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Evaluation of ajowain (*Trachyspermum ammi* L.) genotypes suitable for semi arid regions.

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Abstract

Forty two genotypes of ajowain collected from various sources were planted in Randomized Block Design in three replications at Research Farm, S.K.N. College of Agriculture, Jobner to assess the degree of genetic variability, heritability and genetic advance for seed yield per plant in ajowain (*Trachyspermum ammi* Linn.). The analysis of variance revealed significant differences among the genotypes for all the characters studied viz., day to 50% flowering, plant height, branches per plant, umbels per plant, umbellets per umbel, seeds per umbel, 1000-seed weight, harvest index and seed yield per plant. The estimates of heritability (broad sense) were high for plant height, umbels per plant, harvest index and seed yield per plant whereas, it was moderate for days to 50% flowering, branches per plant, umbellets per umbel, seeds per umbel and 1000-seed weight. The genotypic coefficient of variation and genetic advance expressed as percentage of mean were high for harvest index and seed yield per plant and moderate to low for umbels per plant, seeds per umbel, branches per plant, plant height, days to 50% flowering, umbellets per umbel and 1000-seed weight, respectively.

Key words: ajowain, *Trachyspermum ammi* L, harvest index, seed yield

On the basis of yield as well as other morphological characters, the genotypes namely JA-109, RPA-68, AA-35, AA-4, and PANT-1 were found superior for semi-avid regions of India.

The ajowain (*Trachyspermum ammi* Linn, 2n = 18) belonging to the family Apiaceae (Umbelliferae) is an important seed spice. The ajowain is indigenous to India and Egypt (Sayre, 2001). Ajowain is a cross-pollinated, annual, aromatic and herbaceous plant. Different products are manufactured from ajowain such as oil of ajowain, thymol (both are used in medicine/pharmaceutical industries), dethymolized oil or thymene for industrial purposes and fatty oil.

The ajowain is cultivated in the Mediterranean region and South West Asian Countries, Iran, Iraq, Afghanistan, Egypt and predominantly in India. In India it is mainly cultivated in the states of Rajasthan and Gujrat, other growing states are Uttar Pradesh, Bihar, Madhya Pradesh, Punjab, Tamil Nadu, West Bengal and Andhra

Pradesh. In India, during the year 2002-03, about 1,630 tonnes of ajowain seeds were produced from 10380 ha area whereas, 935 tonnes of ajowain seed worth Rs. 400 lakhs was exported (Anonymous, 2003-04). India is the largest producer and exporter of the ajowain seed in the world. India exports ajowain to around 46 countries.

The importance of ajowain based on its medicinal value and export potential as spices was recognized long back yet it remained neglected from scientific attention for improvement in productivity. Despite the importance of the crop, very limited breeding work has been attempted. The starting point of any systematic breeding programme is the collection of a large germplasm. The adequacy of the germplasm is determined by the amount of genetic variability present in the germplasm. Information on nature and magnitude of variability for different characters is necessary to judge the potentiality of the germplasm collection for breeding programmes.

The material for the present study consisted of 42 ajowain (*Trachyspermum ammi* Linn.) genotypes obtained from NRC on Seed Spices, Ajmer and maintained under "All India Coordinated Research Project on Spices" at S.K.N. College of Agriculture, Jobner.
The genotypes were evaluated during Rabi 2004-05 at Research Farm of S.K.N. College of Agriculture, Jobner in Randomized Block Design with three replications. In each replication, 42 genotypes were sown in plots of 4.0 x 0.60 sq. m. size accommodating 2 rows spaced at 30 cm apart. The plant to plant distance of 10 cm was maintained by thinning at 27th day after sowing. Non-experimental rows were planted as border rows in each bed to eliminate the border effect, if any. All the agronomical practices were followed to raise a good and healthy crop.

Ten single plants were randomly tagged before initiation of flowering so as to reduce the biasness in the plant selection in genotypes in each replication for recording the observation on different morphological characters and seed yield. Data were recorded on the characters viz., plant height (cm), branches per plant, umbels per plant, umbellets per umbel, seeds per umbel, harvest index (%), and seed yield per plant (g), while data on days to 50% flowering and 1000-seed weight (g) were recorded on whole plot basis.

To estimate the variation among the genotypes, analysis of variance was carried out as per the procedure suggested by Fisher (1918). The phenotypic and genotypic coefficient of variations were estimated using the formula proposed by Burton (1952) and Johnson *et al.* (1955), whereas the heritability in broad sense was calculated by the formula given by Hanson *et al.* (1956). The expected genetic advance was calculated by the formula suggested by Johnson *et al.* (1955).

The analysis of variance (Table-1) revealed that significant amount of variability was present in the genotypes for all the morphological traits studied i.e. days to 50% flowering, plant height, branches per plant, umbels per plant, umbellets per umbel, seeds per umbel, 1000-seed weight, harvest index and seed yield per plant. This suggested that the response to selection may be expected in the breeding programme for seed yield per plant or any of its allied characters. This is in agreement with earlier reports of Ramanujam and Joshi (1966), Shah *et al.* (1969), Bhargava *et al.* (1971), Kathiria (1980), Agnihotri *et al.* (1997) in fennel.

Estimates of genotypic and phenotypic variances indicated that in general, phenotypic variances were higher than genotypic variances for all the characters studied indicating the inherence of environmental factors on the character expression. The variability of characters were compared on the basis of coefficient of variation. The range and coefficient of variation indicated that the variability was high for harvest index and seed yield per plant; moderate for umbels per plant, seeds per umbel and branches per plant. It was low for days to 50% flowering, plant height, umbellets per umbel, and 1000-seed weight, which in turn, indicated that simple selection for harvest index, seed yield per plant and umbels per plant might be advantageous as compared to other characters under study (Table-2). Similar pattern of variability for different characters among accessions have earlier been reported in fennel by Kathiria (1980), Agnihotri (1997) and Alam *et al.* (2003).

Table 1. Analysis of variance for different characters in ajowain

S. No.	Characters	Mean sum of squares		
		Replications (2)b	Genotypes (41)	Error (82)
1.	Days to 50% flowering (days)	5.167	91.700**	18.093
2.	Plant height (cm)	88.034**	148.656**	25.002
3.	Branches per plant	0.590	5.811**	1.452
4.	Umbels per plant	20.673	147.557**	25.567
5.	Umbellets per umbel	4.167**	2.436**	0.735
6.	Seeds per umbel	495.947	2049.987**	407.908
7.	1000-seed weight (g)	0.034**	0.016**	0.005
8.	Harvest index (%)	12.917	90.299**	8.372
9.	Seed yield per plant (g)	0.184	2.432**	0.250

** Significant at p =0.01

b The figure in parenthesis represent d.f.

With the help of PCV and GCV alone it is not possible to determine the amount of variation which is heritable. The heritability estimates along with the genetic advance is more meaningful. Estimate of heritability serves as an useful guide to the breeder. The breeder is able to appreciate the proportion of variation that is due to genotypic (broad sense heritability) or additive (narrow sense heritability) effects (that is the portion of genotypic variation that is fixable in pure lines). If heritability of a character is very high (>60%), selection for such a character should be fairly easy. This is because there would be close correction between genotypic and phenotypic variation due to a relatively lesser contribution of environment to the phenotype, but for a character with a low heritability, selection may be considerably difficult or virtually impractical due to masking effect of environment on the genotypic effect.

In the present investigation, broad sense heritability was observed to be high for plant height (cm), umbels per plant, harvest index (%) and seed yield per plant (g). Similar results were also obtained by Mathur et al. (1971) and Godara *et al.* (1995) in coriander. Moderate heritability (40-60 per cent) was observed for days to 50% flowering, branches per plant, umbellets per umbel, seeds per umbel, and 1000-seed weight, which is in agreement with earlier reports of Agnihotri (1997) in fennel.

Genetic advance as percentage of mean for the characters ranged from 3.640% (1000-seed weight) to 37.778 % (harvest index). High magnitude of genetic advance as percentage of mean was estimated for harvest index and seed yield per plant which is in agreement with earlier reports of Mathur *et al.* (1971) for yield per plant in coriander. Moderate genetic advance as percentage of mean was observed for branches per plant, umbels per plant and seeds per umbel which is in agreement with the reports of Sharma and Sharma (1989), Bhandari and Gupta (1991) for seeds per umbel in coriander. Low genetic advance as percentage of mean were observed for days to 50% flowering, plant height, umbellets per umbel and 1000-seed weight. These results are in accordance with the early

Table 2. Mean, range and genetic parameters for different characters in ajowain

S. No.	Characters	Mean	Range		Variance		Coefficient of variation (%)		Heritability in broad sense (%)	Genetic advance	Genetic advance as percentage of mean
			Minimum	Maximum	Genotypic	Phenotypic (GCV)	Genotypic (PCV)	Phenotypic			
1.	Days to 50% flowering (days)	100.62	95.00	113.67	24.53	42.63	4.92	6.49	57.56	7.74	7.69
2.	Plant height (cm)	111.30	97.73	126.67	41.22	66.22	5.77	7.31	62.24	10.43	9.37
3.	Branches per plant	13.58	10.17	16.17	1.45	2.90	8.87	12.55	50.00	1.75	12.92
4.	Umbels per plant	42.10	27.17	54.63	40.66	66.23	15.15	19.33	61.40	10.29	24.45
5.	Umbellets per umbel	14.91	13.20	17.67	0.57	1.30	5.05	7.65	43.55	1.02	6.86
6.	Seeds per umbel	241.22	184.40	301.40	547.36	955.27	9.70	12.81	57.30	36.48	15.12
7.	1000-seed weight (g)	2.39	2.30	2.64	0.01	0.01	2.65	3.97	44.44	0.09	3.64
8.	Harvest index (%)	24.93	16.21	40.51	27.31	35.44	20.96	24.96	76.53	9.42	37.79
9.	Seed yield per plant (g)	4.42	2.47	6.53	0.73	0.98	19.29	22.37	74.33	1.51	34.55

reports of Kathiria (1980) in fennel and Jain *et al.* (2002) in coriander.

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