International J. Seed Spices 6(1), Jan 2016: 90-92

Quantitative genetic analysis for variability studies in cumin (*Cuminum cyminum* L.)

R.S. Meena*, R.K. Solanki and Alka Panwar

ICAR-National Research Centre on Seed Spices, Tabiji-305 206, Ajmer (Rajasthan)

Abstract

In cumin, high estimates (>25 %) of genotypic coefficient of variation (GCV) were recorded for secondary branches (25.62) followed by seed yield/plot (21.85) and umbel/plant (16.89). This indicated presences of adequate genetic variation among the genotypes and sensitivity of the attributes for making further modification by selection. However, the estimates of PCV were higher than corresponding GCV for all the characters explaining environmental factors in influencing their expression. High heritability were obtained for primary branches (48.91%), seeds umbellate^{-1} (43.39 %), seed umbel^{-1} (41.49 %), while it was moderate for umbellate umbel^{-1} (37.85 %), secondary branches (37.84 %), umbel plant^{-1} (37.72 %) and plant height (37.55%), seed yield plot^{-1} (10.61 %), test weight (5.36 %) which clarified that they were least affected by environmental modification and selection based on phenotypic performance would be reliable. High estimates of genetic advance (as percentage of mean) was realized for secondary branches (32.46 %), umbel plant^{-1} (21.36 %), primary branches (19.19%) whereas the value moderate for seed yield plot^{-1} (14.66 %), seed umbel^{-1} (12.23 %) elucidated that they could be improved to a large extent. The path coefficient studies reflected that primary branches, secondary branches and seed per umbel traits had high direct effects on seed yield without having any undesirable negative indirect effects. Nevertheless, it was concluded that primary branches, secondary branches and seed per umbel were the important components in selection for genotypes with higher seed yield per plant .

Keywords: *Genetic variance, correlation, path co-efficient and Cumin*

Introduction

Cumin is an important seed spice crop belonging to family *Apiaceace.* This is low volume and high income crop. It has chromosome number is 2n=14. It is mainly grown in Rajasthan and Gujarat during *Rabi* season and also grown in countries like Bulgaria, Egypt, Argentina, Turkey, Bangladesh, China, Italy, Syria, Pakistan etc. In India the out of the total production of cumin seed Rajasthan state alone contributes around 52% of the total national production. In 2013-14 cumin was grown in 320080 hectares with 163050 tones production in Rajasthan (Source: Spice Board, India).

Cumin is a crop with narrow genetic base, the extent of diversity available in the genus is very low. Explotation of diversity is very much required for improvement. The present crop improvement programme is mainly dependent upon mass selection method. For persuing direct and indirect selection studies are very much required on the assessmen to variability parameters and the association studies of component traits. Cumin crop is susceptible to many pathogens/diseases which effect the seed yield (Dange, 1995 and Sharma *et al*., 2010). Sharma *et al*., (8) reported prevalence of wilt, blight, and powdery mildew in moderate to severe form in Rajasthan and Gujarat State (Khare *et al*., 2014). Environmental conditions and genotype interaction affects the relationships among plant characters. The association and interaction of different traits with yield greatly helps the breeder in selection work with more precession and accuracy. Hence, to understand the crop genetic architecture for knowing the extent of variability and character association a set of 19 genotypes was evaluated at ICAR-NRCSS, Ajmer. The finding of the studies are furnished in the present article.

*Corresponding author email-rsm.nrcs@gmail.com

Materials and methods

Nineteen genotypes were evaluated in Randomized Block Design with three replication at the National Research Centre on Seed Spices, Tabiji, Ajmer during 2011-12. The center is located at 26° 27' 0" N and 74° 38' 0" E latitude and at an altitude of 486 meter above sea level with temperature varying from a minimum of 5-8° C to a maximum of 20-25° C during the cropping season. The soil type is sandy loam. The plot size for each genotype was 3x2 m^2. The entries were raised at 25 x 10 cm spacing. Five plants were randomly selected in each plot and tagged for recording physiological ripening data such as plant height, primary branches, secondary branches, umbel per plant, umbellate per umbel, seed per umbellate, test weight and seed yield as per the descriptor, reported by Kakani *et al*., (2010). Simple linear correlation coefficients were computed and these coefficients were subjected to path analysis as described by Dewey and Lu (1959) using Windostate version 8.5 software.

Result and discussion

The analysis of variance indicated significant differences among genotypes for all the characters. The high estimates (>25 %) of genotypic coefficient of variation (GCV) were recorded for secondary branches (25.62) followed by seed yield plot^{-1} (21.85) and umbel plant^{-1} (16.89). This indicated presences of adequate genetic variation among the genotypes and sensitivity of the attributes for making further modification by selection. The wide difference between PCV and GCV for seed yield plot^{-1} (g) (67.09) followed by test weight (56.04) and secondary branches (41.65). However, the estimates of PCV were higher than corresponding GCV for all the characters explaining environmental factors in influencing their expression (Table 1). High heritability were obtained for primary branches (48.91%), seeds umbellate^{-1} (43.39 %), seed umbel^{-1} (41.49 %), while it was moderate for umbellate umbel^{-1} (37.85 %), secondary branches (37.84 %), umbel plant^{-1} (37.72 %) and plant height (37.55%), seed yield plot^{-1} (10.61 %), test weight (5.36 %) which clarified that they were least affected by environmental modification and selection based on phenotypic performance would be reliable. High estimates of genetic advance (as percentage of mean) was realized for secondary branches (32.46 %), umbel plant^{-1} (21.36 %), primary branches (19.19%) whereas the value were moderate for seed yield plot^{-1} (14.66 %), seed umbel^{-1} (12.23 %) which elucidated that they could be improved to a large extent.

The path coefficient studies (Table 2) illustrated the significance of characters such as primary branches, secondary branches and seed per umbel as these traits had high direct effects on seed yield without having any undesirable negative indirect effects. Similar finding were reported by Poorva *et al*., (2001). Where as umbel per plant, seed per umbellate and test weight had moderate direct effects on seed yield. Umbellate per umbel displayed a relatively low and positive indirect effect *via.* seed per umbellate, seed per umbel and

Table 1. Estimate of genetic parameters assessed in cumin crop

Character	Mean	Genotypic coefficient of variation(GCV)	Phenotypic coefficient of variation (PCV)	Heritability in broad sense (%)	Genetic advance	Genetic Advance as % of mean
Primary branches (no.s)	5.04	13.32	19.04	48.91	0.96	19.19
Secondary branches (no.s)	12.35	25.62	41.65	37.84	4.01	32.46
Umbel per plant (no.s)	28.70	16.89	27.50	37.72	6.13	21.36
Umbellate per Umbel (no.s)	4.99	4.57	7.44	37.85	0.29	5.80
Seeds per Umbellate (no.s)	7.31	6.29	9.55	43.39	0.62	8.54
Seed per umbel (no.s)	36.62	9.21	14.31	41.49	4.80	12.23
Plant height (cm)	37.77	7.04	11.50	37.55	3.36	8.89
Test weight (g)	3.29	12.97	56.04	5.36	0.20	6.18
Seed yield per plot (g)	136.19	21.85	67.09	10.61	19.97	14.66

Table 2. Direct (bold) and indirect effect of characters on seed yield of cumin

	Pbr	Sbr	PHT	U/P	Ul/U	S/Ul	S/U	TW	SY/p(g)
Pbr	**0.359**	0.397	0.158	0.313	0.244	0.103	0.117	0.426	0.368
Sbr	0.440	**0.303**	0.998	0.957	0.225	0.286	0.184	0.954	0.099
PHT	-0.077	0.040	**0.175**	-0.045	0.128	0.126	0.158	0.214	0.195
U/P	-0.049	-0.884	-0.311	**0.203**	0.504	0.301	0.281	0.399	0.749***
Ul/U	-0.024	0.033	-0.143	-0.082	**0.195**	0.105	0.106	0.161	0.288
S/Ul	-0588	0.135	-0.465	-0.509	-0.097	**0.236**	0.132	0.483	0.753***
S/U	0.624	0.269	0.715	0.129	0.038	0.993	**0.903**	0.606	0.497*
TW	-0.315	-0.195	0.324	-0.309	-0.219	-0.194	-0.224	**0.266**	0.108

Residual effect = 0.368

Pbr; Primary branches,Sbr; Secondary branches, PHT; Plant height, U/P; Umbel per plant, Ul/U; Umbellate per Umbel,S/Ul; Seeds per Umbellate,S/U; Seed per umbel ,TW; Test weight, SY/p (g); Seed yieldper plot (g)

test weight The results were in accordance with the earlier finding of Meena *et al.,* (2009) and Srivastava *et al*., (2000). The residual effect which indicates the effects of unexplained factors was 0.368. Nevertheless, it was concluded that primary branches, secondary branches and seed per umbel were the important components in selection for higher seed yield per plant.

References

Dange, S.R.S. 1995. Diseases of cumin (*Cuminum cyminum* L.) and their management. *Journal of Spices and Aromatic Crops* 4: 57-60.

Dewey, DR, Lu K. H. (1959). A correlation and path analysis of components of crested wheat grass seed production. *Agron.* J. 51(6):515-518.

Kakani, R. K, Lal, G., Anwer, M. M., and Meena, S. S. (2010). A manual on minimal Descriptors of seed spice crops (for Characterization and Evaluation). National Research Centre on Seed Spices, Ajmer. 1-81.

Khare, M. N., Tiwari, S. P. and Sharma, Y. K. 2014. Disease problems in the cultivation of I. Cumin (*Cuminumcyminum* L.) II. Caraway (*Carumcarvi* L.) and their management leading to the production of high quality pathogen free seed. *Inter. J. Seed Spices* 4 (1):1-8.

Meena, R. S., Anwar, M. M. and Kakani, R. K. (2009). Correlation and path analysis studies for yield improvement in fennel (*Foeniculum vulgare* Mill.). Published in National Workshop on "Spices and Aromatic Plant in 21st century India" held at S. K. N College of Agriculture, Jobner (Rajasthan), pp. 44.

Sinha, P., Singh, S. P. and Pandey, I. D. (2001). Character Association and Path Analysis in Brassica species. *Indian J. AGril Res.* 35 (1): 63-65.

Sharma, Y. K., Anwer, M. M., Saxena, S. N. and Kant, K. 2010. Getting disease free seed spices. *Indi. Horti*. 55: 22-24.

Sharma, Y. K., Kant, K., Solanki, R. K. and Saxena, R. P. 2013. Prevalence of cumin diseases on farmer's field: A survey of Rajasthan and Gujarat states. *Inter. J. Seed Spices*3: 46-49.

Srivastava, J. P., kamaluddin, Srivastava, S. B. L. and Tripathi, S. M. (2000). Path analysis in Coriander (*Coriandrum sativum* L.). Published in Centennial Conference on Spices and Aromatic Plants held at Calicut. Pp. 71-74.

Received : August 2015; Revised : Novemberl 2015;
Accepted : December 2015.