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SHORT COMMUNICATION

CORRELATION AND PATH ANALYSIS IN CLUSTER BEAN [*CYAMOPSIS TETRAGONOLOBA* (L) TAUB.].

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SUMMARY

The experiment was conducted on cluster bean to identify the correlation among characters and direct and indirect effects of characters on seed yield per plant. Fifty accessions were evaluated during *Kharif* 2014 and observations were recorded on seed yield-related characters. In this study, seed yield per plant is significantly and positively correlated with the traits like number of pods per plant, number of branches per plant, number of seeds per pod, pod length and plant height. Protein content has a negative and significant correlation with the seed yield per plant. The number of pods per plant has a maximum direct effect on seed yield per plant followed by the number of seeds per pods and 100 seed weight.

Keywords : Cluster bean, Correlation and Path coefficient

India is the largest producer of cluster bean seed in the world contributing 80 percent of the total production. In India total area under cluster bean is about 4.24 million ha with a total production of 2.41 million tones with the productivity of 0.57 million tones/ha. In India major producing states are Rajasthan, Gujarat, Haryana, Punjab, Uttar Pradesh and Madhya Pradesh (Pandey and Roy, 2011). Guar has multiple uses – Vegetable, forage, and cover crop (Arora and Pahuja, 2008). Industrially application of cluster bean seeds, are used for extraction of gum (Anil *et al*., 2014). Its gum has diverse industrial applications which can be used in different industry related to food, pharmaceutical, textile, extraction of shale gas and oil, etc. (Pathak *et al*., 2010). Yield is a complex trait, function and interaction of component traits those contribute in yield. A study of the correlation between these traits provides an idea of about how these characters associated with the yield. It could be effectively used to formulate the selection strategies for improving the yield and quality. Correlation study does not reveal the direct and indirect contribution of individual character towards the yield. The path coefficient technique helps in estimating the direct and indirect contribution of various components in building up the correlation towards yield. To provide the basis for selection and yield improvement in cluster bean the present investigation was undertaken to determine the degree of association among characters and to measure direct and indirect effects of various component characters on the seed yield per plant.

The experimental material consisted of 50 diverse accessions of cluster bean collected from different sources (Table.1). The experimental design is the randomized completely block design with three replications. Each accession was sown in 4 m row length with the spacing of 10 cm plant to plant and 45 cm row to row at Dry Land Research Farm of CCS HAU, Hisar during *Kharif*, 2014. All agronomic package and practice were applied to raise a healthy crop. In the present investigation observation were recorded on days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, number of pods per plant, number of seeds per pod, pod length (cm), 100-seed weight, protein content (%), gum content (%) and seed yield per plant (g). The correlation coefficient among all possible character combinations at phenotypic 'r (p)' and genotypic 'r (g)' level were estimated by employing the formula given by (Al-Jibouri *et al*. 1985). Path coefficient analysis was performed as per the formula is given by (Wright, 1921) and adopted by (Dewey and Lu 1959).

Correlation analysis

Correlation among different characters could arise due to the linkage or pleiotropy. Correlation due to the linkage can be manipulated or changed, through

TABLE 1
Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients among eleven characters in clusterbean.

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	Pod length (cm)	100-seed wt. (g)	Protein content (%)	Gum content (%)	Seed yield/ plant (g)
Days to 50% flowering	1	0.741**	0.163*	0.232**	0.085	0.061	0.031	-0.115	0.067	-0.107	0.087
Days to maturity	0.783	1	0.009	0.199*	0.099	0.110	0.022	-0.186*	0.009	-0.052	0.104
Plant height (cm)	0.180	0.007	1	0.317**	0.203*	-0.053	0.085	0.153	-0.102	-0.09	0.249**
No. of branches/plant	0.280	0.229	0.391	1	0.604**	0.045	0.058	-0.009	-0.078	-0.183*	0.549**
No. of pods/plant	0.100	0.117	0.276	0.714	1	0.001	-0.121	-0.034	-0.112	0.016	0.637**
No. of seeds/pod	0.119	0.150	-0.123	0.095	-0.021	1	0.608**	-0.395**	-0.215**	-0.196*	0.301**
Pod length(cm)	0.069	0.032	0.126	0.094	-0.169	0.723	1	-0.274**	-0.190*	-0.231**	0.210**
100-seed wt.(g)	-0.184	-0.249	0.145	-0.057	-0.016	-0.616	-0.364	1	0.117	0.275**	-0.027
Protein content (%)	0.059	-0.001	-0.124	-0.085	-0.169	-0.351	-0.296	0.193	1	-0.194*	-0.270**
Gum content (%)	-0.091	-0.052	-0.137	-0.209	0.022	-0.295	-0.334	0.414	-0.166	1	-0.061
Seed yield/plant (g)	0.097	0.119	0.293	0.396	0.834	0.396	0.275	-0.088	-0.362	-0.066	1

*Significant at 0.05 level.
**Significant at 0.01 level.

the recombination but it could be impossible to overcome the correlation due to the pleiotropy. In the latter case, genetic improvement in one trait is not eventually possible without bringing a change in the associated component characters. The high magnitude of the genotypic correlation coefficient in comparison to phenotypic correlation coefficient shows the strong inherent association with different attributes. (Manivannan *et al*., 2015) also reported that genotypic correlation coefficient was higher than the corresponding phenotypic correlation coefficient for most of the characters. Results of correlation among different characters are given in Table 2. Days to 50% flowering exhibited positive and significant correlation with days to maturity (0.741), plant height (0.163) and the number of branches per plant (0.232). Days to maturity exhibited positive and significant correlation with number of branches per plant (0.199) while significant and negative correlation (-0.186) with 100-seed weight. The result for 100-seed weight was similar as reported by (Sulthan *et al.* 2012). Plant height showed positive and significant correlation with the number of branches per plant (0.317), number of pods per plant (0.203) and seed yield per plant (0.249). Also, several workers (Sulthan *et al.* 2012; Malaghan *et al.* 2014 and Vir and Singh, 2015) were reported the similar results for one and more characters. Number of branches per plant exhibited positive and significant correlation with the number of pods per plant (0.604) and seed yield per plant (0.045) while the significant and negative correlation with gum content (-0.183). The results for the number of pods per plant and seed yield per plant are in agreement with (Sulthan *et al*. 2012; Rai and Dharmati, 2014; Malaghan *et al.* 2014; Manivannan *et al*. 2015 and Vir and Singh, 2015). Numbers of seeds per pod showed positive and significant correlation with the pod length (0.608) and seed yield per plant (0.301) while the negative and significant correlation with 100-seed weight (-0.395), protein content (-0.215) and gum content (-0.196). Some workers were reported similar finding for one or more characters such as (Rai *et al.* 2014 and Vir and Singh, 2015). Seed yield exhibited positive correlation with plant height (0.249), number of branches per plant (0.549), number of pods per plant (0.637), pod length (0.301), number of seeds per pod (0.210) and negative correlation with protein content(-0.270). Similar results for one or more characters were reported by many researchers (Sulthan *et al*. 2012; Malaghan *et al.* 2014; Rai *et al*. 2014; Manuvannan *et al*. 2015 and Vir and Singh, 2015). This study indicate that, trait like plant height, number of branches, number of pods per plant and seeds per pod are positively and significantly correlated with seed yield per plant.

Path coefficient analysis

Partitioning of genotypic correlation into path coefficient analysis revealed the direct effects of component trait on seed yield per plant. Table 3 shows the result of path coefficient analysis. Number of pod per plant had the highest direct and positive effect on seed yield per plant, followed by the number of seeds per pod. Similar results were reported by Elshiek *et al.* (2012). 100 seed weight and pod length also have some direct positive effects suggesting the usefulness of all these mentioned characters for component selection method to improve seed yield per plant in clusterbean. The direct effects slightly negative were observed for days to 50% flowering, gum content and protein content. Number of pods per plant, which

TABLE 2
Path coefficient analysis of seed yield per plant with its component characters in cluster bean

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seeds/ pod	Pod length (cm)	100-seed wt. (g)	Protein content (%)	Gum content (%)	Seed yield/ plant (g)
Days to 50% flowering	-0.060	0.042	0.007	0.015	0.082	0.051	0.012	-0.049	-0.004	0.001	0.097
Days to maturity	-0.047	0.054	0.000	0.012	0.096	0.065	0.005	-0.066	0.000	0.000	0.119
Plant height (cm)	-0.011	0.000	0.041	0.021	0.225	-0.053	0.021	0.039	0.008	0.001	0.293**
No. of branches/plant	-0.017	0.012	0.016	0.054	0.582	0.041	0.016	-0.015	0.005	0.002	0.696**
No. of pods/plant	-0.006	0.006	0.011	0.038	0.816	-0.009	-0.029	-0.004	0.011	0.000	0.834**
No. of seeds/pod	-0.007	0.008	-0.005	0.005	-0.017	0.430	0.123	-0.165	0.022	0.002	0.396**
Pod length(cm)	-0.004	0.002	0.005	0.005	-0.138	0.311	0.170	-0.097	.019	0.003	0.275**
100-seed wt.(g)	0.011	-0.013	0.006	-0.003	-0.013	-0.265	-0.062	0.267	-0.012	-0.003	-0.088
Protein content (%)	-0.004	0.000	-0.005	-0.005	-0.138	-0.151	-0.050	0.052	-0.063	0.001	0.362**
Gum content (%)	0.005	-0.003	-0.006	-0.011	0.018	-0.127	-0.057	0.111	0.011	-0.008	-0.066

showed the highest direct effect, also contributing to seed yield per plant indirectly through the plant height and number of branches per plant. Days to maturity contributed indirectly positive effect through the number of pods per plant, number of seeds per pod and negatively through 100-seed weight. Plant height contributed indirect positive effect through the number of branches per plant contributes indirectly through the number of pods per plant, number of branches per plant contributes indirectly through the number of pods per plant, number of seeds per pods and pod length and plant height. Pod length indirectly contributed mainly through the number of seeds per pod.

So it may be concluding from the finding of correlation and path coefficient study, that the traits like number of pods per plant, number of seeds per pod and pod length were the most important characters. Therefore selection for these characters would give a better response to the improvement in seed yield per plant.

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