

Supplementary Materials

Cytokinin Confers Brown Planthopper Resistance by Elevating Jasmonic Acid Pathway in Rice

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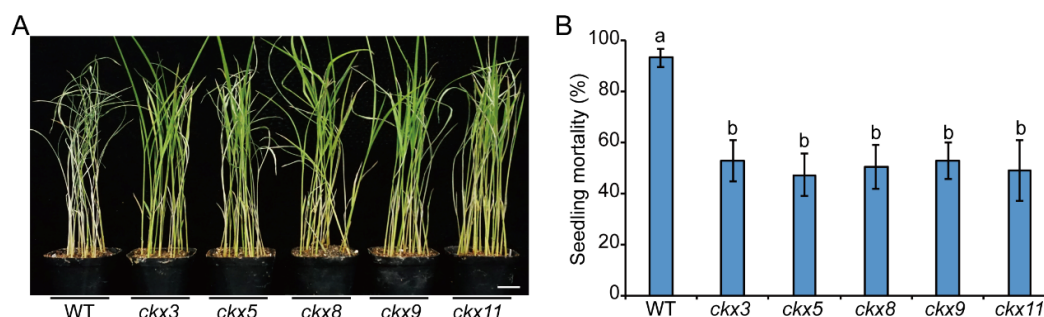


Figure S1. Knockout of *OsCKXs* significantly increases rice resistance to BPH. Representative image (A) and seedling mortality (B) of WT and *cckx* mutants. WT (Nipponbare) and *cckx* mutants at second-leaf stage were infested with BPH, and the seedling mortality of each was recorded seven days after BPH infestation. Data are means \pm SD, $n = 3$. Statistical significance was determined by one-way ANOVA with Tukey's test, different letters on the columns indicate significant differences at $P < 0.05$. Scale bar, 3 cm.

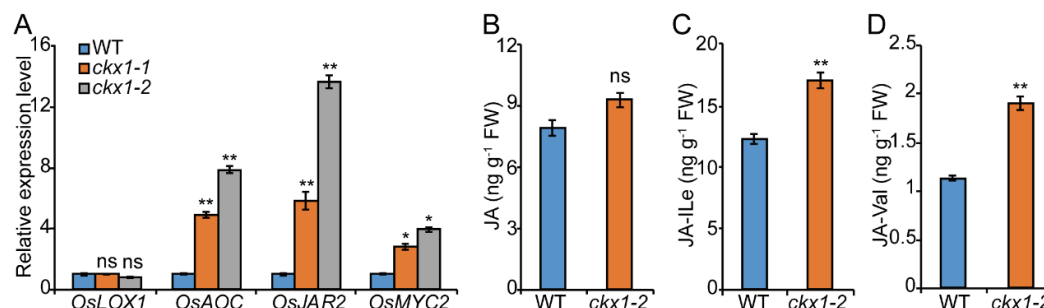


Figure S2. Expression analysis of JA pathway related genes and measurement of JA content in *cckx1* mutants. (A) Transcript analysis of JA pathway related genes in *cckx1*. The expression level of WT plant was set as 1. *Ubiquitin* (*Os03g0234350*) was used as an internal parameter. Levels of endogenous JA (B), JA-Ile (C) and JA-Val (D) in *cckx1* and WT. FW, fresh weight. Values are means \pm SD, $n = 3$. Two-tailed Student's *t*-test, * $P < 0.05$, ** $P < 0.01$, ns, no significant difference.

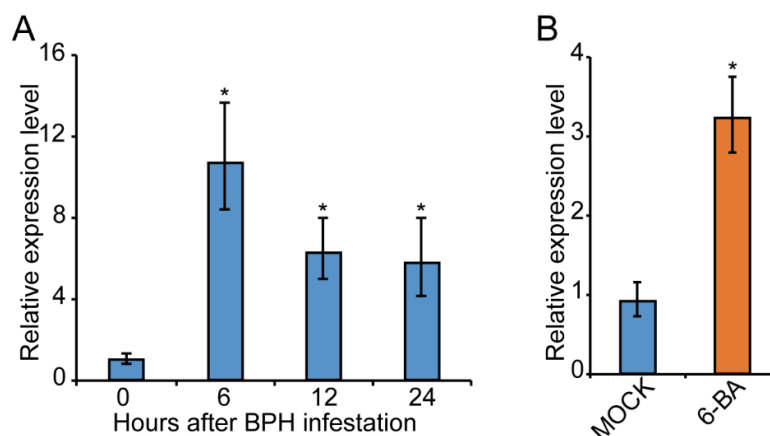


Figure S3. Influence of BPH attack and CK treatment on the transcript level of *OsOPR7*. (A) Effect of BPH infestation on the transcript level of *OsOPR7* in rice. The expression level of *OsOPR7* in plants without BPH infestation was set as 1. (B) Expression level of *OsOPR7* in rice seedlings treated with mock and 0.1 μM 6-BA. Results were presented relative to the value of mock-treated plant. *Ubiquitin* (*Os03g0234350*) was used as internal reference. Values are means ± SD, n = 3. Two-tailed Student's *t*-test, **P* < 0.05.

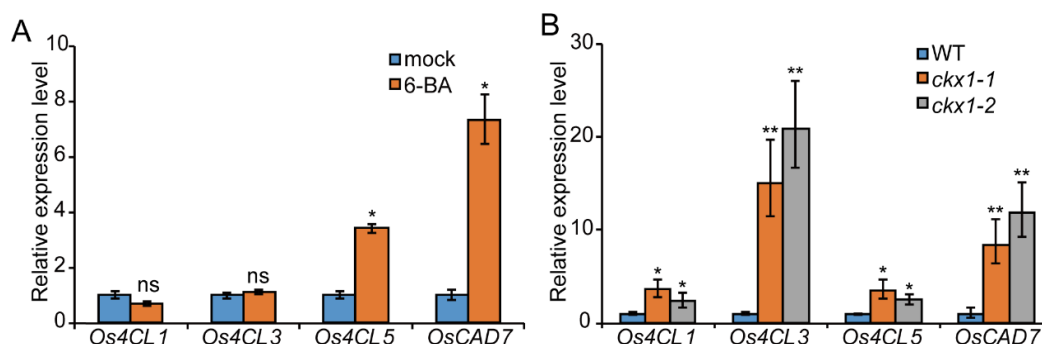


Figure S4. CK induces lignin pathway in rice. Transcript levels of lignin biosynthesis-related genes in rice sheaths from plants pretreated with mock or 0.1 μM 6-BA (A) and *cks1* mutant (B) post infestation with BPH for 24 h. The expression levels of mock-treated plant and WT were set as 1, respectively. *Ubiquitin* (*Os03g0234350*) was used as an internal reference. Two-tailed Student's *t*-test (values are means ± SD, n = 3), **P* < 0.05, ***P* < 0.01, ns, no significant difference.

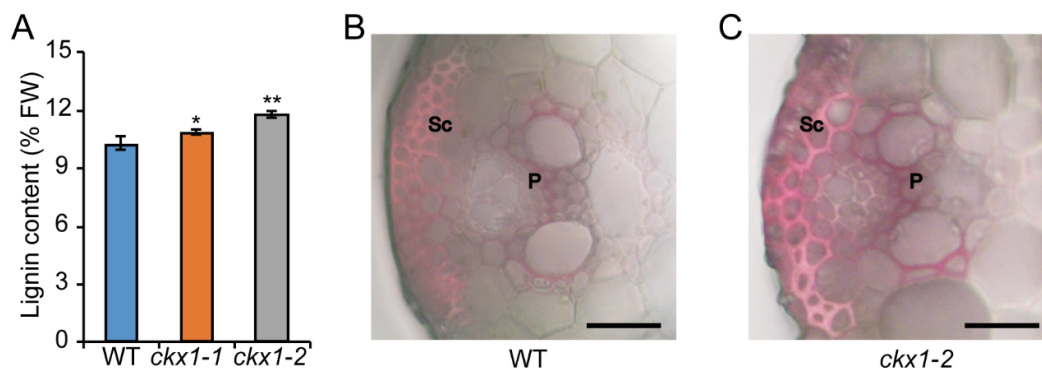


Figure S5. CK facilitates the accumulation of lignin in rice sheaths. (A) Quantification of lignin accumulation in fresh leaf sheaths of *cks1* and WT. FW, fresh weight. Values are mean ± SD of 3 biological replicates. Two-tailed Student's *t*-test, **P* < 0.05, ***P* < 0.01. (B and C) Representative images of lignin accumulation showed by histochemical staining in fresh leaf sheaths of WT and *cks1*. Sc, sclerenchyma; P, phloem. Scale bar, 30 μm.

Table S1. List of primers used in this study.

Primers for qRT-PCR - CK metabolism		
Name	Forward Primer	Reverse Primer
<i>OsIPT1</i>	TCCACCAAGCCCAAGGTTAT	TCGGTGACCTTGTGTTGGTGAT
<i>OsIPT2</i>	TCATCGGACAGTCACCCAAG	CACCTGGATCTTGTTCGGAGT
<i>OsIPT3</i>	TCTGCATGGAGGAGGGAATG	CCGCAACCTCCATCTTCTCT
<i>OsIPT4</i>	GTACGAGTGCTGCTTCCTCTG	CCAGATGCCCCCTGGAGTAGT
<i>OsIPT5</i>	CAGCGTCAGCAGGAGCAT	CGCGGCCGTGAACTCC
<i>OsIPT6</i>	GATCGATGCGGCATATCTCATC	CCTCCAATTGCCCAAAGGATC
<i>OsIPT7</i>	GGATACGAGGATGGTGGTGA	TCGATGGACAGCTTGGTCTT
<i>OsIPT8</i>	AGACCAAGCTTTCCATCGAC	CAGCTGAATCTTGTTCAGCGT
<i>OsIPT9</i>	TTGTGAGGCCTGTGATAAC	GCTTGTGTGCTCCCACT
<i>OsIPT10</i>	GCCATTGCGCAGTTTATC	CACGGAACACCCTGTTCT
<i>OsCKX1</i>	GGAGGAGGAGGTGTTCTACG	GAGGTGCGAGAACCTCAGTA
<i>OsCKX2</i>	ACACTGACACACACAAACCG	CAGTTGAGCATGAGGAGCAC
<i>OsCKX3</i>	GGACAGCATCTCACCAGGATA	GTCCCACTTGTGTCTGAGGA
<i>OsCKX4</i>	TTGAGACCTTCACCGAGGAC	TGAGGATGCCTGTCCTGTTT
<i>OsCKX5</i>	AAAGGAGAGGTGGTGACCTG	GGTGAACCTCGGTGAAGTTGG
<i>OsCKX6</i>	GTGACCTTCACCAGAGACCA	TGTCCGATTGAGCTGGACTT
<i>OsCKX7</i>	GGCCACGTTCACTAAAGACC	TCGCTGCTAGAGAAGAAGGG
<i>OsCKX8</i>	TGAAGCTGGTTTCAGCGAAG	GCTTTGGCACGAACACATTG
<i>OsCKX9</i>	CCTGGCGTATCACCTATGT	CTCCTGCATTGACAGTGTG
<i>OsCKX10</i>	TCGGACTTTGGCCATATTGT	GTGATAAGCGGATTAGGGCA
<i>OsCKX11</i>	CGTGGCTCAACCTCTTCATC	CACCTGGACTTGAGCATGGG
<i>OsUBQ</i>	AACCAGCTGAGGCCCAAGA	CGATTGATTAAACCAGTCCATG
Primers for qRT-PCR - CK signaling		
<i>OsORR1</i>	GCTCACTGGGAGGACTTGAT	CTGCAGCAAGCCGTAAAGAT
<i>OsORR2</i>	ACCTTCTGCTGCTCTTCCAT	CTTCCAAGCAATGGCCAAC
<i>OsORR3</i>	GGGACAAGGTTTGGCAACAT	TCCCAGAAAGGATGGTGGAC
<i>OsORR4</i>	CACTGCAACCTCTTGAGTCG	GGTGGCTTGCAGCATGTTAT
<i>OsORR5</i>	GTGCAGTCAAATGGTGGGTT	CAGTTTGCAAGGTCCGGA
<i>OsORR6</i>	TCAGGACAGGAAGCCATCAG	TAGGTCACAGCGTTCATGGT
<i>OsRR1</i>	GGCGAAACTGGGCAATAG	GCCTCCACAAGGAGATGATACT
<i>OsRR2</i>	ATTTTGCTGAGAGAGAAAAGA	ACGACACCAGATGCCCACTC
<i>OsRR3</i>	CGCAGCTCCAAATATCGAGTT	CACATTCCGATCCAGGCTGAG
<i>OsRR5</i>	ACTACTGGATGCCGGAGATG	CTCCGAGGACATGATCACC
<i>OsRR6</i>	CACAATGTTGAAATGGCACCA	AATTAATGTCAAACTCTGACC
Primers for qRT-PCR – JA and SA pathways		
<i>OsLOX1</i>	GTACGCTGGGTTACAGCTC	TCAGATGGATGTGCTGTTGG
<i>OsAOC</i>	CGTACCTGACCTACGAGGAG	GCCCTTGAGGTAGAAGGTGT
<i>OsJAR2</i>	AGAAGGTTCTCCGCCACTAC	CGGAGCTGAAGAAGACGTTG
<i>OsJamyb</i>	GAGGACCAGAGTGCAAAAGC	CATGGCATCCTTGAACCTCT
<i>OsMYC2</i>	AGCTCAACCAGCGCTTCTAC	CCTTCTTGAGCGACTCCATC
<i>OsICS1</i>	TATGGTGCTATCCGCTTCGAT	CGAGAACCAGCTCTCTTCAA
<i>OsPAL2</i>	AGCTGGTCAACGAGTTCTACA	GAGGGAGTTGACGTCTGTT
<i>OsPAL8</i>	GTGACGAATGTCGCCAAGAA	ATGAGTGGAAGCTGGATCT
<i>OsNH1</i>	TTTCCGATGGAGGCAAGAG	GCTGTCTATCCGAGCTAAGTGT
<i>OsWRKY45</i>	TTCTTGTTGATGTGCTGCTC	CCCCAGCTCATAATCAAGAAC
Primers for CRISPR		
CR-CKX1-F	GGCAGCGTCAGCGGGCAGACTTAC	AAACGTAAGTCTGCCCGCTGACGC