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Genetic variability, heritability and genetic advance for growth, yield and quality components of Byadgi Dabbi ecotypes of chilli (*Capsicum annuum* L.)

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Abstract
In the present study, an attempt has been made to generate information on genetic variability using 55 Byadgi Dabbi ecotypes collected from different locations along with one local check. The variability, heritability and genetic advancement over the mean were performed for 16 selected parameters among the selected Byadgi ecotypes of chilli at Horticultural Research and Extension Station, Devihosur (Haveri). Higher phenotypic coefficient of variation is observed over genotypic coefficient of variation for all the traits studied, indicating the predominance of environment over the genetic parameters. Higher GCV and PCV were observed for Number of fruits per plant, stalk to fruit ratio, plant yield, capsaicin and oleoresin content of fruit. High heritability coupled with high GAM was observed for number of fruits per plant, stalk length, stalk to fruit ratio, plant yield, dry matter content, capsaicin content and oleoresin content. So, these traits imply the potential for crop improvement through selection.

Keywords: Genetic variability, heritability, genetic advance, growth, yield, quality components, Byadgi Dabbi ecotypes, chilli (*Capsicum annuum* L.)

Introduction
Chilli (*Capsicum annuum* L.) is one of the commercial vegetable cum spice crops at the global level. It deserves its place in vegetable, spice and as well as condiments. It is an important constituent of many foods as it is adding flavour, colour, pungency, vitamin A and C. Simultaneously, it is also used medically for the treatment of fever, cold, indigestion, constipation and as pain killer (Dagnoko *et al*., 2013) [3]. In India, there is no home which does not consume chilli. In Karnataka, Byadgi Dabbi and Byadgi Kaddi cultivars are grown in the specific districts such as Dharwad, Gadag and Haveri since centuries and are grown in rain fed condition with an optimal yield of 6-8 quintals per hectare. Though we are able to find trading of other varieties of red chillies at various locations across the country, but the Byadgi varieties are available for trade only in Byadgi, Gadag and Hubballi market. The Byadgi Dabbi cultivar is extensively used for the extraction of oleoresin, also it is most preferred by chilli producer and oleoresin industries due to its thin and wrinkled skin, high colour count, low pungency, characteristic aroma and high oleoresin recovery. The genus *Capsicum* is an often cross pollinated crop and natural cross pollination may go up to 50 per cent depending upon the extent of style exertion, time of dehiscence of anthers, wind direction, temperature fluctuation and insect population (Murthy and Murthy, 1962 and Hosmani, 1993) [9, 5], which accounts for considerable variation in fruit quality and yield parameters. Maximum diversity can be noticed among different cultivars available in India and outside with respect to shape, size, yield, quality and other traits. Identification of a variety better suited for a particular region and its improvement is of immediate task to exploit its potential. The successful of selection depends on the amount of genetic variation present in a population. Larger amount of variability increases the chance of selecting desired genotypes (Vavilov, 1951) [10]. The improvement can be brought out after confirming the variability in different characters among different genotypes. The potential for improvement in any crop is proportional to the magnitude of genetic variability present in the germplasm. A wide range of variability is available in chilli due to its ability to cross pollinate, which provides possibilities to improve fruit yield through a breeding program.

Hence, an experiment was conducted at Horticulture Research and Extension Station (HRES), Devihosur, Haveri with the aim of estimating genetic variability, heritability and genetic advancement of Byadgi Dabbi ecotypes of chilli (*Capsicum annuum* L.).

Material and methods

56 genotypes of Byadgi Dabbi ecotypes (*Capsicum annuum* L.) collected from different locations were evaluated at HRES, Devihosur, Haveri of University of Horticultural Sciences, Bagalkot during *Kharif* 2016-17. The ecotypes were raised in randomized block design with two replications. Five plants were randomly selected per accession and observations recorded on different growth, yield and quality parameters. Analysis of variance in respect of various characters was studied and the genetic variability for the different characters was estimated as suggested by Heritability (broad sense) and genetic advance as percentage of mean were calculated as per Hanson *et al*. (1956) [5] and Johnson *et al*. (1955) [6].

Result and discussion

Chilli (*Capsicum annuum* L.) being an often cross pollinated (12-16%) crop having enormous variability. The purity of Byadgi Dabbi cultivars has been deteriorated as result of outcrossing with other improved varieties which were growing in the range of proximity to the Byadgi Dabbi and growers were using such seeds for further cultivation in the subsequent years as a result, the original traits of Byadgi Dabbi variety was masked, deteriorated and diluted by the dominant traits of other improved varieties or hybrids growing in that area. Simultaneously, the plant breeder can utilize the intra cultivar variation to identify sources of favourable genes, incorporate them into breeding populations and select for a combination of desirable traits that might results in the isolation of new cultivars. To achieve these targets, plant breeders need to know the extent of variability present in a population. Evaluation of large number of collected lines along with popular accessions is the first step towards the target.

Analysis of variance was worked out for growth, yield and quality related traits. Analysis of variance revealed highly significant difference among the ecotypes for all the traits studied. Existence of genetic variability among the genotypes for the characters to be improved is the most basic requirement for successful selection. In the present investigation, variance within the ecotypes was significant (at p=0.05) for all the 16 characters *viz.,* growth, yield and quality parameters (Table 1) indicating the sufficient amount of variability existed for all the characters and considerable improvement could be achieved in most of these characters by selection.

High genotypic coefficient of variation (GCV > 20%) and phenotypic co-efficient of variation (PCV>20%) accompanied with high heritability (h^2>60%) and genetic advancement over the mean (GAM) (>20%) for the traits like stalk length, stalk to fruit ratio, number of fruits per plant, fruit yield per plant, ascorbic acid, capsaicin and oleoresin was observed in the present study (Table 2) which were in accordance with the report of Amit *et al.,* 2014 [1], Maurya *et al.,* 2015 [8] and Abhinaya *et al.,* 2016 [2] indicating the existence of additive gene action which, in turn offers the scope for selection. The traits like plant height, plant spread, number of primary branches per plant, number of secondary branches per plant like fruit length, fruit diameter and fruit weight had exhibited moderate estimate of genotypic and phenotypic co-efficient of variation along with moderate heritability and GAM which are in agreement with the report of Datta and Das (2013) [4] and Kumari *et al.* (2014) [7]. The moderate GCV, PCV, heritability and GAM indicating the governance of non-additive genes. Hence, there is little scope for improvement in growth related trait by means of selection as the traits are influenced much by environment. Days to 50 per cent flowering found to be had low GCV, PCV, heritability and GAM and are in agreement with the report of Abhinaya *et al*. (2016) [2] and this result is appealing that the trait does not play role in selection criteria as it is highly influenced by environment. On the basis of genetical information obtained for different characters as summarized above, it indicates that there is an existence of greater amount of variability for the all the characters in different genotypes, which can be efficiently utilized for further improvement of chilli genotypes by choosing effective breeding program based on genetic makeup of different traits.

Table 1: Analysis of variance (mean sum of squares) for growth, yield and quality parameters in Byadgi dabbi ecotypes

Particulars	Parameters		Replication	Treatments	Error	SEm	CD	
							1%	5%
Growth parameters	Plant height (cm)		274.77	198.48*	112.39	7.50	21.25	28.29
	Plant spread (cm)		3404.26	144.22*	66.17	5.75	21.70	16.30
	Number of primary branches		2.77	0.48*	0.19	0.31	0.88	1.17
	Number of secondary branches		9.03	1.76*	0.73	0.60	1.71	2.28
Yield parameters	Days to 50% flowering		72.32	4.81*	2.74	1.17	4.42	3.32
	Number of fruits/ plant		13.31	98.51*	11.39	2.39	9.01	6.76
	Fruit length (cm)		10.58	1.84*	0.64	0.57	2.14	1.61
	Stalk length (cm)		1.67	0.29*	0.07	0.18	0.68	0.51
	Stalk to fruit ratio		4.85	0.00068*	0.00014	0.01	0.03	0.02
	Fruit diameter (cm)		0.50	0.05*	0.02	0.09	0.35	0.26
	Fruit weight (g)		2.41	0.78*	0.22	0.33	1.25	0.94
	yield / Plant (g)		982.58	918.37*	81.43	6.38	24.08	18.08
Quality parameters	Dry matter (%)		1.84	12.93**	0.85	0.65	2.46	1.85
	Ascorbic acid (mg/100g)	Green	0.02	836.06**	115.43	7.60	28.67	21.53
		Red turning	745.34	865.03**	265.64	11.52	43.49	32.66
		Red wet	53.07	744.04**	103.61	7.20	27.16	20.40
	Capsaicin (SHU)	Green	1482545.71	43612972.07**	143011.83	267.41	1009.03	757.87
		Red turning	721929.14	84725967.86**	115784.94	240.61	907.91	681.92
		Red wet	19431264.55	120094839.11**	438294.65	468.13	1766.44	1326.75
	Oleoresin (%)		0.45	20.13**	0.53	0.52	1.95	1.46

Table 2: Estimates of mean, range components of variance, heritability and genetic advance for growth, yield and quality parameters in Byadgi Dabbi ecotypes

Characters		Range		Mean	GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM (%)
		Min.	Max.								
Plant height (cm)		59.47	95.03	79.22	24.43	101.03	6.24	12.69	24.20	5.01	6.32
Plant spread (cm)		28.09	66.25	51.96	35.67	83.04	11.49	17.54	43.00	8.06	15.52
Number of primary branches		1.9	4.1	2.96	0.14	0.34	12.77	19.57	42.50	0.51	17.15
Number of secondary branches		4.3	8.8	6.39	0.52	1.25	11.24	17.47	41.40	0.95	14.90
Days to 50% flowering		49.5	53.5	50.3	0.06	1.82	0.47	2.65	27.40	0.09	0.17
Number of fruits/ plant		8	35.3	6.36	43.56	54.95	28.80	32.35	79.30	12.10	52.83
Fruit length (cm)		4.03	7.98	2.22	0.60	1.24	12.13	17.50	48.10	1.10	17.33
Stalk length (cm)		1.47	3.12	1.27	0.12	0.18	15.27	19.12	63.80	0.56	25.12
Stalk to fruit ratio		0.025	0.1	0.06	0.00	0.00	26.30	32.51	65.40	0.03	43.81
Fruit diameter (cm)		0.88	1.725	22.91	0.02	0.03	10.13	14.54	48.60	0.18	14.55
Fruit weight (g)		2.11	4.6	3.26	0.28	0.50	16.18	21.66	55.80	0.81	24.89
yield / Plant (g)		20.3	167.6	63.23	418.47	499.89	32.35	35.36	83.70	38.56	60.97
Dry matter (%)		9.91	20.18	14.2	6.04	6.89	17.30	18.48	87.60	4.74	33.36
Ascorbic acid (mg/100g)	Green	72.37	156.4	109.15	360.31	5.74	17.39	19.98	75.70	34.03	31.18
	Red turning	134.8	225.05	175.1	299.70	565.34	9.89	13.58	53.00	25.97	14.85
	Red wet	97.2	172.9	126.87	320.22	423.82	14.10	16.23	75.60	32.04	25.26
Capsaicin (SHU)		1795.16	25778.84	7716.68	59828280	60266570	100.24	100.60	99.30	5875.79	205.73
Oleoresin (%)		5.3	21.42	11.21	9.80	10.33	27.92	28.67	94.80	6.28	56.01

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