Cytogenetic observations on a monosomic in *Sesbania macrocarpa* Muhl. (Leguminosae)[1]

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Summary. Karyotypic analysis of a spontaneous monosomic plant isolated from a population of *Sesbania macrocarpa* (2n = 4x = 24) revealed that one chromosome of the smallest set was missing. The absence of this chromosome caused a deleterious effect on the meiotic system of the plant, resulting in total male and female sterility. The origin of the species in this context is discussed.

Key words. Leguminosae; *Sesbania macrocarpa;* karyotypic analysis; monosomic plants.

The genus *Sesbania* Scop. is tropical and has both annual and perennial species. In this genus there are diploid as well as tetraploid species, based on x = 6. *Sesbania macrocarpa* Muhl. exhibits intraspecific polyploidy with naturally occuring diploids (2n = 12) and tetraploids (2n = 24). These 2 cytotypes are commonly found in rangelands as fodder plants and are also cultivated for green manure. Studies of monosomics and nullisomics has proved helpful in associating genes with specific chromosomes. For example, a complete set of such lines in *Triticum aestivum* has been helpful in understanding the genetic basis of diploidisation, and in genetic improvement through alien substitution and addition of chromosomes. In *Sesbania,* such studies will be of use in analyzing the genetic mechanism underlying the evolution of different species within this genus and evolving better types through judicious chromosomal manipulation and hybridization. The present study reports the mitosis and meiosis of a monosomic in *Sesbania macrocarpa.*

Material and methods. A population of *S. macrocarpa* was originally received during 1967 by the Plant Introduction section of this Institute from the Soil Conservation Research Station, Rehmankheda, Lucknow, India and maintained under Acc. No. I.L. 67–89. A slow growing, small leaved offtype plant was observed in this population during the year 1981. The plant was subjected to cytological investigations to study the possible cause of stunted growth. Karyotypes were studied by treating the freshly collected root tips with para-dichlorobenzene for 3 h, then fixing in 1:3 acetic-alcohol for 3 h and subsequently staining and preparing smears in 2% aceto-orcein. Well spread cells were photographed and idiograms were prepared by cutting out the prints of individual chromosomes and matching them on the basis of length and morphology. Meiotic studies were carried out by smearing anthers from freshly collected young flower buds in 1% aceto-orcein.

Results and discussion: The plant under study had stunted growth, attaining a height of 125 cm as compared to an average height of 282 cm of the normal plants. It had smaller leaves (5 cm × 1 cm) than the normal ones (33 × 8 cm) and the number of leaflets per leaf was also reduced to ⅓ of that found in the normal plants. The main stem remained unbranched, too. The mitotic study of this plant revealed it to be a monosomic with 2n = 4x−1 = 23. On resolving the somatic chromosomes into groups it was found that a single chromosome from the group of the 4 smallest chromosomes was missing (fig. 1). The plant was found to be completely male and female sterile and seed setting did not occur either naturally or upon repeated artificial crossing with normal plants either as male or female parents. The efforts to propagate it vegetatively were not successful as the species is annual in nature.

The origin of the monosomic in the population of *S. macrocarpa* could be as a result of fertilization affected by (n−1) gametes which may originate due to non-disjunction of a bivalent or presence of univalents at meiotic metaphase-I. Our earlier observations on the tetraploid cytotype revealed a regular formation of 12 bivalents in 98% of the cells, whereas 2% of the cells exhibited a configuration of 11 bivalents and 2 univalents.

The absence of a single chromosome had a serious effect on the meiotic system and normal pairing behavior of the chromosomes (fig. 2). The pairing was reduced to a great extent and only 3–6 bivalents were observed as against the possible 11 bivalents and 1 univalent. While all the bivalents moved to the metaphase plate the 11–17 univalents remained scattered, and the unequal disjunction resulted in sterility. All monosomics in hexaploid *Triticum*[2] have been found to be fertile, whereas some monosomics of hexaploid *Avena*[3] are completely sterile. The present case is analogous to the *Avena* monosomics. It appears that the missing chromosome contains some vital genes which regulate the normal course of meiosis and the loss of such genes is not compensated by other chromosomes of the set.

The complete sterility caused by absence of a single chromosome suggests that this tetraploid cytotype of *S. macrocarpa* might be of hybrid origin. Till such time that a multivalent suppressing mechanism is discovered, it may be presumed that this cytotype is an allopolyploid resulting from a wide cross and subsequent genome duplication.

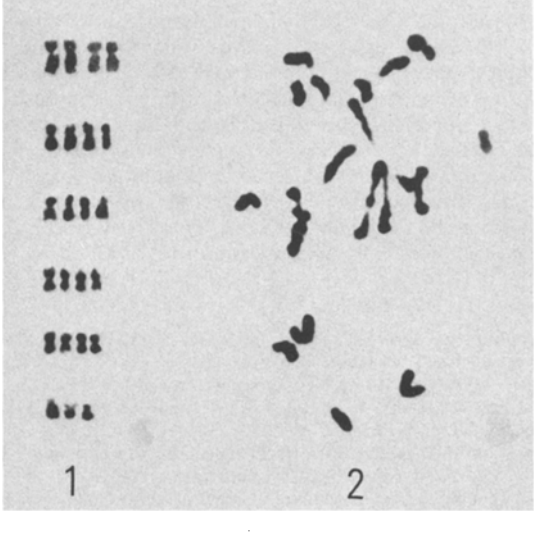

Figure 1. Photo-diogram showing 5 sets of 4 chromosomes and 1 set of 3 chromosomes.

Figure 2. Metaphase-I showing 5 bivalents and 13 univalents.

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2 Sears, E.R., Am. Nat. *87* (1953) 245.

3 McGinnis, R.C., Heredity, Suppl. *20* (1966) 86.

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