SUPPLEMENTARY INFORMATION

Salicylic acid antagonizes abscisic acid inhibition of shoot growth and cell cycle progression in rice

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Supplementary Table S1 Gene expression ratios of *OsCDKB*s, *OsKRP*s, *and Orysa;CycD*s after 5-d treatment with various plant hormones.

Gene name	ABA [a]	ABA-SA [b]	SA [a]	ABA-IAA [b]	IAA [a]	ABA-BAP [b]	BAP [a]	ABA-GA [b]	GA [a]
OsCDKA;1	1.26 ± 0.12*	0.96 ± 0.11	1.19 ± 0.18	0.98 ± 0.11	0.8 ± 0.08*	0.85 ± 0.34	1.55 ± 0.21*	1.61 ± 0.14*	0.99 ± 0.18
OsCDKA;2	0.86 ± 0.10	0.80 ± 0.13	1.00 ± 0.05	0.62 ± 0.08	0.51 ± 0.11**	0.61 ± 0.11	0.77 ± 0.12	0.41 ± 0.34	0.78 ± 0.13
OsCDKB;1	0.43 ± 0.03***	0.64 ± 0.06*	0.80 ± 0.07**	0.53 ± 0.07	0.61 ± 0.02***	0.71 ± 0.15	0.86 ± 0.04**	0.32 ± 0.12	0.68 ± 0.11*
OsCDKB;2	0.39 ± 0.05***	0.73 ± 0.12*	1.00 ± 0.09	0.66 ± 0.05**	0.77 ± 0.06**	0.62 ± 0.08*	0.76 ± 0.05**	0.16 ± 0.06*	0.61 ± 0.07**
OsCDKC;1	1.11 ± 0.10	0.82 ± 0.13	1.09 ± 0.14	0.47 ± 0.01**	0.42 ± 0.03***	0.50 ± 0.05**	0.55 ± 0.03***	0.84 ± 0.17	0.42 ± 0.04***
OsCDKC;2	1.15 ± 0.16	0.88 ± 0.17	1.14 ± 0.16	0.47 ± 0.03**	0.39 ± 0.03***	0.76 ± 0.04*	0.84 ± 0.09	0.800.17	0.34 ± 0.03***
OsCDKD;1	1.07 ± 0.12	0.82 ± 0.16	1.06 ± 0.13	0.50 ± 0.03**	0.48 ± 0.09**	0.72 ± 0.05*	0.71 ± 0.06**	0.58 ± 0.14*	0.36 ± 0.05***
OsCDKE;1	1.33 ± 0.13*	0.90 ± 0.10*	1.09 ± 0.15	0.51 ± 0.05**	0.44 ± 0.05***	0.65 ± 0.08**	0.73 ± 0.09*	1.05 ± 0.28	0.40 ± 0.08***
OsCDKF;1	1.47 ± 0.17*	0.81 ± 0.08**	1.06 ± 0.13	0.74 ± 0.15**	0.64 ± 0.09**	0.33 ± 0.03***	0.36 ± 0.03***	1.63 ± 0.20	0.60 ± 0.26
OsCDKF;3	0.74 ± 0.13	1.04 ± 0.18	1.24 ± 0.03***	0.49 ± 0.08	0.30 ± 0.02***	0.27 ± 0.06*	0.32 ± 0.03***	0.61 ± 0.10	0.29 ± 0.09***
OsCDKF;4	0.77 ± 0.13	0.76 ± 0.16	1.07 ± 0.13	0.42 ± 0.04*	0.35 ± 0.07***	0.59 ± 0.08	0.64 ± 0.01***	0.41 ± 0.08*	0.27 ± 0.06***
OsCDKG;1	1.32 ± 0.07**	0.95 ± 0.13*	1.21 ± 0.07**	0.48 ± 0.07***	0.39 ± 0.07***	0.53 ± 0.02***	0.63 ± 0.03***	0.85 ± 0.13	0.26 ± 0.07***
OsCDKG;2	1.19 ± 0.17	0.73 ± 0.11*	0.99 ± 0.07	0.41 ± 0.07**	0.28 ± 0.03***	0.38 ± 0.05**	0.42 ± 0.09***	1.59 ± 0.22	0.42 ± 0.10***
OsKRP1	0.52 ± 0.10**	0.50 ± 0.15	0.94 ± 0.11	0.69 ± 0.16	0.52 ± 0.10**	0.19 ± 0.04*	0.23 ± 0.01***	0.29 ± 0.1	0.15 ± 0.05***
OsKRP3	0.32 ± 0.05***	0.45 ± 0.05	0.73 ± 0.02***	0.87 ± 0.06**	0.82 ± 0.12*	0.12 ± 0.04**	0.25 ± 0.03***	0.16 ± 0.07	0.19 ± 0.07***
OsKRP4	1.70 ± 0.14**	0.94 ± 0.12**	1.07 ± 0.01***	0.71 ± 0.08**	0.64 ± 0.04***	0.97 ± 0.19*	1.14 ± 0.06*	1.03 ± 0.08*	0.36 ± 0.02***
OsKRP5	1.31 ± 0.03***	0.66 ± 0.05***	0.84 ± 0.05**	1.34 ± 0.07	1.08 ± 0.02**	0.50 ± 0.05***	0.59 ± 0.05***	0.81 ± 0.04*	0.58 ± 0.01***
OsKRP6	0.73 ± 0.24	0.59 ±0.09	0.69 ± 0.17	0.29 ± 0.11	0.13 ± 0.04***	0.29 ± 0.06	0.33 ± 0.07**	0.13 ± 0.08	0.03 ± 0.02***
Orysa;CycD2;1	0.48 ± 0.02***	0.43 ± 0.02	0.65 ± 0.17*	0.68 ± 0.08*	0.62 ± 0.06***	0.50 ± 0.09	0.46 ± 0.10*	0.19 ± 0.03***	0.42 ± 0.05***
Orysa;CycD2;2	0.46 ± 0.04***	0.65 ± 0.09	0.75 ± 0.12*	0.52 ± 0.06	0.56 ± 0.07**	0.45 ± 0.07	0.53 ± 0.08***	0.23 ± 0.03**	0.60 ± 0.01***
Orysa;CycD4;1	2.44 ± 0.26**	0.90 ± 0.09**	1.03 ± 0.14	1.55 ± 0.17*	1.25 ± 0.03***	1.25 ± 0.13**	1.06 ± 0.03*	1.72 ± 0.13*	0.87 ± 0.07
Orysa;CycD4;2	0.70 ± 0.06**	0.74 ± 0.05	0.83 ± 0.12	0.62 ± 0.06	0.62 ± 0.03***	0.56 ± 0.08	0.61 ± 0.09**	0.33 ± 0.01***	0.45 ± 0.07***
Orysa;CycD3;1	0.54 ± 0.07***	0.64 ± 0.07	0.78 ± 0.15	1.37 ± 0.14**	1.29 ± 0.14*	0.89 ± 0.07**	0.96 ± 0.09	0.22 ± 0.02**	0.61 ± 0.05***
Orysa;CycD5;1	0.48 ± 0.03***	0.63 ± 0.03**	0.78 ± 0.16	0.93 ± 0.09**	0.85 ± 0.07*	0.53 ± 0.05	0.49 ± 0.05***	0.26 ± 0.06**	0.51 ± 0.05***
Orysa;CycD5;2	0.95 ± 0.11	1.47 ± 0.03**	1.23 ± 0.16	1.81 ± 0.17**	1.27 ± 0.08**	0.55 ± 0.07*	0.62 ± 0.11**	0.85 ± 0.15	0.68 ± 0.08**
Orysa;CycD5;3	1.49 ± 0.15**	0.84 ± 0.12**	0.95 ± 0.12	0.76 ± 0.07**	0.62 ± 0.09**	0.39 ± 0.06***	0.61 ± 0.10**	1.22 ± 0.14	0.48 ± 0.08***
Orysa;CycD6;1	0.48 ± 0.04***	0.70 ± 0.05**	0.92 ± 0.26	0.54 ± 0.08	0.62 ± 0.01***	0.55 ± 0.10	0.59 ± 0.12**	0.26 ± 0.02**	0.43 ± 0.06***

Gene expression ratio was represented as the ratio of expression levels in hormone-treated seedlings to those in untreated seedlings. Three biological replicates were performed.

a) Asterisks indicate a significant difference from the control mean. b) Asterisks indicate a significant difference from ABA sole treatment.

*P < 0.05, ** P < 0.01, *** P < 0.001; Student's t-test.

Supplementary Table S2 The ratios of the 2C and 4C cells in controls and hormone-treated tissues.

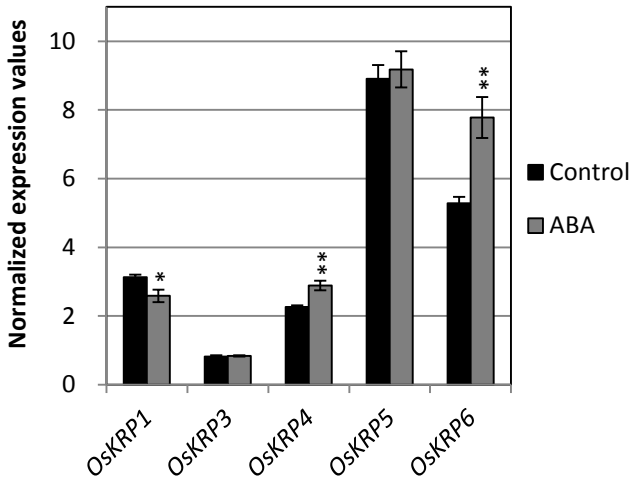
Treatment	Average of the number of counted nuclei per sample	2C %		4C%	
		Mean	SD	Mean	SD
Control (2 d)	18759.8	94.1	0.5	5.9	0.5
Control (5 d)	15516.6	91.9	0.6	8.1	0.6
2 μM ABA (2 d)	16086.4	96.1	0.6	3.9	0.6
2 μM ABA (5 d)	14313.6	96.1	0.5	3.9	0.5
0.4 mM SA + 2 μM ABA (2 d)	19988.2	95.9	0.6	4.1	0.6
0.4 mM SA + 2 μM ABA (5 d)	17814.6	93.4	1.0	6.6	1.0
1 mM SA + 2 μM ABA (2 d)	19548.8	94.7	0.8	5.3	0.8
1 mM SA + 2 μM ABA (5 d)	18323.0	91.5	0.4	8.5	0.4
1 mM SA (2 d)	19213.4	94.2	0.7	5.8	0.7
1 mM SA (5d)	17533.0	92.3	0.4	7.7	0.4

Supplementary Table S3 Sequences of the primers and universal probes.

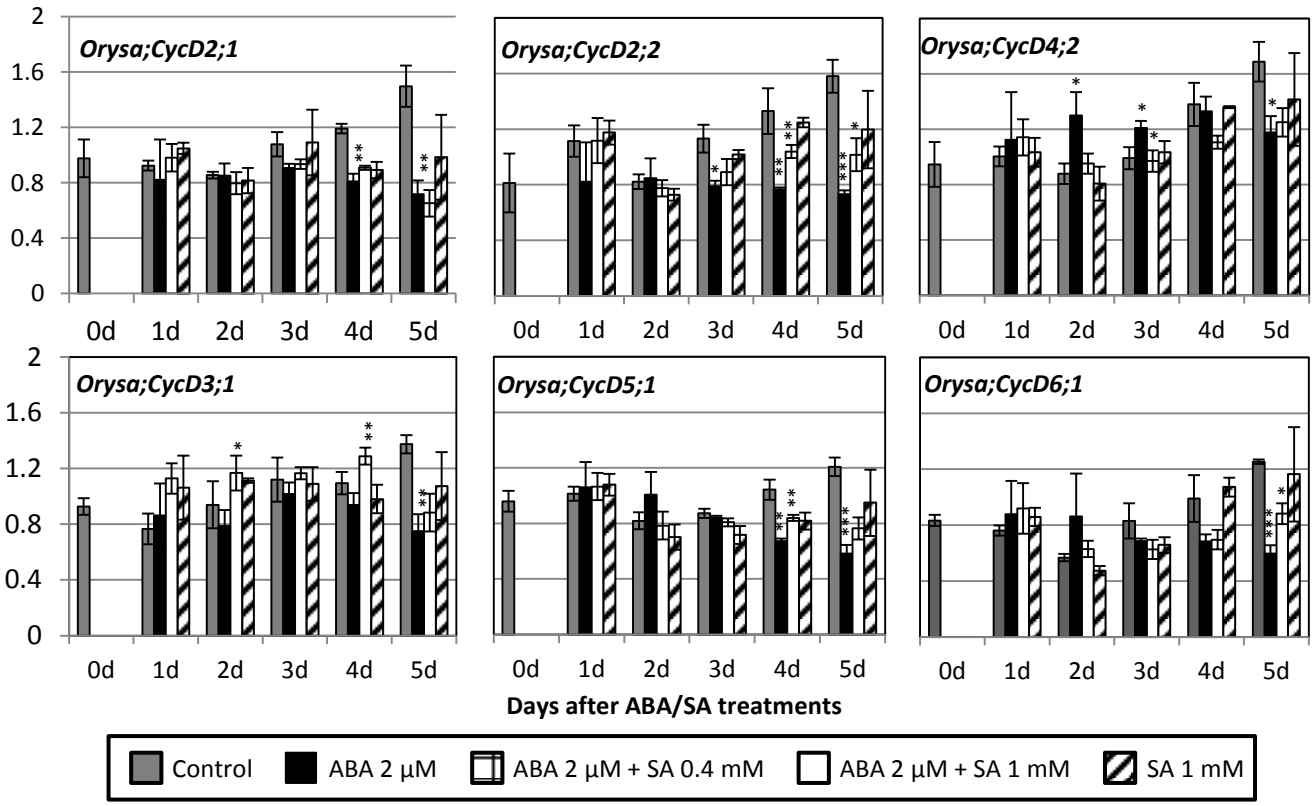
Gene	Locus/Accession No.	Forward primer	Reverse primer	Purpose	TaqMan probes
OsKRP1	Os02g0762400	cgagatcgaggcgttctt	caccggagtccactcgaa	qRT-PCR	#30
		gaaacggccaaagaaggcgac	gtcgaatcggtggttgttagg	cDNA cloning 1st PCR	
		gaggccagtgaattcatgggcaagtacatgaggaagttc	gagctcgatggatcctcagcttcggctgctgaccaccgg	cDNA cloning 2nd PCR	
OsKRP3	Os11g0614800	gacgtcgtcagtggagaaaga	cagggttgtgcttgtgctc	qRT-PCR	#70
OsKRP4	Os10g0471700	gccacaacattattccagca	ggcagtcattcacaggatca	qRT-PCR	#11
		ccttagccgctaatgctccg	tctgccacgctactactgtg	cDNA cloning 1st PCR	
		catggaggccgaattcatgggcaagtacatgcgcaaggcc	gcaggtcgacggatcctcagtctagcttgacccattcaaa	cDNA cloning 2nd PCR	
OsKRP5	Os03g0137800	gcgacaacgttcttgacctc	aggcgttgtctccctggt	qRT-PCR	#55
		cgcgattctcctcccttcc	gaattgcattttgcctctgcc	cDNA cloning 1st PCR	
		catggaggccgaattcatggggaagtacatgcggaagggg	gcaggtcgacggatccctagcagtctagccttgtccattc	cDNA cloning 2nd PCR	
OsKRP6	Os09g0459900	ccaggaaggcgaagaagg	ggagcgtccttgacgatg	qRT-PCR	#108
		agcataagggagggagggag	ggtctgtgcatcctcctgac	cDNA cloning 1st PCR	
		gaggccagtgaattcatggctgccgcggccgccaccgtg	gagctcgatggatccttacgggcgtacccggacccactc	cDNA cloning 2nd PCR	
OsCDKA;1	Os03g0118400	cggcgtactaatgcactgaa	ctctggagctctataccacaagg	qRT-PCR	#37
		attgggcggcaaacggagg	aagggcacagcgttcacag	cDNA cloning 1st PCR	
		gaggccagtgaattcatggagcagtacgagaaggaggag	gagctcgatggatcctcattgtaccatctcaaggtccttg	cDNA cloning 2nd PCR	pGADT7 vector
		catggaggccgaattcatggagcagtacgagaaggaggag	gcaggtcgacggatcctcattgtaccatctcaaggtccttg	cDNA cloning 2nd PCR	pGBKT7 vector
OsCDKA;2	Os02g0123100	gatcggcgtaccaactcatt	tgctctataccacaatgtcacca	qRT-PCR	#37
		tcatccccaagtccaccac	ctcggctgagcaaacaatgc	cDNA cloning 1st PCR	
		gaggccagtgaattcatggagcagtacgagaaggtggag	gagctcgatggatccctacgccacttccaggtccttgaa	cDNA cloning 2nd PCR	pGADT7 vector
		catggaggccgaattcatggagcagtacgagaaggtggag	gcaggtcgacggatccctacgccacttccaggtccttgaa	cDNA cloning 2nd PCR	pGBKT7 vector
OsCDKB;1	Os01g0897000	accggtgttgacatttggtt	tgccagtccctcaaatcagt	qRT-PCR	#68
OsCDKB;2	Os08g0512600	ctcaagaagtacacccacgaga	agatgtcaaccggagtggag	qRT-PCR	#142
		caaaccctaaatccacgcgc	ttcagggcaggctagtcac	cDNA cloning 1st PCR	
		gaggccagtgaattcatggcggcgctccaccaccaggcg	gagctcgatggatcctcagtagagctccttgttcacgtc	cDNA cloning 2nd PCR	pGADT7 vector
		catggaggccgaattcatggcggcgctccaccaccaggcg	gcaggtcgacggatcctcagtagagctccttgttcacgtc	cDNA cloning 2nd PCR	pGBKT7 vector
OsCDKC;1	Os05g0389700	tttgcagagcttctcaatgg	catcaaatattttgctcagttgct	qRT-PCR	#72
OsCDKC;2	Os01g0958000	ggaaagccaatattgacagga	gcgtaccacaaagctcaaaaa	qRT-PCR	#106
OsCDKD;1	Os05g0392300	ttgctgaactgctgcttagg	ttcccaagttgatcaatgtcac	qRT-PCR	#80
OsCDKE;1	Os10g0580300	aagtgataacggggttgttgtt	ttcagcaaaaatgcaaccaa	qRT-PCR	#50
OsCDKF;1	Os06g0334400	cctgctcatctccgaggac	ttggtatgttcctgtctcctga	qRT-PCR	#162
OsCDKF;3	Os03g0847600	tgatatgtgggctgttggtg	tatgatccggtgtcccaag	qRT-PCR	#102
OsCDKF;4	Os02g0700600	tgaagtttcagttccctcaggt	gtcccatgagcacagtgatg	qRT-PCR	#53
OsCDKG;1	Os02g0602100	ggtttcgcgaactacctctg	atgtttcttgaagcgcctgt	qRT-PCR	#15
OsCDKG;2	Os04g0488000	caccaggaaatcaatggaca	gggccatcaagcttcctatc	qRT-PCR	#5
Orysa;CycD2;1	Os07g0620800	aatctgaaatccctgtaaataaggag	tgtggaactgaagagcttgc	qRT-PCR	#150
Orysa;CycD2;2	Os06g0217900	tatgagagctcggcgtcaa	tgaaggctacaaatgtacaacga	qRT-PCR	#63
Orysa;CycD3;1	Os09g0111100	ggctgctctggtcggtatc	gaaccctcctcctcctaagc	qRT-PCR	#7
Orysa;CycD4;1	Os09g0466100	caggcagccacaaaagagtag	cactgtcacctcgtctctgc	qRT-PCR	#103
Orysa;CycD4;2	Os08g0479300	accggcgtggtagaagaa	cttcctggcattgcaaca	qRT-PCR	#110
Orysa;CycD5;1	Os12g058800	ggagaagagataatgaacaaaggaa	ggaatttggggcttcaagta	qRT-PCR	#55
Orysa;CycD5;2	Os03g0617500	tgcacattgcactcacactg	agcactgttcttcagcttctctc	qRT-PCR	#12
Orysa;CycD5;3	Os03g0203800	aaggttgcactcgcctca	cagagctggactccaacca	qRT-PCR	#19
Orysa;CycD6;1	Os07g0556000	agcgagagatagggtgacga	aaagaaagagcagggcaaga	qRT-PCR	#11

Supplementary Table S4 Probes used for microarray analysis.

Gene	Locus/Accession No.	Probe name
OsKRP1	Os02g0762400	Os02g0762400|mRNA|AK103084|CDS+3'UTR
OsKRP3	Os11g0614800	Os11g0614800|COMBINER_EST|Os11g0614800|8
OsKRP4	Os10g0471700	Os10g0471700|mRNA|AK073804|CDS+3'UTR
OsKRP5	Os03g0137800	Os03g0137800|mRNA|AK064723|CDS+3'UTR
OsKRP6	Os09g0459900	Os09g0459900|mRNA|AK063208|CDS+3'UTR



Supplementary Fig. S1 Normalized microarray expression values of *OsKRPs* after ABA treatment for 6 h. Three biological replicates were performed. Error bars show SD (n = 3). *P < 0.05, **P < 0.01; Student's t-test.



Supplementary Fig. S2 Changes in expression of *Orysa;CycD*s in shoots of young rice seedlings during ABA and SA treatment. Error bars show SD (n = 3). Asterisks indicate a significant difference between the ABA-only and ABA + SA treatments (*P < 0.05, **P < 0.01, ***P < 0.001; Student's t-test).