHLSPEPVO
<i>H. chinensis</i>	SIREQSQRDLLKILK	IRGKKCLVIEPKLGGSLALIIQTSLLKEHGVLELRHLSPEPVO
<i>D. turbinatus</i>	SIREQSQRDLLKILK	IRGKKCLVIDPKLGGSLSLIIQTSLLKEHGVLELRHLSPEPVO
<i>V. mangachapoi</i>	SIREQSQRDLLKILK	IRGKKCLVIEPKLGGSLSLIIQTSLLKEHGVLELRHLSPEPVO
<i>B. pendula</i>	SLREQSQRDLLKILK	IRGKKCLVIDPKLGGSLSLIIQTSLLKEHGVLELRHLSADPIQ
<i>O. rehderiana</i>	SLREQSQRDLLKILK	IRGKKCLVIDPKLGGSLSLIIQTSLLKEHGVLELRHLSADPIQ
<i>Q. robur</i>	SLREQSQRDLLKILK	IRGKKCLVIDPKLGGSLSLIIQTSLLKEHGVLELRHLSADPIQ
<i>F. sylvatica</i>	SLREQSQRDLLKILK	IRGKKCLVIDPKLGGSLSLIIQTSLLKEHGVLELRHLSADPIQ
<i>F. excelsior</i>	SLREQSQRDLLKILK	IRGKKCLVIDPKLGGSLSLIIQTSLLKEHGVLELRHLSADPIQ

<i>S. robusta</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>P. chinensis</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>H. chinensis</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKIVHNLMT
<i>D. turbinatus</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>V. mangachapoi</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>B. pendula</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>O. rehderiana</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>Q. robur</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>F. sylvatica</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT
<i>F. excelsior</i>	CTKVVYLVLRPORDLMKIIS	SHVNDISKGLQREYIYFVPRRQV	CEKILEBEKVVHNLMT

<i>S. robusta</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	.....
<i>P. chinensis</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>H. chinensis</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>D. turbinatus</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>V. mangachapoi</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>B. pendula</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>O. rehderiana</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>Q. robur</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>F. sylvatica</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR
<i>F. excelsior</i>	IGEYALYVVPFDEDV	LSFELDLAYKECQVDGDT	SLWHIAKAIHRL	SSFGIIPNVR

<i>S. robusta</i>	.....	MTVPEINTLILIDRE	VDMVTPM	CSQTYEGLLDEFL
<i>P. chinensis</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>H. chinensis</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>D. turbinatus</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>V. mangachapoi</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>B. pendula</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>O. rehderiana</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>Q. robur</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>F. sylvatica</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL
<i>F. excelsior</i>	GKASVLVADILNRMQTE	EEPVNSLDM	TVPEINTLILIDRE	VDMVTPMCSQTYEGLLDEFL

<i>S. robusta</i>	HISNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>P. chinensis</i>	HISNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>H. chinensis</i>	HISNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>D. turbinatus</i>	HISNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>V. mangachapoi</i>	HISNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>B. pendula</i>	RINNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>O. rehderiana</i>	RINNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>Q. robur</i>	HVNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>F. sylvatica</i>	HVNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY
<i>F. excelsior</i>	GVNNGAVELDT	SVMGVQOEGKMM	KVPLNSSDKLFKEIRD	INFEVVVQVLRQKATSMKQDY

i SMG1

S. robusta MGEEQHOAPEQ..... QPESQVESAASEQS..... QKEYSWPVI
P. chinensis MGEEQHOAPEH..... QPESQVESTBASEQS..... QKEYSWPVI
H. chinensis MGEEQHOAPDH..... QPESQVESTBASEQS..... QKEYSWPVI
D. turbinatus MGEEQHOAPEH..... QPESQVESTBASEQS..... QKEYSWPVI
V. mangachapoi MGEEQHOAPEQ..... QPESQVESTBASEQS..... QKEYSWPVI
B. pendula MSVTEAMGEEE.EEEKH..... QTNSPSGVAEITQAT..... QEDHSWPLI
O. rehderiana MSATEAMGEEE.EEEKH..... QNSPSPSGVAEITRAT..... QEEHSSPVV
Q. robur MGQEEEEQENHNHNNHSESSES KSNSPSEVAEITEPTKDQEEQQQKEYSWPVI
F. sylvatica MSVTEAMEEE... VENE..... QNSPSEVAEITEAT..... QKEYSWPVI
F. excelsior MGEEGADAHEHQ..... QPNPDET ESTE FETE TP..... SNGAYSWPLV

S. robusta SFDAPPRTYHFYQFRRT.SPNPNFLKGVKWSPDGSCFLASSDDNTLRIFSLPDNGSSD
P. chinensis SFDAPPRTYHFYQFRRT.GPNPNFLKGVKWSPDGSCFLASSDDNTLRIFSLPDNGSSD
H. chinensis SFDAPPRTYHFYQFRRT.SPNPNFLKGVKWSPDGSCFLASSDDNTLRIFSLPDNGSSD
D. turbinatus SFDAPPRTYHFYQFRRT.SPNPNFLKGVKWSPDGSCFLASSDDNTLRIFSLPDNGSSD
V. mangachapoi SFDAPPRTYHFYQFRRT.SPNPNFLKGVKWSPDGSCV LASADDNTLRIFSLPDNGSSD
B. pendula RFDVPPRTYHFYHOFRT.GPNPNFLKGVKWSPDGSCFLTSSDDNTLRIFSLPDYGS GG
O. rehderiana RFDVPPRTYHFYHOFRT.GSNPNFLKGVKWSPDGSCFLTSSDDNTLRIFSLPDYGS GG
Q. robur RFDVPPRTYHFYHOFRT.SPNPNFLKAVKWSPDGSCFLTSSDDNTLRIFSLPDNGSS GG
F. sylvatica QFDVLPRTYHFYHOFRT.APNPNFLKAVKWSPDGSCFLTSSDDNTLRIFSLPDNGSS GG
F. excelsior HYDAHPRYTYHFYKOFRT.AASNPNFLKGVKWSPDGSCFLTCCDDNTLRIFSLPYDDSSIN

S. robusta YVNTNSSIPAEDSFAADLVVREGESVYDFCWYPYMSASDPVTCVFATPTRDHPHILWDA
P. chinensis YVNTSSIPAEDSFAADLVVREGESVYDFCWYPYMSASDPVTCVFATPTRDHPHILWDA
H. chinensis YVNTSSIPAEDSFAADLVVREGESVYDFCWYPYMSASDPVTCVFATPTRDHPHILWDA
D. turbinatus NINTHSSVPAEDSFAADLVVREGESVYDFCWYPYMSASDPVTCVFATPTRDHPHILWDA
V. mangachapoi YVNTSSVPPEDSFAADLVVREGESVYDFCWYPYMSASDPVTCVFATPTRDHPHILWDA
B. pendula DVSTCSTASD EDSYAANLVVREGESVYDFCWYPYMSASDPVSCVFATPTRDHPHILWDA
O. rehderiana DVSTWSTVSD EDSYAANLVVREGESVYDFCWYPYMSASDPVSCVFATPTRDHPHILWDA
Q. robur DINTCSIAAD EDSYAANLVVREGESVYDFCWYPYMSASDPVSCVFATPTRDHPHILWDA
F. sylvatica DVNTCSIAAD EDSYAANLVVREGESVYDL CWYPYMSASDPVSCVFATPTRDHPHILWDA
F. excelsior YVNTCASAPD EDSYVANLVVREGESVYDYCWYPHMSASNDL CVYATPTRDHPHILWDA

S. robusta SGLRCTYRAYDAVDEITAAFSISFNPGTKIFAGYNKTI R VF DVHRPGRDFAOYSTLQG
P. chinensis SGLRCTYRAYDAVDEITAAFSISFNPA GTKIFAGYNKTI R VF DVHRPGRDFAOYSTLQG
H. chinensis SGLRCTYRAYDAVDEITAAFSISFNPA GTKIFAGYNKTI R VF DVHRPGRDFAOYSTLQG
D. turbinatus SGLRCTYRAYDAVDEITAAFSISFNPA GTKIFAGYNKTI R VF DVHRPGRDFAOYSTLQG
V. mangachapoi SGLRCTYRAYDAVDEITAAFSISFNPA GTKIFAGYNKTI R VF DVHRPGRDFAOYSTLQG
B. pendula SGE LRCTYRAYDAMDEITAAFSIAFNPHG TKIFAGYNKAVR VFDHRPGRDFEOHSTLQG
O. rehderiana SGE LRCTYRAYDAMDEITAAFSIAFNPHG TKIFAGYNKAVR VFDHRPGRDFEOHSTLQG
Q. robur SGE LRCTYRAYDAMDEITAAFSIAFNPA GTKIFAGYNKTI R VF DVHRPGRDFEOHSTLQG
F. sylvatica SGE LRCTYRAYDAMDEITAAFSIAFNPA GTKIFAGYNKTI R VF DVHRPGRDFEOHSTLQG
F. excelsior SQGLRCTYRAYDAMDEITAAFSIGFNPSG TKIFAGYNSLRI R F DVHRPGRDFEOHSTLQR

S. robusta NKEGQTGIISALAFSPTHSGMLATGSYSQTTAIYKEDNMELLYILHGQEGGITHVQFSKD
P. chinensis NKEGQTGIISALAFSPTHSGMLATGSYSQTTAIYKEDNMELLYILHGQEGGITHVQFSKD
H. chinensis NKEGQTGIISALAFSPTHSGMLATGSYSQTTAIYKEDNMELLYILHGQEGGITHVQFSKD
D. turbinatus NKEGQTGIISALAFSPTHSGMLATGSYSQTTAIYREDNMELLYILHGQEGGITHVQFSKD
V. mangachapoi NKEGQTGIISALAFSPTHSGMLATGSYSQTTAIYREDNMELLYILHGQEGGITHVQFSKD
B. pendula NKEGLAGIISALAFCPTEHTGLLAMGSYSQTTAIYTEDNMELLYVLHGHEGGVTHVQFSKD
O. rehderiana NKEGLAGIISALAFCPTEHTGLLAMGSYSQTTAIYREDNMELLYVLHGHEGGVTHVQFSKD
Q. robur NKEGQTGIISALAFCPTEHTGLLAMGSYSQTTAIYQEDNMELLYVLHGQEGGITHVQFSKD
F. sylvatica NKEGQTGIISALAFCPTEHTGLLAMGSYSQTTAIYQEDNMELLYVLHGQEGGITHVQFSKD
F. excelsior NKEGQSGIISALAFSPTHSGVLA TGSYSQTTAIYREDNMEPLYVLHGQEGGITHVQFSKD

S. robusta GNYLYTGGRKDPYIMCWDIRKAVEVVKLYRSTES TNQRIYFDIEPYGRYLG TGGDGDGV
P. chinensis GNYLYTGGRKDPYIMCWDIRKAVEVVKLYRSTES TNQRIYFDIEPYGRYLG TGGDGDGV
H. chinensis GNYLYTGGRKDPYIMCWDIRKAVEVVKLYRSTES TNQRIYFDIEPYGRYLG TGGDGDGV
D. turbinatus GNYLYTGGRKDPYIMCWDIRKA.EVVYKLYRSTES TNQRIYFDIEPYGRYLG TGGDGDGV
V. mangachapoi GNYLYTGGRKDPYIMCWDIRKAVEVVKLYRSTES TNQRM YFDIEPYGRYLG TGGDGDGV
B. pendula GNYLYTGGRKDPYILCWDMRKAVDVVKLYRSEY TNQRIAFDIEPSSGRHLGTGGDGDGV
O. rehderiana GNYLYTGGRKDPYILCWDIRKAVDVVKLYRSECTNQRILFDIEPLGRHLGTGGDGDGV
Q. robur DPYILCWDIRKAVDVVKLYRSECTNQRILFDIEPLGRHLGTGGDGDGV
F. sylvatica GNYLYTGGRK..... DPYILCWDIRKAVDVVKLYRSECTNQRILFDIEPLGRHLGTGGDGDGV
F. excelsior GNYLYTGGRKDPYILCWDIRNTVDIVYKLYRSSKD TNQRIQFDIEPLGRYLG TGGDGDGV

SMG1

<i>S. robusta</i>	HIYDLQTGWISG	YQAAADTVNGFN	FHPFLPMAAS	SSGHRRFQ	IPEEDTEELF	..LRGDE
<i>P. chinensis</i>	HIYDLQTGWISG	VQAAADTVNGFT	FHPFLPMAAS	SSGHRRFQ	IPEEDTEEVF	..LRGDE
<i>H. chinensis</i>	HIYDLQTGWISG	FQAAADTVNGFT	FHPFLPMAAS	SSGHRRFQ	IPEEDTEELF	..LRGDE
<i>D. turbinatus</i>	HIYDLQTGWISG	FQAAADTVNGFT	FHPFLPMAAS	SSGHRRFQ	IPEEDTEELF	..LRGDE
<i>V. mangachapoi</i>	HIYDLQTGWISG	FQAAADTVNGFT	FHPFLPMAAS	SSGHRRFQ	IPEEDTEELF	..LRGDE
<i>B. pendula</i>	HIYDLQTGHVVS	SFHAALDTVSGFS	FHPFLPMAAS	SSGHRRFV	VPDDTYEDMPLT	LSGNE
<i>O. rehderiana</i>	HIYDLQTGHVVS	SFHAALDTVSGFS	FHPFLPMAAS	SSGHRRFV	VPDDTYEDMPLT	LSGNE
<i>Q. robur</i>	HIYDLQTGHVVS	SFQAASDTVSGFS	FHPFLPMAAS	SSGHRRFV	VPDDLYEDVP	..LSGNE
<i>F. sylvatica</i>	HIYDLQTGNWVS	SFQAALDTVSGFS	FHPFLPMAAS	SSGHRRFV	VPDDVSEDI	P..LSVLL
<i>F. excelsior</i>	HIYDLQTGWVVS	SFQAALDTVNGFA	FHPFLPMAAS	SSGHRRFG	GLDDFQENMD	..LSGDE

<i>S. robusta</i>	NCASVWSFSYTS	MAESGVGMNAD	HAKKSVGGAES	HVHYLPMYVLNS	ICVIGFQANL	HPSH
<i>P. chinensis</i>	NCASVWSFSYTS	MAESGVGMNAG	DFNS	.....	QSENGN	IHCDS
<i>H. chinensis</i>	NCASVWSFSYTS	IADSGVGMNTG	DFNK	.....	QPENED	IHCDS
<i>D. turbinatus</i>	NCASVWSFSYTS	MAESGVGMNAS	DFNS	.....	QSENE	IHRDS
<i>V. mangachapoi</i>	NCASVWSFSYTS	MAESGVSKNAG	DFL	.....	QSENE	VHCDS
<i>B. pendula</i>	NCASVWSFSIPT	MVNDTEIKGD	SNS	.....	LSHENL	QHDP
<i>O. rehderiana</i>	NCASVWSFSIAS	TVNDEITNGD	SNC	.....	PSEHENL	HHDP
<i>Q. robur</i>	NCASVWNFSVAS	VNDETELN	GNDFNN	.....	LSEHEE	LHQGP
<i>F. sylvatica</i>	ICGIFLKYLFG	.....	.....	.....	.....	.....
<i>F. excelsior</i>	NCASVWSFSCS	STSDTS	SI	ESGN	.....	.....

PPP2R5

S. robusta .VETQELRRTSVGRPLRHVVVEKADNKRVLSSRRKSTRLQSQVPEPTEDVLEMD EAKYR...
P. chinensis .VETQELRRTSVGRPLRHVVVEKADNKRVLSSRRKSTRLQSQVAEPTEDVLEMD EAKYH...
H. chinensis .IETQELRRTSIGRPLRHVVVEKADNKRVLSSRRKSTRLQSQVPEPTEDVLEMD EAKYD...
D. turbinatus .VETQELRRTSVGRPLRHVVVEKADNKRVPSSRRKSTRLQSQVPEPTEDVFEIDDTKFP...
V. mangachapoi .VETQELRRTSVGRPLRSMVDKADNKRVLSSRRKSTRLQSQVPEPTEDVLEMD EAKSH...
B. pendula QSENQSLGSLTVEPI.HAKENVENKR.CLRROSTFFKSEES EPTEDLIEIDKASGPTIVK
O. rehderiana QSENQSLGSLTAEPV.HAKENVENKR.RLRROSTFFKSEES EPTEDI.EIDKASAPTIVK
Q. roburHAKENVENKR.RLRROSTFFKSEES EPTEDI.EIDKASAPTIVK
F. sylvaticaHAEIIVRNKR.RLRROSTFFKSEES EPTEDI.EIDKASAPTIVK
F. excelsiorQSMSTKTEKRS.SVRRROSTFFKSEES EPTEDI.EIDKASAPTIVK

S. robusta ISPLHEETLHLNVPVLSGSSVQKEQEQGNRATGVKTRLELRTSVGRPLCDVVEKADNKRVP
P. chinensis VSPLEETLHLNVPVLSGSSVQKEQEQGNRATGVKTRLELRTSVGRPLHDVVEKADNKRVP
H. chinensis VSPLEETLHLNVPALS GSSVQKEQEQGNRATGVKTRLELRTSVGRPLHDVVEKADNKRVP
D. turbinatus ISSLHEEALHLNVPASSGSSLQKEQEQGNRAKGVETQELRTSVRRPSCDVVEKADNKRVP
V. mangachapoi VSPLEETLPLNVPSSVSSLRKEQE.GNGATGVETQELRTSVGRPLCGVVEKADNKRVP
B. pendula LVPTKEHVDNKR.PSRRQSARFKSEEPGPIEDLFEIDKASSPTTLKPVHAKESIGN...
O. rehderiana LVHTREHFDKRRQHSRRQSARFKSEEPGPIEDLFEIDKASSPTTLKPVHAKESIGN...
Q. robur
F. sylvatica
F. excelsior

S. robusta SKRKSSTRLQSQVPEPTEDVFEIDDTKFPISSLHEEMVHVNVPASSASSTPKEEQGGINAP
P. chinensis SKRKSSTRLQSQVPEPTEDVFEIDDTKFPISSLHEEMVHVNVPASSVSTPKEEQGGINVP
H. chinensis SKRKSSTRLQSQVPEPTEDVFEIDDTKFPISSLHEEMVHVNVPASSVSTPKEEQGGINVP
D. turbinatus SKRKSSTRLQSQVPEPTEDVFEIDDTKFPISSLHEEALHLNVPASSGSLQKEER.GINAP
V. mangachapoi SKRKSSTRLQSQVPEPTEDVFEIDDTKFPISSLHEEMVHVNVPASSVSTPKEEQGGINAP
B. pendula .KRQSARSKSEEPQEDFEIYDAKFPVSPLLDDSVHETSQMALALSIEKEDDE.GNTALH
O. rehderiana .KRQSARSKSEEPQEDFEIYDAKFPVSPLLDDSVHETSQMALALSIEKEDDE.GNTAL
Q. roburEPEQTEDFEIDSAKFPVSPVHDDLVEHSGQMLSGLSVKEDEDE.GNTAL
F. sylvaticaEPEQTEDFEIDSAKFPVSPVHDDLVEHSGQMLSGLSVKEDEDE.GNTAL
F. excelsiorEKEPAEEDLFEITCDAREPVCSLPDDTVLENDISLVSAAVKNQEVKECVPA

S. robusta EGEVQELRRRTSVGRPLRRAAEKVQSYKEIPLVKMRRPE...
P. chinensis EGEVQELRRRTSVGRPLRRAAEKVQSYKEIPLNVKMRRE...
H. chinensis GGEVQELRRRTSVGRPLRRAAEKVQSYKEIPLNVKMRRE...
D. turbinatus GGEVQELRRRTSVGRPLRRAAEKVQSYKEIPLNVKMRRE...
V. mangachapoi EGEVQELRRRTSVGRPLRRAAEKVQSYKEIPLNVKMRRE...
B. pendula SLBAQEIIRRSVGRPLRRAAEKIQSYKEISINVKMRRLE...
O. rehderiana SLBAQEIIRRSVGRPLRRAAEKIQSYKEIPLNVKMRRE...
Q. robur RFESQEIIRRSVGRPLRRAAEKVQSYKEIPLNVKMRRE...
F. sylvatica RLBAQEIIRRSVGRPLRRAAEKVQSYKEIPLNVKMRRE...
F. excelsior RYEPQKFGRSLSLGRPSRQAAIKVQSYKEIPLNVKMRRE...

SKI3

S. robusta SARNSYQRALNLPWQANIYTDIATSSDLISSLKGDHEYIQNAWOLPEKMGALGALLEGD
P. chinensis SARNSYQRALNLPWQANIYTDIATSSDLISSLNGDHEYIQNAWOLPEKMGALGALLEGD
H. chinensis SARNSYQRALNLPWQANIYTDIATSSDLISSLNGDHEYIQNAWOLPEKMGALGALSLEGE
D. turbinatus SARNSYQRALNLPWQANIYTDIATSSDLISSLNGDHEYIQNAWRPEKMGALGALLEGD
V. mangachapoi SARNSYQRALNLPWQANIYTDIATSSDLISSLNGDCEYIQNAWOLPEKMGALGALLEVD
B. pendula SAKCSYQRALHMAPWQANIYTDIATASDLISSLNKSYGNLNAWOLSEKMGALGALLEGD
O. rehdieriana SAKHSYQRALHLPWQANIYTDIATASDFISLNLKSYENLNAWOLSAKMGALGALLEGD
Q. robur SAKCSYQRALHLPWQANIYTDIATADLISSLTMSDGNDFNDWOLSEKMGALGALLEGD
F. sylvatica SARCSYQRALHLPWQANIYTDIATITDLISSLTKSVGNVNAWOLSEKMGALGALLEGD
F. excelsior SASRSYQRALHLPWQANIYTDIATASDINFLSKEDPNGLNAWOLSAKMGALGALLEGH

S. robusta NSVFWIVLGLCSNQQALRQHALIRGLQLDVSLAIAWANLGGKLYREDEKKLARQAFDCAR
P. chinensis NSEFWIVLASLNNQALRQHALIRGLQLDVSLAIAWANLGGKLYREDEKKLARQAFDCAR
H. chinensis NSEFWIVLGLCSNQQALRQHALIRGLQLDVSLAIAWANLGGKLYRENEKKLARQAFDCAR
D. turbinatus NSEFWIVLGLCSNQQALRQHALIRGLQLDVSLAIAWANLGGKLYRENEKKLARQAFDCAR
V. mangachapoi NSEFWIVLGLCSNQQALRQHALIRGLQLDVSLAIAWANLGGKLYRENEKKLARQAFDCAR
B. pendula NIEFWVALGCLSDHDALQHALIRGLQLNVSLAVGWAYLGGKLYRKGAKQLAKQTFDCAR
O. rehdieriana NNEFWVALGCLSDHSALKQHALIRGLQLDVSLAVGWAYLGGKLYRKGAKQLAKQAFDCAR
Q. robur NYEFWVALGCLSDHNALKQHALIRGLQLDVSLAVGWAYLGGKLYREGENQLARKAFDCAR
F. sylvatica NYEFWVALGCLSDHNALKQHALIRGLHLDVSLAVGWAYLGGKLYREGANQLARKAFDCAR
F. excelsior NYEFWVALGCLSNHIELKQHSIRGLHLDVSLAVAWAYLGGKLYRQEGEKQLAQAFDRAR

S. robusta SIDPSLALPWAGMSADADVRESTLDEAFESCLRAVOILPLAEFQIGLAKFALLSGHLLSS
P. chinensis SIDPSLALPWAGMSADADVRESTLDEAFESCLRAVOIFPLAEFQIGLAKFALLSGHLLSS
H. chinensis SIDPSLALPWAGMSADADVRESTLDEAFESCLRAVOIFPLAEFQIGLAKFALLSGHLLSS
D. turbinatus SIDPSLALPWAGMSADADVRESMLGEAFENCLRAVOIFPLAEFQIGLAKFALLSGHLLSS
V. mangachapoi SIDPSLALPWAGMSADADARESTLDEAFESCLRAVILPLAEFQIGLAKFALLSGHLLSS
B. pendula SIDPSLALPWAGMSADFHARDLAPDEAFESCLRAVOILPLAEFQIGLAKFALLSGHLLSS
O. rehdieriana SIDPSLALPWAGMSADFHARNLAPDEAFESCLRAVOIFPLAEFQIGLAKFALLSGHLLSS
Q. robur SIDPSLALPWAGMSADFNARDPSPDEAFESCLRAVOIFPLAEFQIGLAKLAFSGHLLSS
F. sylvatica SIDPSLALPWAGMSADFHARDPSPDEAFESCLRAVOIFPLAEFQIGLAKLAFVSGHLLSS
F. excelsior SIDPSLALPWAGMSADADSRKCLKPDEAYECCLLAVOIFPLAEFQIGLAKLALQSGYLLQSS

S. robusta QVFGAIQQAVORTPHYPESHNLNGLVREARFVYQAAVSSYRLARFAISSITDPKSHLR
P. chinensis QVFGAIQQAVORTPHYPESHNLNGLVREARFVYQAAVSSYRLARFAISSITDPKSHLR
H. chinensis QVFGAVQQAVORTPHYPESHNLNGLVCEARFVYQAAVSSYRLARFAISSITDPKSHLR
D. turbinatus QVFGAIQQAVORAPHYPESHNLNGLACEARFVYQAAVSSYRLARFAISSITDPKTHLR
V. mangachapoi QVFGAIQQAVORTPHYPESHNLNGLVCEARFVYQAAVSSYRLARFAVSLSAGTDPKSHLR
B. pendula LVLGAIQQAVOHAPHSPESHNLNGLVCEARFDYQSAAAAYRRARCAISSCSASISKSHTR
O. rehdieriana QVFGAIQQAVOHAPHSPESHNLNGLVCEARFDYQSAAAAYRRARCAISSCSASISKSHTR
Q. robur QVFGAIQQAVOHAPHYPESHNLNGLVCEARFDYQSAAAAYRLARCAICSPFDSVPKSHTR
F. sylvatica QVFGAIQQAVOHAPHYPESHNLNGLVCEARFDYQSAAAAYRLARCAICSPFDSVPKSHTR
F. excelsior EVFGAIRHALORAPHYPESHNLNGLVCEARFDYQSAAITSYRLARCAIRYFAGELSVSFLK

S. robusta DISINLARSRLCRAGNAIDAVQECEDLKEKGLLDAEGLQIYAFSLWQLGKHELAI SVTRTL
P. chinensis DISINLARALCRAGNAIDAVQECEDLKEKGLLDVEGLQIYAFSLWQLGKHELAIYVTRTL
H. chinensis DISINLARSRLCRAGNAIDAVQECEDLKEKGLLDTEGLQIYAFSLWQLGKHELAI SVTRTL
D. turbinatus DISINLARSRLCRAGNAIDAVQECEDLKEKGLASL.....
V. mangachapoi DISINLARSRLCRAGNAIDAVQECENLKEIEGLDTEGLQIYAFSLWQLGKHELAI SVTRTL
B. pendula DISINLARSRLCRAGNAIDALLECELNKEGMLDAEGLQIYAFSLWQLGKQDLALSVRNL
O. rehdieriana DVSINLARSRLCRAGNAIDALLECEDLKEKGLDAEGLQIYAFSLWQLGKQDLALSFRNL
Q. robur DISINLARSRLCRAGNAIDALLECEDLKEKGLDVEGLQVYAFSLWKLDKRDLALSVRNL
F. sylvatica DISINLARSRLCRAGNALDALQECEDLKEKGLDVEGLQIYAFSLWKLDKRDLALSVRNL
F. excelsior DISINLARSRLCRAGNVIDAVEECESLKHKGLLDTEGLHIYALSLSLWQLGKNDLALSVRTAL

S. robusta AASVSTMDRTAAGASVSFICRLLYYISGLDSAIN SILKMPKELFQSSKISFVMSAIHALD
P. chinensis AASVSTMDQTAAGASVSFICRLLYYISGLDSAIN SILKMPKELFQSSKISFVVSIAHALD
H. chinensis AASVSTMDRTAAGASVSFICRLLYYISGLDSAIN SILKMPKELFQSSKISFVVSIAHALD
D. turbinatus
V. mangachapoi AASVSTMEWTAAGASVSFICRLLYYISGLDSAIN SILKMPKELFQSSKISFVVSIAHALD
B. pendula ALSVSTMEQKSVAAAPVSFICRMLYICISGLDSAISSILKMPKELFQSSGVSFVVSIAIHALD
O. rehdieriana AASVSTMEQKSVAAASVSFICRMLYICISGLDSAISSILKMPKELFQSSRVSFVVSIAIHALD
Q. robur AASVSAMEQTSVAAAPVSFICRMLYIFMSGLDSAISSILKMPKELFQSSKISFVVSIAHTLD
F. sylvatica AVRVSAMEQTSVAAAPVSFICRMLYIISGLDSAISSILKMPKELFQSSGVSFVVSIAHTLD
F. excelsior AAGILSMEQKLAASVSFLICRLLYYISGQESAIT SILKMPKELFQSSKISFVVSIAHVLD

SKI3

S. robusta QSNRLESVSVSSRY YLSSHEEITGMHYLIALNLIKHGLEDHLGFQSAVGHLRKALHMYP
P. chinensis QSNRLESVSVSSCCYLSSHEEITGMHYLIALNLIKHGLEDHLGFQSAVGHLRKALHKYP
H. chinensis QSNRLESVSVSSRY YLSSHEEITGMHYLIALNLIKHGLEDHLGFQSAVGHLRKALHMYP
D. turbinatus
V. mangachapoi QSNRLESVSVSSRY YLSSHEEITGMHYLIALNLIKNGLEDHLGFQSAVGHLRKALHMYP
B. pendula QSNRLESVSVSSRSFVQSPVEVAGMHFMIALSKVVKHGTEFCLGVQSGVAHLRKLALHMF
O. rehderiana QSNRLESVSVSSRSIVQSPVEVAGMHFMIALSKLVKQGTEFCLGVQCGIAHLRKLALHMF
Q. robur TCDRLFPVSVSSRRFLTSHEEITGMHYLIALGKLVKHGTEFCLGFQSGVAHLRKLALHMYP
F. sylvatica ICNRLESVSVSSRCFLTSPVEEITGMHYLIALGKLVKHGTEFCLGFQSGVAHLRKLALHMYP
F. excelsior QNDQLESVSVSSRS SVTSD E E I T A M H T L I A V G K L V K H G S K D C L A T Q R G V D H L R K A L H K Y P

S. robusta NSVLLRNLG Y L L L L S E D W N T H V S S R C S I I D S S D Y . . K E G L K S A W E I I G A G A V A C H V L C
P. chinensis NSVLLRNLG Y L L L L S E D W N T H V S S R C S I I D A S D Y . . K E G L K S A W E I I G A G A V A C Y V L C
H. chinensis NSVLLRNLG Y L L L L S E D W N T H V S S R C S I I D A S D Y . . K E G L K S A W E I I G A G A V A C Y V L C
D. turbinatus
V. mangachapoi NSVLLRNLG Y L L L L S E D W N T H V S S R C S I I D A S D H . . K E G L K S A W E I I G A G A V A C Y V L G
B. pendula NSSLMRNLG Y L L L S S K E W N D T H V A T R C N I D A S D C A K E G L K S A S E I L G A G A V A C Y A I G
O. rehderiana NSSLMRNLG Y L L L S S K E W N D T H V A T R C N I D T S D C A N K E G L K S A S E I L G A G A V A C Y A I G
Q. robur NSSLRNLG Y L L L S S K E W N D T H V A T R C N V D S T N Y Q N K G G L K S A S E I L G A G A V A C Y A V G
F. sylvatica NSSLRNLG Y L L L S S K E W N D T H V A T R C N V . S T D R Q N K E G L K S A S E I L G A G A V A C Y A V G
F. excelsior NSVLLRNLG Y L L L S S K E Q R D L Y L A T R C S F I D L S D H K K E E G L K S A S E I V G A G T V A C Y S T G

S. robusta NREPKFSFPTCSYQCLNGP GSTKELQKCLRREPWNHNVR YLLVLNL LQKAREERFPV HLC
P. chinensis
H. chinensis NREPKFSFPTCSYQCLNGSESIKELQKCFRREPWNHNPQ YLLVLNL LQKAREERFPV HLC
D. turbinatus
V. mangachapoi NREPKFSFPTCSYRCLNGSGSIKELQKCFRREPWNHNAQ YLLVLNL LQKAREERFPV HLC
B. pendula NKNPKFSFPTCTYQCLKAPGAIQQLQKCLRREPWNHNVR YLLVLNL LQKAREERFPV HLC
O. rehderiana NKNRPFSPPTCTYQCLKAPGAIQQLQKCLRREPWNHNVR YLLVLNL LQKAREERFPV HLC
Q. robur NSNPKFSFPTCTYQCLNGHGAIQQLQKCLRREPWNHNVR YLLVLNL LQKAREERFPV HLC
F. sylvatica NSNPKLSFPTCTYQCLNEP GAIQQLQ
F. excelsior SYNGRFSFPTCRPQWPSGSGAIRLQKNLHQEPWNLNR YLLTVNY LQKAREERFPV HIC

S. robusta TILERLIALSLSNEFYSGKDISCLYQKFQLLCASEICLQGGNIAGCINLAKNASALFLP
P. chinensis
H. chinensis TILERLIALSLSNEFYSGKDISCRYQKFQLLCASEICLQGGNIAGCINHAKNASALFLP
D. turbinatus TILERLIALSLSNEFYSGKDTSCLYQKFQLLCASEICLQVGNIAADCINHAKNASALFLP
V. mangachapoi TILERLIALSLSNEFYSGKDISCLYQKFQLLCASEICLQGGNIADCVNHAKNASALFLP
B. pendula IVLKRLLISVALSSDLYTKTDMSS . . YQKFQLLCASEISLQSEDNIGCVNHAKNASL L L L P
O. rehderiana IVLKRLLISVALSSDLYTKTDMSS . . YQKFQLLCASEISLQSEDNIGCVNHAKNASL L L L P
Q. robur IILKRLLMSVALPSEVYSKTDMC . . YQKFQLLCASEISLHSGNKTG CIDHAKNASK L L L P
F. sylvatica NEVYSKTDMC . . YQKFQLLCASEISL YSGNKIGCINHAKNASK L L L P
F. excelsior LVLERLVAVALSNSQSYSRKDLSSQYMFHLLLCAAEVSLQGGNHSECLKHARLATGLSVH

S. robusta ESYLFFGHLLLCRAYAAEGNCMNLQOEYK KCLELKTDFHVGWGLCKVIESQYNLQSGSNT
P. chinensis
H. chinensis ESYLFFGHLLLCRAYAAEGNFMNVQOEYK KCLELKTDFHVGWGLCKVIESQYNLQSGSNT
D. turbinatus ESYLFFGHLLLCRAYAAEGNFMNLQOEYENCLLELKTDFHIGLGLCKVIESQYKLOTGSNT
V. mangachapoi ESYLFFGHVLCRAYAAEGNFMNLQOEYK KCLELKTDFHVGWGLCKVIECQYKLOTGSNT
B. pendula DDYLFSSHLLQCRAYAAESDSLNIQKEYIRCLELKTDFHIGWGLCKVIEELRYNVQNDANI
O. rehderiana DDYLFSSHLLQCRAYAAESDSLNIQKEYIRCLELKTDFHIGWGLCKVIEELRYNVQNDANI
Q. robur DAYLFFSHLLQCRAYAVEGDIINLQKEYIRCLELKTDFHIGWGLCKVIESQYHVQTDLNI
F. sylvatica DAYLFFSHLLQCRAYAVEGDIINLQKEYLRCLELRTDFHIGWGLCKLLESQYHVQTDLNI
F. excelsior NSSLFFVHLLLCRAYAAENNI VSLTEYRRCMELRTDSHIGWGLCKVIESRYRLQNDSTI

S. robusta IELSLNECSRGSNSWNMMAVSVLGLIC IWNQDFLSAEFLQHACSLAGADSCFFLC
P. chinensis
H. chinensis IELSLNECSRGSNSWNMMAVSVLGLLGIWNQDFLSAEFLVQACSLAGADSCFFLC
D. turbinatus IELSLNECSRGSNSWNMMAVSVLGMIC IWNQDFLSAEFLVQHACSLGGAESCFFLC
V. mangachapoi IELSLNECSRGSNSWNMMAVSVLGLICTWNQDFLSAEFLVQHACSLAGADSCFFVC
B. pendula LELSFKESSKERNYSWNMMAVFNLVWGLISLWNEDFLSAEFLTQACSLAGAESCLFLC
O. rehderiana LELSFKESSKERNYSWNMMAVFNLVWGLISLRNEDFLSAEFLAQACSLAGAESCLLLC
Q. robur LDLCFKESSTERDYNSWNMMAIFNLVWGLIS IWNQDFLSAEFLAQACSLAGAESCLFLC
F. sylvatica LELSFKEYSKERNYSWNMMAVFNLVWGLIS IWNQDFLSAEFLAQACSSAGAESCLFLC
F. excelsior LALNFEESKDIKNNSWNMMAVFDLVQGLIAMWSGDFI GAEEFLMQACSSAGGESCFFLC

SKI3

<i>S. robusta</i>	HGAICMELARQFNDSSEFLSHAVRSLKKAQTTSFIPIPLVALLAQAEASLGSKGKWEKLE
<i>P. chinensis</i>	.....
<i>H. chinensis</i>	HGAICMELARQFNDSVFLACAVRSLKKAQTTSFIPIPLVALLAQAEASLGSKGKWEENL
<i>D. turbinatus</i>	HGAISMELARQFNDSSEFLSHAVRSLKKAQTTSFILTPLVAVLLAQAEASLGSKGKWEKNL
<i>V. mangachapoi</i>	HGAICMELARQFNDSSEFLSRAIRSLKKAQTTSFIPIPLVAVLLAQAEASLGSKGKWEKNL
<i>B. pendula</i>	HGATCMELARQLRDSKFLSLAVKSLAKAQEASVIPLEPVSALLAQAEASLGSKGKWEKNL
<i>O. rehderiana</i>	HGATCMELARQLRDSKFLSLAVKSLAKAQEASVIPLEPVSALLAQAEASLGSKGKWEKNI
<i>Q. robur</i>	HGAICMELARQSRGSGQFLSLAVKSLTEAQKTSLIPLEPVSALLAQAEASLGSKGKWEKNI
<i>F. sylvatica</i>	HGAICMELARQSSGSGQFLSLAVKSLTEAQKTSLIPLEPVSALLAQAEASLGSKGKWEKNI
<i>F. excelsior</i>	HGAICMELARQHCDKYSLSAIRSLKKAQETSSTPLPIMSALLAQAEASLGSMPEKWKDNL

<i>S. robusta</i>	RLEWISWPPVECLIDPWFMMIKKFIAIDIKSHVANYSSNVFYVSPLEMRHAELFFQMHLA
<i>P. chinensis</i>	.....PK.....
<i>H. chinensis</i>	RLEWISWPP.....GLGIARTSMLF.....
<i>D. turbinatus</i>	RLEWISWPP.....EMRHAELFFQMHLA
<i>V. mangachapoi</i>	RLEWISWPP.....EMRHAELFFQMHLA
<i>B. pendula</i>	RLEWFSWPP.....EMRPAELFFQMHLA
<i>O. rehderiana</i>	RLEWFSWPP.....EMRPAELFFQMHLA
<i>Q. robur</i>	RLEWFAWPP.....EMRPAELFFQMHLA
<i>F. sylvatica</i>	RLEWCSWPP.....EMRPAELFFQMHLA
<i>F. excelsior</i>	QDEWFSWPP.....ETRPAELFFQMHLF

<i>S. robusta</i>	RQLEARTDSSSRVECCQSELRQVVVRAIHTNPSARYWKVLRRLAS
<i>P. chinensis</i>	.....IESELSI.....
<i>H. chinensis</i>	.....LEVTKSE.....CSIACIWHSKHLSKLF.
<i>D. turbinatus</i>	RQLEASTDSSSRVECCQSELRQVVVRAIHTNPSARYWKVLRRLAS
<i>V. mangachapoi</i>	RQLQAGTDSSSRVECCQSELRQVVVRAIHTNPSARYWKVLRRLTS
<i>B. pendula</i>	RQSKSMISSSNVEFCQSELRWILRAIHTNPSCIIRYWKVLQKLLT
<i>O. rehderiana</i>	RQSKSVSISSSNAELCQSELRWILRAIHTNPSCIIRYWKVLQKLV.
<i>Q. robur</i>	RQSKSDPKSPSNVEFCQSELRWILRAIHTNPSCIIRYWKVLQKLMT
<i>F. sylvatica</i>	KQSKSGPNTSAHVESYQSELRWILRAIHTNPSCIIRYWKVLQKLI
<i>F. excelsior</i>	KQLK...ESSSESDSCQSELRWILRAIHTNPSCLRYWKVLQKNRE

m APX

S. robusta ASRCITRA VLIRCNKIE TD DVLGSGE SCFR RDALRVAGATIGMELLASSGS
P. chinensis ANRCITRA VFIRCNKIEAD DVFVSAE SCFR RDVLRVAGATIGMELLASSGS
H. chinensis ANRCITRA VFIRCNKIE TD DVFVSGE SCLR RDVLRVAGATIGMELLASSGS
D. turbinatus ANRCISRA VFIRCDKIE TD DVSCSGE SCFR RDVLRVAGATIGMELLASSGS
V. mangachapoi ANRCITRA VFI G CNKIEAD DVSGAGE SCFR RDVLRVAGATIGMELLASSGS
B. pendula ATIAAA TRY TSHA VTIRCYKMET. GVTAEDE DRFRREILKCFGV TIGMELMSSGS
O. rehderiana ATIAAA TRY PSHA VTIRCYKMET. GVTAEDE DRFCRRDILKCFGV TIGMELMSSGS
Q. robur TT TNRYPSYAKYQV TVRCNKMET. DATAEDE DRFCRRDILKCFGV TIGMELMSSGL
F. sylvatica TSTSS TTRYPSHA TVRCNKMEI. DVTAGDE DRFCRRDILKCFGV TIGMELMSSGS
F. excelsior LSRCSPHS GVINC. KIEA. HVNSAD. GFSRRDILHCFGATISMDLIARST

S. robusta FIETASAADLIQRRORS EFLSSIKGTLT TATEGTPDVI PSILTLALNDAMTYDQATKSSGG
P. chinensis FIETASAADLIQRRORS EFLSSVKGTLAMATEGTPDLI PSLTLALNDAMTYDKATSSGG
H. chinensis FIETASAADLIQRRORS EFLSSVKGTLT TATEGTPDLI PSLTLALNDAMTYDKATSSGG
D. turbinatus FIETASAADLIQRRORS EFLSSVRCGLT TATEGTPDLI PSLTLALNDAMTYDKATSSGG
V. mangachapoi FTETASAADLIQRRORS EFLSSVKGTLVAATEGTPDLI PSLTLALNDAMTYDKATSSGG
B. pendula FVEKASAADLIQLRORS EFLSSVKGTLSTAIKSPDLI PSLTLALNDGIMTYDKATSSGG
O. rehderiana FVEKASAADLIQLRORS EFLSSVKGTLSTAIKSPDLI PSLTLALNDIMTYDKATSSGG
Q. robur FVEKASAADLIQRRORS EFLSSVKGTLFTAINGNVELL PSLTLALNDAMTYDKATSSGG
F. sylvatica FVEKASAADLIQRRORS DFNQSNIKGTLSTAIENGTDLI PSLTLALNDATYDKATSSGG
F. excelsior FVEVA NAADLIQRRORS EFLQSAIKGTF AESFRGNPDLI PS ATKSSGG

S. robusta PNGSIHFSSEISRPNKGLSAAALRLLEDAKKEIDSFSKGGPISFADLIQYAAQSAIKATF
P. chinensis PNGSIRFSSSEISRPNKGLSAAALRLLEDAKKEIDSYSKGGPISFADLIQYAAQSAIKATF
H. chinensis PNGSIHFSSEISRPNKGLSAAALRLLEDAKKEIDSYSKGGPISFADLIQYAAQSAIKATF
D. turbinatus PNGSIHFSSEISRPNKGLSAAALSLEDAKKEIDSYSKGGPISFADLIQYAAQSAIKATF
V. mangachapoi PNGSIHFSSEISRPNKGLSAAALSLEDAKKEIDSYSKGGPISFADLVQYAAQSAIKATF
B. pendula PNASIRFSSSEISRPNKGLSAAANLLEEAkkeIDSYSKGGPISYADLIQYAAQSAIKATF
O. rehderiana PNASIRFSSSEISRPNKGLSAAANLLEEAkkeIDSYSKGGPISYADLIQYAAQSAIKATF
Q. robur ANGSIRFSSSEISRPNKGLSAAANLLEEAkkeIDSYSKGGPISYADLIQYAAQSAIKATF
F. sylvatica PNGSIRFSSSEISRPNKGLSAAANLLEEAkkeIDSYSKAGPISYADLIQYAAQSAIKATF
F. excelsior PNGSIRFSSSEISRPNKGLSAAANLLEEVKKEIDSYSKGGPISYADLIQYAAQSAIKSTF

S. robusta LASAIRKCGGNEEKGRFLYTAFGSNGQWGLFDKQFGRDTTEEPDPEGRIPLWEKASVQEM
P. chinensis LASAIRKCGGNEEKGRLLYTAYGSSGQWGLFDKQFGRDTTEEPDPEGRIPLWEKASVQEM
H. chinensis LASAIRKCGGNEEKGRLLYTAYGSSGQWGLFDKQFGRDTTEEPDPEGRIPLWEKASVQEM
D. turbinatus LASAIRKCGGNEEKGRLLYTAYGSSGQWGLFDKQFGRDTTEEPDPEGRIPLWEKASVQEM
V. mangachapoi LASAIRKCGGNEEKGRLLYTAYGSSGQWGLFDKQFGRDTTEEPDPEGRIPLWEKASVQEM
B. pendula LASAIRKCGGNEEKGSLLYTAYGSSGQWALFDKQFGRADTQEPDPEGRVPLWENANVKEM
O. rehderiana LASAIRKCGGNEEKGNLTYTAYGSSGQWALFDKQLGRADTQEPDPEGRVPLWENANVKEM
Q. robur LASAIRKCGGNEEKGRLLYTAYGSSGQWGLFDKQFGRSDTQEPDPEGRVPLWENANVKEM
F. sylvatica LAASIRKCGGNEEKGRLLYTAFGSAGQWGLFDREFGRADTQEPDPEGRVPLWENANVKEM
F. excelsior LASAIRKCGGNEEKGALLYTAYGSSGQWALFDKQFGRSDAQEPDPEGRVPLWENANVKEM

S. robusta KDKFKAIGLGPRLAVMSAFLGPDQNAATEALLATDPDVSPWVKYORSRETVSOTDYEVD
P. chinensis KDKFKAIGLGPRLAVMSAFLGPDQNAATEALLATDPDVSPWVKYORSRETVSOTDYEVD
H. chinensis KDKFKAIGLGPRLAVMSAFLGPDQNAATEALLATDPDVSPWVKYORSRETVSOTDYEVD
D. turbinatus KDKFKAIGLGPRLAVMSAFLGPDQNAATEALLATDPDVSPWVKYORSRETVSOTDYEVD
V. mangachapoi KDKFKAIGLGPRLAVMSAFLGPDQNAATEALLATDPDVSPWVKYORSRETVSOTDYEVD
B. pendula KDKFSAIGFGPRLAVMSAFLGPDQAATEAFLAADPDVSPWVKYORSRETVSOTDYEVD
O. rehderiana KDKFSAIGFGPRLAVMSAFLGPDQAATEAFLAADPDVSPWVKYORSRETVSOTDYEVD
Q. robur KDKFVAIGFGPRLAVMSAFLGPDQAATEALLATDPDVSPWVKYORSRETVSOTDYEVD
F. sylvatica KDKFSAIGFGPRLAVMSAFLGPDQAATEALLATDPDVSKWVKYORSRETVSETDYEVD
F. excelsior KDKFSAIGFGPRLAVMSAFLGPDQAATEALLASDPEVAKWVVKYORSRETVSOTDYEVD

S. robusta LITTLTKLSSLGQOINYEAYTYPVKVDLSKLKL
P. chinensis LITTLTKLSSLGQOINYEAYTYPVKVDFSKLKL
H. chinensis LITTLTKLSSLGQOINYEAYTYPVKVDFSKLKL
D. turbinatus LITTLTKLSSLGQOINYEAYTYPVKVDLGLKLKL
V. mangachapoi LITTLTKLSSLGQOINYEAYTYPVPRVDDL SKLKL
B. pendula LITTLTKLSSLGQOINYEAYSYPKVKVDLSKLKL
O. rehderiana LITTLTKLSSLGQKINYEAYSYPKVKVDLSKLKL
Q. robur LITTLTKLSSLGQOINYEAYTYPVQRVDDL SKLKL
F. sylvatica LITTLTKLSSRLGQOINYEAYTYPVQRVDDL SKLKL
F. excelsior LITTLTKLSSLGQOINYEAYTYPVKVDLSKLKL

n XDH

S. robusta YTI**ELLEIVADQPS**MHVLFIPGNP.....GV
P. chinensis YTI**ELLEILADQPS**MHVLFIPGNP.....GV
H. chinensis YTI**ELLEIVADQPS**MHVLFIPGNP.....VL
D. turbinatus YTI**ELLEIIADQPS**MHVLFIPGNP.....GV
V. mangachapoi YTI**ELLEIPAEQPS**MHVLFIPGNP.....GV
B. pendula YTI**ELLEIRADDFK**FHVLFIPGNP.....GV
O. reherdiana YTI**ELLEIRAGDFK**MHVLFIPGNPGEF.....GV
Q. robur YTI**ELLEIHADDFK**MHVLFIPGNPGKFGFVLLCLHVHVCFVDLVLRTIRIRGCLLIVTVGV
F. sylvatica VQTNPIPKLKDPLIFDCATCP.....GV
F. excelsior YKT**DLEIIRADDFK**LHVVFIPGNP.....GV

S. robusta VTFYTD**DFVESLFEL**GGTASITA....IGHIQ**T**KK**NW**ER**GR**LF**SL**Q**EQ**ID**HK**MD**FI**KQ
P. chinensis VTFYTD**DFVESLFEL**GGTASITA....IGHIGH**T**KK**NW**ER**GR**LF**SL**Q**EQ**ID**HK**MD**FI**KQ
H. chinensis NPSF.....MMG.....ISILEK**L**P**NN**W**ER**GR**LF**SL**Q**EQID**HK**MD**FI**KQ
D. turbinatus VTFYTD**DFVKS**LFELGGTASITA....IGHIA**Q**T**KK**N**W**ER**GR**LF**SL**Q**EQ**ID**HK**MD**FI**KQ
V. mangachapoi VTFYTD**DFVESLFEL**GGTASITA....IGHIG**Q**T**KK**N**W**ER**GR**LF**SL**Q**EQ**ID**HK**MD**FI**KQ
B. pendula VTFYK**EF**VESLYEVLGGH**AS**VTA....IGHIS**H**T**KK**N**W**ER**GR**LF**SL**Q**EQ**ID**HK**MD**FI**KQ
O. reherdiana VAFYK**DF**VESLYEVLGGH**AS**VTK**T**W**LL**L**V**H**V**N**F**L**P**L**S**W...L**F**SL**Q**EQID**HK**MD**FI**KQ
Q. robur VSFYK**DF**VESLYEVLGGH**VS**.....N**W**D**H**GR**LF**SL**Q**EQID**HK**MD**FI**KQ
F. sylvatica VAFYK**DF**V**EL**LYEFL**EA**.....I**GH**T**S**H**T**KK**NW**DR**GR**LF**SL**Q**EQ**ID**HK**MD**FI**KQ
F. excelsior ISFYTD**DFLES**LFELGGTASVTA....I**GH**IS**H**SE**KD**W**EN**GR**LF**SL**Q**EQID**HK**TS**F**IE**H**

S. robusta ELQ**NT**E**I**PL**IL**V**G**HS**IG**SY**IS**L**Q**ML**RR**SP**E**K**V**I.....YY**I**GL**Y**.P**FL**AL**N**L**Q**SK**K**Q
P. chinensis ELQ**NT**E**I**PL**IL**V**G**HS**IG**SY**IS**L**Q**ML**RR**SP**E**K**V**I.....CY**I**GL**Y**.P**FL**AL**N**L**Q**SK**K**Q
H. chinensis ELQ**NT**E**I**PL**IL**V**G**HS**IG**SY**IS**L**Q**ML**RR**SP**G**K**V**I.....YY**I**GL**Y**.P**FL**AL**N**L**Q**SK**K**Q
D. turbinatus ELQ**NT**E**I**PL**IL**V**G**HS**IG**SY**IS**L**Q**ML**RR**SP**E**K**V**V.....YY**I**GL**Y**.P**FL**AL**N**L**Q**SK**K**Q
V. mangachapoi ELQ**NT**E**I**PL**IL**V**G**HS**IG**SY**IS**L**Q**ML**RR**SP**E**K**V**L.....YY**I**GL**Y**.P**FL**AL**N**L**Q**SK**K**Q
B. pendula E**L**EN**T**E**V**PI**L**V**G**HS**IG**SY**IA**ID**M**FR**RS**SE**K**VA.....CC**I**GL**Y**.P**FL**AL**N**L**Q**SK**K**Q
O. reherdiana E**L**EN**T**E**V**PI**L**V**G**HS**IG**SY**IA**L**D**M**F**RR**S**SE**K**VA.....Y**C**I**G**L**Y**.P**FL**AL**N**L**Q**SK**K**Q
Q. robur E**L**EN**T**E**V**PI**L**V**G**HS**IG**SY**MA**ID**I**FR**RS**LE**K**GL.....M**V**L**V**F**E**F.....
F. sylvatica E**L**EN**T**E**V**PI**L**V**G**HS**IG**SY**IS**ID**M**FR**RS**LE**K**MLGV**S**M**D**W**V**Y**C**C**A**N**P**V**L**P**K**S**N**W**T**R**P**K**G**G**P**
F. excelsior E**F**Q**D**V**E**V**P**I**L**V**G**HS**IG**A**W**IS**L**E**I**F**R**RS**Q**E**K**V**I**.....YY**I**GL**Y**.P**FL**AV**N**T**V**SS**A**Q

S. robusta I**I**IG**K**I**A**M**S**K**V**L**S**T**S**A**S**F**L**V**A**S**L**G**L**L**P**R**W**T**L**R**L**I**V**K**N**F**L**G**K**S**W**S**N**A**A**V**E**A**A**C**S**H**L**P**Q**Y**H**V
P. chinensis I**I**IG**K**I**A**M**S**K**V**L**S**T**S**A**S**F**L**V**A**S**L**G**L**L**P**R**W**T**L**R**L**I**V**K**N**F**L**G**K**S**W**S**N**A**A**V**E**A**A**C**S**H**L**P**Q**Y**H**V
H. chinensis I**I**IG**K**I**A**M**S**K**V**L**S**T**S**A**S**F**L**V**A**S**L**G**L**L**P**R**W**T**L**R**L**I**V**K**N**F**L**G**K**S**W**S**N**A**A**V**E**A**A**C**S**H**L**P**Q**Y**H**V
D. turbinatus I**I**IG**K**I**A**M**S**K**V**L**S**T**S**A**S**F**L**V**A**S**L**G**L**L**P**R**W**T**L**R**L**I**V**K**N**F**L**G**K**S**W**S**N**A**A**V**D**A**A**C**S**H**L**P**Q**Y**H**V
V. mangachapoi I**I**IG**K**I**A**M**S**K**L**L**S**T**S**A**S**F**L**V**A**S**L**G**L**L**P**R**W**T**L**R**L**I**A**K**S**F**L**G**K**S**W**S**N**A**A**V**E**A**A**C**S**H**L**P**Q**Y**H**V
B. pendula S**I**IG**K**I**A**A**S**R**V**L**S**V**A**L**S**L**I**V**A**S**L**R**F**L**P**I**R**A**L**R**L**I**L**T**N**S**L**G**K**S**W**S**P**A**A**V**E**A**A**C**S**H**L**V**Q**Y**H**T
O. reherdiana S**I**IG**K**I**A**A**S**Q**L**L**S**A**A**I**S**L**I**V**A**S**L**G**L**F**L**P**I**R**A**L**R**L**I**I**T**N**S**L**G**K**S**W**S**V**A**V**N**A**A**C**S**H**L**V**Q**Y**H**T
Q. roburR**S**Q**V**L**S**V**A**I**S**L**I**A**S**L**K**F**L**P**S**W**A**L**R**L**I**V**T**N**S**L**G**K**S**W**S**A**A**L**E**A**T**C**S**H**L**V**Q**Y**H**T
F. sylvatica M**L**L**V**F**E**F**R**S**R**V**L**S**V**A**L**S**L**V**A**S**L**G**F**L**P**S**W**T**L**R**L**I**V**K**N**S**V**G**K**S**W**S**A**T**A**V**E**A**T**C**S**H**L**V**Q**...
F. excelsior S**F**I**R**R**L**A**G**S**Q**F**L**C**A**A.....L**G**K**S**W**S**S**P**A**V**V**S**F**C**T**S**V**L**V**Q**Y**H**T

S. robusta M**R**N**V**L**F**M**A**M**T**E**F**Q**K**L**A**E**T**P**D**W**A**F**M**R**E**N**Q**D**K**I**A**F**L**F**S**T**D**D**H**W**G**P**L**Q**M**L**D**E**I**A**K**Q**V**P**G**A**S**L**S**
P. chinensis M**R**N**V**L**F**M**A**M**T**E**F**Q**K**L**A**E**T**P**D**W**A**F**M**R**E**N**Q**D**K**I**A**F**L**F**S**T**D**D**H**W**G**P**L**Q**M**L**D**E**I**A**K**Q**V**P**G**A**S**L**S**
H. chinensis M**Q**N**V**L**F**M**A**M**T**E**F**Q**K**L**A**E**T**P**D**W**A**F**M**R**E**N**Q**D**K**I**A**F**L**F**S**T**D**D**H**W**G**P**L**Q**M**L**D**E**I**A**K**Q**V**P**G**A**S**L**S**
D. turbinatus M**Q**N**V**L**F**M**A**M**T**E**F**R**E**L**A**E**T**P**D**W**A**F**M**R**E**N**Q**D**K**I**A**F**L**F**S**T**D**D**H**W**G**P**L**Q**M**L**E**E**I**A**K**Q**A**P**G**A**A**L**A**
V. mangachapoi M**R**N**V**L**F**M**A**M**T**E**F**R**K**L**A**E**T**P**D**W**E**F**M**R**E**N**Q**D**K**I**A**F**L**F**S**T**D**D**H**W**G**P**L**Q**I**L**E**E**I**A**E**Q**V**P**G**A**S**L**S**
B. pendula M**R**N**V**L**F**M**A**M**T**E**F**R**K**L**T**E**T**P**D**W**A**F**V**R**E**K**Q**E**K**L**A**F**L**F**G**V**D**D**H**W**G**P**L**Q**M**F**E**E**I**S**K**H**V**P**G**I**A**L**S**
O. reherdiana M**R**N**I**L**F**M**A**M**T**E**F**R**K**L**T**E**T**P**D**W**A**F**V**R**E**K**Q**E**K**L**A**F**L**F**G**V**D**D**H**W**G**P**L**Q**M**F**E**E**I**S**K**H**V**P**G**I**A**L**S**
Q. robur I**R**N**S**L**F**M**T**M**I**E**F**Q**K**L**T**E**T**P**D**W**A**F**M**R**E**N**R**E**K**L**A**F**L**F**G**V**D**D**H**W**A**P**L**Q**M**F**E**E**I**S**N**Q**V**P**G**I**A**L**S**
F. sylvaticaV**K**F**Y**.....P.....
F. excelsior I**R**N**M**L**F**M**A**M**T**E**F**E**K**L**S**E**K**P**D**L**A**F**M**R**E**K**K**S**Q**I**A**F**L**F**G**D**D**H**W**G**P**L**H**L**Y**E**E**I**R**K**Q**I**P**D**A**R**V**A

O GPS

S. robusta FFKVGVGKRRFRPTVLLLMATALNVRIPVSRVGDTVATDLRTRQOCIAEITSEMIHVA
P. chinensis FFKVGVGKRRFRPTVLLLMATALNVRIPVSRVGDTVATDLRTRQOCIAEITSEMIHVA
H. chinensis FFKVGVGKRRFRPTVLLLMATALNVRIPVSRVGDTVATDLRTRQOCIAEITSEMIHVA
D. turbinatus FFKVGVGKRRFRPTVLLLMATALNVRIPVSRVGDTVATDLRTRQOCIAEITSEMIHVA
V. mangachapoi FFKVGVGKRRFRPTVLLLMATALNVRIPVSRVGDTVATDLRTRQOCIAEITSEMIHVA
B. pendula FFKMVGEGKRRFRPTVLLLMATALNVSIPQPFSEPVVLTKELRARQOCIAEITSEMIHVA
O. rehderiana FFKMVGEGKRRFRPTVLLLMATALNVSIPQPFSEPVVLTKELRARQOCIAEITSEMIHVA
Q. robur WVKVGF...YLESVLLLMATAMNVSILEPSLRGPGDALTELRARQOCIAEITSEMIHVA
F. sylvatica FFKLGVGKRRFRPTVLLLMATAMDVSIPEPPSGPDALTELRARQOCIAEITSEMIHVA
F. excelsior FFKLGVGKRRFRPTVLLLMATAMNLPMSGLPPDATHVTSVSELRTRQOCIAEITSEMIHVA

S. robusta SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
P. chinensis SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
H. chinensis SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
D. turbinatus SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
V. mangachapoi SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
B. pendula SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
O. rehderiana SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
Q. robur SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
F. sylvatica SLLHDDVLDLDDAKRRGIGSLNAVVMGNK.LAVLAGDFLLSRACVALASLKN.....
F. excelsior SLLHDDVLDLDDAKRRGMRSLNFAMGNK.LAVLAGDFLLSRACVALASLKN.....PRIMLEYPSI

S. robustaTEVVSLLATVVEHLVTGETMQMTTSEQRSS.....
P. chinensisTEVVSLLATVVEHLVTGETMQMTTSEQRSS.....
H. chinensisTEVVSLLATVVEHLVTGETMQMTTSEQRSS.....
D. turbinatusTEVVSLLATVVEHLVTGETMQMTTSEQRSS.....
V. mangachapoiTEVVSLLATVVEHLVTGETMQMTTSEQRSS.....
B. pendulaTEVVSLLAKVVEHLVTGETMQMTTSEQRSS.....
O. rehderianaTEVVSLLAKVVEHLVTGETMQMTTSEQRCCQFTLIQLVVAYVANVLLCTFFS
Q. roburTEVVSLLAKVVEHLVTGETMQMTTCEQRCS.....
F. sylvaticaTEVVSLLAKVVEHLVTGETMQMTTSEQRCS.....
F. excelsior SSDQLLAISSVVSLLATVVEHLVTGETMQMTTSDQRCS.....

S. robustaLEYIMOKTYKKTASLISNSCKAIALLAGOTTEVAVLAFEYGNLGLAFQ
P. chinensisLEHYIMOKTYKKTASLISNSCKAIALLAGOTTEVAVLAFEYGNLGLAFQ
H. chinensisLEYIMOKTYKKTASLISNSCKAIALLAGOTTEVAVLAFEYGNLGLAFQ
D. turbinatusLEYIMOKTYKKTASLISNSCKAIALLAGOTTEVAVLAFEYGNLGLAFQ
V. mangachapoiIDYIMOKTYKKTASLISNSCKAIALLAGOTTEVAVLAFEYGNLGLAFQ
B. pendulaMEYIMOKTYKKTASLISNSCKAIALLAGOTAEVAMLAYEYGNLGLAYQ
O. rehderiana LLTKLTFRNTIMEYIMOKTYKKTASLISNSCKAIALLAGOTAGVAMLAYEYGNLGLAYQ
Q. roburMEYIMOKTYKKTASLISNSCKAIALLAGOTSEVAMLAYEYGNLGLAYQ
F. sylvaticaMEYIMOKTYKKTASLISNSCKAIALLAGOTAEVSMLAYEYGNLGLAYQ
F. excelsiorMEYIMOKTYKKTASLISNSCKAIALLAGOTTEVSMLAYEYGNLGLAYQ

S. robusta LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
P. chinensis LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
H. chinensisVCKVFNVFNALIFSMNMISSGSI...FDNPNANIDI
D. turbinatus LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
V. mangachapoi LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
B. pendula LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
O. rehderiana LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
Q. robur LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
F. sylvatica LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI
F. excelsior LIDDVLDFTGTSASLGKGSLSDIRHGIITAPILFAMEEFPQLRAVVDQG...FDNPNANIDI

S. robusta ALEYLGKSHGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNK.
P. chinensis ALEYLGKSHGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNK.
H. chinensisGGACNINTHRDL...AIDSLPESNDEDVRRSRALIDLTOIVITRNK.
D. turbinatus ALEYLGKSHGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNK.
V. mangachapoi ALEYLGKSHGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNK.
B. pendula ALEYLGKSRGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNG
O. rehderiana ALEYLGKSRGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNG
Q. robur ALDYLGKSRGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNG
F. sylvatica ALDYLGKSRGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNG
F. excelsior ALEYLGKSCGRTQRTRELAKKHANLAA...AIDSLPESNDEDVRRSRALIDLTOIVITRNG

p ADH

<i>S. robusta</i>	PVYHYCAVSS	SFSEYTVVHSG	CAVKVSS	FVPLDKICLLSCG	VAAAGLGAAWN	VADISPG	GSTV
<i>P. chinensis</i>	PVYHYCAVSS	SFSEYIVVHSG	CAVKVGS	LAPLDKICLLSCG	VAAAGLGAAWN	VADISPG	GSTV
<i>H. chinensis</i>	PVYHYCAVSS	SFSEYTVVHSG	CAVKVGS	YAPLDKICLLSCG	VAAAGLGAAWN	VADISPG	GSTV
<i>D. turbinatus</i>	PVYHYCAVSS	SFSEYTVVHSG	CAVKVSS	FAPLDKICLLSCG	VAAAGLGAAWN	VADISPG	GSTV
<i>V. mangachapoi</i>	PVYHYCAVSS	SFSEYTVVHSG	CAVKVSS	FAPLDKICLLSCG	VAAAGLGAAWN	VADISPG	GSTV
<i>B. pendula</i>	PVYHYCAVSS	SFSEYTVVHSG	CAVKVSS	LAPLEKICLLSCG	VAAAGLGAAWN	VADISK	GSSV
<i>O. rehderiana</i>	.....SF	QLSVLNN	GV.....	.....	VLLGLGAAWN	VADISE	SGSTV
<i>Q. robur</i>	PIYHYCAVSS	SFSEYTVVHSG	CAVKVSP	LAPLEKICLLSCG	VAAAGLGAAWN	VADICK	KGSTV
<i>F. sylvatica</i>	PIYHYCAVSS	SFSEYTVVHSG	CAVKVSP	LAPLEKICLLSCG	VAAAGLGAAWN	VADISK	KGSTV
<i>F. excelsior</i>	SVYHYCAVSS	SFSEYTVVHSG	CAVKISS	SAPLEKICLLSCG	VAAAGLGAAWN	VANVSE	KGSTV

<i>S. robusta</i>	VIFGLG	TVGLSVA	QGARLRGASRI	IGVDTNPEK	CEKAKAFGVTEFLNPND	CNEPIQOV	IK
<i>P. chinensis</i>	AIFGLG	TVGLSVA	QGAALRGASRI	IGVDTNPEK	CEKAKDFGVTEFLNPND	CNEPIQOV	IK
<i>H. chinensis</i>	VIFGLG	TVGLSVA	QGAALRGASRI	IGIDTNHEK	CEKAKAFGVTEFLNPND	CNEPIQOV	IK
<i>D. turbinatus</i>	VIFGLG	TVGLSVA	QGAALRGAARI	IGIDTNPEK	CEKAKAFGVTEFLNPNE	CNEPIQOV	IK
<i>V. mangachapoi</i>	VIFGLG	TVGLSVA	QGAALRGASRI	IGIDTNPEK	CEKAKVFGVTEFLNPNE	CNEPIQOV	IK
<i>B. pendula</i>	VIFGLG	TVGLSVA	QGAALRGASQI	IGVDTNPEK	AEKAKAFGVTEFLNPND	SNEPMQOV	IK
<i>O. rehderiana</i>	AIFGLR	TVGLSVA	QGAALRGASQI	IGVDTNPEK	GEKAKAFGVTEFLNPND	SDEPLQVI	IK
<i>Q. robur</i>	VIFGLG	TVGLSVA	QGAALRGASRI	IGVDTNPEK	GEIAKAFGITEFLDPND	SNEPIQOV	IK
<i>F. sylvatica</i>	VIFGLG	TVGLSV	.....	.....	.....	.....	IK
<i>F. excelsior</i>	VIFGLG	TVGLSV	VQGAALRGASRI	IGVDTNPEK	NEKAKAFGVTDLLNPND	YNEPIAQVI	IK

<i>S. robusta</i>	RI	DGGT	DYS	FECIGDTGMI	TTALQSCD	DGWGLT	ITLGVPKVKPEVA	AHYGL	FLTGRTL	R
<i>P. chinensis</i>	HL	DGGT	DYS	FECIGDTGMI	TTALQSCD	DGWGLT	ITLGVPKVKPEVA	AHYGL	FLTGRTL	R
<i>H. chinensis</i>	RI	DGGT	DYS	FECIGDTGMI	TTALQSCD	DGWGLT	ITLGVPKVRPEVA	AHYGL	FLTGRTL	R
<i>D. turbinatus</i>	RI	DGGT	DYS	FECIGDTGMI	TTALQSCD	DGWGLT	ITLGVPKVKPEVA	AHYGL	FLTGRTL	R
<i>V. mangachapoi</i>	RI	DGGT	DYS	FECIGDTGMI	TTALQSCD	DGWGLT	ITLGVPKVKPEVA	AHYGL	FLTGRTL	R
<i>B. pendula</i>	RI	TGGADYS	FECIGDTGMV	TTALQSCD	DGWGLT	VTLGVPKKPEVA	MAHYGL	FLITGRTL	K	
<i>O. rehderiana</i>	RI	TGGADYS	FECIGDTGMV	TTALQSCD	DGWGLT	VTLGVPKKPEVA	MAHYGL	FLITGRTL	K	
<i>Q. robur</i>	RI	TGGADYS	FECIGDTGMV	TTALQSCD	DGWGLT	VTLGVPKKPEVA	MAHYGL	FLITGRTL	K	
<i>F. sylvatica</i>	RI	TGGADYS	FECIGDTGMV	TTALQSCD	DGWGLT	VTLGVPKKPEVA	MAHYGL	FLITGRTL	K	
<i>F. excelsior</i>	RM	TGGADFA	FECIGDTGMI	TTALQSCD	DGWGLT	VTLGVPKVKPEVA	MAHYGL	LLTGRTL	T	

<i>S. robusta</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	I	HMP
<i>P. chinensis</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	V	HMP
<i>H. chinensis</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	V	HMP
<i>D. turbinatus</i>	GSLF	GGWPKK	TDI	PSLVEK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	I	HMP
<i>V. mangachapoi</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	I	HMP
<i>B. pendula</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	I	HMP
<i>O. rehderiana</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	I	HMP
<i>Q. robur</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	I	HMP
<i>F. sylvatica</i>	GSLF	GGWPKK	TDI	PSLVDK	YINKEIQ	IDDFI	THNLPFEDINKAFSLMREGK	CLRCV	I	HMP
<i>F. excelsior</i>	GSLF	GGWPKK	TDI	PSLVNM	YLNKQEI	KIDEIFI	THNLPFEDINEAFSLMREGK	CLRCV	I	HMP

q NGLY1

S. robusta MVARKFLVRHDDSDFDVDYNTDNGFEVFKFQFLSLTSLIPDEQKILG.EDGD RVVSSDSD
P. chinensis
H. chinensis MVARKFLVRHDDAAFDVDYD TDDGFVFKFQFLSLTSLIPDEQKVA TCLSSGKMVIALCL
D. turbinatus MVARKFLVRHDDSAFDVDYD TDDGFVFKFQFLSLTSLIPDEQKILG.EDDD RVVSSDSD
V. mangachapoi MVARKFLVRRNGAAFDVDYD TDDGFVFKFQFLSLTSLIPDDQKILG.EDDD RVVSSDSD
B. pendula MVARKFLVLRHNDSDFFVDYD TDDGFVFKFQFLSLTSLIPDEQKIVS.VDDDRVLSDES
O. rehderiana MVARKFLVRHSDHEFDVDYD TDDGFVFKFQIFSLTSLIPPEEQKIVS.VDGNRVLSDDSD
Q. robur MVARKFLVRRHNDADFVVDYD TDDGFELKFKQFLSLTSLVVPDDQKI I A.VDENRVLSDDSD
F. sylvatica MVARKFLVRRHNDADFVVDYD TDDGFELFKYQFLSLTSLVLPDEQKIVG.VDENRVVYDDSD
F. excelsior MVARKFLVQHNGSTFDLDYD TDDGFVFLKFQFLSLTSLIPDEQKIFG.GDDE RTVSDSD

S. robusta LVTISEKLRRLVS...ISEEDKEKQEEETAESSQKS DSEFLK SDEELARILQAEFEALLHQ
P. chinensis
H. chinensis ATLLISSPFRSSGWYRSLKTDKEKQEEETAENSQK DSDFLK SDEELARKLQAEFEALLLQ
D. turbinatus LLAIISDKLRRLVS...ISEENKEKQEEETESSQ. DAELK SDEEFARMLQAEFEALLRQ
V. mangachapoi LVTISEKLRRLVS...ISEEDKEKQEEETESREKFDTEILISDEELARILQAEFEALLLQ
B. pendula LISISEKLRRLVS...INDEVQEQRTSSTNSVRNDSQSLMSDEELARMLQAEFEALLLQ
O. rehderiana LISISEKLRRLVS...INDEVQEHQGTSTNSVRNDFQSLISDEELARMLQAEFEALLLQ
Q. robur LISVAERLRLVS...VNDEVNEQPQSSSHIAGNAALMSDEQLARILQAEFEALMLQ
F. sylvatica LVSISERLRLVS...VNDEV.KQPQES...AGNDAALGMSDEELARMLQAEFEALMLQ
F. excelsior LEMISHKLRLLS...IDEVEKEKT...EPDFAKSDEEFARLLQAEFEALMMQ

S. robusta QYAVVE...NSSQFERQVRPYISRVLMYEDPVRQEAARKSVVPDKLEEKSLVSLAR..EG
P. chinensis
H. chinensis QYAVGE...DSGQFGROIRPYISQVLMYEPPVRQEAARKTVPVDKLEEKALVSLAR..EG
D. turbinatus QYAVGE...HSQFEQQRIRPYISKVLMYEDPVRQEAARKTVPVDKLEEKALVSLAR..EG
V. mangachapoi QYAVGQDSKSSQFEQIRPYISQVLMYEDSDRQEAARKTVPVDKLEEKALVSLAR..EG
B. pendula QYVAAD...DNGEFERRIRPYVDQVRMYEDPVRQEAARKTVPVIELEEKALVSLAK..EG
O. rehderiana QFVAAB...DNGEFESKIRPYVDQVRMYEDPVRQEAARN TVPVELEEKALVSLAK..EG
Q. robur PHIAAG...STEDFEKQIRPYVDKVRMYEDPVYQEAARKTAPVDELEEKALVALAR..EG
F. sylvatica QYVAPE...NTGDFERQIRPYVDKVLGYEDSVRQEAARKTVPVELEEKALISLAKVWG
F. excelsior QFVA SE...NKEQVEQRIRPYVGQVLMYEDPHRQEAARKTVPVDKLEEKALIALAR..EG

S. robusta NFKPSKS EQDHAFLLQLLFWFKQSF SWNAPPCD G.....CGKETSNQ
P. chinensis
H. chinensis NLKPSKS EQDHAFLLQLLFWFKQSF SWNAPPCD G.....CGNETKNQ
D. turbinatus NLKPSKS EQDHAFLLQLLFWFKQSF SWNAPPCD G.....CGNETSSQ
V. mangachapoi NLEPSKS EQDHAFLLQLLFWFKQSF SWNEPPCD G.....CGNETRSQ
B. pendula NFKPSKIEQDDAFLLQLLFWFKQSF RWNAPPCD G.....CGKTI SH
O. rehderiana NFNPSKIEQDHAFLLQLLFWFKK SFRWVDVPPCD G.....CGSKTVRQ
Q. robur NFEPSKV EQDHAFLLQLLFW.....WVNVP CDV.....CGSETINQ
F. sylvatica GVEIN.....LKKLL.....WESGVGIALQALKTL LKDFFSVNFTS CGSETISQ
F. excelsior NFNPTKN EKDHAFLLQLLFWFKQSF RWNAPPCDS.....CNETTVSQ

S. robusta GMGAALPTELSYGATRVELYRCNFCSRITRFPYNDPLKLVETRKGRGGEWANCFTLYCR
P. chinensis .MGMALPTELSYGATQVELYWCNFCSRITRFPYNDPLKLVETRKGRGGEWANCFTLYCR
H. chinensis GMGAALPAELSYGATRVELYRCNFCSRITRFPYNDPLKLVETRKGRGGEWANCFTFYCR
D. turbinatus GMGAALPTELSYGANRVELYRCNFCSRITRFPYNDPLKLVETRKGRGGEWANCFTLYCR
V. mangachapoi GMGAALPTELSYGATRVELYRCHFCSRITRFPYNDPLKLVETRKGRGGEWANCFTLYCR
B. pendula GMGSLPSEIOYGASRVELYICSFCSRITRFPYNDPLKLVETRRGRGGEWANCFTLYCR
O. rehderiana GMGSLSEIOYGASQVELYLC SFCSRITRFPYNDV LKLETRGRGGEWANCFTLYCR
Q. robur GMGSPDSESIOYGASRVELYR.....FWKQEEGVAGSGPIALRFIVE
F. sylvatica GMGSLSEIOYGASRVELYR.....LWKQEGGVAGSGPIALHFIVE
F. excelsior GMGMANSSESLYGASRIELYRCKLCSNVTRFPYNDPMKLETRKGRGGEWANCFTLYCR

S. robusta SFGYESR.....LILDFTDHVWTECYSESLGRWMHLDPCDGVYDKP LLYEKGWNKKL
P. chinensis SFGYESR.....LILDFTDHVWTECYSSESLGRWMHLDPCDGVYDKP LLYEKGWNKKL
H. chinensis SFGYESR.....LILDFTDHVWTECYSSESLGRWMHLDPCDGVYDKP LLYEKGWNKKL
D. turbinatus SFGYESR.....LILDFTDHLWTECYSSESLGRWMHLDPCDGVYDRP LLYEKGWNSKKL
V. mangachapoi SFGYESR.....LILDFTDHVWTECYSSESLGRWMHLDPCDGVYDKP LLYEKGWNKKL
B. pendula AFGYESR.....LILDFTDHVWTECF SQVLRWMHLDPCDGVSDR P LLYEKGWSKKL
O. rehderiana AFGYESR.....LILDFTDHVWTECF SQVLRWMHLDPCDGVYDIP LLYEKGWSKKL
Q. robur LLAMNHVW.....LILDFGDHVWTECF SQVLRWMHLDPCDGVYDKP LLYEKGWNKKL
F. sylvatica LLAMNPVCDQIHTTDQVILDFTDHLWTECFSESLGRWMHLDPCDGVYDKP LLYEKGWKKL
F. excelsior AFGYESR.....LILDFTDHVWTECFSSYLGRWMHLDPCDGEI FDN P LLYEKGWNKKL

r NDH

<i>S. robusta</i>	MLAMDGSWVQEFNLLSTRET.....KIIISLSYRVLDEVMI	MELLS	PKA	SSVS	SSPFS
<i>P. chinensis</i>	.....	MAFR	LF	GFFT	CLYYL
<i>H. chinensis</i>	..MVLGESKQNLSTQSTPSFSEAVPSWKIIISLSYRVLDEVMI	MELLS	PKA	SSVS	SSPFS
<i>D. turbinatus</i>	.....	.....	.....	.....	MYL
<i>V. mangachapoi</i>	.....	MT	MELLS	PKA	SSVS
<i>B. pendula</i>	.....	MEVVS	SKDS	SSV	ASSPFS
<i>O. rehdieriana</i>	.....	MEVVS	SKES	SSV	ASSPFS
<i>Q. robur</i>	.....	MEVLS	PKD	SSV	ASSPFS
<i>F. sylvatica</i>	.....	MEVLS	PKD	SSV	ASSPFS
<i>F. excelsior</i>	.....	.....	MD	CSSL	SSPFS

<i>S. robusta</i>	SPNIGALLRIKIIS..WSOETGLPVSLRVRIRDRIFSLHKKHPMFSKSGYFQKRLTESNEL
<i>P. chinensis</i>	CNFVIEEVL SFGILDPVRSOETGLPVSLRVRIRDRIFSLHKKHPMFSKSGYFQKRLTESNEL
<i>H. chinensis</i>	SPNIGALLRIKIIS..WSOETGLPVSLRVRIRDRIFSLHKKHPMFSKSGYFQKRLTESNEL
<i>D. turbinatus</i>	CNSVEQLLSFGILDPVRSOETGLPVSLRVRIRDRIFSLHKKHPMFSKSGYFQKRLTESNEL
<i>V. mangachapoi</i>	SPNIGALLRIKIIS..WSOETGLPVCLRVRLGDRIFSLHKKHPMFSKSGYFQKRLTESNEL
<i>B. pendula</i>	SPNIGALLRIKIIS..WSOETGLPVSVRVRVGDRIFNHKKHPMFSKSGYFKKRLDSDTDL
<i>O. rehdieriana</i>	SPNIGALLRIKIIS..WSOETGLPVSVRVRVGDRIFNHKKHPMFSKSGYFKKRLDSDTDL
<i>Q. robur</i>	SPNIGALLRIKIIS..WSOETGLPVSVRVRVGDRIFNHKKHPMFSKSGYFKKRLDSDTDL
<i>F. sylvatica</i>	SPNIGALLRIKIIS..WSOETGLPVSVRVRVGDRIFNHKKHPMFSKSGYFKKRLDSDTDL
<i>F. excelsior</i>	SPNVALLRIKIIS..WSOETGLPVSVRVRVADRTFNHKKHPMFSKSGYFKKRLDSDTDL

<i>S. robusta</i>	ELPQNFPGGPETFEMIVLFIYGSSTLVDPFNVAALRCAAEFLEMTEEYCTGNLCDRFDLY
<i>P. chinensis</i>	ELPQNFPGGPETFEMIVLFIYGSSTLVDPFNVAALRCAAEFLEMTEEYCTGNLCDRFNLY
<i>H. chinensis</i>	ELPRNFPGGPETFEMIVLFIYGSSTLVDPFN.....
<i>D. turbinatus</i>	ELPQNFPGGPETFEMIVLFIYGSSTLVDPFNVAALRCAAEFLEMTEEYCTGNLCDRFDLY
<i>V. mangachapoi</i>	ELPQNFPGGPETFEMIVLFIYGSSTLVDPFNVAALRCAAEFLEMTEEYCTGNLCDRFDLY
<i>B. pendula</i>	ELPQGFPGGPETFEMIALFIYGSSTFVDPFNVAALRCAAEFLEMTEYCSNLCERFDLY
<i>O. rehdieriana</i>	ELPQGFPGGPETFEMIALFIYGSSTLVDPFNVAALRCAAEFLEMTEYCSNLCERFDLY
<i>Q. robur</i>	ELPQGFPGGPETFEMIALFIYGSSTFIDPFNVAALRCAAEFLEMTEYCSNLCERFDLY
<i>F. sylvatica</i>	ELPQGFPGGPETFEMIALFIYGSSTLIDPFNVAALRCAAEFLIMTEYCSNLCERFDLY
<i>F. excelsior</i>	TLPNSFPGGPETFEMIALFIYGSSTLVDPFNVAALRCAAEFLQMTEDYGSNLCERFDLY

<i>S. robusta</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRDRPVVT
<i>P. chinensis</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRDRPVVT
<i>H. chinensis</i>	..VVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRDRPVVT
<i>D. turbinatus</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRDRPVVS
<i>V. mangachapoi</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRQPVVT
<i>B. pendula</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRDRPVVT
<i>O. rehdieriana</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRDRPVVT
<i>Q. robur</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRQPVVT
<i>F. sylvatica</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRQPVVT
<i>F. excelsior</i>	LNOVVLQSWDDTLIVLQKCOALLPWEELLIVSRGIESLAFMACMEILDPERRRHPVVT

<i>S. robusta</i>	LEALA GEAWSHEAGKTIVSQELWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYT
<i>P. chinensis</i>	LEALA GEAWSYEAAGKTIVSQELWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYT
<i>H. chinensis</i>	LEALA GEAWSCEAGKTIVSQELWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPMIIVFYA
<i>D. turbinatus</i>	LEALA GEAWSCEAGKTIVSQELWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYA
<i>V. mangachapoi</i>	LEALA GEAWSCEAGKTIVSQELWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYT
<i>B. pendula</i>	LEALASQAWNSETVKEIVSQDLWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYA
<i>O. rehdieriana</i>	LEALASQAWNSETVKEIVSQDLWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYA
<i>Q. robur</i>	LEALASQAWSCEVKEIVSQDLWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYT
<i>F. sylvatica</i>	LEALASQAWSCEVKEIVSQDLWIKDLTALPFGFFKRIIGSLRRQGMKEKVFVSPIIIVFYT
<i>F. excelsior</i>	IKALAHQHWTNQRLNDVMSHDLLIKDLTALPFLFFKRIIGSLRRQGMKEKVFVSPIIIVFYV

<i>S. robusta</i>	NKWILSQKTHQFWEKASPKMGENDTNIKFSVILQGIIDLLPIGEEKASRAIPVGFYFALLS
<i>P. chinensis</i>	NKWILSQKTHQFWEKASPKMGENDTNIKFSVILQGIIDLLPMGEEKASRAIPVGFYFALLS
<i>H. chinensis</i>	NKWILSQKTHQFWEKASPKMGENDTNIKFSVILQGIIDLLPMGEEKASRAIPVGFYFALLS
<i>D. turbinatus</i>	NKWILSQKTHQFWEKASPKMGENDTNIKVSVILQGIIDLLPMGEEKASRAIPVGFYFALLS
<i>V. mangachapoi</i>	NKWILSQKTHQFWEKASPKMGENDTNIDVSVILQGIIDLLPMGEEKASRAIPVGFYFALLS
<i>B. pendula</i>	NKWVSKKTRQFWESSAEKIGDDTNRKVAAILQGIIDLLPMGEEKASRLIPVGFYFALLS
<i>O. rehdieriana</i>	NKWVSKKTRQFWENSAEKIGDDTNCKVAAILQGIIDLLPMGEEKASRLIPVGFYFALLS
<i>Q. robur</i>	NKWVLSKTHQFWENSTERIGDDTNKVAAILQGIIDLLPMGEEKASRVIPVGFYFALLS
<i>F. sylvatica</i>	NKWVLSKTHQFWENSAEKIGDDTNKVAAILQGIIDLLPMGEEKASRVIPVGFYFALLS
<i>F. excelsior</i>	NKRILPNSV.....SKSRVDE.....LSIILGGIIDLPMGEEKAGKAI PVDFYFALLS

NDH

S. robusta RSLKFGLRSDRMVKLQDQIASMLHFAQVEDLHLQIGT.ESSISSKELAAALRSIFSTYVS
P. chinensis RSLKFGLRSDSMVKLQDQIASMLHFAQVEDFSLQIGT.ESSISSKELTAMRSIFSTYVS
H. chinensis RSLKFGLRSDSMVKLQDQIASMLHFAQVEDFHLQIGT.ESSISSKELAAALRSIFSTYVS
D. turbinatus RSLKFGLRSDSMVKLQDQIASMLHFAQVEDFHLRIGT.QSISAKKVLAAMRSIFSTYVS
V. mangachapoi RSLKFGLRSDSMVKLQDQIASMLHFAQVEDFHLRIGT.KAISSSKELAAALRSIFSTYVS
B. pendula RSLKFGLRSDHVKLQDQIASRLQFAQVEDFILPKMGT.DSISGGIELATMBSIISTYVS
O. rehderiana RSLKFGLRSDHVKLQDQIASMLQFAQVEDFILPKMGT.DSISGGIELATMBSIISTYVS
Q. robur RSLKFGLRSD...KLDQDQIASMLHFAQVEDFHPKMG.ESSISSIELATMBSIISTYVS
F. sylvatica RSLKFGFRSDNTVKLHDQIASMLHFAQVEDFHPKMG.KSISGGIELATMBSIISTYVS
F. excelsior KSLKFGDLRNDRLKLDQDQIASMLHFAQVEDFILPKMG.NQSSISSCRELSIMBSIISTYVS

S. robusta .YKVEFNHTPSASNSTIAELWDTFIRVASDLEMGPQSFMEIETVPIISYRLNHDLLYRA
P. chinensis .YKVEFNHTPSASNSTIAELWDTFIQVASDLEMGPQSFMEIETVPIISYRLNHDLLYSA
H. chinensis .YKVEFNHTPSASNSTIAELWDTFIQVASDLEMGPQSFMEIETVPIISYRLNHDLLYRA
D. turbinatus .YKGETNYNPSASNSTIAELWDTFMQVASDLEMGPQSFMEIETVPIISYRLNHDLLYRA
V. mangachapoi .YKVEFNHTPSASNSTIAELWDTFIVQVASDLEMGPQSFMEIETVPIISYRLNHDLLYRA
B. pendula .SNLDTNHTPSSTRNSVVAELWDVYLSHIVPDDIGPAREFMELVERVFNCSQSHDQLYRA
O. rehderiana .SNLDTNHTPSSTRNSVVAELWDVYLSHIVPDPNMGPERFMELVERVFNCSQSHDQLYRA
Q. robur .SNSDMIHTPSSTRNSVVAELWDVYLSHIVPDPNMGPERFMELVERVFNCSQSHDQLYRA
F. sylvatica .SNSDTNHISSTRNSVVAELWDVYLSHIVPDPNMGPERFMELVERVFNCSQSHDQLYRA
F. excelsior LYNTERNRTPSENNSVVAELWDLVLSQIATDSQLGCKRMDLIEETPISSRQSHDNLKYKT

S. robusta MNSFLQAHKDI SQEERGMVCKYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ
P. chinensis MNSFLQAHKDI SQEERGMVCKYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ
H. chinensis MNSFLQAHKDI SQEERGMVCKYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ
D. turbinatus MNSFLQAHKDI SQEERGMVCKYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ
V. mangachapoi MNSFLQAHKDI SQEERGMVCKYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ
B. pendula MNTFLQAHPSISQEEKGAVCRYLNCKKLSQEAACIDAVQNELMPLRLIVQALFVQQLNTHQ
O. rehderiana MNTFLQAHPSISQEEKGAVCRYLNCKKLSQEAACIDAVQNELMPLRLIVQALFVQQLNTHQ
Q. robur MNTFLQAHPSISQEEKGAVCRYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ
F. sylvatica MNTFLQAHPSISQEEKGAVCRYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ
F. excelsior LNNFLQAHPSISQDEKGAVCRYLNCKKLSQEAACIEAVQNELMPLRLIVQALFVQQLNTHQ

S. robusta AFKECSESFRT...GPFSGSVPSRCPNPKSILGES...PYTDGAEEGSSKPLSFLLONE
P. chinensis AFKECSESFRT...GPFSGSVPSRCPNPKSILGES...PYTDGAEEGSSKPLSFLLONE
H. chinensis AFKECSESFRT...GPFSGSVPSRCPNPKSILGES...PFTGTEEGSSKPLSFLLONE
D. turbinatus AFKECSESFRT...GPFSGSVPSRCPNPKSILGES...PYTDGAEEGSSKPLSFLLONE
V. mangachapoi AFKECSESFRT...GTFSGSLPSRCPNPKSILGES...PYTDGAEEGSSKPLSFLLONE
B. pendula AFRECSDFRHAHCGEFSGSLSSRYPNPKSILGES...PYTDGAEPPG.RRPLSFLLOKD
O. rehderiana AFRECSDFRHAHCGEFSGSLSSRYPNPKSILGES...PYTDGAEPPG.RRPLSFLLOKD
Q. robur AFRECSDFRHAHCGEFSGSLSSRYPNPKSILGES...PYTDGAEPPG.GRPLSFLLOKD
F. sylvatica AFKECSESFRT...GPFSGSVPSRCPNPKSILGES...PYTDGAEPPG.SRPLSFLLOKD
F. excelsior AFRECSDFRHAHCGEFSGSLSSRYPNPKSILGES.PMPYIKGSEGGSSKPLSFLLOKD

S. robusta LAIDKDF...RKDYESTSFRIQNLKELMSLKRRLQHLNMSKNSGNSNKT.KSG.KT
P. chinensis LAIDKDF...RNDYESTSFRIQNLKELMSLKRRLQHLNMSKNSGNSNKT.KSS.KT
H. chinensis LAIDKDF...RKDYESTSFRIQNLKELMSLKRRLQHLNMSKNSGNSNKT.KSS.KT
D. turbinatus LVIDKDF...RKDYESTSFRIQNLKELMSLKRRLQHLNMSKNSGNSNKT.KSS.KT
V. mangachapoi LAIDKDF...RKDYESTSFRIQNLKELVSLKRRLQHLNMSKNTESNDTKSS.KT
B. pendula IS...PEFS...RNEFESTSLRIQNLKELMSLKRRLQHLNMSKNTESNDTKSS.KT
O. rehderiana SS...PEFS...RNEFESTSLRIQNLKELMSLKRRLQHLNMSKNTESNDTKSS.KT
Q. robur LAMQRPDFS...RQEFESTSFRIQNLKELMSLKRRLQHLNMSKNTESNDTKSS.KT
F. sylvatica LTMQRPEFS...RQEFESTSFRIQNLKELMSLKRRLQHLNMSKNTESNDTKSS.KT
F. excelsior LTTSSSEFSSEFPKRDYESTSFRIQNLKELMSLKRRLQHLNMSKNTESNDTKSS...EP

S. robusta HGLGKRSVSKRGNPFQGE.TGCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
P. chinensis HGLGKRSVSKRGNPFQGE.TGCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
H. chinensis HGLGKRSVSKRGNPIGOV.TGCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
D. turbinatus YGLGKRSVSKRGNPFQGE.TGCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
V. mangachapoi YGLGKRSVSKRGNPFQGE.TGCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
B. pendula YGMESSRSLSKRKNPLGOV.TGCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
O. rehderiana YGMESSRSLSKRKNPLGOV.TGCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
Q. robur YGMESSRSLSKRKNPLGOV.TSCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
F. sylvatica YGMESSRSLSKRKNPLGOV.TSCIGSVNFASORRYASRLKVICRFALFGSRKSKRKQAS
F. excelsior YGLGERRMSKKNPLGOVNASIGTINFASORRYANRRLKVLQKISLFGGRSKRKRPVAA

S GRPE

<i>S. robusta</i>	MATLLKT.PPLKAPPLAWRPTPI SLKSPKPCVSVFRHRIHSTGIPRRS SLRLD.SAPSLR
<i>P. chinensis</i>	MATLLKT.PPLKAPPPAWRPTPI SLKSPKPCVSVFRHRIHSTGIPRRS SLRLD.SAPSLR
<i>H. chinensis</i>	MATLLKAPPLKAPPLAWRPTPI SLKSPKPCVSVFRHRIHSTGIPRRGRALRLD.SAPSLR
<i>D. turbinatus</i>	MATLLKT.PPLKAPPLAWRPTTI SLKSPKPCVSVFRHRIHSGGIPRRS SLRLD.SPESLR
<i>V. mangachapoi</i>	MATLLKT.PPLKAPPVWRPTPI SLKSPKPCVSVFRHRIHSTGIPSRSLRLD.SAPSLR
<i>B. pendula</i>	.....MRGED..GIEF.....SIRFG.....
<i>O. rehderiana</i>	MATVLT.PTIRVALPPRPTTETS SKSEKPCVSVFRH..STPKHSRLS SLRFS.RIPSLR
<i>Q. robur</i>	.....MFD.....
<i>F. sylvatica</i>	MATVLT.PTIRAPFPPR..STISSKSKPCVSVFRHSTTKPSLP.LTSLRFSHHLPSLR
<i>F. excelsior</i>	.....MVVLG.....

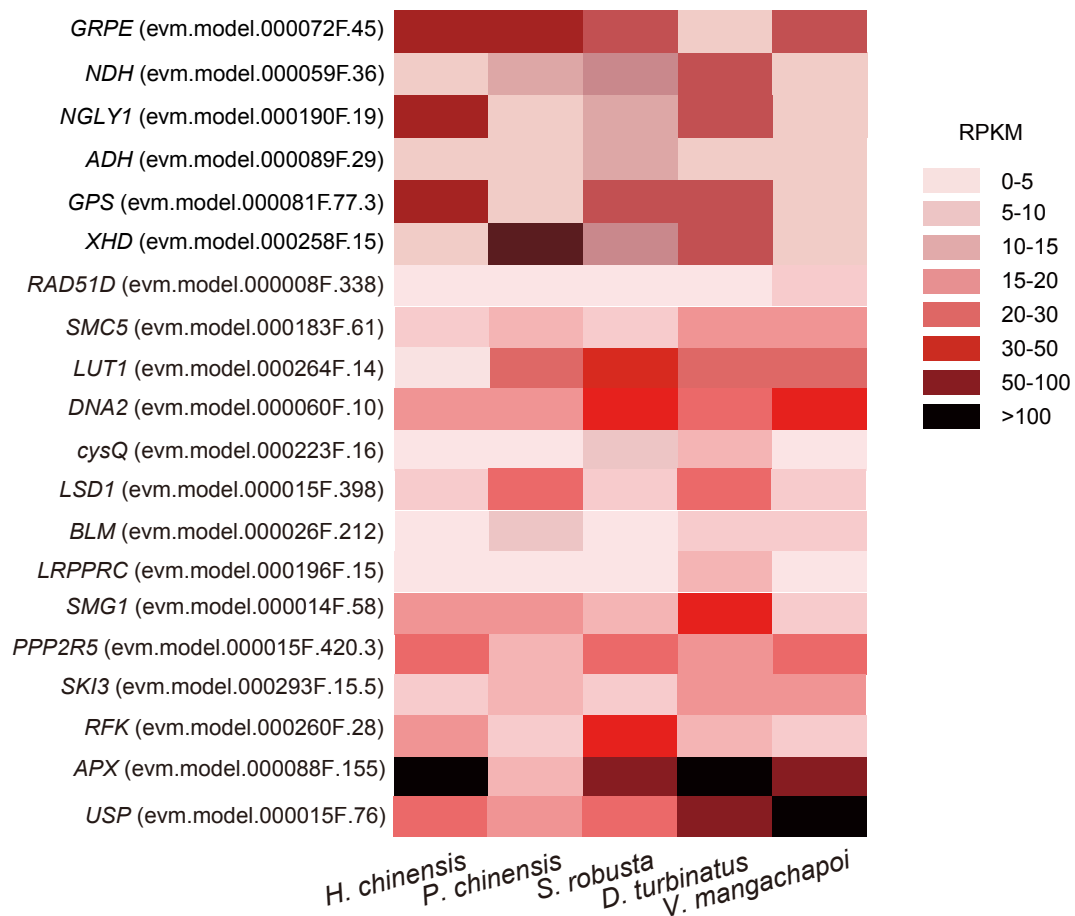
<i>S. robusta</i>	FVKLVSLAASGG.ETETAESKEQVQETE.....IEDSSDGAVAVE
<i>P. chinensis</i>	FVKLVSLAASGG.ETETAESKEQVQETE.....IEDSSDGAVAVK
<i>H. chinensis</i>	FVKLVSLAASGG.ETETAESKEQVQETE.....IEDSSDGAVAVE
<i>D. turbinatus</i>	FVKLVSLASNGG.ETETAESKEQVRETE.....IEDSSDGAVAVE
<i>V. mangachapoi</i>	FVKLVSLAASGG.ETETAESKEQVQATE.....IEDSSDGAVAVE
<i>B. pendula</i>	VEF.....AEDILDGAVRIE
<i>O. rehderiana</i>	FVKFVPPFASSG..DTETTDTQEEVQQPQQ.....AEDILDGADRNE
<i>Q. robur</i>	.....RDIVDGAAVVE
<i>F. sylvatica</i>	FVKFVPPFASSGETETTETQDEVQEPQQEQVQVRGIDLEARKERNIYEDIEDGAVGVE
<i>F. excelsior</i>	.....NLDGVVGV

<i>S. robusta</i>	DGAG.DENS DVEEISTSAVLALLQSYKEALASNNEAKVAFESFLOSIEDEKVDLEKVVV
<i>P. chinensis</i>	DGAG.DENS DVEEISTSAVLALLQSYKEALASNNEPKVAFESFLOSIEENKVDLENKVV
<i>H. chinensis</i>	DGAG.DES DVEDISTSAVLALLQSYKEALASNNEAKVAFESFLOSIEDEKVDLEKVI.
<i>D. turbinatus</i>	DGAG.DES DVEEISAVLALLQSYKEALASNNEAKVAFESFLOSIEDEKVDLEKVVV
<i>V. mangachapoi</i>	DGVD.DESS DVEEVPASAVLALLQSYKEALASNNEAKAFESFLOSIEDEKVDLEKVVV
<i>B. pendula</i>	DGTS.DDVTGAEVPPSVIISLLRSYKEALASNDESRVAFESLKSVEDEKISLERKVT
<i>O. rehderiana</i>	DVTS.DDVTGDEEVPSPVVISLLOS YKEALASNDESRVAFESLKSVEDEKISLERKVT
<i>Q. robur</i>	DISSDDVNGAEVPPSAIVSSLQLYKEALASNDESGVAFESLKSIEBEKISLERKVA
<i>F. sylvatica</i>	DGTSDDINGNEEVPSAILSSLQLYKEALASNDESRVAFESLKSIEBEKISLERKVA
<i>F. excelsior</i>	.....SDGDTVAEPPASAVVASLNLVREALANNDEAKVADISELLESIESEKTELEKREA

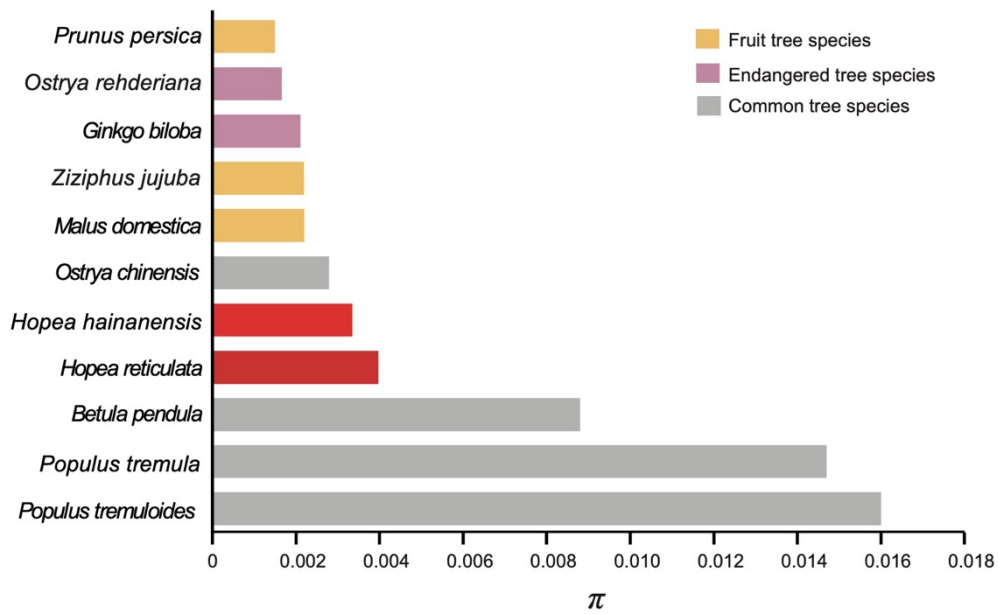
<i>S. robusta</i>	SLSEELATEKDRILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLSVLDNFERAKDQI
<i>P. chinensis</i>	SLSEELATEKDRILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENFLPVDNFERAKDQI
<i>H. chinensis</i>	.....GTEKDRILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI
<i>D. turbinatus</i>	SLSEELATEKDRILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI
<i>V. mangachapoi</i>	SLSEELATEKDRILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI
<i>B. pendula</i>	SLSEELATEKARILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI
<i>O. rehderiana</i>	YLSEELATEKARILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI
<i>Q. robur</i>	SLSEELATEKERILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI
<i>F. sylvatica</i>	SLSEELATEKDRILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI
<i>F. excelsior</i>	TLSEELATEKDRILRI SADFDFNFRKRTERE RLSLVKNAQGEVLENLLPVDNFERAKDQI

<i>S. robusta</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>P. chinensis</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMRDDSTDYEEGI
<i>H. chinensis</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>D. turbinatus</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>V. mangachapoi</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>B. pendula</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>O. rehderiana</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>Q. robur</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>F. sylvatica</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREDSTDYEEGI
<i>F. excelsior</i>	KVATEGEEKINNSYQSIYKQFIEILGSLGVV VETVGCFFDPMLHEAIMREGSTEFKDIGI

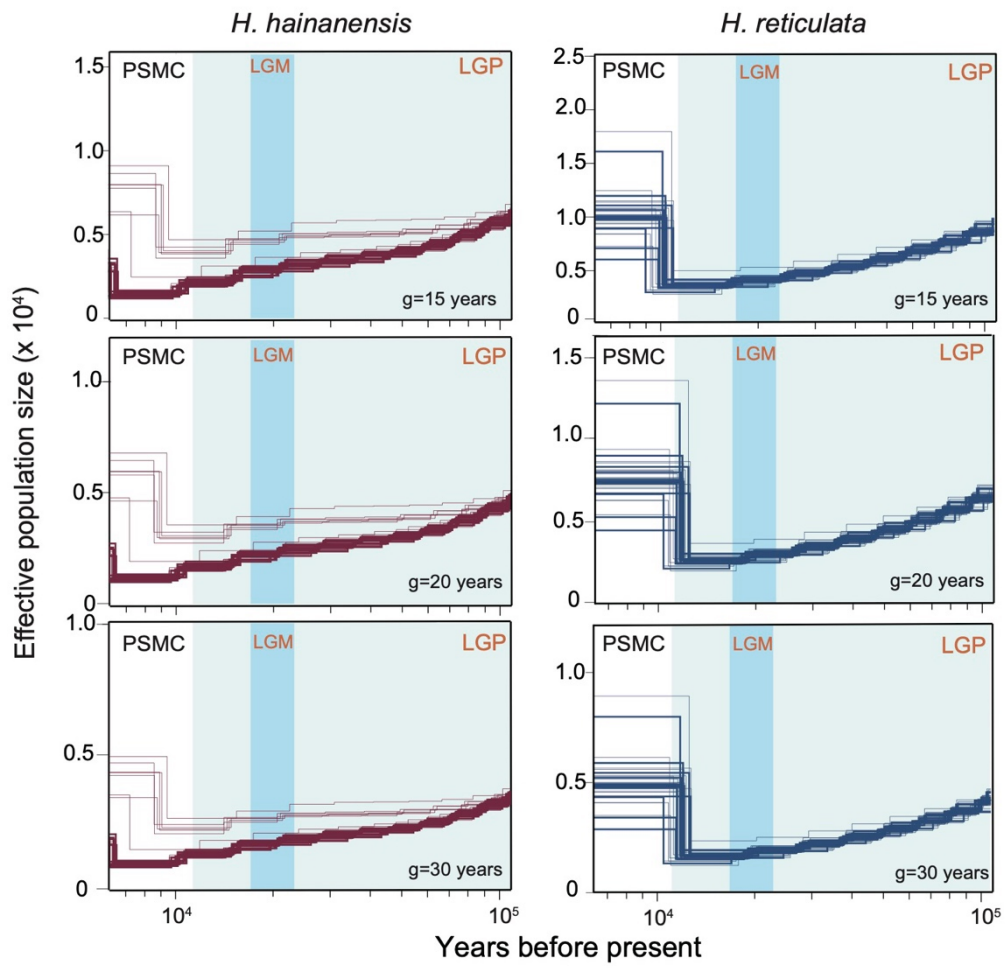
<i>S. robusta</i>	ILQEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>P. chinensis</i>	ILQEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>H. chinensis</i>	ILQEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>D. turbinatus</i>	ILQEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>V. mangachapoi</i>	VLDEFSRNF SQFCSGFMKTWIRF.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>B. pendula</i>	VIEEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>O. rehderiana</i>	VIEEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>Q. robur</i>	ILQEFRKGFKLGDRLLRPA MVKVSAGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>F. sylvatica</i>	ILQEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN
<i>F. excelsior</i>	VLDEFRKGFKLGDRLLRPA MVKVS.....AGPGPAKPAEVESSEGANTSEATQDSEETIN



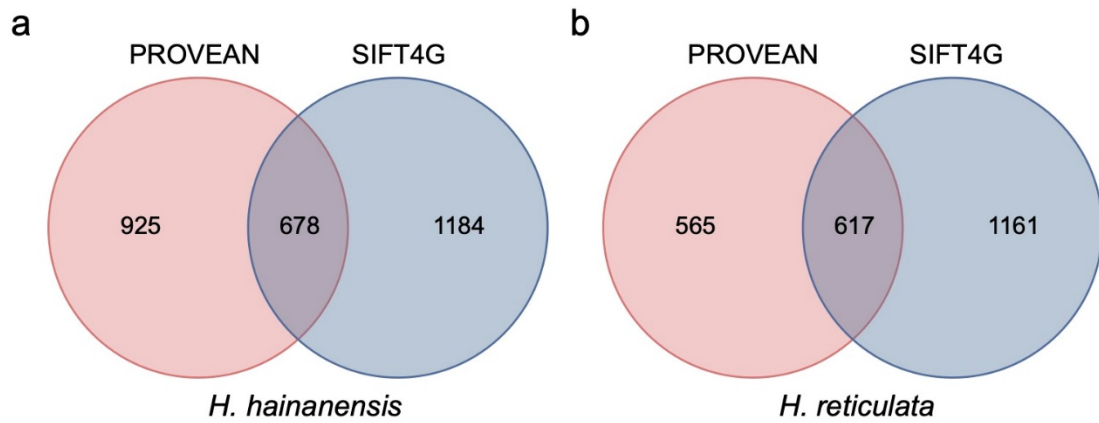
Supplementary Figure 8. Expression of the 20 positively selected genes involved in the responses of plants to environmental stresses in the comparisons between the genomes of our focal Dipterocarpoideae species and those of five temperate tree species comparisons of genomes. The function of each gene is shown in Supplementary Data 2. Expression level of each gene is estimated based on the transcriptome data (Illumina RNA-seq) for gene structure prediction (see Supplementary Table 21). RPKM: reads per kilobase per million mapped reads. Source data are provided as a Source Data file.



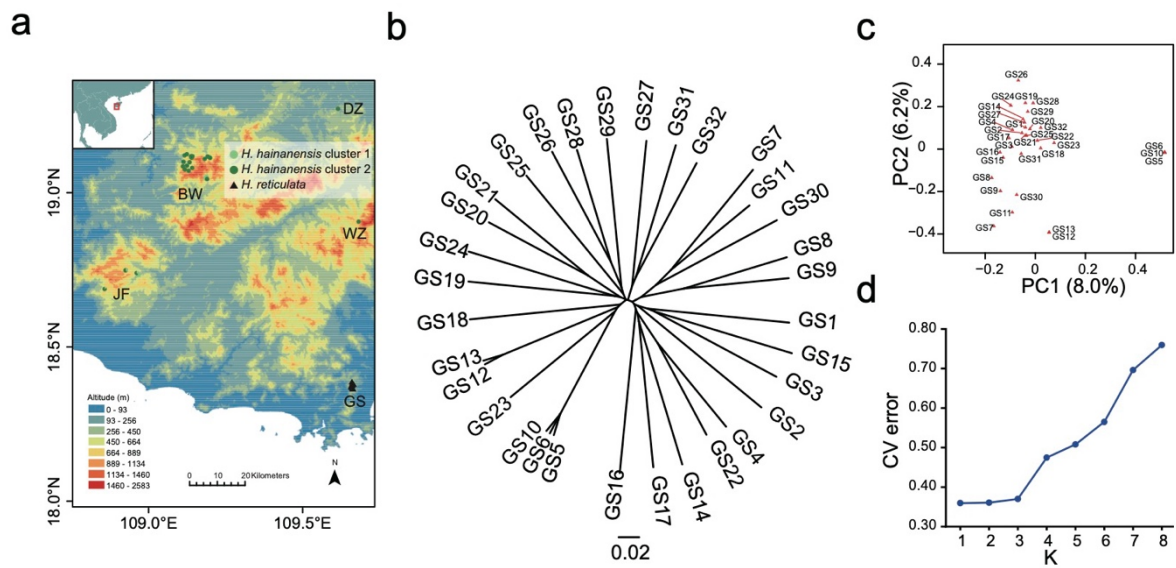
Supplementary Figure 9. Nucleotide diversity (π) of *Hopea hainanensis* and *H. reticulata* populations at the genomic level, with further comparisons with π values from the genomes of other nine tree species^{6,7,8,9,10,11,12}. Source data are provided as a Source Data file.



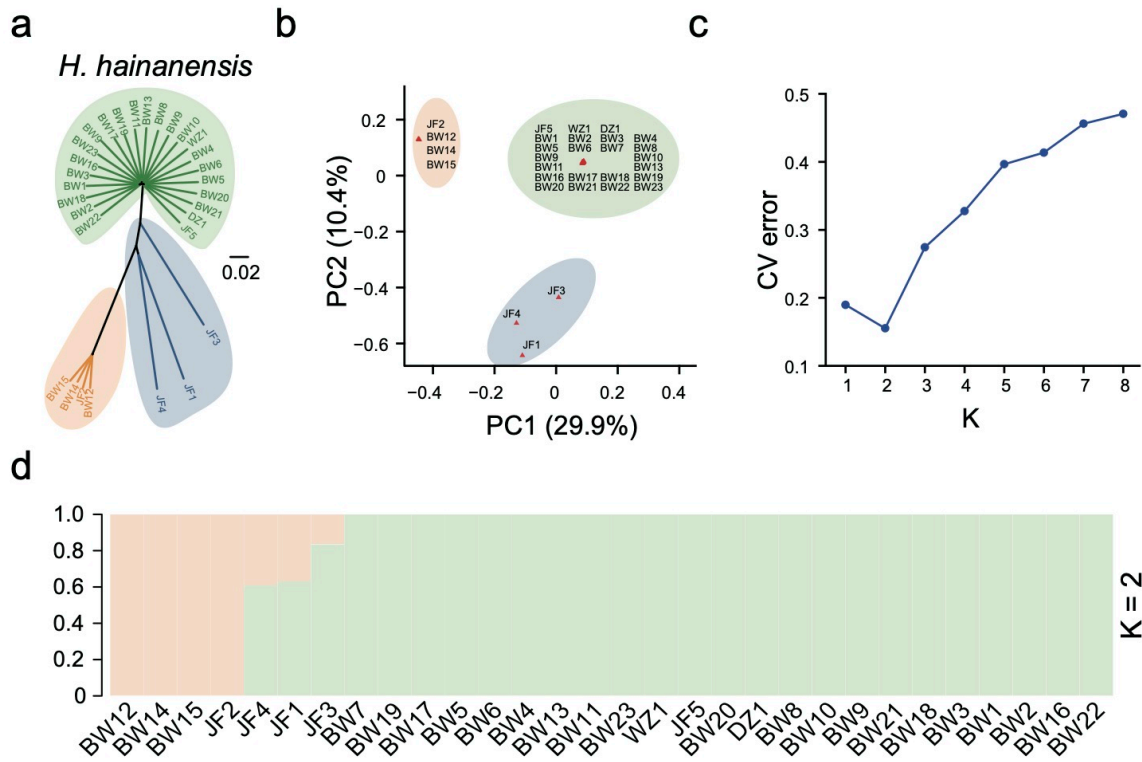
Supplementary Figure 10. Demographic dynamics of *H. hainanensis* (n=30) and *H. reticulata* (n=32) inferred using PSMC.



Supplementary Figure 11. Venn diagrams of the deleterious mutations (DDMs) detected within *H. hainanensis* (n=30) and *H. reticulata* (n=32) populations based on the results from analyses using PROVEAN and SIFT4G.



Supplementary Figure 12. The sampling locations of wild *H. hainanensis* and *H. reticulata* trees for resequencing and analysis of population genomics (a), neighbour-joining phylogenetic tree (b), principal component analysis (PCA) (c) and results of genetic structure analysis for the *H. reticulata* (n=32) population using genetic clustering (d). The sampling map was drawn by Chao-Nan Liu. All sampled trees are located on Hainan Island, China. BW: Bawangling, DZ: Danzhou city, JF: Jianfengling, WZ: Wuzhi mountain, and GS: Ganshiling. Cross-validation error (CV error) of each assumed genetic group number (K) was estimated, and assignment of sampled trees were performed according to the first two principal components from PCA analysis. Source data of Supplementary Fig. 12d are provided as a Source Data file.



Supplementary Figure 13. Results of neighbour-joining phylogenetic tree (a), principal component analysis (PCA) (b), and genetic clustering (c, d) for the sampled trees of *H. hainanensis* (n=30). Cross-validation error (CV error) for each assumed genetic group number (K) was estimated, and assignment of sampled trees were performed according to the first two principal components from PCA analysis. Source data of Supplementary Fig. 13c are provided as a Source Data file.

Supplementary Tables

Supplementary Table 1. The results of genome size estimation using flow cytometry setting the genome of *Solanum lycopersicum* (genome size: 2.07 Gb; 2C = 2.12) as the reference.

Sample	Fuorescence intensity	CV error (%)	2C (pg)	Genome size (Gb)	Ploidy
<i>Hopea chinensis</i>	18.20	4.30	0.81	0.79	2X
<i>Solanum lycopersicum</i>	47.40	1.76	2.12	2.07	
<i>Hopea hainanensis</i>	29.20	4.71	1.60	1.56	4X
<i>Solanum lycopersicum</i>	38.80	3.61	2.12	2.07	
<i>Hopea reticulata</i>	26.90	4.88	1.64	1.60	4X
<i>Solanum lycopersicum</i>	34.70	3.29	2.12	2.07	

Supplementary Table 2. Statistics of clean sequencing data. Pacbio CLR (continuous long-read) reads were generated for *H. hainanensis*, *H. reticulata*, *H. chinensis* and *P. chinensis*, and Pacbio HiFi (high fidelity) reads were generated for *S. robusta*, *D. turbinatus* and *V. mangachapoi*. Depth of sequencing was calculated via clean sequencing data divided by the genome size estimated by *k*-mer analysis (see Table 1).

Species	Abbreviation	Illumina reads		Pacbio reads		Hi-C reads	
		Data (Gb)	Depth (X)	Data (Gb)	Depth (X)	Data (Gb)	Depth (X)
<i>H. hainanensis</i>	Hhai	263.53	168.53	97.17	62.14	77.32	49.45
<i>H. reticulata</i>	Hret	77.13	51.40	87.34	58.21	100.29	66.84
<i>H. chinensis</i>	Hchi	51.16	147.66	42.63	123.04	45.19	130.43
<i>P. chinensis</i>	Pchi	79.65	254.36	124.88	398.80	47.11	136.00
<i>S. robusta</i>	Srob	80.59	244.98	6.64	20.18	50.29	152.87
<i>D. turbinatus</i>	Dtur	82.38	220.76	20.72	55.52	57.42	153.88
<i>V. mangachapoi</i>	Vman	69.98	154.55	8.38	18.51	47.56	105.01

Supplementary Table 3. Proportions of highly homologous regions in each chromosome of *H. hainanensis* and *H. reticulata* according to the coverage depth of Illumina pair-end reads for *k*-mer analysis. The overall sequencing depth was 144X (223.69 Gb/1.56 Gb) for *H. hainanensis* and 51X (77.13 Gb/1.50 Gb) for *H. reticulata*. Regions with coverage depths of 216X – 360X, 360X– 504X and larger than 504X for *H. hainanensis* and of 75.5X – 127.5X, 127.5X – 178.5X and larger than 178.5X for *H. reticulata* (i.e., 1.5 – 2.5, 2.5 – 3.5 and larger than 3.5 folds of overall coverage depth) were thought to be the overlaps of two, three and four sets chromosomes, respectively. The total length of overlapped region was estimated to be 361.86 Mb for *H. hainanensis* and 245.66 Mb for *H. reticulata*, accounting for most (77.9% for *H. hainanensis* and 93.6% for *H. reticulata*) of the difference between the assembled and the estimated genome size (see Methods).

Chromosome_ID	<i>H. hainanensis</i>			<i>H. reticulata</i>				
	Chromosome length (bp)	216X–360X	360X–504X	>504X	Chromosome length (bp)	76.5X–127.5X	127.5X–178.5X	>178.5X
Chr1	56,060,860	0.2368	0.0389	0.0296	66,518,347	0.2481	0.0207	0.0054
Chr2	50,862,877	0.2322	0.0083	0.0022	62,617,095	0.2431	0.0179	0.0040
Chr3	47,502,918	0.1823	0.0187	0.0120	52,787,304	0.2071	0.0125	0.0030
Chr4	25,558,352	0.0630	0.0055	0.0000	29,144,642	0.3376	0.0477	0.0079
Chr5	52,060,348	0.2239	0.0035	0.0012	69,171,435	0.1840	0.0250	0.0039
Chr6	51,918,603	0.2779	0.0270	0.0252	61,919,302	0.1649	0.0241	0.0058
Chr7	45,882,048	0.2183	0.0179	0.0111	44,322,556	0.1633	0.0244	0.0020
Chr8	29,356,050	0.0651	0.0020	0.0003	26,589,551	0.1835	0.0267	0.0034
Chr9	53,961,569	0.3009	0.0445	0.0752	61,289,770	0.2457	0.0238	0.0073
Chr10	52,201,287	0.2773	0.0063	0.0019	54,261,871	0.2230	0.0140	0.0024
Chr11	38,126,576	0.1828	0.0121	0.0100	46,031,668	0.1853	0.0130	0.0059
Chr12	24,842,783	0.0535	0.0008	0.0000	25,649,789	0.1930	0.0304	0.0062
Chr13	44,572,804	0.3358	0.0121	0.0011	54,107,632	0.2173	0.0181	0.0031
Chr14	44,276,399	0.3243	0.0486	0.0788	46,457,576	0.2561	0.0198	0.0045
Chr15	36,124,573	0.2729	0.0246	0.0075	44,011,096	0.2493	0.0195	0.0052
Chr16	22,986,945	0.0622	0.0004	0.0000	41,307,522	0.2041	0.0136	0.0019
Chr17	51,368,458	0.3222	0.0444	0.0779	49,638,002	0.2877	0.0234	0.0068

Chr18	43,707,180	0.3276	0.0078	0.0014	48,129,990	0.3171	0.0322	0.0087
Chr19	28,019,024	0.2591	0.0300	0.0232	44,406,130	0.3137	0.0277	0.0068
Chr20	22,359,377	0.0894	0.0009	0.0009	31,106,232	0.2845	0.0267	0.0045
Chr21	42,884,734	0.2733	0.0581	0.0212	50,897,133	0.1819	0.0173	0.0067
Chr22	41,336,008	0.2288	0.0068	0.0010	46,730,095	0.2382	0.0201	0.0077
Chr23	33,386,394	0.1836	0.0210	0.0099	43,902,429	0.2237	0.0141	0.0023
Chr24	22,647,172	0.0645	0.0013	0.0000	16,233,104	0.1694	0.0074	0.0031
Chr25	30,718,104	0.3955	0.0557	0.1045	34,780,442	0.3108	0.0210	0.0052
Chr26	27,906,433	0.3973	0.0097	0.0018	31,998,611	0.3194	0.0441	0.0181
Chr27	17,551,768	0.2813	0.0177	0.0188	25,311,145	0.2947	0.0245	0.0008
Chr28	14,580,805	0.1385	0.0014	0.0007	20,671,113	0.3952	0.0556	0.0227
Total	1,052,760,449	-	-	-	1,299,991,582	-	-	-

Supplementary Table 4. Lengths of assembled chromosomes for each focal species. Note that only monoploid genome was assembled for all species except the two autotetraploid species *H. hainanensis* and *H. reticulata*.

Chromosome ID	Chromosome length (bp)						
	<i>H. hainanensis</i>	<i>H. reticulata</i>	<i>H. chinensis</i>	<i>P. chinensis</i>	<i>S. robusta</i>	<i>D. turbinatus</i>	<i>V. mangachapoi</i>
Chr1	56,060,860	66,518,347	58,999,814	47,060,898	52,458,056	40,721,971	35,234,553
Chr2	50,862,877	62,617,095	50,750,874	43,239,849	50,588,708	26,050,962	56,851,045
Chr3	47,502,918	52,787,304	53,466,247	51,893,975	54,130,500	35,475,413	39,502,375
Chr4	25,558,352	29,144,642	51,441,790	46,059,081	48,473,062	32,353,911	37,717,841
Chr5	52,060,348	69,171,435	44,472,741	39,227,045	42,867,569	45,090,292	40,985,457
Chr6	51,918,603	61,919,302	46,293,359	29,970,300	46,457,883	29,150,171	49,753,518
Chr7	45,882,048	44,322,556	32,845,991	51,556,864	31,767,639	26,610,888	43,556,076
Chr8	29,356,050	26,589,551	-	-	-	29,516,284	36,579,020
Chr9	53,961,569	61,289,770	-	-	-	42,617,143	33,201,765
Chr10	52,201,287	54,261,871	-	-	-	28,594,060	29,296,269
Chr11	38,126,576	46,031,668	-	-	-	32,794,201	36,846,320
Chr12	24,842,783	25,649,789	-	-	-	-	-
Chr13	44,572,804	54,107,632	-	-	-	-	-
Chr14	44,276,399	46,457,576	-	-	-	-	-
Chr15	36,124,573	44,011,096	-	-	-	-	-
Chr16	22,986,945	41,307,522	-	-	-	-	-
Chr17	51,368,458	49,638,002	-	-	-	-	-
Chr18	43,707,180	48,129,990	-	-	-	-	-
Chr19	28,019,024	44,406,130	-	-	-	-	-
Chr20	22,359,377	31,106,232	-	-	-	-	-
Chr21	42,884,734	50,897,133	-	-	-	-	-
Chr22	41,336,008	46,730,095	-	-	-	-	-
Chr23	33,386,394	43,902,429	-	-	-	-	-

Chr24	22,647,172	16,233,104	-	-	-	-	-
Chr25	30,718,104	34,780,442	-	-	-	-	-
Chr26	27,906,433	31,998,611	-	-	-	-	-
Chr27	17,551,768	25,311,145	-	-	-	-	-
Chr28	14,580,805	20,671,113	-	-	-	-	-
Total (bp)	1,052,760,449	1,229,991,582	338,270,816	309,008,012	326,743,417	368,975,296	439,524,239

Supplementary Table 5. Genome completeness assessments using CEGMA, BUSCO and Illumina sequencing data for *k*-mer analysis (see Supplementary Table 2). A total of 248 core eukaryotic genes (CEGs) and 1,614 conserved embryophyta proteins (CEPs) were used in CEGMA and BUSCO assessments, respectively. LMG: the longest monoploid genome.

Species	CEGMA			BUSCO			Illumina sequencing data	
	Type	Number of CEGs	Percentage (%)	Type	Number of CEPs	Percentage (%)	Mapping ratio (%)	Genome coverage (%)
<i>H. hainanensis</i> (four sets chromosomes)	Fully mapped CEGs	244	96.77	Complete	1,598	99.0	97.38	98.42
	Fully + partially mapped CEGs	245	98.79	Fragmented	6	0.4		
				Missing	10	0.6		
<i>H. hainanensis</i> (LMG)	Fully mapped CEGs	226	91.13	Complete	1,398	86.6	86.21	99.81
	Fully + partially mapped CEGs	232	93.55	Fragmented	26	1.6		
				Missing	190	11.8		
<i>H. reticulata</i> (four sets chromosomes)	Fully mapped CEGs	236	95.16	Complete	1,580	97.9	96.08	92.38
	Fully + partially mapped CEGs	242	97.58	Fragmented	3	0.2		
				Missing	31	1.9		
<i>H. reticulata</i> (LMG)	Fully mapped CEGs	223	89.92	Complete	1,319	81.7	84.21	97.12
	Fully + partially mapped CEGs	227	91.53	Fragmented	34	2.1		
				Missing	261	16.2		
<i>H. chinensis</i>	Fully mapped CEGs	236	95.16	Complete	1,533	95.0	94.45	99.91
	Fully + partially mapped CEGs	240	98.39	Fragmented	10	0.6		
				Missing	71	4.4		
<i>P. chinensis</i>	Fully mapped CEGs	236	95.16	Complete	1,583	98.1	95.41	99.84
	Fully + partially mapped CEGs	239	96.37	Fragmented	7	0.4		
				Missing	24	1.5		
<i>S. robusta</i>	Fully mapped CEGs	236	95.16	Complete	1,590	98.5	96.44	99.99
	Fully + partially mapped CEGs	239	96.37	Fragmented	7	0.4		
				Missing	17	1.1		

<i>D. turbinatus</i>	Fully mapped CEGs	245	98.79	Complete	1,598	99.0	98.69	99.85
	Fully + partially mapped CEGs	248	100.00	Fragmented	3	0.2		
				Missing	13	0.8		
<i>V. mangachapoi</i>	Fully mapped CEGs	229	92.34	Complete	1,567	97.1	96.86	99.90
	Fully + partially mapped CEGs	234	94.35	Fragmented	3	0.2		
				Missing	44	2.7		

Supplementary Table 6. Allele annotation among homologous chromosomes in *H. hainanensis* and *H. reticulata* genomes. Number of allele-identified genes was calculated as four times of the total number of genes with four alleles across all the seven chromosome sets, three times of the total number of genes with three alleles, two times of the total number of genes with two alleles, and the total number of genes with one allele. Chromosome set: a group of clustered chromosomes containing four homologous chromosomes.

	<i>H. hainanensis</i>				<i>H. reticulata</i>			
	Genes with four alleles	Genes with three alleles	Genes with two alleles	Genes with one allele	Genes with four alleles	Genes with three alleles	Genes with two alleles	Genes with one allele
Chromosome set 1	612	1,681	1,762	3,007	345	1,630	2,211	4,341
Chromosome set 2	503	1,712	1,663	2,613	248	1,418	1,954	3,903
Chromosome set 3	498	1,985	1,939	2,806	371	1,356	2,005	3,865
Chromosome set 4	391	1,649	1,809	2,158	336	1,386	1,855	3,485
Chromosome set 5	365	1,690	1,822	2,370	165	1,178	2,200	3,079
Chromosome set 6	440	1,517	1,478	2,231	193	1,203	1,719	3,467
Chromosome set 7	169	964	1,207	1,467	245	749	1,216	1,918
Allele-identified genes	2,978	11,198	11,680	16,652	1,903	8,920	13,160	24,058

Supplementary Table 7. Annotation results of protein-coding genes and BUSCO assessments. A total of 1,614 conserved embryophyta proteins (CEPs) were used in BUSCO assessments. CDS: coding sequence.

		<i>H. hainanensis</i>	<i>H. reticulata</i>	<i>H. chinensis</i>	<i>P. chinensis</i>	<i>S. robusta</i>	<i>D. turbinatus</i>	<i>V. mangachapoi</i>
Gene structure	Gene number	88,703	85,031	29,372	29,651	29,104	31,744	31,006
	Average gene length (bp)	2,690	2,781	2,773	2,872	2,974	2,824	2,910
	Average CDS length (bp)	1,127	1,171	1,132	1,163	1,184	1,181	1,163
	Average exons per gene	5.1	5.3	5.2	5.3	5.4	5.2	5.2
	Average exon length (bp)	221	220	217	219	220	229	226
	Average intron length (bp)	382	373	389	397	409	395	421
	BUSCO assessment	Complete CEPs	1,512 (93.7%)	1,513 (93.7%)	1,515 (93.9%)	1,483 (91.9%)	1,500 (92.9%)	1,513 (93.7%)	1,473 (91.3%)
	Single-copy CEPs	175 (10.9%)	162 (10.0%)	1,306 (80.9%)	1,293 (80.1%)	1,330 (82.4%)	1,286 (79.7%)	1,306 (80.9%)
	Duplicated CEPs	1,337 (82.8%)	1,351 (83.7%)	209 (13.0%)	190 (11.8%)	170 (10.5%)	227 (14.0%)	167 (10.4%)
	Fragmented CEPs	39 (2.4%)	34 (2.1%)	45 (2.8%)	54 (3.3%)	47 (2.9%)	34 (2.1%)	75 (4.6%)
	Missing CEPs	63 (3.9%)	67 (4.2%)	54 (3.3%)	77 (4.8%)	67 (4.2%)	67 (4.2%)	66 (4.1%)
Functional annotation	Swiss-Prot	70,086 (79.0%)	69,960 (82.3%)	23,213 (79.0%)	23,148 (78.1%)	22,747 (78.2%)	24,173 (76.2%)	23,833 (76.9%)
	NR	85,925 (97.9%)	84,422 (99.3%)	28,391 (96.7%)	28,427 (95.9%)	27,821 (95.6%)	30,641 (96.5%)	29,436 (94.9%)
	KEGG	65,391 (73.7%)	65,126 (76.6%)	21,789 (74.2%)	21,638 (73.0%)	21,295 (73.2%)	22,092 (69.6%)	22,475 (72.5%)
	GO	80,762 (91.0%)	77,970 (91.7%)	26,742 (91.1%)	27,022 (91.1%)	26,564 (91.3%)	28,531 (89.9%)	28,206 (91.0%)
	Pfam	68,287 (77.0%)	68,799 (80.9%)	22,664 (77.2%)	22,728 (76.7%)	22,455 (77.2%)	23,370 (73.6%)	23,451 (75.6%)
	Overall		88,341 (99.6%)	84,932 (99.9%)	29,234 (99.5%)	29,498 (99.5%)	28,950 (99.5%)	31,604 (99.6%)	30,807 (99.4%)

Supplementary Table 8. Annotation results of repeat sequences (using Tandem Repeats Finder (TRF), RepeatMasker and RepeatProteinMask) and non-coding RNAs. LTR-RT: long terminal repeat retrotransposon.

Species	Repeat sequences			Non-coding RNA				
	Type	Size (bp)	% of genome	Type	Number	Average length (bp)	Total length (bp)	% of genome
<i>H. hainanensis</i>	TRF	43,630,344	3.97	miRNA	786	120.48	94,696	0.0086
	RepeatMasker	524,298,168	47.70	tRNA	1,857	74.94	139,162	0.0127
	RepeatProteinMask	81,936,177	7.45	rRNA	300	196.98	59,093	0.0054
	Total	542,963,148	49.39	snRNA	1,526	107.82	164,529	0.0150
	LTR-RT	345,420,890	31.42					
<i>H. reticulata</i>	TRF	50,220,382	4.06	miRNA	1,149	115.33	132,512	0.0107
	RepeatMasker	560,712,793	45.29	tRNA	2,213	75.10	166,187	0.0134
	RepeatProteinMask	107,112,585	8.65	rRNA	550	236.08	129,845	0.0105
	Total	587,772,479	47.48	snRNA	1,772	110.15	195,182	0.0158
	LTR-RT	401,299,478	32.42					
<i>H. chinensis</i>	TRF	12,880,263	3.79	miRNA	381	121.51	46,296	0.0136
	RepeatMasker	143,083,785	42.15	tRNA	655	74.99	49,118	0.0145
	RepeatProteinMask	30,960,981	9.12	rRNA	336	240.52	80,814	0.0238
	Total	150,108,579	44.22	snRNA	528	108.33	57,198	0.0169
	LTR-RT	90,401,075	26.63					
<i>P. chinensis</i>	TRF	10,767,710	3.43	miRNA	338	115.04	38,882	0.0124
	RepeatMasker	132,085,261	42.08	tRNA	623	75.25	46,880	0.0149
	RepeatProteinMask	20,963,852	6.68	rRNA	125	380.54	47,567	0.0152
	Total	136,971,552	43.64	snRNA	471	109.80	51,715	0.0165
	LTR-RT	62,301,462	19.85					
<i>S. robusta</i>	TRF	11,405,760	3.49	miRNA	419	119.87	50,227	0.0153
	RepeatMasker	143,206,917	43.76	tRNA	631	75.36	47,551	0.0145
	RepeatProteinMask	25,266,318	7.72	rRNA	136	187.62	25,517	0.0078

	Total	148,596,107	45.40	snRNA	427	107.40	45,858	0.0140
	LTR-RT	79,262,279	24.22					
<i>D. turbinatus</i>	TRF	15,795,432	4.08	miRNA	1,052	141.58	148,939	0.0385
	RepeatMasker	188,535,626	48.69	tRNA	2,187	75.52	165,168	0.0427
	RepeatProteinMask	27,975,591	7.22	rRNA	7,057	400.77	2,828,206	0.7300
	Total	195,643,900	50.53	snRNA	660	112.92	74,529	0.0192
	LTR-RT	108,354,887	27.98					
<i>V. mangachapoi</i>	TRF	23,606,357	5.27	miRNA	445	114.46	50,936	0.0114
	RepeatMasker	216,261,711	48.29	tRNA	583	75.10	43,783	0.0098
	RepeatProteinMask	57,223,275	12.78	rRNA	3,447	175.89	606,284	0.1400
	Total	230,664,898	51.51	snRNA	460	115.99	53,357	0.0119
	LTR-RT	178,277,869	39.81					

Supplementary Table 9. Results of gene family clustering by comparing genomes of our focal species with those of additional 12 Dipterocarpoideae species and other six species, five temperate tree species.

Species	Gene number	Genes in families	Family number	Unique families	Reference
<i>Dipterocarpus alatus</i>	29,203	37,119	24,002	215	13
<i>Dipterocarpus gracilis</i>	27,310	34,063	23,009	106	13
<i>Dipterocarpus intricatus</i>	26,797	33,843	22,753	86	13
<i>Dipterocarpus turbinatus</i>	42,423	29,587	18,183	45	This study
<i>Dipterocarpus zeylanicus</i>	38,375	33,869	23,062	93	13
<i>Gossypium raimondii</i>	37,824	30,040	14,976	371	14
<i>Hopea chinensis</i>	31,744	26,501	17,976	23	This study
<i>Hopea reticulata</i>	37,356	41,351	18,619	432	This study
<i>Hopea hainanensis</i>	33,724	35,651	19,643	342	This study
<i>Hopea mollissima</i>	29,296	31,750	21,327	129	13
<i>Hopea odorata</i>	48,040	36,665	21,647	417	13
<i>Parashorea chinensis</i>	42,508	26,348	17,757	60	This study
<i>Shorea henryana</i>	35,939	29,946	20,042	89	13
<i>Shorea leprosula</i>	44,078	30,259	19,965	188	5
<i>Shorea robusta</i>	35,359	26,475	18,046	51	This study
<i>Shorea roxburghii</i>	29,650	30,441	20,048	99	13
<i>Theobroma cacao</i>	33,950	20,170	14,531	119	15
<i>Vatica mangachapoi</i>	34,469	27,774	18,593	54	This study
<i>Vatica odorata</i>	29,104	32,945	21,821	179	13
<i>Vatica rassak</i>	34,473	32,266	21,637	276	13
<i>Vatica xishuangbannaensis</i>	21,109	31,889	21,692	103	13
<i>Oryza sativa</i>	31,006	23,717	12,779	1,818	16
<i>Arabidopsis thaliana</i>	39,825	23,561	13,131	801	17
<i>Aquilaria sinensis</i>	39,603	22,261	13,899	799	18
<i>Amborella trichopoda</i>	36,861	19,088	12,084	1,034	19
Clustered with 5 temperate tree species					
<i>Betula pendula</i>	24,629	19,530	13,776	395	9
<i>Dipterocarpus turbinatus</i>	31,744	27,801	16,529	143	This study
<i>Fraxinus excelsior</i>	38,948	31,146	14,180	974	20
<i>Fagus sylvatica</i>	61,548	55,954	16,355	2,168	21
<i>Hopea chinensis</i>	29,296	25,584	17,351	54	This study
<i>Hopea exalata</i>	48,040	40,630	18,170	611	This study
<i>Hopea hainanensis</i>	42,508	34,501	18,765	484	This study
<i>Ostrya rehderiana</i>	27,767	22,146	15,060	700	6
<i>Parashorea chinensis</i>	29,650	25,634	17,191	87	This study
<i>Quercus robur</i>	25,808	21,616	12,218	585	22
<i>Shorea robusta</i>	29,104	25,378	17,148	83	This study
<i>Vatica mangachapoi</i>	31,006	25,745	16,651	205	This study

Supplementary Table 11. KEGG categories for the positively selected genes detected in the genomes of our focal species compared with those of the five temperate tree species.

KEGG ID	Map title	N genes	KEGG ID	Map title	N genes
map03440	Homologous recombination	2	map00565	Ether lipid metabolism	1
map00053	Ascorbate and aldarate metabolism	2	map00220	Arginine biosynthesis	1
map00740	Riboflavin metabolism	1	map00073	Cutin, suberine and wax biosynthesis	1
map00232	Caffeine metabolism	1	map00400	Phenylalanine, tyrosine and tryptophan biosynthesis	1
map03018	RNA degradation	3	map00195	Photosynthesis	1
map00902	Monoterpenoid biosynthesis	1	map00010	Glycolysis / Gluconeogenesis	2
map00920	Sulfur metabolism	1	map00350	Tyrosine metabolism	1
map00071	Fatty acid degradation	1	map00240	Pyrimidine metabolism	2
map00900	Terpenoid backbone biosynthesis	1	map00360	Phenylalanine metabolism	1
map03030	DNA replication	1	map03050	Proteasome	1
map00860	Porphyrin and chlorophyll metabolism	1	map02010	ABC transporters	1
map04141	Protein processing in endoplasmic reticulum	3	map01212	Fatty acid metabolism	1
map03015	mRNA surveillance pathway	2	map01210	2-Oxocarboxylic acid metabolism	1
map00230	Purine metabolism	2	map00630	Glyoxylate and dicarboxylate metabolism	1
map03420	Nucleotide excision repair	1	map00260	Glycine, serine and threonine metabolism	1
map00760	Nicotinate and nicotinamide metabolism	1	map01230	Biosynthesis of amino acids	3
map00480	Glutathione metabolism	1	map00030	Pentose phosphate pathway	1
map00130	Ubiquinone and other terpenoid-quinone biosynthesis	2	map04146	Peroxisome	1
map00564	Glycerophospholipid metabolism	3	map00052	Galactose metabolism	1
map00730	Thiamine metabolism	1	map03008	Ribosome biogenesis in eukaryotes	1
map00650	Butanoate metabolism	1	map03040	Spliceosome	2
map00062	Fatty acid elongation	1	map00500	Starch and sucrose metabolism	3

Supplementary Table 12. Genes for *in vitro* functional assays from the genome of *H. chinensis* with substrates and expected reaction products.

Gene ID	Gene name	Substrate(s)	Expected product(s)
evm.model.000015F.76	UDP-sugar pyrophosphorylase (<i>USP</i>)	Glucose 1- phosphate, uridine triphosphate (UTP)	Diphosphate, (uridine diphosphate) UDP- glucose
evm.model.000011F.38	Pyridoxine 4- dehydrogenase (<i>PLR1</i>)	NADPH, pyridoxal	Pyridoxine, NADPH+

Supplementary Table 13. KEGG categories for the contracted gene families detected in the genomes of our focal species compared with those of the five temperate tree species.

KEGG ID	Map title	N gene families
map04626	Plant-pathogen interaction	5
map00903	Limonene and pinene degradation	1
map00909	Sesquiterpenoid and triterpenoid biosynthesis	1
map00730	Thiamine metabolism	1
map04122	Sulfur relay system	1
map00945	Stilbenoid, diarylheptanoid and gingerol biosynthesis	1
map00460	Cyanoamino acid metabolism	2
map00966	Glucosinolate biosynthesis	1
map00950	Isoquinoline alkaloid biosynthesis	2
map00960	Tropane, piperidine and pyridine alkaloid biosynthesis	2
map00360	Phenylalanine metabolism	2
map00350	Tyrosine metabolism	1
map00410	beta-Alanine metabolism	2
map00260	Glycine, serine and threonine metabolism	2
map00380	Tryptophan metabolism	1
map01210	2-Oxocarboxylic acid metabolism	1
map00940	Phenylpropanoid biosynthesis	2
map00040	Pentose and glucuronate interconversions	1

Supplementary Table 14. The significantly expanded/contracted gene families in the genomes of our focal species compared with those of five temperate tree species. NA: not available.

Gene family ID	Encoded protein	KEGG pathway/GO term	Functional category	Reference
30 (expanded)	Disease resistance proteins	GO:0006952 Defense response	Plant immunity	NA
29, 39, 65, 74, 245, 246, 257 (contracted)	Leucine-rich repeat receptor-like kinases (LRR-RLKs)	map04626 Plant-pathogen interaction	Plant immunity	23
22, 68 (contracted)	CC-NBS-LRR (NBS-LRR: nucleotide binding site-leucine rich repeat)	map04626 Plant-pathogen interaction	Plant immunity	24
5 (contracted)	TIR-NBS-LRR	map04627 Plant-pathogen interaction	Plant immunity	24

Supplementary Table 15. Expanded and contracted gene families related to plant immunity in the genomes of our focal Dipterocarpoideae species compared with those of the five temperate tree species. Abbreviations of annotated function of gene families are shown in Supplementary Table 14.

Family ID	<i>H. chinensis</i>	<i>P. chinensis</i>	<i>S. robusta</i>	<i>D. turbinatus</i>	<i>V. mangachapoi</i>	<i>B. pendula</i>	<i>F. excelsior</i>	<i>F. sylvatica</i>	<i>O. rehderiana</i>	<i>Q. robur</i>	Encoded protein
Expanded gene families											
30	0	13	3	256	73	0	0	0	0	0	Disease resistance proteins
Contracted gene families											
29	7	4	9	5	11	30	52	89	26	114	LRR-RLK-1
39	3	2	3	2	6	2	11	102	0	128	LRR-RLK-2
65	3	2	1	4	10	0	12	56	4	97	LRR-RLK-3
74	6	3	2	3	6	29	18	42	16	44	LRR-RLK-4
245	3	2	1	1	3	15	7	26	1	6	LRR-RLK-5
246	3	0	2	3	0	27	5	19	0	6	LRR-RLK-6
257	1	0	2	2	5	13	7	9	0	25	LRR-RLK-7
22	6	2	1	2	16	2	23	149	12	193	CC-NBS-LRR-1
68	1	2	0	2	0	11	9	54	25	73	CC-NBS-LRR-2
5	0	1	1	1	1	73	10	158	4	361	TIR-NBS-LRR-1

Supplementary Table 16. Statistics of re-sequencing data (using Illumina NovaSeq 6000 platform) for *H. hainanensis* and *H. reticulata*.

Species	Sample	Sampling site	Total data (Gb)	The longest monoploid genome (LMG)		The longest two monoploid genomes	
				Mapping rate (%)	Average depth (X)	Mapping rate (%)	Average depth (X)
<i>H. hainanensis</i>	BW1	Bawangling	25.00	85.95	55.57	94.60	33.28
	BW2	Bawangling	27.02	87.10	60.81	95.79	36.19
	BW3	Bawangling	29.31	84.13	61.82	92.64	36.86
	BW4	Bawangling	26.79	86.10	58.90	94.51	34.93
	BW5	Bawangling	26.28	76.57	49.62	84.49	29.76
	BW6	Bawangling	30.58	60.06	47.29	66.16	28.23
	BW7	Bawangling	24.61	73.76	45.23	81.40	27.09
	BW8	Bawangling	21.28	79.04	44.54	86.78	26.41
	BW9	Bawangling	24.21	84.91	54.15	93.36	32.17
	BW10	Bawangling	26.34	81.40	54.34	89.87	32.50
	BW11	Bawangling	25.30	71.53	47.34	78.71	28.29
	BW12	Bawangling	36.09	63.08	59.62	69.28	36.75
	BW13	Bawangling	25.70	66.40	44.45	73.04	26.71
	BW14	Bawangling	36.06	81.14	75.24	89.02	46.30
	BW15	Bawangling	27.22	85.75	59.35	92.82	34.70
	BW16	Bawangling	36.76	87.14	79.51	95.68	47.30
	BW17	Bawangling	27.22	84.14	58.40	94.32	37.24
	BW18	Bawangling	22.85	84.25	48.11	92.70	29.09
	BW19	Bawangling	29.27	84.90	64.70	93.44	38.34
	BW20	Bawangling	25.91	84.34	55.44	92.68	33.62
	BW21	Bawangling	27.79	79.03	55.90	86.87	33.28
	BW22	Bawangling	26.37	85.71	57.78	94.23	34.41
	BW23	Bawangling	22.80	85.57	50.94	93.82	30.20

	DZ1	Danzhou	26.71	85.31	58.42	93.65	34.68
	JF1	Jianfengling	26.25	86.31	56.46	94.74	35.05
	JF2	Jianfengling	29.80	68.13	52.58	74.79	32.57
	JF3	Jianfengling	30.61	85.05	64.52	93.64	39.72
	JF4	Jiangfengling	33.99	60.47	53.32	66.40	33.02
	JF5	Jianfengling	26.73	76.68	52.78	84.53	31.42
	WZ1	Wuzhi	25.35	63.56	41.86	69.87	25.05
<i>H. reticulata</i>	GS1	Ganshiling	27.19	0.81	47.95	89.81	30.36
	GS2	Ganshiling	43.68	0.82	80.63	90.81	50.61
	GS3	Ganshiling	38.15	0.83	66.90	91.66	41.99
	GS4	Ganshiling	33.22	0.78	56.43	85.81	35.70
	GS5	Ganshiling	28.25	0.73	45.49	80.72	28.79
	GS6	Ganshiling	26.84	0.84	49.34	93.25	31.24
	GS7	Ganshiling	35.30	0.83	62.42	92.14	39.39
	GS8	Ganshiling	30.05	0.85	55.68	93.40	35.13
	GS9	Ganshiling	31.42	0.83	55.94	91.27	35.35
	GS10	Ganshiling	30.09	0.84	54.71	92.39	34.49
	GS11	Ganshiling	28.64	0.84	51.09	92.55	32.40
	GS12	Ganshiling	26.96	0.84	49.77	92.68	31.49
	GS13	Ganshiling	29.85	0.82	53.06	90.98	33.52
	GS14	Ganshiling	27.72	0.80	48.44	87.96	30.94
	GS15	Ganshiling	29.33	0.80	50.09	88.73	31.54
	GS16	Ganshiling	30.27	0.84	55.23	92.84	35.05
	GS17	Ganshiling	26.92	0.80	46.91	88.56	29.79
	GS18	Ganshiling	31.38	0.83	55.45	91.93	35.12
	GS19	Ganshiling	26.47	0.82	47.31	90.96	30.05
	GS20	Ganshiling	28.18	0.73	44.93	81.05	28.72

GS21	Ganshiling	44.62	0.82	77.39	90.66	48.58
GS22	Ganshiling	36.48	0.76	58.45	84.21	36.91
GS23	Ganshiling	25.22	0.79	44.50	87.57	28.32
GS24	Ganshiling	26.04	0.81	45.80	89.36	29.20
GS25	Ganshiling	27.35	0.78	44.52	85.90	28.50
GS26	Ganshiling	25.55	0.77	44.09	85.57	28.07
GS27	Ganshiling	26.06	0.66	37.87	73.10	24.34
GS28	Ganshiling	28.91	0.84	52.65	92.91	33.36
GS29	Ganshiling	29.15	0.80	50.70	88.88	32.23
GS30	Ganshiling	25.65	0.84	46.43	92.56	29.45
GS31	Ganshiling	26.03	0.80	45.47	88.65	28.84
GS32	Ganshiling	27.82	0.69	42.22	76.14	26.95

Supplementary Table 17. Categories of SNPs based on genome annotation. Upstream: SNP located within the 1Kb upstream region of a gene. Exonic: SNP located in an exon. Synonymous: SNP that did not caused change of encoded amino acid. Stop gain: SNP that caused encoded amino acid to become a stop codon. Stop loss: SNP that caused loss of a stop codon. Start loss: SNP that caused loss of a start codon. Non-synonymous: SNP that caused change of encoded amino acid. Intronic: SNP located in an intron. Splicing: SNP located in an alternative splicing site. Downstream: SNP located within the 1Kb downstream region of a gene. Upstream/Downstream: SNP that located within the 1Kb upstream region of a gene, at the same time, located within the 1Kb downstream region of another gene. Intergenic: SNP located in an intergenic region. Total: total number of SNPs.

Category		Number of SNPs in <i>H. hainanensis</i>	Number of SNPs in <i>H. reticulata</i>
The longest monoploid genome			
Upstream		207,657	299,880
Exonic	Stop gain	1,672	2,346
Exonic	Stop loss	351	361
Exonic	Start loss	272	332
Exonic	Non-synonymous	109,666	168,449
Intronic		362,658	563,231
Splicing		838	1,372
Downstream		186,002	274,106
Upstream/Downstream		22,165	27,259
Intergenic		1,942,417	2,995,481
Total		2,922,653	4,477,756
The longest two monoploid genomes			
	Upstream	102,324	179,170
Exonic	Stop gain	959	1,601
Exonic	Stop loss	198	235
Exonic	Synonymous	48,434	89,220
Exonic	Non-synonymous	60,174	107,962
Intronic		214,885	369,200
Splicing		518	944
Downstream		92,121	166,974
upstream/downstream		15,342	17,970
Intergenic		1,006,070	2,076,211
Total		1,582,562	3,028,610

Supplementary Table 18. Estimation of mutation rate for the genomes of *H. hainanensis* and *H. reticulata*.

	<i>H. hainanensis</i> vs. <i>H. reticulata</i>	<i>H. hainanensis</i> vs. <i>H. chinensis</i>	<i>H. reticulata</i> vs. <i>H. chinensis</i>
All fourfold degenerate sites	562034	920297	710925
Diverged fourfold degenerate sites	21841	33788	17475
Mutation rate (/site/generation)	1.06 × 10 ⁻⁸ (generation time setting as 15 years)		
	1.41 × 10 ⁻⁸ (generation time setting as 20 years)		
	2.11 × 10 ⁻⁸ (generation time setting as 30 years)		

Supplementary Table 19. Results of KEGG enrichment analysis for the 647 (in *H. hainanensis*) and 581 genes (in *H. reticulata*) with derived deleterious mutations (DDMs) and for the 407 (in *H. hainanensis*) and 300 genes (in *H. reticulata*) with derived major-effect mutations (DMEMs). Fisher's Chi-Square test was used to identify pathways with significant enrichment results. We only present the pathways with significant results in KEGG enrichment analysis.

Genes with DDMs				Genes with DMEMs			
KEGG pathway	Description	Gene number	<i>P</i> value	KEGG pathway	Description	Gene number	<i>P</i> value
<i>H. hainanensis</i>							
map00592	alpha-Linolenic acid metabolism	8	0.0035	map04145	Phagosome	6	0.0297
map00944	Flavone and flavonol biosynthesis	3	0.0097	map03410	Base excision repair	4	0.0397
map00020	Citrate cycle (TCA cycle)	6	0.0322	map00730	Thiamine metabolism	2	0.0484
map00591	Linoleic acid metabolism	3	0.0365				
map00051	Fructose and mannose metabolism	9	0.0457				
map00564	Glycerophospholipid metabolism	12	0.0484				
<i>H. reticulata</i>							
map01502	Vancomycin resistance	2	0.0015	map00944	Flavone and flavonol biosynthesis	2	0.0078
map00052	Galactose metabolism	10	0.0047	map03008	Ribosome biogenesis in eukaryotes	6	0.0203
map00970	Aminoacyl-tRNA biosynthesis	10	0.0063	map01502	Vancomycin resistance	1	0.0335
map01210	2-Oxocarboxylic acid metabolism	7	0.0196	map00052	Galactose metabolism	5	0.0419
map00053	Ascorbate and aldarate metabolism	5	0.0242				
map00565	Ether lipid metabolism	4	0.0350				

Supplementary Table 20. Results of KEGG enrichment analysis for the 195 (in *H. hainanensis*) and 195 genes (in *H. reticulata*) with the DDMs that were homozygous in at least one sampled tree and for the 175 (in *H. hainanensis*) and 150 genes (in *H. reticulata*) with DMEMs that were homozygous in at least one sampled tree. Fisher's Chi-Square test was used to identify pathways with significant enrichment results. We only present the pathways with significant results in KEGG enrichment analysis.

Genes with homozygous DDMs				Genes with homozygous DMEMs			
KEGG pathway	Description	Gene number	<i>P</i> value	KEGG pathway	Description	Gene number	<i>P</i> value
<i>H. hainanensis</i>							
map00500	Starch and sucrose metabolism	11	0.0044	map00950	Isoquinoline alkaloid biosynthesis	2	0.0307
map00591	Linoleic acid metabolism	2	0.0181	map00960	Tropane, piperidine and pyridine alkaloid biosynthesis	2	0.0370
map00592	alpha-Linolenic acid metabolism	3	0.0332	map00260	Glycine, serine and threonine metabolism	3	0.0395
map00940	Phenylpropanoid biosynthesis	5	0.0374	map00565	Ether lipid metabolism	2	0.0464
				map00562	Inositol phosphate metabolism	3	0.0476
<i>H. reticulata</i>							
map00052	Galactose metabolism	6	0.0012	map00944	Flavone and flavonol biosynthesis	2	0.0019
map00500	Starch and sucrose metabolism	10	0.0044	map00230	Purine metabolism	5	0.0228
map01502	Vancomycin resistance	1	0.0210	map00232	Caffeine metabolism	1	0.0375
map00942	Anthocyanin biosynthesis	1	0.0484				
map00460	Cyanoamino acid metabolism	3	0.0486				

Supplementary Table 21. Sampled tissues and types and data size of transcriptome sequencing for the prediction of gene models.

Species	Sampled tissue	Sequencing type	Sequencing data (Gb)
<i>H. hainanensis</i>	Roots, stems, leaves from seedlings; leaves, flowers of 3 different development stages and fruits of 5 different development stages from mature trees	Pacbio Iso-seq	46.26
	Flowers of 3 different development stages and fruits of 4 different development stages	Illumina RNA-seq	63.19
<i>H. reticulata</i>	Roots, stems, leaves from seedlings	Pacbio Iso-seq	34.54
<i>H. chinensis</i>	Leaves from one mature individual	Illumina RNA-seq	6.80
<i>P. chinensis</i>	Stems and leaves from one sapling	Illumina RNA-seq	20.76
<i>S. robusta</i>	Stems and leaves from one mature individual; stems and Leaves from several seedlings	Illumina RNA-seq	42.73
<i>D. turbinatus</i>	Leaves from one sapling	Illumina RNA-seq	10.62
<i>V. mangachapoi</i>	Stems and leaves from one mature individual	Illumina RNA-seq	21.47

References

1. Ashton PS. In *Flora Malesiana* (ed. van Steenis, CGGJ) 237–552 (Martinus Nijhoff, Dordrecht, 1982).
2. Bell CD, Soltis DE, Soltis PS. The age and diversification of the angiosperms re-revisited. *American Journal of Botany* **97**, 1296–1303 (2010).
3. Vega FJ, García-Barrera P, Perrilliat MdC, Coutiño MA, Mariño-Pérez R. El Espinal, a new plattenkalk facies locality from the Lower Cretaceous Sierra Madre Formation, Chiapas, southeastern Mexico. *Revista Mexicana de Ciencias Geológicas* **23**, 323–333 (2006).
4. Bansal M, *et al.* Southeast Asian Dipterocarp origin and diversification driven by Africa-India floristic interchange. *Science* **375**, 455–460 (2022).
5. Ng KKS, *et al.* The genome of *Shorea leprosula* (Dipterocarpaceae) highlights the ecological relevance of drought in aseasonal tropical rainforests. *Communications Biology* **4**, 1166 (2021).
6. Yang YZ, *et al.* Genomic effects of population collapse in a critically endangered ironwood tree *Ostrya rehderiana*. *Nature Communications* **9**, 5449 (2018).
7. Duan NB, *et al.* Genome re-sequencing reveals the history of apple and supports a two-stage model for fruit enlargement. *Nature Communications* **8**, 249 (2017).
8. Huang J, *et al.* The jujube genome provides insights into genome evolution and the domestication of sweetness/acidity taste in fruit trees. *PLoS Genetics* **12**, e1006433 (2016).
9. Salojärvi J, *et al.* Genome sequencing and population genomic analyses provide insights into the adaptive landscape of silver birch. *Nature Genetics* **49**, 904–912 (2017).
10. Verde I, *et al.* The high-quality draft genome of peach (*Prunus persica*) identifies unique patterns of genetic diversity, domestication and genome evolution. *Nature Genetics* **45**, 487–494 (2013).
11. Wang J, Street NR, Scofield DG, Ingvarsson PK. Variation in linked selection and recombination drive genomic divergence during allopatric speciation of European and American aspens. *Molecular Biology and Evolution* **33**, 1754–1767 (2016).
12. Zhao YP, *et al.* Resequencing 545 ginkgo genomes across the world reveals the evolutionary history of the living fossil. *Nature Communications* **10**, 4201 (2019).
13. Tian ZZ, *et al.* Thirteen Dipterocarpoideae genomes provide insights into their evolution and borneol biosynthesis. *Plant Communications* **3**, 100464 (2022).
14. Wang MJ, *et al.* Genomic innovation and regulatory rewiring during evolution of the cotton genus *Gossypium*. *Nature Genetics* **54**, 1959–1971 (2022).
15. Argout X, *et al.* The genome of *Theobroma cacao*. *Nature Genetics* **43**, 101–108 (2011).
16. Goff SA, *et al.* A draft sequence of the rice genome (*Oryza sativa* L. ssp. *japonica*). *Science* **296**, 92–100 (2002).
17. Kaul S, *et al.* Analysis of the genome sequence of the flowering plant *Arabidopsis thaliana*. *Nature* **408**, 796–815 (2000).
18. Ding X, *et al.* Genome sequence of the agarwood tree *Aquilaria sinensis* (Lour.) Spreng: the first chromosome-level draft genome in the Thymelaeaceae family. *GigaScience* **9**, giaa013 (2020).
19. Albert VA, *et al.* The *Amborella* genome and the evolution of flowering plants. *Science* **342**, 1241089 (2013).

20. Sollars ESA, *et al.* Genome sequence and genetic diversity of European ash trees. *Nature* **541**, 212–216 (2017).
21. Mishra B, *et al.* A reference genome of the European beech (*Fagus sylvatica* L.). *GigaScience* **7**, giy063 (2018).
22. Plomion C, *et al.* Oak genome reveals facets of long lifespan. *Nature Plants* **4**, 440–452 (2018).
23. Beck M, Heard W, Mbengue M, Robatzek S. The INs and OUTs of pattern recognition receptors at the cell surface. *Current Opinion in Plant Biology* **15**, 367–374 (2012).
24. Cui HT, Tsuda K, Parker JE. Effector-triggered immunity: from pathogen perception to robust defense. *Annual Review of Plant Biology* **66**, 487–511 (2015).