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Evaluation of Tropical Early Cauliflower (*Brassica oleracea* var. *botrytis*) Genotypes under Norther Dry Zone of Karnataka

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ABSTRACT: Genetic variability was studied for nineteen quantitative characters in forty genotypes of tropical early cauliflower. Analysis of variance revealed significant differences among the genotypes for all the characters except for days to curd initiation, days to curd maturity and curd depth. The genotypes *viz.*, Sanjeev Selection, DC-903, DC-105 and DC-94-2 were found promising as they had more than one desirable quantitative and qualitative traits. Sanjeev Selection had maximum curd yield per hectare (19.37 t/ha) while DC-94-2 exhibited earliest harvestable curd maturity (71.00 days). Good level of phenotypic and genotypic coefficients of variation (PCV and GCV), broad sense heritability and genetic advance as per cent of mean were observed for characters like net curd weight, marketable curd weight, curd yield per hectare. However, lowest coefficient of variation, heritability and genetic advance were observed for days to curd initiation, leaf width and ascorbic acid content of the curd.

Keywords: Cauliflower, genetic variability, co-efficient of variation, heritability and genetic advance.

INTRODUCTION

Cauliflower (*Brassica oleracea* L. var. *botrytis*) is one of the most popular and well-known cole vegetable, which is cultivated across the world under varied range of environmental conditions ranging from temperate to tropics mostly during cold cropping seasons and is generally available throughout the year. The word "Cauliflower" consists of two latin words *i.e.*‘ *caulis* ’ which means stem or stalk and ‘ *floris* which means flower. It belongs to family Brassicaceae, which has characteristics petals, standing opposite to each other, forming a square cross. The flower has total 6 stamens, 4 of them are long and 2 of them are short. The varieties belonging to *Brassica oleracea* have equal set of chromosome number *i.e.* n= 9. It is considered to be a monogenomic species (Thamburaj and Singh 2001).

It is a herbaceous annual vegetable grown for its tender ‘curd’ and biennially for seed production. It has a small, thick stem bearing a whorl of leaves and a branched taproot system. The main growing point develops into a shortened shoot system whose apex make up the convex surface of curd.

All the cultivated forms of cole vegetable are believed to be evolved from *Brassica oleracea* var. *cretica* L., which is commonly renowned as wild cabbage, a leafy kale like plant about 2000 years ago in Eastern Mediterranean region, through the process of mutation, and human selection followed by adaptation (Boriss *et al*., 2006). Where it was domesticated and gave rise to a wide range of cultivated forms. The present tropical Indian cauliflower developed as a result of inter – crossing between European and Cornish types.

The edible part of cauliflower is botanically known as pre floral fleshy apical meristem or immature inflorescences or flowering primordial (Nath *et al.,* 1994). The head of cauliflower is known as "curd" its a group of tightly packed flower buds that have not fully developed. The curd contributes nearly 45 per cent of the gross plant weight. It is the only crop in the Cole group in which the intermediate curding stage lies between the vegetative and reproductive stage.

Cauliflower contains vitamin A (70 IU), vitamin B (50 mg /100g) and vitamin C (75 mg /100g). Among minerals, Ca (0.73 %), P (0.38 %), K (2.71 %) and Fe (205 ppm). Besides vitamins and minerals, it also contains 4.9 % total carbohydrate and 0.2 % fat. Apart

from that it is also an excellent source of protein (16.1%), cellulose (16%), and hemicellulose (8%) (Mehra and Singh 2013). It is a proficient vegetable which has high dietary benefits due to its abnormal amount of antioxidants and anticarcinogenic compounds.

MATERIALS AND METHODS

The experiment was carried out in diverse collection forty genotypes of tropical early cauliflower check cultivar (Pusa Sharda) in Randomized Complete Block Design (RCBD) with two replications of each genotypes at the Vegetable Research Block Kittur Rani Channamma College of Horticulture, Arabhavi. University of Horticulture Sciences Bagalkot during the period from 2022 to 2023. There were 10 plants in each replication maintaining spacing 2 × 1.8 m^2. The plant to row spacing was give 60 × 45 cm. The standard cultural practices crop were followed to rise tropical early cauliflower crop. The observations plant height (cm), number of leaves per plant, leaf length (cm), plant canopy diameter (cm), leaf width (cm), leaf area index (LAI) 4, leaf waxiness, curd colour, days to 50% curd initiation, curd to 50 % curd maturity, net curd weight (g), curd yield per plot (kg), curd yield (q/ ha), ascorbic acid content (mg/ 100gm) for each genotypes were recorded from five randomly selected plants per replications. The analysis of variance was carried out as suggested by (Gariya *et al.,* 2019). Phenotypic co efficient of variation (Dhiman *et al*., 1983) heritability in broad senses and genetic advance (Ahirwar *et al.,* 2013) and correlation co- efficient (Dhatt *et al*., 2008) and path – analysis (Chatterjee *et al.*, 2018)

RESULTS AND DISSCUSTION

Mean performance of genotypes was significant for all the characters (Table 1). Wide range of variation was found for plant height (32.98 -59.21cm), leaf length (20.90 -25.70 cm), number of leaves per plant (8.50 - 18.25), plant canopy diameter (9.10- 24.00 cm), leaf length (4.90- 30.30cm) leaf area index (120.92 -184.87 LAI), days to 50 per cent curd initiation (42.30- 58.30 cm), days to 50 per cent curd maturity (62.70 -71.00), curd equatorial diameter (6.10 -15.26 cm), ascorbic acid content (17.18- 30.70 mg/100g), net curd weight (220.4 - 452.70 g).

Table 1: *Per se* Performance of tropical early cauliflower genotypes for growth parameters.

Sr. No.	Genotypes	Plant height (cm)		Number of leaves		Leaf length (cm)		Plant Canopy diameter (cm)		Leaf width (cm)		Leaf area index (LAI)	
		30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT
1.	DC- 105	15.19	47.52	4.40	8.50	12.55	23.60	6.97	13.00	9.64	16.85	137.32	155.53
2.	DC-903	17.94	35.26	4.90	13.10	9.10	20.90	7.74	13.24	8.80	14.90	120.09	144.77
3.	DC-207	20.28	50.1	4.90	13.30	14.50	23.90	6.57	14.10	8.40	26.85	127.93	163.02
4.	DC-89	20.82	43.93	4.50	13.00	16.00	22.70	7.18	13.90	10.54	16.05	117.83	120.92
5.	DC-7	16.63	42.25	4.60	13.60	14.30	23.10	6.95	14.70	10.74	15.40	122.05	152.18
6.	DC-67-10	30.84	59.21	4.60	13.40	17.80	23.10	6.31	15.30	11.20	17.30	119.83	136.51
7.	DC-76	12.09	32.98	4.60	13.90	17.60	22.70	7.19	14.92	10.74	15.40	122.05	152.97
8.	DC-105-WM	22.04	38.93	4.90	13.50	17.30	22.00	6.97	13.90	11.20	17.30	119.83	136.51
9.	DC-8	20.58	51.00	5.00	13.40	29.00	25.65	6.61	15.10	10.70	17.10	116.51	151.97
10.	DC-1005	21.49	43.27	5.20	13.90	13.42	21.90	9.49	14.10	10.90	17.00	146.11	144.83
11.	DC-94-2	20.71	43.32	5.40	13.50	15.40	22.90	13.10	24.00	8.90	27.15	118.28	141.76
12.	DC-9	20.19	52.97	5.20	14.00	16.30	21.10	3.41	9.10	8.70	18.80	122.68	137.83
13.	DC-104-WC	18.87	53.51	5.00	13.40	17.50	23.70	6.66	14.10	9.64	17.90	116.71	153.08
14.	DC-201-PG	20.56	43.06	5.20	13.70	25.75	23.60	6.95	13.90	8.80	17.30	120.06	141.26
15.	DC-11-HR	18.60	43.01	5.20	14.10	16.10	25.65	7.18	14.70	8.30	14.85	123.36	140.17
16.	DC-71	21.36	52.25	4.60	13.80	14.93	23.20	6.93	15.60	10.54	14.90	118.89	137.15
17.	DC-18	19.90	41.81	5.20	13.20	18.00	23.45	6.70	14.92	10.74	35.50	126.89	184.87
18.	DC-23	20.34	52.25	4.80	9.25	16.30	22.90	6.94	13.90	11.20	16.05	131.48	149.95
19.	DC-20-HR	18.74	43.12	5.50	13.70	15.93	22.50	6.83	15.30	10.90	18.20	112.81	130.93
20.	DC-230	17.18	52.84	5.50	13.70	15.93	22.50	6.83	15.10	21.45	17.20	131.48	158.20
21.	DC-301-3	16.45	50.69	5.60	8.50	14.70	22.60	6.74	14.10	8.90	17.00	112.81	131.54
22.	DC-67	17.41	43.08	4.60	13.60	17.30	25.70	6.74	18.35	11.40	17.15	147.79	139.89
23.	DC-137-SA	18.46	46.23	5.00	13.80	17.30	25.35	12.20	24.00	11.70	18.80	130.23	149.95
24.	DC-98-4	13.34	48.62	5.10	14.30	16.60	24.70	7.10	13.20	12.40	18.80	115.08	152.80
25.	DC-23000	16.62	51.79	5.10	13.60	15.80	23.85	7.36	13.94	11.90	17.90	116.91	135.67
26.	Pusa Shukti	15.48	54.47	4.90	14.00	11.00	24.40	7.09	9.10	12.40	17.30	112.64	147.66
27.	DC-35	14.23	39.25	4.90	13.90	17.90	24.00	6.69	14.79	22.60	18.10	119.12	147.71
28.	DC-303-PSB	16.71	35.45	4.50	14.20	19.60	23.00	11.76	14.98	8.40	14.85	120.14	154.16
29.	DC-394-WTC	12.63	50.20	5.00	13.40	21.30	24.50	7.09	15.70	10.54	18.30	133.10	184.92
30.	DC-522-207	17.76	40.07	5.20	13.70	21.20	25.00	7.03	14.98	10.74	16.05	115.39	131.88
31.	Pusa Sharad	16.36	50.28	4.90	14.20	20.80	24.95	9.74	15.70	11.20	16.40	122.47	156.82
32.	Pusa Meghali	18.24	42.42	5.00	13.30	20.90	23.50	7.24	14.50	10.90	17.60	114.75	156.18
33.	Pusa Ashwini	21.21	60.62	7.90	18.25	19.90	23.90	6.85	15.30	8.90	18.10	118.99	131.30
34.	Pusa Kartki Shankar	17.81	46.29	5.10	14.00	20.10	26.15	6.92	15.52	8.70	18.25	127.78	156.82
35.	Pusa Kartki	13.76	50.46	5.00	13.70	21.20	24.20	6.74	10.35	8.90	17.50	114.72	156.18
36.	Tha Ankiaka Chabi	16.28	37.62	5.10	13.80	21.00	23.30	6.80	14.64	11.40	17.50	131.68	131.30
37.	Ajithgarh Selection	22.20	40.43	5.00	14.30	20.40	20.90	10.39	14.64	17.70	28.30	129.57	152.24
38.	Vashali	28.05	51.50	5.00	14.10	19.70	24.90	6.78	14.70	14.64	17.70	114.72	144.04
39.	Sanjeev Selection	23.78	51.81	4.80	13.60	19.50	25.16	5.00	14.64	24.80	30.30	117.78	148.03
40.	Sonali -45-Selection	21.60	56.85	4.60	13.80	13.80	25.36	3.99	15.34	11.90	19.00	120.45	141.47
	Mean	**18.81**	**46.62**	**5.03**	**13.65**	**17.85**	**23.87**	**7.35**	**14.53**	**11.25**	**18.76**	**123.04**	**146.94**
	SE. m±	**0.35**	**0.936**	**0.30**	**0.66**	**2.07**	**0.55**	**0.65**	**0.92**	**0.58**	**0.31**	**2.57**	**2.576**
	CD at 5%	**1.01**	**2.677**	**0.85**	**5.93**	**5.93**	**1.58**	**1.85**	**2.65**	**1.65**	**0.89**	**7.36**	**7.656**
	CV (%)	**2.66**	**2.838**	**8.33**	**6.82**	**16.43**	**3.27**	**12.43**	**9.00**	**7.23**	**2.34**	**2.96**	**2.676**

Table 2: Estimation of genetic parameters in Tropical early cauliflower genotypes.

Sr. No.	Characters	Range	Mean	GV	PV	GCV (%)	PCV (%)	h^2(%)	GA	GAM
1.	Plant height at 30 DAT (cm)	12.09 -23.78	18.82	14.46	14.66	20.20	20.34	96.6	13.70	29.37
2.	Plant height at 60 DAT (cm)	32.98-59.21	46.62	45.89	47.64	14.53	14.81	98.30	2.28	32.21
3.	Number of leaves at 30 DAT	4.40-7.90	5.03	0.20	0.38	8.999	12.26	53.90	1.88	17.85
4.	Number of leaves at 60 DAT	8.50-18.25	13.65	1.81	2.68	9.85	11.99	67.6	152.0	21.69
5.	Leaf length at 30 DAT (cm)	9.10-29.00	17.85	9.17	17.79	16.97	23.62	51.6	10.17	54.22
6.	Leaf length at 60 DAT (cm)	20.90-25.70	23.87	1.24	1.84	23.80	23.82	67.0	20.27	13.86
7.	Plant canopy diameter at 30 DAT (cm)	3.41 -13.10	7.35	3.06	3.89	23.802	26.85	78.6	0.73	13.74
8.	Plant canopy diameter at 60 DAT (cm)	9.10-24.00	14.53	3.49	5.19	12.856	15.69	67.1	4.47	51.51
9.	Leaf width at 30 DAT (cm)	8.30-24.80	11.25	12.64	13.30	31.618	32.43	95	5.54	17.30
10.	Leaf width at 60 DAT (cm)	14.90-30.30	18.76	24.58	24.77	6.861	26.53	99.2	3.49	37.30
11.	Leaf area Index at 30 DAT	112.64-147.79	123.04	71.24	84.49	7.154	7.47	84.3	120.78	22.6
12.	Leaf area Index at 60 DAT	120.92-184.87	146.94	110.49	124.82	2.461	7.60	88.5	0.288	4.01
13.	Days to 50% curd initiation	42.30-58.30	53.52	23.60	55.52	3.434	9.07	73.0	4.97	21.87
14.	Days to 50% curd maturity	62.70-71.00	66.15	55.64	66.15	25.226	35.92	91.4	3.21	48.5
15.	Curd equatorial diameter (cm)	6.10-15.26	10.75	5.16	7.48	18.792	25.44	98.3	5.08	12.90
16.	Net curd weight (g)	220.4- 452.70	323.83	323.8	398.89	3.571	12.49	67.2	107.00	285.0
17.	Curd yield per plot (kg)	2.10 -5.01	3.28	0.43	0.45	19.93	20.57	93.87	1.30	39.77
18.	Curd yield (t/ha)	8.36- 19.37	12.12	6.42	6.91	20.89	21.69	92.82	5.03	41.47
19	Ascorbic acid estimation (mg/100g)	17.18-30.70	20.19	4.27	6.36	3.215	6.92	67.2	4.10	20.35

GV- Genotypic variance **PCV**- Phenotypic co- efficient of variation **h^2** -broad sense heritability
PV- Phenotypic variance **GCV**- Genotypic co- efficient of variation **DAT –** Days after transplanting
GA- Genetic advancement **GAM**- Genetic advance as per cent over mean curd yield per plot (2.10- 5.01 t/ha) and curd yield per hectare (8.36- 19.37 t/ha) as shown in (Table 2.) high range of variation in the characters indicates good scope for their improvement.

Phenotypic co efficient of variation (PCV) was higher than genotypic co-efficient of variation (GCV) for all the characters were observed by Jindal and Thankur (2004). It is indicating the role of environment in the expression of genotypes (Table 2). Phenotypic co-efficient was highest for days to 50 per cent curd maturity (35.92%), followed by plant canopy diameter (26.85%), curd equatorial diameter (25.44%), leaf length (23. 82%), and was lowest for ascorbic acid (6.92%), highest genotypic co- efficient of variation was observed for leaf width (31.61%) followed by days to 50 per cent curd maturity (25.22%), plant canopy diameter (23.80%), curd yield t/ha (20.89%).

The high values of heritability (above 70%) were observed for leaf width (99.2%) curd equatorial diameter (98.3%), and plant height (98.30%) curd yield per plot (93.87%) and curd yield t/ha (92.82%) thus suggested greater scope for effective selection for these characters. Leaf area index (88.5%), plant canopy diameter (78.6%) days to 50% curd initiation (73.0%) showed moderate level of heritability (50 -70%) its is supported by Kindo and Singh (2018) and lower level of heritability less than (68%) were recoded for leaf length (51.6%), plant canopy diameter (67.1%) and number of leaves per plant (67.6%). These results are in accordance with finding of Singh *et al.* (2013).

High genetic advance (above 20%) was recoded for leaf length (20.27%), plant height (13.70%), it has been also observed by Kumar and Korola (2001); Panse (1967); Batra *et al.* (2000) and moderate genetic advance (10-5%) plant canopy diameter (4.47%), ascorbic acid (14.10%) and leaf width (3.49%) all the reaming characters expressed lower genetic advance. The characters showing high genetic advance indicated that these characters showed additive gene effect and their fore more reliable for effective selection for breeding about improvement in tropical early cauliflower crop.

CONCLUSTIONS

High heritability alone is not enough to make efficient selection in segregating generation unless the information is accompanied for substantial amount of genetic advance. Burton (1952) and Panse (1957) viewed that if a character is governed by non -additive gene action, heritability and genetic advance both would be high. Thus, high estimates of heritability along with high genetic advance provide good scope for further improvement in advance generations of tropical early cauliflower if these characters are subjected to mass, progeny for family selection.

FUTURE SCOPE

— The amount of variability present for all the characters studied hence attention need to be given for these traits during selection for improvement of curd yield.

— Best performing genotypes may be selected for evaluation under different environmental conditions to assess the stability for their performance.

— The characters exhibiting high correlation and direct effect on yield are selected for further breeding programme.

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