K. lignyota has smaller (10–) 11–14 × 4–5 μm oblong–ellipsoid ascospores.

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ROLE OF CYTOMIXIS IN THE SPECIATION OF *JASMINUM*

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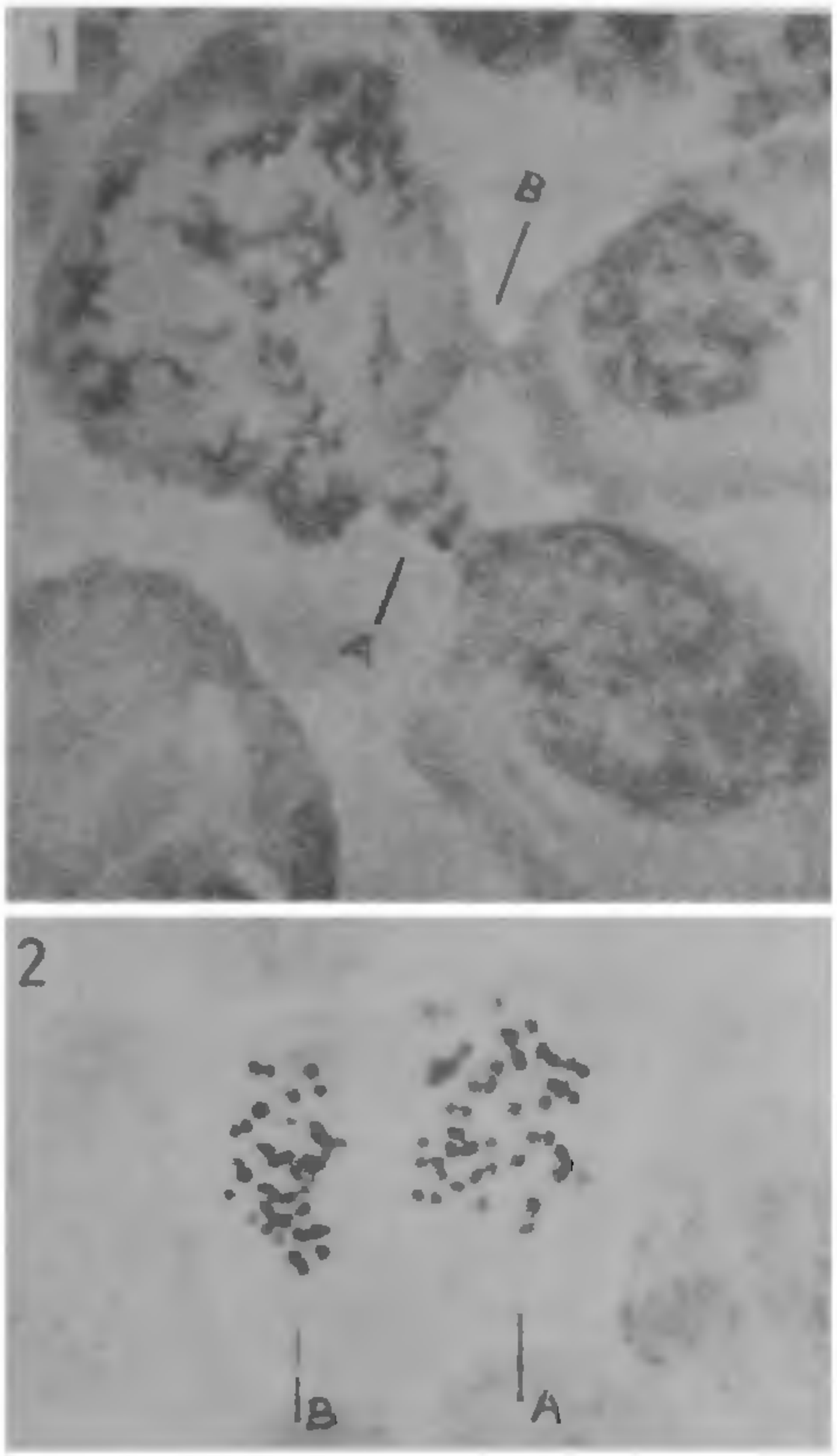
JASMINES are highly domesticated ornamental plants grown mainly for their fragrant flowers and propagated entirely by vegetative means. Sexual reproduction is obsolete and almost absent in many of the *Jasminum* species being either pollen sterile or seed sterile. An earlier study by the authors shows[1] that the sterility of their pollen is ultimately due to some defective gene function in their meiotic cells causing various meiotic abnormalities, including cytomixis which occur spontaneously and abundantly in their pollen mother cells. Variation of hereditary characters by gene mutation and recombination, which form the raw materials of evolution, and operative through the sexual reproduction can be ruled out. At the same time, it is interesting to note that there are about five hundred species of *Jasminum* and several varieties of these exist today[2]. The question, as to how speciation takes place in this type of sexually sterile but vegetatively reproducing plants has been the subject of the authors' investigation for quite some time. These investigations on the hereditary variation through alteration in the somatic chromosome complement of *Jasminum* species offer a clue to solving the problem of the mechanism of speciation in vegetatively reproducing plants. The results of the method of speciation through the process of cytomixis in the shoot meristems of *Jasminum* spp. are presented.

For studying the somatic chromosome number and behaviour in several species of *Jasminum*, samples of *J. angustifolium*, *J. rigidum*, *J. malabaricum*, *J. revolutum*, *J. grandiflorum*, *J. sambac* var. 'sujimallikae', 'gundumalli', 'iruvachy', 'adukkumalli' etc. collected from different parts of South India and grown in the Kerala University Botanic Gardens were used. Shoot tips of these plants were fixed at 4.30 p.m. in 1:1:3 chlor-acetic-ethanol and stained by lactopropionic orcein[3]. The squash preparations were examined immediately after staining.

Shoot meristem cells at various stages of mitosis showed cytomixis. The cytoplasmic communicating channels between adjoining cells were observed to have partial or complete chromosome complement migrating through them (figure 1). Another interesting observation was the occurrence of cells with differing chromosome numbers in the same tissue (figure 2). For instance, in *J. revolutum* (2n = 65) cells with 59, 65 and 78 chromosomes or in *J. sambac* var. 'adukkumalli' (2n = 26) cells with 22, 23, 26 and 27 chromosomes or in *J. angustifolium* (2n = 52) cells with 33, 46 and 52 chromosomes were encountered in the same slide. In other words, a myxoploid condition was existing with no fixity of the chromosome numbers in the shoot meristem cells of the plants investigated. Similar condition with no fixity of chromosome number exists in the root tip cells of *J. humile*, *J. arborescens* and *J. angustifolium* also[4].

Cytomixis as originally defined[5] involves the migration of part or whole complement of chromosomes from one PMC to another. In the PMCs since there is no other division other than the meiotic division, further shuffling of chromosomes could not be expected. Here the meiotic products either degenerate or become nonfunctional in fertilization as indicated by the sterility of pollen and seeds of the jasmines. On the other hand, in the meristematic tissue of the shoot bud, repeated mitotic divisions are likely to involve a series of cytomixis, shuffling of chromosomes and consequent stable genetic constitution. It results in cells with different levels of ploidy but more commonly aneuploidy as observed. When one of these cells with altered chromosome number undergoes normal mitotic divisions, it forms a homogeneous but heteroploid tissue. From this tissue a new strain can be generated in the form of a shoot bud as in a chimera. This sort of chimeral variation spontaneously occurring in other plants has been reported[6]. A shoot arising from such a tissue when propagated vegetatively after



Figures 1, 2. 1. Shoot tip cells in mitosis showing cytomixis. See cytoplasmic bridge A-with chromosomes and B-without chromatin, in *J. revolutum.* **2.** Somatic cells of *J. angustifolium* showing different chromosome numbers A-with 46 and B-with 33 chromosomes (× 1500)

continuous human or natural selection of well adapted variations can account for a population of a new variety or species of plants genetically or morphologically different from the original stock. It appears therefore that such numerical alteration of chromosomes by means of cytomixis in the shoot bud has played a distinct role in the origin of some species of *Jasminum*. This does not rule out the possibility of speciation through intra or extra chromosomal means involving a single gene or group of genes or segments of chromosomes[7,8].

The significance of cytomixis in the sexual cells (PMCs) is found to be different from that of the vegetative shoot tip cells of *Jasminum.* In the PMC, since cytomixis is frequently associated with other abnormalities of meiosis[1] it results in the degeneration and ultimate sterility of pollen. On the other hand, in the vegetative cells of the shoot tip where mitotic abnormalities are rare, cytomixis evidently lead to numerical variation of chromosomes alone and consequent origin of new species. Since the first report of cytomixis and defining the phenomenon[5] there have been many reports of its occurrence in the PMCs of a wide range of plants[9-11] and in callus cultures[12]. Reports on the occurrence of cytomixis in vegetative tissues are rare except in the case of cotton root tip cells[13,14] which are not useful in propagation. Further, the significance of cytomixis in shoot meristems of vegetatively reproducing plants in causing hereditary variation and speciation is reported here for the first time.

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