Indian J. Pl. Genet. Resources 12(2): 242-246, 1999

EVALUATION OF WINGED BEAN (*Psophocarpus tetragonolobus*) GERMPLASM

D. P. PATEL AND T.R. LOKNATHAN, National Bureau of Plant Genetic Resources, Regional Station, Dr. PDKV Campus, Akola 444 104 (Maharashtra State)

Two hundred forty one germplasm accessions both exotic and indigenous were evaluated for 35 descriptors during kharif 1995 and 1996. The accessions possessing one or more than one desirable traits namely EC 178288, EC 178313, EC 178318, EC 178327, EC 178331, EC 38823, EC 38955 need special attention for their utilization in breeding programme. Although this plant species is known for its multiutility, the crop is not grown commercially. Hence being a non-traditional crop, more attention is needed to evolve suitable varieties and package of practices to establish it in the cropping system. Further an effort to collect more germplasm especially from the areas of its cultivation is required for improvement programme.

Key words : Winged bean, germplasm, genetic variability

Psophocarpus tetragonolobus (L) DC popularly known as winged bean or Goa bean or princess bean belongs to family *Leguminoceae* originated either from Medagascor or Mauritius (Burkill, 1935). It is protein rich crop having economic value of its stems, leaves, flowers, pods, seeds and roots and is one of the Cindrellas of the plant world. Masefield (1973) keeps this crop at par or better to wonder crop of soybean with 38 per cent protein and 18 per cent oil in dry seeds. It is also reported that winged bean is one of the most heavily nodulated legimes with as high as 440 nodules per plant and 700 pounds per acre on fresh weight basis (Masefield, 1957). Inspite of all the beneficial attributes the importance of this crop has surprisingly not recognised (Pospisil *et al.*, 1973) and is only grown in small scale all over the world except in few countries viz. Papua New Guinea and Myanmar where it is grown as field crops (Burkill, 1906). In India, winged bean has been grown in different parts on small scale for its green pods and is known as different names in different regions (Thomas, 1983; Singh and Paroda, 1983; Chandel *et al.*, 1984).

In view of its utility, an efforts on collection, evaluation and conservation were started at National Bureau of Plant Genetic Resources, Regional Station at Akola for live maintenance of germplasm as early as 1980. 51 accessions maintained at Satellite Centre, Amravati and 62 accessions from NBPGR, Regional Station, Thrissur were also assembled. Seventy five accessions were imported from National Genebank, Thailand. An effort to introduce germplasm lines from other winged bean growing countries were also made and considerable number of germplasm were received (Table 1).

Table 1. Germplasm holdings of winged bean at NBPGR, Akola

Country	No. of acc(s)	Frequency (%)
India	89	36.92
Ghana	10	4.14
Papua New Guinea	46	19.08
Indonesia (Java)	10	4.14
Nigeria	17	7.05
Philippines	3	1.24
Thailand	64	26.55
USA	2	0.82
Total	241	

MATERIALS AND METHODS

The winged bean germplasm comprising of 241 accessions from eight countries (Table 1) was grown in augmented block design using Akola Local (IC 41891) and AKWB-1 as checks after every 20 test accessions during kharif 1995 and 1996 at experimental farm of NBPGR, Regional Station, Akola. Each accession was sown in two rows of 4 meters long with spacing of 60 cm between rows and 20 cm between plants. Standard cultural practices were adopted to raise the crop under rainfed conditions. One or two protective irrigations were provided in the month of November-December.

Table 2. Range, mean, SE & CV of some important traits of winged bean germplasm

Characters	Season	Max	Min	Range	Mean ± SE	CV	No. of observations
1	2	3	4	5	6	7	8
Days to 50% flowering	S-1	142.0	70.0	72.0	99.42 ± 16.37	16.46	241
	S-2	139.0	73.0	66.0	96.59 ± 14.25	14.75	24
Days to 50% maturity	S-1	210.0	136.0	74.0	181.69 ± 19.60	10.78	241
	S-2	220.0	164.0	56.0	183.20 ± 05.51	03.00	241
No. of pods per plant	S-1	31.0	1.0	30.0	5.61 ± 01.46	26.02	241
	S-2	22.0	1.0	21.0	5.95 ± 01.27	21.30	241
Pod length (CM)	S-1	20.2	8.0	12.2	12.80 ± 02.09	16.32	241
	S-2	19.7	9.0	10.7	13.31 ± 01.72	12.92	241
No. of seeds per pod	S-1	17.0	5.0	12.3	11.23 ± 01.93	17.18	241
	S-2	18.7	7.6	11.1	12.42 ± 02.26	18.19	241
100 seeds weight (g)	S-1	40.1	19.1	21.0	29.04 ± 03.92	13.49	241
	S-2	41.3	16.1	25.2	28.39 ± 04.87	17.62	241
Seed yield/plant (g)	S-1	85.3	2.0	83.3	13.94 ± 02.25	16.15	241
	S-2	68.7	1.0	67.7	14.34 ± 01.38	9.65	241
Shelling ratio (%)	S-1	88.4	38.0	50.4	55.62 ± 08.88	15.96	241
	S-2	75.3	31.0	44.3	50.49 ± 10.67	21.13	241
Green pod yield/plant (g)	S-1	215.5	4.6	210.9	35.31 ± 08.62	24.41	241
	S-2	157.0	2.9	154.1	35.13 ± 09.03	25.70	241
Tuber yld/plant (g)	S-1	335.0	10.5	324.5	83.88 ± 18.88	22.51	228
	S-2	186.0	6.0	180.0	51.20 ± 17.96	25.08	230

S-1 = Kharif 1995 season; S-2 = Kharif 1996 season

Five random plants were used for recording observations on quantitative traits and average value is computed. The qualitative characters were scored by visual observations adopting the winged bean descriptors published by IBPGR (now IPGRI), Rome, 1979.

Table 3. Frequency distribution of some visually recorded traits

Character	Descriptor	No. of observations	Frequency (%)
Vigour index	Poor	1	0.41
	Fair	31	12.86
	Vigourous	147	60.99
	Very vigourous	51	21.16
	Luxurient	11	21.16
	Total	241	
Stem colour	Green	189	78.42
	Greenish purple	34	14.10
	Dark green	2	0.82
	Purple	10	4.14
	Yellowish green	6	2.48
	Total	241	
Terminal leaf shape	Ovate	223	92.53
	Deltoid	-	-
	Ovate-lanceolate	13	5.39
	Lanceolate	5	2.07
Foliage colour	Green	217	90.04
	Pale green	2	0.82
	Dark green	19	7.88
	Yellowish green	1	0.41
	Purple	2	0.82
	Total	241	
Petiole colour	Green	236	97.92
	Dark green	4	1.65
	Greenish purple	1	0.41
	Total	241	
Calyx colour	Green	203	84.23
	Greenish purple	5	2.07
	Purple	12	4.97
	Dark green	8	3.31
	Light green	10	4.14
	Dark purple	3	1.24
	Total	241	
Corolla colour	White	8	3.31
	Light blue	62	25.72
	Blue	155	64.31
	Bluish purple	14	5.80
	Dark purple	2	0.82
	Total	241	
Green pod colour	Light green	2	0.82
	Green	209	86.72
	Dark green	13	5.39
	Purple	6	2.48
	Yellowish green	3	1.24
	Greenish purple	7	2.90
	Light purple	1	0.41
	Total	241	
Seed colour	Brown	49	20.33
	Chacolate	96	39.83
	Yellow	12	4.97
	Cream	6	2.48
	Purplish black	11	4.56
	Ash grey	16	6.53
	Tan	5	2.07
	Mottled	2	0.82
	Pale cream	29	12.03
	Bluish green	7	2.90
	Blue	4	1.65
	Total	241	

RESULTS AND DISCUSSIONS

The range, mean, SE, CV of ten quantitative traits recorded during kharif 1995 and 1996 are presented in Table 2 while, frequency distribution of nine visually recorded traits are presented in Table 3 although characterization was done for 35 descriptors. The promising accessions on the basis of two year performance were identified and are listed in Table 4.

It can be seen from Table 1 that maximum number of entries were from India (35%) followed

Table 4. Promising accessions identified for various economic traits (on the basis of two years performance)

Sr. No.	Attributes	Promising acc(s) identified
1.	Early flowering (< 75 days)	EC 38821 B, 38955, 38954 (all Pa pua New Guinea), EC 27886 (Ghana), EC 178310, 178288 (both Thailand), EC 116811 (Nigera), IC 17006-1, IC 15017,I C 95234 (all India).
2.	Early maturing < 170 days	IC 95234, 15017, 15018, 17004, IC 17005-1, 26940 (all from India) EC 27886 (Ghana), EC 38821 P, 38825 P2, 38825 p3 (all from Papua New Guinea), EC 116881-1 (Nigeria), EC 178288 (Thailand).
3.	High pod number/plant (> 20 pods)	IC 34861, IC 95222,IIHR Sel-12 (all from India), EC 38823,38955, 38821 (all from Papua New Guinea), EC 114273 B (Indonesia).
4.	Long pods > 17 cm	IC 95221, 26940, 21904, 41981 (all from India) EC 27884 (ghana), EC 178299, 178300, 178313, 178327, EC 178331 (all from Thailand).
5.	High seed number/pod	IC 95240, 95228,95231, 17005-1, 26940 A1, 26949 (all from India), EC 38825-3, 38823 (both from Papua New Guinea), EC 178302, 178313, 178327 (all from Thailand)
6.	Bold seeds > 35 g/100	IC 95221, 95223, 95224, 34865, Mysore local (all from India), EC 38824-3 (Papua New Guinea), EC 178274, 178276, 178296, 178313 (all from Thailand).
7.	Seed yield/plant > 40 g	IC 95224, 26946, 41981 (All from India) EC 38823, 38821 B (Both from Papua New Guinea), EC 114273 B EC 114273 C, 121918 (all from Indonesia), EC 178331 (Thailand).
8.	High Shelling Ratio > 60%	EC 21904 (ghana), EC 38954 A (Papua New Guinea), EC 121918 (Indonesia), EC 130184 (USA), EC 142652, 142653 (both Nigeria), IC 95226, 95235, 45225 (all from India).
9.	Green pod yield > 500 g/plant	IC 34861 (India), EC 38823, 38959, 38824, 38855 A, 38957 (all from Papua New Guinea), EC 114273 B (Indonesia)
10.	Tuber yield/plant	IC 95222, 95237-1, 95240 (all from India), EC 38955 A, 38824, EC 38825 (all from Papua New Guinea) EC 27885-1 (Ghana), EC 142600 (Philippines), EC 142666 (Nigeria) EC 142667 (Nigeria), EC 178275-1, EC 178287, 178306,178333 (all from Thailand).

by Thailand (27%) and Papua New Guinea (19%). From Table 2, 3 and 4 it is revealed that a considerable range of variability has been observed for all the characters under evaluation. The low estimates of SE and CV also suggested the presence of genetic variability with low interference on non genetic factors. The present investigation helped to identify some donor genes available for exploitation for the improvement of winged bean crop for seed, pod or tuber purposes. Since this crop is of long duration and is cultivated in small scale for its tender fibreless pods only, the identification of genotypes which are early with high yield potential will be of prime importance. EC 38821B (Papua New Guinea) was earliest in maturity with relatively high yield potential. EC 114273B was one of the selection of Indonesian germplasm which is released as AKWB-1 for its tender fibreless pods (Patel et al, 1990). The accessions possessing single or multiple desirable genes viz. EC 17828, EC 38823 and EC 38955 both from Papua New Guinea need special attention for their utilization in breeding programme.

Under present studies, very good yield potential in terms of pulse seed, pods for vegetable and tuber yield have been realised from the specific

germplasm cultures. They need to be exploited further for development of varieties for commercial cultivation. Further strengthening of the germplasm with availability of related species namely *Psophocarpus palustris* Desv syn *P. longepedunculatus* Hassk will help in searching rare attributes such as non viny determinate types for easy cultivation. Being a non traditional crop, much more research work is needed to evolve early maturing, bushy growth habit, high yielding potential for green pods, seed and tuber, high oil and protein content, non shattering and multiple resistance to diseases and pests and other relevant desirable quality attributes. Similarly agronomic research to develop the package of practices and to establish it in cropping system will have to be emphasised.

REFERENCES

Burkill, I.H. 1906. Goa bean in India *Agric. Ledger* 4: 51-64.

Burkill, I.H. 1935. Dictionary of the economic products of the Malayan Peninsula Vol. II Grown Agents for the Colonies, London.

Chandel, K.P.S., Pant, K.C. and Arora, R.K. 1984. Winged bean in India. NBPGR Sci. Monogr. No. 8 31 p.

IBPGR. 1979. Descriptors for winged bean, IBPGR (now IPGRI) Secretariat, Rome (AGPE : IBPGR/79/5, March 1979)

Masefield, G.B., 1957. The nodulation of annual leguminous crops in Malaya, *Empire Journal of Experimental Agriculture* 25: 139.

Masefield, G.B. 1973. *Psophocarpus tetragonolobus*-a crop with a future. *Field Crops Abstract* 26: 157-160.

Patel, D.P., Thomas, T.A. and Bhagmal. AKWB-1 - A new variety of winged bean for vegetable. Released through Central Varietal Release Committee, ICAR, New Delhi.

Pospisil, F.K. and E. Boamah-Mensah, 1971. Investigation of winged bean in Ghana. *World Crops* 23: 250.

Singh, V.P. and Paroda, R.S. 1983. The winged bean a review. *Haryana J. of Horticultural Sci.* 12: 200-211.

Thomas, T. A., 1983. Winged bean distribution in India. 1st Workshop of AICEP on UU & UEP, NBPGR, New Delhi.