

## Characterising Clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) Germplasm for Yield Components and Quality Traits

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**Abstract:** Five hundred and twenty indigenous collections of clusterbean from Gujarat, Haryana, Madhya Pradesh, Rajasthan and Uttar Pradesh, were studied for various morpho-agronomical and quality traits. A wide range of variations was observed for plant height, days to 50% flowering and maturity, number of branches, clusters and pods per plant, length of cluster and pod, number of pods per cluster, number of seeds per pod, size, shape and color of seeds, seed yield per plant, 100-seed weight and gum and protein content. Breeders may make use of the collections with desirable superior traits. Accessions IC 116568 and IC 116906 had high seed yield per plant with high gum and protein contents.

**Key words:** Clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) germplasm, variability, yield components, quality traits.

Availability of genetic variability is the first prerequisite for bringing about a continuous genetic amelioration in any crop plant. Clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) grown for vegetable, green manure and cattle feed, has a great potential in uplifting the economy of poor masses of the arid and semi-arid regions because of gum content in endosperm of its seed. In the present study, an attempt has been made to evaluate the extent of variability in the clusterbean germplasm for yield components and quality traits.

### Materials and Methods

Five hundred twenty collections from different sites in Gujarat, Haryana, Madhya Pradesh, Rajasthan and Uttar Pradesh were grown at National Bureau of Plant Genetic Resources, Regional Station, Jodhpur (26°18'N and 73°E, altitude 224 m), during

*kharif* seasons of 1988-1989 and 1989-1990, in an augmented design with six checks, viz., D.P. Safed, IC 11388, Maru Guar, PLG-85, Pusa Navbahar and Suvidha. Each line was grown in single row of 3 m length, with inter and intra-row spacing of 60 and 15 cm, respectively. After every twenty rows of accessions, all the six checks were planted to constitute one block. The data were recorded on five competitive plants randomly from each of the accessions, and observations were recorded on days to emergence and seedling vigour, plant height, number of branches, plant type, pubescence, days to flowering and maturity, number of clusters and pods per plant, number of pods per cluster, cluster and pod length, number of seeds per pod, size, shape and color of seeds, seed yield per plant, 100-seed weight, per cent gum content and per cent protein content. Days to

Table 1. The range of variability for different morpho-agronomical and quality characters in clusterbean germplasm excluding checks

Characters	Range		Mean	SEm (±)	CV (%)
	Minimum	Maximum			
Plant height (cm)	28.87	111.15	64.15	0.49	17.59
Branch/plant	00.00	10.17	3.73	0.12	11.58
Days to 50% flowering	35.00	62.00	47.16	0.15	7.13
Days to 50% maturity	68.00	103.00	67.33	0.27	7.17
Clusters/plant	03.83	85.50	11.57	0.27	53.23
Cluster length (cm)	02.27	22.00	6.52	0.11	38.19
Pods/plant	08.08	198.33	35.65	0.72	45.97
Pod length (cm)	03.36	11.33	5.92	0.04	15.04
Seeds/pod	06.11	14.77	8.73	0.03	7.79
Seed yield/plant (g)	01.43	41.78	7.95	0.18	50.94
100-seed weight (g)	02.25	04.40	3.28	0.01	8.54
Gum content (%)	21.77	34.38	28.78	0.27	21.61
Protein content (%)	22.43	29.24	26.37	0.24	20.75

emergence was calculated from sowing to 50% seedling emergence. Seedling vigour was recorded after 15 days of seedling emergence by measuring seedling height. Gum and protein contents of seeds were analysed at Biotechnology Laboratory, NBPGR, New Delhi, by applying Near Infra-Red (NIR) technology (Mandal, 1993).

## Results and Discussion

### *Morpho-agronomical traits*

The collections, in general, exhibited a wide range of variations in plant characters (Table 1). Early seedling emergence was recorded in most of the collections from Rajasthan. Around 57.8% of the characterised germplasm collections had good initial vigour, whereas 35.2 and 7% of the remaining lot had medium to poor vigour, respectively. Accessions collected from Rajasthan showed maximum good

initial vigour (63%) than those from Gujarat and Haryana. Out of 520 accessions, 95 were of single stemmed type, and 31 were with smooth leaves. Foliaceous bracts were found in 24 collections collected from different sites of Mehsana district of Gujarat (Dwivedi *et al.*, 1996). Seven accessions (IC 103200, IC 116868, IC 116897, IC 116953, IC 116958, IC 116960 and IC 116961) had 50% flowering in less than 40 days, while accessions IC 116804, IC 116868, IC 116869 and IC 116930 had mean maturity in less than 70 days. Highest (22.0 cm) and shortest (2.27 cm) cluster lengths were recorded in accessions IC 116914, collected from Mehsana district of Gujarat and IC 116592, collected from Jodhpur district of Rajasthan, respectively. The pods in the single stemmed collections were bigger and fleshy. The branched types produced comparatively small and rough pods. In the present study, accessions IC 116960 and IC 116798 had maximum (11.33

Table 2. Clusterbean accessions showing high grain yield (&gt;20 g), yield components and gum and protein contents in comparison to that of checks

Accessions	Source	Seed yield/ plant (g)	Days to 50%		Branch/ plant	Clusters/ plant	Pods/ plant	Seeds/ pod	100- seed wt. (g)	Gum cont- ent (%)	Protein cont- ent (%)
			Flow- ering	Matu- rity							
IC 116522	Jodhpur (R)	30.95	47	89	7.17	30.83	98.17	8.84	3.80	31.62	26.17
IC 116546	Jodhpur (R)	25.37	44	90	7.67	25.99	57.39	8.78	3.35	30.44	28.15
IC 116565	Barmer (R)	41.78	47	95	10.17	85.50	198.33	9.61	3.40	30.40	27.48
IC 116568	Barmer (R)	26.21	48	96	7.83	26.67	75.60	9.39	3.35	33.53	28.36
IC 116760	Nagaur (R)	21.33	44	97	8.00	25.67	103.00	8.87	3.20	29.27	27.50
IC 116781	Jaisalmer (R)	20.47	42	85	8.33	24.50	88.67	9.10	3.30	29.63	26.40
IC 116822	Hisar (H)	20.83	50	87	7.50	23.33	90.00	8.88	3.20	28.10	27.81
IC 116906	Banaskantha (G)	31.60	47	89	3.50	33.67	82.50	8.94	3.25	32.48	28.19
Checks:											
D.P. Safed	-	9.83	48	84	6.00	16.33	42.00	9.00	3.60	30.31	27.70
IC 11388	-	10.00	48	81	6.33	11.33	37.33	8.00	4.50	28.83	28.44
Maru Guar	-	12.47	49	80	6.67	14.33	42.00	8.00	3.50	29.80	28.23
PLG 85	-	8.30	48	81	0.00	7.00	34.67	10.67	2.50	29.97	28.06
P. Navbahar	-	7.53	49	78	0.00	9.67	28.67	9.33	3.80	29.05	27.93
Suvidha	-	10.53	47	78	5.00	13.00	51.33	9.67	3.15	29.24	27.49

G: Gujarat, H: Haryana, R: Rajasthan.

cm) and minimum (3.36 cm) pod length, respectively. Variability was also observed in pod bearing (all nodes/alternate/irregular) in the present study.

Accession IC 116565, collected from Barmer district of Rajasthan, had the highest number of branches (10.17), clusters (85.50), pods (198.33) and seed yield (41.78 g) per plant, while accessions IC 116906 (Banaskantha, Gujarat) and IC 116522 (Jodhpur, Rajasthan) ranked second and third in seed production and bearing more number of clusters per plant (Table 2). Sanghi *et al.* (1964), Mital *et al.* (1969), Dass *et al.* (1973), Tripathi and Lal (1975) and Dabas (1993) reported that the seed yield

and most of its component characters show moderate to high variability in clusterbean. Out of 520 accessions, 25 showed 100-seed weight more than 3.75 g.

Variability was also noticed in size (small/medium/bold), shape (round/oval/rectangular/flat) and colour, i.e., grey (45.13%)/light grey (27.75%)/dark grey (6.14%)/pink (6.69%)/light pink (12.92%)/purplish grey (1.00%)/whitish grey (0.37%), of seed. In the present investigation, it was also observed that most of the collections from Gujarat bore smooth leaves and pink colored seeds. Hymowitz and Matlock (1961) opined that the seed coat color is environmentally controlled and hence is of

Table 3. Clusterbean accessions showing high grain yield (>33%), yield components and gum and protein content in comparison to that of checks

Accessions	Source*	Gum content (%)	Protein content (%)	Days to 50% maturity	Branch/plant	Clusters/plant	Pods/Plant	Seeds/Pod	100-seed wt. (g)	Seed yield/plant (g)
IC 116558	Barmer	28.59	29.24	89	6.67	18.50	54.83	9.22	3.50	11.58
IC 116568	Barmer	33.53	28.36	96	7.83	26.67	75.00	9.39	3.39	26.21
IC 116572	Jaisalmer	27.09	29.14	92	6.00	12.83	57.17	10.05	3.20	17.57
IC 116577	Jaisalmer	33.37	26.63	90	6.17	12.83	46.67	8.50	3.35	9.27
IC 116601	Bikaner	34.38	25.25	90	0.00	7.00	27.17	8.34	3.33	8.10
IC 116603	Bikaner	33.07	26.38	91	4.84	18.17	43.50	8.45	3.00	11.20
IC 116609	Churu	33.40	26.21	92	4.01	12.17	32.00	7.83	3.40	9.59
IC 116627	Churu	33.32	27.19	89	4.50	11.88	26.67	9.00	3.15	5.80
IC 116676	Churu	33.22	25.96	89	0.00	6.32	28.50	9.33	3.35	7.62
IC 116682	Churu	33.91	26.53	82	0.00	6.83	26.00	8.67	3.20	5.28
IC 116732	Churu	32.30	29.19	89	3.67	8.67	25.83	9.71	3.40	5.48
IC 116752	Nagaur	34.07	26.07	86	5.00	10.03	24.17	8.22	3.20	4.45
IC 116790	Bikaner	28.94	29.04	88	7.17	14.67	45.83	7.67	3.05	7.88

\* All from Rajasthan.

no specific advantage. Seed size and shape are rather important than color. The clusterbean varieties having 100-seed weight of 3.0 g and slightly above, as well as oval shape are more preferred by the guar gum industries to suit the size of the seed used in processing (Dabas, 1993).

#### Quality traits

Information on quality analysis of clusterbean seed is scanty. Gum content in this crop has been reported to vary from 19.1 to 34.1% by Menon *et al.* (1970), 14.6 to 35.5% by Dass *et al.* (1973), 11.23 to 26.33% by Tripathi and Srivastava (1975), 22.4-42.6% by Paroda *et al.* (1977), 15.9-31.8% by Singh *et al.* (1977) and 15.9-31.8% by Dabas (1993). Similarly, protein content in clusterbean has been found to vary from 26.85 to 31.00% (Essar,

1957; Casares and Herrera, 1960; Misra *et al.*, 1968) and 21.0-33.25% (Anonymous, 1976).

In the present study, range of gum and protein content was found to be from 21.77-34.38% and 22.43-29.24%, respectively (Table 1). Highest gum content was recorded in accession IC 116601 (34.38%) and IC 116752 (34.38%), closely followed by accessions IC 116752 (34.07%) and IC 116682 (33.91%) (Table 3). Accessions IC 116601 and IC 116682 were single stemmed. Protein content was more in accession IC 116558 (29.24%), closely followed by accessions IC 116732 (29.19%), IC 116572 (29.14%), IC 116790 (29.04%) and IC 116550 (29%) (Table 3). Collections made from Rajasthan had more diversity for gum content (21.77-34.38%) and protein content (22.43-29.24%). This

may be due to climatic and geographical conditions different from that in Gujarat (gum content, 27.19-32.48% and protein content, 26.19-28.95%), Haryana (gum content, 27.53-32.18% and protein content, 26.06-28.81%) and Uttar Pradesh (gum content, 28.03-30.60% and protein content, 26.99-28.13%).

Accessions IC 116568 (Barmer, Rajasthan) and IC 116906 (Banaskantha, Gujarat) showed high seed yield per plant with high gum and protein content than all other accessions and checks (Table 2). Positive correlation was reported by Menon *et al.* (1970) and Mital *et al.* (1971) between grain yield and gum percentage.

Germplasm lines with high seed yield and quality traits may be further evaluated critically, and breeders may use these clusterbean lines with desirable superior traits in their various improvement programmes.

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