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MULTIVARIATE ANALYSIS IN LENTIL (*Lens culinaris* L.)

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ABSTRACT

Genetic divergence among 22 genotypes of lentil was estimated using D^2 and principal component analysis. The genotypes under study fell into four clusters. The intra-cluster value was the maximum in cluster I and the minimum in cluster II. The inter-cluster distance was larger than the intra-cluster distance in all the cases suggesting the wider genetic diversity among the genotypes of different groups. The inter-cluster value indicated maximum distance between cluster I and II than cluster III and IV. Thus the genetically diverged genotypes of the clusters could be used as parent in hybridization program to get desirable genotypes. Cluster I had the highest mean for days to maturity, plant height, pods/plant and per plot yield while cluster II and III had the highest days to first flowering and 100 seed weight, respectively. Genotypes with these characters in respective groups would, therefore, offer a good scope of improvement of lentil through selection.

Key words: Lentil, cluster analysis, divergence, hybridization

INTRODUCTION

Multivariate analysis is a useful tool in quantifying the divergence between biological population at genotypical level and to assess relative contribution of different components to the total divergence both at intra and inter-cluster levels (Murty and Arunachalam, 1966, Ram and Panwar, 1970, Sachan and Sharma, 1971 and Jatasra and Paroda, 1978). Such a study also permits to select the genetic divergent parents to obtain the desirable recombinant in the segregating generations. The present study was, therefore, undertaken to analyze the genetic divergence of 22 lentil genotypes collected from different parts of Bangladesh.

MATERIALS AND METHODS

Twenty two genotypes of lentil were grown at the Regional Agricultural Research Station, Rahamatpur, Barisal during Rabi season of 2009. A randomized complete block design was used to set the experiment with three replications. The unit plot was of 0.9m×2m in size which contained two continuous rows. Row to row distance was 30 cm. Each row contained more or less about 45-60 plants. The distance between two plots was 50 cm and the distance two blocks was 100 cm. Inter cultural practices were done uniformly for all the genotypes. Thinning was done 25 days after sowing and weeding was done twice. The first weeding was done during thinning and the second one was after about two months of sowing. The crop was harvested during 15-20 March 2009. Harvesting was started when 80% of the spikes of each plot reached maturity i.e. when the grains become hard and contained 14-16% moisture. Data on days to first

flowering, days to maturity, plant height, pods/plant, 100 seed weight and yield per plot were collected from five randomly selected plants from the middle of the paired rows in order to avoid border effects. The data were subjected to principal component and Mahalanobi's D^2 analysis using GENSTAT 5.13 program. The genotypes were grouped into clusters following the method discussed by Tocher (Rao, 1952).

RESULTS AND DISCUSSION

Principal component analysis was carried out with 22 genotypes of lentil. First three Eigen values for three principal coordination axes of genotypes accounted for 78.13% of variation. The first two principal axes accounted for 61.17% of total variation among the six characters describing 22 genotypes. The 22 genotypes fell into four clusters (Table 1). The distribution indicated that the maximum number of genotypes were included in cluster III (12) followed by cluster IV (7), while cluster I and II included only two and single genotype, respectively.

Table 1. Eigen values and percentage of variation for corresponding six components characters in 22 lentil genotypes

Principal component axis	Eigen values	% of total variation accounted for	Cumulative percent
1	2.381	39.69	39.69
2	1.289	21.48	61.17
3	1.017	16.96	78.13
4	0.748	12.47	90.60
5	0.348	5.80	96.40
6	0.216	3.60	100.00

Table 2. Distribution of 22 genotypes of lentil in four clusters

Cluster	Accession no.	Genotype or Accession number
I	2	BLX-02009-04-1 and BLX-02009-04-5
II	1	BLX-02009-17-4
III	12	BARI masur-5, BLX-02009-06-3, BLX-02009-08-4, BLX-02009-09-4, BLX-02009-11-1, BLX-02009-16-3, BLX-02009-06-5, BLX-02009-21-5, LR9-130, Flip-92-52LX955-167, Flip-92-52LX and BARI masur-6
IV	7	BLX-02009-06-2, BLX-02009-17-1, BLX-02009-18-1, BLX-02009-18-3, BLX-02009-19-2, BLX-02009-21-2 and LR9-25

Intra cluster mean for six traits are presented in Table 3. These clusters were able to lead in respect to the highest cluster mean value for maximum characters. Among six characters cluster I stood first for four characters viz. days to maturity (115.0), plant height (47.15 cm), pods per plant (115.5) and yield (2170 kg/ha). Cluster I was formed by two genotypes viz. BLX-02009-04-1 and BLX-02009-04-5. Cluster II stood first for only one character viz. days requirement for first flowering (62.0) but lowest for 100 seed weight (1.7 g) and yield (900 kg/ha). Cluster III having twelve genotypes, this cluster was able to lead only one traits respect of cluster mean value of six characters. The highest cluster mean value was achieved for the character 100 seed weight (2.01 g). Cluster IV was recorded as moderate yielding associated with desired characteristics like

the seed size and faster maturing. D^2 values for all possible combinations were computed between pair of genotypes and the value ranged from 0.936 (between genotypes BLX-02009-17-4 and BLX-02009-04-1) to 0.105 (between genotypes BARI masur-5 and BLX-02009-21-5). Statistical distances represent the index of genetic diversity among the clusters. The inter-cluster distance in all of the cases was larger than intra-cluster distances suggesting wider genetic diversity among the genotypes of different groups. The intra-cluster distances in all the four clusters were low. This indicated that the genotypes within the same cluster were closely related.

The highest inter-cluster distance (18.175) was observed between cluster I and II (Table 4). The intra cluster distance was the highest (0.531) in cluster I. The lowest inter-cluster distance was observed between cluster III and IV (2.923) followed by cluster I and IV (7.600) and between II and III (8.574). Moderate or intermediate distance was found between cluster II and IV (11.414), cluster I and III (10.353). The inter cluster distances were higher than the intra cluster distances suggesting wider genetic diversity among the genotype of different groups. The genotypes belonging to the distant clusters could be used in hybridization program for obtaining a wide spectrum of variation among the segregant. Similar reports were made by Jagadev and Samal (1991) in niger.

Table 3. Average intra (bold) and inter cluster distances (D^2) for 22 lentil genotypes

Cluster	I	II	III	IV
I	**0.531**			
II	18.175	**0.000**		
III	10.353	8.574	**0.324**	
IV	7.600	11.414	2.923	**0.241**

The characters contributing maximum to the divergence were given greater emphasis for deciding the type of cluster for the purpose of further selection and choice of parents for hybridization (Javed *et al*., 1991). Cluster I had the maximum number of characters (4) with the highest intra-cluster means followed by cluster II and III with single character. In cluster I the characters having highest intra-cluster means were days to maturity, plant height, 100 seed weight and yield. Javed and Samal (1991) and Patel *et al*. (1984) and Ali *et al*. (1996) reported plant height and seed yield as higher contributor to seed yield in niger, safflower and mungbean, respectively. In cluster II the higher contributing character was day to 1st flowering. Sagor *et al*. (1976) reported that days to 1st flowering, plant height and pod length contributed maximum towards diversity. 100 seed weight had the maximum cluster mean in cluster III. Similar results were reported by Gupta and Singh (1970).

Table 4. Cluster means for six characters of 22 lentil genotypes

Variable	Cluster			
	1	II	III	IV
Days to 1st flowering	54.50	62.00	55.67	59.14
Days to maturity	115.00	111.00	111.00	111.86
Plant height (cm)	47.15	44.60	42.68	44.91
No. of pod per plant	115.50	97.00	92.17	90.29
100 seed weight (g)	1.80	1.70	2.01	1.90
Yield (kg/ha)	2170.00	900.00	1512.83	1768.43

Considering cluster means, genotypes in cluster I were important for days to maturity, plant height, pods per plant and yield, while cluster II was for days to first flowering and cluster III for 100 seed weight. It may be concluded that the greater divergence in the genotypes due to these characters of the respective clusters would offer a good scope for the improvement of lentil through rational selection.

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