Indian J. Pl. Genet. Resources 13(2): 123-125, 2000

# GENETIC DIVERGENCE FOR YIELD AND ITS COMPONENT TRAITS IN CULTIVATED *MICROSPERMA* LENTILS (*Lens culinaris* MED.)

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**Forty one genotypes of lentil belonging to microsperma group of *Lens culinaris* were grouped into six clusters following non-hierarchical Euclidean cluster analysis utilizing data on a set of eleven characters related to yield and its contributing traits, Number of pods and seeds and leaves per plant, grain yield and biological yields per plant and harvest index were mainly responsible for the genetic divergence. Based on statistical distance and cluster mean values, five genotypes namely LL-19, LL-61, LL-117 and PL-7712 (from cluster IV) and K80 (from cluster V) were found to be most promising and hence, these genotypes may be used in future hybridization programmes to evolve desirable segregants.**

**Key words:** Lentil, germplasm, genetic divergence, cluster analysis

Lentil (*Lens culinaris* Med.) is one of the important pulse crops of Indian sub-continent and ranks fifth on the production map of India with an area of 1.15 million hectares and production of 0.79 million tons with an average yield of 6.81 q/ha (Sharma, 1995). The Indian sub-continent is by far the largest lentil producing region of the world. The majority of the lentils grown throughout the world are local land races and only a few released cultivars are available to farmers (Sardana *et al.*, 1998). The improvement in the crop is limited, though a wide range of genetic diversity is available in collections of lentil (Solth and Erskine, 1981). Genetic diversity is an essential requirement for any crop improvement program, because genetically diverse parents when crossed, can bring together diversity of gene combinations either to exploit heterosis or to obtain superior recombinants. The genetic divergence between populations can be quantified by using several available statistical methods, of which multivariate analysis has been found to be most appropriate (Murty, 1965; Joshi and Dhawan, 1966). Therefore, an attempt was made to evaluate the magnitude of genetic diversity among 41 genotypes of lentil with the help of nonhierarchical Euclidean cluster analysis.

## MATERIALS AND METHODS

The experimental material consisted of 41 genotypes of lentil (mostly cultivars) belonging to microsperma group of *Lens culinaris* Med. procured from different research institutes/universities of Uttar Pradesh. All the 41 genotypes were grown in a randomized block design with 3 replications at the Department of Agricultural Botany Research Farm, Ch. Charan Singh University, Meerut during rabi 1997-1998. Each genotype was evaluated in a plot of two rows of 5 in length. Observations were recorded on five random plants per genotype in each replication for 11 quantitative characters. The data were subjected to non-hierarchical Euclidean cluster analysis to measure genetic divergence following Beale (1969)

and Spark (1973). F test was utilized for assigning appropriate number of clusters.

## RESULTS AND DISCUSSION

The analysis of variance indicated significant differences between genotypes for most of the metric characters studied except internode length, no. of seeds per pod and 100 seed weight. All the 41 genotypes were grouped into six clusters (Table 1). The cluster III had maximum number of 14 genotypes followed by clusters VI and II with 11 and 10 genotypes, respectively. Clusters I and V contained the minimum number of genotypes i.e. one genotype each. In lentil, it was observed that genetic drift and selection in different environments have caused greater genetic diversity than geographical distance (Bhatt, 1970; Chahota *et al.*, 1994).

**Table 1. Distribution of 41 lentil genotypes in different clusters**

| Cluster No. | No. of genotypes | Name(s) of genotypes |
|---|---|---|
| I | 1 | JL-81 |
| II | 10 | L-94, L-103, L-145, L-812, L-271, L-848, L-1205, L-130, LL-1269, P-570 |
| III | 14 | JL-54, K-75, L-59, LL-75, LL-79, LL-97, LL-153, P-75, P-259, P-293, P-406, P-589, P-872, PL-639 |
| IV | 4 | LL-19, LL-61, LL-117, PL-7712 |
| V | 4 | K-80 |
| VI | 11 | L-1282, LG-108, LL-175, LL-189, LL-1258, P-38, P-67, P-276, P-631, P-641, P-870 |

The intra- and inter-cluster divergence among the material studied was of varying magnitude (Table 2). Intra-cluster $D^2$ values ranged from a minimum of 1.897 in cluster II to a maximum of 3.175 in cluster IV. The maximum inter cluster D2 was obtained between clusters IV and V (8.728), followed by clusters I and IV (8.545), clusters I and V (8.055), clusters II and V (7.647) whereas inter cluster $D^2$ value was found to be minimum (2.307) between clusters II and VI suggesting close relationship between the clusters. The maximum inter-cluster distance observed between the clusters IV and V indicate that their members are far apart and it would be useful to attempt crosses among them. The magnitude of heterosis largely depends on the degree of genetic diversity in the parental lines.

**Table 2. Estimates of average intra- and inter-cluster D 2 for six clusters constructed from 41 genotypes of lentil**

| Clusters | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| I | **0.000** | 6.333 | 5.137 | 8.545 | 8.055 | 6.230 |
| II | | **1.897** | 3.749 | 3. 960 | 7.647 | 2.304 |
| III | | | **2.097** | 6.269 | 5.951 | 2.789 |
| IV | | | | **3.175** | 8.728 | 4.830 |
| V | | | | | **0.000** | 6.749 |
| VI | | | | | | **2.283** |

Figures in bold print indicate intra-cluster $D^2$ values.

The cluster mean values for eleven quantitative characters presented in Table 3, provided an interesting picture of the nature of diversity. Crosses among divergent parents are likely to yield desirable combinations. Therefore, a crossing programme should be initiated between the genotypes belonging to different clusters. For this purpose following points are to be considered: (1) choice of clusters whose genotypes are separated by maximum inter-cluster distance, (ii) selection of those genotypes that showed good performance in the selected clusters. Based on these facts, genotypes LL-19, LL-61, PL-7712 and LL-117 of cluster IV (having maximum cluster means for all characters except days to maturity and number of pods per plant) and K-80 of cluster V (with maximum mean value for days to maturity) are expected to give promising transgressive segregants. These genotypes can be utilized in hybridization programmes aimed at yield improvement in lentil.

**Table 3. Mean values of different characters in various clusters**

| Character | | Cluster | | | | | |
|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI |
| 1. | Plant height (cm) | 4.90 | 36.39 | 35.55 | 41.22 | 34.58 | 39.30 |
| 2. | Internode length (cm) | 2.18 | 2.29 | 2.16 | 2.34 | 2.14 | 2.29 |
| 3. | No. of leaves/plant | 109.60 | 108.61 | 102.56 | 125.65 | 94.73 | 115.11 |
| 4. | Days to maturity | 142.67 | 147.23 | 148.07 | 151.08 | 153.33 | 147.24 |
| 5. | No. of pods plant | 59.07 | 92.01 | 61.58 | 87.13 | 51.07 | 76.63 |
| 6. | No. of seeds plant | 83.07 | 130.77 | 89.94 | 134.18 | 74.33 | 111.65 |
| 7. | No. of seeds pod | 1.47 | 1.43 | 1.47 | 1.56 | 1.50 | 1.46 |
| 8. | Grain yield/plant (g) | 1.46 | 2.57 | 1.25 | 3.69 | 0.83 | 1.97 |
| 9. | Biological yield/plant (g) | 6.26 | 8.71 | 5.56 | 10.86 | 4.04 | 5.66 |
| 10. | 100 seed weight (g) | 1.75 | 1.96 | 1.43 | 3.07 | 1.40 | 1.77 |
| 11. | Harvest index | 23.20 | 29.50 | 22.86 | 33.79 | 20.48 | 35.73 |

## REFERENCES


Beale, E.M.L. 1969. Euclidean cluster analysis. *Bull. Int. Stal. Inst.* 43: 92-94.

Bhatt, G.M. 1970. Multivariate analysis approach for selection of parents for hybridization in aiming at yield improvement in self pollinated crops. *Aust. J. Agric. Res.* 21: 1-7.

Chahota, R.K.- S.K.Sharma and C. Lal. 1994. Genetic divergence in microsperma lentils. *Legume Rev.* 17: 32-134.

Joshi, A.B. and N.L.Dhawan. 1966. Genetic improvement of yield with special reference to self fertilizing crops. *Indian J. Genet.* 26A: 101-113.

Murty, B. R. 1965. Heterosis and combining ability in relation to genetic divergence in fluecured tobacco. *Indian J. Genet.* 25: 46-56.

Sardana, S., N.K. Gautam, Dinesh kumar, R.L. Sapra and S.K. Mithal.1998. Genetic divergence in lentil germplasm. *Indian J. Pl. Genet. Resources* 11: 25-29.

Sharma, B. 1995. Pulse production in India. Retrospect and prospect. *In:* Sustaining Crop and Animal Productivity-The Challenge of the Decade (Ed. D.L. Deb). Associated Pub. Co., New Delhi. p. 101-130.

Solth, M. and W. Erskine. 1981. Genetic Resources. *In:* Lentils (Eds. C. Webb and G. Hawtin), CAB Int., ICARDA, Syria.

Spark, D.N. 1973. Euclidean cluster analysis. *Algorithm. Appl. Stat.* 22: 126-130.