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CYTOGENETICS OF THE F_1 OF *SOLANUM GILO*×*S. AETHIOPICUM* CROSS

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ABSTRACT

The F_1 hybrids of *Solanum gilo* (n = 12) × *S. aethiopicum* (n = 12) had 24 somatic chromosomes, were vigorous with 68.5% pollen fertility. They produced 72.3% viable seeds. Close pairing of bivalents with a few unpaired differential segments were noted in F_1. The average chromosome association per cell at diakinesis was 0.12 IV (0–1) + 0.22 III (0–2) + 11.42 II (7–12) + 0.22 I(0–1). Twelve bivalents were recorded in 86% cells. The average chiasma frequency per bivalent was reduced from 1.87 at diplotene to 1.28 at diakinesis. Some bivalents failed to coorient properly at metaphase I plates. At anaphase I, chromatid bridges, fragments and laggards were found in 23% cells and the rest had normal 12:12 separation. Unequal distribution of chromosomes at metaphase II was noted in 10% cells. One to two micronuclei were observed in 7% cells at pollen tetrad stage. The hybrid sterility is segregational in nature. It is suggested that *S. gilo* and *S. aethiopicum* are genetically quite close and their chromosome complements bear high homology in spite of some differentiation through interchange.

Key words: *Solanum aethiopicum*, *Solanum gilo*, interspecific hybrid, segregational hybrid, sterility.

Cytogenetic information on the hybrid between West African *Solanum* species, i.e., *S. gilo* and *S. aethiopicum* is meagre though some studies on cytogenetics of *S. gilo* and its hybrids with some other nontuberiferous species of *Solanum* have been reported [1–3]. The present meiotic study on the F_1 of cross *S. gilo* × *S. aethiopicum* was carried out to understand the chromosomal homology and evolutionary relationship in some West African forms of *Solanum* species.

MATERIALS AND METHODS

Homozygous parental lines of *S. gilo* and *S. aethiopicum* were raised in the garden of the University of Nigeria, Nsuka, Nigeria, in 1985 and crosses were made between them using *S. gilo* as female parent, adopting the emasculation method of Uzo [4]. Meiosis in F_1 hybrid of *S. gilo* × *S. aethiopicum* was studied using the cytological technique of Choudhuri [5]. Pollen fertility was determined by the method suggested in [62].

RESULTS AND DISCUSSION

F_1 generation. The percentages of seedlings surviving at flowering stage were 80.6, 86.7 and 91.3, respectively, in *S. gilo, S. aethiopicum,* and their F_1 hybrid.

RESULTS AND DISCUSSION

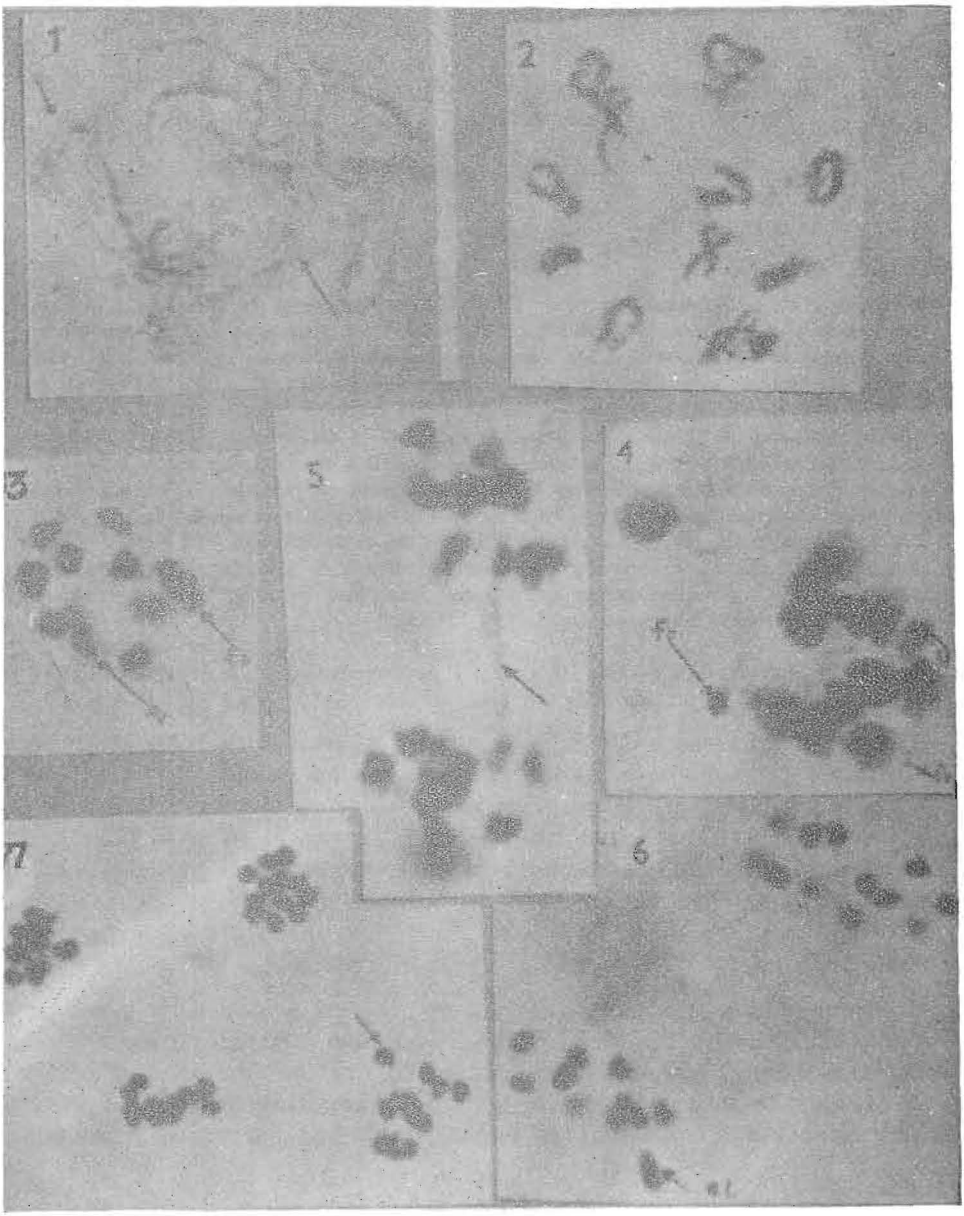

Fig. 1. Meiotic stages in cross *S. gilo* × *S. aethiopicum*.
1) Bivalent pairing at pachytene, 2) pairing at diplotene, 3 & 4) metaphase configurations, 5) anaphase bridge, 6) chromosomal elimination at anaphase, and 7) at telophase.

Meiosis in F_1 hybrids. Bivalents at pachytene showed almost completely close pairing except a few unpaired differential segments (Fig. 1: 1). A total of 122 pollen mother cells (PMC) studied at diplotene had 12 bivalents in each and the average chiasma frequency per bivalent was 1.87 (Fig. 1: 2).

At diakinesis, 100 PMC were analysed and 12 bivalents were noted in 86% cells, one quadrivalent + 10 bivalents in 2% cells, one quadrivalent + 2 trivalents + 7 bivalents in 10% cells, and 1 trivalent + 10 bivalents + 1 univalent in 2% cells. The average chiasma frequency per bivalent at this stage was reduced to 1.28.

At metaphase I, quadrivalents, trivalents, bivalents (rod and ring types), univalents, and even fragment were noted (Fig. 1: 3, 4). Often the bivalents failed to coorient properly on the equatorial plate (Fig. 1: 4).

At anaphase I, 130 cells were analysed in which normal 12 : 12 separation was observed in 76.9% cells, and 7.7% cells in each case had one chromatid bridge (Fig. 1: 5), one laggard, and two eliminated chromosomes.

At metaphase II, total 151 cells were studied, of which normal 12 : 12 separation was recorded in 89.3% cells, 11 : 13 separation in 3.3% cases, 11 : 12 separation with elimination of 1 chromosome in 6.6.% cells, and 10 : 12 separation with elimination of 2 chromosomes in 0.7% cases (Fig. 1: 6). Chromosome elimination was also noted in telophase II (Fig. 1: 7).

Pollen and seed fertility. Out of 500 pollen grains studied in each case, the percentage of fertile pollen was 75.6 in *S. gilo*, 86.7 in *S. aethiopicum*, and 68.5 in the F_1. Out of 300 tetrads studied in the F_1 hybrid, 93% were normal and 7% had one or two micronuclei which were obviously arising out of the eliminated chromosomes.

The production of viable seeds in *S. gilo*, *S. aethiopicum* and their F_1 hybrid was 90.6%, 95.7% and 72.3%, respectively.

In the present hybrid *S. gilo* × *S. aethiopicum*, 12 chromosomes of *S. gilo* paired with 12 chromosomes of *S. aethiopicum*. It indicates high chromosomal homology between the two parents. Similar high frequency of chromosome pairing has been reported in some other nontuberiferous *Solanum* interspecific hybrids [7].

In the present hybrid, unpaired segments in certain chromosomes were noted at pachytene stage. Darlington [8] suggested that failure of pairing among pairable chromosome mates might be either due to segmental differences or mechanical interference with pairing due to the presence of too many homologous chromosomes. Also the effect of hybridization [9] and genetic factors reducing chromosome pairing might have played some role [10].

All these factors may have reduced chromosome pairing in F_1. The occurrence of moderately high frequency (16.7%) of multivalents indicates the presence of translocation heterozygosities [2, 5, 8]. This, in turn, leads to the conclusion that the chromosomes of the two parents, i.e., *S. gilo* and *S. aethiopicum*, are differentiated through interchanges. Easy crossability, high survival of F_1 plants, and intimate chromosome pairing in F_1 suggest close genetic relationship of the two parental species.

Pollen fertility and seed viability in F_1. Hybrid sterility in the present case as evident in reduced pollen fertility and seed viability of F_1 is possibly of segregational nature. Similar hybrid sterility has been reported in *S. melongena* crosses [5].

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