Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8130

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2020) *8*(3), 248-254

Research Article

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Correlation and Path Analysis of the Yield Contributing Characters of Different Ash Gourd [(*Benincasa hispida* (Thunb.) Cogn.] Germplasm

Kalyani Pradhan[1*], Alok Nandi[2], Swarnalata Das[3], Gouri Shankar Sahu[3] and Sandeep Rout[4]

[1]Department of Horticulture, M.S. Swaminathan School of Agriculture,

[4]Department of Agronomy and Agroforestry,

Centurion University of Technology and Management, Paralakhemundi, Odisha-761211, India

[2]Institute of Agricultural Sciences, Siksha O Anusandhan University, Bhubaneswar, Odisha-751003, India

[3]Department of Vegetable Science, College of Agriculture,

Odisha University of Agriculture and Technology, Bhubaneswar, Odisha-751003, India

*Corresponding Author E-mail: kalyanipradhan1@gmail.com

Received: 2.05.2020 | Revised: 6.06.2020 | Accepted: 10.06.2020

ABSTRACT

The objectives of the present study were to evaluate the associations between yield and yield contributing traits and identify the direct and indirect effects of component traits on fruit yield of ash gourd to enable selection of promising lines. Observations were recorded for two seasons (rainy seasons of 2015 and 2016) on 18 ash gourd genotypes (local landraces and released varieties). Correlation coefficients indicated that yield per vine had significant and positive association with number of branches per vine (0.318,0.137) , number of female flowers per vine (0.078, 0.565) , sex ratio (0.579, 0.322), fruit length (0.604, 0.463), fruit diameter (0.743, 0.565), average fruit weight (0.830, 0.758), number of seeds per fruit(0.387,0.286) , weight of seeds per fruit (0.635, 0.478) and vine length (0.395, 0.340). Negative associations were noticed with node to 1st female flower (-0.279, -0.280) and days to 1st fruit setting (-0.465, -0.189). Number of fruits per vine (0.108) was positively associated with yield per vine at phenotypic level only. Path coefficient analysis revealed that number of female flowers per vine (6.221), vine length (5.727), fruit diameter (5.201), fruit length (0.647), days to 1st fruit setting (3.455), number of branches per vine (1.300) and weight of seeds per fruit (0.892) directly contributed to the yield of ash gourd.

Keywords: *Ash gourd, Benincasa, Correlation, Drought tolerant, Path coefficient.*

INTRODUCTION

Ash gourd [*Benincasa hispida* Thunb. Cogn.] is an important vegetable mainly valued for its long storage life and good scope for value addition. The fruits are consumed as baked, fried, boiled, pickled, candied/preserved (Robinson & Decker-Walters, 1997). World famous confectionery locally known as Petha is prepared using ripe flesh of ash gourd in sugar syrup.

Cite this article: Pradhan, K., Nandi, A., Das, S., Sahu, G.S., & Rout, S. (2020). Correlation and Path Analysis of the Yield Contributing Characters of Different Ash Gourd [(*Benincasa hispida* (Thunb.) Cogn.] Germplasm, *Ind. J. Pure App. Biosci. 8*(3), 248-254. doi: http://dx.doi.org/10.18782/2582-2845.8130

Ash gourd is also valued for its medicinal attributes especially in Ayurveda for the cure of peptic ulcer and the fruit juice is used for treating a range of ailments including insanity and epilepsy. It can also prevent kidney damage (Pandey, 2008). The methanolic extract of the fruit is reported to possess anti-ulcer (Grover et al., 2001), anti-inflammatory (Chandrababu & Umamaheshwari, 2002), antihistaminic and antidepressant activities (Kumar & Ramu, 2002). Fruits of *Benincasa hispida* are used in folk medicine for treatment of nervousness and debility (Nadhiya et al., 2014). Its fruits contain a relatively high level of K and low Na and from the index of nutritional value, it has been adjudged as a quality vegetable (Pandey, 2008).

Ash gourd crop has also been found to be drought (Pagare et al., 2011) and salt tolerant (Chauhan, 2010). Drought (dehydration) tolerant plants are able to withstand dehydration due to osmotic adjustment (Morgan, 1984). Due to limited availability of arable land and high market demand for off-season vegetables, cucurbits (plants in the family Cucurbitaceae) are continuously cultivated under unfavorable conditions in some countries. These conditions include environments that are too cold, wet, or dry, or are cool low-light winter greenhouses (Pandey et al., 2015). Fruits of *Benincasa hispida* are used in folk medicine for treatment of nervousness and debility (Nadhiya et al., 2014).

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 India. There is an imperative need to select an ideal plant type having maximum desirable traits to meet the growing demand.

Yield is a complex and polygenically controlled character and is highly influenced by environmental factors. The analysis of various yield contributing traits and their interrelationships can be of immense help for a need based crop improvement programme, especially in selecting desirable genotypes for high yield. A study of correlation between yield and its components and their relative contribution to yield have a great importance in planning effective breeding programmes and selection of suitable plant types. Correlation also provides information on the nature and extent of relationship between all pairs of characters.

When more characters are included in a correlation study, the indirect associations become complex. Path coefficient analysis is an important tool for the better understanding of the crop inheritance in respect of yield. It provides an effective means of partitioning the correlation coefficients into direct and indirect effects of the component characters on yield. Selection on the basis of direct and indirect effects is much more effective and useful than selection for yield *per se*. Considering the above factors, the present study was undertaken to improve fruit yield of ash gourd using correlation and path analysis in respect of yield and yield contributing traits of 18 ash gourd genotypes(local landraces and released varieties).

MATERIALS AND METHODS

The field experiments were carried out during the rainy seasons of 2015 and 2016, at All India Coordinated Research Project on Vegetable Crops, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India. The experiment comprised of 18 genotypes of ash gourd viz., BAGS-1,BAGS-2, BAGS-3,BAGS-4, BAGS-5, BAGS-6, BAGS-7, BAGS-8, BAGS-9, BAGS-10, BAGS-11(local landraces),Kashi Dhawal, Kashi Ujwal, Kashi Surbhi, Pusa Ujwal, Pusa Urmi, Pusa Sabji Petha and Pusa Shreyali. The experiment was laid out in the Randomized Block Design with three replications.

Each genotype was sown in hills, in each plot measuring 3mx3m and accommodating 5 plants /hill. All the recommended cultural practices were adopted to raise a healthy crop. Observations were recorded on 13 quantitative traits of 5 random plants of each genotype per plot. Data were recorded with respect to the characters viz., number of branches per plant, node to 1st female flower, number of female flowers /plant, sex ratio, days to 1st fruit setting, number of fruits/plant, fruit length (cm), fruit diameter (cm), average fruit weight (g), number of seeds /fruit, weight of seeds/fruit (g), vine length(cm) and yield per plant (g). The data were subjected to statistical and biometrical analysis according to the methods suggested by Singh and Chaudhary (1985).Correlation and path coefficient analyses were worked out according to the methods described by Johnson et al. (1955) and Dewey & Lu (1959) respectively.

RESULTS AND DISCUSSION

Genotypic and phenotypic correlations between yield per vine and its components

The genotypic and phenotypic associations with yield per vine and interrelationships of different traits are presented in table 1. in general, the genotypic correlation values were numerically higher than phenotypic values. Yield per vine was positively correlated with number of branches per vine (0.318, 0.137), number of female flowers per plant (0.078, 0.154), sex ratio(0.579, 0.322), fruit length (0.604, 0.463), fruit diameter (0.743, 0.565), average fruit weight (0.830, 0.758), number of seeds per fruit (0.387,0.286), weight of seeds per fruit (0.635, 0.478) and vine length (0.395, 0.340) while it recorded negative association at both levels for days to 1st fruit setting and node to 1st female flower while for number of fruits per vine it was at genotypic level alone.

The present study revealed that the traits *viz.*, number of branches per plant, number of female flowers per vine, sex ratio, fruit length, fruit diameter, average fruit weight, number of seeds per fruit, weight of seeds per fruit and vine length exhibited high positive association with fruit yield at genotypic and phenotypic levels respectively.

Weight of seeds/fruit showed significant positive associations with sex ratio and days to 1st fruit setting (at genotypic level) and with fruit length, fruit diameter, average fruit weight and number of seeds/fruit at both the levels. Number of seeds/fruit had significant positive associations with days to 1st fruit setting and average fruit weight (at genotypic level) and with fruit length and fruit diameter at both the levels. Average fruit weight exhibited significant positive correlation with sex ratio (at genotypic level) and with fruit length and fruit diameter at both the levels. Sex ratio showed significant positive association with fruit length, fruit diameter and fruits/vine at genotypic level. Fruit length and diameter had significant positive association at both levels. Number of female flowers/vine showed significant positive association with sex ratio at genotypic level.

Node to 1st female flower exhibited significant negative correlation with sex ratio, number of fruits/ vine and average fruit weight at genotypic level. Again, number of fruits/vine had significant negative association with fruit length and vine length at genotypic level.

Cause and effect relationships: Upon the assessment of apparent relationships between yield and yield components, it was felt necessary to partition the direct and indirect effects of each character on yield to understand the association more realistically**.** In order to fulfill the requirement, path coefficient analysis was undertaken and the direct and indirect effects of different characters on yield per vine in ash gourd are presented in Table 2.

Direct effects: Number of female flowers per plant (6.221), vine length (5.727), fruit

diameter (5.201), days to 1st fruit setting (3.455), number of branches/plant(1.300), weight of seeds per fruit (0.892) and fruit length (0.647) exhibited positive direct effects on yield, whereas negative directs effect were observed for number of seeds per fruit (-6.249), node to 1st female flower (-4.580), number of fruits per plant (-3.422), average fruit weight (-3.530) and sex ratio (-1.797).

Indirect effects: Sex ratio and number of fruits per plant exerted high positive indirect effects through number of female flowers per plant. Days to 1st fruit setting had high positive indirect effect through sex ratio. Sex ratio, fruit length, average fruit weight, number of seeds /fruit and weight of seeds /fruit exerted high positive indirect effects through fruit diameter. Number of fruits/vine, number of seeds /fruit and weight of seeds/fruit had good indirect positive effect through days to 1st fruit setting. Number of branches/vine and node to 1st female flower had good indirect positive effect through vine length. Sex ratio, number of fruits/vine and average fruit weight exerted good indirect positive effect through node to 1st female flower.

Positive correlations of fruit length with fruit diameter, average fruit weight and yield were in agreement with the findings of Singh et al. (1987) in parwal and Prasad and Singh (1992) in cucumber. Sex ratio exhibited positive correlation with fruit yield. Similar finding was reported in cucumber by Prasunna and Rao (1989).

The present investigation revealed that fruit diameter was positively correlated with average fruit weight and yield. Salk (1982) working on melons also reported strong positive correlation between fruit diameter and average fruit weight**.** Parkash et al. (2000) in ash gourd and Bhave et al. (2003) in bitter gourd confirmed the association of fruit diameter with yield.

The traits viz., number of branches per plant, number of female flowers per vine, sex ratio, fruit length, fruit diameter, average fruit weight, number of seeds per fruit, weight of seeds per fruit and vine length exhibited high positive association with fruit yield at genotypic and phenotypic levels. Hence, during selection, care should be taken to give more emphasis on these traits for realizing the highest fruit yield. Such positive association was quoted by several researchers (Yadav et al., 2007; Resmi & Sreelathakumary, 2012; Dewan et al., 2014).

The negative correlation between fruits per plant and yield was supported by the findings of Priya (2001) in watermelon and Lovely (2001) in ash gourd. Fruits per vine also had negative correlation with average fruit weight. This gives a clear indication that increase in number of fruits per vine would affect the fruit yield. Similar results had been reported by Salk (1982) in melons as well as Resmi and Sreelathakumary (2012) in ash gourd.

In the present study, high direct contribution of number of female flowers per plant to yield is in conformity with the findings of Hawlader et al. (1999).Days to 1st fruit setting exerted high positive direct effect on fruit yield which corroborates the observation of Narayan (1996).Negative correlation of fruits per plant with yield was due to high negative indirect effect through fruit length, while in node to first female flower, negative correlation was through high negative indirect effects of sex ratio, fruits/vine and average fruit weight. This is in conformity with the findings of Rakhi (2001) in melon and Pandey et al. (2003) in snap melon.

Table 1: Genotypic and phenotypic correlation co-efficients (r_g and r_p) between all pairs of 13 characters of genotypes in Aash Gourd

Character		Number of branches/ vine	Node to 1st female flower	Number of female flowers /vine	Sex ratio	Days to 1st fruit setting	Number of fruits/ vine	Fruit length (cm)	Fruit diameter (cm)	Average fruit weight (g)	Number of seeds /fruit	Weight of seeds/ fruit(g)	Vine length (cm)	Yield/ vine (g)
Number of branches/ vine	**G**	1.000	-0.185	-0.246	0.439	-0.194	0.621	-0.437	-0.022	-0.059	-0.168	-0.078	0.436	0.318
	P	1.000	-0.140	-0.175	0.048	-0.114	0.130	-0.344	-0.163	-0.085	-0.089	-0.029	0.389	0.137
Node to 1st female flower	**G**		1.000	-0.116	-0.622**	-0.042	-0.540*	-0.238	-0.418	-0.531*	-0.113	-0.295	0.429	-0.279
	P		1.000	-0.221	0.109	-0.002	-0.104	-0.223	-0.261	-0.338	-0.026	-0.170	-0.026	-0.280
Number of female flowers /vine	**G**			1.000	0.694 **	-0.054	0.609**	0.074	0.233	0.152	0.025	0.053	-0.305	0.078
	P			1.000	0.051	-0.082	-0.000	0.125	0.358	0.236	-0.000	0.114	-0.218	0.154
Sex ratio	**G**				1.000	-0.544**	0.708 **	0.940**	0.499*	0.845**	0.182	0.786**	0.164	0.579*
	P				1.000	-0.084	-0.027	0.255	0.231	0.235	0.113	0.169	-0.047	0.322
Days to 1st fruit setting	**G**					1.000	0.733 **	0.329	0.143	-0.192	0.625**	0.635**	-0.589*	-0.465
	P					1.000	0.022	0.022	-0.134	-0.114	0.334	0.183	-0.383	-0.189
Number of fruits/vine	**G**						1.000	-0.520*	-0.298	-0.141	-0.121	-0.171	-0.502*	-0.395
	P						1.000	-0.154	-0.095	0.041	-0.057	-0.042	-0.052	0.108
Fruit length (cm)	**G**							1.000	0.835**	0.913**	0.580*	0.779**	-0.078	0.604**
	P							1.000	0.804 **	0.726 **	0.526 *	0.742 **	-0.001	0.463
Fruit diameter (cm)	**G**								1.000	0.842**	0.730**	0.808**	0.042	0.743**
	P								1.000	0.663 **	0.574 *	0.728 **	0.035	0.565*
Average fruit weight (g)	**G**									1.000	0.469*	0.804**	0.312	0.830**
	P									1.000	0.375	0.585 *	0.203	0.758**
Number of seeds /fruit	**G**										1.000	0.948**	0.100	0.387
	P										1.000	0.839 **	0.059	0.286
Weight of seed/fruit (g)	**G**											1.000	0.149	0.635**
	P											1.000	0.222	0.478*
Vine length (cm)	**G**												1.000	0.395
	P												1.000	0.340
Yield/ Vine (g)	**G**													1.000
	P													1.000

Table 2: Estimates of direct (diagonal) and indirect effects of component characters on fruit yield of genotypes in Ash Gourd

Character	Number of branches/vine	Node to 1st female flower	Number of female flowers /vine	Sex ratio	Days to 1st fruit setting	Number of fruits/ vine	Fruit length (cm)	Fruit diameter (cm)	Average fruit weight (g)	Number of seeds /fruit	Weight of seeds/ fruit (g)	Vine length (cm)
Number of branches/vine	**1.300**	0.849	-1.530	-0.789	-0.671	-2.126	-0.283	-0.116	0.207	1.052	-0.069	2.495
Node to 1st female flower	-0.241	**-4.580**	-0.722	1.117	-0.146	1.848	-0.154	-2.176	1.874	0.708	-0.263	2.457
Number of female flowers /vine	-0.320	0.532	**6.221**	-2.953	-0.186	-2.083	0.048	1.213	-0.537	-0.156	0.047	-1.747
Sex ratio	0.571	2.847	8.216	**-1.797**	-7.814	-5.557	0.608	9.484	-6.488	-1.135	0.701	0.942
Days to 1st fruit setting	-0.253	0.193	-0.335	4.063	**3.455**	-2.509	0.213	0.743	0.677	-3.904	0.566	-3.376
Number of fruits/vine	0.808	2.473	3.787	-2.918	2.533	**-3.422**	-0.337	-1.549	0.499	0.757	-0.153	-2.875
Fruit length(cm)	-0.568	1.091	0.462	-1.689	1.138	1.779	**0.647**	4.345	-3.224	-3.627	0.694	-0.444
Fruit diameter(cm)	-0.029	1.916	1.451	-3.276	0.494	1.019	0.541	**5.201**	-2.972	-4.562	0.720	0.241
Average fruit weight (g)	-0.076	2.432	0.947	-3.303	-0.663	0.484	0.591	4.379	**-3.530**	-2.933	0.717	1.784
Number of seeds /fruit	-0.219	0.519	0.155	-0.326	2.159	0.415	0.376	3.797	-1.657	**-6.249**	0.845	0.572
Weight of seeds/fruit(g)	-0.101	1.352	0.329	-1.413	2.194	0.586	0.504	4.202	-2.840	-5.925	**0.892**	0.855
Vine length(cm)	0.566	-1.965	-1.897	-0.295	-2.037	1.717	-0.050	0.219	-1.100	-0.624	0.133	**5.727**

Residual effect= 0.80900; Direct effects, diagonal elements; Indirect effects, off diagonal element

CONCLUSION

It may be concluded that the traits number of female flowers per plant, vine length, fruit diameter, number of branches/plant, weight of seeds per fruit and fruit length of ash gourd may be relied upon for selecting high yielding genotypes of the crop. Node to 1st female flower is a dependable character for selecting early fruiting lines of ash gourd.

Acknowledgements

The authors acknowledge with thanks the facilities and funds provided by the All India Coordinated Research Project on Vegetable Crops, Odisha University of Agriculture and Technology, Bhubaneswar, India, as well as the Indian Institute of Vegetable Research (I.C.A.R.), Varanasi, India, for the seeds of ash gourd varieties. Thanks are also due to the

Indian Agricultural Research Institute (I.C.A.R.), New Delhi, India, for providing the seeds of ash gourd varieties.

REFERENCES

Bhave, S. G., Bendale, V.M., Pethe, U.B., Berde, S.A., & Mehta, J.L. (2003). Correlation and path analysis in segregating generations of bittergourd. *Journal of Soils and Crops 13*, 33-40.

Chandrababu, S, Umamaheshwari S. (2002). Studies on the antiinflammatory activity of fruit rind extract of *Benincasa hispida* Cogn. *Indian Drugs 39*(12), 651-653.

Chauhan, S. K. (2010). Summer cucurbits grown under saline water irrigation in semi-arid areas.*Bharatiya Krishi Anusandhan Patrika 25*(2-4), 131-133.

Dewan, M.M.R., Mondal, S., Islam, M.S., Mukul, M.H.R., & Hossen, M.A. (2014). Study on correlation and path analysis of the yield contributing characters of different ash gourd accessions. *Eco-friendly Agriculture Journal 7*(01), 01-05.

Dewey, D. R., & Lu, K.H. (1959). A correlation and path coefficient analysis components of crested wheat grass seed production. *Agronomy Journal 51*, 515-518.

Grover, JK, Adiga, G, Vats, V, & Rathi, SS. (2001). Extracts of *Benincasa hispida* prevent development of experimental ulcers, *Journal of Ethnopharmacology 78*, 159-164.

Hawlader, M.S.H., Haque, M.M, & Islam, M.S. (1999). Variability,correlation and path analysis in bottle gourd.*Bangladesh Journal of Scientific and Industrial Research 34*(1), 50-54.

Johnson, H. W., Robinson, H. F., & Comstock, R. E. (1955). Estimation of genetic and environmental variability in soybeans. *Agronomy Journal 47*, 314-318.

Kumar, D. A., & Ramu, P. (2002). Effect of methanolic extract of *Benincasa hispida* against histamine and acetylcholine induced bronchospasm in guinea pigs. *Indian Journal of Pharmacology 34*, 365-366.

Lovely, B. (2001). Evaluation of genetic divergence in ash gourd. M.Sc. (Ag.) Thesis, Kerala Agricultural University, Thrissur, 76 p.

Morgan, J M. (1984). Osmoregulation and water stress in higher plants. *Annual Review of Plant Physiology 35*, 299–319.

Nadhiya, K., Haripriya, D., & Vijayalakshmi, K. (2014). Pharmacognostic and preliminary phytochemical analysis on *Benincasa hispida* fruit. *Asian Journal of Pharmaceutical and Clinical Research 7*(1), 98-101.

Narayan, R., Singh, S. P., Sharma, D. K., Rastogi, K. B. (1996). Genetic variability and selection parameters in bottlegourd.*Indian Journal of Horticulture 53*(1), 53-58.

Pagare, M. S., Patil, L., Kadam, V.J. (2011). *Benincasa hispida*-A natural medicine. *Research Journal of Pharmacy and Technology 4*(12), 1941-1944.

Pandey S., Rai, M., Ram, D., Singh, B., & Chaubey, P.K. (2003). Component analysis in Snapmelon (Cucumis melo var. momordica), *vegetable science*, *30*(1), 64-67.

Pandey, A. K., Bhardwaj, D. R., Dubey, R. K., Singh, V., Pandey, S. (2015). Botany, diversity, utilization and improvement of ash gourd (*Benincasa hispida* Thunb. Ex Murray Cogn)- A review. *Annals of Horticulture 8*(1), 1-15.

Pandey, A. K. (2008). Underutilized vegetable crops. (1st ed.). Delhi, India: Satish Serial Publishing House.

Parkash, C., Singh, K. P., & Kalloo, G. (2000). Variability analysis and cause and effect relationship in ashgourd (*Benincasa hispida* (Thunb.) Cogn.). *Indian Journal of Plant Genetic Resources 13*, 298-301.

Prasad, V. S. R. K., & Singh, D P. (1992). Estimates of heritability, genetic advance and association between yield and its components in cucumber (*Cucumis sativus* L.). *Indian Journal of Horticulture 49*, 62-69.

Prasunna, M. N., Rao, M. R. (1989). Correlation studies and path coefficient analysis in the segregating population of cucumber. *South Indian Horticulture 37*, 212-214.

Priya, S. S. (2001). Evaluation of watermelon (*Citrullus lanatus* (Thunb.) Matsum and Nakai) genotypes for yield and quality. M.Sc. (Hort.) thesis, Tamil nadu Agricultural University, Coimbatore, 104 p.

Rakhi. (2001). Underutilised and Underexploited Horticultural Crops, K. V. PETER. Kerala Agriculture University, Thrissur. New Delhi, New India Publishing Agency. *1*, 238

Resmi, J., & Sreelathakumary, I. (2012). Character association and path coefficient studies in ash gourd (*Benincasa hispida* (Thunb.) Cogn.). *Agricultural Science Digest 32*(3), 251 – 255.

Robinson, R. W., & Decker-Walters, D. S. (1997). Cucurbits. (2nd ed.). Cambridge: CABI Publishing.

Salk, A.1982. Studies of correlation of some characters associated with yield in melons. *Ege-University-Ziraat-Fatultesi-Dergisi 19*, 19-26.

Singh, R.K., & Chaudhury, B.D. (1985). Biometrical Methods of Quantitative Genetic Analysis. *Harayana J. Hort. Sci*., *12*(2), 151-156.

Singh, R. R., Mishra, G. M., Jha, R. N. (1987). Inter relationship between yield and its components in parwal. *South Indian Horticulture 35*, 245-246.

Yadav, A., Srivastava, J. P., Yadav, J. R., Shukla, I. N., Mishra, G., Kumar, S., & Parihar, N. S. (2007). Correlation and path coefficient analysis in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. *Progressive Research 2*(1/2), 165-166.