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# VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN CORIANDER GENOTYPES

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## Abstract

The study was conducted to know the variability, heritability and genetic advance in coriander genotypes. The experiment was carried out at Agriculture Research Station, Janwada Farm, Bidar. The 41 genotypes collected across the state result raveled that high phenotypic and genotypic coefficients of variation were observed for all the characters except plant height at harvest, 50 per cent flowering, umbellets per umbel, seeds per umbellet and 1000 seed weight, which had moderate phenotypic and genotypic coefficients of variation. Heritability estimates were of very high magnitude for all the characters. The highest heritability estimates were obtained for plant height at flower initiation (99.44) followed by plant height at harvest (99.07). The highest GAM was obtained for essential oil content (136.90) followed by essential oil yield per hectare (131.97) and seed yield per plant (109.67).

***Key words :*** Coriander, genotypes, variability, heritability, genetic advance.

## Introduction

India is well known as "land of spices" across the world since long back. We have been cultivating precious species for fulfilling our various needs since ages. The seed spices have emerged as one of the important group of spice crop of our country. India is the largest producer, consumer and exporter of seed spices in the world. Coriander plays a major role in the group of seed spices. Coriander (*Coriandrum sativum* L.) is an annual herb in the family Apiaceae (Umbelliferae) and is known to be originated in the Mediterranean region (Hedburg and Hedburz, 2003). The coriander seeds are used as an important ingredient in various food preparations whereas; the leaves are often used for garnishing dishes. The leaves, stalks and seeds of coriander contain certain essential oils. In India, coriander is cultivated in the state of Madhya Pradesh, Rajasthan, Gujarat and Tamil Nadu. The productivity of this crop is very low. In India, it occupies an area of 447 thousand hectare with a production of 314 thousand million tones with an average productivity of 0.7 million tonnes/ha (NHB, 2014-2015). In Karnataka, it is grown on 7655 hectares with production of 1110 tonnes and productivity of 140 kg per hectare. From India 0.37 lakh MT of coriander is exported with a value of 21,076.90 lakh rupees (Anonymous, 2013).

Genetic variability is a prerequisite for any improvement in a crop. The success of any crop improvement programme depends on the magnitude of genetic variability and extent to which the desirable characters are heritable. The ultimate goal of breeding programme aims to improve the characteristic of plants so that they become more desirable agronomically and economically, seed yield being a complex polygenic trait composed of several components some of which affect yield directly while, others contributing towards it indirectly. The knowledge of the magnitude and direct ion of inter - relationship between yield and its component characters has great importance in breeding programmes for the selection of desirable types, when correlation studies involve, many characters then it becomes difficult to determine the importance of each of the factors. In such cases path coefficient analysis provides an effective clue for this entangling direct as well as indirect affects characters on dependent characters like seed yield. The prerequisite for genetic alteration is the availability of desirable genes with the knowledge of genetics. Keeping the above point of view, the present investigation was taken up.

## Materials and Methods

The investigation on coriander was carriedout during *Rabi* 2009-10 and 2010-11 at Agriculture Research Station, Janwada Farm, Bidar, (Karnataka State) to know variability, heritability and genetic advance in coriander genotypes. Bidar district receives well distributed rainfall from both south-west and north-east monsoons. 41 genotypes collected from different research stations, local collections and the genotype DWD-3 was sown as check (table 2). Randomised block design was adopted with three replications. The fertilizer applications and other cultural practices were followed as per the recommendations. Observations were recorded. Genotypic and phenotypic coefficient of variations were estimated according to Burton and Devana (1953) based on estimate of genotypic and phenotypic variance.

a. Genotypic coefficient of variation (GCV) = $\sigma g \times 100/\overline{X}$.

b. Phenotypic coefficient of variation (PCV) = $\sigma p \times 100/\overline{X}$.

Heritability estimate ($h^2$) was calculated as the ratio of genotypic variance to the phenotypic variance and expressed in percentage (Falconer, 1981).

Heritability ($h^2$) = $(\sigma^2 g/\sigma^2 p) \times 100$

Genetic advance (GA) for each character was computed by adopting the formula given by Johnson *et al*. (1955).

GA = $h^2 \times k \times \sigma p$

Genetic advance as percentage over mean was worked out as suggested by Johnson *et al.* (1955).

$$\text{Genetic advance over mean} = \frac{GA}{\overline{X}} \times 100$$

## Results

Estimates of variability, heritability and genetic advance of coriander genotypes evaluated are presented

**Table 1 :** Classification of GCV, PCV, heritability and genetic advance values.

| Genetic components | Range (%) | | | References |
|---|---|---|---|---|
| | Low | Medium | High | |
| GCV and PCV | 0-10 | 10-20 | >20 | Sivasubramanian and Menon (1973) |
| Heritability | 0-30 | 30-60 | >60 | Robinson *et al.* (1949) |
| Genetic advance | 0-10 | 10-20 | >20 | Johnson *et al.* (1955) |

**Table 2 :** Genotypes with their source.

| S. no. | Genotypes | Source |
|---|---|---|
| 1. | NRCSS ACr-1 | National Research Centre for Seed Spices (NRCSS), Ajmer, Rajasthan. |
| 2. | Hisar Sugandh | NRCSS, Ajmer, Rajasthan |
| 3. | RCr-41 | -do- |
| 4. | Azad Dhania | -do- |
| 5. | Pant Haritama | -do- |
| 6. | RCr-20 | -do- |
| 7. | RCr-435 | -do- |
| 8. | RCr-436 | -do- |
| 9. | RCr-446 | -do- |
| 10. | RCr-684 | -do- |
| 11. | Sadhna | Regional Agricultural Research Station (RARS), LAM, Guntur |
| 12. | Sindhu | RARS, LAM, Guntur |
| 13. | Sudha | RARS, LAM, Guntur |
| 14. | Rajendra Swati | RARS, LAM, Guntur |
| 15. | GCr-1 | NRCSS, Ajmer, Rajasthan |
| 16. | GCr-2 | -do- |
| 17. | CO-1 | -do- |
| 18. | CO-2 | -do- |
| 19. | JD-1 | -do- |
| 20. | CO-4 | Tamil Nadu Agricultural University (TNAU), Coimbatore |
| 21. | Swathi | RARS, LAM, Guntur |
| 22. | DCC-1 | Bagalkot |
| 23. | DCC-2 | Bijapur |
| 24. | DCC-3 | Bijapur |
| 25. | DCC-4 | Bijapur |
| 26. | DCC-5 | Bijapur |
| 27. | DCC-6 | Gulbarga |
| 28. | DCC-7 | Gulbarga |
| 29. | DCC-8 | Gulbarga |
| 30. | DCC-9 | Gulbarga |
| 31. | DCC-10 | Humnabad |
| 32. | DCC-11 | Humnabad |
| 33. | DCC-12 | Bidar |
| 34. | DCC-13 | Bidar |
| 35. | DCC-14 | Bidar |

***Table 2 continued....***

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| | | |
|---|---|---|
| 36. | DCC-15 | Bidar |
| 37. | DCC-16 | Dharwad |
| 38. | DCC-17 | Dharwad |
| 39. | DCC-18 | Dharwad |
| 40. | DCC-19 | Dharwad |
| 41. | DWD-3 (Check) | University of Agricultural Sciences, Dharwad |

Note : Genotypes from serial number 1 to 5 are long duration ( >120 days to maturity)
Genotypes from serial number 6 to 19 are medium duration (91 to 120 days to maturity)
Genotypes from serial number 20 to 41 are early maturing ( < 90 days to maturity)

**Table 3 :** Variability, heritability and genetic advance in coriander genotypes.

| Character | Range | Mean | GCV | PCV | Heritability (H) | Genetic advance over Mean (GAM) |
|---|---|---|---|---|---|---|
| Plant height at 30 days (cm) | 7.61-25.47 | 16.19 | 25.57 | 26.34 | 94.22 | 24.76 |
| Plant height at flower initiation (cm) | 31.75-60.88 | 43.45 | 22.48 | 22.55 | 99.41 | 14.75 |
| Plant height at harvest (cm) | 37.11-64.00 | 49.25 | 19.09 | 19.18 | 99.07 | 12.74 |
| Primary branches at 30 DAS | 1.46-4.75 | 3.37 | 32.96 | 33.33 | 97.78 | 63.35 |
| Primary branches at harvest | 3.96-13.75 | 7.78 | 37.90 | 38.42 | 97.28 | 44.82 |
| Secondary branches at 30 DAS | 0.35-2.65 | 1.19 | 33.47 | 39.39 | 72.23 | 85.60 |
| Secondary branches at harvest | 10.03-33.00 | 13.48 | 35.17 | 35.76 | 96.75 | 27.40 |
| Number of leaves at 30 DAS | 9.40-17.80 | 13.63 | 26.01 | 29.51 | 77.71 | 24.15 |
| Number of leaves at flowering | 18.65-72.24 | 39.83 | 40.56 | 41.02 | 97.79 | 20.51 |
| Herbage yield (g/pl) | 7.88-27.75 | 14.93 | 3.14 | 3.19 | 96.72 | 12.91 |
| Days to flower initiation | 35.06-79.80 | 46.20 | 20.69 | 20.95 | 97.49 | 14.17 |
| Days to 50% flowering | 43.58-83.99 | 56.20 | 15.61 | 15.87 | 96.80 | 11.46 |
| Days to physiological maturity | 72.52-142.42 | 97.11 | 21.20 | 22.09 | 92.13 | 19.10 |
| Number of umbels per plant | 21.98-74.05 | 40.99 | 38.92 | 39.30 | 98.05 | 19.78 |
| Number of umbellets per umbel | 4.19-6.46 | 5.60 | 14.77 | 15.01 | 96.75 | 32.63 |
| Seeds per umbellate | 4.34-8.76 | 5.52 | 18.94 | 19.04 | 98.91 | 37.84 |
| Seeds per umbel | 18.55-54.64 | 31.38 | 31.16 | 31.35 | 98.80 | 20.34 |
| Thousand seed weight (g) | 8.39-15.14 | 12.17 | 15.04 | 15.33 | 96.29 | 22.26 |
| Seed yield per plant (g) | 0.52-4.36 | 1.75 | 53.54 | 54.93 | 95.02 | 109.67 |
| Seed yield per ha (q) | 1.45-11.64 | 4.70 | 52.72 | 54.15 | 94.78 | 66.63 |
| Essential oil content (%) | 0.25-0.56 | 0.34 | 20.09 | 22.14 | 82.35 | 136.90 |
| Essential oil yield (kg/ha) | 0.37-4.82 | 155 | 69.75 | 71.92 | 94.05 | 131.97 |

in table 3.

High phenotypic and genotypic coefficients of variation were observed for all the characters except plant height at harvest, 50 per cent flowering, umbellets per umbel, seeds per umbellet and 1000 seed weight, which had moderate phenotypic and genotypic coefficients of variation. Herbage yield had low PCV and GCV. There was no wide difference between PCV and GCV among all the traits. The highest GCV was obtained for essential oil yield per hectare (69.75) followed by seed yield per plant (53.54).

Heritability estimates were of very high magnitude for all the characters. The highest heritability estimates were obtained for plant height at flower initiation (99.44) followed by plant height at harvest (99.07).

Genetic advance over mean (GAM) was also high for all the characters except for plant height at flowering, plant height at harvest, days to flower initiation, 50 per cent flowering and umbels per plant, herbage yield and days to physiological maturity which had moderate genetic advance. The highest GAM was obtained for essential oil content (136.90) followed by essential oil yield per hectare (131.97) and seed yield per plant (109.67).

## Discussion

In the present material, the genotypic coefficients of variability (GCV) was less than the phenotypic coefficients of variability (PCV) as it is expected. The analysis of variance for growth and yield characters of

the genotypes showed that the phenotypic and genotypic coefficients of variation were high for all the characters except plant height at harvest, 50 per cent flowering, umbellets per umbel, seeds per umbellet and 1000 seed weight. Herbage yield had low PCV and GCV and rest had moderate estimates of GCV and PCV. There was no wide difference between PCV and GCV among all the traits. This will provide information that natural variation exists for these traits, which can be exploited for improvement of this crop. The highest GCV was obtained for essential oil yield per hectare (69.75) followed by seed yield per plant (53.54). On the other hand, low GCV value was observed for herbage yield indicating little scope for exploitation of genetic variation for this character. Similar variation among the genotypes of coriander were reported by earlier workers (Ali *et al.*, 1993; Godhra, 1995; Rajput and Dhirendrasingh, 2003; Dhirendra *et al.*, 2006; Singh *et al.*, 2006 and Beement and Getine, 2010).

The heritability estimates ranged from 99.40 to 72.23 per cent. Heritability estimates were of very high magnitude for all the characters. The highest heritability estimates were obtained for plant height at flower initiation (99.44) followed by plant height at harvest (99.07). These results are in line with the findings of Jain (2001), Singh *et al.* (2008) and Beement and Getine (2010).

Narrow difference between GCV and PCV indicate the reliability of phenotypic selection for that character. Increased heritability with increased genetic advance shows that the characters were governed by additive gene action and selection will show improvement for these characters (Jicinska, 1981). Whereas, moderate genetic advances is governed by both additive and non-additive gene action and a low genetic advance by the influence of non additive gene action.

Although, heritability indicates the effectiveness of selection, it does not show any indication of genetic progress for selecting best genotype. Johnson *et al*. (1955) suggested that heritability estimate along with genetic advance are more fruitful than heritability alone and should be considered for making an effective selection. From the study it is observed that characters like primary branches (at 30 DAS and harvest), secondary branches at 30 DAS, seed yield per plant, seed yield per hectare, essential oil content and essential oil yield per hectare had a combination of both high heritability and genetic advance indicating effectiveness of these traits based on judging phenotypic performance. These results are in close agreement with the results obtained by earlier workers (Singh *et al*., 2008; Beement and Getine, 2010).

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