International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; 9(2): 917-920

Received: 18-12-2020
Accepted: 27-02-2021

Vishwas R Acharya
Department of Genetics and Plant Breeding, Anand Agricultural University Anand, Gujarat, India

Manju Singh
ASPEE Shakikalm, Biotechnology Institute. Navsari Agricultural University, Navsari, Gujarat, India

RK Patel
Department of Genetics and Plant Breeding, Navsari Agricultural University, Navsari, Gujarat, India

Lakshay Goyal
Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana, Punjab, India

Zeal R Acharya
Department of Genetics and Plant Breeding, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat, India

Corresponding Author:
Vishwas R Acharya
Department of Genetics and Plant Breeding, Anand Agricultural University Anand, Gujarat, India

Diversity analysis in different accessions of coriander (*Coriandrum sativum* L.)

Vishwas R Acharya, Manju Singh, RK Patel, Lakshay Goyal and Zeal R Acharya

DOI: https://doi.org/10.22271/chemi.2021.v9.i2m.11936

Abstract
In order to assess the genetic diversity of coriander and determine the traits effective on seed yield, twenty-eight coriander ecotypes which different provinces of India were evaluated based on morphological traits. Mahalanobis D^2 statistics of multivariate analysis is recognized as a powerful tool in quantifying the degree of genetic divergence among the populations and to identify suitable donors for a successful breeding programme, as it measures forces of differentiation at intra and inter cluster levels. The D^2 analysis indicated presence of ample genetic diversity among the genotypes studied, which were grouped into five clusters through Mahalanobis D^2 statistics. The maximum inter cluster distance was observed between cluster IV and V (D^2 = 471.83). The maximum intra cluster distance was observed within cluster IV (D^2 = 36.48) which included five genotypes followed by cluster III (D^2 = 11.37) which included eight genotypes. Therefore, the genotypes belonging to these different clusters may be undertaken in a hybridization programme for getting better segregants.

Keywords: Coriander, genotypes, d^2 statistics, divergence, cluster

Introduction

Coriander (*Coriandrum sativum* L.) is an annual spice herb. It is commonly known as dhana or dhania belongs to family Apiaeceae (Umbelliferae) and having a somatic chromosome number 2n = 22. According to the climatic conditions, it is mainly cultivated as a winter annual crop. Western Europe and Asia is considered as the centre of origin for coriander. It is probably one of the earliest seed spice known to mankind (Pruthi, 1976) [8]. The genus *Coriandrum* comprised of two species *viz*., *Coriandrum sativum* and *Coriandrum tordylium*. Among them, *C. sativum* is the cultivated one (Diederichsen, 1996) [3].

In India, it is mainly cultivated in the state of Rajasthan, Gujarat, Andhra Pradesh, Tamil Nadu and Madhya Pradesh. The total area under coriander cultivation in India is 629 thousand hectares with an annual production of 756 thousand tonnes during the year 2019-20 (Anonymous, 2020) [2]. Similarly, in Gujarat, the area and production of coriander during 2018-19 were 30.13 thousand hectares and 45.41 thousand metric tons, respectively with an average productivity 1.50 tones/ha. (Anonymous, 2019) [1].

There is limited availability of improved varieties of coriander, farmers are forced to use local materials for sowing which are variable in productivity and susceptible to various diseases. Considering the above points, there is an ample scope to improve the productivity of this crop by varietal improvement and adopting the improved production technology in our country.

Genetic diversity is a basic criterion for the crop improvement, through natural selection or by directed plant breeding approaches. The D^2 statistics is a powerful tool in qualifying the degree of divergence among biological population at genotypic level and to the access the relative contribution of different components to the total divergence. Moreover, genetic divergence through clustering analysis always help to decide the differentiated genetic contusion of the particular genotype. Therefore, study of genetic diversity has immense values for choice of the parents for heterosis breeding. The clustering pattern could be utilized in hybridization the programme and deciding cross combinations which may generate the highest variability for various trait.

Materials and Method

The twenty-eight different coriander genotypes were grown in randomized block design in three replications having two check variety *viz.*, Hissar Anand and Rcr-728 were sown during *Rabi* 2017-18 under Randomized Complete Block Design with three replications at the Research Farm, Genetics and Plant Breeding, N.M.C.A. NAU, Navsari in zone-I South Gujarat (heavy rainfall). In experiment, each plot consisted of 120 plants at 30 x 15 cm^2 inter and intra row spacing. All the recommended package of practices were adopted for raising a successful and healthy crop.

Five randomly selected plants, excluding the border ones, from each plot of all the three replications were tagged and used for recording the observations *viz.* days to 50% flowering, Days to maturity, Plant height (cm), Primary branches per plant, Secondary branches per plant, Umbels per plant, Umbellets per umbel, Seeds per umbel, Seeds per plant, Seed yield per plant (g), 1000-seed weight (g), Harvest index (%) and Total oil content (%).

Mahalanobis's D^2 statistic was computed between all possible pairs of twenty-eight coriander genotypes and the genetic diversity present among the genotypes was assessed (Mahalanobis,1928). Grouping of the genotypes into different clusters was done by using Ward's minimum variance method as described by (Rao, 1952). The first step in grouping the genotypes into different clusters was to arrange the genotypes in the order of their relative distance from each other. For this purpose, the D^2 value of all combinations of each genotype were arranged in ascending order of their magnitude in a tabular form as described by (Singh and Chaudhary, 1985). Based on D^2 values (inter cluster distance) the scale given by (Rao, 1952) for rating of the distance was adopted and the cluster diagram was prepared.

Result and Discussion

For a plant breeder, single character is not of so much importance as the combined merit of a number of desirable traits become more important when he is concerned with a complex trait like yield. So, for improving yield, selection of parents based on a number of characters having quantitative divergence is required which can be fulfilled by D^2 statistic developed by Mahalanobis (1928).

Distribution of genotypes into clusters: Twenty- eight genotypes of coriander were grouped into five clusters by Tocher's method. The results indicated that a maximum number of diverse genotypes (17 genotypes) appeared in cluster I followed by cluster III (8 genotypes), cluster II (1 genotype), cluster IV (1 genotype) and cluster V (1 genotype).

Intra and Inter cluster distances

The average intra and inter cluster distances ($D = \sqrt{D^2}$) were calculated from the D^2 values of the respective accessions within and between the clusters. A reference of Table 2 and Figure 1 indicated that the intra cluster distance ranged from 0.00 to 51.2 (cluster II and III). Inter cluster distance ranged from 11.37 to 471.83. The maximum inter cluster distance was observed between cluster IV and V (D^2 = 471.83). Whereas, the minimum inter cluster distance was observed between cluster II and cluster IV (D^2 = 11.37). The maximum intra cluster distance was observed within cluster III (D = 51.2) which included 8 genotypes followed by cluster I (D = 46.91) which included 17 genotypes. The cluster II, IV and V contained single genotype therefore; its intra-cluster distance

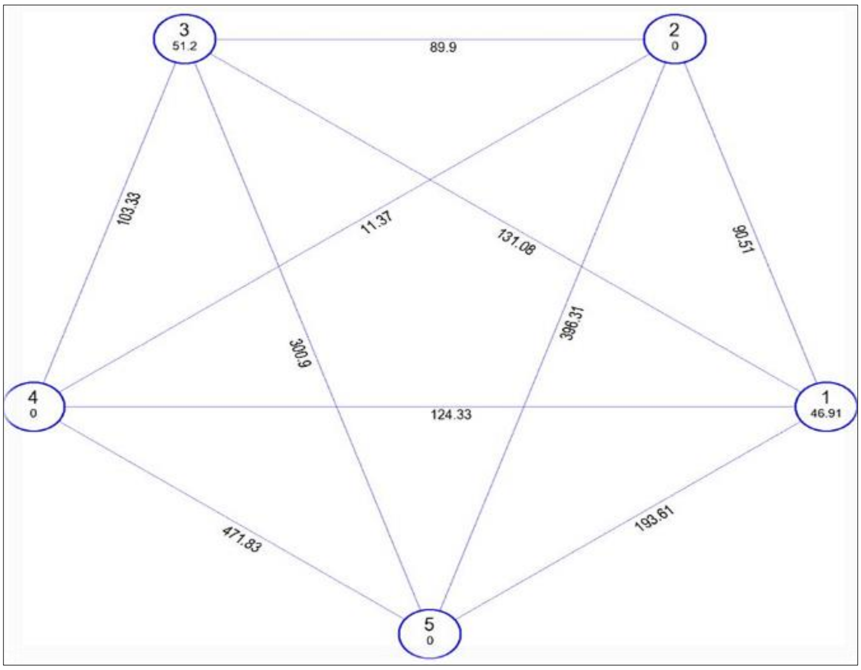

Fig 1: Clustering pattern in coriander genotypes based on morphological characters

Table 1: The distribution of 28 genotypes of coriander into five different clusters on the basis of Mahalanobis D^2 Statistic

Cluster	Number of genotypes	Name of genotypes
I	17	NVS-1, NVS-2, NVS-3, NVS-4, NVS-8, NVS-9, NVS-16, NVS-17, NVS-18, NVS-19, NVS-20, NVS-21, NVS-22, NVS-23, NVS-24, NVS-25, Hissar Anand
II	1	NVS-5
III	8	NVS-6, NVS-7, NVS-10, NVS-11, NVS-12, NVS-14, NVS-15, NVS-26,
IV	1	NVS-13
V	1	RCR-728

Table 2: Average Intra and Inter – cluster (D^2) value for 28 genotypes of coriander

Clusters	I	II	III	IV	V
I	46.91	90.51	131.08	124.33	193.61
II		0.00	89.90	11.37	396.31
III			51.20	103.33	300.90
IV				0.00	471.83
V					0.00

Mean values of clusters

A perusal of data of Table 3 indicated that mean values for different characters in different clusters vary considerably. The result showed that range was wider for the character seeds per plant followed by days to maturity and plant height and narrow for the characters seed yield per plant followed by primary branches per plant and umbellate per umbel. Days to 50% flowering ranged from 41.33 days (cluster II) to 67.33 days (cluster V), plant height ranged from 52.67 cm (cluster II) to 86.67 cm(cluster V), primary branches per plant ranged from 3.00 (cluster II) to 4.33 (cluster V), secondary branches per plant ranged from 5.33 (cluster II) to 8.00 (cluster V), umbels per plant ranged from 16.3 (cluster V) to 27.79 (cluster III), umbellate per umbel ranged from 4.83 (cluster III) to 5.67 (cluster V), seeds per umbel ranged from 15.38 (cluster III) to 28.67 (cluster V), seeds per plant from 149.33 days (cluster II) to 297.33 (cluster V), days to maturity 100.00 days (cluster IV) to 121.33 days (cluster V), 1000-seed weight ranged from 11.33 g (cluster V) to 23.73 g (cluster IV), harvest index ranged from 38.97% (cluster I) to 43.27% (cluster II), seed yield per plant 2.52 g (cluster I) to 3.90g (cluster IV) and total oil content ranged from 12.53% (cluster IV) to 21.37% (cluster V).

Table 3: Cluster means for thirteen characters in twenty-eight genotypes of coriander

Cluster No.	Days to 50% flowering	Plant height (cm)	Primary branches per plant	Secondary branches per plant	Umbellets per umbel	Umbels per plant	Seeds per umbel
I	53.16	72.98	3.86	6.22	5.20	20.27	16.06
II	41.33	52.67	3.00	5.33	5.00	18.00	22.0
III	43.67	64.92	3.79	6.63	4.83	27.79	15.38
IV	39.33	64.00	3.67	5.67	5.33	18.33	19.00
V	67.33	86.67	4.33	8.00	5.67	16.33	28.67

Cluster No.	Seeds per plant	Days to maturity	1000-seed weight (g)	Harvest index (%)	Seed yield per plant (g)	Total oil content (%)
I	198.29	108.76	14.86	38.97	2.52	14.51
II	149.33	100.67	18.73	43.27	2.53	13.43
III	213.21	102.79	19.55	42.60	3.67	19.69
IV	194.00	100.00	23.73	40.87	3.90	12.53
V	297.33	121.33	11.33	43.23	2.73	21.37

Contribution of various characters towards genetic divergence

Each character was ranked on the basis of di values (Table 4). In the present study it was observed that among the traits studied, total oil content (47.62%) contributed largely to total genetic divergence followed by days to maturity (16.27%), days to 50% flowering (13.23%) and 1000- seed weight (12.43%). While low contribution given by charters like umbels per plant (6.35%), seed yield per plant (1.85%) and harvest index (1.06%), seeds per plant (0.53%) and seeds per umbel (0.26%). While plant height, primary branches per plant, secondary branches per plant and umbellets per umbel (0.00) have the least contribution to total divergence (Figure 1). Similar results were earlier obtained in this regard by Patel *et al*. (2000) for seed yield per plant, secondary branches per plant. Srivastava *et al*. (2000) and Gauhar *et al.* (2018) for days to 50% flowering and days to maturity; Meena *et al.* (2014) for 1000 - seed weight and Mengesha *et al*. (2011) for umbels per plant, seeds per umbel and seed yield per plant.

Table 4: Contribution of thirteen characters under study to total divergence

Sr. No.	Characters	No. of times ranked first	% contribution towards divergence
1.	Days to 50% flowering	50	13.23
2.	Plant height (cm)	0	0
3.	Primary branches per plant	0	0
4.	Secondary branches per plant	0	0
5.	Umbels per plant	0	0
6.	Umbellets per umbel	24	6.35
7.	Seeds per umbel	1	0.26
8.	Seeds per plant	2	0.53
9.	Days to maturity	63	16.67
10.	1000-seed weight (g)	47	12.43
11.	Harvest index (%)	4	1.06
12.	Seed yield per plant (g)	7	1.85
13.	Total oil content (%)	180	47.62
	Total	378	100

Table 5: List of coriander genotypes used in experiment

No	Genotype	No	Genotype	No	Genotype	No	Genotype
1	NVC- 1	8	NVC-8	15	NVC- 15	22	NVC- 22
2	NVC- 2	9	NVC-9	16	NVC- 16	23	NVC- 23
3	NVC- 3	10	NVC-10	17	NVC- 17	24	NVC- 24
4	NVC-4	11	NVC- 11	18	NVC- 18	25	NVC- 25
5	NVC-5	12	NVC- 12	19	NVC- 19	26	NVC- 26
6	NVC-6	13	NVC- 13	20	NVC- 20	27	Hissar Anand
7	NVC-7	14	NVC- 14	21	NVC- 21	28	RCR- 728

***Note*:** 1 to 26 genotypes from NAU, Navsari. Hissar Anand from Hissar and RCR- 728 from Rajasthan

Conclusion

It could be concluded that high yielding genotypes coupled with other desirable physiological traits like umbels per plant, seeds per umbel, umbellets per umbel, primary branches per plant, plant height, secondary branches per plant and 1000 - seed weight could be selected as parents for hybridization programme from cluster V and cluster III. Intercrossing genotypes from these clusters might results in hybrids having high vigour and May further results in wide array of genetic variability for exercising effective selection.

References

1. Annonymous. Directorate of Horticulture 2019. https://doh.gujarat.gov.in/Images/directorofhorticulture/pdf/statistics/Area-Production-horticulture-2018-19.pdf.
2. Annonymous. Retrived from: NHB Database 2020. http://nhb.gov.in/StatisticsViewer. aspx?enc=MWoUJibk35dW2g36TUJWAoZqESmAYFi7h2irlsmjlINTcFl1rG/kLbq8ZQbWUvuM
3. Diederichsen, A. *Coriander: Coriandrum Sativum L*. Bioversity International 1996, 3.
4. Gauhar T, Solanki RK, Kakani RK, Choudhary M. Study of genetic divergence in coriander (*Coriandrum sativum* L.). International J Seed Spices 2018;8(1):36-40.
5. Mahalanobis PC. On generalize distance in statistics. Proc. Nat. Ins. India 1928;2:49-55.
6. Meena RS, Kakani RK, Choudhry S, Balraj S, Panwar A. Genetic Diversity analysis in coriander (*Coriandrum sativum* L.) varieties. Indian J agric. Sci 2014;84(12):1508-12.
7. Mengesha B, Alemaw G, Tesfaye B. Genetic divergence in Ethiopian coriander accessions and its implication in breeding of desired plant types. African Crop Science Journal 2011;19(1):39-47.
8. Pruthi JS. Spices and condiments: chemistry, microbiology and technology. New York, Academic Press 1976, 1-6.
9. Rao CR. Advanced Statistical Methods in Biometric Research. Jhon Wiley and Sons Inc., Newyork 1952, 390.
10. Singh RK, Choudhary BD. Biometrical Methods in Quantitative genetics. Kalyani publ. Third Edn 1985, 318.
11. Srivastava JP, Kamaluddin S, Srivastava SBL, Tripathi SM. Path analysis in coriander (*Coriandrum sativum* L.). Centennial Conference 2000.