

Abstract

1. Seventeen species of lichens were recognized among the collections from the Prince Olav Coast. Of these lichens, 15 species are new to the flora of the Prince Olav Coast.

2. The 17 species studied include thirteen crustose, two fruticose, and two foliose lichens.

3. Crustose lichens were mostly fertile and both fruticose and foliose ones were thoroughly sterile.

4. The exposed areas of the continent are rich in lichen flora, while only a few lichens can be found on the Ongul Islands.

1. Introduction

The most striking aspect of flora in Antarctica is abundance of cryptogamic plants. The flora is composed mainly of lichens, mosses, hepatics and algae, whereas only two vascular plants (*Deschampsia antarctica* Dev. and *Colobanthus crassifolius* Hook.) are known from the northern parts of the Antarctic Peninsula.

Lichens are the major components of the antarctic flora. They grow on exposed rocks, soil, mosses and other lichens. About 350 species of lichens have been reported from Antarctica (RUDOLPH, 1965). The southern limit of their distribution is at 86°09' S along 131°14' W (WISE and GRESSITT, 1965).

The earliest record of antarctic lichens was made by HOOKER (1847). Since then the taxonomical studies of antarctic lichens have been made by the following botanists: BORCHGREVINK (1895), VAINIO (1903), ZAHLBRUCKNER (1906), HUE (1908, 1915), DARBISHIRE (1910, 1912, 1923), DODGE and BAKER (1938), DODGE (1945, 1948, 1962), LAMB (1939, 1948), LLANO (1950) and others. Recently LAMB (1964) made an excellent study of Usneaceae of the Antarctic Peninsula and adjacent islands. In 1966, FILSON published a book on lichens and mosses of Mac. Robertson Land, which includes many color illustrations of the plants.

These authors, however, investigated lichens mostly from the western part of Antarctica, and the other areas, especially the eastern part of the Antarctica, have scarcely been explored lichenologically.

The Japanese Antarctic Research Expedition (JARE) was started in 1956, and Syowa Station was established on the East Ongul Island (69°00' S, 39°30' E) located near the Prince Olav Coast, East Antarctica. Since then, small collections of mosses and lichens have been made by the members of JARE. MATSUDA (1963, 1964a, 1964b) studied the distribution and microclimate of the moss communities. FUKUSHIMA (1968) reported on the distribution of mosses in the West Ongul Island. HORIKAWA and ANDO (1961, 1967, 1968) made some taxonomic studies about mosses which had been brought back by JARE. In contrast, there is no information about lichens of this area. The writer had a chance to visit Antarctica as a member of the 9th JARE. During his stay in Antarctica, he made field studies on lichens for eight days and made total 480 collections of lichens and mosses of the Ongul Islands and the Prince Olav Coast. The results of taxonomical studies on lichens are reported in this paper, except for species of *Buellia* and *Lecidea*

which should be studied thoroughly.

The writer wishes to express his sincerest gratitude to Prof. Dr. H. SUZUKI and Dr. H. ANDO of the Hiroshima University for their valuable guidance and encouragement in the course of the work. The writer is indebted to Drs. Y. ASAHINA and S. KUROKAWA of the National Science Museum, Tokyo for their helpful suggestions and loan of many specimens, and also to Prof. Dr. M. SATO of the Ibaragi University, Drs. T. MATSUDA and T. HOSHIAI of the National Science Museum, Tokyo for their valuable advice. He is also indebted to the members of the 8th and 9th JARE for their generous help in carrying out the investigations.

2. Materials and Methods

The plants were collected by the writer on the Prince Olav Coast for eight days during the period from January to February in 1968. The original materials obtained included both mosses and lichens and comprised 480 collections from different localities. These materials were carefully sorted into individual species and segregated into 900 herbarium packets of lichens and about 300 packets of mosses.

This paper is based largely on the materials collected by the writer. He also studied some other materials from the same area collected by the JARE members such as Dr. S. NAKANO*, Dr. E. NISHIBORI*, and Dr. T. MATSUDA**. The materials studied are preserved in the Herbarium of Hiroshima University (HIRO) and a complete set of duplicate specimens is kept at the National Science Museum, Tokyo (TNS).

In carrying out the identification of each species, the writer observed chemical ingredients as well as morphological character of the thalli and apothecia. It is obviously very important to consult the chemistry in studying lichens, but there are only a few recent data on the chemistry of antarctic lichens, for example papers by LAMB (1964, 1968).

* Member of the Wintering Party of JARE, 1956–1957.

** Member of the Wintering Party of JARE, 1961–1962.

3. Outline of the Prince Olav Coast

The Prince Olav Coast (lat. 68° – 70° , long. 39° – 45°) is situated in the west of Enderby Land, East Antarctica. It extends for about 400 kilometers along the coast of Antarctic Continent. As shown in Fig. 1, many outcrops and islands are scattered in this area. These outcrops and islands are more or less covered with snow in midwinter and exposed in spring and summer from October to February (TATSUMI and KIKUCHI, 1959).

Collections were made at the following five localities along the Prince Olav Coast; the Ongul Islands; Lang Hovde; some small outcrops located on the opposite side of the Ongul Islands; Cape Hinode; and Molodezhnaya.

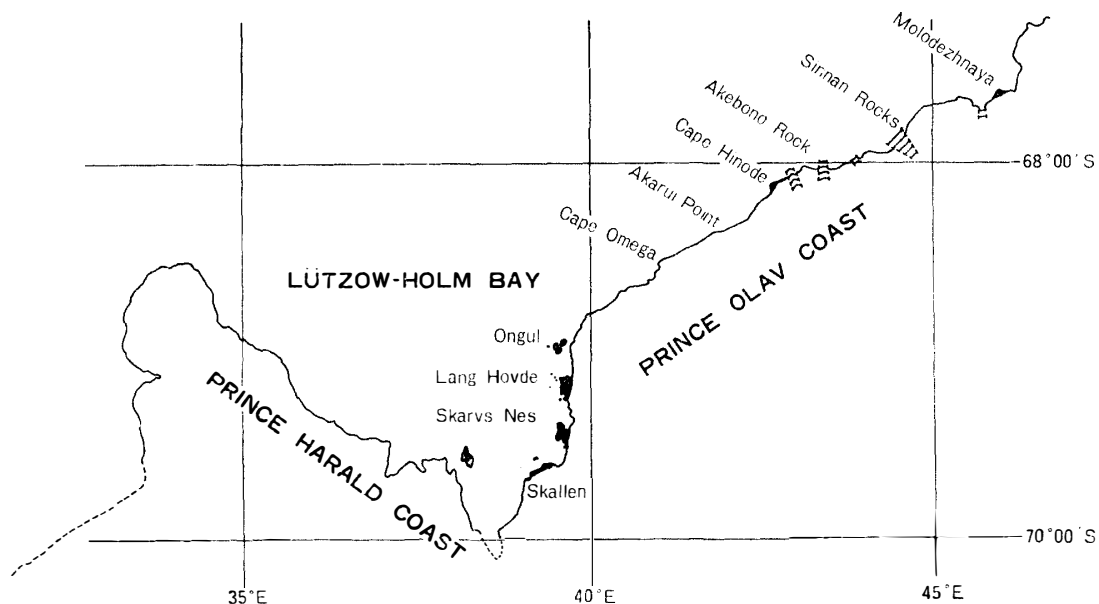


Fig. 1. Map of the Prince Olav Coast.

3.1. Ongul Islands (Plate 1, Fig. 1)

The Ongul Islands consist of two main islands, East and West Onguls, with adjacent small islands such as Mame-zima Island and Ongulkarven Islands. The JARE Syowa Station is situated on the East Ongul Island. The West Ongul Island is larger than the East Ongul Island, extending 3.4 km in north-south direction and 3.6 km in east-west direction. In summer, areas higher than about 10 m above sea level are mostly free from ice and snow. The writer spent three days on the Ongul Islands for investigation of lichens and collected only a few lichens.

3.2. Some continental outcrops (Plate 1, Fig. 2)

Some small continental outcrops are located about 5 km south of the Ongul Islands across the Ongul Strait. The largest outcrop is about 20×50 m in size. They are covered with snow in winter but free of snow in summer. These outcrops are rich in cryptogams. The writer investigated lichens and mosses for four hours and collected many lichens and mosses there.

3.3. Lang Hovde (Plate 1, Figs. 3-4)

Lang Hovde is located at about 30 km southwest of the Ongul Islands. It is the largest outcrop on the continental side of this area, extending about 13 km in east-west direction, 7 km in north-south direction. It is a hilly land with many remarkable glacial troughs, the highest peak being 542 m above sea level. Along the coast, however, there are some small flat fields. In this area some rookeries of the snow petrel and great skua are found. This area, especially along the streams, is very rich in mosses and lichens. The largest community of mosses, which is called "Garden of Moss", is about 50×150 m. Moreover, a remarkable community of *Omphalodiscus antarcticus*, which is about 50×200 m in size, was found there. The writer stayed at Lang Hovde for three days and collected many materials of lichens and mosses.

3.4. Cape Hinode (Plate 1, Fig. 5)

Cape Hinode is situated near the center of the Prince Olav Coast. This area consists of small fields with more or less hilly lands. The writer made about 40 collections.

3.5. Molodezhnaya

Molodezhnaya, where a large observatory base of U.S.S.R. is located, is 300 km east of the Ongul Islands. This area is a flat field with some small hills. The writer visited there and made 45 collections.

4. Enumeration of Species

Among the collections from the Prince Olav Coast, about 600 specimens of lichens were studied. Of these specimens 17 species were identified through this study, of which 15 are new to the flora of the Prince Olav Coast. The 17 species studied comprise thirteen crustose, two fruticose, and two foliose lichens. Crustose lichens were mostly fertile and both fruticose and foliose ones were thoroughly sterile. The areas of continental outcrops are rich in lichen flora, while only a few lichens can be found on the Ongul Islands. About 80 specimens, which are mostly crustose lichens, have been left undetermined. Consequently, the number of species in the areas investigated will increase when these crustose lichens are studied thoroughly. The species reported here are: *Acarospora gwynii*, *Buellia frigida*, *Rinodina archaeoides*, *Rhizocarpon flavum*, *Caloplaca elegans* var. *pulvinata*, *Protoblastenia citrina*, *Lecanora exulans*, *Lecanora expectans*, *Catillaria cremea*, *Parmelia coreyi*, *Parmelia leucobrephala*, *Xanthoria mawsonii*, *Xanthoria* sp., *Omphalodiscus antarcticus*, *Omphalodiscus decussatus* var. *cerebriformis*, *Usnea sulphurea*, and *Alectoria minuscula*.

1. *Acarospora gwynii* DODGE & RUDOLPH, Ann. Mo. Bot. Gdn, **42**, 144 (Pl. 15) (1955). (Fig. 2, A, B)

This species was collected from Lang Hovde and Cape Hinode, where they grew on rocks in small hollows 30–150 cm in diameter located on the top of hills. This species is frequently associated with *Lecanora exulans*.

When the acetone extract of thalli is recrystallized in GE, brownish long needles can be observed (Plate 1, Fig. 7).

Reaction: Thallus K–, PD–, C–, KC–; Medulla K–, PD–, C–, KC–.

Specim. exam.* Lang Hovde: 30 m, hk-3902; 70 m, hk-3930, 3931; 60 m, hk-3947, 3950; 70 m, hk-3977; 150 m, hk-4034–4039, 4044, 4045. Cape Hinode: 45 m, hk-4333; 50 m, hk-4335, 4344.

* In the enumeration of localities, specimens of numbers preceded by "tm", "sn", "en", "th", and "hk" were collected by T. MATSUDA, S. NAKANO, E. NISHIBORI, T. HOSHIAI and H. KASHIWADANI respectively.

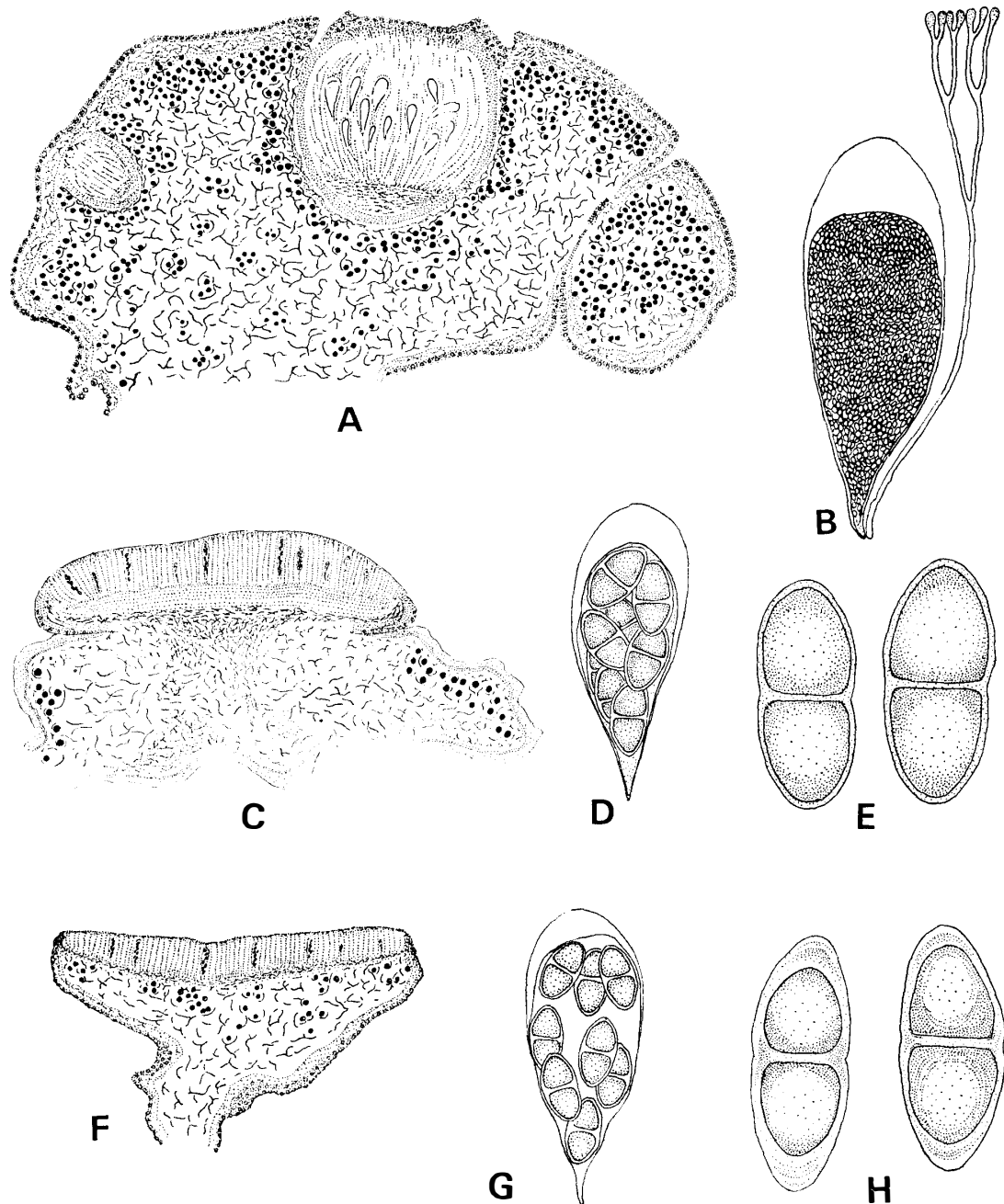


Fig. 2. A-B. *Acarospora gwynii* DODGE & RUDOLPH (A. Vertical section of apothecium and thallus, $\times 25$; B. Spores, $\times 1000$). C-E. *Buellia frigida* DARB. (C. Vertical section of apothecium and thallus, $\times 25$; D. Ascus and spores, $\times 400$; E. Spores, $\times 1000$). F-H. *Rinodina archaeoides* H. MAGN. (F. Vertical section of apothecium, $\times 25$; G. Ascus and spores, $\times 400$; H. Spores, $\times 1000$).

2. *Buellia frigida* DARB., Nat. Antarct. Exped., 5 (Lichens, p. 7) (1910).

(Fig. 2-C, E ; Pl. 1-6)

Many materials of this species were collected from various localities of this area. This species is peculiar in having radiately cracked thalli with black margin. DARBISHIRE (1938) stated in his report that "The apothecium of *Buellia frigida* is distinctly a buellish one, but occasionally a few gonidia help to make a kind of pseudo-amphithecium. It seems that the lecanorine apothecia in this species are produced unexpectedly". The writer also found lecanorine apothecia in specimens of this species collected from this area, especially at more or less shaded localities. Lecanorine apothecia occasionally found in this species seem to be related to some environmental conditions.

Reaction : Thallus K-, PD-, C-, KC-; Medulla K-, PD-, C-, KC-.

Specim. exam. Sôya Coast : 20 m, hk-3655, 3659, 3663, 3669, 3670-3675, 3679, 3682, 3750, 3810, 3811, 3840. Lang Hovde : 60 m, hk-3958, 3964, 3965, 3970, 3973-3977 ; 40 m, hk-3982, 3984, 3990, 3991. Cape Hinode : 45 m, hk-4322. Akebono Rock : 40 m, hk-4411, 4414, 4417. Molodezhnaya : 20 m, hk-4133, 4193.

3. *Rinodina archaeoides* H. MAGN., Acta Horti Gothoburg, 17, 278 (1947).

(Fig. 2-F, G, H)

This species is common on moss tufts, growing in more or less dry places. Usually the moss tufts of the West and East Ongul Islands are covered with this species.

Specim. exam. West Ongul Island : 12 m, hk-3566, 3570, 3579 ; 42 m, hk-3640. Lang Hovde : 60 m, hk-3972 ; 10 m, hk-3986 ; 40 m, hk-4013, 4014 ; 30 m, hk-4023 ; 150 m, hk-4038, 4055 ; 15 m, hk-4064. Sôya Coast : 25 m, hk-3677, 3689, 3693, 3708-3710, 3713, 3717-3719 ; 20 m, hk-3727, 3733, 3734, 3738, 3747-3749, 3751, 3760. Cape Hinode : 45 m, hk-4331, 4360 ; 30 m, hk-4345 ; 90 m, hk-4363 ; 50 m,

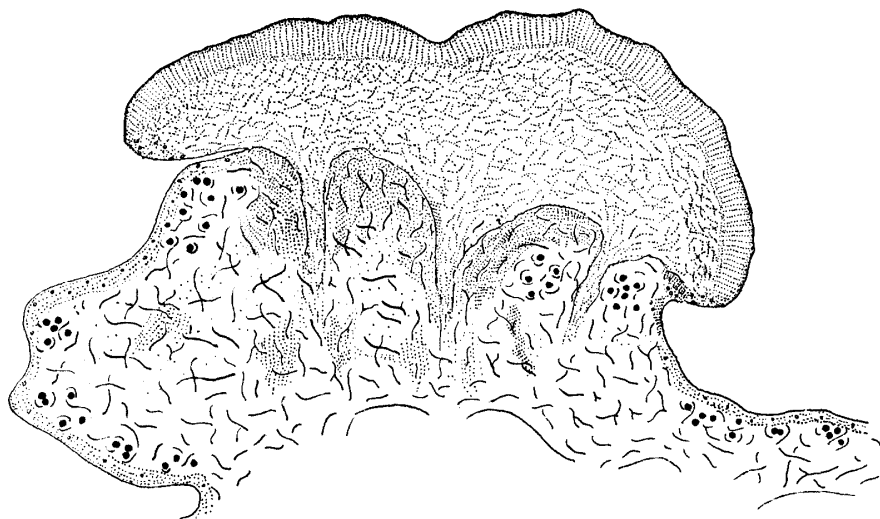


Fig. 3. *Rhizocarpon flavum* DODGE & BAKER. Vertical section of apothecium and thallus, $\times 25$.

hk-4371.

4. *Rhizocarpon flavum* DODGE & BAKER, Ann. Mo. Bot. Gdn, **25**, 552 (1938).
(Fig. 3 ; Pl. 2-6)

This species was collected only at three points. It was usually associated with other lichens, such as *Buellia* and *Lecidea*.

Reaction : Thallus K-, PD-, C-; Medulla K-, PD-, C-.

Specim. exam. Molodezhnaya ; 5 m, hk-3865 ; 15 m, hk-4221 ; 40 m, hk-4232.

5. *Caloplaca elegans* (LINK.) TH. FR. var. *pulvinata* (DODGE & BAKER) MURRAY,
Trans. R. Soc. N. Z., **2**, 64 (1963). (Fig. 4-A, B, C ; Pl. 1-8)

This species was collected at Lang Hovde, West Ongul Island, and Molodezhnaya. Thalli of this species are sparingly lobate. They form rosettes up to 3 cm in diameter, sometimes making tufts *ca.* 1 cm thick. Apothecia are abundant in each specimen. The color of the thalli is distinct orange-red (K+ purple). When the acetone extract is recrystallized in G. E., long, fusiform and pale brown prisms are yielded. These crystals, which are observed in all materials, may be yielded by parietine.

Reaction : Thallus K+ purple, PD-, C-; Medulla K-, PD-, C-.

Chemical ingredient : Parietine.

Specim. exam. West Ongul Island : 12 m, hk-3556-3568 ; 13 m, hk-3572, 3575, 3589, 3590. Lang Hovde : 60 m, hk-3951, 3960, 3976 ; 12 m, hk-4053 ; 15 m, hk-4067, 4070, 4074, 4075, 4078, 4089 ; 120 m, hk-4247, 4248, 4255, 4258, 4266, 4267, 4269, 4271. Molodezhnaya : 5 m, hk-4185.

6. *Protoblastenia citrina* DODGE, Rep. B. A. N. Z. Antarct. Res. Exped., **7**, 222 (1948).
(Fig. 4-D, E, F)

This species was collected at 8 localities of this area by the writer. They usually grow on moss tufts with other lichens. As an exceptional case, he collected one specimen growing on deserted feather of Adélie penguin in the Ongulkarven Island located near the Ongul Island.

Most of our specimens are well fertile or with many apothecia. The morphological characters of thalli coincide well with the original description given by DODGE (1948). DODGE reported in his paper that apothecia are up to 1.5 mm, thecium 35 μ tall, ascospores 6-7 \times 3 μ . The writer, however, observed in his specimens that apothecia are up to 2 mm, hymenium is up to 57 μ high, and spores are 6 \times 16 μ . Although the discrepancy of the sizes of apothecia, hymenium and spores is rather conspicuous, it is probably accounted for by the fact that the type material was sparingly fertile and contained few mature spores.

Reaction ; Thallus K-, PD-, C-; Medulla K-, PD-, C-.

Specim. exam. Lang Hovde : 60 m, hk-3952, 3969 ; 15 m, hk-4092 ; 120 m, hk-4249. Ongulkalven Island : 5 m, hk-4430. Cape Hinode : 45 m, hk-4319 ; 90 m, hk-4356. Akebono Rock : 10 m, hk-4412. Molodezhnaya : 20 m, hk-4125, 4126 ; 5 m, hk-4190, 4212, 4214.

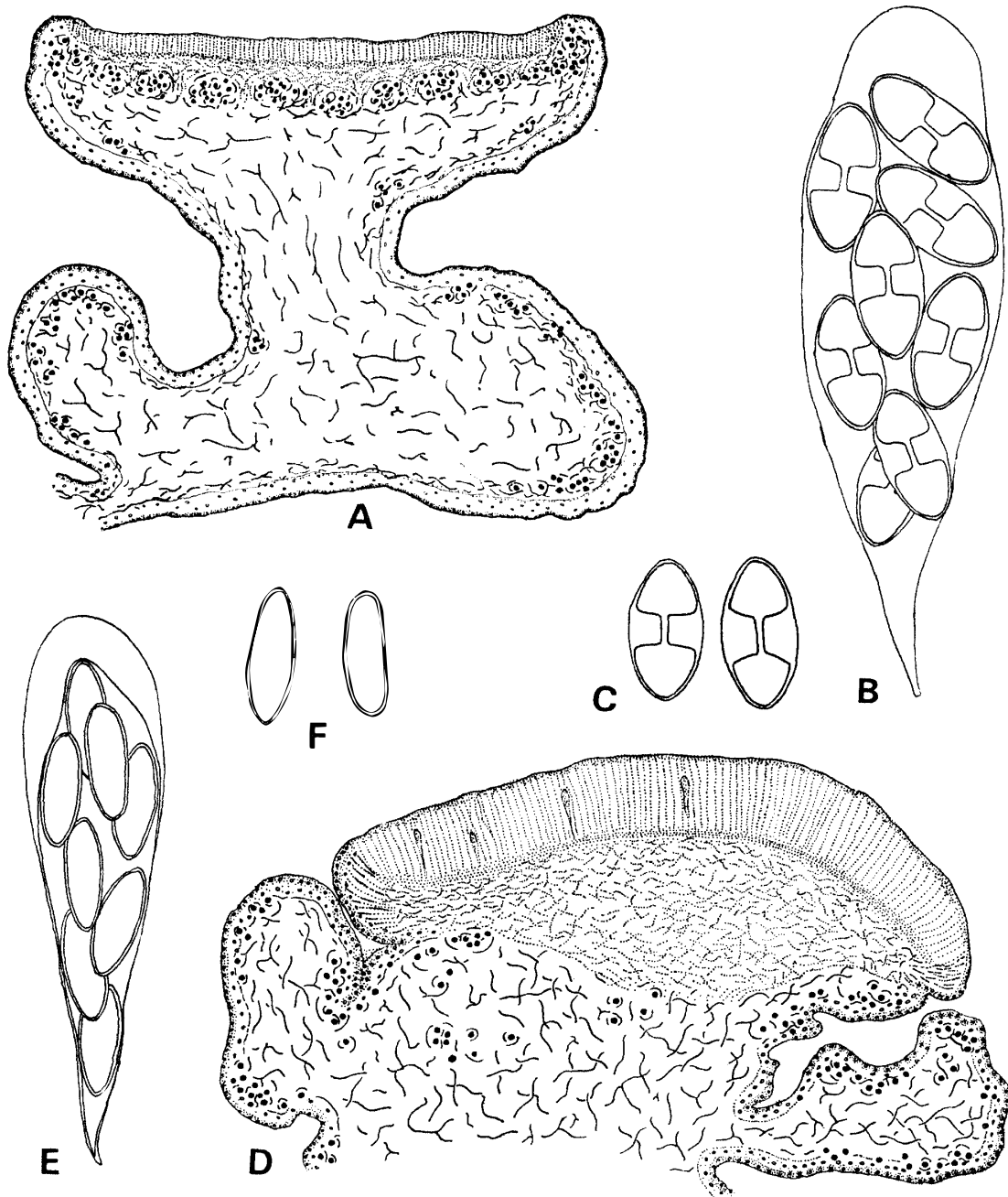


Fig. 4. A-C. *Caloplaca elegans* (LINK.) TH. FR. var. *pulvinata* (DODGE & BAKER) MURRAY (A. Vertical section of apothecium and thallus, $\times 25$; B. Ascus and spores, $\times 1000$; C. Spores, $\times 1000$). D-F. *Protoblastenia citrina* DODGE (D. Vertical section of apothecium and thallus, $\times 25$; E. Ascus and spores, $\times 1000$; F. Spores, $\times 1000$).

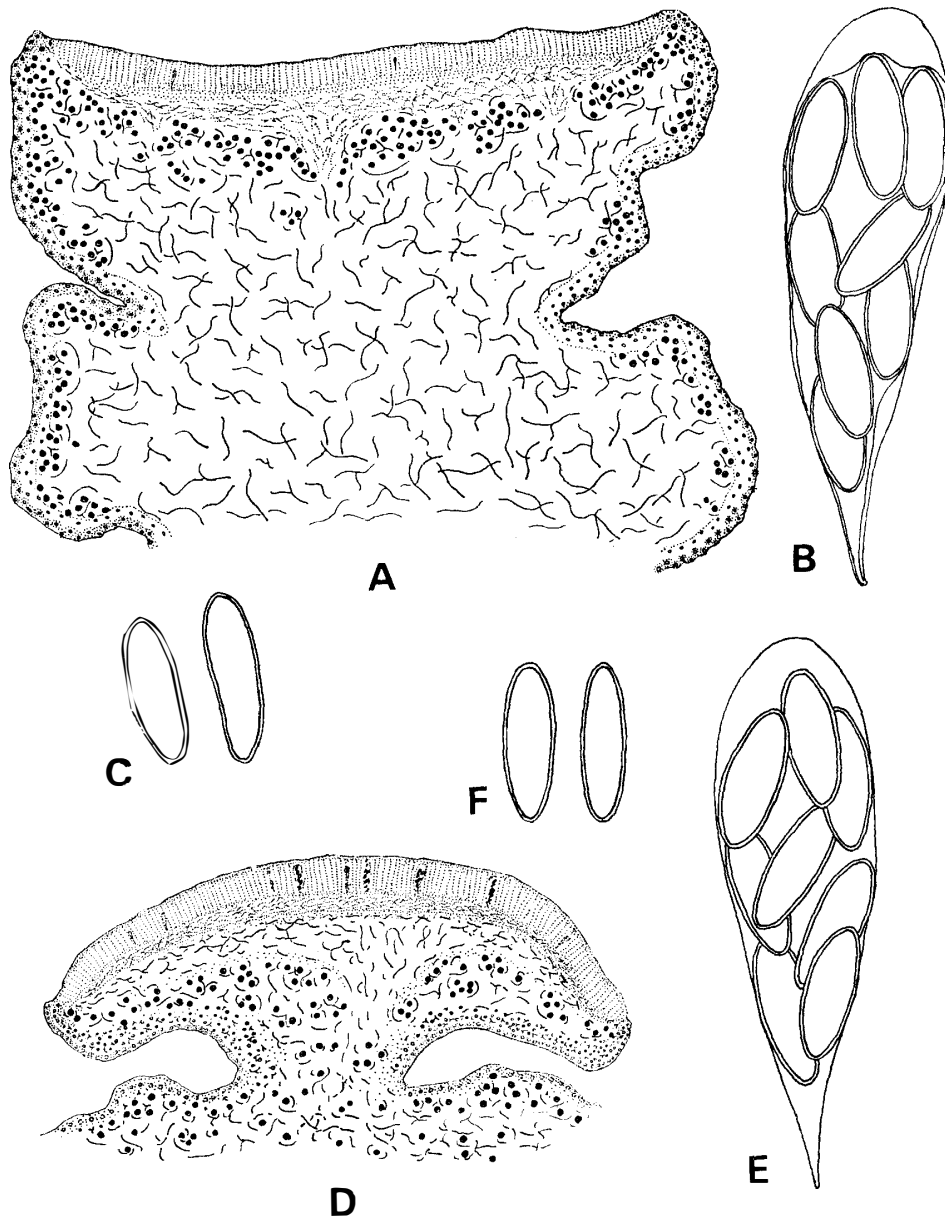


Fig. 5. A-C. *Lecanora exulans* (TH. FR.) DODGE & BAKER (A. Vertical section of apothecium, $\times 25$; B. Ascus and spores, $\times 1000$). D-F. *Lecanora expectans* DARB. (D. Vertical section of apothecium, $\times 25$; E. Ascus and spores, $\times 1000$; F. Spores, $\times 1000$).

7. *Lecanora exulans* (TH. FR.) DODGE & BAKER, Ann. Mo. Bot. Gdn, **25**, 570 (1938).
(Fig. 5-A, B, C ; Pl. 2-2)

Thalli of this species are effigurate and squamulose, but they are sometimes completely covered by large densely clustered apothecia. The disc of the apothecium is variable in color; olive in most specimens and ochre in some specimens. This species is very common in the area investigated.

Reaction: Thallus K-, C-, KC+ yellow, PD-; Medulla K-, C-, PD-.

Chemical ingredients: Usnic acid, zeorine.

Specim. exam. West Ongul Island: 42 m, hk-3600; 25 m, hk-3614. Lang Hovde: 50 m, hk-3963; 70 m, hk-3931; 60 m, hk-3977; 150 m, hk-4036, 4037, 4039, 4040, 4044; 120 m, hk-4248; Herb. Y. ASAHINA, tt-32 in TNS. Sôya Coast: 20 m, hk-3664, 3728, 3745; 15 m, hk-3691. Ongulkalven Island: Herb. Y. ASAHINA, sn-12, 13 in TNS. Cape Hinode: 45 m, hk-4336, 4343, 4344. Akebono Rock: 30 m, yh-4416. Molodezhnaya: 10 m, hk-4169; 40 m, hk-4171; 30 m, hk-4192; 5 m, hk-4189, 4202, 4213.

8. *Lecanora expectans* DARB., Nat. Antarct. Exped., **5** (Lichens) (1910).
(Fig. 5-E, F, G ; Pl. 2-3)

This species was collected only at two localities of Lang Hovde. It grows on moss tufts (*Bryum argenteum* and *Ceratodon purpureus*). The thalli are inconspicuous in contrast to the apothecia which are well developed and cover moss tufts. Although the type specimen and original description have not been available for this study, our specimens coincide with the description and figures of *Lecanora expectans* DARB. given by FILSON (1966).

Reaction: Thallus K-, KC-, PD-, C-; Medulla K-, PD-, C-.

Specim. exam. Lang Hovde: 15 m, hk-4090, 4091, 4093, 4094; 150 m, hk-4031.

9. *Catillaria cremea* DODGE & BAKER, Ann. Mo. Bot. Gdn, **25**, 544 (1938). (Pl. 2-4)

Thalli of this species are cream-buff to buff and they are inconspicuous. Apothecia are very abundant and sometimes clustered. Both internal and external morphological characters coincide with the original description by DODGE (1938). The mature spores are hyaline and 2-celled.

Reaction: Thallus K-, KC-, PD-, C-.

Specim. exam. Lang Hovde: 5 m, hk-3941; 60 m, hk-3948, 3953-3956, 3959, 3967; 40 m, hk-4017, 4018; 12 m, hk-4061; 15 m, hk-4071, 4072, 4077; 9 m, hk-4079, 4081; 15 m, hk-4084, 4085. Cape Hinode: 45 m, hk-4313.

10. *Parmelia coreyi* DODGE & BAKER, Ann. Mo. Bot. Gdn, **25**, 595 (1938).
(Fig. 6-A, B ; Pl. 2-7)

Lobes of this species are dichotomously branched. This species is densely sorediate and the thalli are often completely covered with granular soredia especially on older lobes. *P. coreyi* grows on rocks, sandy loam, and mosses. The plants which grow on sandy loam or mosses have more or less narrower thalli and their rhizine are longer, up to 1.5 mm long.

Reaction : Thallus K+ yellow, KC+ yellow, C-, PD-; Medulla K+ yellow, PD+ yellow, C-.

Chemical ingredients : Zeorine and atranorine.

Specim. exam. Lang Hovde : 10 m, hk-3987 ; 7 m, hk-3897 ; 150 m, hk-4027, 4030 ; 9 m, hk-4051 ; 15 m, hk-4062, 4063, 4068, 4069, 4078, 4082, 4083, 4086, 4088, 4095 ; 10 m, hk-4168 ; Herb. Y. ASAHINA, sn-14, 16 ; tt-35 in TNS. Sôya Coast : 15 m, hk-3685. Molodezhnaya : 5 m, hk-4199, 4202.

11. *Parmelia leucobrepkala* DODGE & BAKER, Ann. Mo. Bot. Gdn, **25**, 592 (1938).

(Fig. 6-C ; Pl. 2-8)

This species has elongate lobes with long marginal white cilia. The lobes are up to 0.5 mm wide and deeply incised. Rhizine are long, up to 2 mm.

This species grows mainly on mosses. The lobes are densely imbricate each other and form thick tufts up to 1 cm thick.

Reaction : Thallus K+ yellow, KC+ yellow, C-, PD-; Medulla K+ yellow, PD+ yellow, C-.

Chemical ingredients : Zeorine and atranorine.

Specim. exam. Sôya Coast : 25 m, hk-3705 ; 20 m, hk-3799, 3800, 3816, 3819, 3821, 3827 ; 10 m, hk-3839 ; 15 m, hk-3841, 3842, 3847;3851, 3854. Molodezhnaya : 10 m, hk-4148.

12. *Xanthoria mawsonii* DODGE, B. A. N. Z. Antarct. Res. Exped., **7**, 236 (1948)

(Fig. 6-D ; Pl. 3-1)

The color of the thalli of this species is distinctly orange red (K+ purple.) This species grows on mosses such as *Ceratodon purpureus* and *Bryum argenteum*.

Reaction : Thallus K+ purple, PD-, C-; Medulla K-, PD-, C-.

Chemical ingredient : Parietine.

Specim. exam. Lang Hovde : 120 m, hk-4280, 4281. Cape Hinode : 80 m, hk-4325-4328. Akebono Rock : 140 m, hk-4425. Molodezhnaya : 20 m, hk-4127, 4128, 4130, 4135, 4141, 4142.

13. *Xanthoria* sp.

(Fig. 6-E ; Pl. 3-2)

Thallus in pulvinate tufts, up to 5 cm in diameter and up to 3 mm thick, lobes irregularly palmate, ca. 1 mm wide, with granulous isidia along the margin. Upper surface yellow, smooth, lower surface pale, smooth. Rhizines sparse, up to 0.5 cm long and 100 μ thick. Thallus 140-160 μ thick. Lower cortex analogous to the upper cortex. Algae sparsely scattered through the medulla. Apothecia not seen. Saxicolous.

Reaction : Thallus K+ yellow, KC+ yellow, PD-, C-; Medulla K-, PD-, C-.

This species is, at present, known only from one locality in Lang Hovde. It resembles *Xanthoria mawsonii* in having similar external and internal morphology. The thalli are K+ purple in *Xanthoria mawsonii* whereas they are K- in this species.

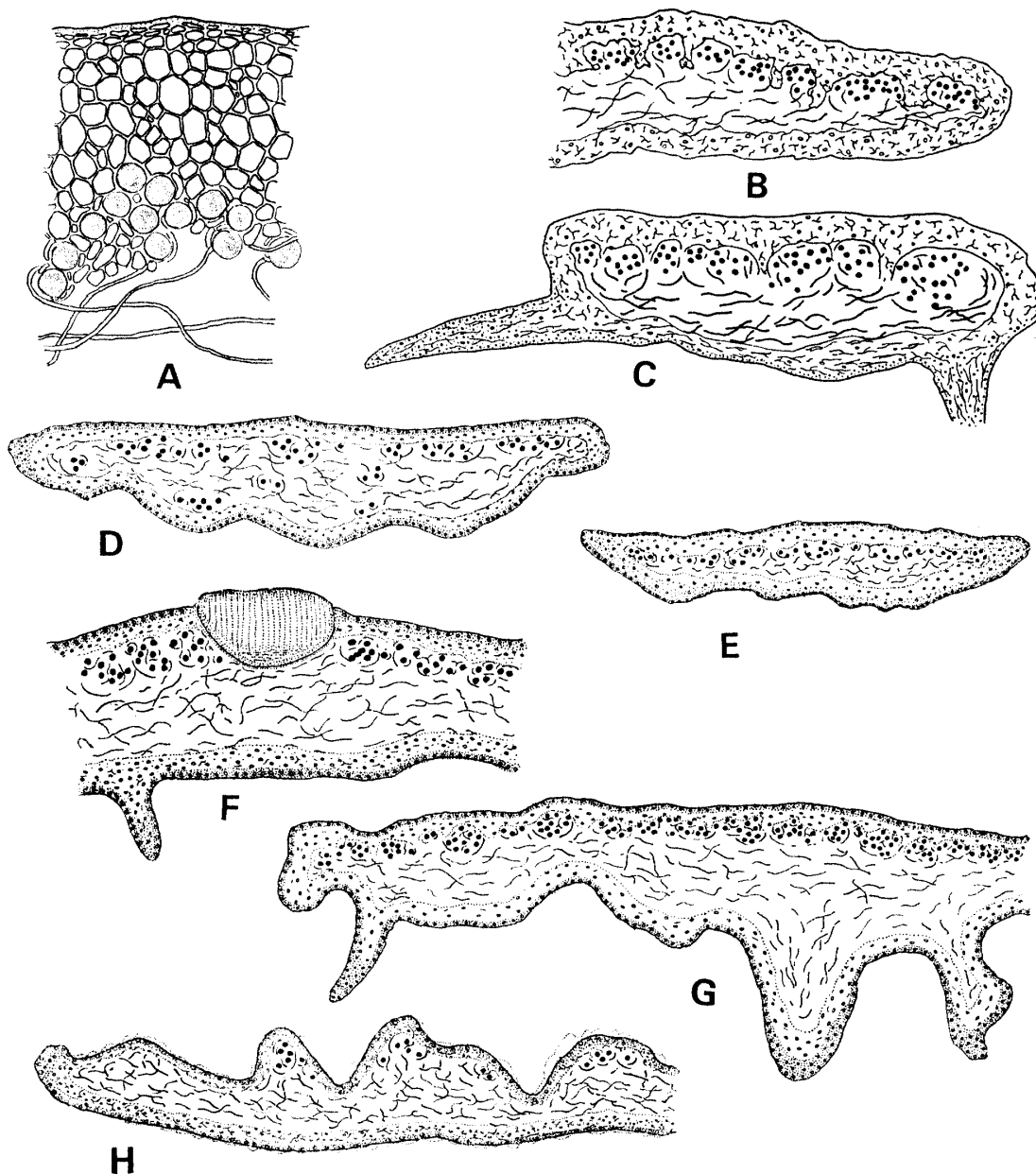


Fig. 6. Vertical sections of thalli. (A. Upper cortex of *Parmelia coreyi* DODGE & BAKER, $\times 400$; B. *Parmelia coreyi* DODGE & BAKER, $\times 25$; C. *Parmelia leucobrephala* DODGE & BAKER, $\times 25$; D. *Xanthoria mawsonii* DODGE, $\times 25$; E. *Xanthoria* sp., $\times 25$; F. *Omphalodiscus antarcticus* (FREY & LAMB) LLANO with an apothecium of *Scutula* sp., $\times 100$; G. *Omphalodiscus antarcticus* (FREY & LAMB) LLANO, $\times 25$; H. *Omphalodiscus decussatus* (VILL.) SCHOL. var. *cerebriformis* (DODGE & BAKER) LLANO, $\times 25$).

Specim. exam. Lang Hovde : 120 m, hk-4261, 4271.

14. *Omphalodiscus antarcticus* (FREY & LAMB) LLANO, Monogr. Lich. Fam. Umbilicariaceae in the Western Hemisphere, p. 76 (1950). (Fig. 6-F, G ; Pl. 3-3, 4)

This species is very variable in size. Plants which grow under more or less dried conditions are small and tightly compressed into cerebriform colonies and have somewhat elongated filamentous umbilicus. On the contrary, plants which grow under rather wet conditions, have single foliate thalli up to 15 cm in diameter. This species is very common in the areas investigated. Immature apothecia of *Scutula* TUL. were found in some specimens collected in Lang Hovde.

Reaction : Thallus K-, C-, KC+ pink ; Medulla K-, KC+ pink, PD-.

Chemical ingredient : Gyrophoric acid.

Specim. exam. Lang Hovde : 10 m, hk-3894, 3980 ; 50 m, hk-3895 ; 5 m, hk-3906-3920, 3922 ; 50 m, hk-3928, 3934, 3935 ; 60 m, hk-3966, 3968 ; 20 m, hk-4004, 4009-4011 ; 30 m, hk-4016 ; 9 m, hk-4052, 4076 ; 15 m, hk-4063 ; 40 m, hk-4259, 4282-4284, 4286 ; Herb. Y. ASAHINA, ?-18 a, 25, 26, 31, 39 in TNS. Sôya Coast : 20 m, hk-3656-3658 ; 10 m, hk-3666, 3671 ; 15 m, hk-3674, 3680, 3683, 3687, 3688, 3694 ; 25 m, hk-3704, 3720, 3729, 3737, 3772, 3773-3776, 3787, 3798, 3815, 3825, 3832, 3837, 3843, 3846 ; 30 m, hk-3831. Cape Hinode : 45 m, hk-4307, 4309. Molodezhnaya : 30 m, hk-4101 ; 25 m, hk-4116.

15. *Omphalodiscus decussatus* (VILL.) SCHOL. var. *cerebriformis* (DODGE & BAKER) LLANO, Lich. Fam. Umbilicariaceae in the Western Hemisphere, p. 38 (1950). (Fig. 6-H ; Pl. 3-5)

LLANO (1954) classified the family Umbilicariaceae into five genera; *Aggyrophora*, *Omphalodiscus*, *Umbilicaria*, *Actinogyra*, and *Lasallia*. Of these genera, *Lasallia* has not yet been reported from Antarctica. As our materials are all sterile, it is very difficult to determine which genus they belong to. However, judging from other morphological features, all of our specimens can be referred to *Omphalodiscus decussatus* var. *cerebriformis*.

This species is one of the commonest lichens in the areas investigated. The thalli of this species are up to 2.5 cm in diameter. They are usually monophyllous and have reticulate ridges on the upper surface. Some of our specimens, however, appear polyphyllous and the ridges are very much elevated. These variations of thalli seem to be caused by environmental conditions.

Reaction : Thallus K-, PD-, C-, KC- ; Medulla K-, PD-, C-, KC-.

Specim. exam. Lang Hovde : 5 m, hk-3923, 3938 ; 80 m, hk-4293, 4299. Sôya Coast : 15 m, hk-3660, 3698 ; 20 m, hk-3695, 3730, 3739, 3741, 3742, 3759, 3777, 3778, 3788, 3790. Cape Hinode : 45 m, hk-4318 ; 60 m, hk-4337, 4338 ; 140 m, hk-4341, 4350, 4359, 4361, 4372. Akebono Rock : 10 m, th-4096. Molodezhnaya : 10 m, hk-4096-4098, 4107-4110 ; 15 m, hk-4112-4114 ; 30 m, hk-4117 ; 20 m, hk-4145, 4149, 4157, 4160-4163 ; 30 m, hk-4165 ; 10 m, hk-4167 ; 40 m, hk-4222, 4224 ; 10 m, hk-4238.

16. *Usnea sulphurea* (KAEN.) TH. FR., Lich. Spitzberg. K. Svenska Vetensk Akad. Handl., 7 (2), 8 (1867). (Fig. 8-A, B; Pl. 3-7)

Central axis of this species usually occupies one-third of the thallus. However, two of our specimens have central axes occupying one-fifth of the thalli. In the latter case, the medulla of the thalli are very loose.

RS and AQ values (ASAHINA, 1956) were calculated in some specimens of this species. The calculation was made at about 1 cm from the base in each specimen. The results are shown in Table 1 and Fig. 7. As seen in Fig. 7, the angle θ , which varies with the thickness of cortex, medulla and axis, is between (25°) 39° - 54° . The specimens with a thin central axis are graphed in 4 and 8 of Fig. 7.

Crystal tests show that all of our specimens contain usnic acid only and they are typical inactive phase (PD-, K-).

Usnea sulphurea shows a bipolar distribution and is one of the most common lichens in the Prince Olav Coast. The peculiar colonies covering rocks can be easily recognized from a long distance. This species was also collected by Drs. S. NAKANO (1957), E. NISHIBORI (1957), T. MATSUDA (1962, 1966) and T. HOSHIAI (1967).

Table 1. Results of the measurement and calculation made on 8 specimens.

Number of specimens	Diameter of branches (mm)	Dimensions of layer (μ)	RS	θ	AQ (%)
1. 3802	0.84	65* 180** 320***	1 : 2.8 : 4.9	46°	38
2. 3763	0.80	70 170 350	1 : 2.4 : 5.0	50	44
3. 3779	0.83	50 180 330	1 : 3.6 : 6.6	50	40
4. 3823	0.90	31 267 270	1 : 8.6 : 8.6	39	30
5. 3824	0.67	30 155 250	1 : 5.1 : 8.3	50	42
6. 3766	0.87	90 136 400	1 : 3.6 : 4.5	54	46
7. 4301	0.67	48 100 250	1 : 2.2 : 5.4	54	38
8. 5020	0.95	65 290 260	1 : 4.5 : 3.1	21	22

* Length of a cortex. ** Length of a medulla. *** Length of a axis.

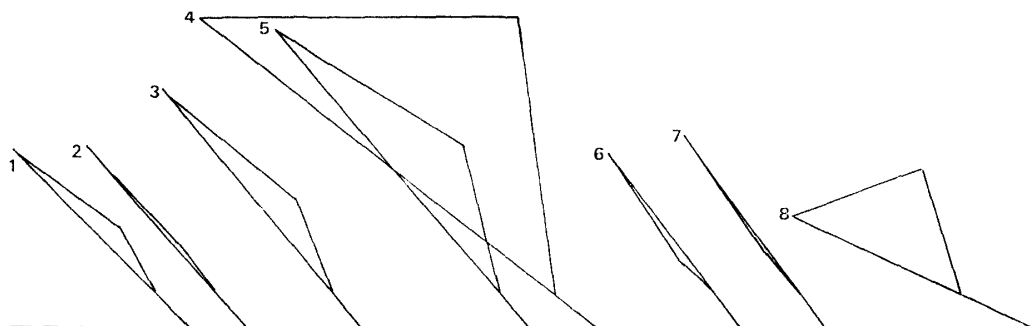


Fig. 7. Diagrams of RS values of different specimens of *Usnea sulphurea* (KAEN.) TH. FR.

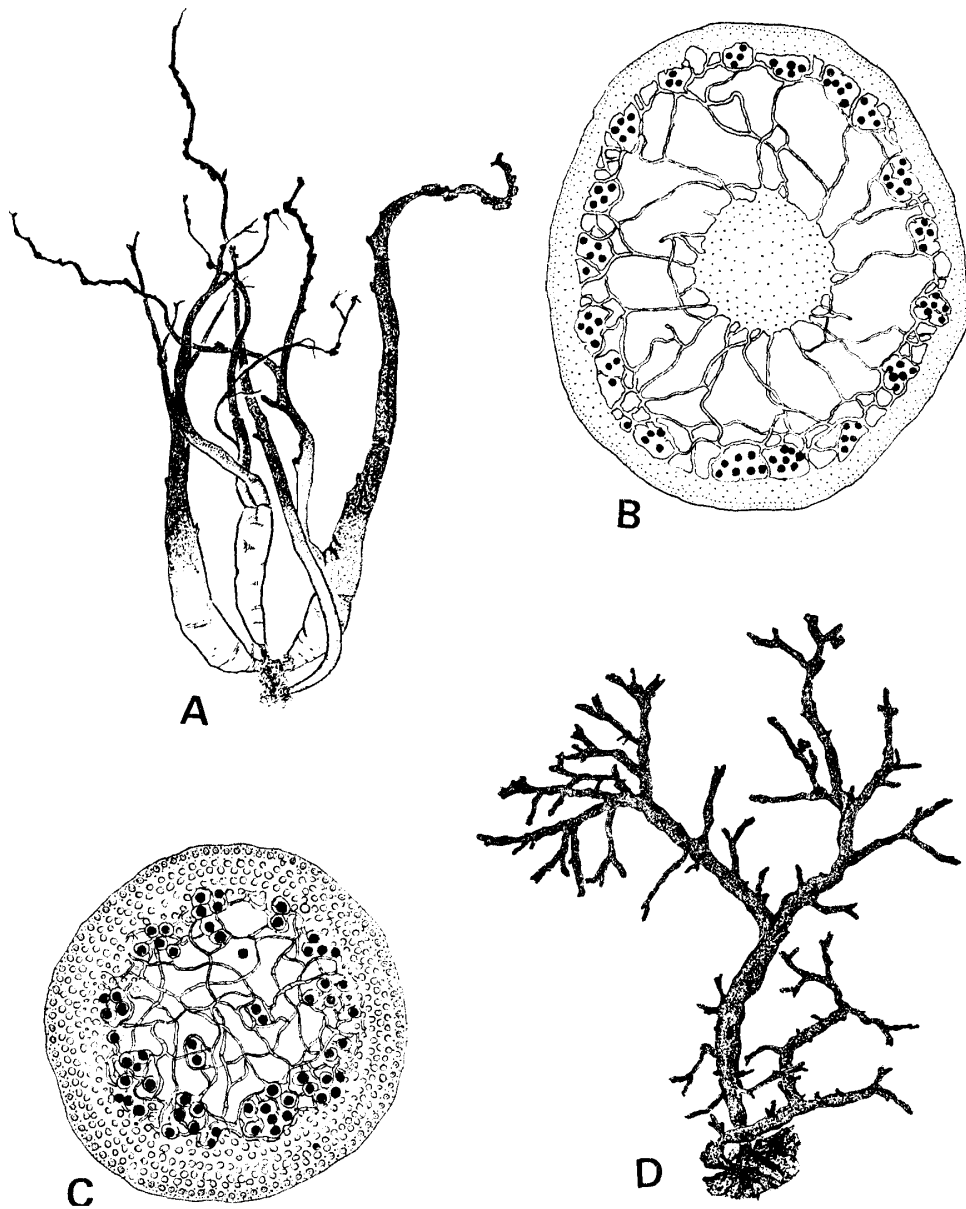


Fig. 8. A-B. *Usnea sulphurea* (KAEN.) TH. FR. (A. General view of thalli, $\times 1.5$; B. Cross section of thallus, $\times 25$). C-D. *Alectoria minuscula* (NYL.) DEGEL. (C. Cross section of thallus, $\times 100$; D. General view of thalli, $\times 15$).

Reaction : Thallus K+ yellow, KC+ yellow, C-, PD- ; Medulla K-, PD-, C-.

Chemical ingredient : Usnic acid only.

Specim. exam. Lang Hovde : 50 m, hk-3924, 3925 ; 150 m, hk-4025, 4026, 4029 ; 80 m, hk-4295-4298 ; 70 m, hk-4301 ; Herb. Y. ASAHINA, sn-20, 21, 22, 23, in TNS. Sôya Coast : 25 m, hk-3699-3703, 3715, 3716, 3744 ; 20 m, hk-3723, 3732, 3744, 3754-3757, 3763-3765, 3771, 3779, 3781, 3783, 3806-3808, 3817, 3823 ; 30 m, hk-3791. Cape Hinode : 30 m, hk-4311 ; 140 m, hk-4320, 4330, 4333, 4337, 4352 ; 130 m, hk-4314, 4366. Akebono Rock : 20 m, hk-4401 ; 30 m, hk-4410. Molodezhnaya : 10 m, hk-4100-4105, 4149 ; 70 m, hk-4111 ; hk-4118, 4223, 4225 ; 20 m, 4231, 4239.

17. *Alectoria minuscula* (NYL.) DEGEL., Nytt Magn. Naturv., **78**, 286 (1938)

(Fig. 8-C, D ; Pl. 3-6)

Alectoria minuscula is a rather variable species. LAMB (1964) reported four forms under the species ; f. *minuscula*, f. *applanata*, f. *biformis* and f. *congesta*. This species usually grows on rocks forming orbicular tufts up to 0.5 cm high and 10 cm in diameter. Sometimes it grows among moss tufts. Even when they grow on rocks exposed to strong wind, well-developed tufts are formed there, especially where water is prevalent. *Al. minuscula*, a common species of *Alectoria* on the Prince Olav Coast, has been reported from several other localities in Antarctica, such as Marie Byrd Land, Queen Mary Coast, Coast of Terre Adélie, and Mac. Robertson Land. This species usually grows together with *Usnea sulphurea*.

Reaction : Thallus K-, PD-, C-, KC- ; Medulla K-, PD-, C-, KC-.

Specim. exam. Lang Hovde : 50 m, hk-3898-3901, 3904, 3905, 3921, 3926, 3927 ; 5 m, hk-3929, 3937, 3944 ; 30 m, hk-4020 ; 20 m, hk-4022, 4287 ; 150 m, hk-4028, 4033, 4041, 4042 ; 70 m, hk-4300. Sôya Coast : 15 m, hk-3690, 3697, 3892 ; 20 m, hk-3714, 3731, 3758, 3768, 3789, 3797, 3809, 3812, 3818, 3821, 3822, 3828, 3829, 3830 ; 25 m, hk-3735, 3836, 3743 ; 10 m, hk-3837. Cape Hinode : 140 m, hk-4316, 4317, 4321, 4329, 4353 ; 130 m, hk-4358, 4364, 4365 ; 80 m, hk-4348. Akebono Rock : 120 m, hk-4404 ; 130 m, hk-4415, 4423. Molodezhnaya : 20 m, hk-4132, 4155 ; 25 m, hk-4238 ; 50 m, hk-4146-4148 ; 15 m, hk-4150, 4154 ; 40 m, hk-4172, 4174, 4187, 4205, 4221.

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