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ASSOCIATION AND PATH ANALYSIS OF URDBEAN [*VIGNA MUNGO* (L.) HEPPER] FOR SEED YIELD AND ASSOCIATED TRAITS

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ABSTRACT

Due to its cleistogamous nature and significance as an autogamous pulse, black gram exhibits little fluctuation. Thus, the study was conducted at Department of Genetics and Plant Breeding, N. M. College of Agriculture, Navsari Agricultural University, Navsari-396 450, India to examine the Urdbean F_3 offspring of the combination NUK-15-02 × GU-1 for association and path analysis of eleven polygenic traits relevant to seed yield in Augmented Block Design, including four checks varieties, T-9, GU-3, GU-2 and GU-1. Strong and positive relationships were found between the pods/plant, harvest index (%), clusters/plant, branches/plant & plant height (cm) and the seed yield. Above listed characteristics may simultaneously increase the amount of seed produced/plant (g), hence they may all be regarded as significant yield-attributing characteristics. Path study showed that pods/plant, followed by clusters/plant and branches/plant, had a direct and beneficial impact on the amount of seed produced/plant (g). Therefore, to increase the seed output/plant (g), these qualities should be given the appropriate weight throughout the selection process.

Key words : Association, Path Coefficient, Augmented Block Design, Black gram, Urdbean.

Introduction

The self-pollinating diploid known as Urdbean [*Vigna mungo* (L.) Hepper] has chromosomal count of 2n=22 and is of Fabaceae family and sub family Papilionaceae (Arumuganathan and Earle, 1991; Sarvani *et al.*, 2020). Blackgram originated mostly in the Indian subcontinent (Zukovskiji, 1962). It is also referred to as mash, urdbean and urd. Protein (25–28%), oil (0.5-1.5%), ash (4.5-5.5%), fiber (3.5-4.5%), carbs (62–65%), vitamins (riboflavin, niacin, thiamine), amino compounds (mostly lysine), phosphorus and iron are all abundant in it (Sohel *et al.*, 2016). The dehydrated seeds are used to a variety of cooked or seasoned foods, as well as utilized to prepare curries, soups and dal (Sarvani *et al.*, 2020).

The year-round production of urdbean, which fits seamlessly with a variety of agricultural practices, is primarily done in the country as a fallow crop following the harvesting of rice. The crop is highly valued both domestically and internationally, while it additionally contributes significantly to the fertility of the soil by improving the physical characteristics of the soil and fixing nitrogen from the atmosphere. It is a resistant to drought crop that works effectively in dry-land agriculture and is primarily used as a combine with additional crops (Gomathi *et al.*, 2020a). India is globally the biggestgrower, considering for 70% of the crop's total production. Although it is cultivated in an area of almost 4.1 million hectares and is the fourth major pulse grain in India, it only produces 2.29 million tons, meaning that average yield in 2020–21 is just 538 kg per hectare (Anonymous, 2021). In India, this crop has an average acreage, production and effectiveness during the past five years of 4.8 million ha, 2.75 million tons, and 0.567 ton per ha, correspondingly. Nine states viz., Andhra Pradesh, Madhya Pradesh, Gujarat, Jharkhand, Karnataka, Rajasthan, Tamil Nadu, Maharashtra and Uttar Pradesh provide more than 90% of the world's urdbean output (Anonymous, 2021).

Association and path assessment are useful tools for predicting the interrelationships among the yield of seeds and its constituent parts. These methods are employed in crop improvement initiatives to create high-yielding improved varieties and to take advantage of the yield potential for increasing blackgram production. The extent that occurred the several yield component traits are related with one other and with the yield itself is estimated by the correlation coefficient. Breeding methods would be particularly effective if there's a favorable relationship among the primary yield aspects; on the other hand, selection becomes quite challenging. When fewer variables are taken into account in the selection process, a correlation study by itself may be sufficient. But when the number of variables rises, the scenario gets more complicated. In order to resolve this complexity, path analysis approach is utilized to separate the coefficient of correlation into both direct and indirect impacts. This allows for the establishment of the relative quality of each feature and the reduction of its numbers in the selection program.

Materials and Methods

Trial was carried out in the Farm of Department of Genetics and Plant Breeding, N. M. College of Agriculture, Navsari Agricultural University, Navsari-396450, India in late *kharif* season of 2021–22. 185 F3 descendants from the combination NUK-15-02 × GU-1 and a total of 4 checks (T-9, GU-3, GU-2 and GU-1) of black gram made up the experimental set. All 18.5 F_3 offspring and checks were assessed using an Augmented Block Design approach, in which every single check was duplicated across five blocks. There were 13 single progeny plants each row, spaced 45 × 20 cm^2. F_3 offspring were dispersed at randomly throughout every block. By following the entire suggested agronomic program of practices and protective measures, the crop developed effectively. Eleven quantitative characteristics were looked at: seed yield, branches/plant, days to maturity, pod length (cm), plant height (cm), seeds/pod, harvest index (%), pods/plant and days to fifty flowering. With the exemption of days to maturity and days to 50% flowering, borders were excluded from these observations, which were conducted on five plants chosen at random from each F_3 progenies. When the first bloom appeared, a few selected plants were tagged. Measurements were gathered for days to maturity and days 50 per cent flowering on an overall basis. The means of the five randomly selected plants were used in the statistical evaluation to provide information for the other qualities.

As indicated by Johnson *et al.* (1955b), Dewey and Lu (1958), accordingly, association and path assessment were examined.

Results and Discussion

Correlation coefficient analysis

Table 1 displays the calculated correlation between every conceivable combination of characters. The outcomes of the current research depicted further seed yield recorded beneficial and significant association along to harvest index (0.679), pods/plant (0.698), plant height (0.684), branches/plant (0.671) and clusters/plant (0.699). It depicted worthless association with 100 seed weight (0.013), pod length (0.120) and seeds/pod (0.141). It also exhibited significant and negative association with days to maturity (-0.178), while highly significant and negative association with 50% flowering (-0.686). Same kind of correlation for seed yield and it sassociated traits were reported from Patel *et al.* (2014) for branches/plant, plant height, clusters/plant, pods/plant and pod length (cm); Gowsalya *et al.* (2016) for branches/plant, pods/plant, plant height and clusters/plant; Sohel *et al.* (2016) for seeds/pod and harvest index; Patidar and Sharma (2017) for seeds/pod, pods/plant, branches/plant, 100 seed weight and harvest index; Rajasekhar *et al.* (2017) for pods/plant, seeds/pod, branches/plant and harvest index; Mohanlal *et al.* (2018) for pods/plant; Priya *et al.* (2018) for seeds/pod; Sushmitharaj *et al.* (2018) for seeds/pod and 100 seed weight; Hadimani *et al.* (2019) for days to maturity and days to 50% flowering; Sathees *et al.* (2019) for pods/plant, plant height, branches/plant and clusters/plant; Senthamizhselvi *et al.* (2019) for clusters/plant and pods/plant; Partap *et al.* (2019) for days to maturity, plant height and pods/plant; Patel and Madhu Bala (2020) for branches/plant, plant height, pods/plant, clusters/plant, harvest index, 100 seed weight and days to 50% flowering; Saran *et al.* (2020) for harvest index, pods/plant and seeds/pod; Sridhar *et al.* (2020) for hundred seed weight; Kiran and Lal (2021) for clusters/plant and Sathya *et al.* (2022) for plant height, branches/plant, 100 seed weight and pods/plant and Teja and Lal (2021) for plant height, harvest index and seeds/pod.

From the association studies, plant height (cm), harvest index (%), pods/plant, branches/plant and clusters/plant were all beneficially and strongly associated with seed yield/plant. This suggests that these characteristics can be enhanced concurrently with seed yield by direct selection. It did, however, show a non-significantly positive association with pod length, 100 seed weight and seeds/pod, indicating that these parameters are not as important for enhancement of crops.

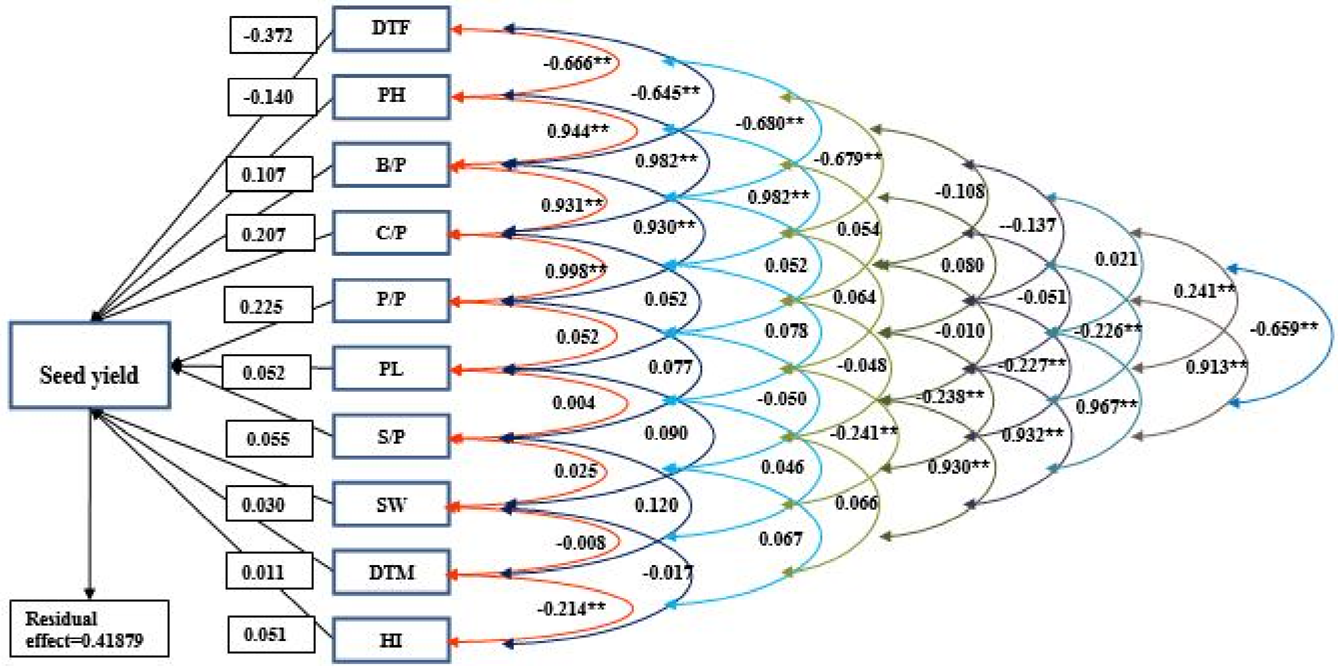

Fig. 1 : Path diagram for seed yield in F_3 progenies of Urdbean. Where, **DTF** = Days to 50% flowering, **PH** = Plant height (cm), **B/P** = Branches/plant, **C/P** = Clusters/plant, **P/P** = Pods/plant, **PL** = Pod length (cm), **S/P** = Seeds/pod, **SW** = 100 seed weight (g), **DTM** = Days to maturity, **HI** = Harvest index (%).

Table 1 : Correlation coefficients of seed yield with related traits in F_3 progenies in Urdbean.

Traits	DTF	PH	B/P	C/P	P/P	PL	S/P	SW	DTM	HI	SY
DTF	**1.000**										
PH	-0.666**	**1.000**									
B/P	-0.645**	0.944**	**1.000**								
C/P	-0.680**	0.982**	0.931**	**1.000**							
P/P	-0.679**	0.982**	0.930**	0.998**	**1.000**						
PL	-0.108^{NS}	0.054^{NS}	0.052^{NS}	0.052^{NS}	0.052^{NS}	**1.000**					
S/P	-0.137^{NS}	0.080^{NS}	0.064^{NS}	0.078^{NS}	0.077^{NS}	0.004^{NS}	**1.000**				
SW	0.021^{NS}	-0.051^{NS}	-0.010^{NS}	-0.048^{NS}	-0.050^{NS}	0.090^{NS}	0.025^{NS}	**1.000**			
DTM	0.241**	-0.226**	-0.227**	-0.238**	-0.241**	0.046^{NS}	0.120^{NS}	-0.008^{NS}	**1.000**		
HI	-0.659**	0.913**	0.967**	0.932**	0.930**	0.066^{NS}	0.067^{NS}	-0.017^{NS}	-0.214**	**1.000**	
SY	-0.686**	0.684**	0.671**	0.699**	0.698**	0.120^{NS}	0.141^{NS}	0.013^{NS}	-0.178*	0.679**	**1.000**

*,** → Significant at 5.0% and 1.0% probability, respectively.
DTF = Days to 50% flowering, **PH** = Plant height (cm), **B/P** = Branches/plant, **C/P** = Clusters/plant, **P/P** = Pods/plant, **PL** = Pod length (cm), **S/P** = Seeds/pod, **SW** = 100 seed weight (g), **DTM** = Days to maturity, **HI** = Harvest index (%), **SY** = Seed yield/plant (g).

Path coefficient analysis

The 10 other yield-contributing features were regarded to be autonomous (causal) factors in this study, with seed yield serving as a dependent variable. The path analysis demonstrated how these independent factors were related to the dependent variable (seed yield), either directly or indirectly through other component features. To investigate both the direct and indirect impacts of each of the other 10 parameters on seed yield, the association coefficients among each variable with seed yield were calculated. Table 2 and Fig. 1 shows the direct as well as indirect impact of these unrelated factors on seed yield.

The maximum beneficial direct influences on seed yield were recorded from pods/plant following clusters/plant and branches/plant, hence the weightage ought to be provided to these three characters during selection to improve the seed yield. Resembling outcomes were further found by Patel and Madhu Bala (2020) and Saran *et al.* (2020) for pods/plant; Sathya *et al.* (2018), Khan *et al.* (2020) and Yadav and Gangwar (2020) for clusters/

Table 2 : Path coefficient analysis of related traits towards seed yield in F_3 progenies of Urdbean.

Traits	DTF	PH	B/P	C/P	P/P	PL	S/P	SW	DTM	HI	Correlation with seed yield/plant
DTF	**-0.37229**	0.09368	-0.06918	-0.1413	-0.15308	-0.00569	-0.00752	0.00063	0.00277	-0.03407	**-0.686****
PH	0.24784	**-0.14072**	0.10127	0.2039	0.22132	0.00284	0.00438	-0.00156	-0.0026	0.0472	**0.684****
B/P	0.24004	-0.13282	**0.1073**	0.1933	0.20957	0.00275	0.00351	-0.00032	-0.00261	0.04999	**0.671****
C/P	0.25322	-0.13812	0.09984	**0.20774**	0.22518	0.00275	0.00429	-0.00147	-0.00273	0.04815	**0.699****
P/P	0.25287	-0.13818	0.09977	0.20755	**0.22538**	0.00273	0.00422	-0.00152	-0.00277	0.04805	**0.698****
PL	0.04015	-0.00758	0.00559	0.01086	0.01166	**0.05272**	0.0002	0.00275	0.00053	0.0034	**0.120^{NS}**
S/P	0.05085	-0.0112	0.00683	0.01617	0.01726	0.00019	**0.05507**	0.00075	0.00137	0.00348	**0.141^{NS}**
SW	-0.00768	0.00716	-0.00112	-0.00998	-0.01119	0.00474	0.00135	**0.0306**	-0.00009	-0.00087	**0.013^{NS}**
DTM	-0.08966	0.03187	-0.02441	-0.0494	-0.05428	0.00243	0.00659	-0.00024	**0.01149**	-0.01243	**-0.178***
HI	0.24538	-0.12851	0.10378	0.19354	0.20953	0.00346	0.00371	-0.00052	-0.00276	**0.05168**	**0.679****

*, ** → Significant at 5.0 % and 1.0% probability, respectively, Residual influence = 0.41879, Bold diagonal numbers are depicting direct effects.
DTF = Days to 50% flowering, **PH** = Plant height (cm), **B/P** = Branches/plant, **C/P** = Clusters/plant, **P/P** = Pods/plant, **PL** = Pod length (cm), **S/P** = Seeds/pod, **SW** = 100 seed weight (g), **DTM** = Days to maturity, **HI** = Harvest index (%), **SY** = Seed yield/plant (g).

plant and Rajasekhar *et al.* (2017), Tanveer *et al.* (2018), Teja and Lal (2021) for branches/plant. The highest negative direct influences on seed yield were recorded by days to 50% flowering followed by plant height (cm) suggesting that these features have less of an impact on selection for increased seed yield. These kinds of results were also depicted by Gill *et al.* (2017) for days to 50% flowering and by Mathivathana *et al.* (2015) for plant height. There was a residual effect of 0.41879. This suggested that in order to cover the majority of the available variance, more features could be included in subsequent investigations.

Conclusion

According to this present inspection's speculation, most traits, including clusters/plant, branches/plant and pods/plant, correlated positively & significantly to seed yield. This suggests that selecting for these characters may produce high seed yields. The aforementioned characteristics all have a positive and strong association with seed production. On another hand, path analysis also depicted that these characteristics directly and favorably affected grain yield.

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