Supplementary data

Table S1. Sequences of probes and primers used in this study.

Probes and Primers	Sequences
MiR165-A	5’-GGGGGATGAAGCCTGGTCCGA-3’
MiR165-S	5’-TCGGACCAGGCTTCATCCCCC-3’
YWLH5	5’-CSATCCAGTCAGAMWCYA-3’*
LH3	5’-AAGTCGACTTATGCTGGCTTGCTTCT-3’
REV-F	5’-TGCTCCACTTGTTCCCTC-3’
REV-R	5’-TAGCCTTACGACCCGATT-3’
FIL-F	5’-ACCGTAACTGTCCGATGT-3’
FIL-R	5’-GAGCCCGAAGTGTATGTG-3’
ACTIN-S	5'-TGGCATCAYACTTTCTACAA-3'*
ACTIN-A	5'-CCACCACTDAGCACAATGTT-3'*
REV-RT-R3	5'-AACTTCAAGGCTCCTACAGTCACG-3'
REV-RT-F3	5'-GAATAGTCCTGCTGGATTGCTCTCA-3'
AtPHB-RT-1S	5'-TTTCTATAGCAGAGGAGGCCC-3'
AtPHB-RT-1A	5'-AGGAGCATACATCTGCGTGT-3'
AtPHV-RT-1S	5'-TCTTCTCTCGATTGCGGA-3'
AtPHV-RT-1A	5'-CTGAGTGTTGACAAGCTCGA-3'
AtCNA-S1	5'-CAGCACCAATTGGCATCTCAA-3'
AtCNA-A1	5'-CAGCCAGAAATCGCGTGGT-3'
ATHB8-211-1S	5'-GAAAAACAGCGAAAAGAGG-3'
ATHB8-477-1A	5'-GGACAATAATCCAGCAGGA-3'

* S=C/G, M=A/C, W=A/T, Y=C/T, D=A/G.

Table S2. Parameters of *hyl1* flower organs.

Genotypes	Stamen number per anther[a]	Length of long anthers[b] (μm)	Length of short anthers[b] (μm)	Anther size[c] (mm^2)
WT	6.0 ± 0.2	2315 ± 185	1789 ± 157	0.14 ± 0.0015
hyl1	5.2 ± 0.7	1833 ± 430	1257 ± 298	0.05 ± 0.0017

[a] More than 95 flowers of *hyl1* and wild type from 10 plants were analyzed.

[b] 413 LS (long stamen) and 140 SS (short stamen) from 10 plants were observed.

[c] More than 95 *hyl1* and wild-type anthers from 10 plants were measured, respectively.

Each value is the mean ± SD.

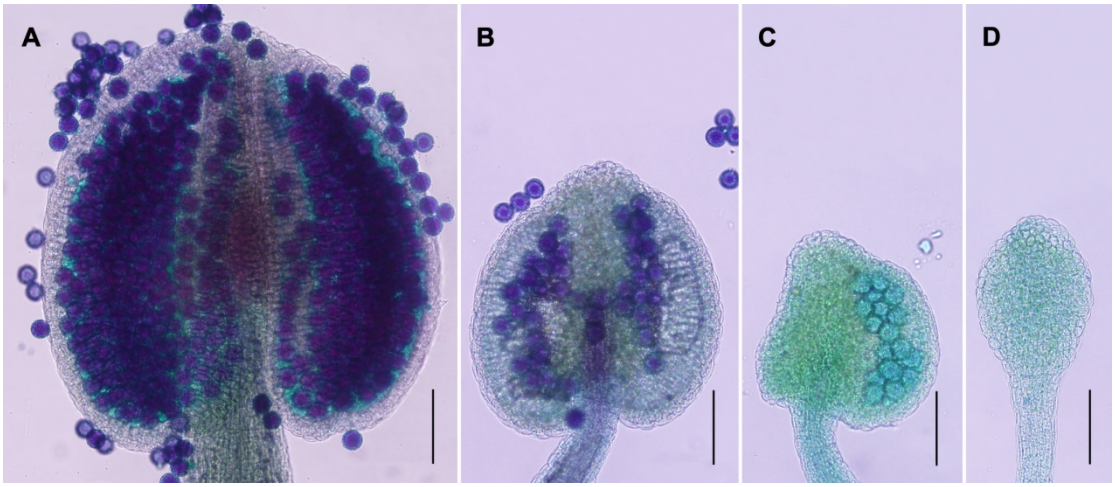

Fig. S1. Detection of pollen viability in anthers stained by Alexander's red. (A) Wild-type anther at stage 13, where plenty mature pollens were released and stained in red. (B-D) Anthers of *hyl1* flowers at anthesis. (B) An1 anther from which a small number of viable pollens stained in red were released. (C) An2 anther containing a few of unviable pollens in green within one microsporagium. (D) An3 anther without any pollen. Scale bars: 100 μm in A-D.

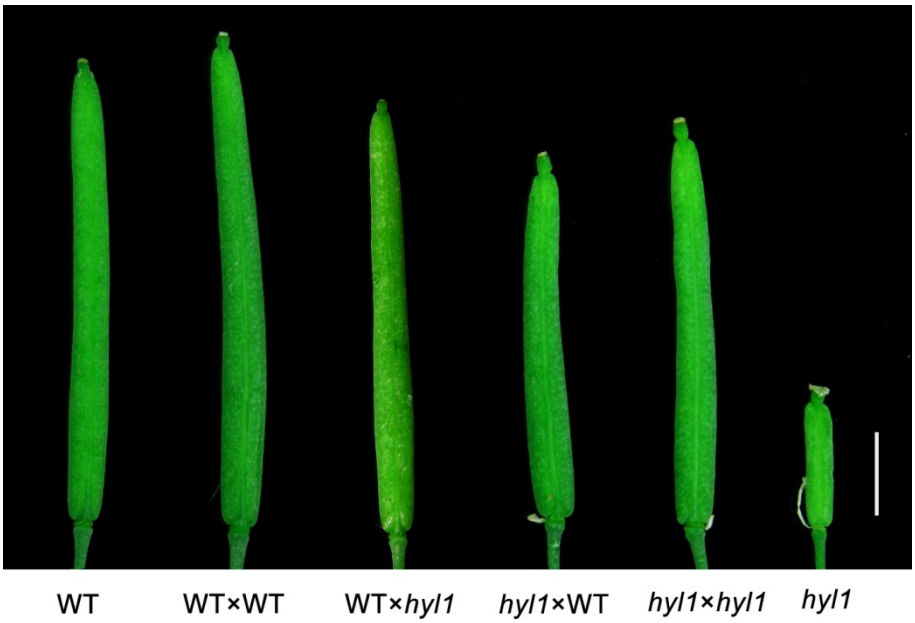

Fig. S2. Siliques of the female plants after crossing by hand pollination. WT, Natural self-pollination of a wild-type plant; WT×WT, hand-aided self-pollination of a wild-type plant; WT×*hyl1*, hand-aided pollination of a wild-type plant with *hyl1* pollens; *hyl1*×WT, hand-aided pollination of a *hyl1* plant with the wild-type pollens; *hyl1*×*hyl1*, hand-aided pollination of a *hyl1* plant with *hyl1* pollens; *hyl1*, natural self-pollination of *hyl1* plant. Scale bar: 1 mm.

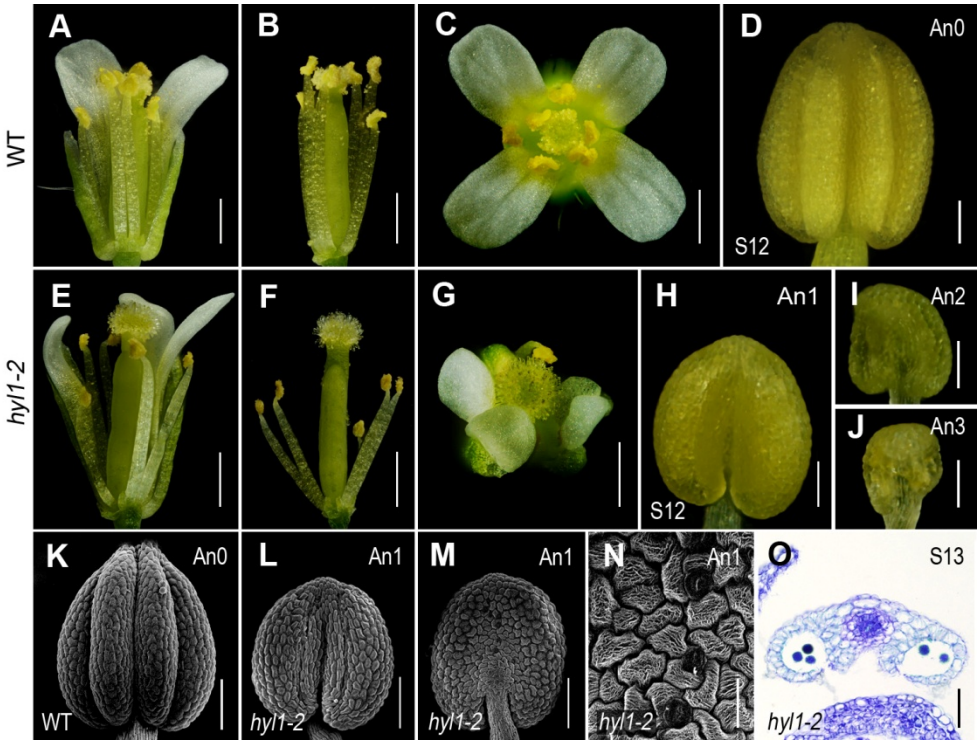

Fig. S3. Anther phenotype of *hyl1-2* mutant. (A-D) The wild-type (col). (A) An opened flower. (B) The same flower of (A) where all sepals and petals were cut off to show stamens and pistil. (C) Overview of the opened flower. (D) An anther at late stage 12. (E-I) *hyl1-2* mutants. (E) An opened flower in which one sepal and one petal were cut off. (F) All sepals and petals were cut off to show stamens and pistil. (G) View over the opened flower. (H-J) Three types of *hyl1* anthers. (H) An1. (I) An2. (J) An3. (K-N) SEM images of anthers. (K) View from the front of wild-type anther at stage 12. (L) View from the front of An1 anther at stage 12. (M) View from the back of An1 anther. (N) Epidermal cells from abaxial region of An1 anther. (O) Cross section of An1 anther at stage 13. An0, wild-type anther; An1, two-functional-microsporangium anthers; An2, anthers with one or two unfunctional microsporangia; An3, aberrant anthers without any microsporangium; S12, anther stage 12; S13, anther stage 13. Scale bars: 500 μm in A-C, E-G; 100 μm in C, D, H-M; 20 μm in N; 50 μm in O.

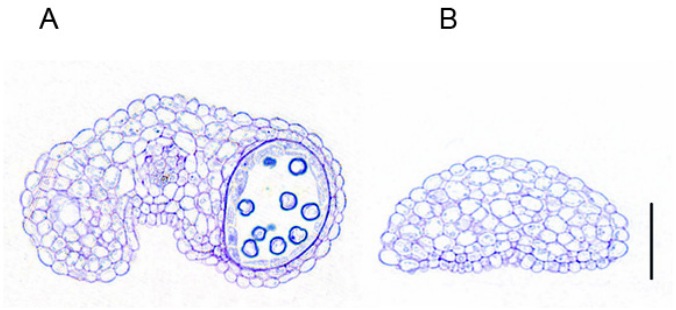

Fig. S4. Cross sections of An2 and An3 anthers of *hyl1* mutants at stage 10. (A) An2 anther containing only one locule. (B) An3 anther without any locule.