

separately in acetic-alcohol (1:3) and squashing young anthers in aceto-carmin (1%). Among these one nullisomic-trisomic plant was detected that was deficient in a complete bivalent, but at the same time carried another extra chromosome in the complement ( $2n = 19$ ,  $2n - 2 + 1$ ). Most PMCs showed eight bivalents and a trivalent at diakinesis (figure 1) although configurations showing nine bivalents and a univalent (figure 2) were not uncommon. At metaphase, the trivalent regularly orientated at the equator along with eight bivalents (figure 3). The overall meiosis was regular giving deficient but viable pollen. Usually aneuploidy adversely affects the health, survival and fertility of individuals<sup>1-4</sup> but nullisomic-trisomic of *C. gigantea* is exceptional in being healthy and fertile, as are also

its nullisomic ( $2n - 2$ ,  $2n = 18$ )<sup>10</sup> and monotrismic ( $2n - 1 + 1$ ,  $2n = 20$ )<sup>5</sup> constitutions.

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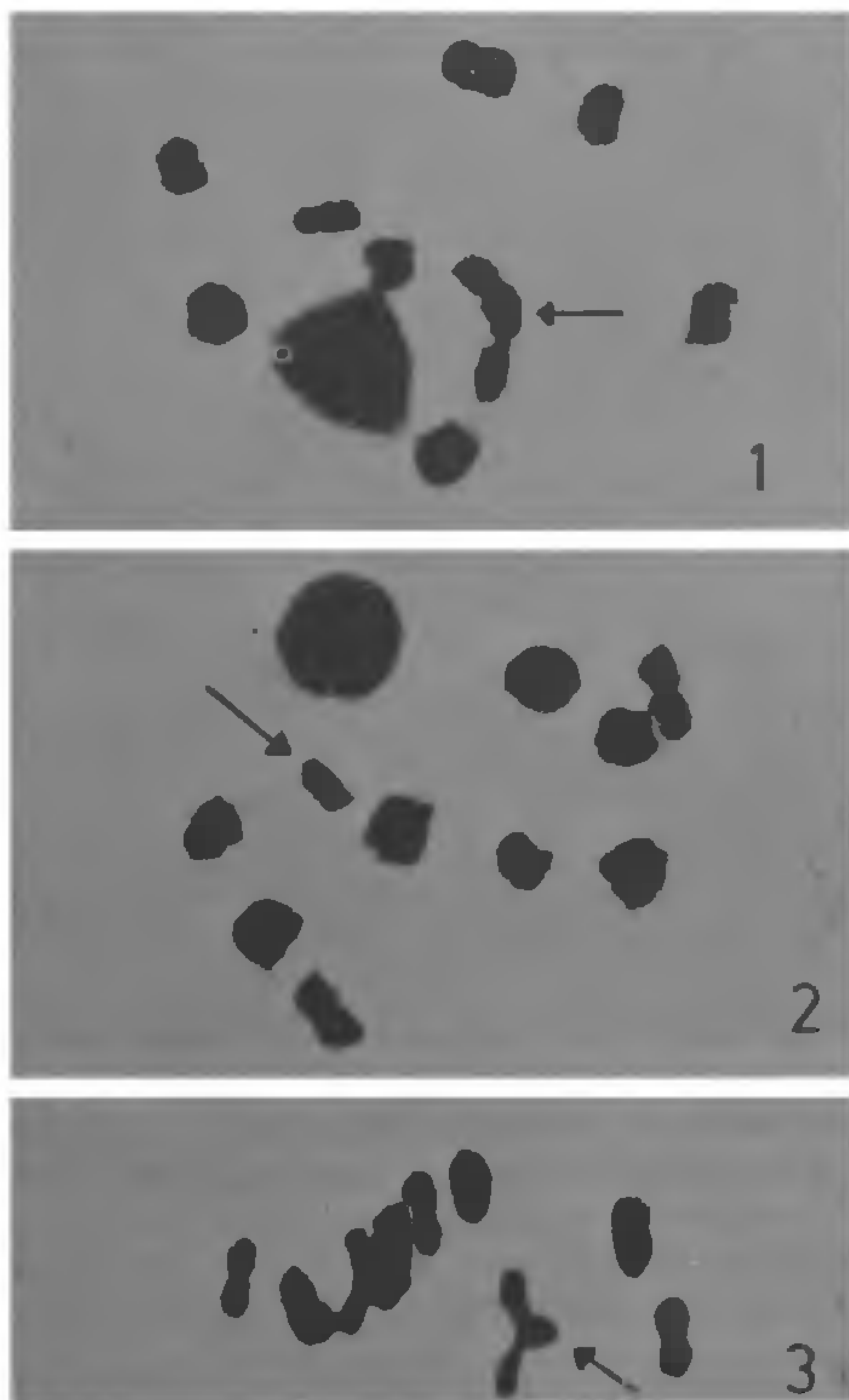
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#### PRODUCTION OF SHEATH OF *CALOTHRIX MARCHICA* LEMM IN PHOTO AND CHEMOHETEROTROPHIC CULTURE

S. P. ADHIKARY and JAYANTI SAHU

Department of Botany, Dharanidhar College, Keonjhar 758 001, India.

IN continuation of our investigations on the heterotrophic growth of various cyanobacteria<sup>1-3</sup>, the present work was undertaken to study the effect of various organic compounds on the growth of a filamentous cyanobacterium *Calothrix marchica* Lemm var. *intermedia* Rao under various growth conditions. The conditions for cultivating the organism and the procedure to determine the growth were described earlier<sup>3</sup>. Allen and Arnon's nitrogen-free medium<sup>4</sup> was used. The growth experiments were conducted in light in the presence of  $10^{-5}$  M DCMU (the concentration at which autotrophic growth of *C. marchica* was completely inhibited) and in dark with various organic carbon compounds (viz. sucrose, glucose, fructose, mannose and xylose) as a



Figures 1-3. Meiosis in the nullisomic-trisomic ( $2n - 2 + 1$ ,  $2n = 19$ ) *C. gigantea*. 1. and 2. Diakinesis showing eight bivalents and a trivalent and nine bivalents and a univalent. 3. Metaphase-I showing normal orientation of eight bivalents and a trivalent (trivalents and univalents arrowed) ( $\times 3,000$ ).

possible energy source for heterotrophic growth. The sugars had a final concentration of 15 mM in the medium and the pH was adjusted to 7.5. Equal amounts of the cyanobacterium (equivalent to 1 mg dry weight) were taken from exponentially growing cultures and inoculated into 25 ml of culture medium for experimental purposes.

The growth of the cyanobacterium increased over the control when the culture medium was provided with fructose, sucrose or glucose and incubated in light. Photoheterotrophic growth was not observed in the presence of mannose and xylose (figure 1). Cyanobacterium did not grow in the inorganic medium in light in the presence of  $10^{-5}$  M DCMU and in darkness. Chemoheterotrophic growth was observed in sucrose, fructose and glucose supplemented cultures; xylose and mannose were less efficient to support the growth of cyanobacterium under similar experimental conditions. These findings agree with earlier reports on *Anabaena* sp.<sup>2,3</sup>, *Chlorogloea fritschii*<sup>5</sup>, *Westiellopsis prolifica*<sup>6</sup> for

which mostly glucose, fructose and sucrose were the best substrates for photo- and chemoheterotrophic growth. Though certain exogenous carbon compounds supported chemoheterotrophic growth, the substrate-induced dark growth was only a fraction of the autotrophic growth of the cyanobacterium. The photostimulation and assimilation of carbon compounds may be due to abundant supply of ATP through photophosphorylation which could support the energy requiring transport of exogenous substrates and their subsequent assimilation in the cells<sup>1,7</sup>.

Formation of sheath layers around the trichomes of *C. marchica* in the cultures grown photo- and chemoheterotrophically in the presence of fructose or sucrose was an important observation in the present investigation. In the mineral medium in light, the filaments were straight, at the base  $8.6 \pm 0.26 \mu$  broad with a close thin and colourless sheath without terminal hair; the cells broader than long and the basal heterocysts hemispherical (figure 2). In photoheterotrophic culture, in the presence of fructose or sucrose, a thick sheath layer was developed around and trichome; at the base the filaments were  $11.8 \pm 0.35 \mu$  broad of which the sheath layer around the cells was  $3.5 \pm 0.12 \mu$  in thickness (figure 3). But in sucrose or fructose-supplemented culture in dark or in light in the presence of DCMU, the giant filaments of cyanobacterium were produced in which the trichomes, devoid of basal heterocyst, were much elongated with cells which were longer than broad and enveloped by a distinct sheath layer; the filaments were  $9.8 \pm 0.22 \mu$  broad of which the sheath layer around the cells was  $2.4 \pm 0.31 \mu$  in thickness (figure 4). Production of giant forms in the cyanobacterium *Westiellopsis prolifica*<sup>6</sup> and in a green alga *Chlorella*<sup>8</sup> in photo- and chemoheterotrophic culture has been reported earlier, of which in the latter strain it was suggested that consumption of sugars leads to inhibition of cell division and consequent increase in the dry weight and significant gigantism of the cells. The reason why the sheath layer was developed around the trichome of *C. marchica* in the presence of sucrose or fructose which supported photo- and chemoheterotrophic growth (figure 1) cannot be explained at the present stage. It has been shown recently that the isolated sheath fractions of *Chroococcus minutus* SAG B.41.79<sup>9</sup> and *Gloeotheca* PCC 6501<sup>10</sup> were composed mostly of carbohydrates. Probably a considerable proportion of the sugar was assimilated by the test organism in certain specific biosynthetic process, for example, in the

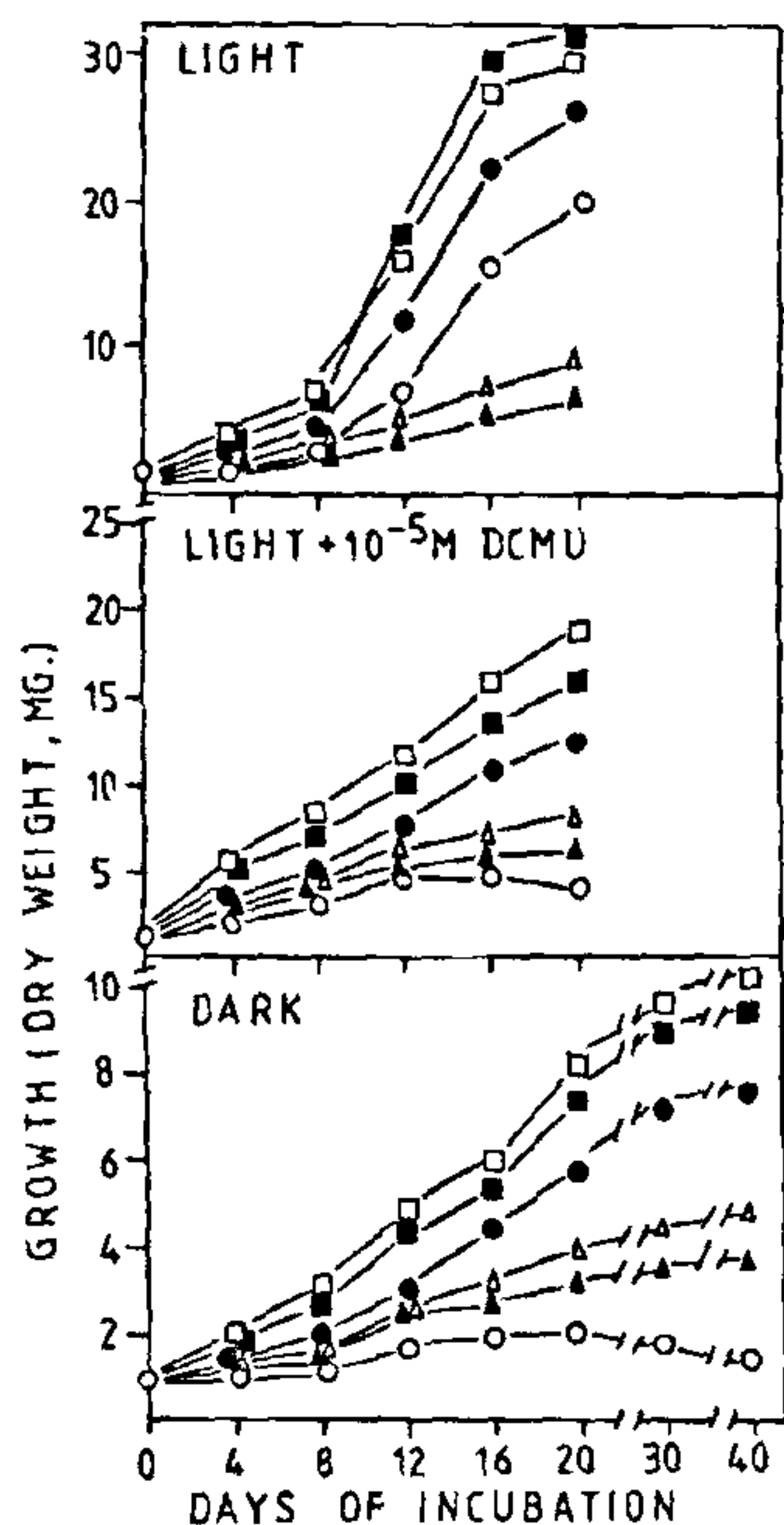
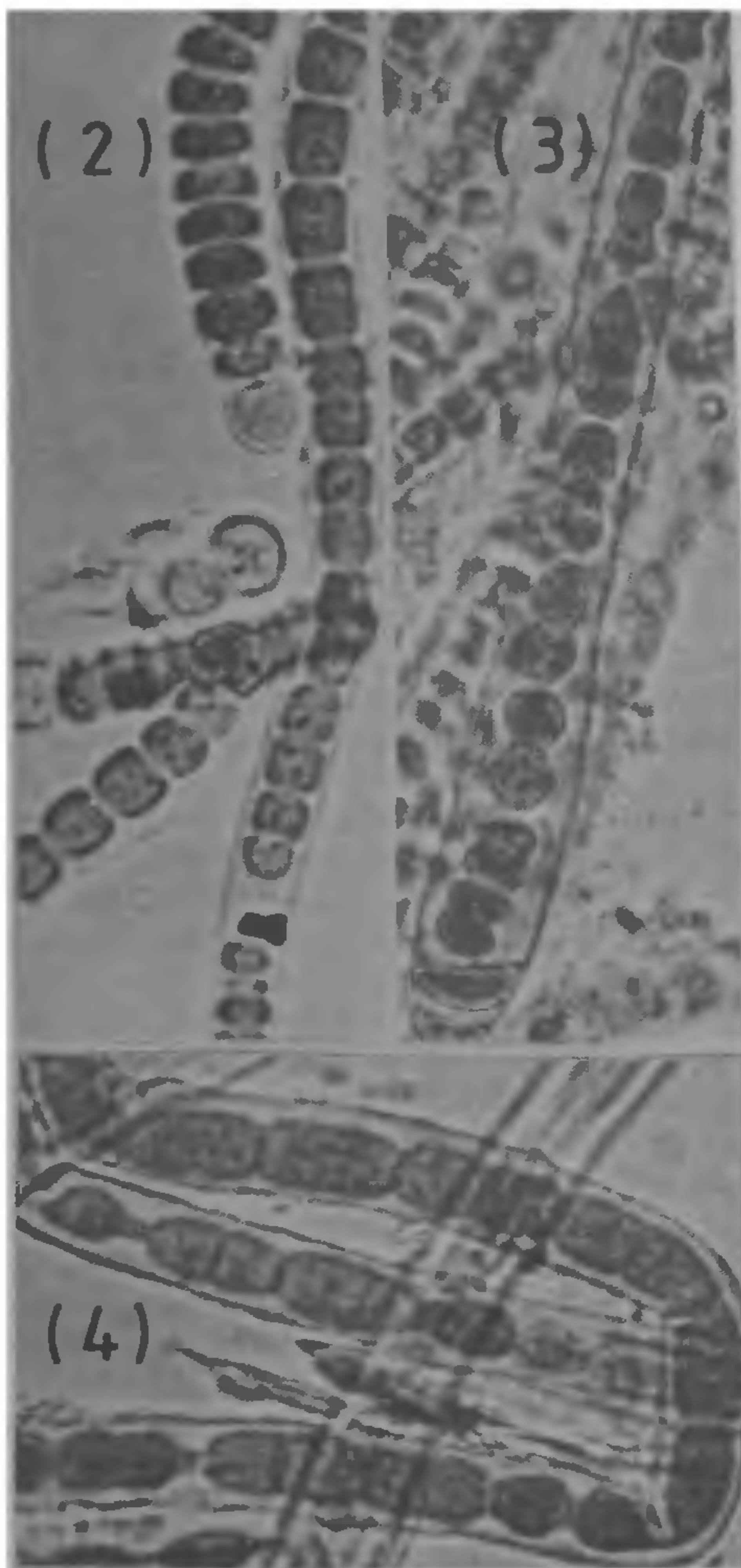


Figure 1. Growth of *C. marchica* in presence of 15 mM concentration of different organic substrates. Control (○—○); fructose (□—□); sucrose (■—■); glucose (●—●); mannose (Δ—Δ); xylose (▲—▲).





**Figures 2-4.** *C. marchica*. 2. From basal inorganic medium in light ( $\times 445$ ); 3. From fructose-supplemented medium in light showing thick sheath layer around the trichome ( $\times 385$ ); 4. From fructose-supplemented medium in dark showing elongated trichome surrounded by thick sheath layer ( $\times 360$ ).

synthesis of sheath layer around the trichome.

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## RADIO PROTECTIVE EFFECT OF GIBBERELIC ACID IN WHEAT VARIETY C 306

S. UPPAL and N. MAHERCHANDANI

*Department of Genetics, Haryana Agricultural University, Hisar 125 004, India.*

CHROMOSOMAL damage produced by gamma radiations was reduced in the germinating barley<sup>1,2</sup>, oats<sup>3</sup> and wheat<sup>4</sup> seeds with GA<sub>3</sub> post-treatment. Growth-promoting effect of GA<sub>3</sub> has been observed in many plant species including barley<sup>2</sup>, rice<sup>5</sup>, corn<sup>6</sup> and wheat<sup>4,7,8</sup>. The present study was planned to see the effect of GA<sub>3</sub> concentrations on the seedling height and chromosomal damage in a responsive wheat variety C 306.

Seeds of wheat variety C 306 were exposed to 20 kr of gamma irradiation at a dose rate of 370 R per min. The moisture content during irradiation was 11%. After irradiation the seeds were soaked, either in water or in GA<sub>3</sub> solution of different concentrations, for 16 h. The seeds were then removed from the solutions and germinated in 9 cm petri dishes on filter papers soaked with solutions of the same concentrations. Root tips were fixed for cytological studies after 36 h. After keeping in fixative for 24 h, the root tips were transferred to 70% ethanol and kept in refrigerator. Seedling height was recorded on 7-day-old seedlings.

GA<sub>3</sub> reduced the frequency of cytologically aberrant cells as seen at different mitotic stages (table 1). Also it may be seen that increasing GA<sub>3</sub> concentra-