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Cytomixis in a *Ruellia* Hybrid (*R. tweediana* × *R. tuberosa*)

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Cytomixis was observed in an interspecific cleistogamous *Ruellia* hybrid (*R. tweediana* × *R. tuberosa*, 2n = 2x = 34). The chromatin migration was found to be from total to partial at different stages of meiosis and two to many PMCs were found to be involved. The various causes leading to cytomixis and their consequences have been discussed.

Key Words: Cytomixis, *Ruellia*, **Speciation**

Introduction

Gates (1911) defined cytomixis as the 'migration of chromatin from one PMC into another'. The phenomenon of cytomixis has been described in a large number of genera of angiosperms and is commonly observed in hybrids and chemically treated (mutagens, clastogens and carcinogens) plants (Morriset 1978, Spare 1978, Lakshmi & Raghavaiah 1981). However, in certain cases, cytomixis has also been observed in plants growing under normal conditions (Bariar 1985, De & Sharma 1983). In our *Ruellia* breeding programme for ornamental excellence, a number of hybrids, auto- and allopolyploids have been produced. A chasmogamous mutant has also been induced in the diploid cleistogamous hybrid (Raghuvanshi et al. 1981). In order to investigate the causes of sterility in the genotypes due to changes in breeding system, detailed meiotic studies were carried out. Besides various cytological anomalies, the phenomenon of cytomixis was observed in a *Ruellia* hybrid for the first time.

Material and Methods

Meiotic analysis of an interspecific cleistogamous *Ruellia* hybrid (*R. tweediana* × *R. tuberosa*, 2n = 2x = 34) was carried out. Plants were grown in uniform agroclimatic conditions. For cytological analysis floral buds were fixed for 48 hr in Carnoy's fluid and squash preparations were made in 2% acetocarmine. Photomicrographs were taken and slides were made permanent by following the ethanol-butanol schedule.

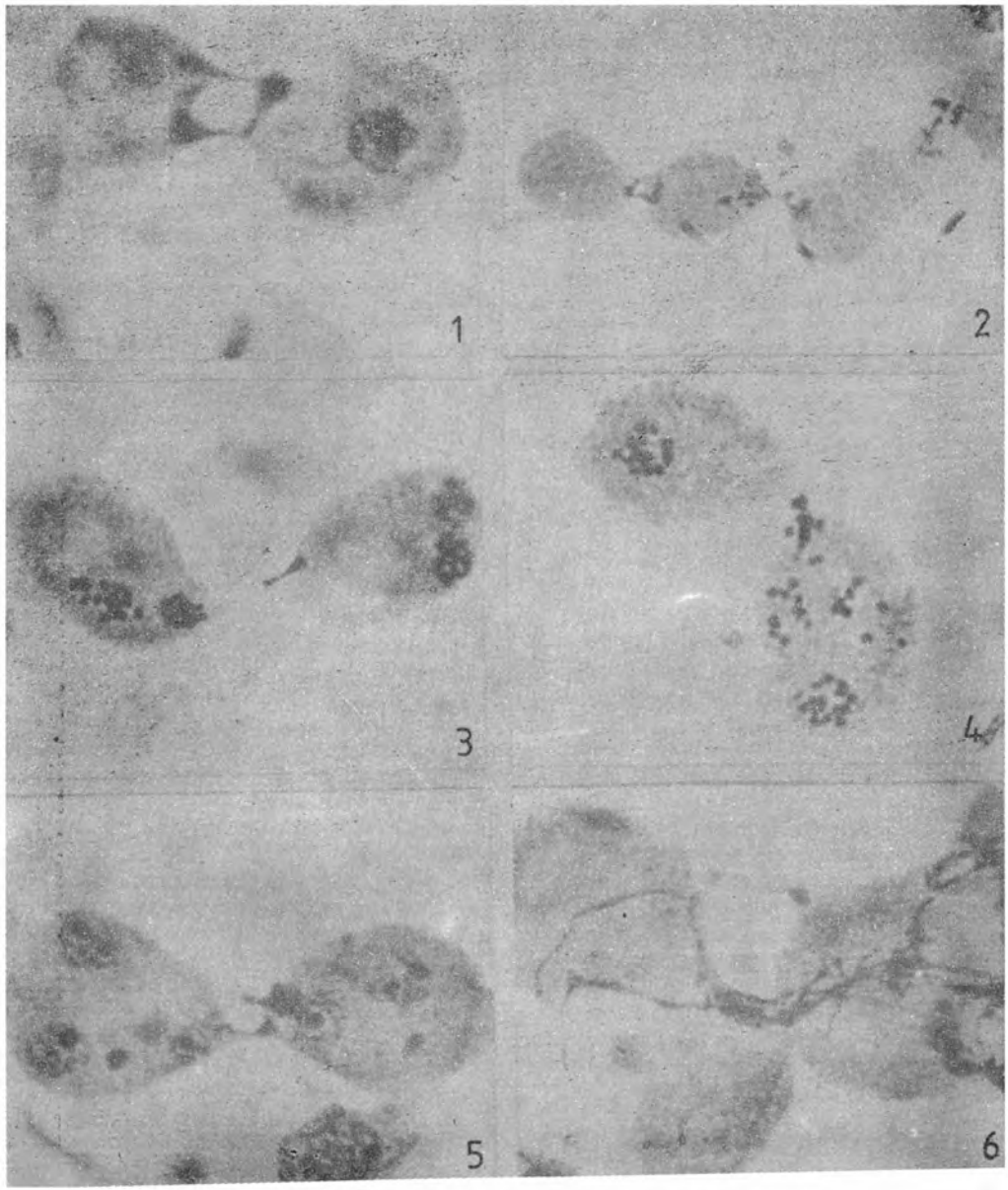
Results and Discussion

Cytomixis was observed at various stages of meiosis up to telophase II (figures 1–6). The percentage of cytomictic PMCs was 14. The chromatin migration was found to be from total (figure 1) to partial (figures 3, 4 & 5). However, partial chromatin migration ranged from single chromosome (figure 3) to all the chromosome of a pole (figures 4 & 5). In general, the adjacent PMC's were seen to be involved in cytomixis (figures 3 & 4) but chromatin transfer through a series of cells was also noticed (figure 2). The formation of continuous chromatin threads through a series of cells was also observed, showing the free migration of chromatin content among these cells (figure 6).

Cytomixis in other materials has been attributed to various causes including non-synchronous premeiotic somatic division (De Nettancourt & Grant 1964), nucleocytoplasmic disturbances (Boback & Herich 1978) and genetic factors (De & Sharma 1983, Bariar 1985, Sinha 1985).

Mendes and Rijo (1951) attributed cytomixis to be due to occurrence of sticky chromosomal bridges during meiotic anaphase. However, a number of workers are of the opinion that it is a real cytological phenomenon and not always an artifact of preparation as suggested by earlier workers (Kamra 1960, Weiling 1965, Omara 1976).

This phenomenon appears to be concerned with genetically unbalanced material such as hybrids and may be due to certain unknown physiological disturbances



Figures 1–6. Cytomixis in *Ruellia;* **1,** PMCs showing migration of total nuclear material at prophase I; **2,** Involvement of many PMCs at metaphase I; **3,** PMCs showing the migration of single chromosome at Anaphase I; **4,** PMCs showing migration of all the chromosomes of one pole at Anaphase I; **5,** PMCs showing migration of the chromosome of one pole at telophase II; **6,** PMCs having the continuous chromatin threads

associated with interaction of two different genomes. In number of cases it has been found in hybrids but not in pure species (De Nettancourt & Grant 1964, Salesses 1970). In the *Ruellia* hybrid also, cytomixis appears to be due to the hybridity as the meiosis of this hybrid was irregular leading to the formation of sterile pollen grains (Raghuvanshi et al. 1981).

Partial chromatin migration causes derangement in chromatin material in both donor and recipient PMCs. Thus it may be a way for the production of aneuploid gametes in nature. Similarly complete genomal migration may be a way for the production of polyploid series in a single species (Sarvella 1958, Omara 1976) and even as one of the modes of origin of B chromosomes (Cheng 1974). Thus cytomixis may play a significant role in the variation and consequently the specification of the taxa.

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