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Studies on genetic variability, heritability and genetic advance for certain metric traits in fenugreek (*Trigonella foenum- garacum L.*)

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Abstract

The present investigation entitled “Studies on genetic variability, heritability and genetic advance for certain metric traits in Fenugreek (*Trigonella foenum- garacum L.*)..” was conducted during *Rabi* seasons of 2018-19 (E1) and 2019-20 (E2) heritability and genetic advance using diallel mating design (excluding reciprocal) at the Main Experiment Station (MES) of the Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Narendra Nagar, Kumarganj, Ayodhya (U.P.) India. Ten diverse parents of fenugreek were crossed in a diallel fashion (excluding reciprocals) for generating experimental material. All the Ten parents and their 45 hybrids were grown in Randomized Block design with three replications. Observations were recorded on the 11 characters viz., Days to 50 per cent flowering, Days to maturity, Plant height (cm), Number of branches per plant, pod length (cm), Number of pods per plant, Number of seed per pods, Test weight (g), Biological yield (g), Harvest index (%) and yield per plant (g).

High heritability (broad sense) along with high genetic advance in per cent of mean were observed for most of the important economic traits showing ample scope of crop improvement by selection.

Keywords: Fenugreek, PCV, GCV, heritability, genetic advance, yield

Introduction

Fenugreek (*Trigonella foenum-graecum L.*) $2n=16$, locally known as ‘Methi’ belongs to the family-*Leguminoaceae* and sub-family-*Papilionaceae*, along with it’s another cultivated species *Trigonella corniculata L.*

Trigonella comes from Latin words ‘little triangle’ in reference to triangular shape of small yellowish white flowers. The spices epithet foenum-gracum means ‘Greek hay’ and according to Rosengarten, the Romans, who got the plant from Greece where it was a very common crop in ancient times, gave it this name it is also called ‘ox horn’ or goat horn because the two seeds pods projecting in opposite direction usually from the nodes of the stem base that resemble with ox or goat horns.

The wild form of fenugreek is found growing in North Western India, Argentina, Egypt, Southern France, Morocco, Spain, Turkey, China, Pakistan and Lebanon are the leading countries for fenugreek production.

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. In India, it occupies an area of about 218 thousand hectare with 220 mt annual productions with share of 2.4 per cent (Anonymous, 2017-18) [2]. Fenugreek is mainly grown in the states of Rajasthan, Gujarat, Punjab, Haryana, U.P., M.P. Maharashtra and Tamil Nadu. Rajasthan alone contributes nearly 60 per cent of total area and 80 per cent of total production of the crop in the country.

Phenotypic variability changes under different environmental conditions while genetic variability remains unchanged and more useful to a plant breeder for exploitation in selection or hybridization. Yield is very complex characteristics controlled by several yield contributing components and it is highly influenced by environmental factors, consequently estimates of heritability and genetic advance are useful for selection.

Material and methods

The present investigation entitled “Studies on genetic variability, heritability and genetic advance for certain metric traits in Fenugreek (*Trigonella foenum- garacum L.*)” was

carried out at Main Experiment Station (Vegetable Research Farm), Narendra Nagar (Kumarganj), Ayodhya (U.P.) India, during Rabi season of 2018-19 (E1) and 2019-20 (E2).

The experimental materials for the present investigation was comprised of ten promising and diverse pure lines/varieties of fenugreek selected on the basis of genetic variability from the germplasm stock maintained in the Department of Vegetable Science, A.N.D. University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) India. The selected parental lines *i.e.* NDM-1(P₁), NDM -2 (P₂), NDM -3(P₃), NDM-5 (P₄), NDM -6 (P₅), NDM-8 (P₆), NDM-9 (P₇), NDM-10 (P₈), PEB (Pusa early bunching) (P₉) and Hisar sonali (ch.) (P₁₀) were crossed in the all possible combinations, excluding reciprocals, during the Rabi season of 2017-18. These 45 F₁s along with their parents were evaluated for the study of heritability and genetic advance for 11 seed yield attributing traits. The ten diverse parental line selected their characteristics and crossed in diallel mating design as suggested by Griffing (1956b) to produce 45 hybrids in Rabi season of 2017-18 and evaluated during Rabi season of 2018-19 and 2019-20. The experiment laid out in randomized block design with three replication and 55 treatment including 10 parents. The observation were recorded Days to 50 per cent flowering, days to maturity, plant height (cm), number of branches per plant, pod length (cm), number of pods per plants, number of seeds per pod, test weight (g), biological yield (g), harvest index (%) and yield per plant (g).

Result and Discussion

The estimates of phenotypic and genotypic coefficient of variation for eleven characters are presented in table 1. Moderate GCV (10-25%) was observed for plant height (10.30%) during E1 and (10.14%) during pooled, number of pods per plant (11.26% and 11.29%) during E2 and pooled

and harvest index (10.45%, 10.31% and 10.49%) during E1, E2 and pooled, whereas, days to 50% flowering (7.10%, 6.78% and 6.94%), days to maturity (1.56%, 1.78% and 1.71%), number of branches per plant (8.05%, 8.17%, and 8.43%), plant height (9.79% in pooled), Pods length (6.24%, 5.80% and 6.64%), number of seeds per pods (5.26%, 7.79% and 5.33%), test weight (1000-grain weight) (2.25%, 2.38% and 2.08%), Biological yield per plant (5.05%, 3.66% and 5.09%) and Seed yield per plant (7.70%, 6.68% and 7.87%) were recorded low GCV (<10%) during E1, E2 and pooled.

Plant height (11.29%, 11.05% and 11.07%), number of branches per plant (10.22%, 10.34% and 10.65%), number of pods per plant (12.38%, 12.36% and 12.32%), Harvest index (11.69%, 11.37% and 11.29%) were recorded moderate PCV(10-25%) during the season E1, E2 and pooled and yield per plant (10.91%) was recorded moderate PCV(10-25%) during pooled. whereas, Days to 50% flowering (8.44%, 8.06% and 8.24%), Days to maturity (4.25, 3.91 and 4.03%), Pod length (8.10%, 7.79% and 8.33%), Number. of seeds per pod (5.36%, 7.99% and 6.17%), 1000-grains weight (6.17%, 6.07% and 6.04%), biological yield (7.28%, 8.78% and 7.22%) recorded low PCV (< 10%) during E1, E2 and pooled and yield per plant (9.48% and 9.19%) also recorded low PCV (< 10%) during E1 and pooled. Similar findings were reported by Maurya *et al.* (2013)^[6], Kole & Saha *et al.* (2013)^[5], Patahk *et al.* (2014)^[7], Singh *et al.* (2014)^[10], Sharma *et al.* (2015)^[9] and Yadav *et al.* (2015)^[12] for seed yield and its contributing characters in fenugreek crop.

High heritability (>60%) was observed for days to 50% flowering (70.81, 70.80 and 70.81), plant height (83.13, 78.59 and 83.30), number of branches per plant (61.81, 62.41 and 62.77), number of pods per plants (82.76, 83.01 and 83.99) and harvest index (79.87, 82.10 and 86.37).

Table 1: Estimates of variability parameters for growth and yield traits in fenugreek during 2018-19 (E1), 2019-20 (E2) and over season (pooled)

Characters	Seasons	PCV (%)	GCV (%)	Heritability in broad sense (%)	Genetic advance in per cent of mean
Days to 50% flowering	E ₁	8.44	7.10	70.81	12.31
	E ₂	8.06	6.78	70.80	11.75
	Pooled	8.24	6.94	70.81	12.03
Days to maturity	E ₁	4.25	1.56	13.51	2.47
	E ₂	3.91	1.78	20.66	2.47
	Pooled	4.03	1.71	18.03	1.50
Plant height (cm)	E ₁	11.29	10.30	83.13	19.34
	E ₂	11.05	9.79	78.59	17.88
	Pooled	11.07	10.14	83.30	19.00
Number of branches per plant	E ₁	10.22	8.05	61.81	13.02
	E ₂	10.34	8.17	62.41	13.29
	Pooled	10.65	8.43	62.77	13.77
Pod length	E ₁	8.10	6.24	59.39	9.91
	E ₂	7.79	5.80	55.57	8.91
	Pooled	8.33	6.64	63.62	10.91
Number of pod per plant	E ₁	12.38	11.26	82.76	21.10
	E ₂	12.36	11.26	83.01	21.14
	Pooled	12.32	11.29	83.99	21.31
Number of seed per pod	E ₁	8.05	5.26	42.71	7.08
	E ₂	5.36	7.97	45.15	7.42
	Pooled	7.99	5.33	44.38	7.31
Test weight (g)	E ₁	6.17	2.25	13.32	1.69
	E ₂	6.07	2.38	15.38	1.92
	Pooled	6.04	2.08	14.32	1.78
Biological yield (g)	E ₁	7.28	5.05	48.19	7.22
	E ₂	8.78	3.66	17.40	3.15
	Pooled	7.22	5.09	49.67	7.39
Harvest index (%)	E ₁	11.69	10.45	79.87	19.24

	E ₂	11.37	10.31	82.10	19.24
	Pooled	11.29	10.49	86.37	20.09
Yield per plant (g)	E ₁	9.48	7.70	65.89	12.87
	E ₂	10.91	6.68	37.50	8.43
	Pooled	9.19	7.87	73.33	13.88

Whereas, pod length (63.62) during pooled and yield per plant (65.89 and 73.33) during E₁ and pooled showed high heritability (>60%).

Pod length (59.39 and 55.47) during E₁ and E₂, number of seeds per pod (42.71, 45.45 and 44.38) during both season and pooled and biological yield (37.50) during E₂ to be recorded moderate heritability (30-60%).

Whereas low heritability (10-30%) to be observed for the traits, Days to maturity (13.51, 20.66 and 18.03) and test weight (13.32, 15.38 and 14.32) and biological yield (17.40) during E₂ also observed low heritability. Heritability, which denotes the proportion of phenotypic variance that is due to genotypic variance and is transmissible from parent to offspring, is in fact an index for selection of a character. By studying the heritability, the value of a character can be assessed for formulating a breeding programme. Similar findings were reported by Singh and Pramila (2009), Maurya *et al.* (2013) [6], Singh (2014) [10], Patahk *et al.* (2014) [7], Sharma *et al.* (2015) [9], and Yadav *et al.* (2015) [12] for plant height, number of branches per plant, grain per pod, 1000-grain weight, harvest Index and grain yield per plant in fenugreek.

High genetic advance was observed (>20%) for number of pods per plant (21.10, 2.14 and 21.31) during E₁, E₂ and pooled. However, days to 50% flowering (12.31, 11.75 and 12.03), plant height (19.34, 17.88 and 19.00), number of branches per plant (13.02, 13.29 and 13.77) were recorded moderate (>10 to <20) genetic advance. Pod length (10.91) during pooled and yield per plant (12.87 and 13.88) during E₁ and pooled showed moderate genetic advance.

Expected genetic advance expressed as percentage of mean was observed low (<10%) for days to maturity (2.47, 2.47 and 1.50), number of seeds per plant (7.08, 7.42 and 7.31), test weight (1.69, 1.92 and 1.78) and biological yield (7.22, 3.15 and 7.39). Similar findings were reported by Prajapati *et al.* (2010) [8], Maurya *et al.* (2013) [6], Patahk *et al.* (2014) [7] and Yadav *et al.* (2015) [12] for yield and its component traits.

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