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Genetic variation for seed yield and its components and their association in coriander (*Coriandrum sativum* L.) germplasm

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Abstract

Evaluation of 360 lines of coriander (*Coriandrum sativum*) at Jobner (Rajasthan) indicated high variability for seed yield (22.82%), umbels plant^{-1} (28.65%) and seeds umbel^{-1} (21.63%) and low variability for days to 50% flowering (12.39%) and umbellets umbel^{-1} (13.30%). High broad sense heritability (91.94%) and genetic advance (56.55%) were obtained for umbels plant^{-1} and seeds umbel^{-1}. Correlation and path coefficient analysis indicated that umbels plant^{-1} and branches plant^{-1} were the most important traits as they exerted positive direct effect on seed yield.

Keywords: coriander, C*oriandrum sativum*, genetic advance, heritability, path analysis, variation.

Introduction

Crop yield is influenced by several genetic factors interacting with the environment and therefore, study of characters which are less affected by the environment, is required to construct suitable selection indices for crop improvement. The adequacy of the genotypes is determined by the amount of genetic variability present in the germplasm and limited information is available in coriander (*Coriandrum sativum* L.) on this aspect. Furthermore, information on association among different morphological characters and with seed yield is necessary for identification of suitable selection criteria for producing high yielding varieties. In the present investigation, 360 lines of coriander were used to evaluate the germplasm on the basis of *per se* performance, correlation and path coefficient analysis. The information is expected to form the basis of designing breeding strategies to improve the yield potential of coriander.

Materials and methods

Three hundred and sixty lines of coriander (indigenous and exotic) were selected from the collection maintained at SKN College of Agriculture, Jobner (Rajasthan). Jobner is situated at 27° 05′ North latitude and 75° 28′ East longitude at an altitude of 427 m above MSL in Jaipur District of Rajasthan (India). The materials were evaluated in an augmented randomized block design during *rabi* season 2003–04. The materials were divided into 12 groups. Each group consisting of 30

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genotypes and 4 checks namely, RCr-20, RCr-41, RCr-446 and Local constituted a block. Each genotype/check was sown in a plot of two rows. The rows were 3 m long spaced at 30 cm x 10 cm. Data on days to 50% flowering was recorded on plot basis, while 10 plants were tagged at random to record data on plant height, branches plant^{-1}, umbels plant^{-1}, umbellets umbel^{-1}, seeds umbel^{-1} and seed yield plant^{-1}. The plot means were analyzed using standard statistical analysis suggested by Federer (1956) and elaborated by Sharma (1998). The phenotypic and genotypic coefficient of variability (PCV and GCV), heritability and genetic advance were computed as per methods of Burton (1952) & Johnson *et al.* (1955). Phenotypic and genotypic correlations were estimated from the phenotypic and genotypic components of variances and covariance. Path analysis based on genotypic correlations was performed according to Dewey & Lu (1959).

Results and discussion

The analysis of variance revealed that significant variability was present in the germplasm for all the characters studied. Estimates of genotypic and phenotypic variances indicated that in general, the phenotypic variances were higher than genotypic variances indicating the role of environmental factors on character expression (Table 1). Umbels plant^{-1} followed by yield plant^{-1} and seeds umbel^{-1} exhibited high genotypic as well as phenotypic coefficient of variation which indicated that simple selection for umbels plant^{-1} and seeds umbel^{-1} might be advantageous as compared to other component under study. Similar findings have also been reported by Rao *et al.* (1981) and Jain *et al*. (2002) in coriander. The GCV and PCV were low for days to 50% flowering, plant height and umbellets umbel^{-1}.

The broad sense heritability was higher for all the characters under study. High heritability values accompanied with high genetic advance were observed for umbels plant^{-1},

Table 1. Mean squares and variances for different characters in coriander germplasm

Source of variation	df	Days to 50% flowering	Plant height	Branches plant^{-1}	Umbels plant^{-1}	Umbellets umbel^{-1}	Seeds umbel^{-1}	Seed yield plant^{-1}
Blocks (ignoring accessions)	11	1165.50**	590.05**	3.680**	154.150**	0.574**	191.050**	7.632**
Entries (eliminating blocks)	363	118.56**	106.51**	0.743**	43.399**	0.397**	57.125**	2.741**
Checks	3	967.24**	538.75**	0.819**	43.521**	2.176**	734.850**	29.499**
Accessions	359	111.18**	100.19**	0.737**	43.319**	0.382**	46.238**	2.362**
Checks vs Accessions	1	223.90*	1078.80**	2.614**	71.585**	0.620**	1932.600**	58.451**
Error	33	43.03	37.447	0.089	3.490	0.031	15.188	0.418
Genotypic variance (v_g)		75.53	69.053	0.654	39.909	0.366	41.937	2.323
Phenotypic variance (v_p)		118.56	106.510	0.743	43.399	0.397	57.125	2.741
Error variance (v_e)		43.03	37.447	0.089	3.490	0.031	15.188	0.418

*Significant at P= 0.05; ** Significant at P= 0.01

Table 2. Mean, standard error, range, genotypic and phenotypic coefficients of variability, heritability and genetic advance for different characters in coriander

Character	Mean ± SE	Range	Genotypic coefficient of variation (GCV)	Phenotypic coefficient of variation (PCV)	Heritability in broad sense (%)	Genetic advance as percentage of mean
Days to 50% flowering	66.62±6.56	43.70–113.97	12.39	15.83	61.29	19.98
Plant height	58.44±6.12	32.99–106.49	13.55	17.12	62.62	22.09
Branches plant^{-1}	5.59±0.30	3.19–9.04	14.40	15.36	87.87	27.81
Umbels plant^{-1}	22.04±1.87	4.36–78.26	28.63	29.86	91.94	56.55
Umbellets umbel^{-1}	4.46±0.17	2.76–7.38	13.30	13.86	91.98	26.27
Seeds umbel^{-1}	25.76±3.90	8.98–61.88	21.63	26.40	67.15	36.52
Seed yield plant^{-1}	6.11±0.65	1.05–14.93	22.82	25.15	82.31	42.65

Table 3. Phenotypic (P) and genotypic (G) correlation coefficients among different characters in coriander

Character		Total plant height	Branches plant^{-1}	Umbels plant^{-1}	Umbellets umbel^{-1}	Seeds umbel^{-1}	Seed yield plant^{-1}
Days to 50% flowering	P	0.304**	0.180**	-0.154**	0.079	0.337**	-0.241**
	G	0.391**	0.222**	-0.583**	0.303**	0.389**	-0.408**
Total plant height	P		0.218**	0.230**	0.220**	0.309**	0.248**
	G		0.400**	0.057	0.372**	0.360**	0.078
Branches plant^{-1}	P			0.436**	0.166**	0.375**	0.338**
	G			0.335**	0.264**	0.478**	0.425**
Umbels plant^{-1}	P				0.060	0.077	0.587**
	G				-0.152**	-0.047	0.742**
Umbellets umbel^{-1}	P					0.526**	0.160**
	G					0.616**	-0.051
Seeds umbel^{-1}	P						0.140**
	G						0.086

**Significant at P=0.01

Table 4. Genotypic path coefficient analysis of six different characters on seed yield in coriander

Character	Days to 50% flowering	Plant height	Branches plant^{-1}	Umbels plant^{-1}	Umbellets umbel^{-1}	Seeds umbel^{-1}	Correlation with seed yield plant^{-1}
Days to 50% flowering	**-0.1350**	-0.0050	0.0527	-0.3410	-0.0060	0.0271	-0.4080**
Plant height	-0.0530	**-0.0142**	0.0949	0.0331	-0.0079	0.0251	0.0784
Branches plant^{-1}	-0.0300	-0.0057	**0.2372**	0.1960	-0.0056	0.0334	0.4250**
Umbels plant^{-1}	0.0786	-0.0008	0.0794	**0.5853**	0.0032	-0.0032	0.7425**
Umbellets umbel^{-1}	-0.0408	-0.0053	0.0627	-0.0890	**-0.0211**	0.0430	-0.0506
Seeds umbel^{-1}	-0.0524	-0.0051	0.1135	-0.0272	-0.0130	**0.0698**	0.0856

** Significant at P=0.01; Residual effect=0.635.
Values in bold indicate direct and indirect effects of character association.

Table 5. Promising progenies of coriander germplasm

Entry	Blocks to which belonged	Geographical origin	Days to 50% flowering	Plant height	Branches plant^{-1}	Umbels plant^{-1}	Umbellets umbel^{-1}	Seeds Umbel^{-1}	Seed yield plant^{-1}	Mean rank	Overall rank
			Rank								
UD-55	I	Jhalarapatan	X	XV	X	XII	VI	XIII	I	9.57	XIII
UD-97	I	Delhi	VIII	V	V	I	IV	I	II	3.71	I
UD-160	II	Delhi	II	IX	IV	VII	VIII	X	III	6.14	VI
UD-20	I	Jaipur	III	II	I	XIII	II	II	IV	3.86	II
UD-95	I	Kota	VII	III	V	X	III	IV	V	5.28	V
UD-23	I	Jaipur	V	XIV	III	III	VI	XI	VI	6.86	VII
UD-74	I	Andhra Pradesh	I	I	II	V	VI	IX	VII	4.43	IV
UD-33	I	Kota	IX	X	X	IX	VI	VIII	VIII	8.57	XI
UD-31	I	Kota	VIII	VII	VIII	III	VII	XII	IX	7.71	IX
UD-18	I	Jaipur	IX	VIII	VII	VI	IV	V	X	7.00	VIII
UD-627	IX	Jhalawar	IV	XI	XI	XIV	V	XV	XI	10.14	XV
UD-22	I	Jaipur	VI	IV	I	II	I	III	XII	4.14	III
UD-68	I	Andhra Pradesh	VIII	XIII	IX	IV	VII	XIV	XIII	9.71	XIV
UD-45	I	Kota	VII	XII	VII	VIII	VII	VII	XIV	8.86	XII
UD-103	I	Delhi	XI	VI	VI	XI	IV	VI	XV	8.43	X

followed by seeds umbel^{-1}, whereas, high heritability and low genetic advance were observed for days to 50% flowering followed by plant height (Table 2). The expected genetic advance was not so low for these characters. Hence, selection will be more effective for all characters.

The association among characters revealed that seed yield was positively correlated with branches plant^{-1} and umbels plant^{-1} at genotypic level whereas, it showed negative and significant association with days to 50% flowering (Table 3).

Path analysis indicated highest positive direct effect of umbels plant^{-1} followed by branches plant^{-1}. The correlations of these two traits with the seed yield were also being positive and significant. The direct effect of days to 50% flowering was high and negative (Table 4). Even though the correlation was significant and negative, this is the result of negative indirect effects of days to 50% flowering on seed yield particularly via umbels plant^{-1}. Similar findings were also reported by Sharma (1984), Sankar & Khadar (1991), Godara (1995) and Jain *et al.* (2003) in coriander. The residual effect was of a high magnitude at genotypic level (0.635) due to weak correlation among the characters.

Fifteen coriander entries were selected as promising on the basis of yield and other morphological characters (Table 5). Among them, UD-97 ranked first followed by UD-160, UD-22 and UD-74. The characters, umbels plant^{-1}, branches plant^{-1} and early flowering were the most important traits, which directly or indirectly influenced seed yield.

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