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Genetic variability and character association in fenugreek (*Trigonella foenum-graecum* L.)

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Abstract

Sixty four genotypes of fenugreek (*Trigonella foenum-graecum*) were evaluated for genetic variability, correlation and path coefficient analysis at Jagudan (Gujarat). Phenotypic and genotypic coefficients of variability were high for grain yield plant^{-1}, number of pods plant^{-1} and number of primary branches plant^{-1}. Moderate heritability estimates along with high genetic advance as percentage of mean were recorded for number of pods plant^{-1}. High heritability estimates along with moderate to low genetic advance as percentage of mean were recorded for days to maturity and plant height. Grain yield was positively correlated with number of pods plant^{-1}, number of seeds pod^{-1} and 1000 seed weight. Results of path analysis revealed that number of pods plant^{-1}, days to 50% flowering and test weight had highest positive direct effects on grain yield. It was concluded that improvement of seed yield in fenugreek is possible through selection for number of pods and seed weight through number of grains and length of pods.

Keywords: fenugreek, path coefficient, *Trigonella foenum-graecum*, variability.

The low productivity of fenugreek (*Trigonella foenum-graecum* L.) in India is mainly due to non-availability of suitable high yielding varieties for various agro climatic regions and poor crop husbandry. The productivity of any crop is mainly attributed to the contribution of the yield components. For any selection programme aimed at yield improvement, a clear understanding and knowledge about these components is very essential. As more variables are included in correlation studies, the indirect associations become complex and path coefficient is useful for evaluating relative contributions of each component. The present study was carried out to assess the variability and character association in 64 diverse genotypes (collected from Jobner, Hissar, Lam and Jagudan) of fenugreek. The 64 genotypes under study were grown in a simple lattice design with two replications at Main Spices Research Station, S D Agricultural University, Jagudan (Gujarat) (23^{0}52' N, 72^{0}43' E, 70 m MSL). Each plot consisted of two rows of 4 m length with inter and intra-row spacing of 30 cm and 10 cm, respectively. A uniform fertilizer dose of 20 kg N, 40 kg P_2O_5 and 10 kg S ha^{-1} was applied and normal agronomic practices were followed. Observations were recorded on five randomly selected plants from each of the plot for nine quantitative characters. The phenotypic and genotypic coefficients of variation were worked out as per Burton (1952) and heritability and genetic advance

were determined following the methodology of Johnson *et al*. (1955). Phenotypic and genotypic correlation coefficients for grain yield were calculated following Jibouri *et al*. (1958) while path coefficient analysis was determined following Dewey & Lu (1959).

The analysis of variance revealed highly significant differences among the genotypes for all the nine characters studied. The estimates of phenotypic and genotypic coefficients of variation (PCV and GCV) were high for grain yield plant^{-1} followed by number of pods plant^{-1} and number of primary branches plant^{-1} and plant height (Table 1). These results are in agreement with earlier reports for number of primary branches plant^{-1} by Singh (2000). Moderate PCV and GCV were observed for 1000 seed weight. The PCV in general, was higher than the GCV for all the characters. This indicates considerable effect of environment on the expression of these characters. However, the differences between PCV and GCV were maximum with respect to number of primary branches plant $^{-1}$, grain yield plant $^{-1}$, number of pods plant $^{-1}$. High estimates of GCV were recorded for grain yield, number of pods plant $^{-1}$ and number of primary branches plant^{-1}, which indicates the presence of high amount of genetic variability for these characters. These results are in agreement with the earlier findings for number of pods plant^{-1} reported by Pant *et al*. (1984) and Chandra *et al.* (2000).

High heritability estimates coupled with higher GCV and high to moderate expected genetic advance were observed for grain yield plant^{-1}. Similar results were recorded for grain yield plant^{-1} by Singh (2000) and for seed yield plant^{-1} whereas, high heritability with high genetic advance was recorded by Pant *et al*. (1984). Higher heritability estimates with highest genetic advance was observed for seed yield plant^{-1} and for number of pods plant^{-1} as reported by Sharma *et al*. (2009). The results of phenotypic and genotypic coefficient of variability, heritability and genetic advance revealed that selection of quantitative characters like number of pods plant^{-1}, 1000 seed weight and number of grains pod^{-1} would be effective for improvement of grain yield in this crop. Positive and significant correlation with grain yield was found with number of pods plant^{-1}, 1000 seed weight and number of seeds pod^{-1} and thus, these characters are considered as main components for grain yield (Table 2). These results are in agreement with Chandra *et al*. (2000).

Among other inter-character correlations, length of pod showed positive and non-significant association with grain yield plant^{-1} at both the levels. Number of branches plant^{-1} and days to 50% flowering had negative and non-significant association with grain yield plant^{-1} as reported by Meena *et al*. (2010).Therefore, the genetic correlation points out relatively strong associations of grain yield plant^{-1} with number of pods plant^{-1}, 1000 seed weight and number of grains pod^{-1}.

Table 1. Mean, range and genetic parameters for various characters in fenugreek

Character	Mean	Range		Coefficient of variation (%)		Heritability* (%)	Genetic advance
		Min	Max	GCV	PCV		
Days to 50% flowering	50.70	43.50	62.00	5.118	5.637	82.40	4.853
Days to maturity	111.18	96.00	123.00	2.867	3.115	84.70	6.043
Plant height (cm)	76.69	29.00	95.80	11.212	12.324	82.80	16.114
No. of primary branches plant^{-1}	5.69	3.90	8.00	13.644	17.670	59.60	1.235
No. of pods plant^{-1}	84.26	29.30	110.00	18.159	21.728	69.80	26.342
Length of pod (cm)	8.88	7.40	11.50	7.405	8.901	69.20	1.127
No. of grains pod^{-1}	16.24	11.90	22.00	9.359	11.075	71.40	2.645
1000-seed weight (g)	13.96	8.620	17.125	10.778	11.251	91.80	2.970
Grain yield plant (g) $^{-1}$	13.79	5.00	21.80	25.788	29.409	76.90	6.424

GCV = Genotypic coefficient of variation; PCV = Phenotypic coefficient of variation; *Broad sense

Table 2. Phenotypic (Rp) and Genotypic (Rg) correlation coefficients among nine characters of fenugreek

Character		Days to maturity	Plant height (cm)	No. of primary branches plant^{-1}	No. of pods plant^{-1}	Length of pod (cm)	No. of grains pod^{-1}	1000-seed weight (gm)	Grain yield plant^{-1} (g)
Days to 50% flowering	Rp	0.8541**	0.1463	-0.0081	0.0445	0.0267	-0.0130	-0.0659	0.0117
	Rg	0.8436**	0.1431	-0.1111	0.0423	0.0079	-0.0384	-0.0760	-0.0316
Days to maturity	Rp	1.000	0.4258**	-0.1578	0.1730	0.0896	0.0719	-0.0617	-0.0075
	Rg		0.3885**	-0.0521	0.1408	0.0952	0.0725	-0.0617	-0.0411
Plant height (cm)	Rp		1.000	-0.1622	0.1423	0.0848	0.1512	-0.1024	-0.0113
	Rg			-0.2524**	0.1272	0.1475	0.2059**	-0.1190	-0.0319
No. of primary branches plant^{-1}	Rp			1.000	0.2726**	0.0113	-0.0734	0.0274	0.0056
	Rg				0.1763*	-0.2646**	-0.3597**	-0.0672	-0.1353
No. of pods plant^{-1}	Rp				1.000	0.1219	0.2494**	-0.0030	0.5286**
	Rg					-0.0177	0.1391	-0.0675	0.5467**
Length of pod (cm)	Rp					1.000	0.4130**	-0.0549	0.1479
	Rg						0.3235**	-0.1330	0.0498
No. of grains pod^{-1}	Rp						1.000	0.0838	0.3087**
	Rg							0.0372	0.2548**
1000-seed weight (g)	Rp							1.000	0.3966**
	Rg								0.4326**

*, ** Significant at 5% and 1% levels, respectively; Upper diagonal shows phenotypic (P) and lower diagonal shows genotypic (G) correlation.

Table 3. Estimate of path coefficient showing direct and indirect effects on seed yield of fenugreek at genotypic level

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of primary branches plant^{-1}	No. of pods plant^{-1}	Length of pod (cm)	No. of grains pod^{-1}	1000-seed weight (g)	Correlation with grain yield
Days to 50% flowering	**0.3260****	0.2784**	0.0477	-0.0026	0.0145	0.0087	-0.0042	-0.0215	0.0117
Days to maturity	-0.3141**	**-0.3678****	-0.1429	0.0192	-0.0518	-0.0350	-0.0267	0.0099	-0.0075
Plant height (cm)	-0.0015	-0.0039	**-0.0100**	0.0016	-0.0014	-0.0009	-0.0015	0.0190	-0.0113
No. of primary branches plant^{-1}	0.0014	0.0090	0.0280	**-0.1728***	-0.0471	-0.0019	0.0127	0.0010	0.0056
No. of pods plant^{-1}	0.0257	0.0812	0.0821	0.1572	**0.5764****	0.0702	0.1437	-0.0047	0.5286**
Length of pod (cm)	0.0021	0.0076	0.0068	0.0009	0.0097	**0.0798**	0.0329	-0.0017	0.1479
No. of grains pod^{-1}	-0.0015	0.0086	0.0179	-0.087	0.0295	0.0489	**0.1184**	-0.0044	0.3087**
1000-seed weight (g)	-0.0263	-0.0206	-0.0408	0.0109	-0.0012	-0.0219	0.0334	**0.3989****	0.3966**

Residual effect: 0.6950; Bold figures shows direct effect; *, ** Significant at 5% and 1% levels, respectively

Hence, these traits can be used as selection criteria. Path analysis at genotypic level was carried out taking eight characters as independent variables and grain yield as dependent variable (Table 3). Number of pods plant^{-1}, 1000 seed weight and number of grains pod^{-1} had highest positive direct effects on grain yield. Hence selection through these three characters will be rewarding for obtaining high yielding lines.

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