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RESEARCH ARTICLE

EVALUATION AND RANKING OF WINGED BEAN (*Psophocarpus tetragonolobus* (L.) DC.) GENOTYPES FOR ENUMERATING AVAILABLE VARIABILITY

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Abstract

Twenty one genotypes of winged bean from different sources were evaluated, at the Department of Olericulture, College of Agriculture, Vellayani, Thiruvananthapuram (Kerala) during 2013-14. Morphology, yield and quality attributes of these genotypes were substantially different. Genotypes PT 21 and PT 1 showed maximum duration for flowering and fruiting in a year, while most of the genotypes showed flower initiation, peak flowering and fruiting under short day period's falls from September to February. Days to first flowering (75.05 to 178.83), pods per plant (44.98 to 154.49) and pod yield (696.60 g to 2703.33g per plant) also showed considerable variations. Based on selection index including both vegetative and qualitative characters PT 21 was ranked first with an index of 24799.37 followed by PT 6 (23324.76). Overall ranking based on all the selected characters showed the relative superiority of PT 21 and PT 1 over others.

INTRODUCTION

Winged bean (*Psophocarpus tetragonalobus* L.), 2n=2x= 18/22, also called as God-sent vegetable, Goa bean, four angled bean and princess pea, has assumed considerable importance as a protein rich multipurpose crop, originated in South-East Asia perhaps Papua New Guinea and is an important leguminous vegetable in Bangladesh, Burma Thailand, Vietnam, Malaysia, Indonesia, Ghana, Nigeria and Sri Lanka. The leaves, flowers, pods, green seeds, dried seeds, and tuberous roots of winged bean are all edible and nutritious (Singh et. al., 2013). It is commonly grown in southern and eastern parts of India and can be consumed by incorporating in a variety of cuisines.

Being a leguminous crop, all parts are rich in protein, vitamin A and other vitamins (Mahto and Dua, 2009). Being an underutilized legume, very little work has been done on its genetic improvement. The knowledge on genetic variability in the available germplasm is a prerequisite for effective selection of superior genotypes. It has also been well established that greater the genetic variability in the population greater will be the chance of obtaining desirable gene combination. Therefore, the present investigation was undertaken with the objective to estimate genetic variability of various yield and attributing characters in winged bean using Fishers' discriminant function analysis.

MATERIALS AND METHODS

Twenty one winged bean genotypes were collected from various sources were used for the present study (Table 1). The genotypes were evaluated at the Department of Olericulture, College of Agriculture, Vellayani, Thiruvananthapuram (Kerala) during 2013-2014. The experimental site was located at 8^{o} $5^{'}$ N latitude and 77^{o} $1^{'}$ E longitude at an altitude of 29 m above mean sea level. Predominant soil type of the experimental site was red loam

belonging to Vellayani series, texturally classified as sandy clay loam with a pH of 5.2 and the area enjoys a warm humid tropical climate. The experiment was laid out in a randomized block design with three replications. Seeds of each genotype were sown in rows at spacing of 125 cm between rows and 50 cm between plants. Recommended agronomic practices were followed to raise the healthy crop. Observations on ten yield attributing traits viz., vine length, days to first flowering, days to first harvest, days to final harvest, pod length, pod girth, pod weight, pods per plant and yield per plant were taken on five competitive plants from each replication of genotype under study. The replicated data were subjected to analysis of variance (as suggested by Panse and Sukhatme, 1985) followed by the selection index developed by Smith (1937) using discriminate function of Fisher (1936) to discriminate the genotypes based on all the characters.

RESULT AND DISCUSSION

Genotypes from different locations showed considerable variability in growth, flowering and yield attributes (Table 2). The genotypes showed distinct variation among each other with respect to vegetative, flower, fruit and seed characters (Plate 1a&b). The pod shape, wing colour and seed colour showed wide variation among the genotypes (Plate 2). A wide range of variation was noticed for days to first flowering. PT 21 recorded the minimum number of days (earliest) for flowering. Number of pods per plant is yet another important factor that decides the yield potential of genotypes; it ranged between 44.98 (PT 5) and 154.49 (PT 21). PT 21also recorded highest yield of 2703.33 g per plant. Regarding seed colour, genotypes PT 3, PT 8, PT 10, PT 11, PT 16 and PT 20 produced black coloured seed, while all others produced tan coloured seeds. Variability in these traits was also reported by previous workers (Philip and Ramachandran, 1986; Seth et al. 1988; Singh and Khanna, 1995; Mohamadali and Madalageri, 2004; Nandan et al., 2010) in winged bean.

Discriminant function analysis gives information on the proportionate weightage to be given to the yield component. Thus, selection index was formulated to increase the efficiency of selection by taking into account the important characters contributing to yield. According to Hazel (1943), a selection based on suitable index was more efficient than individual selection based on individual characters.

Selection index involving characters *viz.*, vine length (X1), days to first flowering (X2), days to 50 % flowering (X3), days to first harvest (X4), days to final harvest (X5), pod length (X6), pod girth (X7), pod weight (X8), pods per plant (X9) and yield per plant (X10) were selected for the analysis. The index value for each genotype was determined and they were ranked. The selection index worked out in the present study is given below.

$$I = 11.597\,X1 - 13.114\,X2 + 11.328\,X3 + 1.376\,X4 + 106.555\,X5 + 143.482\,X6 - 6.661\,X7 + 3.723\,X8 + 0.020\,X9 - 41.974\,X10$$

The scores obtained for the genotypes based on the selection index value were given in Table 1. Based on selection index including both vegetative and qualitative characters PT 21 was ranked first with an index of 24799.37 followed by PT 6 (23324.76). PT 1, PT 4 and PT 7 obtained next three positions with indices of 23165.18, 23085.51 and 22739.01 respectively. The minimum scores were obtained for PT 5 followed by PT 17 with an index of 18879.54 and 19400.60 respectively. Several workers used discriminant function analysis as an ideal method to screen the population in several other legume vegetables. Similar observations were made by earlier workers (Manju, 2006; Jithesh, 2009; Sivakumar, 2012) in vegetable cowpea.

Table 1. Details of winged bean genotypes and their overall ranking based on selection index score

Acc. No.	Source	Features	Index score	Final rank
PT 1	Parassala, Thiruvananthapuram	Green stem with green pod and wing, tan coloured seed	23165.18	3
PT 2	Veliyam, Kollam	Greenish purple stem with green pod and wing, tan coloured seed coat	21846.80	7
PT 3	Anchal, Kollam	Green stem with green pod and wing and black seed coat	22035.98	6
PT 4	Mavelikkara, Alappuzha	Green stem with green pod and wing, tan coloured seed	23085.51	4
PT 5	Varkala, Thiruvanathapuram	Green stem with green pod and wing, tan coloured seed	18879.54	21
PT 6	Munnar, Idukki	Green stem with green pod and wing, tan coloured seed	23324.76	2
PT 7	Alathoor, Palakkad	Purple stem with blue coloured flower and green pod and purple wing colour, brown seed coat	22739.01	5
PT 8	Revathi*, College of Horticulture, Vellanikkara	Greenish purple stem with green pod and wing colour, black seed coat	21571.85	8

PT 9	College of Horticulture, Vellanikkara	Greenish purple stem with green pod and wing, tan seed coat	20686.71	15
PT 10	College of Horticulture, Vellanikkara	Green stem with green pod and wing colour, black coloured seed	20628.69	16
PT 11	College of Horticulture, Vellanikkara	Purple stem with green pod and wing colour, black coloured seed	20811.99	14
PT 12	College of Horticulture, Vellanikkara	Green stem with green pod and wing colour, tan coloured seed	21415.60	11
PT 13	PGK 08/03, College of Horticulture, Vellanikkara	Green stem with green pod and wing, tan coloured seed	21272.87	13
PT 14	College of Horticulture, Vellanikkara	Greenish purple stem with green pod and wing colour, tan seed coat	21512.60	9
PT 15	College of Horticulture, Vellanikkara	Green stem with green pod and wing, tan coloured seed	20212.95	18
PT 16	College of Horticulture, Vellanikkara	Purple stem with green pod and wing colour, black coloured seed	21330.79	12
PT 17	College of Horticulture, Vellanikkara	Green stem with green pod and wing, tan coloured seed	19400.60	20
PT 18	College of Horticulture, Vellanikkara	Green stem with green pod and wing, tan coloured seed	20113.14	19
PT 19	College of Horticulture, Vellanikkara	Green stem with green pod and wing, tan coloured seed	20415.01	17
PT 20	Neyyatinkara, Thiruvanthapuram	Purple stem with green pod and wing, black coloured seed	21475.49	10
PT 21	Nemom, Thiruvananthapuram	Green stem with green pod and wing, tan coloured seed	24799.37	1

[*] *Revathi: released variety of winged bean from Kerala Agricultural University, Thrissur, Kerala, India*

Table 2. Estimates of mean, standard deviation and range for various quantitative characters in winged bean

Parameter	Mean	SD	Minimum	Maximum
Vine length (cm)	677.07	20.79	551.33	813.33
Primary branches/plant	11.46	0.72	6.33	15.66
Days to 1st flowering	113.65	6.59	75.05	178.83
Days to 50 % flowering	125.21	6.97	84.71	187.23
Days to 1st harvest	136.98	5.74	97.13	192.67
Days to final harvest	302.22	3.57	107.98	237.66
Pod length (cm)	18.90	0.52	14.84	21.89
Pod girth (cm)	7.59	0.19	5.03	8.75
Pod weight (g)	19.13	0.89	10.13	22.62
Pods / plant	86.58	7.21	44.98	154.49
Yield / plant (g)	1556.82	132.94	696.6	2703.33

SD: standard deviation

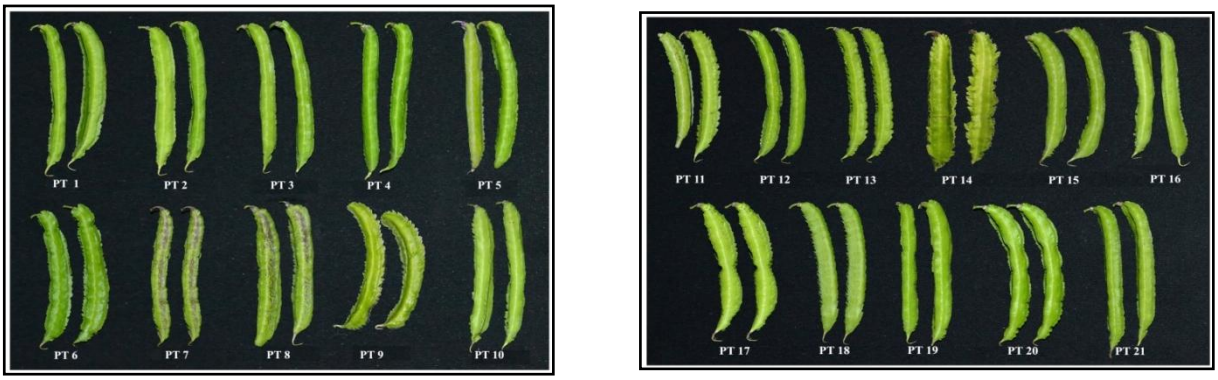

Plate 1. a & b : Variability in pod characters of winged bean genotypes

Plate 2. Variability in seed colour of winged bean genotypes

Hence, based on the discriminant function analysis, it may be concluded that superior genotypes in terms of yield and other characters may be recommended as elite types after further refinement and multilocation trails.

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