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Genetic Variability Analysis in Fenugreek (*Trigonella foenum-graecum* L.) Genotypes

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A B S T R A C T

A research work on genetic variability, analysis was estimated in 21genotypes of fenugreek (*Trigonella foenum-graecum* L.) grown in a Randomized Block Design (RBD) with three replications during *Rabi* season of 2016-17 at the research farm of ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer (Rajasthan). Analysis of variance were estimated for days to 50% flowering (2.37*), days to maturity(24.45**), plant height (110.82**), number of primary branches per plant (0.56*), number of secondary branches per plant (1.32*), number of pods on main axis (5.20**), number of pods per plant (98.96**), pod length (1.03*), number of seeds per pod (1.74*), test weight (2.06*), seed yield per plant (2.31*) and seed yield per plot (38997.63**). The highest estimates of PCV along with GCV were found for seed yield per plot (21.51), number of pods on main axis (13.39) and number of pods per plant (11.13) while, moderate to high PCV and GCV were found for the characters *viz*., plant height, number of primary branches per plant, number of secondary branches per plant seed yield per plant and reaming characters *viz*., test weight, pod length, number of seeds per pod were found low. The estimates of heritability was found very high for seed yield per plot (98.24) and number of pods on main axis (95.27)while, low for days to 50% flowering(46.21). The genetic advance was recorded highest for seed yield per plot (43.92) and number of pods on main axis (26.29) while, low in days to 50% flowering (1.92). Genotypic and phenotypic level revealed that the seed yield was significantly and positively correlated with plant height (0.657*), number of pods on main axis (0.442*), number of pods per plant (0.345*), number of primary branches per plant (0.439*) and days to maturity (0.446*). Path coefficient analysis of different characters contributing towards seed yield per plot showed that seed yield per plot (1.25) had highest positive direct effect followed by test weight (0.668), pod length (0.535) and number of seeds per pod (0.346).

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is an annual diploid species, popularly grown by its vernacular name "*methi''*, belonging to the sub-family ‘*'papilionaceae''* of the family ‘*'fabaceae*‘'. The word ‘*'Trigonella''* is a Latin word, having means from little triangle; referring to its triangular shape of flower. The species name ‘'*Foenum-graecum* ‘' means ‘'Greek-hay'' indicate it is used as a forage crop in the past. Fenugreek is native to the

countries bordering the Eastern shores of Mediterranean, extending to central Asia. It is a self-pollinated crop with chromosome no. 2n=16. It is an important condiment crop grown for both seed as well as leaves purpose, largely in North India during *rabi* season. Fenugreek can be grown under a wide range of climate conditions. It requires cool climate and dry weather at the time of maturity. It can be grown in on types of soils.

Fenugreek is widely cultivated in India, Nepal, Bangladesh, Pakistan, North Africa, East Africa, Russia, Argentina, Egypt, France, Spain, Turkey, Morocco, and China. India the major fenugreek growing states are Rajasthan, Gujarat, Tamil Nadu, Madhya Pradesh, Maharashtra, Haryana, Utter Pradesh, and Punjab, covering an area of 93605 ha with an annual production of 115929 tonnes with a productivity of 1238 kg/ha (Anonymous, 2012). IN Rajasthan, it is widely grown In Nagour, Sikar, Jaipur, Chittorgarh, Jhunjhnu, Kota, Pali, Alwar, Jhalawar, and Churu districts covering an area of 62894 ha with an annual production of 77319 tonnes with a productivity of 1229 kg/ha (Anonymous, 2009). The success of any breeding methodology for improving morphological characters depends primarily on existence of high magnitude of genetic variability and its efficient utilization. If not present, then its creation and management becomes essential to crop breeding. Equally, information regarding genetic architecture of a population especially on the nature and magnitude of the gene action is of vital use to a plant breeder.

Materials and Methods

Twenty-one genotypes of Fenugreek (*Trigonella foenum-graecum* L.) were evaluated in Randomized Block Design (RBD) with three replications during *Rabi* season of 2016-17 at the research farm of ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer (Rajasthan). Each genotype was grown in a plot and row to row distance was 30 cm and plant to plant distance was maintained 10 cm. The observation were recorded on five randomly selected plants for thirteen characters *viz*., days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of pods on main axis, number of pods per plant, pod length, number of seeds per pod, test weight, seed yield per plant and seed yield per plot.

The values were estimated for variation among the genotypes analysis of variance was carried out as per the procedure suggested by Panda and Sukhatme (1963). Heritability in broad sense was calculated by the formula given by Hanson *et al.*, (1956) and the genetic advance (GA) was calculated by the following formula as suggested by Johnson *et al.*, (1955).

Results and Discussion

The analysis of variances for all the characters studied have been presented in Table 1.Mean sum of squares among treatment was found significant for the characters viz. days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of pods on main axis, number of pods per plant, pod length, number of seeds per pod, test weight, seed yield per plant and seed yield per plot.

The average seed yield per plot was 0.525kg and the ranged was observed to be 0.204 to 0.675. The average plant height was found to be 53.69 cm, whereas plant height ranged from 36.80 to 61.69 cm and the average number of pods per plant was found to be 49.11and the ranged was observed to be 38.87 to 64.47.

Table.1 Analysis of variance for different characters in fenugreek genotypes. (Mean sum of squares)

Source of variation	D.F.	Days to 50 % flowering	Maturity of days	Plant height (cm)	Primary branches per plant	Secondary branches per plant	No. of pods on main axis	No. of pods per plant	Pod length (cm)	No. of seeds per pod	Test weight (g)	Seed yield per plant (g)	Seed yield per plot
Replication	2	0.1162	36.0890	17.2755	0.2019	0.5841	0.6724	4.5348	0.7468	2.2555	0.9628	0.6996	1763.22
Treatments	20	2.3781*	24.4522**	110.8299**	0.5625*	1.3225*	5.2045**	98.9644**	1.0323*	1.7428*	2.0660*	2.3105*	38997.63**
Error	40	1.2791	11.8292	6.5679	0.1326	0.2183	0.2461	9.2247	0.2730	0.8103	0.3853	0.3287	688.21

**Significant at p= 0.01; *Significant at p= 0.05

Table.2 Overall mean value of genotypes, their range, genotypes and phenotypic coefficient of variation, heritability in broad sense, genetic advance and genetic advance as % of mean for different characters in fenugreek

Characters	Mean	Range (min.-max. adjusted value)	Genotypic coefficient of variation (GCV %)	Phenotypic coefficient of variation (PCV %)	Heritability in broad sense (%)	Genetic advance	Genetic advance as % of mean
Days to 50 per cent Flowering	44.0479	42.67-45.67	1.3740	2.0213	0.4621	0.8475	1.9241
Maturity of days	131.3970	124.33-137.00	1.5611	2.1728	0.5162	3.0361	2.3106
Plant height (cm)	53.6916	36.80-61.60	10.9798	11.3204	0.9407	11.7789	21.9380
Primary branches per plant	5.2676	4.53-5.80	7.1860	8.2206	0.7641	0.6816	12.9403
Secondary branches per plant	9.9497	8.47-11.13	6.0975	6.6731	0.8349	1.1420	11.4775
No. of pods on main axis	9.8316	6.53-13.40	13.0764	13.3971	0.9527	2.5850	26.2925
No. of pods per plant	49.1192	38.87-64.47	11.1347	11.6930	0.9068	10.7288	21.8424
Pod length (cm)	10.6695	9.67-11.80	4.7150	5.4979	0.7355	0.8887	8.3297
No. of seeds per pod	18.0579	17.00-19.47	3.0875	4.2208	0.5351	0.8401	4.6524
Test weight (g)	12.9303	11.11-14.56	5.7886	6.4180	0.8135	1.3907	10.7551
Seed yield per plant (g)	11.4621	9.79-13.13	7.0911	7.6566	0.8577	1.5507	13.5286
Seed yield per plot (g)	525.3179	204.00-675.67	21.5115	21.7038	0.9824	230.7242	43.9209

In all the other traits the average performance and range of variation was also high. The estimates of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters indicating effect of the environment on the expression of the characters. The estimate of PCV and GCV indicated the existence of fairly high degree of variability for seed yield per plot (PCV: 21.70 and GCV: 21.51), number of pods on main axis (PCV:13.39 and GCV:13.07) and number of pods per plant (PCV:11.69 and GCV:11.13). High magnitude of PCV and GCV was also reported for seed yield by Meena *et al.,* (2010) and moderate for plant height (PCV:11.32 and GCV:10.97) number of primary branches per plant (PCV:8.22 and GCV:7.18) number of secondary branches per plant (PCV:6.67 and GCV:6.09) and seed yield per plant (PCV:7.65 and GCV:7.09), days to germination (PCV:13.89 and GCV:11.76),number of primary branches (PCV:12.01 and GCV:10.57),suggesting that these characters were least affected by environment selection should be done these characters. This observations draw support from the high value of heritability recorded for these characters. The findings are in close harmony with the result of Verma *et al.,* (1916), Jain (2013), Naik *et al.,* (2012), Patil *et al.,* (2016), Sharma and Shekhawat (2015) and Verma *et al.,* (2012).

Low variance values were recorded for test weight (PCV:6.41 and GCV: 5.78), pod length (PCV:5.49 and GCV:4.71) and number seeds per pod (PCV:4.22 and GCV:3.08)The findings are in close harmony with the result of Datta *et al.,* (2005) and Singh *et al.,* (2009).

High heritability in broad sense is helpful in identifying appropriate character for selection and enables the breeder to select superior genotypes on the basis of phenotypic expression of quantitative characters. The estimated values of heritability in broad sense were classified as very high (above 90%), high (75-90%), medium (50-75%) and low (less than 50%).

Analysis of heritability in broad sense was high heritability for seed yield/ plot (98.2%), number of pods on main axis (95.2%), plant height (94.0%) and number of pods per plant (90.6%). High heritability recorded forced yield per plant (85.7 %), number of secondary branches per plant (83.4%), test weight (81.3%), number of primary branches per plant (76.4%).If heritability of a character is high (> 75%), selection for such a character should be fairly easy. Similar result was found in the findings of Verma *et al.,* (2012). Patil *et al.,* (2016), Fufa (2017) and Sharma *et al.,* (2015).

Medium heritability recorded for Medium heritability recorded for plant height (73.5%), number of seed/pod (53.5%), days to maturity (51.6%). Similar findings also reported by Bali *et al.,* (2006) and Arora *et al.,* (1988) in fenugreek.

Low heritability recorded for days to 50% flowering (46.2%). This is indicative of the fact that characters are rather more influenced by the environment and may not respond much to selection.

Genetic advance as percentage of mean ranged between (1.92 %) for days to 50% flowering to (43.92 %) seed yield per plot. The highest estimate of genetic advance as percentage of mean was recorded for days to 50% flowering (43.92%) and number of pods on main axis (26.29%). Similar result was found in the findings of Al-Maamari *et al.,* (2014), Meena *et al.,* (2010) and Verma *et al.,* (2016). Whereas, plant height (21.93%), number pods per plant (21.84%) seed yield per plant (13.52%), number of secondary

branches per plant (11.47%), test weight (10.75%). showed moderate value of genetic advance as percentage of mean in my studied. Whereas, low estimates were observed for days to 50% flowering (1.92%), days to maturity (2.31%), number of seeds per pod (4.64%) and pod length (8.32%).

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