Indian J. Genet., **62**(4): 328-330 (2002)

Evaluation of biparental progenies for horticultural and quality traits in late cauliflower (*Brassica oleracea* var. *botrytis* L.)

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(Received: January 2002; Revised: November 2002; Accepted: November 2002)

Abstract

Sixteen biparental progenies developed from a cross PSB-1 × KT-9 in late cauliflower (*Brassica oleracea* var. *botrytis* L.) were evaluated in RBD with three replications for horticultural and quality traits. BIPs 13, 17 and 19 possessed good yield and quality traits. PCV was low for all the traits except gross plant weight and net curd weight. High heritability and low genetic gain recorded for days to marketable maturity indicated the nonadditive gene effects for this trait. Rest of the traits had low to moderate heritability with low genetic gain indicated the influence of environment. Net curd weight had highly significant and positive association with leaf length, leaf breadth, gross plant weight and harvest index. Path analysis revealed that contributions of gross plant weight and harvest index were maximum directly/indirectly.

Key words: Cauliflower, biparental progenies, heritability, correlation

Introduction

In Himachal Pradesh, snowball group is the major cauliflower group both in terms of off-season as well as seed crop. In mid and high hills of the state, it is grown as an off-season crop during summer months, which sells at a premium in plains and brings lucrative returns to the farmers. The seed production of late cauliflower is also highly remunerative and being done on commercial scale in mid hills of Himachal Pradesh. A large number of cultivars are available in early and mid season groups due to presence of variability in both these groups, however, there are very limited number of cultivars in snowball group as much variability is not available in this type.

Though snowball group provides ideal genotypes both to the farmers and consumers, yet these cultivars are very sensitive to fluctuating environmental conditions resulting sometimes in the development of undesirable traits which make the curds undesirable for marketing. Thus, an attempt was made to study the progenies developed by biparental matings by crossing late group parents for the performance of different horticultural and quality traits and association among different traits.

Materials and Methods

Present studies were conducted at the Experimental Farm of the Department of Vegetable Crops, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan during the year 1999-2000 and experimental materials comprised of 16 biparental progenies developed in F_2 generation of an intervarietal cross PSB-1 × KT-9 through biparental matings. Material was evaluated in RBD with three replications and observations were recorded for stalk length (cm), leaves per plant, leaf length (cm), leaf breadth (cm), days to marketable maturity, gross plant weight (g), net curd weight (g), harvest index (%) and quality traits *viz.* colour, compactness and riceyness.

Statistical analysis was done for all the traits except quality parameters as described by Panse and Sukhatme [1]. Coefficients of variability were calculated as per Burton and DeVane [2] and heritability, genetic advance and genetic gain as per Burton and DeVane [2] and Johnson *et al.* [3]. Correlation coefficients among all the characters were estimated as given by Al-Jibouri *et al.* [4] and path coefficients by Dewey and Lu [5].

Results and Discussion

Mean performance of biparental progenies with respect to different traits has been given in Table 1. It is evident from the Table that minimum stalk length was found in BIP 15 and eight BIPs (of which 9, 10, 14 and 15 were promising) gave the stalk shorter than mean. BIP 10 had significantly lesser number of leaves. Seven BIPs had less number of leaves per plant than mean value, of which BIPs 5, 10, 14 and 19 were promising. Maximum leaf length was found in BIP 9 and seven BIPs showed higher leaf length than mean of which 9, 13, 17 and 19 were promising whereas leaf breadth was maximum in BIP 13 and BIP 13 and 17 were significantly superior ones over the mean. Minimum and maximum days to marketable maturity were exhibited by BIP 8 and BIP 10, respectively. BIPs 2, 3, 5 and 8 were significantly

Table 1. Mean performance of biparental progenies with respect to different traits in PSB-1 × KT-9

BIPs	Stalk length (cm)	No. of leves/ plant	Leaf length (cm)	Leaf breadh (cm)	No. of days to marketable maturity	Gross curd weight (g)	Net curd weight (g)	Harvest index (%)	Curd colour (%)			Compactness (%)			Riceyness (%)	
									Snow white	White	Creamish yellow	Compact	Semi-compact	Loose	Non-ricey	Ricey
2	3.66	15.46	36.16	16.50	135.74	1352.83	560.54	41.35	6.52	89.13	4.35	21.74	58.69	19.57	93.48	6.52
3	3.65	14.93	37.37	16.62	138.37	1509.30	589.77	38.85	2.32	74.42	23.26	13.95	27.91	58.14	79.07	20.93
4	3.26	15.45	39.39	18.11	144.17	1637.66	630.21	38.76	4.26	72.34	23.40	42.55	46.81	10.64	65.96	34.04
5	3.55	14.43	39.05	17.25	138.38	1682.34	644.47	39.08	2.13	80.85	17.02	27.66	48.94	23.40	87.23	12.77
7	3.55	14.74	38.65	18.00	144.39	1616.52	717.39	44.56	2.18	84.78	13.04	82.61	13.04	4.35	100.00	-
8	3.68	16.43	39.59	17.19	135.68	1631.43	653.93	40.29	3.57	92.86	3.57	46.43	39.28	14.29	96.43	3.57
9	2.96	15.17	45.13	19.75	142.58	1784.58	679.58	37.84	-	91.67	8.33	16.67	83.33	-	41.67	58.33
10	2.93	12.09	38.93	18.15	156.35	1245.65	531.40	39.22	-	56.52	43.48	34.78	43.48	21.74	15.00	85.00
12	3.17	15.50	34.81	15.53	150.67	1317.50	537.50	40.89	-	91.67	8.33	41.67	58.33	-	100.00	-
13	3.11	16.57	41.61	20.81	148.71	1597.14	700.00	43.83	-	100.00	-	71.43	28.57	-	100.00	-
14	2.97	14.10	38.91	17.37	141.88	1554.88	620.24	40.67	4.88	82.93	12.19	48.78	39.02	12.20	95.12	4.88
15	2.82	14.58	36.28	17.40	150.67	1553.33	672.08	42.15	4.17	91.66	4.17	70.83	20.83	8.33	95.83	4.17
17	3.60	15.36	42.47	20.53	140.84	2060.80	833.20	40.97	20.69	79.31	-	80.00	20.00	-	100.00	-
18	3.29	15.61	39.22	19.40	151.50	1938.89	773.89	40.10	5.55	77.78	16.67	50.00	44.44	5.56	66.67	33.33
19	3.01	14.40	42.01	18.56	141.91	1774.22	743.11	42.25	11.11	80.00	8.89	43.48	34.78	21.74	95.56	4.44
20	3.14	15.00	36.14	15.78	141.47	1330.00	5.9.64	37.91	7.14	92.86	-	71.43	21.43	7.14	92.86	7.14
Mean	3.26	14.99	39.10	17.78	143.96	1599.19	647.30	40.55								
$CD_{0.05}$	0.47	01.22	04.71	02.36	03.61	0389.27	147.05	03.66								

early while BIPs 10, 12, 13 and 15 were significantly late in maturity. BIP 17 recorded highest gross plant weight and net curd weight followed by BIP 18 and 19. Harvest index was maximum in BIP 7 and BIPs 13, 15 and 19 were also promising. White colour of the curd was exhibited by majority of the BIPs except 3, 4 and 10 which gave white to creamish yellow colour. Compact curds were found in BIP 7 and 17. Majority of the BiPs showed non-ricey curds however 3, 4 and 18 gave considerable percentage of ricey curds.

From the above results, it may be concluded that BIPs 13, 17 and 19 which possessed good yield and quality traits were found best.

Phenotypic coefficients of variability (Table 2) were moderate for gross plant weight and net curd weight while low for rest of the traits. Low coefficients observed may be due to the fact that all the progenies belong to an intervarietal cross PSB-1 × KT9 whose both the parents belong to the late group. Phenotypic coefficients of variability were higher than the genotypic one's for all the traits. However, the differences were not much except gross plant weight and net curd weight, suggesting thereby the environment has got less influence on these traits and selection on phenotypic basis will hold good for genotypic basis too.

Table 2. Coefficients of variability, heritability and genetic advance for different traits in biparental progenies in cauliflower cross PSB-1 × KT-9

Traits	Coefficients of variation		Heritability (bs) (%)	Genetic advance	Genetic gain (%)
	Phenotypic	Genotypic			
Stalk length (cm)	11.41	7.50	43.2	0.33	10.12
Leaves per plant	7.35	5.51	56.3	1.28	8.51
Leaf length (cm)	8.95	5.26	34.6	2.49	6.38
Leaf breadth (cm)	10.63	7.11	44.8	1.76	9.83
Days to marketable maturity	4.44	4.18	88.5	11.66	8.09
Gross plant weight (g)	16.87	8.82	27.4	154.35	9.50
Net curd weight (g)	17.21	10.67	38.5	89.13	13.64
Harvest index (%)	7.22	4.74	43.1	2.58	6.40

Heritability in broad-sense (Table 2) was found to be high for days to marketable maturity and low for rest of the traits. So, selection for days to marketable maturity may be made on phenotypic performance with great reliance. High heritability accompanied with low genetic gain was found for days to marketable maturity indicating that this trait is more likely under the control of non-additive gene action and selection for this trait would be less effective. Rest of the traits had low to moderate heritability with low genetic gain, indicating the influence of environment on these traits.

In contradiction, high values for heritability and genetic gain were reported by Dutta [6] for leaves per plant and gross curd weight; Radhakrishna and Korla [7] for gross plant weight, net curd weight, harvest index and stalk length; Sanjeev [8] for stalk length; and Dharminder [9] and Jamwal *et al.* [10] for gross and net curd weight. This may be due to the difference in materials under study. Results are in consonance with the findings of Sanjeev [8] for days to marketable maturity and harvest index.

Correlation coefficients among different pairs of traits (Table 3) indicated that net curd weight was positively and highly significantly associated with leaf length, leaf breadth and gross curd weight at phenotypic and genotypic levels whereas, association with harvest index was significant at genotypic level only. Gross plant weight also had highly significant and positive correlation with leaf length and leaf breadth. Interrelationship between leaf length and leaf breadth was highly significant and positive while negatively

Table 3. Phenotypic and genotypic correlation coefficients among different traits in BIP's of cauliflower cross PSB-1 × KT-9

Traits		Leaves/plant	Leaf length	Leaf breadth	Days to marketable maturity	Gross plant weight	Net curd weight	Harvest index
Stalk length	P	0.404	–0.061	–0.059	–0.521*	0.088	0.088	–0.003
	G	0.423	–0.162	–0.263	–0.759**	0.281	0.099	–0.256
Leaves per plant	P		0.167	0.150	–0.330	0.283	0.319	0.117
	G		0.105	0.119	–0.346	0.237	0.202	0.045
Leaf length	P		0.865**	–0.080	0.745**	0.674**	–0.123	–0.123
	G		0.821**	–0.152	0.568*	0.539*	0.176	0.176
Leaf breadth	P			0.207	0.708**	0.719**	0.069	0.069
	G			0.273	0.648**	0.720**	0.454	0.454
Days to marketable maturity	P				–0.058	0.004	0.130	0.130
	G				–0.124	–0.003	0.202	0.202
Gross plant weight	P					0.913**	–0.133	–0.133
	G					0.901**	0.241	0.241
Net curd weight	P						0.278	0.278
	G						0.619*	0.619*

*,**-Significant at 5% and 1% level of significance respectively

Table 4. Estimates of direct and indirect effects on net curd weight in BIP's of cauliflower cross PSB-1 × KT-9

Traits	Stalk length	Leaves/ plant	Leaf length	Leaf breadth	Days to marketable maturity	Goss plant weight	Harvest index	Correlation coefficient
Stalk length	0.022	0.002	–0.016	0.027	–0.054	0.230	–0.113	0.099
Leaves/plant	0.009	0.006	0.010	–0.012	–0.024	0.194	0.020	0.202
Leaf length	–0.004	0.001	0.096	–0.086	–0.011	0.465	0.078	0.539*
Leaf breadth	–0.006	0.001	0.079	–0.104	0.019	0.530	0.201	0.720**
Days to marketable maturity	–0.016	–0.002	–0.015	–0.029	0.071	–0.102	0.089	–0.003
Gross plant weight	0.006	0.000	0.017	–0.047	0.014	0.197	0.443	0.619*

Residual effects = 0.0016; *,**-Significant at 5% and 1% level of significance respectively.

significant between stalk length and days to marketable maturity. Dharminder [9]; Dutta and Korla [11] and Dutta *et al.* [12] reported similar associations for net curd weight with gross curd weight and harvest index.

Path analysis (Table 4) indicated that gross plant weight had maximum direct effect on net curd weight followed by harvest index which is in consonance with the results of Dutta *et al.* [12]. Gross plant weight through leaf length, leaf breadth and harvest index; and harvest index through leaf breadth and gross plant weight contributed in considerable amount indirectly which resulted in significant association of these traits with net curd weight. It is evident from the results that gross plant weight and harvest index may be considered while selecting for high net curd weight in late cauliflower.

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