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VARIATION AND CHARACTER ASSOCIATIONS OF GRAIN YIELD AND ITS COMPONENT CHARACTERS IN CORIANDER

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ABSTRACT

A collection of 200 lines of coriander (*Coriandrum sativum* L.) showed significant variability for plant height, branches/plant, days to flowering and maturity, umbels and umbellets/plant, grains/umbellet, 1000-grain weight, straw and grain yield/plant. The heritability estimate was high for 1000-grain weight, days to flowering and maturity, and low for umbels, umbellets, and grain yield/plant. Grain yield/plant had positive and significant correlation with plant height, branches, umbels, and umbellets/plant, grains/umbellet, and straw yield/plant. Path coefficient analysis revealed that umbellets/plant. 1000-grain weight, and branches/plant were the most important characters for selection of high yielding genotypes, as they had direct positive effect as well as positive (except 1000-grain weight) association with grain yield/plant.

Key words: *Coriandrum sativum* L., coriander, coefficient of variation.

The amount of variability for important economic characters in the germplasm collection of any crop sets the limit of progress that can be achieved through selection. An assessment of the variability in the germplasm is, therefore, required to judge its potential as base material for genetic improvement. Further, direct selection for complex characters, such as yield is not effective. Knowledge of association of the simply inherited characters which are less affected by environment, is required to construct suitable selecton indices for the improvement of complex characters. A large collection of coriander germplasm has been accumulated under the All-India Coordinated Spices Improvement Project at S. K. N. College of Agriculture, Jobner. The present investigation aims to obtain information on genetic variability, heritability (broad sense) and genetic advance for different characters in the germplasm collection and also determine association of different characters among each other and with grain yield.

MATERIALS AND METHODS

Two hundred lines of coriander (171 indigenous lines obtained from different agroclimatic regions of the country and 29 exotics) were evaluated in R. B. D., replicated 4 times in plots of 2.0 m × 1.2 m size, accommodating three 2 m long

rows spaced 40 cm apart with 10 cm plant-to-plant spacing. The data on days to 50% flowering and maturity were recorded on plot basis while five plants were tagged at random from the middle row of each plot to record data on 10 plant and yield characters, which were analysed by the standard statistical methods.

The phenotypic and genotypic coefficient of variation (PCV, GCV) and expected genetic advance (GA) were computed following Johnson et al. [1]. Phenotypic, genotypic and environmental correlations were estimated from the phenotypic, genotypic and environmental components of variances and covariances. Path coefficient analysis based on genotypic correlation was performed according to Dewey and Lu [2]. Heritability in broad sense was calculated in accordance with Hanson et al. [3].

RESULTS AND DISCUSSION

Analysis of variance (Table 1) indicated that the genotypes differ significantly for all the characters. Partitioning of the variance into its components revealed that genotypic effects accounted for an appreciable portion of this variability. High heritability was observed for plant height, days to flowering and maturity, grains/umbellet, and 1000-grain weight; the estimates of heritability for umbels, umbellets, and grain yield/plant were low; whereas the estimates for branches and straw yield/plant were moderate. The expected GA as percentage of mean was low for days to maturity, branches and umbels/plant and grains/umbellet; moderate for grain yield, umbellets and straw yield per plant, and 1000-grain weight; and high for plant height and days to flowering. These results are in agreement with the earlier reports [4]. For days to maturity, GA was low in spite of high heritability. On the contrary, GA for grain yield, umbellets and straw yield/plant, and grains/umbellet was high in spite of low heritability. Thus, it appears that the degree of heritability and variance together determine the genetic advance.

Table 1. Coefficients of variation, heritability and genetic advance for yield and other characters

Character	CV (%)		Heritability (broad sense) (%)	GA (% of mean)
	genotypic	phenotypic		
Plant height	22.8	29.9	58.2	35.9
Branches/plant	7.9	16.2	23.8	7.9
Days to flowering	15.4	16.3	90.1	30.0
Days to maturity	4.5	5.0	81.3	8.4
Umbels/plant	12.7	44.2	8.2	7.5
Umbellets/plant	23.4	52.8	19.6	21.3
Grains/umbellet	15.5	25.5	37.2	19.5
1000-grain weight	22.1	22.7	94.6	5.2
Straw yield/plant	25.9	47.7	29.6	28.5
Grain yield/plant	23.7	54.5	19.0	21.3

The association analysis indicated that the grain yield/plant was positively correlated at phenotypic level with plant height, number of branches, umbels and umbellets/plant, grains/umbellet, and straw yield/plant. It had nonsignificant association with days to maturity and 1000-grain weight. The genotypic correlation coefficients of these characters with grain yield were higher than the corresponding phenotypic correlation coefficients, except for plant height (Table 2). Positive and significant association of grain yield with the above characters has also been reported earlier [4, 5]. In a breeding programme, we are often concerned with the improvement in yield as an overall product dependent on a number of morphophysiological attributes. Such characters are often interrelated, hence their effect on yield is also modified by others. Path coefficient analysis helps in separating the direct effect of a component character on yield from indirect effects via other traits. The path analysis based on genotypic correlation coefficients showed that umbellets/plant, which has high positive correlation with grain yield/plant, also had the highest direct effect (Table 3). It may, however, be noted that its influence was reduced to a great extent due to negative indirect effects of days to flowering as well as branches and umbels/plant. The direct effects of branches/plant and 1000-grain weight were also positive and high. The low grain weight–yield correlation coefficient, despite high positive direct

Table 2. Phenotypic (P) and genotypic (G) correlation coefficients between characters of coriander

Character		Branches per plant	Days to flowering	Days to maturity	Umbels per plant	Umbellets per plant	Grains per umbellet	1000-grain weight	Straw yield per plant	Grain yield per plant
Plant height	P	0.60**	0.57**	0.51**	0.36**	0.58**	0.45**	−0.44**	0.18**	0.45**
	G	0.81	0.86	0.74	0.39	0.73	0.68	−0.60	0.21	0.31
Branches per plant	P		0.27**	0.25**	0.49**	0.64**	0.34**	−0.22**	0.72**	0.50**
	G		0.72	0.55	0.65	0.82	0.52	−0.48	1.21	0.60
Days to flowering	P			0.68**	0.05	0.26**	0.35**	−0.61**	0.05	−0.01
	G			0.79	0.34	0.73	0.66	−0.66	0.21	0.17
Days to maturity	P				0.04	0.20**	0.25**	−0.45**	0.13	0.02
	G				0.17	0.52	0.48	−0.51	0.25	0.06
Umbels per plant	P					0.70**	0.18*	−0.01	0.19**	0.53**
	G					0.78	0.21	−0.02	0.42	0.64
Umbellets per plant	P						0.32**	−0.19**	0.12	0.66**
	G						0.65	−0.48	0.20	0.70
Grains per umbellet	P							−0.42**	0.47**	0.27**
	G							−0.71	0.69	0.37
1000-grain weight	P								−0.25**	0.02
	G								0.72	0.02
Straw yield per plant	P									0.58**
	G									0.89

*, **Significant at 5% and 1% levels, respectively.

effect of grain size on yield, is the result of negative indirect effect through umbellets and branches/plant (Table 3).

The direct effects of plant height, days to flowering and maturity, and umbels/plant on grain yield were negative. Contrary to these findings, Joshi et al. [6] obtained positive direct effect of days to flowering, umbellets/plant and plant height. Sri Rama Rao et al. [4] and Gupta [7] also reported positive direct effect of umbels/plant on grain yield.

Table 3. Direct and indirect effects of different characters on grain yield per plant in coriander at genotypic level

Character	Plant height	Branches per plant	Days to flowering	Days to maturity	Umbels per plant	Umbellets per plant	Grains per plant	1000-grain weight	Yield per plant	Correlation with yield per plant
Plant height	**−0.134**	0.388	−0.655	−0.051	−0.270	1.225	0.089	−0.291	0.008	0.311
Branches per plant	−0.109	**0.478**	−0.547	−0.037	−0.455	1.385	−0.068	−0.230	0.047	0.598
Days to flowering	−0.114	0.342	**−0.764**	−0.054	−0.241	1.225	0.087	−0.318	0.008	0.169
Days to maturity	−0.099	0.260	−0.607	**−0.069**	−0.119	0.868	0.062	−0.245	0.010	0.063
Umbels per plant	−0.516	0.311	−0.263	−0.012	**−0.701**	1.320	0.028	−0.010	0.016	0.638
Umbellets per plant	−0.097	0.393	−0.566	−0.035	−0.550	**1.683**	0.084	−0.232	0.008	0.698
Grains per umbellet	−0.091	0.248	−0.508	−0.033	−0.150	1.088	**0.130**	−0.342	0.027	0.370
1000-grain weight	0.081	−0.228	0.504	0.035	0.015	−0.810	−0.092	**0.481**	0.028	0.015
Straw yield per plant	−0.029	0.578	−0.159	−0.017	−0.292	0.329	0.090	0.248	**0.039**	0.889
Residual effect	0.268									

Diagonal figures (in bold) are the direct and nondiagonal values are indirect effects.

Days to flowering and maturity had significant positive correlation with grain yield, but their direct effects were negative, indicating that earliness is desirable. The positive correlation of umbels/plant and plant height with grain yield, despite their negative direct effects, resulted mainly from high negative indirect effects via umbels/plant, umbellets/plant, plant height and 1000-grain weight.

The study, thus, points out that umbellets/plant is the most important component character of grain yield. It is also positively associated with plant height, branches

per plant, days to flowering and maturity, umbels per plant, and grains per umbellet. This character should, therefore, be given special attention while making selection for grain yield. However, it must be borne in mind that this character is highly influenced by environment. Besides, 1000-grain weight, branches/plant and grains/umbellet were the other characters which should be considered in a selection programme. The ideotype to achieve high yield in coriander should, therefore, possess more umbellets and branches/plant, grains/umbellet, high grain weight and earliness. These characters had a wide range of variability, moderate to high heritability, and moderate expected GA, hence selection may be successfully practiced to evolve new high yielding varieties in coriander.

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