Estimates of genetic variability and correlation coefficient for yield and its attributes, in Fenugreek (*Trigonellafoenum-graecum* L.)

Abstract

The current study was conducted throughout the autumn/winter season2021-2022 with the aim of estimating genetic variability for different characters in available Fenugreek germplasmviz:,heritability in broad sense,and genetic advance in per cent of mean and correlation coefficient among the characters pairs. The study's experimental material comprised 42 genotypes along with one check genotype (HisarSonali). There were eleven quantitative characteristics (traits) on which observations were made. The magnitude of the phenotypic coefficient of variation(P.C.V.) was greater than thegenotypic coefficient of variation(G.C.V). The greatest differences in phenotype and genotype have been found in seed yield per plant followed by (no.) number of branches per plant, harvest index, days to maturity, test weight and nonumber. of seed per pod. The heritability estimates for various traits ranged from 15.9 (nonumber. of branches per plant) to 68.3 (plant height).Genetic advance in per cent of mean ranged from 3.36 per cent (No.number of seed per pod) to 12.64 per cent (days to maturity).The phenotypic and genotypic correlation coefficients were computed among the eleven characters. The most (A very) important trait, seed yield per plant exhibited highly significant and positive phenotypic correlation with, harvest index (0.948) and test weight (0.935). While, days to 50% flowering (-0.678) was significantly and negatively correlated with seed yield per plant. These findings suggested that the current fenugreek germplasm has a great deal of promise for effective crop improvement and better yield and yield-(components)attributing traits.

Keyword: Fenugreek (*Trigonella foenum-graecum* L.) variability, GCV, PCV, heritability, genetic advances, correlationgenotypic, phenotypic.

Introduction:

Fenugreek (*Trigonellafoenum-graecum* L.) is a diploid species, belonging to family Fabaceae. All the species of this genus having 2n=16 except T. neoana (2n=30). The word “Trigonella” is a Latin word, having meaning from little triangle; refers to its triangular shape of flower. The

species name “foenum-graecum” means “Greek-hay” indicated that it was used as a forage crop in the past.According to Kumari et al. (2016), the genus has two significant species: *Trigonellacorniculata* L. (kasurimethi) and *Trigonellafoenumgraecum*L. (common methi). Although it is planted all over the world, its original territory is southern Europe and the Mediterranean. In India, it is commonly grown under its common name methi (Achary*aet al*.2011). Seeds have a bitter (taste)flavour because to the alkaloid "Trigonelline." Fenugreek seed contains 6.3% moisture, 9.5% protein, 10% fat, 18.5% crude fibre, 42.3% carbohydrate and 13.4% ash. Fenugreek seed contains 0.02% volatile oil (Ravindran *et al.*, 2001). Fenugreek seed contains rigogenin, neorigogenin, diosgenin, yamogenin and gitogenin. Diosgenin content in fenugreek seed varies from 0.78 to 1.9% (Sharma and Kamal 1982) depending on genotypes as well as on cultural practices. The nutritional value of fenugreek, as reported by Gupta *et al*. (1989), per 100g of edible part.Fenugreek seeds are used to treat dysentery, diarrhoea, dyspepsia, cough, liver and spleen enlargement, rickets, and gout (Sharma *et al.* 1996). Both the leaves and seeds are anti-diabetic, reducing blood sugar and cholesterol levels (Chouhan *et al.* 2017).The asteroid "Diosgenin" has increased the significance of fenugreek since it is necessary for the generation of sex hormones and contraceptives (Meena *et al.* 2017 and Prasad *et al.* 2020). Rajasthan is the fenugreek bowl of the country, contributing about 80% to the country’s production. In India, it has a production of 156’000 MT from an area of 241’000 Ha and with a productivity of 1.54t/ha (Anonymous, 2020-21).

The genetic improvement of a crop depends upon its advisable exploitation adopt through breeding methods. When cultivating certain high production(ive) types, genetic homogeneity is frequently the result. It is also well established that genetic homogeneousness led to genetic vulnerability abiotic and biotic stresses. In crop breeding operations, genotypes are the primary source of diversity for different character types. The potential value of each genotype line as a viable genotype for use in a varietal development programmed may be estimated through appropriate screening and assessment. Selection and hybridization methods approaches are simply followed in bringing about the quantitative improvement in desired character. It is critical to evaluate the nature and extent of variability, heritability and genetic progress for various traits in relation to genotypes available for improving the correlated response to selection.Good genetic improvement along with high heritability estimates provide enough possibilities for further advancement in subsequent generations. Plant breeders find genetic diversity more

beneficial for selection or hybridization, but phenotypic variability changes in response to environmental factors.

Material and Methods

The present research work "Estimates of genetic variability and correlation coefficient for yield and its attributes, inFenugreek (*Trigonella foenum-graecum* L.)has been was carried out in a Randomised Block Design with three replications at the Department of Vegetable Science's main experiment site at Acharya Narendra Deva University of Agriculture and Technology in Kumarganj, Ayodhya (U.P.) over the autumn-winter season of 2021-22 to evaluate the performance of 42 genotypes for several variables to quantify the level of variability and scope of selection in fenugreek.Each treatment consisted of twelve plants in two rows. All essential plant protection techniques and agronomic practices were followed to yield a satisfactory harvest. The observation included:Days to 50% flowering,days to maturity,plant height (cm),no(number) of branches per plant,no. of pods per plant,pod length (cm),no. of seeds per pod,biological yield per plant (g),harvest-index (%), 1000-seed weight (g),seed yield per plant (g).

Estimationofcoefficientofvariation:

In accordance with Burton and de Vane (1953), the genotypic coefficient of variation (GCV) and phenotypic coefficient of variation(PCV) were calculated.

$$GCV = \frac{\text{Genotypic standard deviation}}{\text{Mean}(\bar{X})} \text{x}100$$

$$GCV = \frac{\sqrt{\sigma^2 g}}{\bar{X}} \text{x}100$$

$$PCV = \frac{\text{Phenotypic standard deviation}}{\text{Mean}(\bar{X})} \text{x}100$$

$$PCV = \frac{\sqrt{\sigma^2 p}}{\bar{X}} \text{x}100$$

Correlationcoefficient:

The correlations between different characters at genotypic (g) andphenotypic (p)levels were workedout between characters as suggestedby**Searle**(1961).

i) Phenotypiccorrelationcoefficient betweencharactersX andY

$$r_{xy(p)} = \frac{Cov._{xy(p)}}{\sqrt{Var.\ X\ (p).Var.\ Y\ (p)}}$$

ii) GenotypiccorrelationbetweencharactersXandY

$$r_{xy(g)} = \frac{Cov._{xy(g)}}{\sqrt{Var.\ X\ (g).\ Var.\ Y\ (g)}}$$

Where,

r_{xy} =Correlation coefficients between X and Y.

CovarianceXY=Co-variancebetweencharactersX andY

Var.X=Variancefor Xcharacter

Var.Y=VarianceforY character

Thesignificanceofphenotypiccorrelationcoefficientswastested against(n-2)degreesoffreedomat

5%and1%probabilitylevel.Where,nisthenumberofgermplasmonwhichtheobservationswere recorded.

Result and Discussion:

The analysis of variance for forty-two genotypes for eleven characters are significant showed in Table 1. The estimates of phenotypic coefficients of variation (PCV) were higher than genotypic coefficients of variation (GCV) for all the traits showed in table 2. High magnitudes of PCV and GCV was observed in case of seed yield per plant (11.12 and 7.85%), no. of branches per plant (10.90 and 4.34%), harvest index (9.70 and 4.02%), days to maturity (8.98 and 7.42%), test weight(8.33 and 3.93%),no. of seed per pod (8.05 and 3.62%). Moderate PCV and GCV were recorded in days to 50% flowering (7.88 and 3.60%), biological yield per plant (6.44 and 4.10%), plant height (6.32 and 3.82%). And low PCV and GCV were noticed in, no. pod per

plant (6.17 and 4.62%), and pod length (6.06 and 3.38%). Singh *et al.* (2019), Chaudhary *et al.* (2017), Patel *et al.* (2021) also reported similar resultsin their studies.

Estimates of heritability and genetic advance for eleven characters are presented in table-2. The heritability in broad sense ranged from 15.9 per cent in case of no. of branches Results and Discussion 44 per plant to 68.3 plant height. High estimates of heritability were exhibited for all the characters except no. of branches per plant(15.9), harvest index (17.02), no. of seed per pod (20.03), days to 50% flowering (20.08), test weight (22.03). Upadhyay *et al.* (2020), Gaikwad *et al.* (2020) and *Patel et al.* (2021) also reported high heritability for all traits. Highest value of genetic advance in per cent of mean was shown by days to maturity (12.64 %) while no. of seed per pod (3.36) exhibited lowest value for this parameter. The characters showed high estimate of genetic advance were days to maturity (12.64 %), seed yield per plant (11.41%), no. of pod per plant (7.12%). While low genetic advance in per cent of mean for no. of seed per pod (3.36 %), days to 50% flowering (3.38%), harvest index (3.42), no. of branches per plant (3.56), test weight (3.83) and pod length (3.88). High heritability coupled with high genetic advance were observed for most of the traits except no. of branches per plant (15.09 and 3.56), harvest index (17.02 and 3.42), no. of seed per pod (20.03 ad 3.36), days to 50% flowering (20.8 and 3.38) and test weight (22.03 and 3.83) which indicated opportunity for selection response in available germplasm of fenugreek with low selection, intensity for improvement. Similar results were also reported by Pushpa *et al.* (2012), Maurya *et al.* (2013) and Patel *et al.*(2021). Characters seed yield, no. of branches per plant, no. pod per plant and harvest index exhibited high heritability along with high genetic advance as per cent of mean indicating that it is largely influenced byadditive gene effect and consequently the scope is more for improving seed yield, no. of branches per plant, no. pod per plant and harvest index through selection.

Correlation coefficients:

The nature and strength of connections between yield and its component traits are essential for successful selection in future generations. Correlations between characters are influenced by gene linkage or pleiotropy. As a result, choosing one attribute influences the other related or pleiotropically impacted qualities. Correlation studies have received a lot of study in plant improvement since they aid with successful selection. The phenotypic and genotypic correlation coefficients computed among the eleven characters under study have been present in Table 3and

4, respectively. among general, phenotypic correlation coefficients were larger than genotypic correlation coefficients, indicating a significant underlying link among distinct relationships of features in fenugreek genotypes. The most important trait, seed yield per plant exhibited highly significant and positive phenotypic correlation with, harvest index (0.948) and test weight (0.935). While, days to 50% flowering (-0.678) was significantly and negatively correlated with seed yield per plant (Table- 2). Test weight was significantly and positive correlated with no. of seed per pod (0.931) and harvest index (0.920), while significantly and negatively correlated with days to 50% flowering (-0.535). Harvest index showed highly significant and positive correlation with no. of seed per pod (0.871) and biological yield per plant (0.821) while it showed highly significant and negative correlation with days to 50% flowering (-0.925). Biological yield per plant was highly significantly and positively correlated with no. of branches per plant (0.933) and no. of pod per plant (0.899). While significant and negative correlation with days to 50% flowering (-0.334). No. of seed per pod was highly significantly and positively correlated with no. of branches per plant (0.856) and pod length (0.760).It also showed highly significant and negative correlation with days to maturity (-0.455). Pod length showed highly significant and positive correlation with number of no. of pod per plant (0.910) and plant height (0.718). It also showed significant and negative correlation with days to maturity. The no of pod per plant showed highly significant and positive correlation with no. of branches per plant (0.922). The no. of branches per plant was highly significantly and positively correlated with plant height (0.932) and days to 50% flowering. Plant height showed highly significant and negative correlation with days to maturity (-0.289). Many earlier research workers haves also reported significant and positive association of seed yield per plant with no. pod per plant, no. seed per pod and 1000 seed weight. (Prajapati *et al.*2010), (Kumar *et al.* 2018) and(Prakash *et al.*2021).

Table1:Analysisofvariance(meansquares)forelevenquantitativecharactersinfenugreekgermplasm.

S. No.	Traits	Meansquare		
		Replications	Treatments	Error
		2	41	82
1	Daysto50%flowering	107.42**	17.80*	9.95
2	Daystomaturity	97.80	277.24**	37.17
3	Plantheight(cm)	633.80**	61.60**	22.57
4	No.ofbranchesperplant	0.12	0.41*	0.26
5	No.ofpod perplant	217.55**	85.18**	17.64
6	Podlength(cm)	0.58	0.93**	0.39
7	No.ofseedperpod	3.48	2.69*	1.52
8	Biologicalyieldperplant(g)	155.71**	18.85**	6.17
9	Harvestingindex(%)	218.94**	23.76*	14.65
10	Testweight(g)	0.20	1.35**	0.72
11	Seedyieldperplant(g)	4.53	11.66**	2.93

***-Significantat5percentprobabilitylevel,**-Significantat1percentprobabilitylevel**

Table2:Range,grand mean,phenotypic(PCV),genotypic(GCV) coefficientofvariation,heritabilityinbroadsense,geneticadvance inpercentofmean(Ga)foreleven characters in fenugreek germplasm

Characters	Parameters								
	Range		Mean	Coefficientofvariation(%)			Heritability in broad sense	Genetic advance	Genetic advance in percentof mean
	Min.	Max.		GCV	PCV	ECV	5%	5%	5%
Daysto50% flowering	39.00	50.83	44.93	3.60	7.88	7.02	20.8	1.52	3.38
Daystomaturity	95.66	135.66	120.42	7.42	8.98	5.06	68.3	15.22	12.64
Plantheight(cm)	83.68	105.97	94.28	3.82	6.32	5.03	36.6	4.49	4.76
No.ofbranchesper plant	4.54	6.13	5.15	4.34	10.90	9.99	15.9	0.18	3.56
No.podperplant	89.27	109.85	102.67	4.62	6.17	4.09	56.1	7.31	7.12
Podlength(cm)	11.56	13.56	12.51	3.38	6.06	5.03	31.1	0.48	3.88
No.ofseedperpod	14.70	19.30	17.20	3.62	8.05	7.18	20.3	0.57	3.36
Biologicalyieldper plant(g)	45.26	54.43	50.05	4.10	6.44	4.96	40.6	2.69	5.38
HarvestIndex(%)	36.93	49.55	43.33	4.02	9.70	8.83	17.2	1.48	3.42
Testweight(g)	10.46	13.43	11.62	3.93	8.33	7.34	22.3	0.44	3.83
Seedyieldper plant(g)	17.33	26.73	21.73	7.85	11.12	7.87	49.8	2.48	11.41

***-Significantat5percentprobabilitylevel,**-Significantat1percentprobabilitylevel**

Table-3:Estimatesofphenotypiccorrelationcoefficientsamongelevencharactersinfenugreekgermplasm

Traits	Daysto50% flowering	Days to maturity	Plantheight (cm)	No.ofbranchesper plant	No.ofpodper plant	Pod length(cm)	No.ofseed perpod	Biologicalyieldper plant	Harvest index(%)	Testweight(g)	Seedyieldper plant (g)
Daysto50% flowering	**1.000**	-0.058	0.064	-0.131	-0.088	0.082	-0.020	-0.111	-0.146	-0.184*	-0.194*
Daystomaturity		**1.000**	-0.077	-0.060	-0.025	-0.145	-0.309**	-0.074	-0.004	0.021	-0.060
Plantheight(cm)			**1.000**	0.228*	0.292**	0.117	0.100	0.014	-0.088	-0.103	-0.119
No.ofbranchper plant				**1.000**	0.250**	0.296**	0.131	0.197*	0.175*	0.035	0.269**
No.of pod per plant					**1.000**	0.473**	0.201*	0.528**	-0.019	0.061	0.203*
Podlength(cm)						**1.000**	0.218*	0.332**	0.014	0.034	0.158
No. of seedper pod							**1.000**	0.276**	0.095	0.054	0.226*
Biologicalyield per Plant(g)								**1.000**	-0.095	0.237**	0.492**
Harvestindex(%)									**1.000**	0.190*	0.785**
Testweight(g)										**1.000**	0.291**

***-Significantat5percentprobabilitylevel, **-Significantat1percentprobabilitylevel**

Table4:Estimatesofgenotypiccorrelationcoefficientsamongelevencharactersinfenugreekgermplasm

Traits	Daysto50% flowering	Days to maturity	Plant height(cm)	No. of branches per plant	No.ofpod per plant	Podlength (cm)	No.ofseed per pod	Biological yield per plant	Harvest index(%)	Testweight (g)	Seedyield per plant
Daysto50% flowering	**1.000**	-0.050	0.129	0.369**	-0.056	0.211*	-0.042	-0.334**	-0.925**	-0.535**	-0.678**
Daystomaturity		**1.000**	-0.289**	-0.173	-0.034	-0.179*	0.455**	-0.159	0.182*	-0.002	-0.046
Plantheight(cm)			**1.000**	0.932**	0.758**	0.718**	0.229**	0.334**	-0.448**	-0.017	-0.207*
No.ofbranchesper plant				**1.000**	0.922**	0.706**	0.856**	0.933**	0.570**	0.745**	0.662**
No.of podper plant					**1.000**	0.910**	0.731**	0.899**	0.358**	0.528**	0.566**
Podlength (cm)						**1.000**	0.760**	0.769**	0.353**	0.444**	0.516**
No.ofseed perpod							**1.000**	0.828**	0.871**	0.931**	0.738**
Biologicalyieldper plant(g)								**1.000**	0.821**	0.832**	0.925**
Harvestindex(%)									**1.000**	0.920**	0.948**
Testweight(g)										**1.000**	0.935**

***-Significantat5percentprobabilitylevel, **-Significantat1percentprobabilitylevel.**

CONCLUSION:

Based on the above result of correlation studies it could be concluded that characters like average fruit weight, no. of fruits per plant and fruit circumference showed highly positive significant correlation with the yield. As a result, our research showed that these features may be used in various breeding and development plans. The information can help breeders in developing suitable approaches for increasing yield and improvement of character in fenugreek.

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