

20. Mapping of gametophytic pollen sterility mutant loci, *gps4*, *gps5*, *gps6* and *gps12* in rice

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The rice mutants *gps1-gps12* (*gametophytic pollen sterility*) induced by gamma-irradiation were identified for understanding the pollen development (Yamagata et al., 2007). These mutants cause selective abortion of pollen grains carrying mutant alleles. Heterozygotes for *gps4*, *gps5*, *gps6* and *gps12* showed 54.1%, 48.8%, 50.1% and 51.6% of pollen fertility, respectively, and normal spikelet fertility (Fig. 1 and Yamagata et al., 2007). Here we report linkage mapping of these four genes.

Because homozygotes of *gps4*, *gps5*, *gps6* and *gps12* were not obtained, the heterozygotes were used as seed parents for crossing with a Japonica cultivar Hinohikari to obtain the F₂ mapping populations. Evaluation of pollen fertility and linkage mapping followed Yamagata et al. (2007).

In the F₂ population of *gps4*, normal and semi-sterile plants segregated in a 1:1 ratio (normal: semi-sterile = 46:34, χ^2 for 1:1 = 1.80, 0.50 < P < 0.75). This segregation indicated that the semi-sterility observed in this F₂ population was controlled by the single male gametophytic gene, *gps4*. Linkage analysis showed that *gps4* was located between the SSR markers, *RM5271* and *RM5689*, on chromosome 10 (Fig. 2A). Similarly, *gps5*, *gps6* and *gps12* were mapped on chromosomes 2, 7 and 8, respectively (Fig. 2B, C and D). In the genomic region near *gps4*, *gps5*, *gps6* and *gps12*, any previously reported gene or ortholog gametophytically acting in pollen formation in rice or *Arabidopsis* were not found. Gene cloning and detailed characterization of these mutants will provide novel understanding on male gametogenesis in rice.

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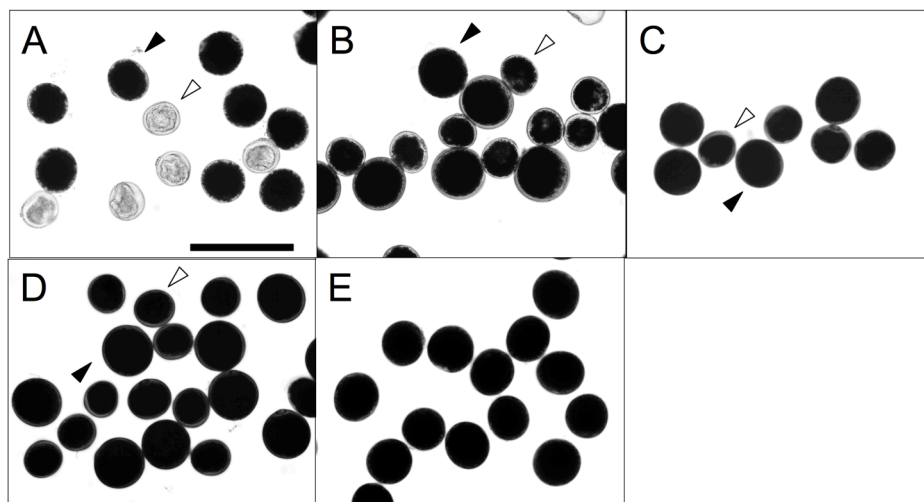


Fig. 1 Pollen of the *gps* heterozygotes used for the linkage analysis in this study.

A: *gps4*. B: *gps5*. C: *gps6*, D: *gps12* and E: T65.

Pollen were stained with I₂-KI solution. Bar = 100 μ m.

Black and white arrowheads indicate normal and sterile pollen grains, respectively.

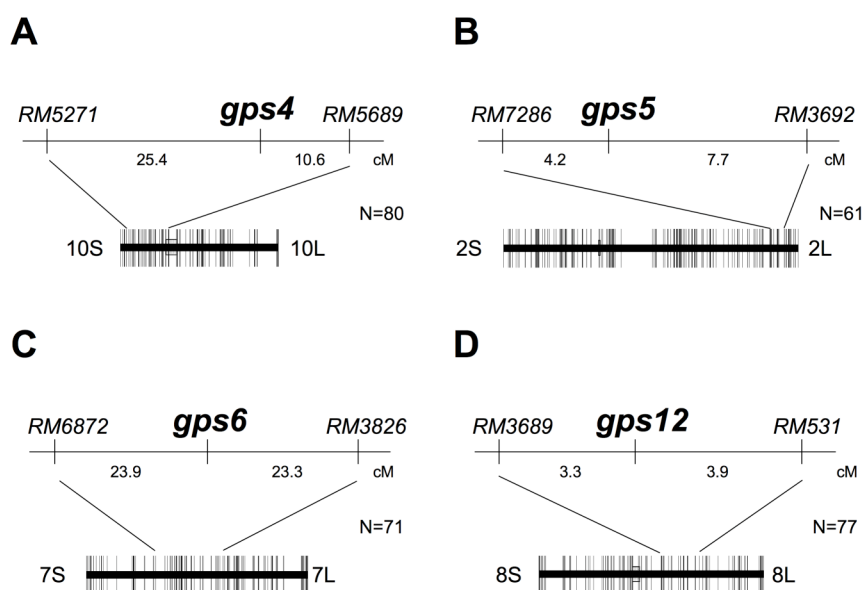


Fig. 2 Linkage maps showing the locations of the *gps4* (A), *gps5* (B), *gps6* (C) and *gps12* (D). The framework maps were quoted from Harushima *et al.* (1998) and SSR marker were of McCouch *et al.* (2002).

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