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Research Article

CORRELATION AND PATH ANALYSES FOR VARIOUS TRAITS IN CORIANDER (*CORIANDRUM SATIVUM L.*)

YADAV S.[1] AND YADAV K.S.[2*]
[1]College of Agriculture, Rewa, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, 482004, Madhya Pradesh, India
[2]ICAR-Krishi Vigyan Kendra, Sagar, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, 482004, Madhya Pradesh, India
*Corresponding Author: Email- ksyadav20@rediffmail.com

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Abstract: Nineteen genotypes were evaluated for various traits in coriander to know the nature of association among themselves. Seed yield per plant was positively and significantly associated with umbels per plant, days to maturity, 1000 seed weight, biomass per plant and harvest index. Plant height showed the positive and significant correlation with umbels per plant and 1000 seed weight. Biomass per plant, harvest index, 1000 seed weight and umbels per plant exhibited direct bearing as seed yield per plant while, seed yield, days to maturity, fruits per umbel, umbels per plant and plant height showed direct contribution towards harvest index in coriander.

Keywords: Correlated response, harvest index, relative selection efficiency

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Introduction

Coriander (*Coriandrum sativum L.*) is an annual herb, belonging to the family *umbeliferae*. In India coriander is cultivated in about 2.82 lakh hectares with annual production of about 1.72 lakh tons. The productivity of coriander is very low (306 kg/ha) in Madhya Pradesh as compared to national average productivity of (610 kg/ha). Coriander was fruit used in Egypt for culinary purposes as early as 1550 BC and is mentioned in the *Ebers papyrus*. It is also mentioned in Sanskrit as drugs implored by Hippocrates about 400 BC. Coriander is the most important Indian condiment crops. It is mostly used for pleasant aromatic adorer. The entire plant when young is used for preparing chutneys, sauces and leaves are used for flavoring curries and soups, coriander oils contains coriandrol. The knowledge of correlation between seed yield and its attributing characters is important for simultaneous improvement of several characters in selection breeding programs. There are very limited efforts have been made for genetic improvement of yield through systematic breeding programs. Genotypic correlation refers to the heritable association between any two characters. It is either due to pleotropic gene action or due to linkage of both. The phenotypic correlation refers to the observable association between two characters. The environmental correlation is entirely due to environmental effects. The path coefficient analysis is standardized regression coefficient which splits the correlation coefficient into the estimate of direct and indirect effects, Therefore it helps in determining the casual factors of seed yield. Only some attempts have been made to know the relationship between yield and contributing characters in seed yield of coriander [1, 2].

Materials and Methods

The present study was carried out at instructional farm of department of horticulture, Jawahalal Nehru Krishi Vishwa Vidyalaya, College of Agriculture, Rewa, M.P. India during winter season. The experimental material of this study comprised nineteen genotypes of coriander were collected from different research station of J.N. Krishi Vishwa Vidyalaya, Jabalpur and land races included in this study were collected from coriander growing various district of state. Nineteen genotypes were evaluated in randomized complete block design with three replications during winter season. Each genotype was grown in four row plots of 4.0 m length with row to row distance of 25 cm. the plant to plant distance was maintained at 10 cm. manually. Fertilizer was applied 60:30:15 kg NPK/ha.

Results and Discussion

The extent of association between seed yield and its component characters is of great importance in selection programme aimed at improvement in seed yield of any crop. Some information on nature and extent of correlation of yield attributes with seed yield are available [1-3] However, such information is barely cited for land races of coriander grown in Madhya Pradesh. In this study, an attempt was therefore made to study the extent and direction of correlation between seed yield and its contributions in coriander. In general, the direction of genotypic and phenotypic correlation was mostly same but the magnitude of genotypic correlations were higher than phenotypic correlations. It may be due to masking influence of environmental factors in the phenotypic expression of the characters. The environmental correlations are of least importance to breeder by they indicate to what extent different characters are influenced by environment. Hence, environmental correlations were also determined in this study. The direction of environmental correlation coefficients was independent to genotypic and phenotypic correlations. The direction of environmental correlation was mostly positive. It revealed that environmental factors contributed in positive direction during the phenotypic expression of genetic values. The environmental correlations are arising due to the effect of heterogeneity, cultural irregularities and popularity of error in the experiment [4]. Such factors cause a harmonic change in plant behaviour expressed in terms of physiological adjustment [4, 5]. At phenotypic level, seed yield per plant showed positive and significant correlation with days to maturity (0.351**), biomass per plant (0.798**) and harvest index (0.592**). It exhibited negative and significant association with umbels per plant (-0.422**) and 1000 seed weight (-0.335*). The association of plant height with umbels per plant (0.375*) and 1000 seed weight (0.308*) was also positive and significant. Biomass per plant showed positive and significant correlation with days to maturity (0.575**) but it exhibited negative and significant correlation with umbels per plant (-0.304*) and 1000 seed weight (-0.485**). The correlation coefficient between harvest index and umbels per plant was also negative and significant (-0.367**).

Table-1 Phenotypic, genotypic and environmental correlations between seed yield per plant and other characters in coriander

Characters		Secondary branches per plant	Umbels per plant	Fruits per umbel	Days to maturity	1000-seed weight	Seed yield per plant	Biomass per plant	Harvest index
Plant height	P	-0.194	0.375**	-0.236	-0.125	0.308*	0.121	-0.018	0.171
	G	-0.485	0.485	-0.290	-0.147	0.350	0.110	-0.057	2.295
	E	0.000	0.021	0.058	0.203	-0.122	0.188	0.204	0.036
Secondary branches per plant	P		0.053	-0.011	-0.43	-0.080	0.144	0.219	-0.091
	G		0.029	-0.152	-0.086	-0.038	0.210	0.439	-0.445
	E		0.081	0.116	-0.045	-0.276	0.153	0.130	0.025
Umbels per plant	P			-0.218	-0.147	0.235	-0.422**	-0.304*	-0.367**
	G			-0.357	-0.238	0.261	-0.516	-0.455	-0.523
	E			0.155	0.449	0.196	-0.193	0.102	-0.251
Fruits per umbel	P				0.057	0.219	0.211	0.203	0.150
	G				0.049	0.248	0.221	0.169	0.348
	E				0.194	0.040	0.174	0.337	-0.086
Days to maturity	P					-0.582**	0.351**	0.575**	-0.109
	G					-0.612	0.416	0.637	-0.138
	E					0.017	-0.139	0.173	-0.225
1000-seed weight	P						-0.335*	-0.485**	0.053
	G						-0.341	-0.553	0.241
	E						-0.365	-0.055	-0.393
Seed yield per plant	P							0.798**	0.592**
	G							0.908	0.666
	E							0.388	0.653
Biomass per plant	P								0.013
	G								0.303
	E								-0.401

* and ** Significant at 5 and 1 per cent, respectively

Table-2 Direct and indirect effects of different characters on seed yield per plant in coriander

Characters		Plant height	Secondary branches per plant	Umbels per plant	Fruits per umbel	Days to maturity	1000-seed weight	Biomass per plant	Harvest index	Correlation with seed yield par plant
Plant height	P	**0.008**	-0.002	0.010	0.009	0.007	0.003	-0.015	0.101	0.121
	G	**-0.200**	0.016	0.120	0.035	0.002	0.010	-0.050	0.178	0.110
Secondary branches per plant	P	-0.001	**0.011**	0.001	0.000	0.002	-0.001	0.185	-0.054	0.144
	G	0.097	**-0.032**	0.007	0.018	0.001	-0.00	0.398	-0.269	0.210
Umbels per plant	P	0.003	0.001	**0.027**	0.009	0.008	0.003	-0.255	-0.217	-0.422**
	G	-0.097	-0.001	**0.249**	0.043	0.003	0.007	-0.402	-0.317	-0.516
Fruits per umbel	P	-0.002	0.000	-0.006	**-0.040**	-0.003	0.002	0.171	0.088	0.211
	G	0.058	0.005	-0.089	**-0.120**	-0.001	0.007	0.150	0.211	0.221
Days to maturity	P	-0.001	0.000	-0.004	-0.002	**-0.054**	-0.006	0.484	-0.965	0.351**
	G	0.029	0.003	-0.059	-0.006	**-0.014**	-0.017	0.564	-0.083	0.416
1000-seed weight	P	0.002	-0.001	0.006	-0.009	0.031	**0.011**	-0.408	0.031	-0.335*
	G	-0.070	0.001	0.065	-0.030	0.009	**0.028**	-0.490	0.146	-0.341
Biomass per plant	P	0.000	0.002	-0.008	-0.008	-0.031	-.005	**0.841**	0.008	0.798**
	G	0.011	-0.014	-0.113	-0.020	-0.009	-0.015	**0.885**	0.183	0.908
Harvest index	P	0.001	-0.001	-0.010	-0.006	0.006	0.001	0.011	**0.591**	0.592**
	G	-0.059	0.014	-0.130	-0.042	0.002	0.007	0.268	**0.605**	0.666

* and ** Significant at 5 and 1 per cent, respectively, Residual effects P=0.018, G= -0.008, Bold figures denoted the direct effects

The correlation between rest possible combination of different characters were positive or negative and non-significant. At genotypic level, the correlation of plant height, secondary branches per plant, fruits per umbel, days to maturity, biomass per plant and harvest index were positive with seed yield per plant. Similarly, biomass per plant showed positive association with all the studied characters except umbels per plant and 1000 seed weight at genotypic level. Harvest index exhibited positive correlation with plant height, fruits per umbel, 1000 seed weight and biomass per plant at genetic level but it showed negative association with secondary branches per plant, umbels per plant and days to maturity. Seeds per umbel, days to maturity and 1000 seed weight also showed negative correlation with secondary branches per plant. At environmental level, the majority of correlation coefficients were positive. Secondary branches per plant showed negative association with days to maturity and 1000 seed weight. Similarly, 1000 seed weight exhibited negative association with seed yield per plant, biomass per plant and harvest index at environmental level. In this study, umbels per plant, days to maturity, 1000 seed weight, biomass per plant and harvest index showed significant and positive association with seed yield per plant (Table 1). The correlation of biomass per plant was negative and significant with umbels per plant and 1000 seed weight but it exhibited significant and positive correlation with days to maturity. The association between 1000 seed weight and days to maturity was also negative and significant. Plant height exhibited positive and significant correlation with umbels per plant and 1000 seed weigh. These results are in agreement with the findings of coriander [10-12]. Path coefficient analysis is a standardized regression coefficient which splits the correlation coefficients into the estimates of direct and indirect effects. All possible correlation coefficients among different characters were partitioned into their direct and indirect effects considering seed yield per plant and harvest index as dependent variables. The results of path coefficient analysis are presented in Table 2 and 3 for seed yield

Table-3 Direct and indirect effects of different characters on harvest index in coriander

Characters		Plant height	Secondary branches per plant	Umbels per plant	Fruits per umbel	Days to maturity	1000-seed weight	Seed yield per plant	Biomass per plant	Correlation with harvest index
Plant height	P	**0.023**	0.003	-0.031	-0.019	-0.010	-0.010	0.191	0.024	1.171
	G	**0.263**	-0.019	-0.172	-0.051	-0.007	-0.011	0.201	0.091	0.295
Secondary branches per plant	P	-0.004	**-0.013**	-0.004	-0.001	-0.003	0.003	0.226	-0.294	-0.091
	G	-0.127	**0.040**	-0.010	-0.027	-0.004	0.001	0.383	-0.699	-0.445
Umbels per plant	P	0.009	-0.001	**-0.082**	-0.017	-0.011	-0.008	-0.664	0.407	-0.367**
	G	0.128	0.001	**-0.354**	-0.063	-0.012	-0.008	-0.939	0.724	-0.523
Fruits per umbel	P	-0.005	0.000	0.018	**0.080**	0.004	-0.007	0.332	-0.272	0.150
	G	-0.076	-0.006	0.126	**0.176**	0.002	-0.008	0.403	-0.270	0.348
Days to maturity	P	-0.003	0.001	0.012	0.005	**0.076**	0.019	0.552	-0.771	-0.109
	G	-0.039	-0.003	0.084	0.009	**0.048**	0.019	0.758	-1.014	-0.138
1000-seed weight	P	0.007	0.001	-0.019	0.017	-0.044	**-0.032**	-0.527	0.650	0.053
	G	0.092	-0.002	-0.093	0.044	-0.030	**-0.030**	-0.621	0.881	0.241
Seed yield per plant	P	0.003	-0.002	0.034	0.017	0.027	0.011	**1.572**	-1.070	0.592**
	G	0.029	0.008	0.183	0.039	0.020	0.010	**1.821**	-1.445	0.666
Biomass per plant	P	0.000	-0.003	0.025	0.016	0.044	0.016	1.255	**-1.340**	.0.13
	G	-0.015	0.017	0.161	0.030	0.031	0.017	1.654	**-1.592**	0.303

* and ** Significant at 1 per cent, level, Residual effects P=0.049, G= -0.023, Bold figures denoted the direct effects

per plant and harvest index respectively. Biomass per plant followed by harvest index, umbels per plant, 1000 seed weight, secondary branches per plant and plant height contributed directly towards seed yield per plant at phenotypic level. The contribution of fruits per umbel and days to maturity was though negative but both contributed indirectly via biomass per plant towards seed yield. At genotypic level, all the studied characters except plant height (-0.200). secondary branches per plant (-0.032), fruits per umbel (-1.20) and days to maturity (-0.014) contributed directly towards seed yield per plant. Plant height and secondary branches per plant contributed indirectly via umbels per plant, fruits per umbel, days to maturity and harvest index towards seed yield per plant at genetic level. The correlation coefficients were further partitioned with their direct and indirect effects by path coefficient analysis in order to judge the relative importance of yield factors. The results revealed that biomass per plant, harvest index, 1000 seed weight and umbels per plant showed direct positive effect on seed yield both at genotypic and phenotypic levels. Fruits per umbel though exhibited direct negative influence but it contributed indirectly via 1000 seed weight, biomass per plant and harvest index [13,14] have also observed the direct contribution of biomass per plant, harvest index, 1000 seed weight and umbels per pant on seed yield in coriander which may be in agreement with the present study. It is thus clear that these traits are major yield factors. Hence, indirect selection base of these traits in form of selection indices would be more effective for the improvement in the yield of coriander. Path coefficient considering harvest index as dependent variable revealed that seed yield per plant, days to maturity, seeds per umbel and plant height are the main component of harvest index having direct positive bearing both at genotypic and phenotypic levels. The direct negative contribution of umbels per plant, 1000 seed weight and secondary branches per plant on harvest index suggests the indirect contribution of these traits through biomass per plant. The existence of small to medium seeded genotypes with more umbels per plant and low fruits per umbel may be the reason of direct negative contribution of these traits on harvest index in the present material. The residual effect observed in this study may be due to the influence of environmental faction of the characters which was not taken in to consideration.

Conclusion

The magnitude of genotypic correlations was higher than phenotypic correlations in coriander. The direction of environmental correlation coefficients was independent to genotypic and phenotypic correlations and showed the direction of environmental correlation were mostly positive. At phenotypic level, seed yield per plant showed positive and significant correlation with days to maturity, biomass per plant and harvest index. The association of plant height with umbels per plant was also positive and significant, while the correlation between rest possible combination of different characters were positive or negative and non-significant. At genotypic level, the correlation of plant height, secondary branches per plant, fruits per umbel, days to maturity, biomass per plant and harvest index were positive with seed yield per plant. At environmental level, the majority of correlation coefficients were positive. Path coefficient analysis in order to judge the relative importance of yield factors. The results revealed that biomass per plant, harvest index, 1000 seed weight and umbels per plant showed direct positive effect on seed yield both at genotypic and phenotypic levels. Hence, the present research work was undertaken to investigate the relative importance of direct and indirect influences of the component traits toward seed yield; and identify the important traits to be considered in coriander improvement programmes.

Application of research: Correlation and path coefficient has described the association between two variables that are not in a cause and effect relationship and express the direct and indirect effect respectively.

Research Category: Vegetable science

Abbreviations:
JNKVV: Jawharlal Nehru Krishi Vishwa Vidyalaya.

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***Research Guide: Late Dr L.M. Singh**
University: Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, 482004, Madhya Pradesh
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