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FACTORS INFLUENCING SEED YIELD IN EARLY INTER-SPECIFIC GENERATIONS OF *VIGNA*

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Correlation and path coefficient analyses were carried out in early generations of inter-specific crosses between greengram (*Vigna radiata* L. Wilczek) and blackgram (*Vigna mungo* L. Hepper). Plant height, pod length, pods per plant, biological yield per plant and harvest index were positively correlated with seed yield per plant. Path coefficient analysis revealed that harvest index, biological yield per plant and pod weight per plant had a direct positive effect on seed yield per plant. Similarly, seed yield per plant and pods per plant had a direct positive influence on harvest index. It is suggested that biological yield per plant, pod weight per plant and harvest index be used as selection indices for the improvement of seed yield in early generations of inter-specific crosses between greengram and blackgram.

Key words. *Vigna radiata, V. mungo*, Yield compound, Inter specific hybridization.

Introduction

Studies in the literature demonstrate an association between seed yield and the components of yield in a number of crops [1–7]. They may arise due to linkage or pleotropism or from development genetic interactions with or without purely phenotypic components. These physiological components and their inter-relationships could determine selection criteria in segregating populations [6,8–11]. This aspect in early generations of interspecific crosses between greengram (*Vigna radiata* L. Wilczek) and blackgram (*Vigna mungo* L. Hepper) is scarce. Hence, this investigation was planned to study the extent and nature of assoiation and direct influence of yield contributing characters on seed yield in early interspecific generations of genus *Vigna.*

Materials and Methods

Three varieties of greengram, PM-105, ML-131 and ML-62, and three varieties of blackgram, JU-2, Mash-1-1 and RU-6, were selected for the present study from genetic stocks of genus *Vigna,* maintained in the Department of Plant Breeding and Genetics, J. N. Agricultural University, College of Agriculture, Rewa (M.P.), India. Five interspecific crosses *viz.* PM-105 x RU-6, ML-131 x JU-2, ML-62 x Mash-1-1-, ML-131 x RU-6 and PM-105 x JU-2 were made. The 5 F_1s, 5F_2s and 5 F_3s along with the parents were evaluated in randomized complete block design with three replications during Kharif (Jul.–Sept.) 1988-89. Each plot consisted of single rows of F_1s and parents, two rows of F_2 and four rows of F_3s which were 3 m long and 30 cm apart. A plant-to-plant distance of 10 cm was maintained in all generations. Ten ompetitive plants from parents and F_1s, 20 and 40 from segregating the generations F_2s and F_3s respectively, were taken at random for recording observations of plant height, branches per plant, pods per plant, pod length, biological yield per plant, pod weight per plant, seed yield per plant and harvest index. Dry weight of plant excluding roots was taken as biological yield per plant while the ratio of seed yield per plant and biological yield per plant in percentage was considered as harvest index. The correlation coefficients were determined in accordance with formula suggested by Miller *et al.* [12]. The direct and indirect effects of different independent variables on dependent variable (grain yield) were estimated with the help of the procedure outlined by Dewey and Lu [13].

Results and Discussion

All possible correlation coefficients between seed yield and its component characters at phenotypic and genotypic levels are presented in Table 1. In general, the direction of genotypic and phenotypic correlations were the same but the magnitude of genotypic correlation was higher than phenotypic correlation. It may be due to the masking influence of environmental factors on the phenotypic expression of the characters. This is in agreement with the findings of Das [14], Usha Rani and Rao [10], and Malhotra *et al.* [3] in greengram where the higher magnitude of genotypic correlation as compared with phenotypic correlations were reported. Even though the environmental correlation coefficients may be of little interest to the breeder, but they do indicate to what extent different characters are influenced by environmental factors. Hence, the environmental correlation coefficients were computed. The direction of environmental correlation coefficient was independent to genotypic and phenotypic correlations. A majority of environmental correlations were positive. Pods

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per plant, pod length, biological yield per plant, pod weight per plant and seed yield per plant were positively correlated among themselves at environmental level. The environmental correlations mainly include the effects of heterogentiy, cultural irregularities and probability of error in the experiment [15]. Such factors cause a harmonic change in plant behaviour and could be explained in terms of physiological adjustments [16]. In the present study, the genotypic and environmental correlations differ in magnitude but were mostly in the same direction revealing that genetic and environmental factors might have an influence on these characters through similar physiological mechanism.

Plant height, pod length, pod weight per plant, biological yield per plant and harvest index had significant positive associations with seed yield per plant. Pod length showed significant positive association with plant height, pods per plant, biological yield per plant and pod weight per plant. Biological yield per plant had significant positive association with plant height, pods per plant, pod length, pod weight per plant and seed yield per plant. Similarly, pod weight per plant was positively orrelated with pods per plant, pod length and biological yield per plant. Significant positive associations between harvest index and pod length were also observed in this study. Significant positive correlation of pods per plant and pod length with seed yield have been observed in greengram [8,10,17–20]. Contrary to the findings of the present study, Bhaumik and Jha [21], Reddy [9] and Singh and Sharma [22] reported negative associations of plant height, pod length, seed weight per plant and harvest index with seed yield per plant in *Vigna* species. The character associations ould be attributed to linkage or pleotropism or from developmental genetic interaction with or without purely phenotypic components. In the intermated generations, new association arised due to breakage in linkages. As such, the direction and magnitude of character association would differ in normal selfed progeny from those in the intermated population. This study reveals that association among important characters can be altered by restoring to interspecific intermating. However, the direction of the change would depend on the initial constitution of parents and selection history. The initial linkage relations would also affect the outcome of intermating because by random mating correlation coefficients would increase if the initial linkage was in repulsion phase and vice-versa if it was in the coupling phase [6].

Path coefficient analysis considering seed yield per plant as dependent variable (Table 2) revealed that harvest index, biological yield per plant, pod weight per plant and plant height had direct positive influences on seed yield. Pods per plant showed direct negative influence on seed yield, however, its indirect influence via plant height, branches per plant, biological yield per plant and pod weight per plant were positive. Indirect effects of pod length on seed yield were

TABLE 1. PHENOTYPIC (P), GENOTYPIC (G) AND ENVIRONMENTAL CORRELATION COEFFICIENTS BETWEEN SEED YIELD AND ITS CONTRIBUTING TRAITS IN EARLY INTERSPECIFIC GENERATIONS OF *VIGNA*.

Characters		Branches per plant	Pods per plant	Pod length	Biological yield per plant	Pod weight per plant	Seed yield per plant	Harvest index
Plant height	P	0.107	0.416**	0.634**	0.574**	0.331**	0.462**	0.109
	G	0.107	0.473**	0.754**	0.697**	0.371**	0.505**	0.119
	E	0.106	0.092	0.141	-0.112	0.022	0.073	0.025
Branches per plant	P		0.105	-0.053	0.053	0.001	-0.052	-0.121
	G		0.128	-0.069	0.085	0.001	-0.047	-0.177
	E		-0.017	0.012	-0.118	0.005	-0.102	-0.177
Pods per plant	P			0.289*	0.576**	0.540**	0.057	-0.184
	G			0.139	0.552**	0.506**	-0.007	-0.201
	E			0.876	0.694	0.792	0.617	-0.066
Pod length	P				0.601**	0.629**	0.712**	0.367**
	G				0.585**	0.606**	0.742**	0.426**
	E				0.675	0.835	0.723	0.069
Biological yield per plant	P					0.696**	0.400**	-0.142
	G					0.699**	0.376**	-0.139
	E					0.709	0.670	-0.186
Pod weight per plant	P						0.478**	0.141
	G						0.474**	0.166
	E						0.538	-0.173
Seed yield per plant	P							0.808**
	G							0.831**
	E							0.439

* and ** Significant at 5 and 1% level, respectively.

positive via plant height, biological yield per plant pod weight per plant and harvest index. Pod weight per plant had indirect positive influence on seed yield via all the characters except pods per plant. The harvest index showed negative indirect influence on seed yield via branches per plant and biological yield per plant. However its indirect effets via rest of the characters were positive. Path coefficient analysis considering seed yield as dependent variable revealed that harvest index, biological yield per plant and pod weight per plant are major yield components in the present population.

Path coefficient analysis on harvest index as dependent variable (Table 3) revealed that seed yield per plant followed by pods per plant and pod weight per plant had direct positive influence on harvest index. Biologial yield per plant showed direct negative influence on harvest index. However, its indirect effects via pods per plant and seed yield per plant were found positive. Similarly, pod length exhibited directed negative influence at phenotypic level but its indirect contribution on harvest index via branches per plant, pods per plant and seed yield per plant were positive. The residual effects observed in this study reflects the unexplainable variable due to characters which are not taken in consideration or due to effect of the environmental factors whose variation can not be explained with path analysis studies in this investigation.

The results of this study indicate that harvest index, biological yield per plant and pod weight per plant are major

TABLE 2. DIRECT AND INDIRECT EFFECTS OF YIELD COMPONENTS ON SEED YIELD PER PLANT BASED ON PHENOTYPIC (P) AND GENOTYPIC (G) CORRELATIONS.

Characters		Plant height	Branches per plant	Pods per plant	Pod length	Biological yield per plant	Pod weight per plant	Harvest index
Plant height	P	0.085	0.004	-0.061	0.078	0.262	0.007	0.087
	G	0.246	0.002	-0.112	-0.055	0.278	0.049	0.098
Branches per plant	P	0.009	0.033	-0.016	-0.007	0.024	0.000	-0.096
	G	0.026	0.014	-0.030	0.005	0.034	0.0001	-0.096
Pods per plant	P	0.035	0.004	-0.147	0.036	0.263	0.012	-0.146
	G	0.117	0.002	-0.237	-0.010	0.219	0.067	-0.165
Pod length	P	0.054	-0.002	-0.043	0.123	0.274	0.014	0.290
	G	0.186	-0.001	-0.033	-0.073	0.233	0.080	0.349
Biological yield per plant	P	0.049	0.002	-0.085	0.074	0.457	0.015	-0.112
	G	0.172	0.001	-0.131	-0.042	0.398	0.092	-0.115
Pod weight per plant	P	0.028	0.000	-0.079	0.078	0.318	0.022	0.112
	G	0.091	0.000	-0.120	-0.044	0.278	0.132	0.137
Harvest index	P	0.009	-0.004	0.027	0.045	-0.065	0.003	0.792
	G	0.029	-0.002	0.048	-0.031	-0.056	0.022	0.820

Residual effects : P = 0.0493; G = 0.0344, Underlined figures denote direct effects.

TABLE 3. DIRECT AND INDIRECT EFFECTS OF YIELD COMPONENTS ON HARVEST INDEX BASED ON PHENOTYPIC (P) AND GENOTYPIC (G) CORRELATIONS.

Characters		Plant height	Branches per plant	Pods per plant	Pod length	Biological yield per plant	Pod weight per plant	Seed yield per plant
Plant height	P	–0.082	–0.005	0.060	–0.050	–0.315	0.003	0.518
	G	–0.261	–0.002	0.121	0.094	–0.355	–0.043	0.564
Branches per plant	P	–0.009	–0.043	0.016	0.004	–0.031	0.000	–0.058
	G	–0.028	–0.018	0.033	–0.009	–0.043	–0.0001	–0.052
Pods per plant	P	–0.034	–0.005	0.144	–0.023	–0.336	0.006	0.064
	G	–0.123	–0.002	0.255	0.017	–0.281	–0.059	–0.008
Pod length	P	–0.082	0.002	0.042	–0.079	–0.351	0.006	0.798
	G	–0.197	0.001	0.035	0.125	–0.297	–0.070	0.828
Biological yield per plant	P	–0.047	–0.002	0.083	–0.047	–0.584	0.007	0.449
	G	–0.182	–0.002	0.141	0.073	–0.509	–0.081	0.419
Pod weight per plant	P	–0.027	–0.0001	0.078	–0.049	–0.406	0.010	0.536
	G	–0.097	–0.000	–0.129	0.076	–0.356	–0.116	0.529
Seed yield per plant	P	–0.038	0.002	0.008	–0.056	–0.234	0.005	1.121
	G	–0.132	0.001	–0.002	0.093	–0.191	–0.055	1.117

Residual effects : P = 0.0697; G =0.0697, Underlined figures denote direct effects.

components of seed yield. Similarly, seed yield per plant and pods per plant are major components of harvest index. Therefore, breeders could select for these haracters to improve seed yield in segregating generations of interspecific crosses between greengram and blackgram.

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