

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

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### ABSTRACT

Analysis of variability carried out for 12 characters in 19 germplasm taking and two checks (AF-1 and RF-125) of fennel (*Foeniculum vulgare* Mill) at, Ajmer revealed highly significant difference among varieties for all the characters studied. High genotypic and phenotypic variances were observed for days to 50 percent flowering, plant height, number of secondary branches, umbel per plant, umbellate per umbel and seed per umbellate and total oil. The highest genotypic coefficient of variation was observed for essential oil (34.17%) followed by total oil (22.013%), seed yield per plant (19.44%) harvest index (15.86%), and Secondary branches (15.82%). High genetic advances as percentage of mean was recorded for essential oil (68.76), total oil (43.58), seed yield per plant (30.002), secondary branches (27.07) and harvest index (23.49) suggesting that phenotypic selection for these traits would be effective.

**Key words :** Fennel, *Foeniculum vulgare* Mill, Variability

### INTRODUCTION

Among seed spices fennel is major seed spice crop. Fennel (*Foeniculum vulgare* Mill.) belonging to family Apiaceae, is a cross pollinated crop. It is a diploid species with the chromosome no.  $2n = 22$  and native of Europe and Meditarrean region. 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 (*Foeniculum vulgare* Mill) through genetic manipulation. Total area under the crop in India is about 53497 hectares with production of 83576 tonnes. In Rajasthan, it occupies an area of 26967 hectors with an annual production of 83576 tonnes.

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 & 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 METHOD

The present experiment was carried out during *rabi* session 2011-2012 at the experimental fields at National Research Centre on Seed Spices Ajmer (26° 27' 0" N, 74° 38' -1" E and 700 meter above sea level). The

field was sandy loam in texture. The study was carried out with 19 germplasm with two checks of fennel. This experiment was laid in randomized block design with 3 replications Plot consisted of 2m 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<sub>2</sub>O<sub>5</sub> / ha and 30 kg K<sub>2</sub>O/ha applied in the soil before sowing. Twenty plants were randomly selected per plot and observations were recorded on days to 50% flowering, plant height (cm), no. of primary branches, no. of secondary branches, umbel per plant, umbellate per umbel, number of seeds per umbellate, test weight (g) and yield per plant (gm), harvest index (%), essential oil (%) and total oil content (%). Analysis of variance in respect of various characters was done as per Panse and Sukhatme (4). Genetic variability for the different characters was estimated. Heritability (broad sense) and genetic advance as percentage of mean were calculated as per Johnson *et al.* (2) respectively.

### RESULT AND DISCUSSION

The analysis of variance for all the traits except number of seeds per umbellate 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.* (5) in fennel. The genotypic and phenotypic variances were higher for days to 50% flowering, plant height, secondary branches, seeds per umbellate, total oil, umbel per plant and umbellate per umbel (Table 1). The highest genotypic and phenotypic coefficient of

variations were observed for seed yield per plant (19.44, 25.95), harvest index (15.87, 22.07), total oil (22.01, 22.90), essential oil (34.17, 34.98) and secondary branches (18.83, 19.06) (Table 2). High genotypic and phenotypic coefficients of variation for umbel/ plant and seed yield/plant were also reported by Rajput *et al.* (5) 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 essential oil (95.40 %), total oil (92.40 %), test weight (71.80 %), secondary branches (68.90 %), primary branches (63.60 %), seed yield per plant (56.10 %) and harvest index (51.70 %) 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 essential oil (95.40 %) with maximum genetic advance (68.75 %) 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 shah *et al.* (7) and Rajput *et al.* (5) for umbels per plant, plant height, number of umbellate per umbel, test weight and seed yield per plant. High heritability estimates coupled with moderate genetic advance as per cent of mean was recorded for umbel per plant and test weight (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 essential oil, total oil, test weight and secondary branches displayed high heritability estimates along with high genetic coefficient of variation. Ramanujan and Joshi (6) suggested that heritability together with genetic advance is a more useful parameter in choice of the best genotype by selection. Mehta and Patel (3) reported high heritability with moderate to all characters except test weight Dashora *et al.* (1) also reported high heritability with high genetic advance for

**Table 1.** Analysis of various characters in fennel

Character	Replication MS* (2 df)	Treatment MS* (20 df)	Error MS* (40 df)	Genotypic variance (Vg)	Phenotypic variance (Vp)	SEm ±	CD	
							P=0.05	P=0.01
Days to 50 % flowering	4.52	27.07*	10.49	5.52	16.01	1.86	5.34	7.15
Plant height up to main umbel (cm)	27.89	190.34*	73.21	39.04	112.26	4.94	14.12	18.89
No. of primary branches per plant	0.05	0.47**	0.07	0.13	0.20	0.15	0.45	0.60
No. of secondary branches per plant	1.49	16.30**	2.12	4.72	6.85	0.84	2.40	3.22
No. of umbels per plant	1.23	13.66**	4.19	3.15	7.35	1.18	3.38	4.52
No. of umbellate per umbel	2.03	15.08*	4.63	3.48	8.12	1.24	3.55	4.75
No. of seeds per umbellate	3.06	15.08	7.60	2.49	10.09	1.59	4.55	6.08
Test weight (gm)	0.07	1.50**	0.17	0.44	0.61	0.24	0.68	0.92
Seed yield per plant (gm)	0.11	1.96*	0.40	0.51	0.92	0.36	1.05	1.40
Harvest index (%)	0.00007	0.002*	0.0004	0.001	0.001	0.01	0.03	0.04
Total oil (%)	0.19	20.41**	0.54	6.62	7.17	0.42	1.21	1.63
Essential oil (%)	0.01	1.57**	0.02	0.51	0.54	0.09	0.25	0.34

\*MS: mean square

**Table 2.** General mean, range, coefficient of variation, heritability in broad sense, genetic advance (absolute value) and genetic advance as percentage of mean in fennel.

Characters	Mean	Range	Genotypic coefficient of variation (%)	Phenotypic coefficient of variation (%)	Environmental coefficient of variation (%)	Heritability (broad sense) (%)	Genetic Advance (Absolute value)	Genetic Advance as % of mean
Days to 50 % flowering	120.69	115.67-126.33	1.947	3.315	2.683	34.50	2.844	2.356
Plant height up to main umbel (cm)	138.36	118.73-153.07	4.516	7.658	6.184	34.8 0	7.591	5.486
No. of primary branches per plant	5.94	5.13-6.73	6.110	7.662	4.623	63.6 0	0.597	10.038
No. of secondary branches per plant	13.73	10.13-18.20	15.826	19.060	10.622	68.9 0	3.718	27.069
No. of umbels per plant	15.26	12.33-20.20	11.639	17.768	13.426	42.9 0	2.397	15.705
No. of umbellates per umbel	30.50	25.87-35.87	6.118	9.341	7.059	42.90	2.518	8.253
No. of seeds per umbellate	30.50	25.87-35.87	5.176	10.417	9.040	24.70	1.616	5.298
Test weight (gm)	6.71	5.25-7.91	9.912	11.697	6.210	71.80	1.162	17.304
Seed yield per plant (gm)	3.71	2.20-5.33	19.440	25.948	17.187	56.10	1.112	30.002
Harvest index (%)	0.15	0.10-0.20	15.865	22.069	15.341	51.70	0.034	23.493
Total oil (%)	11.69	7.78-16.22	22.013	22.903	6.323	92.40	5.096	43.584
Essential oil (%)	2.10	0.58-3.44	34.169	34.980	7.488	95.40	1.445	68.757

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), number of primary branches.

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# Colonization pattern of aphid (*Hyadaphis coriandri* Das) and predator *Coccinella* (*Coccinella septempunctata* L.) on Fennel Crop

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## ABSTRACT

Fennel is an important seed spice crop and grown mainly in the state of Rajasthan and Gujarat. Development pattern of aphid and *Coccinella* population on fennel crop for three years showed that heavy population of aphids was developed on the crop. Maximum numbers of aphids on fennel crop were developed during 5<sup>th</sup> to 11<sup>th</sup> standard week and population level of more than 500 aphids/umbel was recorded during 7<sup>th</sup> to 10<sup>th</sup> standard week. In case of *Coccinella* maximum numbers recorded between 7<sup>th</sup> to 10<sup>th</sup> standard week.

**Key words :** *Hyadaphis coriandri* Das, Coccinellid

## INTRODUCTION

Spices comprise fragrant products of plant origin used for flavouring foods and beverages. Among different group of spices, seed spices includes the single largest group of spices with over 17 items coming under it. The important amongst this group are coriander, cumin, fennel, fenugreek, celery, ajowan dill, anise etc. The seed spices are used as whole and processed form for imparting aroma and pungency to food. They are commonly used to season the food dishes and products. Seed spices are mainly cultivated in the state of Rajasthan and Gujarat at commercial level and on smaller scale in other states like Madhya Pradesh, Punjab, Uttar Pradesh, Bihar and Andhra Pradesh etc. Among different seed spices crops, fennel (*Foeniculum vulgare* Mill) crop grown mostly Gujarat and in Rajasthan state. The fennel crop suffers heavy yield loss up to 50 per cent due to aphids infestation from vegetative growth to crop maturity. Aphids is the major pest of fennel crop causes heavy yield loss in unprotected crops. In fennel crop *Hyadaphis coriandri* is the main aphids species in India. However in Europe and North America *Hyadaphis foeniculi* and in Egypt *Aphis fabae* is major aphid species of fennel crop (Baltrame and Salto, 1 and Sameada *et al.* 7). Losses due to aphid in fennel crop was found up to 903 kg/ha (Mittal and Butani, 6). Coccinellid consists of major predator found feeding on various sucking pests of seed spices. Major coccinellid were found preying on seed spices crops are, *Coccinella septempunctata* L. (Gupta and Yadav, 2). Fennel crop attracts large numbers of predator *Coccinella* which naturally regulate the aphids population on crop

and play one of key component of aphid management on the crop. The present study is based on development pattern of aphids and coccinella population on fennel crop over the period of three year.

## MATERIALS AND METHODS

Three year field experiments on study of colonization pattern of aphids and its predator *Coccinella* were conducted at field experiment centre of NRC on Seed Spices, Ajmer (Rajasthan) India during, 2007-08 to 2009-10. Coriander variety Ajmer coriander-1 was selected for the study and the crop was sown on 15<sup>th</sup> of October having plot size of 3x3m. All recommended practices were followed to raise the good crop except application of insecticides. The average number of population were recorded in fields by counting total number of aphids (Winged and unwinged) and coccinella (both grubs and adults) present per umbel on selected plants at ten location since the appearance on the crop till last presence and thus average number of population was worked out for each standard week. In case of aphids, total numbers of population were recorded up to 500 numbers and beyond this the population was grouped under 500 and 1000 aphids/umbel.

## RESULT AND DISCUSSION

The population recorded of aphids and *Coccinella* on fennel crop over three year showed that aphids population develop at early vegetative stages of the crop and lasted up to maturity of crop (Table-1). The population of aphids persist about three month on the crop and were recorded heavy colonization for more than a month. During