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Monotelodisomics in Pearl Millet

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Summary. In the progeny of crosses between plants with the chromosome number 2n = 13 + 2 telocentrics as the male parents and the normal diploids of *Pennisetum typhoides* S. & H., two plants with 2n = 13 + 1 telocentric chromosome were located. These two plants were heterozygous for an interchange, since at diakinesis and metaphase I associations of four chromosomes were observed. These plants had a chromosome constitution of 2n = 13 + t (or 6" + tI"); one chromosome of a homologous pair was represented by a telocentric chromosome so was monosomic for one arm, that is, these plants were "monotelodisomics" (Kimber and Sears, 1968).

In the progeny of asynaptic pearl millet (*Pennisetum typhoides* S. & H.), plants with chromosome numbers 2n = 13 + 2 fragment chromosomes were obtained. On cytological investigations these fragment chromosomes proved to be telocentrics formed by the misdivision of the centromere of one of the chromosomes of the complement. As these telocentrics were composed of one arm each of a chromosome, an association of three chromosomes (trivalent) involving the two telos and the normal chromosome was observed at diakinesis and metaphase I in the PMC's, as expected. One frequent orientation of such a trivalent at metaphase I resulted in the disjunction of the normal chromosome from the two telocentric chromosomes, giving nuclei with 7 normal and 6 + 2 telo chromosomes. Other types of orientation which resulted in the 7 + 1 telo and 6 + 1 telo were also observed. In the progeny, plants with 2n = 13 + 1 telocentric, 14 + 1 telo and 14 + 2 telocentrics were observed. This shows that pollen or eggs with n = 7 + 1 and 6 + 1 telocentrics were functional.

Some of the plants with 2n = 13 + 2 telocentrics were crossed as male parent to normal diploids and the progeny plants were cytologically screened. Two plants were found to have a chromosome number of 2n = 13 + 1 telocentric, and so were monosomic for one arm of a chromosome. These plants were also interchange heterozygotes, as associations of four chromosomes were observed at diakinesis and metaphase I in the PMC's.

Meiotic behaviour was studied in these two plants and data on the types of association that occurred at diakinesis and metaphse I are presented in Table 1. Associations of four chromosomes were observed in 190 cells (95p) out of 200 examined at diakinesis, and in 129 cells (86 p) of 150 examined at metaphase I; these associations were always chains and never rings (Fig.1). One of these four chromosomes was much shorter and was a telocentric. The high frequency of associations of four was due to the regular formation of a chiasma in the telocentric chromosome. This in turn might be caused by localization of chiasmata in the terminal one-third of the chromosome arm which is characteristic of this species (Burton and Powell, 1968). Interstitial chiasmata were not observed. The chiasma frequency per cell was 11.91 at diakinesis and 11.81 at metaphase I, significantly lower than in a normal diploid (diploids about 12.87). This decrease was due to the formation of a chain of four chromosomes or, where two associations of two were present, both the bivalents being open bivalents. The decrease in chiasma frequency was proportional to the decrease in the number of pairing arms.

Of 130 PMC's examined at metaphase-I, the orientation of the chain of four was alternate in 38 cells (29.23%), adjacent in 73 cells (56.16%) and linear in 19 cells (14.61%)(Fig.2). Anaphase I chromosome distributions were 7 - 7 in 97 cells and 8 - 6 in 3 cells out of 100 cells studied (Fig.3).

Morrison (1954) reported a plant with an interchange and a telocentric in the progeny of the monosomic *Triticum aestivum* variety, Chinese Spring. He attributed the cytological situation to the misdivision of the centromeres of two univalents with subsequent fusion of two nonhomologous centromeres and loss of one telocentric.

Table 1. Types and frequency of associations at diakinesis and metaphase+I

IV	III + 1	2 heteromorphic IIS	1 heteromorphic II +2 IS	Total number of cells
		diakinesis		
190	10	--	--	200
		metaphase I		
129	12	6	3	150

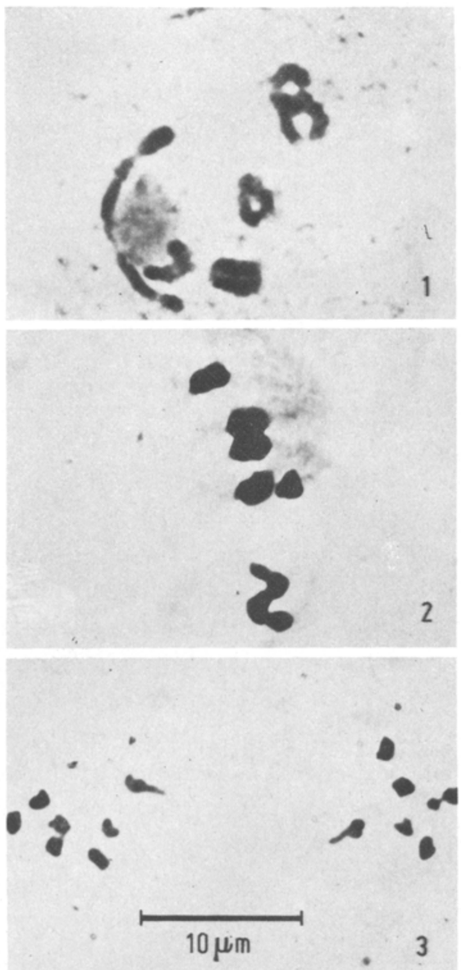

Fig.1. Diakinesis showing one association of 4 and 5 bivalents
Fig.2. Metaphase I showing an alternate orientation of association of 4
Fig.3. Anaphase I showing 7 - 6 + 1 telo distribution of chromosomes

In the present case, the origin of the plants was different from that reported in wheat by Morrison. In all probability, some of the plants of the standard lines were showing interchange, one such plant functioned as a female parent and the functional pollen obtained from the plants with telocentrics had a chromosome constitution n = 6 + 1 telocentric. Cytological screening of the sibs of the plants showing 2n = 13 + 2 telocentrics showed two plants to be translocation heterozygotes, but without telocentrics. Study of the selfed progeny of the female parent used in this cross revealed it to be a translocation heterozygote. In *Pennisetum typhoides*, the spontaneous occurrence of translocations was noted occasionally (Pantulu, unpublished), so it may be assumed that some of the plants of the standard line with interchange might have functioned as the female parents. As already indicated, pollen with 6 + 1 telocentric seems to be functional. Of the resultant zygotes some would have a chromosome constitution of 2n = 13 + 1 telocentric, and two interchange chromosomes. This would result at diakinesis and metaphase-I in associations of four chromosomes and, since one of the four chromosomes was a telocentric chromosome, only chain type associations would be possible.

Thus these two plants had the chromosome constitution of 2n = 13 + t (or 6'' + t1''). One homologous pair was represented by one full chromosome involved in interchange and the other chromosome was represented by a telocentric chromosome and so was monosomic for the other arm, that is, they were "monotelodisomics", adapting the terminology used for wheat aneuploids by Kimber and Sears (1968).

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