ABSTRACT

**Aims:** To find out genetic variation of pigeon pea Germplasms population on Chhattisgarh, with *H. armigera, M. vitrata* Larvae Population.

**Study Design:** Augmented RBD Design in 4 block with 3 check varieties.

**Place and Duration of Study:** College of Agriculture Raipur, IGKV, Chhattisgarh. During Kharif 2019-2020.

**Methodology:** The experimental materials were used 100 local landraces of Pigeonpea and three popular standard checks. The Morphological observations on various agro-morphological characters including qualitative and quantitative characters and Incidence of major insects of Pigeonpea were recorded.

**Results:** outcome of the study reviled that Incidence of major insect of Pigeonpea 10 genotypes of pigeonpea are resistant and 10 are susceptible occurred. Analysis of variance indicated that the mean sum of squares due to genotypes were highly significant for all the characters with p-value of 0.001 and some traits check varieties 0.001. Results of genetic variability analysis state that’s highest genetic advance as percent of the mean for traits are days to fifty percent flowering, plant height, seed protein content, and days to maturity.
Conclusion: The Pigeonpea accession used in the study revealed significant variability for most of the morphological traits. Amongst the genotypes studied, high coefficients of variation were observed for most of the characters studied indicating the existence of sufficient variability.

Keywords: Coefficient of variation; augmented RBD; pigeonpea germplasms; H. armigera; M. vitrata larvae population.

1. INTRODUCTION

A leguminous wonder crop plant has coined the name “Pigeonpea” was in place in Barbados because of its use to feed pigeon by native farmers [1]. Pigeonpea [Cajanus cajan (L.) Millsp.], was extraordinary from the binging with rich nourishment protein in its seed (21%), provides protein supplies of vegetarian population. It has a great range for maturity days (95 days to 299 days) [2]. Only domesticated species in family Cajaninae is Cajanus cajan. Pigeonpea plays an essential role in providing food, shelter, medicine and other livelihood opportunities among the rural population. The grain is consumed as dal, the green seed serves as vegetable and the sticks are used as fuelwood. It is grown predominantly under rainfed conditions of the semi-arid tropics. India is the largest producer of pulses, of which Pigeonpea is widely grown legume after chickpea, covering an area of 4.23 M ha with production 3.89 M tones and productivity of 917 kg/ha in India 2019-20, and it covers an area of 65.9 thousand ha with annual production of 39.9 thousand tons and productivity of 605 kg /ha in Chhattisgarh 2019-20 [3].

The knowledge of nature and extent of genetic variation is available in the Pigeonpea genotypes which is the prerequisite for any plant breeding experiment. Collection, conservation and characterization of genotype is the backbone of any crop improvement programme which in turn depends on the extent of genetic diversity present in gene pool. Diversity in plant genotypes provides the opportunity for plant breeders to develop new and improved cultivars with desirable characteristics. From the very beginning of agriculture, natural genetic variability has been exploited within crop species to meet subsistence food requirement, and now it is being focused on surplus food production to fulfill the requirements of increasing populations. Unfortunately, pigeon pea is considered an “orphan crop” in many countries. In India, the North-Eastern part of the Deccan Plateau along with the adjoining Chhotanagpur plateau, forming the parts of the present-day Odisha, Chhattisgarh and Jharkhand germplasms. Therefore, there is a high probability of finding elite germplasms in the form of locally adapted landraces with desirable agro-morphological traits which may culminate into the breeding of Pigeonpea varieties with higher productivity. The role of genetic diversity in conducting successful plant breeding programmes involving productivity, quality parameters and stress tolerance is very important [4]. The market demand of Pigeonpea is bound to increase in demographically expanding India, where per capita pulse availability has declined from 69 grams in 1961 to 32 grams in 2005 [5]. The per capita availability of protein in the country is already one-third of its requirement and if production of this major pulse is not increased significantly, the problem of malnutrition among the poor will further aggravate. The characterization data provides valuable information about genetic diversity in the germplasms collections and this information is helpful in understanding the pattern of genetic variation in a crop species [6] and its further utilization.

Yield is a complex trait being governed by a large number of cumulative, duplicate and dominant genes and directly or indirectly influenced by the environment as well as response poorly to the direct selection. Keeping these points in view, to find out suitable genotypes or donor to meet any current or future demand for improvement of the Pigeonpea crop, various indigenous Pigeonpea genotypes are taken to study.

2. MATERIALS AND METHODS

The research was conducted on Research Farm, Department of Genetics and Plant Breeding, College of Agriculture Raipur, Chhattisgarh, India. The trial resources comprised of 100 local landraces of Pigeonpea and three popular standard checks. The study materials were obtained from various, parts of Chhattisgarh. The study was started during Kharif 2019-20 in an Augmented Randomized Complete Block Design (RBD) to assess the agro-morphological
characterization, genetic variability and genetic divergence between the 100 local landraces of Pigeonpea *Cajanus cajan* (L.) Millsp.] and three standard checks namely Rajeevelochan, Asha and CGA-1 (Table 1.1)

Climatological data on temperature, rainfall, rainy days, relative humidity and sunshine hours recorded at the Meteorological Observatory Unit, Department of Agro-meteorology, IKGV Raipur, during the cropping period. The weather condition during investigation remained favorable for the growth and development of pulses. Weather during the crop period in all the seasons of two years was normal for Pigeonpea. The total rainfall received during 2019-20 from 30th Standard Meteorological Week, were 1370.8 mm. Similarly, the maximum mean temperature ranged from 34.3°C to 23.6°C during 2019-20. It was higher at the time of sowing of the crop in July and a gradual decrease in temperature was noticed up to January and it again increased with the advancement of the crop period. The mean minimum temperature ranged between 7.3°C to 26.8°C during 2019-2020. The minimum temperature decreased gradually up to the third week of December and again increased. The Morphological observations on various agromorphological characters including qualitative

| Entry No. | Genotype | Entry No. | Genotype | Entry No. | Genotype |
|-----------|----------|-----------|----------|-----------|----------|
| T1        | RP-1     | T35       | RP-36    | T69       | RP-85    |
| T2        | RP-2     | T36       | RP-37    | T70       | RP-89    |
| T3        | RP-3     | T37       | RP-38    | T71       | RP-91    |
| T4        | RP-4     | T38       | RP-41    | T72       | RP-92    |
| T5        | RP-5     | T39       | RP-42    | T73       | RP-93    |
| T6        | RP-6     | T40       | RP-43    | T74       | RP-94    |
| T7        | RP-7     | T41       | RP-44    | T75       | RP-95    |
| T8        | RP-8     | T42       | RP-45    | T76       | RP-96    |
| T9        | RP-9     | T43       | RP-46    | T77       | RP-97    |
| T10       | RP-10    | T44       | RP-48    | T78       | RP-98    |
| T11       | RP-12    | T45       | RP-53    | T79       | RP-99    |
| T12       | RP-13    | T46       | RP-54    | T80       | RP-100   |
| T13       | RP-14    | T47       | RP-55    | T81       | RP-101   |
| T14       | RP-15    | T48       | RP-56    | T82       | RP-102   |
| T15       | RP-16    | T49       | RP-57    | T83       | RP-103   |
| T16       | RP-17    | T50       | RP-60    | T84       | RP-104   |
| T17       | RP-18    | T51       | RP-61    | T85       | RP-105   |
| T18       | RP-19    | T52       | RP-62    | T86       | RP-106   |
| T19       | RP-20    | T53       | RP-63    | T87       | RP-107   |
| T20       | RP-21    | T54       | RP-64    | T88       | RP-108   |
| T21       | RP-22    | T55       | RP-66    | T89       | RP-109   |
| T22       | RP-23    | T56       | RP-67    | T90       | RP-110   |
| T23       | RP-24    | T57       | RP-69    | T91       | RP-112   |
| T24       | RP-25    | T58       | RP-70    | T92       | RP-113   |
| T25       | RP-26    | T59       | RP-72    | T93       | RP-115   |
| T26       | RP-27    | T60       | RP-73    | T94       | RP-116   |
| T27       | RP-28    | T61       | RP-74    | T95       | RP-118   |
| T28       | RP-29    | T62       | RP-75    | T96       | RP-119   |
| T29       | RP-30    | T63       | RP-76    | T97       | RP-120   |
| T30       | RP-31    | T64       | RP-77    | T98       | RP-121   |
| T31       | RP-32    | T65       | RP-78    | T99       | RP-122   |
| T32       | RP-33    | T66       | RP-79    | T100      | RP-123   |
| T33       | RP-34    | T67       | RP-80    | CH1       | Rajeevelochan |
| T34       | RP-35    | T68       | RP-84    | CH2       | Asha |

Note: CH=check variety, T=new treatment entry
and quantitative characters and Incidence of major insects of Pigeonpea were recorded viz. Biological Yield (gm/plant), Days to 50 % Flowering, Days to First Flowering, Days to Maturity, Duration of Flowering, Harvest Index, Helicoverpa armigera Larvae Population, Maruca vitrata Larvae Population, No. of Pods/plant, No. of Primary Branches, No. of Secondary Branches, No. of Seeds/Pod, Plant Height (cm), Pods Length (cm), Pod Width (cm), Protein %/100 gm Seeds, Shelling %, 100 Seed Weight (gm) and Seed Yield (gm/plant). The data recorded 100 local landraces of Pigeonpea and three popular standard checks for different quantitative and qualitative characters were subjected to the statistical analysis viz. analysis of variance, range, mean, standard deviation, standard error, heritability, genetic advance, Genetic advance as percentage of the mean (Table.1).

3. RESULTS AND DISCUSSION

Qualitative traits are reflected as morphological markers for use as genotypes of pigeonpea because they are less influenced by the environment. In the present study, the outcome of agro morphological traits states that categorization of germplasm genotypes determines variation among pigeonpea genotypes. It is not solitary vital for utilizing the appropriate attribute-based donors in breeding programs, but also important in the present era for conserving the unique pigeonpea. Outcomes from this study conformation on conclusions by [7-16] (Devi et al., 2020; Sharma et al., 2020).

Result of the population occurrence on the inflorescence of key insect pest of pigeonpea states that of H. armigera larvae population per inflorescence 10 lowermost genotypes that having bottommost insect population are about as a susceptible genotype beside the H. armigera from the understudy total of pigeonpea genotypes like T80, T90, T89, T79, T78, T94, T88, T81, T83 and T99. Whereas 10 top most genotypes that having uppermost insect population are regarding as a capable resistance genotypes beside the H. armigera from the genotypes under study total of pigeonpea like. T52, T5, T10, T45, T20, T21, T49, T23, T55 and T2.

Observation of M. vitrata insect population on plant 10 bottommost genotypes that having bottommost insect population are regarding as a susceptible germplasms beside the M. vitrata from the understudy total of pigeonpea genotypes like T84, T76, T70, T85, T51, T53, T90, T62, T21 and T94. Whereas 10 topmost genotypes that having topmost insect population are apropos as a capable resistance genotypes against the M. vitrata from the under study total of pigeonpea genotypes like T20, T52, T23, T42, T65, T11, T44, T5, T7 and T18. These same conclusions are conformation on verdicts by [17,18,8].

By using software R Studio, augmented design analysis was done by using observation data of Kharif 2018 Analysis of variance indicated that the mean sum of squares due to genotypes were highly significant for all the characters. Significant mean squares due to seed yield and attributing characters revealed the existence of considerable variability in the material studied for the improvement of various traits (Table 2).

Outcomes from the ANOVA rejected the null hypothesis and determine that all of the population means are not equal. We use the post hoc test Tukey's multiple comparison test to define which population means among a set of means differ from the rest. In these outcomes, variances between means that share a letter are not statistically significant. Highest mean contenting germplasms T14 with group “a” letter and lowest mean containing germplasms T82 with group “1” letter, which indicates that germplasms T14 has a significantly higher mean than germplasms T82 and so on. Means of germplasms followed by the same letter in the table do not differ statistically. Similarly, check genotypes for Seed Yield (gm. /plant) all are not significantly different from each other. (Table 3 to 5).

Results of genetic variability analysis state that’s (Table 6) highest genetic advance as percent of the mean for traits are days to fifty percent flowering, plant height, seed protein content and days to maturity is related to the conclusions by [19-22]. Likewise pods per plant, seed yield per plant, number of primary and secondary branches per plant, biological yield per plant and test weight detected by [23,24,25].

The genetic variability in any breeding material is a prerequisite as it does not only provide a basis for selection but also provide some valuable information regarding the selection of diverse parents for use in hybridization program. The coefficient of variation truly provides a relative measure of variability among different traits. In
Table 2. Analysis of Variance (ANOVA) for Augmented Block Design on 2019 data of quantitative traits

| Source                | Df | BY     | D 50 F   | D F F    | D M     | D F     | H I     | H L P    | M L P    | N P P    |
|-----------------------|----|--------|----------|----------|---------|---------|---------|---------|---------|---------|
| Block unadj.          | 3  | 2092.7 ** | 1453.3 ** | 1258.2 ** | 2000.86 ** | 176.22 ** | 83.24 ** | 1.88 ** | 1.43 ** | 432.09 ** |
| Trt. unadj.           | 102 | 1232.79 ** | 856.11 ** | 1668.18 ** | 586.48 ** | 279.13 ** | 121.19 ** | 1.11 ** | 2.26 ** | 341.43 ** |
| Block adj.            | 3  | 302.25 ** | 209.81 ** | 132.8 **  | 329.39 *  | 21.27 ns  | 2.14 ns  | 0.27 ns  | 0.17 ns  | 18.28 ns |
| Trt. adj.             | 102 | 1180.13 ** | 819.54 ** | 1635.08 ** | 537.31 ** | 274.57 ** | 118.8 **  | 1.06 **  | 2.23 **  | 329.26 ** |
| Control               | 2  | 1304.86 ** | 906.3 **  | 847.72 ** | 972.33 ** | 3.79 ns  | 16.38 ** | 1.17 **  | 0.1 * ns | 3.79 ns  |
| Augmented             | 99 | 1234.45 ** | 857.26 ** | 1700.91 ** | 583.66 ** | 285.03 ** | 121.86 ** | 1.11 **  | 2.31 **  | 344.77 ** |
| Test vs augmented     | 1  | 924.59 ** | 642.28 ** | 1650.83 ** | 583.66 ** | 285.03 ** | 121.86 ** | 1.11 **  | 2.31 **  | 344.77 ** |
| Test + Test.VS.aug.   | 100| 1177.64 ** | 817.8 **  | 1650.83 ** | 583.66 ** | 285.03 ** | 121.86 ** | 1.11 **  | 2.31 **  | 344.77 ** |
| Residuals             | 6  | 22.97   | 15.94    | 9.07      | 39.37    | 8.28     | 0.94     | 0.02     | 0.04     | 8.28     |

* = significant at 5%. = P=0.05; ** = significant at 1%. = P=0.05

| Source                | Df | N P B  | N S B  | N S P  | P H   | P L   | P W   | P S   | S P   | 100 S W | S Y   |
|-----------------------|----|--------|--------|--------|-------|-------|-------|-------|-------|---------|-------|
| Block unadj.          | 3  | 7.05 ** | 50.32 ** | 0.55 ** | 1366.02 ** | 1.8 ** | 0.01 ns | 8.74 ** | 54.64 ** | 4.92 ** | 63.44 ** |
| Trt. unadj.           | 102| 11.17 ** | 66.73 ** | 0.34 ** | 838.91 ** | 0.53 ** | 0.03 ** | 5.37 ** | 33.56 ** | 3.02 ** | 100.49 ** |
| Block adj.            | 3  | 0.85 ns | 5.31 ** | 0.08 *  | 195.11 *  | 0.3 *  | 0.01 ns | 1.25 *  | 7.82 *   | 0.71 *  | 7.66 ns   |
| Trt. adj.             | 102| 10.98 ** | 65.4 **  | 0.32 ** | 804.47 ** | 0.48 ** | 0.03 ** | 5.15 ** | 32.18 ** | 2.9 **  | 98.85 **  |
| Control               | 2  | 0.15 ns | 33.91 ** | 0.4 **  | 1008.45 ** | 0.87 ** | 1 ns    | 6.46 ** | 40.35 ** | 3.62 ** | 1.36 ns   |
| Augmented             | 99 | 11.4 ** | 68.04 ** | 0.33 ** | 836.7 **  | 0.53 ** | 0.03 ** | 5.35 ** | 33.47 ** | 3.01 ** | 102.61 ** |
| Test vs augmented     | 1  | 9.85 ** | 2.76 *   | 0.29 ** | 718.53 ** | 0.08 ns | 0.02 ns | 4.6 **  | 28.75 ** | 2.59 ** | 88.63 **  |
| Test + Test.VS.aug.   | 100| 11.2 ** | 66.03 ** | 0.32 ** | 800.39 ** | 0.48 ** | 0.03 ** | 5.12 ** | 32.02 ** | 2.88 ** | 100.8 **  |
| Residuals             | 6  | 0.33   | 0.36    | 0.01    | 28.62    | 0.04    | 0.003   | 0.18    | 1.15    | 0.1     | 2.99     |

* = significant at 5%. = P=0.05; ** = significant at 1%. = P=0.05

Note: degree of freedom = Df, Biological Yield (gm/plant) = BY, Days to 50% Flowering = D 50 F, Days to First Flowering = D F F, Days to Maturity = D M, Duration of Flowering = D F, Harvest Index = H I, H. armigera Larvae Population = H L P, M. vitrata Larvae Population = M L P, No of Pods/plant = N P P, No of Primary Branches = N P B, No of Secondary Branches = N S B, No of Seeds/Pod = N S P, Plant Height (cm) = P H, Pods Length (cm) = P L, Pod Width (cm) = P W, Protein %/100 gm Seeds = P S, Shelling % = S P, 100 Seed Weight (gm) = 100 S W, Seed Yield (gm/plant) = S Y
Table 3. Comparison of critical difference all traits of pigeonpea. (Alpha = 0.05)

| Traits | A Test Treatment and a Control Treatment | A Test Treatment and a Control Treatment | A Test Treatment and a Control Treatment | A Test Treatment and a Control Treatment |
|--------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| B Y    | 15.14                                  | 15.14                                  | 15.14                                  | 15.14                                  |
| D 50 F | 12.61                                  | 12.61                                  | 12.61                                  | 12.61                                  |
| D F F  | 9.51                                   | 9.51                                   | 9.51                                   | 9.51                                   |
| D M    | 19.82                                  | 19.82                                  | 19.82                                  | 19.82                                  |
| D F    | 9.09                                   | 9.09                                   | 9.09                                   | 9.09                                   |
| H I    | 3.06                                   | 3.06                                   | 3.06                                   | 3.06                                   |
| H L P  | 0.46                                   | 0.46                                   | 0.46                                   | 0.46                                   |
| M L P  | 0.65                                   | 0.65                                   | 0.65                                   | 0.65                                   |
| N P P  | 9.09                                   | 9.09                                   | 9.09                                   | 9.09                                   |
| N P B  | 1.82                                   | 1.82                                   | 1.82                                   | 1.82                                   |
| N S B  | 1.91                                   | 1.91                                   | 1.91                                   | 1.91                                   |
| N S P  | 0.34                                   | 0.34                                   | 0.34                                   | 0.34                                   |
| P H    | 16.9                                   | 16.9                                   | 16.9                                   | 16.9                                   |
| P L    | 0.59                                   | 0.59                                   | 0.59                                   | 0.59                                   |
| P W    | 0.17                                   | 0.17                                   | 0.17                                   | 0.17                                   |
| P S    | 1.35                                   | 1.35                                   | 1.35                                   | 1.35                                   |
| S P    | 3.39                                   | 3.39                                   | 3.39                                   | 3.39                                   |
| 100 S W| 1.01                                   | 1.01                                   | 1.01                                   | 1.01                                   |
| S Y    | 5.46                                   | 5.46                                   | 5.46                                   | 5.46                                   |
Table 4. Comparison of standard errors all traits of pigeonpea

| Traits | Standard Errors Comparison |
|--------|-----------------------------|
|        | A Test Treatment and a Control Treatment | A Test Treatment and a Control Treatment | A Test Treatment and a Control Treatment | A Test Treatment and a Control Treatment |
| B Y    | 6.19                         | 6.19                         | 6.19                         | 6.19                         |
| D 50 F | 5.15                         | 5.15                         | 5.15                         | 5.15                         |
| D F F  | 3.89                         | 3.89                         | 3.89                         | 3.89                         |
| D M    | 8.1                          | 8.1                          | 8.1                          | 8.1                          |
| D F    | 3.71                         | 3.71                         | 3.71                         | 3.71                         |
| H I    | 1.25                         | 1.25                         | 1.25                         | 1.25                         |
| H L P  | 0.19                         | 0.19                         | 0.19                         | 0.19                         |
| M L P  | 0.27                         | 0.27                         | 0.27                         | 0.27                         |
| N P P  | 3.71                         | 3.71                         | 3.71                         | 3.71                         |
| N P B  | 0.74                         | 0.74                         | 0.74                         | 0.74                         |
| N S B  | 0.78                         | 0.78                         | 0.78                         | 0.78                         |
| N S P  | 0.14                         | 0.14                         | 0.14                         | 0.14                         |
| P H    | 6.91                         | 6.91                         | 6.91                         | 6.91                         |
| P L    | 0.24                         | 0.24                         | 0.24                         | 0.24                         |
| P W    | 0.07                         | 0.07                         | 0.07                         | 0.07                         |
| P S    | 0.55                         | 0.55                         | 0.55                         | 0.55                         |
| S P    | 1.38                         | 1.38                         | 1.38                         | 1.38                         |
| 100 S W| 0.41                         | 0.41                         | 0.41                         | 0.41                         |
| S Y    | 2.23                         | 2.23                         | 2.23                         | 2.23                         |

Note: Biological Yield (gm/plant) = B Y, Days to 50 % Flowering = D 50 F, Days to First Flowering = D F F, Days to Maturity = D M, Duration of Flowering = D F, Harvest Index = H I, H. armigera Larvae Population = H L P, M. vitrata Larvae Population = M L P, No of Pods/plant = N P P, No of Primary Branches = N P B, No of Secondary Branches = N S B, No of Seeds/Pod = N S P, Plant Height (cm) = P H, Pods Length (cm) = P L, Pod Width (cm) = P W, Protein %/100 gm Seeds = P S, Shelling % = S P, 100 Seed Weight (gm) = 100 S W, Seed Yield (gm/plant) = S Y
Table 5. HSD method applies for population mean comparisons for Seed Yield (gm/plant)

| Treatment | Adjusted Means | Group | Treatment | Adjusted Means | Group |
|-----------|----------------|-------|-----------|----------------|-------|
| RP-102    | 14.086         | 1     | RP-19     | 22.086         | 1234567890A D F I J L N PQRST |
| RP-99     | 14.086         | 1     | RP-18     | 22.086         | 1234567890A D F I J L N PQRST |
| RP-100    | 15.886         | 12    | RP-13     | 22.086         | 1234567890A D F I J L N PQRST |
| RP-119    | 15.886         | 12    | RP-109    | 23.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-109    | 16.486         | 123   | RP-16     | 23.286         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-31     | 16.773         | 1234  | RP-54     | 23.373         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-29     | 16.773         | 1234  | RP-121    | 24.886         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-45     | 16.773         | 1234  | RP-42     | 25.173         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-97     | 17.086         | 1234  | RP-27     | 26.173         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-98     | 17.686         | 1234  | CH2       | 30.435         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-78     | 17.856         | 123456| RP-6      | 30.486         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-122    | 18.286         | 1234  | CH1       | 30.678         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-35     | 19.173         | 123456789 | CH3   | 31.545         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-32     | 19.173         | 123456789 | RP-20  | 31.545         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-89     | 19.656         | 1234567890 0 | RP-123   | 36.886         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-77     | 19.656         | 1234567890 0 | RP-116   | 37.486         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-110    | 20.086         | 1234567890 8 | RP-101   | 38.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-63     | 20.256         | 1234567890 0 B EF HIJK | RP-106   | 38.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-67     | 20.256         | 1234567890 0 B EF HIJK | RP-107   | 38.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-46     | 20.373         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ | RP-96   | 38.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-70     | 20.856         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ | RP-104   | 38.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-94     | 20.856         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ | RP-105   | 38.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-14     | 20.886         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ | RP-112   | 38.086         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
| RP-7      | 21.486         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ | RP-61    | 38.856         | 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ |
Table 5. Continued

| Treatment | Adjusted Means | Group          | Treatment | Adjusted Means | Group          |
|-----------|---------------|----------------|-----------|---------------|----------------|
| RP-73     | 38.856        | 89 A CD G LM PQRSTUWVXYZ | RP-74     | 40.656        | QRSTUVWXYZ     |
| RP-80     | 38.856        | 89 A CD G LM PQRSTUWVXYZ | RP-53     | 40.773        | R T V X Z      |
| RP-75     | 38.856        | 89 A CD G LM PQRSTUWVXYZ | RP-66     | 41.256        | STUWVXYZ      |
| RP-103    | 39.286        | 0 HIJKLMNOPQRSTUWVXYZ  | RP-91     | 41.256        | STUWVXYZ      |
| RP-115    | 39.286        | 0 HIJKLMNOPQRSTUWVXYZ  | RP-64     | 41.256        | STUWVXYZ      |
| RP-118    | 39.286        | 0 HIJKLMNOPQRSTUWVXYZ  | RP-85     | 41.256        | STUWVXYZ      |
| RP-79     | 39.456        | A CD G LM PQRSTUWVXYZ  | RP-8      | 41.286        | WXYZ          |
| RP-2      | 39.486        | BC E GH K M O UVWXYZ   | RP-26     | 41.286        | WXYZ          |
| RP-34     | 39.573        | DEFG I K NOPQRSTUWVXYZ | RP-5      | 41.286        | WXYZ          |
| RP-28     | 39.573        | DEFG I K NOPQRSTUWVXYZ | RP-24     | 41.286        | WXYZ          |
| RP-60     | 39.573        | DEFG I K NOPQRSTUWVXYZ | RP-17     | 41.286        | WXYZ          |
| RP-113    | 39.886        | HIJKLMNOPQRSTUWVXYZ    | RP-4      | 41.286        | WXYZ          |
| RP-120    | 39.886        | HIJKLMNOPQRSTUWVXYZ    | RP-56     | 41.373        | T V X Z       |
| RP-76     | 40.056        | LM PQRSTUWVXYZ         | RP-57     | 41.373        | T V X Z       |
| RP-62     | 40.056        | LM PQRSTUWVXYZ         | RP-30     | 41.373        | T V X Z       |
| RP-72     | 40.056        | LM PQRSTUWVXYZ         | RP-41     | 41.373        | T V X Z       |
| RP-69     | 40.056        | LM PQRSTUWVXYZ         | RP-84     | 41.856        | UWVXYZ        |
| RP-95     | 40.056        | LM PQRSTUWVXYZ         | RP-93     | 41.856        | UWVXYZ        |
| RP-36     | 40.173        | NOPQRSTUWVXYZ          | RP-25     | 41.886        | WXYZ          |
| RP-43     | 40.173        | NOPQRSTUWVXYZ          | RP-44     | 41.973        | V X Z         |
| RP-55     | 40.173        | NOPQRSTUWVXYZ          | RP-33     | 41.973        | V X Z         |
| RP-37     | 40.173        | NOPQRSTUWVXYZ          | RP-38     | 41.973        | V X Z         |
| RP-48     | 40.173        | NOPQRSTUWVXYZ          | RP-9      | 42.486        | WXYZ          |
| RP-92     | 40.656        | QRSUWVXYZ              | RP-22     | 43.086        | YZ            |

Table 5. Continued

| Treatment | Adjusted Means | Group |
|-----------|---------------|-------|
| RP-12     | 43.086        | YZ    |
| RP-1      | 43.086        | YZ    |
| RP-3      | 43.686        | Z     |
| RP-21     | 43.686        | Z     |
| Treatment | Adjusted Means | Group |
|-----------|----------------|-------|
| RP-23     | 43.686         | Z     |
| RP-10     | 43.686         | Z     |
| RP-15     | 63.486         | a     |

Table 6. Genetic variability analysis for different characters of Pigeonpea

| Trait                                      | Mean | GCV | GCV category | PCV | PCV category | ECV | hBS | Hbs category | GA | GAM |
|--------------------------------------------|------|-----|--------------|-----|--------------|-----|-----|--------------|----|------|
| Biological Yield (gm/plant)                | 156.82 | 13.8 | (Medium)     | 13.94 | (Medium)     | 2   | 97.94 | (High)     | 44.18 | 28.17 | (High) |
| Days to 50 % Flowering                     | 134.94 | 10.53 | (Medium)    | 11.02 | (Medium)    | 3.26 | 91.25 | (High)    | 28   | 20.75 | (High) |
| Days to First Flowering                    | 94.68  | 14.47 | (Medium)   | 14.72 | (Medium)   | 2.65 | 96.75 | (High) | 27.81  | 29.37 | (High) |
| Days to Maturity                           | 188.58 | 11.66 | (Medium)  | 12.18 | (Medium)  | 3.52 | 91.66 | (High)  | 43.45  | 23.04 | (High) |
| Duration of Flowering                      | 53.86  | 20.96 | (High)     | 21.41 | (High)     | 4.39 | 95.8  | (High)   | 22.79  | 42.32 | (High) |
| Harvest Index                              | 21.05  | 22.21 | (High)     | 22.82 | (High)     | 5.23 | 94.75 | (High) | 9.39   | 44.6  | (High) |
| H. armigera Larvae Population              | 4.54   | 10.17 | (Medium)  | 11.36 | (Medium)  | 5.08 | 80.03 | (High)  | 0.85   | 18.76 | (Medium) |
| M. vitrata Larvae Population               | 4.76   | 22.58 | High       | 22.77 | (High)     | 2.96 | 98.31 | (High)  | 2.2    | 46.19 | (High) |
| No of Pods/plant                           | 49.64  | 25.9  | High       | 26.16 | (High)     | 3.67 | 98.03 | (High)  | 26.26  | 52.9  | (High) |
| No of Primary Branches                     | 10.88  | 12.09 | (Medium)  | 12.69 | (Medium)  | 3.85 | 90.79 | (High)  | 2.59   | 23.77 | (High) |
| No of Secondary Branches                   | 17.06  | 23.17 | High       | 23.33 | (High)     | 2.77 | 98.59 | (High)  | 8.1    | 47.46 | (High) |
| No of Seeds/Pod                            | 4.66   | 19.55 | (Medium)  | 19.65 | (Medium)  | 1.95 | 99.01 | (High)  | 1.87   | 40.13 | (High) |
| Plant Height (cm)                          | 239.72 | 11.86 | (Medium)  | 12.08 | (Medium)  | 2.3 | 96.38 | (High)  | 57.59  | 24.02 | (High) |
| Pod Width (cm)                             | 0.57   | 19.04 | (Medium)  | 19.99 | (Medium)  | 6.07 | 90.79 | (High)  | 0.21   | 37.44 | (High) |
| Pods Length (cm)                           | 5.09   | 11.12 | (Medium)  | 11.64 | (Medium)  | 3.47 | 91.14 | (High)  | 1.11   | 21.89 | (High) |
| Protein %/100 gm Seeds                     | 20.39  | 11.71 | (Medium)  | 11.92 | (Medium)  | 2.21 | 96.57 | (High)  | 4.84   | 23.74 | (High) |
| Shelling %                                 | 52.85  | 8.64  | (Low)      | 9.11  | (Low)      | 2.87 | 90.07 | (High)  | 8.94   | 16.92 | (Medium) |
| 100 Seed Weight (gm)                       | 15.51  | 17.03 | (Medium)  | 18.5  | (Medium)  | 7.23 | 84.72 | (High)  | 5.02   | 32.34 | (High) |
| Seed Yield (gm/plant)                      | 31.04  | 13.42 | (Medium)  | 13.9  | (Medium)  | 3.63 | 93.18 | (High)  | 8.29   | 26.72 | (High) |
the present investigation wide range of genetic variability was observed for most of the quantitative traits. High magnitude of the coefficient of variation GCV% and PC V% (more than 20%) in some genotypes was observed for the duration of flowering (20.96, 21.41), Harvest Index (22.21, 22.82), *M. vitrata* larvae population (22.58, 22.77), No of Secondary branches (23.17, 23.33) while shelling percentages are low 8.64 and 9.11 respectively, while rest of the traits recorded low to medium values. Heritability Broad sense is high for all traits and also genetic advance is high for all traits but genetic advance as percent of mean are all for high except for *H. armigera* larvae population and Shelling percent in medium category value estimated. In frequencies distribution of qualitative traits, we found most of the traits are equally distributed in population but some are frequent in population and less diverse (Table 6).

4. CONCLUSION

The above mention characters showing a high estimate of genetic advance as the percent of the mean are governed by additive genes and selection for them will be rewarded. The pigeonpea accession used in the study revealed significant variability for most of the morphological traits. Amongst the genotypes studied, high coefficients of variation were observed for most of the characters studied indicating the existence of sufficient variability. Out of 100 genotypes tested against different insect pests, 10 were categorized at most promising entries against key insect pests the group meet held on; 2021.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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