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GAMMA RAY INDUCED MEIOTIC ABNORMALITIES IN S_{13} MULBERRY

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ABSTRACT
S_{13} is a drought tolerant mulberry variety cultivated under rainfed condition. In order to increase the leaf yield and to improve the quality the hard wood stem cuttings of this taxon were irradiated with Gamma-rays (4kR, 5kR, 6kR, 7kR, 8kR, 9kR and 10kR). Comparable controls were also maintained. It is observed that the lower dosages of gamma - rays i.e., 4kR and 5kR were less effective in inducing variability. At higher dosages viz., 8kR, 9kR and 10kR deformity and inhibition of growth leading to semi lethality to complete lethality was observed. Like delayed sprouting, poor rooting, weathering of inflorescence, stunted growth, plants with weak and feeble branches, plants bearing small leaves with wrinkled and coriacious texture were observed. On the other hand, the moderate dosage like 6kR was found to be fruitful in the induction of beneficial variability in S_{13} mulberry variety. Some of these variants also displayed cytological abnormalities such as anaphase-I with laggard, precocious movement of chromosomes, univalents and bivalents at metaphase-I, disturbed prophase- II and metaphase- II.

KEY WORDS: Gamma irradiation, diploid, *Morus alba*, mutants.

INTRODUCTION

Mutation has served as a vehicle of progress in evolution as well as improvement of living organisms in terms of their economic utility (breeding). Variability at the level of gene (DNA) can be created only through mutations. In diploid mulberry varieties have higher leaf yield as well as better nutritive qualities from the point of silkworm rearing. Being a vegetatively propagated perennial crop with comparatively less number of chromosomes mulberry is suitable for the induction of mutation breeding for its improvement. Most cultivated varieties of mulberry are diploid with 2n= 28 chromosomes, but a few are polyploids (Datta 1954, Das 1961, Gill and Gupta 1979). Autotetraploids have been induced in mulberry by Kedarnath and Laksmikanthan (1965), Tojyo (1966), Sastry *et al.* (1968), Das *et al.* (1970), Dzhafurov and Alekperova (1978) and Alekperova (1979) Hazama (1968) reported that due to slow shoot growth of tetraploids the yield of leaf is less than of diploid. The present communication is the part of the investigation and deals with meiotic behaviour of gamma irradiation diploid mulberry cuttings of S_{13} genotype.

MATERIALS AND METHODS

Hard wood stem cuttings of mulberry variety of S_{13} were selected from young and healthy bushes. Each cutting measuring about 6-8 inches in length 1/2 inch in diameter bearing 3-4 active vegetative buds was preferred. Cuttings were irradiated in different doses of gamma rays 4kR, 5kR, 6kR, 7kR, 8kR, 9kR and 10kR at the Kadwi Memorial Institute of Oncology Bangalore-560021. In each dose 20 cuttings in three replication were used the irradiated cuttings were planted in poly pots and maintained providing necessary agricultural inputs for their response comparable controls were also maintained.
To study meiosis, young male flower buds were fixed in 1:3 acetic-alcohol and later transferred to 70% alcohol. Slides were prepared using standard aceto-carmine squash technique (Sharma and Sharma 1980) and meiotic abnormalities were recorded.

RESULTS

S_{13} mulberry variety is a diploid taxon with 2n=28 chromosomes at somatic metaphase. It revealed 14 bivalents at diakinesis (Fig. 1). Meiotic behavior was normal in control plants (Figs. 2 & 3). Irradiated populations displayed certain meiotic abnormalities. Mutant recovered at 6kR gamma rays showed disturbed orientation of bivalents at metaphase-I (Fig. 4). Irradiated populations also revealed chromosomal abnormalities like anaphase-I showing laggard, metaphase-I with precocious movement of chromosomes and sticky anaphase configuration (Figs. 5 to 12).

DISCUSSION

Mutagenesis (physical and chemical) is known to produce chromosomal aberrations leading to abnormal chromosome behaviour at meiosis and consequently brings about changes in the irradiated population. The chromosomal behaviour during meiosis is considered to be one the most reliable indices for estimating the potency of mutagens and response of genotype to mutation.
The PMCs of control plants showed 14 bivalents at diakinesis and metaphase-I. The meiotic behaviour was also regular with equal separation of chromosomes (14:14) at anaphase-I. However, a number of meiotic abnormalities were recorded in saplings raised from cuttings irradiated with different doses of gamma rays. The most common abnormalities observed include the occurrence of univalents, precocious separations, laggards, stickiness and disturbed polarity. Precocious movement or early disjunction of chromosomes was observed in most of

the treatments. These results are in agreement with those of Hazama (1968), Fujita and Nakajima (1973), Jayaramaiah and Munirajappa (1987), Ramesh (1998) who also reported chromosomal abnormalities due to gamma irradiation in KNG, Mysore local, M_5 and S_{54} mulberry varieties. Stickiness perhaps due to partial dissociation of the nucleo-protein and alteration in their pattern of organization or due to depolymerisation of nucleic acid caused by mutagenic treatment. Rao and Lakshmi (1980) attributed univalent formation to the partial and complete lack of homologous chromosome pairing. The occurrence of lagging chromosome may be due to delayed terminalisation, stickiness of chromosome end or because of failure of chromosomal movement. Different workers in several other taxa have also reported meiotic abnormalities observed in the present investigation after treatment with mutagenic agents (Anis *et al*., 2000; Kumar and Srivastava 2001).

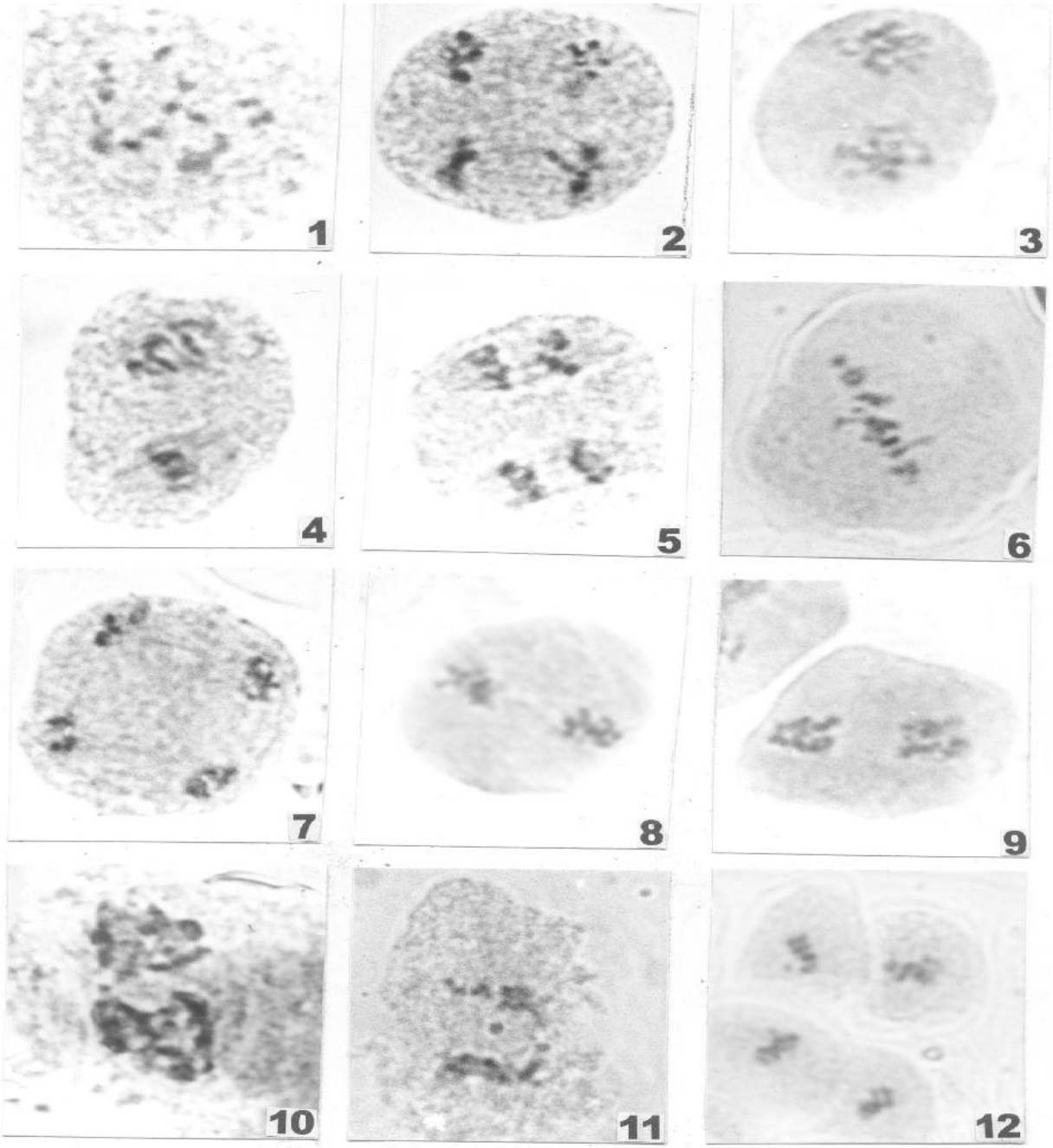

Figure 1-12: Mutagenesis in S_{13} mulberry variety. 1. PMC at diakinesis showing 14 bivalents, 2-3. Anaphase-I and Anaphase-II showing regular separation of chromosomes (control), 4. Metaphase-II showing disturbed orientation, 5. Early Anaphase-II, 6. Metaphase-I showing univalents and bivalents**, 7.** Early Telophase-II, 8-9. Metaphase-II showing different configarations of chromosomes. 10. Disturbed Anaphase-II, 11. Anaphase-I showing laggard, 12. PMCs at Metaphase-I showing laggard.

SUMMARY

Gamma irradiation studies revealed that the lower dosages (4kR and 5kR), in general, were less productive in the induction of mutations. Whereas at the higher dosages (8kR, 9kR and 10kR) deformity and inhibition of growth leading to semi lethality to complete lethality was observed. On the other hand, the moderate dosage like 6kR was found to be fruitful in the induction of beneficial variability in S_{13} mulberry variety.

Morphological leaf mutants like oblong leaf with wrinkled lamina, variants with slender branches bearing small deformed leaves and mutants with increased lamina (Broad leaves) were secured in the irradiated populations. Some of these variants also displayed cytological abnormalities such as anaphase-I with laggard, precocious movement of chromosomes, univalents and bivalents at metaphase-I, disturbed prophase- II and metaphase- II.

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