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To assess the genetic variability, heritability and genetic advance as percent of mean for selection parameters in Okra [*Abelmoschus esculentus* (L.) Moench]

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Abstract
Thirty okra genotypes were evaluated to genetic variability, heritability and genetic advance among the characters of okra. The genotypes were carried out in Randomized Block Design with three replications during the *summer season*- 2021 at Horticulture Research centre of the Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P. (250 110). Analysis of variance revealed significant differences for all characters under studies. The phenotypic coefficient of variations (PCV) was higher than the genotypic coefficients of variations (GCV) for all traits under studied. The maximum GCV and PCV was observed for number of branches per plant and fruit diameter thus there is greater scope for further improvement by genetic manipulation. All the characters were recorded high broad sense heritability. High heritability coupled with high genetic advance as percent of mean for the characters like fruit yield per plant, number of branches per plant, fruit diameter, number of flowers per plant, number of fruits per plant, duration of crop, days to first flower initiation, test weight, fruit length, plant height and number of seed per pod. High heritability combined with high genetic advance indicates that additive gene action plays a major role in governing these characters and these characters can be improved by simple selection.

Keywords: GCV, PCV genetic advance, heritability, okra, variability

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench] usually denoted as Lady's finger or bhindi belongs to the family Malvaceae and extensively cultivated annual crop in both the tropical and sub-tropical provinces of the world (Eshiet and Brisibe, 2015) [9].

The somatic chromosome number of cultivated Okra 2n=130 represent amphidiploid of cross between *A. tuberculatus* 2n=58 with unknown spp. 2n=72. The regular series of polyploides reported in okra n=12 with somatic chromosome number 2n=72, 109, 120, 132 and 144 (Datta and Naug, 1968) [8]. The lowest chromosome number identified in *A. angulosus* 2n=56 (Ford, 1938) and highest chromosome number identified in *A. manihot var. callei* 2n=200 (Singh and Bhatnagar,1975) [10]. Eight species of okra are found in india but only *A. esculentus* is commercially cultivated. The wild species *A. moschatus* are also mainly cultivated for aromatic seed. Another wild species of okra like *A. tuberculatus* and *A. ficulneus* are found in the semi-arid region of north western India and *A. manihot var. tetraphyllus* and *A. crinitus* are found in lower Himalaya's part of Tarai regions while, *A. angulosus* found in Tamil Nadu and Kerala and *A. manihot spp. Tetraphyllus* is found in Rajasthan, Uttar Pradesh, Madhya Pradesh and Orissa (Bisth and Bhat, 2006) [5].

Okra is an erect, herbaceous annual, 1-2 meter tall plant. Stem is green with or without reddish tinge. Leaves are alternate, 3-7 lobed palmate, flowers are solitary, axillary having epicalyx (up to 10) and calyx 5. There are 5 yellow petals and numerous stamens which are united to the base of petals; ovary superior, stigma is 5-9 lobed and fruit of okra is known as capsule which is light green or sometimes red in colour, pyramidal-oblong, beaked longitudinally furrowed, 10-13 cm long, dehiscing longitudinally when ripe. Seed green to dark brown, rounded. The greatest increase in fruit weight, length and diameter occurs during 4th and 6th day after pollination (Sistrunk *et al.*, 1960) [21].

India is the second largest producer of Vegetables in the world after China with an annual production of 196.27 million tonnes from an area of 10.80 million Hectares and productivity

of 18.17 tons per hectare (Anonymous, 2020-21) [3]. India is the leading producer of okra in the world and occupy an area of 512.00 thousand hectares with a production of 6513.00 thousand tonnes and productivity of 12.24 t/ha (Anonymous, 2020-21) [3]. West Bengal is the leading Okra growing state with an area of 77.55 thousand hectares while Gujarat is the leading Okra producing state with production of 921.72 thousand metric tonnes in country. In Uttar Pradesh, it is cultivated in an area of 22.93 thousand hectares with an annual production of 307.29 thousand metric tonnes (Anonymous, 2018) [2].

The success of a breeding programme for the genetic improvement of quantitative characters depends on the magnitude of genetic variability existing in the germplasm and the extent to which the desirable characters are heritable. The determination of genetic variability and partitioning it into heritable and non-heritable components using the genetic parameters viz., phenotypic and genotypic coefficients of variation (GCV & PCV), heritability and genetic advance is necessary to have an insight into genetic nature of yield and its components on which selection can be effectively carried out. Character like yield is complex in inheritance and is improved through its component traits. High yield can be achieved by selection of those yield contributing characters that have high heritability coupled with high genetic advance.

Materials and Methods

The present experiment was conducted at Horticulture Research centre of the Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P. (250 110) during *summer season* 2021. Thirty genotypes of okra (Table-1) were collected from different location of county. The collections were made from different source of supply comprising indigenous and exotic means of collections. The above genotypes were sown in the experimental plot as per sown in Randomized Block Design (RBD) with three replications. Seeds were planted in the soil at a depth of 2.5-3 cm. Each plot was sown row to row 45 cm and plant to plant 30 cm. Various cultural procedures were scheduled according to crop needs during the course of the inquiry. The specifications of the agricultural procedures and packaging used to raise an okra crop. The observation was recorded for five randomly selected plants for fourteen quantitative characters viz., days to first flower initiation, plant height, number of branches per plant, number of flowers per plant, days to first fruit set, fruit length, fruit diameter, number of fruits per plant, days to first fruits harvesting, days to second fruit harvesting, number of seeds per pod, test weight, duration of crop and fruit yield per plant. The data was analyzed for different genetic parameters of variability, heritability and genetic advance using the OPSTAT software. Standard statistical procedure was used for the analysis of variance, genotypic and phenotypic coefficients of variation (Burton, 1952) [6], heritability (Hanson *et al.*, 1956) [12] and genetic advance (Johnson *et al.*, 1955) [13].

Result and Discussion

Analysis of variance (Table-2) was carried out for fourteen quantitative traits namely; days to first flower initiation (126.77**), plant height (233.89**), number of branches per plant (2.65**), number of flower per plant (13.58**), days to first fruit set (70.96**), fruit length (8.71**), fruit diameter (0.59**), number of fruits per plant (14.33**), days to first fruits harvesting (38.00**), days to second fruit harvesting (24.68**), number of seeds per pod (54.26**), test weight (79.57**), duration of crop (139.65**) and fruit yield per plant (827.06**) to know the significant difference among the genotypes. On the basis of mean performance (Table-3), the maximum days to first flower initiation was showed in cultivar Hisar Unnat (49.67 days) and the minimum days to first flower initiation was observed in Punjab Kranti (24.00 days). The genotype IC-014026 recorded the highest plant height (105.95 cm) and minimum plant height occurred in Hisar Naveen (59.13 cm). The germplasm IC-014026 showed the maximum number of branches per plant (5.98) and Hisar Naveen showed the minimum number of branches per plant (2.16). The genotype IC-014026 had recorded maximum number of flowers per plant (18.03) and genotype Varsha Uphar recorded the minimum number of flowers per plant (10.60). The maximum days to first fruit set was recorded in IC-090491 genotype (56.33 days) and the minimum days to first fruit set was exhibited for VRO-4 genotype (41.00 days). The germplasm IC-014026 showed maximum fruit length (13.60 cm) and Varsha Uphar showed minimum fruit length (7.43 cm). Maximum fruit diameter was recorded in cultivar IC-014026 (2.71 cm) and minimum fruit diameter was observed in cultivar Hisar Naveen (1.12 cm). The maximum number of fruits per plant was observed in germplasm IC-014026 (15.29) and minimum number of fruits per plant was observed in germplasm EC-305637 (8.46). The genotype Pusa A-4 (71 days) takes maximum days to first fruit harvesting and cultivar EC-305642 (59 days) takes minimum days to first fruit picking. The genotype Arka Abhay takes maximum days to second fruit harvesting (74 days) and cultivar IC-014026 takes minimum days to second fruit harvesting (64 days). The genotype IC-014026 (48.52) takes maximum number of seeds per pod and cultivar IIVR-II (48.52) takes minimum number of seeds per pod. The maximum test weight was noted in IC-014026 with (65.15 gm) and minimum test weight was found in Kashi Kranti with (44.15 gm). The maximum duration of crop was noted in EC-305637 with 111 days and minimum duration of crops was found in Pusa Sawani with 87 days. The maximum fruit yield per plant was noted in IC-014026 with 145.53 gm and minimum fruit yield per plant was found in Mona with 87.76 gm. Similar results were also found earlier by Chandramouli *et al.* (2016) [7], Mudhalvan *et al.*, (2018) [16], Karthika *et al.* (2019) [14], Kumar *et al.*, (2019) [15], Rambabu *et al.* (2019) [18] and Alam *et al.* (2020) [1].

The GCV was found lower than PCV for all traits studied (Table-4 & Figure-1) which indicated that these characters were having interaction with environment to some extent (Ram and Singh, 1993) [17]. The genotypic and phenotypic variances are of little meaning as they do not have any clear limit. And at the same time, the categorization of the genotypic variance as low or high is difficult, rendering them unsuitable for comparison of two populations with desired precision when expressed in absolute values.

The high percent of genotypic co-efficient of variation (>20%) was observed for number of branches per plant (23.09) followed by fruit diameter (22.73). The moderate genotypic co-efficient of variation (10-20%) was observed for number of fruit per plant (17.73) followed by days to first flower initiation (16.32), fruit yield per plant (15.30), fruit length (15.25), number of flowers per plant (14.30), plant height (10.44) and number of seeds per pod (10.27) while low

(<10) genotypic coefficient of variation was obtained for days to first fruit set (9.38) followed by test weight (8.96), duration of crop (6.80), days to first fruit harvesting (5.26) and days to second fruit harvesting (3.82). The estimates of phenotypic coefficient of variation (PCV) for different characters. The phenotypic coefficient of variation (>20%) was observed for fruit diameter (25.67) and number of branches per plant (24.34). Whereas, moderate (10-20%) phenotypic coefficients of variation were observed for number of fruits per plant (18.72) followed by days to first flower initiation (17.60), fruit yield per plant (15.68), fruit length (16.72), number of flowers per plant (15.09), plant height (11.50), number of seeds per pod (11.33) and days to first fruit set (10.83). while low phenotypic coefficients of variation (<10%) were found for test weight (9.71) followed by duration of crop (7.27), days to first fruit harvesting (5.99) and days to second fruit harvesting (4.69). Further, the present finding showed that estimates of PCV were generally higher than their corresponding GCV for all the characters studied. These findings are similar in agreement with earlier reported by Chandramouli *et al.* (2016) [7], Goswami *et al.* (2016) [16], Shivaramegowda *et al.* (2016) [19], Ullangula (2017) [23], Syfullah *et al.* (2018) [22], Verma *et al.* (2018) [24], Karthika *et al.* (2019) [14] and Alam *et al.* (2020) [1]. The difference among the genotypic coefficient of variance and phenotypic coefficient of variance value for different characters indicated that the influence of environment in expressing the variability with traits. If difference least, mean the environment is much affecting in the variable performance of the characters. But if the difference is more means there is much influence of environment in the expression of the traits.

The heritable variation can be found with the help of heritability estimates and genetic gain; the present investigation heritability could be estimated in only broad sense. The broad sense heritability (Table-4 & Figure-2) was obtained (>80%) in case of fruit yield per plant (95.26%) followed by number of branches per plant (89.95 %), number of flowers per plant (89.96%), number of fruits per plant (89.70%), duration of crop (87.66%), days to first flower initiation (85.95%), test weight (85.17%), fruit length (83.26%), plant height (82.49%) and number of seed per pod (82.17%). The moderate heritability (<80%) was observed for fruit diameter (78.41), days to first fruit harvesting (76.41), days to first fruit set (75.06) and days to second fruit harvesting (66.31). Similar result was also finding earlier by Yadav *et al.* (2016), Ullangula *et al.* (2017) [23], Syfullah *et al.* (2018) [22], Verma *et al.* (2018) [24], Kumar *et al.* (2019) [15], Rambabu *et al.* (2019) [18] and Ansari *et al.* (2020) [4]. The high heritability denotes high proportion of genetic effects in the determination of these characters and can be adopted for improving fruit yield. Fruit yields the character showing high heritability, could be owing to greater contribution of additive genetic components in the inheritance of these attributes.

In present study, high genetic advance (>20%) (Table-4 & Figure-2) for number of branches per plant (45.10%) followed by fruit diameter (41.46%), number of fruits per plant (34.59%), days to first flower initiation (31.17%), fruit yield per plant (30.77%), fruit length (28.67%) and number of flowers per plant (27.93%). Genetic advance as per cent of mean was found moderate for plant height (19.54%), number of seeds per pod (19.18%), test weight (17.03%), days to first fruit set (16.74%) and duration of crop (13.12%) while it was found low for days to first fruit harvesting (9.49%) and days to second fruit harvesting (6.40%). Thereby, suggesting average response for selection based on *per se* performance. Some of these characters have been also reported by Ullangula *et al.* (2017) [23], Syfullah *et al.* (2018) [22], Rambabu *et al.* (2019) [18] and Karthika *et al.* (2019) [14].

Table 1: The details of Germplasm with their Source

S. No.	Germplasm	Source	S. No.	Germplasm	Source
1.	Hisar Naveen	HAU, Hisar	16.	IIVR-II	IIVR, Varanasi
2.	Varsha Uphar	HAU, Hisar	17.	VRO-4	IIVR, Varanasi
3.	Punjab Kranti	PAU, Ludhiana	18.	VRO-5	IIVR, Varanasi
4.	Arka Anamika	IIHR, Bengaluru	19.	VRO-6	IIVR, Varanasi
5.	Arka Abhay	IIHR, Bengaluru	20.	368-A	IARI, New Delhi
6.	Pusa Sawani	IARI, New Delhi	21.	Hisar Unnat	HAU, Hisar
7.	Pusa A-4	IARI, New Delhi	22.	IC-18530	Dr. PDKV, Akola
8.	Parbhani Kranti	MPKV, Rahuri	23.	EC-305642	Dr. PDKV, Akola
9.	Kashi Pragati	IIVR, Varanasi	24.	EC-305643	Dr. PDKV, Akola
10.	Mona	Lawad, Meerut	25.	EC-305644	Dr. PDKV, Akola
11.	Kashi Kranti	IIVR, Varanasi	26.	EC-305645	Dr. PDKV, Akola
12.	U.S-8063	IARI, New Delhi	27.	EC-305639	Dr. PDKV, Akola
13.	IC-090491	IARI, New Delhi	28.	IC-014026	Dr. PDKV, Akola
14.	Y.V.S-9	IARI, New Delhi	29.	EC-305637	Dr. PDKV, Akola
15.	IC-316/2,4,5	IARI, New Delhi	30.	EC-305635	Dr. PDKV, Akola

Table 2: ANOVA for 14 characters in Okra [*Abelmoschus esculentus* (L.) Moench]

Source of variation	DF	Days to first flower initiation	Plant height (cm)	Number of branches per plant	Number of flowers per plant	Days to first fruit set	Fruit length (cm)	Fruit diameter (cm)
Replication	2	14.41	29.29	0.30	1.04	1.20	0.22	0.07
Treatment	29	126.77**	233.89**	2.65**	13.58**	70.96**	8.71**	0.59**
Error	58	6.55	15.45	0.10	0.49	7.07	0.55	0.05

Source of variation	DF	Number of fruits per plant	Days to first fruits harvesting	Days to second fruit harvesting	Number of seeds per pod	Test weight	Duration of crop	Fruit yield per plant
Replication	2	0.61	5.73	9.64	3.73	0.86	10.54	1.77
Treatment	29	14.33**	38.00**	24.68**	54.26**	79.57**	139.65**	827.06**

Error	58	0.53	3.46	3.58	3.66	4.37	6.26	13.51

*, ** significant at 5% and 1% level, respectively

Table 3: Mean performance of 30 genotypes of Okra for 14 characters

S. No	Genotypes	Days to first flower initiation	Plant Height (cm)	Number of branches per plant	Number of flowers per plant	Days to first fruit set	fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Days to first fruits harvesting	Days to second fruit harvesting	Number of seeds per pod	Test weight	Duration of crop	Fruit yield per plant
1	Hisar Naveen	44.33	59.13	2.16	10.89	49.00	7.51	1.12	8.77	66.00	69.67	45.88	47.15	104.67	88.44
2	Varsha Uphar	35.67	70.88	2.42	10.60	54.67	7.43	1.49	8.71	60.67	68.33	40.98	45.66	88.67	94.31
3	Punjab Kranti	24.00	75.36	3.25	11.30	53.67	8.77	1.27	9.57	61.00	66.00	37.37	58.42	89.33	107.66
4	Arka Anamika	32.67	88.67	4.29	13.68	54.00	9.27	1.63	12.17	63.33	68.67	43.26	63.21	96.00	120.98
5	Arka Abhay	36.67	87.86	4.88	15.33	54.33	11.51	2.07	14.70	69.33	74.00	46.60	63.92	104.33	124.96
6	Pusa Sawani	36.33	78.99	4.07	17.34	42.33	9.66	1.51	13.89	67.00	69.67	32.62	55.94	87.00	90.52
7	Pusa A-4	45.33	74.82	3.41	15.46	54.33	9.77	1.27	13.82	71.00	74.00	38.93	55.41	91.00	96.29
8	Prabhani Kranti	31.67	73.99	3.60	12.92	43.33	10.47	1.48	10.38	66.00	69.33	35.76	55.18	97.67	90.70
9	Kashi Pragati	36.67	73.07	3.50	14.81	51.33	9.60	1.30	11.23	64.67	69.00	35.51	50.27	98.33	92.75
10	Mona	35.33	75.24	3.70	12.51	43.33	10.44	2.06	10.27	63.67	69.00	47.46	51.22	96.33	87.76
11	Kashi Kranti	42.00	77.40	2.26	11.86	52.00	8.41	1.15	8.56	61.33	68.00	41.81	44.15	101.00	123.36
12	U.S. -8063	44.00	74.18	3.80	15.93	49.67	10.96	1.51	13.74	67.33	71.00	39.22	53.03	91.33	93.83
13	IC-090491	32.00	86.59	4.51	17.16	56.33	12.38	2.56	14.85	62.67	70.67	38.78	56.33	96.33	95.38
14	Y.V.S-9	43.67	96.69	4.26	16.12	49.00	12.73	2.57	14.48	66.33	70.33	41.78	49.71	106.33	136.66
15	IC-316/2,4,5	39.67	78.21	4.62	17.17	52.00	11.61	2.03	14.22	60.00	65.00	42.65	60.24	98.00	112.44
16	IIVR-II	40.00	84.17	4.69	16.95	45.00	12.06	1.92	14.38	67.00	71.67	31.12	54.12	89.33	104.19
17	VRO-4	38.00	80.87	4.63	14.96	41.00	11.17	1.88	12.33	67.33	72.67	34.44	56.00	99.33	91.08
18	VRO-5	41.67	81.91	3.91	13.19	47.33	10.91	1.77	11.58	60.00	68.00	43.12	57.38	110.33	97.08
19	VRO-6	47.33	90.89	4.72	16.82	55.00	12.88	2.03	13.04	62.67	68.67	40.28	55.26	95.67	104.06
20	368-A	46.67	84.71	4.11	16.11	51.00	12.36	1.89	13.55	60.67	67.00	36.47	59.24	93.67	127.51
21	Hisar Unnat	49.67	79.30	3.90	14.06	55.00	11.73	2.02	12.59	67.00	71.00	39.34	58.52	106.00	105.61
22	IC-18530	42.00	84.41	4.57	13.05	51.67	12.76	1.99	12.16	68.67	72.33	42.65	62.78	108.67	91.45
23	EC-305642	43.00	84.33	4.30	13.51	45.33	12.07	2.13	12.03	59.00	65.00	41.25	52.15	106.33	104.04
24	EC-305643	47.33	79.60	4.24	15.25	54.67	10.43	2.01	12.15	68.33	72.67	41.74	57.82	96.33	105.21
25	EC-305644	36.33	87.69	5.27	16.10	48.67	13.20	2.51	13.70	67.33	72.33	38.55	58.24	96.67	134.21
26	EC-305645	33.33	87.75	5.11	15.96	48.00	11.97	2.37	14.03	69.00	73.00	34.06	60.02	103.33	126.27
27	EC-305639	33.67	91.11	4.72	16.38	41.67	11.18	2.34	9.78	68.33	72.67	40.31	54.78	91.00	128.61
28	IC-014026	24.33	105.95	5.98	18.03	42.33	13.60	2.71	15.29	59.67	64.00	48.52	65.15	91.67	145.53
29	EC-305637	45.67	83.47	2.82	11.78	48.33	8.71	1.64	8.46	59.67	64.33	41.55	58.19	111.00	111.89
30	EC-305635	34.67	73.67	2.24	12.89	41.67	8.81	1.61	8.53	62.00	67.33	37.47	57.42	95.00	95.19
	Mean	38.79	81.70	4.00	14.60	49.20	10.81	1.86	12.10	64.57	69.51	39.98	55.90	98.02	107.60
	Min	24.00	59.13	2.16	10.60	41.00	7.43	1.12	8.46	59.00	64.00	31.12	44.15	87.00	87.76
	Max	49.67	105.95	5.98	18.03	56.33	13.60	2.71	15.29	71.00	74.00	48.52	65.15	111.00	145.53
	SE(d)	2.09	3.21	0.25	0.57	2.17	0.60	0.18	0.59	1.52	1.54	1.56	1.71	2.04	3.00
	C.D. at 5%	4.19	6.44	0.51	1.15	4.36	1.21	0.36	1.19	3.05	3.10	3.13	3.42	4.10	6.02
	C.V. (%)	6.60	4.81	7.72	4.81	5.41	6.84	11.93	6.01	2.88	2.72	4.78	3.74	2.55	3.42

Table 4: Estimates of genetic variability parameters for 14 characters in Okra Okra [*Abelmoschus esculentus* (L.) Moench]

Genotypes	Mean	Min	Max	var (g)	var (p)	Heritability (%)	GA	Genetic advance as % of mean	GA 1%	GA mean 1%	GCV (%)	PCV (%)
Days to first flower initiation	38.79	24.00	49.67	40.07	46.62	85.95	12.09	31.17	15.49	39.94	16.32	17.60
Plant height (cm)	81.70	59.13	105.95	72.81	88.26	82.49	15.97	19.54	20.46	25.04	10.44	11.50
Number of branches per plant	4.00	2.16	5.98	0.85	0.95	89.95	1.80	45.10	2.31	57.80	23.09	24.34
Number of flowers per plant	14.60	10.60	18.03	4.36	4.86	89.86	4.08	27.93	5.23	35.80	14.30	15.09
Days to first fruit set	49.20	41.00	56.33	21.29	28.37	75.06	8.24	16.74	10.55	21.45	9.38	10.83
Fruit length (cm)	10.81	7.43	13.60	2.72	3.27	83.26	3.10	28.67	3.97	36.74	15.25	16.72
Fruit diameter (cm)	1.86	1.12	2.71	0.18	0.23	78.41	0.77	41.46	0.99	53.13	22.73	25.67
Number of fruits per plant	12.10	8.46	15.29	4.60	5.13	89.70	4.18	34.59	5.36	44.32	17.73	18.72
Days to first fruits harvesting	64.57	59.00	71.00	11.52	14.97	76.91	6.13	9.49	7.86	12.17	5.26	5.99
Days to second fruit harvesting	69.51	64.00	74.00	7.04	10.61	66.31	4.45	6.40	5.70	8.20	3.82	4.69
Number of seeds per pod	39.98	31.12	48.52	16.87	20.53	82.17	7.67	19.18	9.83	24.58	10.27	11.33

Test weight	55.90	44.15	65.15	25.07	29.44	85.17	9.52	17.03	12.20	21.82	8.96	9.71
Duration of crop	98.02	87.00	111.00	44.47	50.72	87.66	12.86	13.12	16.48	16.82	6.80	7.27
Fruit yield per plant	107.60	87.76	145.53	271.18	284.69	95.26	33.11	30.77	42.43	39.43	15.30	15.68

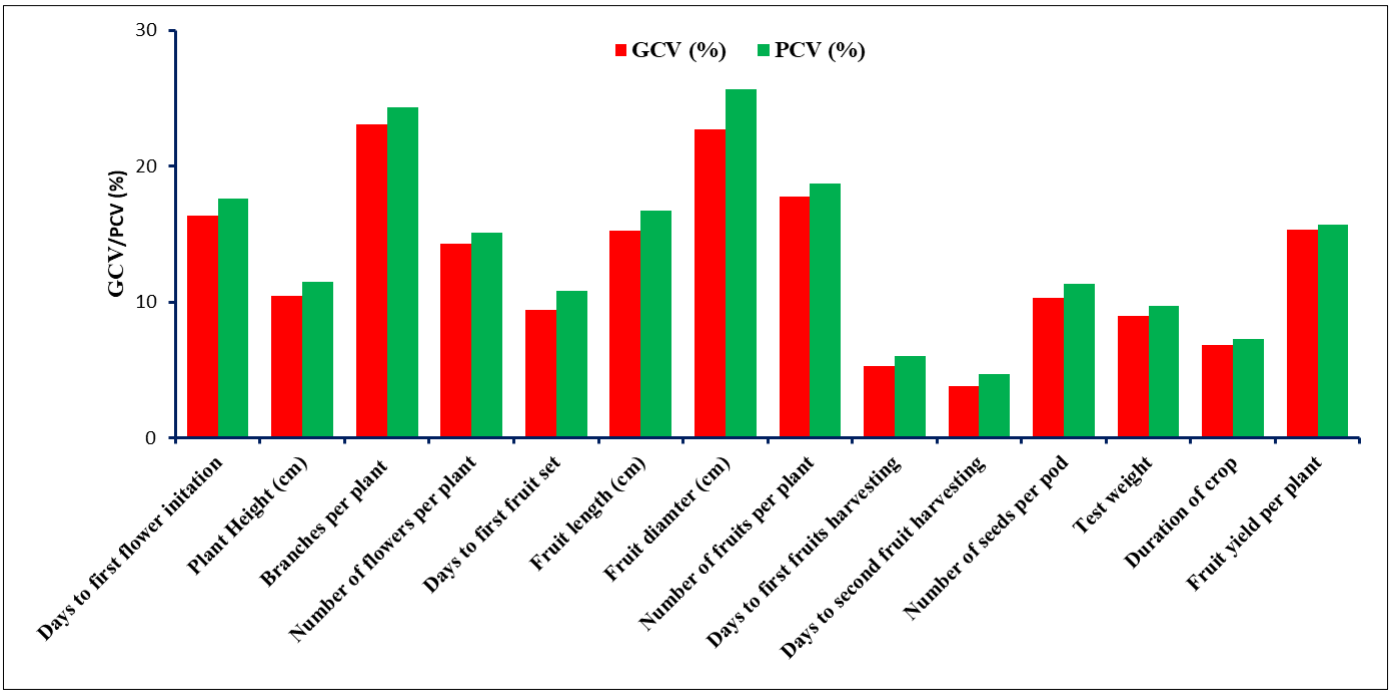

Fig 1: Genotypic coefficient of variation and phenotypic coefficient of variation

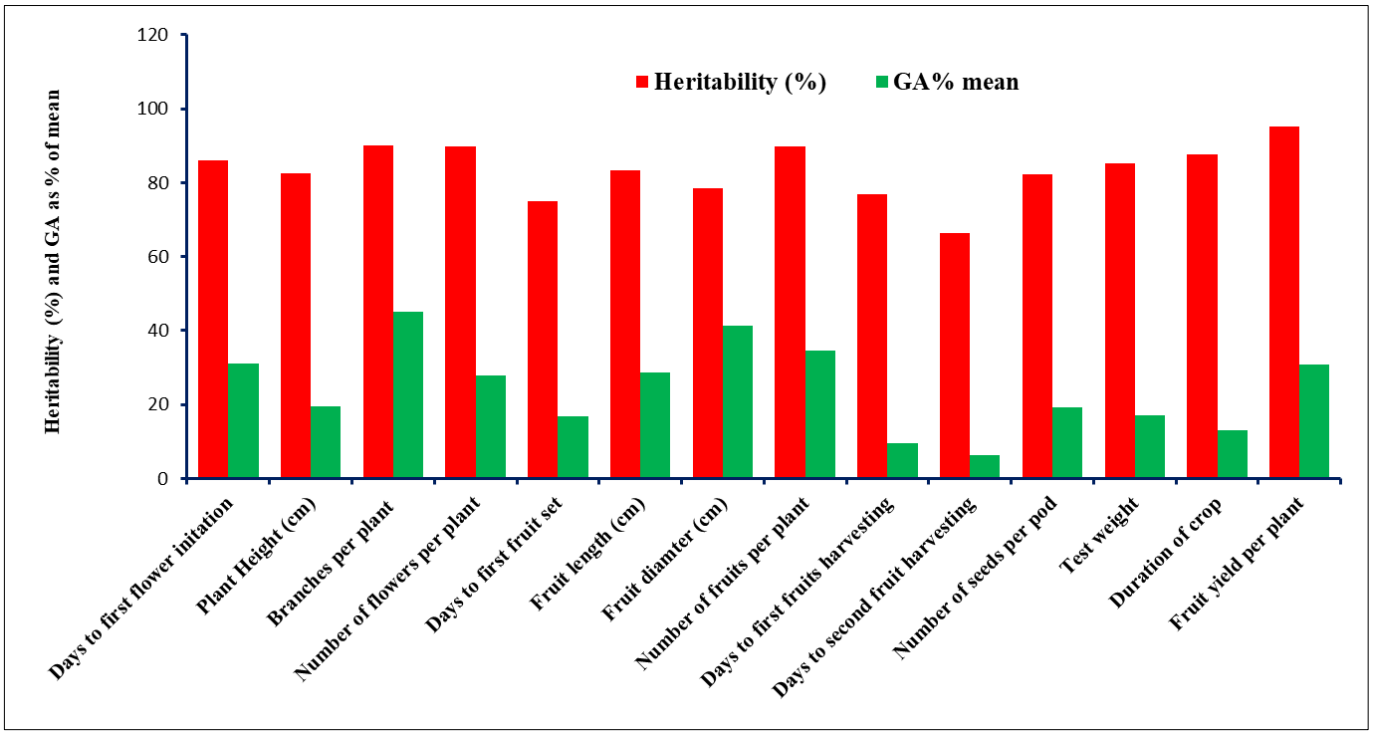

Fig 2: Heritability and Genetic advance as (%) of mean

Conclusion

On the basis of results summarized above, it can be concluded that the PCV and GCV were high for number of branches per plant and fruit diameter, which indicates that high degree of variability in this character and suggests that simple selection could be effective for yield improvement through this trait.

The high heritability denotes high proportion of genetic effects in the determination of these characters can be adopted for improving fruit yield. Fruit yields character showing high heritability, could be owing to greater contribution of additive genetic components in the inheritance of these attributes.

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