Biological Forum – An International Journal **14(3): 581-583(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Assessment of Heritability and Genetic Advance in Parent and F_1 Hybrids of Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]

Muzeev Ahmad[1*], Bijendra Singh[1], Khursheed Alam[2], Mohd Wamiq[2], Imran Ali[3], Rahul Kumar[2] and Rishabh Shukla[1]

[1]Department of Horticulture,
Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (Uttar Pradesh), India.
[2]Department of Vegetable Science,
Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (Uttar Pradesh), India.
[3]Department of Fruit Science,
Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (Uttar Pradesh), India.

(Corresponding author: Muzeev Ahmad)*
(Received 16 May 2022, Accepted 16 July, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present experiment was carried out in a bottle gourd to assess the heritability and genetic advance for yield and quality component traits. Forty-five bottle gourd hybrids were generated by crossing fifteen lines with three testers cross, along with eighteen parents evaluated in a randomized complete block design with three replications at the experiment station of Horticultural Research Centre, College of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, during the summer season of the year 2020 and 2021. The estimation of heritability act as a predictive instrument in expressing the reliability of phenotypic value. Heritability helps the breeder in the election of elite genotypes from diverse genetic populations. Therefore, high heritability helps in effective selection for a particular trait.

The high heritability was recorded in average fruit weight (381.16) and fruit yield (93.47). The low heritability was estimated in fruit length (9.76%), days to first fruit harvest (7.42%), fruit girth (7.38%), days to first fruit set (7.49%), first flower initiation (5.46%), days to 50% flowering (5.60%), number of fruits per plant (4.09%), number of primary branches (2.03%), vine length (1.21%). The estimate of genetic advance was recorded highest for average fruit weight (48.48) followed by fruit yield (37.72), fruit length (34.34) and fruit girth (31.00), number of fruits per plant. The highest genetic gain was observed for fruit yield (119.79%) followed by fruit length (12.51%), crop duration (11.21%), days to first fruit set (9.59%) and days to first fruit harvest (9.51%).

Keywords: Heritability, genetic advance, bottle gourd.

INTRODUCTION

Vegetables are the most sustainable and affordable source of micronutrients including vitamins and minerals, of the new millennium. Vegetable production and consumption have to meet the national increasing population our demand for vegetables to provide nutritional security to every person will be 350 million tonnes by 2030 in the world (FAO, 2017).

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is a crucial vegetable belonging to the Cucurbitaceae family, subfamily cucurbitoideae, and tribe benincaseae (Richardson, 1972). It has a diploid chromosome (2n=2x=22) and belongs to the genus *Lagenaria* with a genome size of 334 Mb (Beevy and Kuriachan 1996; Achigan-Dako *et al.*, 2008). The names "*lagenaria*" and "*siceraria*" are derived from the Latin words "lagena" for bottle and "sicera" for drinking utensils. Its fruit is available in the market thought the year. It is believed to originate in Southern Africa and is widely grown in South and Southeast Asia, China, and Africa (Erickson *et al.*, 2005).

According to dieticians, an adult individual requires 300gm (125gm of leafy vegetables, 100gm root and tuber vegetables, and 75gm of other vegetables) of vegetables daily to maintain proper health. However, the per capita consumption of vegetables in India is only 175g which is very low compared to the recommended dose. The bottle gourd fruit contain vitamin C (11.00mg), thiamine (0.044mg), riboflavin (0.023mg), niacin (0.330mg), protein (0.200g), carbohydrate (2.50g) and trace of mineral-like calcium (20.00mg), phosphorus (10.00mg) and iron (0.700mg) in 100gm of fruit (Thamburaj and Singh 2000).

Bottle gourd is a highly cross-pollinated crop due to its monoecious and and romonoecious nature (Bose *et al*., 2002). Being cross-pollinated crops, it has a wide range of variability for maturity, yield, and fruit characteristics like shape and size (Sidhu, 2002). Sex expression in cucurbits is influenced by genetic, environmental, and chemical factors (Tiedjens, 1928). Bottle gourd is the largest produced cucurbitaceous vegetable in the world preferred in both urban and rural populations. It bears simple, alternate leaves 4-12 cm across with 3-7 separated. The fruit shape varies from flat to round, oval, oblong, and long. The fruit color varies from dark green to cream or yellow. The herbaceous tendril-bearing vine grows to 5 m. It is an important gourd having a wide range of use and is largely cultivated in the tropics and subtropics for its edible fruit. It's easily digestible and cooked vegetable preparation is recommended for patients suffering from stomach problems. In addition, the white pulp of the fruit is emetic, purgative, diuretic, and antibilious and it's having a cooling effect. Oil from the seed is used to relieve headaches and is also diuretic and nutritive (Rahman *et al.,* 2008).

An estimate of genetic advance along with heritability is helpful in assessing the reliability of character for selection. Knowledge of the mechanisms underlying the correlations between different traits is fundamental for understanding the

degree of integration of the phenotype and resolving the constraints imposed on evolutionary processes (Lynch and Walsh 1998).

Alekar *et al.* (2019) estimated high heritability for vine length at last harvest, number of primary branches per vine, number of fruits per vine, average fruit yield per vine, the average weight of fruit, average length of fruit, and yield tonnes per hectare. High heritability estimates are comparatively less affected by the environment.

Thakur *et al.* (2017) recorded high heritability for days to the first male and female flower appear, days to 50% flowering, days to fruit set, days to first fruit harvest, a number of branches per plant, fruit length, fruit girth, fruit weight, no. of fruits per plant and yield(q/h).

Khan *et al.* (2016) reported moderate heritabilityfor fruit yield, the number of fruits per vine, length of fruit, and fruit weight.

MATERIAL AND METHODS

The present experiment was carried out during the summer season of the years 2020 and 2021, to assess the heritability and genetic advance using a line x-tester mating design with three replications at the experiment station of Horticultural Research Centre, College of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut-250110 (U.P.). The experimental materials for the present investigation comprised of fifteen lines with three testers of bottle gourd selected on the basis of the variability. The selected parental lines *i.e.,* IC- 539711, IC- 336757, IC-394736, IC- 321410, IC- 398541, IC- 321460, IC- 541393, IC- 394857, IC- 310188, Vallabh Saral, IC- 385816, IC-336820, IC- 418491, Pant Louki-1, Arka Bahar, Narendra Madhuri (T1), Narendra Rashmi (T2) and Pusa Naveen (T3). The present experiments were conducted in a randomized complete block design with three replications to appraise the performance of forty-five F1 and their eighteen parents (fifteen lines and three testers) for the study of heritability and genetic advance for fruit yield and quality attributing traits. This crop was sown in rows spaced at 3 meters apart with a plant-to-plant spacing of 0.50 meters. Sowing was done in 2020 and 2021. All the recommended agronomic packages of practices and protection measures were followed to raise a good crop. The observation was recorded on days to first flower initiation, days to 50% flowering, days of fruit set, days to first fruit harvest, fruit weight (g), fruit length (cm), fruit girth (cm), number of fruits per plant, vine length (m), number of primary branches per plant, duration of crop and fruit yield (q/h). The estimated heritability in the narrow sense (h^2ns) has been classified by Kempthorne and Curnow (1963) into three categories *viz.,* high (>30%), medium (10-30%), and low (<10%). The genetic advance as percent of mean was categorized as low, moderate, and high by following Johnson *et al.* (1955). Low (0-10%), moderate (10-20%) and high (>20%) respectively.

RESULT AND DISCUSSION

The estimate of heritability and genetic advance in the present mean is present in the Table 1 and Fig. 1. The high heritability was recorded in average fruit weight (381.16) and fruit yield (93.47). The low heritability was estimated in fruit length (9.76%), days to first fruit harvest (7.42%), fruit girth (7.38%), days to first fruit set (7.49%), first flower initiation (5.46%), days to 50% flowering (5.60%), number of fruits per plant (4.09%), number of primary branches (2.03%), vine length (1.21%).

The estimate of genetic advance was recorded highest for average fruit weight (48.48) followed by fruit yield (37.72), fruit length (34.34), fruit girth (31.00), number of fruits per plant (28.94), number of primary branches (27.71) and vine length (23.45). It was moderate for days to first fruit set (12.80), days to first flower initiation (11.67), days to first fruit harvest (10.22), days to 50% flowering (9.46), and crop duration (6.96).

Genetic advance as percent of mean genetic gain, the highest genetic gain was observed for fruit yield (119.79%), moderate in fruit length (12.51%), crop duration (11.21%), and the low genetic advance was recorded in days to first fruit set (9.59%), days to first fruit harvest (9.51%), days to 50% flowering (7.17%).

A perusal of Table 1 revealed that the high estimate of heritability average fruit weight, fruit yield, and low heritability in fruit length, days to first fruit harvest, fruit girth, days to first fruit set, first flower initiation, days to 50% flowering, number of fruits per plant, number of primary branches, vine length.

The estimate of genetic advance was recorded highest for average fruit weight, fruit yield, fruit length, and fruit girth. It was moderate for days to first fruit set, days to first flower initiation, days to first fruit harvest, days to 50% flowering, and crop duration.

Genetic advance as percent of mean genetic gain, the highest genetic gain was observed for fruit yield, moderate in fruit length, crop duration, and the low genetic advance was recorded in days to first fruit set, days to first fruit harvest, days to 50% flowering. Similarity findings for the high estimate of heritability for different bottle gourd traits have been also reported by Deepthi *et al.* (2016); Damor *et al.* (2016); Rashid *et al.* (2020); Singh *et al.* (2021).

Table 1: Estimation of Heritability and genetic advance of parents and hybrids for twelve quantitative characters in bottle gourd.

Genotypes	Mean	Min	Max	Heritability (%)	GA	GA% mean
Days to first flower initiation	46.81	42.00	54.27	5.46	11.67	7.00
Days to 50 % flowering	59.16	53.93	65.47	5.60	9.46	7.17
Days to first fruit set	58.50	52.13	67.80	7.49	12.80	9.59
Days to first fruit harvest	72.62	64.53	80.80	7.42	10.22	9.51
Crop duration	125.67	108.40	131.93	8.75	6.96	11.21
Fruit length (cm)	28.42	15.80	40.20	9.76	34.34	12.51
Fruit girth (cm)	23.79	17.40	31.33	7.38	31.00	9.45
Number of primary branches	7.31	4.33	10.40	2.03	27.71	2.60
Vine length (m)	5.17	3.40	7.07	1.21	23.45	1.55
Number of fruits per plant	14.12	9.53	18.93	4.09	28.94	5.24
Average fruit weight (gm)	786.27	334.67	1163.60	381.16	48.48	488.47
Fruit yield q/h	247.78	111.33	314.40	93.47	37.72	119.79

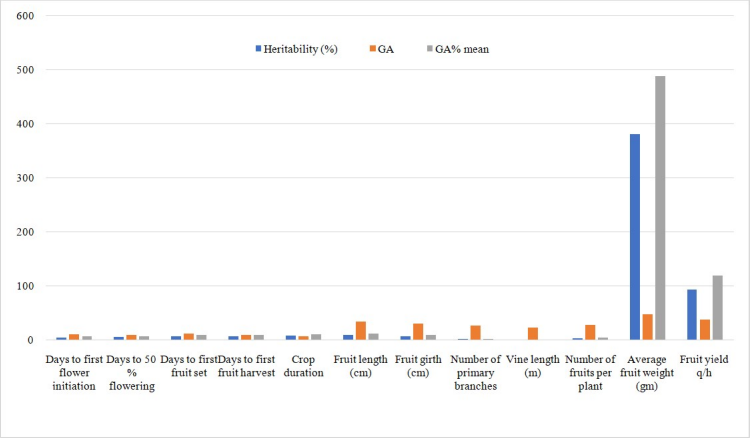

Fig. 1. Estimation of Heritability and genetic advance of parents and hybrids for twelve quantitative characters in bottle gourd.

CONCLUSION

Estimates of moderate heritability with low genetic advance indicated a preponderance of now additive gene action fruit yield per plant. Hence heterosis breeding approach will be more rewarding than the selection for improvement of bottle gourd.

Acknowledgment. We thank all co-Arthurs for providing support during data collection and writing. This research was conducted within breeding and informatic during the research programme.

Conflict of Interest. None.

REFERENCES

Alekar, A. N., Shinde, K. G. and Khamkar, M. B. (2019). Studies on genetic variability, heritability, genetic advance and correlation in bitter gourd (*Momordica charantia* L.) *International Journal of Chemical Studies, 7*(3): 1155-1159.

Beevy, S. S. and Kuriachan, P. (1996). Chromosome numbers of South Indian cucurbitaceae and a note on the cytological evolution in the family. *J. Cytol. Genet., 31*, 65–71.

Bose, T. K., Kabir, J. and Molty, T. K. (2002). Lageniana (Bottle gourd). Vegetable Crops. Naya Prakash, I: pp. 504

Damor, A. S., Patel, J. N., Parmar, H. K., and Vyas N. D. (2016). Studies on genetic variability, heritability, and genetic advance for yield and quality traits in Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] Genotypes. *Int. J. Sci. Environ. Tech. 5*(4): 2301-2307.

Deepthi, B., Reddy, P. S. S., Satyaraj, Kumar, A. S. and Reddy, A. R. (2016). Studies on pcv, gcv, heritability and genetic advance in Bottle gourd genotypes for yield and yield components, *Plant Archives, 16*(2): 597-601.

Erickson, D. L., Smith, B. D., Clarke, A. C., Sandweiss, D. H. and Tuross, N. (2005). An Asian origin for a 10,000-year-old domesticated plant in the Americas. *Proc. Natl. Acad. Sci.*, *102*(18): 315–318.

FAO (2017). The future of food and agriculture – trends and challenges. Rome

Khan, A. M. R., Eyasmin, R., Rashid, M. H., Ishtiaque, S., and Chaki, A. K. (2016). Variability, heritability, character association, path analysis and morphological diversity in snake gourd. *Agriculture and natural resources*, *50*(6): 483-489.

Rahman, A. H. M. M., Anisuzzaman, M., Ahmed, F., Islam, A. K. M. R. and Naderuzzama, A. T. M. (2008). Study of nutritive value and medicinal uses of cultivated cucurbits. *J. Applied Sci. Res*., *4*: 555-558.

Rashid, M., Wani, K. P., Hussain, K. P., Dar, Z. A., Singh, P. K., Khalil, A. (2020). Studies on genetic variability, heritability and genetic advance in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] genotypes. *Inl. J. of Chem. Stud., 8*(3): 455-458

Singh R, Singh B, Prakash S, Kumar M, Kumar V, Chand P, (2021). Genetic variability, heritability and genetic advance in bottle gourd (*Lagenaria siceraria* (Mol.) Standl). *Annals of Horticulture*, *14*(1):72-78.

Singh, K. P., Panda, P. K. and Singh, A. K. (2002). Variability, heritability and genetic advance in ash gourd (*Benincasa hispida* Thunb. Cogn.). Haryana *J. Hort. Sci*., *31*(1/2): 139-140.

Thakur, P., Singh, J., Trivedi, J. and Nair, S. K. (2017). Studies on Genetic Variability, Heritability and Genetic Advance for Yield attributing Traits in Bottle Gourd [*Lagenaria siceraria* (Mol.) Standl.] Genotypes *Trends in Biosciences, 10*(24), 5023-5026.

Thumburaj, S. and N. Singh (2000) Vegetables and Tuber Crops and Spices. ICAR, New Delhi, 271-272.

Tiedjens, V.A. (1928). Sex ratio in cucumber flowers as affected by different conditions of soil and light. *J. Agric. Res., 36*: 721-746.

How to cite this article: Muzeev Ahmad, Bijendra Singh, Khursheed Alam, Mohd Wamiq, Imran Ali, Rahul Kumar and Rishabh Shukla (2022). Assessment of Heritability and Genetic Advance in Parent and F_1 Hybrids of Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. *Biological Forum – An International Journal*, *14*(3): 581-583.