Use of Cytoplasmic Male Sterility for the Production of Hybrid Seeds in Flax (Linum usitatissimum L.)

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CYTOPLASMIC male sterility is extensively used for the large-scale production of hybrid seeds in crops like corn, onion, sugar beets, and sorghums (3). Even though the occurrence of male sterility in plants was first reported in flax (1), cytoplasmic male sterility has not been used profitably for producing hybrid seed. Flax is normally self-pollinated, although insects cause a very small amount of cross pollination. Chances of natural crossing are, however, reduced in cytoplasmic male-sterile strains because of the reduced size of petals and closed tubular nature of the corolla. All this reduces the attraction of the insects to the flowers. Duvick (3), however, has suggested that cytoplasmic floral abnormalities can be dissociated from cytoplasmic male sterility through selection as has been done in Nicotiana (2) and Solanum (4). The present study has revealed that it is possible to develop male-sterile plants in flax also having open corolla with a fairly high percentage of natural crossing.

MATERIALS AND METHODS

Three male-sterile lines of flax were obtained from the USDA and grown at the experimental farm of B. R. College, Bichpuri, Agra, in 1961-62, 62-63, and 63-64. Crosses between a number of Indian flax varieties and male-sterile lines were made in the first season by hand pollination. Indian varieties used were N.P. 12, N.P. (R.R.) 9, 37, 45, 197 and 204, C1150, C1193-1, C120G, S-36, M-10, Maroc (E.C. 11754), Laharpur, Kannauj, and Bichpuri. Two wild species of Linum, i.e., L. africanum and L. aungustifolium, were also used in the crossings.

All the above-mentioned varieties and species with the exception of var. N.P. (R.R.) 9 produced male-sterile hybrids. The hybrids with var. N.P. (R.R.) 9 was, however, male fertile (60-70% fertile pollen). The male-sterile hybrids between Indian varieties and male sterile lines were back-crossed to their respective male parents and the BC1 progenies along with their respective F1 population were grown during the season 1963-64. Observations on various F1 and back-cross progenies regarding the type and the diameter of corolla and pollen sterility were made. Diameter of corolla and fruit set were recorded from five plants from each hybrid generation.

Stainability in acetocarmine and fertilizing ability were the criteria of male sterility. In the latter case some flowers on each of the hybrid plants were bagged before opening to check seed set. The male-sterile hybrids showed 0.5% to 5% stainable pollen but no seeds were obtained from flowers bagged before opening.

RESULTS AND DISCUSSION

Table 1 summarizes the various observations regarding floral characters and fruit set in F1 and BC1 generations, respectively. Perusal of the tables reveals that most of the hybrids in F1 and BC1 generations produced flowers with tubular and narrow corolla. However, hybrids involving varieties C1150, C1193-1 and N.P. (R.R.) 204 as their male parents had broad and funnel-shaped corolla both in F1 and back-cross generations. On the other hand, hybrids with variety S-36...