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STUDY OF GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE AMONG THE CHARACTERS OF BOTTLE GOURD

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Abstract

Studies on genetic variability, heritability and genetic advance were carried out among 52 genotypes of Bottle gourd for character to identify genotypes to be used in breeding programme. The result showed high phenotypic co-efficient of variation for trait like number of fruits per plot (PCV = 67.53) and high genotypic co-efficient of variation for trait like fruit yield per plant (GCV= 26.60). High heritability coupled with high genetic advance as per cent of mean observed for days of male flowering, days of female flowering, length of vine, number of branches/vine, fruit yield/plot, number of fruits per plot, fruit yield per plant (Kg). This indicated substantial of additive geneticvariance in expression of these characters and can be useful in hybridization and selection for higher pod yield.

***Keywords*:** Genetic Variability, Heritability, Genetic Advance and bottle gourd.

Introduction

Bottle gourd [*Lagenaria siceraria* (Mol.) standl.] is an important cucurbitaceous vegetable having wide range of use and is largely cultivated in the tropics and subtropics for its edible fruits. It is also known as is also known as Calabash or white flower gourd and Alabu in Sanskrit, Kaddu, Lauki and Tumari in Hindi, Sorkaya in Telugu, Shorakkai in Tamil, Sorekayi and Halagumbala in Kannada, Lau in Bengali and Assames and Ghiya in Punjab. Bottle gourd is one of the largest produce vegetables in the world. It has a diploid chromosome (2n=2x=22). It is widely grown South and Southeast Asia, China and Africa Bottle gourd is highly cross-pollinated crops due to its monoecious and and romonoecious nature. The amount of cross pollination ranges from 60 to 80 percent (Choudhary, 1987). Being cross-pollinated crops; it has widerange of variability for maturity, yield and fruit characters like shape and size. The fruit colour variesfrom dark green to cream or yellow. In India also demonstrated the significant regional variability (Sivarajand Pandravada, 2005). The available diversity within the species for desired fruit enables a breeder in choosing the most suitable combinations to use for exploitation of hybrid vigourin a given crop. Many of the quantitative traits such as number of fruits per plant and yield per plant are highly influenced by environmental conditions partitioning.

Material and Methods

The experiment was conducted at the Vegetable Research Farm Department of Vegetable Science, Kalyanpur, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur during Kharif season 2016. A set of 52 genotypes indigenous collections of bottle gourd was collected from Kanpur region. Row to row andplant to plant spacing was maintained at 3×0.5m. The crop was successfully raised by recommended agronomic practices during period ofcrop growth. Three plants selected at random per variety per replication avoiding border plants were tagged, which constituted the sample for observations. Observations were recorded on 52 different traits. Phenotypic and genotypic co-efficient of variation, heritability and genetic advance were estimated.

Coefficient of variability: It was denoted in percent as:

Genotypic coefficient of variability (G.C.V.) =

[Genotypic variance (σg)/X]x100

Phenotypic coefficient of variability (P.C.V.) = σ^2p/X]x100

Heritability (In broad Sense): It is calculated by the following formula as suggested by Hanson *et al*. (1956).

$h^2 = [\sigma^2g/\sigma^2p]$x100

Where,

h^2 = Heritability in board sense

σ^2g = Genotypic variance

σ^2p = Phenotypic variance

Genetic advance: It was calculated by following formula as suggested by Johnson *et al.* (1955).

GA = K× h^2×σph

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Where,

GA = Genetic advance

K = selection differential at 5% selection intensity *i.e.* = 2.06

h^2 = heritability value

σ ph = phenotypic standard deviation

Results and Discussion

The ANOVA revealed significant difference indicating that there are enough variations among all the germplasm for all parameters under the study.

Mean and range: The mean, range, standard error and critical difference of eight characters are presented in table 1, which indicated that days to first male flowering varied from 34.33 (BGL-6) to 53.00 (BGL-5). with mean as 40.44 days, days to first female flowering from 38.00 (BGL-6) to 57.00 (BGL-4) with mean as 48.57, length of vine from 6.06 (BGL-76) to 8.03 (BGL-13) with mean as 7.53, number of branches per plant 4.00 (BGL47) to 7.67 (KBGL-29) with mean as 6.06, number of nodes per vine 43.67 (BGL-47) to 54.67 (BGL-45) with mean as 50.01, fruit yield per plot (Kg) from 4.00 (BGL-2) to 12.73 (KBGL-29) with mean of 6.9, number of fruit per plot from 7.33 (BGL-45) to 38.67 (BGL-59) with mean of 10.92, fruit yield per plant (Kg) from 0.80 (BGL-2) to 2.55 (KBGL-29) with mean as 1.38.

Coefficient of variability

Phenotypic Coefficient of variability: In general, the PCV were higher than the respective GCV for all the traits indicating the role of environment for expression of the characters. The maximum amount of phenotypic coefficient of variance was observed for number of fruits per plot 67.53%, fruit yield per plant (Kg) 29.33%, fruit yield per plot (Kg) 29.17%, number of branches per vine 22.37%, days of first male flowering 7.76%, days of first female flowering 7.35%, length of vine 7.27%, number of nodes per vine 7.11%.

Genotypic coefficient of variability (GCV): The estimates of genotypic variance for all the traits are presented in the table 2. Wide range of genotypic coefficient of variability was observed. It is clear form table that maximum genotypic coefficient of variability was observed from fruit yield per plant (Kg) 26.68%, followed by fruit yield per plot (Kg) 26.49%, number of fruits per plot 18.14%, number of branches per vine 15.57%, days to first male flowering 7.46%, days to first female flowering 7.08%, number of nodes per vine 5.49%, length of vine 5.03%.

The maximum difference was found between PCV and GCV for number of fruits per plot and number of branches per vine showed the role of environment for expression of character while minimum differences for remaining characters showed the stability of the traits.

Estimates of heritability and genetic advance: The estimation of heritability in broad sense in percent and genetic advance at 5% selection intensity along with genetic advance in percent of mean is presented in table 3. High heritability estimates were observed for days to first female flowering 92.9% followed by days to first male flowering 92.5%, fruit yield per plot 82.5%, fruit yield per plant 82.2%, moderate heritability for number of nodes per vine 59.7%, number of branches per vine 48.4%, length of vine 47.9% and low heritability for number of fruits per plot 7.2%. Genetic advance at 5% selection intensity (K=2.06) was high for fruit yield per plant 50.00, fruit yield per plot 49.57, number of branches 22.39, days to male flowering 16.25, days to female flowering 14.06, number of fruits per plot 10.07, number of nodes per vine 8.74, length of vine 7.17, which indicated that ample scope of improvement per cycle of selection is possible for these characters.

The heritability in combination with intensity of selection and amount of variability present in the population, influence the gains to be obtained from selection (Burton, 1952). Thus, advance measures the difference between the mean genotypic values of the original populations from which these were selected (Jonson *et al*., 1955). Pointed out the without genetic advance the estimates of heritability would not be practical importance in selection based on phenotypic appearance. The genotypic coefficient of variation alone does not give any idea about the amount of heritable variation. The heritable variation can be obtained with the help of heritability estimates and genetic advance under selection. In the present investigation, heritability was estimated based on broad sense.

High heritability estimates were observed for days to female flowering (92.9%) followed by days to male flowering (92.5%), fruit yield per plot (82.5%), fruit yield per plant (82.2%), number of nodes per vine (59.7%), number of branches per vine (48.4%) length of vine (47.9%), number of fruits per plot (7.2%). If a character showed high heritability and high genetic advance indicates the presence of additive gene action which is flexible in nature the character can the select as such for improvement of such character. If any character under selection showed low heritability and high genetic advance indicated the presence of both active and non-active gene and the traits ascertain for improvement without modification and if the characters exhibited both heritability genetic advance as low there will be more involvement of environmental heritability of character provide a statistical concept and is use for estimated progress determining the extent to which the character is transmitted from parents of the springs it also provide the comparative value of heredity and environment on the character of variation. The effective improvement in a particular traits/ trait for which the selection is made will be based on the quantum of genetic advance. Tomar *et al.* (2020b); Robinson *et al*. (1955); Dubey *et al.*

(2019); Saurabh *et al.* (2017a) reported that the estimates of heritability could not be of practical utility without genetic advance for selection based on phenotypic appearance. As per Hanson (1963) and Tomar (2020a) heritability was influenced by methods of estimation, generation to study, environmental samples employed and the environments. King (1977) and Tomar *et al.* (2015) reported that genetic gain would be over estimate in either of following condition (i) low selection proportion with high heritability and (ii) high selection proportion with low heritability.

Selection for one or more-character results in correlated response. Many other characters (Falconer, 1960; Serle, 1965) and pattern of variation will be also be changed (Waddington and Robberson, 1966) hence the component of selection parameter from a selection group of population will probable to different from those involving diverse material such changes would be quite substance with the useful genes and intense selection for an ideal plant type, which included developmental, componential and qualitative characters pertaining to productivity. High heritability for the traits was mainly due to more contribution of additive component for inheritance of the characters. It is obvious to indicate that these traits are subjected to mass selection and/or any other selection scheme aimed to exploit fixable (additive component) widely adapted genotype could be developed with might process good quality and productivity.

In present study all the characters expect number of branches, fruit yield per plot, number of nodes per vine, length of vine showed high heritability the genetic advance high for days to male flowering, days to female flowering, fruit yield per plot, fruit yield per plant indicating that these characters can be improved through direct selection as also reported by Singh and Nandpuri (1978), Singh and Singh (1988), Kalloo *et al*. (1988). The results are in conformity with the findings of Thambura (1973), Srivastava and Srivastava (1976), Ambesh *et al.,* 2017b.

Conclusion

Analysis of variance for eight characters of fifty-two strains were indicated that the treatments differed highly significant for all the characters.Among the fifty-two strains, the high magnitude of PCV along with GCV were observed for, number of fruits per plot, fruit yield per plot, fruit yield per plant, number of branches per vine. The low magnitude of PCV and GCV were recommended for days to male flowering, days to female flowering, length of vine, number of nodes per vine. The characters that sow high heritability for days to male flowering, days to female flowering, fruit yield per plot, fruit yield per plant and Moderate heritability for length of vine, number of branches, number of nodes. The highest estimates of genetic advance (in percent of mean) were noted for fruit yield per plant, fruit yield per plot, number of branches per vine, days to first male flowering, days to first female flowering. The estimates of genetic advance in percent of mean were comparatively low for other remaining characters.

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Table 1: Mean range and C.V. % of eight characters in bottle gourd (*Lagenaria siceraria*)

Character	Mean	Range		SE (M)	C.V. %
		Minimum	Maximum		
Days of first male flowering	40.44	34.33	53.00	0.836	2.131
Days of first female flowering	48.57	38.00	57.00	0.548	1.954
Length of vine (m)	7.53	6.06	8.30	0.228	5.242
Number of Branches/vine	6.03	4.00	7.67	0.559	16.069
Number of Nodes/vine	50.01	43.67	54.00	0.412	4.510
Fruit yield per plot (Kg)	6.9	4.00	12.73	0.487	12.208
No. of fruit per plot	10.92	7.33	38.67	0.410	65.045
Fruit yield per plant (Kg)	1.38	0.80	2.55	0.313	12.357

Table 2: Estimate of genotype and phenotypic coefficient of variance for eight characters in bottle gourd (*Lagenaria siceraria*)

S. No.	Character	Genotypic coefficient of variation	Phenotypic coefficient of variation
1	Days of male flowering	7.46	7.76
2	Days of female flowering	7.08	7.35
3	Length of vine	5.03	7.27
4	Number of Branches/vine	15.57	22.37
5	Number of Nodes/vine	5.49	7.11
6	Fruit yield per plot (Kg)	26.49	29.17
7	No. of fruit per plot	18.14	67.53
8	Fruit yield per plant (Kg)	26.60	29.33

Table 3: Estimates of heritability and genetic advance in percent of mean for eight characters in bottle gourd

S. No.	Character	Heritability (bs) in %	Genetic Advance	Genetic advance in % over mean
1	Days of male flowers	92.5	6.57	16.25
2	Days of female flower	92.9	6.83	14.06
3	Length of vine	47.9	0.54	7.17
4	Number of branches	48.4	1.35	22.39
5	Number of Nods	59.7	4.37	8.74
6	Fruit yield per plot	82.5	3.42	49.57
7	No. of fruit per plot	7.2	1.10	10.07
8	Fruit yield per plant	82.2	0.69	50.00