ACTA SOCIETATIS
BOTANICORUM POLONIAE
Vol. XXX — Nr 3—4
1961

Sweet-Water Algae of Antarctica

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The plant kingdom of Antarctica is almost entirely composed of lichens, mosses, and algae. To the several collections of Antarctic plants a new one composed mainly of land algae was added by O. S. Vialov in 1956.

The algae in Vialov's collection were identified by N. W. Sdobnikova at the Botanical Institute of the Academy of Sciences of the USSR. This paper describes briefly the identified specimens and the stands where they were collected formulating at the same time some conclusions on the occurrence of this algae.

The sweet-water algae of Antarctica are very little known. In the 19th century and at the very beginning of this century a few reports were published describing the algae from the coasts of Victoria Land, of Graham Land, and from some neighbouring islands. All the data then available were assembled by N. Wille in 1924 in his report on the sweet-water algae collected by the German expedition on the ship "Gauss" of 1901 to 1903 led by E. Drygalski. The German expedition explored the same teritories as the 1956 Antarctic Expedition of the Academy of Sciences of the USSR. From this area N. Wille reported 16 species.

In the other parts of the Antarctic coast between 98° and 107° East longitude explored by the Soviet expedition in 1956 (Vialov 1956) sweet-water algae were unknown.

Among the specimens of this investigation 27 species and forms were identified, six of which were previously unknown on Gauss Mt. and Victoria Land. A characteristic trait of this flora is its specific variability. Only very few species of those brought by the Soviet expedition occur also on the lists compiled by various explorers for other parts of Antarctica. The only species reccurring on almost all the lists is *Prasiola crispa* Menegh.

O. S. Vialov's collection was assembled on Gauss Mt. in the neighbourhood of the Mirnyj Station (Mirnyj I and Folmar) and on Bunger's Oasis where they were thrown out on the shore of Figurnoje Lake and of another small unnamed lake.

Here is a short description of these stands.

1. Gauss Mt., the easternmost point visited by our expedition, is a volcanic cone rising 371 m. above sea level. It is built of basaltic lava probably of Upper Teriatry origin. On the north side the mountain drops by a cliff into the sea and to the south there is an ice-field extending at its foot. The south strongly eroded slope of the cone is covered with fine basaltic rubble. At the bottom of this slope at the altitude of a few metres a small stand of half dried algae was found on February 21 among the rock fragments. From this stand two species were identified: *Phormidium tenue* (Menegh.) Gom. and *Chlorella vulgaris* Beyerinck. The second of these species is not on the list of the German expedition of 1901—1903, though the species in that collection are far more numerous (Wille 1924).

2. Along the coast in the vicinity of Mirnyj Station there are black hillocks built of granite and gneisses. The South-East slope of the highest hillock in Mirnyj I has been named the Cape of Ivan Khmara in memory of the tractor-driver killed in an accident in 1956. On this slope specimens of algae were collected on January 21.

Adjoining to the main snow-covered slope there is a flat rock platform where water from the melting snow flows down the rocks in tiny rivulets forming numerous small pools sometimes connected by minute waterfalls and water-filled crevices. The pools are up to one metre long and about 10 cm deep. The bottom of the pools is covered with sand, small unrounded stones, and penguin feathers left over from the sheddings of the previous seasons. In the main chain of the pools with flowing water the stones and the feathers, at the bottom as well as a parts of the banks were covered by a very thin brown film with small bubles of air caught under it. The film was mainly composed of blue-green algae, mostly from the genus *Phormidium*. In one place on a stretch of sand washed over by flowing water there were a few green tufts of green algae which looked like "salad leaves".

The full list of species from this stand is as follows: *Synechococcus major* Schröt. f. *crassus* (Archer) Elenk., *Microcystis muscicola* (Menegh.) Elenk., *M. parietina* (Näg.) Elenk., *M. pulverea* (Wood) Forti emend. Elenk. f. *irregularis* (B. Peters) Elenk., *Gloeocapsa crepidinum* Thur., *Chlorogloea* sp., *Stratonostoc Linckia* (Roth.) Elenk., *Phormidium autumnale* (Ag.) Gem., *Ph. frigidum* F. E. Fritsch, *Ph. subcapitatum* B. Peters., *Schizothrix Lenormandiana* Gom., *Chlorococcum infusionum* (Schrank) Menegh., *Chlorella vulgaris* Beyerinck, *Prasiola crispa* Menegh., *Tabellaria flocculosa* (Roth) Kutz., *Navicula* sp., *Hantzschia amphioxys* (Ehr.) Grun.

Prasiola crispa and various *Phormidium* species were the most numerous, whereas the other algae were only an admixture.

3. On Folmar Island, the closest island off Mirnyj Station, algae were collected on January 15 in the central part of the suothern coast of the island. The island is built of substratum rocks (granitoids). The algae were collected in a small crevice in which sand and gravel from the weathering of rocks saturated with water from the melting snow accumulated.

On this stand the algae formed a bright green patch. The growth habit of the algae was of two clearly distinguishable kinds: 1) there were tufts of minute "salad-like" leaves 2—3 mm. high (*Prasiola crispa*) and 2) patches of round, merging clods composed of tiny globules like pin-heads.

The species found on this stand were: *Microcystis muscicola* (Menegh.) Elenk., *M. pulverea* (Wood) Forti emend. Elenk., *M. pulverea* (Wood) Forti emend. Elenk. f. *irregularis* (B. Peters) Elenk., *Gloeocapsa crepidinum* Thur., *Phormidium autumnale* (Ag.) Gom., *Ph. tenuissimum* Woronich., *Chlorococcum infusionum* (Schrank) Menegh., *Chlorella vulgaris* Beyerinck, *Prasiola crispa* Menegh.

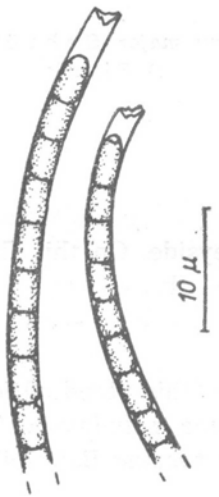

Fig. 1. *Phormidium subcapitatum* B. Peters

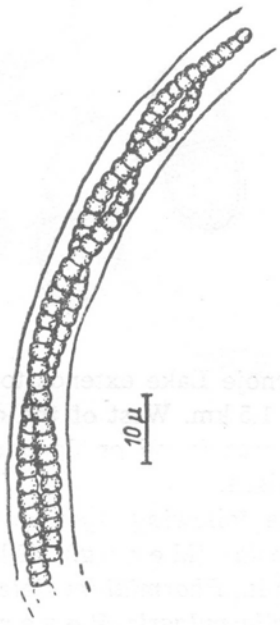

Fig. 2. *Schizothrix Lenormandiana* Gem.

At the end of January O. S. Vialov and some other members of the expedition spent several days in the Bunger Oasis, a rather large tract of land with no ice cover. The area there is strewn with small hilocks built of crystalline rocks: granites, gneisses, and crystalline shales.

The valleys between the hillocks are filled with morain material and at their bottom there often are small lakes, some with sweet water others with brackish or even salt water. The camp of the expedition was pitched on the shore of the largest lake which has been named Figurnoje Lake. The Polish "Dobrowolski" Research Station is now situated near this lake.

4. The Figurnoje Lake has flowing water, it is up to 300 m. wide and is very long. It fills a deep winding valley with several bands and side branches making its shape very complicated.

The northernmost part of the lake to the West-North-West of the camp has a distinct character. At this end the lake discharges into a torrent connecting the Figurnoje Lake with another lake which has been named Lagiernoje Lake. The flat and stony nothern shore of the

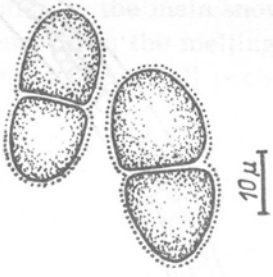

Fig. 3. *Synechococcus major* Schröt. f.*crassus* (Archer) Elenk.

Lagiernoje Lake extends to the precipitous valleyside. On this flat shore about 1.5 km. West of the camp a patch of algae thrown out from the water was found on January 29. They were mainly blue-green filamentous algae.

The following species were identified from this stand: *Microcystis muscicola* (Meneg.) Elenk., *Amorphonostoc paludosum* (Kütz.) Elenk., *Phormidium Retzii* (Ag.) Gom., *Plectonema Battersii* Gom., *Chlorella vulgaris* Beyerinck.

5. Another small lake about 150 m. in diameter was found about one kilometre North-West of the camp in the Oasis. The lake is easy to find because it lies at the prolongation of an elongated surface outcrop of black gabbro-diabase stretching north-westward from the camp. There is another outcrop of gabbro-diabase at the border of a small valley with a salt-water lake at the bottom. Along the gently sloping shore of this lake was a band of algae up to 1.5 m. wide and sometimes even wider. On

this stand the dominant sepcies were blue-green filamentous algae and diatoms (*Amphora* sp.).

The list of species collected from this stand on January 25 is as follows: *Gloeocapsa crepidinum* Thur., *Phormidium Bohneri* Schmidle, *Ph. favosum* (Bory) Gom., *Ph. tenuissimum* Woronich., *Plectonema Battersii* Gom., *Pl. Boryanum* Gom., *Chlorococcum infusionum* (Schrank) Menegh., *Chlorella vulgaris* Beyerinck, *Amphora* sp.

All the identified algae are of three types: *Cyanophyta* (blue-green algae), *Chlorophyta* (green algae), and *Bacillariophyta* (diatoms). The various species of blue-green algae are the most numerous on the list:

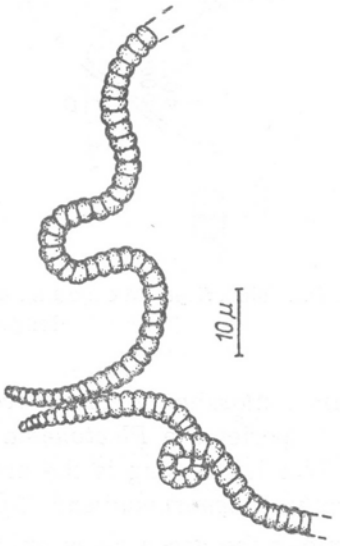

Fig. 4. *Plectonema Battersii* Gom.

they include 20 species which makes 74 per cent of the total number of species. The order *Cyanophyta* is represented by four suborders the most important of which is the suborder *Oscilliatoriales*. We have here a special instance of the general law according to which the representatives of a suborder having the greatest adaptability are the first to occupy the habitats with the most unfavourable conditions. E.g. on the mineral substratum of clay deserts the only pioneers of the plant kingdom are the representatives of the suborder *Oscillatoriales* covering large stretches with a thin felt-like film. On sand and clay deserts, on the barren rocks of polar regions, in hot springs, and in all places where the conditions are extremely unfavourable for the development of life the first place with regard to the number of species and expansion is always occupied by the blue-green algae from the suborder *Oscillatoriales*.

The majority of the *Cyanophyta* species covered by this investigation have a wide ecological amplitude. Only a few of these species are usually found in high latitudes where they have their habitats in cold waters or on cold soils: they are *Synechococcus major* f. *crassus* (fig. 3), *Phor-*

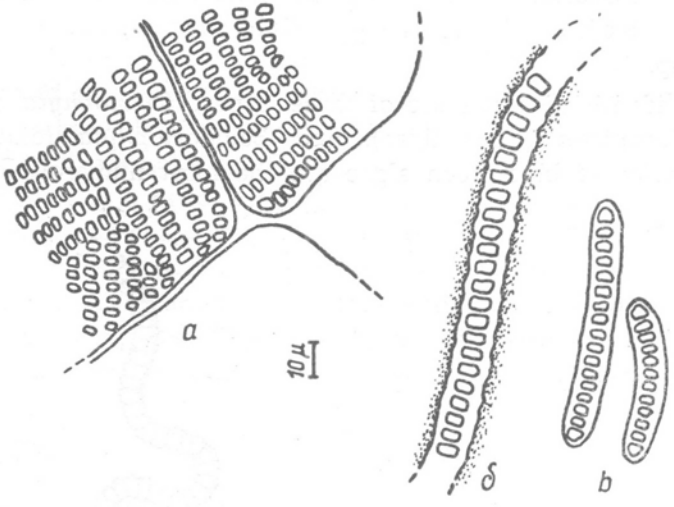

Fig. 5. *Prasiola crispa* Menegh., *a* in the form of membranes, *b* — in the form of long and short threads

midium tenuissimum, Ph. subcapitatum, and *Ph. frigidum.* The typically marine species are *Plectonema Battersii* (fig. 4) and *Gloeocapsa crepidinum.* Worth stressing is the presence in the collection of the rare species *Schizothrix Lenormandiana* (fig. 2) first found on the French coast.

Among the green algae only three species belong to the order *Chlorophyta.* Two representatives of this order belong to the suborder *Proto-*

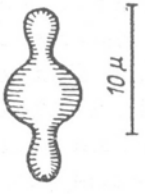

Fig. 6. *Tabellaria flocculosa* (Roth) Kütz.

coccales i.e. *Chlorella vulgaris* and *Chlorococcum infusionum.* Both these species have a very wide distribution extending from the highest to the lowest latitudes. The third species of this order, *Prasiola crispa* from the

suborder *Ulothrichales* (fig. 5 a, b, d), has a rather wide distribution in the world and in Antarctica. A well known ecological characteristic of this last species is its very strong nitrophily. In places where birds collect (in this case penguins) and where the soil is covered with large amounts of their droppings *Prasiola crispa* forms large, silky, wrinkled patches looking like a turf cover clearly discernable with the aked eye.

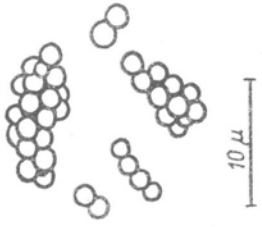

Fig. 7. *Microcystis pulverea* (Wood) Forti emend. Elenk.

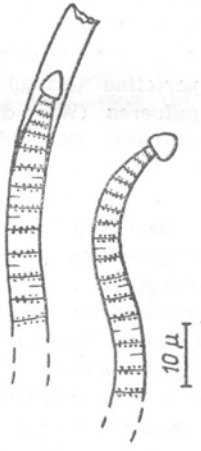

Fig. 8. *Phormidium favosum* (Bory) Gom.

The shed penguin feathers are covered by a thin green-brown film usually formed by two species: *Prasiola crispa* and *Phormidium subcapitatum*. This last species has so far been reported only from Iceland and probably also is a nitrophilous species.

There are only a few species of diatoms in the list of this collection the most common among them being *Hantzschia amphioxys*. As is known this species is almost ubiquitous and has an exceptional ability for adaptation to extremely different conditions. *Tabellaria flocculosa* (fig. 6), which is another representative of the *Bacillariophyta*, is better known as an inhabitant of the northern latitudes and of mountainous regions, but also is an eurythermous species.

A genetically and ecologically interesting trait of the algae of Antarctica is that the dried algae placed in a liquid nutrient medium in June of 1956 did not begin to show signs of life till November, i.e. at the time when the Antarctic summer begins.

The methods applied for the investigation of land algae of moderate latitudes may be inadequate for investigations on Antarctic algae. For

this reason this report on the algae flora from the stands round Mirnyj Station cannot be considered as final and complete.

The list of the collected and identified species of algae is as follows:

CYANOPHYTA

Family *Coccobactreaceae*

1. *Synechococcus major* Schröt. f. *crassus* (Archer) Elenk. (fig. 3)

Family *Microcystidaceae*

2. *Microcystis muscicola* (Menegh.) Elenk.
3. *M. parietina* (Näg.) Elenk.
4. *M. pulverea* (Wood) *Forti* emend. Elenk. (fig. 7)
5. *M. pulverea* (Wood) *Forti* emend. Elenk. f. irregularis (B. Peters.) Elenk.

Family *Gloeocapsaceae*

6. *Gloecapsa crepidinum* Thur.
7. *Chlorogloea* sp.

Family *Nostocaceae*

8. *Amorphonostoc paludosum* (Kütz.) Elenk.
9. *Stratonostoc Linckia* (Roth) Elenk.

Family *Oscillatoriaceae*

10. *Phormidium autumnale* (Ag.) om.
11. *Ph. Bohneri* Schmidle
12. *Ph. favosum* (Bory) Gom. (fig. 8)
13. *Ph. frigidum* F. E. Fritsch.
14. *Ph. Retzii* (Ag.) Gom.
15. *Ph. subcapitatum* B. Peters (fig. 1)
16. *Ph. tenue* (Menegh.) Gom.
17. *Ph. tenuissimum* Woronich

Family *Schizothrichaceae*

18. *Schizothrix Lenormandiana* Gom. (fig. 2)

Family *Plectonemataceae*

19. *Plectonema Battersii* Gom. (fig. 4)
20. *P. Boryanum* Gom.

CHLOROPHYTA

Family *Protococcaceae*

21. *Chlorococcum infusionum* (Schrank) Menegh.
22. *Chlorella vulgaris* Beyerinck

Family *Blastosporaceae*

23. *Prasiola crispa* Menegh. (fig. 5a—B)

BACILLARIOPHYTA

Family *Tabellariaceae*

24. *Tabellaria flocculosa* (Roth.) Kütz. (fig. 6)

Family *Naviculaceae*
25. *Navicula* sp.
26. *Amphora* sp.
Family *Nitzschiaceae*
27. *Hantzschia amphioxys* (Ehr.) Grun.

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