**Supplemental Figure S1.** T-DNA insertion site and transgenic *MGT6* complement.

(A) *MGT6* (At3g58970) contained three exons (black box). The T-DNA insertion site is indicated, and PCR amplification was performed using the primers MGT6ID-F and MGT6ID-R. (B) Genomic sequencing of the mgt6 mutant revealed one T-DNA insertion in the third exon of *MGT6*. (C) The DNA fragment of the *MGT6* complementation mutant was cloned by primers CMGT6-F and CMGT6-R. The transgenic complementation plants were identified by PCR. (D) Phenotype of *MGT6* complementation plants. *MGT6* could fully complement the phenotype of mgt6 and *MGT6*+/-. Bars, 1.5 cm. (E) Alexander staining of the anthers of WT and *MGT6* *MGT6*+/-- complementation plants. Bars, 1 mm.
Supplemental Figure S2. Phenotype of mgt6 under different Mg conditions.

(A) Size of leaves of WT and mgt6 under 100 μM Mg conditions. (B) Young seedlings of WT and mgt6 under different Mg conditions. The developmental defects of mgt6 were rescued under 1 mM Mg conditions. Bars, 1 cm.
Supplemental Figure S3. Phenotype of MGT6+/− and cas9MGT6+/− mutants.

(A) WT and T-DNA insertion mutants of MGT6+/− plants were grown in soil supplied with 100 μM Mg. The MGT6+/− plants have short siliques, indicating reduced fertility. Bars, 1.5 cm. (B) CRISPR/Cas9 was used to generate a heterozygous mutant of MGT6 (cas9MGT6+/−) that has reduced fertility. PCR-based sequencing indicated a frame-shift mutation in the codon region of MGT6. The cas9MGT6+/− plants show short siliques with normal vegetative development. Alexander staining indicated that most pollens were abortive in the anthers of the cas9MGT6+/− mutant. The numbers of seeds in each silique indicating the fertility of cas9MGT6+/− were severely reduced. Bars, 1.5 cm. The means are shown with ± SDs of two biological repeats, n > 10. A two-sample t-test was used to evaluate statistical significance compared with the WT (**P < 0.01).
Supplemental Figure S4. Expression of MGT6 in mgt6, MGT6+/− and WT under different Mg conditions.

(A) The MGT6 transcript was not detected in the mgt6 inflorescences. (B) Expression of MGT6 in the WT, MGT6+/− and mgt6 mutant inflorescences as measured by quantitative RT-PCR. The expression is normalized to that of Tubulin and is presented relative to MGT6 expression in the WT. The data are presented as the means ± SDs of three biological replicates. A two-sample t-test was used to evaluate statistical significance compared with the WT (*P < 0.05, **P < 0.01). (C) qRT-PCR-based analysis of MGT6 expression in WT flower buds under different Mg conditions. The WT plants were grown in the hydroponic cultivation system under long days in the presence of 50 μM, 100 μM, 1 mM, 5 mM and 10 mM magnesium sulfate. The expression level is normalized to that of Tubulin and compared with that of the WT at 50 μM. The error bars indicate SDs and were calculated from three biological replicates.
**Supplemental Figure S5.** GUS staining of *promoterMGT6::GUS* and WT siliques, and the expression of *MGT6* in different tapetum defective mutants.

(A) GUS signal was observed in siliques of plants transformed with the *promoterMGT6::GUS* construct. The white arrowhead indicates GUS staining. (B) No observable GUS signal was detected in the WT inflorescences. Bars, 1 mm. (C) Expression of *MGT6* in the WT, *dyt1*, *tdf1*, *ams*, *myb80* and *tek* mutants inflorescences as measured by quantitative RT-PCR. The expression is normalized to that of Tubulin and is presented relative to *MGT6* expression in the WT. The data are presented as the means ± SDs of three biological replicates.
**Supplemental Figure S6.** Phenotypes of WT and *mgt5* under low-temperature conditions. (A-B) WT and *mgt5* were grown under 18 °C conditions. The photoperiod was set to 16/8 hours (light/dark). Bars, 1.5 cm. (C) Quantitative analyses of flower bud development time for WT and *mgt5* under 23 °C and 18 °C conditions. The means are shown as ± SDs of three biological repeats, n > 30. A two-sample *t*-test was used to evaluate statistical significance compared with the *mgt5* under 23°C (**P < 0.01).
Supplemental Figure S7. Phenotypes of WT and $MGT6^{+/-}$ under short-photoperiod conditions.

(A-C) WT and $MGT6^{+/-}$ were grown under long-photoperiod and short-photoperiod conditions. The photoperiod was set to 16/8 h (light/dark) or 8/16 h (light/dark). Bars, 1.5 cm. (D) Quantitative analyses of flower bud development time for WT and $MGT6^{+/-}$ under short-photoperiod condition. The means are shown as ± SDs of three biological repeats, n > 10. A two-sample t-test was used to evaluate statistical significance compared with the WT (*P < 0.05).
Supplemental Figure S8. Phenotype of MGT6+/− under different Mg conditions.

(A) MGT6+/− plants grown in the hydroponic cultivation system under normal photoperiod in the presence of 100 μM, 5 mM, and 10 mM magnesium sulfate (Mg). Bars, 1.5 cm. (B) Alexander staining of the anthers from MGT6+/− plants grown in the presence of different Mg concentrations. Bars, 1 mm. (C) The number of seeds in each filled siliqua from WT and MGT6+/− plants grown in the presence of different Mg conditions. The means are shown with ± SD for three biological repeats, n > 10. A two-sample t-test was used to evaluate statistical significance compared with the WT (**P < 0.01).