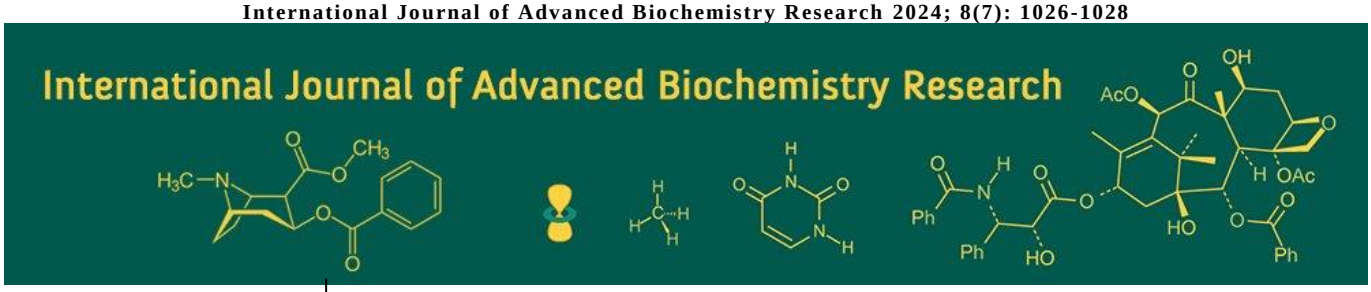

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Assessment of genetic variability, heritability and genetic advance in coriander (*Coriandrum sativum* L.) Genotypes

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Abstract
The present investigation entitled "Assessment of genetic variability of coriander (*Coriandrum sativum* L.) genotypes was executed at Main Experimental Station of Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology Narendra Nagar (Kumarganj), Ayodhya (U.P.) during *rabi* season, 2022 with the objectives to study the genetic variability, heritability in broad sense and genetic advance as per cent of mean among the available genotypes of coriander. Experimental material for the study consisted of 60 genotypes including two check varieties (NDCor-2 and Hisar Anand). The experiment was conducted in Augmented Block Design. Observations were recorded on twelve quantitative characters viz. Days to 50% flowering, No. of nodes per plant, No. of branches per plant, Internodal length(cm), Plant height (cm), No. of umbels per plant, No. of umbellates per umbel, No. of Schizocarps per umbel, No. of schizocarps per umbellate, Umbel diameter (cm), 1000 seed weight (cm) and seed yield per plant (g). In analysis of variance, the variance due to block were highly significant for number of nodes per plant and number of schizocarps per umbellate and significant for all other characters, except number of branches per plant and number of umbels per plant are not significant. High magnitudes of PCV and GCV were observed in case of seed yield per plant. High heritability is found in number of schizocarps per umbel and umbel diameter. While, highest value of genetic advance in per cent of mean was estimated for seed yield per plant and lowest value are observed in number of umbellates per umbel.

Keywords: Genetic variability, heritability, genetic advance, genotypes

Introduction
Coriander is the most important seed spice to be used by mankind as early as 5000 BC. Rajasthan and Gujrat have turned out as "Seed Spices Bowl". The crop is known for its aromatic seeds, leaves and stem. It is an important seed spice crop grown around the world. Coriander (*Coriandrum sativum* L.) is commonly known as "Dhania" having chromosome number 2n=2x=22 and it belongs to family Apiaceae (Umbelliferae). This herb is widely grown as an annual in states of Tamil Nadu, Karnataka, Madhya Pradesh, Uttar Pradesh, Rajasthan, and Punjab. Rajasthan is the leading state and contributes to approximately 40 per cent production in India. In India, it is grown in 6,38,652 ha area with annual production of 8,47,190 tonnes (Anonymous, 2022-23) [1]. It is cultivated in more than fifty countries with India as a leading producer, both in area and production followed by Mexico, China, former USSR, Central America and South America (Morales-Payan, 2011) [10].

Coriander is a smooth, tall annual herb reaching a height of 30-90 cm, characterized by notably enlarged nodes and hollow internodes. It features a long tap root with an erect, spreading leafy stem measuring 300-700 mm. The stems are vertically ridged. The distinctive leaves are flat and fan-like, with the lower leaves being broad and the upper leaves delicately cut with linear lobes. The leaves are alternately arranged on the plant. Coriander flowers appear around 45-60 days after sowing. The small flowers, which are white or pinkish, grow in compound terminal umbels measuring 2-3 mm in diameter. Each flower is bisexual, containing 5 sepals, 5 petals, 5 stamens, and 2 free carpels with an epigynous ovary. The fruit is a spherical, dry schizocarp with a diameter of 3-5 mm, globular and yellow with brown ribs. During dehiscence, the pericarp separates, each containing a single seed with ample endosperm and a small embryo.

The seeds are 3.0 mm in diameter, aromatic, with a faint fragrance and a pleasant aromatic taste. The seed coat is notably thin and delicate, consisting of a pale brown corky pericarp with numerous wavy ridges and furrows.

Being a tropical crop, coriander needs an environment free of frost, especially during flowering and seed production. Produce yield and quality are both increased in a dry and somewhat chilly climate. Loamy or well-drained silt soils work well for farming. Soil that is rain-fed should have a pH of 6 to 8 and be clay-based by nature. The ideal temperature range for coriander is between 20 °C and 25 °C.

Coriander is a rich source of iron, potassium, vitamin A, C, K, folic acid, calcium and magnesium. According to USDA (2013) cholesterol content of its seeds is nil. Coriander seeds possess immense medicinal values and are considered to be carminative, diuretic, tonic stomachic and refrigerant. Coriander has been indicated for a number of medical problems such as dyspeptic complaints, loss of appetite, convulsion and insomnia (Benjumea *et al.*, 2005; Heidar Mir. *et al*., 1992; Duke *et al*., 2002) [2, 7, 5]. Due to the bioactivities of coriander extract, this herb can be considered a valuable functional food against obesity, metabolic syndrome and diabetes (Scandar *et al.*, 2023) [12].

Coriander is notable for its two primary products: its flavor and its green leaves. The green leaves, known for their pleasant aroma, are used in chutneys, sauces, curries, and other dishes. Additionally, the green leaves and tender stems are used as raw salad ingredients. Coriander essential oil is a key ingredient for flavouring liquors, chocolate preparations in confectionery, and masking unpleasant odours in therapeutic preparations. Any crop germplasm that has been genetically improved is the most valuable source of variation for different attributes. An estimate of germplasm's potential value as appropriate genotypes for use in varietal development programmes would be provided by thorough screening and evaluation.

Given this, understanding the genetic diversity, heritability, and genetic divergence of significant economic traits as well as the correlation coefficient between genotype and phenotype is crucial for framing a successful breeding programme. Genetic variability is a prerequisite for any improvement in a crop. Any crop improvement programme's success is determined on the amount of genetic variability and the extent to which desired characters are heritable. The ultimate purpose of a breeding programme is to enhance a plant's trait to increase its desirability.

Materials and Methods

The present experiment was conducted at Main Experiment Station of Department of Vegetable Science at the Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) during *rabi* season 2022. Geographically the experimental site (Kumarganj, Ayodhya) falls under humid subtropical climate and is located at 26.47 N latitude and 82.12 E longitude at an altitude of 113 meter above the mean sea level. Sixty morphologically diverse coriander genotypes along with two checks (NDCor-2 and Hisar Anand) maintained at ANDUA&T, Kumarganj, Ayodhya were used for the investigation. The experiment was conducted in Augmented Block Design. The genotypes were divides into three blocks along with two check varieties in each block. All the recommended agronomic package of practices and plant protection measures were followed to raise a healthy crop stand. The observation was recorded for five selected plants for twelve characters viz., Days to 50% flowering, No. of nodes per plant, No. of branches per plant, Internodal length(cm), Plant height (cm), No. of umbels per plant, No. of umbellates per umbel, No. of Schizocarps per umbel, No. of schizocarps per umbellate, Umbel diameter (cm), 1000 seed weight (cm) and seed yield per plant (g).

The statistical analysis was conducted on the overall mean values of various traits using the Augmented Block Design approach. The phenotypic and genotypic coefficients of variation were calculated based on the method by Burton and de Vane (1953) [3]. Broad-sense heritability was estimated according to Hanson et al. (1956) [6], while the genetic advance and genetic advance as a percentage of the mean were determined using formula suggested by Robinson (1965) [6].

Results and Discussion

In the analysis of variance, the variance due to blocks was highly significant for the number of nodes per plant and the number of schizocarps per umbellate. It was significant for days to 50% flowering, internodal length (cm), plant height (cm), number of umbellates per umbel, number of schizocarps per umbel, umbel diameter (cm), 1000 seed weight (g), and seed yield per plant (g).

Phenotypic coefficients of variation (PCV) were reported with high estimates (>20%) for only one parameter, seed yield per plant (g) (PCV=22.92). The greatest phenotypic coefficient of variation was found in seed yield per plant, which was 22.92. This was followed by internodal length (15.53) and the number of schizocarps per umbellate (15.25). Days to 50% flowering (4.67), number of branches per plant (7.53), and number of nodes per plant (9.11) showed the lowest phenotypic coefficient of variation. The number of umbels per plant (12.93), the number of schizocarps per umbel (12.90), and the seed yield per plant (g) had the highest genotypic coefficient of variation. Days to 50% flowering (2.58), number of umbellates per umbel (3.10), number of branches per plant (4.18), and plant height (cm) (5.36) showed the lowest genotypic coefficient of variation.

Heritability estimates measure the proportion of genetic variability that can be passed on to the total variability. This is a crucial factor for genetic improvement or response to selection. However, the degree of improvement achieved through selection depends not only on heritability but also on the amount of genetic variation in the breeding population and the level of selection pressure applied by the breeder. The broad-sense heritability estimates were high for all traits, indicating that genotypic constitution plays a major role in character expression. Heritability in broad sense ranged from 98.69 per cent in case of no. of schizocarps per umbel to no. of umbellates per umbel (10.88%). However, high heritability (>60%) was reported for no. of schizocarps per umbel (98.69%), umbel diameter (cm) (95.93%), no. of nodes per plant (86.13%), 1000 seed weight (gm) (80.40%) and no. of umbels per plant (79.36%). Moderate (30-60%) was for seed yield per plant (g) (71.40 %) and internodal length (cm) (67.17%). High heritability values indicate that genotypic composition plays a primary role in character expression. The finding of present study agrees with those of Rajbhar *et al.* (2021) [11] and Kumawat *et al.* (2023) [8].

Genetic advance as a percentage of the mean was highest (>20%) for seed yield per plant (33.71%), number of

schizocarps per umbel (26.40%), number of umbels per plant (23.74%), internodal length (21.49%), and 1000 seed weight (20.44%). It was moderate (10-20%) for the number of nodes per plant (16.18%) and number of schizocarps per umbellate (16.13%). However, genetic advance as a percentage of the mean was low for the number of branches per plant (4.79%), plant height (4.75%), days to 50% flowering (2.95%), and number of umbellets per umbel (2.11%). The findings of this study on coriander are consistent with those of Meena *et al.* (2014) [9] and Dhakad *et al.* (2017) [4]. High heritability coupled with high genetic advance as a percentage of the mean was observed for the number of schizocarps per umbel (98.69% and 26.40%) and umbel diameter (95.93% and 21.95%).

Table 1: Estimates of range, grand mean, phenotypic (PCV) and genotypic (GCV) coefficient of variation, heritability in broad sense (h2%), genetic advance in per cent of mean (Ga%) for thirteen characters in coriander genotypes.

Characters	Ranges		General mean $\bar{X}$	PCV (%)	GCV (%)	Heritability (h2(bs)%)	Genetic Advance (Ga)	Genetic advance in percent of mean
	Min.	Max.						
	1	2	3	4	5	6	7	8
Days to 50% flowering	61	76	68.94	4.67	2.58	30.67	2.03	2.95
No. of nodes per plant	6.2	9	7.34	9.11	8.46	86.13	1.18	16.18
Internodal length (cm)	10.28	21.23	16.73	15.53	12.72	67.17	3.59	21.49
No. of branches per plant	5.4	7.7	6.65	7.53	4.18	30.87	0.31	4.79
Plant height(cm)	81.4	140	121.69	12.47	5.36	18.5	5.76	4.75
No. of umbels per plant	17.3	35.2	27.39	14.52	12.93	79.36	6.50	23.74
No. of umbellets per umbel	5	7.6	6.22	9.41	3.10	10.88	0.13	2.11
No. of schizocarps per umbel	35.2	65.3	46.38	12.98	12.90	98.69	12.32	26.40
No. of schizocarps per umbellate	6	12.8	7.92	15.25	10.93	51.33	1.28	16.13
Umbel diameter(cm)	4.02	7.08	5.23	11.11	10.88	95.93	1.15	21.95
1000 seed weight(gm)	5.7	9.99	7.52	12.34	11.06	80.40	15.54	20.44
Seed yield per plant(g)	4.97	14.69	9.74	22.92	19.37	71.40	3.32	33.71

Conclusion

The investigation revealed considerable variation among coriander genotypes. The genotypes NDCor-21, NDCor-23, ND Cor-27, as well as ND Cor-36, ND Cor-58, ND Cor-45, and ND Cor-37, were found to be promising in terms of yield attributes and seed yield per plant. These genotypes could be utilized as breeding material to develop a new variety.

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