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Genetic variability studies in bottle gourd (*Lagenaria siceraria* L.)

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Abstract
The present investigation was carried out to estimate phenotypic and genotypic coefficient of variation, heritability (broad sense) and genetic advance per cent of mean for 14quantitative traits in 21 different genotypes of bottle gourd during Kharif 2018 at Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture Latur, Vasantrao Nike Marathwada Krishi Vidyapeeth (M.S.). Significant differences among the genotypes were observed for all the characters under study. The PCV and GCV values were high for vine length, number of branches per plant, sex ratio, fruit length, fruit diameter, fruit yield per plot, fruit yield per hectare, fruit yield per vine,. High heritability and high genetic advance were observed for characters like vine length, number of branches per plant, node at which first female flower appear, days required first female appear, number of male flower, sex ratio, fruit length, fruit diameter, fruit weight, fruit yield per vine, fruit yield per plot and fruit yield per hectare.

Keywords: GCV, PCV, heritability, genetic advance

Introduction
Bottle gourd (*Lagenaria siceraria* L.) is one of the most popular vegetables of the family, Cucurbitaceae. It can be grown in both summer and rainy season, but it can't tolerate cold (Rastogi and Arrya 1998) [13].

Bottle gourd is a very common nutritious vegetable grown throughout the world Cucurbitaceous family is economically most significant family, supplying edible and nutritious fruits to humanity (Bisognin, 2002) [2]. Fruits are used as sweets, pickles (especially on hills), kofta, petha, halwa, kopoorkand, paratha and rayata. The fruits contain vitamin C (11 mg), thiamine (0.044 mg), riboflavin (0.023 mg), niacin (0.33 mg), mineral matters (0.05%), carbohydrates (2.9%), fats (0.5%) protein (0.2%) and moisture (96.3%) and its different parts possess large number of medicinal properties (Desai and Musmade, 1998) [6]. It is easily digestible and which is used extensively as vegetable and also recommended during convalescence and juice is recommended for heart and Diabetic Patients. The seed are triangular or rectangular shaped with grey to whitish colored, having higher essential amino acid and micronutrient as compared to fruits, excepts calcium, zinc, cobalt and chromium.

There is an urgent need for genetic improvement to develop high yielding cultivars. The study of genetic variability, heritability and genetic advance for yield and its components may be helpful in selection of some useful materials from the existing population. The magnitude of genetic variability existing in crops species, as it provides the basic knowledge of effective selection the total variance i.e. phenotypic variance present in the population genetic variance to the total variance, which is known as heritability. However, the genetic advance predicts the amount of gain expected by imposing a particular intensity of selection. Therefore, for deciding the methodology to be followed the information on these parameters is important. Selection of individuals is made on the basis of phenotype to bring about improvement in the characters in desirable direction. The measurement of this expected improvement is the genetic advance which depends on the genetic variability, magnitude effect of the environment and interaction of component of variability genetic diversity and the intensity of selection. Genetic advance under selection depend upon (i) the phenotypic variability among different plants or females in the base population (ii) the heritability of the character under selection, and (iii) the intensity of selection.

Materials and Methods
An experiment was carried out at Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture Latur during the year 2018 to evaluate twenty one diverse

genotypes of pea. The experiment was laid out in Randomized Block Design (RBD) with two replications. Observations were recorded from five randomly selected plants of each genotype in each replication for eighteen characters *viz.*, vine length (cm), number of branches per plant, node at which first female flower appear, days required for first female flower appear, number of male flower, sex ratio, number of fruit per vine, days required for first harvest, fruit length (cm), fruit diameter (cm), fruit weight (gm), fruit yield per vine (kg), fruit yield per plot (kg), fruit yield per hectare (q), ascorbic acid, carbohydrate (%), protein (%), T.S.S (%) The data generated was averaged and subjected to analyze the variability Genotypic and phenotypic coefficients of variation were estimated by the formulae as suggested by Burton and DeVane (1953) [3]. PCV and GCV values were categorized as low (0-10%), moderate (10.1-20%) and high (>20) values as indicated by Sivasubranian and Menon (1973) [18].

Heritability in broad sense was calculated by the formula as suggested by Allard (1960) [1]. Heritability was classified as suggested Robinson *et al.* (1949) [14] into low (0-30%), moderate (30.1-60%) and high (>60%). The Genetic advance (GA) resulting from selection of five per cent superior individuals was worked out as suggested by Allard (1960) [1]. The GAM% was categorized into low (0–10%), moderate (10.1–20%) and high (>20%) as suggested by Johnson *et al.* (1955) [8].

Results and Discussion

The analysis of variance indicated significance higher amount of variability among the genotype for sixteen character studies viz., vine length, number of branches per plant, node at which first female flower appear, days required first female appear, number of male flower, sex ratio, fruit length, fruit diameter, fruit weight, fruit yield per vine, fruit yield per plot and fruit yield per hectareare given in Table 1. Similar findings reported by Singh *et al*., (2015) [16] in bitter gourd, Thakur *et al*., (2015) [19], Damor *et al*., (2016) [4], Detaba *et al*., (2017) [5] in pointed gourd, Rambhau *et al*., (2017) [21] and Thakur *et al*., (2017) [20].

The phenotypic coefficient of variation ranged from 11.75% for days required to first harvest to 39.70% for fruit yield per hectare. The maximum value of phenotypic coefficient of variation were found in fruit yield per hectare (39.70), fruit yield per vine (36.90), vine length (36.10), fruit yield per plot (34.04), number of branches per vine (31.68), fruit diameter (28.56), sex ratio (24.13) and fruit length (22.15) Table 2, indicated that these characters would respond to selection. The result is in confirmation with finding of Yadav and Kumar (2011) [22], Sharma and Sengupta (2013) [15], Mandal *et al*., (2015) [11] and Kumar *et al*., (2018) [9].

The rest of character such as node at which first female flower appear (19.55%), number of fruit per vine (18.02%), fruit weight (17.58%), day required to first female flower appear (15.68%), days required to first harvest (11.75%) and number of female flower (10.91%) exhibited moderate phenotypic coefficient of variation. The result is in confirmation with finding of Yadav and Kumar (2011) [1], Singh *et al*., (2014) [17], Rambabu *et al.*, (2017) [21] and Maurya *et al*., (2018) [12].

The genotypic coefficient variation ranged from days required to first harvest 9.15 to fruit yield per hectare 38.39. The high value of genotypic coefficient of variation were found for fruit yield per hectare (38.39%), fruit yield per vine (35.78%), vine length (35.33%), fruit yield per plot (32.38%), number of branches per vine (30.84%), fruit diameter (27.70%), sex ratio (23.23%) and fruit length (20.79%) Table 2. The high values of GCV suggested greater phenotypic genotypic variability among the genotypes and responsiveness of the attributes for making further improvement by selection. The result is in confirmation with finding of Yadav and Kumar (2011) [22], Sharma and Sengupta (2013) [15], Kumar *et al*., (2014) in Cucumber, Mandal *et al*., (2015) [11] and Kumar *et al*., (2018) [9].

The moderate variability recorded in carbohydrate (19.26%), node at which first female flower appear (18.39%), number of fruit per vine (17.49%), fruit weight (16.13%), day required to first female flower (14.09%) and number of female flower (10.74%) which indicated the moderate variability due to environment effect. Similar finding reported by Yadav and Kumar (2011) [22], Singh *et al*., (2014) [17], Rambabu *et al.*, (2017) [21] and Maurya *et al.*, (2018) [12].

Days required to first harvest (9.15%) showed lowest value for genotypic coefficient variation. Low GCV indicated that variation is not only due to the genotypes but also due to influence of environment and selection for such character may be misleading. Similar finding reported by Kumari *et al*., (2018) [10] in Bitter gourd and Maurya *et al.*, (2018) [12].

The broad-sense heritability is the ratio of the total genotypic variance to the total phenotypic variance. The most important function of heritability in the genetic studies of metric characteristics is its predictive role in expressing the reliability of phenotypic value as a guide to breeding value Falconer (1989) [7].

Heritability in broad sense estimates were highest for number of female flower (97.03%), vine length (95.80%), number of branches per plant (94.80), number of fruits per vine (94.20%), fruit yield per vine (94.00%), fruit yield yield hectare (93.50%), fruit diameter (92.20%), sex ratio (92.42%), fruit yield per plot (90.50%), node at which first female flower appear (88.50%), fruit length (88.10%), fruit weight (84.30%), days required to first female flower (80.70%), days required to first harvest (60.60%), Table 2. High heritability indicated that, through the character is least influenced by the environment effect. The selection for improvement of such character may not be useful because broad sense heritability is based on total genetic variance. The result is in confirmation with finding of Yadav and Kumar (2011) [22], Sharma and Sengupta (2013) [15], Kumar *et al*., (2014) in Cucumber, Singh *et al*., (2014) [17], Mandal *et al*., (2015) [11], Rambabu *et al.*, (2017) [21] and Kumar *et al*., (2018) [9]

The genetic advance were hight in fruit yield per hectare (76.49%), fruit yield per vine (71.46%), vine length (71.24%), fruit yield per plot (63.46%), number of branches per plant (61.87%), fruit diameter (54.79%), sex ratio (45.98%), number female flower (42.36%), fruit length (40.21%), node at which first female flower appear (35.64%), number of fruit per vine (34.97%), fruit weight (30.51%), day required to first female flower appear (26.07%),. This indicated that, genetic advance is high it shows that character is governed by additive genes and selection will be rewarding for improvement such traits. Similar finding reported by Yadav and Kumar (2011) [22], Sharma and Sengupta (2013) [15], Kumar *et al*., (2014) in Cucumber, Singh *et al*., (2014) [17], Mandal *et al*., (2015) [11], Rambabu *et al.*, (2017) [21] and Kumar *et al*., (2018) [9].

Table 1: Analysis of variance for different characters studied in the genotypes of bottle gourd

Sr. No	Character	Mean of sum square		
		Replication	Treatment	Error
1	Vine length (cm)	102.461	30026.300**	601.554
2	Number of Branches per Plant	0.150	5.220**	0.130
3	Node at which first female flower appear	1.820	10.120**	0.610
4	Days required for first female flower appear	0.240	145.170**	15.500
5	Number of male flower	2.24	469.23**	7.05
6	Sex ratio	0.53	7.11**	0.28
7	Number of fruit per vine	0.060	2.930**	0.080
8	Days required for first harvest	13.040	92.300**	22.670
9	Fruit Length (cm)	15.440	144.650**	9.130
10	Fruit Diameter(cm)	4.420	49.600**	2.010
11	Fruit weight(gm)	314.880	38230.000**	3267.120
12	Fruit yield per vine (kg)	0.490	5.890**	0.180
13	Fruit Yield per plot (kg)	10.450	452.300**	22.530
14	Fruit Yield per hectare (q)	271.470	62091.320**	2082.450

Table 2: Mean, range and different genetic parameters in bottle gourd

Sr. No	Characters	General Mean	Range	PV	GV	PCV (%)	GCV (%)	h^2 (%)	Genetic advance	GA Over mean (%)
1	Vine length (cm)	343.31	210.0.-765.60	15313.97	14712.37	36.10	35.33	95.80	244.41	71.24
2	Number of branches per plant	5.17	2.70-8.90	3.68	5.54	31.68	30.84	94.80	3.20	61.87
3	Node at which first female flower appear	11.85	6.75-18.25	5.37	4.75	19.55	18.39	88.50	4.22	35.64
4	Days required to first female flower.	57.13	47.30-71.05	80.33	64.83	15.68	14.09	80.70	14.90	26.07
5	Number of male flower	141.49	122.77-177.85	238.41	231.09	10.91	10.74	97.03	59.94	42.36
6	Sex ratio	7.97	5.66-12.56	3.69	3.42	24.13	23.23	92.42	3.66	45.98
7	Number of fruit per vine	6.82	4.27- 9.16	1.51	1.42	18.02	17.49	94.20	2.38	34.97
8	Days required for first harvest	64.47	54.30-75.60	57.46	34.83	11.75	9.15	60.60	9.46	14.68
9	Fruit length (cm)	39.57	25.80-54.80	76.89	67.76	22.15	20.79	88.10	15.91	40.21
10	Fruit diameter(cm)	17.60	7.76-28.55	25.81	23.73	28.85	27.70	92.20	9.64	54.79
11	Fruit weight(gm)	819.35	613.00-1005.00	20748.57	17481.44	17.58	16.13	84.30	250.00	30.51
12	Fruit yield per plot (kg)	45.26	21.51-77.43	237.42	214.88	34.04	32.38	90.50	28.72	63.46
13	Fruit yield per hectare (q)	451.10	162.82-826.96	32086.89	30004.13	39.70	38.39	93.50	345	76.49
14	Fruit yield per vine (kg)	4.72	2.21-9.08	36.90	35.78	36.90	35.78	94.00	3.37	71.46

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