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Analysis of Correlations and Path on Yield and Its Components in F_2 Population of Mungbean (*Vigna radiata* (L.) Wilczek)

Rupal Dhoot[1*], K. G. Modha[1], Dhirendra Kumar[1], Meenakshi Dhoot[2] and Chandrabhan Ahirwar[1]

[1]Department of Genetics and Plant Breeding, Navsari Agricultural University, Navsari-396450, Gujarat, India

[2]Department of Plant Breeding and Genetics, MPUAT, Udaipur-313001, Rajasthan, India

*Corresponding Author E-mail: rdhoot96@gmail.com

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ABSTRACT

The study on correlation among quantitative traits and their direct and indirect effect on seed yield in F_2 populations (Meha X GJM-1006, Meha X GJM-1008) of mungbean was carried out at Navsari Agricultural University, Navsari during the summer 2014. Correlation analysis revealed that seed yield was significantly and positively correlated with clusters per plant, pods per plant, straw yield per plant and harvest index in F_2 population of Meha X GJM-1006 and with seeds per pod, straw yield per plant and harvest index in F_2 population of Meha X GJM-1008. It indicates that an association of two characters is not only due to genes but also due to their influence of the environment. The path coefficient analysis on phenotypic basis revealed that pods per plant, days to flowering, days to maturity, clusters per plant, seeds per pod, 100 seed weight, straw yield per plant and harvest index had positive direct effect in F_2 population of Meha X GJM -1006 while straw yield per plant, plant height, primary branches per plant, days to maturity, seeds per pod, 100 seed weight, straw yield per plant and harvest index had positive direct effect in F_2 population of Meha X GJM -1008 on seed yield, indicated that pods per plant and straw yield per plant directly lead to increase in seed yield both the populations, respectively.

Key words: *Mungbean, F_2 Population, Correlation coefficient and Path Analysis.*

INTRODUCTION

Mungbean [*Vigna radiata* (L.) Wilczek, (2n=22, genome size of 579 Mb) Syn, *Phaseolus aureus* Roxb., *Phaseolus radiatus* L.] belongs to family *Fabaceae*, is one of the thirteen food legumes grown in India and third most important pulse crop of India after chickpea and pigeonpea. It is a short duration legume crop cultivated primarily for their dry seeds. Annual mungbean production in India is around 1.61 million tonnes from about 3.38 million ha area[1]. The crops are utilized in several ways, where seeds, sprouts and young pods are consumed as sources of protein, amino acids, vitamins and minerals, and plant parts are used as fodder and green manure. Mungbean protein is easily digested without flatulence.

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They have ability to fix atmospheric nitrogen (N2) in symbiosis with the soil bacteria *Rhizobium*. They can be grown successfully in extreme environments (e.g., high temperatures, low rain fall, and poor soils) with few economic inputs[2]. The quantitative characters are the best indicators of yield. Yield is a complex character which is affected by a number of component characters and the surrounding environments. Thus, selection for grain yield becomes difficult unless the associations between yield contributing characters are known. The statistics which measure the degree and direction of association between two or more variable is known as correlation. Measurement of correlation helps to identify the relative contribution of component characters towards yield. Indirect selection through component character with high heritability is advantageous for polygenic character like yield. Correlation between different characters is an aspect which should be kept in mind for better planning of selection programs. Path analysis is carried out using the estimates of correlation coefficients. Path analysis gives idea about direct and indirect influences of each of the component characters towards dependent trait.

MATERIALS AND METHODS

The present research work was carried out at Navsari Agricultural University, Navsari during the summer 2014. We included 2 F_2 populations of mungbean (Meha X GJM-1006, Meha X GJM-1008) in this study. Experiment was conducted in non-replicated trial as it was segregating material. Each row consisted of 20 plants with spacing of 45 cm x 15 cm inter and inta row spacing. Each F_2 was raised with minimum of 300 plant population and individual plant observations were recorded from 100 randomly selected plants. Observations were recorded for following traits *i.e.* Days to flowering, Plant height (cm), Days to maturity, Primary branches per plant, Clusters per plant, Pods per plant, Seeds per pod, 100-seed weight (g), Seed yield per plant (g), Straw Yield (g) and Harvest index (%). The simple correlations (phenotypic) between different characters were estimated according to Weber and Moorthy[15] and path-coefficient analysis was carried out following Dewey and Lu[3].

RESULTS AND DISCUSSION

In the present study, seed yield per plant recorded significant and positive correlation with clusters per plant, pods per plant, straw yield per plant and harvest index in F_2 population of Meha X GJM-1006 (Table 1). These results are in close agreement with earlier workers Srivastava *et al*[12], Tabasum *et al*[13], Gadakh *et al*[4], Prasanna *et al*[7] for clusters per plant; Tabasum *et al*[13], Srivastava and Singh[11], Gadakh *et al*[4], Prasanna *et al*[7] for pods per plant and Singh *et al*[10] for harvest index (Table 2). While in F2 population of Meha X GJM-1008 it showed significant and positive correlation with seeds per pod, straw yield per plant and harvest index. There are in agreement with the results reported by Reddy *et al*[9], Gadakh *et al*[4], Prasanna *et al*[7] for seeds per pod and Singh *et al*[10] for harvest index. It indicates that an association of two characters is not only due to genes but also due to their influence of the environment. Hence, simultaneous selection based on these characters could be suggested for improvement of yield in segregating populations.

Path coefficient analysis accommodates assistance for categorizing the total correlation into direct and indirect effects. The results of path analysis showed in table 3 and figure 1 (F_2 of Meha X GJM-1006) and table 4 and figure 2 (F_2 of Meha X GJM-1008). The path coefficient analysis on phenotypic basis revealed that pods per plant, days to flowering, days to maturity, clusters per plant, seeds per pod, 100 seed weight, straw yield per plant and harvest index had positive direct effect while plant height and primary branches per plant had negative direct effect on seed yield in F_2 population of Meha X GJM -1006. Whereas straw yield per plant, plant height, primary branches per plant, days to maturity, pods per plant, seeds per pod, 100

seed weight and harvest index had positive direct effect and days to flowering and clusters per plant had negative direct effect in F_2 population of Meha X GJM -1008 on seed yield, indicated that pods per plant straw yield per plant directly lead to increase in seed yield both the populations, respectively.

The results are in accordance with Rao *et al*[8], Srivastava *et al*[12], Reddy *et al*[9], Jyothsna and Anuradha[5], Prasanna *et al*[7] for days to maturity; Makeen *et al*[6], Tabasum *et al*[13], Reddy *et al*[9] Srivastava and Singh[11], Gadakh *et al*[4], Prasanna *et al*[7] for pods per plant; Rao *et al*[8], Makeen *et al*[6], Srivastava *et al*[12], Singh *et al*[10], Srivastava and Singh[11], Gadakh *et al*[4], Jyothsna and Anuradha[5], Prasanna *et al*[7] for seeds per pod, Makeen *et al*[6], Srivastava *et al*[12], Singh *et al*[10], Tabasum *et al*[13], Vyas[14], Reddy *et al*[9], Srivastava and Singh[11], Gadakh *et al*[4], Prasanna *et al*[7] for 100 seed weight and Rao *et al*[8], Tabasum *et al*[13], Vyas[14], Gadakh *et al*[4], Prasanna *et al*[7] for harvest index. But days to flowering and clusters per plant shows positive direct effect in F_2 of Meha X GJM-1006 (Singh *et al*[10],Vyas[14] and Gadakh *et al*[4]) and negative direct effect in F_2 of Meha X GJM-1008 (Rao *et al*[8] and Prasanna *et al*[7]) while for plant height and primary branches per plant shows negative direct effect in F_2 of Meha X GJM-1006 (Prasanna *et al*[7]) and positive direct effect in F_2 of Meha X GJM-1008 (Srivastava and Singh[11]). Path analysis revealed that number of pods per plant had high direct effect, therefore, simple selection for this character would be useful to maximum seed yield. Considering all the aspects together it is apparent from path analysis that maximum effects as well as appreciable indirect influences were exerted by pods per plant, clusters per plant, straw yield per plant and harvest index. These characters also exhibited significant and positive association with seed yield per plant. Hence, they may be considered as the most important yield contributing characters and appropriate prominence should be placed on these components while breeding for high yielding types in mungbean.

Table 1: Phenotypic correlation coefficients of seed yield per plant with other characters in F_2 population of Meha x GJM-1006 in mungbean

Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	SY	ST Y
DF	1.0000									
PH	0.3131**	1.0000								
PB	0.0564	0.2920**	1.0000							
DM	0.6375**	0.2477*	-0.0755	1.0000						
CP	-0.0397	0.2537*	0.5043**	-0.1640	1.0000					
PP	-0.0996	0.0518	0.1696	-0.1567	0.5061**	1.0000				
SP	0.1546	0.0852	0.0326	0.0645	-0.1006	-0.0800	1.0000			
100 SW	-0.0820	-0.1752	-0.2042*	0.0682	-0.0662	-0.0846	-0.0719	1.0000		
SY	-0.0029	-0.0124	0.0747	0.0035	0.3897**	0.8946**	0.1120	0.0098	1.0000	
ST Y	0.1709	0.2977**	0.1260	0.0084	0.1182	0.2388*	0.3421**	-0.3853**	0.2836**	1.0000
HI	-0.2129*	-0.3106**	-0.0704	-0.0730	0.1420	0.4641**	-0.1693	0.3626**	0.4854**	-0.5768**

Table 2: Phenotypic correlation coefficients of seed yield per plant with other characters in F_2 population of Meha x GJM-1008 in mungbean

Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	S Y	ST Y
DF	1.0000									
PH	0.0445	1.0000								
PB	-0.0798	-0.0638	1.0000							
DM	0.5899**	0.0591	-0.0874	1.0000						
CP	-0.1367	0.1680	0.5857**	-0.0456	1.0000					
PP	-0.0340	0.0838	0.1088	0.0564	0.3568**	1.0000				
SP	-0.1140	-0.0468	0.0591	-0.2115*	0.0527	-0.2370*	1.0000			
100 SW	0.0583	-0.0410	-0.0169	0.2022*	-0.1010	-0.2928**	-0.1272	1.0000		
S Y	-0.0843	0.0683	0.0589	-0.0226	0.0499	0.1675	0.2123*	0.1601	1.0000	
ST Y	-0.0019	0.1035	0.2213*	0.0395	0.2445*	0.1214	0.1495	0.1112	0.5920**	1.0000

HI	-0.0959	-0.1421	-0.2528*	-0.1041	-0.2649**	0.1174	-0.0481	-0.0118	0.2190*	-0.5127**

Table 3: Path coefficient analysis of component characters towards seed yield per plant in F_2 population of Meha x Pusa Vishal in mungbean

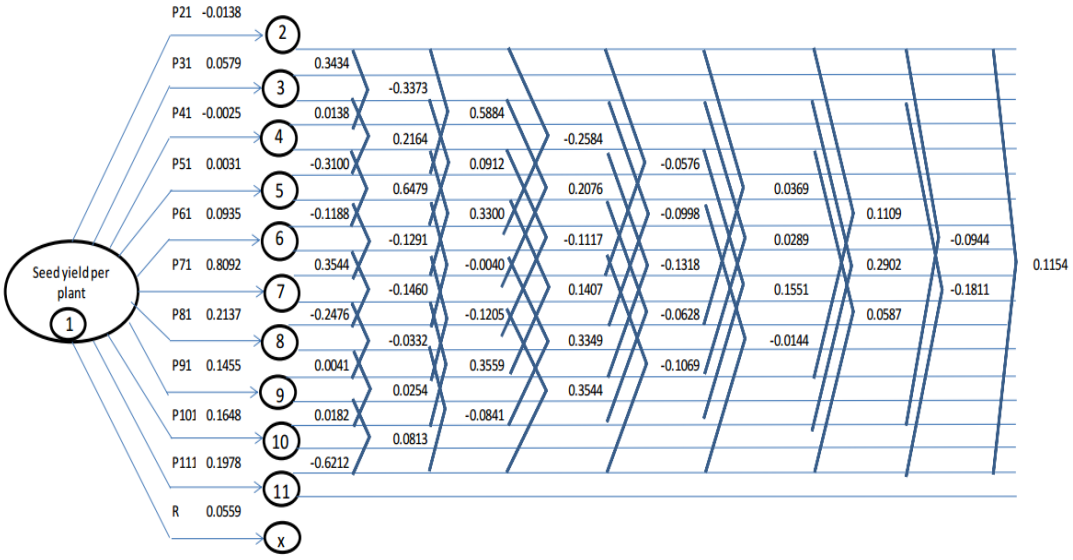
Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	ST Y	HI	Phenotypic correlation with seed yield
DF	**0.0056**	-0.0238	-0.0020	0.0901	-0.0010	-0.0727	0.0200	-0.0044	0.0469	-0.0616	-0.0029
PH	0.0018	**-0.0761**	-0.0106	0.0350	0.0061	0.0379	0.0110	-0.0094	0.0818	-0.0898	-0.0124
PB	0.0003	-0.0222	**-0.0363**	-0.0107	0.0122	0.1238	0.0042	-0.0109	0.0346	-0.0204	0.0747
DM	0.0036	-0.0188	0.0027	**0.1413**	-0.004	-0.1145	0.0084	0.0036	0.0023	-0.0211	0.0035
CP	-0.0002	-0.0193	-0.0183	-0.0232	**0.0242**	0.3696	-0.0130	-0.0035	0.0325	0.0411	0.3897**
PP	-0.0006	-0.0039	-0.0062	-0.0221	0.0122	**0.7303**	-0.0104	-0.0045	0.0656	0.1343	0.8946**
SP	0.0009	-0.0065	-0.0012	0.0091	-0.0024	-0.0584	**0.1294**	-0.0038	0.0939	-0.049	0.1120
100 SW	-0.0005	0.0133	0.0074	0.0096	-0.0016	-0.0618	-0.0093	**0.0535**	-0.1058	0.1049	0.0098
ST Y	0.0010	-0.0227	-0.0046	0.0012	0.0029	0.1744	0.0443	-0.0206	**0.2746**	-0.1669	0.2836**
HI	-0.0012	0.0236	0.0026	-0.0103	0.0034	0.3389	-0.0219	0.0194	-0.1584	**0.2893**	0.4854**

** - Significant at 1.0 per cent level of probability, * - Significant at 5.0 per cent level of probability

Residual = 0.1642

Bold diagonal figures are the direct effects

Fig.1: Diagramatic presentation of factors influencing seed yield in mungbean (F_2 generation of Meha X GJM-1006)



Single arrow represent direct effect, cross lines joining horizontal lines represent indirect effect and R represents residual effect

1 = Seed yield per plant (g)
2 = Days to flowering
3 = Plant height (cm)
4 = Primary Branches per plant
5 = Days to maturity
6 = Clusters per plant
7 = Pods per plant
8 = Seeds per pod
9 = 100-seed weight (g)
10 = Straw yield per plant (g)
11 = Harvest index (%)
R = Residual effect

Table 4: Path coefficient analysis of component characters towards seed yield per plant in F_2 population of Meha x GM-4 in mungbean

Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	ST Y	HI	Phenotypic correlation with seed yield
DF	**-0.0344**	0.0042	-0.0050	0.0249	0.0069	-0.0011	-0.0158	0.0051	-0.0017	-0.0675	-0.0843
PH	-0.0015	**0.0933**	-0.0040	0.0025	-0.0085	0.0028	-0.0065	-0.0036	0.0937	-0.1000	0.0683
PB	0.0027	-0.0060	**0.0625**	-0.0037	-0.0296	0.0036	0.0082	-0.0015	0.2004	-0.1779	0.0589
DM	-0.0203	0.0055	-0.0055	**0.0423**	0.0023	0.0019	-0.0293	0.0179	0.0358	-0.0733	-0.0226
CP	0.0047	0.0157	0.0366	-0.0019	**-0.0505**	0.0119	0.0073	-0.0089	0.2214	-0.1864	0.0499
PP	0.0012	0.0078	0.0068	0.0024	-0.0180	**0.0334**	-0.0328	-0.0259	0.1099	0.0827	0.1675
SP	0.0039	-0.0044	0.0037	-0.0089	-0.0027	-0.0079	**0.1383**	-0.0112	0.1354	-0.0339	0.2123*
100 SW	-0.0020	-0.0038	-0.0011	0.0085	0.0051	-0.0098	-0.0176	**0.0883**	0.1007	-0.0083	0.1601
ST Y	0.0001	0.0097	0.0138	0.0017	-0.0123	0.0041	0.0207	0.0098	**0.9054**	-0.3608	0.5920**
HI	0.0033	-0.0133	-0.0158	-0.0044	0.0134	0.0039	-0.0067	-0.0010	-0.4642	**0.7037**	0.2190*

** - Significant at 1.0 per cent level of probability, * - Significant at 5.0 per cent level of probability

Residual = 0.0559

Bold diagonal figures are the direct effect

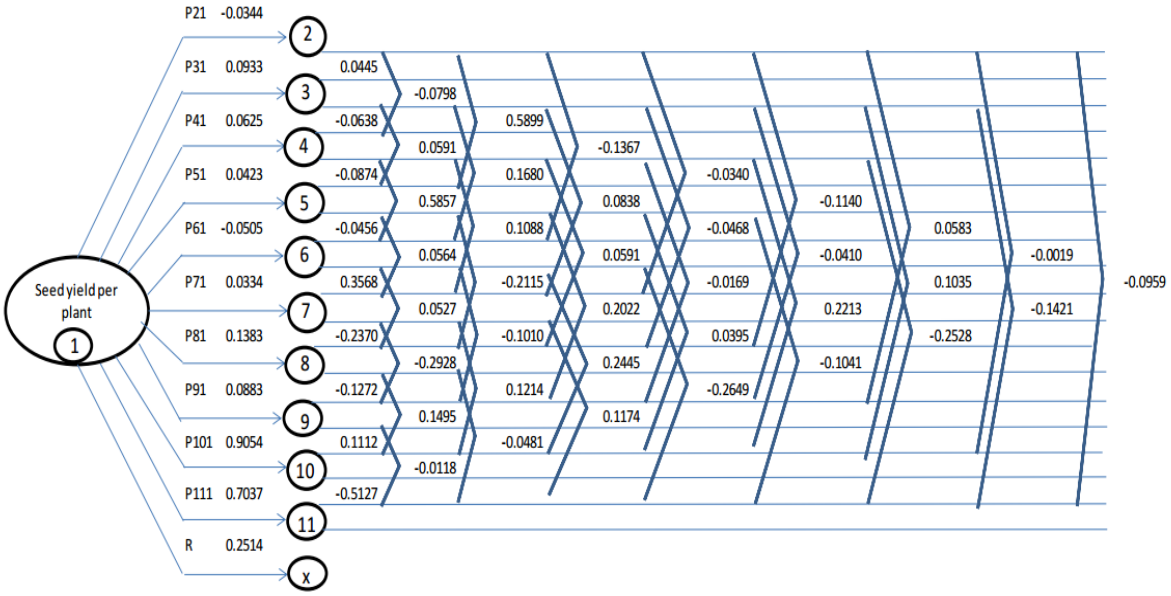
DF - Days to flowering PH - Plant height (cm) DM - Days to maturity

PB - Primary Branches per plant CP - Clusters per plant PP - Pods per plant

SP - Seeds per pod 100 SW- 100-seed weight (g) SY - Seed yield per plant (g)

ST Y - Straw yield per plant (g) HI - Harvest index (%)

Fig. 2: Diagramatic presentation of factors influencing seed yield in mungbean (F_2 generation of Meha x GM-4)



Single arrow represents direct effect, cross lines joining horizontal lines represent indirect effect and R represents residual effect.

1 = Seed yield per plant (g) **5** = Days to maturity **9** = 100-seed weight (g)

2 = Days to flowering **6** = Clusters per plant **10** = Straw yield per plant (g)

3 = Plant height (cm) **7** = Pods per plant **11** = Harvest index (%)

4 = Primary Branches per plant **8** = Seeds per pod **R =** Residual effect

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