International Journal of Plant & Soil Science

34(21): 282-286, 2022; Article no.IJPSS.89542
ISSN: 2320-7035

Genetic Variability, GCV, PCV, Heritability and Genetic Advance Analysis in Fenugreek (*Trigonella foenum- graecum* L.)

Dijendra Kumar [aω*], C. N. Ram [a#], Vikash Singh [aω], Navneet Singh [aω] and Pradip Kumar [a†]

[a] Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Ayodhya- 224 229 (U.P.), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i2131263

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/89542

Original Research Article

Received 03 May 2022
Accepted 12 July 2022
Published 13 July 2022

ABSTRACT

An experiment was carried out using 55 (45 $F_{1's}$ and 10 parents) genotypes of fenugreek to study the variability, heritability and genetic advance in percent of mean. The analysis of variance (ANOVA) revealed highly significant differences among the genotypes for the characters under study indicating presence of sufficient variability among the genotypes. Phenotypic coefficient of variation (PCV) was higher than the respective genotypic coefficient of variation (GCV) for all character that founded little effect on the characters on environment. The highest GCV and PCV were observed in the trait number of branches per plant followed by yield per plant. The high heritability coupled with moderate genetic advance in percent of mean were observed for number of branches per plant and yield per plant.

Keywords: Genetic advance; heritability; GCV; PCV; variability.

[ω] Research Scholar;
[#] Associate Professor;
[†] Assistant Professor;
**Corresponding author: E-mail: dijendrakumar10@gmail.com;*

1. INTRODUCTION

Fenugreek (*Trigonella foenum graecum* L.) locally known as methi belonging to the family Fabaceae and sub family Papilionaceous having chromosome number 2n = 2x = 16 is widely used as spice and condiment to add flavour in various food.

Fenugreek (*Trigonella foenum-graecum* L.) is widely distributed throughout the world. It is an annual herb indigenous to the countries bordering on the eastern shores of the Mediterranean. It is a self-pollinating dicotyledonous plant with branched stems, trifoliate leaves, which bears white flowers and produces golden yellow seeds. Fenugreek is primarily used as a spice in countries where it is grown [1].

Although fenugreek cultivation is mostly concentrated in Asia and the Mediterranean region, it is now widely cultivated in northern Africa, central Europe, North America and Australia. Fenugreek is used as whole seed and in powdered form and often roasted to reduce its bitterness and enhances the flavour. The bitter taste of seeds is due to presence of an alkaloid "*Trigonelline*". The importance of fenugreek has been increased due to presence of asteroid called "*Diosgenin"* and it is used in the synthesis of sex hormones and contraceptives [2].

India occupies a topmost position among the fenugreek growing countries in the world. It is growing in Argentina, Southern France, Spain, Morocco, Egypt, North Western India, Turkey, Pakistan, China and Lebanon are the leading countries for fenugreek production. Though, in India fenugreek is mainly grown in Rajasthan, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, Gujarat and Punjab. Rajasthan state accounting highest production and contributed about 80% of total production in the country (Kumar *et al.* 2018).

India is one of the dominant producers and exporters of fenugreek. The value-added products of fenugreek such as its seeds, powder and oleoresins are exported to Europe, North America, South Africa and other Asian countries [3].

In spite of gaining a prime position among the seed spices grown in Rajasthan, its productivity is low due to non-availability of suitable high yielding varieties for various agro-climatic regions. In order to make this crop more productive and resistant to pest and diseases, breeders have to developed an intensive breeding method for release. In India, it occupies an area of about 133 thousand hectares with 203 MT productions with productivity 1.526. Million tonnes [4-6].

Easing variability in genotypes. In this regard, an attempt was made to study the genetic variability by determining the magnitude of genetic coefficient of variation, heritability and genetic advance in percent of mean for different biometric traits in fenugreek.

2. MATERIALS AND METHODS

The experiment was conducted on fenugreek (*Trigonella foenum-graecum* L.) at Main Experiment Station (Vegetable Research Farm), ANDUAT (Kumarganj), Ayodhya (U.P.) India, during season of 2020-21 (Y_1) and 2021-22 (Y_2). The experiment was conducted in a Randomized Block Design (RBD) with three replications and 55 genotypes (45 F_1 + 10 parents). The crop was planted in row length spaced 30 cm apart where, 10 cm plant to plant spacing was maintained. The experimental plant material for present investigation was comprised of 45 hybrids developed by crossing 10 line (including 2 checks) (NDM-3, NDM-4, NDM-6, NDM-12, NDM-13, NDM-33, NDM-35, Azad Methi-1, Hisar Sonali and Pusa Early Bunching.

The observations were recorded on five plants randomly selected from each genotype in each replication on eleven characters, *viz*., days to 50% flowering, plant height (cm), number of branches per plant, number of pods per plant, pods length (cm), days to maturity, number of seeds per pods, biological yield per plant (g), harvest-index (%), number of pods per plant, 1000-seed weight (g) and seed yield per plant (g). The data were recorded from 45 F_1's and 10 parental lines with 2 testers on eleven characters were subjected to estimate nature and magnitude of variability. Analysis of variance was done by the method suggested by Panse and Sukhatme (1985). The phenotypic and genotypic coefficient of variation were worked out as per Burton (1952) and heritability (broad sense) and genetic advance were determined following the methodology of Johnson et al*.,* [7].

3. RESULTS AND DISCUSSION

Genotypic and phenotypic coefficient of variation were low for all the characters in over season (pooled) except number of branches per plant

during first year had moderate estimates of PCV (12.32%) and GCV (10.68%) Kumar et al. [8].

Genetic advance in percent of mean for most of the characters during first, year second year and pooled was low except for number of branches and yield per plant during first year, second year and pooled and days to 50% flowering during second had moderate estimates of genetic advance in per cent of mean.

Heritability estimates were high for number of branches per plant (75.2%) and yield per plant (85.6%) during first year; days to 50% flowering (81.7%), number of pods per plant (75.4%) and biological yield (79.7%) during second year and pooled analysis revealed that heritability estimated were high for number of branches per plant (76.1%) indicating that the selection based on phenotypic performance of these characters would be more operative. Similar result was also reported by Yadav et al. [9].

Heritability estimates were moderate for days to maturity (69.3%), plant height (67.1%), number of seeds per pod (59.5%), test weight (69.2%), biological yield (56.00%) and harvest index (56.00%) during first year, days to maturity (60.9%), plant height (64.9%), number of branches per plant (59.2%), pod length (55.5%), test weight (56.3%) and yield per plant (74.6%) during second year and pooled analysis revealed that heritability estimated were moderate for days

Table 1. Heritability (%) and genetic advance in Fenugreek over two season (Y_1, Y_2) and pooled

Characters	Season	Heritability in broad sense (%)	PCV (%)	GCV (%)	Genetic advance in per cent of mean
Days to 50% flowering	**Y_1**	45	3.84	2.57	3.55
	Y_2	81.7	6.84	6.19	11.52
	Pooled	64	4.32	3.46	5.70
Plant height (cm)	**Y_1**	67.1	5.18	4.24	7.16
	Y_2	64.9	5.30	4.27	7.08
	Pooled	64.6	5.20	4.18	6.93
Number of branches per plant	**Y_1**	75.2	12.32	10.68	19.07
	Y_2	59.2	9.96	7.66	12.15
	Pooled	76.1	9.93	8.66	15.56
Number of pods per plant	**Y_1**	44.4	3.25	2.16	2.97
	Y_2	75.4	4.71	4.09	7.31
	Pooled	65.9	3.81	3.09	5.17
Pod length	**Y_1**	49.2	7.10	4.98	7.19
	Y_2	55.5	4.90	3.65	5.60
	Pooled	51.4	4.64	3.33	4.92
Days to maturity	**Y_1**	69.3	2.17	1.80	3.09
	Y_2	60.9	1.88	1.47	2.35
	Pooled	70.7	1.87	1.57	2.72
Number of seed per pod	**Y_1**	59.5	5.72	4.42	7.02
	Y_2	43.9	5.24	3.47	4.74
	Pooled	67.7	4.56	3.75	6.36
Biological yield (g)	**Y_1**	56	3.13	2.34	3.61
	Y_2	79.7	5.24	4.67	8.60
	Pooled	75	4.15	3.60	6.42
Harvest index (%)	**Y_1**	56	6.98	5.65	9.43
	Y_2	37.4	6.19	3.79	4.78
	Pooled	42.6	4.71	3.08	4.14
Test weight (g)	**Y_1**	69.2	5.92	4.93	8.44
	Y_2	56.3	5.45	4.09	6.32
	Pooled	73.2	4.66	3.99	7.03
Yield per plant (g)	**Y_1**	85.6	8.91	8.24	15.70
	Y_2	74.6	8.62	7.44	16.96
	Pooled	85.0.8	7.82	7.21	13.69

to 50% flowering (64.00%), days to maturity (70.7%), plant height (64.6%), pod length (51.4%), number of pods per plant (65.9%), number of seeds per pod (67.7), test weight (73.2) and biological yield (75.00%). Moderate estimates of heritability for these characters were also reported by Sharma et al. [10].

Heritability estimates were low for days to 50% flowering (45.00%), pod length (49.2%), number of pods per plant (44.4%) during first year, number of seeds per pod (43.9%) and harvest index (37.4%) during second year and during pooled low for harvest index (42.6%) and yield per plant (27.08%). Similar result has been reported by Kole and Saha [11].

Genetic advances in percent of mean estimates were moderate for most of the characters viz., number of branches per plant and yield per plant in Y_1 as well as pooled while, days to 50% flowering, number of branches per plant and yield per plant during Y_2. Whereas, estimates of low genetic advance in percent of mean were found for all the traits except number of branches per plant and yield per plant during Y_1, Y_2 as well as pooled while, the character days to 50% flowering in the year Y_2. Prajapati et al. [12] also reported that moderate genetic advances for these characters.

4. CONCLUSION

The highest estimate of heritability in broad sense were recorded for eleven characters viz. days to 50% flowering in Y_2 and medium heritability in pooled, and heritability in Y_1, Y_2 and pooled are medium in plant height. In number of branches per plant, highest heritability was found in Y_1, pooled and medium in Y_2. In number of pods per plant, pod length and days to maturity, medium heritability was found in Y_2 and pooled and highest heritability was recorded $_2$ in biological yield and yield per plant in Y_1, pooled. Medium heritability in seed yield per pod, biological yield was found in Y_1, pooled. PCV, GCV range for number of branches per plant was recorded medium in only Y_1. Genetic advance in percent of mean was recorded medium value in number of branches per plant and seed yield per plant for Y_1, Y_2 and pooled, and medium value for days to 50% flowering in Y_2.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Acharya SN, Basu SK, Thomas JE. Medicinal properties of fenugreek (*Trigonella foenum-graecum* L.). A review of the evidence-based studies. Advances in medicinal plant research. India. 2007; 81-122.
2. Meena ML, Narolia SL, Atal MK, Verma N. Evaluation of fenugreek (*Trigonella foenum-graecum* L.) genotypes for horticultural traits. Chemical Science Review and Letters. 2017;6(23):2014-2018.
3. Malhotra SK, Vashishtha BB. Organic production of seed spices. National Research Centre for Seed Spices, Ajmer, India. 2008;90-94.
4. Burton GS, de Vane EW. Estimating heritability in tall descue (*Festuca arundinaces*) from replicated clonal selection. Agron. Journol. 1953;45:478-481.
5. Meena Ramesh Pithia MS, Savaliya JJ, Pansuriya AG. Combining ability studies in vegetable cowpea [*Vigna unguiculata* (L.) Walp.]. Research on Crops. 2010; 11(2):441-445.
6. Panse, V. G. and Sukhatme. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi; 1987.
7. Johnson HW, Robinson HF, Comstock RK. Genotypic and phenotypic correlation in soybean and their implication in election. Agron. J. 1955;47:477-488.
8. Kumar S, Ram CN, Nath S, Kumar S, Kumari M, Singh V. Studies on genetic variability, heritability and genetic advances in fenugreek (*Trigonella foenum-graecum* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9 (5):1358-1361.
9. Yadav Pramila Tripathi DK, Khan KK, Yadav AK. Determination of genetic variation and heritability estimates for morphological and yield traits in chickpea (*Cicer arietinum*) under late sown conditions. Indian Journal of Agricultural Sciences; 2015;85(7):877-882.
10. Sharma Nemichand Shekhawat AS, Nagariya NK. Genetic variability in

fenugreek (*Trigonella foenum-graecum* L.). Annals of Biology. 2015;31(1):94-96. 14.
11. Kole PC, Saha A. Studies on variability and heritability for different quantitative characters in fenugreek under different environments. Journal of Plant Breeding and Crop Science. 2013;5(11):224-228. 17.
12. Prajapati DB, Ravindrababu Y, Prajapati BH. Genetic variability and character association in fenugreek (*Trigonella foenum-graecum* L.); 2010.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/89542