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Genetic variability analysis in coriander (*Coriandrum sativum* Linn.)

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Abstract

The investigation was undertaken to assess the genetic parameters in respect of yield and yield determining characters of nine genotypes namely 2007, 8918, 2002, 9903, 9106, 9807, 2015, 2108 (germplasm lines) including check variety Azad Dhania-1 of coriander (*Coriandrum sativum*). The maximum genotypic coefficient of variability (18.39%), broad sense heritability (93.5%) and genetic advance over mean (36.60%) were obtained for umbels plant^{-1}. Seed yield was positively associated with several characters such as plant height, number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of umbels plant^{-1}, number of umbellets plant^{-1}, number of seeds umbel^{-1} and umbel diameters. Quantitative traits like plant height, number of secondary branches plant^{-1}, number of primary branches plant^{-1}, number of umbel plant^{-1}, number of umbellets umbel^{-1} and number of seeds umbel^{-1} exhibited wide range of variability, maximum genotypic and phenotypic coefficient of variability, broad sense heritability and genetic gain (as per cent of mean). It was found that the genotypes 9106, 2007, 2108 and 2015 were promising.

Keywords: coriander, *Coriandrum sativum*, genetic advance, heritability, quantitative traits

Coriander (*Coriandrum sativum* Linn.) is an annual spice herb that belongs to the family *Umbelliferae/Apiaceae*. It is also one of the most important spices crop grown in India and throughout the world. In India, it is mainly grown in Rajasthan, Madhya Pradesh, Andhra Pradesh and Tamil Nadu with an area of 5.91 lakh ha having a production of 3.38 mt. Information on extent of variation, estimates of heritability and expected genetic advance in respect of yield and yield determining traits constitutes the basic requirement for a crop improvement programme that is lacking, hence, the present investigation was aimed to evaluate variability, heritability and genetic advance of grain yield and its component characters in nine coriander genotypes.

The preliminary trial conducted on nine genotypes of coriander *viz*., 2007, 8918, 2002, 9903, 9106, 9807, 2015, 2108 (germplasm lines) including check variety Azad Dhania-1 were obtained from diverse eco-geographical regions of India and abroad, and the collection maintained at Vegetable Farm, Department of Vegetable Science, Kalyanpur, Chandra Shekhar

Azad University of Agriculture and Technology, Kanpur. The materials were evaluated in Randomized Block Design with three replications during the *rabi* season of 2009–10. The results were evaluated using descriptive statistics and analysis of variance (ANOVA). Data observed on 11 quantitative traits were subjected to statistical and biometrical analysis and the manifests have been demonstrated *viz*., analysis of variance, estimation of variability, estimation of heritability and genetic advance. Analysis of variance was carried out using standard procedure prescribed by Panse & Sukhatme (1985). Variability among accessions was estimated using range, mean, least significant difference, phenotypic and genotypic variance and coefficient of variability according to Burton & Dorane (1953). Broad sense heritability, genetic advance and genetic advance as per cent of the mean were analyzed according to Johnson *et al*. (1955).

The information on genetic parameters of the population of coriander genotypes under study is given in Tables 2, 3 & 4. A wide range of variation was observed among different collections/genotypes with regard to different characters The data shown Table 1, revealed that plant height, number of primary branches, number of secondary branches, days to flowering, days to maturity, number of umbellets umbel^{-1}, number of seeds umbel^{-1}, umbel diameter, 1000-seeds weight and seed yield varied significantly except number of secondary branches per plant.

Parameters of genotypic and phenotypic coefficients of variation (GCV & PCV) are useful in detecting the amount of variability present in the available genotypes. The PCV revealed that the days to maturity showed the maximum range of mean performance (134.33–142.33) followed by plant height (106.00–124.00), days to flowering (73.00–80.00), number of secondary branches plant^{-1} (25.07–30.47), number of umbel plant^{-1} (45.67–80.40), number of seeds umbel^{-1} (29.20–37.60) and seed yields (24.82–30.43). The minimum range of mean performance was obtained for umbellets umbel^{-1}.

Table 1: ANOVA for 11 characters in coriander

Source of variance	d.f.	Plant height (cm)	Days to flowering	Days to maturity	Number of primary branches plant^{-1}	Number of secondary branches plant^{-1}	Number of umbels plant^{-1}	Number of umbellets umbel^{-1}	Number of seeds umbel^{-1}	Umbel diameter (cm)	Test weight (1000 seeds)	Seed yield (g)
Replication	2	0.703	0.875	0.187	0.212	0.718	0.453	0.357	0.789	0.304	0.109	0.750
Treatment	8	200.453**	16.323**	10.436**	3.240*	1.968	19.002**	13.909**	29.268**	9.190**	5.783**	11.398**
Error	16	4.787	0.693	0.669	0.842	0.0389	1.006	0.165	0.188	0.504	0.0291	0.847

*, **, Significant at 5% & 1%, respectively

Table 2. Grand mean of 11 characters in coriander

Sl. No.	Character	Mean	Range		CV %
			Minimum	Maximum	
1	Plant height (cm)	116.297	106.00	124.00	1.8814
2	Days to flowering	77.740	73.00	80.00	1.6924
3	Days to maturity	140.481	134.33	142.33	0.6483
4	Number of primary branches plant^{-1}	11.559	9.27	13.93	6.3167
5	Number of secondary branches plant^{-1}	27.651	25.07	30.47	3.7325
6	Number of umbels plant^{-1}	66.748	45.67	80.40	4.9155
7	Number of umbellets umbel^{-1}	8.874	7.33	10.80	9.2341
8	Number of seeds umbel^{-1}	34.881	29.20	37.60	3.7199
9	Umbel diameters (cm)	18.392	17.60	19.80	4.7396
10	Test weight (1000 seeds)	10.840	9.78	11.78	6.1935
11	Seed yield (g)	27.699	24.82	30.43	2.9222

Table 3. Estimate of genotypic and phenotypic coefficient of variance (GCV and PCV) for 11 characters in coriander

Sl. No.	Character	Phenotypic coefficient of variance (%)	Genotypic coefficient of variance (%)	Difference
1	Plant height (cm)	7.19	6.99	0.2
2	Days to flowering	3.81	3.41	0.4
3	Days to maturity	1.03	0.81	0.22
4	Number of primary branches plant^{-1}	14.77	13.35	1.42
5	Number of secondary branches plant^{-1}	11.00	10.35	0.65
6	Number of umbels plant^{-1}	19.04	18.39	0.65
7	Number of umbellets umbel^{-1}	14.75	11.50	3.25
8	Number of seeds umbel^{-1}	11.33	10.70	0.63
9	Umbel diameters (cm)	6.89	5.01	1.88
10	Test weight (1000 seeds)	8.57	5.93	2.64
11	Seed yield (g)	7.24	6.62	0.62

In the present analysis, the PCV was slightly higher than GCV for all the characters. However, the maximum PCV was observed for number of umbels plant^{-1} (19.04) followed by primary branches (14.77) and number of umbellets umbel^{-1} (14.75). The maximum GCV was obtained for number of umbel plant^{-1} (18.39) followed by primary branches (13.35) and number of umbellets umbel^{-1} (11.50). On the other hand, the minimum GCV (0.81) and PCV was observed for days to maturity (1.03). Therefore, the higher proportion of PCV observed on these traits was due to the larger proportion of GCV. Hence, estimate of GCV and PCV indicated that in general, the PCV was higher than GCV indicating the role of environment factors on character expression.

Heritability and genetic advance help in determining the influences of environment on expression of the characters and extent to which improvement is possible after selection. Thus, in the present study, selection of accessions based on seed number plant^{-1} and seed yield plant^{-1} would be more satisfactory to increase seed yield of coriander. Nevertheless, the maximum heritability value was obtained for number of umbels plant^{-1} (93.5%) followed by plant height (93.2%), number of seeds umbel^{-1} (89.2%), number of secondary branches plant^{-1}

Table 4. Broad sense heritability, general mean, genetic advance and genetic advance as per cent of mean

Sl. No.	Character	Heritability (h^2b)%	General mean (X)	Genetic advance (GA)	Genetic advance over mean (GA %)
1	Plant height (cm)	93.2	116.296	16.06	13.80
2	Days to flowering	80.2	77.740	4.89	6.29
3	Days to maturity	60.7	140.481	1.82	1.29
4	Number of primary branches plant^{-1}	81.7	11.559	2.87	24.82
5	Number of secondary branches plant^{-1}	88.5	27.651	5.55	20.07
6	Number of umbels plant^{-1}	93.5	66.748	24.43	36.60
7	Number of umbellets umbel^{-1}	60.8	8.874	1.64	18.48
8	Number of seeds umbel^{-1}	89.2	34.881	7.26	20.81
9	Umbel diameter (cm)	52.7	18.392	1.38	7.50
10	Test weight (1000 seeds)	47.8	10.840	0.92	8.48
11	Seed yield (g)	83.7	27.699	3.46	12.49

(88.5%) and seed yield (83.7%). Genetic advance is also of considerable importance because it indicates the magnitude of the expected genetic gain from one cycle of selection. The genetic advance was maximum for number of umbels plant^{-1} (24.43%) followed by plant height (16.06%), number of seeds umbel^{-1} (7.26%), number of secondary branches (5.55%) and days to flowering (4.89%). Meanwhile, low genetic advance was obtained for number of umbellets umbel^{-1} followed by umbel diameter and test weight. Singh *et al*. (2006) reported different genetic parameters for seed yield and its components in coriander and his finding supports the present investigation.

It may be concluded that plant height, number of secondary branches plant^{-1}, number of primary branches plant^{-1}, number of umbel plant^{-1}, number of umbellets umbel^{-1} and number of seeds umbel^{-1} were the economically important traits for grain yield. Therefore, the data revealed that among all the genotypes 9106, 2007, 2108 and 2015 gave promising results. Hence, individual plant selection based on these quantitative traits should form the criteria for selection of superior genotypes for future breeding programmes.

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