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Short Communication

Screening of tossa jute (*Corchorus olitorius* L.) germplasm for male sterility*

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In absence of male sterile line in tossa jute (*Corchorus olitorius* L.), manual production of hybrid seed and subsequent exploitation of heterosis has become prohibitive due to high cost of F_1 seed production. If male sterile line is available in tossa jute it may be utilized to get hybrid seed with lower cost of seed production. Male sterility in *C. olitorius* has not been reported so far. However, *C. capsularis* male sterile plants associated with undesirable ribbon leaf and dwarf characters have been reported [1, 2]. The practical utility of this mutant has proved negative [3]. Male sterility was later found to be associated with ribbon leaf nature in a pleiotropic manner by a single gene [4]. Incidentally a good number of *olitorius* germplasm has been collected. These include indigenous collection, improved types, mutant types and exotic collection. Besides our old collection, recently there has been a good collection from Africa through International Jute Organization. The objective of the study is to identify male sterile spontaneous mutant plant through screening of *olitorius* germplasms with a special emphasis on recently collected germplasms through International Jute Organization.

A total of 1541 accessions of *C. olitorius* germplasm comprising of 6 accessions obtained from China, 12 accessions from Indonesia, 40 accessions from Thailand, 97 accessions from Kenya, 71 accessions from Tanzania, 74 accessions from Nepal, 39 other exotic accessions from Australia, Brazil, Burma, Egypt, Germany, Nigeria, Russia and Sudan, 1078 indigenous accessions, 62 accessions of improved types and 62 accessions of mutant types were grown in 3 years in instalments of about one-third accessions in each year during 1998 to 2000 at CRIJAF Main Farm. The plot size of each accession was 3.5m × 0.90m and the row to row and plant to plant distances were 30cm and 4-5 cm respectively. Approximately 200 plants were raised in each plot in each year and nearly 1 lakh population was raised in the entire field for each year. The dates of sowing were 12.06.98, 15.06.99 and 14.06.2000. All the accessions came to flowering during 24.7.98 to 28.10.98 in the first year, 27.07.99 to 09.11.99 in the second year and 25.7.2000 to 10.10.2000 in the third year. A single jute plant on an average flowered for about 64 days and a single accession flowered for about 72 days. In a bid to identify the spontaneous occurrence of any male sterile plant in the population all the actively flowering plants were carefully examined during anthesis to observe any abnormal flower with regard to defective pollen.

The suspected plant detected in 1998 from accession no. OEX-027 and several suspected plants detected in 1999 from accession nos. OIN-210, OIN-279, OIN-323, OIN-332, OIN-451, OIN-455, OIN-512, OIN-597, OIN-600, OIN-613 and OIN-638 showing less amount of pollen grains with highest pollen sterility leading to abortion of flowers at early stage, was selfed, crossed by other normal plant of the same accession and of the standard variety, JRO 524. Selfed and crossed F_1 seeds from these suspected plants were grown in 1999 and 2000 for further critical observation. F_2 seeds of the crosses, suspected plant × other normal plant of the same accession and suspected plant × JRO 524 were grown in 2000 for confirmation of male sterility.

Reciprocal crosses were made in 1998 between distantly related accessions having diverse geographical origin like China and Indonesia, Thailand and Kenya, Tanzania and Nepal, China and Tanzania and exotic and indigenous to detect any nuclear-cytoplasmic interaction in respect of male sterile genes. F_1 and F_2 seeds of these reciprocal crosses were grown in 1999 and 2000 rainy season with a view to detecting male sterile plant.

As jute is a self-pollinated crop, pollen sterility leads to abortion of flowers. Several plants from 30

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accessions showed early abortion of most of the flowers. These plants were tagged and flowers from these plants were collected to study the abnormalities that caused abortion. Pollen grains from these flowers were examined under the microscope after staining with 1% aceto-carmine. It was observed that most of the pollen grains took stain and were fertile and very few were sterile. It was clear from this study that the cause of early abortion of these flowers was not due to pollen sterility.

However, a single plant detected in 1998 from accession no. OEX-027, several plants detected in 1999 from accession nos. OIN-210, OIN-279, OIN-323, OIN-332, OIN-451, OIN-455, OIN-512, OIN-597, OIN-600, OIN-613 and OIN-638 and two plants detected in 2000, one each from accession nos. OIN-932 and OMU-002, showing very less amount of pollen in individual flower leading to abortion of flowers at early stage were selected for critical observation. Table 1 showed the comparison of sterile pollen from these suspected plants and normal plants of the same accession. It was observed from the table that in general the flowers of the suspected plants had more number of sterile pollen in comparison to the normal plants of the same accession. But the flowers of the suspected plants had sufficient fertile pollen to effect fertilization. So the reason of abortion of the flowers of these suspected plants was not due to male sterility.

In all the cases of selfing and crossing of the suspected plants with normal plants of the same accession or standard variety, JRO 524, few attempts of selfing and crossing were successful and there were pod setting. Pod and seed setting from selfing indicated that these plants were not male sterile. Crossed F_1 and F_2 progenies from these suspected plants were carefully examined but their behaviour with regard to pollen fertility was normal.

Geographically divergent genotypes are expected to contain divergent sets of genes arising out of natural selection as well as human selection pressure. It is not impossible that cytoplasm has also diverged in response to unique and particular geographical situations. If this is true then reciprocal crosses between geographically divergent types may show cytoplasmic difference leading to interaction between nucleus and cytoplasm. If such a situation is realized then there is a possibility that male sterile types may occur. This is a hypothetical and theoretical assumption. For this purpose of detecting any nuclear-cytoplasmic interaction in respect to male sterile genes reciprocal crosses were made between distantly related accessions having diverse geographical origin. Careful examination of the F_1 and F_2 population revealed that all the plants of F_1 and F_2 of each cross were fully fertile. So, what was postulated hypothetically and theoretically above, were not realized.

Table 1. Comparative pollen study from the flowers collected from some suspected plants and normal plants of the same accession

Accession Number	Pollen sterility % in	
	Suspected plant	Normal plant of the same accession
OEX-027	8.53	1.31
OIN-210	5.81	0.67
OIN-279	4.74	1.49
OIN-323	5.94	1.54
OIN-332	6.69	2.61
OIN-451	5.67	1.11
OIN-455	6.25	1.90
OIN-512	5.58	1.44
OIN-597	4.63	1.46
OIN-600	3.02	1.78
OIN-613	5.23	1.79
OIN-638	4.75	0.69
OMU-002	5.30	1.17
OIN-932	11.41	0.78

It may be concluded from these studies that either nuclear or cytoplasmic spontaneous male sterile mutant is not present in the available tossa jute germplasm probably due to recent domestication of jute around 200 years ago. Many mutant genes did not accumulate in the population due to lack of human selection pressure for longer time.

In view of the above findings it may be suggested that male sterile plant in *C. olitorius* may be obtained only through induction by physical or chemical mutagenic agents as induced male sterile plants associated with undesirable ribbon leaf and dwarf characters had been reported in a closely related species, *C. capsularis* [1].

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