material some groups of cells with intercellular chromatin connections were observed at meta-anaphase-I (figures 5, 6). In a few cases the whole chromatin material was observed to have been transferred, although cells with double the amount of chromatin material were not observed in their close vicinity (figure 5).

The observations made during the present study appear to be of significance as PMC's with lower and higher than the normal chromosome number have been reported earlier in the genus *Sesbania*[10,11] Baquar and Akhtar[10] reported pollen mother cells with $n = 6$ and 7 in *S. sesban* var. *bicolor*, $n = 6, 7$ and 8 in *S. sesban* var. *sesban* and var. *concolor*, but individual plants with varying chromosome numbers were not observed, as is also the case with the present studies. However, Bir *et al*[11] while reporting chromosomal variations in *S. sesban* and *S. bispinosa* (Jacq.), clearly identified plants with aneuploid and euploid chromosome numbers. In the plants showing $2n + 1$ and $2n + 2$, additional chromosomes were marked out for the latter species[12].

Keeping in view the isolation of aneuploid plants by Bir *et al*[11] and Bir and Sidhu[12] and the occurrence of cytomixis and chromosomal variations in PMC's of the genus *Sesbania*, it appears that cytomixis could be an effective mechanism for numerical changes of chromosomal complements in this genus. The extra chromosomes have been observed to be whole chromosome additions as revealed by the karyotypic and meiotic studies[11,12].

Variation in the chromosome number in different cells has been recorded in a number of species[4,6]. A few cells with higher or lower numbers encountered in the present studies could be ascribed to cytomixis at an early meiotic stage. Kihara and Lilienfeld[13] and several others[7] have observed cytomixis to occur generally from meiotic leptotene to metaphase-I. In the present case, cytomixis has been observed at meta-anaphase-I as clearcut chromatin connections between groups of cells indicating passage of chromatin material from one cell to another, which include some cells wherein the whole of the chromatin material has been transferred. The existence of cells with 5 bivalents and complementary 7 bivalents, however, indicates that this phenomenon might have taken place during the early meiotic stages. The frequency of cells with 7 bivalents was much less than the ones with 5 bivalents. The loss of chromosomes or of total chromatin material is not always accompanied by corresponding increase in the nearby cells.

The present studies along with those of Baquar and Akhtar[10], Bir *et al*[11], and Bir and Sidhu[12] indicate that the phenomenon of cytomixis in the genus *Sesbania* may be of evolutionary significance.

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INHIBITORY EFFECT OF LYCORINE ON SPORE GERMINATION AND GAMETOPHYTE DEVELOPMENT OF *POLYPODIUM VERRUCOSUM* WALL.

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LYCORINE $C_{16}H_{17}NO_4$ is a known alkoid[1] which acts as an inhibitory agent against growth of higher plants. It has also been shown to prevent germination of spores and development of gametophyte in Pteridophyta[2]. Lycorine has an inhibitory effect on the growth rate and on the normal morphogenesis of adventitious shoots, but by adding ascorbic acid this effect was reversed: the growth was stimulated and shoot growth tended to be normal[3]. Lycorine affects biosynthesis of ascorbic acid in plants[4,5]. In eukaryotic cells lycorine inhibits protein synthesis by keeping off the peptide bonds[6]. At 10^{-5} M concentration of lycorine the gametophytes of *Polypodium verru-*

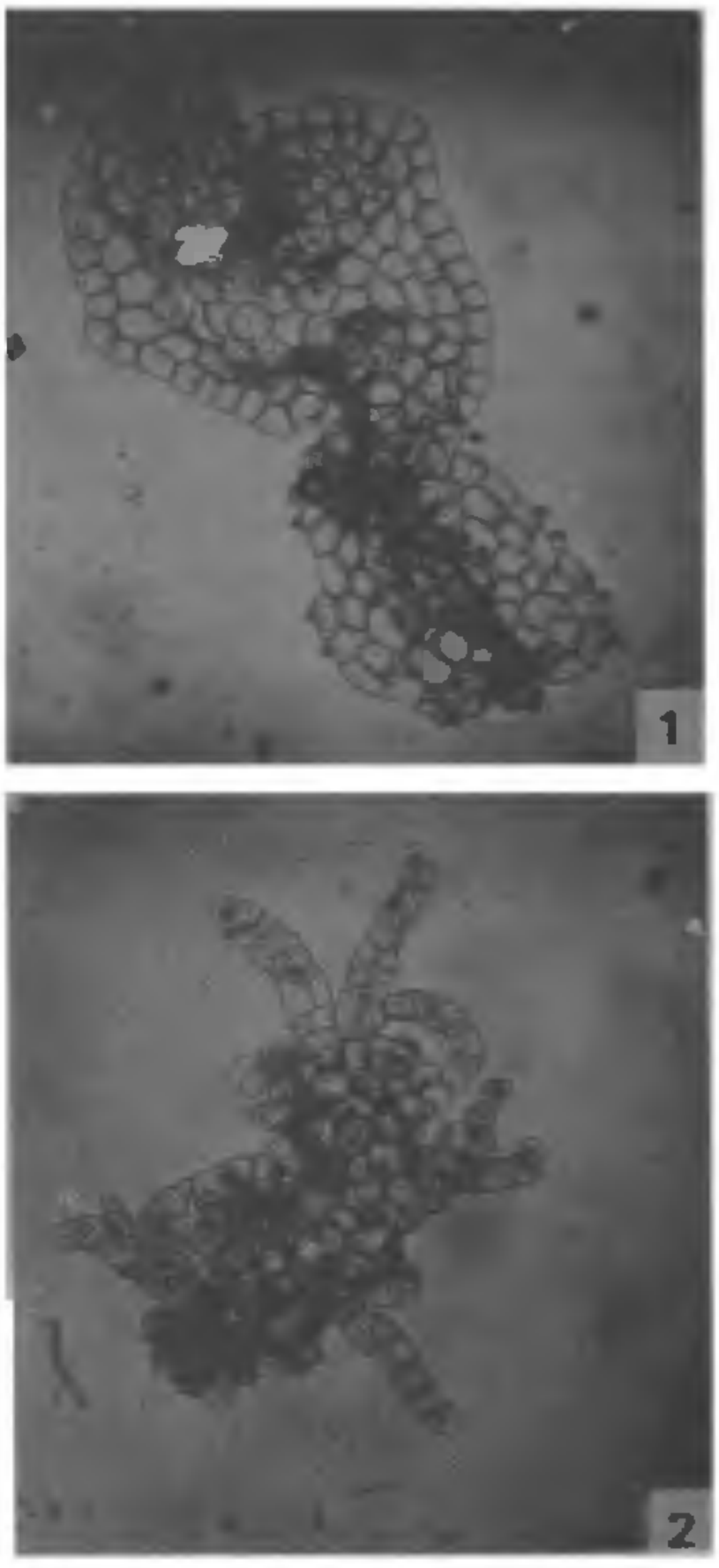
cosum did not survive, while at lower strength, the growth and survival of spores or protonema enhanced with decreasing concentration of lycorine.

Collected from Darjeeling, spores of *P. verrucosum* were stored in a desiccator at 4°C in the laboratory. These were sown in autoclaved sterilized nutrient media[7] (pH 5.8) solidified with 1% of agar mixed different concentrations of lycorine along with control. The culture was maintained at 20° ± 2°C under 1500 lux of continuous flourescent illumination in a culture room. Random samples of 100 germinating spores and a lesser number of gametophytes were used for each observation.

Effects of lycorine were scored on the basis of percentage germination of spores, number of rhizoids, their lengths, percentage conversion of 1D and 2D prothalli, protonemal length and width and survival of germling (table 1).

No spore germinated at 10^{-4} M lycorine. Germination took place at 10^{-5} M concentration but without further growth they died after 4–6 days. The rhizoidal number, its length, protonemal length and width, increased with decrease in the concentration (10^{-5} M to 10^{-10} M) of lycorine. High concentration (10^{-7} M to 10^{-5} M) suppressed rhizoidal initiation but still lower ones (10^{-8} M) permitted these with deformed and swollen tips (figure 1). Cell division, cell number, size of cell and conversion of 1D to 2D stage were checked at high concentration and 10^{-7} M could induce multibranched protonema with highly reduced rhizoids (figure 2). The formation of twin and multibranched protonema by lycorine treatment corresponded with the result of tryptophan treatment in Dierythrosora[8].

Induced morbidity of germlings was detected by decolorization of protonema, brought about by the



Figures 1 and 2. (× 400). **1.** Abnormal protonema (AP) with deformed and swollen tipped rhizoid (DSTR) at 10^{-8} M of lycorine; **2.** Multibranched protonema (MP) with highly reduced form of rhizoid at 10^{-7} M.

Table 1 *Effect of lycorine on spore germination and gametophyte development of Polypadium verrucosum Wall after 16th day of spore sowing (values are mean ± SE)*

Concentration	Germination [%]	Survival [%]	Rhizoid number/ 2D [%]	Prothallus (μm)	Rhizoidal length (μm)	Protonemal length (μm)	Protonema without rhizoid [%]
C	100.001 ± 3.316	100.00 ± 1.154	90.50 ± 0.5	4.00 ± 0.912	195.5 ± 3.201	215.2 ± 4.747	—
10^{-10}	92.25 ± 1.030	86.00 ± 1.154	70.00 ± 1.414	3.2 ± 0.489	131.75 ± 6.712	180.00 ± 0.408	13.00 ± 1.012
10^{-9}	88.00 ± 3.162	72.25 ± 0.478	53.61 ± 0.748	2.50 ± 0.288	97.2 ± 0 800	151.12 ± 0.953	33.25 ± 1.290
10^{-8}	74.00 ± 1.632	57.25 ± 0.853	37.5 ± 1.707	1.85 ± 0.704	61.33 ± 0.666	120.83 ± 1.276	53.00 ± 0 534
10^{-7}	57.25 ± 0.916	41.0 ± 0.816	25.0 ± 0.632	1.14 ± 0.142	24.25 ± 0.526	87.5 ± 1 000	73.00 ± 0.730
10^{-6}	39.5 ± 0.957	25.00 ± 1.290	7.60 ± 0.149	—	—	51.8 ± 0.416	100.00 ± 1.632
10^{-5}	17.5 ± 1.707	—	—	—	—	15.85 ± 2.645	100.0 ± 2.449
10^{-4}	—	—	—	—	—	—	—

chemical, causing disintegration of the chloroplast in a disturbed oxidation-reduction state of the protoplasm. Arnon[9] suggested that ascorbic acid plays an important role in the protection of chloroplast. Lycorine reduced ascorbic acid content rendering the chloroplasts vulnerable and subsequent oxidation of the pigments causes decolorization[10]. Retardation of cellular growth occurs by inhibition of ascorbic acid biosynthesis which results in the accumulation of dehydroascorbic acid in the ascorbate system. RNA and protein synthesis responsible for the cell elongation and initiation of 2D growth were affected by lycorine and 10^{-5} M concentration inhibited gametophytic growth of *P. verrucosum*, completely leading to eventual death of protonema. Likewise, rhizoidal number, rhizoidal length mean cell number, protonemal width and length decreased with the increasing concentration of the chemical.

19 August 1986

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GARCINIA DARWINIANA—A NEW SPECIES OF CLUSIACEAE FROM COORG DISTRICT, KARNATAKA

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DURING the course of floristic surveys in Coorg District, Karnataka, an interesting taxon of *Garcinia* L., was collected which on critical studies and comparison at the herbaria of Botanical Survey of India, Coimbatore (MH), Central National Herbarium, Calcutta (CAL) and at Pune (BSI), was found to be a new taxon. A detailed description and illustrations are provided.

Garcinia darwiniana sp nov

Garcinia gummi-gutta (L.) Robson affinis sed foliis oblongo-lanceolatis et ovario 4-sulcato, 4-loculato differt.

Allied to *Garcinia gummi-gutta* (L.) Robson but differs in having oblong-lanceolate leaves and 4-grooved, 4-locular ovary.

Trees, 10 to 15 m tall, with obscurely quadrangular branches and fissured greyish-black bark. Leaves 6.5–12 × 2.5–4 cm, oblong-lanceolate, apex variable, acute, emarginate or rarely rounded, base cuneate, margins entire, glabrous on both surfaces; main nerves 8 to 14, slender, looped along the margin; petiole 1 to 2 cm long. Flowers surrounded by minute, caducous bracts, in axillary, pseudo-terminal umbellate fascicles; pedicels 2 to 6 mm long. Calyx lobes 4, outer 3–5 × 3–4 mm long, inner 5–7 × 5–7 mm, orbicular to suborbicular, brownish-hairy when young, glabrous with age, margins membranous, slightly transparent, waxy. Corolla lobes 4, each 7–9 × 6–8 mm, orbicular, when young matted with brown tomentum without. Staminate flowers with many stamens in a globular mass, slightly raised above the receptacle (about 1 mm); anthers 2-celled, erect, dehiscing longitudinally; filaments very short; pistillode with 4 stigmas. Pistillate flowers with almost globose ovary. Ovary grooved without, 4-locular, with solitary axile ovule in each locule; stigmas 4, crowned on top of the ovary. Fruits not seen (figures 1 to 3).

Holotype K. R. Keshava Murthy and party 4828A and *Isotypes* 4828 B–C, collected in flowers near Kootuhole, Mercara, on 19th March, 1984, at an altitude of 1200 m are deposited at the Herbarium