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Morphological characterization, Assessment of genetic variability, divergence and character association in bottle gourd (*Lagenaria siceraria* (Mol.) Stand) germplasm: A review

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Abstract
Bottle gourd is equatorial and sub-tropical creeper. Bottle gourd, is the first mankind's considerate vegetable species, imparting food, medicine and other supplementary additionally found as vital crop in every home garden. It was probably originated in Africa and extensively grown in South and Southeast Asia and all over the world. Detailed information about genetic variability, genetic diversity, heritability, genetic advance, correlation and path coefficient and of various quantitative traits and their contribution towards yield is essentaial for maximum improvement of crop and maximum yield. Very less work had done in this direction. Hence, the different scientist work in this direction has been reviewed here.

Keywords: bottle gourd, variability, heritability, genetic advance, correlation, diversity, yield

1. Introduction
Bottle Gourd [*Lagenaria siceraria* (Mol.) Standl.] (2n = 2x = 22) is a vegetable crop cultivated numerous nations. Bottle gourd revealed great morphological and genetic variability and wide environmental alteration in creation (Uddin *et al*, 2014). Proficient source of natural antioxidants and lacks with cholesterol. Moreover, contain niacin, ascorbic acid, iron, Potassium, phosphorous and calcium are the most copious minerals (0.5g) found in the fruit of bottle gourd respectively (Parle and Kaur, 2011). Various digestive ailments can be prevented owing to the presence of dietary fiber. Efficiently contain vitamin A, C and also contains protein (0.2g), water (96.1g), carbohydrate (2.5g) and energy (12kcal) per 100g 0f edible fruit. Poor productivity and production is due to poor genetic genes of open pollinated mixed seed (Ara *et al*. 2014). High yield, greater fruit weight, earliness, fruit morphology, edible quality, and resistance to diseases and insect-pest are the main objective for crop improvement in bottle gourd crop (Behera *et al*. 2015) [2].

2. Morphological Characterization of Bottle Gourd
Morphological characterization of bottle gourd crop is done to analyze the function, development and about the changes in shape, size of seed and fruit. Bottle gourd fruit vary widely among shape and size, and this is within varieties, exhibits the widest variations in fruit shape; these are either long, cylindrical, necked, oblong flat or round, conical pyriform to club shaped, whereas skin texture varies from warted to smooth (Ilyas *et al*., 2017). Tender leaves, shoots, seeds, fresh tendrils, shoot and leaves have been also utilized for cooking and some therapeutic objective **(**Loukou *et al*., 2007). Additionally, *L. siceraria* has a potential to be used rootstock for watermelon as it is likely to have resistance with respect to distinct component of biotic and abiotic stress that includes Fusarium wilt (Yetisir *et al*., 2003) [3], in which salinity and water-logging of soil (Yetisir & Uygur 2009) [15]. As to qualitative features, plant growth habit (all prostrated), corolla color (all white), sex type (all monecious) and tendril shape and branching (all branched and coiled) does not differentiate. Although, the remaining characters exhibited notable variation and were separated into distinguish in division (Table 1). Nine evaluated character divided in three classes whereas seven analyzed traits separated into four classes. The highest-class number was observed in shape of fruit with nine classes (Round, elongated, pyriform, cylindrical, dumbbell, elliptical, flattened, curved, and crooked neck) followed by five classes in shape of leaf (oval, round, kidney, heart, and slightly lobed) and marking on fruit skin of secondary color (Absent, speckled, spotted, streaked, and bisectional). Nine evaluated traits distributed in three classes while seven observed characteristics separated into four classes. The shape (oval, round, kidney, heart, and slightly lobed) and design of secondary color of fruit skin (Absent, speckled, spotted, streaked, and bisectional). Previous evaluation showed that Turkey is not the genetic origin of *L. siceraria*, and the bottle gourds could have been introduced from both Africa and Asia through multiple accession **(**Gürcan *et al.*, 2015) [3]. Though, recent study confirmed that Turkish bottle gourd germplasm has still a vital distinction. At present study, the most evident phenotypical distinct was there in fruit shape and volume.

Table 1: Distribution of 21 qualitative variables of *L. siceraria* from Turkish germplasm

Characteristics	Distribution%								
Cotyledon position	Open		Closed		Intermediate				
	50		39		11				
Shape of leaf	Oval	Round	Kidney	Heart	Slightly lobed				
	2	15	3	79	1				
Size of leaf	Small		Big		Intermediate				
	11		26		63				
Leaf Secondary color	Absent		Light green		Silvering				
	98		1.5		0.5				
Leaf lobe	Absent	Shallow	Intermediate	Deep					
	16	77	6	1					
Leaf blistering	Absent		Present						
	66		34						
Leaf margin	Smooth		Dented						
	11		89						
Framework of secondary fruit color	Absent	Speckled	Spotted	Streaked	Bisectional				
	11	57	21	8	3				
Primary secondary color	Green		Yellow		Milky-Brown				
	87		11		2				
Secondary fruit color	White	Cream	Yellow	Other					
	1	84	13	2					
Time of maturity	Early		Late		Intermediate				
	48		42		20				
Texture of fruit skin	Smooth		Netted		Finely wrinkled				
	34		64		2				
Stem and shape	Depressed	Flattened	Rounded	Pointed					
	50	23	13	14					
Fruit blossom end shape	Depressed	Flattened	Rounded	Pointed					
	50	23	13	14					
Size of flower	Small		Big		Intermediate				
	15		21		64				
Ribs of fruit	Absent	Superficial	Intermediate	Deep					
	79	1.5	4	0.5					
Position of Female flower	Main stem		Lateral branch		Both				
	0.5		95		47				
Peduncle intersectional shape	Round		Slightly angular		Sharply angular				
	11		42		47				
Leaf pubescence, ventral surface	Absent	Low	Intermediate	High					
	0.5	18	57	23.5					
Leaf pubescence, dorsal surface	Absent	Low	Intermediate	High					
	1.5	59	37	2.5					
Shape of fruit	R.	E.	P.	Cy.	D.	E.	F.	C.	Cr.N.
	1.5	6	18	1	8	0.5	0.5	8	57

R. Round; E. Elongated; P. Pyriform; Cy. Cylindrical; D. Dumbell; E. Eliptical; F. Flattened; C. Curved; Cr. Crooked Neck

3. Genetic variability in Bottle Gourd

Genetic variability is the change to the genotypic characteristics in a crop that distinct among each other. Bottle gourd genotypes revealed high heritability for the traits which ranged from 97 to 99%. The characters like vine length (99.98%) showed highest heritability followed by length and width of fruit and fruit (99.97%). Higher genetic advance as percent of average were evaluated in fruit length (96.68%) followed by fruit mass (95.82%). Because of presence of additive genes effect selection is effective for improvement for this trait (Sharma and Sengupta *et al*. 2013) [12].

Singh *et al*. (2014) [2] studied genetic variability, heritability and genetic advance in 8 genotypes of bottle gourd. The highest value of broad sense heritability was recorded for length of fruit followed by days to opening of first male flower and fruit weight. High value of heritability coupled with high genetic gain were noticed for fruit length followed by fruit yield per plant whereas Muralidharan *et al*. 2014 revealed higher values of genetic advance as percent of mean and heritability for most of traits. The character, namely, the days to first female flower anthesis showed lowest values. It was inferred that most of the characters exhibited high heritability and high genetic advance which indicated the pre dominance of additive gene action and hence selection is more effective. Mandal *et al*. (2015) carried out variability studies in 27 bottle gourd genotypes. High genotypic coefficient of variation, high heritability and high genetic gain was observed in traits like sex ratio, length of fruit and fruits per plant.

4. Study of GCV, PCV, heritability and genetic advance

Randhawa *et al*. (1975) reported that if the heritability of a trait is maximum, better will be the opportunity for sorting a genetic good individual.

Hanchinamani, 2006 [4] in their study observed higher value of coefficient of variation at phenotypic level as compared to genotypic level. This indicates the presence of effect of environment. Character, namely, number of misshaped fruits per vine showed highest value at both levels while moderate value was recorded for fruits per vine and total fruit yield per vine. Whereas, Pandit *et al*. (2003) observed additive gene action for characters namely, fruit length and fruit width.

Kumar and Syamal (2009) [6] observed high heritability along with high expected genetic advance for length of edible green fruit and 100 seed weight. High heritability along with low genetic advance was observed in characters namely seeds per fruit, days to first pistillate flowers anthesis and days to first fruits harvest. Whereas, Mandal *et al*. (2015) observed high genotypic coefficient of variation, high heritability and high genetic gain for characters, namely, sex ratio, fruit length and number of fruits per plant.

Yadav *et al*. (2013) in their study on heritability revealed high value of heritability for all the traits. The yield per vine (99.70) showed highest heritability followed by weight of fruit (99.10) and number of male flowers per vine (97.40).

5. Correlation and path coefficient

Miah *et al*. (2000) recorded positive correlation of fruit yield with avg. fruit weight, fruit breadth and nodes per vine at both genotypic and phenotypic level. Whereas Umamaheswarappa *et al*. (2004) [14] observed that fruits per vine had maximum direct effect on fruit yield followed by fruit weight.

Kumar *et al*. (2007) [7] revealed maximum value of correlation at genotypic level. The fruit yield per vine showed positive and significant correlation with branches per vine, length of edible fruits, number of fruits per vine, seeds per fruits and 100 seed weight at genotypic and phenotypic levels. Whereas, Raut *et al*. (2013) [10] observed positive correlation of fruit yield per plant days to emergence of first male flower, number of male and female flower per plant and number of fruits per plant.

Ara *et al*. (2014) reported maximum correlation coefficient for nodal position of initial female flower opening followed by yield per plant, sex ratio between the genotypes whereas, total yield was negatively correlated with edible maturity and fruit yield per plant.

6. Genetic divergence in bottle gourd

Singh *et al*. (2007) [7] in their study divided genetic diversity into 12 groups. Cluster I was the biggest and contained 6 genotypes. Whereas, Kabir *et al*. (2009) grouped accessions into five clusters based on analysis. The biggest cluster was I and III (6) followed by cluster V (5), cluster 11(4) & Cluster IV (3). The highest intra cluster distance was noticed for cluster IV (35.80) followed by cluster I (28.12) whereas minimum distance was found in III (18.87).

Choudhary *et al*. (2011) carried out genetic diversity studies on 35 genotypes of bottle gourd. The genotypes were grouped into four clusters. Cluster IV was very huge which contains 16 genotypes, while cluster III was reported by three genotypes. The maximum inter-cluster distance was recorded between cluster II and IV, while minimum distance was between cluster I and II.

Ara *et al*. (2014) studied genetic diversity of 28 bottle gourd genotypes. On the basis of D2 values, twenty-eight genotypes were grouped into five different clusters. This indicated the existence of genetic diversity among the genotypes. Maximum genotypes were in cluster I involving 10 genotypes, followed by cluster II with 9 genotypes. Cluster III had 4, cluster IV had 3 and cluster V had 2 genotypes. The genotypes from distinct origins (districts) compiled among a group with plants of close affinity. These results showed that geographic diversity may not necessarily be related with genetic diversity. Therefore, the selection of genotypes for hybridization should be base.

7. Conclusion

Bottle gourd is one of the most important warm season vegetables grown in tropical and sub-tropical area. The utilization of variability reported in bottle gourd for various characters in breeding programmers resulted in identification and release of good number of genotypes in bottle gourd. But these released varieties/hybrids cannot be cultivated or continued indefinitely due to genetic drift. This demands replacement of old genotypes by newly developed ones on a regular basis. Those germplasms having maximum value of fruit number per plant and weight of fruit per plant these traits that should be considered in further breeding programmes.

8. References

1. Ara ZG, Zakaria M, Uddin MZ, Rahman MM, Rasul MG, Kabir AFMR, *et al*. Correlation matrix among different parameters of Bottle gourd genotypes. International Journal of Natural and Social Science. 2014; 1:48-51.
2. Behera TK, Sirohi PS, Pal A, Singh I. Pusa Santushti: A new high-yielding bottle gourd variety. International Journal of Vegetable Science. 2015; 21:323-328.
3. Gürcan K, Say A, Yetisir H, Denli N. A study of genetic diversity in bottle gourd [*Lagenaria siceraria* (Molina) Standl.] population, and implication for the historical origins on bottle gourds in Turkey. Genetic Resources Crop Evolution. 2015; 62(3):321-333.
4. Hanchinamani CN, Patil MG, Dharmatti PR, Mokashi AN. Studies on heritability and genetic advance in cucumber (*Cucumis sativus* L.), Crop research. 2011; 41(1):160-163.
5. Kabir MY, Khan ASM, Hassain MS. Genetic diversity in pointed gourd. Journal of Agriculture Rural Development. 2009; 7(1):87-92.
6. Kumar P, Syamal MM. Genetic variability, heritability and genetic advance in bottle gourd, Indian Journal of Arid Horticulture. 2009; 4(2):95-97.
7. Kumar S, Singh R, Pal AK. Genetic variability, heritability, genetic advance, correlation coefficient and path analysis in bottle gourd, Indian Journal of Horticulture. 2007; 64(2):163-168.
8. Milind P, Satbir, K. Is bottle gourd a natural guard? Int. Res. J Pharm. 2011; 2(6):13-17.
9. Rao MN, Roy PV, Reddy BM. Correlation and path analysis in segregating population of ridge gourd, Crop Research Hisar. 2000; 20(2):338-342.

10. Raut RL, Mishra SP, Verma A, Jain PK. Correlation studies in bottle gourd, JNKVV Research Journal. 2013; 47(1):76-79.
11. Singh B, Singh SK. Evaluation trial of Bottle Gourd. The Asian Journal of Horticulture. 2014; 9(1):116-119.
12. Sharma A, Sengupta SK. Genetic diversity, heritability and morphological characterization in bottle gourd (*Lagenaria siceraria* (Mol.) Stand). The Bioscan. 2013; 8(4):1461-1465.
13. Uddin AFMJ, Tahidul MI, Chowdhury MHN, Shiam IH, Mehraj H. Evaluation of bottle gourd (*Lagenaria siceraria* L.) to growth and yield. International Journal of Biosciences. 2014; 5(12):7-11.
14. Umamaheswarappa P, Krishnappa KS, Murthy PV, Adivappar N, Muthu MP. Correlation and path coefficient analysis studies in bottle gourd (*Lagenaria siceraria* (Mol) Standl.). Env. Eco. 2004; 22(4):636-640.
15. Yetisir H, Sari N, Yücel S. Rootstock resistance to Fusarium wilt and effect on fruit yield and quality of watermelon. Phytoparasitica. 2003; 31(2):163-169.