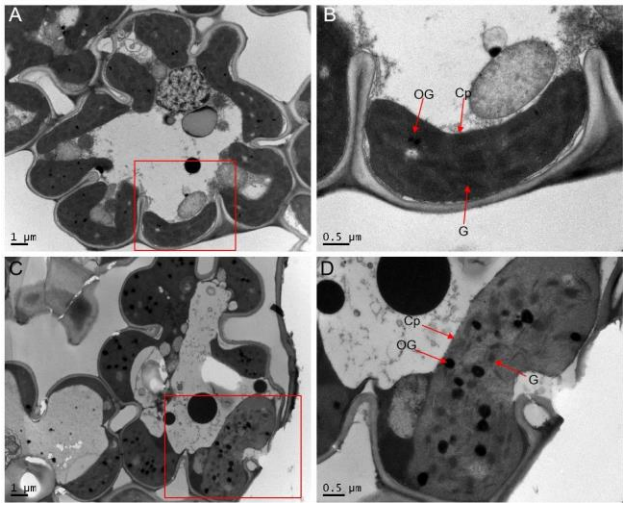
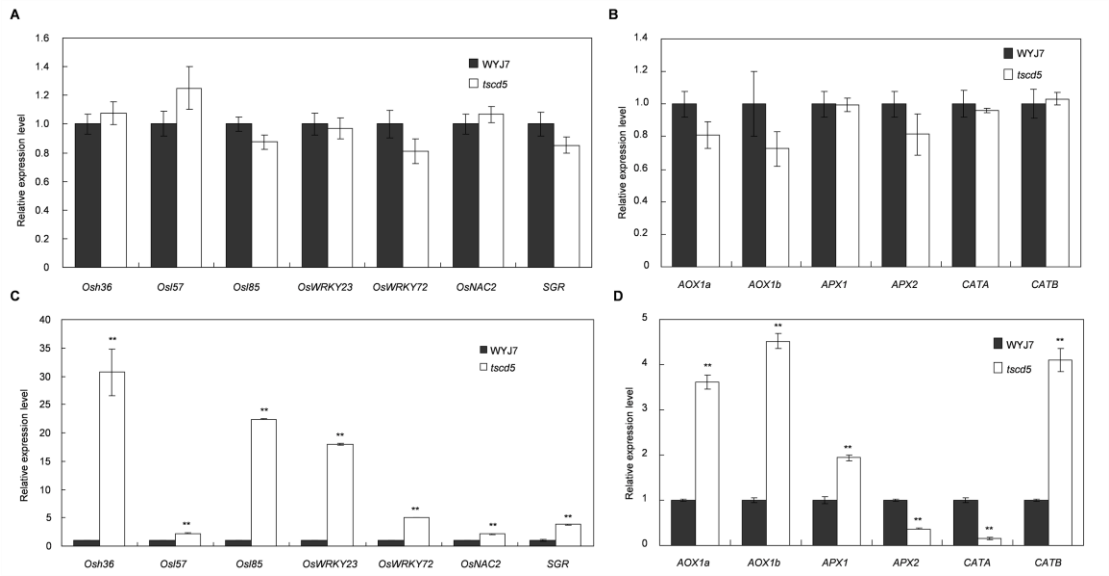


Supplementary Figure S1. Transmission electron microscopy observation of chloroplasts in WYJ7 and the *tscd5* leaves.

(A, B) Chloroplasts structure from WT and *tscd5* at tillering stage under natural high-temperature field conditions (Scale bar = 1 μm). (C, D) are enlargements of a-b respectively (Scale bar = 0.5 μm). CP chloroplast; G granum; OG osmiophilic granule.

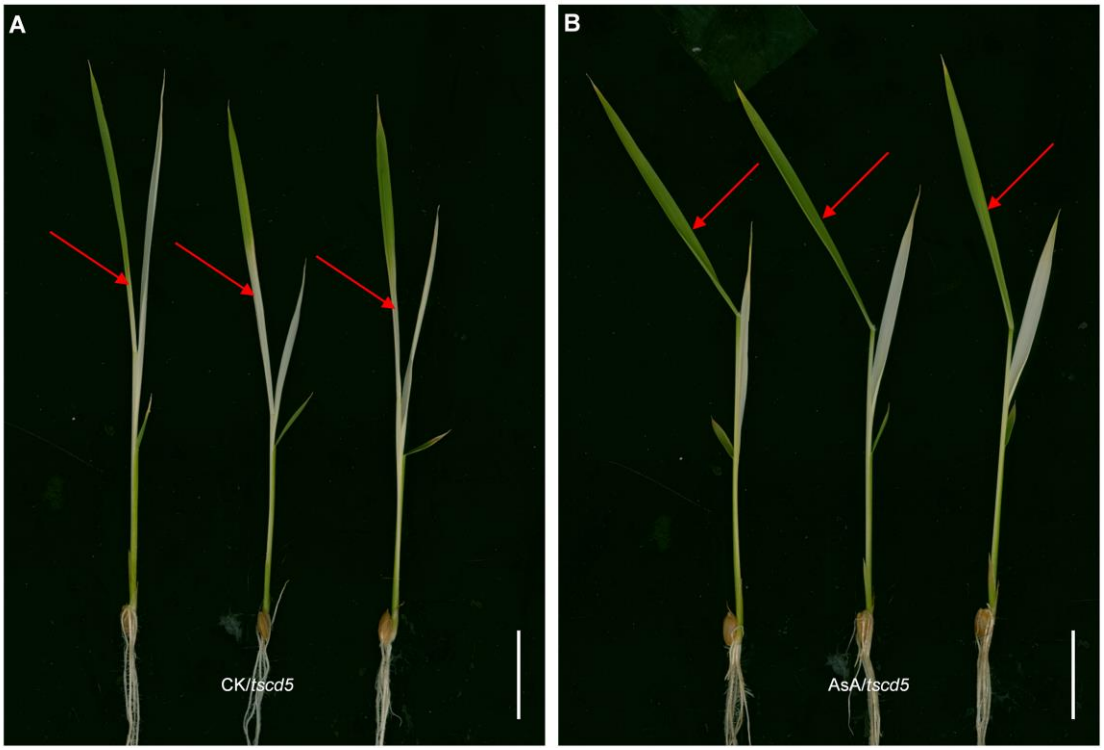


Supplementary Figure S2. Alteration in expression level of senescence and ROS related genes in *tscd5*. (A-B) Expression of genes associated with senescence (A) and ROS (B) in WYJ7 and *tscd5* mutant at 25°C. (C-D) Expression of genes associated with senescence (C) ROS (D) in WYJ7 and *tscd5* mutant at 35°C. *Histone* was used as a control for qRT-PCR. The expression level of each tested genes in WYJ7 was set to 1.0. Mean ± SD n = 3, ** extremely significance at $P < 0.01$ (Student's *t*-test).

Supplementary Figure S3. Sequence alignment and phylogenetic analysis of

TSCD5.

(A) Alignment of TSCD5 protein homolgs from 9 plant species. Blue or pink shades indicate fully or partially conserved amino acid. (B) Phylogenetic tree of TSCD5. Protein sequences include *Oryza sativa Japonica* Group (OsTSCD5 XP_015640505.1) *Panicum miliaceum* (PmTSCD5 RLN01033.1) *Zea mays* (ZmTSCD5 ACG27905.1) *Brachypodium distachyon* (BdTSCD5 XP_003568467.1) *Setaria italica* (SiTSCD5 XP_004962111.1) *Triticum turgidum subsp. durum* (TtTSCD5 VAH07338.1) *Poa pratensis* (PpTSCD5 AXS78096.1) *Aegilops tauschii subsp. tauschii* (AtTSCD5 XP_020161542.1) *Sorghum bicolor* (SbTSCD5 XP_002441088.1).



Supplementary Figure S4. Effect of exogenous ascorbic acid (AsA) on the *tscd5* mutant. (A, B) The phenotype changes in new leaves of *tscd5* mutant seedlings that were untreated or pretreated with an exogenous application of 1mM AsA when they were transferred from the 25°C to the 35°C condition at the 2-leaf stage. Scale bar = 2 cm. (A) CK control check; (B) 1 mM AsA.