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Research Article

Correlation and Path Co-Efficient Analysis in Cauliflower (*Brassica oleracea* var. Botrytis L.)

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ABSTRACT

The present investigation was carried out with 22 genotypes of Cauliflower planted in Randomized Block Design with three replications to know the nature and magnitude of phenotypic coefficient of variation (PCV) was significantly higher than the corresponding genotypic coefficient of variation (GCV) for all the characters under the study, indicating a considerable influence of environment on their expression. Higher magnitude of PCV and GCV (> 30%), respectively were recorded for stalk weight, leaves weight, curd weight with guard leaves, curd weight per plot, curd weight indicating the existence of wide range of genetic variability in the germplasm for these traits. The variability, heritability and genetic advance as per cent of mean for various horticultural traits. The analysis of variance showed significant variation among different genotypes for all the traits under study. Genotype Golden Agahani, Pusa Snowball, Pusa Deepali, Poosi, Haridwar Local, KT-9, Faizabad Local, Rajasthan Local, Pant Gobhi-3 recorded highest curd weight and also performed better for other horticultural traits than check cultivar (Pusa Himjyoti).Genetic analysis indicated that phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) in all of the attributes studied. High heritability (broad sense) estimates coupled with high genetic advance as per cent of mean were observed for yield and other horticultural traits.

Keywords: *Cauliflower, Correlation co-efficient, Path co-efficient,*

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L.) 2n = 2x = 18) of the family Brassicaceae or Cruciferacea is used as a white edible portion called curd. According to Allard (1960) cabbage, cauliflower, Brussels sprout, broccoli and other varieties of oleraceae have been reported morphologically on the basis of few gene differences. The varieties of *Brassica oleracea* have same chromosome number (n=9). *Brassica oleraceae* is a triple tetrasomic with the genomic formula ABBCCDEEF with 6 basic genomes and some secondary pairing (Gerhard, 1960).

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Cauliflower was introduced in India in 1822 when Dr. Jemson, a botanist from Kew, took charge of the Company Bagh (United Provinces, Saharanpur in the Northern Plains) to carry out some horticultural experiments during the period of the East India Company (Nath et al., 1994). India is the second largest producer of cauliflower in the world after China. It is a rich source of minerals like phosphorus, potassium, calcium, sodium and iron and have medicinal values. It is grown in all the agro climatic zones of India. India is a developing country which has achieved self-sufficiency and a good degree of sustainability in food production. But there is urgent need for providing nutritional security to the population through balanced diet as significant population is under nourished. The genetic parameters such as heritability, genetic advance, genotypic and phenotypic coefficients of variability are effective for the breeders to select a genotype having the most desirable traits for yield. Therefore the present research has been undertaken with the objective to study the relative magnitude of genetic variability and heritability for various traits of horticultural importance in cauliflower.

MATERIALS AND METHODS

The experiment was carried out in diverse collection of twenty two genotypes of cauliflower, including check cultivar (Pusa Himjyoti) in Randomized Block Design with three replications of each genotype, at the Vegetable Research Block Tigddu, College of Horticulture, VCSG Uttarakhand University Horticulture and Forestry, Bharsar, Pauri Garhwal (Uttarakhand) during the period from August 2016 to January 2017. There were 9 plants of each entry in each replication in a plot of 1.80 x 0.90 m^2. The plant to plant spacing was given 30cm. The standard cultural practices were followed to raise the cauliflower crop. The observations on number of leaves per plant, leaves weight (g), plant height (cm), days to 50% curd initiation, days to 50% curd maturity, days to full curd maturity at harvesting time, whole plant weight (g), curd weight(g), curd length (cm), curd diameter (cm), curd volume (cm^3), stalk length (cm), stalk weight (g), stalk diameter (cm), curd weight per plot (g), curd dry weight (%), curd weight with gurd leaves (g), Ascorbic acid content (mg per 100gm) for each genotype were recorded from five randomly selected plants per replication. The analysis of variance was carried out as suggested by Panse and Sukhatme (1985). The data were analyzed to estimate genotypic and phenotypic co-efficient of variation (Burton and De-Vane, 1953), heritability in broad sense and genetic advance (Allard, 1960) and correlation co-efficient (Al-Jibouri et al., 1958).

RESULTS AND DISCUSSION

The analysis of variance for eighteen characters revealed highly significant differences for all the characters indicating the existence of enormous amount of genetic variability for growth and yield attributes. The extent of variability present in the genotypes was measured in terms of range, coefficient of variation, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), broad sense heritability and genetic advance (GA). The mean performances of the different traits under study in 22 cauliflower genotypes are shown in Table 1. Significant differences were observed among all the genotypes for all the characters under study. A wide range of variations existing for various quantitative traits has also been reported in cauliflower by various workers (Thakur 1998; Kumar et al., 2002; Dubey et al., 2003; Singh et al., 2013; Chittora & Singh 2015, Gaur & Singh, 2016, Aditya et al., 1989; Sharma et al. 2005; Pandey & Naik 1991, Sharma et al. 1988, Singh & Thakur; 1990, Mehara & Singh 2013, Rahman et al. 2013, Singh et al. 2006). Among the horticultural characters, number of

per plant, leaves weight, plant height, days to 50% curd initiation, days to 50% curd maturity, days to full curd maturity at harvesting time, whole plant weight, curd weight, curd length, curd diameter, curd volume, stalk length, stalk weight, stalk diameter, curd weight per plot, curd dry weight, curd weight with guard leaves, Ascorbic acid content is the traits which revealed the existence of good deal of variability in the germplasm.

The magnitude of phenotypic coefficient of variation (PCV) was significantly higher than the corresponding genotypic coefficient of variation (GCV) for all the characters under the study, indicating a considerable influence of environment on their expression. Higher magnitude of PCV and GCV (> 30%), respectively were recorded for stalk weight, leaves weight, curd weight with guard leaves, curd weight per plot, curd weight indicating the existence of wide range of genetic variability in the germplasm for these traits. This also indicated broad genetic base, less environmental influence and these traits are under the control of additive genes and hence there is a good scope for the further improvement of these characters through selection. Jamwal et al. (1992), Crisp and Kesavan (1978), Mahajan and Gill (1997), Khar et al. (1997), Kumar and Korla (2001), Mehara and Singh (2013), Santosha et al. (2015), and Gaur and Singh (2016). Rest of the characters recorded moderate coefficient of variation except for ascorbic acid content, curd volume, stalk length, and curd dry weight, curd diameter, plant height, curd length, However, the differences between phenotypic and genotypic coefficient of variation were quite low. The characters studied were influenced by environment to lesser extent, thus the selection based on phenotypic performance will be reliable. The genotypic coefficient of variation does not offer full scope to estimate the variation that is heritable or environmental and therefore, estimation of heritability becomes necessary. The magnitude of heritability ranged from 84.88 to 99.81. Heritability estimates were high (>60%) leaves weight, whole plant weight, stalk weight, curd weight with guard leaves, curd weight, curd dry weight, curd weight per plot, ascorbic acid content, plant height, curd volume, curd diameter, stalk length, curd length, days to 50% curd initiation, number of leaves per plant, days to 50% curd maturity, stalk diameter, and days to full curd maturity at harvesting time which showed that selection in these characters would be effective. These findings were in accordance with by Santosha et al. (1015), Mahajan and Gill (1997), Mehara and Singh (2013), Khar et al. (1997), Kumar and Korla (2001), Singh et al. (2013), Chittora and Singh (2015), and Gaur and Singh (2016) in cauliflower. The value of genetic advance as percentage of mean ranged from 15.55- 96.75. The information on heritability alone may be misleading but when used in combination with genetic gain, the utility of heritability estimate increases. In present study, high heritability coupled with high genetic advance as percentage of mean was observed for leaves weight, whole plant weight, stalk weight, curd weight with guard leaves, curd weight, curd weight per plot, ascorbic acid content indicating that most likely the heritability is due to additive gene effects and thus the chances of fixing by selection will be more to improve such traits through pure line selection in the evaluated genotypes. Similar findings were recorded by Kanwar et al. 2010; Singh et al. (2013); Chittora and Singh (2015), and Gaur and Singh 2016 in cauliflower.

Table 1: Genotypic and Phenotypic coefficients of correlation among different trait in Cauliflower

Traits		SW	CW	LW	CL	CD	SD	SL	PH	NL	CV	CWWGL	CDW	DCI	DCM	DFCMHT	AAC	CWPP
WPW	P	0.923**	0.921**	0.978**	0.479**	0.733**	0.843**	0.576**	0.754**	0.807**	0.665**	0.987**	0.046	-0.354**	-0.288*	-0.408**	-0.040	0.921**
	G	0.933**	0.927**	0.980**	0.498**	0.732**	0.931**	0.584**	0.759**	0.857**	0.663**	0.999**	0.043	-0.355**	-0.333**	-0.424**	-0.041^{xx}	0.927**
SW	P		0.788**	0.922**	0.449**	0.736**	0.810**	0.572**	0.716**	0.717**	0.585**	0.908**	-0.047	-0.323**	-0.385**	-0.441**	0.048	0.787**
	G		0.799**	0.926**	0.454**	0.755**	0.845**	0.591**	0.725**	0.743**	0.600**	0.908**	-0.046	-0.337**	-0.393**	-0.510**	0.054^{xx}	0.798**
CW	P			0.845**	0.502**	0.623**	0.770**	0.581**	0.702**	0.756**	0.617**	0.932**	0.109	-0.386**	-0.251*	-0.329**	-0.129	1.000**
	G			0.851**	0.516**	0.631**	0.855**	0.577**	0.715**	0.795**	0.625**	0.946**	0.113	-0.396**	-0.271*	-0.337**	-0.140^{xx}	1.000**
LW	P				0.399**	0.696**	0.837**	0.569**	0.772**	0.796**	0.633**	0.974**	0.085	-0.302*	-0.285*	-0.383**	-0.026	0.845**
	G				0.412**	0.703**	0.905**	0.581**	0.774**	0.838**	0.637**	0.980**	0.081	-0.304*	-0.310*	-0.414**	-0.024	0.852**
CL	P					0.593**	0.520**	0.287*	0.260*	0.476**	0.685**	0.460**	-0.111	-0.472**	-0.315**	-0.330**	0.069	0.505**
	G					0.629**	0.554**	0.300*	0.280*	0.452**	0.721**	0.466**	-0.101	-0.537**	-0.298*	-0.382**	0.070	0.517**
CD	P						0.544**	0.415**	0.414**	0.580**	0.550**	0.684**	-0.355**	-0.320**	-0.229	-0.349**	0.031	0.622**
	G						0.635**	0.422**	0.417**	0.640**	0.540**	0.705**	-0.367**	-0.311*	-0.300*	-0.341**	0.030	0.631**
SD	P							0.426**	0.638**	0.709**	0.559**	0.869**	0.078	-0.357**	-0.337**	-0.309*	-0.215	0.771**
	G							0.507**	0.697**	0.771**	0.645**	0.905**	0.089	-0.411**	-0.294*	-0.530**	-0.206	0.858**
SL	P								0.603**	0.359**	0.632**	0.586**	0.086	-0.139	0.005	-0.104	0.124	0.581**
	G								0.625**	0.385**	0.646**	0.606**	0.094	-0.140	-0.003	-0.071	0.107	0.577**
PH	P									0.595**	0.562**	0.770**	0.199	-0.339**	-0.236	-0.258*	0.081	0.701**
	G									0.646**	0.566**	0.781**	0.189	-0.333**	-0.267*	-0.278*	0.088	0.714**
NL	P										0.443**	0.817**	0.030	-0.367**	-0.517**	-0.507**	-0.204	0.758**
	G										0.492**	0.848**	0.051	-0.461**	-0.506**	-0.597**	-0.214^{xx}	0.795**
CV	P											0.643**	0.121	-0.299*	-0.052	-0.154	0.229	0.616**
	G											0.660**	0.117	-0.291*	-0.107	-0.131	0.232	0.624**
CWWGL	P												0.096	-0.341**	-0.298*	-0.347**	-0.073	0.932**
	G												0.098	-0.356**	-0.298*	-0.414**	-0.068	0.946**
CDW	P													0.050	0.020	-0.055	-0.100	0.109
	G													0.069	0.007	-0.055	-0.096	0.113
DCI	P														0.686**	0.685**	0.213	-0.385**
	G														0.799**	0.750**	0.219^{xx}	-0.396**
DCM	P															0.796**	0.128	-0.249*
	G															1.012**	0.133	-0.269*
DFCMHT	P																0.120	-0.330**
	G																0.161	-0.337**
AAC	P																1.000	-0.132
	G																1.000	-0.143

Where,
WPW [Whole plant weight (g)], SW [Stalk weight (g)], CW [Curd weight (g)], LW [Leaves weight (g)], CL [Curd length (cm)], CD [Curd diameter (cm)], SD [Stalk diameter (cm)], SL[Stalk length (cm)], PH [Plant height (cm)], NL [No. of leaves], CV [Curd volume (cm3)], CWWGL [Curd weight with guard leaves (g)], CDW [Curd dry weight/100gm in (%)], DCI [Days to 50 % curd initiation], DCM [Days to 50% curd maturity], DFCMHT [Days to full curd maturity at harvesting time], AAC [Ascorbic acid content (mg/100gm)], CWPP [Curd weight per plot (g)], **Significant at 5% level of significance,*

***Significant at 1% level of significanc*

CONCLUSION

Different cauliflower genotypes exhibited marked variation in all the traits under study. From the present investigation, it can be concluded that nine genotypes *viz.*, Golden Agahani, Pusa Snowball, Pusa Deepali, Poosi, Haridwar Local, KT-9, Faizabad Local, Rajasthan Local, Pant Gobhi-3 recorded higher curd yield and also performed better for other horticultural traits than check cultivar (Pusa Himjyoti). These genotypes need further testing to be released as a substitute of already existing cauliflower varieties or they can be involved in further breeding programme for development of superior varieties or hybrids for yield and quality improvement in cauliflower. Overall, Golden Agahani, Pusa Snowball, Pusa Deepali, Poosi, Haridwar Local, KT-9, Faizabad Local, Rajasthan Local, Pant Gobhi-3 are best suited for cultivation in the hills of Uttarakhand. PCV was higher than GCV in all of the attributes studied, which signified the presence of environmental influence to some degree in the phenotypic

expression of characters. Highest PCV (42.01) and GCV (41.89) were obtained for stalk weight respectively. High heritability estimates coupled with high genetic gain were observed for leaves weight, whole plant weight, stalk weight, curd weight with guard leaves, curd weight, curd weight per plot, ascorbic acid content . Hence selection can prove effective for improvement in yield. Besides this, high heritability coupled with moderate genetic gain was observed for curd volume, curd dry weight, stalk length, curd diameter, plant height, curd length, days to 50% curd initiation which indicated that these characters are under additive gene effects and these characters are more reliable for effective selection. Thus, selection may be possible for these characters for improving yield.

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