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Study on the genotypic, phenotypic correlation and path coefficient in Pigeon pea (*Cajanus cajan* (L.)

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Abstract

Pigeon pea or red gram [*Cajanus cajan* (L.) Millsp] is one of the important pulse crop. The Experiment was conducted at Agriculture Farm, Nana Ji Deshmukh New Agriculture Campus, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna to evaluate the thirty genotypes/varieties under normal soil and rain fed condition. The experiment was laid out fallowing Randomized Block Design (RBD) with three replications during *Kharif* 2018, The place of experiment in Chitrakoot is situated at $25^0$10' North latitude and $80^0$85' East longitude. The altitude is about 200m above mean sea level The experiment was sown on 29th, July, 2018 and harvested on 18th, February, 2019. Each treatment was grown in 4 m long 6 rows per plot spaced 90 cm apart. The plant to plant distance was maintained 25cm by thinning. Recommended agronomic cultural practices and plant protection measures were adopted to raise a best crop. Observation were recorded Days to 50% flowering, Number of primary branches per plant, Number of secondary branches per plant:, Number of pods per plant, Plant height(Cm), Days to Maturity (DM),100-Seed weight (g) and Seed yield (kg/ha). On the basis of above per se varieties- ICPL 87119, LRG 134 and BDN 2013-1 and BRGL 18-1 are found suitable and best performer in terms of yield and yield contributing characters in agro- climatic condition of Chitrakoot.

Keywords: Pigeon pea, genotypes, germplasm, genotypic, phenotypic correlation and path coefficient

Introduction

The grain legumes grown, pigeon pea [*Cajanus cajan* (L.) millsp.] is the second most important crop of India, belonging to tribe-Phaseoleae subtribe-cajaninae, family – leguminosae, genus – cajanus and species – cajan with chromosome number 2 n = 22. Pigeonpea has versatile use as food, feed, fuel and fodder. It is called by an array of names *viz*., Arhar, Cango Pea, Angole, Rahar, Red Gram and Tur. The name pigeonpea was first reported for plants used in Barbados, where seeds were consideredas most useful feed for pigeon (Plukent, 1692). According to Vander Maesen (1986) pigeonpea originated in India and spread to other countries quite early endowed with several unique characteristics. Pigeonpea or red gram [*Cajanus cajan* (L.) Millsp] is one of the important *kharif* pulse crop of subsistence agriculture. Globally, pigeon pea is cultivated worldwide in developing countries under tropical and subtropical climatic conditions with variety of cropping systems. Generally, spilt seeds of pigeonpea is used as dhal (dry, dehulled, split seed used for cooking) which fulfills requirement of dietary protein. Besides its main use as dhal, tender green seeds are used as a vegetable, while crushed dry seeds serve as animal feed, green leaves as fodder, and stems as fuel wood and to make huts, baskets, *etc*. Globally, it is grown in about 5.52 mha area with an annual production of 4.32 m tons with an average productivity around 790 kg/ha. In India, pigeon pea is the second important legume crop after chickpea. In India, it is cultivated on 3.78 mha area with an annual production of 2.80 m tons with productivity around 740 kg/ha which is lower than global average (Economic survey. (2015-16). In India pigeon pea is cultivated for its seed which contained about 22% protein, therefore forms an important part of vegetarian diet. Pigeon pea is mostly consumed as dry split dhal besides several other uses of various parts of pigeon pea plant.

Estimating the nature and magnitude of correlation coefficient, path coefficient analysis and genetic association between grain yield and yield traits, the traits that contributed to yield and are suitable to identified by variability, correlation and path coefficient analysis between grain yield and its attributes. The information on their genetic variability and traits association contributes with grain yield and among itself is of considerable importance in selection for elite genotype.

Pulse crop pays an important role in Indian economy. They are often referred to as “poor man’s meat”, since they are cheaper source of high quality protein.

Grain legumes or pulses occupy an important place in man's food and nutritional requirements. They are important constituents in the diets of a very large number of people, especially in the developing countries and are good source of protein which helps to supplement cereal diets, improving their nutritive values.

Now a days, prices of pulses have increased significantly as compared to other food crops pushing pulses out of the reach of poor masses. Declining per capita availability of pulses indicates that pace of technological development could not commensurate with the demand of pulses. Wide fluctuation in pulses production particularly in developing countries including India remains a big challenge and needs critical analysis of the factors contributing toward instability in productivity. A holistic approach to develop improved varieties and production technology for different agro-ecological regions and cropping systems is imperative. This requires efforts in consortium mode to foster the necessary framework of knowledge and materials that will result in major scientific breakthroughs.

Genetic variability is the key of any crop improvement programme. This provides an opportunity for breeders to combine desired genes into novel genotypes for enhancing the yield and stability of economically important crop plants. Germplasm serve as the most valuable natural resource for providing useful characters for developing high yielding input responsive genotypes resistant to various biotic and abiotic stresses. Therefore, evaluation of germplasm under the prevailing environments is essential for selecting the donor parents for the traits to be improved in breeding programme.

Though the literature in respect of germplasm evaluation, variability, correlation and path analysis studies in pigeonpea is not meager but these are based on the testing of limited number of germplasm lines. Moreover, the results of earlier studies on such aspects are relevant only for the materials and environments involved in the particular study and can not be generalized. Therefore, study on the above aspects on the available germplasm under the prevailing environment, where, it is to be exploited, is essential for successful utilization of germplasm resources for the development of superior varieties.

Materials and Method

The Experiment was conducted at Agriculture Farm, Nana Ji Deshmukh New Agriculture Campus, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna to evaluate the thirty genotypes/varieties under normal soil and rain fed condition. The experiment was laid out fallowing Randomized Block Design (RBD) with three replications during *Kharif* 2018, The place of experiment in Chitrakoot is situated at $25^0$10' North latitude and $80^0$85' East longitude. The altitude is about 200m above mean sea level The experiment was sown on 29^{th}, July, 2018 and harvested on 18^{th},February,2019. Each treatment was grown in 4 m long 6 rows per plot spaced 90 cm apart. The plant to plant distance was maintained 25cm by thinning. Recommended agronomic cultural practices and plant protection measures were adopted to raise a best crop. Observation were recorded Days to 50% flowering, Number of primary branches per plant, Number of secondary branches per plant:, Number of pods per plant, Plant height (Cm), Days to Maturity (DM),100-Seed weight (g) and Seed yield (kg/ha).

Result and Discussion

The present investigation was carried out with 30 diverse genotypes/varieties of pigeon pea (*Cajanus cajan* L. Millsp.). These varieties were grown during *kharif* season 2018-19.

Correlation coefficients studies

The estimates of correlation coefficients among the 08characters of pigeon pea genotypes at genotypic and phenotypic levels are given in Table 1.1&1.2 In general, genotypic correlations were higher than phenotypic ones in magnitude for all the characters. The character which showed negative association at genotypic level also showed negative association at phenotypic level. The seed yield kg/ha showed significant and positive correlation with no. of pods / plant (0.594) and no. of secondary branches (0.318) exhibited positive correlation coefficient with seed yield kg/ha at genotypic level. At phenotypic level, seed yield kg/ha exhibited highly significant and positive correlation with no. of pods / plant (0.452) and no. of secondary branches (0.239) exhibited positive correlation coefficient with seed yield kg/ha at phenotypic level.

The 100-seed weight exhibited significant and positive correlation with plant height (0.487 &0.0720 and pods /plant (0.469 & 0.197) while negative correlation with days to80% maturity (-0.826 and -0.191); both at genotypic and phenotypic level. The 100-seed weight showed significant and positive correlation with no. of pods / plant (0.324) ;days to maturity with days to 50% flowering(0.574 and 0.409); plant height with no. of secondary branches per plant (0.328 and 0.285) ; no. of pods / plant with no. of secondary branches per plant (0.419 and 0.379) while significant and negative correlation plant height with days to 50% flowering (-0.275) and no. of secondary branches per plant with days to 50% flowering (-0.376 and -0.268) showed negative correlation at both at genotypic and phenotypic level.

Path coefficient analysis

The genotypic and phenotypic correlation coefficient of seed yield with the remaining characters under study were further partitioned into direct and indirect effects using path coefficient analysis and are presented in Table 1.3and 1.4.

The path coefficient showed the highest positive direct effect on seed yield kg/ha was exhibited by no. of pods/ plant (0.763) followed by days to 50% flowering (0.562), no. of primary branches (0.243), no. of secondary branches (0.146) and plant height (0.043). The negative direct effect was recorded with). days to 80% maturity (-0.421) and 100-seed weight (-0.231) at genotypic level. At phenotypic level, the highest positive direct effect on seed yield kg/ha was exhibited by no. of pods/ plant (0.453) followed by no. of secondary branches (0.097), days to 50% flowering (0.092) and no. of primary branches (0.035) while the negative direct effect was recorded with days to 80% maturity(-0.069), 100-seed weight (-0.042) and plant height (-0.033) at phenotypic level., No. of secondary branches(0.320), 100-seed weight (0.247) and plant height (0.111) *via* no. of pods / plant; days to maturity (0.322) *via* days to 50% flowering exerted positive indirect effect whereas days to 50% flowering (-0.242) *via* days to maturity; days to 50% flowering (-0.132) *via* no. of pods / plant and No. of primary branches (-0.228), No. of secondary branches (-0.211) and plant height (-0.154) *via* days to 50% flowering exerted substantial negative indirect effects on seed yield kg/ha at genotypic level. The remaining estimates of the indirect effects in the present analysis were too low to be considered important. The estimate of residual factors at genotypic (0.46117) and (0.77878) at phenotypic level was found moderate indicating that some of characters affecting seed yield has to be included in the present study.

Table 1.1: Estimates of Genotypic Correlations for 08 different quantitative characters in Pigeon pea

S. N.	Characters	Days to 50% Flowering	No. of primary branches	No. of secondary branches	No. of pods/ plant	Plant height (cm)	Days to maturity	100 seed weight (g)	Seed yield (kg/ha)
1	Days to 50% Flowering	1.000							
2	No. of primary branches	-0.406**	1.000						
3	No. of secondary branches	-0.376**	0.303**	1.000					
4	No. of pods/ plant	-0.173NS	-0.044NS	0.419**	1.000				
5	Plant height (cm)	-0.275**	0.087NS	0.328**	0.145NS	1.000			
6	Days to maturity	0.574**	-0.197NS	0.006NS	0.127NS	0.064NS	1.000		
7	100-seed weight (g)	-0.017NS	-0.026NS	0.091NS	0.324**	-0.094NS	-0.125NS	1.000	
8	Seed yield (kg/ha)	0.026NS	0.118NS	0.318**	0.594**	0.063NS	-0.018NS	0.062NS	1.000

*Significant at 5% probability level, **Significant at 1% probability level

Table 1.2: Estimates of Phenotypic Correlations for 08 different quantitative characters in Pigeon pea

S. N.	Characters	Days to 50% Flowering	No. of primary branches	No. of secondary branches	No. of pods/ plant	Plant height (cm)	Days to maturity	100 seed weight (g)	Seed yield (kg/ha)
1	Days to 50% Flowering	1.000							
2	No. of primary branches	-0.096NS	1.000						
3	No. of secondary branches	-0.268*	0.263*	1.000					
4	No. of pods/ plant	-0.161NS	-0.079NS	0.379**	1.000				
5	Plant height (cm)	-0.173NS	0.100NS	0.285**	0.111NS	1.000			
6	Days to maturity	0.409**	-0.172NS	0.031NS	0.106NS	0.031NS	1.000		
7	100-seed weight (g)	-0.046NS	-0.005NS	0.067NS	0.202NS	-0.066NS	-0.087NS	1.000	
8	Seed yield (kg/ha)	-0.031NS	0.025NS	0.239*	0.452**	0.034NS	0.016NS	0.060NS	1.000

*Significant at 5% probability level, **Significant at 1% probability level

Table 1.3: Direct and indirect effects for different characters on seed yield (Kg/ha) at genotypic level in Pigeon pea

S.N.	Characters	Days to 50% Flowering	No. of primary branches	No. of secondary branches	No. of pods/ plant	Plant height(cm)	Days to maturity	100-seed weight(g)
1	Days to 50% Flowering	0.562	-0.099	-0.055	-0.132	-0.012	-0.242	0.004
2	No. of primary branches	-0.228	0.243	0.044	-0.033	0.004	0.083	0.006
3	No. of secondary branches	-0.211	0.074	0.146	0.320	0.014	-0.003	-0.021
4	No. of pods/ plant	-0.097	-0.011	0.061	0.763	0.006	-0.053	-0.075
5	Plant height (cm)	-0.154	0.021	0.048	0.111	0.043	-0.027	0.022
6	Days to maturity	0.322	-0.048	0.001	0.097	0.003	-0.421	0.029
7	100-seed weight (g)	-0.010	-0.006	0.013	0.247	-0.004	0.053	-0.231
Residual = 0.46117			Direct Effect on Main Diagonal (Bold Figure)					

Table 1.4: Direct and indirect effects for different characters on seed yield (Kg/ha) at phenotypic level in Pigeon pea

S. No.	Characters	Days to 50% Flowering	No. of primary branches	No. of secondary branches	No. of pods/ plant	Plant height(cm)	Days to maturity	100-seed weight(g)
1.	Days to 50% Flowering	0.092	-0.003	-0.026	-0.073	0.006	-0.028	0.002
2.	No. of primary branches	-0.009	0.035	0.025	-0.036	-0.003	0.012	0.000
3.	No. of secondary branches	-0.025	0.009	0.097	0.172	-0.009	-0.002	-0.003
4.	No. of pods/ plant	-0.015	-0.003	0.037	0.453	-0.004	-0.007	-0.008
5.	Plant height (cm)	-0.016	0.003	0.028	0.050	-0.033	-0.002	0.003
6.	Days to maturity	0.038	-0.006	0.003	0.048	-0.001	-0.069	0.004
7.	100-seed weight (g)	-0.004	0.000	0.006	0.092	0.002	0.006	-0.042
Residual = 0.77878			Direct Effect on Main Diagonal (Bold Figure)					

Conclusion

On the basis of above per se varieties- ICPL 87119, LRG 134 and BDN 2013-1 and BRGL 18-1 are found suitable and best performer in terms of yield and yield contributing characters in agro- climatic condition of Chitrakoot.

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