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Effect of age of plant on compatibility levels in mid-late maturity group of cauliflower (*Brassica oleracea* L. var. *botrytis*)

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Abstract

Studies were carried out on six genotypes (PalamUphar, DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6) of mid-late group of cauliflower at Experimental Farm of the Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during the period from September 2010 to June 2011 to find out the levels of compatibility. The pollination treatments included self-pollination in open flowers at 25% flowering (OP-I), self-pollination in open flowers at 50-75% flowering (OP-II) and self-pollination in open flowers at more than 75% flowering (OP-III). Majority of the plants in all the genotypes studied were in the compatibility grade 0-10 per cent, whereas, there was little change in the genotypes DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6 for the number of plants in the compatibility grade 0-10 except PalamUphar (OP-III). Hence, those plants falling in 0-10 compatibility grade can be used for the isolation of S-allele homozygotes for the development of self-incompatible lines for hybrid development.

Key words: Compatibility levels, cauliflower, pollination, S-allele.

Introduction

Cauliflower (*Brassica oleracea* L. var. *botrytis*) is an important cole crop in India contributing 4.6% in the total vegetable production in the country. Its average productivity in the country is 16.9 t/ha which is far less than the potential productivity of 35-40 t/ha. Although its maximum productivity of 40-45 t/ha has been achieved in New Zealand. Low productivity in India is because of the fact that only 5% area in cauliflower is under hybrids and rest of the area is under open pollinated or unidentified varieties. The productivity can be achieved by developing location and group specific hybrids in cauliflower. In Himachal Pradesh, it is being cultivated in an area of 3,000 ha with a production of 60,700 tonnes and productivity of 20.2 t/ha (Anonymous, 2011). It is grown commercially as off-season crop during summer-rainy (March to November) season in Shimla, Mandi, Solan, Kullu and Kangra districts of the state, bringing lucrative returns to the farmers. The knowledge of self-incompatibility level within a genotype is basic to the formulation of a breeding programme for the development of hybrids and may also be informative on the relative merits of past selection techniques.

Hence, the present studies were undertaken to identify levels of compatibility in different genotypes of cauliflower.

Materials and Methods

The materials comprised of six elite genotypes of cauliflower developed by the Department of Vegetable Science and Floriculture, CSKHPKV, Palampur, namely PalamUphar, DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6 were grown during 2010-11.The pollination treatments included bud pollination (BP), natural cross pollination (NCP), natural self pollination (NSP), self pollination in open flowers at 25% flowering (OP-I), self pollination in open flowers at 50-75% flowering (OP-II) and self pollination in open flowers at more than 75% flowering (OP-III). For each treatment, 20-25 flowers and buds were selected and average number of seeds per siliqua was counted at the time of harvesting.The compatibility levels were computed according to the formula suggested by Watts (1968).

$$\text{Compatibility (\%)} = \frac{\text{Average number of seeds per siliqua under self-pollination on freshly opened flowers}}{\text{Average number of seeds per siliqua under natural cross-pollination}} \text{X100}$$

The levels of compatibility were calculated by dividing seed set per siliqua under self-pollination in freshly opened flowers with seed set per siliqua under natural cross pollination (NCP)for each plant in each genotype.

Results and Discussion

The plants were grouped under different grades of compatibility on the basis of per cent compatibility. The level of compatibility reveals the extent of compatibility/incompatibility in a given plant on percentage basis and suits better in the development of self-incompatible lines since the main interest of the breeders is to select/identify the plants in the lowest compatibility grade (0-10), which ensures the minimum possible selfs in the ultimate hybrid seed, and those plants falling in the lowest compatibility grade (0-10) can be used for the study of inheritance of self-incompatibility and the development of stable self-incompatibility lines in the following year. The compatibility grades based on OP-I, OP-II and OP-III seed set data are presented in Table 1. Based on OP-I seed set data, as many as 7, 11, 6, 12, 12 and 14 plants out of a total of 15, 15, 14, 15, 15 and 15 plants were in the compatibility grades 0-10 per cent in Palam Uphar, DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6, respectively. One plant in DPCaY-3 was in higher compatibility grades (above 80 per cent).

Based on OP-II seed set data,5, 12, 7, 14, 12 and 13 plants of Palam Uphar, DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6, respectively were in the compatibility grade 0-10 per cent. Two plants in DPCaY-3 and one plant in Palam Uphar were in the higher compatibility grades (above 80 per cent).

Based on OP-III seed set data,12, 14, 8, 15, 14 and 14 plants of Palam Uphar, DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6, respectively were in the compatibility grade 0-10 per cent. In few compatibility grades, there was not even a single plant. There were slight change in the number of plants falling in the compatibility grade 0-10 in the genotypes DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6 based on OP-II and OP-III seed set data but had the maximum change of 7 plants in Palam Uphar on the basis of OP-II seed set data. Absence of more compatibility grades in DPCaY-2, DPCaY-4, DPCaY-5 and DPCaY-6 could be due to more genetic uniformity within the genotypes. Poor or failure of seed setting under bagged inflorescence, which is an indication of high level of self-incompatibility, was further substantiated by the fact that normal seed setting was observed by bud pollination.

This implies that in the genotypes studied, most of the self-incompatible plants might have S-alleles high in dominance series since such alleles do

Table 1. Number of plants in different compatibility grades in seven genotypes based on OP-I, OP-II and OP-III seed set Data (Per cent compatibility grades)

Genotypes		0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	Total no. of plants
PalamUphar	OP-I	7	4	1	3	-	-	-	-	-	-	15
	OP-II	5	3	1	2	1	1	-	1	1	-	15
	OP-III	12	3	-	-	-	-	-	-	-	-	15
DPCaY-2	OP-I	11	3	-	1	-	-	-	-	-	-	15
	OP-II	12	1	1	1	-	-	-	-	-	-	15
	OP-III	14	1	-	-	-	-	-	-	-	-	15
DPCaY-3	OP-I	6	1	3	1	-	2	-	-	-	1	14
	OP-II	7	2			-		1	2		2	14
	OP-III	8	1	1	-	3	1	-	-	-	-	14
DPCaY-4	OP-I	12	2	-	1	-	-	-	-	-	-	15
	OP-II	14	1	-	-	-	-	-	-	-	-	15
	OP-III	15	-	-	-	-	-	-	-	-	-	15
DPCaY-5	OP-I	12	2	1	-	-	-	-	-	-	-	15
	OP-II	12	2	-	1	-	-	-	-	-	-	15
	OP-III	14	-	-	-	1	-	-	-	-	-	15
DPCaY-6	OP-I	14	1	-	-	-	-	-	-	-	-	15
	OP-II	13	-	1	-	1	-	-	-	-	-	15
	OP-III	14	1	-	-	-	-	-	-	-	-	15

not breakdown easily with the advancement in flowering stage (Bateman, 1954; Ockendon, 1974 and 1975; Lawson and Williams, 1976; Wallace, 1979; Sharma *et al.,* 2000; Hallidri and Pertena, 2002; Singh *et al*., 2002; Zur*et al*., 2003; Singh *et al*., 2004; Hamid *et al*., 2010; Kaminski, 2013). Based on OP-III seed set data,12, 14, 8, 15, 14 and 14 plants of Palam Uphar, DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6, respectively were in the compatibility grade 0-10 per cent. In few compatibility grades, there was not even a single plant. There were slight change in the number of plants falling in the compatibility grade 0-10 in the genotypes DPCaY-2, DPCaY-3, DPCaY-4, DPCaY-5 and DPCaY-6 based on OP-II and OP-III seed set data but had the maximum change of 7 plants in Palam

Uphar on the basis of OP-II seed set data. Absence of more compatibility grades in DPCaY-2, DPCaY-4, DPCaY-5 and DPCaY-6 could be due to more genetic uniformity within the genotypes. Poor or failure of seed setting under bagged inflorescence, which is an indication of high level of self-incompatibility, was further substantiated by the fact that normal seed setting was observed by bud pollination.

This implies that in the genotypes studied, most of the self-incompatible plants might have S-alleles high in dominance series since such alleles do not breakdown easily with the advancement in flowering stage (Bateman, 1954; Ockendon, 1974 and 1975; Lawson and Williams, 1976; Wallace, 1979; Sharma *et al.,* 2000; Hallidri and Pertena, 2002; Singh *et al*., 2002; Zur *et al*., 2003; Singh *et al*., 2004; Hamid *et al*., 2010; Kaminski, 2013).

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