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# GENETIC DIVERGENCE ANALYSIS IN BOTTLE GOURD [*LAGENARIA SICERARIA* (MOL.) STANDL]

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## Abstract

The present investigation was carried out at the Vegetable Research Farm Department of Vegetable Science, Kalyanpur, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur during Kharif season 2016. The experiment was laid out 52 trains/lines were sown on July 4th 2016 in randomized block design (RBD) with three replications. Cluster analysis grouped 52 genotypes of bottlegourd into three clusters. Cluster II had maximum number of genotypes (24) followed by cluster I (15) and cluster III (13). Maximum inter cluster distance was observed between cluster II and III (3.234) followed by cluster I and II (3.207). Results of experiment indicate that the genotypes included in these clusters are having broad spectrum of genetic diversity. All three Clusters showed maximum value of cluster mean for number of nodes per vine, days to first female flowering and days to first male flowering.

***Keywords*:** Genetic divergence, $D^2$ statistic and Bottle gourd.

## Introduction

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl] is an important gourd vegetable having wide range of uses and is largely cultivated in the tropics and subtropics for its edible fruits. The origin of bottle gourd is Africa and America, according to Culter and Whitaker, this plant is probably indigenous to tropical Africa. Archaeological evidence showed that the presence of bottle gourd was 1200 years old. Thousands of years of cultivation of this vegetable with its cross-pollinated nature has resulted in a large variation for several quantitative and qualitative characters. But, unfortunately very little attention has been paid for genetic up gradation of this crop. It has been well documented that effectiveness of the selection in a crop under plant improvement program is mainly dependent on the greater the genetic diversity in population, more the genetic potentiality and thereby wider is the scope for the improvement of the crop.

Among the various breeding methods depend on genetic variability present in base population characters association, cause and effect relationship, heritability, genetic advance and genetic divergence to help the breeder's in making an effective selection in a breeding programme. Genetic variability present in a population is of primary importance for any successful selection programme. Greater variability increases the genetic potentiality and wider scope for improvement in the genotype, to explore the purpose of improvement by selection. The $D^2$ statistics of Mahalanobis's (1936) provides a powerful tool for measuring the degree of divergence among group and also for selecting parents for hybridization in out breeding and cross-pollinated crop (Rao, 1952; Dubey *et al.,* 2019). Such a study is expected to be useful not only in the choice of the parents for hybridization but also to serve as an index affecting selection.

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## Material and Methods

The experiment was conducted at the Vegetable Research Farm Department of Vegetable Science, Kalyanpur, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur during Kharif season 2016, Geographically Kanpur is situated in the Gangatic alluvial of Central Uttar Pradesh between the 25.26º to 26.28º north latitude and 79.31º to 80.34º of east longitude about 125.9 Meter above sea level.

Observations were recorded from three randomly selected plants from each genotype on 8 different characters *viz*., days to opening of first male flower, days to opening of first female flower, Length of vine, Number of branches, Number of nodes/plants, Weight of fruit per plot, Number of fruits per plot, Fruit yield per plant. The data were analysed as per the multivariate analysis of genetic divergence using Mahalanobis (1936) $D^2$statistic.

$$D^2 = \sum x_{ij} d_i d_j$$

$$I = ij = 1$$

Where,

$x_{ij}$ = Matrix reciprocal to the common dispersion matrix

$d_i d_j$ = Difference between the means value of two population

For $i^{th}$ and $j^{th}$ characters respectively.

## Results and Discussion

The analysis of variance for 8 characters evaluated, revealed significant differences amonggenotypes. By estimating $D^2$ values in all possible combination of the genotypes, the 52 genotypes of bottle gourd were grouped into three clusters revealingmoderate genetic diversity among parents (Table-1). Maximum number of genotypes was accommodated in cluster II (24) followed by cluster I (15) and cluster III (13). Average intra-cluster distance varied between 3.234 (cluster III) to cluster II (1.728).

Since crossing of genotypes belonging to samecluster do not expect to yield superior hybrids orsegregants, inter cluster distances were also workedout. The inter cluster distance was maximum to thetune of 3.234 between cluster II and III and minimum 1.728 between cluster I and II, indicating thathybridization between the genotypes from cluster II and III can be utilized for getting superior recombinants/ transgressive segregants in segregating generations of bottle gourd. Average intra and intercluster divergence ($D^2$) values are presented in Table-2. The cluster means for various traits werealso computed and presented in the Table-3. Similar results have also been reported earlier Saurabh *et al.,* 2017a and Tomar, 2020a.

Maximum day to first male flowering was recorded in cluster II (44.93) followed by cluster III (44.59) and cluster I (43.53). In case of first female flowering, maximum days were recorded in cluster II (49.17) followed by cluster III (48.56) and cluster I (47.62). Results revealed that female flowers too more time to open than male flowers in every cluster. Cluster II recorded maximum value for length of vine (7.86), No. of Branches/Vine (6.89) and No. of Nodes/Vine (52.33) but minimum was found in cluster I, which was 7.06, 4.96 and 46.60 for length of vine, No. of Branches/Vine and No. of Nodes/Vine, respectively. Maximum fruit yield per plot (9.39) was found in cluster III followed by cluster II and I. Number of fruits per plot (15.36) and fruit yield per plant (1.88) was also found maximum in cluster III followed by cluster II and I. Minimum number of fruits per plot and fruit yield per plant was 9.42 and 1.21 respectively in cluster I. Similar results on genetic divergence in bottle gourd have also been reported earlier Sharma and Sengupta (2013); GulshanAra *et al.* (2014); Sunil *et al.* (2014); Visen *et al.* (2015); Tomar *et al.,* 2015; Jacob *et al.* (2016); Jaiswal *et al.,* 2017b; Tomar *et al.,* 2020b.

In the present investigation, the inter cluster distance was recorded maximum between cluster II and III, therefore genotypes from these clusters can be selected for hybridization and may be utilized for getting superior recombinants/ transgressive segregants in segregating generations of bottle gourd. The genotypes having wide genetic base and desirable characteristics can be involved in intra-specific crosses which would lead to transmission of good genetic gain for various traits including yield for practical utility.

## Conclusion

From the present investigation it is conducted on 52 genotypes of bottle gourd, the cluster II and III were found most divergent and there will be more chances of getting better segregants in $F_2$ and subsequent generations from the crossing of genotypes between cluster II and III. Therefore, hybridization between these groups can prove useful for further breeding programs in bottle gourd.

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**Table 1: Grouping of 52 lines/straits of bottle gourd in three clusters**

| Cluster | No. of genotype | Name of genotype |
|---|---|---|
| I | 15 | BGL-6, BGL-8, BGL-9, BGL-28, BGL-31, BGL-33, BGL-35, BGL-36, BGL-37, BGL-46, BGL-47, BGL-51, BGL-53, BGL-64, BGL-76 (P.N.) |
| II | 24 | BGL-1, BGL -2, KLG, BGL -4, BGL -10, BGL -11, BGL -12, BGL-13, BGL-19, BGL-30, BGL-32, BGL-38, BGL-42, BGL-45, BGL -52, BGL -54, BGL -57, BGL -60, BGL -62, BGL -63, BGL-65, BGL-68, BGL-69, BGL-71 |
| III | 13 | BGL-5, BGL-18, BGL-29, BGL-34, BGL-39, BGL-55, BGL-58, BGL-59, Azad harit, KBGL-29, BGL-70, BGL-73 |

**Table 2: Average intra and inter cluster distance ($D^2$) in bottle gourd**

| Cluster | I | II | III |
|---|---|---|---|
| I | - | 3.207 | 3.207 |
| II | - | 1.728 | 3.234 |
| III | - | - | 2.587 |

**Table 3: Cluster mean of different clusters for 8 quantitative characters in bottle gourd**

| S. No. | Characters | I | II | III |
|---|---|---|---|---|
| **1** | Days of Male Flowering | 43.53 | 44.93 | 44.59 |
| **2** | Days of Female Flowering | 47.62 | 49.17 | 48.56 |
| **3** | Length of vine | 7.06 | 7.86 | 7.45 |
| **4** | No. of Branches/ Vine | 4.96 | 6.89 | 5.69 |
| **5** | No. of Nodes/Vine | 46.60 | 52.33 | 49.67 |
| **6** | Fruit Yield/Plot | 6.05 | 6.10 | 9.39 |
| **7** | No. of fruit per plot | 9.42 | 9.44 | 15.36 |
| **8** | Fruit yield per plant (kg) | 1.21 | 1.23 | 1.88 |