Indian J. Pl. Genet. Resources 13(3): 298-301, 2000

VARIABILITY ANALYSIS AND CAUSE AND EFFECT RELATIONSHIP IN ASHGOURD [*Benincasa hispida* (Thunb.) Cogn.]

CHANDER PARKASH[1], K. P. SINGH AND G. KALLOO, Indian Institute of Vegetable Research, 1, Gandhinagar, Naria, P.B. No. 5002, P.O. B.H.U., Varanasi 221 005 (Uttar Pradesh);
[1]Present address : IARI, Regional Station, Katrain 175 129 (Himachal Pradesh)

The study revealed significant variances for all the eight characters studied. High heritability along with high genetic advance were observed for fruit yield per plant while number of fruits per plant and fruit weight showed only high genetic advance. Genotypic correlations were found higher than the phenotypic correlations. Fruit weight and number of fruits per plant exhibited maximum direct effect on fruit yield.

Key words: *Benincasa hispida*, germplasm, variability, correlation, path analysis

Ashgourd is a monotypic genus with only one cultivated species *Benincasa hispida* (Thunb) Cogn. It is known by several names; as wax gourd, winter melon, hairy melon, chinese preserve melon, ash pumpkin, white pumpkin, kooshmanda (in Sanskrit), petha (in Hindi) etc. Ashgourd has unique characteristic and use in confectionary and ayurvedic medicinal preparations (Ramesh *et al.*, 1989 and Satpute, 1989). Surprisingly, this crop has not been much exploited on commercial basis in the past. Although ash gourd is becoming a crop of industrial importance, relatively less attention has been paid towards the varietal improvement of existing strains available in different parts of the country. There is an imperative need to pick up an ideal plant type having maximum desirable traits.

As variation in a character is an interplay of heritable and non heritable components, selection based on merely phenotypic expression is misleading. To begin with a successful breeding programme in a crop, it is necessary to have the knowledge of the interrelationship among the various characters and their dependency on each other. Correlation analysis measures the degree of association among the different component characters but does not imply any cause and effect relation. Path coefficient analysis, on the other hand, splits the correlation coefficient into direct and indirect effects and thus provides a detailed examination of specific factors responsible for correlation and measures their relative importance. Keeping the above points in view, the present investigation was undertaken to find out the genetic parameters of variability and understand the association of various quantitative characters in ashgourd.

MATERIALS AND METHODS

Forty four germplasm of ashgourd collected from various parts of the country were evaluated in a randomized complete block design with three replications at the experimental farm of the Indian Institute of Vegetable Research, Varanasi during *kharif* season of 1998-99 and 1999-2000. Each entry was sown in a plot size of 4m x 5m with plant-to-plant spacing of 80 cm and row-to-row spacing of 5m. The data were recorded on eight

quantitative characters, viz., number of fruits per plant, fruit weight, fruit length, fruit diameter, vine length, days to first male flower, days to first female flower and fruit yield. Pooled data for the two years were analyzed statistically using SPAR 1 package developed by the IASRI, New Delhi.

RESULTS AND DISCUSSION

Significant differences were observed among the genotypes for all the characters under study. The estimates of various parameters of genetic variability are presented in Table 1. The phenotypic coefficients of variation (PCV) were higher than the genotypic coefficients of variation (GCV) for all the characters which indicated that the manifestation of these characters was highly influenced by the environment. The GCV was higher (25%) for fruit yield (35.57%) followed by fruit weight (26-06%) which indicated that the genotypes had a wide variation for the two characters (Hamid *et al.*, 1 983) and direct selection may be useful to exploit such variation.

Table 1. Genetic parameters of variability

Sr. No.	Character	Mean	SE(m)	PCV (%)	GCV (%)	Heritability in broad sense (%)	Genetic advance as % of mean
1.	Number of fruits per plant	1.70	0.16	23.50	16.19	73.0	44.12
2.	Fruit weight (kg)	9.04	1.02	32.54	26.06	68.4	39.71
3.	Fruit length (cm)	28.38	2.05	15.94	9.89	57.9	20.48
4.	Fruit diameter (cm)	23.8	1.28	15.79	12.66	78.7	25.30
5.	Vine length (cm)	8.30	0.91	20.78	8.52	31.5	13.73
6.	Days to first male flower	56.89	3.45	11.95	5.66	14.5	1.59
7.	Days to first female flower	64.20	3.50	9.97	3.22	9.6	1.15
8.	Fruit yield (kg/plant)	15.26	1.38	38.87	35.57	84.2	56.22

The broad sense heritability (H) estimates were high (80%) only for fruit yield per plant and moderate (50-80%) for number of fruits per plant, fruit weight, fruit length and fruit diameter. The genetic advance expressed as per cent of mean was high (30%) for fruit yield, number of fruits per plant and fruit weight and moderate (20-30%) for fruit length and fruit diameter. Low estimates of heritability (50%) and genetic advance (20%) were observed for vine length, days to first male flower and female flower appearance. Variation in physical characters of ashgourd fruit was also observed by Randhawa *et al.* (1983). From variability analysis, it can be observed that high estimates of GCV, H and genetic advance have been obtained for fruit yield. Yield being a complex character is dependent on a number of components, selection can not be made directly but through contributing characters like fruit weight and number of fruits per plant which have shown high to moderate estimates of various variability parameters.

The estimates of correlation coefficients at phenotypic and genotypic levels are presented in Table 2. A perusal of correlation coefficients realed that genotypic correlation coefficients were, in general, higher than the corresponding phenotypic ones, indicating the inherent association among the various traits. At the phenotypic level, fruit yield showed positive and significant association with number of fruits per plant, fruit weight, fruit length and fruit diameter, while vine length, days to first male and female flower appearance

Table 2. Phenotypic (P) and genotypic (G) correlation coefficients for eight characters in ashgourd

Character		Fruit weight	Fruit length	Fruit diameter	Vine length	Days to first male flower	Days to first female flower	Fruit yield
Number of fruits/plant	P	–0.128	–0.051	–0.099	–0.135	0.112	–0.012	0.467*
	G	0.299	0.394	0.155	–0.112	0.113	–0.164	0.655
Fruit weight	P		0.395*	0.822*	0.246	–0.212	–0.183	0.798*
	G		0.193	0.957	0.401	–0.477	–0.717	0.908
Fruit length	P			0.019	0.114	0.016	–0.045	0.317*
	G			–0.101	0.094	0.188	–0.203	0.332
Fruit diameter	P				0.169	–0.232	–0.208	0.659*
	G				0.518	–0.598	–0.739	0.816
Vine length	P					–0.251	–0.200	0.104
	G					0.172	0.633	0.240
Days to first male flower	P						0.826*	–0.124
	G						0.912	–0.365
Days to first female flower	P							–0.181
	G							–0.704

P = Phenotypic, G = Genotypic, *Significant at 5% level

Table 3. Estimates of direct and indirect effects at the phenotypic (P) and genotypic (G) levels

Character		Number of fruits per plant	Fruit weight	Fruit length	Fruit diameter	Vine length	Days to first male flower	Days to first female flower	Correlation with fruit yield
Number of fruits/plant	P	0.572	–0.113	0.000	0.001	0.005	0.002	0.000	0.467*
	G	0.439	0.477	–0.045	–0.131	–0.002	–0.043	–0.039	0.656
Fruit weight	P	–0.073	0.883	0.000	–0.005	–0.009	–0.003	0.006	0.799*
	G	0.132	0.953	–0.022	–0.812	0.006	0.184	–0.172	0.909
Fruit length	P	–0.029	0.349	0.000	0.000	–0.004	0.000	0.002	0.317*
	G	0.173	0.308	–0.115	0.086	0.001	–0.072	–0.049	0.407
Fruit diameter	P	–0.057	0.725	0.000	–0.007	–0.006	–0.004	0.007	0.658*
	G	0.068	0.824	0.012	–0.848	0.008	0.230	–0.177	0.817
Vine length	P	–0.077	0.217	0.000	–0.001	–0.037	–0.004	0.007	0.105
	G	–0.049	0.639	–0.011	–0.439	0.015	–0.066	0.152	0.241
Days to first male flower	P	0.064	–0.187	0.000	0.002	0.009	0.016	–0.028	–0.124
	G	0.049	–0.759	–0.022	0.507	0.003	–0.385	0.243	–0.364
Days to first female flower	P	–0.007	–0.162	0.000	0.001	0.007	0.013	–0.034	–0.182
	G	–0.072	–0.141	0.023	0.627	0.010	–0.390	0.240	–0.703

Figures in bold letters denote direct effects and the remaining indirect effects
Phenotypic residual effect = 0.0323
Genotypic residual effect = 0.0212

did not show any significant association with fruit yield. Fruit weight exhibited positive and significant correlation with fruit length and fruit diameter besides fruit yield which meant that by

increasing fruit weight and fruit number, fruit yield can be increased. Days taken to first male and female flower appearance were highly correlated with each other but did not show any association with fruit yield.

The results of the phenotypic path coefficient analysis in the form of direct and indirect effects on fruit yield are presented in Table 3. The value of residual effect after deducting the direct and indirect effects was fairly low (0.0323). Fruit weight followed by number of fruits per plant contributed maximum positive direct effect on fruit yield. These characters were having significant and positive correlation with fruit yield and hence can be selected directly for improving yield. Among the other characters, fruit length and fruit diameter also exhibited significant and positive correlation with fruit yield but this correlation was entirely through fruit weight. The association of vine length with fruit yield was positive but its direct effect was negligible and the positive indirect effect was again through fruit weight which meant that increase in vine length may increase the fruit weight and ultimately the fruit yield. Similarly, the remaining two characters, days to first male and female flower were negatively associated with fruit yield but this association was further through fruit weight, meaning thereby that decrease in days taken to first male and female flower appearance may increase the yield via increased fruit weight.

From the estimates of correlation coefficients and direct and indirect effects of the yield contributing characters, it is clear that for bringing out desired improvement towards fruit yield in ash gourd, fruit weight and number of fruits per plant should be used as direct selection parameters.

ACKNOWLEDGEMENTS

Thanks to Dr. Major Singh, IIVR, Varanasi for his help in statistical analysis of the data and to Dr. T. S. Verma, Head, IARI, Regional Station, Katrain, for help in preparing the manuscript.

REFERENCE

Hamid, M. M., M.C. Soma, R.A. Begum and S.M.N. Hussain. 1989. Physio-morphology and yield of different ash gourd (*Benincasa hispida* Cogn.) lines. *Bangladesh J. Agric.* 14(1): 51-55.

Ramesh, M., V. Gaythri, A. Rao and C.S. Rao. Iggg. pharmological actions of fruit juice of *Benincasa hispida. Fitoleropia* **60**(3): 241-247.

Randhawa, K.S., Mohan Singh, S.K. Arora and P. Singh. 1983. Varietal variation in physical characters and chemical constituents of ashgourd fruits. *J. Res. PAU* **20**(3): 251-254.

Satpute, A.D. 1989. Ayurveda's contribution to sports medicine. *Ancient Sci. Life* **8** : 230-234.