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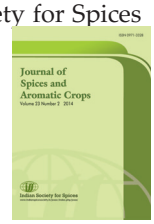

Assessment of genetic variability, correlation and path analysis for yield and its components in ajwain (*Trachyspermum ammi* L.)

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Abstract

Genetic variability, heritability, correlation and path analysis were estimated among 28 germplasm for 10 characters in Ajwain (*Trachyspermum ammi* L.). Analysis of variance revealed significant differences among the germplasm lines for number of secondary branches plant^{-1}, number of umbels plant^{-1}, number of umbellets umbel^{-1}, seed yield plant^{-1}, harvest index and oil content, suggesting sufficient amount of variability in the experimental material. The estimates of genotypic coefficient variation (GCV) and phenotypic coefficient variation (PCV) indicated the existence of fairly high degree of variability for seed yield plant^{-1}, oil content, number of umbels plant^{-1} and harvest index. Lower values of GCV and PCV were recorded in number of umbellets umbel^{-1} indicating the important role of environment in the expression of the characters. High heritability associated with moderate genetic advance was recorded in traits like harvest index and seed yield plant^{-1}. The association study among characters revealed that seed yield was positively and significantly correlated with number of umbellets plant^{-1}. Path coefficient analysis revealed that number of umbellets plant^{-1} had maximum positive direct effect on seed yield plant^{-1}.

Keywords: ajwain, character association, path coefficient, variability

Ajwain (*Trachyspermum ammi* L.) is one of the most important seed spices cultivated mainly for its seed, herb and volatile oil. It has medicinal value specially for curing indigestion, stomach pain and elements concerning digestive system. It is also used in cholera, diarrhea, gastric and urinary trouble. Seed contains volatile oil (2-4%) that is yellow brownish in colour and is used in many ayurvedic medicines and industries. To formulate efficient breeding programme, knowledge about the presence of genetic variability for yield and yield component traits is essential. Superior genotypes can be isolated by selection, if considerable genetic variability exists in the population. The genetic variability along with heritability gives a reliable picture of the genetic advance to be expected for selections while the heritability, coupled with genetic advance aids in predicting the valuable conclusion for effective selection based on phenotypic performance. Correlation and path analysis will establish the extent of association between yield and its components and will also bring out the relative importance of their direct and indirect effects and thus, give a clear understanding of their association with

yield. Keeping this in view, the present investigation was carried out to explore the genetic variability by determining the magnitude of genotypic coefficient of variation, heritability estimates and expected genetic advance of different biometric traits, their correlation and effects in 28 Ajwain germplasm lines.

The experimental materials consisted of 28 diverse germplasm lines. The experiment was laid in Randomized Block Design with three replications during late *kharif* 2012 at the Instructional Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. Each entry was planted in 4 rows of 3.0 m length keeping row to row and plant to plant distance of 30 cm and 10 cm, respectively. The recommended package of practices was followed to raise a healthy crop. The observations were recorded on five randomly selected plants from each genotype in each replication for characters *viz*., plant height (cm), number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of umbels plant^{-1}, number of umbellets umbel^{-1}, harvest index (%), seed yield plant^{-1} (g), oil content (%), while for days to 50% flowering and days to maturity, the data was recorded on whole plot basis. Analysis of variance was done by the method suggested by Panse & Sukhatme (1985). The phenotypic and genotypic coefficient of variation (Burton 1952), heritability (Burton & Davane 1953) and genetic advance (Johnson *et al*. 1955) were computed. The correlation coefficients were calculated according to Al Jibouri *et al*. (1958), whereas path coefficients were calculated following the method of Dewey & Lu (1959).

The analysis of variance indicated significant difference among genotypes for most of the traits studied indicating presence of significant variability in the experimental material. The range, mean and standard error of mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability (h^2) in broad sense, genetic advance (GA) and genetic gain as per cent of mean for various characters are presented in Table 1. The range of variability indicated the existence of variability for all the characters.

In general, PCV values were relatively higher than respective GCV values indicating influence of environment on the expression of character. The estimated of PCV and GCV indicated the existence of fairly high degree of variability.

The highest values of GCV and PCV were observed for seed yield plant^{-1}, oil content (%), number of umbels plant^{-1} and harvest index (%). Lower values of GCV and PCV was recorded for number of umbellets umbel^{-1} indicating the important role of environment in the expression of the character. High magnitude of PCV and GCV was also observed for seed yield plant^{-1} by Singh & Choudhary (2008), Dalkani *et al*. (2012), Singh & Mittal (2002) in fennel and Rajput & Singh (2003) in coriander. These results indicated the presence of ample variability for seed yield and related traits in Ajwain. This observation draws supports from the very high value of heritability (> 70%) recorded for these traits (Table 1). It was also observed that the traits like seed yield plant^{-1}, oil content (%) and

Table 1. Range, mean, phenotypic and genotypic coefficient of variation, heritability and genetic advance and genetic gain for characters in ajwain

Character	Range	Mean ± SE	GCV	PCV	h^2	GA	GG
Number of secondary branches plant^{-1}	49.67 - 70.67	57.73 ± 2.20	7.75	10.18	58.06	7.03	12.17
Number of umbels plant^{-1}	79.67 - 154.33	118.96 ± 4.78	13.65	15.32	79.38	29.80	25.05
Number of umbellets umbel^{-1}	9.67 - 12.33	11.07 ± 0.51	4.09	8.95	20.83	0.43	3.84
Seed yield plant^{-1} (g)	6.67 - 13.00	9.46 ± 0.71	18.23	22.42	66.13	2.89	30.54
Harvest index (%)	26.00 - 39.67	32.55 ± 1.23	10.41	12.28	71.78	5.91	18.16
Oil content (%)	15.40 - 28.13	20.10 ± 0.10	16.88	16.90	99.77	6.98	34.74

number of umbels plant^{-1} exhibited high GCV indicating preponderance of additive gene effect for these traits. The character number of umbels plant^{-1} exhibited high heritability accompanied with high genetic advance. Similarly, high heritability associated with moderate genetic advance was recorded in traits like oil content (%) and harvest index (%).

Character association revealed mutual relationship between two characters and suggested that it is an important parameter for taking a decision regarding the nature of relation to be followed for improvement of the crop under study. The genotypic and phenotypic correlation among the yield and yield components in ajwain are presented in Table 2. Significant correlation of characters suggested that there is much scope for direct and indirect selection for further improvement. In general, the estimates of genotypic correlation coefficient were higher than their corresponding phenotypic coefficient, thereby suggesting strong inherent association among the characters studied. In the present investigation seed yield was positively and significantly correlated only with number of umbellets umbel^{-1} Therefore, this character should be considered while making selection for yield improvement in ajwain. Similar trends were supported by Dalkani *et al*. (2011) in ajwain. Singh *et al*. (2006) and Singh & Prasad (2006) reported positive correlation of most of the traits with seed yield plant^{-1} in coriander.

The information derived from the correlation studies indicated mutual association among the characters, whereas path coefficient analysis helped in understanding the magnitude of direct and indirect contribution of each character on the dependent character like seed yield plant^{-1}.

The results of the present investigation on path coefficient analysis as presented in Table 3 revealed that number of umbellets umbel^{-1},

Table 2. Genotypic and phenotypic correlation coefficients between different characters in Ajwain

	No. of secondary branches plant^{-1}	No. of umbels plant^{-1}	No. of umbellets umbel^{-1}	Harvest index (%)	Oil content (%)	Seed yield plant^{-1}
No. of secondary branches plant^{-1}		0.72**	0.46*	-0.47*	-0.32	0.12
No. of umbels plant^{-1}	0.58**		0.36	-0.51**	-0.32	0.27
No. of umbellets umbel^{-1}	0.24	0.25		-0.30	-0.28	0.65**
Harvest index (%)	-0.36	-0.43*	-0.15		-0.03	-0.20
Oil content (%)	-0.25	-0.28	-0.12	-0.03		0.00
Seed yield plant^{-1}	0.08	0.20	0.22	-0.37	0.00	

*, **Significant at P<0.05 and P<0.01, respectively

Table 3. Direct (diagonal) and indirect effects of different correlated characters towards seed yield plant^{-1}

Character	Number of secondary branches plant^{-1}	Number of umbels plant^{-1}	Number of umbellets umbel^{-1}	Harvest index (%)	Oil content (%)	Seed yield plant^{-1}
No. of secondary branches plant^{-1}	-0.48	0.19	0.35	0.11	-0.04	0.12
No. of umbels plant^{-1}	-0.35	0.27	0.27	0.12	-0.04	0.27
No. of umbellets umbel^{-1}	-0.22	0.10	0.75	0.07	-0.04	0.65**
Harvest index (%)	0.23	-0.14	-0.22	-0.24	-0.00	-0.37
Oil content (%)	0.16	-0.08	-0.21	0.01	0.13	0.00

*,**Significant at P<0.05 and P<0.01, respectively; Residual effect (R)=0.6407

number of umbels plant^{-1} and oil content had maximum positive direct effect on seed yield plant^{-1}. Similar results were reported by Vijayalatha & Chezhiyan (2004), Singh *et al.* (2006) and Singh & Prasad (2006) in coriander. The study also indicated that the inter-correlation estimates for yield components *viz*., number of umbellets umbel^{-1} had significant and positive direct and strong association with seed yield plant^{-1}. Therefore, simultaneous improvement of this trait by selection will improve seed yield.

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