

Phaeocystis Pouchetii (HARLOT) LAGERH. and its Zoospores.

By

C. H. Ostenfeld, Copenhagen.

(With 2 figures in the text.)

During a stay at Thorshavn in the Færøes in the latter part of August 1903, I investigated almost daily the Plankton in the sea off the town, the so-called Nolsøfjord. The main part of the Plankton consisted of Diatoms, which occurred in considerable quantities and in many species; the dominant species were *Rhizosolenia obtusa* HENSEN, *R. styliformis* BRW., *Chatoceras debile* CL., also *Rhiz. faerøensis* OSTF., *Thalassiosira bioculata* (GRUN.) OSTF., and some species of *Chatoceras* besides the one mentioned above. Besides the Diatoms there occurred a small quantity of *Peridiniaceæ*, and the following Flagellatæ: *Dictyocha speculum* EMBG., *Coccolithophora pelagica* (WALL.) LOHM., and *Phaeocystis Pouchetii* (HARLOT) LAGH.; none of these latter three species were common. The character of the Plankton-association answers thus fairly well to that of the Solenia-Plankton described by me (OSTENFELD, 1903), which appears to be characteristic of the Færøese fjords during August-September; specially, it is almost identical with the Plankton from Nolsøfjord collected in August 1902 (l. c. p. 607 and Table IX, Nos. 88—89 p. 604). As I had living material for examination — being able to row out on the fjord and bring home fresh Plankton and examine it at once — I had opportunities of making several observations which could not be made on preserved material. Thus, I found the peculiar Flagellate *Polykrikos*, which had already been

met with by POUCHET (1892, 2) in the Plankton from Nolsøfjord, as well as a large yellowish brown and also a large red species of *Gymnodinium*. Finally, I was fortunate enough to observe the zoospores of *Phaeocystis Pouchetii*. As this organism plays a prominent part in the Plankton of the northern regions and more especially of the waters around Iceland and Greenland and of the Norwegian Sea, I think a description of its zoospores will be of interest, more so, as the only description of them which has been published appears to be incorrect.

The yellowish brown Flagellate *Phaeocystis Pouchetii* was first observed in the sea off the north coast of Norway, in 1882, by G. POUCHET (it is, however, possible that this alga is identical with an organism found previously by G. O. SARS in the sea near Jan Mayen which he shortly mentions as "a yellowish brown, gelatinous mucilage"). In August 1890 he re-found it while staying at Thorshavn, and here he was able to investigate it more closely; shortly afterwards he published his observations (1892, 1) accompanied by a short diagnose of the plant written by the French algologist P. HARIOT, who named it *Tetraspora Pouchetii*. The year following G. LAGERHEIM (1893) founded for this plant a new genus *Phaeocystis*, as he very correctly argued that it had nothing to do with the green-alga-genus *Tetraspora*. In 1892 POUCHET had again an opportunity of observing this plant as he (POUCHET, 1894, pp. 186—188) joined the "La Manche" expedition to Jan Mayen and Spitzbergen, and could thus prove it to be widely distributed in the waters of these regions (Voyage de "La Manche", Histoire naturelle par M. POUCHET).

Some years afterwards G. LAGERHEIM (1896) published a more detailed account of *Phaeocystis* which he had observed in Tromsøund in the north of Norway; and lastly H. H. GRAN (1902) has treated it in his work on the Plankton of the Norwegian Sea.

Besides *Phaeocystis Pouchetii* A. SCHERFFEL (1900) has recently found another species: *Phaeocystis globosa*, which he investigated very thoroughly at Heligoland; it belongs to the southern part of the North Sea, whence GRAN had also material for examination (1902, p. 19).

Thus, we have already a rather large literature on *Phaeocystis*, and to the treatises mentioned above may be added several papers by CLEVE and myself (OSTENFELD, 1899, 1900), in which its area of distribution is widened and its period of vegetation at the various stations is given.

Nevertheless, very little is known regarding the mode of development of this interesting alga. *Phaeocystis Pouchetii* forms a gelatinous thallus, 1—2 mm in size, which is more or less spherical, with some large sack-shaped protuberances, so that it resembles a bunch of grapes, consisting of a few, closely packed and stemless grapes. The cells are arranged in a peripheral layer which is found a little below the surface, and they are often fairly well arranged, four and four, but the layer is not evenly distributed over the whole surface. The space within the layer is filled with mucilage which is probably of a thinner consistency than at the surface. LAGERHEIM (1896, p. 282) is of the opinion that the inner space is filled with water so that the thallus is bladder-shaped; but as regards *P. globosa*, SCHERFFEL (1900, p. 4) very correctly points out that the thallus does not collapse when placed on an object glass and has had almost all the water taken away from it. According to my experience this is also the case with *P. Pouchetii* and the fact that the zoospores, as mentioned below, are able to move in the inner part, may very well correspond with this view, more so, as they move rather slowly.

The consistency of the mucilage is moreover variable; according to SCHERFFEL and GRAN (1902, p. 19) *P. globosa* has a fairly solid surface, which may perhaps be explained by the fact that the thallus is globular, ovate, or sausage-shaped, and never has the sack-shaped protuberances characteristic of the adult thallus of *P. Pouchetii*. POUCHET mentions (1894, p. 186) that *Phaeocystis* from the neighbourhood of Jan Mayen and Spitzbergen had less solid and dense mucilage than those he met with at the Færøes (le mucus . . . moins ferme, moins dense), and it is also my experience that *Phaeocystis* differs considerably at the different stations; perhaps they are geographical races. Both the species of *Phaeocystis* can occur in considerable quantities, thus *P. Pouchetii* can at times quite fill up and spoil the Plankton-nets in Denmark Strait, and POUCHET's method of proving its presence (1894, p. 187), viz. by pouring half a pint of water into a glass and looking at it with the naked eye, shows also how abundantly it may occur. But its presence is confined to certain, comparatively short periods of the year, and nothing is known about its whereabouts during the rest of the time. GRAN (1902, p. 20) is of the opinion that it remains fixed amongst the algæ at the coast, but according to my thinking there is very little to prove this, and the result he arrives at, that the thallus of *P. globosa* on being placed in a damp room sinks to the bottom and that the single cells can escape from the thallus and attach themselves

to the glass (without forming zoospores) hardly proves anything. I am more inclined to believe that it forms resting spores, as is the case with several of the *Chryomonadinae* allied to it, e. g. *Hydrurus*, *Synura*, *Syncrypta*, and that these resting spores sink to the bottom and remain there till the next period of vegetation. There is now hardly any doubt that the species of *Phaeocystis* are neritic forms (see GRAN, 1902, p. 18 and OSTENFELD, 1899, 1900). SCHERFFEL (1900, p. 13) describes and figures (fig. 78) some cells with distinct walls, which he presumes are resting cells.

The structure of the single cells of *P. Pouchetii* has been thoroughly investigated by LAGERHEIM (1896), and that of *P. globosa* by SCHERFFEL, and my investigations do not throw any new light of importance on this subject. Each cell, which is usually 10—12 μ in diameter and somewhat spherical or obtuse angled, is surrounded by a membrane (not by a wall). It contains two yellowish brown chromatophores, oblong and somewhat bent, which evidently, shortly before the division of the cell, break up into fours. POUCHET mentions that *P. Pouchetii* has two chromatophores, and SCHERFFEL explains very fully that *P. globosa* also has two chromatophores only, while LAGERHEIM presumes that *P. Pouchetii* has four "in fully adult cells" (1896, p. 285). As regards the latter, I think I have been able to observe that all the cells, which are not just at the



Fig. 1. *Phaeocystis Pouchetii* (HABROT) LAGERH.

a) vegetative cells, b) zoospore with a drop of Leucosine, c) zoospores of another thallus with small refractive drops, d) a fragment of a thallus in which all the cells have broken up and turned into zoospores.

a—c ZEISS, Apochr., Oc. 8, Obj., Apert. 0.95.

d — — — Oc. 2, Obj., — 0.95.

point of division, contain two only, but their shape, like short, bent bodies, leads one to believe that there are 3—4 in several of the cells (see fig. 1a). Attached to the chromatophores occur some small refractive drops, consisting of oil (they stain black with osmium acid). The chromatophores lie close to the membrane and the greater part of the remainder of the cell is filled with a large refractive drop of Leucosine, which disappears as soon as the cell is about to

die. It must be borne in mind that the cells of *Phaeocystis* are extremely sensitive and disorganize after having been covered some minutes with a covering glass. I have not observed any cell-nucleus, but SCHERFFEL has proved its existence in *P. globosa*. As mentioned above our knowledge of the mode of development of *Phaeocystis* is only fragmentary. The thallus, which, when full-grown, is characteristic in each species, begins as a small globular body in both of them; but how this small globular body originates is not known. On the other hand, POUCHET and LAGERHEIM have both observed the formation of zoospores in the full-grown thallus of *P. Pouchetii*, and SCHERFFEL has done the same in that of *P. globosa*. Unfortunately, nothing further is known respecting these zoospores. The perishability of the material precludes the possibility of culture — at least with our present methods. Judging from our present knowledge of the zoospores they are quite different in the two species. According to SCHERFFEL's careful investigations *P. globosa* has a roundish or ovate-cordate zoospore, 4–6 μ long, with two chromatophores at the anterior end, and two long and one short flagellum. Of *P. Pouchetii* there has hitherto existed one drawing only (see fig. 2a), published in POUCHET's first treatise; it shows an oblong pear-shaped zoospore with a chromatophore at the posterior end, and with two long flagella, of which one is directed forwards, and the other is transversal, very much like the transverse flagellum in the Peridinea. LAGERHEIM once found a thallus of this species with zoospores (1896, p. 285), but unfortunately he was not able to investigate it before it perished. It could a priori be argued that it was not likely that two species which were so closely allied, should differ so widely from each other with regard to their zoospores; besides, POUCHET's figure did not at all resemble a common alga-zoospore. It was therefore a great satisfaction to me to find at Thorshavn — the place where POUCHET had originally carried out his investigations — the thallus of *Phaeocystis Pouchetii* with zoospores, and could prove that the zoospores resembled closely those of *P. globosa*, and that, consequently, POUCHET's figure did not at all represent a zoospore of *P. Pouchetii*, but quite another organism.

From August 28th to September 1st *P. Pouchetii* occurred constantly in the Plankton, but only in small quantities. The thalli were large and had numerous sack-shaped protuberances, and amongst those which had the usual appearance, there occurred several times a few in which all the cells had turned into zoospores, these thalli were of a looser consistency than is the case in the normal vegetative

ones, as also LAGERHEIM (1896, p. 285) mentions with regard to this species, while SCHERFFEL (1900, p. 10) says that this is not always the case in *P. globosa*. I got the impression that the thalli containing zoospores were breaking up, doubtless because the period of vegetation of the alga was on the decline, as indicated by its sparse occurrence, its zoospores, and the lateness of the season. The zoospores moved in the mucilage, but not very quickly, and the position of several of them to each other distinctly showed that they were formed by the bipartition of a vegetative cell; see fig. 1d, which is slightly magnified, and shows the distribution of the zoospores in a fragment of a thallus, they are lying more or less distinctly two and two together. I have not met with the aggregations of zoospores recorded by SCHERFFEL (1900, p. 12) as occurring in *P. globosa*. The structure of the zoospores answers very closely to the structure of those of *P. globosa* as described and accurately figured by SCHERFFEL. They are about 5–6 μ long, and usually more or less ovate-cordate in shape, broadest in front (see fig. 1b and c). They contained two chromatophores. Still, I must point out, that possibly there are not two, but one only, as sometimes it appears as if the two bodies are united together into one strongly bent body which encompasses mantle-like the inner content of the cell; neither do SCHERFFEL's figures (figs. 68–69) show clearly that there are — as he writes — two. In the meantime it is fairly certain that the two species agree in regard to this point. The chromatophores lie nearest to the broad slightly indented front, from the hollow of which the two flagella proceed, these are of an equal length, but somewhat longer than the zoospore; on the other hand I was not fortunate enough to observe the short, third flagellum which SCHERFFEL has met with in the zoospores of *P. globosa* when stained with osmium acid, and that notwithstanding my having used FLEMMING's liquid (strongly diluted) for staining. How far this is owing to some shortcoming as regards my observations or a difference between the two species I must leave undecided, but it would certainly be odd, if two so closely related species should differ from each other in such an essential point. The zoospores usually contained besides the chromatophores a large drop of Leucosine (fig. 1b), and some small refractive drops which occurred close to the chromatophores (fig. 1c).

I was not fortunate enough to observe the zoospores emerge from the mucilage of the thallus, but as some of the thalli contained

portions wherein hardly any zoospores were left, they unquestionably must escape from the mucilage and swim about freely.

My investigations, though fragmentary necessitate the modification of the interpretation of the differences between the two species. As *P. Pouchetii* and *P. globosa* almost agree with each other in regard to the zoospores and the structure of their vegetative cells, but differ in the shape of their adult thalli, the more or less regular position of the cells in the mucilage, and by their different geographical distribution (*P. Pouchetii* is a cold-water form, and *P. globosa* a more temperate one).

Finally, it remains to be explained, if possible, what organism it is POUCHET has figured as a zoospore of *P. Pouchetii*, and though I have not seen the organism myself, I think I can explain the

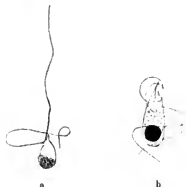


Fig. 2. a) So-called zoospores of *Phaeocystis Pouchetii*, probably *Oxyrrhis* sp. (After POUCHET). b) *Oxyrrhis phaeocysticola* SCHERFFEL (1000:1) (After SCHERFFEL).

matter. SCHERFFEL (1900, p. 3) mentions that in the thallus of *P. globosa* he often met with a flagellate which fed on the cells, he refers it to the genus *Oxyrrhis* and names it *O. phaeocysticola* SCHERFFEL. A form closely allied to it, which is said to be somewhat thicker and shorter (reversed pear-shaped) was found by GRAN (1902, p. 18, footnote) as a regular inhabitant of the thallus of *P. Pouchetii*. If we now compare SCHERFFEL's figure (fig. 81) of *Oxyrrhis phaeocysticola* with POUCHET's so-called zoospore of *Phaeocystis Pouchetii*, there can hardly be any doubt that we have here the same organism or at least two very closely allied organisms. I therefore think that I am justified in saying that POUCHET's figure of the zoospores of *Phaeocystis Pouchetii* is incorrectly interpreted, as it

represents the parasite *Oxyrrhis* which lives in *Phaeocystis*, and that the zoospores of *Phaeocystis Pouchetii* have now for the first time been described.

References to Literature.

- GRAN, H. H. (1902): Das Plankton des Norwegischen Nordmeeres von biologischen und hydrographischen Gesichtspunkten behandelt, p. 17—20. — Report on Norwegian Fishery- and Marine-Investigations. II. 1902. Nr. 5.
- LAGERHEIM, G. (1893): *Phaeocystis*, nov. gen., grundadt på *Tetraspora Pouchetii* HAR. — *Botaniska Notiser*. 1893. p. 32.
- (1896): Über *Phaeocystis Pouchetii* (HAR.) LAGERHEIM, eine Plankton-Flagellate. — Öfv. af K. Svenska Vetensk.-Akad. Förhandl. 1896. Nr. 4.
- OSTENFELD, C. H. (1903): Phytoplankton from the Sea around the Færøes, p. 598—607. — *Botany of the Færøes II*. Det Nordiske Forlag. Copenhagen 1903.
- (1899, 1900): KNUDSEN, M. and OSTENFELD, C.: Iagttagelser over Overfladevandets Temperatur, Saltholdighed og Plankton paa islandske og grønlandske Skibsrønter i 1898 (København 1899), p. 87; og i 1899 (København 1900), p. 71.
- POUCHET, G. (1892, 1): Sur une Algue pélagique nouvelle. — *Comptes rendus des Séances de la Société de Biologie*, Séance d. 16 Jan. 1892.
- (1892, 2): Sur la faune pélagique du Naalsøefjord (îles Færø). — *Comptes rendus des Séances de l'Académie les Sciences*. t. 114. 1892. p. 86—87.
- (1894): Voyage de „La Manche“ à l'île Jan-Mayen et au Spitzberg (Juillet-Août 1892). — E. Leroux, Paris. 1894.
- SCHERFFEL, A. (1900): *Phaeocystis globosa* nov. spec., nebst einigen Betrachtungen über die Phylogenie niederer, insbesondere brauner Organismen. — *Wissenschaftliche Meeresuntersuchungen*. N. F. Bd. 4. Abt. Helgoland. Heft 1. 1900.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical
Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Archiv für Protistenkunde](#)

Jahr/Year: 1904

Band/Volume: [3 1904](#)

Autor(en)/Author(s): Ostenfeld Carl Emil Hansen

Artikel/Article: [Phæocystis Pouchetii \(Hariot\) Lagerh. and its Zoospores. 295-302](#)