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OBSERVATIONS ON SOME INTERESTING FRESHWATER ALGAE FROM THE NETHERLANDS

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SUMMARY

Records are presented of seventeen algae: fourteen Chrysophycean, two Chlorophycean and one Phaeophycean species. Most were growing on glass slides, submerged in small lakes and ditches in the Western part of the Netherlands.

1. INTRODUCTION

In the course of the last few years, systematic and ecological investigations on benthic algae have been carried out by placing artificial substrates, i.e. glass microscope slides in natural habitats. A review of the different aspects of this method is given by SLADECKOVA (1962). The slides proved to be a very efficient means to sample the smaller benthic species, and to study the prostrate parts of larger algae (*Stigeoclonium* spp., *Chaetophora* spp. for example), which might be destroyed when scraping the algae off natural substrates.

In this way, several interesting species have turned up, some of which had not yet been recorded for the Netherlands. Among these are several benthic Chrysophyceae. When trying to identify these species, interesting taxonomical problems turned up; therefore, some of the multicellular Chrysophyceae are subject of further research.

The species concerned are:

Class Chlorophyceae,		
Order Chaetophorales,	Fam. Dicranochaetaceae	*Dicranochaete reniformis* Hieronymus
O. Chlorococcales,	Fam. Chlorococcaceae	*Ectogeron elodeae* Dangeard
Class Xanthophyceae		
O. Mischococcales	Fam. Mischococcaceae	*Mischococcus confervicolum* Naegeli
Class Chrysophyceae,		
Subclass Acontochrysophycidae,		
O. Phaeoplacales,	Fam. Sphaeridiothricaceae	*Sphaeridiothrix compressa* Pascher & Vlk
	Fam. Phaeoplacaceae	*Phaeoplaca thallosa* Chodat

O. Rhizochrysidales,	Fam. Stylococcaceae	*Lagynion scherffelii* Pascher
		Lagynion janei Bourrelly
		Stephanoporus tubulosus Pascher
Subclass Heterochrysophycidae,		
O. Chromulinales,	Fam. Chrysosphaeraceae	*Chrysosphaera gallica* Bourrelly
	Fam. Chrysococcaceae	*Chrysopyxis* cf. *bipes* Stein
	Fam. Chrysochaetaceae	*Chrysochaete brittannica* (Godward) Rosenberg
O. Ochromonadales,	Fam. Dinobryaceae	*Epipyxis borgei* (Lemmerman) Hilliard et Asmund
		Epipyxis utriculus Ehrenberg
	Fam. Ruttneraceae	*Ruttnera spectabilis* Geitler
	Fam. Phaeothamniaceae	*Apistonema pyrenigerum* Pascher
		Phaeothamnion borzianum Pascher

Almost all observations were made on algal material from the "Botshol", an irregularly shaped pond of about two square kilometers, situated nine km South of Amsterdam. This small lake originated in the past centuries as a result of extensive peat-digging; this type of lake is common in the Western part of the Netherlands. Chlorinity of the water in the "Botshol" averages about 0.4‰; it may be classified as eutrophic, oligo- to bêta-mesosaprobic (VAN LIERE & HILLEBRAND 1976).

2. MATERIALS AND METHODS

Microscope glass-slides were inserted into plexiglass holders, either containing a horizontal row of slides, or several slides above each other. These holders were fastened to wooden poles or stainless steel rods, and placed among the reed-stems along the water's edge at a maximum depth of about 70 cm.

Time of exposition to periphyton growth varied from two to four weeks.

3. SOME OBSERVATIONS ON A NUMBER OF THE SPECIES MENTIONED

3.1 Chlorophyceae

– *Dicranochaete reniformis* Hieronymus

Found in an isolated, small pool in the Botshol, in October 1972. Cells possessed one dichotomously branched seta, originating from the side. A few empty cells without top were observed, showing a large pore from which zoids had presumably issued (see *fig. 1*).

– *Ectogeron elodeae* Dangeard

Observed in October 1972 in large numbers on slides from the deeper part (50–70 cm, below water surface) of one transect in the Northern part of the Botshol. Cell shape varied from roughly circular to bean-shaped, with irregular outline and thick cell-wall; diameter measured up to 120 μm.

This species was also found to occur on slides, submerged in the pond of the Hortus Botanicus of the Free University at Amsterdam, in autumn 1973.

3.2 Xanthophyceae

– *Mischococcus confervicolum* Naegeli

This species was encountered frequently in the Botshol, in autumn 1972 and spring 1973, on glass slides and on natural substrates, like reed-stems and epiphytic on filamentous algae (*Oedogonium* spp., *Stigeoclonium* spp.). It was always found with well-developed narrow gelatinous stalks and clearly visible old mothercell walls (see *fig. 2*), as also illustrated by FOTT (1971), and BOURRELLY (1968).

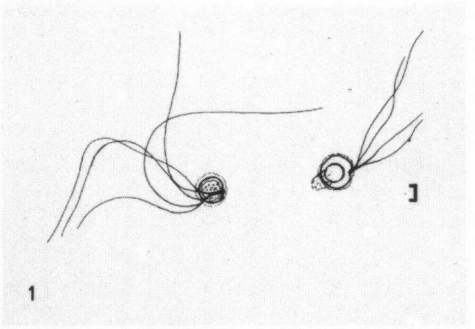
PRESCOTT (1970) illustrated it in a form with club-shaped stalks, enveloping the cells at their ends, as is also mentioned by PASCHER (1925b).

3.3 Chrysophyceae

– *Apistonema pyrenigerum* Pascher

This species was found at several localities: Botshol, Nov. 1973, growing in palmelloid patches of several cm^2 on submerged reed-stems and on glass slides in the filamentous form; Amsterdamse Bos, May 1974, growing on wooden pilings along a ditch, several cm's above water level and in autumn 1973 on the Dutch Wadden Island Schiermonnikoog, beach-plain, in small clumps in the sandy bottom. All these clones have exactly the same aspect as the material described by Pascher: branched filamentous thalli of elongate cells, with one or two chromatophores one of which has a prominent pyrenoid. The cell wall is thick: daughter-cells are enclosed in the old mother-cell walls (see *fig. 3*).

In recent years, several coccolithophorids and benthic *Apistonema*-like thalli have been demonstrated to be different phases in one life-history: *Pleurochrysis scherffelii* Pringsh. (PARKE 1961), *Hymenomonas carterae* (VON STOSCH 1955), *H. roseola* (= *H. coccolithophora*; VALKANOV 1962). Especially the marine organisms have been the subject of extensive electronmicroscopical research. Of the freshwater coccolithophorids, so far only *Hymenomonas roseola* Stein has been studied in this way (MANTON & PETERFI 1969).



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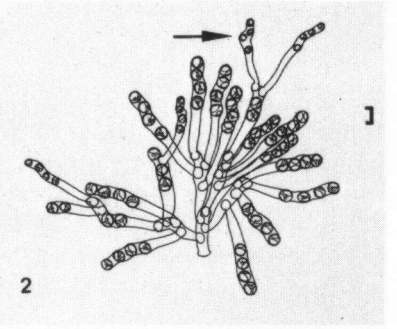

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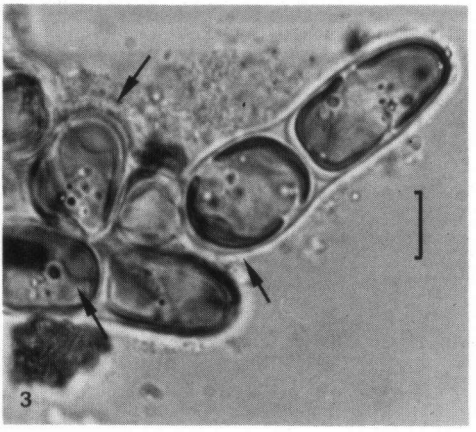

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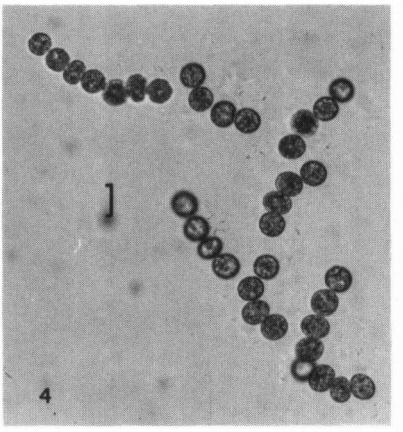

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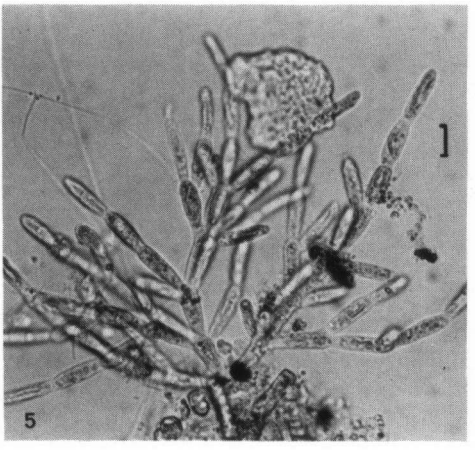

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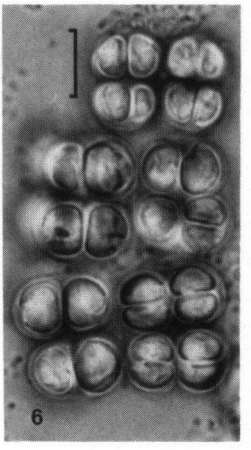

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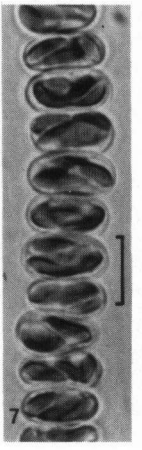

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All *Apistonema*-clones isolated by us showed a wide range of salinity tolerance thus far, in accordance with the findings of BONEY & BURROWS (1966). Culturing experiments are being conducted to find out whether the freshwater clones are part of the life cycle of *Hymenomonas roseola* (which was found to be present in planktonic samples from the Botshol and Amsterdamse Bos).

– *Chrysochaete brittannica* (Godward) Rosenberg

This species was at first found growing on slides in the Botshol in October 1972, and later also in quite a number of other waters where slides were suspended, e.g. the pond of the Hortus Botanicus of the Free University, Amsterdamse Bos, ditches in the polder area South of Amsterdam, a peat-pond "'t Hol" near Kortenhoef, and on reed-stems in a peat-pond in the Stichts-Ankeveense polder, between Amsterdam and Utrecht.

On a number of occasions, the mucilaginous hairs were not present, as mentioned by TSCHERMAK-WOESS (1971) and GEITLER (1968); there could be no doubt as to its identity however, in view of the similarity to figures given by ROSENBERG (1941) and overall similarity to observed thalli that did possess mucilage hairs.

– *Chrysopyxis* sp.

Found epiphytically on *Spirogyra* spp., *Zygnema* spp., *Oedogonium* spp., growing on slides, suspended in an isolated part of the Botshol, in October 1972, November 1973 and October 1975. The shape of the lorica corresponds exactly to the one figured by BOURRELLY (1957, 1968) as "*Chrysopyxis* sp. near to *Ch. bipes* Stein".

– *Chrysosphaera gallica* Bourrelly

This species was first found in the Botshol, growing epiphytically on reed-stems in October 1973, and on glass-slides in April 1974. Later, it was also found on slides from the pond of the Hortus Botanicus of the Free University and from ditches and pools in the vicinity of Amsterdam. Because of some interesting features in its reproduction, it is cultured in the laboratory for further research.

– *Phaeoplaca thallosa* Chodat

This species was found in the same isolated water as *Chrysopyxis* sp., *Phaeothamnion borzianum* and *Sphaeridiothrix compressa.*

Fig. 1. *Dicranochaete reniformis.* Note narrow mucilage investment around cells and open top in right cell.
Fig. 2. *Mischococcus confervicolum.* Note small size of newly emerged autospores (arrow)
Fig. 3. *Apistonema pyrenigerum*, field material. Note clearly visible cell walls and prominent pyrenoids (arrows).
Fig. 4. *Phaeothamnion confervicolum*, palmelloid state, cultured material.
Fig. 5. The same, long-celled form, field material.
Fig. 6. *Ruttnera spectabilis*, cultured material. Note regular arrangement of cells.
Fig. 7. *Sphaeridiothrix compressa*, cultured material. Note two well-developed plastids in cells and rather strong compressing of cells.

Scale bar in all figures equals 10 μm

BOURRELLY (1957, 1968) places this genus in the subclass Acontochrysophycidae on account of the presence of non-flagellated zoospores in one of the two species (*Ph. baicalensis* = *Chrysothallus baicalensis* Meyer 1930). This is argumented in the following way: "l'Auteur (MEYER 1930) a vu une zoösporulation avec zoöspore sans fouet" (BOURRELLY 1957) and "La zoösporulation a été observé par Meyer (loc. cit.); les zoöspores, dépourvues de fouets, possèdent des vacuoles contractiles" (BOURRELLY 1968).

Upon checking Meyer's original publication, the text reads: "Leider ist mir nicht gelungen die Zoösporen, sowie ihren Austritt, zu beobachten". In one of his plates however, he figures two "stehengebliebene Zoösporen". without flagellae, which may have been the cause for the above mentioned misunderstanding. The question of its exact systematic position thus remains open, and has to await knowledge of its zoospores. Meyer's alga certainly belongs in the genus *Phaeoplaca* however; there is great similarity between his figures, those of MATVIENKO (1951) for *Chr. baicalensis*, and those of *Phaeoplaca thallosa* as given by BOURRELLY (1957, 1968), MARGALEF (1948), SMITH (1950) and SKUJA (1948). The material from the Botshol was brought into culture, and experiments are being conducted to investigate its taxonomic position, especially in view of its possible conspecificity with *Chrysochaete brittannica* as mentioned by GEITLER (1968) and TSCHERMAK-WOESS (1971).

– *Phaeothamnion borzianum* Pascher

This species was found on glass slides from an isolated part of the Botshol in autumn 1972 and 1973. It was identified according to PASCHER (1925a) on account of its zoospores (with stigma), which were observed when it was brought into culture.

On glass-slides, the usually illustrated long-celled form as well as the palmelloid state was observed, see *figs. 4, 5.*

GEITLER & SCHIMAN-CZEIKA (1970) observed another species of this genus in Austria, and mentioned that the palmelloid state is found more often than the long-celled form; this holds also true for our species.

– *Ruttnera spectabilis* Geitler

This species was found in the Amsterdamse Bos, May 1974, on wooden pilings above the water level, together with *Apstonema pyrenigerum*, and in the beach-plain of Schiermonnikoog, also accompanied by the same species.

When brought into culture, it showed a transition from the unicellular thick-walled thallus as found in freshly-collected material, into sarcinalike cubic cell-groups (see *fig. 6*). After the cultures had aged, it reverted to the unicellular form.

Zoïdangia were observed as well as zoïds; these were slightly banana-shaped and isokont. GREEN & PARKE (1974) have described this species in detail by investigating the zoids with the electron microscope: they showed it to belong to the class Haptophyceae. More recently, the same authors (1975) come to the conclusion that this species is conspecific with *Chrysotila lamellosa* Anand.

– *Sphaeridiothrix compressa* Pascher et Vlk

Found on slides and reed-stems in an isolated part of the Botshol in autumn

1972, 1973 and spring 1974. GEITLER & SCHIMAN-CZEIKA (1970) propose this species to be identical to *Phaeothamnion confervicolum*; in the last species they found long, unbranched palmelloid thalli, suggesting the appearance of *Sphaeridiothrix compressa*. This does not seem to be very probable; when brought into culture *S. compressa* constantly shows closely appressed oval cells of about 8 × 12 μm, and an unbranched filamentous habit, reaching maximum length of two or three cm (see *fig. 7*).

The palmelloid *Phaeothamnion* shown by GEITLER & SCHIMAN-CZEIKA (1970) has round cells however, as do our cultured clones of palmelloid *Ph. borzianum*, which constantly show a densely branched habit, forming clumps of about one mm diameter.

Since ANDREWS (1970) showed *S. compressa* to possess *Ochromonas*-like zoospores, the taxonomic position of this species is in the subclass Heterochrysophycidae, order Ochromonadales, suborder Phaeothamniineae (not Phaeothamnionineae, as BOURRELLY 1957, 1968 spells the name).

3.4. Phaeophyceae

– *Porterinema fluviatile* (Porter) Waern

This species was first found in the Botshol in spring 1974, growing epiphytically on *Rhizoclonium hieroglyphicum*, floating among reed-stems. Later on it was also found growing on submerged slides in the Botshol, in the pond in the Hortus Botanicus of the Free University, in a ditch in the Amsterdamse Bós and on reed-stems in a peat-pond in the Stichts-Ankeveense polder. At first it was thought to be a form of *Pleurocladia lacustris* (also growing in the Botshol), but when brought into culture, and reproduction was induced, the characteristic crown-shaped terminal and quadrate intercalary plurilocular sporangia proved it to be *Porterinema fluviatile*.

WAERN (1952, 1957) considers it to be a truly brackish species. If this is so, it certainly penetrates deeply into freshwater as well as into marine environments: chlorinity of the above-mentioned Dutch waters is as low as about 0.3‰.

WILCE, WEBBER & SEARS (1970) and RHODES (1972) consider *Porterinema marina* (JAASUND 1965), found in marine habitat on the North Norwegian coast, rightly to be conspecific with *P. fluviatile*. This means that *P. fluviatile* has a remarkably large salinity tolerance; it seems to have the same type of distribution as *Pleurocladia lacustris*, which is also found in freshwater as well as in marine habitats (WILCE 1966).

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