

VARIABILITY AND ASSOCIATION STUDIES FOR SEEDLING CHARACTERS IN BLACKGRAM (*Vigna mungo* (L.) HEPPEL)

A. S. SHANMUGAM¹ and S. R. SREERANGASAMY²

Twenty seven blackgram varieties were studied for the extent of variability, heritability and genetic advance for seedling characters. Phenotypic and genotypic correlation coefficients among the characters and direct and indirect path effects of seedling characters on seed yield and seed weight were estimated. Among the seedling characters, fresh root weight exhibited the highest variability, heritability and genetic advance followed by dry shoot weight and rooting intensity. None of the seedling characters showed any significant correlations with seed yield or seed weight. However, path analysis indicated the positive direct role of dry shoot weight, fresh root weight and shoot length on seed yield and weight. These three seedling characters may be used as early indicators in selection programmes in blackgram.

The seeds are endowed with genetical, physiological and biochemical properties and all of which are resident in the embryo. The embryo and its environs largely decide the characteristics of seedlings that later develop into juvenile phases and further into adult phases. In the present investigation, genetic variability and related parameters of seedling characters and their relationships with seed yield and seed weight in blackgram have been made and the results are discussed.

MATERIAL AND METHODS

Seeds of twenty seven different types of blackgram were graded in the sieve prescribed by ISTA. Seeds which retained in the 6 x 6 size sieve were alone selected and each type was grown in two germination towels moistened with distilled water and kept in the seed germinator at 25±5°C and 90 ± 3% R. H. On the 10th day,

twenty five seedlings were selected in each germination paper and observation were made for the quantitative characters. 100 seed weight and per plant yield of each genotype were also recorded from the plants raised by sowing the same graded seeds and the collected data were subjected to statistical analysis. The method suggested by Burton (1952) was used to compute the PCV and GCV. The phenotypic and genotypic correlation coefficients as described by Johnson *et al.* (1955) were estimated. Path analysis as suggested by Dewey and Lu (1959) was utilized to partition the genotypic correlation coefficients into direct and indirect effects.

RESULTS AND DISCUSSION

The mean, and phenotypic genotypic, coefficient of variation (GCV and PCV) heritability in broad sense and genetic advance as percentage of mean (GA) are

1. Assistant Professor and 2. Director, School of Genetics, Tamil Nadu Agricultural University, Coimbatore 641 003, India.

sented in table 1 for nine seedling characters and two adult characters, namely, yield per plant and seed weight. Among the seedling characters, fresh root weight recorded the highest estimates of GCV and PCV followed by dry shoot weight and rooting intensity. The characters namely the shoot length and root length recorded the least variability among the nine seedling characters. Other characters exhibited moderate variability. On the whole, the variability found in the materials used for the present study was comparatively low.

The heritability estimates in broad sense indicate the proportion of genetic to the total variability. The heritability percentage was high for all the seedling characters except dry root weight and shoot length. The GA as percentage of mean coupled with heritability for a character provide a reliable and meaningful information for effective utilisation in selection programmes (Allard, 1960). Three characters namely, fresh root weight, dry shoot weight and rooting intensity exhibited high values for both the parameters besides possessing high coefficient of variation.

The phenotypic and genotypic correlation coefficients were worked out between pairs of characters and are presented in table 2. In general, the genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients. This might be due to the masking effects of environment in modifying the total expression of the genotype and hence phenotypic expres-

sion was reduced. Salin and Khidir, (1975). Among the fifty five all possible correlations, eleven associations alone were significantly positive both at phenotypic and genotypic levels. They are, No. of rootlets with root length and root intensity; Shoot length with root length, length of rooting zone and dry shoot length; Root length with length of rooting zone and fresh shoot weight; Fresh shoot weight with fresh root weight, and dry shoot weight; Fresh root weight with dry shoot weight and Dry shoot weight with dry root weight.

Length of rooting zone had negative significant association with rooting intensity at both levels. But none of the seedling characters showed any significant positive or negative associations with seed yield or 100 seed weight.

The path coefficients were computed to find out the direct and indirect effects of seedling characters on seed yield and 100 seed weight using the genotypic correlation coefficients. Dry shoot weight and fresh root weight had high positive direct effect followed by shoot length on seed yield (Table 3). Similarly, the direct effect of these characters were also high on seed weight (Table 4). The indirect effects of other characters through these characters on seed yield and 100 seed weight were also positive.

The residual effect for seed yield and 100 seed weight was 73.43 and 79.70 per cent respectively indicating the contribution of seedling characters on final seed yield and seed weight

was however, not substantial. The positive direct path influence of dry shoot weight, fresh root weight and shoot length should be taken note of while formulating the selection programmes of blackgram for improving the seed yield and seed weight. A detailed study of seedling characters using large number of genotypes would be helpful in formulating selection indices. The result obtained at Asian Vegetable Research and Development Centre, Taiwan (Anon, 1977) also showed that the early vigorous vegetative growth appeared to be desirable in achieving high yield in mung bean and the best types were being screened for plant height and dry matter production at 33 days after emergence.

REFERENCES

- ALLARD, R. W. 1960. *Principles of plant breeding*. John Wiley and Sons, New York pp.48
- ANON. 1977. AVRDC Progress Report 1974-9.
- BURTON, G. W. 1952. Quantitative inheritance in grasses. *Proc. Sixth Intern. Grassland Congr., 1*: 277-83
- DEWEY, D. R. and K. H. LU, 1959. A correlation and path coefficient analysis of component of crested wheat grass seed production *Agron. J., 51*: 515-8.
- JOHNSON, H. W., H. P. ROBINSON and R. F. COMSTOCK 1955. Genotypic and phenotypic correlations in soybeans and their implications in selection. *Agron. J., 47*: 477-83
- SALIN, S. H. and M. O. KHIDIR. 1975. Correlations, path analyses and selection indices for castor bean (*Ricinus communis L.*) *Expl-Agric, 11*: 145-54.

Table 1: Mean, Genotypic and Phenotypic Coefficient of Variation (GCV and PCV) Heritability in Brad sense and Genetic Advance for seedling Characters in Blackgram

Characters	Mean	GCV	PCV	Heritability	GA as% of mean
Yield	9.06	40.9	41.5	97.3	83.2
100 seed weight	4.74	12.8	12.9	99.8	26.5
No. of root lets	37.02	13.0	14.8	76.9	23.5
Shoots length	26.88	3.6	5.5	42.0	4.8
Root length	21.39	6.1	7.9	60.1	9.8
Length of rooting zone	13.77	10.3	12.1	72.6	18.1
Fresh shoot weight	0.30	12.6	14.6	74.4	22.5
Fresh root weight	0.05	26.1	29.1	80.5	48.2
Dry shoot weight	0.02	18.8	21.4	76.9	33.9
Dry root weight	0.01	8.6	13.9	38.6	11.1
Rooting intensity	2.72	15.5	17.8	76.0	27.9

Table 2 Phenotypic and Genotypic Correlation Coefficients among Nine Seedling and Two Maturity Characters in Blackgram

	100 seed weight	No. of rootlets	Shoot length	Root length	Length of rooting zone	Fresh shoot weight	Fresh root weight	Dry shoot weight	Dry root weight	Rooting intensity
Yield	0.320	0.183	0.087	0.070	-0.060	0.121	0.065	0.004	0.106	0.193
100 Seed weight	0.322	0.200	0.099	0.075	-0.075	0.127	0.082	-0.009	0.135	0.212
No. of rootlets		0.244	0.029	0.077	-0.104	0.244	0.221	0.327	0.094	0.273
		0.278	0.031	0.095	-0.116	0.285	0.249	0.379	6.137	0.316
			0.006	0.407#	0.108	0.245	0.125	0.195	0.007	0.726**
			0.115	0.489**	0.058	0.264	0.154	0.226	0.111	1.630**
Shoot length				0.436*	0.393*	0.282	0.015	0.470*	0.176	-0.260
				0.637**	0.912**	0.342	0.092	0.659**	0.090	-0.717
Root length					0.471*	0.409#	0.171	0.306	0.220	0.035
					0.505**	0.401*	0.242	0.592**	0.237	0.041
Length of rooting zone						0.289	0.168	0.222	0.128	-0.595**
						0.320	0.205	0.349	0.119	-0.586**
Fresh shoot weight							0.646**	0.602**	0.376	-0.039
							0.783**	0.903**	0.518**	-0.052
Fresh root								0.425*	0.334	-0.016
								0.548*	0.645**	-0.021
Dry shoot weight									0.452*	-0.004
									0.456*	-0.069
Dry weight										-0.064
										-0.229

* Significant at 5% level Values in upper and lower lines—Phenotypic correlation coefficients.

**Significant at 1% level Genotypic correlation coefficients.

Table 3 Direct and Indirect Effects of Seedling Characters on Seed Yield in Blackgram

	100 seed weight	No. of rootlets	Shoot length	Root length	Length of rooting zone	Fresh shoot weight	Fresh root weight	Dry shoot weight	Dry root weight	Rooting intensity	r with seed yield
100 seed weight	<u>0.099</u>	0.033	0.011	-0.033	0.006	-0.589	0.256	0.457	0.007	0.073	0.322
No. of rootlets	0.027	<u>0.127</u>	-0.042	-0.174	-0.003	-0.544	0.158	0.272	0.005	-0.379	0.200
Shoot length	0.003	-0.014	<u>0.367</u>	-0.227	-0.051	-0.705	0.094	0.795	0.046	-0.167	0.100
Root length	0.009	0.059	0.234	-0.356	-0.028	-0.828	0.249	0.714	0.012	0.009	0.075
Length of rooting zone	-0.011	0.007	0.334	-0.180	-0.056	-0.661	0.211	0.421	0.006	-0.136	-0.065
Fresh shoot wt.	-0.028	0.032	0.125	-0.163	-0.018	-2.067	0.805	1.089	0.022	-0.012	-0.127
Fresh root weight	0.024	0.018	0.033	-0.086	-0.011	-1.614	1.028	0.680	0.033	-0.004	0.062
Dry shoot weight	0.376	0.027	0.242	-0.211	-0.019	-1.863	0.563	1.205	0.023	-0.016	-0.009
Dry root weight	0.013	0.013	0.033	-0.084	-0.006	-1.069	0.664	0.550	0.057	-0.030	0.135
Rooting intensity	0.031	0.197	-0.263	-0.014	0.032	0.107	-0.021	0.083	-0.066	0.233	0.212

Underlined figures indicate the direct effects, $R^2 = 0.4607$ Residual effects = 0.7343

Table 4 Path coefficient Analysis—Direct and Indirect Effects of Seedling Characters on 100 Seed weight in Blackgram

	No. of rootlets	Shoot length	Root length	Length of rooting zone	Fresh shoot weight	Fresh root weight	Dry shoot weight	Dry root weight	Rooting intensity	r with 100 seed
No. of rootlets	<u>0.168</u>	-0.064	-0.203	-0.025	-0.207	0.093	0.184	-0.012	0.344	0.278
Shoot length	-0.019	<u>0.557</u>	-0.265	-0.406	-0.268	0.055	0.539	-0.009	-0.151	0.031
Root length	0.082	0.355	<u>-0.415</u>	-0.275	-0.315	0.147	0.483	0.026	0.008	0.095
Length of rooting zone	0.009	0.508	-0.210	<u>-0.445</u>	-0.251	0.124	0.285	-0.013	-0.124	-0.116
Fresh shoot weight	0.044	0.190	-0.167	-0.142	<u>-0.785</u>	0.475	-0.738	-0.056	-0.011	0.285
Fresh root weight	0.026	0.051	-0.100	-0.091	-0.615	<u>0.606</u>	0.447	-0.070	-0.000	0.248
Dry shoot weight	0.038	0.368	-0.246	-0.155	-0.709	0.332	<u>0.876</u>	-0.050	-0.014	0.379
Dry root weight	0.018	0.050	-0.098	-0.053	-0.407	0.391	0.372	-0.709	-0.027	0.137
Rooting intensity	0.274	-0.400	-0.017	-0.261	-0.040	-0.012	-0.056	-0.014	0.277	0.316

Under lined figures are direct effects; $R^2=0.3641$, Residual effect: 0.7974