+ 0·0145 P.H. + 2·2731 B.D. + 1·2986 x), and P.H. and B.D. values of the same plants, recorded at 10-day intervals in the first set, were then fed into this regression for estimating the yields of the types at different time points.

The increments in P.H., B.D. and the estimated yield of all the types showed, on the whole, an increasing trend followed by a decreasing one. The data were fitted to a second degree curve for locating the point where the maximum occurred. In the case of yield, the logistic curve was also fitted to see the agreement between the two methods.

The 10-day periods, during which the increment was maximum in respect of all the three characters as indicated by the second degree curve, and the points at which the rate of fibre-growth was maximum according to the curve of increments (second degree) and the curve of yields (logistic), respectively, were determined. A more or less sigmoid pattern of growth was followed by P.H., B.D. and yield, particularly the first. Further, in most cases, B.D. increased at an increasing rate for a longer period that P.H., and the time points, upto which fibre grew at an increasing rate was intermediate between P.H. and B.D. According to the two curves, one of increments and another of fibre yield. the point of maximum growth rate of fibre yield of most of the types was between 95 and 105 days, the mode being near 100 days. The agreement between the values of maximum growth obtained by the two methods is quite close in a number of types. Types, 1, 3, 5, 7, 9, 10, 12, 13, 14, 15 and 22, for which the point of maximum growth is near for about 100 days can be tentatively grouped together and 6, 19 and 20 in which the point is earlier, can be included in another group. Types 2, 4, 8 and 11 can possibly be put together in an intermediate group. Those, for which values do not agree, have not been assigned to any group. There appears to be a tendency of the growth rate to fall more slowly when the peak occurs at an earlier age.

An attempt was also made to use the logistic curve of growth to determine the optimum date of harvest. It was found that if a loss in yield of 10% could be afforded, the types could be harvested at ages between 110 and 114 days, *i.e.*, a week or ten days earlier.

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* *Types used* : 1. Chensura Green, 2. IRO 632, 3. JRO 753, 4. Sudan Green, 5. Bangkok-I, 6. JRO 620, 7. Least pigmented, 8. Crumpled leaf, 9. Olitorius Red-I, 10. Olitorius Red-II, 11. R-26, 12. O 50-4963, 13. O 59-471, 14. Salyout, 15. Wild Olitorius Red, 16. Black Grey Seed, 17. Small Seed, 18. JRO 878, 19. JRO 4362, 20. JRO 7835, 21. Tanganyika-I, 22. Tanganyika-II.

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SUB-HAPLOID POLLEN IN *ALOE BARBADENSIS* MILL.

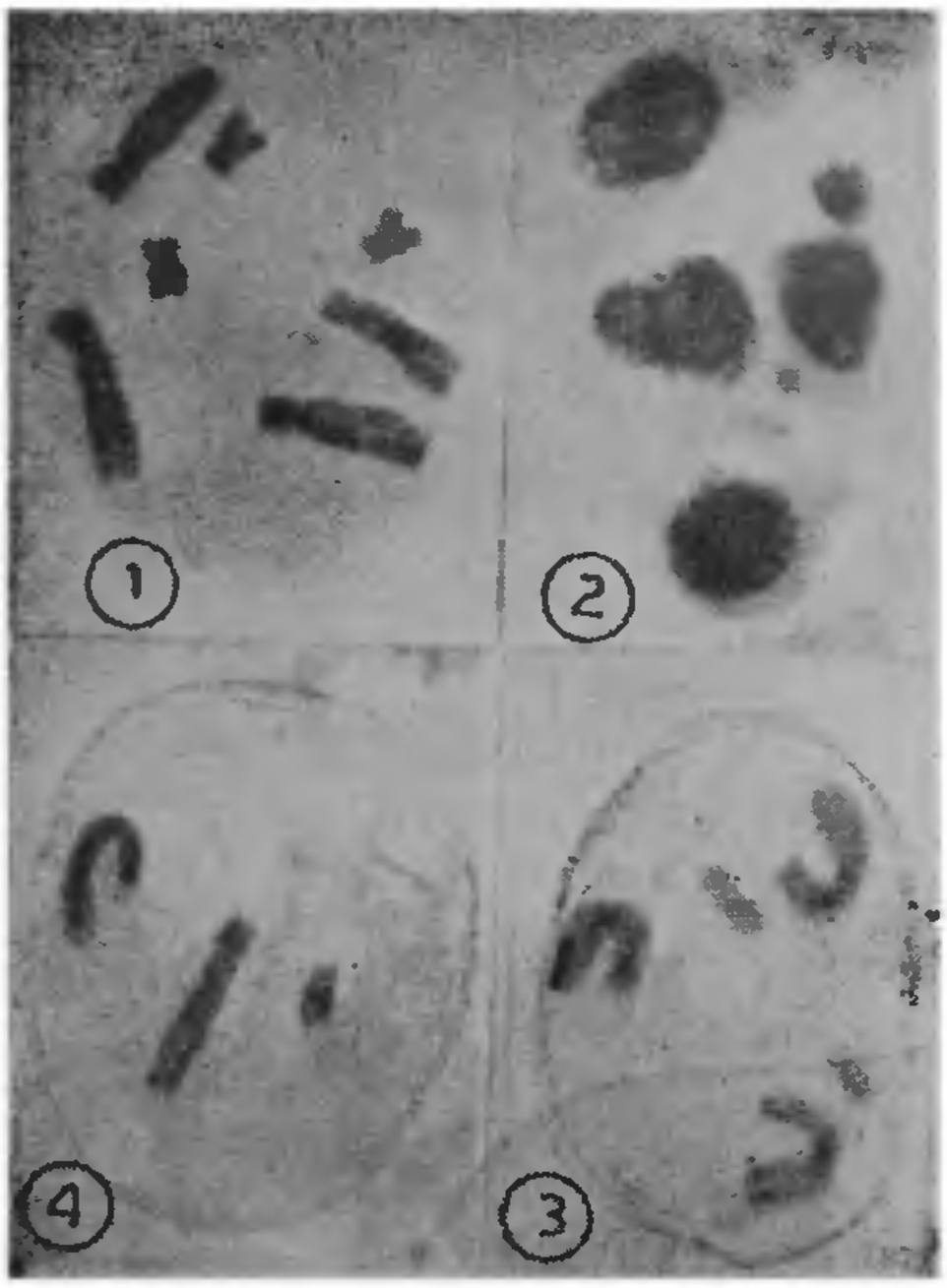
ONE of the several advantages of studying pollen mitosis is the opportunity it provides for characterizing haploid chromosomal complements, especially in plants showing irregular meiosis. While testing pollen fertility and studying pollen mitosis in an ecotype of *Aloe barbadensis*, the author came across a few cases of sub-haploid pollen. A preliminary report of such pollen grain is presented here. Fresh anthers were squashed in aceto-carmine and pollen with intact wall alone were considered for scoring deficiency.

Clones of *A. barbadensis* growing here are self-incompatible[1] and show as high as 60% pollen sterility. As a result, there is no fruit setting. Meiotic irregularities in this plant leading to high pollen sterility have been reported earlier by the author[2].

A majority of the functional microspores show a typical haploid complement of 7 chromosomes (Fig. 1). It comprises four long and three short, more or less acrocentric chromosomes typical of the tribe Aloinae. The sterile pollen grains are irregular in shape, do not take stain and are enucleate at maturity. While studying first mitosis in the microspores, a few were noted with less than seven chromosomes. Meiosis in this plant is highly irregular, resulting in bridges and laggards of various types. This leads to the formation of micronuclei and polyspory (Fig. 2). The deficient pollen originate from such abnormal microspores formed due to aberrant anaphase movements.

In higher plants, deficient microspores usually abort. They are unable to complete the mitotic divisions and the development necessary to form gametophytes. Such pollen grains are also smaller than normal and appear empty. Pollen grains even with just one chromosome less than the haploid complement fail to develop[3-6]. In the present plant, however, some of the deficient pollen are nearly normal in size, synthesize the pollen wall, but are usually less stained and do not seem to develop further into gametophytes. The chromosomes do become double indicating a normal cycle of DNA

synthesis. However, they do not seem to enter anaphase perhaps due to failure of spindle formation.



FIGS. 1–4. Fig. 1. A normal microspore in mitosis showing seven chromosomes in metaphase. Fig. 2. Abnormal tetrad showing micronuclei and deficient microspores. Figs. 3 and 4. Pollen grains of mitosis. All figures, × 1,650.

with $n = 5$ and $n = 3$ respectively in metaphase

Pollen grains with $n = 5$ (loss of one long and one short chromosome) and $n = 3$ (loss of two long and two short chromosomes) are found to proceed normally upto metaphase (Figs. 3 and 4). Considering the total haploid chromosome complement length in this plant[2], these pollen show dificiencies of approximately 20% and 41% respectively. Pal and Khoshoo[7,8], who have considered the chromosome number rather than chromosome length for calculating the extent of deficiency in the pollen, record about 94% deficiency in the pollen of *Amaranthus* hybrids. Some of these grains had a single chromosome instead of the usual 17, and inspite of such extreme deficiency the pollen grains were found to develop a normal wall and to enter mitosis. A clone of *Zephyranthes peurtoricensis* with $2n = 25$ has also been reported to produce pollen with $n = 1$ to 16, 20 and 24[9]. It will be interesting to culture such pollen to obtain chromosomally deficient pollen-plants.

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PROTEOLYTIC ENZYME CHANGES IN MANGO SHOOTS AS AFFECTED BY GROWTH RETARDANTS IN RELATION TO FLOWERING*

THOUGH it has been proved recently that flowering could be induced in mango during an 'off' year by applying growth retardants such as cycocel (2–chloroethyl trimethyl-ammonium chloride) and Alar (N, N-dimethylamino succinamic acid)[2,3], the physiological and biochemical changes that take place following the application of such potent chemicals is not known in mango. Hence, among other aspects, the pattern of seasonal changes of proteolytic enzyme as influenced by growth retardants was studied in 'Mulgoa,' an irregular cultivar of mango. Cycocel and Alar were applied as aqueous sprays at 5000 ppm concentration at monthly intervals starting from May (eighty sprays, upto December), on selected branches of two healthy trees. Leaves of treated shoots were used for the estimation of proteolytic enzyme activity at monthly intervals, one week after spraying. The enzyme activity of leaf extracts was measured based on the aromatic amino acids released by native enzyme from a standard solution of casein[1].

The time of flower bud formation was November in spring flush shoots. Both Alar and cycocel caused an appreciable increase in the percentage of flowering shoots (Table I). A relation between the amino acid increases and a concomitant decrease in protein content of shoots, and *vice versa*, have been observed in the present studies. The enzyme activity gradually increased in the leaf throughout the period of observation, and the retardants significantly reduced this activity (Table III), which must have obviously been responsible for retardation of protein degradation under the treatments. It can therefore be assumed that the growth retardants have a beneficial effect on protein metabolism