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Diversity in the Landraces of Green Gram [*Vigna radiata* (L) R. Wilczek] Collected from Tribal Communities of Peninsular India

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Abstract
Landraces of green gram [*Vigna radiata* (L) R. Wilczek] were collected from tribal communities of Adilabad district of Telangana state of Peninsular India by taking up targeted germplasm surveys. *Gonds* emerged as the major conservators of green gram germplasm among the nine tribal communities from whom germplasm was collected. A total of 69 accessions of landraces collected were characterized and evaluated for nine quantitative characters such as days to 50% fifteen qualitative and flowering, plant height (cm), primary branches per plant, number of clusters per plant, pods per cluster, number of seeds per pod, 100-seed weight (g), pod length (cm) and total pods (no.). ANOVA revealed that there was significant variation for all the traits studied except seeds per pod. The clustering analysis using Ward's minimum variance method gave three major clusters. Examination of the clustering and the associated landrace name revealed that accessions with same landrace name clustered in different clusters and different landraces with distinct names clustered together this shows the existence good diversity among the landraces and also the scope for improvement of popular landraces with other closely associated landraces.

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1. Introduction

Green gram or mungbean is an important pulse crop grown in India and it accounts for 45% of the world mungbean production. Tamooka et al., (2004) felt that the likely centre of origin and domestication is in India. The region of origin of mungbean is proposed to be the forest savannah margin including the western ghats of India (Fuller and Harvey, 2006). India is also considered to be the centre of diversity of mungbean weed (Paroda and Thomas, 1988) and also its wild forms (Lawn, 1995). It has spread to other Asian and African countries. Although it is a popular pulse South East Asia- it is most important grain pulse in Thailand and Philippines; its ranks second in Sri Lanka and third in India, it has become popular worldwide and is a minor pulse in Australia, China, Iran, Kenya, Korea, Malaysia, the Middle East, Peru, Taiwan and the United States. In India it is grown all seasons *viz.* Rainy season, spring/summer and in winter in South India (Sahoo and Jaiwal, 2008). Green gram is a major component of various sequential and intercropping systems in India and huge export potential exists for this crop (Singh and Ahlawat, 2005). The mungbean landraces of India are reported to contain the most diverse plant growth types and protein content (Tomooka et al., 1991). Although, green gram has its origin, domestication and diversity the average yield of green gram is one of the lowest and the utilization of diversity in the release varieties is also low. Major Production constraints for mungbean include lack of suitable varieties and genotypes with adaptation to micro-niche environment; diseases such as Mungbean yellow mosaic virus (MYMV), *Cercospora* leaf spot (*Cercospora canescens*; insects-whitefly, bean thrips; storage pests-bruchids (*Callosobrochus* species); abiotic stessees including salinity, drought, heat and cold stress; indeterminate growth habit, plant type, excessive vegetative growth, low HI, sensitivity to photoperiod, asynchronous flowering, shattering of pods and sprouting of seeds *in situ* after rains. However, breeding to overcome these constraints is also challenging because green gram is a highly self pollinated crop. Hence, identification of landraces for high yield and other quality traits is the best alternative. Moreover, for selection of diverse germplasm lines for green gram crop improvement, it is essential that the collections from tribal communities should be systematically characterized using descriptors encompassing both qualitative and quantitative traits. With this in view, a total of 69 landraces collections were collected from Adilabad district of Andhra Pradesh, which also happens to form part of the region of origin, under the NAIP project on Biodiversity.

1.1 Characteristics of the study area

Adilabad is the largest district in Telangana which lies between 18° 40’ N and 19° 56’ N latitudes and 77° 47’ E and 80° 0’ E longitudes. It is bounded on North by Yavatmal, on the East by Chanda districts of Maharashtra and on the South by Karimnagar and Nizamabad districts of Telangana and on the West by Nanded district of Maharashtra State. About 65% of the district is inhabited by tribal population and 44.8% area of the district is covered mostly by dry deciduous forests. Adilabad district is administratively divided into 52 mandals with 1748 revenue villages and 7 municipalities. Tribal population is dominated by the Gonds (52%), Lambadas (22%), Kolams (8%) and others (*Naikpods, Koya, Andhs, Manne, Pradhan, Proja*-8%). The important rivers that, traverses in this district are the Godavari, the Penganga, the Wardha, the Pranahitha, the Kadam and the Peddavagu. The major crops groups in the district are rice, sorghum, cotton, pigeonpea, maize, soybean etc. Red soils are predominant which include *chalkas, red sandy, deep red loamy*. Very deep black cotton soils are also found in this district. The annual average rainfall is 900 to 1150 mm mostly by South West monsoon. The maximum and minimum temperatures during South West monsoon range from 32° C to 37° C and 21° C to 25° C, respectively.

1.2 Objective of Research

To collect the fast depleting landrace diversity in the green gram germplasm from the tribal regions of Peninsular India and study the extent available diversity in the landraces collected and also to identify potential landraces for immediate release as varieties through selection and/or through improvement in the breeding programmes

2. Experimental

A total of 14 agri-biodiversity surveys were undertaken during 2010-12 in 187 villages belonging to 52 mandals (District sub-units) of Adilabad district of Telangana for collection and conservation and inventory and documentation of agri-biodiversity in general. The overall collection tactics and logistics were taken into consideration as suggested by Astley (1991) and Bennett (1995). Garmin-12 model of Global Positioning System (GPS) was used to record the geographical coordinates of the collection sites. A total of 69 accessions comprising 10 landraces (*Balintapesalu, Chamkipesalu, Chinnapesalu, Gowaranipesalu, Nigurupesalu, Pachchapesalu, Pasupupesalu Peddapesalu, Rabipesalu* and *Tangidipesalu),* which seemed to represent the area and diversity, are characterized and evaluated at NBPGR Regional Station, Rajendranagar during *Kharif*, 2011 and 2012 in augmented block design. Each

accession was grown in two rows of three meter length. Plants were spaced at of 60X10 cm. Ten quantitative characters *viz.* Days to 50% flowering, plant Height (cm), primary branches per plant, number of clusters per plant, pods per cluster, number of seeds per pod, 100-seed weight (g), pod length (cm) and, total pods (no.) were recorded in five randomly selected plants in each accession. Fifteen qualitative characters *viz.* early plant vigour, plant growth habit, leaf colour, terminal leaf length, leaf shape, plant surface, branching pattern, flower colour, leafiness, flowering tendency, twining tendency, raceme position, pod pubescence, pod colour and pod shape were recorded in each accession. Clustering and correlation matrix was worked out using the SAS Enterprise Guide 4.3.

3. Results

As a result of 14 surveys, 69 accessions of green gram landraces were collected. The major tribal groups that contributed green gram germplasm were *Gond (32), Kolam (9), Lambada (3), Nayakpod (3) Manne (1*) and *Koya (1)*. These sixty nine landraces were evaluated for two seasons.

3.1 Qualitative traits

The frequency distribution of the fifteen qualitative traits is presented in Table 1. Most of the accessions (96%) recorded good and very good early vigour. Almost all the accessions recorded erect growth habit. Ten accessions recorded dark green leaf colour, which may used as a morphological marker for any association with insect and disease resistance. Only one accession viz. PSRJ 13018 recorded a terminal leaf length of more than 13 cm. All the 69 accessions possessed entire leaf and were found to be pubescent. Seventy seven percent of the accessions recorded branching all over the plant. Greenish yellow flower colour was recorded in 46 accessions. Abundant leafiness was recorded in 36% of the accessions. Synchronous flowering, which is a very desirable trait for uniform harvesting, was observed in 26 accessions. Twining, which is considered a primitive trait, was not recorded in any of the accessions. Terminal fruiting, recorded as above canopy raceme position, is another highly desirable trait facilitating in easy hand and mechanical harvesting was recorded in 65 accessions. Pod pubescence recorded good variation as sparsely pubescent (26 accs.), moderate (27 accs.) and dense (16 accs.). Most of the accessions (62%) had brown and black pod colour. Pod shape recorded was straight in all the accessions.

3.2 Quantitative traits

Good variation was recorded in the quantitative traits (Table 2) *viz.* plant height (35.6-68.2 cm), days to 50% flowering (35-54), number of primary branches (2.0-5.4), number of clusters per plant (6.4-23.0), number of pods per cluster (4.3-11.2), number of seeds per pod (11.0-15.2), 100-seed weight (1.9-6.5 g), pod length (6.9-13.5) and number of pods per plant (15.4-86.6). ANOVA of the data (Table 3) reported significant difference among all the accessions for all the traits except seeds per pod. Most of the accessions recorded days to 50% flowering between 35- 45 days.

Table 1: Frequency of the descriptor states Recorded in the green gram landraces

Qualitative Trait	Multi scale scores	Frequency
Early plant vigour	Poor	03
	Good	36
	Very good	30
Plant growth habit	Erect	68
	Semi erect	1
Leaf colour	Light green	9
	Intermediate green	50
	Dark green	10
Terminal leaf length	<10cm	35
	10-13cm	33
	>13cm	1
Leaf shape	Entire	69
Plant surface	Pubescent	69
Branching pattern	Central	15
	Basal	1
	All over	53
Flower colour	Yellow	8
	Greenish yellow	46
	Yellowish green	15
Leafiness	Sparse	13
	Intermediate	31
	Abundant	25
Flowering tendency	Synchronous	26
	Intermediate	26
	Asynchronous	17
Twining tendency	None	69
Raceme position	Above canopy	65
	Intermediate	4
Pod pubescence	Sparsely pubescent	26
	Moderate	27
	Dense	16
Pod colour	Straw	2
	Tan	4
	Brown	5
	Brown and black	43
	Black	15
Pod shape	Straight-69	69

Table 2: Mean values of the quantitative traits recorded in the green gram landraces

S.No	Collector No	Days to 50 % flowering	Plant Height (cm)	Primary branches per plant	Number of clusters per plant	Pods per cluster	No. of seeds per pod	100- seed weight (g)	Pod length (cm)	Total pods per plant
1	NAIP-BD-ADB-15	42	45.4	3.6	13.2	10.4	12.4	2.9	7.8	34.8
2	NAIP-BD-ADB-32	44	62.0	3.8	12.6	7.2	12.6	4.2	7.6	21.2
3	NAIP-BD-ADB-37	42	52.8	4.4	14.8	6.0	11.0	3.8	7.7	15.4
4	NAIP-BD-ADB-41	40	51.0	4.2	18.8	8.4	12.2	3.1	7.9	46.2
5	NAIP-BD-ADB-42	50	57.2	3.0	6.4	4.8	12.2	3.1	8.3	29.0
6	NAIP-BD-ADB-43	40	44.0	3.2	15.4	10.2	11.4	3.6	8.7	52.2
7	NAIP-BD-ADB-44	36	51.0	5.4	18.6	6.4	11.8	1.9	7.8	50.4
8	NAIP-BD-ADB-48	44	61.6	4.0	16.2	6.2	13.0	3.0	7.9	41.0
9	NAIP-BD-ADB-52	47	51.8	3.8	15.4	6.6	12.0	3.5	8.5	20.6
10	NAIP-BD-ADB-99	42	54.2	3.2	16.6	7.2	11.8	3.2	7.8	36.4
11	NSJ/NAIP/004	40	47.4	3.0	7.0	4.4	12.8	6.4	11.1	50.2
12	NSJ/NAIP/010	37	48	2.8	8.4	4.4	13.6	2.7	11.4	43.0
13	NSJ/NAIP/019	35	50.0	3.0	8.4	4.6	12.2	4.7	8.7	24.4
14	NSJ/NAIP/042	50	52.4	2.6	11.3	4.3	12.4	2.9	7.2	21.8
15	NSJ/NAIP/050	54	42	3.5	9.5	6.5	11.6	2.7	7.2	24.8
16	NSJ/NAIP/055	40	61.8	3.2	8.6	5.8	11.8	3.5	7.9	31.0
17	NSJ/NAIP/074	40	49.6	3.0	9.0	4.6	12.2	3.3	10.6	15.8
18	NSJ/NAIP/076	35	54.6	2.8	10.0	4.8	13.4	5.7	13.3	33.0
19	NSJ/NAIP/093	42	63.0	3.8	17.4	7.6	13.6	2.3	8.1	39.6
20	NSJ/NAIP/121	42	63.0	3.0	11.2	7.0	12.0	3.1	8.0	27.0
21	NSJ/NAIP/125	36	55.0	3.2	13.0	7.8	13.4	6.5	13.5	45.8
22	NSJ/NAIP/134	36	54.0	2.6	12.8	8.0	12.4	3.5	8.1	57.6
23	NSJ/NAIP/144	35	64.9	3.0	11.6	7.0	11.4	3.9	7.7	54.2
24	NSJ/NAIP/158	37	60.0	3.2	14.4	6.8	12.4	3.6	9.2	55.8
25	NSJ/NAIP/160	36	57.0	3.0	15.0	9.4	12.4	4.0	7.7	69.8
26	NSJ/NAIP/170	37	56.4	3.0	14.8	8.4	12.0	3.1	8.1	62.4
27	NSJ/NAIP/183	37	56.6	3.4	13.6	8.2	11.8	3.7	7.5	45.4
28	NSJ/NAIP/190	40	62.1	4.2	15.4	6.2	11.8	3.3	7.6	52.0
29	NSJ/NAIP/207	42	68.2	3.8	23.0	8.4	12.8	3.3	8.7	35.8
30	NSJ/NAIP/231	44	62.8	4.6	17.6	7.0	12.2	3.0	8.3	35.4
31	NSJ/NAIP/291	39	55.8	4.0	12.6	4.8	14.4	5.3	13.2	49.6
32	NSJ/NAIP/301	40	52.4	3.4	14.2	5.2	13.0	5.7	13.2	50.6
33	NSJ/NAIP/317	47	60.2	3.8	12.3	6.3	11.2	3.0	7.6	38.0
34	NSJ/NAIP/390	35	49.8	2.8	13.0	9.2	13.0	3.2	8.3	48.4
35	NSJ/NAIP/396	36	54.2	2.4	13.2	6.2	11.8	3.3	7.1	46.6
36	PSR-13163	36	52.4	3.8	16.0	6.6	12.0	3.7	7.8	85.6
37	PSR-13174	37	59.4	3.0	13.4	8.0	12.8	3.3	7.6	61.0
38	PSR-13190	37	57.4	3.2	13.0	8.8	11.4	3.7	7.5	61.4
39	PSR-13197	39	53.2	3.4	14.0	8.8	11.6	3.4	7.9	64.4
40	PSR-13248	37	56.8	3.8	17.4	7.8	13.4	3.2	8.1	83.0
41	PSR-13287	36	61.2	2.4	21.4	8.6	12.8	4.5	7.9	85.4
42	PSR-13294	37	54.6	3.2	18.8	7.4	12.4	3.4	7.8	77.8
43	PSR-13297	36	53.6	3.0	15.0	6.2	12.8	3.7	8.2	68.8
44	PSR-13308	37	56.2	3.2	16.0	7.0	12.8	3.7	8.0	78.6
45	PSRJ-13014	40	57.6	2.6	12.6	10.0	12.6	3.4	7.9	51.2
46	PSRJ-13018	36	53.8	2.8	12.6	10.6	11.4	2.7	7.3	83.6
47	PSRJ-13043	37	62.6	2.8	13.0	9.4	11.6	3.4	7.8	67.0
48	PSRJ-13077	36	62.4	3.0	13.4	9.4	12.6	3.1	8.7	80.6
49	PSRJ-13145	37	44.8	3.2	15.6	8.6	11.8	3.5	7.9	44.8
50	RJR-070	40	51.4	3.6	11.2	9.0	12.4	3.1	8.2	54.0
51	RJR-088	37	42.6	3.8	12.4	9.4	12.6	3.3	8.5	68.0
52	RJR-097	40	56.1	3.2	14.6	10.6	12.4	3.0	8.3	40.6
53	RJR-141	37	60.4	4.2	14.0	6.8	11.2	2.5	8.3	40.2
54	RJR-162	40	52	2.8	11.0	7.6	12.6	4.0	8.2	64.8
55	RJR-213	40	50.8	3.2	15.6	8.0	13.6	3.8	8.2	52.6

56	RJR-216	36	49.6	2.0	12.2	8.2	13.4	2.9	8.0	63.4
57	RJR-227	37	50.4	3.8	14.0	11.2	11.4	2.4	7.5	56.8
58	RJR-233	37	55.2	3.0	12.2	9.8	11.6	3.7	7.2	69.0
59	RJR-242	36	58.2	3.4	14.6	7.2	12.6	2.8	8.0	65.2
60	RJR-332	36	60.4	3.8	13.2	5.8	12.8	3.3	8.3	53.4
61	RJR-345	36	56.4	3.4	16.8	6.0	12.0	2.6	7.9	84.0
62	RJR-368	36	54.8	3.2	15.8	7.8	13.8	3.7	7.8	86.6
63	RJR-378	39	45.8	2.6	8.6	5.6	12.2	3.4	7.3	56.6
64	SNJ/2011-27	47	53.4	2.6	14.8	7.2	12.8	3.1	7.7	45.6
65	SNJ/2011-35	39	35.6	3.0	11.3	5.6	12.4	2.4	6.9	25.0
66	SNJ/2011-58	37	55.2	3.0	21.0	7.4	12.0	3.6	7.7	56.2
67	SNJ/2011-64	40	55.4	3.4	21.0	6.8	12.4	3.5	7.3	18.6
68	SNJ/2011-77	37	50.2	3.4	17.6	6.8	12.0	2.5	7.7	38.6
69	SNJ/2011-99	36	47.0	3.2	12.2	7.6	15.2	3.6	10.3	39.0
	Mean	39.1	54.5	3.3	13.9	7.4	12.4	3.5	8.4	50.4
	Standard Deviation	4.0	6.1	0.6	3.3	1.7	0.8	0.9	1.5	18.8
	Minimum	35.0	35.6	2.0	6.4	4.3	11.0	1.9	6.9	15.4
	Maximum	54.0	68.2	5.4	23.0	11.2	15.2	6.5	13.5	86.6

Table 3: Analysis of variance for plant traits studied in green gram landraces

Source	DF	Plant height	Days to 50% flowering	No. Of Primary branches	Number of clusters per plant	Pods per cluster	Seeds per pod	100 seed weight	Pod length	Number of pods per plant
Treatments	71	40.18*	16.48	0.33*	12.38*	2.89*	0.63	0.73*	2.13*	353.99*
Blocks	6	6.92	6.54	0.08	1.76	0.80	0.53	0.07	0.48	172.04
Error		5.09	3.37	0.09	2.78	0.61	0.89	0.05	0.08	135.67

**=p< 0.05*

Table 4: Correlation matrix of the plant traits studied for evaluating the green gram landraces

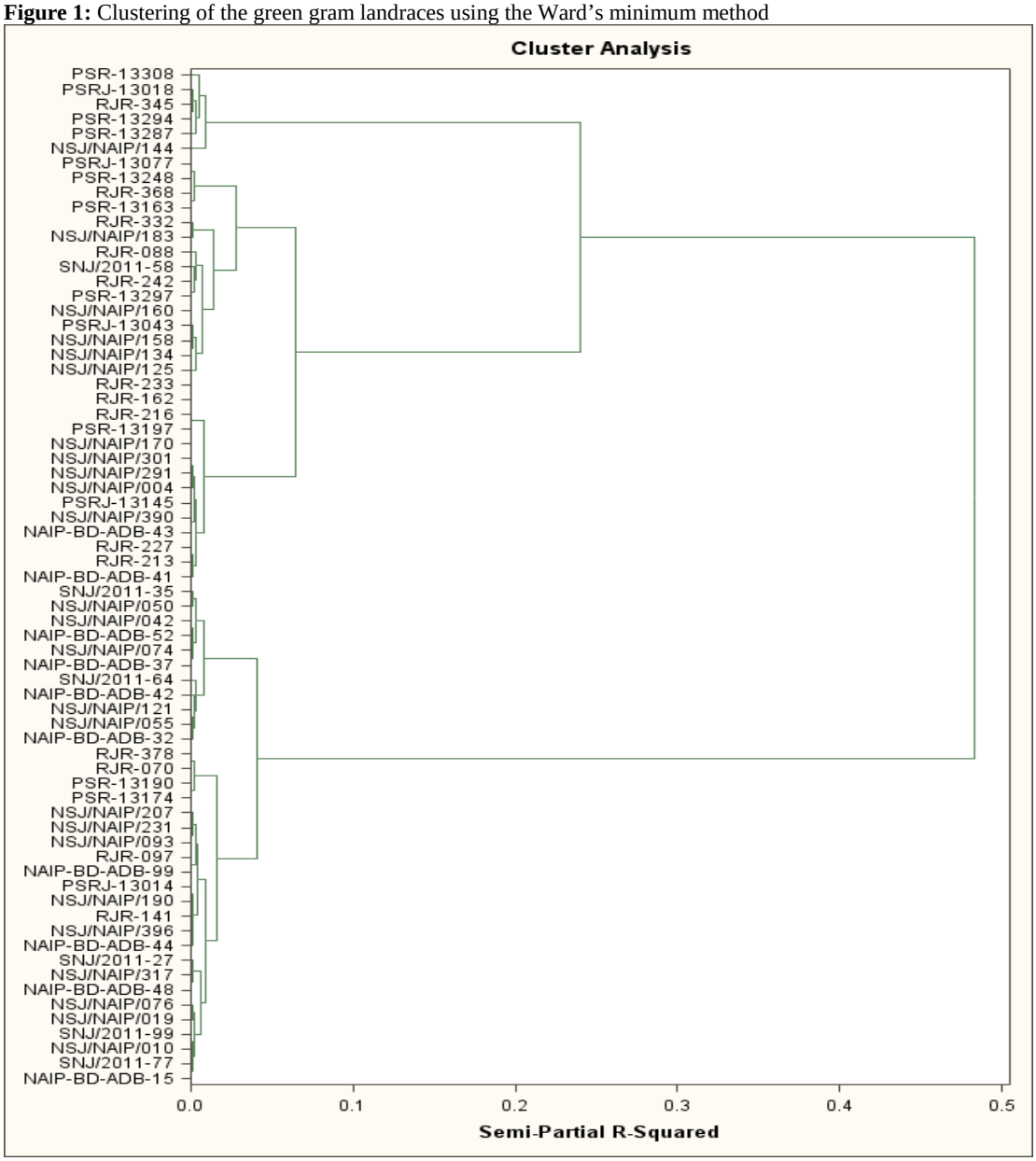
	Days to 50% flowering	Plant height	Primary branches per plant	No. Of clusters per plant	Pods per cluster	Number of seeds per pod	100-seed weight	Pod length
Days to 50% flowering								
Plant height	-0.03							
Primary branches per plant	0.17	0.13						
No. Of clusters per plant	-0.15	0.29	0.35					
Pods per cluster	-0.24	0.04	-0.07	0.31				
Number of seeds per pod	-0.15	-0.05	-0.16	0.00	-0.16			
100-seed weight	-0.17	0.03	-0.20	-0.19	-0.24	0.31		
Pod length	-0.15	-0.07	-0.01	-0.25	-0.35	0.53	0.69*	
Pods per plant	-0.57	0.13	-0.19	0.25	0.41	0.09	0.02	-0.12

** p< 0.05*

Only three accessions *viz.*NAIP-PB-ABD-42 (50), NSJ/NAIP-42 (50) and NSJ/NAIP-50 (54) recorded late flowering. One accession *viz.* NAIP-BD-ADB-44 (5.4) recorded maximum number of primary branches. Branch number had low correlation (0.13) with pods per plant in the present study.

Accessions with an average primary branch number of 3.0 recorded maximum number of pods

Figure 1: Clustering of the green gram landraces using the Ward's minimum method



per plant. Most of the accessions recorded 11-15 clusters per plant. Whereas there were 10 accessions which recorded clusters per plan between 6.4 and 10. Maximum clusters per plant were recorded by accession NSJ/NAIP/207 (23.0) followed by PSR13287 (21.4), SNJ/2011-58 (21) and SNJ/2011-64 (21) and these accessions also recorded on an average of 12 seeds per pod. Most of the accessions recorded between 6 - 8 pods per cluster. There were five accessions *viz.* NAIP-BD-ADB-15 (10.4), NAIP-BD-ADB-43 (10.2), PSRJ-13018 (10.6), RJR-097(10.6), and RJR-227 (11.2) which recorded more than 10 pods per clusters. There was significant diversity in pods per plant. Seven accessions *viz.* PSRJ-13077, PSR-13248, PSRJ-13018, RJR-345, PSR-13287, PSR-13163 RJR-368 recorded more than > 80 pods per plant.

3.3 Correlation

Correlation matrix using the Pearson's coefficient (Table 4) revealed a positive significant correlation only between pod length and 100-seed weight (0.69; $p<0.05$).

3.4 Cluster analysis

The cluster analysis based on Ward's method grouped the 69 accessions and the three local controls into three broad clusters (Fig. 1). Cluster I had nine accessions accessions, Cluster II had 26 accessions and Cluster III had 34 accessions. Interestingly all the controls were grouped together in the third cluster. The accessions were not grouped according to the geographical distribution as for example Cluster I had nine accessions collected from seven different mandals (district sub-divisions).

4. Discussion

Adilabad district of Telangana state in Peninsular India is one of the tribal dominated districts. Also, it is also an important geographic centre catering to the needs of the adjoing districts of the state of Maharashtra. There is a steady exchange of seed/ germplasm between the tribal communities of these districts through fairs/local markets/shandis. Most of rainfall is received during June-September which is the South-West monsoon time. The *Gonds*, who come under adivasi tribes traditionally practice agriculture for their livelihood (von Fürer-Haimendorf 1982), emerged as the major conservators of diversity in the green gram germplasm. The germplasm comprised of 18 named landraces *viz. Balintapesalu, Bodalipesalu, Chamkipesalu, Chinnapesalu, Gowaranipesalu, Jonnapesalu, Mabbupesarlu, Manchipesalu, Mathipesara, Motupesalu, Nallapesalu, Nigurupesalu, Pachchapesalu, Pasupupesalu Peddapesalu, Rabipesalu, Tangidipesalu and Teegapesalu. Paccapesalu*, meaning 'green green gram' was recorded as the most widely cultivated landrace as it was collected 23 times from different villages, *Chinnapesalu*, meaning 'small green gram' was second followed by *Balintapesalu*, a yellow green gram specifically given to lactating mothers, *Pedda pesalu*, green gram with bold seed *and Rabi pesalu*, green gram genotype suitable for taking up during post-rainy season.

Among the qualitative and quantitative traits, wide variation as in the present study was also reported by Sunil et al, (2003) in 89 accessions of green gram germplasm collected from the state of Andhra Pradesh of Peninsular India. The present collection of landraces have been through intense selection process at the farmer level as none of the accessions recorded twining habit, which is undesirable trait, and all the accessions had above canopy raceme position with straight pod shape both of the traits are most desired by farmers, as the above canopy raceme position enables easy harvesting of the pods and straight pod shape produces good quality seed. Increase in branch number would lead to bushy plant type leading to increased pods per cluster and flower drop (Katiyar et al. 2008). The feature of more clusters per plant and more seeds per pod, which was observed in the present study was reported to be desirable feature (Katiyar et al. 2008). Katiyar and Dixit (2011) concluded in their study that pods per plant was the first principal component that was contributing to the genetic divergence in greengram. Majority of the accessions recorded number of seeds per pod between12-14. However, two accessions viz.NSJ/NAIP/291 (14.4) and SNJ-2011-99 (15.2) recorded more than 14 seeds per pod. Genotypes having > 12 seeds per pod were categorized as potential donors by Katiyar et al., (2011). Maximum 100-seed weight was observed in two accessions *viz.* NSJ/NAIP/004 (6.4) and NSJ/NAIP/125 (6.5), which are categorized as large seeded whereas the minimum 100-seed weight was recorded in NAIP-BD-ADB-44 (1.9). Katiyar et al, (2008) reported that there were only two released varieties *viz.* Pusa Vishal and "SML 668", out of the 73 that they studied that had 100-seed weight more than 5g. Seed weight is a primary component in green gram breeding programmes. It is set to be governed by four QTLs accounting for 49% of the variation in seed weight (Fatokun et al, 1992). Also, Katiyar and Dixit (2011), identified eight accessions having 100-seed weight > 5g as potential donors. Path coefficient analysis study by Reddy et al, (2011) have shown that pods/plant and 100-seed weight can be used as selection criteria for identifying high yielding lines. Pod length of more than 13 cm was recorded in 4 accessions *viz.* NSJ/NAIP/076 (13.3), NSJ/NAIP/125 (13.5), NSJ/NAIP/291(13.2), NSJ/NAIP/301 (13.2). Also, accessions having pod length > 10 cm can be used as donors in the greengram crop improvement programme. The data shows that there is wide variation in the germplasm lines which can form a parental sources for advanced breeding lines as genetic erosion and narrowing of genetic base have been reported in breeding lines released in India (Katiyar et al., 2007). Also, most of the accessions in the present study are landraces and the use of the landraces and the wild relatives in crossing programme to increase yield and stability had been emphasised by Singh and Ahlawat (2005). From this point of view, accession NSJ/NAIP/125 may be a potential as it recorded high 100-seed weight and pod length, both these traits have been significantly correlated with grain yield in green gram (Bisht et al., 1998). Similar variation in the quantitative traits was also reported by Sunil et al. (2003) and they identified promising lines based on their findings. Three accessions *viz.* NSJ/NAIP/301, NSJ/NAIP/076, NSJ/NAIP/125 recorded high pod length (≥ 13.0 cm) and high 100-seed weight (> 5.5g). These accessions seem to be very promising for these two traits, which may be used for crop improvement programme. Katiyar et al. (2007) in their analysis on advanced breeding lines have established that 17 lines have been selected through selection method.

Clustering of the accessions was studied along with landrace name, Similar study was reported in horsegram germplasm from the region by Sunil et al., (2008). Based on the passport information and the clustering of the accessions it can be deduced that four accessions in Cluster I *viz.* PSR-13018 and PSR-13043 and RJR-345 and RJR-368 are same genotypes as they were collected from the same village (Table 1) whereas the remaining

seven accessions from the cluster may closely related with differences in traits other than the once studied in the present study. Also, PSR13077 from the cluster has a landrace name of *Pedda pesalu*, which in means 'big green gram' or 'big crop' corresponding to high yield. All the nine accessions in the Cluster I recorded high total number of pods per plant (Table 3.) Also, when the cluster composition was studied along with the popular landrace name associated with the accessions it was found that a landraces *viz. Pacchapesalu, Chinnapesalu, Tangadipesalu* appear in more than one cluster indicating that although they share the landrace name they are distinct based on the traits in the present study and their is good variability among the landraces. However landraces *Balintapesalu (NSJ/NAIP/093 NSJ/NAIP/231), Gowranipesalu (NSJ/NAIP/207) and Nigurupesalu (NSJ/NAIP/055)* have clustered together in Cluster III. Since, the landrace *balinthapesalu*-a yellow green gram and popular landrace gets its name as a food for the lactating mother, it can be improved with the closely related landraces *viz. Gowranipesalu and Nigurupesalu.* Also, the biochemical analysis of these landraces may also distinguish them from each other, similar to the study wherein significant varietal variation was observed in the anti-nutritional constituent's *viz.* Phytin, tannin and trypsin inhibitor activity in greengram (Jessy and Prema 1998).

Conclusion

The present study revealed existence of good variability among the landraces of green gram collected from tribal communities of Adilabad, India. Some of the accessions have traits better than the control varieties, which can be used in the crop improvement programmes. Recent study by Subhojit et al., (2012) had revealed a narrow genetic base of mungbean cultivars in India. These diverse and promising accessions need to be incorporated in the crop improvement programmes.

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