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Genetic variation for seed yield components in jute (*Corchorus* spp.)

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Abstract

Seven varieties comprising four tossa jute (*Corchorus olitorius* L) and three white jute (*Corchorus capsularis* L) were evaluated for seed yield and its components *viz.* pod length, girth of pod, number of filled seed, 100-seed weight in 1998 and 1999. The varieties exhibited significant differences for all traits except pod girth. The variety × year interactions were not significant for pods harvested from bottom position of the branches, for number of filled seeds and 100-seed weight indicating that these three components are reliable for producing good seed yield. The number of filled seeds per pod is uniformly distributed in *capsularis* while in *olitorius* it is declined from bottom to top position of the pods on branches. However, in both species pods harvested from top position of branches had significantly lower 100-seed weight compared to bottom and middle positions of pods on branches. The high values for PCV and GCV for pod length, pod girth and number of filled seeds suggest that there is a possibility of improving seed yield through direct selection for these traits. Number of filled seeds and lengths of pod were strongly correlated with seed yield in pod harvested from bottom and middle position along the branches.

Key words: Jute, pod position, correlation, seed quality

Introduction

Jute (*Corchorus olitorius* and *C. capsularis*) is an important bast fibre crop grown mainly for fibre purpose. Both seed and fibre of good quality cannot be obtained from the same plant and the quality of fibre greatly deteriorates if the crop is left standing until seed maturity. Jute seed crop is raised mainly in dry regions of the country in states of Andhra Pradesh and Maharashtra during the months of June-December.

Jute bears an extra-axillary, usually opposite a leaf base, cymose type of inflorescence. Little attention has been paid towards the effect of pod position along inflorescence branches and correlations between seed yield and its components in producing good quality seed in jute. Earlier studies have shown that seeds formed during first half of the flowering range (3-6 weeks in *C. capsularis* and about 10 weeks in *C. olitorius*) had higher germination percentage than those formed in the last week of the flowering period [1]. With regard to seed size, Ghosh and Sen [2] found influence of seed size on growth characters in *C. olitorius*. Similarly, Bhattacharjee *et al.* [3] reported that increase in the size of seed at planting was beneficial in terms of plant growth and components of seed yield and its quality. The present studies were therefore, initiated with an objective to characterize the variation in seed yield and its attributes in cultivated varieties of jute.

Materials and methods

Seven varieties comprising four tossa jute, JRO 524, JRO 878, JRO 7835, JRO 66 and three white jute, JRC 212, JRC 321, UPC 94 were evaluated in randomized complete block design with four replications during 1998 and 1999 under normal seasonal (mid-May to mid-June sowing) condition in clay loam soil at Central Seed Research Station for Jute and Allied Fibres, BudBud (87°60E' and 23°80N'), Burdwan, India. The origin, year of release and area of cultivation of these varieties are given in Table 1. Each plot consisted of ten rows spaced 30 cm apart. Row length was 3 m during both the years. A spacing of about 10 cm between plants was maintained during final thinning at 21 days after sowing. Fertilizers were applied on the basis of recommendation for jute (40 kg N/ha, 20 kg P_2O5 /ha and 20 kg K_2O/ha). Ten randomly selected plants from each plot were harvested in December at field maturity and sun dried. Each plant was tagged and observations on pod length (cm) and pod girth (cm) were recorded before threshing. After threshing seeds were subjected to sun drying for 3-4 days to bring down the moisture level of seeds. Observations were recorded for number of filled seeds per pod, 100-seed weight (g) and seed yield (g) from different positions (i.e. bottom, middle and top) of all pods per plant along branches. Analysis of variance was carried out assuming year effects as random and cultivar effects as fixed. The homogeneity of error variance was established for the traits studied as per Gomez and

Table 1. Origin, year of release and area of cultivation of seven jute varieties

Sl. No.	Name of variety	Pedigree	Year of release	Area of cultivation
1.	JRC-212	Pure line selection from local material	1954	Medium and high land
2.	JRC-321	Pure line selection from local material 'Hewti'	1954	Low-lying and medium lands
3.	JRO-878	Sudan green × JRO-620	1967	High and medium lands without water logging
4.	JRO-7835	Sudan green × JRO-632	1971	High and medium lands without water logging
5.	JRO-524	Sudan green × JRO-632	1977	High and medium lands
6.	UPC-94	JRC-321 × JRC-212	1983	Low-lying areas
7.	JRO-66	Selection from multiple cross involving CG,TM,JRO 524 indigenous and Peking,Bangkok and Tanganyika-1 exotic parents	1998	High and medium lands

Gomez [4]. Combined analysis of variance was done only for traits that have shown homogeneity of error variances. The variance components, phenotypic and genotypic coefficient of variations were estimated according to Johnson *et al.* [5]. Genetic correlation coefficients were computed as suggested by Miller *et al.* [6].

Results and discussion

In the combined analysis across the years significant differences in seed yield components except pod girth from all three positions were found among varieties. No significant differences in length of pods harvested from top position of the branches were noted among varieties. The average effect of variety was larger relative to the interaction effect for all the traits except pod girth indicating that the ranking of the varieties over years is expected to be stable. But for pod girth trait, interaction effect was relatively larger indicating ranking of variety changes over years.

The variety × year effects were not significant for number of filled seed, and 100-seed weight taken from bottom positions of branch, indicating that varieties produced similar number of filled seeds and hundred seed weight from year to year averaged across years. Thus these two components were reliable for producing a good seed yield.

The mean values of seed yield and its components among seven varieties of jute were generally consistent. In general, varieties of tossa jute (*C. olitorius*) had higher mean values for pod length, number of filled seeds and seed yield in both the years as compared to the white jute (*C. capsularis*) varieties. In varieties of both the species, pods harvested from bottom and middle position of the branches had higher mean values for seed yield components. In addition to this, from the results obtained in this study, it was evident that tossa jute varieties showed wide variation in seed setting i.e. number of filled seeds (204.11 - 101.52) as compared to white jute where uniformity (36.80 -29.69) was observed along the branches. These results are in conformity with earlier reports of Kar [1]. He reported that due to a narrow range of flowering period, seed maturity was more uniform in white jute while due to prolonged flowering period, the growth and development of pod in tossa jute showed wide variation in seed maturity and seed setting.

Amongst tossa jute varieties number of filled seed/pod across years ranged from 101.52 for JRO 66 (top) and 204.90 for JRO 7835 (bottom). JRO 7835 had significantly higher number of filled seeds in pods harvested from bottom position (204.90) and middle position (202.11) than other varieties. The mean 100-seed weight of bottom (0.232g) and middle (0.223g) positions in JRO 878 was significantly higher than that of JRO 524, JRO 7835 and JRO 66 during 1998 only. The mean seed yield ranged from 2.483g to 0.984g in JRO 7835.

In white jute varieties, JRC 321 produced relatively higher number of filled seeds at all position of pods than the other varieties. 100-seed weight of white jute varieties was significantly higher than tossa jute varieties at three positions along the branches. The hundred seed weight ranged from 0.312 g (JRC 212) to 0.369g (JRC 321). In general, seed yield of white jute varieties was lower than that of tossa jute varieties due to less number of pod bearing branches.

The mean, range, phenotypic (PCV) and genetic coefficient of variation (GCV), estimates of component of variance and coefficient of variability (CV) are presented in Table 2. The highest coefficient of variation was shown by seed yield. The least values were shown by pod girth followed by pod length. Generally, only slightly higher PCV values than GCV were obtained for all the traits in both the years signifying that genetic factors exerted the major effect in estimating the variation. PCV values were higher for pod length, number of filled seeds and pod girth and moderate for 100-seed weight and seed yield. GCV values showed similar trends as PCV values. Thus high values of GCV and PCV suggest that there is a possibility of

Table 2. Range, mean, phenotypic (PCV) and genetic coefficient of variation (GCV) and components of variance for seed yield and some of its attributing traits in 7 jute varieties during 1998 and 1999

Trait	PP	Range		Mean		SE		PCV		GCV		σ^2 ph		σ^2 g		σ^2 e		CV %	
		1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
P	B	0.90-6.56	0.88-6.30	3.93	3.78	0.07	0.12	71.45	71.26	71.43	71.19	7.87	7.25	7.86	7.23	0.0060	0.0150	5.99	3.94
L	M	0.95-5.96	0.94-5.76	3.68	3.62	0.07	0.08	69.22	68.56	69.18	68.52	6.48	6.15	6.470	6.14	0.0070	0.0085	4.59	4.63
	T	0.91-5.01	0.88-5.20	3.01	3.17	0.12	0.08	65.58	67.22	65.44	67.16	3.89	4.54	3.88	4.533	0.0160	0.0084	8.49	8.47
P	B	0.44-0.96	0.43-1.00	0.66	0.65	0.02	0.01	38.18	41.71	38.12	41.63	0.063	0.074	0.063	0.073	0.0002	0.0003	4.43	4.55
G	M	0.42-0.99	0.40-1.04	0.66	0.66	0.01	0.03	41.11	46.60	41.07	46.52	0.073	0.097	0.073	0.096	0.0001	0.0003	3.57	3.71
	T	0.39-0.92	0.37-0.98	0.62	0.06	0.11	0.01	42.17	46.37	42.11	46.31	0.068	0.085	0.067	0.085	0.0002	0.0002	4.15	4.27
F	B	29.69-204.90	29.96-193.15	112.91	112.74	9.74	2.23	68.69	67.99	68.41	67.95	6015.13	5875.33	5967.68	5869.51	47.4600	5.8190	12.20	12.20
S	M	32.42-202.11	32.76-169.69	112.95	108.44	4.01	3.26	67.32	64.06	67.21	63.98	5782.55	4826.47	5563.73	4814.04	18.8300	12.4400	7.68	7.68
	T	33.61-153.71	33.77-150.66	88.72	93.24	3.31	3.31	60.43	58.94	60.30	58.81	2874.38	3020.38	2861.57	3007.56	12.8000	12.8249	8.06	8.07
H	B	0.191-0.368	0.166-0.356	0.26	0.25	0.01	0.01	28.54	35.98	28.25	35.87	0.006	0.008	0.006	0.008	0.0001	0.0000	8.10	8.31
W	M	0.186-0.359	0.165-0.379	0.26	0.258	0.011	0.005	29.62	38.79	28.28	38.74	0.006	0.010	0.006	0.010	0.0001	0.0000	8.85	9.11
	T	0.180-0.339	0.156-0.348	0.25	0.23	0.007	0.003	28.00	38.01	28.03	37.98	0.005	0.008	0.005	0.008	0.0001	0.0000	5.75	6.93
S	B	1.724-2.329	1.237-1.926	1.96	1.509	0.121	0.169	11.83	17.08	9.78	15.14	0.054	0.066	0.037	0.052	0.0170	0.0140	13.31	13.30
Y	M	1.577-2.483	1.202-1.603	2.04	1.387	0.107	0.096	16.87	12.41	15.88	9.91	0.119	0.030	0.105	0.019	0.0130	0.0110	11.36	11.39
	T	1.490-2.135	0.984-1.355	1.83	1.190	0.063	0.083	15.47	9.74	15.01	6.19	0.080	0.013	0.076	0.005	0.0050	0.0080	7.46	7.53

PL = Pod length (cm), PG = Pod girth (cm), FS = Number of filled seeds, HW = 100-seed weight (g), SY = Seed yield (g), PP = Pod Position
B = Bottom, M = Middle, T = Top

Table 3. Genotypic correlations among seed yield components of seven varieties of jute

Character	Pod position	Pod girth (cm)		No. of filled seeds		100-seed weight (g)		Seed yield (g)	
		1998	1999	1998	1999	1998	1999	1998	1999
Pod length (cm)	Bottom	−0.99**	−0.98**	0.97**	0.99**	−0.99**	−0.98**	0.51	0.91**
	Middle	−0.99**	−0.99**	0.98**	0.99**	−0.98**	−0.99**	0.79*	0.68*
	Top	−0.99**	−0.99**	0.97**	0.99**	−0.99**	−0.98**	0.44	−0.33
Pod girth (cm)	Bottom			−0.96**	−0.97**	0.99**	0.99**	−0.60	−0.86**
	Middle			−0.95**	−0.98**	0.99**	0.99**	−0.76*	−0.66
	Top			−0.94**	−0.98**	0.99**	0.99**	−0.42	0.37
No. of filled seeds	Bottom					−0.95**	−0.97**	0.68*	0.95**
	Middle					−0.93**	−0.98**	0.88**	0.75*
	Top					−0.94**	−0.97**	0.58	−0.33
100-seed weight (g)	Bottom							−0.56	−0.91**
	Middle							−0.74*	−0.74*
	Top							−0.42	0.35

*, ** Significant at P=0.05 and 0.01 levels, respectively.

improving seed yield through direct selection for these traits.

Genotypic correlation coefficients among five traits are given in Table 3. Pod length showed significant negative association with pod girth and 100-seed weight, and significant positive association with number of filled seeds and seed yield except top position in 1999. From these positive correlations, it can be concluded that varieties with higher pod length gives higher seed yield at bottom and middle portion of branches. Ray *et al.* [7] reported that seed weight per pod had negative correlation with seed yield in *olitorius* jute. Number of filled seed of pods harvested from bottom and middle of branches had shown highly significant positive correlation with seed yield. 100-seed weight had negative correlation with seed yield in both the years except top position that showed lower values. Joseph *et al.* [8] reported that in both white jute, JRC 212 and tossa, JRO 632 basal diameter, number of branches and number of pods showed highly significant positive correlations with seed yield. Thus it is revealed from the present study that, pods harvested from bottom and middle portion of the branches attributed to higher seed yield in both the species of jute.

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