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Character Association and Path Analysis in Coriander (*Coriandrum sativum* L.) for Yield and Its Attributes

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ABSTRACT

Ninety genotypes and three checks (Pant Haritima, Hisar Anand and ACr-728) of coriander (Coriandrum sativum L.) were evaluated in Augmented Block Design during Rabi season of 2009-10 and 2010-11 at Vegetable Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar,to study the genetic variation for thirteen growth and yield characters namely, days to 50 per cent flowering, plant height up to main umbel, plant height including main umbel, number of primary branches per plant, number of secondary branches per plant, number of umbels per plant, number of umbelletes per umbel, number of fruits per umbel, number of fruits per umbellate , seed yield per plot(g), seed yield per plant (g), seed yield kg per ha and 1000-seed weight (g).

Character association indicate seed yield (kg per hectare) have significant and positive correlation with plant height upto mainumbel (0.325), plant height including main umbels (0.331), number of fruits per umbel (0.290), seed yield per plot (0.743) and seed yield per plant (0.361). The path coefficient analysis revealed that the highest direct effect was shown by seed yield per plot (0.6975), toward on seed yield (kg per hectare) followed by number of fruits per umbels (0.2716), seed yield per plant (0.1143), 1000-seed weight (0.060), days to 50 per cent flowering (0.0281), number of primary branches per plant (0.0734) and plant height upto main umbels.

Key words: *Coriander, Coriandrum sativum L correlation, path analysis, yield.*

INTRODUCTION

Coriander *(Coriandrum sativum L.),* is an annual herb that belongs to the umbel family (Apiaceae). It displays broad adaptation as a crop around the world, growing well under many different types of soil and weather conditions. Coriander is one of the major spice crops in India. It is used in spices and its seeds are used for extracting essential oil for its linalool content. India is a major seed spices producer in the world because of its favorable climatic and soil conditions for growing spices and other tropical herbs therefore it is known as the "Home of Spices".

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The major seed spices growing area is concentrated in semi-arid to arid areas of Gujarat and Rajasthan, together contributing more than 80 % of the total seed spices produced in the country. Therefore both the states are esteemed as "Seed Spice Bowl of India". Out of 20 seed spices crops cumin, coriander, fennel, fenugreek, dill and ajowain contributed more than 95 % towards area and production.

Germplasm is a vital source in generating new plant types having desirable traits that help in increasing crop production with quality and thus improve the level of human nutrition. In order to maintain, evaluate and utilize germplasm efficiently and effectively, it is important to investigate the extent of genetic diversity, it contains. Most of these studies were related to yield contributing characters and estimation of variability existing in them. The present study aimed at grouping diverse germplasm lines in to different clusters based on diversity/similarity and thus exploiting the diversity in genetic improvement programme.

MATERIALS AND METHODS

Field research was conducted at Vegetable Research Centre of the G.B. Pant University of Agriculture and Technology, Pantnagar, District Udham Singh Nagar, Uttarakhand during *Rabi* season of 2009-10 and 2010-11. Geographically Pantnagar is situated at 29.5° N latitude, 79.3° E longitude and at an altitude of 243.84 meters above the mean sea level in sub-mountainous region of Shivalik hills, known as *Tarai*. The climate of this place is humid and subtropical and frost can be expected from last week of December to end of the January. The healthy seed of ninety germplasm lines and three checks of coriander seed sown directly in field at row to row distance 45cm and plant to plant distance of 30 cm in second week of November 2009 were Observation on metric traits such as, days to 50% flowering, plant height up to main umbel (cm), plant height including main umbel (cm), number of primary branches / plant, number of secondary branches / plant , umbel / plant, umbelletes / umbel, number of fruits/umbel, number of fruits/umbellate ,yield /plot(gm),yield/plant (gm),yield kg/ha, 1000 seed weight (gm),was recorded at different stages of crop. The observation was recorded on 5 plants, selected at random. The data were analyzed statistically using Principal Component Analysis based Euclidean distances. The computation was done using the computer software.

RESULTS AND DISCUSSION

The phenotypic correlation includes genotypic and environmental effects, which provides information between the observable characters. Phenotypic correlations provides information about the association between two characters.The simple phenotypic correlation coefficients among thirteen characters worked out on the pooled adjusted means of two years and estimates are presented in the Table 1.1.

In present investigation on seed yield showed highly significant and positive correlation with plant height upto main umbel (0.325), plant height including main umbel (0.331), number of fruits per umbel (0.290), seed yield per plot (0.743) and seed yield per plant (0.361). The similar result was reported by Jain, *et al*[7]., Beemnet *et al*[1]., Singh, *et al*. The present study suggested that plant height up to main umbel; plant height including main umbel, number of fruits per umbel, seed yield per plot and seed yield per plant trait may be selected for seed yield improvement of the coriander. 1000-Seed weight showed significant and positive correlation with number of secondary branches (0.490). Highly significant but negative correlation was seen with days to 50 per cent flowering (-0.333), and significant but negative correlation was seen number of fruits per umbellate (-0.243). Seed yield per plant showed highly significant and positive correlation with days to 50 per cent flowering (0.371) and significant but positive correlation

was seen with yield per plot (0.241).These results were agreement with Cosge *et al*[2]., and Jain *et al*[7]., Seed yield per plot (g) showed highly significant and positive correlation with plant height up to main umbel (0.370), plant height including main umbel (0.424) and number of secondary branches per plant (0.327).The similar result was reported. by Suthanthirapandis *et al*[12]., Rao *et al*[9]., Tripathi *et al*. Yield attributing character with respect to yield revealed that primary branch per plant ,secondary branch per plant umbellate per plant and seed per umbel were positively and significant correlated with yield**.** Mehata *et al*[8.] Number of fruits per umbellate showed significant positive correlation with number of fruits per umbel (0.260). The similar result reported by Shah *et al*[10]. Number of fruits per umbel showed highly significant and positive correlation with number of umbellates per umbel (0.416) and significant but negatively correlation with number of secondary branches (-0.230). All the above finding can be confirmed by Jain *et al*[7]., and Singh *et al*. Number of umbels per plant showed highly significant and positive correlation with number of primary branches (0.271), number of secondary branches (0.317).. Number of secondary branches showsed significant and positive correlation with plant height including main umbel (0.213) and highly significant and negative correlation with days to 50 per cent flowering (-0.325). Plant height including main umbel showsed highly significant and positive correlation with plant height up to main umbel (0.790). The result were in agreement with Garg *et al*[5].

Direct Effect

The path coefficient analysis based on pooled data of two years adjusted means estimates are presented in the Table 1.1. That the highest direct effect was shown by seed yield per plot (0.6975), towards seed yield (kg per ha), followed by number of fruits per umbel (0.2716), seed yield per plant (0.1143), weight of 1000-seed (0.0895), days to 50 per cent flowering (0.0281), number of primary branches (0.0734) and plant height up to man umbel (0.0703). Similarly negative direct effect was recorded for number of umbellates per umbel (-0.1652), number of secondary branches (-0.0975), plant height including main umbel (-0.0361), number of fruits per umbellates (-0.0270) and number of umbel per plant (-0.0008).These result were in agreement with Cosge *et al*[2]., and Shah *et al*[10].

Indirect Effect

Days to 50 per cent flowering made positive indirect contribution to yield *via* seed yield per plant (0.0423), number of secondary branches per plant (0.0316), number of fruits per umbellate (0.0186), plant height up to main umbel (0.0134), seed yield per plot (0.0047) and number of umbels per plant (0.00003). The results were agreement with Shah *et al*[10]., and Jain *et al*[7]., The results of present investigation suggest that selection for higher seed yield greater plant height, number of umbels per plant and 1000-seed weight shoud be selection parameters. Plant height up to main umbel made positive contribution to yield indirectly *via* seed yield per plot (0.2583), number of fruits per umbel (0.0460) and days to 50 per cent flowering (0.0157), weight of 1000-seed (0.0089), seed yield per plant (0.0054) and number of fruits per umbellate (0.0008). The similar result reported by Jain *et al.* (2003). Plant height including main umbel showed maximum positive indirect on yield effect *via* yield per plot (0.2959), plant height up to main umbel (0.0555), number of fruits per umbel (0.0460), weight of 1000- seed (0.0151), days to 50 per cent flowering (0.0130) and number of fruits per umbellate (0.0017). These results were in agreement with Jain *et al.* (2003).Number of primary branches per plant showed maximum positive indirect effect on yield *via* seed yield per plot (0.0722), number of fruit per umbel

(0.0322), seed yield per plant (0.0097), and plant height including main umbel (0.0035) ,

Number of secondary branches per plant had maximum positive indirect effect on yield *via* seed yield per plot (0.2282), weight of 1000-seed (0.0438), number of umbellates per umbel (0.0327), plant height up to main umbel (0.0119), and number of primary branches per plant (0.0096). Number of umbels per plant had maximum positive indirect effect on yield *via* seed yield per plot (0.1167), number of fruits per umbel (0.0247), number of primary branches per plant (0.0199), number of umbellates per umbel (0.0079), number of seeds per plant (0.0068), plant height up to main umbel (0.0045) and number of fruits per umbellate (0.0034). Number of umbellates per umbel made positive indirect contribution to yield *via* number of fruits per umbel (0.1130) and number of secondary branches per plant (0.0193), plant height up to main umbel (0.0110), seed yield per plot (0.0098), days to 50 per cent flowering (0.0070), number of primary branches per plant (0.0060) and number of umbels per plant (0.0004). Number of fruits per umbel had maximum positive indirect effect on yield *via* seed yield per plot (0.0583), number of secondary branches per plant (0.0223), seed yield per plant (0.0125), plant height up to main umbels (0.0119), number of primary branches per plant (0.0087) and days o 50 per cent flowering (0.0056). Number of fruits per umbellate made positive indirect contribution to yield *via* number of fruits per umbel (0.0707), yield per plot (0.0161), seed yield per plant (0.0048), plant height including main umbel (0.0023), number of primary branches per plant (0.0016) and number of umbels per plant (0.0001). Seed yield per plant made positive indirect contribution to seed yield *via* seed yield per plant (0.0275), plant height up to main umbel (0.0260), number of fruits per umbel (0.0227) weight of 1000 -seed (0.0172) and number of primary branches per plant (0.0076). The similar results were reported by Singh *et al.* (2008). 1000- seed weight made positive indirect contribution to yield *via* yield per plot (0.1346), number umbellates per umbels (0.0213), plant height up to main umbels (0.0070) and number of fruit per umbellates (0.0022). Seed yield per plant made positive indirect contribution to yield *via* yield per plot (0.1680), days to 50 per cent flowering (0.0304), number of fruits per umbel (0.0298) and number of secondary branches per plant (0.0148), number of primary branches per plant (0.0062), number of umbellates per umbel (0.0051) and plant height up to main umbel (0.0033).The similar finding have also reported by Gurbuz[6], Datta[3] and Singh *et al*[11].

As regards the residual effect, it was seen that apart from the variables under study, there could be certain factors influencing the yield as evident from the estimates of residual factor +0.3340. The correlation coefficient becomes more meaningful when genotypic correlations are partitioned into components of direct and indirect effects through path analysis because correlation coefficients indicate only the inter relationship of the characters irrespective of cause and effect[4]. Therefore, partitioning of correlation coefficient into direct and indirect effects appears logical to operate effective selection programme. Path analysis differs from simple correlation in that it points out the cause and their relative importance. An in depth analysis of direct and the indirect effects of various characters on yield was carried out in present study to assess the relative importance of various yield components in coriander. For path analysis, yield was taken as dependent variables and all other 13 characters used for correlation studies, were considered as causal variables.

Table No. 1.1 Genotypic and phenotypic correlation coefficients for 14 characters in garlic

Sl.no	character		Number of leaves per plant	Length of leaves per	Width of leaves	Yield per plant (g)	Length of each	Diameter of each bulb (cm)	Number of cloves per bulb	Length of each clove	Diameter of each	Days to harvest	Total soluble solids	Dry matter (%)	Acidity (%)
1.	Plant height (cm.)	P	0.56**	0.38	0.12	0.05	0.38	0.51**	0.22	0.18	0.16	-0.10	0.477*	-0.207	0.456*
		G	0.60	0.50	0.13	0.05	0.46	0.56	0.26	0.23	0.25	-0.21	0.264	-0.240	0.520
2.	Number of Leaves per plant	P		0.24	0.22	-0.12	0.14	0.37	0.56**	-0.20	0.02	0.04	0.563**	-0.234	0.433*
		G		0.35	0.23	-0.15	0.14	0.41	0.63	-0.20	0.03	0.17	0.735	-0.300	0.497
3.	Length of Leaves (cm)	P			0.03	0.43*	0.38	0.62**	0.35	0.01	0.40*	0.12	0.35	0.02	0.57**
		G			0.02	0.77	0.66	0.84	0.45	-0.07	0.61	0.58	0.61	-0.07	0.79
4.	Width of Leaves (cm)	P				-0.32	0.20	0.13	-0.12	-0.20	-0.00	0.32	0.05	0.16	-0.01
		G				-0.43	0.19	0.14	-0.14	-0.28	0.02	0.74	0.03	0.13	-0.02
5.	Yield per plant (g) fresh	P					0.11	0.30	0.26	-0.13	0.42*	0.04	0.13	-0.18	0.44*
		G					0.19	0.38	0.21	-0.13	0.64	-0.12	0.36	-0.21	0.53
6.	Length of each bulb (cm)	P						0.41*	0.07	-0.16	0.37	0.16	0.28	-0.07	0.49*
		G						0.52	0.08	-0.14	0.51	0.27	0.35	-0.12	0.61
7.	Diameter of each bulb (cm)	P							0.17	0.08	0.23	0.24	0.24	-0.06	0.56**
		G							0.22	0.00	0.40	0.56	0.34	-0.12	0.68
8.	Number of cloves per bulb	P								-0.24	0.10	-0.09	0.57**	-0.17	0.33
		G								-0.31	0.74	-0.02	0.80	-0.26	0.40
9.	Length of each clove (cm)	P									-0.01	-0.14	-0.18	0.14	-0.17
		G									0.01	-0.38	-0.23	0.13	-0.22
10.	Diameter of each clove (cm)	P										-0.12	0.27	-0.11	0.44*
		G										-0.07	0.49	-0.11	0.55
11.	Day to harvest	P											-0.07	0.34	0.03
		G											-0.40	0.55	-0.00
12.	Total soluble solids (T.S.S. %)	P												-0.18	0.51**
		G												-0.30	0.76
13.	Drys matter (%)	P													-0.26
		G													-0.42

Table No. 1.2: Direct and indirect effect of different characters on yield in garlic (phenotypic)

Sl. No.	Characters	Plant height (cm.)	Number of Leaves per plant	Length of Leaves (cm)	Width of Leaves (cm)	Length of each bulb (cm)	Diameter of each bulb (cm)	Number of cloves per bulb	Length of each clove (cm)	Diameter of each clove (cm)	Day to harvest	Total soluble solids (T.S.S. %)	Dry matter (%)	Acidity (%)	Yield per plant(g)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	Plant height (cm.)	-0.042	0.184	0.058	-0.011	0.013	0.095	0.088	-0.032	-0.010	0.013	0.004	0.092	0.012	0.456
2.	Number of Leaves per pl	-0.024	0.324	0.037	-0.020	-0.033	0.032	0.063	-0.083	0.011	0.002	-0.001	0.109	0.014	0.433
3.	Length of Leaves (cm)	-0.014	0.079	0.151	-0.003	0.114	0.094	0.106	-0.052	-0.000	0.034	-0.005	0.068	-0.001	0.572
4.	Width of Leaves (cm)	-0.005	0.073	0.005	-0.089	-0.085	0.049	0.023	0.018	0.011	-0.000	-0.013	0.010	-o.010	-0.012
5.	Length of each bulb (cm)	-0.002	-0.41	0.066	0.029	0.259	0.028	0.051	-0.024	0.007	0.036	-0.001	0.026	0.011	0.449
6.	Diameter of each bulb (cm)	-0.016	0.043	0.058	-0.018	0.030	0.244	0.070	-0.010	0.009	0.032	-0.006	0.055	0.004	0.496
7.	Number of cloves per bulb	-0.022	0.120	0.094	-0.012	0.078	0.100	0.171	-0.025	-0.094	0.019	-0.009	0.047	0.004	0.564
8.	Length of each clove (cm)	-0.009	0.184	0.054	0.011	0.044	0.018	0.029	-0.146	0.013	0.009	0.003	0.110	0.010	0.334
9.	Diameter of each clove (cm)	-0.008	-0.067	0.001	0.017	-0.035	-0.039	0.014	0.035	-0.057	-0.001	0.006	-0.035	-0.008	-0.177
10.	Day to harvest	0.006	0.008	0.061	0.000	0.111	0.091	0.039	-0.015	0.000	0.086	0.005	0.053	0.006	0.442
11.	Total soluble solids (T.S.S. %)	0.004	0.014	0.019	-0.029	0.011	0.039	0.041	0.014	0.008	-0.010	-0.040	-0.014	-0.021	0.036
12.	Dry matter (%)	-0.020	0.182	0.053	-0.004	0.035	0.069	0.041	-0.083	0.010	0.023	0.003	0.194	0.011	0.517
13.	Acidity (%)	0.008	-0.076	0.003	-0.014	-0.049	-0.01	-0.011	0.025	-0.008	-0.009	-0.013	-0.035	-0.062	-0.261

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