

GENETIC DIVERSITY, HERITABILITY AND MORPHOLOGICAL CHARACTERIZATION IN BOTTLE GOURD (*LAGENARIA SICERARIA* (MOL.) STAND)

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ABSTRACT

A field experiment was conducted at Vegetable Research Farm, Maharajpur, J.N.K.V.V., Jabalpur (M.P.) during winter season in the year 2008-09 and 2009-10. The present investigation was undertaken with 16 genotypes of bottle gourd for evaluating their performance for various horticultural characters. There was a great deal of significant variation for all the characters among the genotypes. The significantly higher yield in Narendra Shivani (311.53 q/ha) might be due to higher values of yield attributes (fruit set percentage, fruit length, number of fruit per vine, fruit weight and fruit width) followed by Narendra Sanker Lauki. Whereas, the lower yield was found in case of Narendra Jyoti (101.86 q/ha), respectively due to lower yield attributes. High genotypic co-efficient of variation (GCV) was observed for fruit weight (39.48%). In all cases, phenotypic co-efficient variances were higher than the genotypic co-efficient variance. High heritability with high genetic advance in percent of mean was observed for all characters were under additive gene control and selection for genetic improvement for this trait would be effective. Among all the genotypes, Narendra Shivani, Narendra Sanker Lauki, and NS 421 gave promising results.

INTRODUCTION

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is an important gourd having wide range of uses and is largely cultivated in the tropics and subtropics for its edible fruits. Tender fruits are used as vegetable and also for preparation of sweets and pickles especially in the hills. The bottle gourd can be easily distinguished from other pumpkin varieties by its white flowers and characteristic fruit, seed and leaf shapes (Cutler and Whitaker, 1967). Bottle gourd variability has been studied by many authors, including Heiser (1979); Marimoto and Mvere, (2004); Marimoto *et al.* (2005) etc. Studies in India demonstrated the significant regional variability (Sivaraj and Pandravada, 2005). These findings were in line with the results reported by Sakar (2004), who reported fruit size and shape as the most apparently distinguishable morphological traits in the Mediterranean region. The sex expression, sex ratio and fruit set is one of the most important problems in cucurbits. Most of the cucurbitaceous crops are monoecious nature, bear more male flowers and less female flowers separately on the same plant. In cucurbitaceous vegetables only male flowers appear in the beginning and the female flower appears later while growth, flowering and sex expression was come up by their genetic makeup. Selection may not be effective in population without variability, in terms of variability, it is the genetic fraction of the observed variation that provides measures of transmissibility of the variation under study and responds to selection. The relation of genotypic variability to

observe variability represents heritability when the heritability of quantitative characters becomes high. The present study was, for such motives, undertaken with the objective to find out and determine the study on genetic diversity, heritability and morphological characterization in bottle gourd (*Lagenaria siceraria* (Mol.) Stand).

MATERIALS AND METHODS

A field experiment was conducted at Vegetable Research Farm, Maharajpur, J.N.K.V.V., Jabalpur (M.P.) during winter season in the year 2008-09 and 2009-10 to study on genetic diversity, heritability and morphological characterization in bottle gourd (*Lagenaria siceraria* (Mol.) Stand). The experiment was laid out in a randomized block design with three replications. The climate condition of Jabalpur is sub-tropical with hot dry summer and cold winter and located at 23.91°N latitudes and 79.58°E longitudes. The average rainfall of is about 1375mm. which is mainly distributed from mid June to September. The average maximum and minimum temperature ranges between 46.6°C to 21°C. The soil was clay in texture with pH 7.2, medium in organic carbon 0.64%, available nitrogen (371 kg/ha), phosphorus (16.2 kg/ha) but high in potassium (296 kg/ha). The experiment comprising 16 genotypes viz., NS-421, Ketan, Warad, Dharwad-1, Narendra Rashimi-1, Narendra Jyoti (NDBG-4), Narendra Dharidar-1, Narendra Dharidar-2 (NDBG-613-4), Narendra Sankar Lauki, (NDBGH-4), Kashi Ganga, Samrat, Vardan-f-1, Narendra

Shishir (round), Narendra Madhuri (round), Narendra Shivani (long) and Jabalpur Local. The observation were recorded on each genotype on seventeen quantitative characters, morphological character (growth habit, highly vigorous, moderate vigorous, less vigorous), vine length (cm), primary branches per vine, internodal length (cm), internodes per vine, nodes per vine up to first male flower, nodes per vine up to first female flower, fruits set per nodes), phenological characters (days to first appearance of male flower, days to first appearance of female flower, fruit set percentage, sex ratio), Yield parameters (fruits per vine, fruits per plot, length of fruit(cm), weight of fruit (kg), width of fruit (cm), yield per vine (kg), yield per plot (kg), yield (q/ha). Phenotypic and genotypic variance of the genotypes was estimated and heritability as described by Mahaveer *et al.* (2004), Munsri and Acharyya (2005) and Gayen and Hussain (2006) in bottle gourd were used. The estimates of heritability in broad sense in the present investigation have been classified in three categories i.e. high heritability (> 75 percent), moderate heritability (50-75 percent) and low heritability (< 50 percent).

RESULTS AND DISCUSSION

The outcome of the investigation revealed that the mean performance of 16 genotypes were evaluated and found significant variation among morphological and phenotypic characters are presented in Table 1. The vine length of bottle gourd was observed significantly higher under Narendra Shivani (342.52 cm) followed by Narendra Sankar Lauki (332.47 cm) it was also found significantly higher among genotypes. Narendra Shivani which had also more primary branches per vine (5.83). Internodal length of Narendra Jyoti (15.26 cm) was the highest over other genotypes and proved significantly superior; Ketan (14.17 cm), Narendra Shishir-1 (14.08 cm) and Samart(13.59 cm) were not reached to significance level in attaining internodal length with each others, whereas, the genotype Narendra Shishir (21.79) expressed higher nodes per vine upto first male flower and found significantly superior over the remaining genotypes, Similar trend was observed significantly higher in case of fruit set per vine upto first male flower in Narendra Shishir (46.55) over the rest of genotypes except Narendra Rashmi-1 (42.55) and Narendra Madhuri (46.55) and days to appearance of first female flower was shifted under Narendra Shishir (53.21) which was significantly superior over the genotypes. Ghevaria *et al.* (1995), Hawlader *et al.* (1999), Janakiran *et al.* (1991), Koffi *et al.* (2009) and Singh *et al.* (2002) in bottle gourd.

Fruit per vine and fruit per plot was significantly higher under Narendra Shivani (16.33, 81.65) followed by Sankar Lauki (9.58, 47.91). The fruit length and fruit width were recorded significantly higher under Narendra Shivani (89.05cm) and Narendra Shishir (54.87cm), respectively and remaining were not comparable but fruit width of Narendra Madhuri (54.82cm) was found similar to Narendra Shishir. Yield is a submissive contribution of yield attributes, therefore, yield viz., yield per vine, yield per plot and yield per hectare were similar trend in case of bottle gourd with the highest significant values were noticed under Narendra Shivani as 16.33 kg, 81.65 kg and 311.53 q/ha for respective characters and found superior over other genotypes. These traits were at par with each other's

Table 1: Mean performance of 16 genotypes as influenced by Morphological and Phenological characters of bottle gourd

| S.No. | Treatment | Vine Length (cm) | Primary branches per vine | Internodal length (cm) | Internodes per vine | Nodes per vine up to 1st male flower | Nodes per vine upto 1st female flower | Fruits set per node | Days to first appearance of male flower | Days to first appearance of female flower |
|-----------------|----------------------------------|------------------|---------------------------|------------------------|---------------------|--------------------------------------|---------------------------------------|---------------------|---|---|
| 1 | NS-421 | 201.19 | 4.63 | 10.62 | 19.36 | 18.24 | 20.35 | 23.00 | 39.10 | 46.99 |
| 2 | Ketan | 241.48 | 2.56 | 14.17 | 16.51 | 16.28 | 19.38 | 20.84 | 39.10 | 45.55 |
| 3 | Warad | 251.16 | 2.16 | 13.29 | 16.72 | 17.55 | 19.24 | 20.67 | 38.11 | 45.44 |
| 4 | Dharwad-1* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5 | Narendra Rashmi -1 | 178.73 | 1.77 | 14.08 | 15.76 | 8.45 | 10.35 | 12.89 | 42.55 | 48.88 |
| 6 | Narendra Jyoti (NDBG-4) | 160.72 | 2.20 | 15.26 | 15.81 | 9.48 | 11.95 | 13.36 | 41.77 | 48.00 |
| 7 | Narendra Dharidar-1 | 227.31 | 4.66 | 11.82 | 14.15 | 13.29 | 15.51 | 17.56 | 37.10 | 44.55 |
| 8 | Narendra Dharidar-2 (NDBG-613-4) | 238.33 | 4.52 | 11.64 | 12.31 | 17.46 | 20.01 | 22.56 | 39.00 | 46.11 |
| 9 | Narendra Sankar Lauki (NDBGH-4) | 323.47 | 5.77 | 10.71 | 16.94 | 15.34 | 17.91 | 19.26 | 36.66 | 43.88 |
| 10 | Kashiganga | 270.95 | 5.40 | 11.61 | 16.13 | 18.06 | 20.44 | 22.34 | 39.44 | 45.11 |
| 11 | Samart | 141.88 | 4.17 | 13.59 | 14.41 | 11.50 | 14.28 | 16.51 | 36.10 | 43.33 |
| 12 | Vardan-f-1 | 152.40 | 4.15 | 12.54 | 16.86 | 14.18 | 16.01 | 18.55 | 39.21 | 45.66 |
| 13 | Narendra Shishir | 250.88 | 4.14 | 11.53 | 16.17 | 21.79 | 24.15 | 26.47 | 46.55 | 53.21 |
| 14 | Narendra Madhuri | 260.29 | 4.84 | 12.39 | 14.77 | 18.13 | 20.54 | 23.35 | 41.32 | 46.88 |
| 15 | Narendra Shivani | 342.52 | 5.83 | 10.75 | 15.82 | 18.53 | 20.72 | 22.56 | 38.77 | 45.44 |
| 16 | Jabalpur Local | 260.11 | 3.72 | 11.85 | 15.41 | 13.59 | 15.27 | 16.94 | 36.11 | 43.22 |
| Mean | | 218.84 | 3.78 | 11.61 | 14.75 | 14.49 | 16.63 | 18.55 | 36.93 | 43.26 |
| SEm ± | | 0.99 | 0.80 | 0.37 | 0.47 | 0.81 | 0.60 | 0.57 | 0.22 | 0.26 |
| C.D. (P = 0.05) | | 2.87 | 2.32 | 1.09 | 1.36 | 2.25 | 1.73 | 1.63 | 0.64 | 0.75 |

*Dharwad-1 variety are not germinated

Table 2: Mean performance of 16 genotypes as influenced by Yield attributes characters of bottle gourd

| S.No. | Treatment | Number of fruit per vine | Number of fruit per plot | Fruit length (c.m.) | Fruit weight (kg) | Fruit width (c.m.) | Yield (q/ha) |
|-------------|----------------------------------|--------------------------|--------------------------|---------------------|-------------------|--------------------|--------------|
| 1 | NS-421 | 9.21 | 46.06 | 34.94 | 1.36 | 30.77 | 237.95 |
| 2 | Ketan | 7.23 | 36.18 | 39.94 | 1.15 | 28.16 | 158.95 |
| 3 | Warad | 7.44 | 37.21 | 35.64 | 1.23 | 25.56 | 173.79 |
| 4 | Dharwad-1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5 | Narendra Rashmi -1 | 6.28 | 31.40 | 45.65 | 1.07 | 30.37 | 119.67 |
| 6 | Narendra Jyoti (NDBG-4) | 5.04 | 25.20 | 42.06 | 1.09 | 25.53 | 101.86 |
| 7 | Narendra Dharidar-1 | 8.24 | 41.23 | 38.77 | 1.41 | 33.82 | 214.09 |
| 8 | Narendra Dharidar-2 (NDBG-613-4) | 8.37 | 41.85 | 42.17 | 1.24 | 35.12 | 197.53 |
| 9 | Narendra Sankar Lauki (NDBGH-4) | 9.58 | 47.91 | 48.11 | 1.28 | 34.33 | 235.74 |
| 10 | Kashiganga | 8.85 | 44.26 | 40.12 | 1.31 | 33.61 | 222.47 |
| 11 | Samart | 7.26 | 36.30 | 33.74 | 0.99 | 30.58 | 138.21 |
| 12 | Vardan-f-1 | 8.53 | 42.65 | 29.43 | 1.23 | 26.22 | 210.84 |
| 13 | Narendra Shishir | 8.29 | 41.45 | 23.72 | 1.54 | 54.87 | 233.61 |
| 14 | Narendra Madhuri | 7.44 | 37.21 | 23.20 | 1.42 | 54.82 | 202.13 |
| 15 | Narendra Shivani | 16.33 | 81.65 | 89.05 | 1.07 | 20.71 | 311.53 |
| 16 | Jabalpur Local | 8.19 | 40.96 | 36.33 | 1.34 | 28.83 | 206.37 |
| Grand total | | 7.89 | 39.47 | 37.67 | 1.170 | 30.83 | 184.73 |
| SEm ± | | 0.48 | 2.40 | 0.29 | 0.03 | 0.20 | 10.55 |
| C.D. at 5% | | 1.38 | 6.94 | 0.86 | 0.099 | 0.58 | 30.47 |

Dharwad-1 variety are not germinated

Table 3: Coefficient of variability, heritability and genetic advance as percent of mean

| S. No. | Characters | Range | Mean | Variability | | Heritability(%) | Genetic advance as % of mean |
|--------|--|---------------|--------|-------------|-------|-----------------|------------------------------|
| | | | | P.C.V | G.C.V | | |
| 1 | Vine length(cm) | 342.52-141.88 | 218.84 | 37.11 | 37.11 | 99.98 | 75.67 |
| 2 | Number of Primary branches per vine | 58.34-17.71 | 3.78 | 42.77 | 42.72 | 99.75 | 87.21 |
| 3 | Internodal length (cm) | 14.17-10.62 | 11.61 | 29.13 | 28.95 | 98.77 | 54.09 |
| 4 | Number of internode per vine | 19.32- 12.31 | 14.75 | 28.55 | 28.37 | 98.75 | 58.16 |
| 5 | No. of node per vine up to 1 st male flower | 21.79-8.45 | 14.49 | 36.28 | 35.84 | 97.61 | 72.46 |
| 6 | No. of node per vine up to 1 st female flower | 24.15-10.35 | 16.63 | 34.41 | 34.22 | 98.90 | 69.45 |
| 7 | Number of node per Fruit set | 26.47-12.89 | 18.55 | 33.30 | 33.16 | 99.13 | 67.92 |
| 8 | Days to 1 st appearance of male flower | 46.55-36.10 | 36.93 | 27.63 | 37.62 | 99.95 | 56.34 |
| 9 | Days to 1 st appearance of female flower | 53.21-43.22 | 43.26 | 27.26 | 27.25 | 99.95 | 55.57 |
| 10 | Number of fruit per vine | 16.33-5.04 | 7.89 | 40.33 | 39.87 | 97.72 | 80.48 |
| 11 | Number of fruit per plot | 81.65-25.20 | 39.67 | 40.32 | 39.86 | 97.72 | 80.56 |
| 12 | Fruit length (cm) | 89.05-23.20 | 37.67 | 47.40 | 47.40 | 99.97 | 96.68 |
| 13 | Fruit weight (Kg) | 1.54-0.99 | 1.17 | 29.60 | 39.48 | 99.16 | 95.82 |
| 14 | Fruit width (cm) | 54.87-20.71 | 30.83 | 40.53 | 40.52 | 99.97 | 82.64 |
| 15 | Yield per vine (Kg) | 16.35-5.34 | 9.69 | 38.45 | 38.02 | 97.83 | 76.78 |
| 16 | Yield per plot (Kg) | 81.77-26.74 | 48.49 | 38.42 | 37.99 | 97.79 | 76.77 |
| 17 | Yield per ha (q.) | 311.53-101.86 | 184.73 | 38.42 | 38.00 | 97.79 | 76.78 |

*Dharwad-1 variety are not germinated

among NS-421 (12.49, 62.43 and 237.95), Narendra Sankar Lauki (12.37, 61.88 and 235.74), Narendra Shishir (12.26, 61.32 and 233.61), Kashiganga (11.68, 58.40 and 222.41) and Narendra Dharidar-1 (11.24, 56.20 and 214.09) (Table 2) and depicted the effect of genotypes on yield of bottle gourd Fig. 1. Similar view was given by Pitchaimuthu *et al.* (1997), Ram *et al.* (2007) and Sit *et al.* (2007) in bottle gourd.

Regression Analysis

The yield per plot and yield per vine was positively correlated with correlation co-efficient of 1. This was further supported by the regression analysis (eqn 1). Thus, unit increase in yield per vine caused increase in yield per plot by 4.999 kg/plot (Fig. 2).

$$Y = 4.999x + 0.016$$

$$R^2 = 1 \text{ (eqn 1)}$$

In the present findings phenotypic coefficient of variation were observed to the higher than the corresponding genotypic coefficient of variation all the characters excepted fruit weight studied, however the difference was narrow which implied their relative resistance to environmental variation. It also described that genetic factors were predominantly responsible for expression of these attributes and selection could be made effectively on the basis of phenotypic performance. The finding of Kumar *et al.* (2007), Kumar *et al.* (2011) and Yadav *et al.* (2008) in bottle gourd. High estimates of genotypic coefficient of variation was recorded for fruit length (47.40%), followed by number of primary branches per vine (42.72%), fruit width (40.52%), However low estimates of genotypic coefficient of variation was noted for character like days to first appearance of female flower (27.25%), days to first appearance of male flower (27.62) (Table 3). In the present studies, the heritability

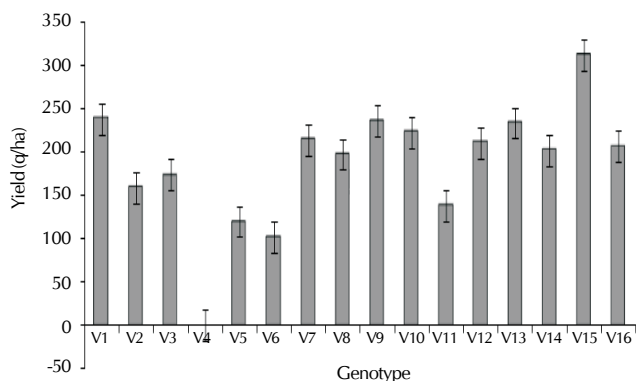


Figure 1: Effect of genotypes on yield of bottle gourd (standard error bars indicates the CD values Table 2)

estimates (broad sense) were estimates for the characters, whereas, the genetic advance estimates were measured the unit of character under measurement. Hence genetic advance was expressed as to predict the genetic gain expected for a trait in the next generation of selection programme. The obtained result indicated that the high heritability for the characters which ranged from 97 to 99% and like vine length (99.98%), fruit length and fruit width (99.97%), days to first appearance of male and female flower (99.95%), primary branches per vine (99.75%), fruit weight (99.16%), nodes per fruit set (99.13%), nodes per vine up to first female flower (98.90%), internodes per vine (98.75%), yield per vine (97.83%), number of fruit per vine (99.72%) and nodes per vine up to first male flower (97.61%) were recorded higher magnitude under investigation. High genetic advance as percent of mean were observed in fruit length (96.68%) followed by fruit weight (95.82%) with in fact demonstrate the presence of additive genes effect and selection for genetic improvement for this trait would be effective. Such high GA may be due to the action of additive genes. Lower genetic advance as percent of mean were recorded in intermodal length (54.09%) Table 3. Similar view was given by Hawlader *et al.* (1999), Husna *et al.* (2011), Mathew *et al.* (2000), Panse V. G. (1957), Singh *et al.* (2002) and Wani *et al.* (2008) in bottle gourd.

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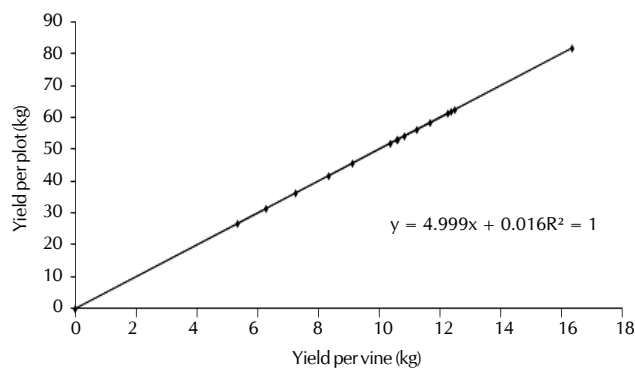


Figure 2: Regression between yield per plot (kg) and yield per vine (kg)

correlation and path analysis in bottle gourd (*Lagenaria siceraria* (Mol.) stand). *Bangladesh J. Scientific and industrial Research.* **34(1)**: 50-54.

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