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COMBINING ABILITY STUDIES FOR YIELD AND SOME OF ITS ATTRIBUTES IN WHITE JUTE (*CORCHORUS CAPSULARIS* L.)

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ABSTRACT

Diallel cross involving eleven genotypes of white jute (*Corchorus capsularis* L.) revealed predominant role of additive gene action in the inheritance of all the characters studied, except basal diameter. Parents Tripura Cap., Brazil and Cap. Main Land China were identified as desirable combiners for fibre yield. Crosses JRC 212 x EC-4143, JRC 321 x Cap. Main Land China, EC-4143 x JRC 412, and Tripura Cap. x Liza were superior combinations for fibre yield and its attributes on the basis of their sca effects.

Key words: Combining ability, yield attributes, white jute.

In order to develop an appropriate breeding programme it is essential to assess the nature of inheritance of yield and its component traits and the potentiality of the parents in hybrid combinations. Combining ability studies help in identifying potential lines, which on hybridization would give rise to desirable segregates. The present investigation has been carried out to study the combining ability for yield and its components in white jute.

MATERIALS AND METHODS

Eleven genetically and geographically diverse genotypes of white jute were crossed according to diallel mating design, excluding reciprocals. These genotypes included four Indo-Gangetic types, viz., JRC 212, JRC 321, Tripura Cap. and JRC 412 and seven exotic types namely, EC-4143, C-58-9435, Cap-5-PRC, Brazil, Cap. Main Land China, Liza and Helsamira. Parents and 55 F_1s were grown in randomized block design with two replications at the CRIJAF, Barrackpore during rainy season. Each genotype occupied a 2 m long and

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60 cm wide plot, with the spacing of 30 cm between rows and 7 cm between plants within the row. Observations were recorded on ten randomly selected plants for seven quantitative traits. The proportion of dry fibre weight of ten plants to fibre plus dry stick weight of these ten plants or the fibre percentage was considered as an approximate measure of harvest index. Fibre percentage was transformed to angular values for final analysis. The experimental data were analysed following Model 1, Method 2 of Griffing [1]. Relative importance of gca and sca was calculated as suggested by Baker [2].

RESULTS AND DISCUSSION

The estimates of mean squares due to general and specific combining ability showed that gca was highly significant for all the characters, except base diameter; and sca was significant for all the characters, except fibre percentage (Table 1), indicating that both additive and nonadditive genetic components of variance were important in the

Table 1. Mean squares for combining ability for different characters in an 11 x 11 diallel cross of jute

Source	d.f.	Fibre yield	Fibre %	Plant height	Base diameter	Top diameter	Node number	Days to flowering
Gca	10	6.89**	6.66**	0.42**	0.02	0.014**	129.4**	400.4**
Sca	55	3.51**	0.87	0.03**	0.02*	0.002**	24.5**	37.4**
Error	65	0.51	0.78	0.02	0.01	0.001	10.4	9.5

*,**Significant at 5 and 1% levels, respectively.

manifestation of all these characters, except fibre percentage and base diameter. High values of $2\sigma^2g/(2\sigma^2g + \sigma^2s)$ for fibre percentage, plant height, and days to flowering (Table 2) indicated the predominant role of additive gene effects in the expression of these characters. In view of this observation, the response to selection was expected to be highest for these characters. In the case of node number and top diameter, the role of gca and sca was found to be equal. For fibre yield and basal diameter, the ratio was low, suggesting that these characters were largely determined by nonadditive genetic

Table 2. Estimates of variance components of gca (σ^2g), sca (σ^2s) and the relative importance of gca (σ^2g) and sca (σ^2s)

Character	σ^2g	σ^2s	$\frac{2\sigma^2g}{2\sigma^2g + \sigma^2s}$
Fibre yield	0.490	2.994	0.25
Fibre percentage	0.452	0.086	0.91
Plant height	0.031	0.015	0.81
Base diameter	0.001	0.008	0.16
Top diameter	0.001	0.001	0.64
Node number	9.159	14.194	0.56
Days to flowering	30.070	27.835	0.68

component of heritable variance as was also reported by [3]. The response to selection would be obviously lower for fibre yield and base diameter.

The estimates of gca effects (Table 3) suggested that the parents Cap. Main Land China and Tripura Cap. were good combiners for fibre yield and fibre percentage. The parent Brazil emerged as a desirable combiner for fibre yield, base diameter, top diameter, node number and earliness. On the other hand, parents Cap-5-PRC and Helmasira were poor combiners.

Table 3. Estimates of gca effects for different characters

Parent	Fibre yield	Fibre percentage	Plant height	Base diameter	Top diameter	Node number	Days to flowering
JRC 212	0.06	0.95**	0.09**	- 0.02	- 0.042**	1.65	9.57**
JRC 321	0.22	- 0.28	0.10**	0.02	0.009	0.38	- 2.04*
EC-4143	- 0.06	- 0.27	- 0.03	0.03	0.011	- 1.58	- 4.73**
C-58-9435	- 0.02	0.20	0.12**	0.01	- 0.025*	3.25**	3.69**
Tripura Cap.	0.74**	0.61*	- 0.42**	0.02	0.040**	- 5.95**	- 5.54**
Cap-5-PRC	- 1.08**	- 0.34	0.02	- 0.05	- 0.023*	- 0.90	1.61
Brazil	0.77**	- 1.08**	0.04	0.10**	0.027**	1.76*	- 4.27**
Cap. Main Land China	1.13**	0.64**	0.18**	- 0.02	- 0.039**	3.25**	8.46**
JRC 412	- 0.18	- 0.24	0.12**	- 0.01	- 0.017	3.35**	0.42
Liza	- 0.36	0.88**	0.03	- 0.02	- 0.003	- 0.50	0.11
Helmasira	- 1.22**	- 1.07**	- 0.25**	- 0.04	0.062**	- 4.71**	- 7.27**
SE (gi)	0.19	0.23	0.03	0.03	0.009	0.85	0.82
SE (gi-gj)	0.28	0.35	0.05	0.04	0.014	1.26	1.21

*,**Significant at 5% and 1% levels, respectively.

Out of 55 F_1s, 18 for fibre yield, 1 for fibre percentage, 6 for plant height, 4 for base diameter, 3 for top diameter, 8 for node number and 7 for days to flowering showed significant sca effects in positive direction. None of the cross-combinations appeared simultaneously superior for all the characters. Crosses JRC 212 x EC-4143, JRC 321 x Cap. Main Land China, EC-4143 x JRC 412, and Tripura Cap. x Liza, which had significant positive sca effect for fibre yield (Table 4), also exhibited significant sca effects for some of other attributes contributing to fibre yield. Among these desirable cross combinations, the parents identified as good general combiners were involved in only 2 crosses. Two crosses had both the parents which were not good general combiners. Due to absence of desirable

Table 4. Estimates of sca effects of desirable crosses for different characters

Cross	Fibre yield	Fibre percentage	Plant height	Base diameter	Top diameter	Node number	Days to flowering
JRC 212 x EC-4143	1.43*	- 0.06	0.36**	0.18	- 0.008	13.41**	3.95
JRC 212 x Cap-5-PRC	2.84**	- 0.28	0.01	0.07	0.007	- 0.47	8.60**
JRC 321 x Cap. Main Land China	1.97**	0.11	0.26*	0.06	0.011	6.75*	- 1.13
EC-4143 x JRC 412	3.27**	1.38	0.22*	0.22*	- 0.022	4.82	- 0.40
Tripura Cap x Cap-5-PRC	2.14**	- 0.02	0.42**	- 0.08	- 0.035	5.24	3.22
Tripura Cap x Liza	3.14**	- 0.74	- 0.03	0.24*	0.065*	- 1.07	- 2.78
Cap. Main Land China x JRC 412	1.57*	- 1.07	0.16	0.01	- 0.002	- 0.82	9.91**
Liza x Helmasira	1.40*	0.22	0.08	0.07	- 0.028	6.49*	0.45
SE (sij)	0.60	0.74	0.10	0.09	0.030	2.70	2.59
SE (sij-sik)	0.97	1.20	0.17	0.15	0.048	4.37	4.19
SE (sij-skl)	0.93	1.15	0.16	0.14	0.046	4.18	4.01

*,**Significant at 5% and 1% levels, respectively.

male sterile line in this species, the development of F_1 hybrids utilizing some of the crosses having desirable sca effects is not possible.

Hence, emphasis has to be laid on the general combining abilities of the parents. As the parents Tripura Cap. and Cap. Main Land China emerged as good general combiners for some important characters, the progeny of their cross (Tripura Cap. x Cap. Main Land China) should be chosen initially. Then intercrossing among the segregating progenies of this cross should be made at least for three cycles to elicit more genetic variability through recombination followed by testing the intercrosses for gca in the two later cycles to mop up more additive effects. The promising general combiners might be taken for further hybridization in pedigree method of breeding.

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