ON THE ASEXUAL AND SEXUAL REPRODUCTION OF *CHARACIOSIPHON RIVULARIS* IYENGAR

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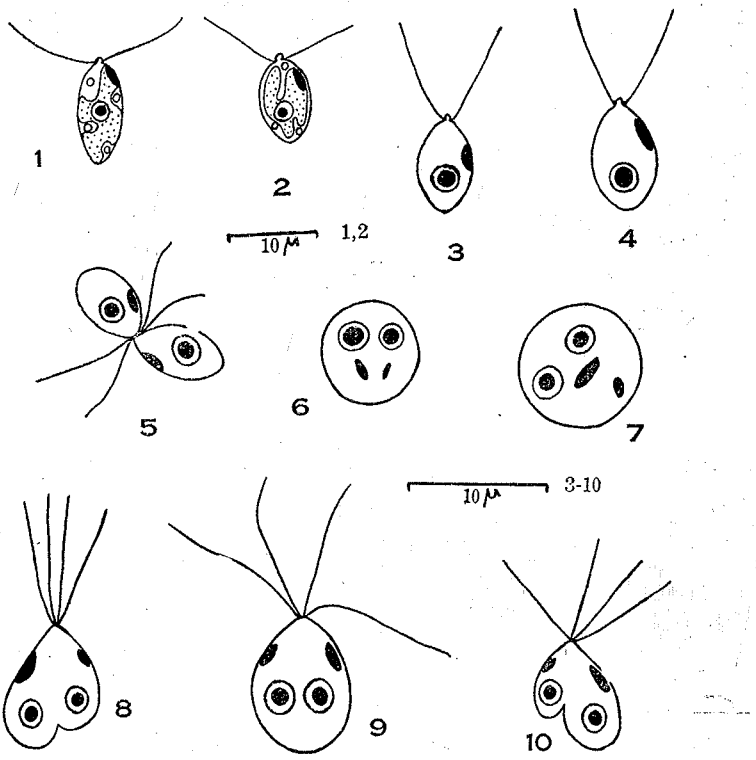
This alga was found by the author in February 1936, growing on tiny stones and pebbles in the bed of a shallow stream at Vaiyampatti near Trichinopoly in South India. A preliminary account of this unique alga was published by him in the same year (Iyengar, 1936). In this note, he has given only a very brief account of the asexual and sexual reproduction of the alga. He collected the alga again from the Vaiyampatti stream in 1941 and brought it to Madras and kept it growing in the Laboratory in glass dishes in rain water to which some Knop's solution was added, and made some more observations on its reproduction and growth, which are given here briefly below.

Asexual Reproduction

Just before zoospore formation the contents of the thallus change from a bright green to a darkish brown colour, and the entire contents of the thallus become converted into a mass of biflagellated zoospores. The zoospores after wriggling inside the thallus for some time finally escape outside through the rupture of the apical portion of the thallus. The zoospores come out in brown clouds which are quite visible to the naked eye for some time until they disperse in the water.

The zoospores are biflagellate and spindle-shaped with a definite papilla at the anterior end (Text-figs. 1, 2). They are 5–7 μ broad and 7–12 μ long, and possess a large anterior eye-spot which is elliptic in shape, a more or less stellate chloroplast in which is embedded a pyrenoid, and three to five contractile vacuoles which are distributed in all parts of the zoospore. The zoospore after swarming for some time settles down by its anterior end, and covers itself with a wall and secretes a mucilaginous attaching pad at the base (Text-figs. 12, 14). The germlings, which soon grow in size, are obovate in shape and possess a stellate chloroplast in which is embedded a large pyrenoid, a single nucleus and a number of contractile vacuoles (about 2–5). At the basal end of the germling two thin thread-like structures traverse downwards from the protoplast through the thick wall (Text-figs. 12, 14). These are the persisting old basal portions of the flagella of the zoospore when it settled down. The young germling, in possessing a stellate chloroplast with a pyrenoid in it and the persisting ciliary stalks at the base and several contractile vacuoles, closely resembles individuals of *Characiochloris* (Pascher, 1927, pp. 485–87; Korschikoff, 1932, pp. 557–62).

The development of the germlings was studied in the following manner. A few clean glass slides were placed at the bottom of the culture vessels in which the alga was growing. When the zoospores

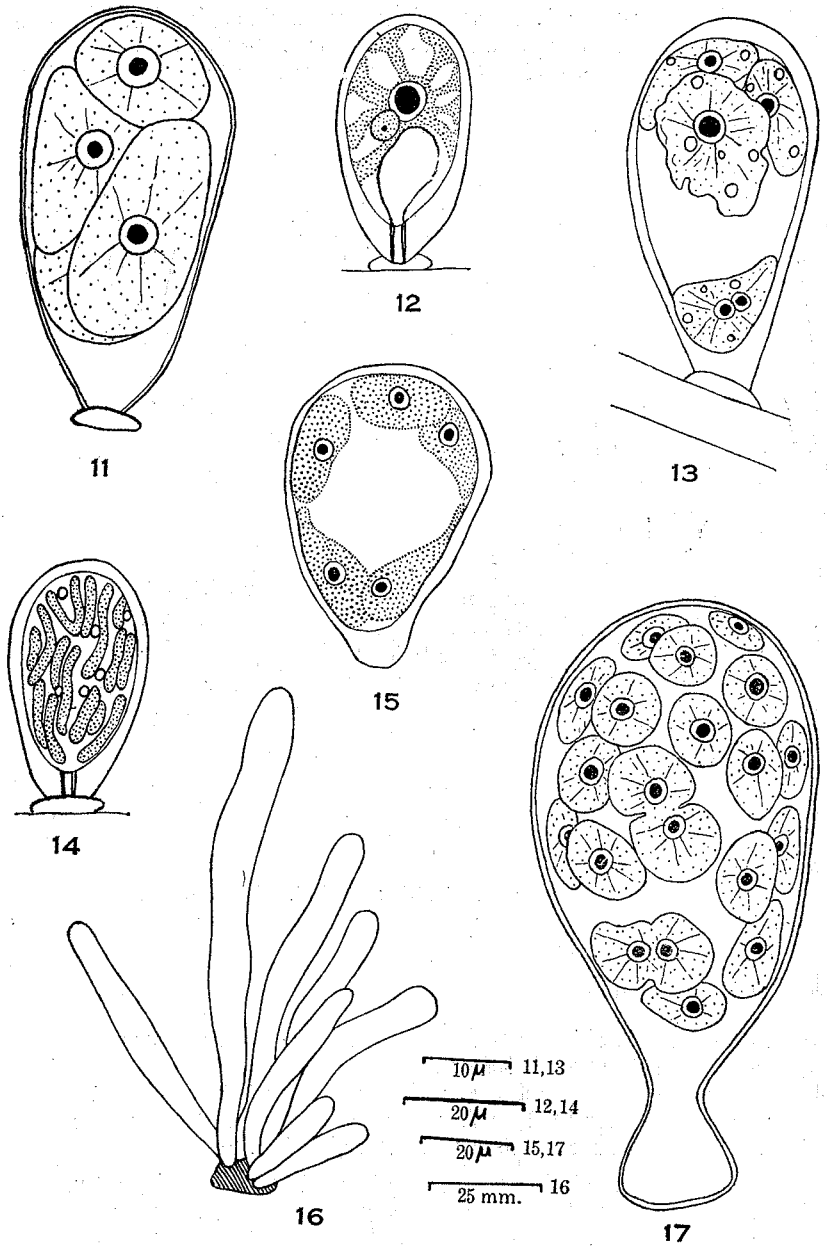


FIGS. 1–10. *Characiosiphon rivularis* Iyengar.

Figs. 1, 2. Zoospores showing chloroplast, pyrenoid, eye-spot and contractile vacuoles. Figs. 3, 4. Gametes. Figs. 5, 8, 9, 10. Conjugation. Figs. 6, 7. Zygotes. (In Figs. 3–10, only eye-spots and pyrenoids shown : chloroplasts and contractile vacuoles not shown.)

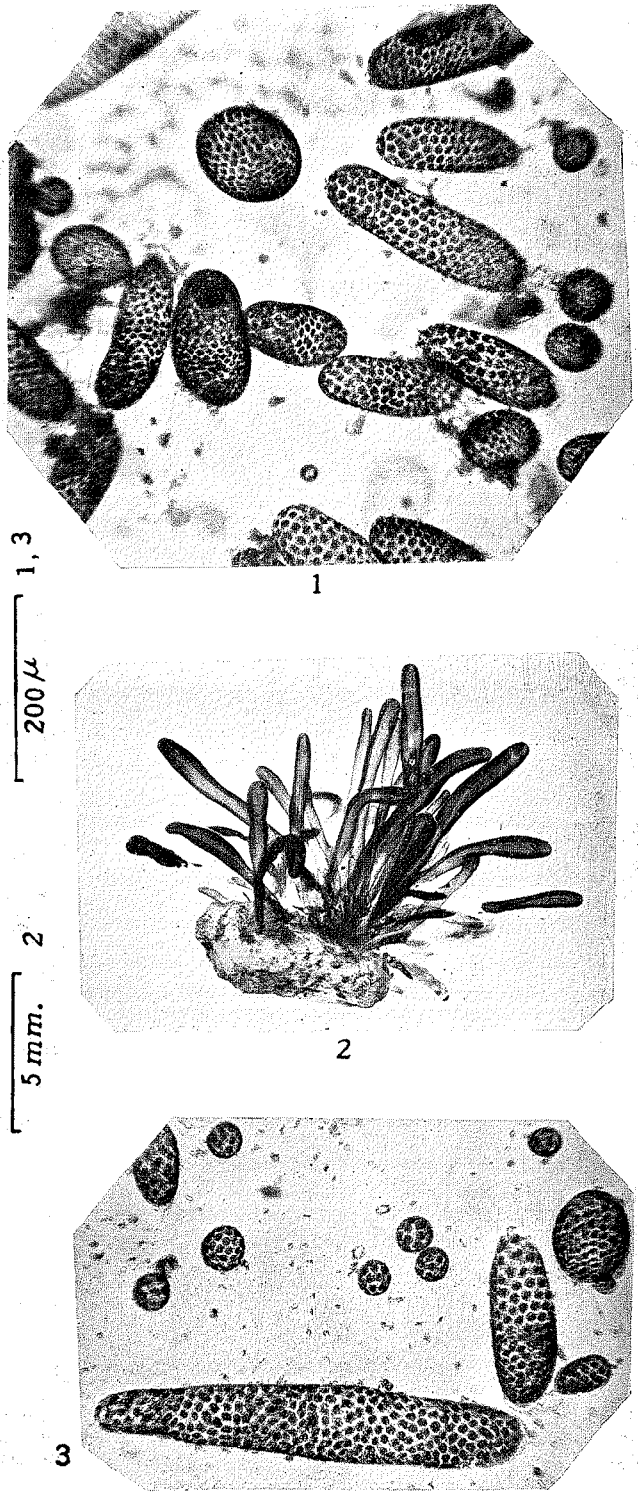
settled down at the sides and the bottom of the culture vessel, quite a good number of them settled down on these slides also. The slides were taken out periodically, and the various stages of development of the germlings were examined under the microscope. The slides were returned to the culture vessels after examination.

The protoplast of the young germling first divides into two and then the daughter-protoplasts divide again forming four protoplasts, each of which again divides (Text-figs. 11, 13, 15). In this way by a series of divisions the protoplasts keep increasing in number (Text-fig. 17). No cross wall is formed separating the daughter-protoplasts. During each division of the protoplast, the pyrenoid divides first and then the chloroplast and the nucleus divide, and two protoplasts are formed each



FIGS. 11–17. *Characiosiphon rivularis* Iyengar.

Figs. 11, 13. Germlings with four protoplasts. Fig. 12. Median optical section of a very young germling showing the stellate chloroplast with a pyrenoid, the nucleus and the basal ciliary strands. Fig. 14. Surface-view of germling in Fig. 12, showing the edges of the stellate chloroplast, a number



Characiosiphon rivularis Iyengar

FIGS. 1, 3. Photomicrographs of germlings growing attached to slides kept in the culture dishes, showing various stages of development.

FIG. 2. Photograph of a cluster of plants.

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of contractile vacuoles and the basal ciliary strands. Fig. 15. A germling with eight protoplast (only five seen in optical section). Fig. 16. A cluster of young plants. Fig. 17. A germling with a larger number of protoplasts showing some of the protoplasts dividing. (Protoplasmic connections not shown in Figs. 11, 13, 15 and 17).

with its own chloroplast, pyrenoid and nucleus. In this way the protocoenocytic germling (see Iyengar, 1936, p. 315) grows larger and larger (Pl. V, figs. 1, 3) and finally becomes an adult protocoenocytic plant (Pl. V, fig. 2). The young germling is obovate at first (Text-figs. 11, 13, 15, 17) and then becomes cylindrical and gradually grows longer and longer (Text-fig. 16; Pl. V, figs. 1, 3). The fully developed alga is somewhat clavate in shape (Pl. V, fig. 2).

Sexual Reproduction

The contents of some other plants divide into a mass of biflagellate gametes which also, as in the case of the zoospores, escape out through the rupture of the apical end of the thallus. The gametes are exactly like the zoospores in shape and structure. They are of various sizes. The smaller gametes are 4–5 μ broad and 6–7 μ long (Text-fig. 3) and the larger gametes 5–6 μ broad and 7–9 μ long (Text-fig. 4). All intermediate sizes between the very small and the very large gametes are found.

It was observed that gametes from the same plants did not generally fuse. But, if gametes from different plants were brought together, they fused readily. The conjugation was either isogamous, between two small gametes (Text-fig. 5) or two large gametes (Text-fig. 9), or anisogamous, between a small and a large gamete (Text-figs. 8–10). As soon as the gametes escape from the plants, they are positively phototactic. But the conjugated pairs become negatively phototactic and swim away to the less lighted side of the culture vessel. The quadriflagellate zygote swims for a time and finally settles down, loses its flagella, becomes round and surrounds itself with a wall. The zygotes retain the two eye-spots of the gametes for quite a long time (Text-figs. 6, 7). The author watched for the further developmet of the zygotes. Unfortunately, they did not develop further, but degenerated and died.

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