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Assessment of Genetic Variability, Heritability and Genetic Advacnce for Biometrical Traits among Lentil (*Lens culinaris* Medikus.) Genotypes

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Abstract

The field experiment under present investigation was conducted at Agriculture Research Farm of B.R.D. Post Graduate College (Campus), Deoria (U.P.) during *rabi* 2018-19 in normal soil, timely sown and irrigated conditions. Total 25 genotypes including five checks were evaluated under Randomized Block Design. Genetic variability, heritability and genetic advance were studied in 25 genotypes of lentil (*Lens culinaris* Medikus) in Uttar Pradesh to estimate variability parameters for high yield and their attributing traits. The high magnitude (> 12%) of PCV along with GCV was observed for primary branches per plant (21.114 %), plant height (25.917 %) secondary branches per plant (25.045 %), pods per plant (29.664 %), seed yield per plant (21.174%) and 100 seed weight (36.006 %). High estimates of heritability (>75%) were observed for most of the traits except no. of secondary branches per plant (57.729), no. of seeds per pod (65.783), harvest index (64.27) and seed yield per plant (70.926); which showed moderate heritability (50-75%). High estimates of genetic advance in per cent over mean was found for no. of seeds per plant (70.255), biological yield per plant (68.46), 100 seeds weight (66.761) and no. of pods/plant (59.832). High heritability accompanied with high genetic advance indicates that the heritability is due to additive genetic effect and selection may be effective.

Key words : *Lentil, seed yield, variability, heritability, genetic advance and coefficient of variation.*

Introduction

Traditionally pulses have been considered important elements of cropping systems. They are popular because of their importance as a source of protein and ability to fix atmospheric nitrogen (N) and thus improve soil fertility (1). Pulses are the crops of national importance in India and have been grown since time immemorial. India is the largest producer and consumer of pulses in the world and also a key player with 25 per cent share in the global pulse basket from an area about 33 per cent (2).

Lentil (*Lens culinaris* Medikus subsp. *culinaris*), is one of the most important pulse crop of India, grown in winter season and belonging to family-Fabaceae, sub-family-Faboideae with chromosome number 2n=14. Lentil has versatile uses as food, feed, fuel and fodder. It is known by at least 30 common names in various parts of the world *viz.,* Massour, Mangu/Margu, Masura, Renuka, Mangalaya etc. (3). Lentil seeds contain protein concentration ranging from 22-34.6 per cent and 100g dried seeds contain 340- 346 kcal, 20.2g protein, 0.6g fat, 65.0g total carbohydrates, about 4g fiber, 2.1g ash, 68mg Ca, 325mg P, 7.0mg Fe, 29mg Na, 780mg K, 0.46mg thiamine, 0.33mg riboflavin and 1.3mg niacin (3). It also contains some anti-nutritional factors, such as, trypsin inhibitors, hemagglutinins and oligosaccharides that cause flatulence. These problems can be greatly reduced by heating and sprouting. However, India's rank 2nd in the world in respect of production as well as acreages followed by Turkey. In India, lentil is mostly grown in northern plains, central and eastern part of India. It is grown in about 1.62 m ha with total production 1.23 mt, and productivity 841 Kg/ha (5).

The success of any crop breeding programme depends on the nature and magnitude of variability existing with germplasm collections. The genetic reconstruction of plant is required for developing high yielding varieties by incorporating and improving the characters. Yield improvement through genetic means usually comes from exploitation of new germplasm or traits. Germplasm serves as the most valuable natural source in providing needed attributes for engineering successful varieties (6). Keeping this in view, the present study was carried out to reveal the genetic variability, heritability and genetic advance.

Materials and Methods

The present investigation was carried out during *Rabi,* 2018-19 at Agriculture Research Farm of B.R.D.P.G. College Campus, Deoria (UP). Geographical, Baba Raghav Das Post Graduate College Deoria is located in the east part of U.P. India, the site of experiment is located

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Table-1 : Analysis of variance of randomized block design for 12 characters of lentil genotypes.

S.N.	Characters	Sources of variation		
		Replication d.f. (2)	Treatment d.f. (24)	Error d.f. (48)
1.	Days to 50% flowering	14.464	258.183**	6.021
2.	Days to maturity	25.196	294.279**	9.22
3.	Plant height (cm)	16.636	303.04**	6.067
4.	Number of primary branches per plant	0.103	1.705**	0.033
5.	Number of secondary branches per plant	0.065	27.123**	5.321
6.	Number of pods per plant	261.869	17116.979**	120.699
7.	Number of seed per plant	3011.97	108623.23**	229.222
8.	Number of seeds per pod	0.053	0.135**	0.02
9.	100-seed weight (g)	0.395	8.056**	0.304
10.	Seed yield per plant (g)	2.247	46.578**	5.599
11.	Biological yield per plant (g)	36.765	696.683**	5.599
12.	Harvest index (%)	130.818	195.702**	30.588

*,** Significant at 5% and 1% probability level, respectively.

Table-2 : Range, mean, genotypic and phenotypic coefficient variation, heritability and genetic advance in percent over mean for 12 characters of lentil genotypes.

Characters	Range			Variance						
	Min.	Max.	Mean	^{2} g	^{2}p	GCV (%)	PCV (%)	h^2 (BS) (%)	GA (%)	GAM
Days to 50% flowering	64.69	95.06	78.55	84.05	90.08	11.627	12.036	93.315	18.244	23.136
Days to maturity	95.98	143.81	113.398	95.02	104.24	8.555	8.961	91.155	19.172	16.827
Plant height (cm)	30.63	83.19	39.549	98.9908	105.0583	25.157	25.917	94.225	19.895	50.306
No. of primary branches/plant	2.41	4.99	3.638	0.557305	0.589957	20.522	21.114	94.465	1.495	41.088
No. of secondary branches/plant	9.03	21.61	14.167	7.267278	12.58871	19.029	25.045	57.729	4.219	29.784
Number of pods per plant	126.77	423.02	256.431	5665.427	5786.126	29.352	29.664	97.914	153.428	59.832
Number of seed per pods	1.93	2.60	2.276	0.038314	0.058243	8.6	10.603	65.783	0.327	14.368
Number of seeds per plants	230.68	945.45	553.137	36054.76	36528.71	34.328	34.553	98.703	388.609	70.255
100-seed weight (g)	2.22	9.23	4.84	2.734141	3.037703	34.16	36.006	90.007	3.232	66.761
Biological yield per plant(g)	22.51	82.14	40.986	219.0419	258.599	36.11	39.235	84.703	28.06	68.462
Harvest index (%)	41.15	71.10	55.702	55.03814	85.62565	13.319	16.612	64.278	12.253	21.997
Seed yield per plant(g)	9.92	27.70	20.276	13.6595	19.2589	17.832	21.174	70.926	6.412	30.937

33at 26.5°N latitude, 83.79°E longitudes and 68 meters (223 feet) above the mean sea level. The experimental materials comprised of 20 lines of lentil genotypes with five checks *viz.,* (LEE-150, LEE-151, LEE-152, LEE-153 and LEE-154) present in the genetic stock of Department of Genetics and Plant Breeding, B.R.D.(P.G.) College, Deoria (U.P.). The experiment was laid out in a randomized block design with three replications. The entire experimental field was divided into 03 blocks of equal size and each block had 03 plots. Out of 03 plots in a block, 3 plots were used for accommodating the test genotypes which were not replicated while remaining 5 were allocated to checks *i.e.* LEE-150, LEE- 151, LEE-152, LEE-153, LEE-154. The five checks were randomly allocated along with the test genotypes in a block. Each plot was consisted of single row of 4 m length, following inter and intra row spacing of 25 cm and 10 cm, respectively and the recommended packages of practices were followed for raising a healthy crop and all necessary plant protection measures were taken to control the pest and diseases. Five competitive plants from each plot were randomly selected for recording observations on all the 12 metrict traits, except days to 50 per cent flowering and days to maturity, which was recorded on the plot basis. Averages of the data from the sampled plant of each plot in respect of different characters were used for various statistical analysis. The data were recorded for the twelve metric characters *viz.*, days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of pods per plant, number of seeds per pod, seed yield per plant (g), 100-seed weight (g), biological yields (g), number of seeds per plant and harvest index (%).

The mean data after computing for each character was subjected to standard method of analysis of variance following (7), genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were estimated by the formula as suggested by (8), heritability in broad sense (h^2) was estimated by the formula as suggested by (9) and genetic advance and genetic advance as per cent of mean by following (10).

Results and Discussion

The analysis of variance for the Randomized Block Design, accommodating 20 lentil germplasm accessions and the 5 checks replicated in three blocks, was done for 12 characters. The mean squares due to blocks, checks, and error for all the characters are presented in Table-1. The mean squares due to replication were non-significant for all the characters. However, variations due to treatment were highly significant for all the characters. The mean square due to error were non-significant for all the characters at the given probability level.

The general mean, range, GCV, PCV, heritability and genetic advance over mean for all the traits studied are given in the Table-2. The characters number of seeds per plant (230.68 - 945.45) showed highest range followed by number of pods per plant (126.77 - 423.02) while the minimum range was observed in case of number of seeds per pod (1.93 - 2.60) followed by number of primary branches per plant (2.41 - 4.99). The other parameters with high range of variation were days to maturity (95.98 - 143.81) and days to 50% flowering (64.69 - 95.06). Similar results was reported by (10).

A wide range of phenotypic and genotypic coefficient of variability was observed. The high magnitude (>12%) of PCV along with GCV was observed for primary branches per plant (21.114 %), plant height (25.917 %) secondary branches per plant (25.045 %), pods per plant (29.664 %), seed yield per plant (21.174%) and 100 seed weight (36.006 %). Moderate estimate of PCV along with GCV were recorded for seeds per pod (10.603%) and number of seed per pods (29.664%) harvest index (16.612%) while days to maturity (18.96%), days to 50% flowering (12.063 %) and showed high PCV and GCV (less than 10%). Difference between GCV and PCV values for the mentioned characters was very broad indicating influence of the environment on the expression of the traits. Similar results was reported by (11).

Heritability and genetic advance are important selection parameters. Heritability estimate along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone. High estimates of heritability (>75%) were observed for most of the traits except no. of secondary branches per plant (57.729), no. of seeds per pod (65.783), harvest index (64.27) and seed yield per plant (70.926); which showed moderate heritability (50-75%). None of the traits showed low heritability (<50%). Similar results was reported by (12).

High heritability accompanied with high genetic advance indicates that the heritability is due to additive genetic effect and selection may be effective, while high heritability coupled with low genetic advance indicates the predominance of non-additive gene action. High estimates of genetic advance in per cent over mean was found for no. of seeds per plant (70.255), biological yield per plant (68.46), 100 seeds weight (66.761) and no. of pods/plant (59.832). Rest of the characters showed low to moderate genetic advance in per cent over mean.

References

1. Sonkar S., Singh S., Mishra M., Shamim Pragya, Suman Shatrughan and Prakash H.G. (2020). Effect of soaking and boiling on the acceptability of pulses. *Progressive Research-An International Journal,* 15(3): 209-211.
2. Ali M. (2007). Global pulse production-trends and challenges. National symposium on legumes for Ecological sustainability: emerging challenges and opportunities. IIPR-Kanpur: 7-10.
3. Kay D. (1979). Food legumes. Tropical Development and Research Institute (TPI). *TPI Crop and Product Digest*, 3: 48-71. UK.
4. Adsule R.N., Kadam S.S. and Leung H.K. (1989). Lentil. In: Salunkhe D K, Kadam SS, editors. *CRC Hand Book of World Legume*. Volume II. Boca Raton, U.S.A.: CRC Press. p. 131-52.
5. Anonymous (2019). Project Coordinator's Report (Rabi Crops), *Ministry of Agriculture,* GoI, New Delhi.
6. Hawkes J.G. (1981). Germplasm collection, evaluation and use. In: plant Breeding II, ed. K.J. Frey. *Iowa State Univ. Press*. Iowa pp. 57-84.
7. Panse V.G. and Sukhatme P.V. (1988). Statistical methods for agricultural worker. *ICAR Publ.,* (II ed.), New Delhi.
8. Burton G.W. (1952). Quantitative inheritance in grasses. *Proc. Int*. Grassland Congr., 6: 277-283.
9. Lush J.L. (1949). Intra-sire correlation or regression offspring on dam as a method of estimating heritability of characteristics. *Ann. Prod. Am. Animal Prod.*, 33: 293-301.
10. Johnson H.W., Robinson H.F. and Comstock R.E. (1955a): Estimates of genetic and environmental variability in soybean. *Agron. J.,* 47: 314-318.
11. Kumar V. (2020). Genetic variability and character association among the yield and yield attributing components in lentil (*Lens culinaris* Medik.). *Bangladesh J. Bot.,* 49(2): 305-312.
12. Tadesse T., Leggesse T., Mulugeta B. and Sefera G. (2014). Correlation and path coefficient analysis of yield and yield components in lentil (*Lens culinaris* Medik.*)* germplasm in the highlands of Bale, Ethiopia. *International J. Biodiversity and Conservation*, 6(1): 115-120.