*Plant Archives* Vol. 26, No. 1, 2026 pp. 1972-1976 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.1.271

# ANALYSIS OF GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN LEAFY CORIANDER GENOTYPES

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(Date of Receiving : 23-01-2026; Date of Revision : 20-03-2026; Date of Acceptance : 01-04-2026)

**ABSTRACT**

An experiment was conducted to evaluate leafy coriander genotypes for yield and quality. The experiment was conducted at the Department of Spices and Plantation Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during the year 2024. The study was undertaken on fifteen genotypes of coriander using Randomized Block Design with two replications. High genotypic and phenotypic coefficient of variance was observed for fresh root weight. High heritability was observed in number of days to taken for germination, plant height, number branches per plant, number of leaves per plant, leaf weight, leaf Area, leaf area index, No. of days taken for harvest, fresh plant weight, fresh shoot weight, root length, fresh root weight, dry plant weight, herbage yield per plot, moisture content, total essential oil content, total phenol content, total Flavonoids content, total Ascorbic acid content and high genetic advance as percent of mean was observed for total essential oil content. Therefore, greater emphasis should be given on these characters while selecting for higher yield and related traits.

***Keywords :*** Coriander, GCV, PCV, Genetic variability, Heritability and Genetic advance as percent of mean.

## Introduction

A well-known culinary and medicinal herb from the Apiaceae family is *Coriandrum sativum* L (Diederichsen, 1996). It is also referred to as cilantro, dhania, or Chinese parsley. One of the world's oldest spice crops, cilantro dates from approximately 1600 (Spence, 2023). It is widely grown in Bangladesh, India, Russia, central Europe, and Morocco and has been raised since the beginning of human history (Coşkuner *et al.*, 2007). However, studies on C. sativum have always focused on the aerial parts of the herb, seed and scientific investigation on the root is limited (Mandal *et al.*, 2015). Although it rarely finds a place in food preparation, coriander root is also edible (Al-Khayri, 2023). Although the oil comprises trans-tridecen, immature fruits and leaves have an unpleasant scent that is called "stink bug smell." Worldwide, a lot of people grow this plant to make essential oils, spices, or seeds (Zheljazkov *et al.*, 2014). Coriander was once one of the most important essential oil plants in the world. Mature seed has a totally different flavour and aroma from fresh herbage. Due to its therapeutic qualities, coriander is employed in the culinary and pharmaceutical industries in addition to cooking (Uitterhaegen *et al.*, 2018). It will flourish in any kind of soil, including light, well-drained, moist, loamy, as well as light to heavy black soil, but it thrives in dry climates. The seeds are sown in the Western region during the monsoon season and during the cold season. After planting the fruit halves, germination takes place 10 to 25 days later, and the plant is ready for harvesting in 3–4 months. Any improvement in a crop requires genetic diversity. The degree of genetic variability and the heritability of the desired traits determine the efficiency of any crop improvement action. The ultimate objective of a breeding program is to enhance a plant's characteristics to make it more desirable. In breeding programs targeted at increasing production, the survey of genetic variability using appropriate genetic parameters such as genotypic and

phenotypic coefficients of variation, heritability estimates, and genetic advance as a percentage of mean is essential.

## Materials and Methods

The current research was carried out at Horticultural College and Research Institute, Coimbatore during 2022-24. The objective of this study is to evaluate the leafy coriander (*Coriandrum sativum* L.) genotypes for yield and quality. The coriander genotypes were raised in open field condition in randomized block design with two replications. Fifteen different genotypes Viz., CSL1, CSL2, CSL3, CSL4, CSL5, CSL7, CSL8, CSL9, CSL10, CSL11, CSL12, CSL17, CSL18, CSL19, CSL20 were used for the study as shown in the Table-1. Line sowing of coriander was done. The seeds were split into halves by rubbing on hard surface before sowing. Bed size of 3×1.5 $m^2$ were prepared and sowing was taken up at a spacing of 30 cm between lines. The Plant growth and yield parameters were recorded *viz*., No. of days to taken for germination, plant height (cm), no. of branches per plant, No. of leaves per plant, leaf weight (g), leaf area ($cm^2$), leaf area index, no. of days taken for harvest, fresh plant weight, fresh shoot weight, Fresh root length, fresh root weight, dry plant weight, herbage yield per plot. The quality parameters such as Moisture content, Total chlorophyll content, Total essential oil content, Total phenol content, Total Flavonoid content, Total Ascorbic acid content was recorded.

**Genotypic and Phenotypic coefficient of variation**

According to (Burton, 1952), the mean values were utilized for genetic studies to calculate genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) using following equations.

Phenotypic coefficient of variation (GCV)

$$= \frac{\sqrt{\sigma_p^2}}{\bar{x}} \times 100$$

Genotypic coefficient of variation (PCV)

$$= \frac{\sqrt{\sigma g^2}}{\bar{x}} \times 100$$

Where,

$\sigma_p^2$ = Phenotypic variance

$\sigma_g^2$ = Genotypic variance

$\bar{x}$ = Grand mean

GCV and PCV were classified as suggested by Sivasubramaniam and Madhava Menon, 1973 as follow.

Low: <10%

Moderate: 10-20%

High: >20%

**Heritability ($h^2$)**

Implementing the formula provided by Falconer, 1996, heritability in broadest sense was calculated and reported as percentage.

$$\text{Heritability } (h^2) = \frac{\sigma_g^2}{\sigma_p^2} \times 100$$

Where,

$\sigma_g^2$ = Genetic variance

$\sigma_p^2$ = Phenotypic variance

Johnson *et al.*, 1955 provided broad sense heritability scales.

Low: <30%

Moderate: 30-60%

High: >60%

**Genetic advance (GA)**

For each character genetic advance (GA) was determined using Johnson *et al.*, 1955 formula.

$$GA = \sigma_p \times h^2 \times K$$

Where,

$\sigma_p$= Phenotypic standard deviation

$h^2$ = Heritability in broad sense

K = Selection differentiation at 5 % selection intensity (2.06)

**Genetic advance (GA) as per cent of mean**

Genetic advance as percentage over mean was calculated as suggested by Johnson *et al.*, 1955.

$$GA\ as\ per\ cent\ of\ mean = \frac{GA}{Grand\ Mean} \times 100$$

The ranges of per cent over mean was calculated as suggested by Johnson *et al.*, 1955

Low: <10%

Moderate: 10-20%

High: >20%

## Result and Discussion

For all growth, yield and quality characteristic, phenotypic coefficient of variation (PCV) was greater than the genotypic coefficient of variation (GCV) as shown in the Table-2 and Figure-1.

**Genotypic and Phenotypic coefficient of variation**

The high range of phenotypic coefficient of variation was recorded among the characters of leaf

weight (22.63 %), leaf area per plant (25.30 %), leaf area index (25.30 %), fresh plant weight (23.45 %), fresh shoot weight (22.24 %), fresh root weight (38.54 %), dry plant weight (26.51 %), herbage yield (34.81 %), total essential oil content (35.96 %), total phenol content (23.96 %). The moderate range of phenotypic coefficient of variation was recorded among the characters of number of days taken for germination (12.15 %), number of branches per plant (12.61 %), number of leaves per plant (12.26 %), root length (12.35 %), total ascorbic acid content (10.72 %). The low range of phenotypic coefficient of variation was recorded among the characters of plant height (8.31 %), number of days taken for harvest (7.46 %), moisture content (0.77 %), total chlorophyll content (9.73 %), total flavonoid content (8.48 %). The high range of genotypic coefficient of variation was recorded among the characters of leaf weight (20.74%), leaf area per plant (24.66 %), leaf area index (24.66 %), fresh plant weight (22.23 %), fresh shoot weight (21.44 %), fresh root weight (33.46 %), dry plant weight (25.06 %), herbage yield (29.31 %), total essential oil content (33.67 %), total phenol content (21.69 %). The moderate range of genotypic coefficient of variation was recorded among the characters of number of days taken for germination (11.68 %), number of branches per plant (10.51 %), number of leaves per plant (11.95 %), root length (12.04 %).The low range of genotypic coefficient of variation was recorded among the characters of plant height (6.80 %), number of days taken for harvest (6.74 %), moisture content (0.71 %), total chlorophyll content (7.47 %), total flavonoid content (7.17 %), total ascorbic acid content (8.96 %).

For all the characters in the present research, the phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV), indicating the impact of environmental influence on the expression of these characters (Fig. 1). A narrow difference between PCV and GCV indicated less environmental interference on these traits, but a wide difference revealed PCV and GCV sensitivity to environmental changes. There was potential for improvement of these qualities through selection, especially those showed high variability and a less difference between GCV and PCV. These traits are important economically (Majumdar *et al.*, 1969). Similar finding was reported by Nair *et al.*, 2012 for chlorophyll content, plant height and vegetative yield in leafy coriander.

**Heritability**

Heritability is an important biometric parameter that assists plant breeders in selecting suitable breeding methods. It represents the proportion of variability in a trait that is controlled by genetic factors within a population. High broad-sense heritability is useful for identifying characters suitable for selection and enables breeders to select superior genotypes based on the phenotypic expression of quantitative traits (Dhakad et al., 2017). Based on the estimated values, broad-sense heritability is generally classified into three categories: high (more than 60%), medium (30%–60%), and low (less than 30%) (Johnson *et al.*, 1955). All the characters exhibited high heritability value for all growth, yield and quality Characters except total chlorophyll content *viz.*, number of days taken for germination (92.45 %), Plant height (66.97 %), number of branches per plant (69.50 %), number of leaves per plant (94.85 %), Leaf weight (84.03 %), Leaf Area (95.02 %), Leaf area index (95.02 %), number of days taken for harvest (81.70 %), Fresh plant weight (89.84 %), Fresh shoot weight (92.94 %), Root length (95.08 %), Fresh root weight (75.41 %), Dry plant weight (89.36 %), Herbage yield per plot (70.89 %), Moisture content (85.51 %), Total Essential oil content (87.66 %), Total phenol content (81.91 %), Total Flavonoids content (71.48 %), Total Ascorbic acid content (69.82 %). The low range of heritability was recorded in the character of total chlorophyll content character (59.00 %).

**Genetic advance**

Heritability indicates how effectively a genotype can be selected based on its phenotypic performance; however, it does not provide information about the expected genetic improvement or progress achieved through selection. Heritability combined with genetic advancement estimates would provide more accurate data than heritability alone. According to the Johnson *et al.*, 1955, heritability estimates and genetic advancement should always be taken into account simultaneously because high heritability was not necessarily correlated with high genetic growth. When heritability estimates are combined with genetic advancement expressed as a percentage of mean, their usefulness increase (Allard, 1999; Johnson *et al.*, 1955). The high range of genetic advance expressed in per cent of mean was recorded for number of days taken for germination (23.14 %), number of leaves per plant (23.97 %), Leaf weight (39.18 %), Leaf Area (49.53 %), Leaf area index (49.53 %), Fresh plant weight (43.40 %), Fresh shoot weight (42.58 %), Root length (24.19 %), Fresh root weight (59.87 %), Dry plant weight (48.81 %), Herbage yield per plot (50.84 %), Total Essential oil content (64.95 %), Total phenol content (40.44 %). The moderate range of genetic advance expressed in per cent of mean was recorded

for Plant height (11.47 %), number of branches per plant (18.05 %), number of days taken for harvest (12.56 %), Total chlorophyll content (11.83 %), Total Flavonoids content (12.49 %) and Total Ascorbic acid content (15.42 %). The low range of genetic advance expressed in per cent of mean was recorded for Moisture content (1.36 %). Similar results were obtained in leafy coriander by Nair *et al.*, 2012 and Thakur, 2018.

## Conclusion

The highest PCV and GCV was recorded for fresh root weight (38.54 and 33.46 respectively), moderate PCV was recorded for No. of branches per plant (12.61) and moderate GCV was recorded for fresh root length (12.04) and low range PCV and GCV was recorded for moisture content (0.77 and 0.71 respectively). The high range of heritability value was recorded for number of days to taken for germination (92.45 %), plant height (66.97 %), number branches per plant (69.50 %), number of leaves per plant (94.85 %), leaf weight (84.03 %), leaf Area (95.02 %), leaf area index (95.02 %), No. of days taken for harvest (81.70 %), fresh plant weight (89.84 %), fresh shoot weight (92.94 %), root length (95.08 %), fresh root weight (75.41 %), dry plant weight (89.36 %), herbage yield per plot (70.89 %), moisture content (85.51 %), total essential oil content (87.66 %), total phenol content (81.91 %), total Flavonoids content (71.48 %), total Ascorbic acid content (69.82 %) and the maximum range of genetic advance was recorded for total essential oil content (64.95), moderate range of genetic advance was recorded for number of branches per plant (18.05) and low range of genetic advance was recorded in the moisture content (1.36).

**Table 1 :** The following fifteen genotypes of leafy coriander were included in trial

| Treatments | Genotypes | Source |
|---|---|---|
| CSL-1 | CS.11 | HC&RI, TNAU, Coimbatore |
| CSL-2 | AGCR.1 | NRCS, Ajmer, Rajasthan |
| CSL-3 | CS.203 | HC&RI, TNAU, Coimbatore |
| CSL-4 | CS.196 | HC&RI, TNAU, Coimbatore |
| CSL-5 | A1 | LAM, Guntur, Andhra Pradesh |
| CSL-6 | Parimala Coriander | Collection from Karnataka |
| CSL-7 | CS.206 | HC&RI, TNAU, Coimbatore |
| CSL-8 | A2 | LAM, Guntur, Andhra Pradesh |
| CSL-9 | CS.202 | HC&RI, TNAU, Coimbatore |
| CSL-10 | CS.182 | HC&RI, TNAU, Coimbatore |
| CSL-11 | Chikkamagaluru | Collection from Karnataka |
| CSL-12 | CS.193 | HC&RI, TNAU, Coimbatore |
| CSL-13 | CO-4 | HC&RI, TNAU, Coimbatore |
| CSL-14 | RMT-5 | Private seed company |
| CSL-15 | CS.206 | HC&RI, TNAU, Coimbatore |

**Table 2 :** Performance of genetic variability for growth, yield and quality parameters in leafy coriander genotypes

| Traits/Genetic parameters | Range | Mean | GCV | PCV | H2 | GA | GAM |
|---|---|---|---|---|---|---|---|
| No. of days taken for germination | 10.5-15.25 | 12.31 | 11.68 | 12.15 | 92.45 | 2.85 | 23.14 |
| Plant Height (cm) | 21.84-28.80 | 26.55 | 6.8 | 8.31 | 66.97 | 3.04 | 11.47 |
| No. of Branches per plant | 6.50-9.95 | 8.25 | 10.51 | 12.61 | 69.5 | 1.49 | 18.05 |
| Leaf area per plant ($cm^2$) | 19.94-49.38 | 31.63 | 24.66 | 25.3 | 95.02 | 15.66 | 49.53 |
| Leaf area index | 0.053-0.131 | 0.084 | 24.66 | 25.3 | 95.02 | 0.04 | 49.53 |
| No. of days taken for harvest | 39.50-48.50 | 44.20 | 6.74 | 7.46 | 81.7 | 5.55 | 12.56 |
| No. of leaves per plant | 17.80-26.95 | 22.46 | 11.95 | 12.26 | 94.85 | 5.38 | 23.97 |
| Fresh leaf weight per plant (g) | 1.81-3.76 | 2.95 | 20.74 | 22.63 | 84.03 | 1.15 | 39.18 |
| Fresh plant weight (g) | 4.09-11.09 | 7.52 | 22.23 | 23.45 | 89.84 | 3.26 | 43.4 |
| Fresh shoot weight per plant (g) | 4.61-10.04 | 6.30 | 21.44 | 22.24 | 92.94 | 2.68 | 42.58 |
| Fresh root length (cm) | 6.55-11.3 | 9.05 | 12.04 | 12.35 | 95.08 | 2.18 | 24.19 |
| Fresh root weight per plant (g) | 0.18-0.74 | 0.42 | 33.46 | 38.54 | 75.41 | 0.24 | 59.87 |
| Dry weight (g) | 0.32-0.88 | 0.53 | 25.06 | 26.51 | 89.36 | 0.26 | 48.81 |
| Herbage yield (kg) | 2.94-7.48 | 4.20 | 29.31 | 34.81 | 70.89 | 5.55 | 50.84 |
| Moisture content (%) | 91.26-93.78 | 92.66 | 0.71 | 0.77 | 85.51 | 1.26 | 1.36 |
| Total chlorophyll content (SPAD) | 26.80-36.80 | 30.85 | 7.47 | 9.73 | 59 | 3.65 | 11.83 |
| Total essential oil content (%) | 0.10-0.28 | 0.17 | 33.67 | 35.96 | 87.66 | 0.11 | 64.95 |
| Total phenol content (mg/g) | 0.29-0.58 | 0.38 | 21.69 | 23.96 | 81.91 | 0.15 | 40.44 |
| Total flavonoid content (mg/10ml) | 0.97-1.27 | 1.14 | 7.17 | 8.48 | 71.48 | 0.14 | 12.49 |
| Total ascorbic acid content (mg/g) | 0.23-0.27 | 0.24 | 8.96 | 10.72 | 69.82 | 0.03 | 15.42 |

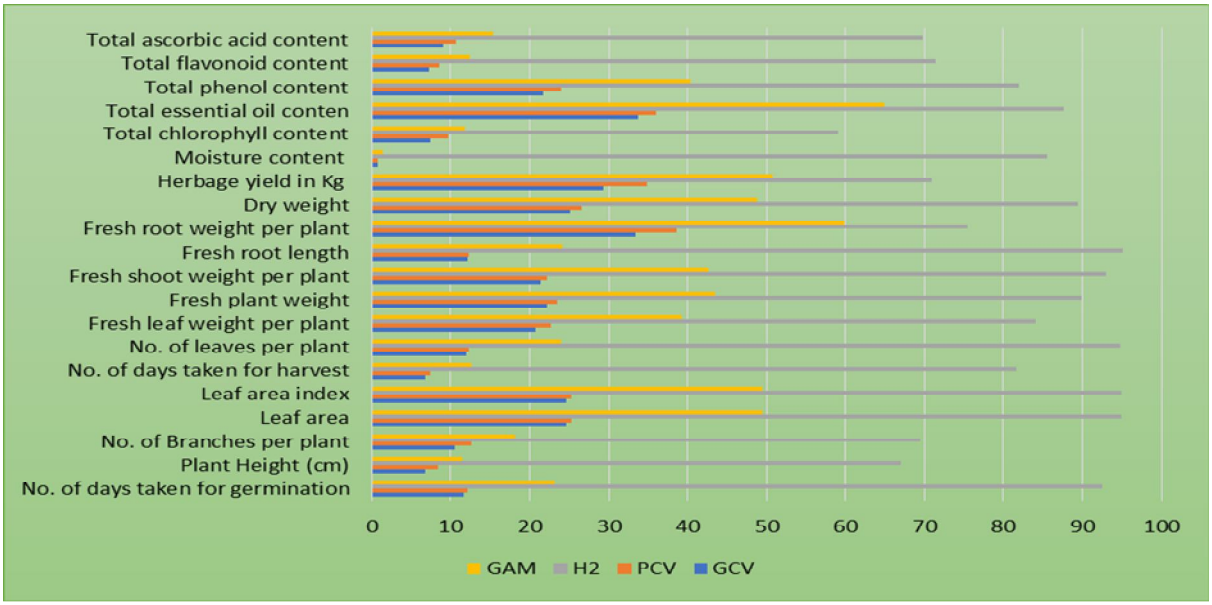


**Fig. 1 :** Estimates of genetic variability for growth, yield and quality parameters in leafy coriander genotypes

## Acknowledgement

Author is thankful for Tamil Nadu Agricultural University, Coimbatore, for providing the research material needed to conduct the research work.

## References

Al-Khayri, J. M., Banadka, A., Nandhini, M., Nagella, P., Al-Mssallem, M. Q., & Alessa, F. M. (2023). Essential oil from Coriandrum sativum: A review on its phytochemistry and biological activity. *Molecules*, **28**(2), 696.

Allard, R. 1999. Principles of Plant Breeding. John Wiley & Sons.

Begum, S., Ramappa, K. T., Nidoni, U., Hiregoudar, S., & Ramesh, G. (2023). Studies on Exploration of the Proximate Composition, Physical Attributes and Qualitative

Phytochemical Analysis of Fresh Coriander Leafy Vegetables. *International Journal of Plant & Soil Science*, **35**(18), 10-16.

Coşkuner, Y., & Karababa, E. (2007). Physical properties of coriander seeds (*Coriandrum sativum* L.). *Journal of Food Engineering*, **80**(2), 408-416.

Dewanto, V., Wu, X., Adom, K. K., & Liu, R. H. (2002). Thermal processing enhances the nutritional value of tomatoes by increasing total antioxidant activity. *Journal of agricultural and food chemistry*, **50**(10), 3010-3014.

Dhakad, R. S., Sengupta, S. K., Lal, N., & Shiurkar, G. (2017). Genetic diversity and heritability analysis in coriander. *The Pharma Innovation Journal*, **6**(8), 40-46.

Diederichsen A. Coriander, promoting the conservation and use of underutilized and neglected crop. International Plant Genetic Research Institute. (IPGR), Rome, Italy. 1996.

Falconer, D. S. (1996). *Introduction to quantitative genetics*. Pearson Education India.

Johnson, H. W., Robinson, H. F., & Comstock, R. (1955). Estimates of genetic and environmental variability in soybeans.

Majumdar, P., Prakash, R. and Haque, M.F. (1969). "Genotypic and phenotypic variability in quantitative characters in groundnut."

Mandal, S., & Mandal, M. (2015). Coriander (*Coriandrum sativum* L.) essential oil: Chemistry and biological activity. *Asian Pacific Journal of Tropical Biomedicine*, **5**(6), 421-428.

Nair, B., S. Sengupta, A. Naidu, A. Mehta, K.P. Singh, and P. Jain. 2012. "Assessment of heritability and genetic advance in coriander germplasms." *JNKVV Research Journal* **46** (3):317-321.

Panse, V. G., & Sukhatme, P. V. (1954). Statistical methods for agricultural workers.

Thakur, R. 2018. "Variability and association studies for foliage yield components and its quality parameters in coriander (*Coriandrum sativum* L.)." Indira Gandhi Krishi Vishwavidhyalaya, Raipur.

Singleton, V. L., & Rossi, J. A. (1965). Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *American journal of Enology and Viticulture*, **16**(3), 144-158.

Sivasubramaniam, S., & Madhava Menon, P. (1973). Genotypic and phenotypic variability in rice.

Spence, C. (2023). Coriander (cilantro): A most divisive herb. *International Journal of Gastronomy and Food Science*, **33**, 100779.

Uitterhaegen, E., Burianová, K., Ballas, S., Véronèse, T., Merah, O., Talou, T., ... & Simon, V. (2018). Characterization of volatile organic compound emissions from self-bonded boards resulting from a coriander biorefinery. Industrial Crops and Products, **122**, 57-65.

Zheljazkov, V. D., Astatkie, T., & Schlegel, V. (2014). Hydrodistillation extraction time effect on essential oil yield, composition, and bioactivity of coriander oil. *Journal of oleo science*, ***63***(9), 857-865.