

Chemical Hybridizing Agents in Induction of Male Sterility in Rice (*Oryza sativa* L.)

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Abstract

Effect of two chemical hybridizing agents (CHA's) viz., maleic hydrazide (MH) and 2,4-D on inducing pollen sterility in rice and its effective concentration is studied. The level of the efficacy differed with the chemical and its concentrations and also the spraying stage. Among the formulations studied maleic hydrazide at 0.2% induce more pollen sterility as compared with its other concentrations and the different 2,4-D formulations in both (R 24 and Palghar 1) the varieties of rice.

Key words : Rice, Pollen sterility, Chemical hybridizing agents, Maleic hydrazide, 2,4-D.

In conventional methods used in the improvement of self-pollinated crops, genetic recombination is restricted since populations rapidly approach homozygosity under selfing. Use of genetic male sterility has permitted breeders to more easily utilize the repeated hybridization and selection cycles in several self-pollinated crops. The problems in the use of genetic male sterility relate to its maintenance, perpetuation and transfer. The transfer of male sterility may be accompanied by undesirable traits through linkage and pleiotropy. Since the pioneering work on the gametocidal property of maleic hydrazide in gladiolus and corn (1), a wide range of chemicals has been screened and many to selectively induce male sterility in crop plants. To overcome several potent gametocides at different formulations were tried since last many years, keeping in view that the chemicals must have least effect on female organ (2). Significant progress has been achieved in China on the use of gametocodes in rice (3). The present study was conducted to study the effect of two chemical hybridizing agents on inducing pollen sterility and its effective concentration.

Methods

The pot culture experiment was conducted at the green house of Botany Department, College of Agri-

culture, Dapoli, Dist. Ratnagiri during the *kharif* of 2007, using two chemical hybridizing agents viz., maleic hydrazide (MH) and 2,4-D on Ratnagiri-24 (V_1) and Palghar-1 (V_2) cultivars of rice.

The pot culture experiment was laid out in simple randomized block design with three replications. The chemical hybridizing agents viz., maleic hydrazide (MH) and 2,4-D were used at three concentrations i.e. maleic hydrazide (MH) 0.05, 0.1 and 0.2%, whereas 2,4-D at 0.1, 0.2 and 0.4%. The chemical hybridizing agents were applied as foliar sprays at booting stage. Twelve plants were treated in each treatment. The spikelets which were about to bloom were collected

Table 1. Effect of different concentrations of gametocides on pollen sterility in rice.

Treatments	Pollen sterility (%)		Tr means
	V_1	V_2	
T ₁ Control	9.77	9.45	9.61
T ₂ 2,4-D-0.1%	75.67	79.00	77.33
T ₃ 2,4-D-0.2%	82.67	75.67	79.17
T ₄ 2,4-D-0.4%	86.33	84.33	85.33
T ₅ MH-0.05%	74.67	71.00	72.83
T ₆ MH-0.1%	80.00	82.00	81.00
T ₇ MH-0.2%	81.33	88.00	84.67
Var mean	70.06286	69.92143	
	Var	Treat	VXT
SE ±	0.627	1.172	1.658
CD (5%)	NS	3.407	4.819

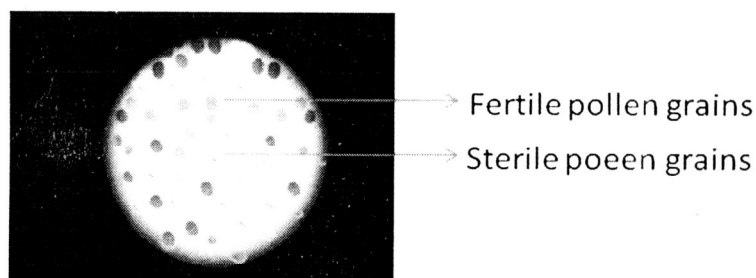


Figure 1. Microscopic observations of male sterile (pinkish) and fertile (no stain or lightly stained) pollen grains.

randomly and stored in 70% alcohol. In the laboratory the anthers in each spikelet were crushed in the presence of 2% acetocarmine stain. The pollen grains which stained pinkish were considered as fertile and those which did not take the stain or lightly stained were classified as sterile (Fig. 1).

Results and Discussion

The mean observation on pollen sterility is presented in Table 1. There were significant differences on the induction of pollen sterility amongst the different treatments at all three sprays and between varieties except in one sprays. The maximum pollen sterility was observed in the treatment MH at 0.2% (88.00%) at three spray was much higher than the control (9.45). There was increase in pollen sterility with increase in concentration of the chemicals. MH induced higher pollen sterility at all the three concentrations than 2,4-D.

The analysis showed that the maximum pollen sterility in V_1 observed at T_4 (86.33%) followed by T_3 (82.67%) and T_7 (81.33%) as compared to T_1 (9.77%), while in V_2 maximum pollen sterility obtained at T_7 (88.00%) followed by T_4 (84.33%) and T_6 (82.00%) as compared to T_1 (9.45%).

The Palghar-1 variety, MH at 0.2% induced maximum pollen sterility (88.00%) as against the minimum (9.45%) in the control. MH caused deformation of anthers with pollen grain production low or absent, which became severe with increasing concentrations. There was an increase in the pollen sterility with increase in concentration of both the gametocides. This

is in agreement with the findings of Bose and Sharma (4) and Aswathanarayana and Mahadevappa (5), who reported that the pollen sterility increased with increase in concentration of gametocides.

Between the two stages i.e. booting and prebooting, we applied gametocides at booting stage. Because booting stage accounting for a higher pollen sterility has been confirmed earlier by Parmar et al. and Aswathanarayana and Mahadevappa (5). The higher pollen sterility at booting stage may be due to the fact that this stage coincides with the spikelet differentiation stage and reduction division stage leading to degeneration of pollen mother cell and resulting in higher pollen sterility. In hybrid rice breeding where almost complete male sterility is required, MH at higher concentration appeared to be more suitable.

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