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Heritability and Genetic Advance for Yield and Its Attributes in Coriander

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A B S T R A C T

The present study was conducted during rabi season in the year 2015-2016 at HCRI Venkataramannagudem, Andhra Pradesh. Thirty coriander (Coriandrum sativum L.) genotypes were evaluated to estimate the correlation coefficient in Randomized Complete Block Design with two replications. In the present study, GV, PV, GCV and PCV values were recorded at high range the traits fresh weight (g), dry weight (g), number of umbels per plant, harvest index (%), oil content (%) and grain yield per plant (g) indicating the existence of more variability for these traits among the genotypes. Moderate to low variability was recorded for plant height, number of primary branches per plant, number of secondary branches per plant, number of leaves, leaf area, days taken to 50% flowering, number of umbellets per umbel, umbel diameter, number of schizocarps per umbel, number of schizocarps per plant, days taken to maturity, herbage yield (g) and thousand seed weight (g) since they had moderate to low GCV and PCV values. High heritability coupled with high genetic advance as per cent of mean indicates the operation of additive gene action as observed in case of number of primary branches per plant, fresh weight (g), dry weight (g), number of umbels per plant, number of schizocarps per umbel, number of schizocarps per plant, herbage yield (g), harvest index (%), oil content (%) and grain yield per plant (g). Hence, direct selection based on these traits in genetically diverse material could be effective for desired improvement. Moderate genetic advance as per cent of mean with high or moderate heritability indicates the action of both additive and non-additive genes as computed in case of plant height, number of secondary branches per plant, number of leaves, leaf area, days taken to 50% flowering, number of umbellets per umbel, umbel diameter (cm), days taken to maturity and thousand seed weight (g) and therefore selection based on these traits may not be of great advantage.

Introduction

Coriander (*Coriandrum sativum* L.) is a native of Mediterranean region wherefrom its spread to Europe, Asia, North and South – America and Australia. It is the most important seed spice crop cultivated throughout the world both for seed and leaf purpose. It is grown in more than fifty countries with India at ranking 1st, both in area and production followed by

Mexico, China, former Soviet Union, Central America and South America (Morales-Payan, 2011). The crop grows in tropics and requires a cool but comparatively dry frost-free climate, particularly at flowering and seed formation stages (Sharma and Sharma, 2004). It is grown in almost all the states of India either for grain or leaf or dual purpose. In India the crop is cultivated mainly in Rajasthan, Madhya Pradesh, Andhra Pradesh, Orissa, Tamil Nadu and Karnataka on an area of 5.43 lakh ha with a production of 5.24 lakh metric tonnes (Tiwari, 2014). The average crop productivity is only 965 kg ha**-1** and is much lower in rainfed farming situation (477 kg ha-**1**). The low productivity under rainfed situation is mainly due to terminal moisture stress that affects growth and productivity. Growing coriander in rainfed in Godavari zone farming situation demands highly productive types with short (75 days) to medium (85-100 days) duration for cultivation. Locally grown indigenous genotypes are low in productivity and give poor returns to the farmers. Critical evaluation of available selections of improved types with high yield potential/ traits is of great value to the breeder for crop improvement (Moniruzzaman, 2013). Mengesha and Getinetalemaw (2010) evaluated some Ethiopian coriander genotypes and reported that identification and evaluation of elite or promising genotypes for yield and quality is an important crop improvement strategy. Sarada and Giridhar (2009, 2011) opined that it is possible to realize 1500 kg ha-1 under rainfed conditions if a proper combination of genotypes and management are available to the farmers. Keeping this in view, the present study was undertaken to evaluate promising diverse genotypes from Godavri zone of Andhra Pradesh. Correlation will establishes the extent of association between yield and its component and also bring out the relative importance gives a clear understanding of their association with yield. Keeping this in view, the present investigation was done to know the association among characters analysis in coriander.

Materials and Methods

The present investigation entitled "Evaluation of Coriander *(Coriandrum sativum* L.) Genotypes in Godavari Zone of Andhra Pradesh" was carried out during the year 2015-16 at Horticulture College and Research Institute, Dr. Y.S.R Horticultural University, Venkataramannagudem, West Godavari District. The location falls under Agro-climatic zone-10, humid, East Coast Plain and Hills (Krishna-Godavari zone) with an average annual rainfall of 900 mm at an altitude of 34 m (112 feet) above mean sea level. The geo-graphical situation is 16^{o} $63^{'}$ $120^{"}$ N latitude and 81^{o} $27^{'}$ $568^{"}$ E longitude. It experiences hot humid summer and mild winter. A total of thirty genotypes were taken for evaluation study out of which fifteen genotypes were sourced from HRS Devihosur (Haveri) Karnataka (Ranibennur-1, Ranibennur-2, Ranibennur-3, Byadagi-1, Hangel-1, Hangel-2, Savanur-1, Savanur-2, Savanur-3, Hirekerur-1, Hirekerur-2, Hirekerur-3, Shiggaon-1, Shiggaon-2, Shiggaon-3) whereas, the rest of the accessions were sourced from HRS Lam Guntur, Andhra Pradesh (LCC-200, LCC-331, LCC-321, LCC-323, LCC-325, LCC-334, LCC-335, LCC-316, LCC-328, LCC-320, LCC-317, LCC-319 and LCC-322; and two checks *viz.*, AD-1 (local check) and Suguna (commercial check). The experiment was laid out in RBD with two replications and thirty genotypes. The observations were recorded on various growth, seed yield and quality parameters. The crop was raised at a plant spacing of 30 cm x 15 cm. The seed were sown during 2nd of November and harvested during 2^{nd} fortnight of February. A basal fertilizer dose of 35 kg N, 35 kg P2O5 and 35 kg K2O ha-1 was given at the time of soil

preparation each year. Soil was prepared to a fine tilth and the seed sown in rows using a labor. At 20 days after sowing (DAS), the plants were thinned 15 cm apart to maintain a uniform plant population. Need-based plant protection measures were taken up to raise a healthy crop. Plants were uprooted at harvest. Threshing was done with wooden sticks and seeds winnowed to remove any impurities. Five randomly selected plants from each replication were used for recording of yield attributes.

Results and Discussion

The population means, ranges, genotypic coefficients of variation (GCV), phenotypic coefficients of variation (PCV), heritability, genetic advance and genetic advance as per cent of mean (GAM) values for different quantitative characters are presented in table 17.

The estimates of phenotypic variance were higher than those of genotypic variance for all the traits, thereby indicating the influence of environment in the expression of these traits. Since these estimates solely do not provide means to assess the nature of genetic variability, phenotypic and genotypic coefficients of variation were also computed. The PCV was significantly higher than GCV for most of the traits under study confirming the environmental intervention.

Plant height (cm)

The phenotypic variance (PV) and genotypic variance (GV) recorded for plant height were 38.20 and 34.68, respectively. The phenotypic coefficient of variation (PCV) (10.361) for this character was moderate and the genotypic coefficient of variation (GCV) (9.872) was low. This trait recorded high heritability of 90.77 per cent with moderate genetic advance as per cent of mean (GAM) (19.37%).

The estimates of PCV and GCV were distant to each other for this character which indicated that plant height was much influenced by environmental factors. Moderate PCV and low GCV for this attribute was in conformity with Nilkolay *et al.* (2014) in coriander. And also presence of high heritability was in agreement with Nilkolay *et al.* (2014) in coriander. Similar results were found by Patahk *et al.* (2014) in fenugreek.

Number of primary branches per plant

The PV and GV recorded for number of primary branches per plant were 17.08 and 12.09 respectively. A high PCV (22.63) and moderate GCV (19.04) were estimated for this trait. This character exhibited high heritability (70.79%) coupled with high GAM (33.012%).

The presence of high heritability was in agreement with Nilkolay *et al.* (2014) in coriander, Patahk *et al.* (2014) in fenugreek, and Patel *et al*. (2008) in fennel. High heritability in conjunction with high GAM was observed for this trait indicating the preponderance of additive gene action governing the inheritance of this character and offers the best possibility of improvement through simple selection procedures.

Number of secondary branches

The PV and GV recorded for number of secondary branches were 7.99 and 4.42, respectively. The estimates of PCV (23.43) high and GCV (17.43) were in moderate range. A moderate heritability (55.33%) coupled with high GAM (26.71) was recorded for this trait.

The moderate estimates of GCV for this character are in line with the findings of Patahk *et al.* (2014) in fenugreek. The high GAM observed for this trait, may be attributed to the preponderance of additive gene action

and that these characters possessed a high selection value. These outcomes are in accordance with the findings of Patahk *et al.* (2014).

Number of leaves

The number of leaves recorded a PV of 15.55 and GV of 10.41. Values in low range were estimated for both PCV (4.05) and GCV (3.31). A high heritability of 66.90 per cent with low GAM (5.59%) was recorded for this trait.

The high heritability for this trait indicates the prevalence of additive gene action in governing the inheritance of this character, however since the GAM is in low range the expected improvement could be lesser.

Leaf area (cm^2)

The PV and GV recorded for leaf area were 16.96 and 14.68 respectively. A low PCV and GCV (5.601 and 5.211 respectively) was recorded for this character. Very high heritability at 86.56 per cent with low GAM (9.987 %) was recorded for this trait.

The very high heritability for this trait indicates the prevalence of additive gene action in governing the inheritance of this character, however since the GAM is in low range the expected improvement could be lesser. According to Meena *et al*. (2014) in coriander.

Fresh weight of whole plant (g)

The PV and GV recorded for fresh weight were 289.02 and 286.48 respectively. PCV and GCV was high (23.85, and 23.7 respectively). Very high heritability of 99.12 per cent and very high GAM (48.709 %) were recorded for fresh weight. High PCV for this attribute was in conformity with conclusions with Singh *et al.* (2005) in coriander.

Dry weight of whole plant (g)

PV and GV recorded for dry weight were 8.11 and 6.41 respectively. The PCV and GCV were high (24.80 and 22.06 respectively). High heritability of 79.11 percent was recorded along with a high GAM of 40.43 per cent for this character.

The estimates of PCV and GCV were high for this trait and similar results were found by Singh *et al.* (2005) in coriander, High heritability and GAM was observed for this character and the similar results were found by high heritability estimates are reported by Singh *et al.* (2008), Rajput and Singh (2003), indicating that these characters are less influenced by environmental factors and are under the control of additive gene effect for improvement for such character would be rewarding. High heritability with high GAM for this trait indicates the preponderance of additive gene action governing the inheritance of this character and offers the best possibility of improvement through simple selection procedure.

Days to 50 % flowering

This trait recorded PV and GV values as 4.89 and 43.33 respectively. The estimates of PCV and GCV (4.38 and 3.61, respectively) were at low range. This character exhibited higher heritability (68.11 %) coupled with low GAM of 6.15 per cent.

Low estimates of PCV and GCV recorded for this trait indicated the presence of less genetic variability as a result of which less scope for selection. Similar results were found by Singh and Choudhray (2008) in Ajowan, and High heritability for this character was also estimated by the earlier workers Meena *et al.* (2014) in coriander, and Patel *et al.* (2008) in fennel.

Table 22 Estimates of mean, range of various characters along with top ranking genotypes in coriander

S.No.	Characters	Mean	Range		Top ranking genotypes	Commercial check	Local check
			Minimum	Maximum			
1	Plant height at 60DAS(cm)	59.65	49.09	71.81	LCC-322 (71.81), LCC-200 (69.64), LCC-319 (68.27), LCC-334 (67.94), LCC-323 (65.95)	Suguna (54.29)	AD-1 (58.69)
2	Number of primary branches at 60DAS	18.256	9.28	29.15	LCC-335 (29.15), LCC-316 (23.01), LCC-331 (22.68), LCC-328 (22.41), LCC-334 (21.84).	Suguna (18.69)	AD-1 (18.50)
3	Number of secondary branches at 60DAS	12.056	7	18.3	LCC-332(18.29), LCC-335(17.40), Shiggaon-3(214.32), Ranibennur-1(14.08), LCC-317(14.04).	Suguna (12.39)	AD-1 (13.56)
4	Number of leaves at 60DAS	97.222	90.3	103.56	LCC-331 (103.56), Byadagi-1 (103.05), LCC-321(101.95), Hirekerur-2 (101.61), LCC-316 (101.56)	Suguna (91.91)	AD-1 (99.07)
5	Leaf area at 60DAS(cm)	73.533	65.68	79.99	LCC-325 (79.99), LCC-320 (79.27), Hangel-1 (78.71), LCC-328 (77.59), LCC-316 (77.38)	Suguna (70.72)	AD-1 (71.58)
6	Fresh weight at 60DAS(g)	71.269	7.04	19.18	LCC-200 (19.18), LCC-325 (18.69), LCC-321 (18.34), LCC-323 (18.20), LCC-328 (17.92)	Suguna (16.24)	AD-1 (14.21)
7	Dry weight at 60DAS (g)	11.478	1.42	3.17	LCC-317 (3.17), LCC-323 (3.15), LCC-328 (3.02), LCC-320 (2.94), Shiggaon-3 (2.86)	Suguna (2.61)	AD-1 (2.81)
8	Days taken for flower initiation	41.47	39.5	44.5	LCC-316 (39.50), LCC-335 (40), LCC-328 (40), Hangel-2 (41), Savanur-2 (41).	Suguna (41.00)	AD-1 (41.00)
9	Days taken to 50%flowering	50.435	47.24	54.6	LCC-335 (47.24), LCC-328 (47.71), Savanur-2 (47.71), Savanur-1 (48.18), AD-1 (48.29).	Suguna (50.40)	AD-1 (48.29)
10	Days taken for complete flowering	55.67	54	59.5	Shiggaon-1, AD-1, Suguna, LCC-200 and LCC-331(54)	Suguna (54.00)	AD-1 (54.00)

11	Number of umbels per plant	30.345	21.32	42.43	LCC-316 (42.43), LCC-320 (40.68), LCC-322 (39.60), LCC-319 (38.01), LCC-334 (36.96).	Suguna (33.39)	AD-1 (34.62)
12	Number of umbllets per umbel	7.436	6.5	8.4	LCC-331 (8.40), LCC-200 (8.38), LCC-322 (8.28), Hangel-2 (8.24), LCC-319(8.19).	Suguna (7.14)	AD-1 (7.60)
13	Umbel diameter (cm)	4.851	3.63	5.74	Hirekerur-1 (5.74), LCC-331 (5.73), LCC-317 (5.68), LCC-321 (5.57), Ranibennur-2 (5.48)	Suguna (4.66)	AD-1 (3.82)
14	Number of schizocarps per umbel	32.023	23.33	41.58	LCC-319 (41.58), LCC-316 (39.08), LCC-331 (36.96), AD-1 (36.78), Savanur-3 (36.49),	Suguna (24.36)	AD-1 (36.78)
15	Number of schizocarps per umbellets	4.89	3.9	5.9	LCC-317 (5.90), LCC-319 (5.60), LCC-316 (5.50), Savanur-2 (5.40), Suguna (5.32).	Suguna (5.32)	AD-1 (3.90)
16	Number of schizocarps per plant	188.805	144.05	228.04	LCC-317 (228.04), LCC-321 (218.02), LCC-335 (216.61), LCC-331 (213.48), Suguna (213.06).	Suguna (213.06)	AD-1 (144.05)
17	Days taken to maturity	95.398	89.18	106.6	Savanur-1 (89.18), Savanur-2 and Hirekerur-2 (89.32), Hirekerur-1 (89.61), Hirekerur-3 (90.86).	Suguna (95.55)	AD-1 (94.53)
18	Herbage yield (g)	6.413	4.33	8.12	Shiggaon -3 (8.12), LCC-328 (8.06), LCC-325 (7.63), AD-1 (7.61), LCC-200 (7.59).	Suguna (7.12)	AD-1 (7.61)
19	Biomass production (g)	28.92	18.51	46.35	LCC-321 (46.35), LCC-331 (43.43), LCC-328 (38.22), LCC-316 (38.01), LCC-334 (37.41).	Suguna (30.00)	AD-1 9(22.50)
20	Harvest index (%)	35.227	21.02	57.75	Suguna (57.75), Shiggaon-3 (54.60), Hirekerur-2 (53.49), Savanur-2 (45.56), Savanur-3 (43.26).	Suguna (57.75)	AD-1 (41.10)
21	Thousand grain weight (g)	10.556	8.6	12.05	LCC-322 (12.05), LCC-335 (11.81), LCC-321 (11.47), LCC-200 (11.45), Shiggaon-3 (11.44).	Suguna (10.88)	AD-1 (10.08)
22	Grain size (mm)	3.64	2.96	4.61	LCC-322 (4.16), LCC-335 (4.07), LCC-321 (3.95),	Suguna (3.75)	AD-1 (3.48)

					Shiggaon-3 (3.95), LCC-334 (3.900.		
23	Oil content (%)	0.292	0.18	0.41	LCC-335 (0.41), LCC-334 (0.39), LCC-316 (0.39), Hirekerur-3 (0.36), Shiggaon-2(0.35).	Suguna (0.24)	AD-1 (0.26)
24	Grain yield per plant (g)	9.963	4.1	17.33	Suguna (17.33), LCC-328 (15.60), LCC-331 (13.80), LCC-316 (13.44), LCC-323 (12.66),	Suguna (17.33)	AD-1 (9.25)
25	Grain yield per plot (g)	119.55	65.8	207.9	Suguna (207.90), LCC-328 (187.20), LCC-331 (165.60), LCC-316 (161.25), LCC-323 (151.92),	Suguna (207.90)	AD-1 (110.97)
26	Grain yield per ha (kg)	296.01	158.94	502.17	Suguna (502.17), LCC-328 (452.17), LCC-331 (400.00), LCC-316 (389.49), LCC-323 (366.96),	Suguna (502.17)	AD-1 (268.04)

Table 17 Mean, Range, Variability, Coefficients of variability, heritability and Genetic advance for different characters in coriander genotypes

Character	GV	PV	GCV	PCV	H2	GA	GAM	Mean	Range
PH60	34.68	38.20	9.872	10.361	90.772	11.557	19.375	59.65	49.09-71.81
NPB60	12.09	17.08	19.045	22.635	70.798	6.026	33.012	18.256	9.28-29.15
NSB60	4.42	7.99	17.436	23.439	55.336	3.221	26.719	12.056	7.0-18.3
NL60	10.41	15.55	3.318	4.056	66.902	5.435	5.59	97.222	90.30-103.56
LA60	14.68	16.96	5.211	5.601	86.564	7.344	9.987	73.533	65.68-79.99
FW60	286.48	289.02	23.749	23.854	99.127	6.943	48.709	71.269	7.04-19.18
DW60	6.41	8.11	22.064	24.805	79.113	0.928	40.431	11.478	1.42-3.17
DT50F	3.33	4.89	3.617	4.383	68.115	3.102	6.15	50.435	47.24-54.60
NUPP	37.92	39.41	20.293	20.689	96.206	12.442	41.003	30.345	21.32-42.43
NULPU	0.24	0.32	6.62	7.597	75.946	0.884	11.885	7.436	6.5-8.4
UD	0.25	0.38	10.384	12.66	67.276	0.851	17.546	4.851	3.63-5.74
NSPU	18.47	20.51	13.422	14.144	90.047	8.402	26.237	32.023	23.33-41.58
NSPP	547.76	578.22	12.396	12.736	94.733	46.926	24.854	188.805	144.05-228.04

DTM	21.14	24.70	4.82	5.21	85.592	8.763	9.186	95.398	89.18-106.60
HY	0.73	1.17	13.291	16.881	61.986	1.382	21.556	6.413	4.33-8.12
HI	100.96	103.48	28.523	28.877	97.561	20.445	58.036	35.227	21.02-57.75
1000SW	0.46	0.93	6.43	9.144	49.441	0.983	9.313	10.556	8.60-12.05
OC	0.00	0.00	20.354	22.962	78.57	0.108	37.166	0.292	0.18-0.41
GYPP	8.51	9.79	29.273	31.402	86.898	5.6	56.213	9.963	4.10-17.33

PH60	Plant height at 60DAS	DT50F	Days taken to 50%flowering	DTM	Days taken to maturity
NPB60	Number of primary branches at 60DAS	NUPP	Number of umbels per plant	HY	Herbage yield
NSB60	Number of secondary branches at 60DAS	NULPU	Number of umbllets per umbel	HI	Harvest index
NL60	Number of leaves at 60DAS	UD	Umbel diameter	1000SW	1000 seed weight
LA60	Leaf area at 60DAS	NSPU	Number of schizocarps per umbel	OC	Oil content
FW60	Fresh weight at 60DAS	NSPP	Number of schizocarps per plant	GYPP	Grain yield per plant
DW60	Dry weight at 60DAS				

Number of umbels per plant

PV and GV for this character were 39.41 and 37.92 respectively. High values of PCV and GCV (20.68 and 20.29 respectively) were estimated for this trait. Very high heritability of 96.20 per cent was recorded with very high GAM of 41.003 per cent for this trait.

The estimates of PCV and GCV were moderate for this trait and the similar results were obtained by Meena *et al.* (2014) in coriander, Patel *et al.* (2008) in fennel. Presence of high heritability and GAM was in agreement with Singh and Choudhray (2008) in Ajowan, Meena *et al.* (2014) in coriander, indicating that these characters are less influenced by environmental factors and are under the control of additive gene effect for improvement for such character would be rewarding.

Number of umbellets per umbel

The PV and GV for number of umbellets per umbel were 0.32 and 0.24 respectively. The estimates of PCV and GCV (7.59 and 6.62 respectively) were in low range. This trait exhibited high heritability of 75.94 per cent coupled with moderate GAM of 11.88 per cent.

The estimates of PCV and GCV were low for this trait and the similar results were found by Singh and Choudhray (2008) in Ajowan. Presence of high heritability was in agreement with Patel *et al.* (2008) in fennel and Meena *et al.* (2014) in coriander.

Umbel diameter (cm)

The PV and GV of 0.38 and 0.25 were recorded for umbel diameter. The estimates of PCV and GCV were in moderate range 12.66 and 10.38 respectively. This character exhibited higher heritability (67.27 %) coupled with moderate GAM of 17.54 per cent.

Number of schizocarps per umbel

This trait recorded PV and GV values as 20.51 and 18.47 respectively. The estimates of PCV and GCV (14.14 and 13.42, respectively) were at moderate range. This character exhibited higher heritability (90.04 %) coupled with high GAM of 26.23 per cent.

Moderate estimates of PCV and GCV recorded for this trait indicated the presence of less genetic variability as a result of which less scope for selection. Similar results were found by Nilkolay *et al.* (2014) in coriander, and High heritability for this character was also estimated by the earlier workers Nilkolay *et al.* (2014) in coriander, Patel *et al.* (2008) in fennel, Meena *et al.* (2014) in coriander.

Number of schizocarps per plant

The PV and GV for this trait were 578.22 and 547.76 respectively. Moderate PCV and GCV of 12.73 and 12.39 respectively were estimated for this character. It has exhibited very high heritability (94.73%) coupled with high GAM of 26.23 per cent.

Days taken for maturity

The PV and GV (24.70 and 21.14 respectively) for this trait with low PCV and GCV of 5.21 and 4.82 per cent respectively. This trait exhibited high heritability of 85.59 per cent coupled with low genetic advance (8.76) and low GAM of 9.186 per cent. High estimates of heritability recorded for this trait indicates presence of more genetic variability and thus more scope for selection of this trait by Meena *et al.* (2014) in coriander. Low GAM indicated that this trait was highly influenced by environment.

Herbage yield (g)

The PV and GV were 1.17 and 0.73 respectively. The PCV and GCV (16.88 and 13.29 respectively) estimates were in moderate range. This trait exhibited high heritability of 61.98 per cent coupled with high GAM of 21.55 per cent.

Harvest index (%)

The PV and GV for harvest index were 103.48 and 100.96 respectively. There were high estimates for PCV and GCV at 28.87 and 28.52 per cent respectively. This trait exhibited very high heritability of 97.56 per cent coupled with very high GAM of 58.03 per cent.

High estimates of PCV, GCV, heritability and GAM recorded for this trait indicates the presence of high genetic variability and thus more scope for selection of this trait similar results recorded by Singh and Choudhray (2008) in Ajowan. High heritability was found by Banerjee and Kole (2004).Presence of high heritability coupled with high genetic advance revealed that straight selection has more scope for further improvement in this character.

Thousand-grain weight (g)

The PV and GV of 0.93 and 0.46 respectively were recorded for thousand seed weight. The estimates of PCV and GCV (9.144 and 6.43 respectively) were at low range. This character recorded a moderate heritability (49.44%) coupled with low GAM of 9.31 per cent.

Low estimates of PCV and GCV recorded for this trait indicates the presence of low degree of genetic variability and thus a limited scope for selection. Similar results were reported by Singh and Choudhray (2008) in Ajowan.

Oil content (%)

The PV and GV for this trait were 0 and 0 respectively. The estimates of PCV and GCV (22.96 and 20.35 respectively) were at high range. This trait exhibited high heritability of 78.89 per cent coupled with high GAM of 37.16 per cent.

High heritability and GAM recorded by this character. Similar work recorded by Patel *et al.* (2008) in fennel

Grain yield per plant (g)

The PV and GV of 9.79 and 8.51 respectively were recorded for this trait. PCV (31.40) and GCV (29.27) were estimated at high range. This trait exhibited high heritability of 86.89 per cent coupled with very high GAM of 56.21 per cent.

High estimates of PCV and GCV recorded for this trait indicates the presence of high degree of genetic variability and thus a greater scope for selection on the basis of this character. Similar results were also reported by Meena *et al.* (2014) in coriander, Singh and Choudhray (2008) in Ajowan, Patahk *et al.* (2014) in fenugreek and Anubha *et al* (2013). High heritability in conjunction with high GAM was observed for this trait which indicates the preponderance of additive gene action governing the inheritance of this character and offers the best possibility of improvement through simple selection procedure. These results are in accordance with the conclusions of Singh and Choudhray (2008) in Ajowan.

In the present study, GV, PV, GCV and PCV values were recorded at high range the traits fresh weight (g), dry weight (g), number of umbels per plant, harvest index (%), oil content (%) and grain yield per plant (g) indicating the existence of more variability

for these traits among the genotypes. Moderate to low variability was recorded for plant height, number of primary branches per plant, number of secondary branches per plant, number of leaves, leaf area, days taken to 50% flowering, number of umbellets per umbel, umbel diameter, number of schizocarps per umbel, number of schizocarps per plant, days taken to maturity, herbage yield (g) and thousand seed weight (g) since they had moderate to low GCV and PCV values.

High heritability coupled with high genetic advance as per cent of mean indicates the operation of additive gene action as observed in case of number of primary branches per plant, fresh weight (g), dry weight (g), number of umbels per plant, number of schizocarps per umbel, number of schizocarps per plant, herbage yield (g), harvest index (%), oil content (%) and grain yield per plant (g). Hence, direct selection based on these traits in genetically diverse material could be effective for desired improvement. Moderate genetic advance as per cent of mean with high or moderate heritability indicates the action of both additive and non-additive genes as computed in case of plant height, number of secondary branches per plant, number of leaves, leaf area, days taken to 50% flowering, number of umbellets per umbel, umbel diameter (cm), days taken to maturity and thousand seed weight (g) and therefore selection based on these traits may not be of great advantage.

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