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Studies on genetic variability, heritability and genetic advance for vegetative growth, flowering, pod and pod yield parameters in yardlong bean (*Vigna unguiculata* L. var. *sesquipedalis*)

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Abstract
The present investigation was undertaken to estimate the genetic variability, heritability and genetic advance for 20 parameters including, vegetative growth, flowering, pod and pod yield parameters etc. with thirteen genotypes of yardlong bean (*Vigna unguiculata* L. var. *sesquipedalis*) in a randomized block design with three replications during *Rabi* season of 2017-18 at AICRP on Vegetable Crops of Orissa University of Agriculture & Technology at Bhubaneswar, Odisha, India. Analysis of variance revealed significant differences among the genotypes for all the parameters studied indicating the presence of sufficient variability in the studied material. High magnitude of PCV and GCV were observed for pod yield per hectare, pod yield per plant, number of pods per plant and number of harvests suggesting the existence of wide range of genetic variability in the germplasm for these traits and thus the scope for improvement of these characters through simple selection would be better. High heritability were found with leaf area, pod yield per hectare and pod yield per plant and high genetic advance were recorded with pod yield per hectare, pod yield per plant and number of pods per plant indicated that the heritability is due to additive gene effects which may be improved through simple plant selection methods.

Keywords: Yardlong bean, PCV, GCV, heritability, GA

Introduction
Yardlong bean (*Vigna unguiculata* var. S*esquipedalis* L.) is one of the most important leguminous tropical vegetable crop. It is called as chinese long bean, string bean, snake bean, snake pea, snap pea, bodi, bora, sitao, pea bean, asparagus bean and borboti and having chromosome number 2n = 2x = 22. Yardlong bean is widely grown throughout Asia especially in the South and South East Asian countries and is originated in Africa. It is a highly self-pollinated, profuse climbing annual, growing up to a height of five meters producing blue to violet flowers after 8-10 weeks of sowing. The crop is preferred for its green pods as vegetable. The genetic variability is the primary source of vegetable breeding in which selection acts to evolve superior genotypes. Yield being a complex quantitative character, direct selection for yield may not result in successful improvement. Consideration of quantitative approaches for exploitation of the extensive genetic variability available in yardlong bean is of utmost importance, which in turn is dependent on good estimates of the genetic parameters. Estimates of genetic parameters serve as a base for selection and hybridization as the degree of variability for a given character is a basic prerequisite for its improvement. Although several yardlong bean accessions have been introduced for evaluation and utilization, information on the nature and extent of variability among these collections for traits of economic importance is lacking. Thus, this study was undertaken to estimate the nature and magnitude of variability for yield and yield related characters with the help of genetic parameters as such as phenotypic as well as genotypic coefficients of variation, heritability and genetic advance. Evaluation and characterization of genotypes is necessary to describe their performance in terms of vegetative growth, flowering, pod and pod yield parameters. Genetic variability available within the yardlong bean genotypes has not been fully explored and screened. Therefore, this genetic wealth has not been fully exploited and should offer interesting possibilities for the future. The genetic parameters such as heritability, genetic advance, genotypic and phenotypic coefficients of variation provide an effective tool in the hands of a breeder to select a genotype having the most desirable traits for yield.

Materials and method

The experiment was conducted during *Rabi* season in 2017-18 at the All India Co-ordinated Research Project on Vegetable Crops, Orissa University of Agriculture and Technology, Bhubaneswar. The location is at latitude of 200 15' N and longitude of 850 52' E. It is about 60 km away from Bay of Bengal at an altitude of 25.5 meters above mean sea level (MSL).

The seeds of all the genotypes after treating with Captan @ 2 g/kg of seed were sown in the basins on 20th September 2017. After sowing seeds, the basins were irrigated.The experimental field was brought to a fine tilth by ploughing thrice followed by harrowing. Before final harrowing, FYM and vermicompost was incorporated and land was levelled properly. Then the individual plots were laid out of scheduled size in RBD design with 3 replications. The fertilizers were applied as per the standard recommendation i.e. 60:80:70 kg NPK/ha. Five plants of each genotype from the middle two rows in each replication were used for observations. The estimates of genetic parameters such as phenotypic and genotypic variance computed here as per method suggested by Burton and Devane (1953) along with the coefficients of variation permits a sound basis to determine the variability components as well as to know the relative amounts of heritable and non-heritable variation for each of these characters. Statistical analysis for all of the parameters was carried out using INDOSTAT statistical software.

Results and discussion

The analysis of variance (ANOVA) showed highly significant differences among the genotypes for 20 quantitative characters of yardlong bean studied (Table 1). The studies suggested that it is possible to isolate superior genotypes during the selection process. Genetic variability is a basic information needed for the breeders to improve the crops by adopting appropriate method of selection based on variability that exist in the material. Existence of variability among yardlong bean genotypes were also reported by Tyagi *et al*. (2000) [13] and Anbu *et al.* (2000)[1]. In the present study, wide variability was recorded. The PCV was higher than GCV for all the characters studied during the investigation. The phenotypic coefficient of variations (PCV) ranged from 5.73% in days to first pod harvest to 36.16% in average pod yield per hectare (q/ha) (Table 2). PCV estimates were low (below 10%) for days to first pod harvest (5.73%), number of seeds per pod (8.51%) and pod length (8.82%). The PCV was moderate (10-15%) for 6 characters *viz*. fresh weight of the pod (11.2%), internodal length (12.39%), days to first flowering (12.75%), days to 50% flowering (13.58%), leaf area (14.87%), number of flower cluster per plant (14.95%). Relatively high PCV estimates (>15%) were observed in fresh leaf weight (15.5%), Dry weight of vine 16.76%), Fresh weight of vine (17.15), number of flower per cluster (18.23%), pod breadth (18.54%), vine length at final harvest(19.29%), primary branches per plant(19.39%), number of harvests (21.34%), number of pods per plant (29.87%), average pod yield per plant (34.88%),pod yield per hectare (36.16).Minimum differences were evident between the values of GCV and PCV for most of the traits studied except vine length at final harvest and fresh weight of the vine. The existence of minimum variation between these two parameters indicated that environment has a little effect in expression of these characters and phenotype truly represents the genotype. The present trend were also observed and repeated by Bhardu and Navale (2012) [3] and Prasanthi (2004) [12]. In this study, presence of high to moderate coefficients of variation in case of vine length at final harvest, fresh weight of the vine, primary branches per plant, dry weight of the vine, number of pods per plant, number of flowers per cluster, days to 50% flowering indicated the presence of good amount of variability among the materials evaluated and therefore, selection for these characters may be quite hopefully used in yardlong bean improvement programme. The similar trend of research was observed by Upadhaya and Mehta (2010) [16] and Borah and Khan (2000) [4].

The GCV values were lower than PCV with range of 3.82% (days to first pod harvest) to 35.52% (average pod yield per hectare). These types of trend were observed because PCV estimates include the variations due to environment (E) and genotype x environment (G×E) interactions. The larger difference in magnitude of GCV and PCV for vine length at final harvest (12.8-19.27), fresh weight of vine (12.31% - 17.15%), number of flowers per clusters (13.09% -18.23%), fresh weight of the pod (7.13% -11.2%) indicated the influence of environmental fluctuations on these traits. Similarly, relatively low difference of GCV and PCV for other characters like leaf area, dry weight of vine, pod length, pod breadth etc. indicate that these are mostly governed by genetic factors with minor effects of environment. Relatively higher values for GCV for characters like average pod yield per hectare, average pod yield per plant indicated better scope for genetic improvement in yardlong bean genotypes.

The heritability estimates for 20 characters ranged from 33.5% in pod length to (87.8%) with leaf area and average pod yield per hectare (84.6%) recorded moderate heritability. The number of pods per plant (82.2%), number of harvests (82.4%), number of flower cluster per plant (78.1%), days to 50% flowering (77.9%) estimated moderate heritability (70-90%).The characters pod breadth (67.3%), primary branches per plant (63.5%), days to first flowering (63.4%), fresh leaf weight (62%), inter nodal length (61%), dry weight of vine (60.8%), number of flower per cluster(51.6%), fresh weight of vine (51.5%) estimated low (< 70%) heritability. In the present experiment, heritability (bs) was highest for leaf area, average pod yield per hectare followed by average pod yield per plant and majority of the traits showed low to moderate levels of heritability suggesting that these characters might be less heritable and more influenced by environment and by ignoring these genotypes on the basis of such characters would be worthless in yardlong bean improvement. The results obtained are in agreement with the findings of Vavilapalli *et al.* (2013) [15] and Manivannan and Anandakumar (2013) [8]. Considering the heritability estimates with genotypic coefficient of variation values, it is observed that high values were obtained for both the parameters in case of pod yield per hectare, average pod yield per plant, number of harvests and number of pods per plant. So selection may be quite effective based on these characters. The results obtained are in agreement with the findings of Kumar and Devi (2009) [6] and Eswaran *et al.* (2007) [5].

The range of genetic advance (GA) among different characters was 0.6% in number of flowers per cluster to 227.53% in fresh weight of vine. The expected GA (as% of mean) was in the range of 5.25% (days to first pod harvest) to 61.85% (average pod yield per hectare). Expected GA were found low (<10%) for fresh weight of the pod (9.35%), number of seeds per pod (6.3%) and pod length (6.08%). Similarly moderate values of expected GA (10-20%) was recorded for inter nodal length (15.56%), days to first

flowering (16.64%), vine length at final harvest (17.53%), fresh weight of the vine (18.21%), fresh leaf weight (19.81%). Whereas, relative higher value of GA (>20%) was recorded for average pod yield per hectare (61.85%), average pod yield per plant (56.08%), number of pods per plant (43.67%), number of harvests (36.21%), leaf area (26.9%), pod breath (25.7%), primary branches per plant (25.36%), number of flower cluster per plant (23.44%) and days to 50% flowering (21.79%).

Table 1: Analysis of variance for 20 characters of 13 genotypes of Yardlong bean

Sl. No.	Characters	Mean sum of squares		
		Replication (3)	Genotype (13)	Error (24)
1	Pod length(cm)	29.64	23.52*	9.37
2	Pod breath(cm)	0.16	0.62**	0.08
3	Fresh weight of the pod (g)	0.03	4.74**	1.55
4	Number of Pods per plant	17.38	153.63**	7.16
5	Number of harvests	0.79	11.93**	0.79
6	Number of seeds per pod	6.75	5.10*	1.89
7	Average pod yield per plant	1046.70	20254.84**	573.79
8	Average pod yield per hacter(q/ha)	21.74	1505.96**	18.29
9	Primary branches per plant	0.62	1.25**	6.20
10	Leaf area (cm sq.)	31.39	1063.56**	47.21
11	Fresh leaf weight	1.08	2.09**	0.35
12	Internodal length (in cm)	0.09	13.79**	2.42
13	Vine length at final harvest(cm)	1403.87	13105.79**	3886.58
14	Fresh weight of vine (g)	12334.30	93240.58**	22243.38
15	Dry weight of vine(g)	453.69	5041.95**	890.87
16	Days to 1st flowering	9.25	54.85**	8.86
17	Days to 50% flowering	23.56	97.00**	8.39
18	Days to first pod harvest	8.96	20.73**	6.09
19	No. of flower per cluster	0.03	0.66**	0.15
20	No. of flower cluster per plant	3.03	12.29**	1.16

*Significant at 5% level of probability
** Significant at 1% level of probability Figures in parentheses indicate degrees of freedom

Table 2: Estimation of different parameters of variability and genetic advances under selection (5%) for 20 characters in 13 genotypes of yardlong bean

Sl. No.	Characters	Range	Mean	CV	GCV (%)	PCV (%)	h^2 bs (%)	GA	GA as% of mean
1	Pod length(cm)	38.94-49.22	42.56	7.19	5.1	8.82	33.5	2.58	6.08
2	Pod breath(cm)	2.31-3.72	2.79	10.6	15.21	18.54	67.3	0.71	25.7
3	Fresh weight of the pod (g)	11.40-16.53	14.45	8.63	7.13	11.2	40.5	1.35	9.35
4	Number of pods per plant	13.05-32.200	25.04	10.68	25.9	29.87	82.2	13.44	43.67
5	Number of harvests	7.33-12.66	9.94	8.96	19.37	21.34	82.4	3.60	36.21
6	Number of seeds per pod	17.86-22.80	20.23	6.81	5.10	8.51	36.0	1.27	6.30
7	Average pod yield per plant(g)	108.34-374.62	242.12	9.89	27.45	34.88	82.2	160.00	56.08
8	Average pod yield per hectare(q/ha)	27.91-98.86	62.69	6.82	28.52	36.16	86.4	45.05	61.85
9	Primary branches per plant	2.91-4.74	3.83	11.71	15.43	19.39	63.5	0.97	25.36
10	Leaf area (cm sq.)	114.34-164.93	132.04	5.2	13.93	14.87	87.8	35.52	26.9
11	Fresh leaf weight (g)	5.06-7.69	6.23	9.55	12.21	15.5	62.0	1.23	19.81
12	Internodal length (cm)	16.66-24.66	20.11	7.73	9.67	12.39	61.0	3.13	15.56
13	Vine length at final harvest(cm)	327.70 -545.33	432.81	14.4	12.8	19.27	44.2	75.88	17.53
14	Fresh weight of vine (g)	963.40-1554.00	1249.1	11.93	12.31	17.15	51.5	227.53	18.21
15	Dry weight of vine(g)	221.58-357.42	284.49	10.49	13.07	16.76	60.8	59.76	21.00
16	Days to 1 st flowering	34.33-47.66	38.56	7.72	10.15	12.75	63.4	6.42	16.64
17	Days to 50% flowering	39.00-57.00	45.33	6.39	11.98	13.58	77.9	9.87	21.79
18	Days to first pod harvest	54.66-65.33	57.74	4.27	3.82	5.73	44.5	3.03	5.25
19	Number of flower per cluster	2.27-3.37	3.12	12.69	13.09	18.23	51.6	0.60	19.37
20	Number of flower cluster per plant	11.98-18.45	14.76	7.31	13.04	14.95	76.1	3.46	32.44

Conclusion

In the present investigation, high estimates of heritability coupled with high genetic advance for characters such as leaf area, pod yield per hectare, pod yield per plant, vine length at final harvest and fresh weight of the vine may be ascribed to effect of additive genes (Panse and Sukhatme, 1954; Liang and Walter, 1968) [10, 7] and may be amenable for selection. Considering the three genetic parameters together such as genotypic coefficient of variation, heritability and predicted genetic gain at a glance it is observed that the characters like number of pods per plant, number of harvests, average pod yield per plant, average pod yield per hectare showing high to moderate values for the above three important genetic parameters suggested that additive gene action is responsible for expression of these characters**.** So, direct selection through these characters will be effective in improvement of yardlongbean.

References

1. Anbu Y, Manivannan N, Murugan S, Thangavelu P, Ganesan J. Variability studies in cowpea (*Vigna*

unguiculata (L.) Walp.) Legume Research. 2000; 23(4):279-280.
2. Bhardu D, Naval PA. Genetic variability parameters in F_2 and F_3 populations of cowpea (*Vigna unguiculata* (L.) Walp.), Legume Research. 2012; 35(1):75-77.
3. Borah HK, Khan AKF. Variability, heritability and genetic advance in fodder Cowpea. Madras Agricultural Journal. 2000; 87(1/3):165-166.
4. Burton GW, Devenace EM. Estimating heritability in fall fescue (*Festuca circunclinaceae*) from replicated clonal material, Agronomy Journal. 1953; 45:478-481.
5. Eswaran RS, Kumar T, Venkatesan M. Genetic variability and association of component characters for earliness in Cowpea (*Vigna unguiculata* (L.) WALP). Legume Research. 2007; 30(1):17-23.
6. Kumar KM, Devi DSR. Variability studies in Yardlong bean (*Vigna unguiculata sub sp. Sesquipedalis* (L.) Verdc.). Journal of Research ANGRAU. 2009; 37(1/2):58-61.
7. Liang GH, Walter TL. Heritability estimates and gene effects for agronomic traits in grain sorghum, Crop Science. 1968; 8:77-80.
8. Manggoel W, Uguru MI, Ndam ON, Dasbak MA. Genetic variability, correlation and path coefficient analysis of some yield components of ten Cowpea [*Vigna unguiculata* (L.) Walp] accessions, Journal of Plant Breeding and Crop Science. 2012; 4(5):80-86.
9. Manivannan A, Anandakumar CR. Genetic variability, character association and path analysis in Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub). Journal of Food Legumes. 2013; 26(3&4):34-37.
10. Panse VG, Sukhatme PV. Statistical methods for agricultural workers, Indian Council of Agricultural Research. New Delhi, 1954, 361.
11. Panse VS, Sukhatme PV. Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi, 1954, 152-155.
12. Prasanthi L. Variability and heritability studies in cowpea. Journal of Maharashtra Agriculture University. 2004; 29(3):362-363.
13. Tamgadge S, DOD VN, Mahorka VK, Peshattiwar PD. Genetic variability, heritability and genetic advance in Cowpea [*Vigna unguiculata* (L.) Walp]. The Asian Journal of Horticulture. 2008; 3(1):30-32.
14. Tyagi DC, Kumar N, Agarwal MC. Genetic variability and association of component characters for seed yield in Cowpea (*Vigna unguiculata* (L.) Warp.). Legume Research. 2000; 23(2):97-101.
15. Upadhyay D, Mehta N. Biometrical Studies in Dolichos Bean (*Dolichos lablab* L.) for Chhattisgarh Plains. Research Journal of Agricultural Sciences. 2010; 1(4):441-447.
16. Vavilapalli S, Celine VA, Duggi S, Padakipatil S, Magadum SK. Genetic Variability and Heritability Studies in Bush Cowpea (*Vigna unguiculata* (L.) Walp.). Legume Genomics and Genetics. 2013; 4(4):27-31.