

Figure S1. Recombinant vector map of various constructs used for genetic transformation. (A) Construction of the pBI121-*ProNAC068*-sense *PdOLP1* vector overexpressing the poplar *PdOLP1* gene; (B) Construction of the pBI121-*ProNAC068*-antisense *PdOLP1* vector expressing the antisense poplar *PdOLP* gene; (C) Construction of the pBI121-*PdOLP1*-GFP vector expressing the *PdOLP1*-GFP fusion protein.

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PdOLP1 : ---MTAR---PIFACAFVILCLFHAARPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PagOLP1 : ---MATAK---PIFACAFVILCLFHAARPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PagOLP3 : ---MATAK---PIFACAFVILCLFHAARPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PtrOLP : ---MTAR---PIFACAFVILCLFHAARPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PouOLP : ---MTAR---PIFACAFVILCLFHAARPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PdOLP2 : ---MADAT---QLFTCALISCLFHVAREPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PagOLP2 : ---MADAT---QLFTCALISCLFHVAREPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PagOLP4 : ---MADAT---QLFTCALISCLFHVAREPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
PtoOLP : ---MADAT---QLFTCALISCLFHVAREPELITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 77
HbOLP : ---MAAT---LFFFSIT-TLTLISQATPPGVOGLITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 78
JcOLP : ---MADAT---VLFSTISTALFVLSFGQAMP---LTLTLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 78
VfOLP : ---MKMT---LFFSAISATFVILCLFQATPPGGLITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 80
MeOLP : ---MAAPKPPMFFSTITVTLTLFQATPHGVOGLITLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 82
RcOLP : MAYSSAITALLFYSTIT-TLTSFSQATPP---GLTLTLVNNCPTIYPAIQPNAGHPVLEKGGFPLTLTHRSFRAPDQWSGRI : 82

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PdOLP1 : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PagOLP1 : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PagOLP3 : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PtrOLP : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PouOLP : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PdOLP2 : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PagOLP2 : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PagOLP4 : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
PtoOLP : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 163
HbOLP : WARTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 164
JcOLP : WARTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 164
VfOLP : WERTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 166
MeOLP : WARTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 168
RcOLP : WARTGCCHSNGKFCQATGDCNRIECNGLGGAPATLAAQTLHHGHKDFSSYGVSLVDGPNLPMVTTPHEGKGVCPVVGCRANLLS : 168

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PdOLP1 : TCPDELKRSRSP--AGVVGCKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 247
PagOLP1 : TCPDELKRSRSP--AGVVGCKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 247
PagOLP3 : TCPDELKRSRSP--AGVVGCKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 247
PtrOLP : TCPDELKRSRSP--AGVVGCKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 247
PouOLP : TCPDELKRSRSP--AGVVGCKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 247
PdOLP2 : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 249
PagOLP2 : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 249
PagOLP4 : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 249
PtoOLP : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 249
HbOLP : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 250
JcOLP : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 250
VfOLP : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 252
MeOLP : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 254
RcOLP : TCPDELKRSRSLGRHGIVVCGKSGCCAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTYAHDPSLMHECSSPRELKVIFCH : 254

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Figure S2. ClustalW alignment of the amino acid sequences of PdOLP1, and its homologous proteins.

The GenBank accession number for PdOLP1: MK052942; PdOLP2: Podel.01G248000.1; PagOLP1: Pop_G09G014129.T1; PagOLP2: Pop_A01G056866.T1; PagOLP3: Pop_A09G059600.T1; PagOLP4: Pop_G01G020795.T1; PtrOLP: XP_024463852.1; PouOLP: XP_011042680.1; PtoOLP: APA20308.1; MeOLP: XP_021626825.1; HbOLP: XP_021636655.1; RcOLP: XP_002531364.1; VfOLP: ARV78462.1; JcOLP: XP_012065012.1. “*” is used to indicate the AWS domain, “-” indicates the THN domain, and the “.” means the FU domain, which involved in the mechanism of signal transduction by receptor tyrosine kinases.

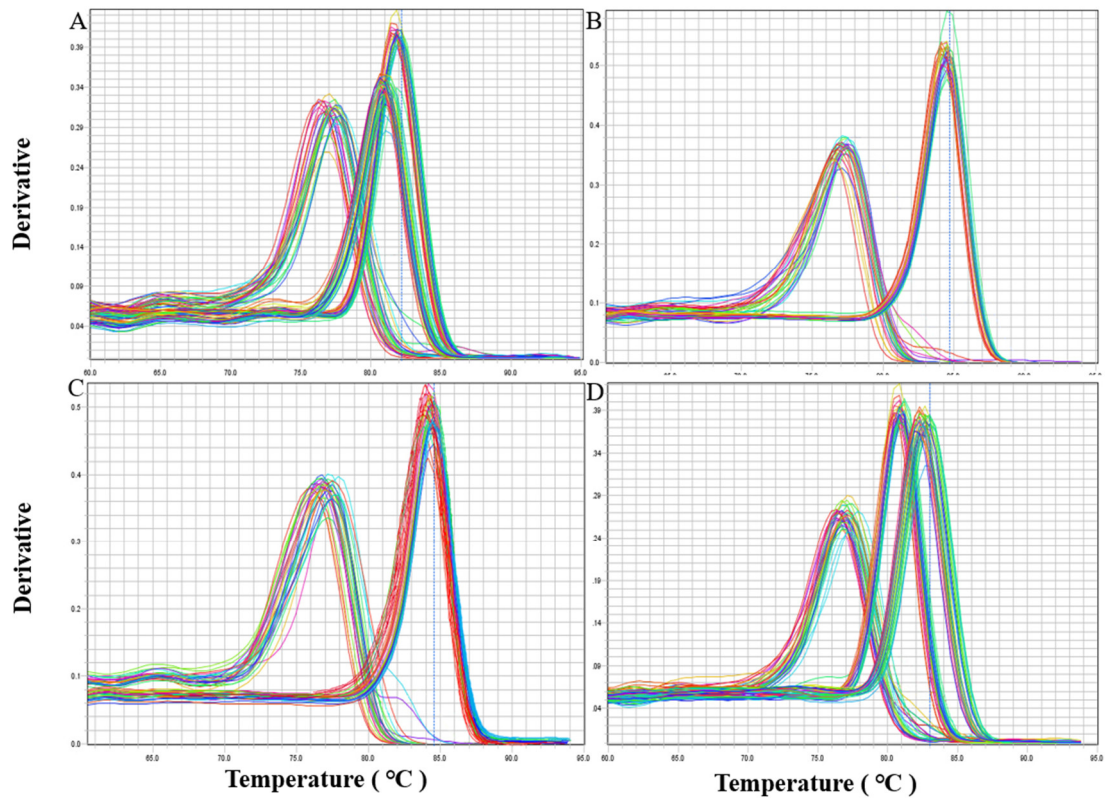


Figure S3. Melting curves of eight secondary cell wall biosynthesis genes. The left, middle and right melting curves of figure A represents the tested genes *PtrFRA1*, *PtrC4H1* and *PtrCCoAOMT1*, respectively.

The left and right melting curves of figure B represents the tested genes *TUA1* and *PtrCAD10*, respectively.

The left and right melting curves of figure C represents the tested genes *PtrTUB7* and *PtrMYB90*, respectively.

The left, middle and right melting curves of figure D represents the tested genes *UBQ1*, *PtrSuS1* and *Ptr4CL3*, respectively.

Figure S4. Standard curves of eight secondary cell wall biosynthesis genes.

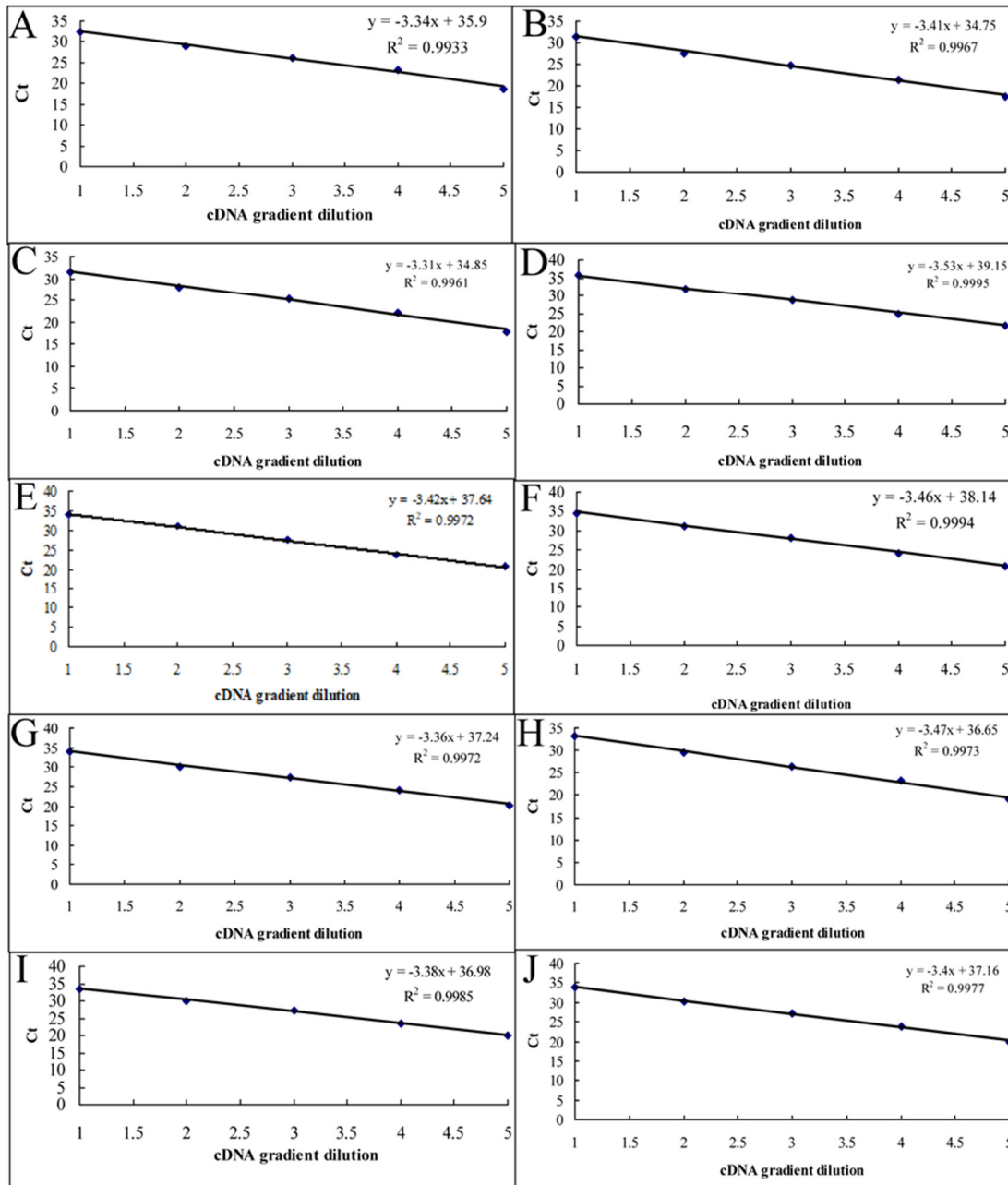


Figure A shows the standard curve of *PtrC4H1*.
 Figure B shows the standard curve of *PtrCAD10*.
 Figure C shows the standard curve of *PtrCCoAOMT1*.
 Figure D shows the standard curve of *Ptr4CL3*.
 Figure E shows the standard curve of *PtrMYB90*.
 Figure F shows the standard curve of *PtrSuS1*.
 Figure G shows the standard curve of *PtrTUB7*.
 Figure H shows the standard curve of *PtrFRA1*.
 Figure I shows the standard curve of *TUA1*.
 Figure J shows the standard curve of *UBQ1*.

Table S1. Details of the samples isolated from *Populus deltoides*.

Name	Description	Collection Date
Immature xylem	Collected from a vigorously developing <i>Populus deltoides</i> Marsh tree in a field near the Chinese Academy of Forestry. Bark was peeled and four to eight partially lignified cell layers were shaved off from the wood side at chest height. Samples were scraped into liquid nitrogen.	2009/8/20
Immature phloem	The bark was peeled and four to eight cell layers from the bark side representing immature phloem were scraped into liquid nitrogen.	2009/8/20
Mature phloem	Isolated from the bark side, nearer to the pith than immature phloem. Exists inside of and is stiffer than immature phloem. Scraped into liquid nitrogen.	2009/8/20
Mature xylem	Isolated from the exposed wood core, closer to the pith. Most rigid vascular tissue. Scraped into liquid nitrogen.	2009/8/20
Leaf bud	Very short internodes of the central branches (not apex), not the developmental branches. Initiate from leaf primordia and form branches and mature leaves after blooming.	2009/8/20
Male flower bud	Terminal buds of shoot apex/tips of a 15-year-old adult male tree. Prerequisite for floral/flower initiation or differentiation during the growth stage.	2009/8/20

Table S2. Sequences of the sense and antisense probes used for in situ hybridization.

Antisense RNA probe (5'-3')	Sense RNA probe (5'-3')
CGTGGTGGAGGGTAATCTGTGCCAAAGCGG	CCGCTTTGGCACAGATTACCCTCCACCACG

Table S3. Primers used for vector construct and expression analysis.

Primer name	Forward primer (5'-3')	Reverse primer (5'-3')
P1	ATGACTACTGCTAGGCCAAT	TTAGTGACAAAAGATAACTTTA
P2	CTAGAGTCGACCTGCAGACGGCCCGGGCTGGTATCC	CCTCAGATCTACCATGGTTTTTCCTTTTGGTTCAAGA G

P3	CATTTGGAGAGAACACGGGGGACTCTAGAATGACTACT GCTAGGCCAATCT	TGTTTGAACGATCGGGGAAATTCGAGCTCTTAGTGA CAAAAGATAACCTTAAG
P4	CATTTGGAGAGAACACGGGGGACTCTAGATTAGTGACA AAAGATAACCTTAAG	TGTTTGAACGATCGGGGAAATTCGAGCTCATGACTA CTGCTAGGCCAATCT
P5	TCCGGCCGCTTGGGTGGAGAG	CTGGCGCGAGCCCCTGATGCT
P6	GCCCTGTGGTAGGTTGC	TGCGGACTGTTGTAATGGTT
P7	AGGTTCTGGTTTGGGGTCTT	TTGTCCAAAAGCACAGCAAC
P8	GTTGATTTTTGCTGGGAAGC	GATCTTGGCCTTCACGTTGT
P9	ATGGATAACTCATCCTGGGTT	TCACCACTTTGTGTGATTTTGC
P10	ATGGCATTTCGCGGCTATGAATC	TCAGCATCCAGGTCCAATAGT
P11	ATGCACGAGGATTACAAGTG	TCATGTTCTAAGTAGCTCTGC
P12	ATGCATATGGCTACCTATTATAC	TCAAGCTACGAAATCATGAAAC
P13	ATGTCTCTCGACTGTCTACGCT	TTAGGTCATGCATTAAGTAGGAC
P14	GGCCTCTAGAATGACTACTGCTAGGCCAAT	GGCGGTACCTTAGTGACAAAAGATAACTTTA

Note:

- (1) Primer pair of P1 for amplifying the coding region of *PdOLP1* from cDNA of *P. deltooides*, and Primer of P2 for amplifying the promoter fragments of *PdOLP1* from *P. deltooides*;
- (2) Primer pair of P3 and P4 for amplifying the sense and antisense *PdOLP1* from cDNA of *P. deltooides*;
- (3) qRT-PCR primers P5 for *NptII* gene, P fo6r *PdOLP1*, P7 and P8 for *TUA1* and *UBQ1*;
- (4) Primer pair used for amplifying the coding region of PtoWRKY40 (P9), PtoARF1 (P10), PtobZIP5 (P11), PtoBEL8 (P12), and PtobHLH7 (P13) of *P. tomentosa*;
- (5) Primer of P14 for amplifying the *PdOLP1* and inserted into pGreenII 62-SK vector.

Table S4. Primers used for analysis of wood formation genes.

Gene name	Description	NCBI or JCI accession number	Primer sequence (forward/reverse)	Amplification efficiency (%)	R ²
<i>PtrCAD10</i>	Cinnamyl alcohol dehydrogenase	XM_002300175.1	CAGCACTTTGTACTCCGTAT TCC/TGCTTCCCTGGTTCTGT CATT	95.89	0.9967
<i>Ptr4CL3</i>	4-coumaryl:CoA ligase	XM_002297663.2	ACTAGCCCATCCAGAGATA TCCGA/TCATCTTCGGTGGC CTGAGACTTT	92.16	0.9995
<i>PtrC4H1</i>	4-coumarate:cinna mate-4-hydroxylase	AF302495.1	CCCTCTTGGGTTCTTTTCGTT/ CAAACACGGGGACAGGTAT A	99.07	0.9933
<i>PtrMYB90</i>	Myeloblastoma 90	XM_002329715	CCGAAGAGGAAGAAGAAA GACT/TCAGTGCGACCTGGG AAAA	95.85	0.9972
<i>PtrCCoAOMT1</i>	Caffeoyl CoA 3-O-methyltransferase	XM_002313089	TTGGTGGGCTGATTGGGTA/ GCTCCAAAACAAAGTCCCT GT	100.005	0.9961
<i>PtrTUB7</i>	beta-tubulin 7	XM_002299006.1	TTGAGCCATACAACGCCAC / CGGAAGCAGATGTCATACA AA	98.61	0.9972
<i>PtrFRA1</i>	Fragile fiber 1	XM_002302396.1	CAGCAGAACTGTTATGATA GC / TGTTGCGGGCACGATTTG	94.13	0.9973
<i>PtrSuS1</i>	Sucrose synthase 1	GU559729.1	TTCCCTCGCCCAACTCTT/ GATGCAGGCTTTCCTTGTC	94.55	0.9994
<i>TUA1</i>	α -tubulin 1	CA822230;CA825391	AGGTTCTGGTTTGGGGTCTT /TTGTCCAAAAGCACAGCAA C	97.7	0.9985
<i>UBQ1</i>	Ubiquitin 1	BU879229	GTTGATTTTTGCTGGGAAGC /GATCTTGGCCTTCACGTTG T	95.92	0.9977

Table S5 Primers used in qRT-PCR analysis of *PdOLP1* coexpressed genes

Gene name	Gene ID	Forward primers (5'→3')	Reverse primers (5'→3')
PtrXYL5	Potri.018G009300	CCGAGAAGTTAGGCAA AG	AACCCAAACAAAGCA CC
PtrBHLH110	Potri.005G230800	AATAACAGAGGCTAAA AGG	AAAAGGAGGGCAGG GAGA
PtrBHLH71	Potri.005G071100	GCATCAATCATAGGTG GGGC	TCCGAGAAGAGAGAA GAGCA
PtrSER	Potri.014G026100	CAACTCGTGTAATGGG AAC	AGGGCGGCTGTAATC AAC
PtrZF	Potri.008G055100	GGTTCAACTACCTGAAA CAGC	CTTCTACAGCCACCG CCAACA
PtrGLY48	Potri.005G058300	TGCTTTTCTCTTGTTG GCC	GTGCCAAAAGGTTTCG TGTCT
PtrPK	Potri.001G117800	GCCATTGTTGCAGGGGT TAT	TGCTTAGCCGACCAT CAGAA
PtrLRR5	Potri.003G179100	AATGGAGTGGTGCAAA GCTG	GGGATGGCCTTGAA AACACC
PtrPOD	Potri.003G214700	TGTTCGTTTGGCAGGAG G	AAGGGCAACCAGGTC ACTA
PtrPCD2	Potri.011G001800	ACCCTCGTGATTCCCCT TTT	GATAATGGCAGCGAC CGAAG
PtrGRAS	Potri.003G202100	TTCACCGAAGATGAGC AGCT	AGCTTTTGTGACCCTC TCCA
PtrGLU	Potri.006G116900	GCGCACCATTCCCTTTC TAG	GCCCACTTCCTGTTCA ACTG
PtrPP2	Potri.012G120400	TCACTGTGGATGTGGCA GA	TTGGGAGAACCAGT GAG
PtrNAC75	Potri.018G068700	AGGTCTGCATCTGGTT TGGA	TCAACCACTCTGCCT CTTGT
PtrBEL1	Potri.010G197300	CTGCTGGTGTTAGTGGA AGC	TTGACGTGGTGAGGT ATGCT
PtrBZIP42	Potri.017G106700	CACAGGTGGTTTGGTT CCG	CAGGTGATGTCTTCC AGGTC
PtrMYB	Potri.002G168900	TGATTTGGTAGAGGTAA GCAGC	CCTGTCTCCGACCAG CTTAT
PtrMYB308	Potri.018G005300	AGCGTGGACACCTCTTG AAG	ATTCATCCAACGAAG CCTGC
PtrDyn	Potri.003G024900	GCTCAACCAATACTCA GGCG	CGGGGAAGGAAATT TGGCAA

Table S6. OLP sequences of *P. deltoides* and the homologous genes from 51 other plants.

>PdOLP1 MK052942 Populus deltoides
MTTARPIFACAFVILCTLFHAARPELILTLVNNCPFTIYPAILPNAGHPVLEKGGFPL
QTLTHRSFRAPDQHWGRIWGRTGCTYSNGKFQCATGDCNNRIECNGLGGAPPAA
LAQITLHHGHNDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLSTCPDE
LKFRSPAGHVVGCKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTY
AHDSPSLMHECSPRELKVIFCH

>PdOLP2 Podel.01G248000.1 Populus deltoides
MATATQLFTCALLISCTLFHVARPELIITLVNNCHFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQLWSGRIWGRTGCAHSNGKFHCVTGDCNNRIECNGLGGATPAT
LAQITIIHHGHKDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLATCPEKL
QFRSLGRHGHVAGCKSGCEALGTDELCCRNHYNSPQTCRASTFSEFFKHACPATFT
YAHDSPLTHECSPRELKVIFCH

>PagOLP1 Pop_G09G014129.T1 Populus alba × Populus glandulosa
MATAKPIFACAFVILCTLFHAARPELILTLVNNCPFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQQWSGRIWGRTGCTHSNGKFQCATGDCNNKIECNGLGGAPPAT
LAQITLHHGHNDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLSTCPDE
LKFRSPAGHVVGCKSGCEAFRTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTY
AHDSPSLMHECSPRELKVIFCH

>PagOLP2 Pop_A01G056866.T1 Populus alba × Populus glandulosa
MATATQLIACALLISCTLFHVARPELIITLVNNCPFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQLWSGRIWGRTGCAHSNGKFHCVTGDCNNRIECNGLGGATPAT
LAQITIIHHGHKDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLATCPEKL
QFRSLGRHGHVVGCKSGCEALGTDELCCRNHYNSPQTCRASTFSEFFKHACPATFT
YAHDSPLMHECSPRELKVIFCH

>PagOLP3 Pop_A09G059600.T1 Populus alba × Populus glandulosa
MATAKPIFACAFVILCTLFHAARPELILTLVNNCPFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQLWSGRIWGRTGCTHYNGKFQCTTGDCNNKIECNGLGGAPPAT
LAQITLHHGHNDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLSTCPDE
LKFRSPAGHVVGCKSGCEAFRTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTY
AHDSPSLMHECSPRELKVIFCH

>PagOLP4 Pop_G01G020795.T1 Populus alba × Populus glandulosa
MATATQLFTCALLISCTLFHVARPELIITLVNNCPFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQLWSGRIWGRTGCAHSNGKFHCVTGDCNNRIECNGLGGATPAT
LAQITIIHHGHKDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLATCPEKL
QFRSLGRHGHVVGCKSGCEALGTDELCCRNHYNSPQTCRASTFSEFFKHACPATFT
YAHDSPLIHECSPRELKVIFCH

>PtrOLP XP_024463852.1 Populus trichocarpa
MTTARPIFACAFVILCTLFHAARPELILTLVNNCPFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQHWSGRIWGRGTGCHSNGKFQCTTGDCNNRIECNGLGGAPPAT
LAQITLHHGHNDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLSTCPDE
LKFRSSAGHVVGCKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTY
AHDSPSLTHECSSPRELKVIFCH

>PeuOLP XP_011042680.1 Populus euphratica
MTTARPIFAYAFVILCTLFQAARPELILTFVNNCPFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQHWSGRIWGRGTGCHSNGKFQCTTGDCNNRIECNGLGGAPPAT
LAQITLHHGHNDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLSTCPDE
LKFRSPAGHVVGCKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATFTY
AHDSPSLMHECSSPRELKVIFCH

>PtoOLP APA20308.1 Populus tomentosa
MATATQLIACALLISCTLFHVARPELIITLVNNCPFTIYPAIQPNAGHPVLEKGGFPL
QTLTHRSFRAPDQLWSGRIWGRGTGCAHSNGKFHCVTGDCNNRIECNGLGGATPAT
LAQITIHHGHKDFSSYGVSLVDGFNLPMTVTPHEGKGVCPVVGCRANLLATCPEKL
QFRSLGGHGHVVGCKSGCEALGTDELCCRNHYNSPQTCRASTFSEFFKHACPATFT
YAHDSPSLMHECSSPRELKVIFCH

>MeOLP XP_021626825.1 Manihot esculenta
MAAPKPPMFFSTITVTLILFQATPHGVQGLLTLVNNCPFTVYPAIQPNSGHPVLEK
GGFPLPTLTHRSFPAPNQHWSGRIWARTDCTHANGKFYCATGDCNHQLECNGLGG
ASPATLAQFSLHHGHKDFSSYGVSLVDGFNVPMTITPHEGTGVCVVGCRANLLAT
CPEKLQLRYPAGHGRVVACKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHAC
PATFTYAHDSPSLMHECSSPRELKVIFCH

>HbOLP XP_021636655.1 Hevea brasiliensis
MAATLFFFSITTILILSQATPPGVQGLFLTLVNNCPFTVYPAIQPNSGHPVLEKGGFPL
PTLTHRSFPAPNQPSGRIWARTGCTHTNGKFHCATGDCNHQLECNGLGGASPAT
LAQFSLHHGHKDFSSYGVSLVDGFNVPMTVTPHEGQGVCPVVGCRANLLATCPEK
LQLRYPAGHGPVVACKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATF
TYAHDNPSLMHECSSPRELKVIFCH

>RcOLP XP_002531364.1 Ricinus communis

MAYSSAAITALLFYSTITTLTSFSQATPPGLILTLVNNCPTYTIYPAIQPNNSGSPVLEKG
GFPLTTLTHRSFPVFNHHWSGRIWARTGCTHYNGKFHCATGDCNHQIECNGLGGA
TPATLAQFSLHHGHNDFFSSYGVSLVDGFNIPMTVTPHEGKGVCVVGCRANLLAT
CPAKLQLRYPAGHGPVVACKSGCEAFGTDEFCCRNHYNSPQTCRASSYSQFFKHA
CPATFTYAHDSPSLMHECSPRELKVIFCH

>DzOLP XP_022756598.1 Durio zibethinus
MASPLYFSLFFLATLFLLCSEFAKASEPDLILTLVNNCPTIYPAIQPNAGHPVLQRGG
FALQTLTHRSFPAPT VHWSGRIWARTGCTHSNGQFYCATGDCGHRIECNGLGGAT
PVTLAQFSLHHRGHKDLSSYEVSLVDGFNIPMTVTPHDGKGLCPVVGCRANLLAT
CPNQLQLRSPPGHGPVVGCKSGCQAFGTDELCCRNHYNSPQTCRASSYSEFFKHAC
PATFTYAHDSPSLMHDCASPRELKVIFCH

>CjOLP BAI63297.1 Citrus jambhiri
MASTSPIFISATILLSSYAKASFILTLVNNCPPVWPAIQPNAGHPVLERGGFYLHS
LTHRSFPAPAQHWSGRIWARTGCTYAHGKFSCVTGDCGHRLESNGLGGATPATLA
QFSLHHGHNDLSSYGVSLVDGFNVPMTVTPHEGKGVCVVGCRADLLATCPQNL
QVRSPPGHGRVVACKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATMT
YAHDSPSLMHDCSSPRELKVIFCH

>VfOLP ARV78462.1 Vernicia fordii
MKMATLFFSAISATFLILCTFCQATPPGLILTLVNNCPTVYPAIQPNNSGFPVLEKGG
FPLSTLTHRSFAVFNQHWSGRIWGRTGCTHTNGKFHCATGDCNHQIECNGLGGAT
PVTLAQFSLHHGHNDFFSSYGVSLVDGFNLPMTVTPHEGKGVCVVGCRANILNTC
PAKLQVRYPVGHGQVVACRSVCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHAC
PATYTYAHDSPSLMHECSPRELKVIFCH

>TcOLP XP_007016468.1 Theobroma cacao
MASPLCASLFCFATLFLLCSEFAAATQPGLILTLVNNCPTVYPAIQPNAGHPVLERG
GFALQTLTHRSFPAPTAHWSGRIWARTGCTHSNGHFYCATGDCGHRIECNGLGGA
TPVTLAQFSLHHGGHGHKDLSSYAVSLVDGFNVPMTVTPHEGKGLCPVVGCRANLLA
TCPDKLQLRSPPGHGPVVGCKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHA
CPATFTYAHDSPSLTHECASPRELKIIFCH

>CsiOLP XP_006488293.1 Citrus sinensis

MASTSPIFISATILLSSYAKASFILTLVNNCPFPVWPVPAIQPNAGHPVLERGGFYLHS
LTHRSFPAPAQHWSGRIWARTGCTYAHGKFSCVTGDCGHRLECENGLGGATPATLA
QFSLHHGHNDLSSYGVSLVDGFNVPMTVTPHEGKGVCVVGCRADLLATCPQNL
QVRSPPGHGRVVACKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATMT
YAHDSPSLMHDCSSPRELKVIFCH

>CcOLP XP_006424795.1 Citrus clementina
MASTSPIFISATILLSSYAKASFILTLVNNCPFPVWPVPAIQPNAGHPVLERGGFYLHS
LTHRSFPAPAQHWSGRIWARTGCTYAHGKFSCVTGDCGHRLECENGLGGATPATLA
QFSLHHGHNDLSSYGVSLVDGFNVPMTVTPHEGKGVCVVGCRADLLATCPQNL
QVRSPPGHGRVVACKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKHACPATMT
YAHDSPSLMHDCSSPRELKVIFCH

>VvOLP XP_002281193.1 Vitis vinifera
MASSSTISSSFVFFAVFLFLCTLSHATNPGLILTVVNNCPFTIWPVPAIQPNAGHDVLER
GGFALHTLTHRSFAAPSHHWSGRIWARTGCTYINGKFSCVTGDCGGRLECSGSGG
AAPATLAQFTLHHGQNDFFSSYAVSLVDGFNLPMTVTPHEGKGLCPVVGCRANLLE
TCPGKLQMWSPPHEGKVVACKSGCEAFGTDELCCRNHYNSPQTCRASSFSEFFKH
ACPATFTYAHDSPSLMHECSPRELKVIFCH

>HuOLP XP_021278215.1 Herrania umbratica
MASTLCASLFCFVTLFLLCSFAGATQPGLILTLVNNCPFTVYPAIQPNAGHPVLERG
GFALQTLTHRSFPAPTAHWSGRIWARTGCTHSNGHFYCATGDCGHRIECSGLGGA
PPVTLAQFSLHHGGHKDLSSYAVSLVDGFNVPMTVTPHEGKGLCPVVGCKANLLA
TCPDKLQLRSPPGHGPVVGCKSGCQAFGTDELCCRNHYNSPQTCRASSFSEFFKHA
CPATFTYAHDSPSLTHECASPRELKIIFCH

>JrOLP XP_018823302.1 Juglans regia
MLFSRVKKMASLSLRFTLFSTAAFLILCIFTEATPHHPEFILTLVNNCPFTVWPVPAIQ
NSGHAVLERGGFALNTLTHHSFPAPAQHWSGRIWARTGCSYNHGHFSCATGDCG
GRLECENGLGGSSPATLAQFSLHHGHNDLSSYAVSLVDGFNVPMTVTPHEGKGLCP
VVGCRASLLATCPDRLQVRSPPGHGPVVACKSGCEAFGTDELCCRNHYNSPQTCR
ASSFSEFFKHACPATFTYAHDSPSLMHECSPRELKIIFCH

>QsOLP XP_023907784.1 Quercus suber
MASSSFVFLTATFLILCTLTRATNPGLFLTLVNNCPFTVWPVPAIQPNAGHPVLERGGF
ALHTLTHHSFPAPTQHWSGRIWARTGCTYANNRFSCATGDCGNRLECDGLGGATP
ATLAQFSLHHGHTDLSSYAVSLVDGFNVPMTVTPHEGKGQCPVVGCRANLLATCP
DKLQLRSPPGHGPVVACKSGCEAFGTDELCCRNHYNSPQTCRASTFSEFFKHACPA
TFTYAHDSPSLMHECSPRELKVIFCH

>GhOLP XP_016689054.1 Gossypium hirsutum
MASSLLVLATIFVLCSFGKASHPGLILTVNNCPFTIYPAIQPNAGHPVLERGGFALH
TLTHRSFPAPTVHWSGRIWARTGCTYSNGHFSCATGDCGHRIECNGLGGATPVTIA
QFSLHHGGHDKDLSSYEVSVDGFNIPMTVTPHEGKGLCPVVGCRANILATCPGKLQ
YRSPPHGPVVGCKSGCAAFTDELCCRNHYNSPQTCRASSYSEFFKHACPATFTYA
HDSPSLMHDCSPRELKVIFCH

>GrOLP XP_012446484.1 Gossypium raimondii
MASSLLVLATIFVLCSFGKATHPGLILTVNNCPFTIYPAIQPNAGHPVLERGGFAL
HTLTHRSFPAPTVHWSGRIWARTGCTYSNGHFSCATGDCGHRIECNGLGGATPVTI
AQFSLHHGGHDKDLSSYEVSVDGFNIPMTVTPHEGKGLCPVVGCRANILATCPGKL
QYRSPPHGPVVGCKSGCAAFTDELCCRNHYNSPQTCRASSYSEFFKHACPATFTYA
AHDSPSLMHDCSPRELKVIFCH

>GaOLP XP_017650093.1 Gossypium arboreum
MASSLLVLATIFVLCSFGKATHPGLILTVNNCPFTIYPAIQPNAGHPVLERGGFAL
HTLTHRSFPAPTVHWSGRIWARTGCTYSNGHFSCATGDCGHRIECNGLGGATPITI
AQFSLHHGGHDKDLSSYEVSVDGFNIPMTVTPHEGKGLCPVVGCRANILATCPGKL
QYRSPPHGPVVGCKSGCAAFTDELCCRNHYNSPQTCRASSYSEFFKHACPATFTYA
AHDSPSLMHDCSPRELKVIFCH

>JcOLP XP_012065012.1 Jatropha curcas
MATATVLFSTISTALFILFSFGQAAPLILTLVNNCPFTVYPAIQPNAGHPVLEKGGFP
LSTLTHRSFPVFNQHWGRIWARTGCTHTNGKFHCATGDCNHQLECNGLGGAPPA
TLAQFSLHHGHNDFFSSYGVSLVDGFNLPMTITPHEGKGVCVVGCRANLLTTCPOK
LQVRYVPVGHGPVVACKSGCLAFGTDELCCRNHYNNPQTCRASSYSEFFKHACPAT
FTYAHDSPSLMHECSPRELKVIFCH

>EsOLP XP_006409911.1 Eutrema salsugineum

MAKTSPLAASFLLLLISSAAAADTGRFLFTVVNHCPFTVWPVWPAIQPNAGHPVLEKGG
GFALPTNTHRSFSAPATHWSGRIWGRGTGCSHYNGKFSCVTGDCGHRLECENGLGGA
TPASLAQFDLHHGAHLDLSSYGVSLVDGFNVPMTVTPHEGRGVCPVVGCREDLK
TCPAHLQLRSGHGGHVVACKSGCEAFRTDELCCRNHYNSPQTCRASSHSLFFKHA
CPSTMTFAHDSPLMHDCSSPRELKVIFCH

>RsOLP XP_018463081.1 Raphanus sativus
MASRASLPLAASFLLLLISSFAADTGRFLFTVVNHCPFTVWPVWPAIQPNAGHPVLEKGG
GFALPTNTHRSFSAPTSHWSGRIWGRGTGCSHYNGKFSCVTGDCGNRLECENGLGGA
TPASLAQFDLHHGGHQDLSSYGVSLVDGFNVPMTVTPHEGRGVCPVVGCREDLK
TCPAHLQLRSGHGGHVVACKSGCEAFRTDELCCRNHYNSPQTCRASSHSLFFKHA
CPSTMTFAHDSPLMHDCSSPRELKVIFCH

>BnOLP XP_013676421.1 Brassica napus
MAKTSPLAASFLLLLISSATSADTGRFLFTVVNHCPFTVWPVWPAIQPNAGHPVLEKGG
FALPTNTHRSFLPPSTHWSGRIWGRGTGCSHYNGKFSCVTGDCGHRLECENGLGGATP
ASLAQFDLHHGGHQDLSSYGVSLVDGFNVPMTVTPHEGRGVCPVVGCREDLK
CPAHLQLRSHGGHVVACKSGCEAFRTDELCCRNHYNSPQTCRASSHSLFFKHACPS
TMTFAHDSPLMHDCSSPRELKVIFCH

>BrOLP XP_009140942.1 Brassica rapa
MAKTSPLAASFLLLLISSTTADTGRFLFTVVNHCPFTVWPVWPAIQPNAGHPVLEKGG
FALLTNTHRSFFPPSTHWSGRIWGRGTGCSHYNGKFSCVTGDCGHRLECENGLGGATP
ASLAQFDLHHGGHQDLSSYGVSLVDGFNVPMTVTPHEGRGVCPVVGCREDLK
CPAHLQLRSHGGHVVACKSGCEAFRTDELCCRNHYNSPQTCRASSHSLFFKHACPS
TMTFAHDSLMLMHDCSSPRELKVIFCH

>BooOLP XP_013632142.1 Brassica oleracea var. oleracea
MVKTSPLPTGFFFLISSFAADTGRFLFTVVNHCPFTVWPVWPAIQPNAGHPVLEKGG
FALPTNTHRSFSPPTTHWSGRIWGRGTGCSHYNGKFSCVTGDCGNRLECENGLGGATP
ASLAQFDLHHGGHRDLSSYGVSLVDGFNVPMTVTPHEGRGVCPVVGCREDLRTC
PAHLQLRSGHGGHVVACKSGCEAFRTDELCCRNHYNSPQTCRASSHSLFFKHACPS
TMTFAHDSPLMHDCSSPRELKVIFCH

>BoOLP AAO12209.1 Brassica oleracea

MAKTSPLAASFLLLLISSAAAADAGRLFLTVVNHCPFTVWPVPAIQPNAGHPVLEKGGFALPTNTHRSFFPPSTHWSGRIWGRGTGCSHYNGKFSCVTGDCGHRLECNGLGGA TPASLAQFDLHHGGHQDLSSYGVS LVDGFNVPMTVTPHEGRGVCPVVGCREDLLK TCPAHLQLRSHGGHVVACKSGCEAFRTDELCCRNHYNSPQTCRASSHSLFFKHACP STMTFAHDSPSLMHDCSSPRELKVIFCH

>RcOLP [XP_024159050.1](#) Rosa chinensis
MAHSHSLSLSLLSATLLILCSLAHATYPGHILTVVNNCPFIWPAIQPNNSGSPVLEKGGFALPSLTHRSFPAPTQWWSGRIWARTGCSHSHNHFSCLTGDCGGKLECNAGGA TPATLAQFVLHHGPNDLWSYGVS LVDGFNIPMTVTPHEGKGVCPVVGCKANLLAT CPDRLQVRSPAGHGPVVACKSACEAFGTDELCCRNKYNSPHTCRASSFSQYFKQA CPATFTYAHDSPMLMHQCSSQRELKVIFCH

>OeOLP [XP_022881590.1](#) Olea europaea
MAFPSTIFSLLLLVLCTLPKATHAGLILTLVNNCPYTIWPAIQPNAGHPVLERGGFA LHTLTHRSFPAPTTHWSGRVWARTGCTYAKGHFSCATGDCGGRLECEGLGGAAP ATLAQFTLHHGHADFSSYGVS LVDGFNIPMTVTPHEGKGVCPVVGCRVDLLATCP HGLKYYAPDGHVMGCKSGCTAFGTDELCCRNHYNSPQTCHASSYSAFFKHACPA TVTYAHDNPSLMHECSPRELKVIFCH

>FaOLP [ABB86299.1](#) Ficus awkeotsang
MILTLVNNCPYPVWPVPAIQPNAGHPVLERGGFFLYSLTHRSFPAPTQHWSGRIWGRGT GCISAYNRFSCATGDCGGQLECNAGGKTPATLVQLSLHHGHNDLSSYGVS LVDGFNLGLTVTPHEGKGVCPVVGCRPDLLATCPDRLQVRSPHGHVVACKSGCDAFGTD ELCCRNRYNSPQTCRASSYSAFFKHACPSSTYAHDTPSLMHDCSSPRELKVIFCH

>CsOLP [XP_010470049.1](#) Camelina sativa
MAKTSPLAASFLLLISFSSAADSGRLFLTVVNNCPFTVWPVPAIQPNAGHPVLEKGGF ALPTFTHRSFSAPTTHWSGRIWARTGCAHYNGKFSCVTGDCGNRLECNGLGGATP ASLAQFDLHHGGHKDFSSYGVS LVDGFNVPMTVTPHEGHGVCPVVGCREDLLKT CPGHLQVRSHAGHVVACKSGCEAFHSDELCCQGHYNSPNTCKASSHSLFFKHACP STFTFAHDSPSLMHDCSSPRELKVIFCH

>ErgOLP [XP_012827362.1](#) Erythranthe guttatus
MAATYLFPLSIFVICTVAKATHPGLILTVVNNCPYTIWPAIQPNAGHPALERGGFA LSSLTHRSFPAPSAHWSGRLWARTGCIYAHGRFSCATGDCGGRLECGGLGGAAPA

TLAQFTLHHGHADFSSYSVSLVDGFNIPMTVTPHEGKGQCPVVGCRADLLATCPH
ALQVRGPPHGGVIGCKSGCAAFTDELCCRNHYNSPQTCRASSYSEFFKHACPATF
TYAHDSPSLTHECSAPRELKVIFCH

>FvOLP XP_004294572.1 Fragaria vesca
MARSHSILLLSATLLILCSLAHATSPGHILTVVNNCPFPIWPAIQPNTGGQILERGGFF
LPSLSHRSPAPTQSWSGRIWARTHCSRSNNRFSCLTGDCGGKLECNAGGATPAT
LAQFVLHHGPNDLWSYGVSLVDGFNVPMTPHEGKGVCPVVGCKADLLATCPG
QLQVRSHPGVVACKSACEAFGSDELCCRNKYNSPQTCRASSFSQFFKHACPATFTY
AHDSPMLMHQCSSPRELKVIFCH

>InOLP XP_019199014.1 Ipomoea nil
MAAPISLFSLSLLLTLCLVCKATAPGLILTVVNNCPYTVWPAIQPNAGHPVLERGGF
ALNTLTHRSFAAPNAHWSGRIWARTGCTYAHGHFSCASGDCGGRLECDGAGGAT
PATLAQFVLHHGHADFSSYGVSLVDGFNLPMTVTPHEGKGKCPVVGCRANLLDTC
PAGLQFRSHGGHGPVVGCKSGCEAFKTDELCCRNHYNNPQTCKGSTYSEFFKHAC
PATFTYAHDSPSLMHECSAPRELKVIFCH

>NtOLP XM_018769102.1 Nicotiana tomentosiformis
MASSSTKTLLSLSLFLTLALSQATYSGLILTVVNNCPYTIWPAIQPNAGHPVLERG
GFALHTLTHRSFAAPTTHWSGRIWARTGCSYAHGKFNCATGDCGGRIECDGLGGA
TPATLAQFVLHHGHADFSSYGVSLVDGFNIPLTVTPHEGKGQCPVVGCRAEILQTC
PAVLQLRSHGGHGPVVGCKSGCEAFKTDELCCRNHFNSPQTCKGSSYSEFFKHACP
ATFTYAHDSPSLMHECSPRELKVIFCH

>NnOLP XP_010259948.1 Nelumbo nucifera
MTLLSSASASRSSFLLFALSLLLLLRCRSTLTHATSPGFILTVVNNCPFTIWP
AGHVVLERGGFALQTLTHRSFPAPAHHWSGRLWARTGCTYSNGRFSCATGDCGGR
LECNAGGVTPATLAQFSLHHGHNDQSSYGVSLVDGFNLPMTVTPHEGKGVCPVV
GCKANLLETCPKSLQLRCPGHPVVGCKSGCEAFGTDELCCRNHYNSPQTCKASS
YAEFFKHACPATVTYAHDSPSLMHQCSSPRELKVIFCH

>ElgOLP XP_010918389.1 Elaeis guineensis
MASSSSCSSFPLISLTFYSLLFLIVVQQVAAQYPAMTLTVVNNCPFTVWPAVQPNSG
HDVLEKGGFALSTLTHRSFPAPTHHWSGRIWGRTGCTFSGGRFSCATGDCGGRLEC
GGLGGAAPATLAQITLHHGRRDLSSYGVSLVDGFNVGMTVTPHEGKGQCPVVG

RANLLATCPDVLQVRAPVGGHVGCKSGCQAFGTDELCCRNKYNNPRTCRASTYS
EFFKHACPATFTYAHDSPSLTHDCESPKEKLVIFCH

>EgOLP XP_010033142.1 *Eucalyptus grandis*

MARAAASLLFPTAVLLLLLLAPSPSQALTLTLVNNCPFTVWPVPAIQPNAGHPVLERGG
FPLTLTHRSFPHRRPWSGRVWARTACSHGHGGHFCATGDCGGRLECEGLGGATPA
TLAQFSLHHGHADFSSYAVSLVDGFNVPMTVTPHEGKGVCPVVGCRANLLATCPPH
LQMRSPAGHGPVVACKSGCEAFRTDELCCRNHFNSKDTCRPSSYSEFFKHACPATFT
YAHDSPSLMHECSPRELKLVIFCH

>NtOLP NP_001312698.1 *Nicotiana tabacum*

MASSSTKTLTSLSLFLTLALSQATYSGLLTLVNNCPYTIWPAIQPNAGHPVLERGG
FALHTLTHRSFAAPTTHWSGRIWARTGCSYAHGKFNCATGDCGGRIECDGLGGATP
ATLAQFVLHHGHADFSSYGVSLVDGFNIPLTVTPHEGKGQCPVVGCRAEILQTCPAV
LQLRSHGGHGPVVGCKSGCEAFKTDELCCRNHFNSPQTCKGSSYSEFFKHACPATF
TYAHDSPSLMHECSPHELKVILCH

>PaOLP XP_021820385.1 *Prunus avium*

MASSYHNNSLALLTTFLILCSLTHATSPAPFLTLVNNCPFLWPVGIQPNAGHPVLER
GGFYLPALSHRSFPTPTQPWSGRIWARTHCTHTQNHFSCLTGDCGGRLECNGAGGA
APATLAQVSLHHGPNDLFSYGVSLVDGFNVPITPHEGHGVCVVGCKADLLATC
PERLRVTSHAGVVACKSACEAFRSDELCCRNHYNSPQTCRASSYSEFFKRACPATFT
FAHDSPTLMHQCSSPHELKLVIFCH

>AtOLP NP_001324474.1 *Arabidopsis thaliana*

MHIEKYFSLYTHWHTFHTKSYTMAKTSPLAASFLLISFSSAVDTSRLFLTVV
NNCPFTVWPVPAIQPNAGHPVLEKGGFALPTFTHRSFNVPTTHWSGRIWARTWCAHY
NGKFSCLTGDCGNRLECNGLGGAPPASLAQFDLHHGGHDFSSYGVSLVDGYNVP
MTVTPHEGHGVCVVGCREDLIKTCPAHLQVRSVSHGHVVACKSGCEAFHTDELCC
RGHYNSPNTCKASSHSLFFKHACPSSFTFAHDSPSLMHDCASPRELKVIFCH

>AlOLP XP_020885214.1 *Arabidopsis lyrata*

MHIKIYFSLYIYTHVALSHLHQKLHTMAKTSPLAASFLLISFSSAVDTSHLFLTVV
NNCPFTVWPVPAIQPNAGHPVLEKGGFALPKYTHRSFNAPTTHWSGRIWARTGCAHY

NGKFSCITGDCGNRLECNGLGAPPASLAQFDLHHGGHHDFSSYGVSLVDGYNVP
MTVTPHEGHGVCPPVVGCREDLIKTCPAHLQVRSHSGHVVACKSGCEAFHTDELCC
RGHYNSPNTCKASSHSLFFKHACPSSFTFAHDSPSLMHDCSSPRELKVIFCH

>DcarOLP XP_017251860.1 Daucus carota

MAFFYHSLILFISLSTLSAATQQPFLITVNNCPFTIWPAIQPNYGHVPVLENGGFCLP
ALSHRSFPAPTSPWSGRIWARTHCTSPSHHFSCATGDCGTGKLECMGHGGSPATL
AQFSLHHGPTDLSSYAVSLVDGFNVPMTVTPHEGHGVCPPVVGCKGDLLATCPRAL
QVRASGGHVVGCKSACEAFGKDEFCCRGHFNSPQTCKPSSYSEFFKSACPSTFTYA
HDTPSLTHECSAPRELKVIFCH

>NsOLP XP_009800616.1 Nicotiana sylvestris

MASSSTKTLSSLCLTLCALSQATYSGLILTLVNNCPYTIWPAIQPNAGHPVLERGG
FALHTLTHRSFAAPTTHWSGRIWARTGCSYAHGKFSCATGDCGGRIECEGLGGATPA
TLAQFALHHGHADFSSYGVSLVDGFNIPLTVTPHEGKGQCPVVGCRAEILQTCPAVL
QLRSHGGHGPVVGCKSGCEAFKTDELCCRNHFNSPQTCKGSSYSEFFKHACPATFT
YAHDSPSLMHECSPRELKIIFCH

>CpOLP XP_021887635.1 Carica papaya

MASSASSSSSSLLLASTFLILFTLVKSTYPGLNITLVNNCPYTVWPAIQPNAGDPVLE
KGGFALHSLTHHSFAAPSQHWGRFWGRTGCRYANGLFSCVTGDCGHRLECNGLG
GATPATLVEFSLHHGHNDFFSYRVSVDGFNLPLTVTPHEGKGLCPVVGCRANLLE
TCPEKLQLRYGHGPVVACKSGCEAFKTDELCCRNHYNSPQTCRASSFSEFFKHACP
STFTYAHDSSLLHECSPRELKIIFCH

>GmOLP XP_003538000.1 Glycine max

MARSLFLCSLLIFAVTTFSSPTGALILTLVNNCNVTVWPAIQPNAGHPVLAGGGLTLR
TLTHQSIPVPDAHWSGRVWARTGCAYSGTAFSCASGDCGGRLQCNGAGGAPPATLA
QFEVHHGSNDYASYGVSLVDGFNVPMTVTPHEGKGVCPVVGCRDDLLATCPHVL
QHRVPAVHGPVVACKSGCEAFHTDELCCRNHFNNPSTCKGSIYSSFFKHAYPATFTF
AHDTPSLMHQCSPRELKVIFCH

>CrOLP XP_006294865.1 Capsella rubella

MAQTSPLAASFLLISFSSAADTGRLFLTVVNNCPFTVWPAIQPNAGHPVLEKGGF
ALPTFTHRSFSAPTTHWSGRIWARTGCAHYNGKFSCITGDCGNRLECNGLGATPA

SLAQFDLHHGGHKDFSSYGVSLVDGYNVPMTPHEGHGVCVVGCREDLLKSCP
AHLQVRSHSGHVVACKSGCEAFRSDELCCRGHYNSPNTCKASSHSLFFKHACPSTF
TFAHDSPSLMHDCSSPRELKVIFCH

>NaOLP XP_019237711.1 Nicotiana attenuata

MASSSTKTLTSLSLFLTLALSQATYSGLILTLVNNCPYTIWPAIQPNAGHPVLERGG
FALHTLTHRSFAAPTTHWSGRIWARTGCSYAHGKFNCATGDCGGRIECDGLGGAAP
ATLAQFALHHGHADFSSYGVSLVDGFNIPLTVTPHEGKGQCPVVGCRAEILQTCPAV
LQLRSHGGHGPVVGCKSGCEAFKTDELCCRNHFNSPQTCKGSSYSEFFKHACPATF
TYAHDSPSLMHECSPRELKVIFCH

>MdOLP XP_008357503.1 Malus x domestica

MAVSRSHFHSPLLSATTFLILAAVVHATHPQPSILTLVNNCPFIWPAIQPNAGHPVL
ERGGFFLNALTHRSFPAPTQPWSGRIWARTHCTQNGPHLSCLTGDCGGRLECNGAG
GATPSTLAQISLHHGGPADLFSYGVSLVDGFNVPLTVTPHEGHGVCVVGCKANLL
ATCPDRLKVTSPKGVVACKSACEAFGTDELCCRNHYNSPQTCRASGYSQFFKQACP
TTTFAHDSPTLMHQCSSPRELKVIFCH

>DcatOLP XP_020683326.1 Dendrobium catenatum

MLPFFPLLSLLLISLPPPTFSQYPPSILTIVNNCPFTICPAIAPNSGHDVLEHGGFCLPTL
SHRSFPAPTHHWSGRIWGRTGCTHTGTHFSCATGDCGNRLECSGFTGATPATLAQLT
LHHGGHRDLVSYAVSLVDGFNLPMTPHEGRGLCPVVGCREDLSTCPPELQVRF
PAGGSVVGCKSGCAAYGTDELCCRNMYNSPKTCRASTYSEFFKHHCPATFTYAHS
PSLTHDCEGPKELKVIFCH

>SIOLP NP_001234714.1 Solanum lycopersicum

MASSSAKILLPLSLLFTLLSLSQSTNPNFILTLVNNCPYTIWPAIQPNAGHPVLERGGF
TLHSLTHRSFPAPNAHWSGRIWARTGCNYQHGFYCATGDCGGRIECDGLGGAAP
ATLAQFVLHHGHADFSTYGVSLVDGFNIPLTVTPHEGKGVCVVGCRANLLESCPA
VLQFRSHGGHGPVVGCKSACEAFKSDEFCCRNHYNSPQTCKPSSYSQFFKHACPAT
FTYAHSPLMHECSPRELKVIFCH

Table S7. Anatomical characteristics of stem cross-section of the *PdOLP1* transgenics and wildtype plants.

Poplar line	Phloem		Cambium		Xylem		Width ratio of xylem /phloem
	Number of cell layers	Width (μm)	Number of cell layers	Width (μm)	Number of cell layers	Width (μm)	
Non-transgenic poplar	30-33	359.01	6-8	34.13	53-57	661.17	1.84
<i>PdOLP1</i> -OE OE3	28-31	311.81	5-7	29.89	43-48	527.99	1.69
<i>PdOLP1</i> -OE OE12	29-31	331.53	5-7	31.32	43-49	541.23	1.63
<i>PdOLP1</i> -OE OE21	29-32	339.68	6-7	32.74	44-49	552.28	1.63
<i>PdOLP1</i> -DR DR8	34-37	393.15	7-9	37.18	60-66	727.49	1.85
<i>PdOLP1</i> -DR DR15	34-38	402.05	7-10	39.04	60-67	763.45	1.90
<i>PdOLP1</i> -DR DR32	34-38	411.05	7-10	40.28	61-67	785.81	1.91

Notes :

PdOLP1-OE, *PdOLP1*-overexpressing lines; *PdOLP1*-DR, *PdOLP1*-downregulated lines. Cell layers, stems thicken by cell proliferation within the vascular cambium. The vascular cambium increases the number of cell layers in the phloem or xylem zones through periclinal division. The xylem and phloem regions show an orderly radial arrangement, so the cell layers can be accurately counted (see Figure 5a-f).

Table 8 Dry weight biomass, wood density and carbon storage of transgenic poplar and control plants

Poplar line	Dry weight biomass (g)	Wood density unit: (g·cm ⁻³)	Carbon storage (m ³)
Non-transgenic poplar	46.13	0.76	0.137
<i>PdOLP1</i> -OE OE3	34.61	0.57	0.101
<i>PdOLP1</i> -OE OE12	35.89	0.62	0.103
<i>PdOLP1</i> -OE OE21	36.67	0.64	0.109

<i>PdOLP1</i> -DR DR8	57.54	0.89	0.174
<i>PdOLP1</i> -DR DR15	59.66	0.91	0.181
<i>PdOLP1</i> -DR DR32	62.77	0.94	0.186

Measurements were conducted on transgenic poplar plants overexpressing *PdOLP1* (OE3, OE12 and OE21), and *PdOLP1* downregulated plants (DR8, DR15 and DR32) and Non-transgenic poplar plant. The results are given as means \pm SD of three independent assays. Asterisks indicate significant differences ($P < 0.05$) when compared with the control plants

Table S9. Binding sites in the promoter of the *PdOLP1* gene recognized by bZIP, WRKY, BLH, bHLH and MYB transcription factors.

The promoter of poplar *PdOLP1*

>*PdOLP1* promoter

ACGGCCCGGGCTGGTATCCCTCTTCGCCACCGTGTGTGTCGCCGACCACTGTTACCTCGATCTAA
AACACTCCTCTCTTTCTCTCAAGAATAACCCTCGGGGTTTTACACTGAACTCCATGGACATGAA
TTTTGCTTCCAATTAACGAAGTGCATGAAAATATTGACCTGAATTAATTTGTGGATAGACGA
CCAGCTAATTGAAAATATCGTTGAAAGAAACCATTTAAAATATCGTTTCCTTACTTAGTTTTCGT
GTGTGTGATTAGTGGTTTTTTAAAATATCGCACTACATTATAAACATTATTTTTTAAAAAATAA
CACAGTTTGGTAAAAAATTGAAAGAATAATATATATTGAAAAAATATTTAGAAAATATTATAA
TTTTAAAATAACTATGTTTTTTAATATTGTTTTGTCCACCGCTGTATATCATGGTTGTTAGTTA
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TCCCACGCTGCATATATACACGTATTACTTTTTCTCTTCTCACTTTGGCCTCTGCCTTTCCTTTT
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ACAGATGATGCTAGAACACTGATATGAGAAAACGAGGCCAATCCGAATCTACTTTATTAAAAAA
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ACGATTTTTTACATTTTTTTCCTAAATGATTAATAATGCCACCACCTTCACGATGCTATAGGT
AGATGCACAAACTACAGAGTAATGGCGGCTTCTTCAAAAGCTCCAAAGCCAGAAGAATCCCC
TCCAATTTGCCCTTGGCATATTTGGCTCCTGCATAATTCTAAGCTTCAATCCTTCTAACCAA
CTTTCAAACCAGAGGTATTCTAATTAATTGTAGTCGGCAGGGAAAGCTTTCTGAATTCCAGG
CTCAAGCCCTCAGAATTCAAAAGGACTAAAATACGTGCATCCTCATCTGAAAATACACAAAAGC
ACTCCAAAAGCACATCTTCACCTTCTCCCTCCCCACTCAACATTTAAGGAGAGGGGTATGTAT

GGTATTACGACATCACCCACAGAGGAAAAGAGAAAAGCTCGAAATCATGCATTCTTATCTCAAA
 CCCTCGA **TGAC**TATAAGTAGTACACTTCCGGC **ACACTTG**TCTCTTGAACCAAAAAGGAAAAA

BLH, WRKY, bZIP, MYB, and bHLH binding sites in promoter of *PdOLP1*.

Gene name	BLH binding site	WRKY binding site	bZIP binding site	bHLH binding site	MYB binding site
<i>PdOLP1</i>	TGCA (marked in red)	TGAC (marked in green)	ACACNNG (marked in pink)	CANNTG (marked in blue)	TATCC (marked in yellow)