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Characterization and evaluation of cumin (C*uminum cyminum* L.) germplasm

R.S. Meena*, R. K. Kakani, Y. K. Sharma, R. D. Meena, R. K. Solanki, Sharda Choudhary, Krishna Kant and Alka Panwar

ICAR - National Research Centre on Seed Spices, Ajmer

Abstract

Cumin is one of the important seed spice crop of India, the level of diversity available in cumin is low. A set of 140 cumin lines collected from various parts of the country were evaluated for 19 agro-morphological characters. The germplasm set showed ample diversity for both qualitative and quantitative traits. Among the qualitative traits studied, maximum diversity was recorded for early plant vigour, plant growth, stem pigmentation, stem characters, nature of branching, foliage density, umbel compactness, arrangement of umbellate and seed colour. Variability observed for quantitative traits showed high range variation for plant height, number of branches, umbel per plant, umbellate per umbel, seed per umbellate, test weight and yield. Seed yield showed significant positive correlation with umbels per plant.

Key words: Cumin, germplasm, quantitative traits, qualitative traits, variability

Cumin commonly known as Jeera in Hindi language, is an important seed spice crop belonging to family *Apiaceace*. In India it is mainly grown in Rajasthan and Gujarat states during *Rabi* season. Syria, Morocco, Turkey, Greece, Egypt, Iran, etc are other cumin growing countries in the world. Total production of cumin seed in India is about 90%, out of which Rajasthan state alone contributes around 52% of total national production.

During 2011-12 cumin was grown in 4.67 lakh hectares with 1.77 lakh tonnes production in Rajasthan. (Source: Spice Board, India). Cumin seed and oil are used in culinary, pharmaceutical etc (Behera *et al.,*5 and Agarwal and Sharma, 1). Being such an important crop, efforts for its genetic improvement is limited to selection of natural variants and their advancement for varietal development. Therefore, an its essential to study the extent of genetic variability available in hand for isolating the potential genotype for advancement. Thus, the present study was carried out on characterization and evaluation of cumin germplasm to know the extent of variability available in the set of 140 germplasm lines.

In the present investigation, 140 cumin germplasm line were evaluated for 19 traits, the trial was carried out at the ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer, The germplasm set was raised in 3 m row (spacing 50 cm x 15 cm) length in an Augmented Block Design (ABD) with two check varieties RZ-19 and GC-2 in each block. Recommended package of practices were followed during the cropping season to raise the crop. The data on qualitative and quantitative descriptor were recorded on five randomly selected plants using minimal descriptors developed by NRCSS, Ajmer (Kakani *et al.*,7). Five plants were selected randomly in each germplasm line and were tagged for recording the qualitative and quantitative characters. All the quantitative data were analyzed statistically by Indostat verson 8.5 software.

Genetic variability assessment of 140 cumin lines for 19 traits comprising of 12 qualitative and 07 quantitative showed significant differences. All the germplasm lines were classified in to different categories based on 12 qualitative traits studied (Table 1). For the early plant vigour, 82 germplasm lines ranked under very good category whereas 18 were under poor category. For plant growth habit, 85 lines showed semi erect behaviour. In cumin past studies suggest ample amount of variability. Avtar *et. al.,* (3) found seed yield as maximum contributor to total diversity. Under salinity, Singh *et. al.,* (9) found Relatively high GCV and PCV, heritability along with high genetic advance as percentage of mean for grain yield, umbels per plant, grains per umbel, and harvest index. Selection based on these traits would be effective for yield in cumin under salinity. Bairwa *et al.,* (4) also observed high GCV for yield per plant followed by plant height, no of branches and test weight. These kind of studies taking both parametric and non-parametric traits have also done in other crops eg., Sen and Ghosh (8) in green gram; Arora

*Corresponding author e-mail: rsm.nrcs@gmail.com

Table 1: Classification of cumin germplasm as per quality traits

Characters	Class and Frequency
Seedling colour	Dark Green-98
	Light Green-42
	Purple/pink-3
Seedling crown pigmentation	Green-135
	White-2
Early plant vigour	Poor-18
	Good-40
	Very Good-82
Plant growth habit	Erect-40
	Semi Erect-85
	Spreading-15
Stem pigmentation	Present-30
	Absent-110
Stem characteristic	Succulent-125
	Hard-15
Nature of branching	Basel Branch-125
	Non Basal Branch-15
Flower colour	White-134
	Purple-6
Foliage density	Sparse-88
	Dense-52
Umbel compactness	Compact-68
	Loose-72
Arrangement of umbellate	Corymbs type-135
	Non Corymbs type-5
Seed colour	Ash colour-78
	Grey colour-62

et al., (2) in black gram and Chandel (6) reports on variability for plant growth habit, branching pattern and seed colour in black and green gram. Characterization of germplasm based on morphological traits signifies the extent of variability present in the population and also provides needful information for selection desirable genotypes for varietal development and also genotypes which can be conserved for unique traits.

The variability for quantitative traits in cumin germplasm set was of wide range (Table 2). Plant height ranged from 13-36 cm, branches from 2-8, umbel per plant 4-37, umbellate per umbel 3-6, seed per umbellate 4-9, test weight 1.7-8.2 g and yield 5.0-17.0 g. As per the germplasm evaluation, few promising lines have been identified for important traits (Table 3.), these lines can be useful genetic resource for cumin improvement. Association studies (Table 4) showed significant and positive correlation between umbels per plant with seed yield suggesting that a direct selection based on the independent trait will contribute towards enhancement of seed yield. Whereas, branches per plant and seeds per umbellate which also are important in performing indirect selection showed non-significant positive correlation with seed yield.

Table 2: Variability recorded for quantitative characters

Character	Min.	Max.	Mean	SD
Plant height (cm)	13.0	36.0	24.09	4.65
Branches plant^{-1}	2.0	8.0	4.69	0.96
Umbels plant^{-1}	4.0	37.0	15.79	5.65
Umbellates umbel^{-1}	3.0	6.0	4.97	0.54
Seeds umbellate^{-1}	4.0	9.0	6.07	0.91
Test weight (g)	1.73	8.23	4.32	0.98
Yield per plant (g)	5.0	17.0	35.72	23.81

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Table 3: Identified promising germplasm of cumin

Traits	Promising germplasm
Plant height (>25cm)	JC-02-32, JC-02-28, AC-02-3, AC-1, Hairy Cumin, AC-21, AC-17, AC-31-5, AC-11, AC-27, AC-17, AC-62, AC-12, JC-00-61, AC-9, JC-02-36, AC-236-02, AC-3, AC-72, JC-26-5, AC-431, AC-00-61, AC-16, JC-91-262, JC-94-44, AC-2, JC-02-27, JC-95-197, AC-21, JC-00-22, AC-A, JC-99-16, GC-3, JC-02-21, , AC-62, JC-100-58, AC-02-3, AC-2, JC-25-127, AC-5, JC-02-36, S-231-04, AC-5-3001, AC-21, AC-23, AC-167, AC-18, AC-9, JC-442, GC-2, AC-12 , JC-00-72,AC-16
Branchs plant^{-1} (>6)	AC-72, AC-62, EC T.
Umbels plant^{-1} (>32)	AC-1, AC-21
Umbellates umbel^{-1} (>5)	AC-3, AC-72, JC-21, H.CUMIN, JC-02-32, AC-02-3, AC-00-62, JC-00-66, AC-167, AC16, AC-62, JC-442, JC-00-61, JC-02-3, GC-2, EC-248513, JC-02-16, AC-5-3001
Seeds umbellate^{-1} (>5)	AC-21, AC16, AC-02-3, AC-167, AC-2, EC T., JC-26-5, AC-16, JC-21, Hairy Cumin, AC-17, AC-231, AC-72, JC-02-16, AC0061, JC-02-21, HAIRY CUMIN, AC-21, AC-02-31, UC-342, , JC-02-27, JC-95-197, AC-5, EC-248513, AC-27, AC-9,JC-99-16, AC-12, JC-02-16, JC-02-28, AC-17, JC-02-36, AC-236-02, JC-00-72, AC-5-3001, AC-72, AC-72, AC-62, AC-70, JC-00-65, AC-3, AC-42, AC-167, AC-21, AC-3-A, JC-25-127, AC-42, AC-5, JC-00-27, JC-02-31, JC-26-5EC-279081, AC-431, JC-02-28, S-231-04, GC-3, AC-72, AC-23, AC-11, AC-00-62, JC-00-21, AC-27, JC-00-22, E C243575, AC3, JC-00-66, AC-39, AC-42, UC-36, AC-22, GC-3, JC-00-22, JC-02-32, JC-00-22, JC-02-32, JC-94-44, AC-1, EC-279054, AC-31-5, AC-9, AC-62, JC-442, JC-00-61, JC-96-116, JC-02-3, JC-00-27, AC-11, AC-19, GC-2, JC-2311, JC-9636, AC-12, EC-279054, AC-3-A, EC-279081, AC-431, AC-169, AC-02-3, AC-231, JC-02-14.
Test weight (>4.15g)	AC-18, AC-5-300, JC-02-16, AC-2, AC-2, EC-243578, AC-39, AC-21, AC-22, AC-16, AC-16, AC-10, JC-38-90, JC-02-21, AC-31-5, UC-36, AC-02-31, AC-11, AC-11, AC-11, UC-342, AC-19, AC-23, AC-62, AC-02-3, JC-02-3, AC-02-3, EC-279054, EC-279054, AC-3, JC-02-28, JC-99-33, AC-62, AC-00-62, JC-02-32, JC-02-32, JC-02-32, EC248513, JC-02-32, A-13, AC-21, AC-21, AC-42, JC-02-28, AC-9, AC-21, AC-9, AC-3, JC-25-127, JC-95-197, JC-00-72, AC-167, JC-21, JC-00-21, AC-167, AC-22, S-231-04, AC-4, AC-14, AC-12, AC-17, JC-94-262, AC-17, AC-27, AC-27, GC-2, JC-00-22, JC-00-22, JC-00-22, JC-02-31, AC-169, AC-70
Yield plant^{-1} (>6)	JC-94-44, JC-21, JC-00-21, AC-72, AC-72, AC-21, AC-21, UC-342, A-13, JC-94-262, AC-1, AC-31-5

Table 4: Correlation coefficients of yield attributing characters

Variety	Plant height	Branches plant^{-1}	Umbel plant^{-1}	Umbellate umbel^{-1}	Seed umbellate^{-1}	Test weight	Yield
Plant height	1	0.07	0.36**	0.26**	0.33**	0.13	0.09
Branches plant^{-1}		1	0.44**	0.28**	0.29**	-0.04	0.13
Umbel plant^{-1}			1	0.31**	0.23*	0.05	0.24*
Umbellate umbel^{-1}				1	0.30**	0.14	-0.05
Seed umbellate^{-1}					1	0.08	0.08
Test weight						1	-0.01

** Significant at 1 % level, * Significant at 5 % level

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