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Path coefficient analysis in pigeonpea (*Cajanus cajan* L. Millsp)

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Abstract
An investigation was carried out in pigeonpea to understand the association of six component characters *viz*., plant height, days to 50% flowering, number of primary branches per plant, number of secondary branches per plant, number of pods per plant and test weight on yield and their direct and indirect effects. The estimates of genotypic correlations coefficients are higher than phenotypic correlation coefficients indicating that strong genetic association among the traits. Path coefficient analysis (genotypic) revealed that plant height, number of secondary branches per plant, pods per plant and test weight were made maximum direct contribution towards seed yield. Correlations of plant height, number of primary branches per plant and number of pods per plant were also played significant role with positive effect which were reflected in path analysis as high direct effects, which are important in improving the yields strategically.

Keywords: Pigeon pea, correlation studies and path analysis

1. Introduction
Pigeon pea [*Cajanus cajan* (L) Millsp.] is the fifth important pulse crop of the world. Pigeonpea is a hardy, widely adapted, and drought tolerant crop. It has a wide range of maturity which helps in its adaption in a wide range of environments and cropping systems. Pigeon pea is the second most important protein rich pulse crop after chickpea in India and fifth most important crop in the world. Pigeon pea or red gram (*Cajanus cajan*) 2n=2x=22 is globally covered and grown in India. In India it occupies an area of about 5.39 m ha with an annual production of 4.60 million tonnes with the productivity of 913 kg /ha. (FAOSTAT (2018). Pigeon pea is the main source of protein for Indian vegetarians and it contains 20-21% of proteins. Seeds are used as green peas, split peas and whole grain. The world health organization recommended. But the average productivity is remains low due to most of the area in is cultivated under rainfed area of poor fertile soils. It is contributes to improving the soil fertility (Olawuyi and Fawole, 2005). The green revolution has been confined by and large to the cereals while the production of pulses has remained stagnant. Pigeonpea plays an important role by virtue of its multipurpose use in food, feed, fuel and farming.
The crop suffers from yield losses due to various biotic stresses like wilt, Sterility Mosaic disease, helicoverpa pod borer etc. Therefore, it is necessary to increase the production of pigeonpea by developing pest resistant varieties. To develop high yielding varieties, knowledge on the existing genetic variability in the crop needs to be studied. Yield is a complex trait that is highly influenced by environment.
The information on correlation of yield with yield attributes and direct and indirect effects of each component character on yield will assist the breeders in the identification of traits contributing to yield to make significant genetic gain This information is highly useful for breeders in the selection of parents and breeding material for the development of high yielding varieties of pigeonpea suited to rain fed conditions. Correlation studies helps in determination of the interrelationship between various traits and give a better understanding of the contribution of each trait in the genetic makeup of the crop (Kimani, 2000) [5]. Yield is a complex character which is controlled by polygenes. For enhancing the yield, better understanding of contributing character is essential and keeping this view the present study was carried out to find the inter- relationship among the yield and its contributing traits and also their direct and indirect effect contribution to yield.

2. Materials and Methods

The present studies was carried out with 17 genotypes *viz*., LRG 609, LRG 616, LRG 623, LRG 618, LRG 621, LRG 105, LRG 52, LRG 602, LRG 613, LRG 617, LRG 608, LRG 601, LRG 620, LRG 606, LRG 611 and LRG 614. These genotypes were developed at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh in 2020-21. The accessions were grown on the field using randomized block design with two replications. Each plot consisted of two rows spaced at 1.50 m between and 0.3m within rows. Two seeds from each accession were planted at 5 cm depth from the soil, and thinned to one three to four weeks after planting. All recommended agronomic practices were duly carried out to raise successful crop. Observation were recorder on five randomly selected plants in each replication for seven charterers *viz*., plant height (cm), days to 50 per cent flowering, number of primary branches per plant, number of secondary branches per plant, number of pods per plant, test weight (g) and seed yield per hectare (Kg). The data were subjected to analysis of variance with Statistical Analysis System package (SAS, 1999). The phenotypic correlation coefficients were computed using the formula suggested by Falconer (1964) [4]. The Path-coefficient analysis was conducted as described by Dewey and Lu (1959) [2].

3. Results

Correlation co-efficient is an important statistical constant, which reveals the degree of association among the characters. Especially genotypic correlation was higher than the phenotypic correlation indicating that there is a strong inherent relationship among the characters studied. Analysis of variance revealed that significant differences among the entries for the traits studied. At genotypic and phenotypic level Plant height, number of primary branches per plant and number of secondary branches per plant showed significantly positive correlation with seed yield at both genotypic and phenotypic levels. These findings are supported by earlier findings of Feroz Mohamad *et al*.(2008). Whereas characters pods per plant and test weight had positive correlations with yield which were confirmed by earlier findings of (Bhadru 2010) [1]. This clearly reveal the importance of these component characters play a major role in yield improvement. Path coefficient analysis was done to determine the direct and indirect contributions of different traits towards single plant yield. The results were presented in Table 2. Residual effect was found to be 2.10627, which indicated that the characters other than studied would have a influence on yield. Whereas characters *viz*.,Plant height(0.841), number of secondary branches per plant(2.412), pods per plant (1.914) and test weight (1.377) had direct positive effect on yield. Hence, selection on these studied characters might be useful in genetic improvement for yield. Negative and negligible direct effect on single plant yield was observed by the traits days to fifty per cent flowering (-3.291) and number of primary branches per plant (-4.904), (Table 2). Similar research proofs were reported by Verma (2018). Based on the correlation studies characters viz., plant height, number of primary and number of secondary branches per plant showed highly positive association with single plant yield. Hence these traits could be included while designing the selection index in yield enhancing breeding programme. Path coefficient analysis, the residual effect of path coefficient analysis was 2.10627 which is indicating the there is a need to include other characters to be included for the study and for consideration for crop improvement. It was inferred that the traits *viz.*, number of pods per plant, pod weight and number of secondary branches per plant directly contribute to single plant yield. Therefore, they can be considered in a breeding programme for improvement of single plant yield**.**

Table 1: Correlation between seven character combinations in Pigeon pea

	DFF	Plant height (cm)	No of pri.br/plant	No of sec.br/plant	Pods/plant	Test wt (g)	Yield (Kg/ha)
Days to 50% flower G (DFF) P		-0.346* -0.190 NS	-0.554** -0.441**	-0.056 NS -0.025 NS	0.296 NS 0.241 NS	0.186 NS 0.172NS	-0.0167 NS -0.173 NS
Plant height GP			0.835** 0.561**	0.596** 0.398*	0.255 NS 0.145 NS	0.230 NS 0.182 NS	0.135 NS 0.052 NS
No of Pri. Branches GP				0.709** 0.375*	0.269 NS 0.223 NS	0.273 NS 0.243 NS	0.233 NS 0.209 NS
No of Sec. Branches GP					0.036 NS 0.027 NS	0.037 NS 0.041 NS	-0.259 NS –0.176 NS
Pods/plant GP						0.093 NS 0.096 NS	0.81 NS 0.056 NS
Test weight GP							-0.114 NS -0.104 NS

Table 2: Direct and indirect genotypic path effect of components on yield in pigeonpea.

Character	Days to 50% flower	Plant height (cm)	No. of Primary branches	No of secondary branches	Number of pods/plant	Test weight(g)
Days to 50% flower	-3.291	1.893	1.82405	0.18513	-0.97502	-0.61279
Plant height (cm)	-0.29100	0.841	0.70220	0.50111	0.21444	0.19338
No. of Primary branches	2.71785	-4.09496	-4.904	-3.47768	-1.32031	-1.34072
No of secondary branches	-0.13565	1.43711	1.71023	2.412	0.08671	0.08873
Number of pods/plant	0.77681	0.49651	0.52421	0.07001	1.947	0.18089
Test weight(g)	0.25632	0.31664	0.37645	0.05066	0.12792	1.377

Residual effect:2.10627

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