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Genetic advance and heritability for yield and different attributes in coriander (*Coriandrum sativum* L.) in high hill regions of Uttarakhand, India

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ABSTRACT

Huge amount of variability in the germplasm provides better chance of selection in desired genotypes. Hence knowledge of the significance and type of variability existing in the germplasm for yield and its attributing traits is an important pre-requisite to carry out any crop improvement programme. In the present study twenty four coriander (*Coriandrum sativum* L.) genotypes were evaluated to estimate the variability studies in Randomized Complete Block Design with three (03) replications. Evaluation for different horticultural traits Pali LC, KP Local, Pant Haritma, Dhulet Local, Siku LC and Pant LC recorded highest fruits per umbel and also gave better yields for other horticultural traits like seed yield per plot (g) than check cultivar HL Normal. Genetic analysis indicated that Phenotypic Coefficient of Variation (PCV) was higher than Genotypic coefficient of variation (GCV) in all of the attributes studied. The selection for the characters like plant height (cm), seed yield per plot (g) can be performed to achieve improvement. The Phenotypic Coefficient (PC) and Genetic Coefficient (GC) were found high for almost all the traits except maturity duration, days to 50% flowering and days to first umbel unfolding, test weight (g) and number of primary branches per plant and plant height (cm). Environment and its interaction with the genotypes were observed to be significant for all the traits in the present study.

Key words : *Randomized complete Block design, Phenotypic coefficient, Genotypic coefficient, Coriander and genotypes*

Introduction

Coriander (*Coriandrum sativum* L.), is an annual herb which belongs to family Umbelliferae. Coriander was originated from the Mediterranean region between the Eastern Mediterranean and Caucasus mountains (Vaidya, 2000). A strong odour of whole plant and especially the unripe fruit is a peculiar character. Its name has been derived from the Greek word "Koris" meaning bed bug because of unpleasant view of seed coat colour. (Gruenwalded, 2004).

Abbreviations

% : Per cent; and; cm : centimeter; R C: Degree centigrade; *et al* : And others; g: gram; E: East; GA: Genetic Advance; GG: Genetic Gain; GCV: Genetic Coefficient of Variation; *i.e.,* : That is; m: Metre; m^2: Square metre ; mm: Millimetres; MSL: Mean Sea Level; N: North; PCV: Phenotypic Coefficient of Variation; RCBD: Randomized Complete Block Design.

The major constituent of coriander oil contains coriandrol. It is a plant with thin stem, bearing several primary and secondary branches which attains height upto 90-100 cm. Its leaves are alternate with compound shape and petiole has a pair of stipules sheathing with the stem base. The seeds are generally green and round (botanically fruit) which attain grey brown colour at maturity time. It requires a relatively cool and humid climate. International organization for Standardization (ISO) has listed 109 spices worldwide. In India around 63 spices are grown including seed spices. Out of 63 spices, 20 are classified as seed spices (Anwer *et al.*, 2011). Out of 20 seed spices 10 are mandate and main seed spices of the National Research Centre of Seed Spices (NRCSS) Ajmer, India.

Materials and Methods

Experimental site

The investigations entitled "Genetic Advance and Heritability for Yield and different attributes in coriander (*Coriandrum sativum* L.) in High Hill Regions of Uttarakhand." was conducted at Medicinal and Aromatic Block, Department of Spices, Plantation, Medicinal and Aromatic Plants, College of Horticulture, Bharsar, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar.

Location and climate

Site is located at Bharsar, Pauri Garhwal in between 29^0 20'- 29^0 75' N Latitude and 78^0 10'-78^0 80' E Longitude at an altitude of 1950 m asl. (Annonymous 2016).

Details of the experiment are as under: **Experimental design** : Randomized Complete Block Design (RCBD), Total number of genotypes of coriander: **24, Replication** : 3, **Spacing** : 15 cm x 30 cm, **Plot size** : 1.20 m x 1.50 m, Number of plants per plot: **40, Total number of plots** : 72, **Sowing season and year:** Spring season (16/02/2016), **Harvesting season and year :** Rainy season (15/06/2016)

Experimental material and layout

The experimental material that is 24 genotypes of coriander for present investigation were collected from four different states of India namely, Uttar Pradesh, Andhra Pradesh, Rajasthan and Uttarakhand (Table 1). Seeds of coriander were directly sown in the field plots in the month of February 16 2016 at a spacing of (15×30) cm in a plot of (1.2×1.5) m^2 size. There were five rows in each plot. Forty plants per plot were raised after thining out operation. Each germplasm was sown in a Randomized Block Design (RBD) with three replications.

Statistical analysis

The statistical analysis were carried out for each character under the study using MS-Excel, OPSTAT and SPAR 1.0 packages. The mean values of data were also subjected to analysis of variance as described by Gomez and Gomez (1983) for Randomized Complete Block Design (RCBD).

Results

Variability Studies

Parameters of variability

Genetic variability in *Kharif* season of year 2016 was examined to be as an important factor which is important prerequisite for crop breeding programmes. The phenotypic coefficients of variation (PCV) were observed highest and lowest respectively for seed yield per plot (121.07%) and maturity duration (13.38%). Similarly, the genotypic coefficients of variation (GCV) was found highest for seed yield per plot (116.73%) etc.

Heritability

In the present investigation, estimates of heritability in broad sense were also worked-out which varied from 51.78% to 96.37% for different characters under study (Table 3). The classification of heritability value was done as per Sharma (1989). Highest heritability was observed for seed per plant (96.37) etc.

Genetic advance and genetic gain

The classification of values of genetic gain and genetic advance was done as per Sharma, 1994. As shown in (Table 2) the range for genetic advance was from 0.73 to 185.15 where highest genetic advance and genetic gain were observed respectively for seed yield per plot (185.15) and seed per plant (234.90).

Variability Studies

The analysis of variance indicated highly significant differences among the genotypes for all the traits studied which indicates the presence of genetic diversity in the existing germplasm *viz*, plant height

(cm), primary branches per plant, secondary branches, umbel per plant, umbellates per umbel etc. These results were in agreement with Sharma and Sharma (1989); Megeji and Karla (2002); Karla *et al* (2003); Shah *et al.* (2003) and Rajput and Singh (2003).

Mean performance of genotypes

The mean performance of the genotypes revealed a wide range of variability for all the traits. The variation was maximum for days to maturity (70.60-118) etc. The same extent of variability for the trait was also seen in the reportings of Srivastava *et al.* (2000); Tripathi *et al.* (2000); Rajput and Singh (2003); Singh *et al.* (2005); Singh *et al.* (2006) and Bertini *et al.* (2010).

Parameters of variability

Phenotypic and Genotypic Coefficient of Variations

In the present observations, phenotypic coefficient of variation were observed to be higher than the corresponding genotypic coefficient of variation for all the characters studied and differences were considerable for the character due to environmental variations. The finding of Tripathi *et al.* (2000); Megeji and Karla (2002) and Rajput and Singh (2003) were similar to that of the present findings.

Heritability, Genetic Advance and Genetic Gain

Sharma (1994) has indicated that genetic coefficient of variability with heritability estimates would gave a trusty indication of improvement through selection. Highest heritability was recorded for seed per plant (96.37) etc. Heritability for above studied traits was also reported earlier by Bhandari and Gupta (1991). The range for genetic advance was from 0.73 to 185.15. These present findings are fully agreed with Tripathi *et al.* (2000) and Bhandari and Gupta (1991).

Variability Studies

Mean performance

Among all the germplasm, Bareilly Local was found earliest in days to 50% flowering (36.60 days). Seed yield per plot was recorded significantly maximum in the genotype Pant Haritma (307.80). Besides this,

Table 1. List of coriander genotypes studied along with their sources

S. No.	Genotypes	Source/Place of Collection	Treatment
1	Pant LC	Pantnagar (Uttarakhand)	T1
2	Pali	Pabau (Uttarakhand)	T2
3	KP Local	Pabau (Uttarakhand)	T3
4	Bareilly Local	Bareilly (U.P.)	T4
5	PLC	Pantnagar (Uttarakhand)	T5
6	Pant Haritma	G.B.P.U.A.&T., (Uttarakhand)	T6
7	PD-21	G.B.P.U.A.&T., (Uttarakhand)	T7
8	R-CO-75	Dholpur (Rajasthan)	T8
9	ALC	Sikandrabad (A.P)	T9
10	RL-13	Rudrapur (Uttarakhand)	T10
11	Siku-LC	Pauri (Uttarakhand)	T11
12	Kota	Pabau (Uttarakhand)	T12
13	LS-800	Saharanpur (U.P.)	T13
14	Dhulet Local	Bharsar (Uttarakhand)	T14
15	CO-4	Bharsar (Uttarakhand)	T15
16	HL-Normal+	Bharsar (Uttarakhand)	T16
17	HL-Thick	Bharsar (Uttarakhand)	T17
18	HL-Big	Bharsar (Uttarakhand)	T18
19	Thailisain LC	Thalisain (Uttarakhand)	T19
20	Raltham LC	Pauri (Uttarakhand)	T20
21	Hanumangarh Rajasthan	Hanumangarh (Rajasthan)	T21
22	Jaunpur Local	Jaunpur (U.P.)	T22
23	Small CO	Sultanpur (Uttarakhand)	T23
24	Lakhimpur	Lakhimpur (U.P.)	T24

[+]Check Cultivar (Nearest village to Bharsar campus)

seven genotypes had more seed yield per plot than check cultivar HL- Normal (73.28).

Coefficients of variability

The phenotypic coefficients of variation (PCV) and genotypic coefficients of variation (GCV) were recorded highest for seed yield per plot etc. The evaluation of heritability in broad sense were found maximum for seed yield per plant etc.

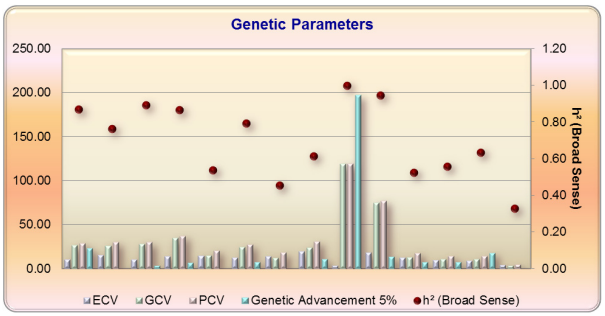

Fig. 1. Genetic parameters of experiment

Discussion

Coriander (*Coriandrum sativum* L.) is a common seed spice crop cultivated in the whole world due to its wider cosmopolitan adaptability, high yielding and appropriate for use even in dried form. Acquiring this, need for continuous crop improvement in coriander, can be achieved by isolating best breeding lines / varieties having desirable biotic and abiotic resistance with other horticultural traits.

Variability Studies

The analysis of variance were done for all the characters in Randomized Block Design in the year 2016. The analysis of variance indicated highly significant differences among the genotypes for all the traits studied which indicates the presence of genetic diversity in the existing germplasm.These results were in agreement with Sharma and Sharma (1989); Megeji and Karla (2002); Karla *et al.* (2003); Shah *et al.* (2003) and Rajput and Singh (2003).

Yield is a quantitative polygenic character and it is a resultant of interactions of several genetic and environmental factors. According to Grafius (1959) and Whitehouse *et al.* (1958) which are not done by the genes for yield but their components, the multiplicative interactions result in ultimate yield.

Parameters of variability

Phenotypic and Genotypic Coefficient of Variations

In the present findings, phenotypic coefficient of variation were observed to be higher than the corresponding genotypic coefficient of variation for all the characters studied and differences were considerable for the character due to environmental variations. The finding of Tripathi *et al.* (2000); Megeji and Karla (2002) and Rajput and Singh (2003) were similar to that of the present findings. High genotypic coefficient of variation as well as phenotypic coefficient of variation was noted for seed yield per plot, seed yield per plant and test weight. The findings are in close harmony with the result of Megeji

Table 2. Range, Mean, PCV, GCV, Heritability and Genetic gain for different traits for coriander germplasm in (*Kharif* 2016).

Sr. No.	Characters	Range	Mean	Coefficients of Variability (%)		Heritability (%)	Genetic Gain (%)	Genetic Advance
				Phenotypic	Genotypic			
1.	Days to 50% flowering	36.60-57.20	45.96	13.73	10.27	56.00	15.84	7.28
2.	Days to first umbel unfolding(days)	26.53-47.80	36.88	16.62	13.53	66.34	22.72	8.38
3.	Maturity duration	70.60-118.00	97.44	13.38	11.14	69.38	19.12	18.63
4.	Plant height.	23.10-67.64	45.14	28.26	26.39	87.22	50.78	22.92
5.	Primary branches/plant	1.57-4.37	2.51	31.42	25.18	64.24	41.83	1.05
6.	Secondary branches / plant	2.37-8.20	5.17	29.64	28.01	89.33	54.55	2.82
7.	Umbel/plant	4.24-18.57	9.64	38.96	36.50	87.75	70.43	6.79
8.	Umbellates / umbel	2.83-6.20	3.91	20.50	15.03	53.72	22.76	0.89
9.	Umbel diameter	15.03-41.18	26.81	30.51	23.94	61.55	38.68	10.37
10.	Fruits/ umbel	8.40-27.13	16.50	31.74	24.26	58.39	38.18	6.30
11.	Fruits / umbellate	2.27-4.87	3.96	17.33	12.47	51.78	18.43	0.73
12.	Test weight (g)	1.61-23.48	8.95	76.89	74.86	94.77	150.06	13.43
13.	Seed yield/ plant	0.06-8.03	2.12	118.50	116.33	96.37	234.90	4.98
14.	Seed yield/plot	2.33-307.80	79.87	121.07	116.73	92.96	231.81	185.15

and Korla (2002); Rajput and Singh (2003) and Beemnet *et al.* (2010) for seed yield.

Heritability, Genetic Advance and Genetic Gain

The genotypic coefficient of variation does not allow full range to evaluate the variation that are required for inheriting and hence estimation of heritability becomes essential, suggests that genetic coefficient of variability with heritability evaluate would give a best indication of expected amount of improvement through selection.

Highest heritability were recorded for seed per plant (96.37) and test weight (94.77%). These were also reported earlier by Bhandari and Gupta (1991).

The classification of values of genetic gain and genetic advance was done as per Sharma, 1994. While genetic gain was ranged from low to high as 15.84-234.90% for different characters under study. It was found high for the characters *viz*, seed per plant, seed yield per plot etc. These present findings coincides with Tripathi *et al.* (2000); Bhandari and Gupta (1991).

Conclusion

The characters studied for phenotypic coefficients of variation were found higher in context than genotypic coefficients of variation, though difference was lowest in majority of cases. The phenotypic coefficients of variation (PCV) and genotypic coefficients of variation (GCV) were recorded highest for seed yield per plot, seed yield per plant and test weight. The heritability in broad sense were found highest for seed yield per plant etc therefore suggesting that straight line selection for different traits may bring valuable improvement in identifying chief genotypes in coriander. Besides this, maximum heritability estimates assosciates with high genetic gain were found in seed yield per plant etc. Which indicates that all these traits are under the additive gene effects and these all traits are more stable for this type of effective selection.

Recommendation

Through this study we recommends that farmers of high hilly regions up to the altitude of 2000 meter mean sea level must have to use some genetic land races like, Dhulet Local, Pali Local since these are much resistant to both biotic and abiotic factors where as some varieties which are released by the Pantnagar Agriculture University like, Pant Haritma can also be sown for getting better yield.

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