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STUDY OF CROSSABILITY AND F_1 OF INTERSPECIFIC HYBRIDIZATION BETWEEN *BRASSICA RAPA (B. CAMPESTRIS)* AND *B. NIGRA*

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Abstract

Interspecific hybridization between yellow seeded variety, Binasarisha-6 of B. *rapa* var. Yellow Sarson ($2n=20$; AA) and Nigra-1 of *B. nigra* ($2n=16$; BB) were made. The crosses with Binasarisha-6 of *B. rapa* var. Yellow Sarson as a female parent were only successful. Chromosome number in root tip cells of the F_1 hybrids was 18, which was half of the sum total of the somatic chromosome number of the parents and indicated hybrid nature. Hybrids exhibited intermediate morphology between the parents. All the hybrids showed complete pollen sterility with shrivelled, pointed tip, and pale colour anthers and reduced filaments and failed to set siliquae and seeds.

Key Words **:** Interspecific hybridization, *Brassica rapa, B. nigra,* interspecific hybrid

Introduction

In *Brassica,* interspecific hybridization is a potential and useful method for transferring valuable traits between species of commercial interest (Rahman, 2001; Seyis *et al.,* 2003). It is also used to elucidate intergenomic relationships to develop synthetic amphidiploids and has been widely applied for improving *Brassica* (Choudhary *et al.,* 2002). In Japan, about 60% of the registered rape cultivars have been bred through interspecific crosses (Shiga, 1970). Further, the crossability study would give an idea on the cross compatibility relationship among the species, the direction of success of crossing and the crossability barriers of some combinations, if any.

The present study reports the interspecific crossability between *Brassica rapa* var. Yellow Sarson and *B. nigra* and study of F_1 hybrids through morphological and cytological studies.

Materials and Method

Binasarisha-6 of *B. rapa* and Nigra-1 of *B. nigra* were selected for the interspecific hybridization programme. Pot experiments were conducted during 2002-03 and 2003-04 cropping seasons at BINA experimental farm,

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Mymensingh. To get synchrony in flowering in Nigra-1 with Binasarisha-6, the Nigra-1 plants were exposed to 16 hours photoperiod for 15 days. Flower buds of the female parents supposed to open in the next morning were selected for emasculation. The emasculated buds were immediately pollinated with freshly collected pollens from the male parent and then bagged with thin brown paper bags. The siliquae bearing hybrid seeds were collected after proper maturation. To confirm the hybridity of the collected F_1 seeds, young root tips of the germinating seeds were used for mitotic chromosome counts. The young root tips were at first fixed in acetic alcohol (1:3) after pretreatment in saturated aqueous mono-bromonaphthalene solution for two and a half hours. The root tips were then heated in 10% HCI at 60°C for 12 minutes, and were stained with 1% acetocarmine on a slide. The individual chromosome was counted with microscope under oil emmersion. For pollen fertility study, anthers from F_1 flowers were taken directly in a drop of 1% acetocarmine on a slide, pressed gently, mounted with a cover slip and then examined under microscope. Pollen grains those were shrunken and not stained were classified as sterile. The ratio of stained pollens to the total was expressed as percentage of pollen fertility. Photographs were taken from semi-permanent slides.

Results and Discussion

Number of siliquae and seed setting in siliquae was fairly good in the cross between Binasarisha-6 and Nigra-1. Of the 134 crosses performed using Binasarisha-6 as female parent, 44 siliquae developed containing hybrid seeds giving 33% cross success. However, in their reciprocal crosses, not a single siliqua was developed, although 158 flower buds of Nigra-1 was pollinated with the pollens of Binasarisha-6. Crossability results of the present investigation are in agreement with the findings of Rahman (1981), Rao *et al.* (1993) and Choudhary *et al.* (2000), who reported that both-way cross do not yield equal performance in the *Brassica* interspecific crossing. Chromosome number in root tip cells of the hybrids (2n-AB) was 18 which showed the chromosome number of amphihaplod between the two species, *B. rapa* ($n^{=}10$, A) and *B. nigra* ($n^{=}8$, B) under study and confirms hybridity (Fig. 1a). The hybrids produced very high number of primary and secondary branches and were found to be intermediate between the parents for most of the other morphological attributes. Leaf shape of the hybrids was intermediate between the parents with more dissection than those of parents (Fig. 1b) and intermediate in hairiness. The hybrid flowers were intermediate in size and with yellow petals resembling the parents. Stem colour was greenish violet similar to that of Nigra-1. This intermediate morphology of

F_1 in *Brassica* like the present investigation was also reported earlier (Liu, 1994; Sandhu and Gupta, 2000; Choudhary *et al.,* 2002).

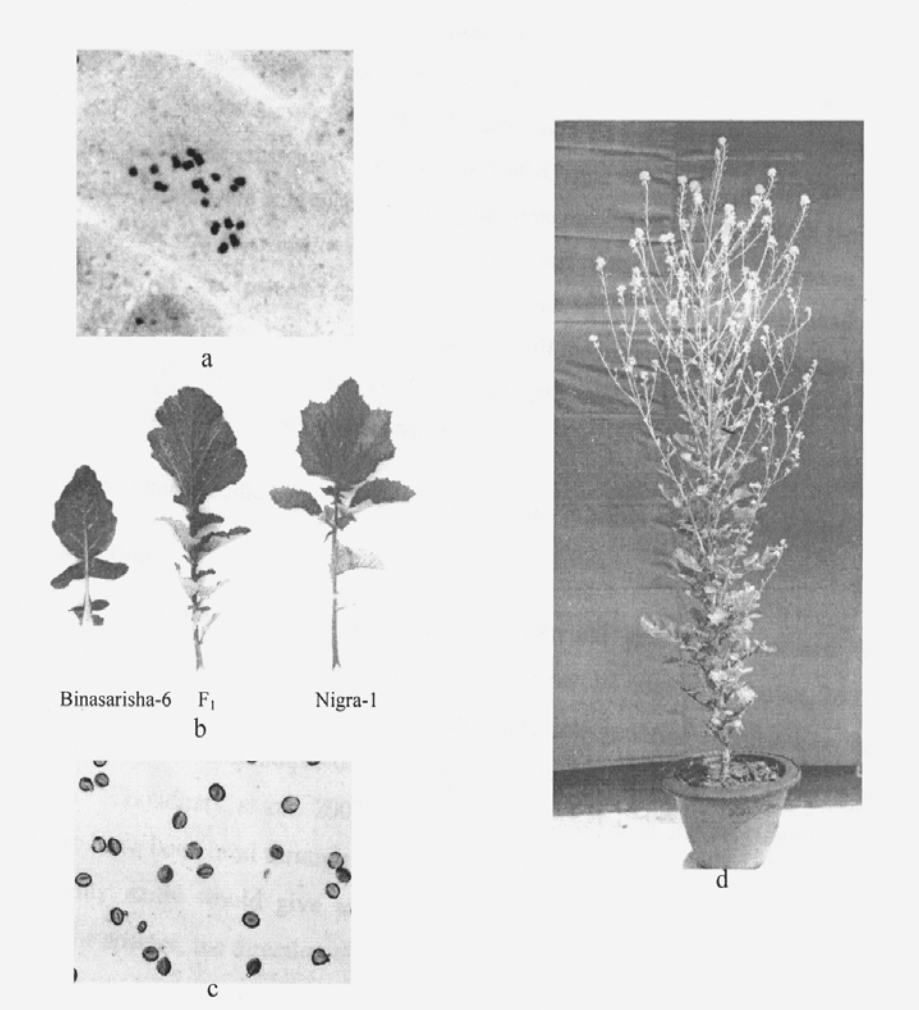

Fig. 1. a : Somatic chromosome number 18 of hybrid between Binasarisha-6 and Nigra-1.
b : leaves of Binasarisha-6, hybrid and Nigra-1, c : sterile pollen grains of hybrid.
d : sterile in hybrid plant.

The hybrids flowered abundantly and were with shrivelled, pointed tip and pale colour anthers with reduced filaments. Akbar (1989) and Batra *et al.* (1990) also

reported similar morphology of anthers in interspecific hybrids within the genus *Brassica.* The hybrids showed complete pollen sterility. Finally, the hybrids failed to set siliquae. In a cross of *B. tournefortii* ($2n^{=}20$, TT) with yellow and brown sarson genotypes of *B. rapa,* Choudhary and Joshi (2001) reported that F_1 plants showed high pollen sterility. A much higher degree of sterility in the interspecific hybrids, similar to the present observations, was also noticed earlier in the interspecific/intergeneric hybrids of *Brassica* (Inomata, 1994; Churung *et al.,* 1999). Song *et al.* (1993) also observed very high pollen sterility in the F_1s obtained from all possible combinations of interspecific crosses of the diploid species within the U-triangle. Complete pollen sterility observed in the hybrids of the present study might be due to the meiotic irregularities and segregation anomalies (Stebbins, 1966) resulting absence of affinity to allosyndetic pairing between the chromosomes of A and B genomes (Inomata, 1980; Prakash and Hinata, 1980).

From the present investigation, it can be concluded that polyploidization of such hybrids can lead to the production of synthetic *B. juncea.*

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