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Variability of some morphological characters in fennel (*Foeniculum vulgare*)

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ABSTRACT

Field experiment was conducated during 2006–08 on the nature and variability with released varieties of fennel (*Foeniculum vulgare* Mill.) for yield and yield attributes. Analysis of variability was carried out for 12 characters in 13 diverse varieties of fennel at Ajmer showed highly significant difference among varieties for all the characters. High genotypic and phenotypic variances were observed for umbel/plant, umbellate/umbel and seed yield/plant. The highest genotypic coefficient of variation was observed for yield/plot (18.23), followed by umbel/plant (15.10), umbellate/umbel (9.19) and test weight (6.92). High genetic advances as percentage of mean was recorded for seed yield/plot, umbel/plant, umbellate/umbel, test weight, number of branches/plant, angle of primary branches, seed/umbel and plant height suggesting that phenotypic selection for these traits would be effective.

Key words: Fennel, *Foeniculum vulgare*, Variability

Fennel [*Foeniculum vulgare* Mill. (syn) *Foeniculam officinale*] is an annual, stout aromatic plant that belongs to family Apiaceae. The fruits (seeds) are used as stimulant, carminative and in the cure of colic pains. India is a major seed spices producer in the world. Among seed spices fennel is contributed about 17.47% of total seed spices production. Very few efforts have been made to improve fennel through genetic manipulation.

Since most of the yield-attributing characters are quantitatively inherited and highly affected by environment, it is difficult to judge whether the observed variability is heritable or not. The genetic parameters genotypic and phenotypic variances, genetic advance, genetic gain and heritability are useful in understanding the nature of inheritance of different traits. Therefore, a study was undertaken to elicit information on the nature and magnitude of variability present in the released varieties of fennel for yield and its attributes.

MATERIALS AND METHODS

The present experiment was carried out during 2006–08 at the experimental fields at National Research Centre on Seed Spices, Ajmer (26° 27′ 0″ N, 74° 38′ -1″ E and 700 m above sea level). The field was sandy loam in texture. The maximum and minimum temperature during growing season of fennel (*Foeniculum vulgare* Mill) (October to April) recorded was 39°C and 5°C, respectively. Monsoons (August to October) offer medium rainfalls with average contribution of about 50 mm. The study was carried out with 13 released varieties of fennel, namely 'Pant Madhurika', 'Hisar Swarup', 'Rajendra Saurabha', 'Azad Saunf 1', 'GF1', 'GF2', 'GF11', 'Co1', 'RF101', 'RF125' and 'NRCSS AF1'. Five national varieties mostly grown in all fennel growing area of the country are included in the experiment. This experiment was laid in randomized block design with 3 replications. Plot consisted of 2 m long, 6 rows spaced 60 cm apart. Plant spacing within rows was maintained 20 cm.Timely management practices were followed to grow a good crop. The soils are sandy loam, therefore 90 kg N/ha. 40 kg P_2O_5/ha and 30 kg K_2O/ha applied in the soil before sowing. Ten plants were randomly selected/plot and observations were recorded on plant height (cm), no. of primary branches, angle of primary branches, length of lower node of stem from ground surface, length of upper node of stem from ground surface, length of middle node of stem from ground surface, diameter of umbel, umbel/plant, umbellate/umbel, seed/umbel, test weight (g) and yield/plot (g). Analysis of variance in respect of various characters was done as per Panse and Sukhatme (1978). Genetic variability for the different characters pooled data of 2 years was estimated. Heritability (broad sense) and genetic advance as percentage of mean were calculated as per Johnson *et al.* (1955), respectively.

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RESULTS AND DISCUSSION

The analysis of variance for all the traits except length of lower node and test weight showed highly significant differences among the genotypes, indicating sufficient amount of variability in the materials. A wide range of variability for different characters was also observed by Rajput *et al*. (2004) in fennel. The genotypic and phenotypic variances were higher for seed yield/ plot, umbel/plant and umbellate/umbel (Table 1). The highest genotypic and phenotypic coefficient of variations were observed for seed yield/ plot (24.4, 18.2), umbel/ plant (17.6, 15.1), umbellate/ umbel (10.1, 9.2) and test weight (8.6, 7.0) (Table 2). High genotypic and phenotypic coefficients of variation for umbel/ plant and seed yield/plant were also reported by Rajput *et* al. (2004) in fennel. The results suggested that characters showing high value of genotypic and phenotypic coefficient variation can be improved by careful selection.

High heritability estimates (broad sense) were found for plant height (cm) (72%), no. of primary branches(87%), angle of primary branches (97%), length of middle node (65%), diameter of umbel (83%), umbel/plant (73%), umbellate/ umbel (84%), seed/umbel (79%) and test weight (g) (65%) indicating that these characters were less influenced by the environmental and direct selection for these traits would be effective for further improvement. The high heritability of umbel/plant(73%) with maximum genetic advance(26.6%) was observed which might be due to heritability with additive gene impact and selection may be effective. (Table 2). These results are in agreement with the results obtained by Agnihotri *et al*. (1997) and Rajput *et al*. (2004) for umbels/plant, plant height, number of umbellate/umbel, test weight and seed yield/plant. High heritability estimates coupled with moderate genetic advance as per cent of mean was recorded for plant height (cm), no. of branches, angle of primary branches, umbel/plant, umbellate/umbel, seed/umbel and yield/plot (g) indicate the predominance of additive gene action for these characters. The higher estimates of heritability indicate that these characters were comparatively less affected by environment. The characters namely

Table 1 Analysis of variance characters in fennel (pooled data of 2 years)

Character	Replication MS* (2 df)	Treatment MS* (12 df)	Error MS* (24 df)	SEm ±	CD	
					P=0.05	*P*=0.01
Plant height (cm)	26.94**	274.62*	76.43	4.85	14.73	19.96
No. of branches	0.02	0.47	0.06	0.13	0.40	0.55
Angle of primary branches	0.64	33.30*	1.00	0.56	1.70	2.29
Length of lower node of stem from ground surface	0.57	0.17	0.23	0.26	0.80	1.08
Length of upper node of stem from ground surface	11.99*	3.49*	2.20	0.82	2.50	3.39
Length of middle node of stem from ground surface	2.076**	2.73*	0.95	0.54	1.65	2.23
Diameter of umbel	0.14	2.31*	0.40	0.35	1.06	1.44
Umbel/plant	72.62*	68.99*	18.53	2.39	7.25	9.83
Umbellate/umbel	32.21*	16.28*	2.65	0.90	2.74	3.72
Seed/umbel	9.60*	7.79*	1.67	0.72	2.18	2.95
test weight(g)	1.01	1.93	3.19	0.99	3.01	4.08
Yield/plot (g)	0.51	0.24	0.11	0.18	0.55	0.75

*MS: mean square

Table 2 Range, mean, coefficient of variation, heritability and genetic advance in fennel (pooled data of 2 years)

Character	Range	Mean ± SEm	PCV (%)	GCV (%)	Heritability (%)	Genetic advance (%)
Plant height (cm)	127–65	144±5.05	6.64	5.64	72	9.87
No. of branches	5.82–7.13	6.51±0.14	6.08	5.68	87	10.95
Angle of primary branches	55.89–67.36	61.28±0.58	5.44	5.35	97	10.86
Length of lower node of stem from ground surface	3.14–3.98	3.48±0.27	6.93	3.82	30	4.34
Length of upper node of stem from ground surface	16.09–9.49	17.95±0.86	6.01	3.65	37	4.58
Length of middle node of stem from ground surface	12.66–5.95	14.31±0.56	6.66	5.37	65	8.93
Diameter of umbel	15.41–8.18	16.38±0.36	5.36	4.88	83	9.15
Umbel/plant	19.69–37.82	27.15±2.49	17.66	15.10	73	26.61
Umbellate/umbel	21.19–29.37	23.18±0.94	10.05	9.19	84	17.33
Seeds/umbel	21.99–27.97	24.65±0.75	6.54	5.79	79	10.58
test weight (g)	8.21–0.43	9.35±1.03	8.57	6.92	65	1 1.52
Yield/plot (g)	0.67–0.38	1.16±0.19	24.39	18.23	56	28.06

umbel/plant, umbellate/umbel and yield/plot in seeds displayed high heritability estimates along with high genetic coefficient of variation. Johnson *et. al.* (1955) suggested that heritability together with genetic advance is a more useful parameter in choice of the best genotype by selection. Mehta and Patel (1983) reported high heritability with moderate to all characters except test weight. Dashora *et al*. (2003) also reported high heritability with high genetic advance for number of umbels/plant and seed yield/plant in fennel. The study indicated that sufficient variability for different yield attributes are present in fennel, which can be utilized for further improvement in this crop. It is also suggested that for improving seed yield in fennel, more emphasis should be given to plant height (cm), no. of primary branches, angle of primary branches, diameter of umbel, umbel/plant, umbellate/umbel and seed/umbel.

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