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Short communication

Genetic variability, correlation and path analysis in fenugreek (*Trigonella foenum-graecum* L.)

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ABSTRACT

Genetic variability, heritability, correlation and path analysis were estimated among 28 fenugreek genotypes for 11 quantitative traits. The highest genotypic and phenotypic coefficients of variation were observed for dry matter content and dry weight at flower initiation. High heritability was observed for dry matter content and plant height. The highest genetic advance as percentage of mean was recorded for dry matter content and dry weight at flower initiation. The biological yield (0.819), No. of pods per plant (0.715**), plant height (0.415**), dry matter content (0.389**), dry weight at flower initiation (0.376**) and 1000-seed weight (0.297**) exhibited positive and significant correlation with the seed yield per plant. Path coefficient analysis revealed that dry matter content had highest direct effect on seed yield followed by plant height and No. of seeds per pod.**

Key words: Correlation coefficient, fenugreek, genetic variability, path coefficient analysis.

INTRODUCTION

Fenugreek (*Trigonella foenum-graecum* L.), popularly known as *'Methi'* is an important seed spice crop largely grown in during winter season in northern India. It is an annual spice crop both leaves and seeds are extensively used for medicinal purposes. Its seeds are used as condiments and flavouring food preparations. They are aromatic, carminative, tonic and galactagogue. Fenugreek is considered to have originated in South Eastern Europe and West Asia (Gangopadhyay *et al.*, 3). The variability is a prerequisite for improvement of yield in any crop. The performance of locally available varieties of fenugreek is poor in the Malwa region of Madhya Pradesh. Hence, there is a need for genetic improvement to develop high yielding genotypes. Therefore, an experiment was conducted to study on genetic parameters such as variances, heritability (broad sense) and genetic advance for different morphological characters in the germplasm collection.

MATERIALS AND METHODS

A collection of 28 divergent fenugreek genotypes, 25 from College of Agriculture, Jobner and 3 from Mandsaur local, were evaluated in randomized block design with three replications during the winter of 2011-12. The experiment was conducted at Horticulture Farm, College of Horticulture, RVSKVV, Mandsaur (M.P.). Each plot size was 2 × 2 m^2 with row to row distance 40 cm and plant to plant distance was adjusted at 20 cm by thinning at three leaf stage. At the time of maturity, data were recorded on five randomly selected plants in each plot for different traits. The analysis of variance was calculated following standard procedures. The genetic parameters were studied by working out the genotypic and phenotypic coefficients of variation, heritability in broad sense and genetic advance. The genotypic and phenotypic correlations and path analysis was done to partition total correlation into direct and indirect effects using standard procedures.

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences among genotypes for all the traits studied (Table 1). The range of variation was high for dry matter content (37.45-87.34) followed by plant height (36.20-83.20) and No. of pods per plant (52.40-82.22) among all the characters, while lowest range was observed for dry weight at flower initiation (0.91-1.78) followed by pod length (8.20-13.00) and days to 50% flowering (44.00-53.00). When the variation is compared on the basis of coefficient of variation, the magnitude of phenotypic variance was as compared to genotypic variance for all the characters in the present investigation indicating a positive effect of environment on the characters. The difference between PCV and GCV were however low. High coefficient of variation was recorded for dry matter content followed by dry weight at flower initiation, plant height and 1000-seed weight, while, lowest variability was recorded for days to 50% flowering followed by number of branches per plant and No. of

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Table 1. General mean, range, coefficient of variation, heritability (in broad sense), genetic advance and genetic advance as percentage of mean in fenugreek.

Trait	Mean	Range		PCV (%)	GCV (%)	Heritability -BS (%)	Genetic advance	Genetic advance as percentage of mean
		Min.	Max.					
Plant ht. (cm)	72.49	36.20	83.20	11.93	11.78	97.5	17.36	23.95
No. of branches/plant	16.64	12.40	20.20	8.45	7.64	81.7	2.37	14.24
Dry wt. at flower initiation (g)	1.27	0.91	1.78	14.68	14.43	96.6	0.37	29.13
Days to 50% flowering	47.81	44.00	53.00	4.68	3.93	70.6	3.25	6.80
Dry matter content (g)	69.02	37.45	87.34	23.24	23.18	99.5	32.88	47.64
No. of pods/plant	71.78	52.40	82.22	10.17	9.83	93.5	14.05	19.57
No. of seeds/pod	15.75	12.80	18.40	9.33	8.00	73.5	2.22	14.10
Pod length (cm)	10.42	8.20	13.00	9.80	9.26	89.3	1.88	18.04
1000-seed wt. (g)	15.39	11.75	21.00	11.82	11.07	87.7	3.29	21.38
Biological yield/plant (g)	33.26	27.54	42.70	9.11	8.99	92.6	6.15	17.82
Seed yield/plant (g)	14.48	11.14	19.28	10.26	8.85	74.4	2.28	15.75

seeds per pod. Characters like plant height, days to 50% flowering, and 1000-seed weight were found to be consistent, both at phenotypic and genotypic levels having lowest coefficient of variation. It suggested that these traits were least influenced by the non-genetic factors and were hence quite stable. This finding is in accordance with those of Chandra *et al.* (2) and Banerjee and Kole (1).

The broad sense heritability was found to be higher (>70%) for almost all characters. Highest heritability was observed for dry matter content (99.5) followed by plant height (97.5), dry weight at flower initiation (96.6), No. of pods per plant (93.5), biological yield per plant (92.6), pod length (89.3), 1000-seed weight (87.7), No. of branches (81.7), seed yield per plant (74.4), No. of seeds per pod (73.5), and days to 50% flowering (70.6). Similar findings were reported by Chandra *et al.* (2), Verma and Korla (8) and Meena *et al.* (4). High range of genetic advance was recorded for dry matter content (32.88), followed by plant height (17.36), No. of pods per plant (14.05), biological yield (6.15), 1000-seed weight (3.29), days to 50% flowering (3.25), No. of branches per plant (2.37), seed yield per plant (2.28), No. of seeds per pod (2.22), pod length (1.88), and dry weight at flower initiation (0.37). Genetic advance (as percentage of mean) for the traits ranged from 6.80 (days to 50% flowering) to 47.64% (dry matter content). The highest genetic advance was recorded for dry matter content (47.64%) followed by dry weight at flower initiation (29.13%), plant height (23.95%), 1000-seed weight (21.38%), No. of pods per plant (19.57%), pod length (18.04%), biological yield (17.82%), seed yield per plant (15.75%), No. of branches per plant (14.24%), No. of seeds per pod (14.10%) and days to 50% flowering (6.80%). This finding is accordance with those of Prajapati *et al*. (5).

Genotypic correlation among the yield and yield components in fenugreek are presented in Table 2. In the present investigation, seed yield per plant observed to be highly significant and positive association with biological yield, No. of pods per plant, plant height, dry matter content, dry weight at flower initiation, 1000-seed weight, No. of seeds per pod, days to 50% flowering and but it was positively non significantly correlated with pod length and No. of branches. Similar findings have been reported by Singh *et al.* (7) and Sarada *et al*. (6). Phenotypic correlation is presented in Table 2. The seed yield per plant had highly significant positive correlation with biological yield, No. of pods per plant, plant height, dry matter content, dry weight at flower initiation, 1000-seed weight and No. of seeds per pod, but it was positively non-significantly correlated with days to 50% flowering, No. of branches and pod length.

Path coefficient analysis was carried out for characters under study using genotypic and phenotypic correlation coefficient (Table 3) and taking seed yield per plant as dependable variable, in order to see the causal factor and also to identify the components which are responsible for producing seed yield per plant. Genotypic path analysis of the different traits revealed that dry matter content had highest positive direct effect on seed yield per plant followed by plant height, No. of seeds per pod, 1000-seed weight, biological yield, days to 50% flowering. No. of pods per plant and No. of branches per plant had the highest negative direct effect on seed yield.

Table 2. Genotypic and phenotypic correlation coefficient among 11 quantitative traits in fenugreek.

Trait		Plant height (cm)	No. of branches/ plant	Dry wt. at flower initiation (g)	Days to 50% flowering	Dry matter content (g)	No. of pods/ plant	No. of seeds/ pod	Pod length (cm)	1000-seed wt. (g)	Biological yield/ plant (g)	Seed yield/ plant (g)
Plant height (cm)	G	0.00	0.077	0.582**	0.045	0.209	0.524**	-0.106	-0.155	0.153	0.522**	0.472**
	P		0.075	0.573**	0.040	0.207	0.498**	-0.086	-0.144	0.143	0.504**	0.415**
No. of branches/ plant	G			0.260*	0.076	0.095	-0.096	0.112	0.004	0.183	0.058	0.067
	P			0.230*	0.026	0.079	-0.058	0.100	0.013	0.162	0.063	0.103
Dry wt. at flower initiation (g)	G				0.095	0.371**	0.346**	0.358**	0.091	0.088	0.375**	0.420**
	P				0.092	0.364**	0.322**	0.297**	0.084	0.067	0.356**	0.376**
Days to 50% flowering	G					0.150	0.408**	0.101	-0.293**	-0.635**	0.154	0.280*
	P					0.130	0.317**	0.121	-0.231*	-0.514**	0.123	0.196
Dry matter content (g)	G						0.472**	-0.019	0.406**	-0.098	0.517**	0.453**
	P						0.457**	-0.014	0.385**	-0.088	0.492**	0.389**
No. of pods/ plant	G							0.166	-0.015	0.184	0.827**	0.855**
	P							0.171	-0.026	0.179	0.756**	0.715**
No. of seeds/ pod	G								0.248*	0.053	0.208	0.351**
	P								0.155	0.013	0.179	0.261*
Pod length (cm)	G									0.182	0.098	0.102
	P									0.166	0.097	0.081
1000-seed wt. (g)	G										0.367**	0.388**
	P										0.333**	0.297**
Biological yield/ plant (g)	G											0.898**
	P											0.819**
Seed yield/ plant (g)	G											
	P											

**,* 1 and 5% level of significance, G = genotypic, P = phenotypic

Table 3. Direct and indirect effects of different traits on seed yield in fenugreek at genotypic and phenotypic levels.

Trait		Plant height (cm)	No. of branches/ plant	Dry wt. at flower initiation (g)	Days to 50% flowering	Dry matter content (g)	No. of pods/plant	No. of seeds/ pod	Pod length (cm)	1000-seed wt. (g)	Biological yield/plant (g)
Plant height (cm)	G	0.544**	-0.031	-0.160	0.051	0.140	-0.324	-0.050	0.014	0.188	0.098
	P	-0.063	0.003	0.056	0.004	-0.013	0.110	-0.005	-0.005	0.011	0.316**
No. of branches/ plant	G	0.042	-0.402	-0.071	0.087	0.064	0.059	0.053	0.000	0.225*	0.011
	P	-0.005	0.042	0.023	0.002	-0.005	-0.013	0.005	0.000	0.013	0.040
Dry wt. at flower initiation (g)	G	0.317**	-0.105	-0.274	0.108	0.249*	-0.214	0.169	-0.009	0.108	0.071
	P	-0.036	0.010	0.098	0.008	-0.023	0.071	0.016	0.003	0.005	0.223*
Days to 50% flowering	G	0.024	-0.031	-0.026	0.140	0.100	-0.252*	0.048	0.027	-0.780**	0.029
	P	-0.003	0.001	0.009	0.090	-0.008	0.070	0.007	-0.007	-0.040	0.077
Dry matter content (g)	G	0.114	-0.038	-0.102	0.171	0.671**	-0.291**	-0.009	-0.038	-0.121	0.097
	P	-0.013	0.003	0.036	0.012	-0.063	0.101	-0.001	0.012	-0.007	0.309**
No. of pods/ plant	G	0.285*	0.039	-0.095	0.465**	0.317**	-0.617**	0.078	0.001	0.226*	0.156
	P	-0.032	-0.002	0.032	0.029	-0.029	0.221*	0.009	-0.001	0.014	0.474**
No. of seeds/ pod	G	-0.058	-0.045	-0.098	0.116	-0.013	-0.103	0.471**	-0.023	0.065	0.039
	P	0.005	0.004	0.029	0.011	0.001	0.038	0.055	0.005	0.001	0.112
Pod length (cm)	G	-0.084	-0.002	-0.025	-0.334**	0.272*	0.009	0.117	-0.093	0.223*	0.018
	P	0.009	0.001	0.008	-0.021	-0.024	-0.006	0.008	0.032	0.013	0.061
1000-seed wt. (g)	G	0.083	-0.074	-0.024	-0.724**	-0.066	-0.114	0.025	-0.017	0.229*	0.069
	P	-0.009	0.007	0.007	-0.046	0.006	0.040	0.001	0.005	0.078	0.209
Biological yield/ plant (g)	G	0.284*	-0.023	-0.103	0.175	0.347**	-0.510**	0.098	-0.009	0.451**	0.188
	P	-0.032	0.003	0.035	0.011	-0.031	0.167	0.010	0.003	0.026	0.628**

**,* 1 and 5% level of significance, G = genotypic, P = phenotypic

The positive indirect effect on seed yield *via* No. of pods per plant and biological yield per plant.

Phenotypic path analysis (Table 3) of the different characters revealed that biological yield per plant had highest positive direct effect on seed yield per plant followed by No. of pods per plant, dry weight at flower initiation, days to 50% flowering, 1000-seed weight, No. of seeds per pod, No. of branches per plant and pod length. Plant height and dry matter content had the highest negative direct effect on seed yield. The positive indirect effect on seed yield *via* No. of pods per plant. Traits, *viz*., plant height and dry matter content imparted negative direct effect on seed yield per plant. Thus, increasing seed yield per plant direct selection for these traits should be avoided instead indirect selection should be more appropriate strategy.

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