A STUDY OF A UNIALGAL CULTURE OF *GEMINELLA INTERRUPTA*

by

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Geminella is a genus in the Family Ulothrichaceae. Although asexual reproduction by means of zoospores is known for most genera in the family, but zoospores are not definitely known for this genus.

Samples were collected in a stagnant water from an old limestone quarry on the way to Martinsviel six miles east from Bloomington, Indiana. In this collection there was a number of Chlorophyceae mixed with *Oscillatoria Bornetii* Zukal, among which there were filaments identified as *Geminella interrupta* (Turp.) Lagerheim (1883).

Single cells of this species were isolated with fine glass pipettes and placed individually in tubes of soil-water medium containing powdered calcium carbonate (Pringshein, 1950). The tubes were illuminated with light of 500 + foot candles intensity from a battery of flurescent tubes in a culture room in which the temperature was kept at 21°C. After growth was apparent in the tubes they were transferred to a location where they received only 75–100 foot candle of light. These unialga cultures were also cultivated on the modified Bristol's agar medium (Bold, 1950) in plates, with the same illuminations as stated above for soil-water cultures.

Prolonged and periodic observations of these clonal cultures of. *G. interrupta* are found that reproduction by zoospores does occur in the genus *Geminella*, and their arrangement of the vegetative cells in a filament is not constant but varied by the age and environment condition.

The morphology of the vegetative filaments of *Geminella interrupta* under favorable growth condition is as follows, free-floating uniseriate filaments of broadly ovoid or subcylindric cells; pairs of cells separated from the next pair in the series by at least a cell's length; surrounded by a tubular envelope of homogeneous structure. The individual cells are 5–8 micon in diameter, 6–15 micron in length. The equatorial region of a cell contains a laminate chloroplast covering 2/3 of the cell wall, partially encircles the protoplast. (Fig. 1.)

Filaments from an old soil-water culture of two or more months usually lose its unique character of this species—"pairs of cells separated from the next pair in the series by at least a cell's length." Cells of the old filament each has the same equal distance but not attained to a cell's length, and further more some of the older ones may even have their cells adjoined to form continous filaments. (Figs. 2, 5.)

Zoospores are usually produced in the soil-water cultures only when the culture is in active vegetative condition. The production of zoospores may be induced at will by the transfer of vegetative cells from soil-water cultures to soil extract agar (modified

Bristol's agar add soil extract), followed by subsequent transfer to distilled water after 2–3 days. (Figs. 3, 4.)

Zoospore is produced singly in a sporangium. The average size of the zoospore is 6–8 micron in width and 7–15 micron in length. The shape of the zoospore is ovoid with the narrow end as the anterior. They are naked with two flagella of equal length inserting in the anterior end. Two contractile vacuoles are located at the base of the flagella, and a bright red stigma occurs a short distance back from the anterior end. The parietal chromatophore occupies most of the body. The sporangial wall swells and releases the zoospores through a rupture. The zoospores swim about actively in the liquid medium for varying length of time, depending on the amount of light to which they are exposed. The cells remain motile in longer times under about 50 foot candles intensity. for several hours. The zoospores shorten the time of swimming when they are exposed in strong light or under darkness.

At the beginning of quiescence in the zoospores the flagella begin to shorten and the anterior end begins to round up gradually. By the vegetative cell division of the quiescent cell a filament is formed.

DISCUSSION

The filamentous condition in alga is an important advance over the unicellular condition. In the unicellular alga there is no vegetative division. In the filamentous form, on the other hand, a dividing cell is partitioned by a septum which arises as an annular ingrowth from the longitudinal walls and, after nuclear division, gradually cuts across the protoplast. The two daughter-cells adopt the portions of the mother-wall as their own. This type of division has been designated as vegetative division. It is the coming in of vegetative division which made all the structures of the higher algae possible. In fact, vegetative division is the basis of the structure of all the higher plants.

According to Blackman (1900, p. 654) and Smith (1950, pp. 6–9, 61) the filamentous condition is derived from some palmellate ancestor which tends in a filamentous direction. If the cells, instead of dividing into four or eight daughter-cells as it is usual in the Palmellaceae should divide into two cells only, and, if the cell division should always take place in the same plane, then we shall leave a simple filament of cells.

According to Fritsch (1929, p. 110; 1935, pp. 18, 198), the filamentous condition is derived directly form motile unicellular form through the introduction of vegetative division and the faculty of limitless division of a purely vegetative type. But he still believes that Ulothrix is the simplest filamentous form.

During the present experiment it gives us a strong evidence, that the seriately arranged cells of *Geminella* separated from one another by gelatinous material can be closed and come in contact with each other to form a true filament in a single strain, is only determined by environmental factors. It proves that a continuous filamentous condition is quite possibly derived from a palmelloidal gelatinous discontinuous seriately

arranged cell bodies. On the other hand it also brings a question that the species in *Gemillena* may not so many as have been discribed. The varieties in the cell arrangement among different species discribed may be just varied in growth conditions of a single species.

The definite occurrence of zoospores in *Geminella* by this experament proves the position in the family Ulotrichaceae more naturally. A careful and thorough study with cultural method is greatly helpful in algae morphology as well as taxonomy.

SUMMARY

The Green alga, *Geminella interrupta* (Turp.) Lagerhaim has been found to have a variation with growth in cell arrangment, based on observations of the organism in Unialgal culture. The reproduction by zoospores in the genus *Geminella* is also found. It gives stronger evidences to support the Blackman and Smith's idea of "the filamentous condition is derived from some palmellate ancestor."

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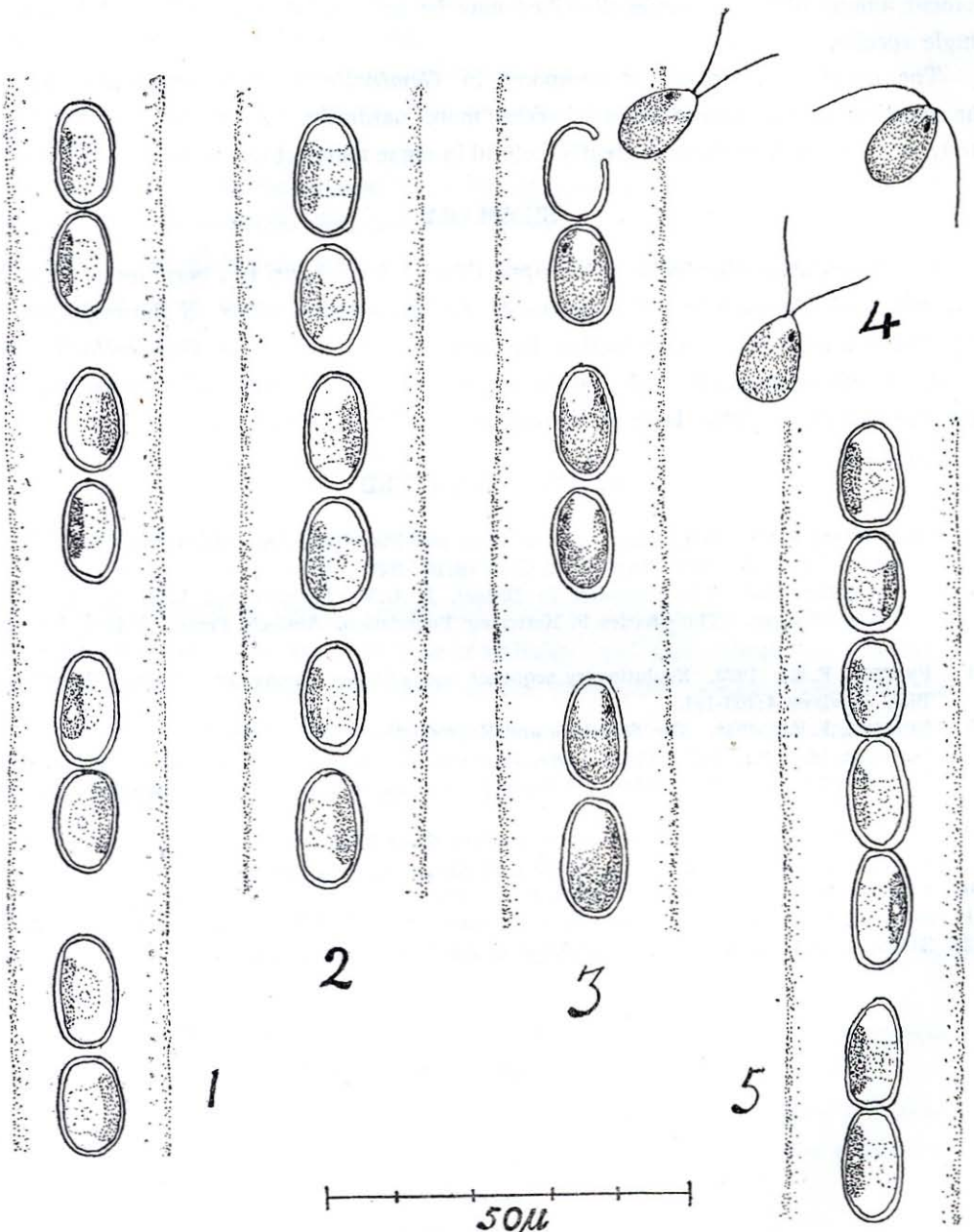

Figs. 1-4. Vegetative filaments and zoospore formation in Geminella interrupta (Turp.) Lagerhaim.
Fig. 1. Filament under favorable growth condition.
Figs. 2, 5. Filaments from old culters.
Fig. 3. The liberation of zoospores from the sporangia.
Fig. 4. Zoospores.