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Short Communication

# Inheritance pattern of spikelet fertility restoration in hybrid Rice

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The information on the genetic control of fertility restoration of cytoplasmic male sterility system facilitates formulation of effective breeding plans for efficient transfer of fertility restoring genes to promising breeding lines and subsequently contributes to the development of superior restorer lines. The present study was undertaken to elucidate the genetic basis of fertility restoration ability of two restorers of wild abortive cytoplasmic male sterility in rice.

The cross combinations involving wild abortive cytoplasmic male sterile line PMS 2A and restorers IR 54 and PRR 22 constituted the basic experimental materials for the inheritance of fertility restoration studies during *kharif*, 1999 at the Indian Agricultural Research Institute, New Delhi. The $F_1$ and $F_2$ plants of these crosses were transplanted using single seedling per hill at a spacing of 20 cm between rows and 10 cm between plants within the row. Spikelet fertility of the hybrids was taken as the basis of classification of $F_2$ plants segregating for fertility restoration. The plants were classified as completely sterile (0%), semisterile (1-40%), semifertile (40-70%) or fully fertile (> 70%) based on observation on spikelet fertility restoration [1-3]. The goodness of fit to Mendelian segregation pattern of plants segregating for fertility restoration was tested by chi-square technique.

The segregation pattern for spikelet fertility restoration corresponded with digenic mode of inheritance in both the crosses (Table 1). The two independently segregating fertility restoring genes present in these restorers exhibited recessive epistatic interaction as evident from goodness of fit of segregation data on fertile, semifertile, semisterile and sterile plants to an epistasis with recessive gene action (9:3:4). The fertility restoring action of one of the genes seemed to be stronger than the other as the presence of one *of the genes alone conferred semifertility. Thus,* homozygous condition for the recessive alleles of any one of the two genes but homozygous or heterozygous condition of the dominant alleles of the other gene resulted into semifertile or semisterile/sterile plants depending upon which of the two alleles was stronger or weaker. The expressivity of the weaker fertility restoring gene appeared to vary with the genotypes of individual plants in segregating progenies as a result of which segregating plants were semisterile or completely sterile. Furthermore, the two genes appeared to have additive effects in imparting fertility restoration since the presence of both the dominant genes imparts full fertility in the plants possessing male sterility inducing cytoplasm. These results were in confirmity with the earlier reports suggesting the role of digenic recessive epistatic interaction in the inheritance of fertility restoration of wild abortive cytoplasmic male sterility system [3-6].

**Table 1.** Segregation for restoration of spikelet fertility in $F_2$ populations

| Cross combination | Segregation pattern | | | | Genetic ratio | Probability |
|---|---|---|---|---|---|---|
| | FF | SF | SS | CS | | |
| PMS 2A × IR 54 | 94 | 48 | 14 | 36 | 9:3:4* | 0.05-0.10 |
| PMS 2A × PRR 22 | 96 | 41 | 14 | 45 | 9:3:4* | 0.10-0.20 |

FF : Filly fertile, SF : Semi fertile, SS : Semi sterile, CS : Completely Sterile

* Segregation pattern by pooling semisterile and completely sterile plants together

The mode of action of the restorer genes existing in IR 54 corresponded to an epistasis with recessive gene action in the present investigation in contrary to an epistasis with incomplete dominance as reported earlier [3]. The differential mode of action of restorer genes could presumably be due to the influence of female parent genotype or due to variable expression of the weaker gene in different genetic backgrounds. The differential segregation behavior could also be due to the existence of certain modifiers influencing the *penetrance and expressivity of fertility restoring genes.* Penetrance and expressivity of the fertility restoring genes are known to be affected by the genotype of the parents in a cross as well as by the genotypes of individual plants in segregating progenies [7].

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