

Effect of self and cross pollination on the fruit set behaviour of some promising apple genotypes

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Abstract

Self-incompatibility, one of the main problems causing low productivity of apple was studied for selecting suitable pollinizer cultivar. Fruit set on self pollination ranged from 2.09% (EC161286) to 5.76% (Red Baron) and cross pollination gave fruit set in the range of 9.90% (EC 161287x EC161286) to 76.17% (Red Baron x EC161286). Red Baron accounted for maximum average fruit set (52.74 %) as female parent followed by Spur Red Delicious (28.0 %). Among different pollinizers, Red Baron and EC161287 shared 55.75% and 47.10% fruit set, respectively, when these were crossed with different female parents.

Key words: Apple, *Malus x domestica*, self-incompatibility, cross compatibility, fruit-set, self-pollination, pollinizers, Red Baron

Introduction

Apple (*Malus x domestica* Borkh.), is the leading commercial fruit of the temperate regions of India. Apple and most other temperate fruits are essentially cross-pollinated and this mode of pollination and fruit set are due to self- incompatibility (Brown, 1975) and in some cases cross incompatibility. The incompatibility whether self or cross seems to be of gametophytic type and controlled by monogenic s gene locus (Arora, 1993). Fruit set, therefore, exclusively depend upon the type of pollinizer(s) to be used in a temperate fruit orchard. Keeping the above in mind, an attempt has been made through the present study to determine the suitable pollinizer for the orchard of some upcoming commercial cultivars as well as exotic collections.

Materials and methods

The experiment was conducted in Apple Germplasm Collection Block of the Fruit Breeding and Genetic Resources Department, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, H.P, India. The experimental materials included healthy bearing (8-9 years) apple trees of cv. Anna, Aziza, Red Baron, Spur Red Delicious, EC161286, EC161287 and Unknown (standard tree having greenish yellow fruit) as pollinizer and four varieties viz., Red Baron, Spur Red Delicious, EC161286 and EC161287 as female parent. So for each female parent six cross combinations appeared and data generated from these combinations regarding fruit set were analysed by Randomised Block Design with four replications. Fruit set was calculated as fruits/100 flower clusters as per formula laid by Westwood (1923) .

$$\text{Fruit set/100 flower clusters} = \frac{\text{Number of fruit set}}{\text{Number of flower clusters}} \times 100$$

Number of flower clusters: Information regarding self pollination were recorded in first year to facilitate cross pollination in the next year. Controlled pollination was done by

following the standard method of emasculation and pollination on selected flower clusters by marking four branches in the periphery of a tree of each cultivar. Fruit set was calculated 45 days after pollination.

Results and discussion

Fruit set on self pollination: Fruit set on self-pollination generally varies from cultivar to cultivar (Redalen, 1980, Shaova, 1980). In the present experiment Red Baron gave maximum fruit set (5.76%) while EC161286 gave the least (2.09%) on self pollination (Table 1). EC161287 and Spur Red Delicious recorded 2.80 and 3.24% fruit-set, respectively. In earlier experiment fruit set on self pollination varied from 0.5 to 21% in a wide range of variety (Popov, 1984). Self-pollination study indicated that the extent of fruit set on spur basis was low, thereby implying the necessity of cross pollination.

Table 1. Fruit set on self pollination in apple cultivars used as female parents

Cultivars	Fruit set (%)
EC161286	2.09
EC161287	2.80
Red Baron	5.76
Spur Red Delicious	3.24

Fruit set on cross pollination: In present study the maximum fruit set to the extent of 76.17% was observed in Red Baron when crossed with EC 161286 and least 9.9% was found in the cross combination of EC161287 X EC161286 (Table 2). Red Baron as female parent gave highest average fruit set of 52.74%, while EC161286 gave least average fruit set of 21.42%. The result of earlier investigation gave the idea that in apple 83.62% fruit set was found when Starkrimson was crossed with Granny Smith (Pasqual *et al.*, 1981) and highest 83.33% fruit set was found when Gallia Beauty was pollinated with Tydemans Early Worcester (Bist and Sharma, 1986, Bhartiya *et al.*, 1986). In the

present study, fruit set was a little bit low probably because of the occurrence of spring frost shortly after pollination.

Table 2. Fruit set on cross pollination in different female apple cultivars

	Cross combination	Fruit set (%)
1	EC161286 x Anna	20.75 (27.10)
	EC161286 x Aziza	17.75 (24.52)
	EC161286 x EC161287	11.10 (19.43)
	EC161286 x Red Baron	65.81 (54.28)
	EC161286 x Spur Red Delicious	17.09 (24.28)
	EC161286 x Unknown	18.87 (25.68)
	SE(m)± 1.20 CD 2.56	Average : 25.23
2	EC161287 x Anna	12.49 (20.69)
	EC161287 x Aziza	12.33 (20.56)
	EC161287 x EC161286	09.90 (18.32)
	EC161287 x Red Baron	43.88 (41.49)
	EC161287 x Spur Red Delicious	27.23 (31.45)
	EC161287 x Unknown	22.72 (28.50)
	SE(m)± 0.65 CD 1.39	Average : 21.23
3	Red Baron x Anna	15.98 (23.56)
	Red Baron x Aziza	15.41 (22.91)
	Red Baron x EC161286	76.17 (60.79)
	Red Baron x EC161287	67.23 (55.09)
	Red Baron x Spur Red Delicious	73.92 (59.30)
	Red Baron x Unknown	67.74 (54.19)
	SE(m)± 0.61 CD 1.30	Average : 52.74
4	Spur Red Delicious x Anna	12.39 (20.61)
	Spur Red Delicious x Aziza	11.58 (19.90)
	Spur Red Delicious x EC161286	10.73 (19.60)
	Spur Red Delicious x EC161287	62.98 (52.53)
	Spur Red Delicious x Red Baron	57.57 (49.49)
	Spur Red Delicious x Unknown	12.75 (20.91)
	SE(m)± 0.56 CD 1.19	Average : 28.00

Values in parentheses are transformed values.

Fruit set shared by pollinizers: Among seven pollinizers used in this experiment, cultivar Red Baron shared maximum average fruit set (55.75%) with different female parents followed by

EC161287 (47.10%). Cultivar Aziza was very weak pollinizer and contributed only 14.26% average fruit set with female parents (Table 3). In orchard, therefore, Red Baron can be used as female parent as well as effective pollinizer.

Table 3. Average fruit set shared by pollen parents

Pollinizers	Average fruit set (%)
Anna	15.40
Aziza	14.26
Red Baron	55.75
Spur Red Delicious	39.41
EC 161286	32.26
EC 161287	47.10
Unknown	30.52

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