Biological Forum – An International Journal **13(3a): 232-237(2021)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Assessment of Genetic Variability for Different Parameters in Fenugreek under Moisture Regime

Bhuri Singh*[1] and Vivechana Rajpoot[2]
[1]*Department of Basic Science, College of Horticulture and Forestry, Jhalawar 326023, (Rajasthan), India.*
[2]*Department of Botany, Government College, Kota-324001, (Rajasthan), India.*

(Corresponding author: Bhuri Singh)*
(Received 03 July 2021, Accepted 10 September, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: An experiment was conducted to assess the genetic variability in fenugreek genotypes under moisture regimes. Thirty genotypes of fenugreek were sown in RBD with three replications during *rabi* season 2019-20. The results of ANOVA showed significant differences among the genotypes for all the parameters under study indicating the presence of wide spectrum of variability among the genotypes. High PCV (>20), high heritability (>60) coupled with high genetic advance as percentage of mean (>20%) was observed for proline content in leaves (mg/g) at 60 DAS and maturity and seed yield per plant suggesting that these parameters are genetically governed by additive gene action and genotypes RMt-143, RMt-305, GM-1, AFG-3 and RMt-303 can be utilized in selection for fenugreek improvement.

Keywords: Fenugreek, genetic advance, heritability, moisture, variability.

INTRODUCTION

Moisture stress is considered to be one of the most important abiotic factors affecting the plant growth and developmental aspects in addition to the adverse impacts on social and economic life of mankind (Anjum *et al.,* 2012) as well as impairing crop production (Hamrouni *et al.,* 2001). The adaptability and responses of the plants to moisture stress depends on duration, magnitude of stress and developmental stage of the plant (Kramer and Boyer, 1995). Drought is severely affected the growth and especially grain filling stage in the crops such as wheat (Rao *et al.,* 2021). Fenugreek (*Trigonella foenum-graecum* L.) is an annual herbaceous crop belonging to the Fabaceae family, widely grown in India, Pakistan, Egypt, and Middle Eastern countries of the world. In India, it is mainly cultivated in Rajasthan, Gujarat, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Himachal Pradesh and Haryana with total area of 1,22,000 hectares and production of 192,000 metric tonnes (Anonymous, 2020). Fenugreek can be grown under wide range of climatic conditions and well-drained soil. Cool climate and dry weather are essential at the time of maturity. Fenugreek plant is susceptible to moisture stress during pre-flowering and post flowering stages, since a soil matric potential lower than 0.3 Megapascal causes substantial reduction in yield (Alhadi *et al.,* 1999). Fenugreek is mostly grown inarid and semi-arid areas of the world but responds well to minimum application of irrigation (Acharya *et al.,* 2006).

In the recent couple of years, the shifting pattern of rainfall has noticed. Due to this, irregular supply of water to rainfed dependent crop become major concern. This pattern of unusual water supply resulted drastic reduction in the yield and quality of the fenugreek. Improving moisture tolerance or selecting tolerance genotypes is considered one of the better ways for successful cultivation of crops in the arid and semi-arid areas or areas with water deficit (Basu *et al.,* 2009; Ahari *et al.,* 2009).

Therefore, it is an urgent need to identify moisture tolerant fenugreek genotypes with high genetic yield potential to achieve an effective breeding programme. Genetic variability in fenugreek is still highly needed, because the diversity of a crop determines the selection efficiency to improve it. Absolute variability in various parameters cannot be decisive in observing which traits shows the maximum degree of variability. Moreover, relative values of PCV and GCV give a reliable idea of the extent of variability in the population. Therefore, this study was carried out to screen the moisture tolerance and high yield potential fenugreek genotype with a distinct genetic variability for fenugreek improvement.

MATERIALS AND METHODS

The present study was conducted at Experimental Farm, College of Horticulture and Forestry, Jhalawar-326 023. The experimental materials consisting of thirty genotypes of fenugreek are given in Table 1.

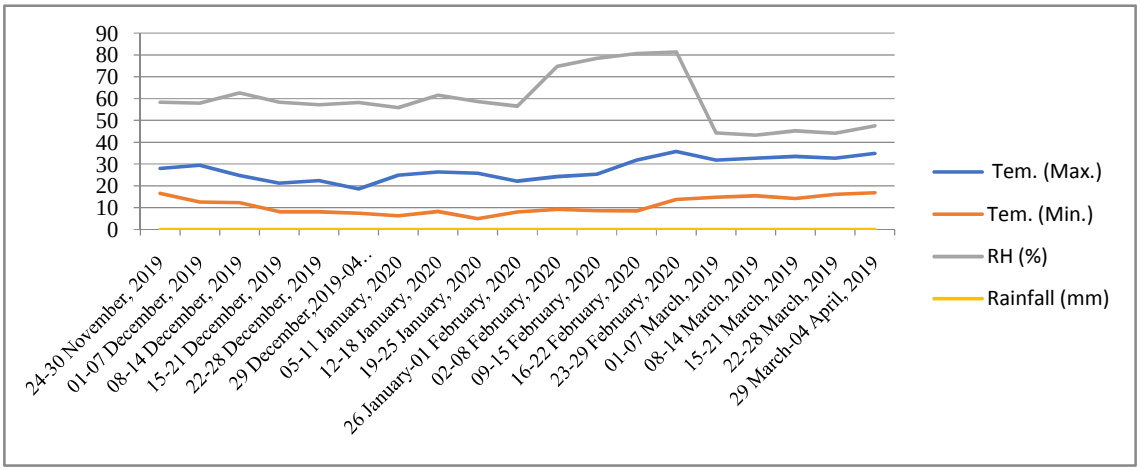
Table 1: List of thirty genotypes of fenugreek used in the study.

Sr. No.	Genotype	Sr. No.	Genotype
1.	RMt-305	16.	Jhunjhunu local
2.	GM-1	17.	Azad Methi
3.	MP local-1	18.	Nagour local-1
4.	MP local-2	19.	Hisar Mukta
5.	Jaipur local	20.	CO-2
6.	Karnataka local	21.	Hisar Sonali
7.	Chittorgarh local	22.	RMt-351
8.	Jhalawar local	23.	GM-2
9.	Nagour local-2	24.	AFG-3
10.	RMt-303	25.	RMt-1
11.	RMt-143	26.	AFG-2
12.	Rajendra Kranti	27.	Lam selection
13.	Hisar Suvarna	28.	Sikar local
14.	AFG-1	29.	AFG-4
15.	Pant Ragni	30.	Hisar Madhavi

The experiment was laid out in randomized block design with three replications during *Rabi* season 2019-20 under moisture stress condition. Irrigation was given at the time of seed sowing for establishing the crop. Moisture stress condition was created by withholding irrigation at the time of pre flowering stage which commensurate with 40-45 days after sowing (DAS) and post flowering stage which commensurate with 70-80 days after sowing (DAS). Seeds of each genotype was directly sown in a two rows of 5 m row length in each replication with a spacing of 30×10 cm maintained. All recommended cultural practices were adopted uniformly in order to ensure a healthycrop stand except irrigations.

Observations were recorded on five randomly selected plants in each genotype and each replication after eliminating border and unhealthy plants for all the parameters under study except days to 50 percent flowering and days to maturity which were recorded on plot basis. Furthermore, observations were recorded on parameters *viz.* days to 50 percent flowering, days to maturity, plant height at maturity(cm), number of branches per plant, number of pods per plant, pod length(cm), number of seeds per pods, test weight(g), seed yield per plant(g), total chlorophyll content in leaves(mg/g) at 60 days after sowing (DAS) and maturity, proline content in leaves at 60 days after sowing (DAS) and maturity and crude protein content (%). Mean weekly meteorological data for the period of experiment are presented in Graph 1.

Graph 1: Mean weekly meteorological data of during the experimentation.



To work out the analysis of variance (Goulden,1959), phenotypic and genotypic coefficient of variation (Burton, 1952), heritability in broad sense (Lush, 1940) and genetic advance as per cent of mean (Johnson *et al.*, 1955) were calculated as per statistical method using web based statistical package OPSTAT from CCSHAU, Hisar, Haryana.

RESULTS AND DISCUSSION

Analysis of variance was conducted to eliminate the variation due to causes other than genotypes from total variation. The analysis of variances revealed highly significant variation among the genotypes ($p < 0.01$) for all the parameters under study (Table 2). This suggested that the material had adequate variability and response to selection may be accepted in the breeding programme for seed yield or any of its supporting parameters under moisture stress condition. These results are in agreement with the findings of Ahari *et al.,* (2009); Dashora *et al.*, (2011); Verma and Ali (2012); Yadav *et al.*, (2013); Kole and Saha (2014), Sharma *et al.,* (2015), Meena *et al.,* (2017); Singh and Naula (2017).

Table 2: ANOVA for different parameters in fenugreek under moisture stress conditions.

S. No.	Source of Variance	d. f.	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12	C-13	C-14
1.	Replication	2	0.54	0.578	92.170	1.277	6.316	0.040	0.403	0.0014	0.075	0.540	0.138	0.751	15.200	0.711
2.	Genotype	29	19.69**	60.270**	180.844**	8.912**	153.591**	1.880**	5.121**	5.4186**	16.667**	2.750**	15.939**	2689.119**	13827.14**	11.921**
3.	Error	58	1.64	2.382	56.892	0.581	2.728	0.080	0.140	0.0034	0.048	0.207	0.142	2.684	23.395	0.285

*and ** represent significant at 5 (%) and 1(%) level of significant, respectively

Parameter details: C-1: Days to 50 percent flowering, C-2: Days to maturity, C-3: Plant height at maturity (cm), C-4: Number of branches per plant, C-5: Number of pods per plant, C-6: Pod length (cm), C-7: Number of seeds per pod, C-8: Test weight (g), C-9: Seed yield per plant (g), C-10: Total chlorophyll content in leaves(mg/g) at 60 DAS, C-11: Total chlorophyll content in leaves(mg/g) at maturity, C-12: Proline content in leaves (mg/g) at 60 DAS, C-13:Proline content in leaves (mg/g) at maturity and C-14: Crude protein content (%).

Further, the data obtained from the mean performance study (Table 3) also showed high significant difference indicating the existence of sufficient variability for all the parameters among the genotypes investigated under moisture stress condition. The results revealed that the days to 50 per cent flowering ranged from 49.00 days (RMt-305) to 58.67 (Pant Ragini) with the mean value of 53.89 days, days to maturity varied from 102.33 (RMt-305) to 123.33 (Pant Ragini) with the mean value of 115.82 days, plant height at maturity was observed in minimum Hisar Mukta (44.22 cm) and maximum in Karnataka local (74.33 cm) with the mean value of 61.11cm, number of branches per plant varied from 7.22 (GM-1) to 14.77 (RMt-305) with the mean value of 9.50, minimum number of pods per plant was observed in Lam selection (40.44), while maximum in RMt-305 (71.11) with the mean value of 49.65,pod length ranged from 8.28 cm (Hisar Suvarna) to 12.09 cm(AFG-3) with the mean value of 9.75 cm, number of seeds per pod ranged from 12.83 (Nagour local-2) to 17.78 (RMt-305) with the mean value of 14.68, test weight ranged from 10.54 g (Rajendra Kranti) to 15.60 g (Sikar local) with the mean value of 12.50 g, seed yield per plant was recorded lowest in GM-1 (7.19 g), while highest in RMt-143 (15.13 g) with the mean value of 10.58 g,total chlorophyll content in leaves at 60 days after sowing(DAS) ranged from 36.04 mg/g (AFG-3) to 40.75 mg/g (RMt-305) with the mean value of 37.67 mg/g, total chlorophyll content in leaves at maturity ranged from 19.45 mg/g (Pant Ragni) to 28.16 mg/g (RMt-1) with the mean value of 24.95 mg/g, proline content in leaves at 60 days after sowing (DAS) ranged from 34.50 mg/100g (RMt-351) to 156.61 mg/100g (GM-1) with the mean value of 95.61 mg/100g, proline content in leaves at maturity ranged from 76.08 mg/100g (RMt-351) to 360.46 mg/100g (GM-1) with the mean value of 219.64 mg/100g and crude protein content ranged from 14.38 percent (Rajendra Kranti) to 22.18 percent (Lam selection) with the mean value of 17.75 percent.

Table 3: Mean value for different parameters of fenugreek genotype under moisture stress conditions.

S. No.	Genotype	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12	C-13	C-14
1.	RMt-305	49.00	102.33	52.89	14.77	71.11	10.80	17.78	12.42	14.73	40.75	27.98	137.10	301.83	18.46
2.	GM-1	53.00	110.33	73.67	7.22	51.77	10.28	17.28	13.28	14.30	38.51	24.82	156.61	360.46	15.70
3.	MP local-1	55.67	115.67	71.44	7.33	44.22	9.17	13.22	10.95	8.08	37.96	25.46	119.27	277.08	20.14
4.	MP local-2	56.00	113.67	63.22	7.33	46.89	9.72	13.27	11.93	9.15	37.56	25.23	92.37	214.00	15.42
5.	Jaipur local	57.33	114.67	56.66	7.66	47.77	8.83	14.05	10.68	8.22	39.16	22.71	130.24	298.25	16.77
6.	Karnataka local	55.67	117.00	74.33	9.33	44.99	8.81	14.22	15.57	12.10	38.15	25.51	112.83	258.73	18.46
7.	Chittorgrh local	56.33	118.00	47.56	8.11	50.11	8.97	12.89	12.03	10.39	38.38	24.66	99.01	229.65	19.73
8.	Jhalawar local	56.00	114.67	65.00	8.22	41.00	10.34	13.94	12.56	9.78	39.22	26.55	92.42	209.06	15.24
9.	Nagour local-2	56.67	114.67	63.77	9.11	48.55	8.44	12.83	11.17	7.47	38.25	25.31	102.28	232.98	19.98
10.	RMt-303	50.33	117.33	68.11	9.65	53.44	10.22	16.28	12.49	13.51	37.13	24.25	113.10	259.77	18.86
11.	RMt-143	51.00	119.00	71.33	8.20	63.66	9.72	16.83	12.63	15.13	37.91	27.75	97.17	223.66	19.63
12.	Rajendra Kranti	51.33	105.33	63.89	11.22	51.99	8.62	15.61	10.54	13.41	38.03	26.51	68.89	169.49	14.38
13.	Hisar Suvarna	54.00	120.33	62.66	9.55	49.78	8.28	14.83	11.68	10.10	38.12	26.00	127.55	292.94	17.63
14.	AFG-1	55.33	114.67	67.78	11.11	51.11	10.33	14.25	12.76	11.91	36.78	27.60	121.17	280.35	15.49
15.	Pant Ragini	58.67	123.33	63.44	9.11	41.55	9.35	15.39	13.06	10.76	36.94	19.45	111.51	254.91	16.49
16.	Jhunjhunu local	56.00	117.33	53.00	9.00	48.55	9.60	13.00	11.96	9.13	37.15	21.95	104.97	244.28	20.22
17.	Azad Methi	54.33	115.33	62.44	9.44	47.33	9.57	14.78	12.11	8.39	37.34	27.28	102.07	234.63	17.89
18.	Nagour local-1	56.33	118.00	63.33	8.44	48.55	9.54	13.44	10.90	8.16	37.48	24.48	133.30	303.55	17.82
19.	Hisar Mukta	52.67	122.33	44.22	9.00	51.11	9.87	14.72	13.78	12.94	37.21	20.73	69.21	157.39	15.02
20.	CO-2	56.67	116.00	60.89	7.66	48.55	10.37	14.88	11.99	11.53	37.76	20.66	109.88	250.36	16.01
21.	Hisar Sonali	53.00	120.33	63.33	10.22	47.55	9.82	14.77	10.62	9.82	36.94	22.49	100.28	231.12	15.97
22.	RMt-351	49.67	114.00	61.44	11.55	62.55	10.30	14.16	12.67	12.15	36.44	27.90	34.50	76.08	20.02
23.	GM-2	50.67	112.00	62.77	10.22	51.11	10.55	13.77	11.81	7.19	38.28	23.41	66.73	150.50	17.86
24.	AFG-3	52.67	120.67	65.78	12.44	62.00	12.09	14.50	14.58	13.88	36.04	23.29	71.79	172.92	19.39
25.	RMt-1	50.33	112.33	46.77	11.66	48.78	9.41	16.00	11.15	9.75	37.46	28.16	86.77	198.24	16.50
26.	AFG-2	53.00	119.33	60.44	10.66	44.00	9.76	16.16	13.21	8.09	37.15	25.85	79.97	182.47	20.60
27.	Lam selection	55.67	115.33	52.22	7.77	40.44	9.24	14.39	13.84	10.74	36.53	26.77	35.55	86.61	22.18
28.	Sikar local	54.67	118.33	52.22	9.22	40.55	9.83	13.22	15.60	7.27	36.72	26.36	65.73	149.68	17.46
29.	AFG-4	52.33	118.67	63.88	10.55	48.33	10.05	15.55	13.26	9.56	37.57	24.75	41.62	94.32	17.06
30.	Hisar Madhavi	52.33	113.67	54.89	9.22	42.00	10.47	14.39	13.86	9.73	37.08	24.77	84.40	193.75	16.20
	Mean	53.89	115.82	61.11	9.50	49.64	9.57	14.68	12.50	10.58	37.67	24.95	95.61	219.63	17.75
	Minimum	49.00	102.33	44.22	7.22	40.44	8.28	12.83	10.54	7.19	36.04	19.45	34.50	76.08	14.38
	Maximum	58.67	123.33	74.33	14.77	71.11	12.09	17.78	15.60	15.13	40.75	28.16	156.61	360.46	22.18
	CD	2.09	2.52	12.33	1.25	2.70	0.46	0.61	0.10	0.36	0.74	0.62	2.68	7.91	0.87
	CV	2.37	1.33	12.34	8.02	3.33	2.90	2.55	0.47	2.06	1.21	1.51	1.71	2.20	3.01

Parameter details: C-1: Days to 50 percent flowering, C-2: Days to maturity, C-3: Plant height at maturity (cm), C-4: Number of branches per plant, C-5: Number of pods per plant, C-6: Pod length (cm), C-7: Number of seeds per pod, C-8: Test weight (g), C-9: Seed yield per plant (g), C-10: Total chlorophyll content in leaves(mg/g) at 60 DAS, C-11: Total chlorophyll content in leaves(mg/g) at maturity, C-12: Proline content in leaves (mg/g) at 60 DAS, C-13:Proline content in leaves (mg/g) at maturity and C-14: Crude protein content (%).

Variability among thirty genotypes of fenugreek for all the parameters measured in terms of phenotypic coefficient of variation, genotypic coefficient of variation, heritability in broad sense and genetic advance as percent of mean under moisture stress condition are given in Table 4. In the present study the magnitude of phenotypic coefficient of variation were found higher than the corresponding genotypic coefficient of variation for all the parameters studied under moisture stress condition, which indicted effect of stress on the trait's expression. It means that the apparent variation is not only due to genotypes but also due to the influence of environment. However, the differences were narrow which implied their relative tolerance to environmental variation. It also described those genetic factors were pre-dominantly responsible for expression of those attributes and selection could be made effectively on the basis of phenotype

performance. Commonly the change in mean is associated with higher variation for most of the parameters in moisture stress conditions except proline content in leaves at 60 days after sowing and maturity. Thus, the selection could be made on the basis of phenotypic performance offering scope for crop improvement.

The estimation of phenotypic coefficients of variation and genotypic coefficients of variation were observed to be highest (>20%) for proline content in leaves at 60 days after sowing (DAS) (31.35 and 31.30) and maturity (30.96 and 30.88) and seed yield per plant (22.34 and 22.25) in moisture stress condition. Thus, selection might be more effective for these characters because the response to selection is directly proportional to the variability present in the experimental material. Similar findings were also reported by Pathak *et al.,* (2014); Narolia *et al.,* (2017); Panwar *et al.,* (2017).

Table 4: Coefficient of variation, heritability (h^2) (broad sense) and genetic advance (GA) as (%) of mean for different parameters under moisture stress condition.

Sr. No.	Parameters	Coefficient of variances		h^2_{bs}	GA as (%) of mean
		Genotypic	Phenotypic		
1.	Days to 50 (%) flowering	4.55	5.13	78.62	8.31
2.	Days to maturity	3.79	4.02	89.01	7.37
3.	Plant height at maturity (cm)	10.52	16.22	42.07	14.05
4.	Number of branches per plant	17.54	19.29	82.70	32.87
5.	Number of pods per plant	14.28	14.67	94.85	28.66
6.	Pod length (cm)	7.95	8.46	88.26	15.38
7.	Number of seeds per pod	8.78	9.14	92.23	17.37
8.	Test weight (g)	10.75	10.76	99.81	22.11
9.	Seed yield per plant (g)	22.25	22.34	99.15	45.64
10.	Total chlorophyll content in leaves (mg/g) at 60 DAS	2.44	2.73	80.36	4.51
11.	Total chlorophyll content in leaves (mg/g)at maturity	9.20	9.32	97.36	18.69
12.	Proline content in leaves(mg/g)at 60 DAS	31.30	31.35	99.70	64.38
13.	Proline content in leaves (mg/g)at maturity	30.88	30.96	99.49	63.46
14.	Crude protein content (%)	11.09	11.49	93.15	22.06

Further, it may be feasible to determine the amount of heritable variation and the relative degree to which a character is transmitted from parent to offspring, by the estimate of heritability (Hanson *et al.,* 1956). Heritability estimates provides guide for the selection procedure to be followed by the breeder for improvement of these traits under moisture stress condition.

In the present study the magnitude of broad sense heritability ranged from 42.07 (plant height at maturity) to 99.81 (seed yield per plant) and high heritability (>60) was sown by all the parameters under study except plant height at maturity. Similar findings were also reported by Singh *et al.,* (2014) in pearl millet; Singh and Naula (2017); Singh *et al.,* (2019); Verma *et al.,* (2016) in fenugreek crop.

Heritability value alone provides no indication of the amountof genetic progress that would result from selecting the best individuals as it includes both additive and non-additive geneaction. In the present investigation, expected genetic advance as percentage of mean (>20%) recorded maximum with proline content in leaves at 60 DAS (64.38) and maturity (63.46) followed by seed yield per plant (45.64), number of branches per plant (32.87), number of seeds per pod (28.66), crude protein content (22.06) and test weight (22.11) in moisture stress condition. These results are in agreement with Pathak *et al.,* (2014); Mamatha *et al.,* (2017); Naroliya *et al.,* (2017).

Johnson *et al.,* (1955) has pointed out that heritability estimate along with genetic advance were more useful than heritability estimates alone in predicting the response to selection.

Therefore, genetic advance as percentage of mean was calculated in order to determine the relative merits of different characters that can be further utilized in the selection programme. High heritability(>60%) coupled with high genetic advance as a percentage of mean (>20%) was observed for proline content in leaves at 60 DAS and maturity, seed yield per plant, number of branches per plant, number of pods per plant, crude protein content and test weight indicating the presence of additive gene action and the rest of parameters, days to 50 percent flowering, days to maturity, pod length, total chlorophyll content in leaves at 60DAS and maturity and plant height at maturity showed high heritability associated with low genetic advance as percent of mean due to its low genotypic coefficient of variation. These reported results are in agreement with the findings of Kumari *et al*., (2015).

CONCLUSIONS

From the above investigation, it can be revealed that the genotypes showed a significant variation and genetic gain among each other under moisture regime condition. The parameters *viz*., Proline content in leaves at 60 DAS and maturity, seed yield per plant, number of branches per plant, number of pods per plant, crude protein content and test weight showed high value for heritability and genetic advance as percentage of mean. The most promising genotypes RMt-143, RMt-305, GM-1, AFG-3 and RMt-303 were showed high values for the above-mentioned important parameters Thus, these parameters and genotypes should be considered during selection for higher yield potential in fenugreek under moisture stress condition at pre and post

flowering stages. On the basis of the value and tolerance, these genotypes are needed to evaluate for breeding purposes.

FUTURE SCOPE

The above selected genotypes could be used in the breeding programme in the development of new varieties against drought resistance. Furthermore, these genotypes also frame a path for researchers and breeders in the selection of locally available such superior germplasms. Further, investigation is needed to elucidate the mechanism of such genotypes with respect to climate resilience and adverse conditions.

Acknowledgement. The authors are highly grateful to Dr. Bhuvnesh Nagar and Nirmal Kumar Meena, Assistant Professor (s) for help in shaping up of this manuscript.

Conflict of Interest. There is no conflict of interest involved in the study.

REFERENCES

Acharya, S., Srichamroen, A., Basu, S., Ooraikul, B., & Basu, T. (2006). Improvement in the Nutraceutical Properties of Fenugreek (*Trigonella foenum-graecum* L.). *Songklanakarin Journal of Science and Technology*, *28*(1): 1-9.

Ahari, D. S., Kashi, A. K., Hassandokht, M. R., Amri, A., & Alizadeh, K. (2009). Assessment of Drought Tolerance in Iranian Fenugreek (*Trigonella foenum-graecum* L.). *Journal of Food, Agriculture and Environment*, *7*(3&4): 414-419.

Alhadi, F. A., Yasseen, B. T., & Jabr, M. (1999). Water Stress and Gibberellic Acid Effects on Growth of Fenugreek Plants. *Irrigation Science*, *18*(4): 185-190.

Anjum, S. A., Saleem, M. F., Cheema, M. A., Bilal, M. F., & Khaliq, T. (2012). An Assessment to Vulnerability, Extent, Characteristics and Severity of Drought Hazard in Pakistan. *Pakistan Journal of Science*, *64*(2): 138-143.

Anonymous (2020). Pocket Book of Agriculture Statistics 2020; Department of Agriculture, Co-operation and Farmers Welfare, Ministry of Agriculture and Farmer's Welfare, GoI. pp 37.

Basu, S. K., Acharya, S. N., Bandara, M. S., Friebel, D., & Thomas, J. E. (2009). Effects of Genotype and Environment on Seed and Forage Yield in Fenugreek (*Trigonella foenum-graecum* L.) Grown in Western Canada. *Australian Journal of Crop Sciences*, *3*(6): 305-314.

Burton, G. W. (1952). Quantitative Inheritance in Grasses. *Proceeding of 6th International Grassland Congress*, *1*: 277-283.

Dashora, A., Maloo, S. R., & Dashora, L. K. (2011). Variability, Correlation and Path Coefficient Analysis in Fenugreek (*Trigonella foenum-graceum* L.) under Water Limited Conditions. *Journal of Spices and Aromatic crops*, *20*(1): 38-42.

Goulden, O. C. (1959). Methods of Statistical Analysis (2nd Edition), *Willey and Sons, Inc., New York*.

Hamrouni, I., Salah, H. B., & Marzouk, B. (2001). Effects of Water-deficit on Lipids of Sunflower Aerial Parts. *Phytochemistry*, *58*: 227-280.

Hanson, C. H., Robinson, H. P., & Comstock, R. E. (1956). Biometrical Studies of Yield in Segregating Populations of Korean Lespedeza. *Agronomy Journal*, *48* (5): 268-272.

Johnson, H. W., Robinson, H. F., & Comstock, R. E. (1955). Estimate of Genetic and Environmental Variability in Soybean. *Agronomy Journal*, *47*(7): 314-318.

Kole, P. C., & Saha, A. (2013). Studies on Variability and Heritability for different quantitative characters in Fenugreek (*Trigonella foenum-graceum* L.*). Journal of Plant Breeding and Crop Science*, *5*(11): 224-228.

Kramer, P. J., & Boyer, J. S. (1995). Water Relations of Plants and Soils. *Academic Press, San Diego*.

Kumari, J., Kulkarni, G. U., & Sharma, L. K. (2015). Studies on Genetic Variability, Correlation and Path analysis in Fenugreek (*Trigonella foenum-graceum* L.). *Frontiers in Crop Improvement*, *3*(1): 46-48.

Lush, J. L. (1940). Intro-site Correlation and Regression of Off-spring Corn as a Method of Estimating Heritability of Characters. *Proceedings American Society of Animal Production*, *33*(4): 293-301.

Mamatha, N. C., Tehlan, S. K., Srikanth, M., Ravikumar, T., Batra, V. K., Reddy, P. K., & Kumar, M. (2017). Variability Studies for Yield and Its Attributing Traits in Fenugreek (*Trigonella foenum-graecum* L.). *International Journal of Pure Applied Bioscience*, *5*(3): 1075-1079.

Meena, R. P., Singh, D., Meena, B. L., Meena, S. K., & Kumari, R. (2017). Evaluation of Fenugreek (*Trigonella foenum-graecum* L.) Genotypes under Normal and Limited Moisture Conditions. *Journal of Plant Development Sciences*, *9*(4): 283-295.

Narolia, S. L., Meena, M. L., Atal, M. K., & Verma, N. (2017). Genetic Variability, Heritability and Genetic Advance in Fenugreek (*Trigonella foenum-graecum* L.) Genotypes. *International Journal of Pure Applied Bioscience*, *5*(6): 452-458.

Panwar, A., Sharma, Y. K., Meena, R. S., Solanki, R. K., Aishwath, O. P., Singh, R., & Choudhary, S. (2017). Genetic Variability, Association Studies and Genetic Divergence in Indian Fenugreek (*Trigonella foenum-graecum* L.). *Legume Research*, *41*(6): 816-821.

Pathak, A. R., Patel, A. I., Joshi, H. K., & Patel, D. A. (2014). Genetic Variability, Correlation and Path Coefficient Analysis in Fenugreek (*Trigonella foenum-graecum* L.). *Trends in Biosciences*, *7*(4): 234-237.

Rao, D.S., Raghavendra, M., Gill, P., Madan, S., & Munjal, R. (2021). Effect of Drought Stress on Grain Quality Attributes in Wheat (*Triticum aestivum* L.) varieties. *Biological Forum – An International Journal*, 13(3): 58-63.

Sharma, N., Shekhawat, A. S., Malav, S., & Meena, C. P. (2015). Genetic Variability and Stress Susceptibility Index under Limited Moisture Condition in Fenugreek (*Trigonella foenum-graecum* L.). *Green Farming*, *6*(1): 37-40.

Singh, A., & Naula, R. (2017). Variability Parameters for Growth and Yield Characters in Fenugreek. *International Journal of Agriculture Sciences*, *9*(14):4077-4080.

Singh, A. K., Singh, D. R., Singh, A., Maurya, J. K., Pandey, V. P., & Sri, O. M. (2019). Studies on Character Association and Path Analysis of Yield with Important Yield Contributing Traits in Fenugreek (*Trigonella foenum-graecum* L.). *Journal of Pharmacognosy and Phytochemistry*, *8*(3): 4616-4619.

Singh, B., Upadhyay, P. K., & Sharma, K. C. (2014). Genetic variability, correlation and path analysis in pearl millet (*Pennisetum glaucum* L.). *Indian Research Journal of Genetics and Biotechnology*, *6*(3), 491-500.

Verma, P., & Ali, M. (2012). Genetic Variability in Fenugreek (*Trigonella foenum-graecum* L.) Assessed

in South -Eastern Rajasthan. *International Journal of Seed Spices*, *2*(1): 56-58.

Verma, P., Solanki, R. K., Dhasora, A., & Kakani, R. K. (2016). Genetic Variability in Fenugreek (*Trigonella foenum-graecum* L.) as Expressed under South-Eastern Region of Rajasthan State. *International Journal of Seed Spices*, *6*(1): 93-95.

Yadav, Y., Yadava, P., Pandey, V. P., & Kumar, A. (2013). Genetic Variability, Correlation and Path Coefficient Analysis Studies in Fenugreek (*Trigonella foenum-graceum* L.). *The Asian Journal of Horticulture*, *8*(2): 456-459.

How to cite this article: Singh, B. and Rajpoot, V. (2021). Assessment of Genetic Variability for Different Parameters in Fenugreek under Moisture Regime. *Biological Forum – An International Journal*, *13*(3a): 232-237.