

Genetic Variability, Heritability and Genetic Advance for Yield and Yield Attribute Traits in Ash Gourd [*Benincasa hispida* (Thunb.) Cogn.]

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Abstract The present study was undertaken with sixty genotypes of ash gourd were evaluated to determine genetic variability, heritability and genetic advance for seventeen contributing characters during the 2015-16. Significant variations were recorded for the various characters studied. Widest range of variation was observed in number of seeds per fruit followed by duration of crop, days to first fruit harvest, days to 50% flowering, days to fruit set and days to first female flower appears. Maximum genotypic and phenotypic coefficient of variation (GCV

and PCV) was observed for number of seeds per fruit followed by fruit yield kg/plot. High magnitude of heritability was observed for number of seeds per fruit (95.9%) followed by 100 seed weight, (83.6%), average fruit weight (72.9%) and days to first female flower appears date (70.6%). The maximum genetic advance as percentage of mean was observed high for number of seeds per fruit (51.40%), fruit yield per plot (33.32%), 100 seed weight (30.83%). On the basis of this investigation selection criteria are number of seed per fruit bringing out the improvement in ash gourd because they appearance with high value of GCV, PCV, heritability and genetic advance.

Keywords Ash gourd, Genetic variability, Heritability, Genetic advance, Fruit yield.

Introduction

Ash gourd [*Benincasa hispida* (Thunb.) Cogn.] popularly known as Wax gourd, or white pumpkin is important cucurbitaceous vegetable grown throughout India in rainy season. It belongs to the family Cucurbitaceae having chromosome number $2n=24$. It is widely grown all over the country in tropical and sub-tropical regions and possesses large variability for morphological and quality belonging to a monotypic genus, is a native Indonesia (Java) and Japan. It is a potential crop of tropical Africa and America [1].

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Table 1. Analysis of variance for fruit yield and its component characters in ash gourd. *:Significant at 5%, **:Significant at 1%.

Sl. No.	Character (df)	Meansums of square		
		Repli- cation (2)	Treat- ments (59)	Error (118)
01	Days to 50% flowering	8.687	139.405**	33.203
02	No. of branches per plant	0.478	2.006*	1.408
03	Node number of first female flower appears	16.203	44.942**	6.770
04	Days to first female flower appears date	2.412	116.603**	14.211
05	Node number of first male flower appears	2.085	7.287**	3.968
06	Days to first male flower appears date	15.093	37.395**	11.100
07	Days to fruit set	15.000	130.950**	33.549
08	Days to 1 st fruit harvest	1.875	19.432**	9.095
09	Fruit length (cm)	0.007	5.528**	2.378
10	Fruit girth (cm)	0.093	19.095**	7.356
11	Average fruit weight (kg)	0.038	0.415**	0.045
12	Number of seeds per fruit	363.000	28473.492**	402.474
13	Number of fruits per plant	0.189	4.006**	1.251
14	T.S.S. (%)	0.008	0.071**	0.039
15	100 seed weight (g)	0.070	1.519**	0.093
16	Fruit yield/plot (kg)	2.132	75.953**	12.826
17	Duration of crop (sowing to last harvest)	0.125	23.217**	9.613

Among the cucurbits, ash gourd is considered a prized vegetable because of its high nutritional value, long storage life and good transport qualities, besides its medicinal properties. The mature fleshy fruit is either eaten raw or cooked as vegetable marrow or candied as sweet meat popularly known as petha. It is a good source of carbohydrate, vitamin A, vitamin C and minerals like iron and zinc [2, 3]. The flesh is white to pale green, with a rather bland flavor [4]. Ash gourd juice has potential to improve the weak nervous system [5].

As a result of continued selection, a large number of landraces and forms with restricted local distribution have been accumulated in different growing

areas. There is substantial variation in ash gourd vegetative traits, especially, fruit characters. Assessment of variability and heritability of various quantitative and quality traits is important in this underutilized vegetable crop. Genotypic and phenotypic coefficients of variation, heritability and genetic advance constitute the important genetic parameters frequently applied in vegetable breeding. Coefficient of variation allows a meaningful comparison of the variation of several traits of plants belonging to the same population, as well as a comparison of the variation for the same traits as expressed by different populations (of the same or different crops).

Heritability is used to describe properties of the inheritance of quantitative traits. Heritability tells us about the additive genetic variance and phenotypic variance. The main purpose of estimating heritability and the genetic parameters that compose the heritability estimate is to compare the expected gains from selection based on alternative selection strategies [6]. Prediction of selection response is one of the important practical uses of heritability estimate in plant breeding. Heritability coupled with genetic advance is more reliable in predicting the selection response than either of the two parameters alone.

Materials and Methods

The study was carried out during *kharif* season (2015-16) at Research cum Instructional farm, IGKV, Raipur. The experiment comprised of sixty genotypes of ash 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 50% flowering, number of branches per plant, node number of first female flower appears, days to first female flower appears, node number of first male flower appears, days to first male flower appears, days to fruit set, days to first fruit harvest, fruit length (cm), fruit girth (cm), average fruit weight (g), number of seeds per fruit, number of fruits per plant, total soluble solid (%), 100 seed weight (g), fruit yield per plot (kg)

Table 2. Genetic parameters of variability for fruit yield and its component character in ash gourd.

Sl. No.	Characters	Mean	Range		Coefficient of variation (%)		Heritability (h ² %)	GA as % of mean
			Min	Max	GCV	PCV		
01	Days to 50% flowering	93.62	81.67	111.00	6.36	8.85	51.6	9.40
02	Number of branches per plant	10.71	9.00	13.67	4.17	11.83	12.4	2.99
03	Node number of first female flower appears	39.15	30.00	47.00	9.11	11.28	65.3	15.17
04	Days to first female flower appears	75.07	65.00	89.00	7.78	9.26	70.6	13.47
05	Node number of first male flower appears	33.00	28.67	36.95	3.19	6.83	21.8	3.06
06	Days to first male flower appears	65.94	60.00	74.00	4.49	6.76	44.1	6.14
07	Days to fruit set	82.70	72.27	99.00	6.89	9.82	49.2	9.95
08	Days to 1 st fruit harvest	130.58	125.47	136.67	1.42	2.71	27.5	1.53
09	Fruit length (cm)	21.79	19.33	25.67	4.70	8.50	30.6	5.37
10	Fruit girth (cm)	52.42	47.66	61.33	3.77	6.40	34.7	4.58
11	Average fruit weight (kg)	2.67	1.98	3.90	13.14	15.39	72.9	23.21
12	Number of seeds per fruit	379.64	247.69	680.35	25.48	26.02	95.9	51.40
13	Number of fruits per plant	8.79	7.24	13.35	10.91	16.76	42.3	14.56
14	TSS (%)	2.36	2.06	2.67	4.40	9.47	21.5	4.24
15	100 seed weight (g)	4.21	2.87	6.67	16.35	17.88	83.6	30.83
16	Fruit yield/plot (kg)	22.36	14.73	42.67	20.52	26.03	62.1	33.32
17	Duration of crop (sowing to last harvest)	137.39	134.00	147.00	1.55	2.74	32.1	1.30

and duration of crop (sowing to last harvest). The data were analyzed to estimate genotypic and phenotypic co-efficient of variation using the formula of [7], heritability in broad sense [8] and genetic advance was estimated by formula suggested [9].

Results and Discussion

The analysis of variance of all the characters under study is presented in Table. This analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all characters. This is an indication of existence of sufficient variability among the genotypes for fruit yield and its components traits. Significant mean sum of squares due to fruit yield and attributing characters revealed existence of considerable variability in material studied for improvement for various traits. These findings are in general agreement with the findings [10, 11].

The investigation for present of variability in sixty genotypes of ash gourd was measured in term of range, phenotypic coefficient of variation (PCV), genotypic coefficient of variance (GCV), heritability (broad sense) and genetic advance (Table 2). Wide

range of variation observed for all the characters. The wide range was recorded for number of seeds per fruit (247.69–680.35) followed by duration of crop (134.00–147.00), days to first fruit harvest (125.47–136.67), days to 50% flowering, (81.67–111.00), days to fruit set (72.27–99.00), days to first female flower appears (65.00–89.00), days to first male flower appears (60.00–74.00), fruit girth (cm) (47.66–61.33), node number of first female flower appears (30.00–47.00), node number of first male flower appears (28.67–36.95), fruit length (cm) (19.33–25.67), fruit yield per plot (kg) (14.33–42.67), number of branches per plant (9.00–13.67), number of fruits per plant (7.24–13.35) indicating that presence of sufficient variability among the genotypes these are used for selecting desirable characters. But, 100 seed weight (g) (2.87–6.67), total soluble solids (2.06–2.67°Brix), average fruit weight (1.98–3.90 kg) was recorded minimum variation and less scope for selection of this character from the present collection. Similar result has been found [12] in sponge gourd and [13] in bottle gourd.

High magnitude of genotypic as well as phenotypic coefficient of variations were recorded for traits viz., number of seeds per fruit (25.48 and 26.02) and fruit yield per plot in kg (20.52 and 26.03), suggested

the substantial improvement on Ash gourd through selection for these traits. Moderate GCV and PCV were recorded for 100 seed weight (g) (16.35 and 17.88), average fruit weight (kg) (13.14 and 15.39) and number of fruit per plant (10.91 and 16.76) suggested existence of considerable variability in the population. Selection for these traits may also be given the importance for improvement program. Characters like node number at which first female flower appears (9.11 and 11.28), days to first female flower appears (7.78 and 9.26), days to fruit set (6.89 and 9.82) days to 50% flowering (6.36 and 8.85), fruit length (cm) (4.70 and 8.50) and days to first male flower appears (4.49 and 6.76), total soluble solid (4.40 and 9.47), number of branches per plant (4.17 and 11.83), fruit girth (cm) (3.77 and 6.40), node number at first male flower appears (3.19 and 6.83), duration of crop (1.55 and 2.74) and days to first fruit harvest (1.42 and 2.71) had low genotypic and phenotypic coefficient of variation.

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. These characters implied their relative resistance to environmental variation. These findings were observed earlier [14] for number of fruits per plant and for vine length [15], number of primary branches per vine, number of nodes on the main axis, number of fruits per plant, fruit length, girth and weight.

In the present investigation high magnitude of heritability was recorded for most of characters. The highest heritability was recorded for the characters for number of seeds per fruit (95.9%) followed by 100 seed weight (83.6%), average fruit weight (72.9) and days to first female flower appears date (70.6%) suggesting the important role of genetic constitution in the expression of the traits. The above heritability estimation, it is clear that these traits are less influ-

ence by the environment and controlled by the additive gene action. The moderate heritability was observed for node number of first female flower (65.3%), fruit yield per plot (62.1%), days to 50% flowering (51.6%), and low heritability was observed for days to fruit set (49.2%), days to first male flower appears (44.1%) and number of fruits per plant (42.3%) fruit girth (34.7%), duration of crop (32.1%), fruit length (30.6%), days to first fruit harvest (27.5%), node number of first male flower (21.8%), total soluble solid (21.5%), and number of branches per plant (12.4%), high heritability characters are suggesting the important role of genetic constitution in the expression of the characters and these traits are considered to be dependent from breeding point of view. All the estimated heritable characters are less influence by environmental factors and control by additive gene. Similar results were also reported [16] for fruit length, fruit girth, fruit weight and female flower and fruit yield per plant. Similar results were also reported [17].

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 number of seeds per fruit. 100 seed weight, average fruit weight, 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 [10, 18].

The study revealed sufficient genetic variability for quantitative traits among the varieties, which can be exploited for varietal improvement. Therefore, a gene pool can be generated by crossing the variety of interest which can be further used as a source material to develop promising varieties in ash gourd.

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