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Original Research Article

Genetic Diversity, Heritability and Agromorphological Characterization in Bottle Gourd [*Lagenaria siceraria* (Mol.) Standl.]

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Keywords

Lagenaria siceraria, Genetic variability, Heritability, Genetic advance, Fruit yield, Pharmacology

A B S T R A C T

An experiment was carried out to analyze genetic variability analysis for yield and its contributing traits in 69 bottle gourd genotypes for evaluating their performance for various horticultural characters during *kharif* season of 2015. The experiment was conducted using a randomized complete block design with three replications. The genetic parameters between yield and yield contributing characters of different bottle gourd genotypes were studied. A wide range of variation was recorded for node number at which first female flower appears, days to first male and female flower appears, days to 50% flowering, fruit length, fruit weight and yield per plot which indicated that there is better scope for selection for the improvement of these characters. These findings are in close proximity with the results of variability for flowering, fruit size, number of nodes on main vine, fruit weight and yield/plant.

Introduction

Lagenaria siceraria (Mol.) Standl. (bottle gourd), of the family Cucurbitaceae, having chromosome number 2n = 22. It is a climbing perennial plant widely cultivated as a vegetable crop in tropical countries, such as India, Japan and Thailand. The bottle gourd belongs to the genus Lagenaria that is derived from lagena, meaning, "bottle". In the older literature it is often referred to as *Lagenaria vulgaris* (common) or *Lagenaria leucantha* (white flowered gourd) but it is now generally agreed that the correct name is *Lagenaria siceraria* (Mol.) Standl. It seems that bottle gourd was originated from India because its wild races are still found in Dehradoon (high humid area) and Malabar costal area. Old Indian script reveals its cultivation 2000 B.C.

Lagenaria siceraria (Mol.) Stand. Family Cucurbitaceae belongs to the *Lagenaria* species may be the only cucurbit plant known in both new and old worlds in early prehistoric times. Archaeological supports man's association with bottle gourd in Peru from 1100 to 13000 years B.C. Fruits of which are widely used in Ayurveda and other folk medicines traditionally used for its cardioprotective, cardiotonic, general tonic, diuretic, aphrodisiac, antidote to certain poisons and scorpion strings, alternative purgative, cooling effects. It cures pain, ulcers and fever and used for pectoral cough, asthma and other bronchial disorders-especially syrup prepared from the tender fruits. It is grown in rainy season and as well as summer season vegetable and its

fruits are available in the market throughout the year. Bottle gourd is a rich source of minerals and vitamins. Tender fruits are used as cooked vegetable and also for making sweets. There is a vast scope for cultivation of bottle gourd in Chhattisgarh as there is a regular demand of crop for vegetable as well as for medicinal uses. It is highly renumerative crop which fetches sizeable income to the farmer within two or three months.

Materials and Methods

The study was carried out during *kharif* season (2015) at Research cum Instructional farm, IGKV, Raipur. The experiment comprised of sixty nine genotypes of bottle gourd collected from different region of southern Chhattisgarh. The experiment was laid out in a randomized block design with three replication at 3.0 × 0.75 m row to row and plant to plant spacing. All the recommended cultural practices were adopted to raise a healthy crop. Data were recorded on five randomly selected plants with respect to characters *viz.*, days to first male flower appears, days to first female flower appears, days to 50% flowering, number of branches per plant, node number of first female flower appears, node number of first female flower appears, days to fruit set, days to first fruit harvest, number of fruits per plant, fruit length (cm), fruit diameter (cm), average fruit weight (g), 100 seed weight, fruit yield per plant, duration of crop (sowing to last harvest).

Results and Discussion

The observation on five plants from each genotype in all three replications for fruit yield and its components characters were used for calculating the mean performance. The observations were first averaged for five plant taken randomly for each genotype in each replication and were later averaged over the replications. The mean performance of different genotype are presented in Table 1 and described below.

Heritability estimate provide the information regarding the amount of transmissible genetic variation to total variation and determine genetic improvement and response to selection. Heritability estimate along genetic advance are normally more useful in predicting the gain under selection than that of heritability alone. However, it is not necessary that a character showing high heritability will also exhibit high genetic advance (Johnson *et al.*, 1955). An attempt has been made in the present investigation to estimate heritability in broad sense and categorized as low (<50%), moderate (50%-70%) and high (>70%) as suggested by Robinson (1966).

In the present investigation high magnitude of heritability was recorded for most of characters. The highest heritability was recorded for the characters days to 50% flowering (99.1%), node number of first female flower (97.3%), node number of first male flower (97.1%), number of branches per plant (96.9%), days to first female appears (96.3%), days to fruit set (96.0%), 100 seed weight (92.8%), days to first fruit harvest (88.8%). fruit yield per plot (87.7%), days to first male flower appears (84.1%), fruit length (81.9%), fruit girth (73.9%), and Similar results reported by Singh and Kumar (2002) for fruit length, fruit girth, fruit weight and female flower and fruit yield per plant; Gayen and Hossain (2006) for number of primary branches per plant, number of days to first male flower anthesis, number of days to first female flower anthesis, fruit length, fruit weight, number of fruits per plant, fruit yield per plant. Similar results were also reported by Rahman *et al.*, (1986), Munshi and Acharyya (2005). The moderate

heritability was recorded for the characters duration of crop (63.8%), number of fruit per plant (50.4%) Low heritability was observed for average fruit weight (20.1%). The heritability value alone however, provides no indication of the amount of genetic improvement that would result from selection of superior genotypes. The heritability estimates would be reliable if it is limited in broad sense, additive and non-additive gene effect are accompanied with high genetic advance. To facilitate the comparison of progress in various characters of different genotypes genetic advance was calculated as percentage of mean. The magnitude of genetic advance as percentage of mean easy categorized as high (>20%), moderate (20-10%) and low (<10%) as suggested by Johnson *et al.,* (1955).

Genetic advance as percentage of mean was observed high for number of branches per plant (77.94%), node number of first male flower (63.16%), node number of first female flower (57.39%), %), 100 seed weight (49.18%), fruit yield per plot (48.74%), fruit girth (36.65), fruit length (35.59%), days to 50% flowering (24.26%), average fruit weight (23.43%), days to fruit set (23.01%). days to first male flower appears (22.93), days to first female flower appears (21.33), and The moderate genetic advance as percentage of mean was observed for number of fruit per plant (18.16%), days to first fruit harvest (17.25%) and Duration of crop (4.89%) showed low genetic advance as percentage of mean. The high value of genetic advance for these traits showed that these characters are governed by additive genes and selection will be rewarding for the further improvement of these traits. Moderate genetic advance for the traits suggest that both the additive and non-additive variance are operating in these traits and the traits exhibiting low genetic advance indicates significance of non-additive gene effects. Genotypic and phenotypic coefficient of variation are simple measure of variability, these measures are commonly used for the assessment of variability. The relative value of these types of coefficients gives an idea about the magnitude of variability present in a genetic population. Thus, the component of variation such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were computed. The phenotypic coefficient of variation was marginally higher than the corresponding genotypic coefficient of variation indicated the influence of environment in the expression of the character under study.

Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are categorized as low (less than 10%), Moderate (10-20%) and high (more than 20%) as suggested by Sivasubramanian and Madhavamenon (1973). Genotypic and phenotypic coefficients of variation of different characters are presented in Table 2. High magnitude of genotypic as well as phenotypic coefficient of variations were recorded for traits *viz*., number of branches per plant (38.45 and 39.05), node number at which first male flower appears (31.10 and 31.56), node number at which first female flower appears (28.25 and 28.63), fruit yield per plot in kg (25.41 and 27.14), 100 seed weight (24.78 and 25.73), average fruit weight in gram (24.50 and 54.62), fruit girth (20.70 and 24.08).

Moderate GCV and PCV were recorded for fruit length (19.10 and 21.11), number of fruits per plant (12.40 and 17.47), days to first male flower appears (12.14 and 13.24), days to 50% flowering (11.67 and 11.72), days to fruit set (11.40 and 11.64), days to first female flower appears (10.75 and 10.96), suggested existence of considerable variability in the population.

Table.1 Mean performance for fruit yield and its components in bottle gourd

Genotype	Days to 1st Male flower appears	Days to 1st female flower appears	Fruit length (cm)	Fruit diameter (cm)	Days to 50% flowering	Node number of first male flower appears	Node number of first female flower appears	Days to fruit set	Days to 1st fruit harvest	No of fruits per plant	100 seed weight (gm	No. of branches Per plant	Average fruit weight (g)	Fruit yield (kg/ ha)	Fruit yield (q / ha)	Duration of crop (sowing to last harvest)
IBG-1	65.80	66.33	21.00	10.91	70.67	17.67	27.20	79.53	76.65	7.49	21.07	3.33	955.67	50.12	185.63	**153.33**
IBG-2	66.43	57.53	25.00	7.81	72.67	24.93	38.67	78.40	77.68	5.14	12.83	5.20	1330.00	33.40	123.70	**158.49**
IBG-3	45.37	56.00	30.20	8.83	51.67	18.87	21.20	58.60	62.84	8.25	14.86	4.23	1326.33	61.00	225.93	**148.67**
IBG-4	53.37	59.33	33.80	10.29	61.33	11.87	21.07	64.87	67.20	8.88	14.79	4.63	866.67	46.25	171.30	**162.33**
IBG-5	59.00	64.97	21.50	10.30	65.67	20.13	30.73	71.13	66.27	9.91	14.43	7.07	1166.67	55.00	203.70	**151.33**
IBG-6	60.47	64.13	24.40	12.22	63.67	21.00	11.93	67.93	72.26	8.76	13.78	7.10	916.67	55.94	207.19	**156.67**
IBG-7	58.60	59.63	20.20	12.55	59.33	18.43	24.93	63.20	66.86	9.45	17.33	10.37	857.50	53.90	199.63	**166.33**
IBG-8	52.00	62.93	22.20	11.86	57.33	13.00	22.40	64.27	65.42	10.40	14.67	6.67	900.00	45.92	170.07	**158.87**
IBG-9	49.53	59.97	21.80	12.54	55.33	12.73	26.73	64.80	69.01	10.33	17.86	3.47	1013.33	43.38	160.67	**151.33**
IBG-10	49.77	60.40	30.20	9.53	60.33	11.83	25.60	65.33	67.74	8.56	20.74	4.67	1265.33	46.08	170.67	**154.33**
IBG-11	56.80	65.50	26.00	9.41	63.67	13.33	21.33	75.20	69.71	9.35	19.94	4.17	1450.00	77.52	287.11	**158.67**
IBG-12	60.60	66.33	21.10	8.62	65.67	16.53	19.93	71.93	71.35	8.85	14.25	4.20	821.50	58.84	217.93	**151.45**
IBG-13	57.00	70.33	31.60	9.53	72.67	21.87	23.93	73.53	75.77	9.14	10.07	2.47	940.00	46.88	173.63	**155.83**
IBG-14	56.50	63.60	30.00	7.18	62.33	16.30	24.42	68.73	72.98	8.56	14.31	4.27	759.67	51.96	192.44	**160.43**
IBG-15	50.70	68.97	19.50	11.21	63.67	19.27	24.93	74.87	73.86	10.47	13.76	4.17	1200.00	39.70	147.04	**157.38**
IBG-16	58.33	63.47	23.60	11.20	61.33	20.47	26.13	71.67	70.56	11.60	14.12	4.17	1365.00	38.50	142.59	**150.55**
IBG-17	56.47	57.73	30.20	12.54	62.33	20.80	30.00	71.20	75.28	9.40	15.90	3.43	877.33	50.70	187.78	**152.00**
IBG-18	57.00	63.70	22.83	9.89	61.67	21.10	25.93	64.20	73.09	9.23	13.03	4.40	966.67	49.00	181.48	**154.00**
IBG-19	52.00	59.57	26.27	10.02	60.33	11.73	20.67	65.40	72.41	10.70	17.98	3.30	485.67	56.16	208.00	**157.00**
IBG-20	50.00	64.33	25.40	9.59	63.67	15.00	26.20	72.27	75.60	8.82	11.36	4.37	1057.33	44.64	165.33	**156.37**
IBG-21	67.23	72.63	31.30	9.82	72.67	16.67	29.67	75.73	84.07	10.84	12.46	4.63	865.67	39.96	148.00	**159.33**
IBG-22	65.00	69.63	20.30	12.09	68.00	16.63	27.87	75.80	74.99	10.16	12.24	7.27	1166.67	59.72	221.19	**159.00**
IBG-23	59.30	76.73	30.40	11.16	64.00	12.47	23.40	65.67	88.36	8.98	16.04	4.57	576.00	54.84	203.11	**159.00**
IBG-24	64.33	69.00	25.40	9.83	74.33	17.83	31.07	78.33	77.82	10.55	20.91	3.37	1049.67	44.08	163.26	**149.67**
IBG-25	60.20	63.33	25.10	10.15	73.00	18.73	30.73	75.93	75.59	9.13	15.95	3.23	1390.13	43.56	161.33	**151.00**
IBG-26	56.80	68.23	24.07	7.75	62.00	18.60	29.00	64.00	74.97	8.59	12.73	2.80	533.33	63.80	236.30	**150.00**
IBG-27	60.20	68.40	31.30	12.07	66.33	20.93	29.73	74.73	73.06	10.39	11.89	3.43	816.00	40.88	151.41	**160.50**
IBG-28	56.67	67.71	27.95	10.63	52.67	17.53	32.20	63.20	72.32	10.03	14.31	3.76	1390.14	38.68	151.56	**160.41**
IBG-29	56.80	70.07	28.00	8.91	67.33	15.87	31.93	72.80	78.32	8.03	13.30	4.27	1530.00	35.12	130.07	**161.00**
IBG-30	59.77	66.60	24.37	10.09	63.33	14.13	28.83	70.87	78.10	9.19	18.42	5.37	400.00	58.92	218.22	**151.00**
IBG-31	67.80	71.33	26.33	9.86	71.67	15.13	33.73	74.93	75.60	10.02	23.09	5.37	790.50	58.87	218.04	**153.00**
IBG-32	63.00	68.20	36.23	11.53	68.67	18.07	23.00	73.67	76.69	10.40	13.39	4.83	1133.33	41.52	153.78	**160.67**

IBG -33	59.80	65.00	30.33	10.13	66.33	17.00	13.60	68.87	73.91	10.05	16.69	4.37	1016.67	46.00	170.37	**152.00**
IBG-34	59.60	65.13	27.33	10.61	69.33	20.17	32.80	70.87	74.09	8.71	13.46	4.40	1203.33	42.00	155.56	**154.67**
IBG-35	68.00	75.67	25.59	11.87	74.33	20.00	21.53	80.73	84.42	10.63	13.61	3.80	1340.33	40.00	148.15	**152.00**
IBG-36	46.53	58.13	28.67	10.25	54.67	12.27	17.73	63.07	72.14	9.22	12.92	3.73	823.33	65.00	240.74	**164.67**
IBG-37	53.93	59.00	24.33	7.96	56.00	13.20	18.47	63.40	71.10	8.59	21.07	4.83	1172.67	43.00	159.26	**150.00**
IBG-38	47.60	61.00	25.03	10.78	55.00	14.00	11.93	65.47	70.26	11.73	10.52	3.70	971.67	44.00	162.96	**156.00**
IBG-39	55.00	64.13	31.30	10.46	62.33	12.67	21.87	65.80	74.22	9.84	14.40	4.83	816.67	50.00	185.19	**161.00**
IBG-40	55.00	70.80	24.17	12.73	60.00	12.40	19.80	66.20	79.70	10.34	14.50	5.73	936.00	42.00	155.56	**161.33**
IBG-41	57.67	54.07	24.83	11.21	67.67	17.53	32.20	75.27	63.49	9.61	13.84	3.53	1066.67	68.00	251.85	**152.67**
IBG-42	49.60	56.33	27.67	8.44	53.33	11.07	17.67	61.40	63.36	8.32	13.26	4.63	1168.00	39.00	144.44	**154.00**
IBG-43	49.13	51.27	27.10	7.69	54.33	13.20	16.50	60.93	63.85	10.49	28.64	2.60	1363.00	48.00	177.78	**156.00**
IBG-44	48.40	53.20	31.67	12.07	55.00	11.73	20.92	53.27	67.92	10.52	18.36	4.73	945.17	73.00	270.37	**159.67**
IBG-45	44.20	52.90	24.27	7.39	52.67	13.53	17.50	55.40	66.65	7.97	18.20	2.53	1000.00	53.00	196.30	**169.33**
IBG-46	47.80	54.67	25.67	6.96	54.33	9.67	15.78	55.53	71.44	7.88	10.86	4.37	673.67	70.00	259.26	**168.67**
IBG-47	66.20	71.40	33.00	12.86	72.00	17.67	31.67	73.47	84.31	10.73	18.82	4.47	1140.00	38.00	140.74	**152.33**
IBG-48	54.80	66.30	25.60	9.51	67.33	16.53	27.53	75.60	77.20	9.67	16.01	4.33	1235.00	42.00	155.56	**153.00**
IBG-49	54.60	64.83	34.47	10.20	66.67	14.60	27.33	69.80	73.90	8.41	13.88	3.83	933.33	48.00	177.78	**152.00**
IBG-50	45.80	50.13	23.50	12.30	52.67	13.83	16.58	53.47	62.72	11.04	18.95	2.83	971.67	51.00	188.89	**154.00**
IBG-51	51.60	58.00	30.10	9.04	61.67	16.20	22.55	64.07	67.99	8.65	13.06	9.42	547.67	39.00	144.44	**150.33**
IBG-52	52.20	58.07	32.00	9.96	60.00	19.87	31.89	64.47	70.43	9.33	11.98	7.70	1016.67	36.00	133.33	**150.33**
IBG-53	57.00	62.77	25.57	8.87	65.00	15.55	30.47	73.47	71.09	8.52	22.52	6.80	767.67	47.00	174.07	**158.67**
IBG-54	58.33	62.67	25.23	11.97	65.67	20.00	27.67	64.73	77.87	10.56	17.22	10.32	1213.33	72.00	266.67	**159.00**
IBG-55	73.00	51.80	52.93	9.09	77.67	32.78	32.78	84.93	63.31	9.19	16.81	3.40	600.00	37.00	137.04	**161.67**
IBG-56	62.60	69.73	25.93	14.00	70.67	29.13	40.78	76.33	70.12	10.92	21.78	3.47	1183.67	49.00	181.48	**150.00**
IBG-57	45.80	50.20	24.43	6.46	51.33	10.00	9.67	57.87	62.76	11.42	12.99	3.83	1283.20	75.00	277.78	**157.33**
IBG-58	68.40	75.33	35.17	11.02	76.33	26.55	38.44	66.40	86.32	10.27	18.86	6.30	560.00	67.00	248.15	**151.33**
IBG-59	57.80	74.63	24.57	11.58	74.00	26.89	32.11	80.20	84.68	15.80	22.99	5.73	850.00	65.00	240.74	**146.67**
IBG-60	48.40	52.50	24.40	6.97	50.67	17.33	22.22	57.93	64.79	9.26	11.29	9.50	1303.33	49.00	181.48	**158.67**
IBG-61	64.00	69.67	20.50	11.80	69.00	31.11	41.00	82.80	75.64	10.59	18.96	6.73	416.00	117.00	433.33	**166.67**
IBG-62	45.00	54.60	39.97	6.28	51.00	9.89	10.67	50.47	65.66	8.72	12.80	6.67	850.00	64.00	237.04	**150.33**
IBG-63	59.60	50.40	31.53	10.61	68.67	19.00	26.44	76.00	61.16	9.14	12.58	8.73	1088.00	69.00	255.56	**153.67**
IBG-64	63.80	69.50	26.97	13.40	69.00	20.78	27.55	78.20	72.02	10.68	15.79	9.24	1057.33	48.00	177.78	**150.00**
IBG-65	66.00	67.73	19.97	13.05	69.33	34.25	33.00	76.13	67.05	10.27	17.87	6.93	865.67	53.00	196.30	**154.67**
IBG-66	44.20	50.43	36.13	6.15	50.33	10.00	12.67	51.87	64.54	8.47	30.39	6.83	1166.67	76.00	281.48	**160.67**
IBG-67	64.00	70.70	30.47	9.26	74.33	27.89	32.07	77.47	83.86	10.35	14.93	5.67	576.00	95.00	351.85	**160.33**
IBG-68	56.60	62.33	34.97	12.97	67.00	27.55	32.67	68.73	78.65	11.27	20.85	8.63	1049.67	75.00	277.78	**152.00**
IBG-69	71.93	59.00	28.93	7.71	47.00	21.83	19.07	79.80	87.65	12.14	13.45	9.20	1390.13	72.00	266.67	**152.67**
Mean(x)	**56.91**	**63.05**	**27.56**	**10.34**	**62.60**	**17.78**	**25.37**	**69.03**	**72.79**	**9.69**	**16.04**	**5.17**	**996.01**	**53.50**	**198.29**	**155.92**
S Em	1.7345	2.6678	1.4301	0.7339	0.4065	0.5527	0.6831	0.9283	1.3327	0.6888	0.6411	0.2040	47.6201	2.9299	10.8606	2.0170
CD	4.8508	7.4610	3.9996	2.0526	1.1368	1.5456	1.9103	2.5962	3.7271	1.9263	1.7930	0.5705	133.1788	8.1941	30.3737	5.6408
CV	5.2789	7.3283	8.9870	12.2939	1.1247	5.3824	4.6642	2.3292	3.1710	12.3071	6.9215	6.8304	8.2811	9.4847	9.4868	2.2406

Table.2 Genetic parameter of variability for fruit yield and its component character in bottle gourd

S.No.	Characters	Mean	Range		Coefficient of variation (%)		Heritability (h^2 %)	GA as percent of mean
			Min m	Max m	GCV	PCV		
01	Days to first male flower appears	56.91	44.20	73.00	12.14	13.24	84.1	22.93
02	Days to first female flower appears	63.05	50.13	76.73	10.75	10.96	96.3	21.83
03	Fruit length (cm)	27.56	19.50	39.97	19.10	21.11	81.9	35.59
04	Fruit girth (cm)	10.34	6.15	14.00	20.70	24.08	73.9	36.65
05	Days to 50% flowering	62.60	47.00	77.00	11.67	11.72	99.1	24.26
06	Node number of first male flower appears	17.78	9.67	34.25	31.10	31.56	97.1	63.16
07	Node number of first female flower appear	25.37	9.67	41.00	28.25	28.63	97.3	57.39
08	Days to fruit set	69.03	50.47	84.93	11.40	11.64	96.0	23.01
09	Days to first fruit harvest	72.79	61.16	88.36	8.89	9.43	88.8	17.25
10	No. of fruits per plant	9.69	5.14	15.80	12.40	17.47	50.4	18.16
11	100 seed weight	16.04	10.07	30.39	24.78	25.73	92.8	49.18
12	Number of branches per plant	5.17	2.47	10.37	38.45	39.05	96.9	77.94
13	Average Fruit weight (g)	996.01	400.00	1530.00	24.50	54.62	20.1	23.43
14	Fruit yield/plot (kg)	53.50	30.12	117.00	25.41	27.14	87.7	48.74
15	Duration of crop (sowing to last harvest)	155.92	148.67	169.33	2.98	3.73	63.8	4.89

Selection for these traits may also be given the importance for improvement programme. Characters like days to first fruit harvest (8.89 and 9.43) and duration of crop (2.98 and 3.73) had low genotypic and phenotypic coefficient of variation. Similar finding were also reported earlier by Rahman *et al.*, (1986), Singh and Kumar (2002), Munshi and Acharyya (2005), Gayen and Hossain (2006) and Pandit *et al.*, (2009).

Phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all the traits indicating that environmental factors were influencing their expression. Wide difference between phenotypic and genotypic coefficient of variations indicated their sensitiveness to environmental fluctuations whereas narrow difference showed less environmental interference on the expression of these traits. The traits which showed high phenotypic and genotypic coefficient of variations are of economic importance and there is scope for improvement of these traits through selection.

Heritability estimates along with genetic advance are more useful than the heritability value alone for selecting the best individual. High heritability coupled with high genetic advance was observed for days to first male flower appears, days to first female flower appears, days to 50% flowering, number of branches, node number of first female flower appears, node number of first male flower appears, days to fruit set, days to first fruit harvest, fruit length, fruit girth, average fruit weight, number of fruit per plant, 100 seed weight and fruit yield per plot indicating that most likely the heritability is due to additive gene effects and selection may be effective. Low heritability coupled with low genetic advances was observed for duration of crop indicating that the heritability is due to non-additive gene effects and heterosis may be effective. Similar results were also reported by Rahman *et al.*, (1986), Singh and Kumar (2002), Gayen and Hossain (2006) and Yadav *et al.*, (2008). Rest of the traits showed moderate to low heritability estimates coupled with moderate to low genetic advance as percentage mean indicated the role of non-additive genetic variance in their expression. The genetic variability was estimated and presented in Table 2.

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