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On the Snow Vegetation of the Grecian Mountains

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Studies of the nivicolous microorganisms of the Bulgarian (K o l, 1956) and Grecian mountains show that the snow vegetation of the Balkanian Mountains is just as interesting and special as its higher flora. As far as I know, no one has as yet examined the nival vegetation of the mountains of Greece.

In this paper, I have worked out the nival collections of professor C. R e g e l, collected for me in 1935. The snow samples examined came from the Taygetos 1900 m, 1. July ; Taygetos 2210 m, July ; Epirus (Smolika) about 2300 m, July. R e g e l' s note is as follows : "Leider war der Sommer so trocken, fast kein Schnee auf den Bergen".

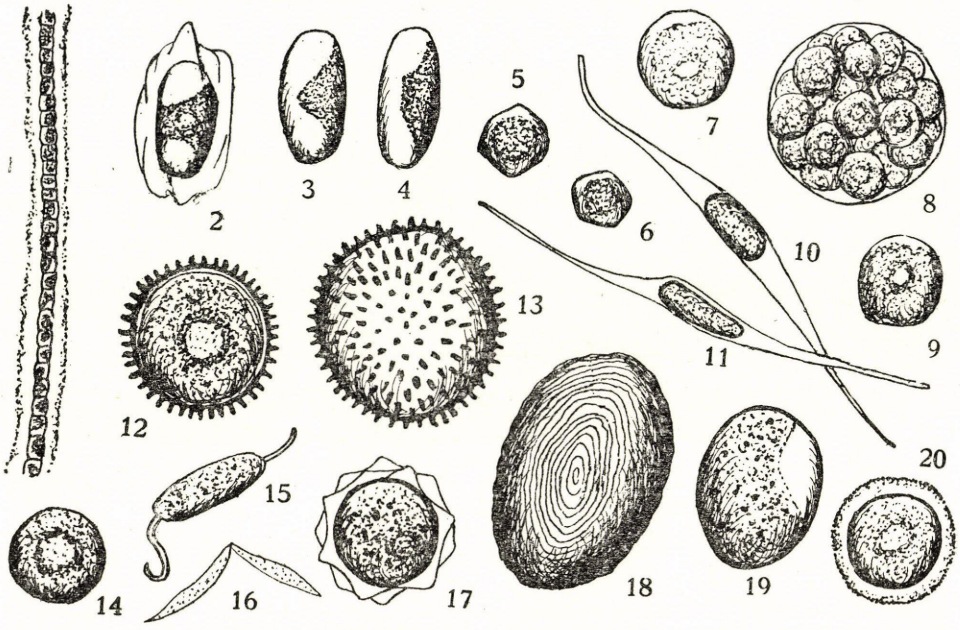
Microorganisms found in the snow samples.

Microorganisms	Taygetos		Smolika (Epirus)
	1900 m	2200 m	2300 m
Algae			
Chlamydomonas nivalis Wille	2	2	2—3
Cystococcus nivicolus Kol			2—3
Gloeotila protogenita Kg.	2	2	
Ophiocytium capitatum Wolle			1—2
Scotiella antarctica F. E, Fritsch ?			1—2
Scotiella nivalis Chodat	1—2	2	2—3
Tetraedron valdezii Kol			2
Trochiscia nivalis Lagerh.			2
Fungi			
Chionaster bicornis Kol			2
Selenotila nivalis Lagerh.		1—2	

Aside of the microorganisms enumerated above, there were Phanerogamous plant detritus, hyphae of fungi, spores and many cryoconites in the snow samples.

As is to be seen in the Table, the snow vegetation of the Smolika is richer, since I found 7 algal and 1 fungus species in the snow samples originating from

this locality, whilst there were but 3 algal and 1 fungus species in the snow of Taygetos. In all snow samples of both localities, *Chlamydomonas nivalis* and *Scotiella nivalis* were present in the highest quantity. Both are the characteristical plants of the highest III. cryovegetational type. The microorganisms identified from these snow samples are all real cryobionts, with some few exceptions *(Gloeotila mucosa, Ophiocytium capitatum)*. Of the nivicolous fungi, *Selenotila nivalis* is characteristical of the snow of the Taygetos, whilst *Chionaster bicornis* is characteristical of the snow of the Smolika.



The nivicolous microorganisms of the mountains of Greece. Fig. 1. *Gloeotila protogenita* Kg. (×1500). — Fig. 2—4. *Scotiella nivalis* (Chodat) Fritsch, various developmental stages. Fig. 2. (×1500), Fig. 3—4. (×1000). — Fig. 5—6. *Tetraedron valdezii* Kol (×2000). — Fig. 7—9. *Cystococcus nivicolus* Kol, Fig. 7, 9. (×1000), Fig. 8. Autosporangia (×1300). — Fig. 10—11. *Chionaster bicornis* Kol (×1000). — Fig. 12. (×1000); Fig. 13. *Trochiscia nivalis* Lagerh. (×1500) — Fig. 14. (×1200); Fig. 17. (×1500); Fig. 20. (×1000), *Chlamydomonas nivalis* resting stage. — Fig. 17. *Zygospore*; Fig. 15. *Ophiocytium capitatum* Wille (×1000). — Fig. 16. *Selenotila nivalis* Lagerh. (×1700). — Fig. 18. (×900); Fig. 19. (×550), *Scotiella antarctica* Fritsch, various developmental stages.

I. Algae

Chlorophyceae

Chlamydomonas nivalis Wille (Fig. 14, 17, 20)

This algal organism appears in the largest quantities and has by far the widest range in the reign of perpetual snow. From the Antarctic to the Arctic regions, it appears everywhere in suitable biotops. I am of the opinion that the name *Chlamydomonas nivalis* is to be regarded as a nomen collectivum, embracing most of the *Chlamydomonas* species causing red snow. Within this group,

the separation of the several species will probably be possible by cultures only.

In the examined snow samples, I have found only the resting stage, the globular cells of 9—15 μ diameters of this alga, the same as in the snow samples collected in Bulgaria.

Figure 20. shows a cell of 15 μ diam. wrapped in a thick mucilage envelope ; I have seen only some few pieces of it. The 15 μ diameter Zygospore is smaller than the one described by W i l l e ; it has the same size as the one living on the snow of the Bulgarian mountains (K o l, 1956). Even the ribbing of the cell wall of the Zygospore (Fig. 17) displays differences when compared with the drawing of W i l l e (P a s c h e r, H. 4. p. 198, Fig. 137). It is highly possible that we have to deal also in this case with an endemic Balkanian form of *Chlamydomonas nivalis*. This suggestion will, however, be validated and wholly cleared by the examination of living material only.

Cystococcus nivicolus Kol (Fig. 7—9).

I have described this alga from the yellow snow of the Bükk Mountains in Hungary (K o l, 1955), where, in the case of large quantities, it causes a butter-yellow discoloration of the snow surface . The globular cells have a diameter of 12—21 μ, the autosporangium being of 21 μ diameter (Fig. 8).

In these snow samples, most of the cells found belonged to *Chlamydomonas nivalis*, *Scotiella nivalis* and *Cystococcus nivicolus* (Table 1). It is also frequent on the snow patches of the mountains of Bulgaria.

Gloeotila protogenita Kg. (Fig. 1.).

The filaments found in the snow samples of the Taygetos are 2,5—3 μ broad. Accordingly, they are much narrower than the plant described by K ü t z i n g ; even so, I regard it as belonging to this species and is a narrower form of it. They are enveloped in a thick mucilage sheath.

W i t t r o c k mentions *Gloeotila mucosa* from the snow of Greenland ; there is a high probability that we are confronted in both cases by a nivicolous form of *Gloeotila protogenita*.

Scotiella antarctica F. E. Fritsch (Fig. 18, 19).

I found two different stages of this alga in the snow samples of the Smolika which I have also seen in the snow samples of the Bulgarian mountains. There is a smooth, elliptical cell, 38 μ broad, 45 μ long (Fig. 19), and another elliptical cell with weakly undulating cell-wall, 35 μ broad, 45 μ long (Fig. 18) ; both are probably different developmental stages of Scotiella antarctica.

This species was also found in the mountains of Bulgaria.

Scotiella nivalis (Chodat) Fritsch (Fig. 2—4.).

The cells are 6—10 μ broad, 10—29 μ long ; I found various developmental stages (Table 1).

One of the furthest ranging cryobionts, frequent also on the snow of the Bulgarian mountains.

Tetraedron valdezii Kol (Fig. 5—6.).

I have described this algal organism from the snow of Alaska. They are cells with thick walls, of a penta- or hexagonal shape, of 5 μ diameter. The plants originating from the snow of the Smolika are smaller than the ones from Alaska.

A *Tetraedron pachydermum* var. *minor* Reinsch. of bigger measurements was found also in the Bulgarian mountains (Kol. 1956).

Trochiscia nivalis Lagerh. (Fig. 12—13)

I found it only in the snow samples of the Smolika, the cells had 20 μ diameters.

Trochiscia nivalis is known from the snow surfaces of both the northern and the southern hemispheres ; it was first described by L a g e r h e i m from the Andes, and was found also in the Bulgarian mountains.

Xanthophyceae

Ophiocytium capitatum Wolle (Fig. 15)

The cells originating from the snow of the Smolika are somewhat smaller than the ones described by W o l l e, they are 4 μ broad and 13 μ long.

It is a cryoxenous microorganism, and probably happened on to the snow surface from the adjacent areas.

II. Fungi.

Chionaster bicornis Kol (Fig. 10—11)

I described this nival fungus from the snow of Alaska ; the specimens found in the snow of the Smolika are 1/3 longer than the Alaskan ones, 5—7 μ broad and 75—80 μ long. Both *Chionaster nivalis* and *Chionaster bicornis* were found in the Bulgarian mountains, whilst only *Ch. bicornis* was present in the snow samples from Greece.

Selenotila nivalis Lagerh. (Fig. 16)

This nival fungus was described by L a g e r h e i m from the snow of the Andes.

It was found in several snow surfaces in Europe ; I found it in samples collected at 2200 m a. s. l., in the snow of the Taygetos.

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