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A DITERTIARY COMPENSATING TRISOMIC IN PEARL MILLET *PENNISETUM AMERICANUM* (L.) LEEKE[1]

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ABSTRACT

A ditertiary compensating trisomic in a pearl millet strain has been reported in the progeny of an interchange heterozygote and its cytology discussed. The plant is morphologically distinct with the characteristic features of trisomy and formed a chain of seven chromosomes with the absence of a ring of four or six chromosomes.

INTRODUCTION

Compensating trisomics can be synthesized from the existing trisomic and translocation stocks or may be induced by radiation or chemical mutagenesis. They constitute a good source of primary trisomics (Burnham, 1962; Khush, 1973). Inspite of their utility in arm location of marker genes, position of centromere and construction of linkage maps, these were produced in a few plant species like *Datura* (Blakeslee, 1927; Avery *et al.*, 1959), *Triticum* (Smith, 1947) and tomato (Khush and Rick, 1967). There are practically no reports on compensating trisomics in pearl millet althrough tertiary trisomics were reported by a few investigators (Tyagi, 1975; Moorthy *et al.*, 1979, Venkateswarlu and Mani, 1978). The present communication reports the origin and cytological behaviour of a ditertiary compensating trisomic in pearl millet, *Pennisetum americanum* (L.) Leeke.

MATERIAL AND METHODS

An interchange heterozygote exhibiting an association of six chromosomes was synthesized by crossing two translocation stocks obtained following γ-irradiation. In the progeny of this, an off type plant was observed which was cytologically studied. Young spikelets of this plant were fixed in 1:3 acetic alcohol and anthers were squashed in 2% acetocarmine. Estimates of pollen fertility were made by I_2KI test.

RESULTS AND DISCUSSION

The trisomic plant looked markedly distinct from the normal diploid. It was weak, semidwarf (Fig. 1) and deep green. Leaves were short and narrow with wavy margins. Spike was short with regularly distributed spikelets. Kernels were small. There was also difference in leaf index and stomatal index.

Cytology of the trisomic plant re-

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vealed the presence of an extra chromosome (Figs. 2-5). Several types of associations of the extra chromosome were observed at diakinesis and metaphase I (Figs. 3, 4, 5; Table I). The maximum possible association of seven chromosomes plus four bivalents was observed in highest frequency (32.14%). Other associations recorded were 1 V+5 II, I IV+1 III+4II, 1 III+6 II, 1 VI+4 II+1 I, 7 II+ 1I, 1 IV+5 II +1 I, IV +4II +2 I, 4 II+7 I. Septavalents observed were mostly chain type or frying-pan shaped (Figs. 3, 5) whereas hexavalents were J-shaped. Rings of four and six were absent. The number of chiasmata per cell varied between 5.72-16.82 with a mean frequency of 12.72 .Terminalization coefficient at diakinesis was observed to be 0.933. This is more or less similar to that of the diploid 0.94. At anaphase I several types of separation of chromosomes were observed (Table II), the most frequent being 8:7 (71.43%) (Fig. 2). In about 23% of cells abnormalities such as laggards ranging from 1-3 and chromatin bridges were noticed. Second divisions were normal except for the presence of micronuclei in 5.3% of cells. Pollen fertility in this plant was as high as that of the diploid (94.4%).

The meiotic analysis shows that the highest possible association is a configuration of seven chromosomes. In the case of interchange, tertiary, isotertiary compensating and telotertiary compensating trisomics the maximum possible association is of five chromosomes. Hence the plant does not belong to the above types. On the otherhand it corresponds to the ditertiary compensating trisomics described and reviewed by Burnham (1962) in *Datura* and Khush (1973) in tomato.

An association of 7 chromosomes was observed in pearl millet by Pantulu (1967) in one of the plants raised from the seeds irradiated with γ-rays. He explained the extra chromosome as an isochromosome since it formed ring of three chromosomes in a low frequency of cells. Venkateswarlu and Mani (1978) mentioned an association of seven, involving

TABLE I

CHOROMOSOMAL CONFIGURATIONS AND THEIR FREQUENCY AT DIAKINESIS

Type	Number of cells observed	Frequency (%)
1 VII+4 II	45	32.14
1 VI+4 II+1 I	21	15.00
1 V+4 II+2 I	2	1.43
1 V+5 II	19	13.57
1 IV+1 III+4 II	12	8.57
1 IV+5 II+1 I	10	7.14
1 IV+6 II	16	11.43
7 II+1 I	13	9.30
4 II+7 I	2	1.43

TABLE II

ANAPHASE I SEGREGATIONS IN TRISOMIC

Type of segregation	Number of PMCs observed	Percentage
8 : 7	100	71.43
9 : 6	6	4.28
10 : 5	2	1.43
7 : 8+Chromatin Bridge	4	2.86
7 : 7+1 L	16	11.43
8 : 6+1 L	2	1.43
7 : 6+2 L	6	4.28
6 : 6+3 L	4	2.86

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Figs. 1-5. Fig. 1. Disomic and trisomic plants. Fig. 2. Anaphase I with 8 : 7 segregation (× 2250). Fig. 3. Diakinesis showing frying pan association of 7 chromosomes + 4 II (× 2155). Fig. 4. Diakinesis with 1 VI + 4 II + 1 I (× 2500). Fig. 5. Chain of 7 chromosomes + 4 II at diakinesis (× 1975).

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nucleolus organizing chromosome in the same crop in a plant obtained from the progeny of selfed interchange heterozygote. They assumed that an interchange complex of seven chromosomes was produced by non-disjunction and syngamy of a n+1 and n gametes. However, they have not worked out its cytology and origin. In the present case the extra chromosome is not an iso-chromosome since smaller ring associations were not noticed. It is presumed that the ditertiary compensating trisomic is formed by missing of one chromosome which is compensated for by two tertiary chromosomes.

REFERENCES

AVERY A. G., S. SATINA AND J. RIETSEMA 1959. *Blakeslee : the Genus Datura* 28 / pp. The Ronald Press, New York.

BLAKESLEE, A. F. 1927. Nullisomic, a compound chromosomal type in *Datura*. *Proc. N. T. Acad. Sci.* **30** : 1-29.

BURNHAM, C. R. 1962. *Discussions in cytogenetics*. Burgess, Minneapolis, Minnesota.

KHUSH, G. S. 1973. *Cytogenetics of aneuploids*. Academic Press, New York.

KHUSH, G. S. AND C. M. RICK 1967. Novel compensating trisomics of the tomato; cytogenetics, monosomic analysis and other applications. *Genetics* **55** : 297-307.

MOORTHY, J. V. V. S. N., P. SUKHADEV., M. V. SUBBARAO AND V. MANGA 1979. Meiosis in tertiary trisomic plants of pearl millet. *Indian J. Bot.* **2** : 70-72.

SMITH, L. 1947. A fragmented chromosome in *Triticum monococcum* and its use in studies on inheritance. *Genetics* **32** : 341-349.

TYAGI, B. R. 1975. Tertiary trisomics in pearl millet. *Proc. Indian natn. Sci. Acad.* **41B** : 54.-549.

VENKATESWARLU, J. AND J. N. R. MANI 1978. Tertiary trisomics in pearl millet. *Genetica* **48** : 145-150.

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