Nachdruck verboten. Übersetzungsrecht vorbehalten.

Kleinere Mitteilungen.

Homothallism and other variations in *Pleodorina californica* Shaw.

By

L. H. Tiffany.

(With 4 figures in the text.)

Since its original description by SHAW (1894), *Pleodorina californica* has been collected in many localities in the United States as well as in Europe. The adult colonies containing about half reproductive cells and half vegetative cells have made identification of the species quite certain even by amateurs.

The genus *Pleodorina* is a member of the Volvocales. Two other species, *P. illinoisensis* KOFOID and *P. charkowiensis* KORSCHIKOFF, are not recognized as such by all algologists. PASCHER (1927), for example, places both species in the genus *Eudorina*.

During the summer of 1933 *P. californica* grew in great numbers in a marshy pond on Middle Bass Island in Lake Erie some few miles north of the Ohio shore (U.S.A.). A careful examination of this material over a period of several weeks revealed some variations and perhaps new characteristics in the species that merit special mention. These are enumerated below.

1. Colonies of 32 cells were noted, almost evenly divided in numbers between vegetative and reproductive cells. The number of cells to a colony was, however, more often 64 or 128. WEST and WEST (1905) report colonies of *P. californica* from the Outer Hebrides with only 32 cells, but this form of the WEST's because of other characteristics will be discussed in a later paragraph. 2. Plants collected in early July were heterothallic (Figs. 2 and 3), thus confirming the observations of CHATTON (1911). Colonies of late July were largely homothallic (Fig. 4). The homothallic colonies



Fig. 1. Pleodorina westii sp. nov. (Redrawn from WEST.) — Fig. 2. Pleodorina californica. Female colony with antherozoids within the colonial envelope; one antherozoid about to fuse with an egg (antherozoids slightly enlarged). — Fig. 3. Pleodorina californica. Male colony. — Fig. 4. Pleodorina californica. Colony showing sterile cells, fertile cells, eggs, packets of antherozoids, young autocolony, and zygospores.

were usually predominately male or female; that is, a "female" colony contained one to four packets of antherozoids and a "male" colony had one or two female gametes. Several colonies were noted having the following heterogeneous composition: vegetative cells, undifferentiated reproductive cells, autocolonies, female gametes, packets of antherozoids, and zygotes (Fig. 4).

3. The antherozoids usually occurred in cup-shaped clusters rather than flat plates. The clusters of antherozoids remained intact after liberation from the coenobium for three to five hours. Upon separation, invariably in the vicinity (or nearly so) of a female coenobium, the antherozoids migrated in the direction of the latter coenobe. Sometimes they moved in many directions around the female coenobe, but always in its immediate vicinity. Antherozoids of a given cluster in a homothallic plant were not observed to separate within the colony producing them. It appears that antherozoids and eggs from the same colony do not fuse.

4. Antherozoids entered the female colony through the gelatinous envelope anterior end first and swam around within the coenobe for several minutes. Contact with the egg was made by the anterior end of the antherozoid (Fig. 2). Actual fusion was not observed.

5. The zygotes were spherical, reddish brown in color, 22–33 μ in diameter, with a thick wall either smooth, finely granulate, or irregularly thickened (Fig. 4).

Discussion.

1. There appears to be considerable justification for the differentiation of species (or sometimes genera) among the Volvocales largely on the basis of the presence or absence of mammillate protuberances at the posterior end of the coenobe (SMITH, 1930, 1933). *Platydorina caudata* KOFOID has been collected in the United States in Illinois, California, Iowa, and Ohio. The posterior projections are universally present. *Eudorina carteri* G. M. SMITH, *E. unicocca* G. M. SMITH, and *E. plusicocca* G. M. SMITH are all described (SMITH, 1930) as distinctly mammillate at the posterior pole of the coenobe. *E. unicocca* has been collected by the writer in a small inlet of Lake Erie near the Ohio shore and in all cases is very distinct.

In view, therefore, of the apparent morphological soundness and constancy of these mammillate protuberances, it seems best to recognize *Pleodorina californica* of WEST & WEST as a distinct species.

Pleodorina westii sp. nov. (Fig. 1).

Pleodorina californica WEST & WEST (non Shaw), 1905, p. 506, Pl. 6 Fig. 14.

Coloniis ellipsoideis, cum lobis posterioribus, e cellulis 32 compositis, 90–113 μ diam. mentientibus: cellulis vegetativis 6.5–7 μ diam., cellulis fructiferis 13.4—16.5 μ ; zygosporis ignotis. Hab. in Loch Fadaghoda, Lewis, Outer Hebrides.

2. In recent years it has become more and more apparent that the so-called "fixity of sexual states" in many plants is by no means universally constant. SCHAFFNER (1921, 1922, 1930, 1931) has adduced a colossal array of evidence for the environmental control and reversal of sexual states in numerous Spermatophyta, such as Salix, Zizania, Myriophyllum, Peltandra, Ricina, Arisaema, Typha, Zea, and Cannabis. The sexual state, whether dioecious or monoecious, has been used as of prime importance in differentiating species among the Oedogoniaceae. Even in this group, however, a few species are both monoecious and dioecious, and others if dioecious may be both gynandrosporous and idioandrosporous (TIFFANY, 1930). The filament of certain species of Spirogyra may be both male (-)and female (+). Similar variations occur in many other groups of plants as well as in animals.

SHAW (1922) established a number of new genera closely related Among other so-called differentiating characteristics he to Volvox. lavs stress on whether the colony is dioecious or monoecious; for example, Copelandosphaera and Volvox are homothallic, while Merrillosphaera and Janetosphaera are heterothallic. G. M. SMITH (1930) on the basis of observations made earlier by CARTER described E. carteri as homothallic. A closely related species, E. plusicocca, is separable from E. carteri only if it proves to be heterothallic.

As noted above, heterothallic colonies of Pleodorina californica were collected largely in early July, while homothallic colonies did not appear until late July. The water of Fisher Pond, where the species grew in such abundance, underwent marked changes during the month of July. Due to a decided paucity in rainfall during the summer of 1933, the depth of the water in the pond changed during July from about twenty inches to about six inches. Along with this increasing shallowness of water occurred a rise in temperature and in p_{H} . It can only be said, of course, that homothallic colonies of *P. californica* were found later in the summer, at a higher temperature, and at a higher p_H of the water than were the heterothallic colonies. There is no direct proof as yet of cause and effect.

It must be recorded, however, that P. californica on the basis of these observations is both homothallic and heterothallic. Τt appears in addition that, whatever may be the hereditary basis of differentiating sexual states, the expression of heterothallism or homothallism in P. californica may be affected by the environment.

These observations on P. californica, as well as variations in many other plants, are sufficient, it seems, to question the validity of the establishment of algal species, and certainly genera, on the basis solely or even largely of whether the plant is homothallic or heterothallic. It may be that in some plants sexual states are definitely fixed. It certainly is not true for all.

Department of Botany, Ohio State Univ., Columbus, Ohio (U.S.A.) and Franz Theodore Stone Biol. Laboratory, Put-in-Bay, Ohio (U.S.A.).

Literature cited.

- CHATTON, E. (1911): Pleodorina californica à Banyuls-sur-mer. Son cycle évolutif et sa significance phylogénique. Bull. Sci. France et Belgique T. 44 p. 309-331, Pl. 7 Figs. 1-2.
- PASCHER, A. (1927): Volvocales. Die Süßwasserflora Deutschlands, Österreichs und der Schweiz Bd. 4 p. 1-506, Fig. 1-451. Jena.
- SCHAFFNER, JOHN H. (1921): Reversal of the sexual state in certain types of monecious inflorescences. Ohio Journ. Bot. Vol. 21 (6) p. 185-200, Pl. 1-2 Figs. 1-51.
- (1922): Control of the sexual state in Arisaema triphyllum and Arisaema dracontium. Amer. Journ. Bot. Vol. 9 p. 72-78.
- (1926): The nature and cause of secondary sexual states with special reference to Typha. Bull. Torrey Bot. Club Vol. 53 p. 189—208.
- (1930): Sex reversal and the experimental production of neutral tassels in Zea mays. Bot. Gaz. Vol. 90 (3) p. 279-298, Figs. 1-4.
- (1931): The fluctuation curve of sex reversal in staminate hemp plants induced by photoperiodicity. Amer. Journ. Bot. Vol. 18 p. 424-430, Text-Fig. 1.
- SHAW, W. R. (1894): Pleodorina, a new genus of the Volvocineae. Bot. Gaz. Vol. 19 p. 279-283, Pl. 27.
- (1922): Janetosphaera, a new genus, and two new species of Volvox. Phillippine Journ. Sci. Vol. 20 p. 477—508, Pl. 1—5 Figs. 1—5.
- (1922 a): Merrillosphaera, a new genus of the Volvocaceae. Ibid. Vol. 21 p. 87-129, Pl. 1-8 Fig. 1.
- (1922 b): Copelandosphaera, a new genus of the Volvocaceae. Ibid. Vol. 21 p. 207-232, Pl. 1-4 Figs. 1-16.
- Sмітн, G. M. (1930): Notes on the Volvocales. I—IV. Bull. Torrey Bot. Club. Vol. 57 p. 359—370, Pl. 17—18 Figs. 1—11.
- -- (1933): The fresh-water algae of the United States. 716 p. 449 Figs. New York and London.
- TIFFANY, L. H. (1930): The Oedogoniaceae, a monograph. 254 p. 64 Pl. 640 Figs. The Author, Columbus, Ohio.
- WEST, W. & G. S. WEST (1905): The freshwater plankton of the Scottish Lochs. Trans. Roy. Soc. Edinburgh Vol. 41 (3) p. 477-518, Pl. 1-7.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: Archiv für Protistenkunde

Jahr/Year: 1935

Band/Volume: 85_1935

Autor(en)/Author(s): Tiffany L.H.

Artikel/Article: <u>Homothallism and other variations in Fleodorina californica</u> <u>Shaw. 140-144</u>