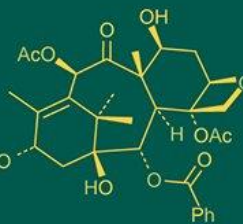
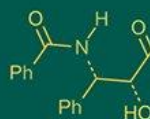


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Studies on genetic variability, heritability and genetic advance in coriander (*Coriandrum sativum* L.) genotypes under Northern dry zone Karnataka

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Abstract

A field experiment was conducted during *Rabi* 2023 to evaluate the genetic variability among 95 coriander (*Coriandrum sativum* L.) genotypes along with four checks for growth, yield and associated traits. Genetic parameters, including genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (h^2) and genetic advance as percent of mean (GAM), were estimated to assess the extent of variability and scope for selection. The results revealed substantial variability among genotypes for all traits studied. Among growth traits, plant height exhibited moderate to low variability with moderate heritability and low to moderate genetic advance, indicating limited response to direct selection. In contrast, days to germination, number of primary branches and number of secondary branches showed moderate variability coupled with high heritability (86-90%) and high genetic advance (27-30%), suggesting the predominance of additive gene action and effectiveness of selection. Phenological traits such as days to first flowering, days to 50 percent flowering and crop duration recorded low variability despite high heritability, accompanied by low genetic advance, indicating restricted improvement through selection. Among yield attributes, seed weight per umbel exhibited high variability (GCV: 21.70%; PCV: 22.58%) along with very high heritability (92.30%) and genetic advance (43.00%), highlighting its strong potential as a selection criterion. Similarly, number of umbels per plant, test weight, and seed yield (per plant, plot and hectare) showed moderate variability with high heritability (>84%) and substantial genetic advance (>24%), suggesting that these traits are mainly governed by additive genetic effects and can be effectively improved through selection. Overall, the study demonstrates the presence of significant genetic variability and identifies key traits for enhancing seed yield in coriander through targeted breeding strategies.

Keywords: Coriander, genetic variability, heritability, genetic advance, seed yield, additive gene action

Introduction

Coriander (*Coriandrum sativum* L.) is an important seed spice crop belonging to the family Apiaceae and is widely cultivated for its aromatic seeds and tender leaves. India is one of the major producers and exporters of coriander, where the crop holds significant economic and culinary importance. However, productivity of coriander is often limited due to narrow genetic variability and the influence of environmental factors. Genetic variability is an essential prerequisite for crop improvement as it provides scope for effective selection of superior genotypes. Estimation of genetic parameters such as genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability and genetic advance helps in understanding the nature of gene action and the effectiveness of selection for yield and its related traits. Therefore, the present investigation was undertaken to assess the genetic variability among 95 coriander genotypes along with four checks for growth, yield and associated traits during *Rabi* 2023.

Materials and Methods

The present investigation was conducted during *Rabi* 2023 at the College of Horticulture, Bagalkot, University of Horticultural Sciences Bagalkot, Karnataka, India, to assess the genetic variability among coriander (*Coriandrum sativum* L.) genotypes. The experimental material consisted of 95 genotypes collected from Horticultural Research and Extension

Centre Devihosur and local collection, along with four check varieties viz., DCC-46 (Varadevi-1), DCC-81 (Varadevi-2), DWD-3 and Local-1. The experiment was laid out in an Augmented Randomized Complete Block Design (Augmented RCBD) with five blocks during both the seasons. Each genotype was grown in a plot size of 2 m × 2 m with a spacing of 30 cm × 20 cm. Recommended package of practices for coriander cultivation was followed uniformly for all the genotypes throughout the crop growth period. Observations were recorded on growth, yield and yield contributing traits from five randomly selected plants in each genotype. Morphological characterization was carried out based on standard descriptors, and the data generated were subjected to statistical analysis for estimation of genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sense [$h^2(bs)$] and genetic advance as percent of mean (GAM) using the 'augmentedRCBD' package in R software (version 4.1.3) (Aravind *et al.*, 2020) [1] to assess the extent of genetic variability among the coriander genotypes.

Results

The evaluation of 95 coriander (*Coriandrum sativum* L.) genotypes along with four checks during Rabi 2023 revealed substantial variability for growth, yield and associated traits (Table 1), indicating the presence of considerable genetic diversity among the genotypes.

Growth parameters

Plant height exhibited moderate to low variability across different growth stages. At 30 DAS, plant height ranged from 7.93 to 30.85 cm with moderate variability (GCV: 14.77%; PCV: 19.37%) and moderate heritability (58.15%) coupled with moderate genetic advance (23.24%). However, at 60 DAS and at harvest, lower GCV and PCV values along with moderate heritability and low genetic advance indicated limited scope for improvement through direct selection.

Days to germination ranged from 6.10 to 11.10 days and

exhibited moderate variability (GCV: 13.88%; PCV: 14.67%) with high heritability (89.59%) and high genetic advance (27.11%), indicating the predominance of additive gene action. Similarly, number of primary branches (2.88-8.28) and secondary branches (5.76-15.36) per plant showed moderate variability with high heritability (>86%) and high genetic advance (~30%), suggesting good prospects for improvement through selection.

Phenological traits, including days to first flowering (40.55-50.30 days), days to 50 percent flowering (44.40-55.40 days) and crop duration (92.45-104.95 days), exhibited low variability (GCV<5%) despite high heritability (>80%). The low genetic advance observed for these traits indicates limited effectiveness of selection and relative stability of these characters.

Yield and its related parameters

Among yield attributes, number of umbels per plant (13.13-32.61) showed moderate variability (GCV: 14.40%; PCV: 15.54%) with high heritability (85.94%) and high genetic advance (27.55%), suggesting its usefulness as a selection criterion. Number of seeds per umbellate (4.63-8.13) also exhibited moderate variability with very high heritability (92.74%) and appreciable genetic advance (22.80%), indicating strong additive genetic control.

Seed weight per umbel (0.14-0.51 g) recorded high variability (GCV: 21.70%; PCV: 22.58%) along with very high heritability (92.30%) and high genetic advance (43.00%), highlighting its strong potential for selection. Test weight (3.73-7.62 g) showed moderate variability with high heritability (87.65%) and genetic advance (24.05%).

Seed yield per plant (4.82-9.47 g), seed yield per plot (197.41-499.12 g) and seed yield per hectare (493.52-1247.80 kg) exhibited moderate variability (GCV: 12.99-16.73%; PCV: 13.89-18.17%) with high heritability (>84%) and substantial genetic advance (>25%), indicating that these traits are predominantly governed by additive gene effects and can be effectively improved through direct selection.

Table 1: Estimates of genetic variability parameters for growth, yield and its related parameters among the coriander genotypes (Rabi-2023)

Sl. No	Character	Mean	Range		Coefficient of variation (%)		h ² (%)	GAM (%)
			Min.	Max.	GCV	PCV		
Growth parameters								
1	Plant height at 30 DAS (cm)	19.26	7.93	30.85	14.77	19.37	58.15	23.24
2	Plant height at 60 DAS (cm)	42.14	30.18	53.50	7.26	9.56	57.67	11.38
3	Plant height at Harvest (cm)	51.10	36.13	63.03	7.32	8.99	66.25	12.29
4	Days to germination	8.41	6.10	11.10	13.88	14.67	89.59	27.11
5	Number of primary branches	5.91	2.88	8.28	15.59	16.72	86.91	29.99
6	Number of secondary branches	11.23	5.76	15.36	15.41	16.53	86.84	29.62
7	Days to first flowering	44.74	40.55	50.30	4.17	4.50	86.20	8.00
8	Days to 50 percent flowering	48.96	44.40	55.40	4.06	4.33	87.96	7.86
9	Crop duration	97.31	92.45	104.95	2.58	2.86	81.29	4.80
Yield and its related parameters								
10	Number of umbels per plant	23.64	13.13	32.61	14.40	15.54	85.94	27.55
11	Number of seeds per umbellate	6.41	4.63	8.13	11.48	11.92	92.74	22.80
12	Number of umbellate per umbel	5.23	4.06	5.98	6.00	6.82	77.36	10.88
13	Seed weight per umbel (g)	0.34	0.14	0.51	21.70	22.58	92.30	43.00
14	Test weight (g)	5.26	3.73	7.62	12.45	13.30	87.65	24.05
15	Seed yield per plant (g)	7.28	4.82	9.47	12.99	13.89	87.41	25.05
16	Seed yield per plot (g)	359.44	197.41	499.12	16.73	18.17	84.78	31.77
17	Seed yield per hectare (kg)	898.60	493.52	1247.80	16.73	18.17	84.78	31.77

^{ns} = $p > 0.05$; * $p < 0.05$; ** $p < 0.01$

Discussion

The evaluation of 95 coriander genotypes along with four checks during Rabi 2023 revealed considerable genetic variability for growth, yield, and associated traits, indicating ample scope for selection and crop improvement. The presence of moderate to high genotypic (GCV) and phenotypic (PCV) coefficients of variation for several traits reflects the existence of substantial inherent variability among the genotypes, which is essential for effective selection in breeding programmes (Rai *et al*, 2024, Saroj *et al*, 2022) [4, 5].

Traits such as number of primary branches, number of secondary branches, number of umbels per plant, seed weight per umbel and seed yield exhibited moderate to high variability coupled with high heritability and high genetic advance as percent of mean. This combination suggests the predominance of additive gene action, thereby indicating that these traits are less influenced by environmental factors and can be effectively improved through direct phenotypic selection. Among these, seed weight per umbel recorded particularly high variability and genetic advance, highlighting its importance as a key yield-contributing trait (Pandey *et al*, 2018, Patel *et al*, 2018) [2, 3].

On the other hand, traits such as plant height at different growth stages, days to first flowering, days to 50 percent flowering and crop duration exhibited relatively low variability despite showing moderate to high heritability. The low genetic advance observed for these traits indicates the involvement of non-additive gene effects and/or environmental influence, thereby limiting the effectiveness of direct selection. Consequently, improvement of these traits may require alternative breeding strategies such as hybridization followed by selection in segregating generations.

The yield and its related traits, including seed yield per plant, seed yield per plot and seed yield per hectare, recorded moderate variability along with high heritability and substantial genetic advance, suggesting that these traits are predominantly governed by additive gene effects (Singh *et al*, 2013, Verma *et al*, 2018) [6, 7]. The close correspondence between GCV and PCV values for these traits further indicates minimal environmental influence on their expression, thereby enhancing the reliability of selection.

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