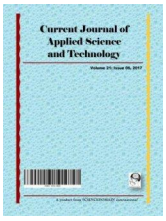

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Genetic Variability in Yield Attributes of Lentil Genotypes under New Alluvial Zone

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Authors' contributions

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

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ABSTRACT

The experiment was conducted under new alluvial zone in West Bengal to evaluate the heritability for yield components and its impact on seed yield in 10 diverse genotypes of Lentil. In consideration of two successive years, the significant hierarchy was shown in 2nd year for the characters except in days to 1st flowering. ASHA and WBL-77 were effective for earliness in maturity among all genotypes. The maximum growth rate was observed in K-75 and KLS-218. The different varieties showed high significant variations in 1000 seed weight with top most effect in PRE-COZ. Interaction of two factors i.e variety (V) x year (Y) showed a significant variation in plant height and pod number, as well as seed yield through it, was non-significant in days to 1st flowering, maturity and seed weight. Results indicated that the genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) showed the genetic influence of these morphological traits. The heritability (h^2%) in addition to high genetic advance as percentage of mean was >20% for most of the characters indicated the influence of additive gene. In observation of the correlation matrix, the total parameters maintained two distinct groups considering plant growth parameters and direct yield attributing traits. A negative or non-significant relationship was followed in between these groups of growth and yield traits though the strong positive correlation was followed within diverse traits of each group.

Keywords: Seed germplasm; genetic variability; lentil; field parameters.

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1. INTRODUCTION

Cultivated lentil (*Lens culinaris* Medik) is the 3rd most important cool-season grain legume in the world after chickpea and pea [1]. The annual production of lentil in India was 1.1 million tons (2014) considering the 2nd position in the global scenario. Among the pulses, lentil is of special interest with 23.7% content of grain protein, providing environmental and ecological benefits through crop rotation, especially by contributing to soil fertility and rhizosphere diversity through biological N_2 fixation. Comparing the production potential with other countries, the up gradation of qualitative and quantitative yield attributes is vital, especially for seed production.

Genetic variability is the pre-requisite for plant breeding program where we can select superior type in qualitative and quantitative manner. Characterisation consists of highly heritable characters will be valuable to establish better plant in addition to adaptation in wide environments. The experiment was undertaken to study the magnitude of genetic variability for creating the better scope of selection in crop improvement program. Genetic parameters such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are helpful tools in detecting the degree of variability present in germplasm. Heritability and genetic advance are important selection criteria in estimating the resultant effect in selection of suitable genotype(s) for yield and its attributing traits.

The researchers commonly studied the heritability for seed yield, yield components and the other agro-morphological traits in Lentil. Seed yield is a complex trait that is quantitatively inherited with low heritability value [2]. Alghamdi [3] observed that the highest estimates of broad sense heritability were obtained for flowering date (0.986), number of pods per plant (0.96), number of seeds per plant (0.957) and maturity date (0.905),. Ibrahim [4] indicated narrow-sense heritability was high for 100-seed weight and low for seed yield per plant. Kalia and Sood [5] revealed high broad-sense heritability estimates (0.97) along with high genetic advance (126%) for pod yield. The present investigation aimed at the performance and genetic variability of ten Lentil genotypes in order to employ the most successful genotype(s) in a breading program particularly in West Bengal condition.

2. MATERIALS AND METHODS

Ten Lentil genotypes were sown in two successive years, November 2015 and 2016 under AB-Block Seed Farm, Bidhan Chandra Krishi Viswavidyalaya (BCKV). These genotypes are WBL-81, DPL-62, SUBRATA, PL-639, WBL-77, PL-406, ASHA, KLS-218, K-75, and PRE-COZ. The experiment was laid out in a Randomise block design (RBD) with 3 replications considering a specific unit of plot size 2m x 3 m with 25 cm and 50 cm distance in row to row and plot to plot respectively. The eight important field parameters were estimated viz. Days to 1st flowering, Plant height at 50% flowering, Plant height at maturity, Days to maturity, Seed yield/plot, Number of pod/plant, Seed yield/plant, and 1000 seeds weight. Recommended intercultural practices were done as and when necessary for proper growth and development of the plants. The evaluation was done through statistical analysis of factorial RBD (2 factors) considering OP Stat software. The genetic parameters like broad sense heritability (h^2%), genetic advance etc. of mean [6] were calculated using MS excel programme. Each character was recorded from ten competitive plants in each plot as random basis.

3. RESULTS AND DISCUSSION

The study on different field parameters related to plant growth with interlinking in yield contribution was evaluated in consideration of ten Lentil genotypes in successive years. The variable nature of these characters showed variability in yield either in an individual plant or in experimental plot. The earliness in reproductive stage was observed in WBL-77 and ASHA that was continued till their maturity as effective selection criteria for a variety. The plant height is also important criteria for bearing the pod which was promising in K-75 and KLS-218. A few characters directly contributing in augmentation of seed yield in which variability was found for all genotypes with the top most effect contributing varieties, WBL-77 and ASHA. These two varieties maintained a significant superiority with rest genotypes though a non-significant variation was observed in between them. The earliness in reproductive nature contributed similar fashion with pod number and seed yield. The important contributing parameters were 1000 seeds weight which was highly significant among different varieties with the top most effect in PRE-COZ. The same superiority was also maintained in seed yield/plant through it was not showed its effect in total plant yield.

Table 1. Variable nature of yield attributing parameters in different varieties of Lentil

Variety	Days to 1st Flowering	Plant Height at 50% Flowering (cm)	Plant Height at Maturity (cm)	Days to Maturity	Number of Pod/Plant	1000 Seed Weight (g)	Seed Yield/Plant (g)	Seed Yield/Plot (g)
WBL-81	56.667	35.948	46.612	101.667	95.633	20.465	3.433	208.517
DPL-62	55.667	34.307	45.237	99.167	85.433	21.413	3.063	156.067
SUBRATA	56.500	34.508	47.125	98.167	98.083	21.023	3.535	181.333
PL-639	60.000	39.983	47.033	107.667	87.950	19.667	2.975	167.350
WBL-77	54.167	31.758	41.668	95.667	110.850	21.442	4.168	263.050
PL-406	59.500	38.068	49.627	107.500	81.683	18.047	2.617	173.900
ASHA	52.167	30.648	46.745	94.667	106.967	19.737	3.597	251.150
KLS-218	59.167	39.817	50.863	109.500	88.233	18.380	3.227	184.733
K-75	55.000	40.492	51.383	104.000	89.867	22.438	3.543	167.003
PRE-COZ	59.833	35.013	44.635	102.333	96.483	40.098	3.620	191.733
SEm (±)	0.766	0.459	0.384	0.955	1.837	0.264	0.065	5.595
LSD (0.05)	2.200	1.319	1.104	2.744	5.279	0.759	0.186	16.080

Table 2. Variability in year considering the yield attributing parameters of Lentil

	Days to 1st Flowering	Plant Height at 50% Flow- ering (cm)	Plant Height at Matu- rity (cm)	Days to Maturity	Number of Pod/Plant	1000 Seed Weight (g)	Seed Yield/Plant (g)	Seed Yield/Plot (g)
Y1	56.600	36.692	46.539	101.300	89.670	22.035	3.287	166.831
Y2	57.133	35.417	47.646	102.767	98.567	22.507	3.469	222.137
SEm (±)	0.342	0.205	0.172	0.427	0.821	0.118	0.029	2.502
LSD (0.05)	NS	0.590	0.494	1.227	2.361	0.339	0.083	7.191
Interaction (VxY) between Variety and Year								
SEm (±)	1.083	0.649	0.543	1.350	2.597	0.373	0.092	7.913
LSD (0.05)	NS	1.865	1.561	NS	7.465	NS	0.263	22.741

NS- Non-Significant, Y1- 1st year, Y2-2nd year

Table 3. Genetic variability of different characters considering two-years observation

	GCV		PCV		h^2%		GA%	
	Y1	**Y2**	**Y1**	**Y2**	**Y1**	**Y2**	**Y1**	**Y2**
Days to 1st Flowering	5.299	7.072	5.595	7.690	89.696	84.575	9.340	12.046
Plant Height at 50% Flowering	13.305	8.552	13.382	8.834	98.856	93.707	30.576	19.474
Plant Height at Maturity	8.386	6.634	8.529	6.724	96.676	97.359	16.921	13.277
Days to Maturity	7.377	10.292	7.743	10.556	90.767	95.061	9.776	13.858
1000 Seed Weight	24.037	23.063	24.079	23.103	99.650	99.654	71.563	67.941
Number of Pod/Plant	18.824	17.198	18.991	17.954	98.254	91.753	27.587	23.230
Seed Yield/Plant	8.687	6.787	8.704	6.847	99.595	98.266	65.004	49.175
Seed Yield/Plot	23.733	70.252	24.626	70.813	92.88	98.421	24.792	65.466

GCV-Genotypic coefficient of variance, PCV-phenotypic coefficient of variance, h^2-Heritability, GA-Genetic advance. Y1- 1st year, Y2-2nd year

Correlation Matrix of different yield attributing parameters

	Days of 1st flowering	**Plant height at 50% flowering stage (cm)**	**Plant height at maturity**	**Days to maturity**	**1000 seed weight (g)**	**Number of pod/plant**	**Seed yield/plant (g)**
Plant height at 50% flowering stage (cm)	0.401^{**}						
Plant height at maturity	0.182^{NS}	0.583^{**}					
Days to maturity	0.653^{**}	0.668^{**}	0.580^{**}				
1000 seed weight	0.208^{NS}	-0.135^{NS}	-0.330^{*}	-0.083^{NS}			
Number of pod/plant	-0.432^{**}	-0.542^{**}	-0.373^{**}	-0.519^{**}	0.155^{NS}		
Seed yield/plant (g)	-0.003^{NS}	-0.318^{*}	-0.426^{**}	-0.266^{*}	0.879^{**}	0.512^{**}	
Seed yield/plot (g)	-0.361^{**}	-0.431^{**}	-0.186^{NS}	-0.363^{**}	0.002^{NS}	0.748^{**}	0.311^{*}

*NS- Non-Significant; * significant; ** Highly significant*

In observation of two successive years, the significant hierarchy was shown in 2nd year for all characters except in days to 1st flowering. In the interaction of two factors i.e variety (V) x year(Y) showed a significant variation in plant height and pod number as well as seed yield through it was non-significant in 1st flowering, maturity and seed weight .The significant variation among different genotypes of the selected traits was effective for plant breeders and it was highly effective in an excessive degree of variation.

The genetic co-efficient of variance (GCV) and phenotypic co-efficient of variance (PCV) showed the genetic pressure of these morphological traits where genetic influence was prominent for all traits which may be supportive in the selection procedure. The heritability (h^2%) in addition to high genetic advance as percentage of mean was >20% for most of the characters indicated the influence of additive gene. The analysis of variance revealed that all the genotypes were different in highly significant level for most of the parameters indicating an immense scope for improvement for lentil genotypes under north-eastern plain zone of India.

In association of different parameters, days to maturity showed a positive correlation with the growth parameters like plant height, days to flowering etc. though it was negatively correlated with the direct yield attributing parameters like 1000 seeds weight, number of pods etc. or yield of plant/plot. In observation of correlation matrix, it is clearly observed that the considerable parameters maintained two different groups viz; plant growth parameters and direct yield attributing traits within each group. A positive co-relation was followed within the traits of each group through negative or non-significant relationship was followed in between the two groups.

The genetic variability of diverse cultivars in several crops was characterised by several researchers considering the yield attributing parameters [7,8,9,10]. The present findings highlighted the characters scheduled for selection to fulfil the breeders' target in upgradation of the cultivar with special reference to quality seed similar to observation of Ashish Singh et al. [11].

4. CONCLUSION

The overall result indicated a core set of germplasm where WBL-77 followed by ASHA in addition to PRE-COZ may be suitable for quality seed crop production considering the genetic factors like plant height for earlier development and quantification of yield in individual plant or plot. These parameters were considerable as selection criteria for upgradation of Lentil seed production.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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