International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(4): 476-478

Received: 03-05-2017
Accepted: 04-06-2017

Geeta Choudhary
Mahatma Jyoti Rao Phule College of Agriculture, Jaipur, Rajasthan, India

JK Ranjan
National Research Centre for Seed Spices, Tabiji, Ajmer, (Rajasthan) India

Rajesh C Jeeterwal
Division of Plant Breeding and Genetics, Rajasthan Agricultural Research Institute (RARI), Durgapura, Jaipur, (Rajasthan) India

Correspondence
Geeta Choudhary
Mahatma Jyoti Rao Phule College of Agriculture, Jaipur, Rajasthan, India

Genetic variability, heritability and correlation studies in fennel (*Foeniculum vulgare* Mill.)

Geeta Choudhary, JK Ranjan and Rajesh C Jeeterwal

Abstract
Fourty two germplasms were randomly selected from germplasms developed in a fennel population *i.e.* RF-101. These progenies along with four checks namely GF-11, AF-1, RF-101 and RF-125 were evaluated in randomized block design in three replications during *Rabi* 2011-2012, to estimate diversity and correlation for seed yield and its component traits, association of seed yield with its component characters on seed yield. Analysis of variance revealed significant diversity for all the traits. High estimates of PCV along with GCV as well as broad sense heritability and genetic advance as percentage of mean were observed for seed yield per plant, umbels per plant and seeds per umbel. Moderate heritability along with low genetic advance as percentage of mean was recorded for branches per plant. Low heritability along with low genetic advance as percentage of mean was recorded for days to 50% flowering and plant height. Seed yield per plant had positive and significant correlation with branches per plant, umbels per plant, seeds per umbel, 1000-seed weight and umbellets per umbels and showed negative significant correlation with days to 50% flowering.

Keywords: Fennel, Genetic diversity, heritability, genetic advance, correlation analysis

Introduction
Spices occupy an important place in the lives of people since Vedic and Bibilical times. They have been considered indispensable in seasoning of food, flavouring of beverages, perfumery, cosmetics and medicines. The lure of spices prompted explorers like Columbus and Vasco da Gama to undertake hazardous sea journey to discover India “the land of spices”. A wide variety of spices are grown in the country of which seed spices is a group. Seed spices include all those annuals whose dried seeds are used as spices viz., fennel, fenugreek, coriander, cumin, ajowain, dill and nigella.

Fennel (*Foeniculum vulgare* Mill, 2n=22) is an important seed spice crop, mainly grown for its seeds in the Rajasthan and Gujarat. Among all the seed spices, fennel has potential as cash crop in the state of Rajasthan. Development of high yielding varieties requires knowledge of the existing genetic variability and also the extent of association among yield contributing characters. The genetic variability with heritability and genetic advance provide an idea of the expected gain in the next generation. Correlation and path coefficient analysis measures the extent of association between yield and their components and their direct- indirect effects.

The evaluation of germplasm is essential before they can be used in hybrid development, the present investigation was planned for phenotypic evaluation. Furthermore information on association among different morphological characters and with seed yield is necessary for formation of suitable selection criteria for producing high yielding inbred lines. The present investigation, therefore, was planned with the objectives which may provide the basic information on nature and magnitude of variability for important traits.

The present investigation was made to explore the genetic diversity, to determining the genetic coefficient of variation, heritability and genetic advance of different traits and their correlation 42 fennel germplasm lines.

Material and methods
The material for the present study consisted of 46 Germplasm lines of fennel (*Foeniculum vulgare* Mill.), which were developed by random selection and continued selfing of a number of plants from RF-101 and was maintained at National Research Centre for Seed Spices, Tabiji (Ajmer, Rajasthan). The Germplasm lines were evaluated during *Rabi* 2011 at Research Farm of National Research Centre for Seed Spices, Tabiji,

Ajmer in Randomized Block Design with three replications with four checks *viz.*, GF-11, AF-1, RF-101 and RF-125 in a plot size of 3.0 x 0.50 sqm. accommodating one row 50 cm apart with intra row spacing of 20 cm maintained by thinning at 25th days after sowing. Non experimental rows were planted as border rows in each bed to eliminate the border effect if any. All the standerd agronomical practices were followed to raise a good and healthy crop. Observations were recorded for plant height (cm), branches per plant, umbels per plant, umbellets per umbel, seeds per umbel, 1000- seed weight (g), seed yield per plant (g) and 50% flowering.

Analysis of variance was carried out as per the procedure suggested by Fisher (1918). The character associations between different pairs of characters were estimated using the Pearson's product-moment correlation method. Coefficients of variation were calculated by the formulae suggested by Burton (1952) [3] and Johnson *et al.* (1955) [5]. The expected genetic advance was calculated by the following formula as suggested by Johnson *et al.* (1955) [5]. Heritability in broad sense was calculated by the formula given by.

Result and discussion

Analysis of variance revealed significant amount of genetic diversity among the germplasm lines for all the characters studied *viz.* days to 50% flowering, plant height, branches per plant, umbels per plant, umbellets per umbel, seeds per umbel, 1000-seed weight and seed yield per plant (g) (Table 1).

The genotypic coefficient of variation and genetic advance expressed as percentage of mean were high for seed yield per plant, umbels per plant, seeds per umbel and moderate to low for umbellets per umbel, 1000- seed weight, braches per plant, plant height and days to 50% flowering, respectively. indicating the role of environmental factors on the character expression. The variability of characters was compared on the basis of coefficient of variation. The range and coefficient of variation indicated that the variability was high for seed yield per plant (g), umbels per plant, seeds per umbel, umbellets per umbel; moderate for branches per plant and plant height (cm). It was low for 1000-seed weight (g) and days to 50% flowering, which in turn, indicated that simple selection of inbred lines on the basis of seed yield per plant (g), umbels per plant, seeds per umbel and umbellets per umbel might be advantageous as compared to other characters under study. In the present investigation, broad sense heritability was observed to be high for seeds yield per plant, seeds per umbel. Genetic advance as percentage of mean for the characters ranged from 38.27% (plant height) to 90.06 (seeds Per umbel). High magnitude of genetic advance as percentage of mean was estimated for seed yield per plant (g). The umbels per plant, branches per plant, seed yield per plant (g) and seeds per umbel had higher magnitude of heritability and genetic advance as percentage of mean. The umbels per plant, branches per plant, seed yield per plant (g) and seeds per umbel had higher magnitude of heritability and genetic advance as percentage of mean (Table 2).

The association analysis revealed that the seed yield per plant was significantly and positively correlated with branches per plant, umbels per plant, seeds per umbel, 1000- seed weight and umbellets per umbel. While, its association with days to 50% flowering was negative and significant. (Table 3).

On the basis of yield as well as other morphological characters the germplasm lines namely AF-189, AF-286, AF-86, AF-175, AF-176 and AF-284 were found superior. Based upon the present investigation, it is suggested that in breeding programmes major emphasis should be given for selection of characters like branches per plant followed by umbels per plant, seeds per umbel, 1000-seed weight and umbellets per umbel, as these had positive correlation coefficient with seed yield with high direct effect.

Table 1: Analysis of variance for seed yield and its component traits in fennel

S. No.	Characters	Mean sum of squares		
		Replication (d.f. =2)	Germplasm lines (d.f. =45)	Error (d.f. =90)
1	Days to 50% flowering	7.730	11.581**	2.141
2	Plant height (cm)	1604.138**	299.156**	54.182
3	Branches per plant	21.964**	2.321**	0.593
4	Umbels per plant	6.181**	13.618**	0.929
5	Umbellets per umbel	11.529	49.000**	6.240
6	Seeds per umbel	2683.326	24997.209**	1450.852
7	1000- seed weight (g)	0.0675	3.365**	0.713
8	Seed yield per plant (g)	2.486	13.165**	1.8929

* significant at p = 0.05 and ** significant at = 0.01

Table 2: Mean, range and genetic parameters for different characters in fennel.

Characters	Range	Mean ± SEm	Coefficient of variation (%)		Heritability (Broad sense) %	Genetic advance as % of mean
			Genotypic	Phenotypic		
Days to 50% flowering	100.33-110.67	103.597±0.844	1.515	2.404	39.70	1.515
Plant height (cm)	111.00-165.50	145.382±4.249	6.297	10.179	38.27	6.297
Branches per plant	4.00-7.33	5.443±0.444	9.135	13.907	43.15	9.135
Umbels per plant	7.20-19.67	11.041±0.556	21.119	23.056	83.91	21.119
Umbellets per umbel	10.00-00.67	23.122±1.442	17.181	20.041	73.50	17.181
Seeds per umbel	268.00-588.33	445.814±21.991	21.114	22.249	90.06	21.114
1000- seed weight (g)	3.67-9.00	5.876±0.487	7.977	8.715	83.80	7.977
Seed yield per plant (g)	4.93-12.33	8.906±0.794	22.548	25.559	77.83	22.548

Table 3: Genotypic and phenotypic correlation coefficient between different characters in fennel

Characters	G/P	Days to 50% flowering	Plant height (cm)	Branches per plant	Umbels per plant	Umbellets per umbel	Seeds per umbel	1000-seed weight (g)	Seed yield per plant (g)
Days to 50% flowering	G	1	0.2565	0.1307	-0.1272	0.1933	0.2225	-0.1336	-0.4634
	P	1	0.1117	0.0108	-0.0765	0.1099	0.1034	-0.0875	-0.2922**
Plant height (cm)	G		1	0.5325	0.1430	0.6383	0.4069	0.2938	-0.0088
	P		1	0.2429**	0.0924	0.3144**	0.2677**	0.1575*	-0.0100
Branches per plant	G			1	0.3560	0.4577	0.4049	0.1879	0.3064
	P			1	0.2781**	0.3319**	0.2854**	0.1076	0.2381**
Umbels per plant	G				1	0.0295	-0.1178	0.2117	0.2819
	P				1	0.0460	-0.0839	0.1580*	0.2338**
Umbellets per umbel	G					1	0.6541	0.2405	0.2291
	P					1	0.5030**	0.1917*	0.1596**
Seeds per umbel	G						1	0.2651	0.2051
	P						1	0.2100**	0.1676*
1000- seed weight (g)	G							1	0.2137
	P							1	0.1622*
Seed yield per plant (g)	G								1
	P								1

* significant at p = 0.05 and ** significant at = 0.01

References

1. Agnihotri P. Genetic divergence in the germplasm of fennel. M.Sc. (Ag.) Thesis, Rajasthan Agricultural University, Bikaner, Campus-Jobner (Rajasthan). 1990.
2. Agnihotri P, Dashora SL, Sharma RK. Variability, correlation and path analysis in fennel (Foeniculum vulgare Mill). Journal of Spices and Aromatic Crops, 1997; 6(1):51-54.
3. Burton GW. Quantitative inheritance in grasses. Proceeding of the Sixth International Grassland Congress, Pennsylvania. 1952; 1:227-283.
4. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal. 1959; 51:515-518.
5. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability in soybean. Agronomy Journal. 1955; 47: 314-318.
6. Wright, S. 1921. Correlation and causation. Journal of Agricultural Research. 1955; 20:557-587.
7. Federer LIT. Augumented designs. Hawain planters record. 1956; 20:191- 207.