***Original Research Article***

**GENETIC VARIABILTY, HERITABILITY AND GENETIC ADVANCE ININ RIDGE GOURD**

**Abstract**

To investigate thegenetic variability, heritability in broad sense and genetic advance over mean in the Ridge gourd.The research experiment was conducted during the *kharif* season, 2021 with two replications in randomized block design. The six generations of three crosses are Cross-I P1 x P2 (Arka Sumeet x Konkan Harita), Cross-II P1 x P3 (Arka Sumeet x Jaipur Long), CrossIII P4 x P5 (Saloni-5 x NRG-9) along with five parents are Arka Sumeet, Konkan harita, Jaipur long, Saloni-5 and NRG-9with the observation of eighteen attributes recorded. The phenotypic coefficient of variation,genotypic coefficient of variation,genetic advances over mean and broad sense in heritability reported thatthe higherPCV and GCVshowedfor the vine length, node number at which first male flower appeared,number of branches vine-1, sex ratio,fruit yield vine-1, number of fruitsvine-1these characters showedhighest variability indicated characters for further development and the showed In addition to the highest genetic advance over mean along with the highest heritability (broad sense) included the vine length (97.10,98.40,80.90&55.17,65.23,40.27percent), node number at which first male flower(96.70,85.60,96.80 &48.31,29.43,58.67 percent) and female flowers appeared(82.80,86.00,98.10 &20.04, 25.17, 40.41 percent), number of branches vine-1 (92.20,96.30,95.00&40.80,56.32,52.94 percent), number of pickings(86.20,70.10,95.60&29.60, 13.64,31.48percent), fruit length(87.10,71.00,96.60&18.24,10.36,26.18percent), sex ratio(95.20,96.50,92.50&48.85,46.35, 36.39 percent), diameter of fruit(88.10,95.40,93.80&28.12,28.77,30.74percent) and number of fruits per vine(98.70,97.30,98.90&41.15,35.34,45.09percent), fruit yield per vine(98.30,98.10,99.30&70.00,61.20,78.03percent), weight of fruit(97.00,97.60,98.90&29.02,26.90,34.92percent), fruit yield per plot (98.40,98.10,99.30&70.05,61.28,78.01percent) along with the yield per hectare(98.40,98.10,99.30&70.04,61.27,78.02percent).In highvariability and heritability accompanying genetic advance over mean to results mentioned the traits included increased possibility of improvement through direct selection, a lower dependence on environmental factors and more control over the additive nature of gene action.

**Key words:**Genetic advance, Heritability, Selection, Variability, Six generation

**INTRODUCTION**

A major cucurbitaceouscrop ridge gourd (*Luffa acutangula* L. Ruxb.) Particularly warm season crop. It pertains to the Cucurbitaceae family and is widely grown inIndia during the summer as well as*kharif* season. Its chromosome number is 2n=26. India regards the sensitive fruits of the ridge gourd as a well-known and popular culinary vegetable due to its high yield potential and rich nutritional content (Seshadri, 1985).Recognising the convoluted quantitative inheritance process is essential for establishing effective methods of selection aimed at enhancing yield and associated attributes.

Ridge gourds come in a variety of genotypes and cultivars, each with unique traits, and are cultivated throughout the nation. Geographical variations or spontaneous cross-pollination may be the cause of this genetic variability. Prior to starting any breeding effort, it is essential to have a complete grasp of the genetic variability that currently exists in a crop Singh (1992).

Any trait's ability to be selected for effectively depends on the degree of heritability as well as the degree of phenotypic and genotypic variability. The degree of heritability reveals how well genotypes may be chosen depending on phenotypic performance Johnson *et al.* (1955).

Plant breeders can select crop types better suited to the demands of various populations by using geneticresources toproduce innovative plant gene combinations.systems of agriculture (Glaszmann*et al.,* 2010). The degree of transmissibility of desired traits, the type and magnitude of genetic diversity, and the actual anticipated genetic gain for the character in a population all affect how effective selection is (Golani *et al.,* 2007).

Heritability, genetic advancements, and genotypical and phenotypic coefficient of variationspermit breeders to research progenies' genetic diversity and potential. To ascertain whether selection is preferable, dividing the overall variability into its heritable and non-heritable components will be helpfulbecause the environment has a significant influence on many economic attributes, which are quantitative in nature. Breeding evolution is controlled by the traits of both non-genetic and geneticchanges.

 **MATERIAL AND METHODS**

The experiment wasstudied that at Mahatma Phule Krishi Vidyapeeth, Rahuri, Dept. of Horticulture, AICRP on Vegetable Crops. with two replications andRandomized block design estimated that *kharif*-2021. The six generations in three crosses are Cross-I P1 x P2 (Arka Sumeet x Konkan Harita), Cross-II P1 x P3 (Arka Sumeet x Jaipur Long) Cross-III P4 x P5 (Saloni-5 x NRG-9) with five parents namely Arka Sumeet, Konkan harita, Jaipur long, Saloni-5, NRG-9in ridge gourd. Parents as well as crosses are five plants selected randomly recordedthat growth, flowering, yield and fruit attributes wasindicated thatsix generations in three crosses and with five parentsfor eighteen traits*viz*., the vine length (m), days to appearances of first male flower and first female flower, number of branches/vine, number of nodes at which first male flower appear and first female flower appeared, sex ratio, days to 50 percent flowering, number of picking, days to last pickings, days to first pickings, fruit weight (g), fruit yield/vine (kg), fruit diameter (cm),number of fruits/vine, , length of fruit (cm), fruit yield/plot (kg) and fruit yield/hectare.To determine the significance of differences between generations, including parents, F1, F2, and back crosses, the first step in generation mean analysis to analysis of variance for Randomized Block Design (RBD)for statistical analysis. As recommended by Panse and Sukhatme (1967), the analysis of variance was performed for all metric qualities under investigation.

**Estimations of component of variations**

 In phenotypical and genotypical variance was indicated by respectively mean squared values (Johnson *et al.,* 1955a).

1. Environmental variance (σ2e) = MSe
2. Genotypic variance (σ2g) = MSg-MSe/r
3. Phenotypic variance (σ2p) = (σ2g)+ (σ2e)

Where,

 MSg is genotypic mean sum of square

 MSe is an error mean sum of square

 R is number of replications

**Estimations coefficient of variation**

 The coefficient of variation was considered in both genotypical and phenotypical terms Burton and De Vane (1953).

1. Phenotypic coefficient of variation (PCV)

 √σ2p

PCV (%) = ------ x 100

 X̅

Where, σ2p = Phenotypic variance

X̅ = General mean of character

1. Genotypic coefficient of variation (GCV)

 √σ2g

GCV (%) = ------ x 100

 X̅

**Estimations of the heritability (percentage)**

 The ratio of genotypic to phenotypic variance called as heritability. The general heritability percentages were computed for a range of attributes (Lush, 1949).

 σ 2g

h2 (b.s.) = -------- x 100

 σ 2p

 Where, σ 2g = Genotypic variance

 σ 2p = Phenotypic variance

Genetic advances expressed as over mean were evaluated by the following formula.

 GA

 Genetic advance as over mean (GAM) = -------- x 100

 X̅

According to the formula, Johnson *et al.* (1955a) suggested the heritability and anticipated genetic advancements.

 **RESULTS AND DISCUSSION**

HeritabilityBroad-sense, genetic advance as over meanand the phenotypic and genotype coefficient of variations all showed genetic variability in the six generations of ridge gourd showed table 1. For each cross trait, when phenotypical coefficient of variation (PCV) exceeded the matching genotypical coefficient of variation (GCV), it suggested that the attributes were less affected by environmental influences. Narrow variations between the PCV and GCV stated that affectlittle influenced by the environmental conditions, but wide differences between the GCV and PCV suggested that their environmental conditions play a significant accomplish. Similarly, wasreported bythe Gautham and Balamohan (2018), Kannan and Rajamanickam (2019) andPanda *et al.* (2022) of ridge gourd,Alekar (2019) of bitter gourd observed Maurya *et al.* (2018)along with Deepa *et al.* (2018) of cucumber crop.

 highrangeof both PCV and GCV and wasindicatedthat thevine length, number of branchesvine-1, sex ratio, fruit yieldvine-1, number of fruitsvine-1, node number at which first male flower appeared, fruit yieldplot-1, number of fruits vine-1along with fruit yieldha-1showed that the higher variability theseattributeswhich is beneficialto theadvances development,likewiseobserved thatGautham and Balamohan (2018) withKannan and Rajamanickam (2019)in ridge gourd and Deepa *et al.* (2018) of Cucumber. In medium values of both the PCV along withGCVwereshowedthat these charactersnumber of pickings, node number at which first female flower appear, fruit diameter, fruit weight, fruit length, similarly,reportedin ridge gourd that Singh *et al.* (2002), Kumar *et al.* (2017), Ananthan with Krishnamoorthy (2017). Yadagiri *et al.* (2017) in bitter gourd,these variations in the populations, some of which allowed additional selection. However, the lower both PCV andGCVindicated thatdays to 50 percent flowering, days to appearance of first male flower anddays to appearance offirst female flower, number of pickings, days to first picking, fruit length anddays to last picking. These characterswere lowest magnitudes variability's, there was a low chance for their traits to improve. Similarly, wereindicated that Kanimozhi *et al.* (2014) in wax gourd.

In both high heritability andgenetic advancementoverthe mean were showed vine length(98.40% & 65.23%), number of branchesvine-1(96.30&56.32), node number at which first male flower appeared(85.60%&29.43%) and first female flower appeared(86.00% & 25.17%), sex ratio(96.50%&46.35%), fruit weight(97.60% & 26.90%), fruit diameter(95.40%28.77%), number of fruitsvine-1 (97.30%&35.34), fruit yieldvine-1(98.10%&61.20%) along with fruit yieldplot-1(98.10% &61.20%) and fruit yieldha-1(98.10% &61.20%).showed theseattributeswas lesseraffected bythe environmentfactors and governed by the additivenature of gene action andgreater betterimprovement for direct selection. Reportedthat the bottle gourd by theDoddamani *et al*. (2018) of Cucumber,Sharma and Sengupta (2012), Gautham and Balamohan (2018), Kannan and Rajamanickam (2019) in ridge gourd. High heritability along with moderate genetic advance over mean, these attributes are days to first male flower appeared(80.70%&04.82%), days at which first female flower appeared(88.20%&06.09%) and days to first picking(92.0% &05.94%) in cross-III, number of picking(70.10% &13.64%), days to 50 percent flowering(96.70% &13.03%) andfruit length71.00% &10.36%). The higher heritability coupledwith lower genetic advance asover mean wasnoted for cross-I and cross-II of days to appearance of first male flower and first female flower, days to first pickings and days to last picking.The cross-III for days to last picking and days to 50 percent floweringthese charactersshowed some degreeof the non-additively nature of gene effect and inadequate the selection for crop improvement. Similarlyreported that Pathak *et al.* (2014) of bitter gourd andMaurya *et al.* (2018)of bitter gourd

**CONCLUSION**

The highestvalues Both the genotypical and phenotypical coefficients of variation (GCV and PCV) and wasreportedinvine length,node number at which first male flower appeared, number of branches vine-1, sex ratio, number of fruitsvine-1, fruit yield vine-1, fruit yield plot-1besides fruit yield ha-1,greater selection scope is provided when widely ranges of variants appear and selection is based on these attributes.The traitsare highly heritability and combined with thegenetic advance as over mean wereshowedthe vine length (97.10, 98.40, 80.90 & 55.17, 65.23, 40.27 percent), the node number at which the first male (96.70, 85.60, 96.80 & 48.31, 29.43, 58.67 percent) and female flowers appeared (82.80, 86.00, 98.10 & 20.04, 25.17, 40.41 percent), number of branches vine-1 (92.20, 96.30, 95.00 & 40.80, 56.32, 52.94 percent), number of pickings (86.20, 70.10, 95.60 & 29.60, 13.64, 31.48 percent), fruit length (87.10, 71.00, 96.60 & 18.24,10.36, 26.18 percent), sex ratio (95.20, 96.50, 92.50 & 48.85, 46.35, 36.39 percent), diameter of fruit (88.10, 95.40, 93.80 & 28.12, 28.77, 30.74 percent) and number of fruits per vine (98.70, 97.30, 98.90 & 41.15, 35.34, 45.09 percent), fruit yield per vine (98.30, 98.10, 99.30 & 70.00, 61.20, 78.03 percent), weight of fruit (97.00, 97.60, 98.90 & 29.02, 26.90, 34.92 percent), fruit yield per plot (98.40, 98.10, 99.30 & 70.05, 61.28, 78.01 percent) along with the yield per hectare (98.40, 98.10, 99.30 & 70.04, 61.27, 78.02 percent) these traits governed by the additive genes actions for greater chance of selection. In high variability, high heritability (broad sense) along with high genetic advance over mean for further hybridization for crop improvement.

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**Table.1 Genotypic coefficient of variation, Phenotypic coefficient of variation, heritability and per cent mean of genetic advance of six generations in three crosses**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **ArkaSumeet x Konkan haritaC1:(P1xP2)** | **Arka SumeetxJaipurlong C2:(P1x P3)** | **Saloni-5 x NRG-9 C3: (P4 x P5)** |
| **Sr.****No.** | **Character** | **GCV(%)** | **PCV(%)** | **h2 bs(%)** | **GAM(%)** | **GCV(%)** | **PCV(%)** | **h2 bs(%)** | **GAM(%)** | **GCV(%)** | **PCV(%)** | **h2 bs(%)** | **GAM(%)** |
| 1. | Numberofbranchespervine | 20.63 | 21.49 | 92.20 | 40.80 | 27.86 | 28.39 | 96.30 | 56.32 | 26.37 | 27.05 | 95.00 | 52.94 |
| 2. | Lengthofvine(m) | 27.17 | 27.57 | 97.10 | 55.17 | 31.92 | 32.19 | 98.40 | 65.23 | 21.74 | 24.17 | 80.90 | 40.27 |
| 3. | Daystoappearancefirstmaleflower | 04.02 | 04.17 | 92.90 | 07.98 | 02.60 | 02.90 | 80.70 | 04.82 | 05.70 | 05.83 | 95.50 | 11.47 |
| 4. | Daystoappearancefirstfemaleflower | 04.77 | 04.91 | 94.40 | 09.56 | 03.15 | 03.35 | 88.20 | 06.09 | 06.37 | 06.39 | 99.40 | 13.09 |
| 5. | Nodenumberatwhichfirstmaleflowerappeared | 23.84 | 24.24 | 96.70 | 48.31 | 15.44 | 16.70 | 85.60 | 29.43 | 28.94 | 29.41 | 96.80 | 58.67 |
| 6. | Nodenumberatwhichfirstfemaleflowerappeared | 10.69 | 11.75 | 82.80 | 20.04 | 13.80 | 14.21 | 86.00 | 25.17 | 19.80 | 20.00 | 98.10 | 40.41 |
| 7. | Daysto50%flowering | 07.12 | 07.25 | 96.50 | 14.42 | 06.43 | 06.54 | 96.70 | 13.03 | 03.38 | 03.50 | 93.40 | 06.74 |
| 8. | Sexratio | 24.31 | 24.91 | 95.20 | 48.85 | 22.90 | 23.32 | 96.50 | 46.35 | 18.36 | 19.09 | 92.50 | 36.39 |
| 9. | Daystofirstpicking | 04.05 | 04.26 | 90.60 | 07.95 | 03.01 | 03.14 | 92.0 | 05.94 | 06.01 | 06.18 | 94.40 | 12.03 |
| 10. | Numberofpickings | 15.48 | 16.68 | 86.20 | 29.60 | 07.90 | 09.44 | 70.10 | 13.64 | 15.63 | 15.99 | 95.60 | 31.48 |
| 11. | Daystolastpicking | 04.78 | 04.83 | 97.90 | 09.75 | 04.49 | 04.53 | 97.90 | 09.15 | 04.04 | 04.06 | 98.60 | 08.26 |
| 12. | Lengthoffruit (cm) | 9.49 | 10.17 | 87.10 | 18.24 | 05.96 | 07.08 | 71.00 | 10.36 | 12.93 | 13.15 | 96.60 | 26.18 |
| 13. | Diameterof fruit(cm) | 14.54 | 15.48 | 88.10 | 28.12 | 14.30 | 14.63 | 95.40 | 28.77 | 15.40 | 15.90 | 93.80 | 30.74 |
| 14. | Weightoffruit (g) | 14.30 | 14.52 | 97.0 | 29.02 | 13.22 | 13.38 | 97.60 | 26.90 | 17.04 | 17.14 | 98.90 | 34.92 |
| 15. | Numberoffruitspervine | 20.10 | 20.23 | 98.70 | 41.15 | 17.39 | 17.62 | 97.30 | 35.34 | 22.01 | 22.14 | 98.90 | 45.09 |
| 16. | Fruityieldpervine(kg) | 34.27 | 34.56 | 98.30 | 70.00 | 29.99 | 30.28 | 98.10 | 61.20 | 38.01 | 38.15 | 99.30 | 78.03 |
| 17. | Fruit yield/plot(kg) | 34.28 | 34.57 | 98.40 | 70.05 | 30.03 | 30.32 | 98.10 | 61.28 | 38.00 | 38.13 | 99.30 | 78.01 |
| 18. | Fruit yield(q/ha) | 34.28 | 34.56 | 98.40 | 70.04 | 30.03 | 30.32 | 98.10 | 61.27 | 38.00 | 38.13 | 99.30 | 78.02 |