Indian J. Genet., **66**(1): 55-56 (2006)

Short Communication

Genetic analysis of leaf characters of some induced macromutants of jute (*Corchorus olitorius* L.)

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(Received: July 2005; Revised: January 2006; Accepted: January 2006)

Genetic backgrounds of the macromutants played a significant role on the inheritance of leaf characters in *olitorius* jute [1]. Using eight established macromutants, from the same experimental data of F_1 and F_2 generations of the present investigation, it was clearly established by the author [2] that, a tall genotype with increased base diameter and having leaves : longer and narrower in dimension with narrow leaf angle, less vertical separation, coupled with longer petiole, might be suitable for increasing the fibre yield of *olitorius* jute. Based on these criteria of selection, the present investigation was, therefore, undertaken to study the scope of genetic manipulation of leaf characters of some induced macromutants of *olitorius* jute.

The eight established macromutants, i.e., Round leaf, Long narrow leaf, Ribbon leaf, Stiff stem, Crumpled leaf, Tobacco leaf, Drooping leaf, Palmate leaf and a cultivated variety JRO-632 were used in a 9 × 9 diallel cross, without reciprocals. The nine parents along with F_1 and F_2 generations were grown, respectively, in 1997 and 1998 in randomised block design with two replications. The row and plant spacings were maintained at 30 cm and 5 to 7 cm, respectively. Three rows of 3 m length constituted a plot for each parent and F_1 hybrid and five rows for each entry of F_2 population. Fertilizers, NPK were applied in the ratio of 40 : 20 : 20 kg/ha and all other normal cultural practices were followed. Observations were recorded on five and ten random plants, respectively from each entry of F_1 and F_2 generation for different leaf characters. Leaf length, leaf breadth and petiole length were measured in centimeter from 6th to 10th five top leaves. Mean leaf angle was measured in degree from the 4th, 5th and 6th leaf downwards from the top point of bifurcation. Vertical separation of leaves was measured in centimeter as the distance between the two successive leaves in the same plane from the topmost region downwards from the point of bifurcation. The observations recorded were subjected to combining ability analysis using Method 2 Model 1 of Griffing [3]. In order to have better understanding of the nature of heterosis and gene effects, heterotic component analysis suggested by Gardner and Eberhart [4] was also done.

Analysis of variance for combining ability showed highly significant variances in general combining ability (*gca*) and specific combining ability (*sca*) in both F_1 and F_2 generations, indicating the importance of both additive and nonadditive gene actions in the genetic control of all the five leaf characters. Further subdivision of heterosis component revealed that average heterosis was significant for leaf length and leaf breadth in both the generations, indicating superiority of crosses over the midparental values. Variety heterosis was significant for all the characters in both the generations, indicating predominant role of dominance and dominance × dominance type of epistatic gene actions. Specific heterosis was significant for all the characters except leaf breadth in F_1 generation, indicating the presence of genetic divergence among the parents.

Table 1 represents the estimates of *gca* effects and variety heterosis for different leaf characters in both F_1 and F_2 generations. Based on the plant type concept [2], in general, Long narrow leaf showed a consistent trend of positively significant *gca* effects for leaf length and petiole length in both F_1 and F_2 generations, indicating its importance for long leaf with good petiole length. This mutant also showed consistently, negatively significant *gca* effects for vertical separation in both the generations, indicating the variety as a good combining parent for less vertical separation. Ribbon leaf had consistently negatively significant *gca* effects for leaf breadth and vertical separation in both the generations, indicating thereby the mutant as a suitable combiner for narrow leaf breadth and less vertical separation. Crumped leaf and Stiff stem were good combiners for long petiole length and narrow leaf angle, respectively. Similarly, estimates of variety heterosis indicated stiff stem for long leaf and petiole length, Round leaf for narrow leaf breadth and less vertical separation and Tobacco leaf for narrow leaf angle could be helpful for improving the fibre yield of jute.

Normally *sca* effects do not contribute appreciably in the improvement of self pollinated crops except where exploitation of heterosis is feasible. But the crosses showing consistently significant *sca* effects both in F_1

Table 1. Estimates of general combining ability effects and variety heterosis for five leaf characters of jute in F_1 and F_2 generation

Parents		Leaf length		Leaf breadth		Petiole length		Leaf angle		Vertical separation	
		gca effect	heterosis	*gca* effect	heterosis	*gca* effect	heterosis	*gca* effect	heterosis	*gca* effect	heterosis
1.	F_1	0.175	–0.885**	–0.280**	–0.110	0.070	–0.314*	0.408	2.705**	0.279	0.996**
	F_2	–0.273	–1.361*	–0.290**	–0.155	0.030	–0.407	–0.308	1.512	–0.021	0.679
2.	F_1	–0.375**	–1.553**	0.258**	–0.506**	0.226**	–0.581**	1.812**	–0.391	0.450**	0.817*
	F_2	–0.284	–1.571*	0.319**	–0.369*	–0.022	–0.950**	1.788**	1.515	0.571**	–1.035*
3.	F_1	0.643**	–1.226**	0.048	–0.255	0.404**	–0.326**	1.930**	0.266	–0.346*	–0.721*
	F_2	0.865**	–0.331	–0.049	–0.421**	0.078	–0.769**	2.029**	1.333	–0.398*	–0.574
4.	F_1	–0.213	0.988**	0.013	–0.012	0.256**	–0.094	–0.002	0.884	0.220	–0.393
	F_2	–0.378	0.883	–0.069	–0.031	0.334**	0.046	0.224	0.776	0.275	–0.030
5.	F_1	–0.115	1.103**	–0.678**	1.032**	–0.231**	0.785	–0.379	0.644	–1.077**	1.238**
	F_2	–0.425	0.098	–0.854**	0.872**	–0.714**	0.074	–0.180	1.279	–1.181**	0.973
6.	F_1	0.722**	–0.678**	0.195*	–0.347*	0.001	–0.086	–0.433	–6.866**	–0.256	0.089
	F_2	1.156**	0.034	0.321**	–0.212	0.275*	0.335	–0.744	–8.363**	–0.049	0.426
7.	F_1	0.501**	–1.119**	–0.200	–0.181	0.098	–0.216	–0.392	–0.516	–0.098	0.075
	F_2	0.992**	–1.038	0.033	–0.096	0.355**	0.173	–0.767	–1.096	–0.019	0.203
8.	F_1	–0.437**	1.296**	0.821**	–0.321*	–0.260**	–0.276*	0.885*	–0.434	0.639**	–0.399
	F_2	–1.175**	0.389	0.739**	–0.345	0.082	0.150	1.392*	–0.885	0.593**	–0.733
9.	F_1	–0.901**	2.075**	–0.358**	0.443**	–0.565**	1.098**	–0.829**	4.937**	0.189	–0.065
	F_2	0.479	2.597**	–0.149	0.761**	–0.418**	1.355**	–3.435**	4.297**	0.229	0.093
SE	F_1	±0.112	±0.234	±0.074	±0.153	±0.057	±0.119	±0.388	±0.806	±0.156	±0.323
	F_2	±0.299	±0.622	±0.299	±0.173	±0.103	±0.214	±0.647	±1.344	±0.197	±0.410

Parents : 1. JRO-632, 2. Round leaf, 3. Long Narrow leaf, 4. Crumpled leaf, 5. Ribbon leaf, 6. Tobacco leaf, 7. Drooping leaf, 8. Palmate leaf and 9. Stiff stem; * and **significant at P = 0.05 and P = 0.01, respectively.

and F_2 generation are likely to yield transgressive segregants. The additive × additive epistatic effect might be responsible for the consistency of *sca* effects of such crosses [5]. Jinks [6] obtained transgressive segregants in *Nicotiana rustica* and suggested that a prerequisite for high, uniform and stable heterotic effect is the correct gene content which can be assembled in the homozygous state, or if the appropriate alleles are completely dominant, as a heterozygote without affecting its performance. Based on the above reasonings along with the plant type concept [2], crosses Long narrow leaf × Palmate leaf, Crumpled leaf × Stiff stem and Ribbon leaf × Stiff stem for long leaf length; Tobacco leaf × Drooping leaf for narrow leaf angle; Ribbon leaf × Stiff stem for long petiole length; and Round leaf × Crumpled leaf, Long narrow leaf × Crumpled leaf and Tobacco leaf × Palmate leaf for less vertical separation were expected to throw up desirable transgressive segregants due to their consistent trend of significant *sca* effects in both F_1 and F_2 generations. The first three crosses consistently produced higher fibre yield than the other crosses. Moreover, these three crosses produced fibre yield at per with the standard variety, JRO-632 in both F_1 and F_2 generations. Presence of the induced macromutant Stiff stem in the latter two crosses might have produced higher fibre yield per plant (13.20g, 13.70g in F_1 and 12.70g, 10.95g in F_2, respectively) than the first one (10.10g and 10.20g in F_1 and F_2, respectively). Stiff stem was not only a good general combiner for narrow leaf angle but also produced positive and significant variety heterosis consistently for leaf length and petiole length. Hazra [7] stressed the importance on the use of narrow and acute angled leaf mutants for increasing the fibre yield per unit area of land.

References

1. **Maity S. and Sen S.** 1986. Effect of background mutation on the inheritance of leaf characters in jute (*Corchorus olitorius* L.). Exptl. Genet., **2**: 17-21.
2. **Roy S. and Ghosh Dastidar K. K.** 2004. Association of leaf characters with fibre yield, plant height and base diameter in tossa jute (*Corchorus olitorius* L.). Indian J. Genet., **64**: 249-250.
3. **Griffing B.** 1956. Concept of general and specific combining ability in relation to diallel crossing systems. Aust. J. Biol. Sci., **9**: 463-493.
4. **Gardner C. O. and Eberhart S. A.** 1966. Analysis and interpretation of the variety cross diallel and related populations. Biometrics, **22**: 439-452.
5. **Naidu M. R., Gill K. S. and Sandhu G. S.** 1990. Combining ability in the F_1 and F_2 generations of diallel cross in hexaploid triticale. Indian J. Genet., **50**: 373-377.
6. **Jinks J. L.** 1983. Biometrical genetics of heterosis. *In*: Heterosis Reappraisal of theory and practice (Ed. R. Frankel). Springer-Verlag Publication, Berlin, pp. 1-46.
7. **Hazra S. K.** 1988. Chemical mutagenesis — a potential tool for improvement in bast fibre crops. *In*: Proc. IJO/JARI Training Course on Breeding and Varietal Improvement of Jute, Kenaf and Allied Fibres', Nilgunj, Barrackpore, West Bengal, 139-147.