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CROSSING EFFICIENCY IN INTER SPECIFIC HYBRIDZATION IN BRASSICA SPECIES

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ABSTRACT

Studies on crossing efficiency in interspecific hybridization in *Brassica* species was carried out in the research farm of Agril Botany Section, College of Agriculture, Nagpur during *rabi* 2020 by crossing three varieties from *Brassica juncea* (TAM 108-1, ACN-9, Kranti) and one variety from *Brassica carinata (*PC-6) both direct and reciprocal. The results revealed that when *juncea* was used as female parent the mean percentage success in crossing was 76.10 per cent as compared to 48.29 per cent when *carinata* was used as female parent. Maximum per cent success in hybridization was recorded in TAM 108-1 x PC-6 (92.80 per cent), followed by Kranti x PC-6 (77.30 per cent) and PC-6 x Kranti (63.78 per cent) and the least in PC-6 x TAM 108-1 (39.59 per cent). From the pollen studies it is observed that pollen fertility did not show much variation as compared to pollen size and pollen intensity. Maximum pollen size (2.98 µm) and fertility (98.1 per cent) was recorded in ACN-9, but it recorded the least pollen intensity (1.99 pollen mm^{-2}). Highest pollen intensity was observed in Kranti (6.59 pollen mm^{-2}). Thus, it is inferred that to get maximum seed set *juncea* should be used as female parent unless no cytoplasmically governed traits are concerned and in the interspecific hybridization efforts should also be intensified to get adequate F_1 seeds by increasing the frequency of emasculation and pollination so that limitations in seed set can be overcome.

(Key word: *Brassica* species, interspecific crosses, pollen studies)

INTRODUCTION

The increase in productivity in the oilseed Brassicas through breeding is not conspicuous like that in cereal crops. One reason is that the improvement of Brassicas has mostly been confined to the exploitation of the naturally occurring genetic variability in the cultivated species (Roy, 1980). *Brassica juncea* commonly cultivated in the Indian subcontinent has limited variability left for direct selection for higher yield. Genetic variability being limited, breeders need to resort to wide hybridization, which can be a viable method for incorporation of desirable characters including seed yield. Improvement of Brassica through interspecific hybridization by introgression of genes, which are otherwise not available, has been suggested by many workers. Keeping in view the limitations in the interspecific crosses (cross incompatability and F_1 plant sterility), this work was taken up to study the problems of inter specific hybridization using two species of Brassica.

MATERIALS AND METHODS

Three varieties from *Brassica juncea* namely TAM-108, ACN-9, Kranti and one variety i.e., PC-6 from *Brassica carinata* were chosen as parents for the crossing progrmme and crosses were made between *carinata* × *juncea, juncea* ×*carinata* during *rabi*, 2020 in the research farm of Agril Botany Section, College of Agriculture, Nagpur. Observations were recorded on number of pollinations made, number of siliquae set, number of seeds siliquae^{-1} in each cross. Pollen diameter, pollen fertility, pollen intensity were also recorded for each parents used in crossing programme according to the technique described by Robert (1977) and Vasil'eva (2009). Six inter-specific (three jn × cr and three cr ×jn) crosses were made in this study as mentioned in Table 1. Percentage success in hybridization was worked out for each cross as per the formula given by Vijaykumar *et al*. (1996).

$$\text{Per cent success in hybridization} = \frac{\text{No.of filled siliquae set}}{\text{No.of pollinations made}} \text{ X } 100$$

RESULTS AND DISCUSSION

The data on per cent success in hybridization are presented in Table 1 and Plate 1. Among the six interspecific crosses, percentage success in hybridization ranged from 39.59 per cent (PC-6 ×TAM-108) to 92.80 per cent (TAM-

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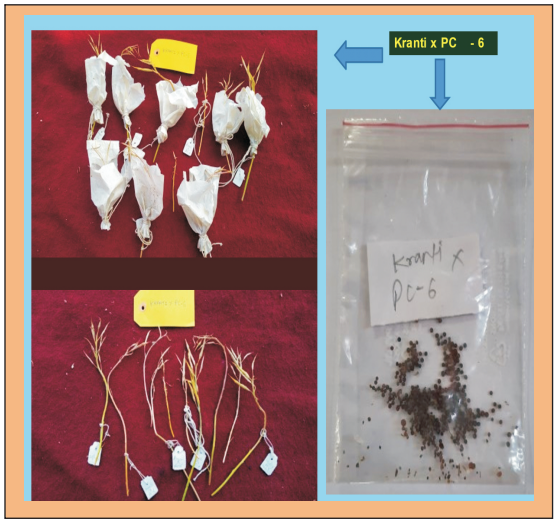
TAM 108 -1 x PC - 6
TAM 108-1 x PC-6


PC - 6 x TAM 108 -1
PC-6 x TAM 108-1

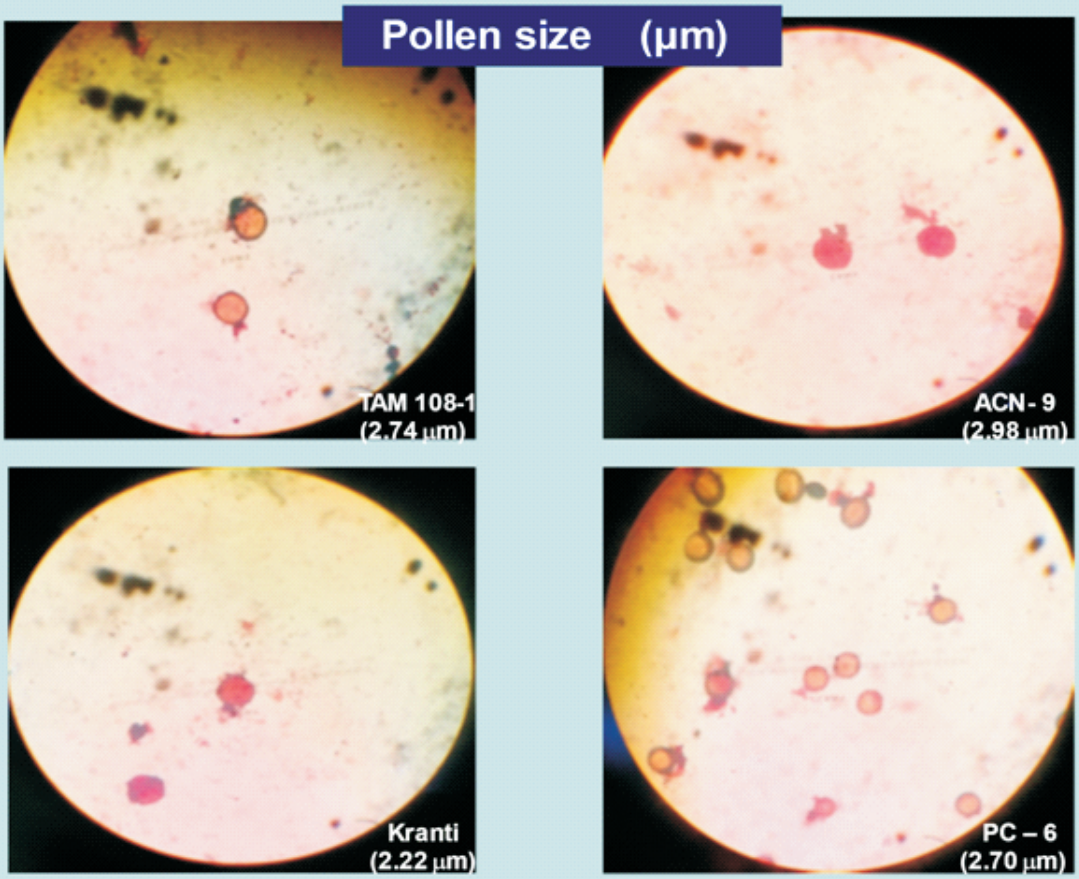

ACN - 9 x PC - 6
ACN-9 x PC-6


PC – 6 x ACN -9
PC-6 x ACN-9


Kranti x PC - 6
Kranti x PC-6


PC-6 x Kranti
PC-6 x Kranti

Pollen size (µm)



Pollen intensity (Pollen mm $^{-2}$)

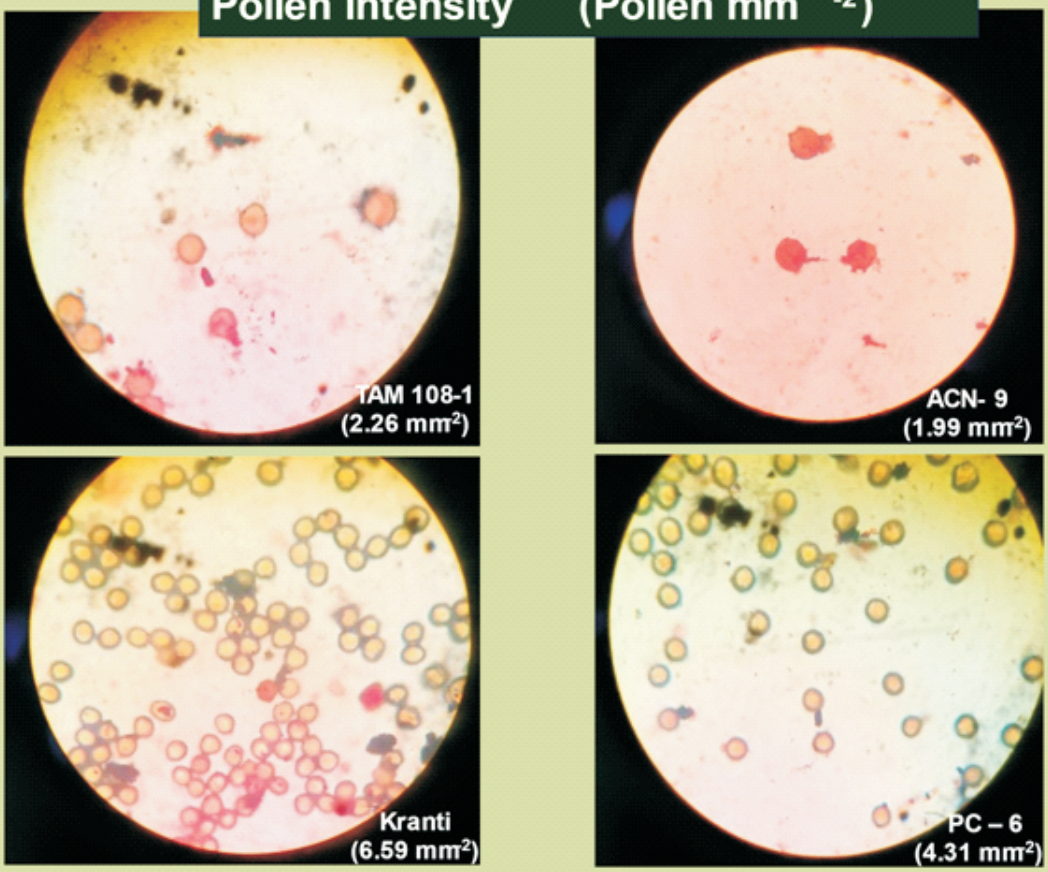


Table 1. Details of the success in interspecific hybridization

Crosses	Code	No. of pollination made	No. of siliquae set	Percentage success in hybridization
B. juncea* x *B. carinata				
TAM -108-1 x PC-6	T x P	154	143	92.80
ACN-9 x PC-6	A x P	189	110	58.20
Kranti x PC-6	K x P	150	116	77.30
			Mean	**76.10**
B. carinata* x *B. juncea				
PC-6 x TAM -108-1	P x T	197	78	39.59
PC-6 x ACN-9	P x A	130	54	41.50
PC-6 x Kranti	P x K	185	118	63.78
			Mean	**48.29**

Table 2. Pollen studies in the parents used in interspecific hybridization

Sr.No	Variety	Pollen diameter (µm)	Pollen fertility (%)	Pollen intensity (pollen mm^{-2})
1	TAM -108-1	2.74	97.30	2.26
2	ACN-9	2.98	98.10	1.99
3	Kranti	2.22	96.80	6.59
4	PC-6	2.70	96.70	4.31

108 ×PC-6). In the interspecific crosses, when *juncea* was used as female parent, the mean percentage success in crossing was 76.10 per cent. But when *carinata* was used as female parent the mean success was only 48.29 per cent. Similar to this result Bijral *et al.* (1993), Vijaykumar *et al.* (1996) and Patil *et al.* (2002) also reported significant difference in per cent success of hybridization in *Brassica* species which may be due to the effect of plasmogene, which is transmitted through the maternal parent. Maximum per cent success in hybridization was recorded in TAMS 108-1 x PC-6 (92.80 per cent), followed by Kranti x PC-6 (77.30 per cent) and PC-6 x Kranti (63.78 per cent).

The data related to pollen traits *ie*. pollen size (µm), pollen fertility (%) and pollen intensity (pollen /mm^2) are presented in Table 2 and Plate 2. Maximum pollen size when observed under microscope at 40X x 10X magnification was observed in ACN-9 (2.98 µm) followed by TAM 108-1 (2.74 µm) and PC-6 (2.70 µm). The least pollen size was observed in Kranti (2.22 µm). Pollen fertility in per cent did not show much variation among the varieties studied. Pollen fertility of *Brassica* varieties ranged from 96.70 per cent (PC-6) to 98.10 per cent(ACN-9) when observed under microscope at 40X x 10X magnification. Highest pollen intensity was recorded in Kranti (6.59 pollen mm^{-2}) followed by PC-6 (4.31 pollen mm^{-2}) and TAM 108-1 (2.26 pollen mm^2). The lowest pollen intensity was recorded in ACN-9 (1.99 pollen mm^{-2}). The low success in hybridization observed in the crosses involving ACN-9 as either male or female might be due to low intensity of pollen produced in ACN-9. In accordance to this result Pipino *et al.* (2010), Nadeem *et al.* (2011) and Atram *et al.* (2015) reported that the pollen size and pollen intensity varied from variety to variety in rose which has indirectly affected the success in hybridization.

It is inferred from this study that to get maximum seed set *juncea* should be used as female parent unless no cytoplasmically governed traits are concerned and in the interspecific hybridization efforts should also be intensified to get adequate F_1 seeds by increasing the frequency of emasculation and pollination so that limitations in seed set can be overcome.

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