International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 1928-1930

Received: 14-07-2018
Accepted: 18-08-2018

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Studies on variability of some morphological characters in coriander (*Coriandrum sativum* L.)

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Abstract
Analysis of variability carried out for 17 characters in 20 genotypes of Coriander (*Coriandrum sativum* L.) revealed highly significant differences among genotypes for all the characters studied. High genotypic and phenotypic variation was observed for character like plant height secondary branches and plant spread. High genotypic and phenotypic co-efficient of variation was observed for seed yield per plant, essential oil, seed yield per ha and plant spread.
High heritability was observed for the characters like plant height at harvest, days to first flowering, seed yield per hectare, maturity, dry matter production, seed yield per plot, harvest index, essential oil content, days to 50 percent flowering and test weight. High genetic advance was observed for plant spread, seed yield per plot and plant height at harvest. High genetic advance as percent of mean was observed for number of primary branches at harvest, plant spread, harvest index, essential oil and seed yield per plant and per hectare. High genetic advance over percent of mean coupled with high heritability was observed for the characters like plant height at harvest, plant spread, harvest index, essential oil, dry matter, number of umbellets per umbel, seed yield per plant and seed yield per hectare. Therefore, greater emphasis should be given on these characters while selecting for higher yield and related traits.

Keywords: coriander, variability, genotypic and phenotypic

Introduction
Coriander (*Coriandrum sativum* L.) is an important seed spice belongs to family Apiaceae (Umbelliferae) and possess 2n=22 chromosomes with cross-pollination as mode of reproduction. Western Europe and Asia are considered to be the centre of origin of this crop (Gal, *et al.*, 2010) [8]. It is also one of the most important spice crop grown in India and throughout the world. In India it is mainly grown in Rajasthan, Gujarath, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. In India, coriander is grown with an area of 522.66 thousand hectare with the production of 461.71 thousand MT and productivity is 1.13 MT per hectare (Anon, 2015) [1].
In Karnataka, coriander is mainly grown under *rainfed* conditions both in *kharif* and *rabi* season in an area of 2.65 thousand hectares with a production of 0.82 MT (Anon, 2015) [1]. Yield is a complex trait and direct selection for this trait based on heritability estimates alone will not be rewarding. Seed yield is dependent on various other component traits like plant height, number of branches, seed weight *etc*. Knowledge on the relationship between these traits helps in achieving the improved yield (Thakur and Saini, 1995) [18]. Knowledge regarding association and path coefficient analysis between yield and its components traits are important in determining the component characters that could be used as selection parameters for effective improvement of the crop.

Materials and Methods
The present investigation was carried out at Zonal Agricultural and Horticultural Research station (ZAHRS), Babbur farm, Hiriyur taluk, Chitradurga (Dist) coming under the central dry zone of Karnataka. The experimental material comprised of twenty diverse genotypes like Rcr-475, RCr-480, RCr-728, RCr-446, RCr-20, RCr-41, RCr-435, RCr-436, RCr-684, GCr-1, GCr-2, ACr-1, Co-1, Co-2, Co-3, Co-4, DCC-1, DCC-2, DCC-3 and DCC-4. These genotypes are collected from SKNA-Sri karana narendra agriculture, Jobner, Rajastan, HRES-Horticultural Research and Extension Station, Devihosur, TNAU- Tamilu Nadu Agriculture University, Coimbatore, GAU- Gujarath Agriculture University, Gujarat, NRC- National

Research center Seed Spice, Ajmer, Rajastan. The experiment was laid out in the Randomized Complete Block Design with replicated thrice. The seeds of twenty genotypes were sown on 3rd Nov 2016 at ZAHRS, Babbur farm, Hiriyur during *rabi* season with a spacing of 30 x 22.5 cm between row to row and plant to plant spacing were maintained. 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 17 characters viz., plant height (cm), number of primary branches per plant, number of secondary branches per plant, plant spread (cm^2), days to first flowering, days to 50 percent flowering, days to harvesting, number of umbels per plant, number of umbellets per umbel, number of seeds per umbel, days taken to maturity, dry matter production (g), seed yield per plant (g), seed yield per hectare (q), harvest index (%), test weight (g) and essential oil content (%).

The analysis of variance for testing the variation among treatments was carried out as per the method suggested by Panse and Sukhatm (1957) [12]. The phenotypic correlation coefficients were calculated as per methods given by Fisher and Yates (1963) [7]. Path analysis based on phenotypic correlations was performed according to Dewey & Lu (1959) [5].

Results and Discussion

The magnitude of variance, as such does not reveal the relative amount of variability as ascertained through co-efficient of variation. PCV was higher than GCV for all the characters studied. The characters like plant height at harvest, number of umbellets per umbel, number of seeds per umbellet, test weight, seed yield per plant, seed yield hectare, maturity and harvest index showed very narrow differences between phenotypic and genotypic co-efficient of variation indicating less influence of environment in the expression of these characters (Table 1). Thus, selection for these characters would be more effective. The other characters *viz.*, primary branches at harvest, number of secondary branches at harvest, number of umbels per plant, seeds per umbellet and essential oil showed moderate differences between GCV and PCV indicating more sensitivity of these characters to environmental factors. Thus, response to selection would be poor. These results are confirmed by Mengesha and Alemaus (1993), Kole (2004) [2] and Krishnamoorthy and madalageri (2002) [10] in coriander, fenugreek and ajowan.

High value of PCV was recorded for seed yield per plant, essential oil, seed yield per ha, seed yield per plot, and plant spread which indicates that maximum amount of variability is present in genotypes for these characters. These results are in conformity with Singh *et al.* (2005) [16] in coriander.

High value of GCV was recorded for seed yield per plant, essential oil and seed yield per ha due to genetic character, indicating that selection for yield attributing characters would be more effective. Similar results were obtained by RAJPUT and Dhirendrasingh (2003) [14] in coriander.

High PCV with equal GCV was recorded for plant height at harvest, dry matter production, days taken for first flowering, days taken for 50 percent flowering, number of umbellet per umbel, test weight, seed yield per plant, seed yield per hectare indicating maximum variability existing in the genotypes for these characters and offers good scope for improvement by simple selection through these characters. Similar results were obtained by Rajput and Dhirendrasingh (2003) [14] and Patel *et al.* (2008) [13] in coriander and ajowan, respectively.

However, the effectiveness of selection for any character depends not only on the amount of phenotypic and genotypic variability, but also on the estimates of broad sense heritability.

Heritability value indicates the heritable properties of variation. Burton and Devane (1952) had suggested that genotypic co-efficient of variation together with heritability estimates would give the best picture of the amount of progress to be expected by selection. In the present study, heritability ranged from 24.06 (Seeds per umbellet) to 78.20 (Plant height at harvest). High heritability was noticed for the characters like plant height at harvest, days to first flowering, seed yield per hectare, maturity, dry matter production, seed yield per plot, harvest index, essential oil content, days to 50 percent flowering and test weight. Similarly, high heritability estimates were reported by Singh *et al.*(2006) [15] and Rajput and Singh (2003) [14], indicating that these characters are less influenced by environmental factors and are under the control of additive gene effect and improvement for such characters through simple selection would be rewarding.

High genetic advance was observed for plant spread, seed yield per plot and plant height at harvest as these characters were controlled by additive gene action; selection for these characters will improve the yield. These results are in conformity with the findings of Singh *et al.* (2006) [15] in coriander.

Low genetic advance was observed for number of umbellets per umbel, seeds per umbellet, harvest index and essential oil indicating that these characters were governed by non additive gene action and selection for these characters is not useful. Similar results are reported by Fikreselassie *et al.* (2012b) [6] in fenugreek.

High genetic advance as percent of mean was observed for number of primary branches at harvest, plant spread, harvest index, essential oil and seed yield per plant and per hectare. This indicates that, the characters were governed by additive genes and selection will be rewarding for improvement of such traits. Similar results are reported by Mengesh and Alemaus (2010) [11] and Singh *et al.* (2006) [15] in coriander.

Moderate genetic advance as percent of mean was observed for plant height, number of primary branches at harvest, days to first flowering, maturity, number of umbellets per umbel, dry matter, seed yield per plant and test weight which indicates that the characters were governed by non additive genes and hence may be useful for Heterosis breeding.

Heritability estimates along with genetic gain (genetic advance as percent of mean) is more useful than heritability alone in predicting the resultant effect for selecting the best individuals (Johnson *et al.*, 1955) [9]. Genetic advance is the measure of improvement that can be achieved by practicing selection in a population.

High heritability with low genetic advance indicates the importance of non-additive gene action, while high heritability with high genetic advance indicates the additive gene effects.

In the present study, high genetic advance over percent of mean coupled with high heritability was observed for the characters like plant height at harvest, plant spread, harvest index, essential oil, dry matter, number of umbellets per umbel, seed yield per plant and seed yield per hectare. Thus, these characters were under additive gene effect and could be improved by simple selection procedure. Number of primary branches, secondary branches, umbels per plant, days to first flowering, days to 50 percent flowering have shown high heritability coupled with low genetic advance over mean which indicate the presence of certain degree of non additive gene effects.

The high heritability is being exhibited due to favorable influence of environment rather than genotype and selection for such trait may not be rewarding. The findings are in accordance with results reported by Singh *et al.* (2008) [17], Rajput and Singh (2003) [14] and Mengesh and Alemaus (2010) [11] in coriander and fenugreek.

Table 1: Estimates of mean, range and genetic parameters for growth and yield traits in coriander (*Coriandrum sativum* L.) genotypes

Sl. No	Characters	Mean± S.Em	Range	GV	PV	GCV (%)	PCV (%)	h^2 (bs) (%)	GA	GAM
Growth parameters										
1	Plant height	48.8± 3.03	37.4-70.27	104.09	133.12	20.89	23.63	78.20	18.586	38.06
2	Number of primary branches	5.7± 0.520	4.13- 7.30	0.74	1.6162	15.05	22.25	45.79	1.199	20.98
3	Number of secondary branches	11.041± 0.69	8.3-13.90	1.9853	4.9554	12.76	20.1	40.06	1.837	16.60
4	Plant spread	517.6± 45.05	380.6-645	12118.1	18656	21.26	26.38	64.95	182.76	35.30
Yield parameters										
5	Days to first flowering	45.5± 1.83	39.3-58.6	30.12	40.72	12.06	14.02	73.95	9.72	21.36
6	Days to 50% flowering	50.2±2.080	43.6-63.6	31.97	45.72	11.24	13.45	69.92	9.74	19.37
7	Umbels/plant	19.9± 1.730	13.2-28.1	12.27	21.81	17.57	23.40	56.26	5.41	27.16
8	Umbellate/umbell	4.87± 0.260	3.96-5.50	0.097	0.3132	6.41	11.40	31.17	0.35	7.37
9	Seeds/umbellet	4.893±0.400	3.8-5.70	0.162	0.6756	8.35	17.04	24.06	0.407	8.44
10	Days taken to maturity	99.98± 3.41	94.6-110	11.10	47.83	3.33	6.91	23.26	3.309	3.31
11	Seed yield/plant	4.31±0.750	2.6- 6.20	0.862	2.66	21.54	37.86	32.36	1.088	25.24
12	Seed yield/plot	245.91±21.8	279.5- 505	3062.67	4574.64	22.5	27.50	66.95	93.28	37.93
13	Seed yield/ha	8.28± 0.720	9.3-16.80	4.44	6.10	25.45	29.81	72.84	3.7071	44.74
14	Dry matter(qha^{-1})	32.34± 1.54	2.8- 8.22	20.13	27.65	13.87	16.25	72.83	7.88	24.38
15	Test weight(g)	11.07± 0.85	8.06-14.50	2.788	5.10	15.08	20.41	54.57	2.5408	22.95
16	Harvest index (%)	28.72± 2.44	38.86-56.52	47.55	24.01	25.44	28.16	70	0.177	45.65
Quality parameters										
17	Essential oils (%)	0.38± 0.037	0.1-0.8	0.0105	0.015	26.47	31.63	70.05	0.17	45.65

Conclusions

The study indicated that sufficient variability for different yield attributing characters in coriander, which can be utilized for further improvement in this crop. It is also suggested that for improving seed yield in coriander, more emphasis should be given to plant height, plant spread, Branches, seed yield per hactere, seed yield per plant, Dry matter, Test weight and effective umbels plant-1 which could be considered selection indices for further crop improvement.

References

1. Anonymous. Statistics of Horticulture crops. Department of Horticulture, Government of Karnataka, 2015.
2. Banerjee A, Kole PC. Genetic variability, correlation and path analysis in fenugreek (*Trigonella foenum-graecum* L.). J Spices and Arom. Crops. 2004; 13(1):44-48.
3. Burton GW, Devane EM. Estimating heritability in tall fescue (*Festuca arundinacea* L.) from replicated clonal material. Agron. J. 1953; 45:478-481.
4. Datta S, Chatterjee R, Medda PS, Chattopadhyay PK. Evaluation of ajowan (*Trachyspermum ammi* L.). Introduction for growth, yield and quality. J Spices and Arom. Crops. 2001; 10(1):37-39.
5. Dewey JR, Lu KH. A correlation and path analysis of components of crest wheat grass seed production. Agrononomy Journal. 1959; 51:515-518.
6. Fikreselassie M, Zeleke H, Alemayehu N. Correlation and path analysis in Ethiopian fenugreek land races. J Plant Breed crop Sci. 2012b; 2(3):132-142.
7. Fisher RA, Yates F. Statistical tables for biological, agricultural and medical research. 6. Aufl. Oliver and Boyd, London. 146 S. Preis 30, 1963.
8. Gal G, Anwer MM, Meena SS, Mehta RS, Maeria SP. Advances in Production technology of coriander. National Research centre on Seed Spices Ajmer Raj. 2010, 1-5.
9. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability in soyabean. Agron. J. 1955; 47:314-318.
10. Krishnamoorthy V, Madalageri MB. Variability and corre-lation studies in ajowan (*Trachyspermum ammi*). J Med. Arom. Pl. Sci., 2002; 24(2):364-370.
11. Mengesha B, Alemaus G. Variability in ethiopian coriander accessions for agronomic quality traits. African Crop Sci. J. 2010; 18(2):43-49.
12. Panse VG, Sukatme PV. Statistical methods for agricultural Workers. IInd Edn, 1957, 152-157.
13. Patel DG, Patel PS, Patel ID. Studies on variability of some morphological characters in ajowan. J Spices and Arom. Crops. 2008; 17(1):29-32.
14. Rajput SS, Dhirendrasingh. Variability in Coriander (*Coriandrum sativum* L.) for yield and yield components. J Spices and Arom. Crops, 2003; 12(2):162-164.
15. Singh D, Jain SK, Rajput SS, Khandewal V, Shiva N. Genetic variation for seed yield and its components and their association in coriander (*Coriandrum sativum* L.) germplasm. J Spice and Arom. Crops. 2006; 15(1):25-29.
16. Singh SP, Prasad R, Singh SK. Path co-efficient analysis of seed yield in coriander. Int. J Agric. Sciences. 2005; 1(1):58-61.
17. Singh SP, Katiyar RS, Rai SK, Yadav HK, Tripathi SM., Nigam HK *et al.*, Studies on genetic variability and character association in coriander (*Coriandrum sativum* L.) grown on sodic soil. J Medi. Arom. Plant. Sci., 2008; 30(2):164-167.
18. Thakur SR, Saini JP. Variation, association and path analysis in finger millet (*Eleusine coracana*) under aerial moisture stress condition. J Agri Sci. 1995; 65(1):54-57.
19. Vedamuthu P, Rajan FS. Yield components in coriander. South Indian Horticulture. South Indian Horticultural Association, Coimbatore. 1990; 37(5):287-290.