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**B Sailaja**

Department of Vegetable  
Science, College of Agriculture,  
OUAT, Bhubaneswar, Odisha,  
India

**A Mohanty**

Senior Scientist, AICRP on  
Vegetable Crops, OUAT,  
Bhubaneswar, Odisha, India

**GS Sahu**

Department of Vegetable  
Science, College of Agriculture,  
OUAT, Bhubaneswar, Odisha,  
India

**D Lenka**

Department of Plant Breeding  
and Genetics, College of  
Agriculture, OUAT,  
Bhubaneswar, Odisha, India

**P Tripathy**

Department of Vegetable  
Science, College of Agriculture,  
OUAT, Bhubaneswar, Odisha,  
India

**P Ranjith**

Department of Plant Breeding  
and Genetics, College of  
Horticulture, OUAT, Chiplima,  
Odisha, India

**Corresponding Author:****B Sailaja**

Department of Vegetable  
Science, College of Agriculture,  
OUAT, Bhubaneswar, Odisha,  
India

## Variability studies in bottle gourd (*Lagenaria siceraria* L.)

**B Sailaja, A Mohanty, GS Sahu, D Lenka, P Tripathy and P Ranjith**

**Abstract**

A field experiment was conducted at All India Co-ordinated Research Project on Vegetable Crops, Odisha University of Agriculture and Technology, Bhubaneswar with seventeen genotypes of bottle gourd [*Lagenaria siceraria*] in Randomized Block Design with three replications during Post Rabi 2018-19. The analysis of variance revealed highly significant differences among the mean sum of squares due to genotypes for different quantitative characters studied except leaf weight, days to flowering and 50% flowering indicating the presence of variability among the genotypes. The high GCV and PCV were observed for fruit circumference (39.26 and 39.65), fruit length (38.04 and 38.82), Fruit girth (33.55 and 32.48), internodal length (24.75 and 28.00), yield per plant (21.33 and 22.98) and plant height (20.71 and 21.38) indicating high variability available in the germplasm for these characters for further improvement. High heritability coupled with high genetic advance as per cent of mean was observed for characters viz., fruit circumference followed by fruit length, fruit girth, plant height, yield and internodal length indicating that these characters were least influenced by the environmental effects and governed by additive genes.

**Keywords:** Bottle gourd, variability, heritability, genetic advance

**Introduction**

Bottle gourd [*Lagenaria siceraria*] belongs to the family Cucurbitaceae having somatic chromosome number  $2n=22$ . It is highly cross pollinated crop due to its monoecious and andromonoecious nature (Swiander *et al.* 1999) <sup>[10]</sup>. Bottle gourd was domesticated in Asia and at the same time indigenous to Africa (Whitaker & Davis, 1962) <sup>[12]</sup>. In India it is cultivated in states like Odisha, Uttar Pradesh, Punjab, Gujarat, Meghalaya and Assam, making a total area of 157 hectares and estimated production is 268 million tonnes (NHB, 2017-18). Bottle gourd exhibits great morphological and genetic variability and wide environmental adaptation in nature (Uddin *et al.* 2014) <sup>[11]</sup>. The fruits vary widely in shape and size, and this is within or among the cultivars, exhibits the widest variations in fruit shape; these are either long, cylindrical, necked, oblong flat or round, conical pyriform to club shaped, while skin texture varies from warted to smooth. Fruit color also varies from pale to dark green, with either smooth or rough fruit texture (Mashilo *et al.* 2016; Mashilo *et al.* 2017) <sup>[5, 6]</sup>.

**Materials and Methods**

The experiment was carried out at All India Co-ordinated Research Project on Vegetable Crops, OUAT, Bhubaneswar, during *rabi*, 2018-19 with 17 bottle gourd genotypes. The experiment was laid out in Randomized Block Design (RBD) with three replications. In each replication, each entry was grown in a plot having four basins with 3 plants basin<sup>-1</sup>. From randomly selected 5 plants per each plot observations were recorded for fifteen characters viz., plant height (cm), internodal length(cm), leaf area (m<sup>2</sup>), leaf weight (kg), days to flowering, days to 50% flowering, node at which female flower appear, node at which male flower appear, fruit length (cm), fruit girth (cm), fruit circumference(cm), fruit weight(g), number of seeds fruit-1, fruit yield plant-1 (g) and fruit yield hectare-1 (q).

**Results and Discussion**

Results of analysis of variance are presented in Table 1 which revealed the nature and magnitude of variability for different quantitative characters to be significant indicating the existence of large amount of variation in all the characters studied except leaf weight, days to flowering and 50% flowering indicating the presence of variability among the genotypes that are clearly observed among the bottle gourd genotypes. The mean sum of square for genotypes was maximum in case of seeds per fruit followed by plant height. The general mean results indicated wide variation ranging from number of leaf weight(0.05 kg) to plant height (543.00cm). The range was highest in case of plant plant height (350.00-728.86cm) and lowest

range was observed in leaf weight (0.30- 0.70). Results from table 2 indicated that the phenotypic variance ranged from (0.04 for leaf weight to 38247.70) for plant height. The genotypic variance ranged from (0.03) for fruit weight to (12657.00) for plant height. A wide range of variability was observed for plant height, Seeds per fruit, leaf area, fruit circumference, fruit length, yield per plant, yield per hectare. Similar to the present findings, investigations carried out earlier also revealed wide variations for various characters.

**Table 1:** Analysis of variance (mean sum of squares) for 15 characters of 17 genotypes of bottle gourd

Sl. No.	Character	Mean sum of squares		
		Replication	Genotype	Error
1	Plant height (cm)	411.92	38,800.72	829.43
2	Fruit length (cm)	14.20	448.82	6.10
3	Fruit circumference (cm)	0.76	511.42	3.32
4	Fruit girth (cm)	0.34	23.63	0.52
5	Leaf area (m <sup>2</sup> )	191.62	8,614.93	953.27
6	Leaf weight (kg)	0.003	0.006	0.001
7	Internodal length (cm)	0.02	43.34	3.69
8	Fruit weight (kg)	0.03	0.09	0.001
9	Seeds/fruit	2,082.14	16,155.76	1,089.27
10	Days to flowering	33.45	34.21	11.19
11	Days to 50% flowering	6.51	59.01	10.29
12	Node at which female flower appear	17.11	61.98	6.367
13	Node at which male flower appear	0.33	41.04	10.63
14	Yield/plant (kg)	0.03	1.31	0.06
15	Yield/ ha (q)	2363.88	15245.28	820.541

**Table 2:** Genetic parameter for fourteen characters in bottle gourd genotypes

Sl. No.	Characters	General mean	Range	GV	PV	PCV	GCV	Heritability (b.s.) (%)	GA (at 5% level)	GAM
1.	Plant height (cm)	543.00	350-728.86	12657.00	38247.70	21.38	20.71	93.85	224.51	41.34
2.	Fruit length (cm)	31.93	7.46-49.76	147.50	444.70	38.82	38.04	96.02	24.52	76.79
3.	Fruit circumference (cm)	33.14	21.70-59.36	169.30	509.20	39.65	39.26	98.07	26.54	80.10
4.	Fruit girth (cm)	8.54	5.23-13.20	7.70	23.20	33.55	32.48	93.68	5.53	64.76
5.	Leaf area (m <sup>2</sup> )	316.69	174.70-399.76	2553.80	7979.40	18.70	15.95	72.81	88.83	28.05
6.	Leaf weight (kg)	0.05	0.03-0.07	0.04	0.04	27.93	25.14	63.03	0.07	62.30
7.	Internodal length (cm)	14.68	3.21-21.10	13.20	40.80	28.00	24.75	78.14	6.62	45.07
8.	Fruit weight (kg)	1.06	0.70-1.30	0.03	0.09	16.67	16.50	98.04	0.35	33.67
9.	Seeds/fruit	404.52	268.50-529.86	5022.10	15429.50	19.32	17.51	82.17	132.33	32.71
10.	Days to flowering	36.03	29.00-40.90	7.60	26.75	12.05	7.68	40.67	3.64	10.10
11.	50% flowering	42.66	35.30-51.33	16.20	52.15	12.07	9.44	61.20	6.49	15.22
12.	Node at which female flower appear	28.69	20.83-36.46	18.50	57.74	17.39	15.00	74.43	7.65	26.66
13.	Node at which male flower appear	29.67	23.66-36.46	10.10	33.94	15.36	10.729	48.785	4.581	15.43
14.	Yield/plant (kg)	3.02	1.90-4.00	0.41	1.27	22.98	21.33	86.20	1.23	40.80

In the present experiment, the highest estimates of heritability in broad sense was observed for 98.07% in fruit circumference followed by fruit weight (98.04%), fruit length (96.02%), plant height (93.85%), fruit girth (93.68%), yield per plant (86.20), indicating that these characters are less affected by environment. Similar findings were reported by (Kandasamy *et al.* 2019; Singh *et al.* 2017 and Yadav *et al.* 2008) [8, 9, 13]. Moderate heritability was recorded for node at which male flower appear (48.78%), Days to flowering (40.67) indicating high influence of environment.

Heritability estimates along with genetic advance are more valuable than heritability alone in predicting the response of selection. Genetic advance is the quantum of genetic gain

The study of data in table 2 revealed that the phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the 14 characters taken and the magnitude of differences between PCV and GCV were observed to be narrow for all the studied characters except except leaf weight, days to flowering, 50% flowering, node at which male flower appear which indicates lesser influence of environment in the expression of these characters and selection of these traits based on phenotype would be effective. Similar findings were also reported by Himani *et al.* 2018 [2]. PCV was highest (39.65) for fruit circumference followed by fruit length (38.82). PCV was lowest for days to flowering (12.053) followed by 50% flowering (12.07) and node at which male flower appear (15.36) in ascending order. The characters like, node at which male flower appear (15.36), fruit weight (16.67), node at which female flower appear (17.39) exhibited moderate values for PCV (10- 20%). Relatively higher PCV (>20%) was observed in rest of the characters.

GCV represents the heritable components of total variation. fruit circumference (39.65) followed by fruit length (38.04) and fruit girth (32.48) which indicated maximum variability existing in the genotypes that provides better scope for genetic improvement in the character through effective simple selection. The high GCV for fruit circumference and fruit length were also reported by (Joydip *et al.* 2015 and Muzeev Ahmad *et al.* 2019). [3, 7] Lowest GCV were observed for days to flowering (7.68) followed by 50% flowering (9.44), which reveals that the extent of response of these traits for selection would be less than that of other traits.

expected during a selection process. High heritability coupled with high genetic advance as per cent of mean was recorded for most of the characters, highest in fruit circumference followed by fruit weight, fruit length, plant height, fruit girth, yield per plant, seeds per fruit, internodal length, node at which female flower appear, leaf area, leaf weight, 50% flowering except node at which male flower appear, days to flowering. These characters had also high GCV which indicated that these characters were least influenced by environmental effects and were governed by additive genes and selection on the phenotypic performance will be rewarding for improvement of such traits. These findings were also reported by (Kumar *et al.* 2009 and Yadav *et al.*

2008) [4, 13]. High heritability and moderate GA as per cent mean values were observed for 50% flowering which indicates the influence of non-additive gene action and considerable influence of environment on the expression of this trait and genetic improvement of this trait would be effective on a moderate scale. Similar trends were observed by (Kandasamy *et al.* 2019) [8], average days to flowering recorded low heritability accompanied by low GA which indicates that these characters are highly influenced by environment and selection of these traits will be less effective.

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