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ORIGINAL ARTICLE

Correlation, Variability and Heritability in Pigeon Pea

Anuradha Chetukuri[1], Vijayalakshmi .P[1], Bhargavi .V[1], Pavan kumar.D[1], Sreelaxmi .A[2] & Siddiq,E.A[1]
[1]Institute of Biotechnology, ANGRAU, Rajendranagar, Hyderabad, Andhra Pradesh, India
[2]Agriculltrual Research station, ANGRAU, Tandur. Andhra Pradesh, India.

ABSTRACT
Pigeon pea (Cajanus Cajan (L)) is a leguminous crop, grown about 50 countries in the tropics and subtropics. The study was conducted during the Rabi season at Acharya N.G. Ranga Agricultural University, Hyderabad. The experimental material consisted of 84 germplasm lines of pigeon pea procured from ICRISAT, Hyderabad. The 84 Pigeon pea lines, three checks were evaluated for genetic and phenotypic variation, character association among the grain yield & its component traits. The experiment was laid out in a Randomized Complete Block Design with three replications. The results indicated that genotypes showed significant variability for all traits. The phenotypic variance was high for all traits compared to genotypic variance. Heritability (broad sense) was generally high for all traits with exception of Days of pod initiation (0.0084). The result also revealed that, the genotypic correlation of all traits were positively correlated with total yield except Days of pod initiation, and also the phenotypic correlation of all traits were positively correlated with total yield, except days of pod initiation, pod length and 100 seed weight. The analysis of variance showed presence of highly significant differences among the all traits. The major advantages of phenotypic and genotypic correlation between yield and its contributing characters are basic and foremost important for plant selection. In this study Total plant yield, Number of seeds per plant and Number of pods per plants have been identified as selection criteria for obtaining good parental lines in a pigeon pea breeding program.
Key wards: *Pigeon pea. Correlation, variability and grain yield.*

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INTRODUCTION

Pigeon pea (Cajanus cajan (L,) is one of the most important food legumes grown in over 82 countries across the globe, it ranks as the world's fifth most important pulse crop. The crop is cultivated in an estimated area of 2.9 million hectares in the world with an average of 684 kg/ha [9]. The major pigeon pea producing areas in the world are India, Eastern Africa, Central and South America, the Caribbean and West Indies, India with a total area of 2.6 million hectares and an average yield of 719 kg/ha [12] produces nearly 92% of the world's entire pigeon pea crop, though the average seed yields are relatively low, the crop can yield 1600-2900 kg/ha under favourable management [12]; while an exceptional yield of over 8000 kg/ha of dry has been reported in the first harvest in Australia by [15], It is energy rich but is cultivated largely under energy starvation condition. About 90% of pigeon pea constituting medium and late maturing genotypes is either inter cropped. According to [2] pigeon pea as field crop was grown on 4.36 ha, with a production of 3.24 million tones and an average productivity of 0.74 [14]. It is mainly cultivated for its dry seeds and green vegetables in dry areas of the tropics and subtropics. The bright colour of pigeon pea flowers were attracted by number of insects which affect cross fertilization with the average out crossing up to 20% [11]. Pigeon pea is highly proteinaceous and the seed can be prepared into various meals and served as substitute for cow pea. It also provides fuel wood and fodder for the small scale farmer in subsistence agriculture in Nigeria [14]. The success of recombination breeding depends on parental diversity to obtain progressive segregants. Crop yield is one of the complex characters controlled by several interacting genotypic and environmental factors. There are quite few yield components which are less complex, highly inherited and less influenced by the environmental changes [6]. Determination of genetic diversity of any given crop species is necessary for improvement of the crop because it generates baseline data to guide selection of parental lines and design of breeding scheme. In the present study, the genetic variation among Pigeon pea genotypes was studied, for improvement of the crop yield based on the available breeding strategies for selection of parental lines.

MATERIAL AND METHODS

The field experiment was conducted during the Rabi season 2009 at Acharya N.G. Ranga Agricultural University, Hyderabad. The experimental material consisted 84 germplasm lines of pigeon pea along with a local check for yield and other agronomic characters. The genotypes are WC-25,WC-41,WC-2,WC-32, WC-1, WC-34, WC-5, WC-20, PPE-45-2, WC-9, NALLAKANDI, WC-42, WC-39, ICP-7035, ICP-7066, WC-44, 4985-10, PRG-158, 4985-11, ICP-10531, 4985-7, WC-30, ICP-20062, 4979-2, ICP-6364, ICP-77303, ICP-7044, WC-6, WC-3, WC-16, ICP-8863, WC-24, WC-10, ICP-20036, WC-13, ICP-7532, WC-26, WC-31, WC-29, WC-11, ICP-7529, WC-8, 4985-4, WC35, ICP-13198, ICP-6682, ICP-98008, ICP-85060, WC-45, WC-21, WC-14, LRG-41, WC -17, WC-7, ASHA, WC-19, ICP-87089, WC-37, ICP-2711, PRG-100, 4985-1, 332WR, WC-18, ICP-7068, ICP-8634, ICP-909, ICP-7061, WC-36, ENT-11, WC-43, ICP-97253, ICP-6628, LAXMI, WRG-79, 4978-5, ICP-85063, WC-15, LRG-37, TTB-7, BRG-2, LRG-30, 87089, ICP-332, 4985-4. The experiment was laid out in a Randomized Complete Block Design with three replications. The following data was collected on days to 50% flowering, days to pod initiation, days to maturity, plant height at harvest (meter), Number of effective primary, secondary branches, Number of pods per plant, Number of seed per plant, pod length, Number of seeds per pod, 100 seed weight and total yield.

RESULT AND DISCUSSION

The average performances of the 84 pigeon pea genotypes are shown above Table 1. The characters of genotypes varied significantly for all the traits studied. Days to 50% flowering, Days of pod initiation and days to maturity varied between 70 -123, 71- 128 and 118 -162 days, respectively. Also, primary, secondary branches, and pod length varied between 3-11, 4-16.7, and 3cm and 6.5 cm respectively while plant height varied between 74 and 163cm. The greatest variation was observed in number of pods per plant. The minimum pods per plant were 42 with the maximum value of 657 pods per plant.

The genetic, phenotypic and heritability variances are shown in table 2. Generally the phenotypic variance was higher than genotypic variance. The phenotypic variance was relatively high for Number of seed per plant (213344.09), Number of pods per plant (23775.07), Days of pod initiation (4159.40), followed by Total plant yield (806.83), moderate for plant height (598.97), 50% of flowering (140.56), 100 seed weight (99.82) and days to maturity (62.20). The phenotypic variance was low for primary (5.78), secondary branches (19.97), pod length (8.40) and Number of seed per pod (0.46). The genotypic variance was relatively high for Number of seed per plant (75780.13), Number of pod per plant (8504.50), plant height, (350.05), followed by total yield (269. 18). Also moderate for 50% of flowering (140.14), Days of pod initiation (34.79), and days to maturity (60.63). The genotypic variance was low for primary (3.08), secondary branches (9.97), pod length (0.43), 100 seed weight (4.49) and Number of seed per pod (0.08). Heritability (broad sense) was generally high for all traits with exception to Days of pod initiation (0.0084).

The simple genotypic and phenotypic correlation for the association among the characters studied for the 84 genotypes were shown in Table 3 & 4. The genotypic variance of Total plant yield was found to be positively correlated with days to 50% flowering, days to physical maturity, plant height, number of primary and secondary branches, Number of pods per plant, Number of seed per plant, pod length, and Total plant yield. The days to pod initiation was negatively correlated with Total plant yield. The phenotypic and genotypic correlation of days to 50% flowering was positively correlated with days to pod initiation, days to physical maturity, plant height, number of primary and secondary branches, Number of pods per plant, Number of seeds per plant, pod length, and Total plant yield, but negatively correlated with Number of seeds per pod and 100 seed weight. The genetic correlation of days to pod initiation was positively correlated with days to 50 % of flowering, days to maturity, primary branches, Number of pods per plant and Number of seed per plant, but negatively correlated with plant height, secondary branches, Number of seeds per pod, 100 seed weight and Total plant yield. The phenotypic correlation of days to pod initiation was positively correlated with all traits except days to maturity, Number of seeds per pod and Total plant yield. The phenotypic and genotypic correlation of days to maturity was negatively correlated with secondary branches; Number of seeds per pod, pod length and 100 seed weight, reaming all traits were positively correlated. The genetic correlation of plant height, primary and secondary branches were positively correlated with all traits, but negatively correlated with 100 seed weight. The phenotypic correlation of plant height was negatively correlated with pod length and 100 seed weight, also primary branches of phenotypic correlation was negatively correlated with Number of pods per plant and Number of seed per plant. The phenotypic and genotypic correlation of Number of pods per plant and Number of seed per plant were negatively correlated with pod length in case of genetic correlation Number of seeds per pod and 100 seed weight also negatively correlated.

Genetic information of various economic traits are of value to plant breeders because they help in determining the type of breeding procedures to be followed in self as well as cross pollinated crops [1].

The analysis of variance for different genotypes showed the existence of high differences for all the characters. This with a high coefficient of variation (CV%) for 100 seed weight, Total plant yield, No. of seeds per plant and Number of pods per plant indicates enough variation on which selection can be effective. In previous studies, [4] found that seeds per pod and 100-seed weight were negatively correlated with Total plant yield, here also observed at similar patron of result. The results showed, maturity period of pigeon pea lines ranges from 118 -162 days. [5] also reported that the maturity period of pigeon pea lines ranges from 120-270 days and that each specific maturity group is adapted to a specific environment. They found that early, medium and late maturing groups are suitable for areas with low, medium and high rain fall respectively. Therefore, studying the three groups at one location would favour the group most adapted to that location. The medium maturity group (160-180 days) are best adapted to Hyderabad conditions where the present investigation was carried out. The plant height was positively correlated with grain yield. This was supported by [10, 13, 8 and 3], similarly accordance with our results. Plant height positively correlated with Total plant yield. The high value of genotypic and phenotypic variation suggest that there is good scope for yield improvement through selection for pods/plant, seeds/plant and yield/plant. These findings are in agreement with other reports [7]. The heritability value was highest (0.9971) for days of 50% flowering which was followed by days to maturity (0.9749). Plant height, primary, secondary Number of seeds/pod, Number of pods/plant and yield/plant showed moderate heritability values ranging from (0.5844) to (0.3324). Lowest heritability value of (0.0084) was recorded for days of pod initiation. In this study, Number of seeds per pod, Number of pods per plant and Total plant yield has been identified as selection criteria for obtaining good parental lines in a pigeon pea breeding program.

Table. 1. Means, Ranges, Standard deviation and Coefficient of variability (C.V%) for characters evaluated in Pigeon pea.

S.No.	Character	Mean	Standard Error(±)	Minimum	Maximum	C.V%
1	50% days of Flowering	0.37	0.52	72.00	123.00	0.63
2	Days of pod initiation	37.08	52.44	71.00	18.00	53.31
3	Days to maturity	0.72	1.02	118.00	162.00	0.86
4	Plant Height	9.11	12.88	74.00	163.67	12.91
5	primary branches	0.95	1.34	3.00	11.00	31.86
6	secondary branches	1.83	2.58	4.00	16.67	31.45
7	No. of pods/ plant	71.35	100.90	42.53	657.67	62.84
8	No. of seeds/plant	214.14	302.84	127.60	197.30	62.67
9	Pod length	1.63	2.31	3.00	6.53	57.85
10	No. of seeds/pod	0.35	0.50	3.33	5.00	51.08
11	100 seed weight	5.64	7.97	6.73	41.23	76.69
12	Total plant yield	13.42	18.99	9.30	97.13	66.48

Table .2: Genetic parameters for pigeon pea

S.No.	Character	Genetic variance	Phenotypic variance	Heritability
1	50% days of Flowering	140.14	140.56	1.00
2	Days of pod initiation	34.79	4159.40	0.01
3	Days to maturity	60.63	62.20	0.97
4	Plant Height	350.05	598.97	0.58
5	primary branches	3.08	5.78	0.53
6	secondary branches	9.97	19.97	0.50
7	No. of pods/ plant	8504.50	23775.07	0.36
8	No. of seeds/plant	75780.13	213344.09	0.36
9	Pod length	0.43	8.40	0.05
10	No. of seeds/pod	0.08	0.46	0.15
11	100 seed weight	4.49	99.82	0.05
12	Total plant yield	269.18	806.83	0.33

Table. 3:Genotypic correlation

S.No.		50% days of Flowering	Days of pod initiation	Days to maturity	Plant Height (cm)	primary branches	secondary branches	No. of pods/ plant	No. of seeds/plant	Pod length (cm)	No. of seeds/pod	100 seed weight (gm)	Total yield
1	50% days of Flowering	1	1.3674	0.348	0.1879	0.1016	0.0049	0.3466	0.3435	0.1454	-0.0629	-0.197	0.3862
2	Days of pod initiation		1	0.0106	-0.2677	1.5742	-0.2113	0.0333	0.0297	-0.5248	-0.2558	-0.5464	-0.2191
3	Days to maturity			1	0.3024	0.0302	-0.2079	0.2993	0.2961	-0.2887	-0.0404	-0.0332	0.4367
4	Plant Height				1	0.3102	0.529	0.534	0.5375	0.5001	0.2499	-0.2983	0.5774
5	primary branches					1	0.4127	0.1151	0.1225	0.0091	0.4692	-0.01	0.1367
6	secondary branches						1	0.3403	0.3523	0.0872	0.483	-0.0408	0.0838
7	No. of pods/ plant							1	0.9999	-0.313	-0.0675	-0.2034	0.8053
8	No. of seeds/pla nt								1	-0.3199	-0.0602	-0.2024	0.8032
9	Pod length									1	0.7582	-0.3913	0.0345
10	No. of seeds/pod										1	0.2056	0.1636
11	100 seed weight											1	0.0215
12	Total plant yield												1

Table.4: Phenotypic correlation

S.No.		50% days of Flowering	Days of pod initiation	Days to maturity	Plant Height	primary branches	secondary branches	No. of pods/ plant	No. of seeds/plant	Pod length	No. of seeds/pod	100 seed weight	Total plant yield
1	50% days of Flowering	1	0.1179	0.344	0.1456	0.0739	0.0022	0.207	0.2044	0.0311	-0.0271	-0.0408	0.2214
2	Days of pod initiation		1	-0.0036	0.0079	0.1603	0.0102	0.0431	0.0432	0.0079	-0.0383	0.0169	-0.0125
3	Days to maturity			1	0.2307	0.0294	-0.13	0.1899	0.1873	-0.0655	-0.0106	-0.0034	0.2476
4	Plant Height				1	0.1701	0.2957	0.2848	0.2862	-0.0205	0.0661	-0.0107	0.2676
5	primary branches					1	0.158	-0.0108	-0.0079	0.0225	0.1107	0.0622	0.0045
6	secondary branches						1	0.1449	0.1485	0.0867	0.092	0.0373	0.0502
7	No. of pods/ plant							1	0.9995	-0.0539	0.052	0.0077	0.5641
8	No. of seeds/plant								1	-0.0541	0.052	0.0075	0.5636
9	Pod length									1	0.0929	-0.0291	-0.0177
10	No. of seeds/pod										1	-0.0371	0.106
11	100 seed weight											1	-0.0475
12	Total plant yield												1

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