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RESEARCH ARTICLE

Correlation and path analysis for yield and yield componenets in black gram [*Vigna mungo* (L.) Hepper]

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SUMMARY

The experimental material consisted of 100 germplasm lines and four checks *viz.*, Uttara, Pant U-31, Shekhar and NDU-1. Experiment was laid out in Augmented design having 10 blocks of 14 plots each, out of 14 plots 10 were used for test genotypes while remaining four were used for checks and each plot consisted of single row of 4 m length, the inter and intra row distance was kept 30 cm and 10 cm, respectively. The observations recorded on 11 quantitative characters *viz*., days to 50 per cent flowering, days to maturity, plant height (cm), number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of seeds per pod, seed yield per plant (g), 100-seed weight (g), biological yield per plant (g) and harvest index (%). The data recorded on these characters were utilized for simple correlation co-efficient, path co-efficient. A very strong positive association of grain yield per plant was obsevered with number of clusters per plant, number of pods per cluster, number of seeds per pod, biological yield per plant and harvest index. Thus, the characters showing highly significant positive correlation among yield and its components suggested that selection would be highly effective and efficient in improving these traits, while days to maturity showed negative correlation with grain yield. The path analysis identified biological yield per plant followed by harvest index, as the direct positive contributors towards seed yield. The number of clusters per plant, number of pods per cluster and seeds per pod via biological yield per plant contributed indirectly towards grain yield. But biological yield per plant contributed substantial negative indirect effect on it via harvest index and also harvest index contributed substantial negative indirect effect on it via biological yield per plant. The remaining estimates of the indirect effect in the present study too low to be negligible important.

Key Words : Correlation, Path analysis, Urdbean, Germplasm

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Globally, the pulses are the second most important group of crops after cereals. More than a dozen of pulse crops are grown but the global pulse production in 2008 was estimated to be 61.34 million tonnes from an area of 73.33 million hectare with an average productivity of 836 kg per hectare. Among various grain legumes grown, urdbean [*Vigna mungo* (L.) Hepper.] is the important pulse crop of India, belonging to family- Leguminosae (Fabaceae). It is cultivated over a wide range of agro-climatic zones of the country, mainly in Maharashtra, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Rajasthan and Karnataka. In India total area under urdbean is around 2.25 million ha with production 1.40 million tonnes and productivity of 550 kg/ha during 2010-11 (Anonymous, 2012). Uttar Pradesh also having the potential area of about 5.46 lakh ha. under urdbean cultivation with production of 3.65 lakh tonnes and productivity of 668 kg / ha. during 2010-11 (Anonymous, 2012). As seed yield is the very comlex charater and depends upon numerous genetic factors interacting with the environment, it is always advisable to find out the interrelationship of yield component with highly heritable characters and giving selection pressure on these characters, which account for the indirect selection. To accumulate optimum contribution of yield contributing characters, it is essential to know the correltion of the various characters along with path co-efficients. The present study was undertaken to estimate association between yield contributing characters alongwith path analysis for developing suitable selection criterion for blackgram improvement.

MATERIAL AND METHODS

The experimental material consisted of 100 urdbean germplasm and 4 check varieties *viz.*, Uttara, Pant U-31, Shekhar and NDU-1. The germplasm lines were procured from IIPR-Kanpur, Deptt. of GPB, Narendra Dev University of Agriculture and Technology, Kumarganj and C.S. Azad University of Agriculture and Technology, Kanpur. The checks used in the experiment are adapted varieties of the region. The variety of urdbean including elite lines and land races of late maturity duration constituted the experimental material for this study. These genotypes exhibited wide spectrum of variation for various agronomical and morphological characters. The experiment was conducted to evaluate 100 germplasm lines with four checks under normal soil and irrigated condition using Augmented design during *Kharif*, (2011). The entire experimental field was divided into 10 blocks of equal size and each block was having 14 plots. The checks were accommodated randomly in each block with test genotypes. Each plot represented by 1 row of 4 meter length, keeping row to row distance of 30 cm and plant to plant spacing of 10 cm. All the recommended cultural practices were applied to raise a good crop. The observations were recorded on 5 randomly selected plants from days to 50 per cent flowering, days to maturity, plant height (cm), number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of seeds per pod, seed yield per plant (g), 100-seed weight (g), biological yield per plant (g) and harvest index (%).The simple correlation between different characters were estimated according to Searle (1961); whereas path co-efficient analysis was carried out according to Dewey and Lu (1959).

RESULTS AND DISCUSSION

The seed yield or economic yield in almost all crops is referred as super character which results from the multiplicative interactions of several other characters that are termed as yield components. Thus, genetic architecture of seed yield, in urdbean as well as other crops, is based on the balance or overall net effect produced by various yield components directly with one another. Therefore, identification of important yield components and information about their association with yield and also with each other is very useful for selecting efficient genotypes for evolving high yielding varieties. In this respect, the correlation co-efficient which provides symmetrical measurement of degree of association between two variables or characters, help us in understanding the nature and magnitude of association among yield and yield components.

In the present investigation, correlation co-efficients were computed among 11 characters (Table 1). The seed yield per plant exhibited highly significant and positive correlation with number of clusters per plant, number of pods per cluster,

Table 1: Estimates of simple correlation co-efficient between different characters of urdbean germplasm

Sr. No.	Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches / plant	Clusters / plant	Pods / clusters	Seeds / pod	100 seed weight (g)	Biological yield / plant (g)	arvest index (%)	Seed yield / plant (g)
1.	Days to 50 % flowering	1.0000	0.740**	0.067	-0.062	-0.114	0.196*	0.164	0.004	-0.012	0.111	0.007
2.	Days to maturity		1.000	0.127	0.039	-0.058	0.046	-0.071	0.027	-0.058	0.017	-0.133
3.	Plant height in (cm)			1.000	0.279**	0.038	-0.086	-0.012	0.180	0.045	0.002	0.055
4.	Primary branches / plant				1.000	0.244*	-0.059	-0.033	-0.079	0.050	0.101	0.131
5.	Clusters / plant					1.000	0.015	-0.088	0.024	0.469**	0.180	0.624**
6.	Pods / clusters						1.000	0.117	-0.132	0.375**	0.154	0.474**
7.	Seeds / pod							1.000	-0.200*	0.278**	0.054	0.331**
8.	100 seed weight(g)								1.000	-0.042	0.148	0.151
9.	Biological yield / plant (g)									1.000	-0.488**	0.614**
10.	Harvest index (%)										1.000	0.287**

* and ** indicate significance of values at P=0.05 and 0.01, respectively

number of seeds per pod, biological yield per plant and harvest index Thus, these characters emerged as most important associates of seed yield per plant and has also been observed by previous workers (Kumar *et al.,* 2007; Issacs *et al.,* 2000; Katna and Verma, 2001; Sharma *et al.,* 2005; Bakshi *et al.,* 2006; Kumar *et al.,* 2008).

Number of clusters per plant, number of pods per cluster, seeds per pod, harvest index, biological yield per plant, 100-seed weight had strong positive association with one another besides, having strong positive association with seed yield per plant. The occurrence of positive association at significant level of seed yield with most of its component traits and positive association between most of the yield components reveals less complex inter-relationships between yield and yield components. Such situation is favourable from breeding point of view because selection for one trait may bring correlated response for improvement of other traits which are positively associated with it. The existence of positive associations between seed yield and its components in most of the cases for providing rapid improvement of characters due to correlated response during selection is in agreement with the reports of (Singh *et al.,* 2001; Chauhan *et al.,* 2007; Ali and Gupta *et al.,* 2008).

All the characters showed highly significant and positive correlation with grain yield except days to maturity which showed non- significant and negative correlation. Path-co-efficient analysis is a tool to partition the observed correlation co-efficient into direct and indirect effects of independent variables on the dependent (seed yield) variable to provide clear picture of character associations for formulating efficient selection strategy. Path analysis differs from simple correlation in that it point out the causes and their relative importance, whereas the later measures simply the mutual association ignoring the causation. It is a useful technique for assessing the direct and indirect effects of different characters on seed yield.

In the present study, the path-co-efficient analysis was carried out using simple correlation co-efficients among 11 characters are given in Table 2. The highest positive direct effect on seed yield per plant was exhibited by biological yield followed by harvest index, number of clusters per plant, number of pods per cluster, number of seeds per pod, 100-seed weight, number of primary branches per plant and plant height. These characters have also been reported as major direct contributors toward seed yield in urdbean (Kumar and Mishra, 2005 and Chauhan *et al.,* 2007). The contribution of characters, other than discussed above had very low direct effect, to be considered of any importance. Number of clusters per plant, pods per cluster, number of seeds per pod exhibited considerable positive indirect effect on seed yield per plant but, harvest index showed considerable negative indirect effect on it via biological yield per plant. Biological yield per plant showed considerable negative indirect effect on it via harvest index.

In the present study, path analysis identified harvest index, biological yield per plant, 100-seed weight, seeds per pod, pods per cluster, number of clusters per plant, primary branches per plant, plant height and directly contributed to seed yield. While, clusters per plant, pods per cluster and seeds per pod were indirect positive contributors and harvest index and biological yield per plant were negative contributor to seed yield. The characters mentioned above should be given due consideration at the time of formulating selection strategy in segregating generation as well as during selection of parents and donors for synthesizing high yielding varieties in urdbean.

Table 2: Direct and indirect effects of different characters on grain yield per plant in urdbean germplasm

Sr. No.	Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches / plant	Clusters / plant	Pods / clusters	Seeds / pod	100 seed weight	Biological yield / plant (g)	Harvest index (%)	Seed yield / plant (g)
1.	Days to 50% flowering	-0.004	-0.067	0.001	-0.001	-0.021	0.025	0.021	0.001	-0.009	0.062	0.007
2.	Days to maturity	-0.003	-0.090	0.001	0.001	-0.011	0.006	-0.009	0.004	-0.041	0.010	-0.133
3.	Plant height in (cm)	0.000	-0.011	0.009	0.005	0.007	-0.011	-0.002	0.025	0.032	0.001	0.055
4.	Primary branches / plant	0.000	-0.004	0.003	0.018	0.045	-0.008	-0.004	-0.011	0.035	0.056	0.131
5.	Clusters / plant	0.000	0.005	0.000	0.004	0.186	0.002	-0.011	0.003	0.334	0.099	0.624
6.	Pods / clusters	-0.001	-0.004	-0.001	-0.001	0.003	0.129	0.015	-0.018	0.267	0.085	0.474
7.	Seeds / pod	-0.001	0.006	0.000	-0.001	-0.016	0.015	0.127	-0.028	0.198	0.030	0.331
8.	100 seed weight	0.000	-0.002	0.002	-0.001	0.004	-0.017	-0.025	0.140	-0.030	0.082	0.151
9.	Biological yield / plant (g)	0.000	0.005	0.000	0.001	0.087	0.048	0.035	-0.006	0.713	-0.271	0.614
10.	Harvest index (%)	0.000	-0.002	0.000	0.002	0.033	0.020	0.007	0.021	-0.348	0.554	0.287

Residual effect = 0.384, Bold figures indicate direct effect

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