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Correlation studies in yard long bean (*Vigna unguiculata* subsp. *sesquipedalis* (L.) Verdcourt) crosses under open field and rainshelter

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Abstract

Correlation analysis was done among ten crosses of yard long bean for vegetative, flowering and yield characters, in order to understand the nature of interrelationship among the characters under two different environment conditions viz., open field and rainshelter at the Department of Vegetable Science, College of Agriculture, Vellayani, Thiruvananthapuram during 2017. Positive correlation was observed for pod yield per plant with fruit set percentage, number of pods per plant and pollen viability both in open field and rainshelter (0.639, 0.804; 0.791, 0.574 and 0.801, 0.576 respectively). Pod length was positively correlated with pod girth (0.652 and 0.587 respectively) and pod weight (0.820 and 0.806 respectively) under open field and rainshelter. Fruit set percentage showed strong positive association with number of pods per plant (0.759 and 0.813) and pollen viability (0.777 and 0.806), under both conditions. Number of pods per plant exhibited significant positive correlation with pollen viability in open field (0.986) as well as rainshelter (0.938). Correlation studies revealed that, in open field as well as under rainshelter, pod yield per plant showed significant positive correlation with fruit set percentage, pods per plant and pollen viability and hence selection of hybrids based on these characters could be effective for improving pod yield of the crop.

Key words: Correlation, crosses, open field, rainshelter, yard long bean

INTRODUCTION

Yard long bean (*Vigna unguiculata* ssp. *sesquipedalis* (L.) Verdcourt.) is a pole type vegetable cowpea (2n= 24), an important member of Fabaceae family, grown for its long, tender and succulent pods, used as vegetable. Among all the leguminous vegetables, cowpea is one of the most important crops, cultivated in almost all parts India. It has great demand as vegetable, especially in South India, being a rich and inexpensive source of protein, minerals, fibres and a good source of both vitamins A and C, providing 17% and 31% of the recommended daily allowance for these Vitamins respectively (USDA, 2005), hence often referred to as the 'poor man's meat'. Yard long bean is grown extensively in Kerala since ancient times, hence this region is home to its rich and diverse germplasm. Because of its quick growth habit and enrichment of soil fertility by fixing atmospheric nitrogen, it has become an essential component of sustainable agriculture. Sivakumar (2012) reported high genetic variability among 44 genotypes of yard long bean and 22 genotypes of bush cowpea. However, research efforts to improve the crop by utilizing the variability in traditional cultivars have been limited. Breeding of hybrids in yard long bean with high yield, quality, uniformity and resistance to pests and diseases through heterosis breeding has gained momentum lately. In Kerala, production of vegetables is low during monsoon period due to heavy rainfall and associated occurrence of pests and diseases. Hence, protection of vegetables from heavy rains by providing shelters has gained much importance. Hence identifying yard long bean hybrids suited for cultivation under rainshelter is important.

Correlation studies help a breeder to identify heritable characters associated with yield. Indirect selection of a quantitative character through highly heritable correlated characters can result in faster crop improvement than through direct selection (Cruz and Regazzi, 2006). Assessment of the association and relative contribution of yield components is of utmost importance in optimizing the yield of a crop. It is beneficial when a highly heritable

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character is associated with an economic character like yield. Positive correlation between desirable characters is favourable, as it helps simultaneous improvement of both the characters. Therefore, the aim of the present investigation was to ascertain the nature of interrelationship between vegetative, flowering and yield characters among ten crosses of yard long bean under two different environments *viz*., open field and rainshelter.

MATERIALS AND METHODS

The experimental site was located at 8.5^0 North latitude and 76.9^0 East longitude, at an altitude of 29 m above mean sea level. The region enjoyed humid tropical climate with an average minimum and maximum temperature of 23.52 ^{0}C and 32.17 ^{0}C respectively and a scanty rainfall of 3.70 mm during the cropping period. Predominant soil type of the experimental site was red loam of Vellayani series, texturally classified as sandy clay loam. The experiment was carried out in two parts at the Department of Vegetable Science, College of Agriculture, Vellayani, Thiruvananthapuram during 2017. In part I, a crossing block was laid out, where seeds of ten crosses, selected based on the specific combining ability and *per se* performance from previous M.Sc. programme, were produced. The ten crosses were VS 34 x VS 50, VS 50 x VS 26, VS 34 x VS 13, VS 50 x VS 13, VS 50 x VS 16, VS 16 x VS 38, VS 54 x VS 26, VS 34 x VS 54, VS 13 x VS 26, VS 50 x VS 38 (VS 34- Githika, VS 50- Kakamoola local, VS 26- Vellayani Jyothika, VS 13- Neyyattinkara local, VS 16- Pattom local, VS 38- Palayam local, VS 54- Thirupuram local). In part II, the crosses were evaluated in open field and rainshelter conditions as two separate experiments. The crop was raised according to the package of practices recommendations of Kerala Agricultural University. Both the experiments were laid out in randomized block design with 11 treatments (10 crosses + NS 634 as check) in three replications from September to February. Five plants were randomly selected and tagged in each treatment under both rainshelter and open field to record the observations and the average of these five plants was worked out in each replication for statistical analysis. Analysis of variance (ANOVA) for individual character was carried out as suggested by Panse and Sukhatme (1967) for randomized block design. Simple correlation analysis was carried out between fifteen characters studied under open field and rainshelter conditions and the results are furnished in tables 1 and 2 respectively.

RESULTS AND DISCUSSION

Variability among yard long bean hybrids for pod characters under open field and rainshelter was studied by Feba and Sarada (2018). Hybrid VS 50 x VS 13 recorded maximum fruit set percentage under both open field and rainshelter (66.55 % and 56.80 % respectively), with VS 50 x VS 26 (55.27 per cent) and VS 34 x VS 50 (55.05 per cent) being on par in rainshelter. The hybrid VS 34 x VS 50 recorded the highest pod yield (1058.20 and 689.67 g plant^{-1}) followed by hybrid VS 50 x VS 26 (973.27 and 674 g plant^{-1}) under open field and rainshelter respectively. In open field, pod yield per plant showed significant positive correlation with fruit set percentage (0.639), pods per plant (0.791) and pollen viability (0.801) and positive correlation with number of primary branches per plant (0.483), seeds per pod (0.570) and pod protein (0.428) (Table 1). Under rainshelter, pod yield per plant showed significant and positive association with fruit set percentage (0.804) and number of seeds pod^{-1} (0.673) and positive association with vine length (0.546), number of pods plant^{-1} (0.574), pod protein (0.422) and pollen viability (0.576). This indicated that higher pod yield may be obtained in an indirect manner with selection for the positively related characters, which should be given importance in selection. Positive correlation of pod yield per plant with number of pods per plant was earlier reported by Ullah *et al.* (2011); Bhardu and Navale (2011); Subbiah *et al.* (2012); Singh (2013) and Sapara and Javia (2014) in cowpea. Earlier reports of positive correlation between pod yield per plant and seeds per pod was given by Subbiah *et al.* (2012) and Parmar *et al.* (2014). Association between pod yield and number of primary branches per plant was reported by Subbiah *et al.* (2012) and Sivakumar and Celine (2014). A positive correlation between two desirable traits makes selection easy for improving both the traits simultaneously, while the reverse is the case for negative correlation. Significant negative correlation of pod yield per plant with

Table 1: Correlation between biometric and yield characters among ten hybrids and check of yard long bean in open field and rainshelter

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1 O	1	0.541	-0.111	-0.010	-0.125	0.255	0.297	0.464	-0.115	0.263	0.568	0.221	-0.337	-0.089	0.335
R		0.677 *	-0.196	0.135	0.659 *	-0.554	-0.453	-0.530	0.582	0.412	-0.100	-0.396	0.615*	0.514	0.546
X2 O		1	-0.109	0.357	0.103	0.015	0.269	0.161	0.084	0.277	0.162	-0.055	-0.214	0.173	0.483
R			0.261	-0.333	0.505	-0.447	-0.141	-0.320	0.369	-0.099	0.209	-0.025	0.522	0.265	0.236
X3 O			1	-0.115	-0.288	-0.122	-0.415	-0.301	-0.223	-0.595	-0.082	0.972**	0.200	-0.294	-0.310
R				-0.144	-0.345	0.305	0.019	-0.060	-0.065	-0.542	0.692*	0.934**	-0.038	-0.238	-0.603*
X4 O				1	-0.055	-0.098	-0.133	-0.224	0.393	0.193	-0.470	-0.216	-0.129	0.463	0.254
R					-0.055	-0.084	-0.219	-0.297	0.339	0.390	0.013	0.001	-0.118	0.354	-0.172
X5 O					1	-0.405	-0.488	-0.137	0.759**	0.542	-0.388	-0.301	0.610	0.777**	0.639*
R						-0.369	-0.414	-0.073	0.813**	0.630*	-0.463	-0.575	0.597	0.806**	0.804**
X6 O						1	*0.652**	0.820**	-0.317	-0.040	0.600	-0.081	-0.484	-0.325	0.008
R							0.587	0.806**	-0.209	0.005	0.427	0.472	-0.455	-0.378	-0.092
X7 O							1	0.679*	-0.647*	0.010	0.771**	-0.298	-0.812	-0.590	-0.278
R								0.681 *	-0.483	-0.148	0.485	0.233	-0.714*	-0.534	-0.160
X8 O								1	-0.326	0.176	0.767**	-0.167	-0.464	-0.276	0.126
R									-0.120	0.030	0.240	0.193	-0.507	-0.183	0.132
X9 O									1	0.555	-0.678*	-0.340	0.607	0.986**	0.791**
R										0.609*	-0.266	-0.251	0.534	0.938**	0.574
X10 O										1	-0.119	-0.537	-0.152	0.628*	0.570
R											-0.449	-0.589	0.178	0.584	0.673*
X11 O											1	0.053	-0.517	-0.664*	-0.211
R												0.773	-0.478	-0.399	-0.493
X12 O												1	0.074	-0.390	-0.349
R													-0.263	-0.425	-0.752**
X13 O													1	0.527	0.428
R														0.418	0.422
X14 O														1	0.801**
R															0.576
X15															1

*(**- significant at 1%; *- Significant at 5%)*

X1-Vine length at final harvest (cm); X2-Primary branches plant^{-1}; X3-Days to first flowering; X4-Peduncle length (cm); X5-Fruit set %; X6-Pod length (cm); X7-Pod girth (cm); X8-Pod weight (g); X9-Pods plant^{-1}; X10-Seeds pod^{-1}; X11-Hundred seed weight (g); X12-Days to harvest; X13-Pod protein (%); X14-Pollen viability (%); X15-Yield (g plant^{-1}), O- open, R- rainshelter

days to first flowering (-0.603) and days to harvest (-0.752) was observed under rainshelter. Negative correlation of pod yield with days to flowering has earlier been reported by Manggoel *et al.* (2012) in cowpea.

Significant positive correlation of pod length with pod girth (0.652) and pod weight (0.820) was observed in open field. High positive correlation was observed between pod girth and pod weight (0.679). Under rainshelter also, pod length showed strong positive correlation with pod weight (0.806) and positive correlation with pod girth (0.587). Pod girth and pod weight also showed significant positive correlation (0.681). The results are in agreement with the reports of Santos *et al.* (2014) and Sivakumar and Celine (2014).

Significant positive correlation was observed between days to first flowering and days to harvest in open field (0.972) as well as rainshelter (0.934) and it conforms with the findings of Santos *et al.* (2014). Days to first flowering and days to harvest were negatively correlated with pod yield per plant, in open conditions and under rainshelter. Days to first flowering showed negative association with number of seeds per pod (-0.595) in open field, which is in accordance with the results of Shanko *et al.* (2014) and Sharma *et al.* (2017). Number of seeds per pod exhibited significant positive correlation with fruit set percentage (0.630) and number of pods per plant (0.609) under rainshelter, which was also earlier reported by Shanko *et al.* (2014) in cowpea. Fruit set percentage showed strong positive association with number of pods plant^{-1} (0.759) and pollen viability (0.777) in open field. Similar results were obtained under rainshelter conditions also where; high positive correlation was noticed for fruit set percentage with number of pods per plant (0.813), number of seeds per pod (0.630) and pollen viability (0.806). High pollen viability might have led to the enhanced pollination efficiency resulting in more fruit set, number of pods per plant and seeds per pod.

Pod girth and number of pods per plant showed significant negative correlation (-0.647) in open field and negative correlation under rainshelter (0.483), which was earlier reported by Parmar *et al.* (2014) in vegetable cowpea. Number of pods per plant exhibited significant positive correlation with pollen viability in open field (0.986) as well as rainshelter (0.938). Number of seeds per pod showed high positive correlation with pollen viability (0.628) in open field. Pollen viability was positively correlated with pods per plant, fruit set percentage and seeds per pod in open field as well as rainshelter. Nameirakpam and Khanna (2018) also opined that fruit set had high significant correlation with pollen germination in cowpea. In open field, hundred seed weight had significant positive correlation with pod girth (0.771) and pod weight (0.767), which is in accordance with the findings of Sapara and Javia (2014). Also, positive association was observed between hundred seed weight and pod length (0.600) in open field, and it is in line with the findings of Parmar *et al.* (2014).

CONCLUSION

Correlation studies revealed that, in open field as well as under rainshelter, yield per plant showed significant positive correlation with fruit set percentage, pods per plant and pollen viability and hence selection of crosses based on these characters could be effective for improving pod yield of the crop.

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