5. Singh, S., *Curr. Sci.*, 1979, 48, 821.
6. Sriskantha, A. and Sivanesan, A., *Trans. Br. Mycol. Soc.*, 1980, 74, 431.
7. Yen, J. M., *Bull. Trimest. Soc. Mycol. Fr.*, 1978, 94, 385.

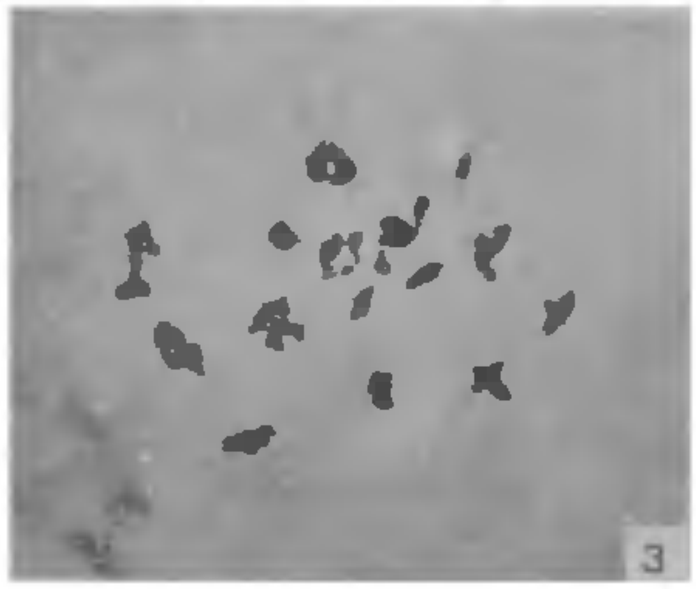
POLYPLOIDY INDUCED IN GINGER BY COLCHICINE TREATMENT

K. RAMACHANDRAN
Department of Botany, University of Kerala, Kariyavattom, Trivandrum 695 581, India

THIS study relates to tetraploidy induced in a local clone of ginger (*Zingiber officinale* Rosc.) by colchicine treatment. All eyes, except one were removed from pieces of rhizomes about 7 cm in length. The eyes which had begun to sprout were treated with 0·25% solution of colchicine in distilled water. The treatments were carried out in April and May 1979. Ninety pieces of rhizomes were treated in this way. Eleven of the plants which showed visible changes were planted in separate pots. Chromosome number in root tips and stomatal size were checked at intervals. Four of these turned out to be solid, nonchimeral tetraploids. One variegated chlorophyll mutant was also induced by the treatment.

The tetraploids showed vigorous growth, but failed to flower in the first year. The rhizomes of these plants were stored in a cool, dry place during the dormancy period. In April 1980 pieces of rhizomes were planted in pots and in the field. The tetraploids flowered in August, at nearly the same time as the diploids.

The tetraploids have thicker, stouter pseudostems and are more vigorous than the diploids (figure 1). They have larger, thicker rhizomes and larger, thicker and darker green leaves. Flowers and floral parts are bigger. Cell size is increased, as shown by stomata and



Figures 1-3. 1. Diploid (left) and tetraploid (right) plants of *Zingiber officinale*. **2.** Root tip cell of the tetraploid showing 44 chromosomes (× 1125). **3.** Metaphase I in PMC of tetraploid showing eight quadrivalents and six bivalents (× 1125).

guard cells and pollen grains. Cytological studies confirmed that the plants are complete, nonchimeral tetraploids.

The cytology of the diploid clone is similar to that reported earlier[1]. It has a somatic chromosome number of $2n = 22$. Quadrivalents indicating structural hybridity for interchanges, and bridges and fragments, characteristic of inversion heterozygotes have been found at meiosis. The diploid showed 87% aborted pollen. The tetraploid had $2n = 44$ chromosomes in root tip cells (figure 2). Meiosis in PMCs showed a high frequency of quadrivalents at first metaphase (figure 3). Associations of more than four chromosomes, up to eight, have also been observed frequently. At first anaphase, the tetraploid showed one or more aberrations including bridges and fragments and laggards. Single chromatid bridges with one associated fragment and double chromatid bridges with two fragments have been observed as in the diploid. However, the pollen was 85% stainable and well-filled, and larger than in the diploid.

The present study has opened up possibilities of improvement of this crop in which the lack of seed set had limited the scope of conventional plant breeding methods to selection from a few local and exotic clones[2]. The tetraploids are more vigorous than the diploids and there is considerable promise of improvement in yield. They can directly be utilized as new improved varieties by vegetative propagation.

The author is thankful to Prof. C. A. Ninan for suggestions and encouragement.

6 *November* 1981

1. Ramachandran, K., *Cytologia*, 1969, **34**, 213.
2. Muralidharan, A., *J. Plant Crops*, 1973, **1**, Suppl., 19.

SELECTION OF BENGAL GRAM (*CICER ARIETINUM* L.) MUTANTS FOR LATE SOWN CONDITIONS IN NORTH INDIA

S. K. SINHA, RENU KHANNA-CHOPRA AND
K. R. KOUNDAL
Water Technology Centre
Indian Agricultural Research Institute
New Delhi 110 012, India

IN north India, particularly in Punjab, Haryana and Western U.P., the cropping pattern has considerably changed in the past few years. Rice is now a dominant kharif crop in these areas, which is often followed by wheat. Both crops together make the cropping pattern intensive in respect of fertilizers, water and other inputs. A leguminous crop after rice could provide a balance in this new pattern. Bengal gram also known as chickpea (*Cicer arietinum*) could be a desirable legume but this crop is traditionally sown in the later half of October.

Studies on the growth and reproductive behaviour of Bengal gram showed that early flowering provided no significant advantage if irrigation is available[1]. Therefore, the genotypes which required almost the same time for flowering even after delayed sowing could be successful. With this objective, a progamme to induce mutations in an otherwise good and acceptable variety JG-62 was started in November 1975. Seeds (500) of JG-62 were soaked in distilled water for 6 hr and were subsequently treated with 0·03% EMS for 16 hr. Twentysix plants which set fruits were collected individually. All seeds from each plant were sown in the last week of November 1976. The distance between rows and between plants was 50 cm and 25 cm respectively. More than 400 plants reached maturity. On the basis of the date of flowering, plant structure and seed characters 200 plants were selected. In 1977, seeds from each plant were put in one row of 4 metre length. This year, leaf characteristics, flowering habit, nodulation at flowering, podding intensity and seed characters were used as selection criteria to reduce the number to 84 variants. In 1978, 28 variants and the parent were sown in both normal (last week of Oct.) and late (last week of Nov.) sowings to assess the performance of variants as a late sown crop. Data on the number of days to flower were recorded. At the time of harvest, total dry matter m^{-2}, grain yield m^{-2}, nitrogen content of grains, 1000 grain weight and harvest index were recorded. Irrigation was given when required.

The average dry matter (DM) m^{-2} of 29 genotypes including 28 variants and the parent was 925 g/m^{-2} in normal (early) sowing and 1070 g/m^{-2} in late sowing (figure 1). However, the dry matter produced by genotypes ranged from 600 to 1300 g^{-2} in early sowing and from 710 to 1800 gm^{-2} in late sowing. Therefore, it was clear that the same or even more dry matter could be produced in a late sown crop as compared to a normal sown crop, provided that irrigation was given. Nonetheless, it is important to note that superior variants could be obtained as compared to parent in respect of dry matter. At present it is difficult to say whether increase in dry matter occurred because of increase in photosynthesis rate or for some other reason.

The parent took 64 and 82 days for the first flower to open in early and late sowings respectively. The average for 28 variants was 68 days to flower in early sowing and 82 days to flower in late sowing. Amongst the variants 11 flowered earlier than the parent, 7 flowered along with the parent while 10 took more time to flower as compared to the parent in late sowing