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CONTRIBUTION TO OUR KNOWLEDGE OF DUTCH FRESHWATER ALGAE. I

BY

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This paper, the first of an intended series on rare or otherwise interesting Dutch freshwater algae, deals with some planktonic algae observed in the waters of the Loenerveense Polder. The Loenerveense Polder is a large shallow pondlake with an average depth of about 1.5 meter. The vegetation mainly consists of *Potamogeton* spp. and *Chara* spp. with large patches of *Fontinalis antipyretica* L.

The pH is fairly constant and ranges from 7,8 to 8,7, with highest values in summer. Colour ranges from 19 to 28; $KMnO_4$ consumption from 22 to 30 p.p.m.; chloride from 37,5 to 48,5, and bicarbonate from 86 to 118 p.p.m. Bicarbonate hardness in german degrees varies from 4,0 to 5,4. NO_2 is present in concentrations varying from 0 to 0,14 p.p.m. The O_2 content is rather constant, with maxima in summer: 8,4 to 15,1 p.p.m. Other chemical data are not available.

On account of composition and productivity of the plankton the pondlake must be regarded as slightly eutrophic.

In the Loenerveense Polder a rich phytoplankton community was found; rich at least in species, though rather poor in individuals. Several interesting algae were observed, from which in this paper *Gloeoactinium limneticum* G. M. Smith, *Dinobryon suecicum* var. *longispinum* Lemmermann and two new species of the genus *Kephyrion* are discussed and described.

Gloeoactinium limneticum G. M. Smith.

This alga, described in 1926 by Smith from Iowa, America, had never been found since its discovery (Huber-Pestalozzi, private communication). This may be due, as is explained below, to the special conditions under which the alga seems to live.

Gloeoactinium was observed for the first time in the beginning of 1951, on Jan. 17th, in a sample of nannoplankton at a water temperature of 1° C. From then on the alga was present in varying numbers till April 18th, when it was observed at a water temperature of 8° C. As soon as the temperature of the water rose above 10° C, the alga disappeared from the plankton. Maximum development was reached during the month of March at temperatures varying from 1,5 to 7,5° C. At that time the maximum number of colonies was 23,1 per c.c. at a water temperature of 2,5° C, and 13,1 per c.c. at a watertemperature

of 7,5° C. The alga reappeared, after a prolonged absence, on Dec. 1951 at a water temperature of 1° C. The number of colonies per c.c. amounted at this time to 0,1.

This time the alga remained present in the plankton till April 9th 1952, the temperature ranging from 1,0 to 8,5° C.

Maximum development in 1952 occurred during the second half of March at a temperature ranging from 3,0 to 5,2° C, the maximum number of colonies per c.c. being 15,2 at a temperature of 5,2° C.

In both 1951 and 1952 the temperature ranges in which *Gloeoactinium limneticum* appeared and developed were nearly identical. In both years maximum development took place between 1,5 and 7,5° C.

It is evident from these observations that *Gloeoactinium limneticum* belongs to the stenothermic coldwater forms, and is therefore present in the plankton community during a fairly short period only.

There is a small difference in the ranges at which maximum development occurred; in 1951 the range was: 1,5 — 7,5° C, in 1952: 3,0 — 7,3° C.

The maximum in the population in 1952 was also lower than in 1951. This may be explained by the fact that in 1952 the temperature rose steadily and rather quickly, so that the favourable range was soon passed. In 1951, however, the temperature did not rise steadily but dropped now and then, in this way prolonging the period favourable for maximum development. In 1951 the maximum development of the alga extended over a period of six weeks, during which the temperature rose slowly from 1,5 to 7,5° C, then dropping again to 6° C. In 1952, however, maximum development took place during three weeks only, in which time the temperature rose quickly from 3,0 to 7,3° C, and did not return to lower values.

It is evident that the quicker rise in temperature in 1952 may have caused the shortened period of development in that year. From these observations it is clear that *Gloeoactinium limneticum* is able to live in the plankton only at temperatures varying between 0 and 8° C, while its optimum is found at circa 5° C. The development increases in the range of 0–5° C and decreases in the range from 5° C upwards. Above 10° C the alga disappears from the plankton completely.

TABLE I

Periodicity of *Gloeoactinium limneticum* G. M. Smith.

	1951									
date	17/1	25/1	5/2	19/2	5/3	19/3	2/4	16/4	1/6	17/12
number/c.c.	1,7	1,7	2,3	4,2	23,1	13,1	5,3	1,4	—	0.1
temp.	1,0	4,0	3,2	1,5	2,5	7,5	6,0	7,8	10,5	10,0

	1952								
date	15/1	28/1	14/2	25/2	10/3	24/3	9/4	22/4	6/5
number/c.c.	0,3	0,2	2,7	4,0	15,4	2,0	1,6	—	—
temp.	3,0	0,8	1,5	3,0	5,2	7,5	8,5	14,0	15,2

Dinobryon suecicum var. **longispinum** Lemmermann. Fig. 1a–e.

This alga too is a new record for the Dutch flora. It was observed in the Loenerveense Polder and in some other pondlakes of the same

region (Het Hol and the Kortenhoefse Plassen). In the Loenerveense Polder it has been observed for two years in succession in the nannoplankton. It could be found throughout the year, but most frequently in spring and early summer, at a temperature range of 7 to 20° C. Below 7° C and above 20° C the species becomes rare, though it was found several times in the summerplankton at values above 20° C. No maximum development of any importance occurred. Largest numbers reached were 1,5 per c.c. in 1951 at a water temperature of 10,5° C and 1,8 per c.c. in 1952 at a temperature of 7,5° C.

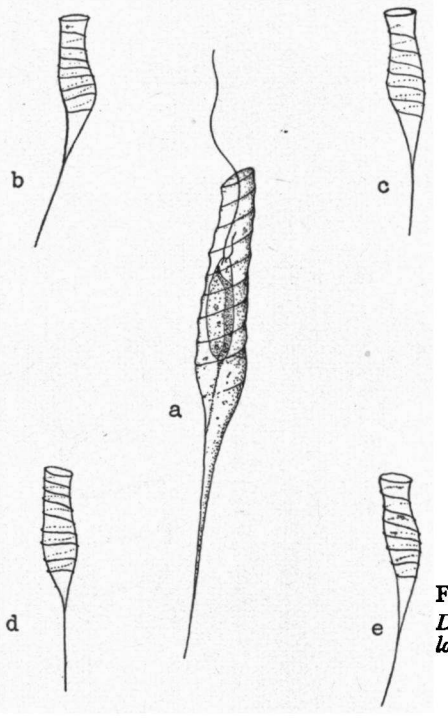

Fig. 1.
Dinobryon suecicum var. *longispinum* Lemmermann.

The specimens found in the Loenerveense Polder agreed very well with the descriptions given by LEMMERMANN (1904), SKUJA (1948), and LUND (1952). The envelop is very delicate, constricted below the apex, which is always obliquely set. The posterior end narrows into a long fine stalk. Across the wall of the envelop runs a spiral band, which is not, as LUND (1952) states, confined to the anterior end of the envelop. The spiral band makes 7–10 turns in the specimens observed in the Loenerveense Polder, and 7–13 in specimens from other places. The envelop with stalk measures 28–53 μ; this is more than the length recorded by LEMMERMANN (1904) viz. 32–34 μ, SKUJA (1948) viz. 30–40 μ, and LUND (1952) viz. 32–43 μ. The greatest width is 4–6 μ in the posterior part of the envelop. The length of the stalk varies from 14–23 μ, which is considerably more than the length recorded

by LEMMERMANN (1904) viz. 12–13 μ, SKUJA (1948) viz. 15 μ, and LUND (1952) viz. 10–15 μ.

The oval protoplast is fixed to the wall of the envelop by a delicate thread, which is contractile. Its location within the envelop varies, and is not always in the anterior part, as LUND (1952) states, but often in the posterior part. The protoplast measures 12 μ in average length and 3 μ in width. There are two flagella, of which one is about four times shorter than the other one, and does not project beyond the envelop. The large flagella (average 12 μ) is bent backwards when the alga is swimming. There is a single parietal chromatophore coloured yellow-brown and provided with a small red stigma in the anterior part.

Sometimes two chromatophores were observed; according to Skuja (1948) this occurs shortly before multiplication.

The form of the envelop may vary somewhat, as shown in Fig. 1b–e.

Kephyrion annulatum spec. nov. Fig. 2a–b.

Diagnosis.

The envelop is oval, with greatest width halfway, rounded at the posterior end, and with a conical apex. Three rather thick bands run straight or, more rarely, in an oblique direction across the wall of the envelop.

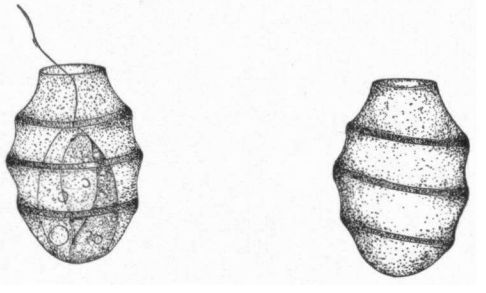

Fig. 2a–b. Kephyrion annulatum spec. nov.

These bands are rings, and form no spiral as in *Kephyrion spirale* (Lackey) Conrad. The protoplast is often very difficult to observe, on account of the dark brown colour of the envelop. There is a single parietal yellow-brown chromatophore. A small round and red stigma is present at the base of the single flagellum. One contractile vacuole has been observed; it is situated in the posterior half of the cell.

The protoplast is metabolic and situated in the posterior part of the envelop.

Measurements:	protoplast:	length	7–9 μ
		width	4–6 μ
		flagellum	10–11 μ
	envelop:	length	10–12 μ
		width	6–8 · μ
		aperture (diam.)	2,5–3,5 μ

Kephyrion annulatum spec. nov.

Lorica ovalis, brunnea, conica in parte anteriori, rotundata in parte posteriori, symmetrica, transverse annulata, annulis 3; 10–12 μ longa, 6–8 μ lata, diam. oris 2,5–3,5 μ.

Protoplastus in parte posteriori loricae affixus, 7–9 μ longus, 4–6 μ latus. Flagellum singulum, 10–11 μ longum. Chromatophorum luteo-brunneum, parietale, stigmate rubro, rotundo, apicaliter locatum. Vacuolus contractilis singulus, in parte posteriori locatus.

Monadae libere natantes, nannoplanctonicae.

Kephyrion annulatum is related to *Kephyrion ovale* (Lackey). It differs from this species in the larger dimensions and the fewer and coarser rings on the wall of the envelop. With *Kephyrion cupuliforme* Conrad, the new species is the largest known member of the genus. In the Loenerveense Polder *Kephyrion annulatum* is most frequent in spring, but has occasionally been found in the summer months also. It occurs at a temperature range from 1 to 19° C.

Kephyrion colliferum spec. nov. Fig. 3a–c.

Diagnosis.

The envelop is egg-shaped, with a rather thick wall. The posterior end is rounded, the anterior end furnished with a small collar, which

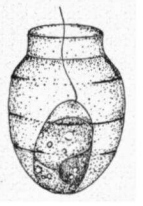

Fig. 3a

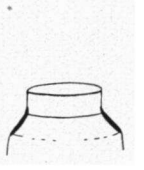

Fig. 3b

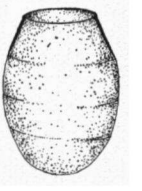

Fig. c

Fig. 3a–c. Kephyrion colliferum spec. nov.
a. normal specimen, b. detail of collar, c. specimen without collar.

is not hyaline. Just below the collar the wall is thickened as in *Kephyriopsis ovum* Pascher et Ruttner. Only rarely the collar is missing, than the thickened part of the lorica is found directly at the orifice. Two or three poorly developed bands run across the wall of the envelop. The protoplast is often very difficult to observe in detail, because of the dark brown colour of the receptacle. The following observations on the protoplast have been made in young specimens with a lighter coloured envelop.

There is a single yellow-brown chromatophore resting against the side of the cell. The single flagellum is of about body-length. A stigma and vacuole have not been observed, but may be present. Reproduction by normal cell-division, the new envelop of the daughter cell being formed in free-swimming state.

Measurements:	protoplast:	length	4–6 μ
		width	3–4 μ
		flagellum	5–7 μ
	envelop:	length	6–8 μ
		width	5–6 μ
		aperture (diam.)	1,5–2 μ

Kephyrion colliferum spec. nov.

Lorica ovalis vel obovata, brunnea, symmetrica, cum collo parvo in parte anteriori. Pars loricae ante collo crassior.

Lorica transverse annulata, annulis 2 vel 3; 6–8 μ longa, 5–6 μ lata, diam. oris 1,5–2 μ.

Protoplastus obovatus vel ellipsoideus, 4–6 μ longus, 3–4 μ latus. Chromatophorum singulum, luteo-brunneum, laminiforme, parietale, sine stigmate. Flagellum singulum, 5–7 μ longum.

Monadae libere natantes, nannoplanctonicae.

Kephyrion colliferum has been found throughout the year, except in November, December and January, in varying numbers in the nannoplankton.

It occurred at a temperature ranging from 1,5 to 20° C. In 1951 the alga developed a slight maximum in May–June at a water temperature of 10 to 19° C. Reproduction was observed during this maximum.

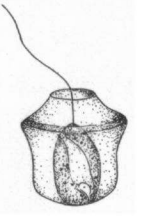

Fig. 4

Fig. 5

Fig. 4. Kephyrion rubri-claustri Conrad.
Fig. 5. Stenokalyx laticollis Conrad.

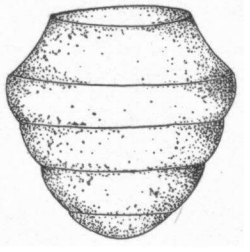

Fig. 6

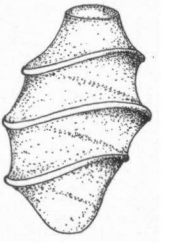

Fig. 7

Fig. 6. Kephyrion hemisphaericum (Lackey) Conrad.
Fig. 7. Kephyrion spirale (Lackey) Conrad.

In January and February two other members of the *Lepochromulinoideae* were observed in the nannoplankton of the Loenerveense Polder viz. *Kephyrion rubri-claustri* Conrad (Fig. 4) and *Stenokalyx laticollis* Conrad (Fig. 5).

To the species of the genus Kephyrion known to occur in the waters of the Netherlands (*Kephyrion cupuliforme* Conrad, *K. doliolum* Conrad and *K. ovum* Pascher) two further ones may be added, viz. *Kephyrion hemisphaericum* (Lackey) Conrad (Fig. 6) and *K. spirale* (Lackey) Conrad (Fig. 7). Both species have been found in freshwater ditches and small ponds in the neighbourhood of Amsterdam.

My thanks are due to Dr G. Huber-Pestalozzi, Zürich and Dr B. Fott, Prague, who kindly gave their opinion on the two new *Kephyrion* species.

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