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Studies on Genetic Variability and Heritability Analysis in Rice bean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] Germplasm

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ABSTRACT
The present investigation was conducted during Kharif, 2014 at Research Block, Department of Crop Improvement, V. C. S. G. Uttarakhand University of Horticulture and Forestry, College of Forestry, Ranichauri Campus, Tehri Garhwal, Uttarakhand. The 28 diverse genotypes of rice bean including three checks viz., PRR-1, PRR-2 and BRS-1 were evaluated in field conditions using Randomized Complete Block Design with three replications. The characters studied were days to 50 per cent flowering, days to maturity, plant height, stem thickness, number of primary branches per plant, leaflet size , number of pods per plant, number of seeds per pod, pod length, 100 seed weight and seed yield per plant. High magnitudes of phenotypic and genotypic coefficients of variation were noticed for stem thickness and number of pods per plant. High estimates of heritability coupled with high genetic advance in per cent of mean were observed for stem thickness, pod length, 100 seed weight and seed yield per plant.
Keywords: *Genotypic coefficient of variance (GCV), Phenotypic coefficient of variation (PCV), Heritability, Genetic advance, yield, rice bean*

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INTRODUCTION

Rice bean (*Vigna umbellata*, (Thunb.) Ohwi and Ohashi), variously known as climbing mountain bean, mambi bean, oriental bean, and haricot bean is a native of South and South East Asia [13] and is locally known as Naurangi or Rayansh. Rice bean is a self pollinated crop but there is some evidence of natural cross pollination [15]. It is a diploid (2n=24) and less known pulse [13]. This underutilized and under exploited crop has recently gained attention as an additional grain legume/pulses crop and possess immense potential due to its high nutritional quality, high grain yield ability and multi-purpose usage such as food, animal feed, cover crop and as soil enriched, it is more tolerant to pest and disease and in storage it is less infected by storage pest [3].The nutritional quality of rice bean is excellent due to the presence of high amount of protein and appreciable quantities of limiting amino acids such tryptophan and methionine which rank it as one of the best among the pulses [9]. The seed contain vitamins such as thiamine, riboflavin, niacin, and ascorbic acid [6].

Genetic variability plays an important role in a crop for best selecting of genotypes for making rapid improvement in yield and other desirable characters as well as to select the potential parent for hybridization programmes. This crop had a greater genetic variation with regard to fruit yield and its components. Heritability is an index for calculating the relative influence of environment on expression of genotypes. Heritability percentages in broad sense are estimated for the various characters of vegetative growth, fruit yield and its components for effective selection. Genetic advance under selection measures the role of genetic progress as the deviation between the mean genotypic value of the selected families and the mean genotypic value of the base population due to selection.

MATERIAL AND METHODS

The present investigation was carried out during *Kharif* 2014 at Research Block of Crop Improvement, College of Forestry, Ranichauri, Tehri Garhwal, Uttarakhand. The experimental site, College of Forestry, Ranichuari is located at 10 km away from Chamba (Reshikesh-Gangotri road) at an altitude of about 2100 m above mean sea level, lying between 30^0 15' N latitude and 78^0 30' E longitudes under mid hill zones of Uttarakhand. The field evaluations of the genotypes were carried out in the experimental block of Department of Crop Improvement. The experimental materials for the present investigation comprised of 28 diverse entries of rice bean obtained from the Department of Crop Improvement, College of Forestry, Ranichauri. The experiment was conducted in the Randomized Complete Block Design (RBD) during *kharif* season under rainfed condition. There were 25 entries along with the three check was planted during the first week of June, 2014. The seeds were sown on 03 June, 2014, at about 4-6 cm depth by opening furrow with *kutla.* Each furrow was manually dribbled with seed and covered with soil immediately. The recommended row to row distance 30 cm and 15 cm between plants was maintained after germination by thinning of extra plant population after 20 days of germination. At maturity, crop was cut from the ground level with the help of sickles and tied into bundles and tagged. The bundles were allowed to dry under the sun for 8-10 days. Manual threshing of bundles of individual plot was done.

Result and Discussion

Analysis of Variance

The results of analysis of variance for Randomized Complete Block Design for different characters of twenty-five rice bean germplasm including three checks have been presented in Table-1. The mean squares due to genotypes were highly significant for all the characters under study. It indicated that the germplasm tested were highly variable. Substantial variations in rice bean have also been reported by earlier workers [16, 18, 10].

Genetic variability

The data in Table-1further depicted that genotypic and phenotypic variance were highest for plant height (46.25 cm and 60.58 cm) followed by days to 50% flowering (29.69 and 49.45), number of pods per plant (16.82 to 22.98) and days to maturity (16.24 to 29.33). The characters like seed yield per plant (1.31g to 1.66g) followed by stem thickness (0.98 mm to 1.26 mm) and 100 seed weight (0.96g to 1.12g) had medium genotypic and phenotypic variances. Rest of characters had low values at genotypic and phenotypic variance. The variance is expressed as deviation from mean value. Therefore, it could never be assigned as high and low.

The magnitude of phenotypic coefficient variation (PCV) were greater than their corresponding genotypic coefficient variation (GCV) in respect of all quantitative traits indicating that the apparent variation is not only due to genotypes but also due to influence of environment although the difference between GCV and PCV were narrow. A maximum genotypic and phenotypic coefficient of variation was observed for stem thickness (GCV=21.34%, PCV=24.13%) while high phenotypic coefficients of variation (PCV) were recorded for number of pods per plant (21.52%). Moderate estimates (<20% - >10%) of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed for pod length (GCV=14.65%, PCV=16.33%), number of seeds per pod (GCV=12.71%, PCV=16.29%), 100 seed weight (GCV=14.02%, PCV=15.14%) and seed yield per plant (GCV=14.31%, PCV=16.13%), whereas moderate estimate at genotypic coefficient of variation only by number of pods per plant (18.41%) and phenotypic coefficient of variation were recorded only by number of primary branches (18.45%). The low estimates (<10%) of GCV and PCV were recorded for days to 50% flowering (GCV=6.02%, PCV=7.77%), days to maturity (GCV=2.55%, PCV=3.42%) and leaflet size (GCV=6.41%, PCV=8.09%) whereas, low estimate at genotypic coefficients of variation were recorded for plant height (9.13%) and number of primary branches (8.26%).

Genetic variability is the basis for any heritable improvement in the crop plants. The magnitude of phenotypic coefficient of variation was high as compared to the genotypic coefficient of variation for all the characters studied indicating the important role of environmental variation in expression of different traits in rice bean. The result of present investigation were within agreement to the finding of Tabasum *et al*. [17] for number of pods in mung bean, Manggoel *et al*. [7] for 100 seed weight in cowpea, Nwosu *et al*. [11] for number of pods per plant in cowpea, Meshram *et al*. [8] for 100 seed weight in cowpea, Narashimulu *et al*. [10] and Degafa *et al*. [4] for seed yield per plant, number of pods per plant and number of primary branches in mung bean, Ramya *et al*. [4] and Ajayi *et al*. [1] for number of pods per plant and 100 seed weight in cowpea.

Heritability and Genetic Advance

The estimates made with regards to heritability (broad sense) and genetic advance in per cent of mean for all the eleven characters are also presented in Table 1. The heritability in broad sense ranged from 20.05% in case of number of primary branches to 100 seed weight 85.74% for 100 seed weight. High heritability was recorded for 100 seed weight (85.74%), pod length (80.50%), seed yield per plant (78.70%), stem thickness (78.19%) and plant height (76.34%). Moderate estimates of heritability was observed for number of pods per plant (73.19%), leaflet size (62.90%), number of seeds per pod (60.84%), days to 50% flowering (60.04%) and days to maturity (55.37%) while, low heritability was noticed only by number of primary branches (20.05%). High heritability for different traits indicated that large proportion of phenotypic variance was attributed to genotypic variance and therefore, reliable selection could be made for these traits on the basis of phenotypic expression.

Table 1: Estimates of variance and genetic parameters of different characters in rice bean

S. No	Characters	General mean	Variance			Coefficient of variation (%)			Heritability h2 (%)	Genetic advance in % of Mean
			Genotypic	Phenotypic	Environment	Genotypic	Phenotypic	Environment		
			σ2g	**σ**2p	**σ**2e	(GCV)	(PCV)	(ECV)		
1.	Days to 50% flowering	90.51	29.69	49.45	19.76	6.02	7.77	4.91	60.04	9.61
2.	Days to maturity	158.15	16.24	29.33	13.09	2.55	3.42	2.29	55.37	3.91
3.	Plant height (cm)	74.45	46.25	60.58	14.33	9.13	10.45	5.08	76.34	16.44
4.	Stem thickness (mm)	4.65	0.98	1.26	0.27	21.34	24.13	11.27	78.19	38.87
5.	Pod length (cm)	6.62	0.94	1.17	0.23	14.65	16.33	7.21	80.50	27.08
6.	No. of pods per plant	22.28	16.82	22.98	6.16	18.41	21.52	11.14	73.19	32.45
7.	Leaflet size (cm)	6.37	0.17	0.27	0.10	6.41	8.09	4.93	62.90	10.48
8.	No. of primary branches	3.02	0.06	0.31	0.25	8.26	18.45	16.49	20.05	7.62
9.	No. of seeds per pod	6.06	0.54	0.97	0.38	12.71	16.29	10.19	60.84	20.42
10.	100 seed weight	7.00	0.96	1.12	0.16	14.02	15.14	5.72	85.74	26.74
11.	Seed yield per plant (gm)	7.99	1.31	1.66	0.35	14.31	16.13	7.44	78.70	26.15

The estimates of genetic advance in per cent of mean were very high for stem thickness (38.87%), number of pods per plant (32.45%), pod length (27.08%), 100 seed weight (26.74%), seed yield per plant (26.15%) and number of seeds per pod (20.42%) exhibited high genetic advance (>20%). Plant height (16.44%) and leaflet size (10.48%) recorded moderate genetic advance (>10% - <20%), whereas days to 50% flowering (9.61%) number of primary branches (7.62%) and days to maturity (3.9%) showed low genetic advance (<10%). High genetic advance has also been reported by Narasimhulu *et al*. [10] in mung bean.

Similar results have also been reported by Vaghela *et al*. [18] was found for days to 50% flowering and 100 seed weight in chickpea. Tabasum *et al.* [17] 100 seed weight and number of seeds per pod in mung bean, Idahosa *et al*. [5] for plant height in cowpea, Ali *et al*. [2] for plant height in chickpea, Meshram *et al*. [8] for 100 seed weight and number of seeds per pod in mung bean, Manggoel *et al*. [7] and Nwosu *et al*. (2013) for 100 seed weight, days to 50% flowering and number of pods per plant in cowpea, Meshram *et al*. [8] for days to maturity and number of seeds per pod in mung bean, Ajayi *et al.* [1] 100 seed weight and number of pods per plant in cowpea, Ramya *et al*. [14] in black gram; Degafa *et al*. [4] for days to maturity in mung bean.

CONCLUSION

Wide spectrum of variation was observed for yield and its components in rice bean germplasm. Genotypic and phenotypic variances were highest for plant height, days to 50% flowering, number of pods per plant and days to maturity. High magnitudes of genotypic and phenotypic coefficients of variation were noticed for stem thickness and number of pods per plant indicates higher variability among characters. Hence, these characters are more suitable for selection procedure.

A high estimate of heritability coupled with high genetic advance in per cent of mean was observed for stem thickness, pod length, 100 seed weight and seed yield per plant indicated possibility of obtaining

reasonable response to selection in these owing to their high transmissibility but moderate to high variability.

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