Int.J.Curr.Microbiol.App.Sci (2017) *6*(4): 1947-1953

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 4 (2017) pp. 1947-1953**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.604.232

Genetic Characterization for Seed Yield, its Contributing Traits and Oil Content in Ajwain (*Trachyspermum ammi* L.) Over the Environments

Monika Meena[1], N.S. Dodiya[1], Baudh Bharti[1]*, Ram Kunwar[2] and Brajendra[3]

[1]Department of Plant Breeding and Genetics, Maharana Pratap University of Agriculture and Technology, Udaipur - 313 001, Rajasthan, India
[2]Department of Plant Breeding and Genetics, SKNAU, Jobner, Rajasthan-303329, India
[3]ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad-500030, India
**Corresponding author*

Keywords

Correlation, Path, Seed yield, Oil content, Ajwain.

Article Info

Accepted:
15 March 2017
Available Online:
12 April 2017

A B S T R A C T

For present study experimental material consisted of 25 elite genotypes of ajwain. Observation was recorded on 11 quantitative traits in ajwain. High estimates of heritability (broad sense) were obtained for oil content and seeds per umbelet. The magnitude of PCV as expected was greater than the corresponding GCV for all the characters indicating importance of environment in expression of characters. Oil content, number of umbels per plant and seeds per umbelet showed high GCV and heritability coupled with high genetic advance as per cent of mean which revealed that these three traits might be under control of additive gene effects and therefore they are more reliable for effective selection.

Introduction

Ajwain (*Trachyspermum ammi* L. Sprague; 2n=18), belongs to the family Apiaceae, a highly valued medicinally important seed spices. It is native of Egypt and is cultivated in Iraq, Iran, Afghanistan and India. It is also known as Bishop's weed and Carum in English and 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 used in many *Ayurvedic* medicines and industries. In India, it is grown in Gujarat, Rajasthan, Madhya Pradesh, Bihar, Punjab, Tamil Nadu, West Bengal, Andhra Pradesh and Uttar Pradesh. In India, 19000 m t of Ajwain was produced from 27000 ha area with the productivity of 703.70 kg/ha (Anonymous 2014a). In Rajasthan, it is cultivated in Chittorgarh, Udaipur, Jhalawar, Pratapgarh, Baran, Rajsamand, Bhilwara and Kota districts covering an area of 12620 ha with the production and productivity of 9220 m t and 730.58 kg/ha, respectively (Anonymous 2014a). Ajwain is an annual herbaceous plant. The plant is profusely branched having height of 60-90 cm, erect with soft hair. It has feather like leaves, 2-3 pinnately divided, and linear segments. Flower is terminal compound umbel. The minute grayish white fruits are

oval in nature. The flowers are protandrous and cross pollination occurs through insects (Malhotra and Vijay, 2004).

Materials and Methods

Experimental material consisted of 25 elite genotypes of ajwain *viz.*, UA-7, UA-28, UA-29, UA-30, UA-32, UA-41, UA-48, UA-53, UA-63, UA-66, UA-70, UA-71, UA-83, UA-87, UA-90, UA-113, UA-125, UA-127, UA-131, UA-141, UA-149, UA-168, UA-169, UA-175 and UA-191 and along with three checks namely, Gujarat Ajwain-1, Pratap Ajwain-1 and Local check. These genotypes were evaluated under four different environments *viz.*, E_1 (late *kharif*, during 2013-14 at Udaipur), E_2 (late *kharif*, during, 2013-14 at Pratapgarh), E_3 (late *kharif*, during 2014-15 at Udaipur) and E_4 (late *kharif*, during 2014-15 at Pratapgarh) in Randomized Block Design with three replications (Table 1). Each genotype was sown in four row plot of 3.0 m row length. Row to row and plant to plant distance was maintained as 30 cm and 10 cm at each location, respectively. All the recommended agronomical practices and plant protection measures were adopted to raise a healthy crop to attain maturity. Fertilizers were applied @ 20 kg N: 20 kg P_2O_5 at the time of sowing as basal dose while 20 kg N/ha was top-dressed in two split doses in thirty and sixty days respectively. Crop was irrigated 6 times during the crop season. First irrigation was given immediately after sowing and there after irrigation was given at an interval of 20-25 days. The observations were recorded on ten randomly selected plants of each genotype in each replication for each environment for 11 quantitative characters *viz.*, plant height, number of primary branches per plant, number of umbels per plant, number of umbelets per umbel, number of seeds per umbelets, biological yield per plant, seed yield per plant, test weight and oil content. However, days to 50% flowering and days to 75% maturity were recorded on plot basis, while oil content was estimated by using AOAC (1965) and average pooled mean values were used for statistical analysis. Standard statistical procedures were followed for estimating genetic constants i.e. phenotypic and genotypic coefficients of variation (Burton, 1952), heritability in broad sense (Hanson *et al.*, 1956) and expected genetic advance (Johnson *et al.*, 1955).

Results and Discussion

Analysis of variance on pooled basis mean square due to environment were significant for all the characters except days to 50% flowering, days to 75% flowering and plant height, similarly due to genotypes were significant for all these characters except days to 50% flowering, days to 75% flowering it indicated that ample genetic variability present for these traits further, Interaction of genotypes with environment were significant for all characters except days to 50% flowering, days to 75% flowering and plant height, seeds per umbelet, biological yield per plant and test weight. Mean square due to replication was non-significant for all the characters under the study (Table 2). The mean performance of all genotypes, extent of variability with respect to various characters in different diverse genotypes of oat measured in terms of general mean, range, coefficients of variation along with the amount of heritability in broad sense and expected genetic advance as per cent of mean for eleven characters were given in table 3 and 4 respectively. On the basis of *per se* performance, days to 50% flowering was recorded minimum in UA-53 (74.50) followed by UA-41 (75.25), UA-127(75.33) and UA-168 (75.34). Similarly days to 75% maturity was minimum recorded in local check (162.33) followed by UA-113 (162.43) and UA-87 (162.57). Maximum mean values of seed yield per plant was observed in UA-

66 (12.07) followed by UA-63 (11.95), UA-7 (11.81) and UA-83 (11.81). However it was lowest mean values was recorded in UA- 169 (8.26). Maximum mean values of oil content was observed in UA-32 (4.42) followed by UA-191 (4.17) and UA-70 (4.08), while it was recorded minimum mean values in UA-149 (2.42). Absolute variability in different traits does not permit in deciding as to which character is showing the highest degree of variability, the relative values of phenotypic variance, genotypic variance and coefficients of variations (PCV and GCV). Therefore, it gives an idea about the magnitude of variability present in a population. In the present investigation, the information obtained showed that the estimates of phenotypic coefficient of variation were higher than the genotypic coefficient of variation meaning thereby that the apparent variation was not only due to genotypes but also influenced by environment.

Table.1 Twenty eight diverse Ajwain (*Trachyspermum ammi* L.) accession

SN	Name of Genotypes	Origin	State	SN	Name of Genotypes	Origin	State
1	UA-7	Udaipur	Rajasthan	15	UA-90	Chittorgarh	Rajasthan
2	UA-28	Chittorgarh	Rajasthan	16	UA-113	Chittorgarh	Rajasthan
3	UA-29	Chittorgarh	Rajasthan	17	UA-125	Chittorgarh	Rajasthan
4	UA-30	Chittorgarh	Rajasthan	18	UA-127	Neemauch	M.P.
5	UA-32	Chittorgarh	Rajasthan	19	UA-131	Neemauch	M.P.
6	UA-41	Chittorgarh	Rajasthan	20	UA-141	Neemauch	M.P.
7	UA-48	Chittorgarh	Rajasthan	21	UA-149	Radhapur	Gujarat
8	UA-53	Chittorgarh	Rajasthan	22	UA-168	Banaskantha	Gujarat
9	UA-63	Pratapgarh	Rajasthan	23	UA-169	Banaskantha	Gujarat
10	UA-66	Pratapgarh	Rajasthan	24	UA-175	Banaskantha	Gujarat
11	UA-70	Bhilwara	Rajasthan	25	UA-191	Banaskantha	Gujarat
12	UA-71	Bhilwara	Rajasthan	26	Gujarat Ajwain-1	Banaskantha	Gujarat
13	UA-83	Chittorgarh	Rajasthan	27	Pratap Ajwain-1	Banaskantha	Gujarat
14	UA-87	Chittorgarh	Rajasthan	28	Local check	Banaskantha	Gujarat

Table.2 Analysis of variance for different characters in Ajwain over the environments

Characters	Environment	Rep/Env	Genotype	G x E	Pool Err
	[3]	[8]	[27]	[81]	[216]
Day to 50% flowering	4.88	5.14	9.45	3.15	21.61
Days to 75% maturity	188.91	8.18	28.33	3.50	108.60
Plant height (cm)	22.74	25.98	120.89**	20.76	35.12
No of primary branches	68.10**	0.43	4.43**	1.21**	0.33
No of umbels per plant	396.12**	35.06	1819.86**	429.94**	71.86
No of umbelets per umbel	73.02**	0.65	4.84**	1.95**	0.53
Seeds per umbelet	60.62**	0.90	43.78**	1.93	2.21
Biological yield per plant (g)	13.13**	4.12	25.33**	2.59	3.16
Seed yield per plant (g)	5.95**	0.81	7.65**	1.25**	0.51
Test weight (g)	0.03**	0.01	0.04**	0.00	0.01
Oil content (%)	4.85**	0.09	3.50**	0.13**	0.05

*, ** significant at 1% and 5% level, respectively

Table.3 Estimates of variability, heritability and genetic advance as percentage of mean different characters in Ajwain over the environments

Characters	Range		Grand mean	Coefficients of variability		Heritability	Genetic	Gen. adv. as %
	Lowest	Highest	($\bar{x}$) ± SE	GCV	PCV	(b s) (%)	advance (GA)	of means (5%)
Plant height	92.67	103.92	97.35±1.71	2.97	6.39	21.57	2.76	2.84
No of primary branches	7.42	8.92	8.67±0.17	5.98	10.89	30.10	0.59	6.75
No of umbels per plant	93.50	146.30	118.17±2.45	9.11	14.83	37.72	13.62	11.52
No of umbelets per umbel	8.92	11.75	10.53±0.21	4.66	10.59	19.36	0.44	4.22
Seeds per umbelet	14.91	22.92	20.73±0.43	9.01	11.42	62.25	3.04	14.64
Biological yield per plant (g)	22.92	29.10	26.29±0.51	5.24	8.39	38.98	1.77	6.74
Seed yield per plant (g)	8.26	12.07	11.14±0.21	6.56	10.19	41.37	0.97	8.69
Test weight (g)	1.02	1.22	1.13±0.02	5.11	7.49	46.54	0.08	7.18
Oil content (%)	2.42	4.42	3.45±0.06	15.35	17.36	78.20	0.96	27.97

Table.4 Mean performance of twenty eight genotypes of ajwain on pooled basis for seed yield, its component traits and oil content

Genotypes	Days to 50 % flowering	Days to 75% maturity	Plant height (cm)	No. of primary branches per Plant	No. of umbels per plant	No. of umbeletes per umbel	Seeds per umbelets	Biological yield per plant (g)	Seed yield per plant (g)	Test weight (g)	Oil content (%)
UA-7	78.83	165.92	96.33	9.25	108.58	10.84	18.92	27.45	11.81	1.19	3.71
UA-28	76.00	166.18	93.00	9.41	116.42	10.25	18.50	26.74	11.51	1.16	3.79
UA-29	77.33	164.75	93.50	8.58	93.50	9.33	20.59	27.70	11.76	1.19	3.75
UA-30	76.08	167.34	95.08	10.25	116.33	10.42	20.33	26.74	11.51	1.16	3.42
UA-32	77.08	163.92	103.92	9.42	139.33	11.17	21.83	26.51	11.41	1.16	4.42
UA-41	75.25	164.01	96.92	8.68	116.67	8.92	22.50	26.75	11.52	1.16	4.01
UA-48	75.75	165.58	93.83	8.92	123.91	10.33	21.00	27.31	11.75	1.19	2.91
UA-53	74.50	164.59	96.17	8.67	116.17	10.92	18.83	25.50	10.44	1.14	3.50
UA-63	77.42	166.67	95.92	7.75	106.71	11.00	21.25	27.46	11.95	1.18	2.46
UA-66	76.50	164.25	98.67	7.42	109.50	10.59	14.91	28.07	12.07	1.22	3.54
UA-70	77.17	165.75	92.67	8.08	117.96	10.09	16.67	27.22	11.71	1.18	4.08
UA-71	76.50	166.02	103.02	7.84	104.75	10.42	18.00	27.13	11.67	1.18	3.42
UA-83	77.00	166.08	98.42	8.67	115.25	10.33	19.67	27.46	11.81	1.19	2.58
UA-87	76.50	162.57	93.16	8.50	115.58	11.33	21.17	26.51	11.41	1.14	3.29
UA-90	75.67	165.58	94.67	9.08	104.42	10.83	21.50	26.70	11.49	1.16	3.58
UA-113	76.50	162.43	97.58	8.92	107.17	9.92	21.08	25.23	10.88	1.08	3.75
UA-125	77.83	164.58	95.17	7.50	113.08	10.25	21.08	23.49	9.78	1.02	4.00
UA-127	75.33	164.00	97.33	8.68	114.25	10.67	21.79	25.56	11.02	1.09	3.49
UA-131	75.75	166.42	103.46	8.42	113.58	10.75	21.71	25.46	10.98	1.09	3.04
UA-141	76.08	164.91	99.83	9.25	112.67	9.50	22.00	25.14	10.35	1.12	2.62
UA-149	76.42	166.50	98.25	9.00	136.08	10.59	21.84	25.93	10.88	1.08	2.42
UA-168	75.34	166.67	98.08	8.67	109.67	11.58	21.17	24.23	10.46	1.02	2.67
UA-169	76.50	166.17	100.75	8.33	122.34	10.75	22.25	22.92	8.26	1.06	3.38
UA-175	75.83	167.50	96.83	8.67	127.57	10.58	22.34	24.61	10.62	1.04	3.62
UA-191	77.08	168.01	101.50	8.42	129.33	11.75	22.50	24.61	10.62	1.03	4.17
GA-1	76.50	163.49	98.25	9.08	146.30	9.92	22.92	26.51	11.27	1.13	3.79
UA-1	76.83	163.84	94.39	8.59	141.08	10.83	21.50	29.10	11.43	1.15	3.91
Local check	76.50	162.33	99.08	8.75	130.67	10.92	22.54	27.96	11.65	1.17	3.21
GM	76.43	165.22	97.35	8.67	118.17	10.53	20.73	26.29	11.14	1.13	3.45
SEm	1.34	3.01	1.71	0.17	2.45	0.21	0.43	0.51	0.21	0.02	0.06
CD5%	3.74	8.38	4.77	0.46	6.82	0.58	1.20	1.43	0.57	0.06	0.18
CD1%	4.93	11.06	6.29	0.61	8.99	0.77	1.58	1.89	0.76	0.08	0.24
CV%	6.08	6.31	6.09	6.65	7.17	6.90	7.17	6.76	6.41	6.38	6.47

The phenotypic and genotypic coefficient of variation was higher for oil content (17.36 and 15.35) followed by number of umbels per plant (14.83 and 9.11) and seeds per umbelet (11.42 and 9.01) and lowest for plant height (6.39 and 2.97). These results showed that higher magnitude of genotypic coefficient of variation for the above traits offer a better opportunity for improvement through selection. The results are in consonance with Singh *et al.,* (2006), Pathak *et al.,* (2014) and Ghanshyam *et al.,* (2015).

The genotypic coefficient of variation provides help to measure the genetic variability in a character and accordingly, it is not possible to partition existing heritable variation in population based solely on this estimate. Burton (1953) suggested that genotypic coefficient of variation together with heritability estimates would give the best result of the amount of genetic advance to be expected from selection. High estimates of heritability (broad sense) were obtained for all the characters. The heritability in broad sense ranged from (21.57 -78.20). Higher value of heritability was obtained for oil content (78.20) and seeds per umbelet (62.25), while number of umbelets per umbel (19.36) showed the lowest value of heritability. Similar results have been reported by Krishnamoorthy and Madalageri (2002), Singh *et al.,* (2006), Pathak *et al.,* (2014) and Ghanshyam *et al.,* (2015).

The genetic advance as per cent of mean ranged between 2.84 % and 27.97%. High genetic advance as percent of mean was recorded for oil content (27.97%) followed by seeds per umbelet (14.64%) and number of umbel per plant (11.52%). However, the heritability estimates along with genetic advance is more useful than heritability values alone for selecting individual. From the above findings oil content seeds per umbelet and number of umbel per plant possessed greater estimates of genetic advance as per cent of mean coupled with high amount of heritability indicating that these traits are governed by additive gene action and continued selection would be helpful in modifying the selection procedure. The characters numbers of umbelets per umbel and plant height showed low heritability with low genetic advance as per cent of mean indicated non-additive gene ac tion and can be improved through multiple crosses. Similar findings have been reported by Pathak *et al.,* (2014) and Ghanshyam *et al.,* (2015). High estimates of heritability along with high genetic advance provide good scope for further improvement in advance generation if characters subject to mass progeny or family selection.

From the result out of 11 characters studied oil content, number of umbels per plant and seeds per umbelet showed high GCV and heritability coupled with high genetic advance as per cent of mean which revealed that these three traits might be under control of additive gene effects and therefore they are more reliable for effective selection.

References

Ajibouri, H.A., Millar, P.A. and Robinson, H.F. 1958. Genotype and environmental origin. *Agronomy J.,* 50: 633-637.

Anonymous. 2014a. Department of Agriculture Cooperation and Statistics, India

Anonymous. 2014b. National Horticulture Board New Delhi.

AOAC. 1965."Official Methods for oil analysis for association of Official Agricultural Chemists, Washington" 10th Ed., D.C.

Dashora, A. and Sastry, E.V.D. 2011. Variability, character association and path coefficient analysis in fennel. *Indian J. Horticulture*, 68: 351-356.

Fisher, R.A. 1954. Statistical methods for research workers. 12th Eddn., *Biol. Monograph and Manuals*, 5: 130-131.

Ghanshyam, Dodiya, N.S., Sharma, S.P., Jain, H.K. and Dashora, A. 2015. Assessment of genetic variability, correlation, path analysis for yield and its components in ajwain (*Trachyspermum ammi* L.). *J. Spices and Aromatic Crops*, 24: 43-46.

Krishnamoorthy, V. and Madalageri, M.B. 2002. Variability and correlation studies in ajowan (*Trachyspermum ammi* L.). *J. Med. Aromatic Plant Sci.*, 24: 364-370.

Malhotra, S.K. and Vijay, O.P. 2004. Handbook of Herbs and Spices, Ed. K.V. Peter, Wood head Publishing Ltd. Cambridge, England, 107-116.

Pathak, A.R., Patel, A.I., Joshi, H.K. and Patel, D.A. 2014. Genetic variability, correlation and path coefficient analysis in fenugreek (*Trigonella foenum-graecum* L.). *Trends in Biosci.*, 7: 234-237.

Singh, R.K., Chaudhary, B.D. 1977. Biometrical Methods in Quantitative Genetic Analysis, Kalyani Publishers, New Delhi pp: 252.

Singh, S.P., Prasad, R. and Singh. D. 2006. Variability and character association of grain yield and its component character in coriander. *J. Appl. Biosci.*, 32: 64-67.

How to cite this article:

Monika Meena, N.S. Dodiya, Baudh Bharti, Ram Kunwar and Brajendra 2017. Genetic Characterization for Seed Yield, Its Contributing Traits and Oil Content in Ajwain (*Trachyspermum ammi* L.) Over the Environments. *Int.J.Curr.Microbiol.App.Sci*. 6(4): 1947-1953. doi: https://doi.org/10.20546/ijcmas.2017.604.232