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Cytology of the F_1 Hybrid of *Solanum zuccagnianum* Dun. × *S. melongena* L.

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Summary. A study on the breeding behaviour of a hitherto unstudied *Solanum* species, i.e. *S. zuccagnianum* with *S. melongena*, is reported. Meiosis in the F_1 hybrid, *S. zuccagnianum* × *S. melongena*, although normal, was characterized by quadrivalent formation. It is suggested that this is due to segmental interchange and that this is one of the causes of the sterility observed in the hybrid. Cryptic structural differences were also observed by pachytene study.

Introduction

The cytogenetic relationship of the eggplant, *Solanum melongena* L. (2n = 24), with the other non-tuberiferous *Solanum* species is not well understood. *S. zuccagnianum* Dun. (2n = 24), a hitherto unstudied species, bears a close morphological resemblance to the scarlet eggplant (*S. integrifolium* Poir.). The hybrids between *S. melongena* and *S. integrifolium* have been reported to be sterile by many workers (Tatebe, 1936; Miwa *et al.*, 1958; Fukumoto, 1962; Katarzin, 1965). The causes of sterility in these cases were not explained. In order to study the breeding behaviour of *S. zuccagnianum* with *S. melongena*, a cross was made between them and the results are presented here.

Materials and Methods

S. zuccagnianum was obtained from Mr. N. Narasimha of Rao, Coimbatore, Tamil Nadu. It was crossed with AC 1 (Purple Round), a cultivar of *S. melongena*, maintained at the Faculty of Agriculture, Annamalai University.

For meiotic studies, floral buds were fixed in Carnoy's mixture (6:3:1) saturated with ferric chloride and smeared in aceto-carmine.

Results

The cross could be effected in one direction only i.e., using *S. zuccagnianum* as the female parent. The F_1 plants were tall, shrub-like, perennial, robust and healthy, exhibiting hybrid vigour in plant height and spread. But they were unproductive. Even though flower buds were formed in abundance, they dropped off at an early stage. A very small number of buds reached the preblossom stage, but they too were shed without opening. Attempts at self budpollination and back crossing with the parents failed to set fruits. Examination of the pollen teased out from mature buds indicated complete pollen sterility.

The data on chromosome association at metaphase I in the hybrid are presented in Table 1. The production of 10 bivalents and a quadrivalent was most common, being observed in 74.0% of the PMC's (Fig. 1). The quadrivalent was mostly ring-shaped, and was chain-like in rare cases. Complete pairing into 12 bivalents was observed in 16.7% of the cells. Disjunction of chromosomes at anaphase I was mostly normal, showing 12/12 separation. In a few cells, delayed separation of 1 to 2 bivalents was noticed. Subsequent stages of meiosis were normal.

Table 1. *Chromosome association at metaphase I in S. zuccagnianum × S. melongena*

	Association		Cells observed	
	II	IV	Number	Percent
	12	—	9	16.7
	10	1	40	74.0
	8	2	5	9.3
Mean	10.15	0.93		

Discussion

Chromosome pairing in the F_1 hybrid, *S. zuccagnianum* × *S. melongena*, showed a high degree of bi-

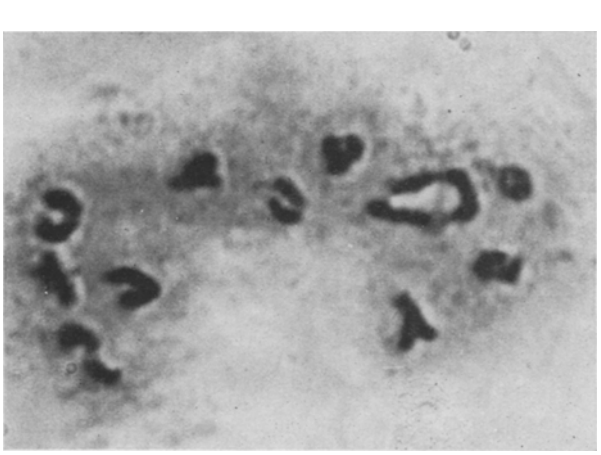

Fig. 1. Metaphase I in the hybrid showing 10 II + 1 IV (× 1800)

valent formation, with an average of 10.15 II per cell. However, it was characterized by the occurrence of quadrivalents in 83.3% of the PMC's examined. Anaphase I separation and the later stages of meiosis were normal. Presumably, the chromosomes of these two species possess some homology and the quadrivalent might be formed by segmental interchange between the two genomes.

The hybrid showed complete sterility in spite of good chromosome pairing and normal anaphase separation. A similar type of sterility with normal meiosis has been reported in hybrids between *S. melongena* as one parent and *S. integrifolium*, *S. indicum* or *S. xanthocarpum* as the other parent (Tatebe, 1936; Rajasekaran, 1968). This phenomenon has been attributed to cryptic structural differences of the parental chromosomes. In the present study, sterility might be caused by segmental interchange as well as small cryptic differences. The presence of the latter is supported by pachytene study which showed certain unpaired segments. The possible role of genic, plasmatic or extrakaryotic factors in causing sterility cannot be ruled out. However, it should be pointed out that chromosome doubling in similar sterile hybrids, *S. indicum* × *S. melongena* and *S. xanthocarpum* × *S. melongena*, restored fertility in the amphidiploids (Rajasekaran, 1968).

The shedding of floral buds before opening, observed in the present hybrid, may be taken to be an extreme form of hybrid sterility. This does not appear to have been previously reported for this genus.

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References

1. Fukumoto, K.: Nuclear instability and chromosomal mosaicism in high polyploids of *Solanum* species and hybrids. Jap. J. Bot. **18**, 19–53 (1962). — 2. Katarzin, M. S.: Distant hybridization of the eggplant. Trud. Priklad. Bot. Genet. Sete KC **37**, 122–129 (1965). — 3. Miwa, T., Saito, Y., Yamamoto, S.: The effect of plant growth regulators on the interspecific and intergeneric pollinations in some plants of Solanaceae. Bull. Fac. Agri. Univ. Miyazaoi **4**, 153–165 (1958). — 4. Rajasekaran, S.: Cytogenetic studies on sterility in certain interspecific hybrids of *Solanum*. Ph. D. thesis of Annamalai University 1968. — 5. Tatebe, T.: Genetic and cytological studies on the F_1 hybrid of scarlet or tomato eggplant (*Solanum integrifolium* Poir.) × eggplant (*Solanum melongena* L.). Bot. Mag. (Tokyo) **50**, 457–462 (1936).

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