The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
20(2): S2: 833-838, 2025 www.thebioscan.com

Morphological characterization of bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]

Virendra Kumar[1], Anil Kumar*, Akhil Kumar Chaudhary[2], Suman Poonia[3], Shyam Prakash[4], Nimit Singh[5], Pravesh Kumar[6], Hradesh Shivahare[7]

[1,2,3,4,5,6&7]Research Scholar, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya-224 229 U.P., India

*Assistant Professor, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya-224 229 U.P., India

*E. Mail: akkakori@gmail.com

DOI: 10.63001/tbs.2025.v20.i02.S2.pp833-838

KEYWORDS
Bottle gourd, Morphological characterization, DUS testing, diversity.
Received on:
07-04-2025
Accepted on:
09-05-2025
Published on:
19-06-2025

ABSTRACT

This study characterized the morphological diversity of 36 F1 hybrids and 9 parental genotypes of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) using 19 morphometric traits following DUS (Distinctness, Uniformity, and Stability) guidelines. Field experiments were conducted in a randomized complete block design with three replications during the Zaid seasons of 2023–24 and 2024–25 in Uttar Pradesh, India. Significant variability was observed in vine length (long, medium, short), stem shape (angular), leaf traits (margin, shape, lobes), and fruit characteristics (length, diameter, shape, skin color, base shape). All genotypes exhibited branched tendrils, while seed shape varied between triangular and rectangular. The results highlight substantial genetic diversity, particularly in fruit morphology, providing valuable insights for breeding programs aimed at enhancing yield, disease resistance, and fruit quality. These findings provide critical baseline information for the development of elite cultivars with enhanced agronomic traits while supporting biodiversity conservation efforts for this important cucurbit species.

INTRODUCTION

Cucurbitaceous vegetables are the largest family containing the maximum number of edible species in the vegetable kingdom. Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is one of the important vegetables of this family, with high genetic diversity for fruit shape and other fruit characteristics, resulting in a variety of uses (Bisognin, 2002, Morimoto *et al.*, 2005). Identification of genotypes based on morphological characteristics, viz. vine, leaf, flower, fruit and seed characteristics, is the most widely used method. It is vital for plant breeding programs to have sufficient diversity available to allow for the production of new genotypes aimed at improving crop productivity and withstanding damage from biotic and abiotic factors (Querol, 1987).

According to the International Union for Protection of New Plant Varieties (UPOV), any new characteristic used in varietal characterization should be clearly defined, accepted and should have a standard method of observation, minimally or not affected by the environment, accessible to breeders, and associated with reasonable costs and efforts. The National Test Guidelines are to be developed for the conduct of DUS testing. Such characterization studies are lacking in bottle gourd. The available information suggests that modern genotypes often lack additional characters that farmers consider important. Significant genetic variation may exist among bottle gourd genotypes. Some may be superior in certain traits but lack other aspects. Their morphological characteristics may also differ; hence, there is a need for a detailed study of genetic variation in cultivated bottle gourd genotypes to generate data. This data will be essential to validate suggested comparative advantages and may provide new options for crop improvement.

Materials and Methods

Thirty-six hybrids (F1) along with nine parents were evaluated under a randomized complete block design with three replications at the Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, during the Zaid seasons 2023-24 and 2024-25. Geographically, the experimental site falls under a humid subtropical climate and is located between 24.47° and 26.56°N latitude and 82.12° and 83.58°E longitude, at an altitude of 113 meters above mean sea level. The soil type at the experimental site was sandy-loam with an average fertility level and a pH range varying from 6.5 to 8.5. Based on their diversity and elite status for different economically important traits, nine promising genotypes Narendra Kamna, Narendra Rashmi, NDBG-619, NDBG-7, Narendra Pooja, Pant Lauki-3, Kashi Ganga, Arka Bahar, and Pusa Naveen-were selected for use in the crossing program. Crosses were made using a half-

diallel mating design, including all possible combinations except reciprocals. A total of thirty-six hybrids, along with their respective parents (obtained by selfing), were harvested separately and raised in a randomized complete block design with three replications. All recommended package practices were followed.

Data Observation

Observations of 19 morphological characters related to botany were recorded in accordance with the DUS guidelines for bottle gourd (PPV & FRA, 2009). Data were recorded from each replication, avoiding the border rows, at specified stages of the crop growth period when the characters had their full expression. For the assessment of colour characteristics, the Royal Horticultural Society (RHS, 2001) colour chart was used. All observations on the stem, leaves and flowers were recorded from the first inflorescence to the first harvesting, whereas observations on fruits were recorded at the commercial and physiological maturity stages. The data were observed for all the 19 morphometric traits from the following plant parts: Plant: growth habit; Stem: shape, length of internodes of the main stem, and number of primary branches; Leaf blade: margin; Leaf: shape; Leaf blade: number of lobes; Tendril: branching; Petiole: length; Ovary: length; Peduncle: length; Fruit: length, diameter, shape in longitudinal section, neck, skin colour, shape of base at blossom end; and Seed: shape, within four assessing groups viz., MG (measurement by a single observation on a group of plants or parts of plants), MS (measurement on a number of individual plants or parts of plants), VG (visual assessment by a single observation on a group of plants or parts of plants), VS (visual assessment by observations on individual plants or parts of plants)-as discussed in the DUS guidelines of bottle gourd.

Plant characteristics: Plant growth habit was measured using a scale: more than 5.5 m = long vine, 3.5-5.5 m = medium vine, less than 3.5 m = short vine. Stem shape was observed by VS (visual assessment), viz.: rounded and angular. Stem length of internodes of the main stem was measured using a scale: more than 14 cm = long internode, 10-14 cm = medium internode, less than 10 cm = short internode. Stem: number of primary branches was measured using a scale: more than 12 = many, 6-12
= medium, less than 6 = few primary branches.

Leaf characteristics: Leaf characteristics were assessed based on traits such as leaf length, leaf blade: margin, leaf: shape, and leaf blade: number of lobes. Leaf margin was observed by VS (visual assessment), viz.: entire, serrate, and multifid. Leaf shape was observed by VS, viz.: cordate, oblong, ovate, obovate, orbicular, and reniform. Leaf blade: number of lobes was observed by VG (visual group assessment), viz.: 3 lobes, 5 lobes, and 7 lobes.

Tendril branching: Tendril branching was observed by VS (visual assessment), viz.: un-branched and branched.

Petiole length: Petiole length was measured using a scale: more than 15 cm = long petiole, 10-15 cm
= medium petiole, less than 10 cm = short petiole.

Ovary length: Ovary length was measured using a scale: more than 5 cm = long ovary, 2.5-5 cm = medium ovary, less than 2.5 cm = short ovary.

Fruit characteristics: fruit length was measured by scale for more than 45 cm = long fruit, 20-45 cm
= medium fruit, less than 20 cm short fruit. Fruit diameter was measured by vernier callipers for more than 12 cm = large, 8-12 cm = medium and less than 8 cm is short. Fruit: shape in longitudinal section observed by vs viz: elongate straight, elongate- curved, cylindrical, oval, club, pyriform, round and any other. Fruit neck was observed by vg viz: straight and crooked, fruit: skin colour by vg viz: light green, green, dark green, mottle green and striped green. Fruit: shape of base at blossom end by vg viz: acute, semi blunt, blunt and depressed.

Seed characteristics: Seed shape assessed by vs viz: triangular and rectangular. This was consistent with the results of Huh *et al.*, (2014) on Korean and Turkish watermelon populations and Aruah *et al.*, (2010) on variations among some Nigerian Cucurbita landraces. The greatest diversity was observed in fruit characters, especially fruit shape, fruit skin colour, and blossom-end fruit shape. This aligns with the findings of Bisognin (2002), who reported that cucurbits exhibit similarities in above-ground development but display high genetic diversity in fruit shape and other fruit characteristics.

Results and discussion

Among the 9 varieties and 36 F_1, including a check of bottle gourd, considerable variation was observed in all the important traits under study. The characterization of bottle gourd genotypes is presented in Table-1. In the present study, Among the 9 varieties and 36 F_1, including a check of bottle gourd, 38 long-viny, 1 short-viny, and 7 medium-viny genotypes showed vine length. Among the 9 varieties and 36 F_1, including a check of bottle gourd, all the genotypes had angular stem shape. In the present study, Among the 9 varieties and 36 F_1, including a check of bottle gourd, 1 long, 26 medium and 19 short genotypes showed stem length: length of internodes of the main stem. Out of the 9 varieties and 36 F_1, including a check of bottle gourd studied, 41 had fewer numbers and 5 had a medium count of primary branches observed on the stem. In case of leaf characteristics firstly we considered leaf margin in which have entire 30 and Serrate 16 Among the 9 varieties and 36 F_1, including a check of bottle gourd. Among the 9 varieties and 36 F_1, including a check of bottle gourd, 17 genotypes have Cordate, 28 genotypes have Oblong and 4 genotypes have Ovate. In case of Leaf blade: number of lobes 16 genotypes have 3 lobes while in 30 genotypes found 5 lobes. Among the 9 varieties and 36 F_1, including a check of bottle gourd, all the genotypes had branched Tendril. In case of Petiole: length 25 genotypes have medium; 12 short type and 9 genotypes have long type of genotype. In case of Ovary: length 34 genotypes have medium ovary while in 13 genotypes long length of ovary is found. Among the 9 varieties and 36 F_1, including a check of bottle gourd, 25 genotypes have Short remaining 20 have medium and 1 have long Peduncle length. In case of Fruit: length all the genotypes have medium fruit length. In case of Fruit: diameter 35 genotypes have Small and 11 genotypes have medium fruit diameter. In case of Fruit: shape in longitudinal section 27 genotypes have Elongate straight and 19 genotypes have cylindrical type of fruit shape. In case of Fruit: neck all the genotypes have straight fruit neck. In case of Fruit skin colour 30 genotypes have Light green and 15 genotypes have green in colour. In case of Fruit shape of base at blossom end 26 genotypes have Acute and 20 genotypes have Semi blunt type of fruits. In case of Seed shape 24 genotypes have Triangular and 22 genotypes have Rectangular in shape. Seed weight indicates that the characteristics are genetically controlled as reported earlier by Stephenson *et al.*, (1988) and Mondal *et al.*, (1989), Kalyanrao *et al.*, (2016). The study's findings revealed significant variation a Among the 9 varieties and 36 F_1, including a check of bottle gourd genotypes for key morphological traits, underscoring the genetic diversity within the species. Overall, the observed genetic diversity

Table-1 Characterization of bottle gourd genotypes

Genotypes	Morphological characters																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Parents																			
Narendra Kamna (P1)	7	2	3	5	1	1	5	2	5	7	3	5	3	3	1	1	1	1	1
Narendra Rashmi (P2)	7	2	3	5	2	2	5	2	3	5	5	5	3	1	1	2	1	1	2
NDBG-619 (P3)	7	2	5	5	2	2	5	2	7	7	3	5	3	1	1	1	2	2	1
NDBG-7 (P4)	3	2	3	5	2	3	3	2	7	5	3	5	3	3	1	1	1	1	1
Narendra Pooja (P5)	7	2	5	5	1	2	3	2	5	5	5	5	3	3	1	1	2	1	2
Pant Lauki-3 (P6)	7	2	3	5	2	2	5	2	5	5	5	5	3	1	1		2	1	2
Kashi Ganga (P7)	7	2	3	5	1	1	3	2	5	5	3	5	5	1	1	1	2	1	2
Arka Bahar (P8)	7	2	7	5	1	1	3	2	5	5	5	5	5	1	1	1	2	1	2
Pusa Naveen (P9)	5	2	5	5	1	2	5	2	3	5	3	5	3	3	1	2	1	2	2
Hybrids																			
P1×P2	7	2	3	5	2	2	5	2	5	7	5	5	3	3	1	1	1	1	1
P1×P3	7	2	3	5	1	2	5	2	5	7	3	5	3	1	1	1	1	1	1
P1×P4	7	2	5	5	1	1	3	2	3	7	3	5	3	3	1	1	1	1	1
P1×P5	7	2	3	5	1	1	5	2	5	7	5	5	3	3	1	1	1	1	1
P1×P6	7	2	5	5	2	1	5	2	5	7	5	5	3	3	1	1	1	1	1
P1×P7	7	2	3	5	1	1	5	2	5	7	3	5	3	3	1	1	2	1	2
P1×P8	5	2	5	5	1	1	5	2	5	5	5	5	3	1	1	1	2	1	2
P1×P9	7	2	3	5	1	1	5	2	3	5	3	5	3	3	1	2	1	2	2
P2×P3	7	2	5	5	2	2	5	2	3	5	5	5	3	1	1	2	2	1	2
P2×P4	7	2	3	5	2	2	5	2	3	5	5	5	3	1	1	2	1	1	1
P2×P5	7	2	5	3	1	2	5	2	3	5	5	5	3	1	1	2	2	1	1
P2×P6	7	2	5	3	2	2	5	2	5	5	3	5	3	1	1	2	1	1	1
P2×P7	7	2	3	3	1	1	5	2	5	5	3	5	5	3	1	1	2	1	2
P2×P8	7	2	3	5	1	1	5	2	5	5	5	5	5	3	1	2	1	1	1
P2×P9	7	2	3	5	1	2	5	2	5	5	3	5	3	1	1	2	1	1	1
P3×P4	5	2	5	3	2	2	5	2	7	7	3	5	3	3	1	2	1	2	2
P3×P5	7	2	5	5	1	2	5	2	7	7	5	5	5	3	1	1	1	2	1
P3×P6	7	2	5	5	2	2	5	2	7	7	5	5	3	1	1	1	1	1	1
P3×P7	7	2	5	5	1	1	5	2	5	7	3	5	3	1	1	1	1	1	2
P3×P8	7	2	5	3	2	2	5	2	5	5	5	5	3	1	1	2	2	1	2

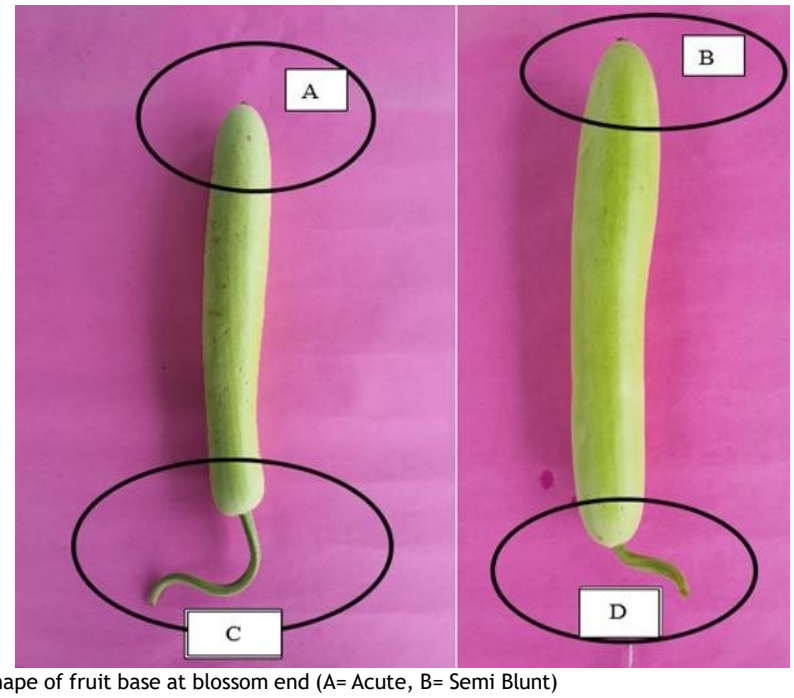
P3×P9	7	2	5	5	1	2	5	2	7	5	3	5	3	3	1	1	2	2	2
P4×P5	7	2	5	5	1	3	3	2	7	5	3	5	3	3	1	2	2	1	1
P4×P6	7	2	5	5	2	2	3	2	5	5	5	5	3	1	1	1	2	1	1
P4×P7	7	2	3	5	1	3	3	2	7	5	3	5	5	1	1	1	2	1	2
P4×P8	5	2	5	5	1	2	3	2	5	5	8	5	5	1	1	1	2	1	2
P4×P9	7	2	3	5	1	3	3	2	7	5	3	5	5	3	1	1	2	1	2
P5×P6	7	2	3	5	2	2	3	2	3	5	5	5	3	1	1	1	1	1	2
P5×P7	7	2	5	5	1	2	3	2	5	5	3	5	3	1	1	1	1	1	1
P5×P8	5	2	5	5	1	2	3	2	5	5	5	5	5	1	1	1	1	1	1
P5×P9	7	2	5	5	1	1	5	2	5	5	3	5	5	3	1	2	1	1	1
P6×P7	5	2	5	5	2	2	5	2	5	5	3	5	3	1	1	1	1	1	2
P6×P8	7	2	3	5	2	2	3	2	3	5	5	5	3	1	1	1	1	1	1
P6×P9	7	2	3	5	1	2	3	2	3	5	3	5	3	1	1	1	2	1	1
P7×P8	7	2	5	5	1	2	5	2	3	5	5	5	3	1	1	1	2	1	2
P7×P9	7	2	5	5	1	1	5	2	3	5	3	5	3	1	1	2	1	1	1
P8×P9	7	2	5	5	1	2	5	2	5	5	3	5	5	3	1	2	1	1	1
Sarita (check)	5	2	5	5	1	2	3	2	5	5	3	5	3	1	1	1	2	1	2
	3.Short viny 5.Medium viny 7.Long viny	1. Rounded 2. Angular	3.Short 5.Medium 7.Long	3.Less 5.Medium 7.Many	1. Entire 2. Serrate 3. Multifid	1. Cordate 2. Oblong 3. Ovate 4. Obovate 5. Orbicular	3 lobes 5 lobes 7 lobes	1. Un-branched 2. Branched	3. Short5 5. Medium 7. Long	3. Short 5. Medium 7. Long	3. Short 5. Medium 7. Long	3. Short 5. Medium 7. Long	3.Small 5. Medium 7.Large	1. Elongat e straight 2. longate - curved 3. Cylindrical 4. Oval 5. Club	1. Straight 2. Crooked	1. Light green 2. Green 3. Dark green 4. Mottle green 5. Striped green	1. Acute 2. Semi blunt 3. Blunt 4. Depressed	1. Raised 2. Flat 3. Depressed	1. Triangular 2. Rectangular
	Descriptor characters: 1. Plant: growth habit, 2. Stem: shape, 3. Stem: length of internodes of main stem, 4. Stem: number of primary branches, 5. Leaf blade: margin, 6. Leaf: shape, 7. Leaf blade: number of lobes, 8. Tendril: branching, 9. Petiole: length, 10. Ovary: length, 11. Peduncle: length, 12. Fruit: length, 13. Fruit: diameter, 14. Fruit: shape in longitudinal section, 15. Fruit: neck, 16. Fruit: skin colour, 17. Fruit: shape of base at blossom end, 18. Fruit: shape of apex at peduncle end 19.Seed: shape																		

offers valuable opportunities for developing improved bottle gourd varieties through selective breeding (Duhan *et.al.*,2017; Taş *et.al.*,2019; Sharma *et.al.*,2013; Kumar *et.al.*,2018).

Acknowledgement

I express my wholehearted gratitude and sincere thanks to my Major Advisor Dr. Anil Kumar, working as an Assistant professor, Department of Vegetable Science at the College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Uttar Pradesh, India, for suggesting this interesting research work and for all his scholarly guidance, keen interest, support and suggestive criticism throughout the course of this investigation and preparation of this research. Despite her multidimensional responsibilities, the most affectionately extended kind cooperation and encouragement.

Fig 1: Character-I: shape of fruit apex at peduncle end (C= Flat, D= Raised) Character-II:



shape of fruit base at blossom end (A= Acute, B= Semi Blunt)

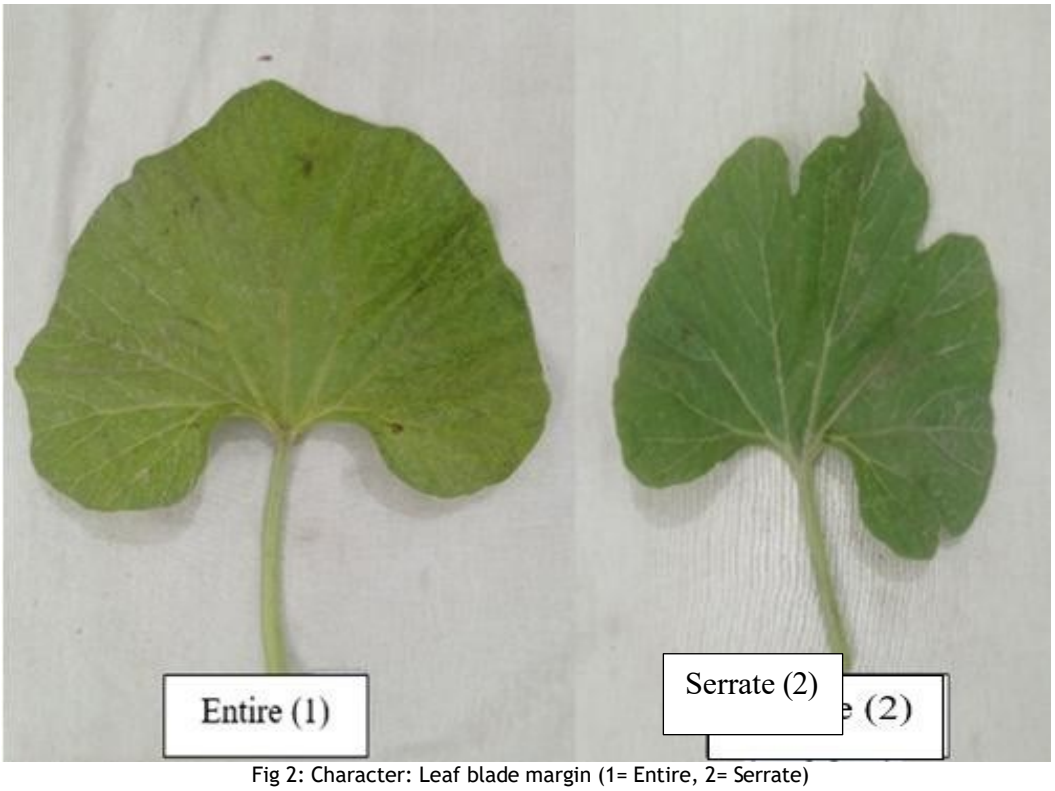


Fig 2: Character: Leaf blade margin (1= Entire, 2= Serrate)

Fig 2: Character: ovary Length (5= Medium, 7= Long)

Fig 2: Character: Seed Shape (1= Triangular, 2= Rectangular)

REFERENCES

- Aruah C B, Uguru, M I and Oyiga B C. (2010). Variations among some Nigerian Cucurbita landraces. *African Journal of Plant Science* 4(10): 374-86.
- Bisognin D A. (2002). Origin and evolution of cultivated cucurbits. *Ciencia Rural* 32(5): 715-23.
- Chakraborty, S., & Chaurasiya, A. K. (2022). Morphological Characterization of Bottle Gourd [*Lagenaria siceraria* (Mol). Standl.] Germplasms in Garo Hills of Meghalaya, In North-East. *Research Conclave*. Singapore: Springer Nature Singapore, 3-24.
- Duhan, D. S., Panghal, V. P. S., & Rana, M. K. (2017). Morphological characterization of bottle gourd [*Lagenaria siceraria* (Mol.) Standley] genotypes. *Vegetable Science*, *44*(2), 70-73.
- Huh, Y. C., Choi, H. S., Solmaz, I., Sari, N., & Kim, S. (2014). Morphological characterization of Korean and Turkish watermelon germplasm. *Korean Journal of Agricultural Science*, *41*(4), 309-314.
- Kalyanrao, K., Tomar, B. S., Singh, B., & Aher, B. M. (2016). Morphological characterization of parental lines and cultivated genotypes of bottle gourd (*Lagenaria siceraria*). *Indian J. Agric. Sci*, ***86*(1)**, 65-70.
- Kumar, R., Kumar, R., Prasad, B. D., Solankey, S. S., Kumar, J., & Bamaniya, B. S. (2018). Genetic variation study using morphological and DNA marker-based genotyping in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). *Curr. J. Appl. Sci. Technol*, *31*, 1-10.
- Mondal S N, Rashid A K, Hossain A K and Hossain M A. (1989). Genetic variability, correlation and path-coefficient analysis in watermelon. Bangladesh *Journal of Plant Breeding and Genetics* **2(1-2)**: 31-5.
- Morimoto, Y., Maundu, P., Fujimaki, H., and Morishima, H. (2005). Diversity of landraces of the white- flowered gourd (*Lagenaria siceraria*) and its wild relatives in Kenya: fruit and seed morphology. *Genet. Resour. Crop Evol*. 52, 737-747.
- Querol D. (1987). Genetic Resources-A Practical Guide to their Conservation. *Zed Books Ltd,* London and New Jersey. 55-57.
- Sharma, A. and Sengupta, S.K. (2013). Genetic diversity, heritability and morphological characterization in How to cite this article: bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). *The Bioscan*. 8(4): 1461-1465.
- Sivaraj, N. and Pandravada, S.R. (2005). Morphological diversity for fruit characters in bottle gourd germplasm from tribal pockets of Telangana region of Andhra Pradesh, India. *Asian Agri. History*, 9: 305-310.
- Stephenson A G, Devlin B and Horton J B. (1988). The effects of seed number and prior fruit dominance on the pattern of fruit production in Cucurbita pepo. *Annals of Botany*, **62**: 653-61.
- Taş, A., Yetişir, H., Denli, N., & Gürcan, K. (2019). Morphological characterization of bottle gourd (*Lagenaria siceraria* (Molina) Standl.) germplasm and formation of a core collection. *Journal of agricultural sciences*, *25*(2), 205-214.