Genetic Resources

Intraspecies Variation in *Cajanus platycarpus* for Some Agronomic Traits and Crossability

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Wild relatives of food crops are important in plant breeding to develop cultivars with new plant characters. Thirteen accessions of *Cajanus platycarpus*, a wild relative of pigeonpea, are maintained at ICRISAT. This paper examines variation among the accessions for some economically important traits, and their crossability with pigeonpea.

Scarified seeds of each accession were sown on 13 Jul 1989 in single-row plots, 60-cm apart in two replications with 20-cm plant-to-plant spacing. The experiment was conducted in a randomized block design on rainfed Vertisols. One spray of endosulfan (0.2%) was given at flowering to protect the crop from pod borers. Data on days to flower and maturity were recorded on plot basis while yield and yield components were recorded on three randomly selected competitive plants. Seed protein content was determined in plot bulk samples according to Singh and Jambunathan (1981). The combined amount of the sulfur-containing amino acids, methionine, and cystine was determined using a Beckman 119 CL Amino Acid Analyzer. For hybridization, 2–3 plants of each accession, and two pigeonpea lines, ICPL 85030 and ICPL 88014, were sown in pots in a greenhouse. Young flower buds were hand-pollinated soon after emasculation. Periodic counts were made for the hybrid pod retention.

Crossability with pigeonpea. Several earlier attempts to cross pigeonpea with *C. platycarpus* failed (Dundas 1986). To find a variation for crossability within *C. platycarpus*, each of the 13 accessions was crossed with two pigeonpea lines ICPL 88014 and ICPL 85030. Using *C. platycarpus* as female parent, a total of 1443 hand pollinations (30–70 in each cross) were made and it was observed that 86% of the pollinated buds abscissed within 10 days of pollination, and in most crosses the young pods dropped within 30 days. Only the crosses of ICPL 88014 with ICPW 64, 67, 70, 71, and 72, and of ICPL 85030 with ICPW 64, 66, 69, and 70 produced 1–3 fully grown pods. The number of seeds in these pods varied from 1–3. Unfortunately, all the hybrid seeds were undeveloped, shrivelled, and dark brown, and they failed to germinate. Reciprocal pollinations using *C. platycarpus* as male parent were unsuccessful. These observations suggest that although no viable hybrid seeds between *C. platycarpus* and pigeonpea were obtained, there is some variation in the ability to hold hybrid pods till maturity. Accessions such as ICPW 64 and ICPW 70 which produced hybrid pods with both the pigeonpea lines, are better than the rest in this regard. Evidently, pigeonpea pollen in ICPW 64 and ICPW 70 provided some physiological stimulus for pods to develop but ovule development was subsequently arrested.

Yield and yield components. Significant differences among the accessions were observed for all the traits except number of primary branches, pod length, and pod width (Tables 1 and 2). Days to flowering was 36–49, and days to maturity was 82–96. The earliest to flower was ICPW 68. In general, *C. platycarpus* accessions had poor branching, and ICPW 62 with six primary and two secondary branches was the best. For seed size, the variation was large (4.0–7.4 g 100-seeds^{-1}). Maximum number of pods plant^{-1} were recorded in ICPW 66. The highest seed yield was recorded in ICPW 71, followed by ICPW 63, ICPW 70, and ICPW 66. As in pigeonpea (Reddy 1990), in *C. platycarpus* too seed yield was positively associated with number of primary branches ($r = 0.45^{*}$) and number of pods plant^{-1} ($r = 0.83^{**}$).

Seed protein and amino acids. Seed protein content in *C. platycarpus* was higher (27.6–31.6%) than in pigeonpea (22.0%). Besides 29.7% sulfur-containing amino acids—considered important for enhancing the nutritive value of legume seed protein—ICPW 70 was rich in methione and cystine. This accession can be a useful parent in breeding programs aimed at protein-quality improvement.

The present study suggests that *C. platycarpus* is a useful genetic resource for pigeonpea breeders. Besides having high seedling growth rate (Dundas 1986), the *C. platycarpus* germplasm contains genes for very early flowering, and high protein. The variation among the accessions for crossability offers hope for transferring the useful genes from *C. platycarpus* to pigeonpea. The problem of total abscission of hybrid pods could be overcome by selecting appropriate accessions such as ICPW 64 and ICPW 70. Further, using embryo rescue techniques it should be possible to obtain successful hybrids between pigeonpea and *C. platycarpus*.

Table 1. Mean values of some characteristics of *Cajanus platycarpus* accessions grown at ICRISAT Asia Center, rainy season 1989.

Accession	Origin	Days to flowering	Days to maturity	Branches plant^{-1} primary	Branches plant^{-1} secondary
ICPW 61	Uttar Pradesh	39	85	5.0	0.5
ICPW 62	Uttar Pradesh	45	92	4.0	0.5
ICPW 63	Uttar Pradesh	46	95	5.5	0.5
ICPW 64	Uttar Pradesh	42	90	4.5	1.0
ICPW 68	Uttar Pradesh	36	83	4.5	1.0
ICPW 60	Himachal Pradesh	42	82	6.0	1.0
ICPW 71	Himachal Pradesh	40	91	5.5	0.5
ICPW 65	Maharashtra	45	96	4.5	1.5
ICPW 66	Maharashtra	43	94	6.0	2.0
ICPW 67	Maharashtra	49	96	4.5	1.5
ICPW 69	Maharashtra	46	93	4.0	1.0
ICPW 70	Maharashtra	44	93	4.0	1.0
ICPW 72	Punjab	46	91	4.0	1.0
Control					
ICPL 87		-	-	-	-
SE		±2.8	±2.7	±0.8	±0.42
Mean		43.1	90.6	4.8	1.00
CV (%)		9.2	4.2	23.6	61.19

Table 2. Mean values of some characteristics of *Cajanus platycarpus* accessions grown at ICRISAT Asia Center, rainy season 1989.

Accession	Origin	Pod length (cm)	Pod width (cm)	Seeds pod^{-1}	100-seed mass (g)	Pods plant^{-1}	Grain yield plant^{-1} (g)	Seed protein (%)	Cystine + Methionine (g 100-g^{-1} protein)
ICPW 61	Uttar Pradesh	4.5	1.3	4.3	7.0	37	10.4	28.1	2.42
ICPW 62	Uttar Pradesh	4.8	1.3	4.4	6.8	31	10.3	27.9	2.42
ICPW 63	Uttar Pradesh	4.8	1.3	4.4	6.4	57	15.5	28.1	-
ICPW 64	Uttar Pradesh	4.8	1.2	4.4	6.5	27	7.9	29.8	2.18
ICPW 68	Uttar Pradesh	4.6	1.2	4.0	6.9	42	7.1	28.9	2.33
ICPW 60	Himachal Pradesh	4.3	1.3	4.4	7.4	43	12.7	27.6	2.27
ICPW 71	Himachal Pradesh	4.8	1.3	4.3	7.0	67	19.6	28.8	-
ICPW 65	Maharashtra	4.8	1.2	4.4	4.1	44	8.0	31.6	2.24
ICPW 66	Maharashtra	4.3	1.2	4.5	4.0	77	14.5	31.0	2.21
ICPW 67	Maharashtra	4.3	1.2	4.4	4.8	47	9.7	29.1	2.26
ICPW 69	Maharashtra	4.7	1.3	4.4	5.2	49	11.8	28.5	-
ICPW 70	Maharashtra	4.5	1.3	4.3	5.0	68	14.8	29.7	2.49
ICPW 72	Punjab	4.6	1.3	4.2	6.0	35	9.3	29.3	-
Control									
ICPL 87		-	-	-	-	-	-	22.0	2.03
SE		±0.20	±0.04	±0.11	±0.18	±10.1	±2.89	±0.18	-
Mean		4.61	1.24	4.36	5.91	47.8	11.63	28.57	2.31
CV (%)		6.28	4.97	3.50	4.30	29.9	35.12	0.88	-

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Preliminary Studies on the Incidence of Major Diseases and Insects in *Cajanus platycarpus* Germplasm at ICRISAT Asia Center

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Genetic variation in the tertiary genepool of the cultivated species is of immense value to plant breeders in developing long-term research and development strategies. *Cajanus platycarpus* is a wild relative of pigeonpea which, at present, cannot be crossed with the cultivated types. However, some successful efforts have been made in this direction using advanced techniques such as embryo rescue. The present study identifies promising characteristics in *C. platycarpus* accessions which can be used in future hybridization programs.

For phytophthora blight screening, 1-week-old seedlings grown in pots in a greenhouse (25°C) were drench-inoculated with a mycelial suspension of P3 isolate of *Phytophthora drechsleri* var *cajani*. Blight mortality was recorded when the susceptible control showed 100% mortality. For sterility mosaic (SM) disease screening, the seedlings raised in pots were staple-inoculated with SM-infected leaves carrying the eriophyid mite vector. Disease observations were recorded when the susceptible control showed 100% disease incidence. For fusarium wilt screening, the accessions were sown in wilt-sick soil in pots in a greenhouse (28±2°C) with the wilt-susceptible control. Observations were recorded at maturity of test lines. Screening for cyst nematode was done in 15-cm diameter plastic pots filled with nematode-infested soil with an infestation level of 15–20 nematode eggs and juveniles per cm^3 of soil. The root systems were examined 30–35 days after germination for the presence of young cysts. The number of young cysts on each root system was counted and rated on 1–9 scale with 1 being highly resistant (no cyst) and 9 highly susceptible (>30 cysts).

Table 1. Reaction of *Cajanus platycarpus* accessions to major pigeonpea diseases and insects, IAC, rainy season 1992.

Accession	Phytophthora blight (%)	Sterility mosaic (%)	Cyst nematode (1–9)	Pod borer (%)	Podfly (%)	Total pod damage (%)
ICPW 60	93.3	100	7	18.7	46.4	63.8
ICPW 61	0.0	100	7	26.1	14.2	40.3
ICPW 62	25.0	100	2	6.2	21.2	27.7
ICPW 63	44.4	100	8	15.8	60.8	74.9
ICPW 64	35.3	100	7	5.5	42.0	47.5
ICPW 65	0.0	100	6	15.1	30.7	45.3
ICPW 66	18.2	100	-	17.4	33.5	50.9
ICPW 67	6.3	100	8	17.2	66.7	77.4
ICPW 68	5.6	100	8	24.6	51.2	65.2
ICPW 69	0.0	100	2	25.1	32.2	52.2
ICPW 70	10.1	100	3	9.5	49.3	58.8
ICPW 71	0.0	100	8	15.4	35.5	47.4
ICPW 72	10.5	100	6	8.3	46.5	54.8
Control	95.0	100	9	100.0	-[1]	100.0

1. Due to 100% pod-borer damage, podfly damage could not be assessed.