*Journal of Physical, Biomedical and Biological Sciences*
*eISSN: 3005-6489*
*www.jpbab.com*
*J. Phys. Biomed. Biol. Sci., Volume, **3**: 22*

**Original Research Article** **Open Access**

# CORRELATION AND REGRESSION ANALYSIS FOR MORPHOLOGICAL TRAITS OF CORIANDER

**UMAR M***

*Department of Plant Breeding and Genetics, Faculty of Agricultural Sciences, University of the Punjab, P.O BOX. 54590, Lahore, Pakistan*
**Correspondence author email address: umar.ranjha4321@gmail.com*

*(Received, 24th August 2023, Revised 12th January 2024, Published 13th January 2024)*

***Abstract*** *This study, conducted between 2023 and 2024, examines the physical characteristics and genetic variation of Coriandrum sativum, or coriander. A popular herb for culinary and medicinal uses, coriander was studied for its root length, stem length, leaf length, leaf width, and leaf area. Essential oils and extracts from C. sativum show promising antibacterial, antifungal, and antioxidative properties as distinct chemical components in various plant parts. As a consequence, they contribute significantly to food preservation by preventing degradation. This research indicates that Coriandrum sativum is resistant in adverse settings because of the significant positive connections among its morphological characteristics. Regression analysis also reveals the crucial role that shoot length plays in encouraging overall plant growth, providing valuable information that can be used to enhance farming methods and increase crop yields.*

**Keywords*:*** *Coriandrum sativum; Antioxidant Characteristics; Regression; correlation; morphology*

## Introduction

One of the first used spices is coriander, or *Coriandrum sativa* Linn, which belongs to the Umbelliferae or Apiaceae family and possesses advantageous medical effects (Momin et al., 2012). Coriander's annual plant, growing 20–70 cm high, has a prominent taproot and thin branching stems (Diederichsen, 1996). In Sanskrit literature, coriander is termed "kusthumbari" or "dhanayaka"; in Hindi, it is called Dhania, and in Bengali, it is called Dhane. Coriander originated in the eastern Mediterranean and is grown in Europe, Africa, and Asia. Because each portion of *C. sativum* has a distinct flavor, they can all be eaten and used as a seasoning (Nadeem et al., 2013). Since ancient times, Coriander has been used for medical purposes. It is utilized as a natural preservative to lessen pain and inflammation, to cure certain disorders, and for its antifungal and anticancer qualities (De and De, 2019). Coriander's qualities cannot be understated. The antioxidant activity of coriander is one of its most well-known and well-studied uses. Antioxidants are substances that prevent oxidation, a chemical process that can produce free radicals and chain reactions that can harm an organism's cells. Coriander fruit (seed) and leaves (cilantro) are used in soups, bread, puddings, chicken and fish meals, curried meat dishes, and other ethnic foods (Sisein, 2014). High concentrations of vitamin B12, folate, vitamin C, vitamin A, and phenolics are found in C. sativum. Furthermore, because of its antioxidant and antibacterial properties, C. sativum is regarded as an alternative food preservative.

There's a correlation between the global demand for *Coriandrum sativum* and the popularity of healthy cuisines. (Sahib et al., 2013) Because of the growing global population and its corresponding consumption needs, *C. sativum* has a remarkable international market. According to FAOSTAT (https://www.fao.org/faostat), the combined yield of coriander, fennel, badian, and anise was 11,362 hg/ha in 2020. According to Arizio and Curioni (2011), the United Kingdom, Malaysia, Sri Lanka, the United States, and Japan are the top importers of *Coriandrum sativum*, accounting for almost 63% of global imports. Although coriander may be grown year-round, its production is primarily for its leaves and a larger grain yield because the crop is extremely susceptible to dry, warm temperatures (Horn et al., 2023). When grain is cultivated in dry, cold weather without frost, especially during the flowering and fruit setting period, it produces the most.

## Materials and methods

Between 2023 and 2024, a study was carried out in the Department of Plant Breeding and Genetics' greenhouse facilities at the University of the Punjab. The study used a thorough randomized block design repeated three times to ensure the accuracy and validity of the results. Coriander plant samples were gathered for our study from the Faculty of Agricultural Science, University of the Punjab Lahore, Pakistan. Fertilization and irrigation were used following crop needs. Early on, information was gathered on several morphological parameters,

including root length (cm), shoot length (cm), leaf length (cm), leaf width (cm), and leaf area ($cm^2$).

**Length of Leaf (cm)**

Three leaves were chosen randomly from each plant to calculate leaf length, and each was noted on a cm scale. Next, the average value of all three measurements was calculated.

**Leaf Stretch (cm)**

Each leaf's base, center, and tip were measured to determine its breadth. Three leaves were randomly chosen from each plant, and the width of each position was measured. Next, the average value of all three measurements was determined.

**Leaf Area (square cm)**

The leaf area was determined by multiplying the leaf length by the leaf breadth and adding a correction coefficient of 0.74 cm. The following formula was used to get the leaf area:

**= *leaf width* × *leaf length* × 0.74**

Percentages and proportions fractions should typically not be directly analyzed under most morphometric data collection situations since the values may have various weights, and their variances and means may not be independent. Statistix 8.1 software was used to analyze and evaluate data from various metrics. A mixed ANOVA table was used to extract the genotypic variance ($\sigma^2_g$) and phenotypic variance ($\sigma^2_p$). Mean values were used to calculate the genetic analyses of the environmental coefficient of variation (ECV), genotypic coefficient of variance (GCV), and phenotypic coefficient of variation (PCV) and their formula is given below

1. ECV = $\frac{\sqrt{\delta 2e}}{\bar{x}} x100$
2. GCV = $\frac{\sqrt{\delta 2g}}{\bar{x}} x100$
3. PCV = $\frac{\sqrt{\delta 2p}}{\bar{x}} x100$

$\bar{x}$ Refers to a character's grand mean. The broad scene heritability estimate (H2) was computed, and its formula was given.

$$\mathbf{H^2 = \frac{\delta^2 g}{\delta^2 p} \; x\; 100}$$

The approach was used to calculate the genetic progress and its formula is written as

$$G.A = K \cdot \sqrt{\delta^2 p}\; x\; H^2$$

Where K = 2.64 at 1% selection intensity.

**RESULT AND DISCUSSION**

The results of the analysis of variance indicate that there are significant changes between different genotypes in traits, including root length (cm), shoot length (cm), leaf length (cm), leaf width (cm), and leaf area (cm2). This suggests that, especially about these features, there was significant genetic variability among various genotypes. Breeders should concentrate on finding and highlighting the features of these qualities passed down from parents to offspring (heritable) rather than those affected by external influences (non-heritable), as there is already a significant degree of genetic diversity identified (Chen et al., 2021)./breeders can efficiently enhance and improve high heritability features by separating and prioritising the heritable elements. By selecting and breeding people with desired features more likely to be inherited by the next generation, this targeted method makes improving those specific attributes more predictable and efficient (Ali et al., 2015; Collard and Mackill, 2008; Iqra et al., 2020; Naveed et al., 2012; Waseem et al., 2014). A comprehensive analysis of variance was conducted on the following variables: root length (cm), shoot length (cm), leaf length (cm), leaf width (cm), and leaf area ($cm^2$). (Table 1).

The following measurements were made for *Coriandrum sativum* plants that were collected from three different locations: leave width (3.2333 ± 0.1494 cm), leave length (2.9500 ± 0.1506 cm), leave area (7.0559 ± 0.5470 cm2), root length (6.0250 ± 0.1680 cm), and shoot length (25.475 ± 0.663 cm).

**Table I Analysis of variance for studied traits**

| SOV | RL | SL | LW | LL | LA |
|---|---|---|---|---|---|
| **Locations** | 5.23639* | 245.934* | 0.47111* | 0.78556* | 6.61501* |
| **Grand Means** | 6.0250 | 25.475 | 3.2333 | 2.9500 | 7.0559 |
| **CV** | 8.00 | 4.51 | 8.00 | 8.84 | 0.89763 |
| **Standard Error** | 0.1680 | 0.6631 | 0.1494 | 0.1506 | 0.5470 |
| **Error** | 0.08472 | 1.319 | 0.06694 | 0.06806 | 13.43 |

The correlation research evaluated the connections between various physical features of *Coriandrum sativum.* Strong and positive relationships have been identified between all the assessed characteristics, revealing the plant's remarkable ability to withstand severe and hot environmental conditions (Aaliya et al., 2016; Ali and Malik, 2021; Ali et al., 2010b; Yeganehpoor et al., 2017). The plant's higher rate of photosynthetic respiration and the build-up of organic compounds inside its body, which promote intense

growth and development, are responsible for this resistance.

**Table 2. Relationships between Morphological Characteristics**

| | SL | LW | LL | RL |
|---|---|---|---|---|
| **LW** | 0.7450* | | | |
| **LL** | -0.1729 | -0.0164 | | |
| **RL** | -0.5906* | -0.3930* | 0.7921* | |
| **LA** | 0.3626* | 0.6210* | 0.7700* | 0.3746* |

**LL = leaf length, LW = leaf width, LA = Leave area, RL = Root length, SL = shoot length**

Regression analysis results indicate that height is the component that contributes more positively. The largest coefficient (397.62) is found in shoot length[iii], followed by leave area (53.34). On the other hand, negative contributions were noted for Root length (-6.01), leave width (-59.55), and leaf length (-61.63). These results are depicted in the regression equation illustrated in **Table 3**. Regression analysis is a helpful instrument for plant scientists who want to determine the critical traits of plants that have an important effect on the yield of crops (Ahmad et al., 2012; Ali et al., 2017; Cooper et al., 2014). Through analyzing an enormous dataset comprising a variety of characteristics, scientists can accurately pinpoint the most important factors that lead to elevated crop plant yields. According to this analytical approach; Researchers can find and clarify the significant variables crucial to increasing agricultural output (Ali et al., 2016; Ali et al., 2010a; Ali et al., 2014; Lambin et al., 2000).

**Table 3**: **Analysis of Factors via Stepwise Multiple Linear Regression for *Coriandrum sativum***

| *Element* | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| **SL** | 224.88 | 73.05 | 3.08 | 0.02 | 52.14 | 397.62 |
| **RL** | -6.01 | 1.93 | -3.12 | 0.02 | -10.57 | -1.45 |
| **LW** | -59.55 | 22.81 | -2.61 | 0.03 | -113.49 | -5.61 |
| **LL** | -61.63 | 23.07 | -2.67 | 0.03 | -116.18 | -7.07 |
| **LA** | 29.93 | 9.90 | 3.02 | 0.02 | 6.51 | 53.34 |

## Conclusion

The study on *Coriandrum sativum* concluded by underlining the plant's resistance to environmental challenges and highlighting notable genetic variability in significant characteristics. The correlation and regression analysis results indicated the critical variables affecting its growth, with shoot length being one of them. The results provide useful data for researchers and breeders who want to improve farming techniques and opt for features to increase crop yields.

## References


Aaliya, K., Qamar, Z., Ahmad, N. I., Ali, Q., Munim, F. A., and Husnain, T. (2016). Transformation, evaluation of gtgene and multivariate genetic analysis for morpho-physiological and yield attributing traits in Zea mays. *Genetika* **48**, 423-433.

Ahmad, H. M., Ahsan, M., Ali, Q., and Javed, I. (2012). Genetic variability, heritability and correlation studies of various quantitative traits of mungbean (Vigna radiate L.) at different radiation levels. *International Research Journal of Microbiology* **3**, 352-362.

Ali, F., Ahsan, M., Ali, Q., and Kanwal, N. (2017). Phenotypic stability of Zea mays grain yield and its attributing traits under drought stress. *Frontiers in plant science* **8**, 1397.

Ali, F., Kanwal, N., Ahsan, M., Ali, Q., Bibi, I., and Niazi, N. K. (2015). Multivariate analysis of grain yield and its attributing traits in different maize hybrids grown under heat and drought stress. *Scientifica* **2015**.

Ali, Q., Ahsan, M., Kanwal, N., Ali, F., Ali, A., Ahmed, W., Ishfaq, M., and Saleem, M. (2016). Screening for drought tolerance: comparison of maize hybrids under water deficit condition. *Advancements in Life Sciences* **3**, 51-58.

Ali, Q., Ahsan, M., and Saleem, M. (2010a). Genetic variability and trait association in chickpea (Cicer arietinum L.). *Electronic Journal of Plant Breeding* **1**, 328-333.

Ali, Q., Ali, A., Ahsan, M., Nasir, I. A., Abbas, H. G., and Ashraf, M. A. (2014). Line× Tester analysis for morpho-physiological traits of Zea mays L seedlings. *Advancements in Life sciences* **1**, 242-253.

Ali, Q., and Malik, A. (2021). Genetic response of growth phases for abiotic environmental stress tolerance in cereal crop plants. *Genetika* **53**, 419-456.

Ali, Q., Muhammad, A., and Farooq, J. (2010b). Genetic variability and trait association in chickpea (Cicer arietinum L.) genotypes at seedling stage. *Electronic Journal of Plant Breeding* **1**, 334-341.

Chen, F. L., Zimmermann, M., Hekman, J. P., Lord, K. A., Logan, B., Russenberger, J., Leighton, E. A., and Karlsson, E. K. (2021). Advancing genetic selection and behavioral genomics of working dogs through collaborative science. *Frontiers in Veterinary Science* **8**, 1017.

Collard, B. C., and Mackill, D. J. (2008). Marker-assisted selection: an approach for precision plant breeding in the twenty-first century. *Philosophical Transactions of the Royal Society B: Biological Sciences* **363**, 557-572.

Cooper, M., Messina, C. D., Podlich, D., Totir, L. R., Baumgarten, A., Hausmann, N. J., Wright, D., and Graham, G. (2014). Predicting the future of plant breeding: complementing empirical evaluation with genetic prediction. *Crop and Pasture Science* **65**, 311-336.

De, A. K., and De, M. (2019). Functional and therapeutic applications of some important spices. *In* "The role of functional food security in global health", pp. 499-510. Elsevier.

Diederichsen, A. (1996). "Coriander: Coriandrum Sativum L," Bioversity International.

Horn, L. N., Mulima, E. P., and Fwanyanga, F. M. (2023). Coriander Cultivation and Agricultural Practices. *In* "Handbook of Coriander (Coriandrum sativum)", pp. 11-20. CRC Press.

Iqra, L., Rashid, M. S., Ali, Q., Latif, I., and Mailk, A. (2020). Evaluation for Na+/K+ ratio under salt stress condition in wheat. *Life Sci J* **17**, 43-47.

Lambin, E. F., Rounsevell, M. D., and Geist, H. J. (2000). Are agricultural land-use models able to predict changes in land-use intensity? *Agriculture, Ecosystems & Environment* **82**, 321-331.

Momin, A. H., Acharya, S. S., and Gajjar, A. V. (2012). Coriandrum sativum-review of advances in phytopharmacology. *International Journal of Pharmaceutical Sciences and Research* **3**, 1233.

Nadeem, M., Muhammad Anjum, F., Issa Khan, M., Tehseen, S., El-Ghorab, A., and Iqbal Sultan, J. (2013). Nutritional and medicinal aspects of coriander (Coriandrum sativum L.) A review. *British Food Journal* **115**, 743-755.

Naveed, M. T., Qurban, A., Muhammad, A., and Babar, H. (2012). Correlation and path coefficient analysis for various quantitative traits in chickpea (Cicer arietinum L.). *International Journal for Agro Veterinary and Medical Sciences (IJAVMS)* **6**, 97-106.

Sahib, N. G., Anwar, F., Gilani, A. H., Hamid, A. A., Saari, N., and Alkharfy, K. M. (2013). Coriander (Coriandrum sativum L.): A potential source of high-value components for functional foods and nutraceuticals-A review. *Phytotherapy Research* **27**, 1439-1456.

Sisein, E. A. (2014). Biochemistry of free radicals and antioxidants. *Scholars Academic Journal of Biosciences* **2**, 110-118.

Waseem, M., Ali, Q., Ali, A., Samiullah, T. R., Ahmad, S., Baloch, D., Khan, M. A., Ali, S., Muzaffar, A., and Abbas, M. A. (2014). Genetic analysis for various traits of Cicer arietinum under different spacing. *Life Sci J* **11**, 14-21.

Yeganehpoor, F., Zehtab-Salmasi, S., Shafagh-Kolvangh, J., Ghassemi-Golezani, K., and Dastborhan, S. (2017). Assessment of Grain Yield Correlation with some Morphological and physiological traits, yield components and Essential oil in Coriander (Coriandrum sativum L.). *Advances in Bioresearch* **8**.

**Declaration**

**Conflict of interest**

There is no conflict of interest among the authors.

**Data Availability statement**

All authenticated data have been included in the manuscript.

**Ethics approval and consent to participate**

These aspects are not applicable in this paper.

**Consent for publication**

Not applicable

**Funding**

There were no sources providing support, for this paper.