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Studies on comparison of biparental and F_4 progenies in late cauliflower (*Brassica oleracea* var *botrytis* L)

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ABSTRACT

The material comprising of biparental (BIP) and F_4 progenies were planted in compact family block design with three replications. The performance of different families indicated that the means were high in F_4s bud pollinated (BP) and mix pollinated (MP) progenies than BIP's (BP and MP) for all the characters except for harvest index. BIPs irrespective of method of pollination gave lesser plant frame, less leaves per plant, leaves per whorl, low stalk length, early maturity besides less gross weight, net curd weight and harvest index. The range was also wider in BIPs than F_4s for all the characters. Similarly coefficients of variation were also high in BIPs than F_4s for all the characters except for gross weight and net curd weight.

Keywords: Biparental; F_4; cauliflower; BP; MP

INTRODUCTION

Cauliflower a member of family Cruciferae has been described as the `Aristocrat of Cole crops' and is grown throughout the world for tender white curds. Cauliflower is good source of proteins, carbohydrates, minerals and vitamins (Choudhury 1996). The leading cauliflower growing states in the country are West Bengal, Bihar, Uttar Pradesh, Punjab, Rajasthan and Karnataka. Snowball group is major contributor in terms of seed crop as well as off-season crop and brings lucrative returns to the farmers.

The seed production of late cauliflower is also highly remunerative and is being done on commercial scale in northern Indian hills. There are only limited cultivars in late group and their continuous use is resulting in low production per unit area besides susceptibility to serious diseases as it has already witnessed

remarkable changes in plant type, curd shape, curd size, curd weight and quality attributes by virtue of selection and exploitation of existing genetic variability.. This necessitates the identification/ development of new cultivars possessing high yield potential, superior quality and resistance to diseases which could be used for cultivation in case of breakdown of these recommended cultivars.

Before taking up any breeding programme in a crop it is of prime importance to ensure that the base population is adequately improved. For achieving this objective the development of biparental progenies in F_2 or advanced generations suggested by Comstock and Robinson (1948, 1952) has been found to be a promising approach in Indian cauliflower (Dadlani 1977, Lal et al 1990). Present investigations were undertaken in late cauliflower to assess the nature and extent of genetic variability generated through biparental mating.

MATERIAL AND METHODS

Present study entitled `Studies on comparison of biparental and F_4 progenies in late Cauliflower (*Brassica oleracea* var *botrytis* L)' was conducted at experimental farm of Department of Vegetable Crops, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP. The experimental materials comprised of six biparental (BIP) and six F_3 progenies of an inter-varietal cross PSB-1 x KT-9. Five plants each in BIPs and F_3s were selected on the basis of plant and curd characters. These plants were both bud pollinated (BP) and mix pollinated (MP). The seeds obtained from bud and mix pollination of each selected plant were harvested separately and considered as different entries (BIP bud and mix pollinated and F_3 bud and mix pollinated ie F_4).

The whole material comprising of biparental and F_4 progenies was planted in compact family block design with three replications. Spacing was 60 x 45 cm and observations were recorded for plant frame (cm), number of leaves per plant, number of leaves per whorl, stalk length (cm), days to harvesting, gross curd weight (g), net curd weight (g) and harvest index (%). Simple statistical analysis was done to study the performance of different families.

RESULTS AND DISCUSSION

The data with respect to BIP (BP and MP) and F_4 (BP and MP) for all the traits under study are given in Table 1. The mean performance of different families indicated that these were high in F_4 (BP and MP) than BIP (BP and MP) for all the characters except stalk length, days to harvesting and harvest index. Similarly between BIP and F_4 irrespective of method of pollination (BP and MP) the means were high in F_4 than BIP. Likewise between MP and BP the means were high in MP than

Table 1. Range, mean and coefficient of variation for different traits in BIP (BP and MP) and F_4 (BP and MP) families

Character		Range	Mean ±SE	CV (%)
Plant frame (cm)	1	45.28-58.26	2.28±0.92	8.95
	2	48.15-60.78	53.98±0.96	9.12
	3	51.44-57.70	54.74±0.75	8.27
	4	51.30.-58.99	54.84±0.63	6.87
Number of leaves per plant	1	17.42-21.67	19.55±0.38	9.83
	2	18.20-23.00	20.75±0.40	10.00
	3	18.25-21.66	20.53±0.31	8.98
	4	19.91-23.69	21.14±0.31	8.80
Number of leaves per whorl	1	4.35-5.42	4.89±0.09	9.58
	2	4.55-5.75	5.20±0.10	9.72
	3	4.56-5.52	5.15±0.08	8.98
	4	5.00-5.79	5.27±0.08	8.80
Stalk length (cm)	1	2.88-3.57	3.24±0.06	9.54
	2	2.46-3.70	2.98±0.06	10.51
	3	2.85-3.50	3.04±0.05	9.64
	4	2.74-3.63	3.22±0.06	10.63
Days to harvesting	1	125.75-133.42	130.63±0.54	1.91
	2	121.17-138.50	129.49±0.93	3.65
	3	121.17-137.50	128.28±0.70	3.19
	4	127.67-137.92	133.22±0.65	2.79
Gross curd weight (g)	1	1370.00-2266.89	1859.41±74.08	20.17
	2	1341.44-2560.00	1905.08±92.32	24.53
	3	1695.28-2440.67	1973.08±73.58	22.29
	4	1700.00-2633.22	2178.59±91.21	24.81
Net curd weight (g)	1	710.00-1130.00	899.98±40.25	22.32
	2	656.32-1175.00	72.17±49.01	28.07
	3	765.67-1209.33	925.34±40.73	26.47
	4	745.33-1258.11	1028.60±49.59	28.82
Harvest index (%)	1	43.09-61.14	49.04±1.37	14.66
	2	36.90-56.97	46.21±1.40	15.25
	3	42.36-52.74	46.87±1.05	13.25
	4	44.08-52.04	47.22±0.96	11.67

1= BIPs (BP), 2= BIPs (MP), 3= F_4s (BP), 4= F_4s (MP)

BP. The coefficients of variation ranged from 1.91 to 28.82 per cent. It was high in MP than BP in BIP for all the characters whereas for stalk length, gross weight and net curd weight in F_4 (MP). Maximum coefficients of variation were noticed for net curd weight (28.82, 28.07, 26.47 and 22.32%) followed by gross curd weight (24.81, 24.53, 22.29 and 20.17%) and harvest index (15.25, 14.66, 13.25 and 11.67%). Low values of coefficient of variation were found for other traits viz plant frame, number of leaves per plant, number of leaves per whorl, stalk length and days to harvesting.

The range was narrow in F_4 (BP and MP) than BIP (BP and MP) for all the characters. It was comparatively narrow for plant frame (51.44-57.70, 51.30-58.99) followed by number of leaves per plant (18.25-21.66, 19.91-23.69), number of leaves per whorl (4.56-5.52, 5.00-5.79), stalk length (2.85-3.50, 2.74-3.63), days to harvesting (121.17-137.50, 127.67-137.92) while, gross curd weight (1695.28-2440.67, 1700.00-2633.22), net curd weight (765.67-1209.33, 745.33-1258.11) and harvest index (42.36-52.74, 44.08-52.04) exhibited comparatively wider range. Similarly range was wider in mixed pollination than bud pollination for all the characters except for plant frame and days to harvesting.

The means in the families indicated that F_4 (BP and MP) performed better than BIP (BP and MP) for all the characters except for harvest index. BIPs irrespective of method of pollination gave lesser plant frame, less leaves per plant, leaves per whorl, low stalk length, early maturity besides less gross weight, net curd weight and harvest index. The range was also wider in BIP than F_4 for all the characters. Similarly coefficients of variation were also high in BIP than F_4 for all the characters except for gross weight and net curd weight. The superiority of BIP might be due to the creation of variability by breakage of undesirable linkages. Similarly Singh and Sharma (1983) reported superiority of BIP over F_3 progenies in okra. While Dadlani et al (1983), Jagdish et al (1984) and Kanwar and Korla (2001) reported the superiority of F_3 progenies over BIP with respect to coefficients of variation in cauliflower. The values of mean, range and coefficients of variation were comparatively high in mixed pollination than bud pollination for all the characters which indicated that the genetic makeup is comparatively increased with mixed pollination than bud pollination. Though the differences in the values of these estimates were not much pronounced yet this may be due to some extent of cross pollination as late group is largely self compatible (Nieuwhof 1969).

Comparison of means BIP (BP) and BIP (MP)

The means of BIP bud pollinated and BIP mix pollinated were compared with respect to all the traits under study

(Table 2). The 't' ratio indicated significant differences in means of both these families for number of leaves per whorl, number of leaves per plant, stalk length and plant frame while non-significant for rest of the traits.

Comparison of means F_4 (BP) and F_4 (MP)

The means of F_4 bud pollinated and F_4 mix pollinated progenies were compared with respect to different traits (Table 3). Significant differences in the means were noticed for days to harvesting, net curd weight, gross curd weight and stalk length. All other characters were non-significantly different.

Comparison of means BIP (BP) and F_4 (BP) progenies

Comparison of BIPs (BP) and F_4 (BP) progenies with the help of `t' ratio (Table 4) indicated that there were significant differences in mean value of BIP and F_4 progenies for plant frame, number of leaves per plant, number of leaves per whorl, days to harvesting, gross curd weight and harvest index. The differences were non significant for stalk length and net curd weight.

Comparison of means of BIP (BP) and F_4 (MP) progenies

Comparison of BIPs (BP) and F_4 (MP) progenies (Table 5) indicated the significant differences in mean value of number of leave/plant, number of leaves/ whorl, number of days to harvesting, gross curd weight (g), net curd weight (g) and harvest index (%). The non-significant differences were for plant frame and stalk length.

Comparison of means of BIP (MP) and F_4 (BP) progenies

The means of BIP mixed pollinated and F_4 bud pollinated progenies were compared with respect to different traits (Table 6). Non significant differences in the means were noticed for all the characters.

Comparison of means of BIP (MP) an F_4 (MP) progenies

The means of BIP mixed pollinated and F_4 mix pollinated were compared with respect to all the traits under study (Table 7). The 't' ratio indicated significant differences in means of both these families for stalk length, days to harvesting, gross curd weight and net curd weight while non-significant for rest of the traits.

The mean performance of different characters observed under bud and mix pollination of both the populations (BIP and F_4) indicated that characters like plant frame, number of leaves per plant, number of leaves per whorl and stalk length showed better performance under bud pollination than mixed pollination and gross and net curd weight gave better performance under mixed pollination. The performance of F_4 as a whole was on higher side in comparison to BIP. The differences in the mean values of the families with respect to all the characters were further confirmed by 't' test. The non-significant differences

Table 2. Comparison of means of BIP (BP) and BIP (MP) progenies

Trait	Mean		
	BIP (BP)	BIP (MP)	t-ratio
Plant frame (cm)	52.28	53.98	-2.27*
No of leaves/plant	19.55	20.75	-2.47*
No of leaves/whorl	4.89	5.20	-3.87*
Stalk length (cm)	3.22	2.98	2.28*
Days to harvesting	130.63	129.49	1.25
Gross curd weight (g)	1859.41	1905.08	-0.744
Net curd weight (g)	898.98	872.17	0.992
Harvest index (%)	49.04	46.21	0.304

Table 3. Comparison of means of F_4 (BP) and F_4 (MP) progenies

Trait	Mean		
	F_4 (BP)	F_4 (MP)	t-ratio
Plant frame (cm)	54.74	54.84	-0.165
No of leaves/plant	20.53	21.14	-1.52
No of leaves/whorl	5.15	5.27	-1.93
Stalk length (cm)	3.04	3.25	-2.1*
Days to harvesting	128.28	133.22	-5.80*
Gross curd weight (g)	1973.08	2178.59	-3.61*
Net curd weight (g)	925.34	1028.60	-3.68*
Harvest index (%)	46.87	47.22	-0.595

Table 4. Comparison of means of BIP (BP) and F_4 (BP) progenies

Trait	Mean		
	BIP (BP)	F_4 (BP)	t-ratio
Plant frame (cm)	52.28	54.74	-3.44*
No of leave/plant	19.55	20.53	-2.18*
No of leaves/whorl	4.89	5.15	-3.61*
Stalk length (cm)	3.22	3.04	1.68
Days to harvesting	130.63	128.28	3.05*
Gross curd weight (g)	1859.41	1973.08	-2.25*
Net curd weight (g)	898.98	925.34	-1.07
Harvest index (%)	49.04	46.87	2.57*

Table 5. Comparison of means of BIP (BP) and F_4 (MP) progenies

Trait	Mean		
	BIP (BP)	F_4 (MP)	t-ratio
Plant frame (cm)	52.28	54.84	-3.70
No of leave/plant	19.55	21.14	-3.52*
No of leaves/whorl	4.89	5.27	-5.28*
Stalk length (cm)	3.22	3.25	-0.273
Days to harvesting	130.63	133.22	-3.70*
Gross curd weight (g)	1859.41	2178.59	-5.55*
Net curd weight (g)	898.98	1028.60	-4.69*
Harvest index (%)	49.04	47.22	2.36*

Table 6. Comparison of means of BIP (MP) and F_4 (BP) progenies

Trait	Mean		
	BIP (MP)	F_4 (BP)	t-ratio
Plant frame (cm)	53.98	54.74	-1.13
No of leave/plant	20.75	20.53	-0.505
No of leaves/whorl	5.20	5.15	-0.694
Stalk length (cm)	2.98	3.04	-0.625
Days to harvesting	129.49	128.28	1.17
Gross curd weight (g)	1905.08	1973.08	-1.12
Net curd weight (g)	872.17	925.34	-1.92
Harvest index (%)	46.21	46.87	-0.836

Table 7. Comparison of means of BIP (MP) and F_4 (MP) progenies

Trait	Mean		
	BIP (MP)	F_4 (MP)	t-ratio
Plant frame (cm)	53.98	54.84	-1.33
No of leave/plant	20.75	21.14	-0.89
No of leaves/whorl	5.20	5.27	-0.98
Stalk length (cm)	2.98	3.25	-2.75*
Days to harvesting	129.49	133.22	-3.79*
Gross curd weight (g)	1905.08	2178.59	-4.09*
Net curd weight (g)	872.17	1028.60	-5.14*
Harvest index (%)	46.21	47.22	-1.43

by 't' test indicated that there was no difference in the mean performance for characters like days to harvesting, gross curd weight, net curd weight and harvest index in BIP (BP) vs BIP (MP) and for plant frame, number of leaves per plant, number of leaves per whorl and harvest index in F_4 (BP) vs F_4 (MP). The significant differences indicated that these characters performed differently with bud and mixed pollination whereas between BIP and F_4 might be due to different genetic background.

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