

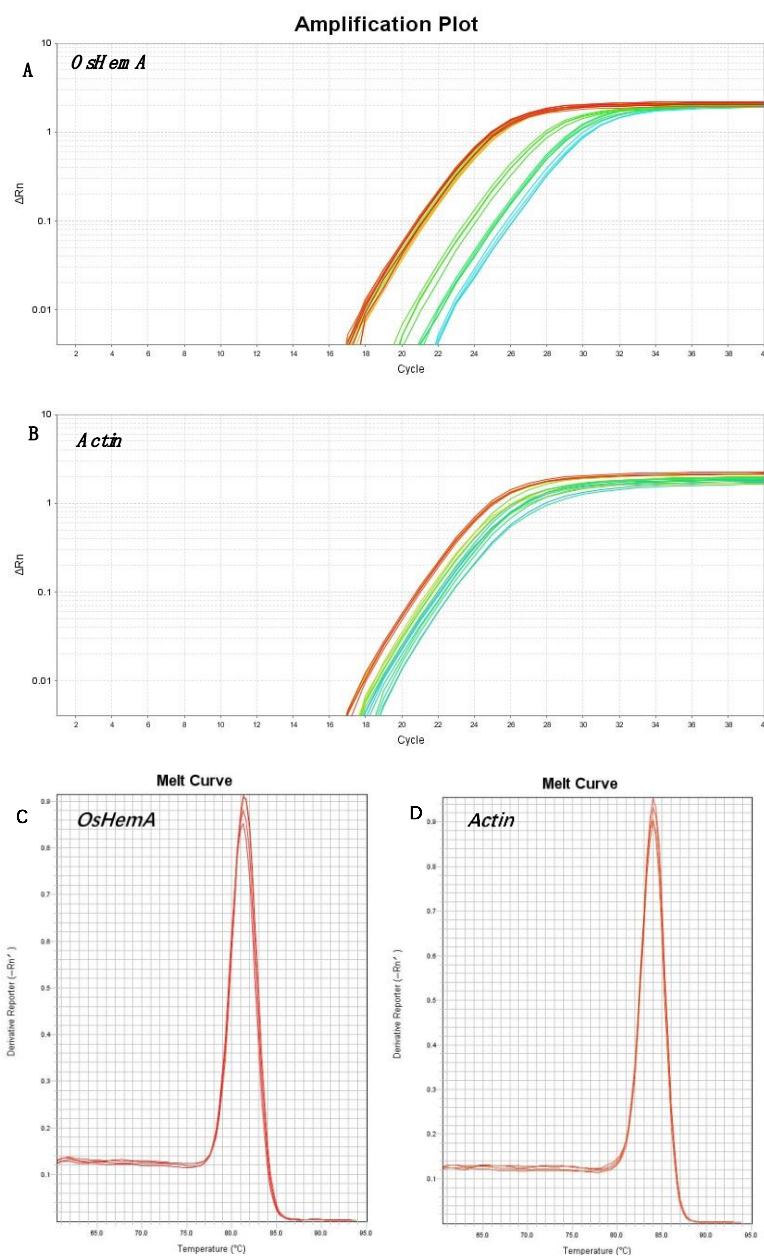
Appendix A Origin and pedigree selection of *cbd1*.

Appendix B All Markers used in our research

Type	Primer	Forward primer (5'-3')	Reverse primer (5'-3')
Primers for gene mapping	D1	CACCGCCTTCATCGTTG	TAGCGTCGGTCCATTG
	D2	CGACACATGGTGCAGATATGA	TGTGACACGGTAGTGACG
	D3	TATGGATGCGGATGAGGA	CCACATAGTAAGAAATCTAGGG
	D4	TCATGGAAGAAGCCAACAAG	TCATCCAGCCTCCTCATAG
	D5	TTTGGTTCGTGGCATAG	TAGGTTGGAGTACACGGTAG
	D6	ATTGGCTCGGTCTACTGC	CATCTGAATCCAATCAAGACA
Primers for gene cloning	CR1	GAGCGAAATGCGAGTAAATAC	CAAGCCTAAGGATGAGTTCT
	hemAPG	CCGGCGGCCAACGTTGATGTCGC	GAATTCCCGGGATCCAAATCGG
	<i>OshemA</i> -GFP	CATTTCACCG	GCTCCACTGT
		CGGAGCTAGCTCTAGAACATGATGGC	TGCTCACCATGGATCCGTTCTGGGA
		GAGCACGACG	CTTCTCCAC
	GFP- <i>OshemA</i>	CGAGCTGTACAGATCTATGATGGC	GCCAAATGTTGAACTCAGTCAGT
Primers for gene expression	<i>HEML</i>	AGAACAAAGGGCAGATTGCTGCTG	TGTTTCGTCAAGTCACGGAGAGCA
	<i>HEMB</i>	TGGCATTGTCAGGGAAAGATGGAGT	CCAAAGCAGCACGTATTGCTCAA
	<i>CHLD</i>	TAGCACAGCTGTAGAGTGGTTT	TTGCCAGCCACCTCAAGTATCTCA
	<i>CHLH</i>	GCACGGGAACTTGGCTTCAATTA	ACATGTCCTGGAGCTGCTTCTCAT
	<i>CHLI</i>	AGGGATGCTGAACTCAGGGTGAAA	AAGTAGGACTCACGGAACGCCTT
	<i>CHLM</i>	GCTTCATCTCCACGCAGTTCTACT	GCAATGACGAATCGAACAGCACA
	<i>CRD</i>	TGGATCTAACATGACACGCACCCA	ACTGTAACGGCATTCTCTCCGGT
	<i>DVR</i>	TTCTTCGAGAGGGTGATCAGGGAA	GAAACTGGCAATGGCAGCCAAGAA
	<i>POR</i>	TCGTCGGCCTCGTCTGAGTTATT	AGGCCTCTCACTGAAAGCTGAA
	<i>CHLG</i>	CCAGCCACTGATGAAAGCAGCAAT	AGAGCGCTAACACTCGCGAACAA
	<i>CAO</i>	ACACCTTCATCTGGGCTCAAGGA	AGATGCGTGAACATTGCTTGGTG
	<i>OshemA</i>	CCGACCGGTACATGAAGGAAAG	GCAAGTTCTCACGCATCTCCAC
	<i>Actin1</i>	TGCTATGTACGTCGCCATCCAG	AATGAGTAACCACGCTCCGTCA

Evolutionary descriptions			
Phyletic Profile	19 genes in 10 species (out of 12) single copy in 4 species, multi-copy in 6 species		(?)
Evolutionary Rate	0.80		(?)
Gene Architecture	Median Protein Length 535 (std. 42.8) Median Exon Count 3 (std. 1.13)		(?)
Orthologs by organism			
	Organism Protein ID UniProt Description	AAs	InterPro
Aegilops tauschii, genome GCF_001957025.1			
LOC109773670 glutamyl-tRNA reductase 1, chloroplastic			
LOC109785066 glutamyl-tRNA reductase 3, chloroplastic			
LOC109758780 glutamyl-tRNA reductase 2 isoform X1>			
Ananas comosus, genome GCF_001540865.1			
LOC109714137 glutamyl-tRNA reductase 2>			
LOC109705892 glutamyl-tRNA reductase 2>			
Brachypodium distachyon, genome GCF_000005505.3 (<i>annual false brome;false brome;purple false brome</i>)			
LOC100841654 (I1I561) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
LOC100843576 (I1HZT0) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
Oryza brachyantha, genome GCF_000231095.1			
102708094 (J3N3V5) Glutamyl-tRNA reductase>>		IPR000343 36343 15895 18214 36291 06151 364	
Oryza sativa Japonica Group, genome GCF_001433935.1 (<i>Japonica rice</i>)			
HEM1_ORYSJ (P0C587) Glutamyl-tRNA reductase, chloroplastic>>		IPR036343 00343 15895 18214 36291 06151 364	
Panicum hallii, genome GCA_002211085.1			
PAN46616.1			
Setaria italica, genome GCF_000263155.2			
LOC101762832 (K4A8A1) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
Sorghum bicolor, genome GCF_000003195.3 (<i>broomcorn;milo</i>)			
CSWWF1_SORBI (CSWWF1) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
CSY8W9_SORBI (CSY8W9) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
Triticum urartu, genome GCA_000347455.1			
M7YLM0_TRIUA (M7YLM0) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
M7YBM7_TRIUA (M7YBM7) Glutamyl-tRNA reductase>>		IPR013103 36343 00343 15895 18214 36291 061	
M7ZOT9_TRIUA (M7ZOT9) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
Zea mays, genome GCF_000005005.2 (<i>maize</i>)			
100193466 (B4FF46) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	
LOC103626130 glutamyl-tRNA reductase, chloroplastic			
100191548 (B4F970) Glutamyl-tRNA reductase>>		IPR036343 00343 15895 18214 36291 06151 364	

Appendix C Homologs of OsHemA shown in Poales. Homologs of OsHemA protein were searched in Orthologs Database by organism. Among the 10 species in Poales, 4 species have a single copy in and 6 species have multi-copy. The protein IDs were shown in the ‘Orthologs by organism’ panel.



Appendix D Amplification plots and melt curves of *OsHemA* gene and its reference gene *Actin1*. Amplification plots and melt curves of *OsHemA* gene and its reference gene *Actin1*. A, amplification plot of *OsHemA* gene. B, amplification plot of *Actin1* gene. C, melt curve of *OsHemA* gene; (B) Melt curve of *Actin1* gene. All the figures were from one of the tissue expression pattern experiments, drawing by ABI 7500 software version 2.3.

Appendix E Comparison of agronomic traits of wild-type (WT) and mutant *cbd1*

	Plant height (cm)	Effective tiller number	Number of primary branches per panicle	Flag leaf length (cm)	Flag leaf width (cm)	Main panicle Length (cm)	Number of full grains per panicle	1000-grain weight (g)
WT	111.41±1.84	9.94±2.31	12.80±0.56	86.6±3.7	2.08±0.09	17.49±0.44	177.15±9.49	27.13±0.12
<i>cbd1</i>	112.97±2.33	9.41±1.62	13.53±0.92	84.1±4.2	2.05±0.10	17.95±0.93	195.95±14.36**	27.27±0.29

** Significant at P<0.01 compared to WT by student T test.