

12. A new gamete eliminator from *Oryza glaberrima*

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Rice is the staple food for the world and more than 90 percent of the crop is grown in developing country. In order to provide rice to the world's growing population, new varieties with the higher yield potential, wider adaptation, multiple resistance or tolerance for biotic or abiotic factors are essential. However, narrowing of the gene pool by further concentrating favorable alleles already presented in early domesticates, especially in plant domesticates by both farmers and breeders in past years.

Two rice species are cultivated for food production. *Oryza sativa* originated in Asia and is widely grown. *O. glaberrima* originated and is cultivated in West Africa, having some advantages such as early maturity, drought tolerance, resistance to rice yellow mottle virus, blast disease and African rice gall midge, and responsiveness to mineral fertilizer. Both species have same genome AA (Chang 1976, Morinaga et al. 1957). The high sterility of interspecific hybrids is a serious reproductive barrier (Jones et al. 1997, Morinaga et al. 1957, Morishima et al. 1962, Morishima et al. 1963, Sano et al. 1979, Sano 1983). They are isolated from each other by strong F₁ sterility barrier although their chromosomes (n=12) normally pair in the hybrid (Chu et al. 1969).

Hybrid sterility and introgression of the quantitative trait loci controlling many important agronomic traits are the key constraints for utilization of the *Oryza* relatives. In order to shed more light on these issues, sterility of interspecific hybrids controlled by QTLs in preliminary population was used as the study target and the genetics of hybrid sterility in the progenies of *O. sativa* x *O. glaberrima* hybrids was studied. Backcross experiments were conducted to introduce alien factors controlling hybrid sterility from *O. glaberrima* into *O. sativa* or from *O. sativa* into *O. glaberrima* (Sano 1990). We developed a series of *O. glaberrima* introgression lines in the background of *O. sativa* for genetic analysis of traits specific to the species. Large variation in pollen sterility was observed during development. One *O. glaberrima* accession, IRGC102375 introduced from the International Rice Research Institute, was used as female parent, and Danjingyou 1 (a *japonica* cultivar from Yunnan) was used as male parent to make the cross. Further backcrossing with Danjingyou 1 as a male parent was continued after pollen grain fertility check. Genotyping with 225 SSR markers was done in the BC₆F₁ sterile plants. One sterile plant with one heterozygous marker was selected to make BC₇F₁ secondary mapping population.

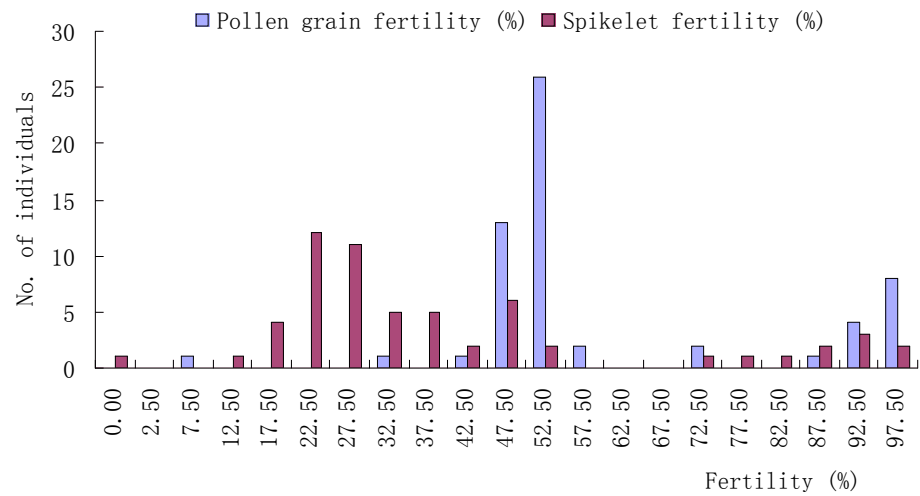


Fig. 1. Distribution of pollen and spikelet fertility in BC₇F₁ of IRGC102375/Dianjingyou 1/8/Dianjingyou 1.

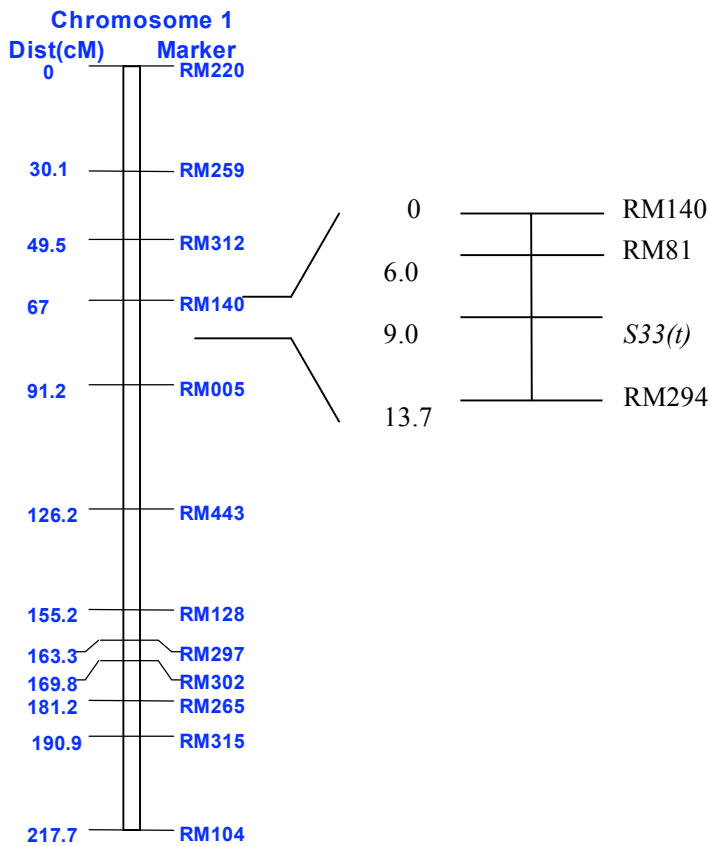


Fig. 2. Sterile gene mapping result in chromosome 1 from BC₇F₁ of IRGC102375/Dianjingyou 1/8/Dianjingyou 1 secondary mapping population.

Flowering spikelets were collected from each plant and stored in 70% ethanol. Pollen fertility was estimated as the percentage of pollen grains that could be stained with I2-KI solution.

BC₇F₁ population not fitted the expected 1:1 ratio, with more semi-sterile type ($X^2=29.9$, $p<0.005$). Distribution of spikelet fertility was near the same (Fig. 1), which means there was a gamete eliminator caused pollen grain and spikelet semi-sterility, but the role is not full (Sano 1990). This gamete eliminator was mapped on chromosome 1 as a new gene *S33* (t) between RM81 and RM294 since no gamete eliminator from *O. glaberrima* was reported in this region (Fig. 2).

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References

- Chang, T. T., 1976. The origin, evolution, cultivation, dissemination, and diversification of Asian and African rices. *Euphytica* 25: 425-441.
- Chu, Y. E., H. Morishima and H. I. Oka, 1969. Reproductive barriers distributed in cultivated rice species and their wild relatives. *Japan. J. Genet.* 44: 207-223.
- Jones, M. P., M. Dingkuhn, G. K. Aluko and M. Semon, 1997. Interspecific *Oryza sativa* L. X *O. glaberrima* Steud. progenies in upland rice improvement. *Euphytica* 92: 237-246.
- Morinaga, T. and H. Kuriyama, 1957. Cytogenetical studies on *Oryza sativa* L.. IX. The F₁ hybrid of *O. sativa* L. and *O. glaberrima* Steud. *Japan. J. Breed.* 7: 57-65 (English with Japanese summary).
- Morishima, H., K. Hinata and H. I. Oka, 1962. Comparison between two cultivated rice species, *Oryza sativa* L. and *O. glaberrima* Steud. *Japan. J. Breed.* 12: 153-165 (English with Japanese summary).
- Morishima, H., K. Hinata and H. I. Oka, 1963. Comparison of modes of evolution of cultivated forms from two wild rice species, *Oryza breviligulata* and *O. perennis*. *Evolution* 17: 170-181.
- Sano, Y., Y. E. Chu and H. I. Oka, 1979. Genetic studies of speciation in cultivated rice, 1. Genic analysis for the F₁ sterility between *O. sativa* L. and *O. glaberrima* Steud. *Japan. J. Genet.* 54: 121-132.
- Sano, Y., 1983. A new gene controlling sterility in F₁ hybrids of two cultivated rice species. *J. of Heredity* 74: 435-439.
- Sano, Y., 1990. The genic nature of gamete eliminator in rice. *Genetics* 125: 183-191.