

GENETIC VARIABILITY AND VARIETAL PERFORMANCE IN ASH GOURD [*Benincasa hispida* (Thunb) Cogn.] GENOTYPES

KALYANI PRADHAN¹, ALOK NANDI², SWARNALATA DAS², GOURI SHANKAR SAHU¹, SUBRATA SARKAR² AND ANJANA PATNAIK²

¹Department of Vegetable Science, ²All India Coordinated Research Project on Vegetable Crops
Orissa University of Agriculture and Technology, Bhubaneswar-751003

e-mail: kalyanipradhan1@gmail.com

KEYWORDS

Variability
Ash gourd
Heritability
genotypes.

Received on :
05.04.2018

Accepted on :
14.07.2018

***Corresponding
author**

ABSTRACT

An experiment was conducted at All India Coordinated Research Project on Vegetable Crops, Orissa University of Agriculture and Technology, Bhubaneswar in two seasons viz. *kharif*, 2015 and *kharif*, 2016, with the objective to find out suitable ash gourd genotypes for earliness and high yield under Odisha conditions out of 18 ash gourd genotypes (11 landraces collected from different districts of Odisha and 7 released varieties). Results revealed that in respect of fruit yield, the genotype Kashi Surbhi (10134.686 g/plant) was the best followed by Kashi Dhawal (7678.655 g/plant), Pusa Sabji Petha (6626.995 g/plant), Pusa Urmi (6376.530 g/plant) and BAGS-8 (6124.365 g/plant). Kashi Surbhi was also the earliest in respect of fruit setting while BAGS-2 was noted for highest number of female flowers per plant (39.50). The genotype BAGS-1 recorded the maximum number of fruits per plant (4.965) while fruit weight was highest in Kashi Dhawal. BAGS-7 produced maximum number and weight of seeds per fruit. The characters number of seeds/fruit and weight of seeds/fruit having high GCV, heritability and GA(%) are under the influence of additive gene action. It may be concluded that the genotypes Kashi Surbhi and Kashi Dhawal can be recommended for cultivation in Odisha.

INTRODUCTION

Ash gourd [*Benincasa hispida* (Thunb) Cogn.] is a cucurbitaceous vegetable crop grown under wide agro-climatic conditions both for mature and immature fruits. It is believed to have originated in India. It is preferred among the growers and consumers because of long shelf life under ambient conditions, good portability and appreciably good nutritive value. Ash gourd has wide use in confectionary and ayurvedic medicinal preparations. 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 select an ideal plant type having maximum desirable traits including high productivity in order to meet the growing demand. Indo-China region being a centre of diversity is endowed with great variability in terms of morphological characters especially, growth habit, maturity including shape, size and flesh thickness of fruits (Rubatzky and Yamaguchi 1997). Rind and seeds of a gourd discovered at the Kana site in Papua New Guinea are identified as remains of *Benincasa hispida*; therefore, it may be possibly domesticated at the Kana site (Matthew, 2003). In India, a wide range of variability is available for different component characters in ash gourd (Mandal *et al.*, 2002) but very sporadic efforts have been made for its genetic improvement. The fact that almost no hybrid is under cultivation reflects the negligence of crop improvement in ash gourd. Considering the potentiality of this crop, there is a need to develop varieties suitable for

cultivation under specific agro-ecological conditions. A thorough knowledge regarding the amount of genetic variability existing for various characters is essential for initiating the crop improvement programme. With limited variability, much improvement cannot be achieved, hence, the breeders will have to enrich the germplasm or they can resort to creation of greater variability through hybridization, mutation and polyploidy breeding. Development of productive and potentially ideal type is the main aim of any crop improvement programme. It is also necessary to become familiar with the detailed genetic structure of germplasm material to be used in hybrid breeding. Such studies are also useful in selection of parents for hybridization to recover superior transgressive segregants. Since such studies are very meagre particularly under Odisha conditions, the present investigation was carried out with a set of varieties and landraces of ash gourd.

MATERIALS AND METHODS

The study was carried out during the *kharif* seasons of 2015 and 2016, at All India coordinated Research Project on Vegetable crops, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha. 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, Kashi Dhawal, Kashi Ujwal, Kashi Surbhi, Pusa Ujwal, Pusa Urmi, Pusa Sabji Petha and Pusa Shreyali.

Each genotype was sown in hills in each plot measuring 3m x 3m and accommodating 5 plants /hill. Observations were recorded on 13 quantitative traits on 5 plants of each genotype per plot. The experiment was laid out in the Randomized Block Design with three replications. 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., 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 girth (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).

RESULTS AND DISCUSSION

Analysis of variance for all the characters under study showed significant variations among the genotypes (Table 1). A perusal of Table 2 shows that the Genotypic and Phenotypic variances were highest for fruit yield /plant followed by average fruit weight and number of seeds per fruit. Phenotypic co-efficient of variation (PCV) and Genotypic co-efficient of variation (GCV) were maximum in case of sex ratio followed by yield per plant and weight of seeds/fruit (Table 3). Closeness was observed

between the values of phenotypic coefficients of variation (PCV) and genotypic coefficients of variation (GCV) in case of the characters fruit length, fruit girth, number of seeds per fruit and weight of seeds per fruit, thereby showing that these traits were less influenced by the environment and there was a highly significant effect of genotype on phenotypic expression. This is in conformity with the findings of Rahman *et al.* (1986), Singh and Kumar (2002), Munshi and Acharyya (2005), Gayen and Hossain (2006) and Pandit *et al.* (2009). Heritability (bs) was highest for number of seeds /fruit followed by weight of seeds/fruit and fruit length. Genetic advance (% of mean) was found to be maximum in case of average fruit weight followed by yield/plant and number of seeds /fruit.

The characters yield/plant, weight of seeds/fruit, number of seeds /fruit and average fruit weight had high genotypic coefficient of variation (GCV), heritability and genetic advance (% mean). It indicates that the abovementioned traits are under the influence of additive gene action and selection may effectively be based on these characters as their phenotypic expression would give good indication of their genotypic potential. High genotypic coefficient of variation (GCV), high heritability and genetic advance for yield per plant and fruit weight were reported by Kanimozhi *et al.* (2015). Similar results were also reported by the researchers Rahman *et al.* (1986), Singh and Kumar (2002), Gayen and Hossain

Table 1: Analysis of variance (mean squares) for various biometrical traits in ashgourd

| Sl no. | Character df | Replication (2) | Mean sum of square Treatment (17) | Error (34) |
|--------|---------------------------------|--------------------|---|---------------|
| 1 | Number of branches/plant | 0.326 | 0.341 | 0.104 |
| 2 | Node to 1st female flower | 0.172 | 16.933** | 8.629 |
| 3 | Number of female flowers /plant | 91.84 | 46.959** | 10.825 |
| 4 | Sex ratio | 0.005 | 0.003 | 0.002 |
| 5 | Days to 1st fruit setting | 0.562 | 7.415** | 3.503 |
| 6 | Number of fruits/plant | 0.35 | 0.617 | 0.466 |
| 7 | Fruit length (cm) | 1.738 | 13.779** | 1.44 |
| 8 | Fruit girth (cm) | 3.174 | 3.877 ** | 0.832 |
| 9 | Average fruit weight (g) | 255404.4 | 864865.875** | 105855.3 |
| 10 | Number of seeds /fruit | 3436.5 | 43070.765** | 1589 |
| 11 | Weight of seeds/fruit (g) | 19.053 | 147.793** | 14.255 |
| 12 | Vine length (cm) | 10165.11 | 23196.646** | 5550.229 |
| 13 | Yield/plant (g) | 3304299 | 7304561.00** | 1087331 |

** Significant at 1% level

Table 2: General mean, range, co-efficient of variation (C. V.), genotypic variance, phenotypic variance for 13 characters of genotypes in ashgourd

| Sl. No. | Characters | General mean | Range | C.V. (%) | Genotypic Variance | Phenotypic Variance |
|---------|---------------------------------|--------------|--------------------|-------------|-----------------------|------------------------|
| 1 | Number of branches/plant | 2.294 | 1.30-3.175 | 14.847 | 0.118 | 0.223 |
| 2 | Node to 1st female flower | 26.014 | 18.25-30.00 | 11.293 | 4.152 | 12.781 |
| 3 | Number of female flowers /plant | 31.375 | 20.75-39.50 | 10.486 | 18.067 | 28.893 |
| 4 | Sex ratio | 0.106 | 0.070-0.225 | 48.11 | 0 | 0.003 |
| 5 | Days to 1st fruit setting | 58.792 | 55.50-62.25 | 3.184 | 1.956 | 5.46 |
| 6 | Number of fruits/plant | 4.134 | 3.080-4.965 | 16.52 | 0.075 | 0.542 |
| 7 | Fruit length (cm) | 20.424 | 16.535-25.22 | 5.872 | 6.17 | 7.61 |
| 8 | Fruit girth (cm) | 15.731 | 13.925-18.080 | 5.797 | 1.523 | 2.355 |
| 9 | Average fruit weight (g) | 2289.765 | 1468.09-3400.68 | 14.209 | 379505.3 | 485360.6 |
| 10 | Number of seeds /fruit | 458.083 | 242.99-871.90 | 8.701 | 20740.88 | 22329.88 |
| 11 | Weight of seeds/fruit (g) | 25.806 | 14.585-44.505 | 14.632 | 66.769 | 81.024 |
| 12 | Vine length (cm) | 588.053 | 406.99-844.055 | 12.668 | 8823.209 | 14373.44 |
| 13 | Yield/plant (g) | 5055.527 | 2320.285-10134.686 | 20.625 | 3108615 | 4195946 |

Table 3: Genotypic co-efficient of variation (GCV), Phenotypic co-efficient of variation (PCV), Heritability (in broad sense) and Genetic advance (GA) for 13 characters of genotypes in ashgourd.

| Sl. No. | Character | Phenotypic co-efficient of variation(PCV) | Genotypic co-efficient of variation (GCV) | Heritability (in broad sense) (%) | GA Expressed in % of Mean |
|---------|---------------------------------|--|---|-----------------------------------|---------------------------|
| 1 | Number of branches/plant | 20.5956 | 15.0043 | 53.07 | 22.5177 |
| 2 | Node to 1st female flower | 13.7431 | 7.8328 | 32.48 | 9.1964 |
| 3 | Number of female flowers /plant | 17.132 | 13.5475 | 62.53 | 22.0687 |
| 4 | Sex ratio | 49.8142 | 13.1624 | 6.98 | 7.1645 |
| 5 | Days to 1st fruit setting | 3.9743 | 2.3788 | 35.82 | 2.933 |
| 6 | Number of fruits/plant | 17.8048 | 6.6444 | 13.93 | 5.1079 |
| 7 | Fruit length (cm) | 13.5066 | 12.1616 | 81.08 | 22.5581 |
| 8 | Fruit girth (cm) | 9.7548 | 7.8437 | 64.65 | 12.9923 |
| 9 | Average fruit weight (g) | 30.4258 | 26.9041 | 78.19 | 49.0074 |
| 10 | Number of seeds /fruit | 32.6211 | 31.439 | 92.88 | 62.4176 |
| 11 | Weight of seeds/fruit (g) | 34.8811 | 31.6643 | 82.41 | 59.2128 |
| 12 | Vine length (cm) | 20.3875 | 15.9734 | 61.39 | 25.7808 |
| 13 | Yield/plant (g) | 40.518 | 34.8752 | 74.09 | 61.8376 |

Table 4: Mean performances of yield and attributing characters of genotypes in ash gourd.

| Genotypes /Characters | Number of branches/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 girth(cm) | Average fruit weight (g) | Number of seeds /fruit | Weight of seeds /fruit(g) | Vine length(cm) | Yield /plant(g) |
|-----------------------|--------------------------|---------------------------|---------------------------------|-----------|---------------------------|-------------------------|-------------------|-----------------|--------------------------|------------------------|---------------------------|-----------------|-----------------|
| BAGS-1 | 2.25 | 26 | 36.75 | 0.11 | 58 | 4.965 | 17.645 | 14.39 | 1468.09 | 242.99 | 14.585 | 526.055 | 2320.285 |
| BAGS-2 | 2.275 | 29 | 39.5 | 0.105 | 59.5 | 4.915 | 17.835 | 14.76 | 1595.87 | 343.625 | 18.775 | 493.44 | 3165.5 |
| BAGS-3 | 1.9 | 23.75 | 38 | 0.105 | 59 | 4.59 | 21.21 | 16.66 | 2839.025 | 568.105 | 26.645 | 433.63 | 4733.3 |
| BAGS-4 | 2.515 | 23 | 27.75 | 0.09 | 58.5 | 3.94 | 18.11 | 14.895 | 1665.825 | 454.94 | 21.51 | 484.54 | 2759.08 |
| BAGS-5 | 3.175 | 26.5 | 22.75 | 0.07 | 59.25 | 4.205 | 16.905 | 14.08 | 1425.1 | 326.075 | 18.12 | 663.66 | 3484.725 |
| BAGS-6 | 2.125 | 28.75 | 20.75 | 0.07 | 58.75 | 4.615 | 20.325 | 15.375 | 1874.795 | 471.09 | 21.875 | 567.69 | 4476.85 |
| BAGS-7 | 2.075 | 28.75 | 31 | 0.11 | 63.5 | 4.025 | 23.025 | 16.755 | 2263.66 | 871.9 | 44.505 | 566.375 | 5168.405 |
| BAGS-8 | 2.505 | 26.5 | 35.75 | 0.095 | 58.75 | 3.59 | 16.535 | 14.93 | 1583.79 | 365.69 | 18.425 | 555.415 | 6124.365 |
| BAGS-9 | 1.85 | 25.75 | 30.5 | 0.1 | 56.25 | 3.25 | 19.055 | 14.61 | 1660.945 | 349.75 | 16.055 | 615.915 | 4053.865 |
| BAGS-10 | 2.93 | 29.25 | 31.75 | 0.105 | 57.25 | 3.425 | 20.42 | 16.55 | 2429.23 | 493.94 | 27.145 | 747.13 | 5063.94 |
| KASHI DHAWAL | 2.55 | 18.25 | 34.75 | 0.1 | 58.5 | 4.53 | 23.32 | 17.775 | 3400.685 | 477.755 | 32.21 | 679.875 | 7678.655 |
| KASHI UJWAL | 2.18 | 23.75 | 32.75 | 0.1 | 59.25 | 4.125 | 22.32 | 18.08 | 2612.015 | 711.86 | 40.96 | 651.09 | 6024.94 |
| KASHI SURBHI | 2.615 | 26.5 | 33 | 0.255 | 55.5 | 4.39 | 23.45 | 18.07 | 3381.965 | 487.565 | 32.105 | 598.855 | 10134.69 |
| PUSA UJJWAL | 2.305 | 26.25 | 29.25 | 0.1 | 60.25 | 4.38 | 20.285 | 14.52 | 2490.265 | 460.565 | 29.465 | 629.955 | 4454.33 |
| PUSA URMI | 2.365 | 28.25 | 28.25 | 0.1 | 56.5 | 4.45 | 17.82 | 13.925 | 2622.48 | 404.875 | 22.58 | 844.055 | 6376.53 |
| PUSA SABJI PETHA | 2.15 | 23.75 | 32.5 | 0.1 | 58.75 | 3.565 | 25.22 | 16.68 | 3282.3 | 474.005 | 36.52 | 591.05 | 6626.995 |
| PUSA SHREYALI | 1.3 | 30 | 31.25 | 0.095 | 58.5 | 3.08 | 23.52 | 16.37 | 2343.18 | 377.125 | 21.97 | 529.24 | 3484.73 |
| BAGS-11 | 2.23 | 24.25 | 28.5 | 0.105 | 62.25 | 4.365 | 20.63 | 14.74 | 2276.54 | 363.64 | 21.055 | 406.99 | 4868.285 |
| SEm (±) | 0.324 | 2.938 | 3.29 | 0.051 | 1.872 | 0.683 | 1.2 | 0.912 | 325.354 | 39.862 | 3.776 | 74.5 | 1042.752 |
| CD at 5 % | 0.683 | 6.198 | 6.942 | 0.108 | 3.949 | 1.441 | 2.532 | 1.925 | 686.453 | 84.104 | 7.966 | 157.185 | 2200.063 |

(2006), Yadav *et al.* (2008) and Sureja *et al.* (2010).

The mean values of different growth and yield parameters with respect to different genotypes are presented in Table 4. The genotypes significantly differed for number of branches per plant, node to first female flower, fruit length, fruit diameter, average fruit weight, number of fruits per plant, fruit yield/plant, number of seeds/fruit and weight of seeds/fruit.

Results revealed that in respect of fruit yield, the genotype Kashi Surbhi (10134.686 g/plant) was the best followed by Kashi Dhawal (7678.655 g/plant), Pusa Sabji Petha (6626.995 g/plant), Pusa Urmi (6376.530 g/plant) and BAGS-8 (6124.365 g/plant). Kashi Surbhi was also the earliest in respect of fruit setting. Fruit length and girth were highest in Pusa Sabji Petha and Kashi Ujwal respectively. while fruit weight was highest in Kashi Dhawal. Performance evaluation of the landraces revealed that BAGS-7, BAGS-8, BAGS-10 and BAGS-11 were promising for fruit yield. BAGS-7 recorded high yield along with maximum number and weight of seeds per fruit. The genotype BAGS-1 produced the maximum number of fruits per plant

(4.965) while BAGS-2 was noted for highest number of female flowers per plant (39.50).

On comparing the yield of 11 local land races of BAGS series with Pusa Ujjwal (National Check) which recorded an average yield of 4454.350 g/plant, it was observed that the landraces BAGS-3, BAGS-6, BAGS-7, BAGS-8, BAGS-10 and BAGS-11 had yield advantage of 6.26 %, 0.5 %, 29.72 %, 37.49 %, 13.68 % and 9.29 % respectively over Pusa Ujjwal (National Check).

It may be concluded that the variety Kashi Surbhi was the best in respect of yield and earliness while BAGS 8 was the highest yielder among the landraces. The genotypes Kashi Surbhi and Kashi Dhawal can be recommended for cultivation in Odisha.

ACKNOWLEDGEMENT

The authors acknowledge with thanks the facilities and funds provided by the All India Coordinated Research Project on Vegetable Crops, Orissa University of Agriculture and

Technology, Bhubaneswar, as well as the Indian Institute of Vegetable Research(I.C.A.R.), Varanasi, India.

REFERENCES

- Gayen, N. and Hossain, M.** 2006. Study of heritability and genetic advance in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. *J. Interacad.* **10(4)**: 463-466.
- Kanimozhi, R., Mohammed Yassin, G., Kumar, S. R., Kanthaswamy, V. and Thirumeni, S.** 2015. Genetic analysis in segregating generation of wax gourd. *International J. Veg. Sci.* **21(3)**: 281-296
- Mandal, J., Sirohi, P. S. and Behera, T. K.** 2002. Inheritance of fruit characters in ash gourd (*Benincasa hispida* (Thunb.) Cogn.). *Veg. Sci.* **29**: 113-15.
- Matthew, P. J.** 2003. Identification of *Benincasa hispida* (wax gourd) from the Kana archaeological site, Western Highlands Province, Papua Guinea. *Archaeol. Ocea.* **38**: 186-91.
- Munshi, R. and Acharyya, P.** 2005. Varietal evaluation in bottle gourd genotypes. *Indian Agric.* **49(3&4)**: 213-221.
- Pandit, M. K., Mahato, B. and Sarkar, A.** 2009. Genetic variability, heritability and genetic advance for some fruit character and yield in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. *Acta Horticulturae.* **809**: 221-225
- Rahman, A. K. M. M., Das, M. K. and Haque, M. M.** 1986. Variability, correlation and path analysis in bottle gourd (*Lagenaria vulgaris* L.). *Bangladesh J. Agric. Res.* **50(6)**: 483-489.
- Rubatzky, V. E. and Yamaguchi, M.** 1997. *WorldVegetables*. Chapman and Hall, New York, USA, p. 843 .
- Sharma, A. and S. K. Sengupta.** 2013. Genetic Diversity, Heritability and Morphological Characterization In Bottle Gourd [*Lagenaria Siceraria* (Mol.) Standl.]. *The Bioscan.* **8(4)**: 1461-1465
- Singh, D. K. and Kumar, R.** 2002. Studies on the genetic variability in bottle gourd. *Progressive Hort.* **34(1)**: 99-101.
- Singh, M. K., Bhardwaj, D. R. and Upadhyay, D. K.** 2014. Genetic architecture and association analysis in bitter gourd (*Momordica charantia* L.) land races. *The Bioscan.* **9(2)**: 707-711.
- Singh, R. K. and B. D. Chaudhury.** 1985. Biometrical method of quantitative genetic analysis. *Haryana J. Hort. Sci.* **12(2)**: 151-156.
- Sureja, A. K., Sirohi, P. S., Patel, P.S.V.B., Mahure and H. R.** 2010. Estimation of genetic parameters in ash gourd. *Indian J. Hort.* **67(4)**: 170 -173.
- Yadav, J. R., Yadav, A., Srivastava, J. P., Mishra, G., Parihar, N. S. and Singh, P. B.** 2008. Study on variability, heritability and genetic advance in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. *Progressive Res.* **3(1)**: 70 -72.