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Genetic variability, heritability, genetic advance, correlation coefficient and path analysis in coriander

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ABSTRACT

A field experiment was conducted with 30 diverse genotypes (Local Coriander-LC-4, Surabhi, Kashmiri Dhania-P D-4, Local Lucknow-LL-4, Pusa Sugandha, Local Dhania-L D-5, Local Dhania-L D-4, Kalmi Dhania- KD-6, Kashmiri Dhania –P D-1, Local Dhania-LL-3, Local Coriander-LC-2, Coriander Kalmi-CK-2, Coriander Kalmi-CK-1, Local Katuai, Kashmiri Dhania-PD-2, Local Lucknow-LL-2, Pant Haritama, Coriander Kalmui-CK-4, Local Coriander-LC-1, Local Lucknow-LC-5, Kalmi Dhania-3- KD-3, Kalmi Dhania-4-KD-4, Kashmiri Dhania-PD-3, Kashmiri Dhania-PD-5, Local Lucknow-LL-1, Local Coriander –LC-3, Coriander Kalmi-CK-3, Kalmi Dhania-2-KD-2 and Kalmi Dhania –5-KD-5 in randomized block design with three replications. Analysed data revealed that among all the genotypes Local Lucknow-LL-4, Coriander Kalmi-CK-2, Kalmi Dhania-KD-6, Local Dhania-LD-5 and Kashmiri Dhania-PD-2 gave promising results.

Key words: Coriander, genetic variability, habitability, genetic advance, path analysis, correlation coefficient.

INTRODUCTION

Coriander is 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 Tamilnadu. In India coriander is cultivated in an area of about 5.91 lakh ha with a production of about 3.38 MT. India ranks first in terms of area and production in the world (Datta *et al*., 4). Coriander is an annual herbaceous plant extensively grown in India. Its name has been derived from Greek world “Koris” means bed-bug, because of unpleasant, fetid bug like odour of the green unripened fruits. Coriander is an important spices and annual herb, which is botanically known as *Coriandrum sativum* L. and belong to the family Apiaceae, indigenous to Southern Europe and the Mediterranean region, is one of oldest consumed spices in India. Coriander leaves is used for preparing chutneys, sauces and for curries and soups. The seeds are extensively used as condiments and medicine. The coriander oil is used as valuable ingredient in perfumes and food industries (Sivaraman *et al.,* 13). The coriander seeds are used as spices in the preparation of curry powder and pickling spice. They are used for flavouring pastry, cookies-cakes, tobacco, bakery product, meat fish, soda, syrups, candy, preserve and liquour Thamburaj and Singh (14). Genetic variability forms the basis for crop improvement. Parameters of genotypic and phenotypic coefficients of variation (GCV&PCV) are useful in detecting the amount of variability present in the available genotypes. Heritability and genetic advance help in determining the influences of environment in expression of the characters and extent to which improvement is possible after selection. Path analysis facilitates the partitioning of correlation coefficient in the direct and indirect effects on yield and any other attributes. The present investigation was, therefore, under taken to as certain magnitudes and extent of genetic variability, heritability, genetic advance, correlation and path analysis in coriander.

MATERIALS AND METHODS

The experimental material comprised thirty diverse genotypes (Local Coriander-LC-4, Surabhi, Kashmiri Dhania-P D-4, Local Lucknow-LL-4, Pusa Sugandha, Local Dhania-LD-5, Local Dhania-L D-4, Kalmi Dhania-KD-6, Kashmiri Dhania –P D-1, Local Dhania-LL-3, Local Coriander-LC-2, Coriander Kalmi-CK-2, Coriander Kalmi-CK-1, Local Katuai, Kashmiri Dhania-PD-2, Local Lucknow-LL-2, Pant Haritama, Coriander Kalmi-CK-4, Local Coriander-LC-1, Local Lucknow-LC-5, Kalmi Dhania-3- KD-3, Kalmi Dhania-4-KD-4, Kashmiri Dhania-PD-3, Kashmiri Dhania-PD-5, Local Lucknow-LL-1,Local Dhania(LD-1), Local Coriander –LC-3, Coriander Kalmi-CK-3, Kalmi Dhania-2-KD-2 and Kalmi Dhania –5-KD-5 and were sown during rabi, 2006-07 under the randomized

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block design with three replications at Horticultural Research Farm, Department of Applied Plant Science, Babasaheb Bhimrao Ambedkar University, Vidhya-Vihar, Raebareli Road Lucknow-226 025 (U.P.), India . Row to row and plant-to-plant spacing were maintained at 30cm and 10cm respectively. All the agronomic package of practices was adapted to grow a healthy crop. In each replication five plants randomly selected were marked for observation. Observations were recorded for ten characters viz., plant height (cm), Number of secondary branches/plant, days to 50%flowering, Number of umbel/ plant, Number of umbellets/ umbel, days to maturity, test weight (g), Number of seeds /umbel, yield/ plot(kg), and yield/plant (g). The recorded data were analyzed as suggested by Panse and Sukhatme (10). The genotypic and phenotypic coefficient of variance was calculated as per the formula suggested by Burton (2). Henson (6) and Johnson (7) for heritability and genetic advance. Al-Jibouri e*t al*. (1) for correlation coefficient and Dewey and Lu (5) for path coefficient.

RESULTS AND DISCUSSION

The mean of sum of all traits indicating the presence of wide variability in square was highly significant for the genotypes (Table 1) days to maturity showed a wide arrange (103.10-121.60) followed by plant height (92.13-112.67), No. of umbel/plant (59.85-88.07) and days to 50% flowering (58.10-67.18) while yield/plot showed least range (0.24-0.35) and other characters showed moderate range viz. yield/plant (10.74-14.67), test weight (9.93-13.48), No. of secondary branches/plant (6.35–8.15) and no. umbellets /umbel (6.08-7.66).

In general the phenotypic variance and phenotypic coefficient of variation were higher than the respective genotypic variance and genotypic coefficient of variance for all the traits (Table 2), indicating a considerable

Table 1. Range, mean and analysis of variance for different quantitative characters in coriander.

Characters	Range		Mean	Standard mss value error ±		CD at 5%
	Min.	Max.				
Plant height (cm)	92.13	112.67	103.13	3.32	48.87**	6.66
No.of secondary branches/plant	6.35	8.15	6.93	0.34	0.522 **	0.69
Days to 50%flowering	58.10	67.18	62.99	1.55	12.21**	3.10
No.of umbel/plant	59.85	88.07	75.99	2.07	125.49**	4.14
No. of umbellets/umbel	6.08	7.66	6.83	0.33	0.540**	0.66
Days to maturity	103.10	121.60	113.52	1.93	45.72**	3.86
Test weight (g)	9.93	13.48	11.61	0.49	4.24**	0.98
No.of seeds/umbel	43.97	56.27	49.39	1.28	‘45.43**	2.56
Yield/plot(kg)	0.28	0.35	0.28	0.15	0.22	0.30
Yield/plant(g)	10.74	14.67	12.40	0.49	3.98*	0.99

Table 2. Components of variance, coefficients of variation, heritability, genetic advance and genetic advance as percentage of mean for different quantitative traits.

Characters	Variance		Coefficient of variation		Heritability (%)	Genetic advance	Genetic advance as % of means
	Phenotype	Genotype	Phenotype	Genotype			
Plant height (cm)	27.37	10.75	5.07	3.18	39.30	4.23	4.10
No.of secondary branches/plant	0.30	0.12	7.86	4.86	88.20	0.43	6.20
Days to 50%flowering	6.48	2.87	4.04	2.69	94.20	2.32	3.68
No.of umbel/plant	46.11	39.68	8.94	8.29	86.00	12.04	15.84
No.of umbellets /umbel	0.19	0.18	7.89	5.19	83.20	0.48	7.02
Days to maturity	18.96	13.37	3.84	3.22	80.50	6.33	5.57
Test weight (g)	1.44	1.40	7.51	5.41	81.80	0.93	8.01
No.of seeds/umbel	16.78	14.32	8.99	7.52	97.04	4.61	3.25
Yield / plot (kg)	0.01	0.00	21.13	8.92	65.00	0.04	14.28
Yield / plant (g)	1.25	0.88	8.29	7.66	85.30	7.20	58.06

influence of environmental on their expression. In the present investigation, genotypes were found to posses high to moderate phenotypic variance for various characters as revealed by phenotypic coefficient of variance. The phenotypic coefficient of variance varied from 3.84 (days to maturity) to 21.13 (yield /plot). Similar results have been reported by Kamaluddin *et al*. (8) and Mandal and Hazara (9). The PCV expressed in terms of percentage were comparatively high for yield/plot followed by Number of seed/umbel, No. of secondary branches/ pant and test weight (g). As the estimates of phenotypic variability cannot differentiate between the effect of genetic and environmental effects, so the study, of genetic variability is effective in partitioning out the real genetical difference. Higher the GCV, more the chance of improvement in that characters.

In the present investigation GCV were comparatively high for yield/plot (kg) followed by Number of umbel/ plant, yield/ plant (g), Number of seeds/umbel, test weight, Number of umbellets/umbel and Number of secondary branches/plant. The GCV is less than the corresponding PCV, indicating the role of environment in the expression of the traits under observation .The different between GCV and PCV were more in case of yield/plot and Number of secondary branches/plant. The large difference between GCV and PCV indicated that environmental effects to a large extent influenced the traits. The character having high GCV possessed better potential for further gain and improvement Burton (2).

Burton and De Vane (3), has suggested that GCV together with heritability estimate would give best option expected for selection. Heritability estimates were high (>80%) for Number of seeds /umbel, days to 50%flowering, Number of secondary branches/plant, Number of umbel/plant, yield/ plant, Number of umbellets /umbel, test weight and days to maturity. High heritability for the characters controlled by polygene might be useful to plant for making effective selection. Johnson *et al.,* (7) reported that the heritability estimates along with genetic advance is more useful than the resultant effect for selecting the best genotypes as it suggests the presence of additive gene effects. High estimate of genetic advance were recorded for Number of umbel/ plant followed by yield /plant and days to maturity.

The information on heritability alone may be misleading, when used in combination with genetic advance, the utility of heritability estimates increases. In the present study, high genetic advance coupled with high heritability was observed for Number of umbel /plant followed by yield/plant and days to maturity. It indicated that additive gene effects were more important for these traits. Therefore, improvement in these traits would be more effectively done through selection in the present materials.

Depending upon the variability, heritability and genetic advance estimates, it could be predicted that improvement by direct selection was possible in coriander for traits like yield/plant, Number of umbel / plant, days to maturity and Number of seeds/umbel.

Yield/plant in coriander is the result of interaction of number of inter-related characters. Therefore, selection should be based on these components characters after assessing their correlation with yield/plant. In the present study, the value of correlation at phenotypic level were higher than the genotypic correlation indicating that there is strong inherent association between the various characters studied. The yield/plant showed positive and significant correlation with Number of umbel/ plant, Number of umbellets/umbel at genotypic and phenotypic level (Table 3&4). This indicate that fruit yield could be improved by making selection on the basis of Number of umbel/plant, Number of secondary branches/plant, Number of seeds/plant ,and Number of umbellets/umbel. These findings are in line with those Sanker and Khader (11), Shah *et al.* (12), and Datta *et al.* (4).

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Table 3. Estimate of phenotypic (P) and genotypic (G) correlation for different characters in coriander.

Characters		Plant height (cm)	No.of secondary branches /plant	Days to 50% flowering	No.of umbel/ plant	No.of umbellets/ plant	Days to maturity	Test wt. (g)	No.of seeds/ umbel	Yield/ plot	Correlation with fruit yield/plant
Plant height (cm)	P		0.044	-0.249	0.142	-0.039	0.276	-0.067	0.154	-0.046	0.027
	G		0.398*	0.714**	0.186	-0.077	0.389	-0.333	0.271	0.149	0.224
No.of secondary branches/plant	P			0.042	0.428*	0.041	0.205	0.043	0.450*	0.079	0.540**
	G			0.093	0.528**	0.166	0.398*	0.402*	0.426*	-0.121	0.432*
Days to 50% flowering	P				-0.076	-0.099	0.018	0.119	0.109	0.166	0.136
	G				-0.091	0.021	0.013	0.157	0.146	-0.173	0.116
No.of umbel/plant	P					0.203	0.425*	0.082	0.529**	0.430*	0.597**
	G					0.399*	0.430*	0.137	0.645**	0.549**	0.791**
No.of umbellets/plant	P						-0.052	0.525**	0.516**	0.432*	0.547**
	G						-0.160	0.440*	0.529**	0.296	0.407*
Days to maturity	P							-0.062	-0.053	0.119	0.296
	G							-0.068	0.073	0.014	0.412*
Test weight	P								-0.160	0.455*	0.674**
	G								-0.224	0.525**	0.412*
No.of seeds/umbel	P									0.404*	0.429*
	G									0.156	0.156
Yield/plot	P										0.155
	G										0.185

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

Table 4. Direct (diagonal) and indirect effects of different traits contributing to yield in coriander.

Characters	Plant height (cm)	No.of secondary branches /plant	Days to 50% flowering	No.of umbel/ plant	No.of umbellets/ plant	Days to maturity	Test wt. (g)	No.of seeds/ umbel	Yield/ plot	Correlation with fruit yield/plant
Plant height (cm)	**0.048**	0.004	0.033	-0.034	-0.004	-0.070	0.003	-0.005	0.016	0.224
No.of secondary branches/plant	-0.002	**-0.096**	-0.006	0.078	0.004	0.052	-0.002	0.009	0.035	0.432
Days to 50%flowering	-0.012	-0.004	**-0.133**	0.018	-0.010	0.002	0.001	0.004	0.050	0.116
No.of umbel/plant	0.067	0.031	0.010	**0.398**	0.020	-0.082	0.001	-0.001	0.120	0.791
No.of umbellets/umbel	-0.002	0.004	0.013	0.048	**0.099**	-0.013	0.001	0.001	0.029	0.407
Days to maturity	-0.013	0.020	-0.001	0.077	-0.005	**0.253**	0.002	0.002	0.065	0.412
Test weight (g)	0.003	0.004	0.003	-0.019	-0.002	-0.016	**-0.039**	0.006	0.102	0.412
No.of seeds/umbel	-0.007	0.024	0.015	-0.007	-0.003	-0.013	0.006	**-0.036**	0.090	0.156
Yield/plot (kg)	-0.002	-0.008	0.009	0.007	0.013	0.002	-0.002	0.004	**0.070**	0.185

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