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STUDY OF GENETIC DIVERSITY ON MORPHOLOGICAL TRAITS FOR VARIOUS GENOTYPES OF CORIANDER (*CORIANDRUM SATIVUM* L.)

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ABSTRACT

In November 2020, the current investigation was conducted at the Instructional Cum Research Farm of the RCSM, College of Agriculture, Kolhapur. Thirty genotypes of coriander were used in the experiment, which was set up using a Randomized Block Design (RBD) with two replications. In order to determine the genetic variability for the different morphological characters such as the days to germination at 50%, days to germination at 100%, total plant height (cm), number of leaves, leaf length (cm), leaf area (cm^2), length of main stem (cm), number of primary branches, number of secondary branches, average weight of leaves (g), average weight of stem (g). characters for seed yield *viz*., total plant height (cm), number of primary branches, number of secondary branches, number of umbels per plant, number of umbellets per umbels, number of seed per umbel, seed yield per plant (g).

The results of this study showed that for every trait, the phenotypic coefficient of variation was marginally higher than the corresponding genotypic coefficient of variation. This finding may be explained by environmental factors that influence the expression of these characters or by some degree of genotype-environment interaction. Characters such as average weight of roots (g), number of seeds per umbel at 75 DAS, number of umbels per plant at 45 DAS, number of umbellets per umbel at 60 DAS, number of seeds per umbel at 60 DAS, seed yield per plant (g), and average weight of stem (g) showed high genotypic as well as phenotypic coefficients of variation. However, the remaining samples showed modest genotypic and phenotypic coefficients of variation characters viz., length of main stem at 30 DAS, number of leaves at 30 DAS, days to 100 % germination, plant height at 75 DAS, number of primary branches at 30 DAS.

With the exception of the length of the main stem at 30 DAS, the number of leaves at 30 DAS, the plant height at 75 DAS, and the days until germination at 100%, all traits have high heritability combined with strong genetic progress as a percentage of mean, indicating that these qualities are governed by additive gene action.

The number of primary branches, leaves, average leaf weight, number of secondary branches, average stem weight, plant height, and foliage yield all showed highly significant and positive correlations with each other at the genotypic and phenotypic levels. Similarly, the number of seeds per umbel, plant height, and number of primary branches all showed highly significant and positive correlations with foliage yield.

The results of path analysis showed that plant height had the most negative direct influence on foliage production, while the number of primary branches, average weight of stem, average weight of leaves and number of secondary branches had the highest positive direct effect.

Plant height, the number of primary branches, the number of secondary branches and the number of umbels per plant showed the greatest negative direct effect on seed yield, while the character seed yield per plant at 75 DAS and the number of umbellets per umbel at 75 DAS exhibited positive direct effects on seed yield.

Therefore, based on the results of this investigation, the following genotypes have been identified: CO-23 and CO-6, CO-13 for plant height; CO-23 and CO-30 for number of leaves at 60 DAS; CO-30 and CO-14 for leaf length at 30 DAS; CO-23 and CO-30 for stem length; CO-23 and CO-30 for leaf area;

CO-23 and CO-13 for primary branches at 30 DAS; CO-23 and CO-19; CO-4 for number of secondary branches at 60 DAS; CO-23 and CO-30, CO-13 for average weight of leaves; CO-10 and CO-29 for average weight of stem; CO-23 and CO-11 for average weight of roots; CO-30 and CO-20, CO-24 for root length; CO-23 and CO-23, CO-13, CO-30, CO-22, CO-11 for foliage yield; CO-23 and CO-24, CO-30 for number of umbels per plant; CO-30 for number of umbels per plant; CO-23 and CO-29 for number of umbellets per umbel at 75 DAS, CO-23 and CO-21 for seed per umbel at 60 DAS, CO-23 and CO-27, CO-30 for seed per at 75 DAS, CO-23 and CO-27, CO-30 for number of seeds per plant. Whereas, CO-23 and CO-30 for number of seeds per umbellet at 60 DAS and number of seeds per umbel at 75 DAS, CO-13, CO-29 and CO-27 were found superior genotypes for further enhancement of seed yield per plant.

Keywords
Variability, Genotypes, Morphology, Germination, Leaf area, Branches, Umbels, Umbellets, Foliage yield, Seed yield.

Introduction

Coriander is considered both as an herb and spice. It is one of the crop in which every part is used in one or other forms. Coriander is important spice crop having great variability for its foliage, seed and essential oil. For its crop improvement genotypes collected from various parts of states. The green leaves having a fragrant and strongly aromatic taste that lends a characteristic flavour to soups, salad, curries and other oriental dishes. Coriander is a great source of potassium, iron, folic acid and vitamin A, K, C. Coriander is botanically known as *Coriandrum sativum* L. belongs to the family Apiaceae (Umbelliferae) with 2n=2x=22. It is an herbaceous plant commonly known as “Dhania” in Hindi, “Kusthumbari” or “Dhanayaka”in the Sanskrit literature; while “Dhane” in Bengali and “Kothimbir” or “Dhana” in Marathi.it is mainly sown for its fruits as well as for the tender green leaves throughout the year.

A necessary spice in the kitchen is coriander. The states of Rajasthan and Gujarat are the main producers of coriander; Madhya Pradesh, Maharashtra, Haryana, Punjab, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Bihar, and Karnataka cultivate minor amounts of the spice. Rajasthan and Gujarat account for 80% of India's coriander output, presently known as the "Seed Spice Bowl". Additionally a good melliferous plant, coriander enables honey bees to harvest almost 500 kg of honey per hectare, according to a research, Ramanenke *et al*., 1991.

Coriander is grown as an annual crop in the summer or winter, depending on the climate. This crop is tropical or subtropical, and it can withstand drought and heat. It is somewhat resistant to both hot temperatures and mild frost. For vegetative development, temperatures between 15 and 25°C and for seed production, between 20 and 30°C, together with dry, cold conditions, are thought to be optimum, Singh and Bhandari, 2015. It grows well under different types of soil and weather conditions Simon, 1990.

Generally speaking, the plant's overall height might vary from 30 to 90 cm. With an inflorescence, the tall, slender, sympodial, monochasial stem is branched. Stems have hollow internodes and noticeably expanded nodes that are ridged vertically. The leaves have a green or light green color and a shiny, waxy underside. The arrangement of the leaves is alternating. Pinnately composed, the leaves decompose regularly. Sometimes, during the blossoming season, leaves become violet or crimson. The leaves have a powerful scent. The plants need 45-65 days to reach the blooming stage. The food industries employ the essential oil Linalool, which is found in dry seeds of coriander and ranges from 0.1% to 1.0%. Seeds have a high lipid content (284.4% of total seed weight), which may be significant for the food industry. Herbs and spices are a valuable source when looking for natural antioxidants from a safety perspective. For thousands of years, coriander has been utilized in medicine, Mathias *et al*., 1994. Among other things, the fruits of the coriander plant have been used to treat gout, rheumatism, vomiting, dysentery, diarrhea, gout, indigestion, cough, bronchitis, and giddiness, Kumar *et al*., 1977.

The method to be used for its application in genetic improvement is suggested by an evaluation of the variability parameters, namely, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability, and genetic advance of the yield contributing characteristics, Acharya *et al*., 2020. In order to carefully select and develop plants to desired genotypes, genetic variability between populations must exist, Singh *et al*., 2005. Every genotype received identical experimental conditions. The intrinsic genetic composition of the genotypes, which in part controlled this morphological manifestation through the activity of endogenous growth regulators, is responsible for the diversity in plant height, Srivastava *et al*. 2000. Broadly speaking, high heritability aids in determining the right character for selection and allows the breeder to choose superior genotypes based on the phenotypic manifestation of quantitative features, Rajput and Singh, 2003. According to reports, coriander's high heritability and notable genetic advancement for each plant's umbels indicate the need of selection for increased seed output, Ranjan *et al*., 2016. High heritability combined with minimal genetic advancement for traits such as test weight, days to blooming, days to harvest, and umbel per plant suggests that environmental factors, rather than genotypes, drive these traits, Sanker and Khader 1991 and Singh *et al*. 2006.

Materials and Methods

A field experiment entitled "Study of Genetic Variability on Morphological Characters for Different Genotypes of Coriander (*Coriandrum sativum* L.)" was conducted at the Instructional-cum-Research farm of Horticulture Section, Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur during Rabi season, 2020.

The soil at the experimental location was well-drained, belonging to the sandy loam textural class, with a consistent texture and moderate levels of potassium, phosphorus, and nitrogen. The prepared field's layout followed the experimental design. The field was then partitioned using a randomized block design into small plots based on treatments and replication. Following the dibbling method of seed planting, a quick light watering was performed. Throughout the crop growth phase, additional irrigations were administered every ten to fifteen days, dependent on the weather conditions. The experimental field was kept weed-free and tidy by adhering to intercultural techniques including plant protection and weeding as needed. When the soil was being prepared, 25 tons of farm yard manure per hectare was applied. The prescribed amount of potassium, phosphorus, and nitrogen was sprayed as urea, single super phosphate, and muriate of potash, respectively, at a rate of 100:50:50 kg $N:P_2O_5:K_2O$ per hectare. At the time of seeding, a basal dosage of half the nitrogen and the full doses of potassium and phosphorus were applied, and the soil was thoroughly mixed. Thirty days after planting, a top treatment containing the remaining half of the nitrogen dose was applied by irrigation.

The experimental material for the present investigation comprised of 30 genotypes of coriander collected from different parts of Maharashtra. The lists of genotypes under study are presented in Table-1.

Table 1 : Different Genotypes of Coriander included in the study

Sr. No.	Genotype code	Location	Sr. No.	Genotype code	Location
1	**C-1**	Lasona, Osmanabad	**16**	**C-16**	Dipak Gauri, Solapur
2	**C-2**	Satara (Local)	**17**	**C-17**	Sangamner (Local)
3	**C-3**	Khed, Pune	**18**	**C-18**	Shrirampur (Local)
4	**C-4**	Daund, Pune	**19**	**C-19**	Dodi, Sinnar
5	**C-5**	Tapkiri Shetphal, Solapur	**20**	**C-20**	Wadgaon Landaga, Sangamner (Local)
6	**C-6**	Kalamba, Kolhapur	**21**	**C-21**	Wadgaon Landaga, Sangamner (Local)
7	**C-7**	Dharur, Beed	**22**	**C-22**	Kolhapur (Local)
8	**C-8**	Pimpalgaon, Ahilyanagar	**23**	**C-23**	Loni, Rahata (Local)
9	**C-9**	Latur (Local)	**24**	**C-24**	Dhule (Local)
10	**C-10**	Chas**,** Sinnar (Local)	**25**	**C-25**	Nimgaon, Ahilyanagar
11	**C-11**	Indore, Solapur (Local)	**26**	**C-26**	Sangali (Local)
12	**C-12**	Solapur (Local)	**27**	**C-27**	Hitani, Kolhapur
13	**C-13**	Jabvalpuri, Solapur (Local)	**28**	**C-28**	Chinchvihire, Rahuri
14	**C-14**	Jyoni Jawari, Solapur	**29**	**C-29**	Khamaswadi, Osmanabad
15	**C-15**	Ujani Jawari, Solapur	**30**	**C-30**	Jagudan, Gujarat

Seeds were line sown on 27th November, 2020 in a randomized block design with two replications at 10 cm distance between the rows. Each block was of 1.20 meter length and 1.20 meter breadth with a spacing 15 cm between lines. Five plants were selected randomly from each genotype in each replication. The randomly selected plants were tagged for recording observations on various morphological characters and harvested separately to record post-harvest observations. The following observations for Growth Parameters such as Days for 50% germination, Days to 100% germination, Total plant height (cm), Length of main stem (cm), Leaf length (cm), Root length (cm), Leaf area (cm^2), Number of leaves, Number of branches per plant, Number of secondary branches, Average weight of leaves (g), Average weight of stem (g), Average weight of roots (g). Flowering characters such as Number of umbels per plant, Number of umbellets per umbel and Yield contributing characters such as Days to harvesting, Foliage yield (g), Number of seeds per umbel, Seed yield per plant (g) were recorded on five plants from each genotype at different growth stages of crop and average values for replications and genotype were worked out. Morphological characters were recorded as per DUS guidelines released by Protection of plants Varieties and Farmers Right's Authority in 2012.

The mean performance of coriander genotypes for morphological traits was calculated by Microsoft office excel worksheet, 2007 version. The analysis of variance for each variable was done as per the procedure described by Panse and Sukhatme (1985). The mean and standard error (SE), critical difference (CD) were worked out as per standard methods (Panse and Sukhatme, 1967).

Result and Discussion

The first crucial step in breeding for high production, quality and disease resistance is to examine genetic variants. This chapter covers the findings from the current study, "Study of Genetic Diversity on Morphological Traits for Various Genotypes of Coriander (*Coriandrum sativum* L.)," in the headings listed below.

Analysis of Variance

To evaluate the variation for each character, a randomized block design analysis of variance was used. The "F" test was used to mark the significance. Table-2 provides the analysis of variance for thirty characters. The analysis of variance indicated that significant amount of variability was present among the 30 genotypes of coriander at 5% and 1%, respectively. According to the analysis of variance, there was a considerable degree of variation among the 30 coriander genotypes.

Table 2 : Analysis of variance for different characters studied in the 30 genotypes of coriander

Sr. No	Character	Replication	Treatment	Error
1.	Days to 50% germination	20.41	5.24*	1.76
2.	Days to 100% germination	18.15	5.80*	2.28
3.	Plant height at 15 DAS	0.22	4.88*	0.90
4.	Plant height at 30 DAS	15.20	5.02*	1.39
5.	Plant height at 45 DAS	34.05	9.42*	3.93
6.	Plant height at 60 DAS	1313.20	213.36*	81.20
7.	Plant height at 75 DAS	1501.00	194.87*	80.65
8.	Number of leaves at 15 DAS	0.06	1.51*	0.52
9.	Number of leaves at 30 DAS	12.33	11.85*	6.15
10.	Number of leaves at 45 DAS	0.00	18.38*	4.67
11.	Number of leaves at 60 DAS	297.48	20.82*	9.33
12.	Leaf length at 15 DAS (cm)	2.01	0.93*	0.12
13.	Leaf length at 30 DAS (cm)	0.77	0.71*	0.34
14.	Leaf length at 45 DAS (cm)	0.03	0.37*	0.20
15	Length of main stem at 30 DAS (cm)	0.24	3.29*	1.24
16	Length of main stem at 45 DAS (cm)	190.10	73.21*	27.97
17	Length of main stem at 60 DAS (cm)	473.76	132.26*	52.10
18	Leaf area ($cm^{2)}$	4468.44	5934.74*	5934.38
19	Number of primary branches at 15 DAS	0.00	0.19*	0.03
20	Number of primary branches at 30 DAS	0.08	0.07*	0.02
21	Number of secondary branches at 45 DAS	0.35	1.64*	0.80
22	Number of secondary branches at 60 DAS	14.30	15.82*	0.65
23	Average weight of leaves (g)	0.03	0.20*	0.04
24	Average weight of stem (g)	1.57	0.22*	0.02
25	Average weight of roots (g)	0.00	0.06*	0.00
26	Root length (cm)	16.96	8.19*	1.13
27	Foliage yield (g)	118461.92	12494.86*	2573.22
28	Number of umbels per plant at 45 DAS	21.48	391.36*	15.49
29	Number of umbels per plant at 60 DAS	1.01	39.54*	5.31
30	Number of umbellets per umbel at 60 DAS	29.12	384.57*	29.23
31	Number of umbellets per umbel at 75 DAS	439.56	774.07*	123.21
32	Number of seeds per umbel at 60 DAS	1496.00	1788.93*	76.30
33	Number of seeds per umbel at 75 days	1496.00	9726.87*	584.71
34	Seed yield per plant (g)	7684.01	8190.66*	665.94

* and **-Significant at 5% and 1%, respectively

Days to germination

Both the 50% and 100% germination rates show a considerable range in the data. The average number of days to 50% germination was 11.65 days, with a range of 9.00 to 16.00 days. Early 50% germination (9.00 days) was demonstrated by genotypes CO-1 and CO-14, which was statistically comparable to genotypes CO-11 (12.00 days). The largest number of days required for 50% germination was obtained by the genotype CO-7 (16.00).

With a population mean of 14.5 days, the number of days needed to achieve 100% germination varied from 11 to 19 days. The CO-14 genotype needed 11.00 days to reach 100% germination, which was statistically comparable to the 15.00 days needed by the CO-3, CO-4, and CO-5 genotypes. The CO-7 genotype needed 19.00 days to reach 100% germination. Results of this study collaborate with the results of Singh *et al*., (2003) and Singh *et al*., (2005) in coriander.

Plant height (cm)

The data representing plant height measured at various intervals, namely 15, 30, 45, 60, and 75 days after sowing. Among the various genotypes, CO-23 exhibited the greatest plant height at 15 DAS (10.00 cm), which was statistically comparable to CO-13 (9.70 cm). The genotype CO-3 was observed to have the shortest plant height, measuring 4.30 cm. The genotype CO-23 exhibited the tallest plant height at

30 DAS (15 cm), which was comparable to the genotype CO-13 (13.50 cm), whereas the genotype CO-9 showed the shortest height (8.00 cm) among all genotypes. The genotype CO-23 exhibited the highest plant height at 45 DAS (20.00 cm), closely followed by genotype CO-7 (19.70 cm), whereas genotype CO-1 recorded the lowest height (11.30 cm) among all the genotypes. The genotype CO-23 exhibited the greatest plant height at 60 DAS (91.75 cm), which was statistically comparable and on par with genotype CO-6 (88.80 cm). In contrast, genotype CO-20 recorded the shortest height (41.60 cm) among all the genotypes. The genotype CO-23 (110 cm) exhibited the tallest plants at 75 DAS, being statistically on par with the genotype CO-6 (99.20 cm), which demonstrated the highest range among all the genotypes, while genotype CO-8 (62.50 cm) showed the lowest range among them. The result of present findings is in close conformity with the result reported by Anjana Duwal *et al*. (2019), they found plant height of different varieties.

Number of leaves per plant

The data represents the number of leaves per plant at various stages, specifically 15, 30, 45, and 60 days after sowing. The coriander genotypes exhibited notable differences in the number of leaves per plant across all growth stages.

The genotype CO-23 recorded the highest number of leaves per plant (8.60), which was comparable to genotype CO-30 (8.10). The lowest number of leaves per plant was found in genotype CO-9 (4.80) at 15 DAS. Similarly, the observations for the number of leaves at 30 DAS for all genotypes were recorded, and genotype CO-23 produced the highest number of leaves per plant (25.50), which was statistically comparable to genotypes CO-11 (22.90) and CO-30 (21.40). The lowest number of leaves per plant was recorded in the germplasm CO-13 (12.70). The data was collected for the total number of leaves at 45 days for all genotypes, with an average of 15.91. The genotype CO-23 achieved the highest count of leaves per plant (23.70), followed by genotype CO-30 (21.40). The lowest count of leaves per plant was observed in genotype CO-4 (11.50). The measurements for the number of leaves at 60 DAS for all genotypes were noted, with genotype CO-23 yielding the highest number of leaves per plant (23.70), which was statistically comparable to genotype CO-30 (21.40), while the minimum number of leaves per plant was recorded in the germplasm CO-04 (11.50).

Leaf length (cm)

The data measuring the leaf length at various growth stages, specifically 15, 30, and 45 days post-sowing, indicated that all genotypes of coriander exhibited a marked difference in leaf length at all growth phases.

The span observed for leaf length at 15 DAS across all coriander genotypes varied from 2.40 cm to 5.00 cm. The genotype CO-30 exhibited the highest leaf length (5.00 cm), which was statistically similar to the genotypes CO-10 (4.80 cm) and CO-14 (4.60 cm). The lowest leaf length (2.40 cm) per plant was noted in genotypes CO-5 and CO-8. Leaf length measured at 30 DAS after sowing for all the genotypes observed, and the genotype CO-30 demonstrated the greatest leaf length (5.30 cm), followed by genotypes CO-10 (4.90 cm) and CO-14 (4.70 cm), while the genotype CO-8 recorded the shortest leaf length among all genotypes, which was (2.40 cm). Likewise, the range noted for leaf length at 45 DAS was consistent across all the genotypes. The genotype CO-30 recorded the longest leaf length at 6.50 cm, which was comparable to the leaf lengths of the genotypes CO-14 (6.30 cm) and CO-10 (5.70 cm), whereas the genotype CO-3 exhibited the shortest leaf length (3.60 cm) among all the genotypes. The result of present findings is in close conformity with findings reported by Rekha Thakur (2018).

Root length (cm)

The data gathered for the root length prior to harvesting was collected at the green stage of coriander. The genotypes exhibited considerable variation for the root length. The root length in coriander genotypes ranged from 5.25 to 14.20 cm. The genotype CO-30 displayed the highest root length (14.20 cm), which was statistically comparable to the genotypes CO-19 (12.20 cm) and CO-24 (12.20 cm), while the genotype CO-1 had the shortest root length (5.25 cm) among all the genotypes.

Leaf area (cm^2)

The data indicating the leaf area during the green stage of coriander harvesting. The genotypes of coriander exhibited a considerable variation regarding leaf area. The leaf area for coriander genotypes ranged from 4.41 cm^2 to 9.68 cm^2, averaging 6.71 cm^2. Genotype CO-23 exhibited the largest leaf area of 9.68 cm^2, which was statistically comparable to genotypes CO-30 (9.19 cm^2) and CO-13 (8.22 cm^2), while genotype CO-29 recorded the smallest leaf area of 4.41 cm^2, which was statistically similar to 12 other genotypes.

Length of main stem (cm)

The data measuring the length of the main stem at various intervals, specifically 30, 45, and 60 days after sowing.

30 DAS the length of the primary stem noted in the coriander genotype CO-23 (17.50 cm) was the highest among all the genotypes and statistically comparable to CO-6 (15.90 cm) and CO-12 (15.40 cm). The genotype CO-9 recorded the shortest stem length (11.30 cm). The comparable outcome was noted at 45 DAS within a range of 24.70 cm to 52.10 cm. The genotype CO-23 (52.10 cm) exhibited the highest range among all the genotypes, succeeded by the genotypes CO-6 (51.00 cm) and CO-12 (43.70 cm), whereas the genotype CO-17 yielded the shortest main stem (24.70 cm). Similarly, the length of the main stem was noted to range from 26.23 cm to 72.00 cm at 60 DAS. The genotype CO-23 exhibited the longest main stem length (72.00 cm), which was comparable to the genotypes CO-12 (59.50 cm) and CO-7 (58.66 cm). The genotype CO-16 displayed the shortest main stem length (26.23 cm) among all the genotypes.

Number of primary branches

Observations regarding the quantity of main branches of coriander at various intervals, specifically 15 and 30 days post-sowing. The coriander genotypes exhibited notable variation at both 15 and 30 days for the number of primary branches per plant. The number of primary branches per plant measured at 15 DAS ranged from 1.00 to 2.00. The genotype CO-23 (2.00) showed the highest number of primary branches, which was statistically comparable with the genotype CO-30, whereas CO-12 and CO-28 showed fewer primary branches. Similarly, the range noted for primary branches at 30 DAS spanned from 1.00 to 2.50. The genotype CO-23 documented a significantly higher count of primary branches per plant (2.50) followed by the genotypes CO-30 (1.90) and CO-14 (1.80) and the remaining ones. The genotype CO-28 noted a lower number of primary branches (1.00). The results are in confirmation with Datta and Chaudhari (2006) who obtained primary branches per plant in the range of 5.37 to 8.23 among all the genotypes.

Number of secondary branches

Number of secondary branches per plant noted at various growth stages, specifically at 45 and 60 DAS. The coriander genotype CO-23 recorded the highest number of secondary branches per plant (7.90), which was comparable to genotypes CO-13 (6.80) and CO-30 (6.40), as well as CO-2, CO-17, CO-18, and CO-20 (6.30) and nine other genotypes, while genotype CO-22 showed the lowest number of secondary branches per plant (2.15) at 45 DAS. Likewise, the observations noted for secondary branches per plant at 60 DAS varied between 6.80 and 16.10. The genotype CO-23 and CO-19 showed the highest count of secondary branches per plant (16.10), which was comparable to the genotypes CO-4 (15.60), CO-9, CO-10, and CO-13 (15.50), whereas the genotype CO-3 (6.80) exhibited a lower number of secondary branches per plant at 60 days. The current results align with those found by Rahman (2000), who observed the quantity of secondary branches varying from 15.85 to 25.50 across all the genotypes.

Average weight of leaves (g)

Marked differences were noted among the coriander genotypes concerning the average weight of leaves prior to harvesting at the green stage. The coriander genotypes displayed significant diversity in average leaf weight, which varied from 0.60 g to 2.39 g. The genotype CO-23 (2.38 g) exhibited the highest average leaf weight, which was statistically comparable to the weights of genotypes CO-30 (2.33 g) and CO-13 (2.00 g), whereas genotype CO-1 showed the lowest weight (0.59 g) among all genotypes.

Average weight of stem (g)

All genotypes exhibited a notable variation for the average weight of stems, varying from 0.37 g to 1.77 g. The genotype CO-10 showed the highest average weight of stems (1.77 g), which was comparable to the genotypes CO-29. Measurements for average weight of stems (g) were taken prior to harvesting at the green stage.

Average weight of roots (g)

All genotypes observed a notable variation in the average weight of roots. The data indicates the average weight of roots at the point of green stage harvesting. The root weight varied from 0.37 g to 1.77 g. The genotype CO-10 (1.77 g) exhibited a significantly higher average weight of roots, comparable to the genotypes CO-29 (1.75 g), CO-6 (1.60 g) and CO-22 (1.30 g), whereas the genotype CO-24 showed the lowest average weight of roots (0.37 g).

Foliage yield (g)

Regarding the amount of foliage produced per plant, the coriander genotypes under study varied greatly from one another. Significant variance was seen in all genotypes, ranging from 195.8 g to 555.0 g. The largest foliage yield (555.0 g) was produced by the genotype CO-23, which was statistically comparable to the genotypes CO-13 (484.50 g) and CO-30 (472.80 g). CO-17 produced the lowest foliage yield (195.80 g). Variation in foliage yield could be attributed to their genetic traits and environmental factors were findings stated by Anilkumar *et al*., 2018. The outcomes of the current study are consistent with the findings stated by Anjana Duwal *et al*., 2019, who observed notable differences in the coriander crop.

Number of umbels per plant

The data shows how many umbels each plant produced at 45 and 60 days following harvest, respectively. The quantity of umbels per plant varied significantly among all coriander genotypes.

The genotypes of coriander varied greatly in terms of umbels per plant at 45 DAS, ranging from 8.90 to 59.00. Out of all the genotypes, CO-23 generated the most umbels per plant (59.00). While the genotype CO-1 showed the fewest umbels per plant (8.90), this was statistically comparable with the genotypes CO-24 (55.00) and CO-30 (54.00). Comparable to the genotypes CO-24 (27.50) and CO-30 (26.50) the umbels per plant at 60 DAS ranged from 11.30 to 27.70. Out of all the genotypes, the CO-23 generated the most umbels per plant (27.70), while the CO-13 genotype produced the fewest umbels per plant (11.30).

Number of umbellets per umbel

The information shows the number of umbellets per umbel at 60 and 75 days following seeding.

The trait umbellets per umbel 60 DAS recorded by the various coriander genotypes ranged from 8.90 to 59.50, with the genotypes CO-29 (59.00), CO-29 (56.90), and CO-26 (47.50) showing the highest scores. Out of all the genotypes, the CO-23 genotype had the most umbellets per umbels (59.50), whereas the CO-1 genotype had the fewest umbellets per umbels (8.90) in comparison to the CO-23 and the other genotypes. Data on the number of trait umbellets per umbel at 75 DAS ranged from 26.30 to 116.80. Among all the genotypes, the CO-23 genotype exhibited the highest number of umbellets per umbel (116.80), whereas the CO-1 genotype showed the lowest count (26.30) compared to all other genotypes. The outcome of current findings closely

aligns with the results reported by Rajput and Singh (2003), which discovered that the evaluated genotypes were the superior ones for umbellets per umbel.

Number of seeds per umbel

The number of seeds per umbel at 60 days exhibited a moderate positive indirect effect on seed yield through seeds per umbel at that time (0.2771); it also showed a low positive indirect effect on seed yield via the number of umbels per plant at 60 days (0.1592). Plant height at 30 days was measured at 0.1257, while at 75 days, it was recorded at 0.1247; there was a minimal positive indirect effect through secondary branches measured at 60 days, which was 0.0116. The outcomes of current findings align with the outcomes indicated by Abdul Kaium *et al*., 2015, who observed a notable difference in the quantity of seeds per umbel among the two varieties.

Seed yield per plant (g)

The seed yield per plant at 75 days showed a highly significant positive indirect effect on seed yield through seed per umbel at 60 days (0.6823), umbellets per umbel at 75 days (0.4075), umbel per plant at 60 days (0.4030), and plant height at 30 days (0.3245). In contrast, this characteristic exhibited a non-significant positive indirect effect on seed yield through plant height at 75 days (0.2197). Rajagopalan *et al*., 1996 obtained seed yield of 13 coriander cultivars in range of 0.36-0.68 t/ha at the Tamil Nadu Agricultural University, Coimbatore, India.

Conclusion

The variance analysis revealed that considerable variation existed among the genotypes for the majority of traits, indicating opportunities for further genetic enhancement in coriander. The primary focus for yield enhancement through selection should be on the traits of plant height, leaf count, leaf length, leaf area, main stem length, primary branch count, secondary branch count, average leaf weight and average stem weight for foliage yield. On the other hand, the traits that were emphasized for seed yield included plant height, primary branch count, secondary branch count, umbel count per plant, umbellet count per umbel, and seed count per umbel, which were identified as more dependable traits based on correlation coefficients and their direct impact on foliage and seed yield.

Based on the performance observed in the current study, genotypes CO-23 and CO-6, CO-13 for height of the plant, CO-23 and CO-30 for quantity of leaves at 60 DAS, CO-30 and CO-14 for leaf length at 30 DAS, CO-23 and CO-12 for length of stem, CO-23 and CO-30 for area of leaves, CO-23 and CO-13 for primary branches at 30 DAS, CO-23 and CO-19, CO-4 for quantity of secondary branches at 60 DAS, CO-23 and CO-30, CO-13 for average leaf weight, CO-10 and CO-29 for average stem weight, CO-23 and CO-11 for average root weight, CO-30 and CO-20, CO-24 for length of roots, CO-23 and CO-13, CO-30, CO-22, CO-11 for yield of foliage, CO-23 and CO-24, CO-30 for quantity of umbels per plant, CO-23 and CO-29 for quantity of umbellets per umbel at 75 DAS, CO-23 and CO-27, CO-30 for quantity of seeds per plant, CO-22 and CO-13, CO-12 for chlorophyll levels. Meanwhile, CO-23 and CO-30 for quantity of seeds per umbel at 60 DAS and quantity of seeds per umbel at 75 DAS, CO-13, CO-29 and CO-27 were identified as superior genotypes for further improvement of seed yield per plant.

Table 3 : Estimation of genetic parameter in coriander genotypes.

Sr. No.	Characters	Mean	Range (Min and Max)	GCV (%)	PCV (%)	Heritability (B. S.) %	Genetic advance	Genetic advance as % of mean
1.	Days to 50 % germination	11.65	9.00-16.00	11.33	16.06	49.73	1.91	16.460
2.	Days to 100 % germination	14.05	11.00-19.00	9.43	14.31	43.46	1.80	12.81
3.	Plant height at 15 DAS	6.33	4.00-10.30	22.29	26.86	68.86	2.41	38.11
4.	Plant height at 30 DAS	10.67	8.00-15.00	12.61	16.79	56.42	2.08	19.51
5.	Plant height at 45 DAS	14.41	11.30-20.00	11.50	17.93	41.14	2.19	15.19
6.	Plant height at 60 DAS	65.61	42.00-89.15	12.38	18.49	44.87	11.21	17.09
7.	Plant height at 75 DAS	81.44	60.10-110.00	9.27	14.41	41.46	10.02	12.30
8.	Number of leaves at 15 DAS	5.79	4.80-8.60	12.10	17.43	48.22	1.00	17.31
9.	Number of leaves at 30 DAS	18.69	12.70-25.50	9.03	16.05	31.65	1.95	10.47
10.	Number of leaves at 45 DAS	15.90	11.50-23.50	16.45	21.34	59.44	4.15	26.13
11.	Number of leaves at 60 DAS	22.23	17.50-31.00	11.09	17.36	40.88	3.25	14.61
12.	Leaf length at 15 DAS	3.05	2.40-5.00	20.82	23.71	77.14	1.15	37.68
13.	Leaf length at 30 DAS	3.86	1.70-6.10	11.08	18.87	34.53	0.51	13.42
14.	Leaf length at 45 DAS	4.59	3.60-5.50	12.75	15.22	70.20	1.01	22.01
15.	Length of main stem at 30 DAS	13.71	4.00-10.30	7.38	10.98	45.21	1.40	10.23
16	Length of main stem at 45 DAS	36.02	11.30-17.50	13.20	19.74	44.71	6.55	18.18
17	Length of main stem at 60 DAS	49.63	24.70-52.10	12.75	19.34	43.48	8.60	17.32
18	Leaf area (cm^2)	6.71	4.00-8.20	15.92	21.92	52.79	2.05	23.83
19	Number of primary branches at 15 DAS	1.41	1.00-2.50	19.76	23.62	70.02	0.48	34.07
20	Number of primary branches at 30 DAS	1.47	1.00-2.00	9.93	15.31	42.07	0.19	13.27

21	Number of secondary branches at 45 DAS	5.86	3.50-7.90	11.04	18.88	34.17	0.78	13.29
22	Number of secondary branches at 60 DAS	11.24	6.80-16.10	24.49	25.53	92.04	5.44	48.41
23	Average weight of leaves (g)	1.49	0.60-2.39	19.00	23.31	66.44	0.47	31.91
24	Average weight of stem (g)	1.00	0.37-1.77	31.36	34.65	81.93	0.59	58.48
25	Average weight of root (g)	0.41	0.20-0.95	42.45	44.84	89.60	0.34	82.77
26	Root length (cm)	8.46	5.25-14.20	22.19	25.52	75.59	3.36	39.75
27	Foliage yield	365.61	195.80-555.00	19.26	23.74	65.85	117.73	32.20
28	Number of umbels per plant at 45 DAS	35.92	8.90-59.00	38.16	39.70	92.38	27.14	75.55
29	Number of umbels per plant at 60 DAS	16.47	11.30-27.70	25.11	28.75	76.30	7.44	45.20
30	Number of umbellets per umbel at 60 DAS	36.49	8.90-59.50	36.52	39.41	85.87	25.44	69.73
31	Number of umbellets per umbel at 75 DAS	74.42	26.30-116.80	24.23	28.45	72.54	31.65	42.52
32	Number of seed per umbel at 60 DAS	81.49	12.40-139.80	35.90	37.47	91.82	57.76	70.88
33	Number of seeds per umbel at 75 DAS	165.34	68.50-300.70	40.89	43.42	88.66	131.14	79.31
34	Seed yield per plant	180.35	25.00-316	34.01	36.89	84.96	116.46	64.57
35	Chlorophyll content	1.80	3.25-5.30	10.18	17.68	33	0.21	12.06

Table 4: Genotypical Correlation Matrix

	PH	**NL**	**LL**	**LA**	**PB**	**SB**	**AVWL**	**AVWS**
PH	1.0000	0.4865	0.2144	0.1879	0.8477	0.1516	0.6488	0.4278
NL	0.4865	1.0000	0.3853	0.6716	1.2161	0.4471	0.8145	0.1995
LL	0.2144	0.3853	1.0000	0.2266	0.3598	0.2260	0.4796	0.3848
LA	0.1879	0.6716	0.2266	1.0000	0.6355	0.2041	0.6538	0.0776
PB	0.8477	1.2161	0.3598	0.6355	1.0000	0.5266	1.1403	0.3856
SB	0.1516	0.4471	0.2260	0.2041	0.5266	1.0000	0.3555	0.3351
AVWL	0.6488	0.8145	0.4796	0.6538	1.1403	0.3555	1.0000	0.4682
AVWS	0.4278	0.1995	0.3848	0.0776	0.3856	0.3351	0.4682	1.0000
FY	0.3900	0.7997	0.1262	0.3994	0.8369	0.6074	0.7542	0.4079

Table 5: PATH matrix of FY

	PH	**NL**	**LL**	**LA**	**PB**	**SB**	**AVWL**	**AVWS**
PH	-0.4192	-0.2039	-0.0899	-0.0788	-0.3553	-0.0635	-0.2719	-0.1793
NL	0.1186	0.2437	0.0939	0.1637	0.2964	0.1090	0.1985	0.0486
LL	-0.0731	-0.1313	-0.3408	-0.0772	-0.1226	-0.0770	-0.1634	-0.1311
LA	-0.0492	-0.1760	-0.0594	-0.2620	-0.1665	-0.0535	-0.1713	-0.0203
PB	0.3762	0.5397	0.1596	0.2820	0.4438	0.2337	0.5060	0.1711
SB	0.0325	0.0959	0.0485	0.0438	0.1130	0.2146	0.0763	0.0719
AVWL	0.3081	0.3868	0.2277	0.3105	0.5415	0.1688	0.4749	0.2223
AVWS	0.0962	0.0448	0.0865	0.0174	0.0867	0.0753	0.1052	0.2248
FY	0.3900	0.7997	0.1262	0.3994	0.8369	0.6074	0.7542	0.4079
Partial R^2	-0.1635	0.1949	-0.0430	-0.1046	0.3714	0.1303	0.3582	0.0917

R Square = 0.8353 Residual Effect = 0.4058

Table 6: Phenotypical Correlation Matrix

	PH75	**NL60**	**LL30**	**LA**	**PB30**	**SEC 60**	**AVL**	**AVS**	**PH75**
PH75	1.0000	0.3484	0.2638	-0.2538	0.3208	0.0725	0.6242	0.4785	1.0000
NL60	0.3484	1.0000	0.3887	-0.2520	0.6562	0.2219	0.6313	0.3031	0.3484
LL30	0.2638	0.3887	1.0000	-0.0755	0.2952	0.0202	0.3275	0.2666	0.2638
LA	-0.2538	-0.2520	-0.0755	1.0000	-0.2632	-0.2229	-0.5227	-0.3403	-0.2538
PB30	0.3208	0.6562	0.2952	-0.2632	1.0000	0.0951	0.5956	0.2350	0.3208
SEC 60	0.0725	0.2219	0.0202	-0.2229	0.0951	1.0000	0.2564	0.1138	0.0725
AVL	0.6242	0.6313	0.3275	-0.5227	0.5956	0.2564	1.0000	0.4331	0.6242
AVS	0.4785	0.3031	0.2666	-0.3403	0.2350	0.1138	0.4331	1.0000	0.4785
FY	0.3903	0.4109	0.0449	-0.2277	0.4788	0.4565	0.5270	0.3689	0.3903

Table 7: PATH matrix of FY

	PH75	NL60	LL30	LA	PB30	SEC 60	AVL	AVS
PH75	0.1145	0.0399	0.0302	-0.0291	0.0367	0.0083	0.0715	0.0548
NL60	-0.0079	-0.0227	-0.0088	0.0057	-0.0149	-0.0050	-0.0144	-0.0069
LL30	-0.0528	-0.0778	-0.2001	0.0151	-0.0591	-0.0040	-0.0655	-0.0534
LA	-0.0352	-0.0349	-0.0105	0.1386	-0.0365	-0.0309	-0.0725	-0.0472
PB30	0.1078	0.2204	0.0992	-0.0884	0.3359	0.0320	0.2001	0.0789
SEC 60	0.0272	0.0834	0.0076	-0.0838	0.0358	0.3758	0.0963	0.0428
AVL	0.1396	0.1411	0.0732	-0.1169	0.1332	0.0573	0.2236	0.0968
AVS	0.0971	0.0615	0.0541	-0.0691	0.0477	0.0231	0.0879	0.2030
FY	0.3903	0.4109	0.0449	-0.2277	0.4788	0.4565	0.5270	0.3689

R Square = 0.5199 Residual Effect = 0.6929

References

Abdul, K., Islam, M., Sultana, S., Hossain, S., Shovon, S.C. and Mahjuba, A. (2015). Yield and yield contributes of coriander (*Coriandrum sativum* L.) as influenced by spacing and variety. *International Journal of Scientific and Research Publications*, Vol- **5**(3).

Acharya, M., Patel, R.K. and Lakshay, G. (2020). Genetic diversity of coriander for yield and its attributing characters, *International Journal of Current Microbiology and Applied Sciences*, **9**(2).

Agedew, K.R. (2006). Growth, yield and quality component in coriander genotypes. *Indian J. Hort*, **46**(1), 107-110.

Bhandari, M.M. and Gupta, A. (1993). Association analysis in coriander. *Journal of Genetics and Plant Breeding*, **53**(1), 67-70.

Cheema, J., Talou, T., Wannes, W.A., Cerny, M. and Marzouk, B. (2004). Essential oil, fatty acid and sterol composition of Tunisian coriander fruit different parts, *J. Sci, Food Agric*, **89**, 1659-1664.

Choudhari, D.R. and Malhotra, S.K. (2010). Combining ability of physiological growth parameters in coriander. *Indian J. Agric. Res*, **34**(1), 55-58.

Datta, C.S. and Satya, B. (2006a). Correlation and path analysis studies on Coriander (*Coriandrum sativum* L.). *The Horticulture Journal*, **19**(1), 65-67.

Dhakad, K. (2010). Correlation and path coefficient analysis of productivity elements in coriander (*Coriandrum sativum* L.). *Journal of Central European Agriculture*, **14**(4), 1512-1517.

Gauhar, T., Solanki, R.K., Kakani and Choudhari, M. (2018). Variability and character association studies in coriander (*Coriandrum sativum* L.). *International J. Seed Spices*, **8**(1), 36-40.

Harishchand, R., Meraj, V.R., Khan, P. and Dwivedi, D.K. (2017). Correlation coefficient and path analysis in coriander (*Coriandrum sativum* L.) genotypes, *International Journal of Current Microbiology and Applied Sciences*, **3**(6), 418-422.

Jain, U.K., Singh, D. and Amrita (2002). Correlation and path analysis for certain metric traits in coriander. *Progressive Agriculture*, **3**, 86-88.

Jindal, L.N., Singh, T.H., Allah, R. and Bansal, M.L. (1985). Genetic variability & path coefficient analysis in coriander. *Crop Improvement*, **12**(2): 133-136.

Kumar, S. (1997). Effect of foliar application of chemicals and growth regulator on growth and seed yield in coriander (*Coriandrum sativum* L.). *Progressive Horticulture*, **43**(2), 193- 195.

Mangesha, B. and Alemaw, G. (2010). Variability in Ethiopian coriander accessions for agronomic and quality traits. *Afr. Crop Sci. J*., **18**: 43-49.

Panse, V.G. and Sukhatme, P.V. (1985). Statistical method for agricultural workers. *Ind. Council of Agric. Res. Publication*, 87-89.

Rajgopalan, A.R., Manavalan, S.A., Khader, D.A., Azhakiya, R.S. and Khair, M.D. (1996). Evaluation of coriander cultivars for yield and quality. *Indian Cocoa Arecanut and Spices J*, **20**(1), 13-14.

Sanjeev, A., Sharma, R.K. and Agrawal, S. (1990). Quality evaluation in coriander. *Indian Cocoa arecanut and Spices Journal*, **13**(4), 137-138.