The Pharma Innovation Journal 2023; 12(2): 3707-3710

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 3707-3710

www.thepharmajournal.com
Received: 08-11-2022
Accepted: 16-12-2022

MK Ghasolia
Ph.D. Scholar, Department of Genetics and Plant Breeding, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Ashok Kumar Meena
Ph.D. Scholar, Department of Genetics and Plant Breeding, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Dr SS Rajput
Assistant Professor, Department of Genetics and Plant Breeding, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Rohitash Sharma
Ph.D. Scholar, Department of Genetics and Plant Breeding, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Corresponding Author:
MK Ghasolia
Ph.D. Scholar, Department of Genetics and Plant Breeding, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Character association and path analysis in Cluster bean [*Cyamopsis tetragonal* (L). Taub.]

MK Ghasolia, Ashok Kumar Meena, Dr SS Rajput and Rohitash Sharma

Abstract
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. Ten genotypes were evaluated during *Kharif* 2019, 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 clusters per plant, number of pods per plant, pod length and biological yield per plant. Days to 50% flowering has a negative and significant correlation with the seed yield per plant. The number of clusters per plant has a maximum direct effect on seed yield per plant followed by the days to maturity, number of pods per plant and biological yield.

Keywords: cluster bean, genotype, correlation coefficient and path analysis

Introduction
Cluster bean (2n=2x=14) commonly known as guar, is an important self-pollinated leguminous crop belonging to family Leguminosae. Guar is a crop of arid and semi-arid tropical areas spread over the North and Northwestern part of India requiring low inputs and care. Guar is mainly cultivated for food as vegetables, feed and fodder (Pawan kumar *et al*., 2017) [12]. It has been established as a high-valued cash crop mainly cultivated in the arid and semi-arid regions during kharif and summer season. Vavilov (1951) [15] has suggested that India as a geographic center of variability for guar, although it is not found to exist as wild in this region. Hymowitz (1972) hypothesized cluster bean is considered to be originated by domestication of the African wild species Cyamopsis senegalensis, which appear to be the ancestor of the *Cyamopsis tetragonal*. It is cultivated mainly in rainy season as a rainfed crop in arid zones of India and various other parts of the world (Pathak *et al*., 2010) [10].
Cluster bean is potential vegetable cum industrial crop grown for its tender pods for vegetable and endosperm gum i.e., galactomannan (22-33%) and guar meal (Singh *et al*., 2014). Guar seeds are mainly used for extraction of gum (30-35%) having good binding properties and high demand in food, petroleum, pharmaceutical and paper industries. Guars enrich the soil productiveness by fixing atmospheric nitrogen for its own necessities and also for the succeeding crop.
The crop is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat and Punjab and to a limited extent in Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala. Guar has multiple uses Vegetable, forage, and cover crop (Arora and Pahuja, 2008) [4]. Industrially application of cluster bean seeds, are used for extraction of gum (Anil *et al*., 2014) [2]. 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) [10]. Yield is a complex trait, function and interaction of component traits that contribute to yield. A study of the correlation between these traits provides an idea of about how these characters associated with the yield.
It is grown in almost all states of India, but the major concentration is in arid and semiarid regions of northwestern states of Rajasthan, Gujarat, Haryana, Punjab, Uttar Pradesh, Madhya Pradesh and Tamil Nadu (Rai and Dharmatti, 2013) [13]. In, Gujarat, it is mainly grown in Banaskantha, Mahesana, Ahmedabad, Anand, Kheda, Gandhinagar and Kutch districts. The cultivated area under guard in Gujarat was 1.23 lakh ha with a production of 0.86 lakh tones and productivity of 699.4 kg/ha (Anonymous, 2021) [3].
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.

Materials and Methods

The experimental material consisted of 10 diverse accessions of cluster bean collected from RARI, Durgapur. 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 Agronomy Farm, M.J.R.P. University, Achrol, Jaipur during *Kharif* 2019. 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 primary branches per plant, number of clusters per plant, number of pods per plant, number of seeds per pod, pod length (cm), 100-seed weight, biological yield per plant harvest index (%) 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 Dewey and Lu (1959) [5]. Path coefficient analysis was performed as per the formula is given by (Wright, 1921) and adopted by (Dewey and Lu 1959) [5].

Results and discussion

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 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) [9] 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 1&2.

Correlation coefficient analysis revealed that seed yield per plant exhibited significant and positive correlation at both genotypic and phenotypic level with number of clusters per plant, number of pods per plant, pod length and biological yield per plant. Days to 50% flowering has a negative and significant correlation with the seed yield per plant. Hence, direct selection for these traits would therefore be most effective in the improvement of cluster bean genotypes. These findings are in close proximity with the results of Anandhi and Oommen (2010) [1], Pathak *et al*. (2011) [11], Girish *et al*. (2012) [6] and Rai and Dharmatti (2014) [14]. The association studies indicating that seed yield of cluster bean can be improved by selecting genotype having higher values for these traits at both genotypic and phenotypic levels.

Path coefficient analysis

Partitioning of genotypic correlation into path coefficient analysis revealed the direct effects of component trait on seed yield per plant. Path coefficient analysis revealed the positive direct effect at genotypic level for the character *viz*., number of clusters per plant, days to maturity, number of pods per plant and biological yield. Hence, desirable improvement may be brought out by selecting genotypes with higher number of clusters per plant, days to maturity and number of pods per plant. However negative direct effect on seed yield was observed in days to 50 per cent flowering, plant height and number of primary branches per plant. These results are in agreement with Kumar (2016) [7] and Lakshmanan and Abdul (2016) [8]. The results of the study indicated that the characters with positive correlation have shown high direct effects. Thus, number of clusters per plant, number of pods per plant, number of seed per pod and days to maturity had high direct and correlation values.

Table 1: Genotypic correlation coefficients between different traits in cluster bean genotypes

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. primary branches per plant	No. of clusters per plant	No. of pods per plant	No. of seeds per pod	Pod length	100-seed weight (g)	Biological yield/ plant	Harvest Index (%)	Seed yield Per Plant (g)
Days to 50% flowering	1.000											
Days to maturity	0.680**	1.000										
Plant height	0.058	0.304	1.000									
No. of primary branches per plant	0.466**	-0.311	-0.346	1.000								
No. of clusters per plant	-0.365*	-0.744**	-0.275	0.471**	1.000							
No. of pods per plant	-0.286	-0.050	-0.284	0.742**	0.143	1.000						
No. of seeds per pod	0.805**	-0.924**	-0.485**	0.750**	0.490**	0.929**	1.000					
Pod length	-0.448*	-0.808**	0.836**	0.179	0.691**	0.220	0.842**	1.000				
100-seed weight (g)	0.830**	-0.422*	-0.508**	-0.676**	-0.533**	0.542**	0.449*	0.275	1.000			
Biological yield/ plant	-0.194	-0.122	0.327	-0.188	0.441*	-0.066	-0.244	0.690**	-0.442*	1.000		
Harvest Index (%)	0.003	0.128	-0.290	-0.288	-0.546**	0.294	0.185	-0.172	0.203	-0.722**	1.000	
Seed yield per plant	-0.374*	-0.077	-0.006	0.051	0.543**	0.525**	0.053	0.737**	0.275	0.763**	-0.079	1.000

*Significant at P = 0.05 and ** significant at P = 0.01

Table 2: Correlation coefficients between different characters in cluster bean genotypes at phenotypic level

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. primary branches per plant	No. of clusters per plant	No. of pods per plant	No. of seeds per pod	Pod length	100-seed weight (g)	Biological yield/ plant	Harvest Index (%)	Seed yield Per Plant (g)
Days to 50% flowering	1.000											
Days to maturity	0.588**	1.000										
Plant height	0.043	0.311	1.000									
No. of primary branches per plant	0.460**	-0.142	-0.044	1.000								
No. of clusters per plant	-0.200	-0.444*	-0.025	0.334	1.000							
No. of pods per plant	-0.248	-0.127	-0.203	0.632**	0.141	1.000						
No. of seeds per pod	0.789**	-0.518**	-0.437**	0.675**	0.461**	0.798**	1.000					
Pod length	-0.127	-0.374*	0.741**	-0.006	0.547**	0.196	0.834**	1.000				
100-seed weight (g)	0.692**	-0.045	-0.441*	0.005	-0.323	0.444*	0.398*	0.047	1.000			
Biological yield/ plant	-0.086	-0.128	0.224	-0.236	0.382*	-0.046	-0.137	0.558**	0.373*	1.000		
Harvest Index (%)	-0.163	0.145	-0.212	0.252	0.492**	0.087	0.045	-0.332	0.200	-0.603**	1.000	
Seed yield per plant	-0.242	-0.040	-0.035	0.079	0.482**	0.446*	0.020	0.654**	0.142	0.625**	0.009	1.000

Table 3: Direct (diagonal) and indirect effects of yield components on seed yield per plant at genotypic level in cluster bean genotypes.

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. primary branches per plant	No. of clusters per plant	No. of pods per plant	No. of seeds per pod	Pod length	100-seed weight (g)	Biological yield/ plant	Harvest Index (%)	Seed yield Per Plant (g)
Days to 50% flowering	-0.5231	0.4237	0.1570	0.0662	-0.1974	0.0924	-0.0364	0.1959	-0.0879	-0.0039	-0.0507	-374*
Days to maturity	-0.4301	0.6674	-0.0613	0.0330	-0.0238	-0.0606	-0.0491	-0.1735	0.0371	0.0554	-0.1466	-0.077
Plant height	0.0774	0.0297	-0.6241	0.0900	-0.0849	0.0251	0.0694	-0.1508	-0.1549	0.0343	0.0306	-0.006
No. of primary branches per plant	0.0126	-0.0062	0.0347	-0.2624	-0.0282	0.0875	0.0077	0.0214	0.0154	0.0147	0.0212	0.051
No. of clusters per plant	-0.3713	0.0441	-0.3243	-0.2796	0.8592	-0.3909	0.5299	-0.4343	0.3782	0.5425	0.0130	0.543**
No. of pods per plant	0.0624	0.0403	0.0344	0.3116	-0.1403	0.5896	0.1672	0.0988	0.0580	-0.0806	0.1201	0.525**
No. of seeds per pod	0.0217	-0.0288	-0.0839	-0.0240	-0.1678	-0.1475	0.4235	0.0869	-0.0601	0.0596	-0.0316	0.053
Pod length	0.2036	0.1777	-0.3181	0.1174	-0.2400	0.1522	-0.1517	0.3652	0.0588	-0.1093	-0.0951	0.737.**
100-seed weight (g)	-0.0068	-0.0028	-0.0245	0.0063	0.0156	0.0067	0.0079	0.0044	0.2578	0.0130	-0.0012	0.275
Biological yield/ plant	0.0048	0.0668	-0.0853	-0.0946	-0.3527	0.1460	0.1224	0.1286	-0.2048	0.4298	0.1827	0.763**
Harvest Index (%)	0.0389	-0.1108	-0.0476	-0.0858	-0.0053	-0.1364	-0.0406	0.0702	0.0114	0.1146	0.4821	-0.079

Table 4: Direct (diagonal) and indirect effects of yield components on seed yield per plant at phenotypic level in cluster bean genotypes.

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. primary branches per plant	No. of clusters per plant	No. of pods per plant	No. of seeds per pod	Pod length	100-seed weight (g)	Biological yield plant	Harvest Index (%)	Seed yield Per Plant (g)
Days to 50% flowering	-0.4425	0.2438	0.0903	0.0338	-0.1008	0.0487	-0.0126	0.1058	-0.0509	-0.0012	-0.0307	-0.242
Days to maturity	-0.0463	0.5326	-0.0067	0.0037	-0.0025	-0.0061	-0.0049	-0.0186	0.0039	0.0058	-0.0156	-0.040
Plant height	-0.2245	-0.0878	-0.5985	-0.2163	0.1758	-0.0869	-0.1846	0.3877	0.4341	-0.1085	-0.0760	-0.035
No. of primary branches per plant	0.0540	-0.0309	0.1389	-0.1453	-0.1012	0.3571	0.0128	0.0878	0.0537	0.0713	0.0915	0.079
No. of clusters per plant	0.0437	-0.0057	0.0306	0.0275	0.6524	0.0369	-0.0478	0.0453	-0.0443	-0.0650	-0.0008	0.482**
No. of pods per plant	-0.0243	-0.0161	-0.0174	-0.1116	0.0425	0.4271	-0.0524	-0.0410	-0.0195	0.0310	-0.0473	0.446**
No. of seeds per pod	-0.0206	0.0424	0.1216	0.0132	0.1810	0.1722	0.3697	-0.0932	0.0804	-0.0682	0.0224	0.020
Pod length	-0.0021	-0.0019	0.0031	-0.0011	0.0021	-0.0016	0.0011	0.2726	-0.0004	0.0011	0.0010	0.654**
100-seed weight (g)	0.0541	0.0219	0.1855	-0.0358	-0.1087	-0.0415	-0.0521	-0.0210	0.1385	-0.0987	0.0071	0.142
Biological yield/ plant	-0.0001	-0.0028	0.0040	0.0041	0.0137	-0.0057	-0.0038	-0.0051	0.0085	0.3327	-0.0076	0.625**
Harvest Index (%)	0.0307	-0.0819	-0.0305	-0.0572	-0.0018	-0.0946	-0.0136	0.0498	0.0067	0.0837	0.3252	0.009

Residual effect = 0.03715

Conclusion

In conclusion, the correlation studies, revealed that seed yield per plant had highly significant and positive association with pod length, number of pods per plant, number of pods per cluster and number of clusters per plant. Direct selection based on these traits could result in simultaneous improvement of afore said traits and marketable seed yield in cluster bean.

From path analysis, it can be inferred that very high positive direct effect on seed yield per plant was exerted by number of clusters per plant, days to maturity, number of pods per plant and biological yield at both genotypic and phenotypic levels. Hence, in the improvement programmed importance may be given for this trait to improve genetic yield potential in cluster bean.

References

1. Anandhi K, Oommen SK. Variability and heritability of yield and related characters in cluster bean (*Cyamopsis tetragonal* (L.) Taub.). Leg. Res., 2010;30(4):287-289.
2. Anil SK, Pahuja SP, Kadian R, Yadav, N Bhusal. Principal factor and cluster analysis for seed yield and bacterial leaf blight resistance in advance F4 progenies of cluster bean. Forage Res. 2014;39:165- 69.
3. Anonymous. All India Estimates of Area, Production and Yield of Foodgrains, Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India New Delhi –110 001; c2021.
4. Arora RN, SK Pahuja. Mutagenesis in guar [*Cyamopsis tetragonoloba* (L.) Taub.]. Plant Mutate. Rep. 2008;2:7-9.
5. Dewey DR, KH Lu. A correlation and path coefficient analysis of components of crested wheat grass and seed production. Argon. J. 1959;51:515-518.
6. Girish MH, Gasti VD, Mastiholi AB, Thammaiah N, Shantappa T, Mulge R, *et al*. Correlation and path analysis for growth, pod yield, seed yield and quality characters in cluster bean (*Cyamopsis tetragonal* (L.) Taub.). Karnataka J. Agric. Sci. 2012;25(4):498-502.
7. Kumar V. Path analysis in cluster bean [*Cyamopsis tetragonal* (L.) Taub] genotypes for vegetable pod yield. International Journal of Applied Science and Technology. 2016;2(1):21-24.
8. Lekshmanan KD, Abdul VM. Correlation and path coefficient analysis of yield and its component characters among different accessions of cluster bean [*Cyamopsis tetragonal* (L.) Taub.]. Legume Research. 2016;1:1-4.
9. Manivannam A, CR Anandakumar, R Ushakumari GS, Dhayia. Genetic diversity of guar genotypes (*Cyamopsis tetragonal*) based on agro morphological traits. Bangladesh J. Bot. 2015;44:59-65.
10. Pathak R, Singh SK, Singh M, Henry A. Molecular assessment of genetic diversity in cluster bean (*Cyamopsis tetragonal*) genotypes. Journal of Genetics. 2010;89(2):243-46.
11. Pathak R, Singh M, Henry A. Stability, correlation and path analysis for seed yield and yield-attributing traits in cluster bean (*Cyamopsis tetragonal*). Indian Journal of Agriculture Science. 2011;81(4):309-313.
12. Pawan kumar, Garg DK, Babu Lal Jat. Correlation coefficient and Path coefficient analysis for seed yield and its component traits in cluster bean *[Cyamopsis tetragonal* (L.) Taub.] Genotypes. International Journal of chemical studies. 2017;5(4):920-922.
13. Rai SP, Dharmatti PR. Correlation and path analysis for cluster bean vegetable pod yield. The Bioscan. 20138(2):711-14.
14. Singh SP, Dharmatti PR. Correlation and path analysis for cluster bean vegetable pod yield. The Bioscan. 2014;9(2):811-14.
15. Vavilov NI. The origin, variation, immunity and breeding of cultivated plants. 1951;72(6):482.