B-CHROMOSOMES IN *PANICUM COLORATUM*

THE presence in germ cells of certain chromosomes in excess of the normal complement found in root tips has been recorded in several plants like maize, rye, *Sorghum*, *Poa*, etc. These chromosomes are in many cases smaller than the regular choromosomes, may be heterochromatic and may pair among themselves when two or more of them are present. They seldom pair with the regular chromosomes and usually have no discernible effects on plant characters except that an accumulation of them leads to a reduction in pollen- and seed-fertility and plant vigour. The most striking feature of such chromosomes is their persistence in germ cells and absence in root tips. In view of these distinct characteristics and their uncertain genetic role, they are commonly referred to as 'B' or accessory or supernumerary chromosomes to distinguish them from the 'A' or primary chromosomes (*see* review by Müntzing[1]). In the present report, the behaviour of B-chromosomes in plants of *Panicum coloratum* L., identified during the course of our cytological studies in the tribe *Paniceæ* of *Gramineæ*, is described.

Panicum coloratum is a native of Africa and is a good fodder grass. Meiosis was studied in five plants during microsporogenesis in preparations made by the propino-carmine technique (Swaminathan *et al.*[2]) and in Feulgen squashes. At diakinesis and metaphase I, 18 bivalents were observed. Besides these, there was one accessory chromosome in three plants; there were two in one plant and there were three in another (Figs. 1-3). All the pollen mother cells examined contained these

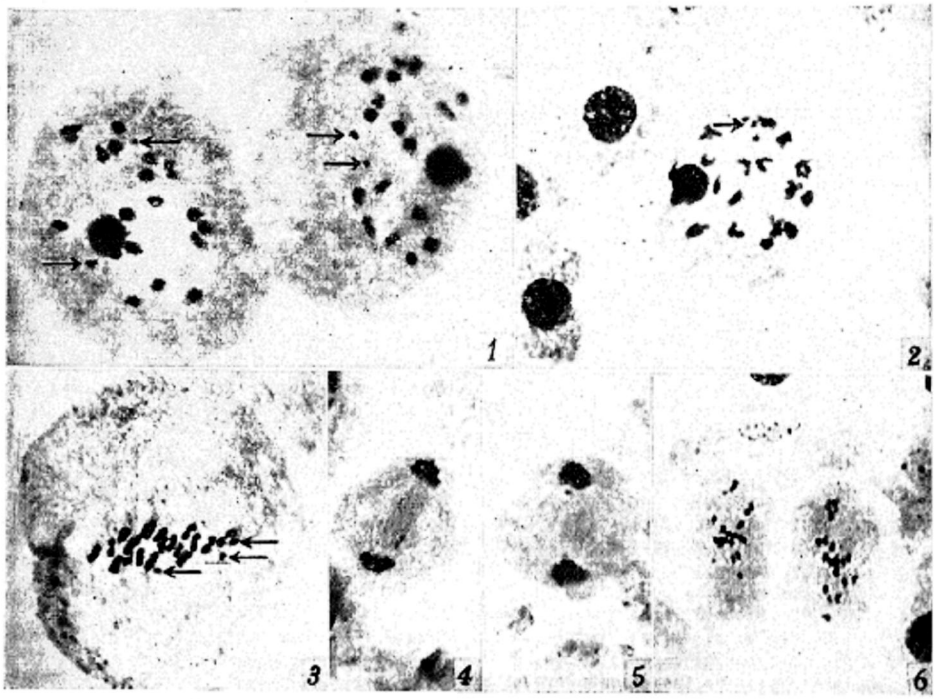

FIG. 1. Diakinesis, 18 bivalents and 2 B-chromosomes.
FIGS. 2 and 3. Diakinesis and Metaphase I respectively in a plant with 3 B-chromosomes.
FIG. 4. Late Anaphase. I. An undivided B-chromosome is going to one pole.
FIG. 5. Regular separation of a B-chromosome which has divided during the first division.
FIG. 6. Irregular separation of chromosomes at Anaphase II resulting from the presence of several B's.
Arrows indicate B-chromosomes (Magnification of Microphotographs, × 750).

chromosomes which were stained in the same way as the normal chromosomes. They were Feulgen-positive. The number of B-chromosomes was usually constant in the different pollen mother cells of a plant; in the plant with two B-chromosomes, however, only one could be identified in some cells. The pairing of the regular complement was in no way affected by the presence of the B-chromosomes. The B's themselves did not show pairing both at diakinesis and metaphase I in any of the 100 cells examined in each plant. They were also never found to be attached to the normal chromosomes. The mean chiasma frequency per bivalent of the regular complement at diakinesis and metaphase I in a plant with one B was 1·874 and 1·855 respectively. The values were nearly the same in the plants with two and three B's.

The B-chromosomes divided at metaphase of either the first or second division. When the division took place at M I, they separated to the poles and got included in two of the spores of the tetrad at the end of the second division. When there was no division during M I, the B's went to either pole and divided during M II (Figs. 4 & 5). In the plants with two and three B-chromosomes, each of them showed an independent behaviour, i.e., one may divide during the first division and the others during the second division. Occasionally, a B-chromosome undergoing division lagged in the equatorial plate while the regular chromosomes had completed division and reached the poles. Division of the B-chromosomes during the second division followed by their irregular separation resulted in the accumulation of five and six B's in spores of the plant with three B-chromosomes. The presence of several divided B-chromosomes at metaphase II seemed to disturb the anaphase movement of normal chromosomes (Fig. 6). Probably as a result of this, there was 20% pollen sterility in the plant with three B-chromosomes in contrast to the 5 to 10% sterility shown by the other plants. Due to extensive seed-shedding in these plants, criticial data on seed fertility could not be gathered.

The B-chromosomes could also be seen in the pollen. In most cells, they divided and went to the opposite poles during the first pollen mitosis; in a few cases the divided B's were found to proceed to the same pole. Pollen transmission of the B-chromosomes is thus possible.

Seeds from the *P. coloratum* plants were germinated and the somatic chromosomes were studied in orcein and feulgen squashes made from the tips of primary roots. No B-chromosomes have so far been observed in the root tip cells. Attempts are being made to find out whether these chromosomes are present in shoots and young leaves.

To summarise, the B-chromosomes in *P. coloratum* are absent in root tips, do not pair but undergo a mitotic division during meiosis, divide during pollen mitosis and are not heterochromatic. Their presence causes no visible changes either in the morphological characters or vigour of plants but accumulation of five or more of them during the second division of meiosis results in irregularities in the separation of the normal chromosomes and consequently in some degree of pollen abortion. Detailed studies on large populations of *Panicum coloratum* are now in progress to gather information on the adaptive and genetic significance of the B-chromosomes and the causes for their elimination in roots. Colchicine treatment of seeds has been done to ascertain how chromosome doubling affects the number and pairing behaviour of the B-chromosomes.

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CAROTENOID IN *PILA VIRENS* (LAMARCK)

Goodwin[2] has remarked that information on the carotenoid distribution of the lower forms of fresh-water animal life is meagre. This is particularly the case with the molluscs. While the carotenoid distribution of a fairly good number of marine molluscs has been studied, our knowledge of the fresh-water molluscs is limited only to a few forms like *Planorbis corneus*, *Limnæa stagnalis* and the New World species of the apple snail, *Pila canaliculata*. Comfort[4] investigated the last of these species and reported the occurrence of carotenoids in the eggs and the liver of the new-born larvæ