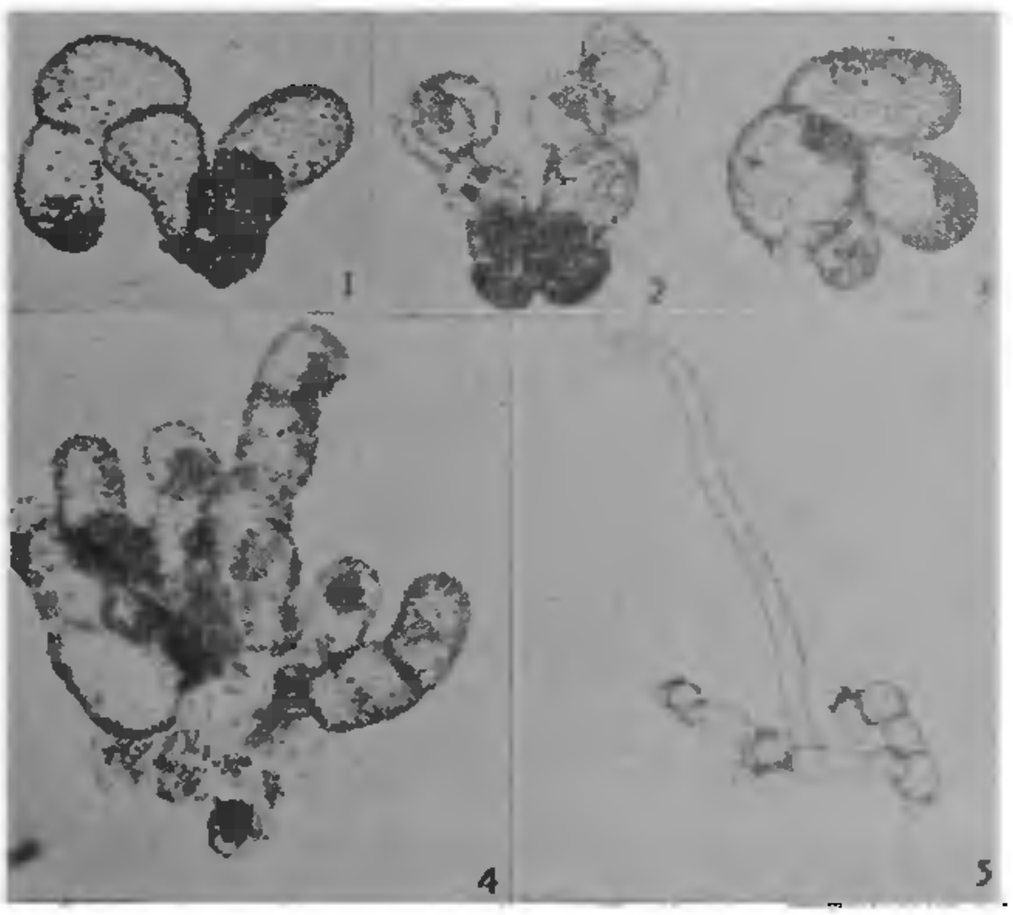
germ-cell in 3X failed to exhibit polarity gradient and, unlike the germ-cells in X and 2X spores, retained potentiality to undergo mitosis more than once, the plane of spindle being different at each division. In many cases, the rhizoidal differentiation was either inhibited or considerably delayed.

Based upon such variations as: (*a*) plane of division in the first germ-cell, (*b*) its number of mitotic divisions, and (*c*) subsequent fate of the filamentous protonemata, the growth patterns may be described under the following three broad categories:

(1) In contrast to the highly asymmetrical plane of division in X and 2X germ-cells, in 3X, it may be oblique or vertical. The two almost equal-sized cells grow into two separate filaments and the differentiation of the rhizoidal cell is bypassed. As shown in Fig. 1,



FIGS. 1–5. Fig. 1. Ten-day-old protonema showing two divisions of the germ cell, the rhizoidal differentiation is inhibited, × 100. Fig. 2. Sixteen-day-old protonema developed as that of Fig. 1 or from a binucleate, abnormal spore, × 100. Fig. 3. Three successive divisions of the germ cell after the differentiation of the first rhizoid, the plane of division is different each time, × 125. Fig 4. Ditto, Twenty-day-old, rosette shaped protonema, × 125. Fig. 5. Fifteen-day-old protonema showing highly differential, monoplanar growth, × 100.

the cell on the left forms a filament of three cells, each cell exhibiting highly differential growth. In some cases, regular alternation of spindle axis was observed at each mitosis (Fig. 2).

(2) The germ-cell may divide repeatedly in more than one plane, resulting in a rosette of filaments (Figs. 3, 4). A comparison of the protonema depicted in Fig. 5 with those in Figs. 3–4 show well-marked differences in cell and chloroplast size in different protonemata and also within the same protonema. The chromosomal analysis of the different types of protonemata demonstrated variable numbers from below the haploid level ($n = 41$) to well above the diploid level ($n = 82$). Thus, if the various patterns are evaluated in terms of the genotype, we can regard each viable spore as distinct.

(3) In one-month-old cultures, 32% protonemata did not grow beyond the filamentous stage and produced antheridia only. In other 35%, the filaments entered biplanar growth and formed cordate prothalli which bore archegonia. A detailed study on the sex organs and fertilization is in progress.

The results obtained simulate those produced by colchicine[2] and ionizing radiations[1] and to account for the disturbed growth sequences observed in the present material, the events at meiosis and the early developmental stages of the gametophyte may be envisaged as a continuum in the life-cycle.

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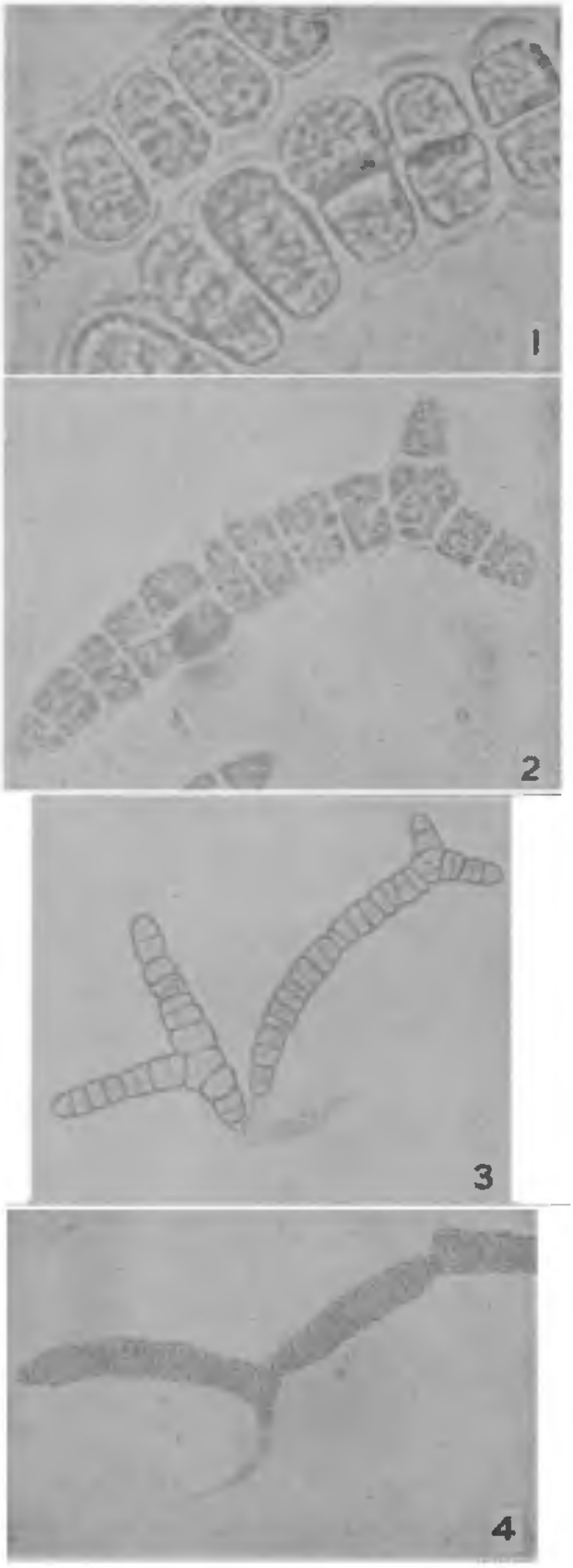
SOME CULTURAL OBSERVATIONS ON *SCHIZOMERIS LEIBLEINII* KUETZING

IN recent years, *Schizomeris leibleinii* Kuetz. has been studied in cultures by some workers. The studies show that the alga is highly variable in its morphological and cytological characters. Prasad and Srivastava (1963) have recorded the occurrence of zoospores as having 2–8 or more flagella and Patel (1967) has described a variable number of chromosomes as 15, 28 and 30, some cytological details and occurrence of thick-walled cysts. The species recently collected and cultured has yielded certain observations unrecorded so far.

The present form was growing attached to some decaying twigs of water plants in an open slow-flowing drain at Allahabad during November 1970. The alga readily produced zoospores when put in a liquid medium. It was reared in unialgal culture starting from such zoospores obtained from a single filament. It grows well in both liquid and solid

De's (1939) medium. Generally, after about three weeks' growth in a liquid or solid medium, the alga produces thin-walled resting cells or aplanospores with richly-accumulated food granules. They occur in uni-, bi- or multiseriate filaments and have a pale-green colour. Later, they become thick-walled (Fig. 1). At this stage, if the alga is transferred to a freshly-prepared solid agar medium (De's medium solidified with 1·5% agar), the cell-contents of the aplanospores are liberated by the rupture of the lateral wall and divide to form a few-celled (2–5) germlings which differ from those formed by the zoospores. In the latter case, germlings are typical unbranched short filaments, whereas the aplanospores on germination on solid agar plates, surprisingly produce processes giving an appearance of branched filaments. The processes formed in the apical cell present a look of typical dichotomy (Figs. 2 and 3) and by their further growth, result into a branched filament (Fig. 4). However, the processes, formed in an intercalary or in the basal cell, remain suppressed by the apical growth and give appearance of small outgrowths at later stage. These observations were repeatedly confirmed under identical cultural conditions. The inoculated agar plates were placed in an incubating chamber with an arrangement for continuous light (180 lux by a fluorescent tube and the temperature varying between 25° C and 30° C). The branches usually initiate till a few-celled growth of the germling but occasionally even in longer filaments. When the filaments with aplanospores are transferred to a liquid medium, there is profuse production of zoospores which germinate in the fashion recorded by earlier authors but rare occurrence of such branched germlings has been observed by us even in this condition.



FIGS. 1–4. *Schizomeris leibleinii* Kuetzing. Fig. 1. Filaments showing aplanospores, × 850. Figs. 2–3. Young branched filaments formed by the germination of aplanospores, × 750 and × 200 respectively. Fig 4. A mature branched filament, × 150.

It is interesting to note that in contrast to the present form of *Schizomeris*, Mitra (1947) recorded branching in *Uronema terrestre*, mostly in the germlings produced by the germination of zoospores and only occasionally from the aplanospores. But his record that the growth on solid medium coupled with weak illumination is conducive to the production of branching holds good also for the present form of *Schizomeris leibleinii*. Although occasional occurrence of branching in the germling stages is known in other genera of Ulotrichales like *Ulothrix* (Silva, 1953), *Uronema* (Mitra, 1947), the phenomenon is for the first time being recorded in the genus *Schizomeris*. Whether the occurrence of branching in these genera is significant with reference to the phylogeny of the group and

throws light on the evolution of Chaetophorales or an expression of certain specialized conditions, remains an open question till enough data to support either view is available.

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POST-HARVEST CHEMICAL TREATMENT OF APPLE FRUITS AGAINST ROT AND DETERIORATION

POST-HARVEST losses of apple fruits on account of infection by *Alternaria tenuis* have been reported by Grewal.[3] During studies on microbial deterioration of apple fruits in transit and storage in recent years, the authors frequently encountered this fungus causing rot and decay which gives the fruits an unsightly appearance rendering them practically unfit for sale and consumption. A perusal of literature revealed that no worthwhile attempt has been made in this country to find suitable control measures against this disease. Studies of Dharam Vir[1] and Dharam Vir *et al.*[2] have shown that intensity of losses on account of such type of diseases occurring during transit and storage can be substantially reduced by suitable treatments. Results of the evaluation of three chemicals as post-harvest dip treatment for the control of this disease are presented.

EXPERIMENTAL

Three chemicals, *i.e.*, calcium propionate, allisan and thioacetamid, were used in the investigations. Apple fruits (variety Ambari) in healthy and firm condition were selected and each fruit was given a small cut at four uniform places (Fig. 1). This was followed by inoculations which were done by spraying the spore suspension of *A. tenuis* prepared in sterilized water, on to the fruits with the help of an atomiser. After 12 hours of incubation, fruits were divided into four lots, three of which were treated with different chemicals while the fourth was kept as control. The treatment was done by dipping the fruits in water solution of each chemical prepared in sterilized water at 1,000 ppm, for a period of 2-3 min. Fruits kept as control were subjected to the same procedure except that no chemical solution was used and instead the fruits were dipped in sterilized water for the same period. Fifteen fruits were used for each treatment. The fruits were later dried, closely packed together in cardboard boxes and incubated at room temperature (21-24° C). The boxes were periodically opened and fruits in various treatments were examined for the initiation of rotting around the cuts. It was observed that while in the untreated fruits, rotting initiated around the cuts on the third day, the treatment of fruits with thioacetamid suppressed the development of symptoms up to 35 days. Fruits treated with calcium propionate and allisan developed rotting on the sixth and 10th day respectively. These investigations clearly bring out the efficacy of thioacetamid as a post-harvest dip treatment for prolonging the storage life of apple fruits against rot and decay caused by this disease. The use of thioacetamid does not present any health hazard problems.

FIG. 1. Showing efficacy of thioacetamid for the control of apple rot. A and B represent respectively treated and untreated (control) fruits.

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