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Research Article

ESTIMATES OF GENETIC VARIABILITY AND CORRELATION STUDIES IN CUMIN

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Abstract- Twenty genotypes of cumin were evaluated in normal, salinity and moisture stress conditions during R*abi* 2005-06 for nine quantitative traits to estimate the nature and magnitude of variability, heritability (bs), genetic advance as % of mean and interrelationship among the traits. Analysis of variance indicated significant variability for all the traits. High estimates of phenotypic coefficient of variation (PCV) along with genetic coefficient of variation (GCV) were observed for biological yield, seed yield, plant height and number of umbels/plant in all the three environments. High variability were observed for branches/plant, umbels/plant, 1000 seed weight and seed yield under stress condition while, days to 50 % flowering, plant weight and 1000 seed weight was under normal condition. The genetic advance was found high for seed yield, biological yield, branches/plant and umbels/plant in stress condition while high genetic advance for plant height, biological yield and seed yield in normal condition. A considerable variation was observed in normal condition in compared to salinity and moisture stress condition for most of the traits, which was confirmed, by high mean and wide range of variation as evidenced by high PCV and GCV values. Significant and positive correlation of seed yield was observed with seeds/plant and biological yield in stress condition but in normal condition, seed yield has positive correlation with branches/plant.

Keywords- Genetic variability, Heritability, Genetic advances, Correlation coefficient, Cumin

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Introduction

Cumin is an important spice crop grown in Rajasthan and Gujarat. It is an autogamous and mainly cultivated for seed, which is used in flavoring, vegetables, pickles, soups, sausages, cheese and biscuits. The typical aroma in cumin is due to presence of cuminol or cumin aldehyde (19.25-27.02%) in its volatile oil of the seed [1]. Cumin seed is extensively used in Aururvidic medicine also. In Rajasthan cumin is successfully cultivated in the moisture and salt stress affected soils. Salinity is a problem of increasing in dimension and is restricting in cultivation of crop throughout the world. In India, too salinity is affecting large tracks of land mainly in arid tracts where channel irrigation has been provided recently. In semi arid regions of Rajasthan the problems of salinity is wide spread and is too prolonged due to continuous use of salinity water and inherent salinity of the soil itself. In addition to the salinity drought is another common adverse environment factor limiting crops production particularly is tropical and subtropical regions. In India majority of cultivation is still depends on rainfall and conserved moisture thus, present study was conceived with objective to estimate the magnitude and direction of variability with inter-relationships of super genotypes for obtaining higher yield of cumin.

Materials and Methods

An experiment was conducted with twenty genotypes of cumin during *rabi* 2005-2006 at agricultural research farm of department of plant breeding & genetics, SKN College of Agriculture, Jobner in the Randomized Block Design (RBD) with three replications under three environments with normal salinity and moisture stress condition. The row-to-row and plant-to-plant spacing of 30 x 10 cm was maintained. The standard package of practices for cumin cultivation was adopted during the course of experimentation. Ten randomly selected plants from each genotype from each replication for recording observations of nine quantitative characters like seed yield. Two characters *viz*; 50 % days to flowering and 50 % days to maturity were computed on whole plant basis. The mean data after computing for characters were subjected to standard methods of analysis of variance [5]. Genetic and phenotypic coefficient of variance, heritability (bs) and genetic advance as per cent of mean were estimated by the formula as suggestion by [4].

Results and discussion

The analysis of variance indicated significant difference among all the traits in all the three environment. The extent of variability with respect to various character in diverse genotype of cumin measured in terms of general mean range under the C_1, C_2 and C_3 environments [Table-1]. The highest mean value of plant height (25.33 cm), umbels per plant (10.96), umbellets per umbel (4.54), seeds per umbel (24.09), biological yield (24.00) and seed yield (13.09) was observed in normal condition followed by moisture stress and saline condition whereas days to 50 % flowering (75.28), branches per plant (21.38) 1000 seed weight (3.70 g) shows highest value in moisture stress condition followed by normal and salinity condition.

The characters like umbels per plant, umbellets per umbel, seeds per umbel, biological yield, 1000 seed weight and seed yield shows widest range in normal condition followed by moisture stress condition and lowest in salinity conditions were found. Data depicted in [Table-2] revealed that phenotypic variances was found higher than the genetic variances for all the characters thus indicated the influences of environmental factors on these traits. Highest phenotypic & genotypic variances was observed for seed yield (26.72 and 30.23), respectively followed by biological yield (31.00 and 17.4), umbels per plant (17.23 and 12.64), branches per plant (17.24 and 16.09) and plant height (20.69 and 16.09) in salinity

Table-1 *Mean Range and SE± value for nine quantity traits of cumin genotypes under three environments (C_1, C_2 and C_3)*

Traits	Normal moisture			Salinity condition			Moisture stress condition		
	Mean	Range	SE±	Mean	Range	SE±	Mean	Range	SE±
Days to 50 % flowering	74.562	71.30-78.0	0.58	74.98	73.0-78.70	0.83	75.28	72.0-77.00	0.70
Plant height (cm)	25.33	21.17-29.23	0.79	17.02	11.03-21.00	1.28	21.38	17.73-25.56	1.58
Branches/plant	4.20	3.77-4.83	0.19	3.03	2.03-3.70	0.21	4.32	3.63-4.83	0.12
Umbels/plant	1.096	8.73-12-70	0.63	4.71	3.87-5.77	0.32	10.82	8.07-13.47	0.52
Umbellets/umbel	4.54	4.17-4.90	0.16	3.80	3.30-4.20	0.14	4.25	3.90-4.73	0.17
Seeds/umbel	24.09	20.47-27.60	0.93	14.04	11.20-17.37	0.72	20.50	17.73-23-90	1.18
1000 seed weight (g)	3.66	3.10-4.05	0.04	3.52	2.89-3.61	0.12	3.70	3.23-4.14	0.05
Biological yield (g)	24.00	18.16-33.23	1.17	8.55	4.48-11.77	1.27	18.24	11.46-23-36	1.77
Seed yield (g)	13.09	1079-16.48	1.04	4.49	2.69-7.39	0.37	10.75	8.41-14.85	0.89

Table-2 *Estimates of genetic variability parameters for yield and yield attributing traits of cumin genotypes under three environments (C_1, C_2 and C_3)*

Character	Environment	Coefficient of variation		Heritability (bs) %	Genetic advance as % of mean
		GCV (%)	PCV (%)		
Days to 50 % flowering	C_1	1.84	2.28	65.33	3.07
	C_2	1.32	2.33	32.20	1.54
	C_3	1.73	2.36	53.74	2.61
Plant hight (cm)	C_1	9.00	11.17	64.92	14.94
	C_2	16.09	20.69	60.49	25.78
	C_3	9.06	15.66	33.50	10.80
Branche/plant	C_1	5.05	9.28	29.59	5.66
	C_2	12.48	17.24	52.43	18.62
	C_3	8.80	10.09	76.07	15.82
Umbels/plant	C_1	8.18	13.51	36.71	10.22
	C_2	12.64	17.29	53.82	19.11
	C_3	13.77	16.08	73.35	24.30
Umbellets/umbel	C_1	3.45	7.05	23.97	3.48
	C_2	5.31	8.33	40.58	6.97
	C_3	2.56	7.24	12.57	1.86
Seeds/umbel	C_1	5.99	8.96	44.80	8.27
	C_2	9.57	12.97	53.70	14.35
	C_3	6.14	11.68	27.65	6.65
1000 seed weight (g)	C_1	6.92	7.19	92.55	13.72
	C_2	6.82	9.24	54.57	10.39
	C_3	7.32	7.66	91.26	14.41
Biological yield	C_1	12.28	17.78	47.55	17.48
	C_2	17.40	31.00	31.52	20.13
	C_3	16.53	23.56	49.24	23.90
Seed yield	C_1	10.34	17.20	36.13	12.80
	C_2	26.72	30.23	78.13	48.66
	C_3	15.27	20.39	54.40	22.8

condition. In all traits per-cent PCV and GCV was higher in salinity condition followed by moisture stress condition and normal condition for all the characters. Similar findings were reported by [8,7] in fennel and [9] in wheat under salinity condition. High heritability coupled with high genetic advance as percentage of mean (GAM) was recorded for branches per plant (52.43 and 18.62), umbellets per umbel (40.58 and 6.97), seeds per umbel (53.70 and 14.53) and seed yield (78.13 and 48.60) under salinity condition [8,7]. Whereas, the characters *viz*; umbels per plant (73.35 and 24.30) and biological yield (49.29 and 23.90) shows higher heritability & high genetic advance in moisture stress condition. Under normal condition traits like days to 50 % flowering (63.33 & 3.07) and 1000 seed weight (92.55 and 13.72) showed high heritability coupled with high genetic advance. Similar findings reported by [2] in cumin.

In general, heritability and genetic advance are important selection parameters. High heritability estimated along with high genetic advance is more helpful in predicting the gain under selection than the heritability alone. However, it is not necessary that a character showing high heritability will also exhibit high genetic advance [4]. Heritability is a good index of transmission of characters from parents to it progeny. The estimates of heritability help the plant breeder in selection of elite genotypes from diverse genetic population.

The phenotypic as well as genotypic correlation between different pairs of traits [Table-3] showed higher estimates of genetic correlation coefficient than the corresponding phenotypic. This indicated little role of environment in the expression of genetic relationship on the genotypes. In general, the genotypic correlation coefficients were greater than the corresponding phenotypic and environmental correlation coefficient, which indicated higher degree of association between two traits of phenotypic levels.

In the present study, branches per plant had positive and significant correlation at phenotypic with seed yield in normal condition as well as salinity condition. Whereas, under salinity and moisture stress conditions seeds per umbel and biological yield have positive and significant correlation with seed yield. Similar results were also reported by [3] in fennel and [6] in cumin.

The salinity as well as stress tolerant genotypes of cumin are forthcoming option in changing scenario of climate and undergoing degradation of underground water used for irrigation in the regions of western Rajasthan and adjoining parts of Gujarat.

Conflict of Interest: None declared

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Table-3 *Estimates of genotypic (g) and phenotypic (p) correlation coefficient for yield and its attributes under three environments of cumin (C_1, C_2 and C_3)*

Traits			X_1 DF	X_2 Pt ht	X_3 Br/pt	X_4 um/pt	X_5 Um/um	X_6 Seeds/um	X_7 1000 seed wt	X_8 Bio yd	X_9 Seed yd
X_1 days to flowering	G	C_1	-	-0.855	0.319	0.195	0.678	-0.169	0.201	-0.147	-0.124
		C_2	-	-0.933	0.288	0.078	0.338	-0.052	-0.766	-0.480	-0.198
		C_3	-	-0.770	0.747	0.296	0.856	0.279	0.503	0.141	0.244
	P	C_1	-	-0.583**	0.205	0.092	0.334*	0.008	0.152	-0.032	-0.022
		C_2	-	-0.347	0.303	0.117	0.173	-0.004	-0.234	-0.090	-0.101
		C_3	-	-0.525**	0.399	0.158	0.190	0.086	0.311	0.219	0.110
X_2 plant height	G	C_1	-	-	-0.138	0.136	-0.627	0.464	-0.321	0.243	0.249
		C_2	-	-	0.761	0.044	-0.304	0.423	0.363	0.460	0.594
		C_3	-	-	0.052	0.181	-0.710	0.279	-0.300	0.276	0.372
	P	C_1	-	-	-0.019	0.164	-0.188	0.423**	-0.215	0.188	0.160
		C_2	-	-	0.220	0.133	0.003	0.205	0.042	0.306	0.432**
		C_3	-	-	0.096	0.185	-0.114	0.461**	-0.226	-0.030	0.243
X_3branches/plant	G	C_1	-	-	-	0.152	0.290	0.217	0.152	0.935**	0.417
		C_2	-	-	-	0.891	0.697	0.715	0.342	0.575	0.718
		C_3	-	-	-	0.649	0.569	0.542	0.261	0.394	0.483
	P	C_1	-	-	-	0.104	0.308	0.171	0.106	0.384*	0.488**
		C_2	-	-	-	0.662**	0.421**	0.560**	0.177	0.499**	0.542**
		C_3	-	-	-	0.469**	0.223	0.244	0.283	0.209	0.272
X_4 umbels/plant	G	C_1	-	-	-	-	-0.646	-0.213	-0.036	0.343	-0.023
		C_2	-	-	-	-	0.639	0.743	0.705	0.858	0.763
		C_3	-	-	-	-	-0.466	0.213	0.350	0.219	0.184
	P	C_1	-	-	-	-	-0.106	-0.049	-0.019	0.149	0.140
		C_2	-	-	-	-	0.456**	0.651**	0.335*	0.604**	0.649**
		C_3	-	-	-	-	-0.001	0.255	0.322	0.102	0.173
X_5 umbellets/umbel	G	C_1	-	-	-	-	-	0.620	0.080	0.454	-0.149
		C_2	-	-	-	-	-	0.606	0.660	0.629	0.449
		C_3	-	-	-	-	-	0.374	0.155	0.388	0.476
	P	C_1	-	-	-	-	-	0.300	0.005	-0.619**	0.168
		C_2	-	-	-	-	-	0.414**	0.109	0.350	0.364*
		C_3	-	-	-	-	-	0.319	0.129	-0.100	0.311
X_6 seeds/umbel	G	C_1	-	-	-	-	-	-	-0.041	-0.014	0.045
		C_2	-	-	-	-	-	-	0.491	0.953	0.668
		C_3	-	-	-	-	-	-	-0.160	0.404	0.394
	P	C_1	-	-	-	-	-	-	-0.007	0.028	0.065
		C_2	-	-	-	-	-	-	0.272	0.701**	0.559**
		C_3	-	-	-	-	-	-	-0.086	0.126	0.452**
X_7 1000 seeds wt.	G	C_1	-	-	-	-	-	-	-	0.207	0.323
		C_2	-	-	-	-	-	-	-	0.829	0.691
		C_3	-	-	-	-	-	-	-	0.195	0.085
	P	C_1	-	-	-	-	-	-	-	0.036	0.250
		C_2	-	-	-	-	-	-	-	0.389**	0.429**
		C_3	-	-	-	-	-	-	-	0.147	0.082
X_8 biological yield	G	C_1	-	-	-	-	-	-	-	-	0.289
		C_2	-	-	-	-	-	-	-	-	0.733
		C_3	-	-	-	-	-	-	-	-	0.910
	P	C_1	-	-	-	-	-	-	-	-	0.237
		C_2	-	-	-	-	-	-	-	-	0.575**
		C_3	-	-	-	-	-	-	-	-	0.456**
X_9 seed yield	G	C_1	-	-	-	-	-	-	-	-	-
		C_2	-	-	-	-	-	-	-	-	-
		C_3	-	-	-	-	-	-	-	-	-
	P	C_1	-	-	-	-	-	-	-	-	-
		C_2	-	-	-	-	-	-	-	-	-
		C_3	-	-	-	-	-	-	-	-	-

*No significant ** Significant correlation of seed yield with branches/plant