

NORSK POLARINSTITUTT  
SKRIFTER NR. 144

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HILDUR KROG

THE MACROLICHENS  
OF ALASKA



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NORSK POLARINSTITUTT  
OSLO 1968

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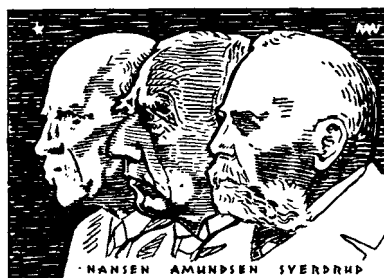
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Manuscript received November 1967

Printed March 1968

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PUBLISHED BY NORSK POLARINSTITUTT

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Postboks 307 — Blindern, Oslo 3

## Preface

The purpose of this study is to make a survey of the macrolichen flora of Alaska, and to compare it to the known lichen flora elements of other northern regions. The main basis for the work is the material which I collected on different occasions during the years 1950–1957.

From 1950 to 1954 I was employed as a general biologist at the Arctic Health Research Center in Anchorage, Alaska. During this period, time did not permit any extensive lichen studies, but I did have the chance to make small collections in the Anchorage area from time to time. More important was the advantage of acquiring a first-hand knowledge of the country through field work and travel. In the summer of 1953, however, I had the opportunity, thanks to the encouragement of Dr. LAURENCE IRVING of the Arctic Health Research Center, to spend 6 weeks collecting lichens in the White Mountains area north of Fairbanks, in the company of the Norwegian botanist Dr. OLAV GJÆREVOLL.

The lichens collected in this limited but very interesting part of interior Alaska were brought back to Norway in 1954, and a preliminary study proved the desirability of obtaining material from other parts of Alaska as well. During the summer of 1957 I got the opportunity to spend 4 months in Alaska, collecting the main part of the material on which this study is based.

The areas which I visited in 1957 were, with due regard to accessibility, selected for maximum variety. With Anchorage and Fairbanks as main bases I travelled by car over the larger part of the highway system in the State. The opening of the Denali Highway in the middle of the summer made a very interesting part of the Alaska Range accessible for collecting. In July, I had the opportunity to spend 10 days in Mekoryuk Village on Nunivak Island, travelling from Anchorage in an amphibian airplane belonging to the Fish and Wildlife Service. Thanks to the co-operation of the pilot, Mr. DAVID SPENCER, who was making a survey of the local musk ox herd, I was able to visit several different localities on the island. In the beginning of August, I spent one week in Kotzebue and Nome, and at the end of August and beginning of September, I spent two weeks in southeast Alaska, travelling by commercial airlines. For practical reasons the Aleutian Islands had to be omitted. It was with regret that a planned trip to the Arctic Coast had to be cancelled because of a temporary restriction on civilians travelling with military transportation.

Although it was possible to cover only a very small part of this large country in one summer, I believe that reasonably representative samples were obtained

both from lowland and high mountain areas in the interior, from the coastal forests and coastal mountain regions of south-east and south central Alaska, and from the arctic tundra of the Bering Sea and Bering Strait regions. It is my hope that the publication of this material will stimulate further study of the lichen flora of one of the most interesting regions in the Northern Hemisphere.

Oslo, November 1967

HILDUR KROG

## Contents

Abstract .....	7
Acknowledgments .....	7
Introduction .....	8
History of the lichenological exploration of Alaska .....	8
Geological history .....	12
Topography, climate and vegetation .....	17
Materials and methods .....	24
List of localities .....	26
Enumeration of the species .....	29
Dermatocarpaceae .....	29
Sphaerophoraceae .....	30
Collemaaceae .....	32
Stictaceae .....	35
Peltigeraceae .....	45
Cladoniaceae .....	54
Umbilicariaceae .....	79
Stereocaulaceae .....	86
Parmeliaceae .....	92
Usneaceae .....	132
Physciaceae .....	148
Teloschistaceae .....	153
Plant geographical discussion .....	154
The circumpolar element .....	156
Disjunct species found both in Eurasia and North America ..	159
The Asiatic-North American element .....	160
The American element .....	163
The distribution patterns of chemical strains .....	165
Summary and conclusions .....	166
Literature .....	168
Index to genera and species .....	176





## Abstract

Distributional data and comments on chemical properties have been given for 326 personally studied species of Alaskan macrolichens. A close connection with the Asiatic lichen flora has been demonstrated. The present day distribution has been discussed in view of geological and climatological changes of the past.

The following new taxa have been described: *Cetraria elenkinii*, *C. simmonsii*, *C. simmonsii* var. *intermedia*, *C. simmonsii* var. *lobulata*, *Hypogymnia imshaugii*, *H. imshaugii* var. *inactiva*, *H. lugubris* ssp. *beringiana*, *Parmelia denalii*, *P. olivaceoides*, *Pilophorus vegae*, and *Umbilicaria angulata* var. *compacta*. The following combinations have been made: *Hypogymnia lugubris* (PERS.) KROG, *H. pseudophysodes* (ASAH.) KROG, *Stereocaulon sterile* (SAV.) LAMB, and *Umbilicaria scholanderi* (LLANO) KROG.

## Acknowledgments

My travels in Alaska during the summer of 1957 were supported by grants from the Norwegian Research Council for Science and the Humanities, the University of Oslo, the Norwegian Polar Institute, and the Department of Foreign Affairs, together with a FULBRIGHT travel grant. The financial aid from these institutions is gratefully acknowledged.

The field work in White Mountains in 1953 was made possible by the cooperation and assistance of the Arctic Aeromedical Laboratory, Ladd Air Force Base, and its commanding officer at the time, Lt. Colonel KARSTENS, who provided equipment as well as air transportation to an otherwise unaccessible area. In 1957 the Anchorage branch of the US Fish and Wildlife Service provided air transportation to Nunivak Island and Prince William Sound. For these very important services my sincere thanks are due.

I am indebted to the University of Alaska, and to Dr. A. W. JOHNSON, for sponsoring my program in Alaska.

The Norwegian Research Council for Science and the Humanities has supported my work on Alaskan lichens on a part-time basis from 1954 to 1967. For this financial aid I extend my best thanks.

The identification of the lichens has been carried out at the Botanical Museum of the University of Oslo. Thanks are due to its Directors, Dr. ROLF NORDHAGEN and Dr. ROLF BERG, for providing working facilities and clerical assistance.

I extend my sincere thanks to the Directors and Curators of the main herbaria in Great Britain, Sweden, Denmark and Finland for loan of material and for permission to study in their lichen herbaria. Without access to these important collections this work could not have been accomplished. I am also indebted to my colleagues both in Europe and in the United States for their willingness at any time to discuss lichenological problems.

In a study comprising the entire macrolichen flora of a large region it is desirable to have critical species and genera revised by specialists. This has been done to a considerable extent, when specialists have been available. I am particularly indebted to Dr. Y. ASAHINA of Tokyo for giving his opinion on certain species of the Pacific region, especially within the genus *Cladonia*, to Dr. G. DEGELIUS of Gothenburg for revising the genus *Collema*, to Dr. S. KUROKAWA of Tokyo for revising the genus *Anaptychia* s. lat., to Dr. I. M. LAMB of Cambridge, Mass. for revising the genus *Stereocaulon*, to Dr. J. MOTYKA of Lublin for revising the genera *Alectoria* and *Usnea*, to Dr. J. POELT of Berlin for revising the genus *Physconia*, to Dr. R. SANTESSON of Uppsala for revising part of the genus *Cornicularia*, and to Dr. H. A. SIERK of Jacksonville, Ill., for revising part of the genus *Leptogium*.

Dr. E. DAHL, Vollebekk, Dr. G. DEGELIUS, Gothenburg, and Dr. O. A. HØEG, Oslo, have critically read the manuscript and offered a number of valuable suggestions for formal corrections, which I have gratefully followed.

I am indebted to Mr. Y. SOLBERG, Vollebekk, and Mr. L. TIBELL, Uppsala, for verification of certain lichen substances by means of chromatography.

Thanks are due to Professor LEIV AMUNDSEN for helping with the Latin diagnoses for new taxa, to Miss CLARA BAADSNES for obtaining the necessary literature, to Mrs. ELLEN AAGAARD-HANSEN for expert typing of the manuscript, to Miss BERGLIOT MAURITZ for doing the photographic work, and to Mr. PETER SAVALOV for translating literature passages from the Russian.

To all my Alaskan friends, who did their utmost to help me in every respect and to make my stay in Alaska as pleasant as possible, I extend my sincere thanks.

Finally, I wish to express my deep gratitude to Dr. EILIF DAHL, Professor of Botany, the Agricultural College of Norway, Vollebekk, who initiated my interest in lichens, taught me the basic principles of lichen chemistry, gave me access to his valuable private library of lichenological literature, and generously placed his profound knowledge of arctic lichens at my disposal. Without his continued encouragement and interest this work could not have been accomplished.

## Introduction

### HISTORY OF THE LICHENOLOGICAL EXPLORATION OF ALASKA

The history of botanical investigations in Alaska dates back to 1741, to VITUS BERING's second expedition and the collections of G. W. STELLER. The earliest record which I have been able to find of lichen collectors in Alaska is, however, more than 80 years younger.

When reviewing the history of lichenological exploration in Alaska one should bear in mind a few facts about the inaccessibility of this large country even less than 50 years ago. The Alaska Road Commission went into operation in 1905, the Alaska Railroad was built in 1923, and the first airplane flights to Alaska were performed in 1920 and 1924. Prior to that time Alaska could only be reached by

sea. This explains why most of the older collections are from the coastal regions. The early travellers who ventured inland from the coast had to rely on river boats, horses, dogsleds, and their own strong legs. As this was long before the days of waterproof clothing and mosquito repellants, one can only feel a tremendous admiration for those early explorers who under such adverse conditions had the energy and interest to engage in the collecting of botanical specimens in their spare time.

Arctic Bibliography, vol. I–XI (1953–1963) and E. HULTÉN: "History of botanical exploration in Alaska" (HULTÉN 1940) have been valuable sources in the compilation of the following survey.

The naturalist G. T. LAY and the surgeon A. COLLIE were in 1825–28 members of the expedition to the Pacific Ocean and Bering Strait in His Majesty's ship «Blossom» under the command of Captain F. W. BEECHEY, "to meet and assist the FRANKLIN and PERRY polar expeditions, and at the same time to make scientific observations in areas visited". They collected a few lichens in Kotzebue Sound in 1826–27, enumerated by HOOKER & ARNOTT (1841).

B. C. SEEMANN, naturalist of the expedition in H. M. S. «Herald» under Captain KELLETT, in search of Sir JOHN FRANKLIN, collected lichens in the Bering Strait region in 1848. Reported by BABINGTON (1851).

C. WRIGHT, botanist of the US North Pacific Exploring Expedition under Commanders RINGGOLD and RODGERS in 1853–56, collected some lichens in the Bering Strait region. These have mainly been reported on by TUCKERMAN (1858, 1859, 1882, and 1888).

J. T. ROTHROCK, as a member of the Western Union Telegraph Expedition, collected plants in Alaska in 1865–68. In his publication "Sketch of the flora of Alaska" (ROTHROCK 1868) there is a list of lichens compiled by H. MANN. The localities are only vaguely indicated.

A. KELLOGG, surgeon to a survey party organized by the US Coast and Geodetic Survey on board the revenue cutter «Lincoln», collected plants on the southern coasts of Alaska in 1867. The lichens were reported on by TUCKERMAN (1882).

W. H. DALL was a member of a Coast Survey party to the southern coasts of Alaska, the Aleutians, Pribilof Islands and Nunivak Island in 1871–74. Among his botanical collections there were apparently also lichens, as one specimen was mentioned by HOWE (1911a).

L. M. TURNER, weather observer at St Michael, made some collections, mostly phanerogamic plants, during the years 1874–77. A few lichen specimens were mentioned by HOWE (1911a).

The surgeon E. B. ALMQUIST, participating in NORDENSKIÖLD's Arctic Expedition in the ship «Vega», collected lichens in Siberia, the Bering Strait region and Japan during the years 1878–79. The Bering Strait lichens were reported on by NYLANDER (1885a, b, 1888). ALMQUIST himself published his ecological observations in 1887.

T. H. BEAN accompanied a US Coast Survey party under W. H. DALL to Alaska in 1880. His task was primarily to investigate fishes and fisheries of Alaska, but he also collected lichens from a great variety of localities including south-east and south central Alaska, the Aleutian Islands, the Bering Sea and Bering Strait

regions, the Arctic Coast, and a few localities in Siberia. This material was reported on by ROTHROCK (1884).

C. L. HOOPER, captain of the revenue-steamer «Corvin» on the expedition in search of DE LONG and the «Jeanette» in 1881, reported 4 lichen species from Alaska, according to CUMMINGS (1904). HOOPER's publication not seen.

C. L. MCKAY, weather observer of the US Signal Service, collected plants at Nushagak, Alaska, for the US National Museum in 1881. In this collection there was only one lichen, reported by KNOWLTON (1886).

Sergeants J. MURDOCH and M. SMITH made collections of natural history as members of the International Polar Expedition to Point Barrow in 1881–83. The plants were reported on by GRAY (1885) with notes on cryptogams, including a few lichens, by Dr. FARLOW.

ARTHUR KRAUSE and AUREL KRAUSE of the Bremen Geographical Society collected plants in the Chilcat region in south-east Alaska in 1882. In "Die Flora des Chilcatgebietes" KURTZ (1895) mentioned a lichen collection which was not yet studied.

W. L. HUFF made a small collection of plants at Hotham Inlet and Fort Cosmos in 1885. A few lichens were reported by CUMMINGS (1904).

C. H. TOWNSEND, naturalist of the US Fish Commission steamer «Albatross» commanded by Z. L. TANNER of the US Navy, collected plants along the Alaskan coast in 1886–96. Some lichens from Attu Island were reported by CUMMINGS (1904).

G. E. COOLEY collected plants in south east Alaska in 1891. The lichens were treated by CUMMINGS (*in* COOLEY 1892).

C. W. HAYES in connection with the SCHWATKA Yukon Basin Expedition made a small collection of lichens in 1891. Reported on by CUMMINGS (*in* HAYES 1892).

W. PALMER of the US Natural Museum collected plants in the Pribilof Islands in 1891. Some lichens from St Paul Island were determined by Mr. W. W. CALKINS and published by MACOUN (1899).

J. H. TURNER, assistant of the US Coast and Geodetic Survey, collected some lichens on St Michael Island in 1891. Reported by CUMMINGS (1904).

J. M. MACOUN, assistant naturalist to the Geological Survey of Canada, collected plants in the Pribilof Islands during the years 1891, 1892, 1896, and 1897. His publication on the collections (MACOUN 1899) included a list of lichens. During the same years, and also in 1901, he made collections in various localities on the southern Alaskan coasts and in the Aleutian Islands. These were reported on by JOHN MACOUN (1902).

F. FUNSTON, field agent of the US Department of Agriculture, collected some lichens in the upper Yukon Valley in 1893. Reported by CUMMINGS (1904).

R. REULEAUX collected a few lichens at Sitka in 1894, reported on by STIZENBERGER (1895).

W. M. CANBY made a small collection of plants in south-east Alaska in 1897. One lichen was mentioned by CUMMINGS (1904).

W. H. EVANS of the US Department of Agriculture collected plants along the southern coast of Alaska in 1897–98. The lichens were reported on by CUMMINGS (1904).

R. S. WILLIAMS of the New York Botanic Garden collected plants in the Yukon in 1898–99, including a few specimens from Skagway, Alaska. The lichens were reported by HOWE (1911c).

E. F. GLENN, captain of the Cook Inlet Exploring Expedition, collected plants in the Cook Inlet region in 1899. One lichen was reported by CUMMINGS (1904).

W. A. SETCHELL, professor of the botanical faculty of the University of California, collected lichens on an expedition to the Cape Nome–St Michael region in 1899. These were reported on by CUMMINGS (1904).

W. TRELEASE, mainly, but also F. V. COVILLE, T. H. KEARNEY, A. SAUNDERS, W. H. BREWER, W. R. COE, C. PALACHE, T. KINCAID, and L. J. COLE, all members of the HARRIMAN Expedition, collected lichens on the southern coasts of Alaska in 1899. This collection was the main basis for "The lichens of Alaska" by CUMMINGS (1904).

A. J. COLLIER, assistant geologist of the US Geological Survey, collected some plants in the Cape Nome region in 1900. In his publication on the vegetation of the area (COLLIER *in* BROOKS 1901) is a list of lichens determined by CUMMINGS.

A. W. GREELY collected a few botanical specimens at Columbia Glacier in Prince William Sound in 1902. One lichen was mentioned by HOWE (1911a).

F. L. HESS of the US Geological Survey collected lichens on the southern coast of Seward Peninsula in 1903–07. These were published by HERRE (1920). In the same list are included specimens from Skagway, White Pass, Tanana and Eagle, provided by Dr. H. HEATH of Stanford University. It is not clear who collected these specimens.

J. D. CULBERTSON made a small collection of plants at Windham Bay in 1905. Lichen specimens collected by him are cited by BERRY (1941).

F. B. McKECHNIE accompanied an expedition under the auspices of the US National Museum to Ketchikan, the Aleutians, Pribilof Islands and Nome in 1911. The lichens collected on this occasion were reported on by HOWE (1913a).

A. S. FOSTER, mainly, but also T. C. FRYE and D. WAYNICK, collected lichens on the south-east coast of Alaska in 1913, on an expedition under the direction of Dr. FRYE, sent by the Bureau of Soils to investigate the kelp beds along the southern coast of Alaska. This collection was reported on by HERRE (1919) and MAGNUSSON (1932).

F. JOHANSEN, chief of the southern party of the Canadian Arctic Expedition 1913–18, collected lichens on the Arctic Coast of Alaska. Reported on by MERRILL (1924).

O. J. MURIE and L. J. PALMER of the US Bureau of Biological Survey made during the years 1920–35 collections of lichens in various parts of Alaska in connection with studies on reindeer grazing. Stray publications on these collections have appeared. The species of *Cladonia* in PALMER's collection were published by MERRILL (1929). In 1922 HADWEN & PALMER published a list of lichens from the Bering Sea and Bering Strait area, partly collected by the investigators, and partly by Mr. C. THORNTON, a local botanist from Nome. In a publication by PALMER & ROUSE (1945) a list of common tundra lichens is given.

The Swedish botanist E. HULTÉN, assisted by W. J. EYERDAM, collected plants along the southern coasts of Alaska and the Aleutian Islands in 1932. HULTÉN's lichen collection was reported on by DEGELIUS (1937), and EYERDAM's collection by HEDRICK (1936).

W. J. EYERDAM collected lichens in Prince William Sound in 1939–40. These

were determined by JONES, DEGELIUS and THOMSON, and published by EYERDAM (1949). In 1945 and 1947 he collected lichens in south-east Alaska and the Kodiak Island group. These were reported on by THOMSON (1950a).

L. D. STAIR collected plants in the Yakutat region in 1945. His publication on the collection (STAIR 1947) also contained a list of lichens.

W. J. CHRISTIAN made some botanical collections at Adak Island in 1946–47. The few lichen specimens were identified by W. L. DIX and published by STAIR (1948).

L'abbe ERNEST LEPAGE collected plants in various parts of Alaska in 1948. The lichens of the collection were reported on by HERRE (1950a).

P. F. SCHOLANDER and W. FLAGG collected lichens in the Arctic Coast District in 1948. These collections are largely unpublished except for notes on *Cladoniae* by EVANS (1955), *Umbilicariae* by LLANO (1950, 1956) and remarks on some new species, varieties and forms by LLANO (1951).

G. A. LLANO collected lichens in various parts of Alaska, mainly in the Brooks Range, in 1949. This collection is also largely unpublished except for the publications mentioned above under SCHOLANDER and FLAGG.

Since 1950 several smaller and larger collections of lichens have been made in Alaska, and have been reported on by different authors, for instance Heusser (1954), HOWARD (1958, 1963), KROG (1962), McCULLOUGH (1965), JOHNSON et al. (1966), and WEBER & VIERECK (1967). Dr. JOHN THOMSON has collected Alaskan lichens which are partly published as an exsiccate *Lichenes Arctici*.

There are undoubtedly many relatively recent and as yet unreported lichen collections from Alaska in various herbaria. I have personally seen parts or all of the collections made by SCHACKLETTE in 1958, 1960, 1965, and 1966, LØNØ in 1961, HULTÉN in 1961 and NEILAND in 1961, 1962, and 1963.

The present survey of collectors of Alaskan lichens does not claim to be exhaustive. At times a person may be cited in literature as the collector of one or more Alaskan lichen specimens, without any data on his activities in Alaska being available. At other times an old herbarium specimen from Alaska may be seen, credited to some unfamiliar collector whose records were never published. However, these cases are not believed to represent collections of any importance.

As is clearly shown from the preceding list the majority of the collectors were not even biologists. Only 4 can be said to have been trained lichenologists, viz. LLANO, SCHOLANDER, THOMSON and WEBER, and their valuable collections are largely unpublished. Most of the older publications are outdated, and the collections are in need of revision.

## GEOLOGICAL HISTORY

The review of Alaska's geological history is mainly based on the following literature: WAHRHAFTIG (1965), HOPKINS (1959), SCHWARZBACH (1961), CHANEY (1940), and AXELROD (1960).

The oldest rock unit in Alaska is the Birch Creek schist of the Yukon-Tanana upland and the Alaska Range. This schist was originally sand and mud deposits thought to have been folded and metamorphosed in early Precambrium.

During much of the Paleozoic era most of Alaska was under water. Thick deposits of this age are found throughout the State. In the Brooks Range the Paleozoic rocks consist largely of limestone, sandstone and shale, or their metamorphic equivalents. In the central part of Alaska the same types of rocks are found, interbedded with chert, volcanic rock and graywacke. In southern and south eastern Alaska graywacke and volcanic rock are common throughout the Paleozoic sequence, interbedded with limestone, slate, schist and nonmarine red beds. There are some indications of mountainbuilding activity in Alaska during early Devonian, but it is not believed to have had any effect on the present topography of the country.

In early Carboniferous time extensive submarine volcanic eruptions occurred in various parts of Alaska, and during part of the Permian and Triassic most of Alaska south of the Arctic Circle was a great submarine volcanic field. The basalt flows of this age constitute the greenstone formations which are so common in Alaska. The eruptions of greenstone were followed by further deposits of limestone and shale over the sea floor.

A new period of orogenic activity began in the Jurassic. In southern Alaska the andesite flows and tuffs of early Jurassic were intruded in mid-Jurassic time by an enormous granitic batholith that stretched from the Talkeetna Mountains through the southern Alaska Range to the Aleutian Islands. From this time on, parts of Alaska were rapidly uplifted to form mountains. Sediments deposited in adjacent basins became the graywacke, argillite and conglomerate that make up great parts of the mountain ranges of southern and central Alaska. This was a period of deformation by uplifts, depressions, sliding and folding. The orogenic activity reached its climax and culminated in late Cretaceous time. At that time great batholiths were intruded in the Alaska Range, the Interior Plateaus, the Kodiak and Chugach Mountains and throughout south eastern Alaska. The Paleozoic rocks of the Brooks Range were thrust northward and folded in flat folds overturned to the north. By the end of the Cretaceous most of Alaska was dry land.

Orogenic activity continued in the North American Cordillera throughout the Tertiary, especially in the belt adjacent to the Pacific Ocean. Tertiary rocks along the coast of the Gulf of Alaska were tightly folded, thrust, and raised to great heights. In the remainder of Alaska the orogenic activity of Cenozoic time was much less intense than that of the Cretaceous, but at least one period of intensive mountain building is indicated in central Alaska in Tertiary time.

Geological evidence indicates that Siberia and Alaska represent segments of a single continental land mass, separated by the temporarily submerged Bering-Chukchi platform. This platform is at present covered with 100–500 ft of water and thick layers of marine sediments. However, most of the islands in the Bering Sea and Bering Strait are composed of typical continental rocks similar to those found in parts of Siberia and Alaska. Segments of the same mountain arc are found on the Wrangel Islands, on Herald Island in the Chukchi Sea, and on Lisburne Peninsula.

Paleontological records show that the Bering-Chukchi platform must have been above sea level during most of the Tertiary, only briefly interrupted by temporary

submergences. Nonmarine sediments of Eocene age, containing for instance *Sequoia*, are found on St Lawrence Island. Marine sediments tentatively assigned to Pliocene are found on Seward Peninsula and on the Pribilof Islands. No other Tertiary sediments have been identified with certainty in western Alaska north of the Aleutian chain. Faunal interchanges apparently took place between the continents at different periods from early Eocene to middle or late Pliocene, but the almost complete lack of interchange during middle Eocene seems to indicate the temporary existence of a water barrier at that time.

For marine organisms a land barrier is indicated throughout most of the Tertiary. The molluscan fauna of the early, middle and late Tertiary sediments along the coast of the Gulf of Alaska shows no relationship to the contemporary Atlantic faunas. On the other hand, closely related faunas of the middle Tertiary existed on the Arctic Coast of Alaska and in the North Atlantic.

In the Northern Hemisphere a warm climate is believed to have prevailed into high latitudes from the Cambrian to the end of the Tertiary. The early Tertiary was considerably warmer than today, and the limit of the warm to temperate zone lay an average 10–15° north of its present position. The polar tree line lay 20–30° farther to the north than it does today, and polar ice caps did not exist.

During the Eocene period a temperate vegetation, the Arcto-Tertiary Geoflora, ranged into high northern latitudes including Alaska, northern Siberia, Spitsbergen and Greenland. Parts of the vegetation, which was mainly composed of a mixture of temperate conifers and deciduous hardwoods, probably extended southwards along mountain ranges into regions with a predominantly subtropical flora. The Arcto-Tertiary Geoflora retreated southwards in response to the cooling climate following Eocene, and by early Miocene it dominated the forests of middle latitudes in both western North America and Eurasia.

In the Pacific coastal region of North America species of the East Asian element of the Geoflora had a prominent place in the forests of the later Oligocene, indicating important migration around the northern Pacific Basin.

In the course of the Tertiary a gradual cooling-off process set in, leading to the establishment of conditions approximating those of the present time. In Pliocene there were probably already extensive polar ice caps, and traces of glaciation from that period have been found in Alaska and in Iceland.

The Quaternary period is characterized by its unique climatological conditions. Periodic lowering of temperatures led to the formation of large inland ice sheets both in Europe, northern Asia and North America. The formation of the ice sheets is believed to have been caused rather by lowering of temperature than increase in precipitation. In North America the main ice mass (the Laurentian Ice), spreading from north-eastern Canada, was directly connected with the Cordilleran ice complex of western North America. To the south the advance of the ice was halted by high temperatures; in the north the low precipitation had the same effect. For this reason the northern and central parts of Alaska, with the exception of Brooks Range and part of the Seward Peninsula, were never glaciated. The Alaska Range and the southern parts of Alaska were, however, heavily glaciated, although nunataks and certain icefree coastal areas probably did exist.

In Asia large parts of western Siberia were glaciated, and the mountains of



eastern Siberia carried considerable ice caps. However, because of the continental type of climate, large areas of central and eastern Siberia were glaciated to a much lesser extent than the neighbouring areas to the west.

Four different ice ages are generally recognized in the Pleistocene, alternating with interglacial periods with climates similar to today's or somewhat warmer. The four glacial epochs are in North America known as the Nebraskan, Kansan, Illinoian and Wisconsin, corresponding to the Günz, Mindel, Riss and Würm in Europe. The Wisconsin glaciation in Alaska consisted of at least two major glacial advances and several minor oscillations of the ice fronts during the later major advance. Fig. 1 shows the areas covered by glaciers at the time of their maximum spread during the Pleistocene period.

In central Alaska the extent of the Wisconsin glaciation was much less than the extent of the Illinoian glaciation. In southern Alaska, however, the Wisconsin glaciation seems to have had almost the same extent as the Illinoian glaciation. In the region between Cape St Elias and Icy Point, along the Gulf of Alaska, there is indication that the Wisconsin glaciation was less extensive than Recent glaciers, and that parts of the shore were not glaciated. This is believed to be due to the coastal mountains having a lower relief during Wisconsin time than in Recent time.

Near the beginning of the Pleistocene epoch the Bering-Chukchi platform was depressed to form a seaway connecting the Pacific Ocean with the Arctic Ocean. During Pleistocene the repeated growth and disappearance of large glaciers was accompanied by repeated fluctuations of the sea level. The surface of the sea lay at least 100 ft higher than today during the warmest interglacial periods when glacial ice disappeared almost completely throughout the world, and the sea level was lowered by more than 300 ft during the maximum glacial ages. A reduction in sea level of 300 ft would result in the exposure of nearly all of the Bering-Chukchi platform, connecting Alaska and Siberia by a plain more than 1000 miles wide (Fig. 2).

Paleontological studies have shown that the vegetation of the land bridge during the Wisconsin glacial consisted of treeless arctic tundra. Little direct evidence is available concerning the character of the vegetation on the land bridge during its earlier periods of existence in Pleistocene time. However, comparisons of the present vegetation of Alaska and Siberia, and of the fossil Pleistocene floras of the two regions suggest that the Bering land bridge has supported only tundra vegetation and that no continuous belt of forest ever extended across the land bridge during the Pleistocene epoch.

During the postglacial warm period the timberline extended westward in Alaska, but this coincided with the closing of the land bridge by the rising sea about 10,000–11,000 years ago. Present information indicates that the Bering land bridge has not been covered by forests since late Tertiary time.

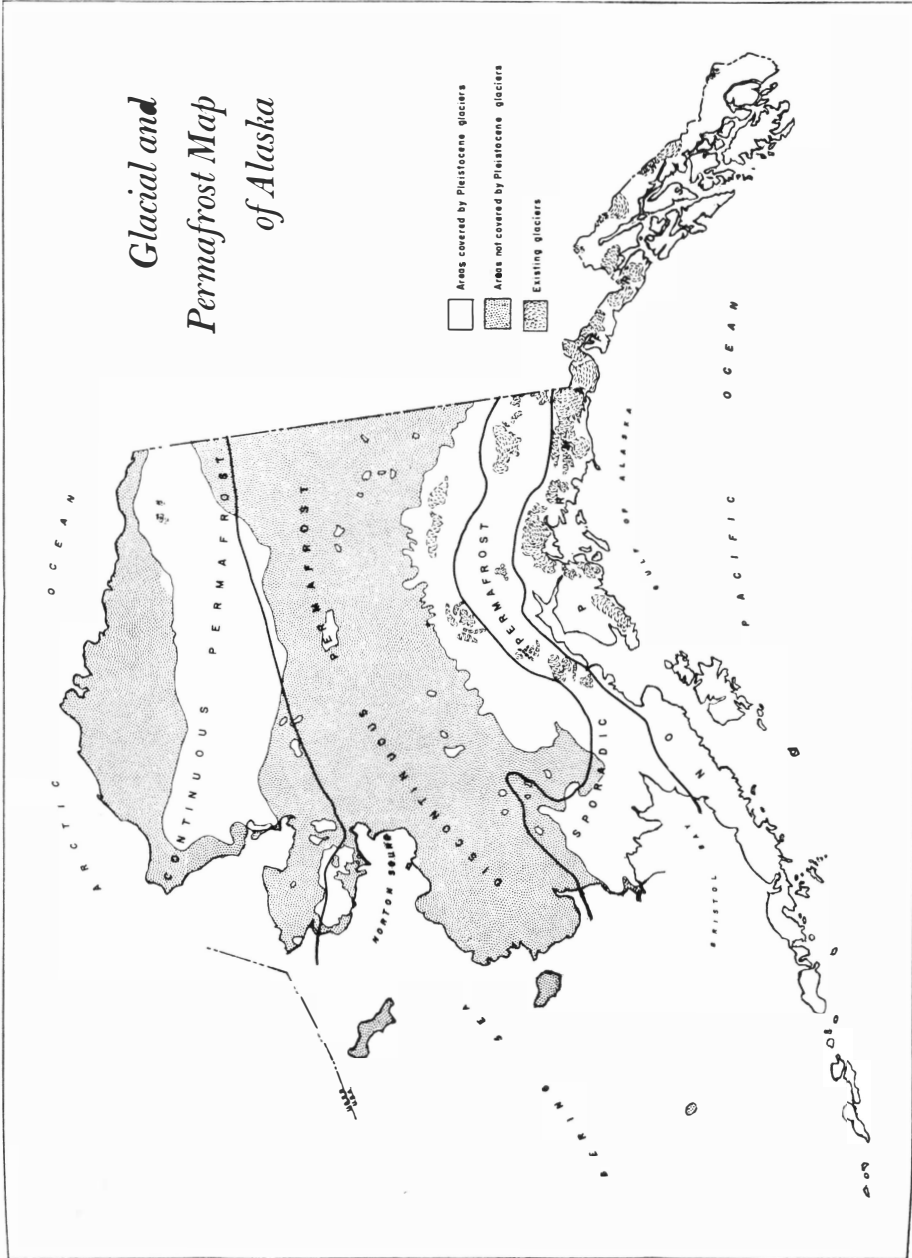


Fig. 1. Present areas occupied by glaciers and by permafrost, and areas formerly covered by glaciers at the time of their maximum spread during the Pleistocene period. (Compiled by US Geol. Surv. 1957. — From BLACK 1958).

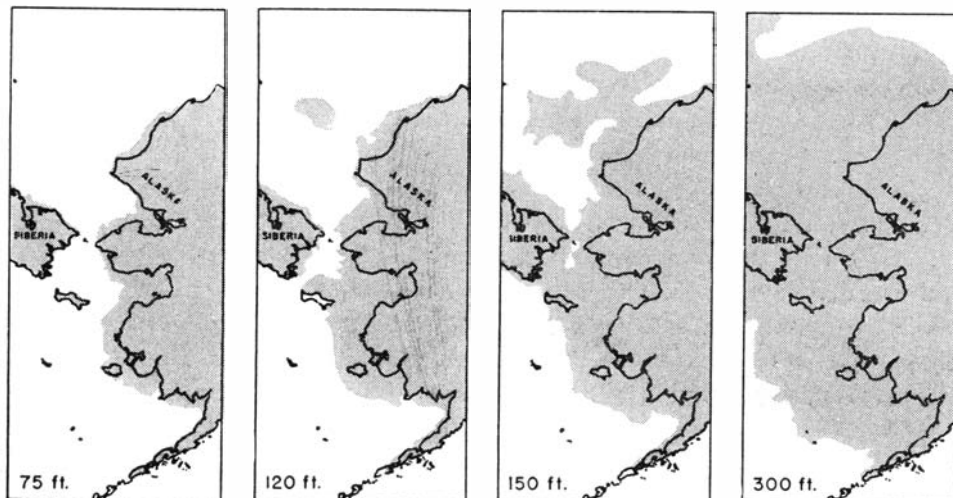


Fig. 2. Development of the Bering Sea land bridge. The diagrams show expansion of land areas when sea level sank 75, 120, 150, and 300 ft during the Pleistocene period.  
(Prepared by D. M. HOPKINS. — From FLINT, Jr. 1958.)

## TOPOGRAPHY, CLIMATE AND VEGETATION

For information on the topography, climate and vegetation of Alaska the following literature has been consulted: WAHRHAFTIG (1965), WATSON (1959), SIGAFOOS (1958), and HEUSSER (1965).

The major physiographic structures of the western United States and Canada can be traced into Alaska and serve as a base for a subdivision of the country into a few large units with a certain homogeneity in geological origin and surface expression. Most of Alaska falls within the physiographic unit known as the North American Cordillera:

The Pacific Mountain System in Alaska is represented by an arcuate belt of high mountains bordering the Pacific Ocean, consisting of two separate mountain ranges with intervening lowlands. The northern range forms the Coast Mountains, the Alaska Range and the Aleutian Range; the southern range forms the Chugach-Kenai-Kodiak mountains.

The southern and south eastern regions of Alaska are dominated by rugged mountains, ice fields and glaciers, fjords and islands. The Aleutian chain, an arcuate island belt between the Pacific Ocean and the Bering Sea, is part of the crest of a long submarine ridge with numerous volcanos, many of them still active.

Central Alaska from the Canadian border to the coasts of the Bering and Chukchi Seas belongs to the Intermontane Plateaus. This is a region of wide river basins, plateaus and lowlands, a few minor mountain ranges and several isolated rounded domes. Near the coast and on the islands there is a belt of arctic tundra.

The Rocky Mountain System continues into Alaska as the Arctic Foothills and the Arctic Mountains, of which the Brooks Range is the most dominating feature.

The area north of the Brooks Range, the Arctic Coastal Plain, is a continuation of the Interior Plains of North America. It consists of treeless arctic tundra of low relief, with local pingos, sand dunes and thaw lakes.

The Pacific coast enjoys a generally mild oceanic type of climate. The main ocean current of the North Pacific brings warm waters from the coast of Japan eastwards and reaches the North American west coast in the vicinity of British Columbia and the southernmost part of Alaska. A subordinate current (the Alaska current) carries the warm waters to the north and west along the Alaskan coast and the Aleutian Islands. The high mountains of the Pacific coast form a barrier to the warm humid air blowing in from the Pacific, trapping most of the moisture as rain and snow. In this zone the characteristic features of the climate are high precipitation, high humidities and fog frequencies, considerable cloudiness and small variations in temperature. This type of climate is conducive to the formation of icefields and glaciers. Because of the rugged terrain there is a tendency towards pronounced differences in temperatures and precipitation in local areas separated by relatively short distances. Inland fjords are commonly colder with less precipitation than the outer shoreline.

The highest mean annual precipitation has been measured at Little Port Walter on Baranof Island with more than 220 inches. Most of the precipitation falls in the winter time, and in lower regions much of it falls as rain. At higher elevations the snowfall reaches impressive figures. Thompson Pass in the Chugach Range has a mean seasonal snowfall in excess of 600 inches, and a record snowfall of 975 inches.

With the exception of Cook Inlet, the sea remains open during winter in southeastern and southern Alaska as far as Bristol Bay, but glacial ice may be locally abundant.

The change from an oceanic to a semicontinental climate is rather abrupt along the coastal mountain barriers, but towards the western parts where the relief is lower the change is more gradual. The most pronounced change occurs along the higher ridges of the Chugach Range.

In the outer coast region there is no permafrost, but farther inland sporadic permafrost may be encountered.

The degree of oceanicity of an area can be evaluated by the calculation of hygrothermic indexes. Since most of the Pacific coast of Alaska climatologically falls in the temperate zone, the AMANN index for hygrothermy in temperate oceanic areas (AMANN 1929) seems well suited. It is expressed by the formula

$$H = \frac{PT}{tv_{II} - t_I}$$

where P is mean annual precipitation measured in cm, T is mean annual temperature in centigrades, and  $tv_{II}$  and  $t_I$  are the mean temperatures of July and January respectively.

According to AMANN (op. cit.) an oceanic climate is characterized by an index higher than 50. Indexes for stations on the Atlantic coast of Europe commonly range between 60 and 100. Stations on the south east coast of Alaska have high

to very high hygrothermic indexes, but the values decrease gradually as one moves westwards along the Gulf of Alaska (Table I). In Prince William Sound there is a marked difference between Valdez in the inner part of the sound and Cordova in the outer part. Anchorage, situated on a sheltered inlet which freezes up in the winter, has an index of 3, an indication of a strongly continental climate. Even so, the Anchorage area is not truly continental in the same sense as interior Alaska. During the winter a continental climate prevails, but during summer there is a certain oceanic influence on the climate when moist air occasionally passes northwards through Cook Inlet.

Table I. *Hygrothermic indexes for some Alaskan stations along the Pacific coast.*

Station	H
1. Ketchikan	239
2. Sitka	125
3. Juneau	91
4. Yakutat	95
5. Cordova	59
6. Valdez	17
7. Seward	43
8. Anchorage	3

In the central regions of Alaska the mountain barriers prevent any oceanic influence from the Pacific and Arctic Oceans. To the west the region opens out to the Bering Sea, and its climate gradually merges with that of the Bering Sea littoral. Warm water from the Pacific only reaches the southern and deeper parts of the Bering Sea, while the north-eastern part is influenced by cold water from the Arctic Ocean. The air currents over the cold waters are relatively dry. There are no coastal barriers to induce precipitation and there is no marked coastal rainy belt. The air gradually loses moisture as it moves inland. During the winter the Bering Sea is covered with ice southwards to about 58°N, and winter temperatures on the islands and coast become very low.

Interior Alaska has a decidedly continental semi-arid climate with comparatively hot summers and long cold winters. Fort Yukon has had record high readings of 100°F, and record low readings of -75°F. Precipitation over the interior basin averages annual amounts of 10-13 inches. The heaviest rainfall occurs in June-July, and is predominantly of the convection shower type. Thunderstorms are common in this area during the summer.

The temperature amplitudes gradually decrease from the interior basin towards the coast, while precipitation increases. Going north along the coast the temperature amplitude increases again, while precipitation drops to low levels (Table II).

Most of this region is underlain by discontinuous permafrost. Thawing of the frozen ground during the summer months leads to a sharp contrast between the

high air temperatures and the low temperatures of the ground saturated with icy water.

The Arctic Coast is the only region in Alaska with a truly arctic climate. The Arctic Ocean is frozen about 10 months of the year, and during the winter the area takes on a continental character. Winter temperatures generally lay between  $-45^{\circ}$  and  $-60^{\circ}\text{F}$ , and high wind and drifting of snow is common. During a few summer months maritime conditions influence the climate, but the low temperature of the ocean leads to very little evaporation, and the winds blowing in over the coast are relatively dry. Annual precipitation varies from 4 to 10 inches. Despite the continuous sunshine during the summer, temperatures do not go above the middle eighties. The entire area is underlain by permafrost.

Table II. *Mean January and July temperatures in degrees Fahrenheit, and mean annual precipitation in inches for some stations in central Alaska, grouped by location from the east westwards towards the Bering Sea.*

Station	T-January	T-July	P
Fort Yukon	-18.6	61.3	6.53
Fairbanks	-9.8	60.9	11.92
McGrath	-8.7	58.7	19.13
Holy Cross	0.3	57.6	18.35
Bethel	6.8	54.5	18.17
Nome	5.6	49.6	18.69
Kotzebue	-6.6	52.6	8.02

Some aspects of the climatic variations within Alaska are shown in Fig. 3 (mean daily minimum temperatures in January), Fig. 4 (mean daily maximum temperatures in July), and Fig. 5 (average annual precipitation).

The vegetation of south-eastern Alaska is dominated by the coastal conifer forest of north-western North America. Partly due to a shorter growing season and higher precipitation this type of forest does not reach the luxuriant development in Alaska as it does in Washington and Oregon. In south-east Alaska the most common conifer is western hemlock (*Tsuga heterophylla*). Westwards around the Gulf of Alaska Sitka spruce (*Picea sitchensis*) gradually becomes more important on the coast and mountain hemlock (*Tsuga mertensiana*) inland. On Kodiak Island and Alaska Peninsula *Picea sitchensis* represents the last outpost of the coastal conifer forest. Beyond this limit coastal grasland and tundra takes over.

The formation of muskeg and glaciers, induced by the high precipitation, inhibits the development of forests in certain areas. On glacial moraines and outwash, willow (*Salix*), alder (*Alnus*) and cottonwood (*Populus*) are commonly found.

The interior forest is the north-western extension of the Canadian boreal forest, dominated by white spruce (*Picea glauca*) and birch (*Betula*), with aspen (*Populus tremuloides*), black spruce (*Picea mariana*) and larch (*Larix laricina*) mixed in.

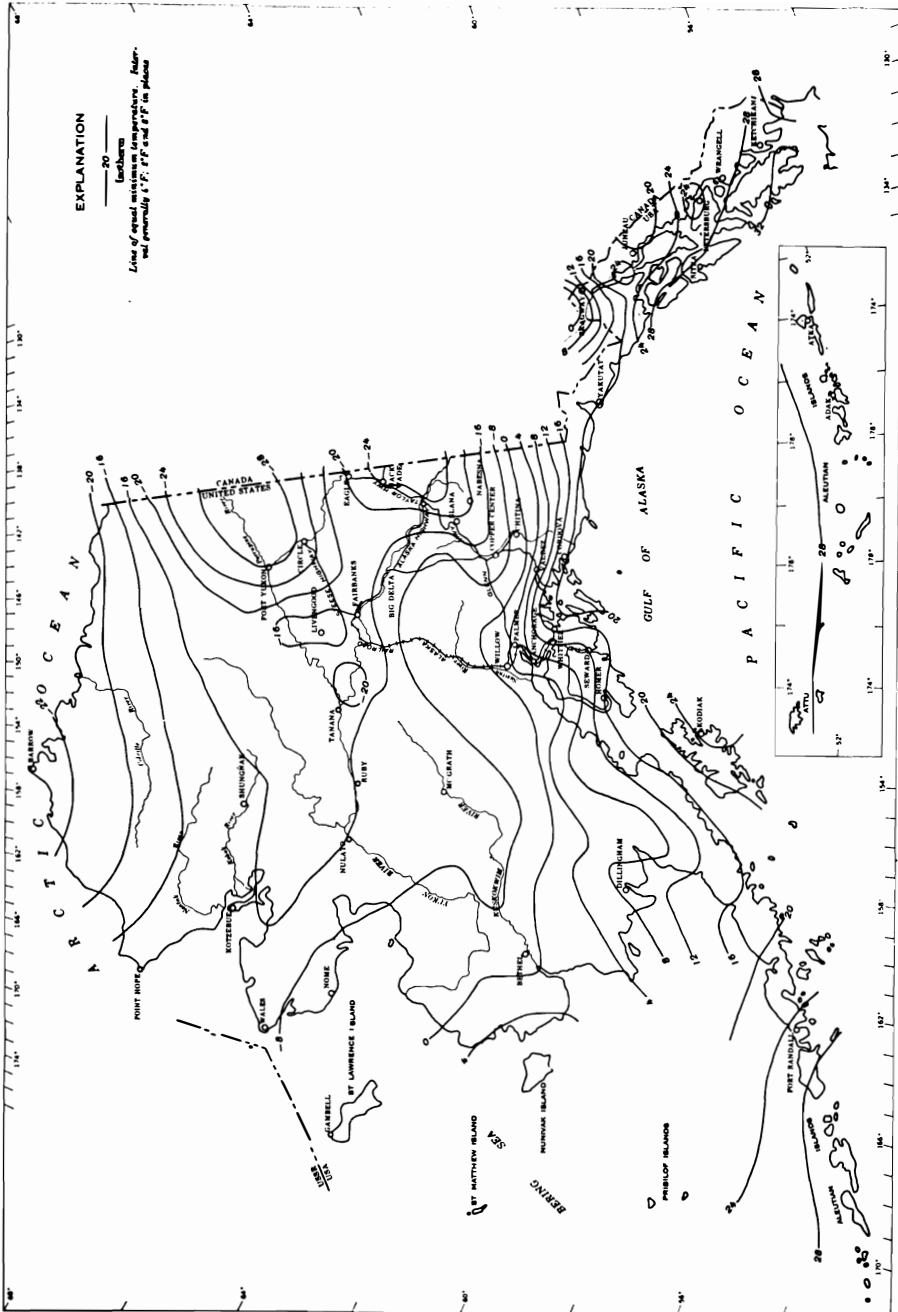


Fig. 3. Mean daily minimum temperatures ( $^{\circ}$ F) in January, based on the period 1931-52. (From WATSON 1959.)

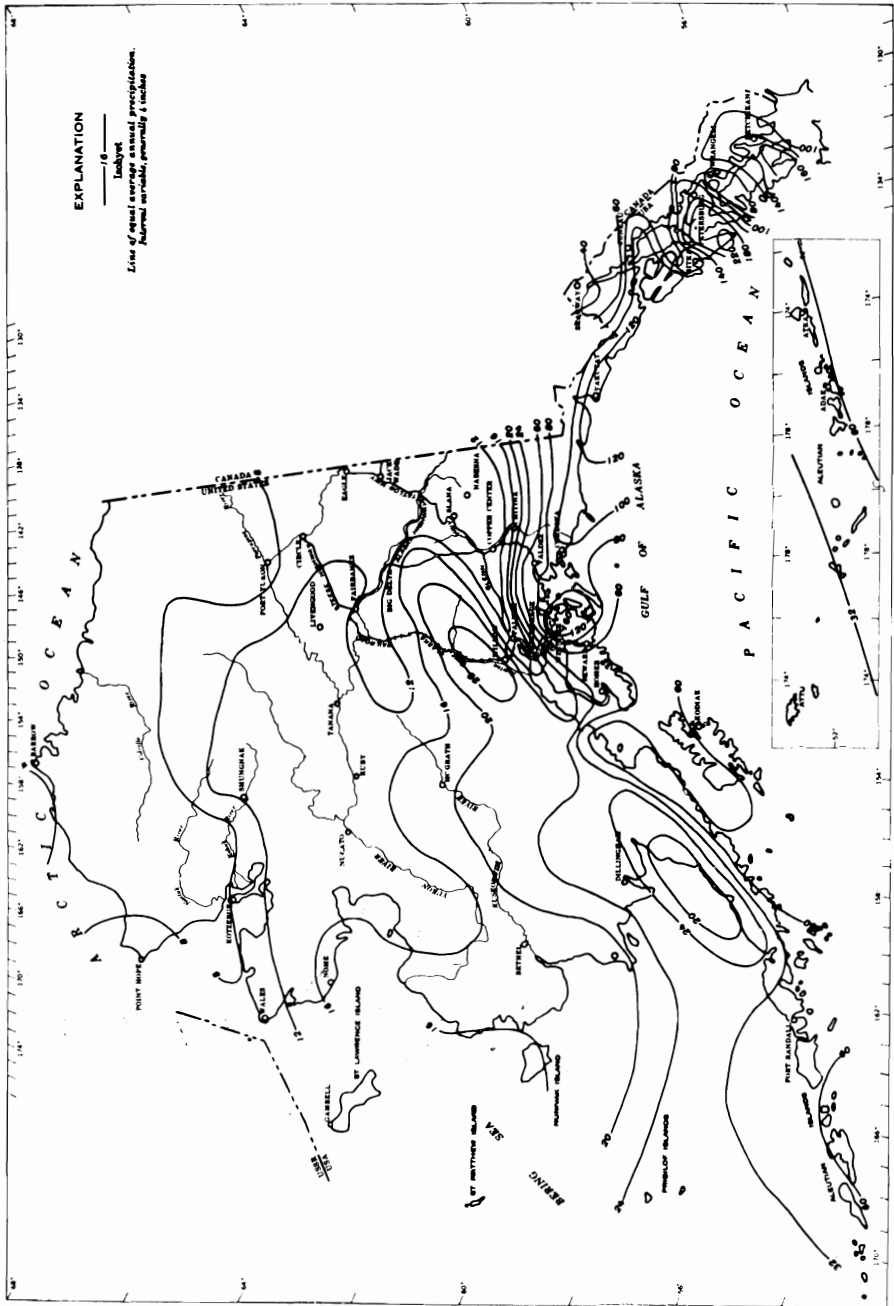


Fig. 4. Mean daily maximum temperatures (°F) in July, based on the period 1931-52. (From WATSON 1959.)



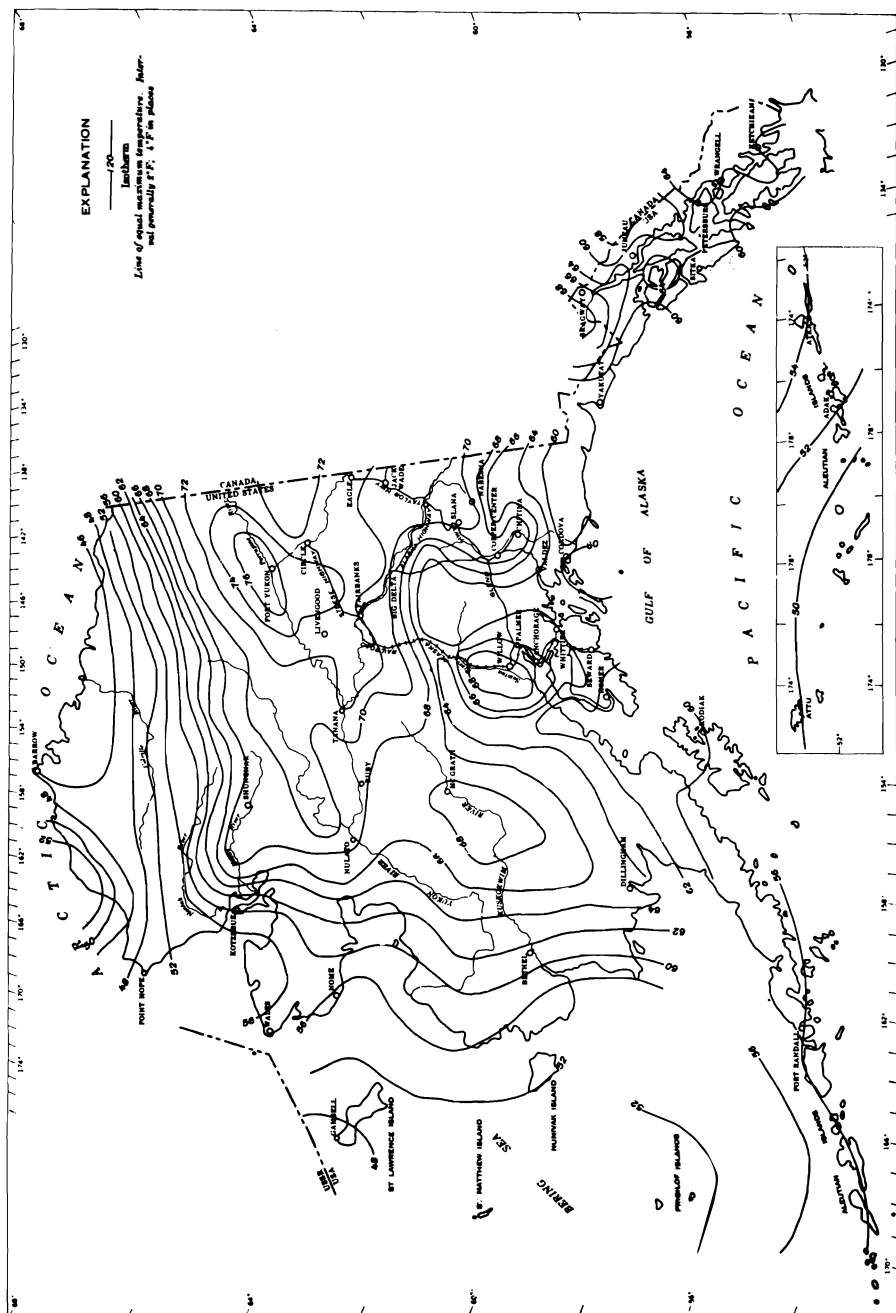


Fig. 5. Mean annual precipitation in inches, based on the period 1931-55. (From Watson 1959.)

Along river floodplains balsam poplar (*Populus tacamahacca*), alder and willow often dominate the vegetation. Within the forested region large treeless areas may result from poor drainage or soil instability, or from repeated forest fires.

The interior forest type extends southwards south of the Alaska Range, and reaches the sea around Cook Inlet where it merges with the coastal forest type.

In central Alaska white spruce usually forms the timberline forest. The timberline ranges in altitude from 200–800 ft in western Alaska, 1000–1500 ft on the south slope of the Brooks Range, and 2000–3000 ft in interior Alaska. Along river and creek beds dense stands of tall willows may be found in areas otherwise dominated by alpine heath communities.

Arctic tundra is found along the coasts of the Bering Sea, Bering Strait and Arctic Ocean. Plant composition and distribution in the arctic tundra are strongly influenced by elevation and exposure, drainage, substratum and permafrost, with the result that a wide variety of local types is encountered.

## MATERIALS AND METHODS

The present study of Alaskan macrolichens is based mainly on my own collections. Personally studied herbarium material has been included when the species in question were not represented in my own material. Reasonably probable literature records, not verified by me, have been included in brackets.

The first set of the collection is deposited in the herbarium of the Botanical Museum, University of Oslo, and a duplicate set will be deposited in the herbarium of the University of Alaska, College, Alaska.

Nomenclature and abbreviation of author names largely follow HALE & CULBERSON (1966). Herbarium symbols are those given by LANJOUW & STAFLEU (1964).

Species new to Alaska are marked with an asterisk.

A certain amount of undescribed species are naturally met with in a poorly explored region. As the importance of some of these species was overlooked in the field, the material gathered was not always as large as could be desired. However, in some cases it seemed better to recognize the species, even if all aspects of variation within the species could not be covered. Part of the material remains undetermined.

Colour reactions on thalli have been carried out with 10% KOH (K), aqueous solution of  $\text{CaCl}_2\text{O}_2$ , or lately, and much more effectively, commercial bleach solution (C), and alcoholic solution of p-phenylendiamine (PD). When a stable solution was desired, PD was substituted by an alcoholic solution of o-dianisidine (OD) (SANTESSON 1966).

Chemical studies have been incorporated to a large extent, but have not been carried out consistently for all species. ASAHINA's method of microcrystallization (ASAHINA 1936–39) has been employed. Lack of equipment prevented the simultaneous use of chromatography, but the importance of the combined application of both methods is emphasized.

Whenever possible, chemical properties are given for each species. When no author is cited the information is derived from my own observations. The results

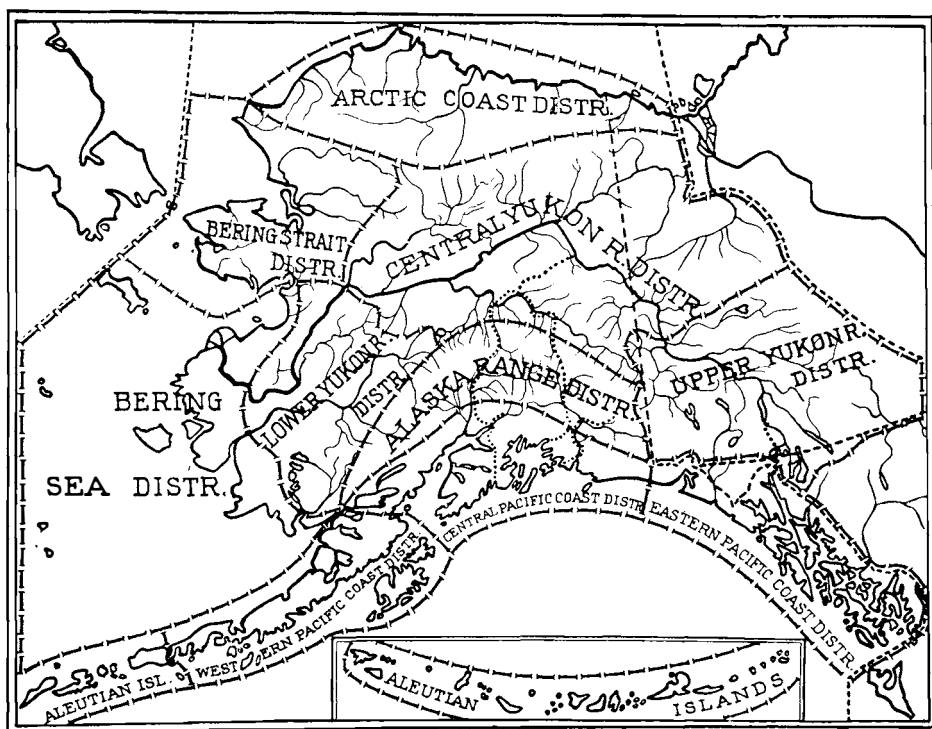


Fig. 6. The phytogeographical districts of Alaska and Yukon.  
(From HULTÉN 1941.)

of the chemical analyses of certain species sometimes pointed towards the desirability of investigations of a larger material (cf. *Cetraria islandica*, *Alectoria ochroleuca*, *A. sarmentosa*, *Hypogymnia enteromorpha*). This was beyond the scope of the present study.

Chemical lability has been observed in several cases, with 2, 3 or more lichen substances occurring together or in any combination with each other, sometimes making it difficult even to point out main and accessory substances. A knowledge of the relationship between the various lichen substances may be of importance in deciding their taxonomic value.

Chemospecies have not been recognized in this study. When no morphological variance was observed, a difference in chemical properties has been recorded by the term chemical strain. When chemical differences were accompanied by slight morphological difference the rank of variety has been applied.

The geographical division introduced by HULTÉN (1941) has been followed. HULTÉN divided Alaska and Yukon into 11 districts approximating phytogeographic units (Fig. 6). The Upper Yukon River District falls almost entirely within the Yukon Territory in Canada. Of the remaining 10 Alaskan districts 6 are represented in this study. No collections were made in the Western Pacific Coast District, the Aleutian Islands, the Lower Yukon River District and the Arctic Coast District.

The zonal distribution of the species has been indicated by the terms high arctic, low arctic, boreal and temperate, without a further division into subzones. Only the distribution in the Northern Hemisphere has been considered in this study.

In the introductory chapters to the genera a few remarks on literature have been included. They are not intended to be exhaustive, but merely to indicate what is available to the interested beginner who wants to know more about the lichens of this particular region.

## LIST OF LOCALITIES

### Eastern Pacific Coast District

	N. lat.	W. long.
Juneau area:		
Douglas skibowl, forested area with northern exposure, el. 100–800 ft. . . . .	58°17'	134°27'
Granite Basin, from Basin Rd, el. 600 ft, into Granite Basin and part way up Mt Juneau, el. 2500 ft . . . . .	58°19'	134°20'
Loop Rd, south of Mendenhall Lake, el. 50 ft . . . . .	58°24'	134°34'
Mendenhall Glacier Trail, on the side of McGinnis Mt, el 100–1500 ft . . . . .	58°27'	134°35'
Mendenhall Lake, el. 50 ft . . . . .	58°26'	134°34'
Montana Creek, open forest and swamp area, el. 300 ft . . . . .	58°26'	134°38'
Mt Roberts, trail on the northwest slope of the mountain to the summit, el. 400–3800 ft . . . . .	58°17'	134°20'
Shrine of St Therese, open western exposure on sea shore . . . . .	58°29'	134°48'
Sitka area:		
Harbour Mt, trail from the city on southern slope of the mountain to the summit, el. 100–2000 ft . . . . .	57°05'	135°19'
Indian River Trail, through forested area north of the city, el. 200 ft . . . . .	57°05'	135°16'
Sitka National Monument, totem park in open forested area close to the sea shore SE of the city . . . . .	57°03'	135°19'
Ketchikan area:		
Deer Mt, trail on western slope of the mountain, el. 500–3000 ft . . . . .	55°21'	131°36'
Saxman Village, low hills between Ketchikan and Saxman, el. 50–100 ft . . . . .	55°19'	131°36'
Ward Lake, NW of Ketchikan, el. 100 ft . . . . .	55°22'	131°44'

### Central Pacific Coast District

Prince William Sound:		
Fish Bay, dense coniferous forest with scant lichen vegetation, sea level. . . . .	60°30'	146°00'
Pigot Bay, sea level . . . . .	60°51'	148°23'
Richardson Highway:		
Mile 9, SE of Valdez, el. 100 ft . . . . .	61°04'	146°02'
Mile 24, el. 2000 ft . . . . .	61°05'	145°44'
Mile 37, near Tsaina River, el. 2000 ft . . . . .	61°12'	145°31'
Mile 45, slope NW of highway, el. 1400–3500 ft . . . . .	61°15'	145°17'

	N. lat.	W. long.
Kenai Peninsula:		
Cooper Creek camp ground, el. 400 ft .....	60°29'	149°53'
Granite Creek Ridge, el. 1000–2200 ft .....	60°47'	149°13'
South of Hidden Lake, sparsely forested hills between highway and Hidden Lake, el. 800–1200 ft .....	60°28'	150°14'
Homer, on Kachemak Bay, road to the east of the city, el. 50 ft .....	59°40'	151°37'
Ingram Creek camp ground, el. 50 ft .....	60°50'	149°05'
Marathon Mt, W of Seward, el. 200–3000 ft .....	60°07'	149°29'
Ninilchik, on Cook Inlet, el. 50 ft .....	60°03'	151°40'
Portage Glacier, along the road to the glacier and on hillside between the road and the river from Byron Glacier, el. 100–800 ft .....	60°47'	148°50'
Salamatof, on Cook Inlet, sea level .....	60°37'	151°20'
Seward, on east and west side of Resurrection Bay and in forest area behind Seward Sanatorium, el. sea level to 50 ft .....	60°07'	149°26'
Skilak Lake, between Kenai River and the rocky peninsula protruding into Skilak Lake S of Hidden Lake, on Caribou Island, and around recreation area in western part of the lake, el. 200 ft .....	60°25'	150°20'
Windy Point, on Turnagain Arm, el. 50 ft .....	60°56'	149°34'
Northern Cook Inlet area:		
Bird Creek Ridge, rising steeply from Turnagain Arm, paralleling Bird Creek on its west side, el. 100–3600 ft. ....	60°59'	149°28'
Campbell Creek, near Anchorage, el. 400–1000 ft .....	61°10'	149°40'
Eagle River Valley, el. 200–400 ft, and mountain ridge north of the river, el. 400–3200 ft .....	61°18'	149°28'
Eastchester Swamp, in Anchorage, el. 50 ft .....	61°13'	149°49'
Knik River, near Anchorage-Palmer highway, el. 50 ft .....	61°30'	149°03'
O'Malley Rd, near Anchorage, el. 500 ft .....	61°09'	149°48'
Potter, on Turnagain Arm, sea level to 100 f .....	61°04'	149°48'
Rabbit Creek, along Rabbit Creek Rd, el. 500–800 ft, and on mountain ridge S of the creek up to 3000 ft .....	61°06'	149°45'
Talkeetna Mountains:		
Bald Mt Ridge and Government Peak, el. 3000–4800 ft. ....	61°44'	149°19'
Buffalo Mine, in the lower foothills of Talkeetna Mts, by Moose Creek, el. 1000 ft .....	61°43'	149°03'
Independence Mine, area between the mine and Willow Rd from Susitna River to the summit, el. 1800–4000 ft .....	61°46'	149°17'
Little Nelchina, about mile 135 on Glenn Highway, el. 2500 ft .....	61°59'	146°58'
Little Susitna River south of Fishhook Creek, el. 1200 ft .....	61°45'	149°14'
Mabel Mine, el. 2500–4200 ft .....	61°48'	149°13'
Puritan Creek, on Glenn Highway, S of Anthracite Ridge, el. 2200 ft. ....	61°49'	148°07'

### Alaska Range District

#### Denali Highway:

Mile 0–37, el. 3000–4200 ft, including a couple of hills south of the highway of el. 4600 ft and a mountain ridge north of the highway at mile 28, el. 6000 ft. .	63°06'	145°30' – 146°40'
Mile 70, mountain slope N of highway, el. 3800–5000 ft. ....	63°12'	147°12'
Mile 100, el. 2800 ft .....	63°18'	148°00'

#### Mount McKinley National Park:

Mt McKinley Park camp ground, el. 2000 ft .....	63°44'	148°56'
Polychrome Pass, el. 3800 ft. ....	63°31'	149°57'

	N. lat.	W. long.
Savage River, mountain slope E of the river, el. 2600–5000 ft .....	63°45'	149°16'
Toklat, mountain ridge above ranger cabin, el. 3200–4000 ft .....	63°31'	150°04'
Wonder Lake, el. 2000–2600 ft .....	63°30'	150°53'

Richardson Highway:

Base of Rainbow Mts, low ridge E of highway, el. 3500 ft .....	63°19'	145°42'
Darling Creek, el. 2000 ft .....	63°38'	145°54'
Mile 170, el. 2700 ft .....	62°47'	145°29'

### Central Yukon River District

Alaska Highway:

Mile 1450, el. 1000–1200 ft .....	64°16'	164°12'
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Steese Highway:

Circle Hot Springs, el. 1000 ft .....	65°29'	144°39'
Cleary Summit, el. 1200–1500 ft .....	65°05'	147°26'
Eagle Summit, el. 4000 ft .....	65°29'	145°25'
12-Mile Summit, el. 3000 ft .....	65°23'	145°58'

White Mountains:

Beaver Creek east of Sheep Creek, forest covered slopes between Sheep Creek and Mascot Creek, el. 900–2000 ft .....	65°44'	147°05'
Cache Mt, ridge paralleling the south fork of Fossil Creek, up to el. 4000 ft. . .	65°31'	147°24'
Fossil Creek, el. 1200 ft .....	65°28'	147°40'
Granite outcrop close to the limestone ridge, el. 2800 ft. ....	65°30'	147°35'
Headwaters of Sheep Creek, el. 2000–3500 ft .....	65°40'	146°59'
Lion Peak, el. 3500–4500 ft .....	65°38'	146°46'
The limestone ridge, between Beaver Creek and Fossil Creek, el. 2000–3500 ft	65°30'	147°30'

### Bering Sea District

Nunivak Island:

Mekoryuk Village, el. sea level to 50 ft. ....	60°23'	166°11'
Nash Harbour, with bird cliffs rising steeply from the sea, el. sea level to 100 ft	60°15'	166°46'
Robert's Mt, el. 1700 ft .....	60°13'	166°12'

The lake where the geese don't fly, in the western part of the island, exact location unknown. The Eskimo name is derived from the habit of the wild geese to assemble on this particular lake in the moulting season.

### Bering Strait District

Seward Peninsula:

Anvil Peak, N of Nome, el. 200–700 ft. ....	64°34'	165°22'
King Mt, el. 300–1000 ft .....	64°37'	165°19'
Rainbow Creek, E of Grand Central River and NW of Salmon Lake, in the foothills of the Kigluaik Mts, el. 600–2400 ft. ....	64°56'	165°05'

Baldwin Peninsula:

Kotzebue, on both sides of the lagoon, sea level to 50 ft .....	66°54'	162°36'
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## Enumeration of the species

### DERMATOCARPACEAE

#### *Dermatocarpon* ESCHW.

In Middle Europe the genus *Dermatocarpon* has been studied by ZSCHACKE (1934). Since then no attempt has been made towards a comprehensive study of the genus. It comprises many critical species, crustose as well as foliose, and is badly in need of revision. Chemistry seems to play no role in the genus.

#### \**Dermatocarpon arnoldianum* DEGEL.

BERING STRAIT DISTRICT: Ukinyik Creek drainage including the high ridges on either side of the valley. — Coll. VIERECK & BUCKNELL (O).

New to North America. This species is previously known from Scandinavia and the Alps.

The specimen cited above was erroneously reported as *D. miniatum* by KROG (1962). The present determination is confirmed by DEGELIUS.

#### \**Dermatocarpon fluviatile* (WEB.) TH. FR.

EASTERN PACIFIC COAST DISTRICT: How Kan Bay. — Coll. A. S. FOSTER (UPS).

A boreal-temperate, circumpolar species. The specimen had been determined as *D. miniatum* by HERRE and revised by SANTESSON.

#### *Dermatocarpon intestiniforme* (KÖRB.) HASSE

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake.  
Spores  $10-12 \times 6.5-8 \mu$ .

Previously reported from Alaska by KROG (1962). A low arctic-boreal, probably circumpolar species.

#### *Dermatocarpon miniatum* (L.) MANN

BERING STRAIT DISTRICT: Vicinity of the Kukpuk River including steep slopes and ridges to the east of the river. Outcrops of Angmakioq Mt. — Coll. VIERECK & BUCKNELL (O). (KROG 1962).

First reported from Alaska by HERRE (1919). A high arctic-temperate, circumpolar species.

The epithet *D. miniatum* is generally used in a wide sense, and may eventually prove to contain more than one species.

#### *Dermatocarpon reticulatum* H. MAGN.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Kenai Lake. — Coll. GJÆREVOLL; Skilak Lake. Richardson Highway: Mile 45.

Previously reported from Alaska by KROG (1962). Restricted to the mountain areas of western North America.

I have seen material of this species from British Columbia, Washington, Oregon, Montana, Colorado and New Mexico. Most of the specimens studied were practically identical with the specimen from Kenai Lake. They were very thick, monophyllous or slightly polyphyllous, with the upper surface a grayish white colour, sometimes with a purple tinge. The type specimen which is in Uppsala, has a tan colour and is on the whole much thinner and more fragile. However, anatomical sections disclosed no important differences. The most striking feature is the strongly papillose under surface. The different appearance of the type specimen might possibly be due to moisture and shading.

The specimens from Skilak Lake and Richardson Highway were small, polyphyllous and dark, in part slightly pruinose. Only the papillose under surface led to the inclusion of these specimens in the present species, and a larger material might indicate a separation into two different species.

*Dermatocarpon rivulorum* (ARN.) DT. & SARNTH.

CENTRAL YUKON RIVER DISTRICT: White Mts: Cache Mt. Spores  $16-19 \times 7.5-(8.5) \mu$ .

Previously reported from Alaska by KROG (1962). Known from Fennoscandia, Great Britain, Austria, Germany, Czechoslovakia, Hungary, and south west Greenland.

SPHAEROPHORACEAE

*Sphaerophorus* PERS.

MITUNO (1938) has studied the genus *Sphaerophorus* in Japan, with special emphasis on anatomy and chemistry.

In addition to the species cited below, two additional species, *S. turfaceus* ASAH. and *S. tuckermanii* Räs. have been reported from Alaska. They are not considered distinct species in the present work.

*Sphaerophorus fragilis* (L.) PERS.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Government Peak; Puritan Creek. Northern Cook Inlet area: Eagle River; Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; 12-Mile Summit.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by ROTHROCK (1868). A high arctic-temperate, circumpolar species, common and widespread in Alaska. Contains squamatic acid and sphaerophorin (MITUNO 1938).



*Sphaerophorus globosus* (HUDS.) VAIN.

var. *globosus*

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River; Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Ingram Creek camp ground; Seward; Marathon Mt; Homer. Richardson Highway: Mile 9; mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak; headwaters of Sheep Creek; Cache Mt; granite outcrop close to the limestone ridge. Steese Highway: Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt; Mekoryuk Village; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue. Seward Peninsula: King Mt.

var. *gracilis* (MÜLL. ARG.) ZAHLBR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Montana Creek. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9. Prince William Sound: Fish Bay; Pigot Bay.

First reported from Alaska by BABINGTON (1851). A high arctic-temperate, circumpolar species, common and widespread in Alaska.

The inland and alpine form of *S. globosus* grows over rocks or on the ground among mosses and other lichens. A few specimens from Kotzebue and Denali Highway correspond to TUCKERMAN Lich. Americ. Septentrion. Exs. no. 50, characterized by recurved branchlets. ASAHINA (*in* MITUNO 1938) described this form as a new species, *S. turfaceus*, giving the distribution range as being Japan, North America, the Aleutian Islands, Kamchatka, and Lapland. In my opinion it is a modification of little taxonomic value.

The coastal form of the species, often found on the trunks and branches of conifers, shows considerable variation. One form, here referred to as var. *gracilis*, seems to develop in areas with excessive moisture. It is sparingly branched, and more or less covered with pale, coralloid branchlets. RÄSÄNEN (1933) described this form as a new species, *S. tuckermanii*, but the rank of species does not seem justified in this case.

According to MITUNO (1938) *S. globosus* contains squamatic acid and sphaerophorin. A few specimens from coastal areas reacted PD+, K-, pointing to the presence of psoromic acid. The same chemical strain has been observed in Scandinavian material from coastal regions.

*Sphaerophorus melanocarpus* (Sw.) DC.

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Ward Lake; Saxman Village.

First reported from Alaska by MAGNUSSON (1932). A tropical-temperate, euoceanic species known from western Europe, western North America and eastern Asia, and also from the Southern Hemisphere.

Contains sphaerophorin (MITUNO 1938).

## COLLEMATACEAE

### *Collema* WIGG.

The genus *Collema* is not very well known in North America. In Europe it has been monographically treated by DEGELIUS (1954), and this monograph is also very valuable for students of North American lichens. It includes references to verified American material. Some additional American species have been discussed by DEGELIUS (1962). Most older North American records need revision.

TUCKERMAN (1882) reported *C. polycarpon* from islands of the Bering Strait, and MERRILL (1924) cited *C. crispum* from Camden Bay, Alaska. These records need verification. *C. ceraniscum* is known from the Siberian part of the Bering Strait region and will most likely be found also in Alaska.

No species in this genus is known to contain any lichen substances, and all thallus reactions are negative.

The Alaskan collection has been revised by DEGELIUS.

### *Collema furfuraceum* (ARN.) DU RIETZ

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Granite Basin Rd.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Northern Cook Inlet area: Knik River. Kenai Peninsula: Portage Glacier Rd; Cooper Creek camp ground; Skilak Lake; Nililchik.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

First reported from Alaska by WEBER & VIERECK (1967). A boreal-temperate, circumpolar species, quite common in Alaska on cottonwood trees.

### \**Collema glebulentum* (NYL. ex CROMB.) DEGEL.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 9.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

An arctic-alpine species, widely distributed in Europe and also known from Novaya Zemlya and Greenland. Its occurrence in Alaska may point towards a largely circumpolar distribution.

### \**Collema multipartitum* SM.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge.

Probably not circumpolar. Widely distributed in temperate regions of Europe, restricted to bare calcareous rock. It is also reported from British Columbia in Canada.

### \**Collema ryssoleum* (TUCK.) SCHNEID.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge.

A mainly temperate species with a disjunct distribution comprising the Mediterranean area and North America. The previous American records were from the east coast. A saxicolous species mainly on siliceous rock.

*\*Collema subfurvum* (MÜLL. ARG.) DEGEL.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek Rd. Kenai Peninsula: Ninilchik.

A subtropical-boreal, suboceanic, widely distributed species. In North America it was previously known from the east coast.

*Collema tenax* (Sw.) ACH.

BERING STRAIT DISTRICT: Seward Peninsula: Port Clarence. — Coll. ALMQUIST (H, S).

First reported from Alaska by NYLANDER (1888). A low arctic-temperate, circumpolar, common and widespread terricolous species.

[*Collema tuniforme* (ACH.) ACH.]

ALASKA RANGE DISTRICT: Kantishna, Quigley Hill. — Coll. CROASDALE. (HOWARD 1963).

CENTRAL YUKON RIVER DISTRICT: Wiseman, N bluff of Wiseman Creek. — Coll. CROASDALE. (HOWARD 1963).

A high arctic-temperate, probably circumpolar species, restricted to calcareous substrata.

*Collema undulatum* LAUR. ex FLOT.  
var. *granulosum* DEGEL.

CENTRAL YUKON RIVER DISTRICT: White Mts: Junction of Beaver Creek and Fossil Creek; the limestone ridge.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak.

Previously reported from Alaska by DEGELIUS (1954). Var. *granulosum* has an arctic-alpine distribution, possibly more or less circumpolar, restricted to calcareous substrata.

*Leptogium* (ACH.) S. GRAY

The genus *Leptogium* has been monographically treated for North America by SIERK (1964). As he points out, there has been a great deal of misidentifications in this genus, and older records need verification.

*L. crenatum* is known in the collections of the Vega Expedition from Pitlekai and from Bering Island. It should be looked for in Alaska. *L. tenuissimum* was reported from Alaska by SIERK. However, the locality cited, Arakamtchetchene Isl., Bering Strait, belongs to Siberia. This circumpolar species, also known from British Columbia, is almost certain to be found in Alaska. *L. tremelloides* was reported from Alaska by CUMMINGS (1892a). According to SIERK (op. cit.) this record represents *L. cyanescens*.

No lichen substances have been demonstrated in this genus, and all thallus colour reactions are negative.

Part of the Alaskan material has been revised by SIERK.

*Leptogium californicum* TUCK.

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge.

Previously reported from Alaska by SIERK (1964). A North American species largely restricted to the western regions.

The specimen cited above was determined by SIERK. I have not seen sufficient material of *L. californicum* to be able to distinguish it successfully from *L. lichenoides*.

*Leptogium cyanescens* (PERS.) KØRB.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin Rd.

First reported from Alaska by SIERK (1964). A temperate-subtropical, widely distributed suboceanic species.

*Leptogium hirsutum* SIERK

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Granite Basin Rd.

CENTRAL YUKON RIVER DISTRICT: White Mts: Fossil Creek.

Previously reported from Alaska by SIERK (1964). Known from eastern and western North America, China, Japan and Siberia.

The specimens cited above were determined by SIERK.

*Leptogium lichenoides* (L.) ZAHLBR.

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge.

First reported from Alaska by HERRE (1919). A high arctic-temperate, circumpolar species.

[*Leptogium minutissimum* (FLÖRKE) FR.]

ALEUTIAN ISLANDS: Attu Island: Casco Point. — Coll. VAN SCHAACK. (SIERK 1964).

A low arctic-boreal, terricolous, possibly circumpolar species.

*Leptogium palmatum* (HUDS.) MONT.

EASTERN PACIFIC COAST DISTRICT: Egg Harbour, Coronation Island. — Coll. FRYE (O); East Island in the Kashevarof Group. — Coll. FRYE (O); How Kan Bay. — Coll. FRYE (S). (HERRE 1919).

A suboceanic species known from the coastal regions of Europe, Japan, and western North America.

*Leptogium parculum* NYL.

BERING STRAIT DISTRICT: Seward Peninsula: Port Clarence. — Coll. ALMQUIST (H, S). (NYLANDER 1885b).

This species is known only from the type locality. It probably has a limited distribution in the Bering Strait region.

*Leptogium saturninum* (DICKS.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Independence Mine; Puritan Creek. Northern Cook Inlet area: Knik River;

Potter; Rabbit Creek Rd; Bird Creek Ridge. Kenai Peninsula: Portage Glacier Rd; Granite Creek Ridge; Coopei Creek camp ground; Skilak Lake; Seward. Richardson Highway: Mile 9; mile 24.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Savage River; Toklat. Richardson Highway: Base of Rainbow Mts; Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Fossil Creek; granite outcrop close to the limestone ridge. Steese Highway: Eagle Summit; Circle Hot Springs. Alaska Highway: Mile 1450.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from islands of the Bering Strait by TUCKERMAN (1882), and as *L. myochroum* from Port Clarence by NYLANDER (1888). A low arctic-temperate, circumpolar species, common in most parts of Alaska.

*Leptogium sinuatum* (HUDS.) MASS.

CENTRAL YUKON RIVER DISTRICT: White Mts: Fossil Creek.

First reported from Alaska by ALMQUIST (1887) as *L. scotinum*. A low arctic-temperate, circumpolar species.

## STICTACEAE

*Lobaria* SCHREB.

No up to date monograph covers the genus. Especially the tropical and sub-tropical species are in need of revision.

*L. quercizans* has been reported from Alaska by CUMMINGS (1904) and HEDRICK (1936). CUMMINGS' record undoubtedly stands for *L. linita*, as it is referred to as a "small sterile specimen growing on the earth". *L. quercizans* is an eastern North American species, and is not expected in the Alaskan lichen flora.

*Lobaria hallii* (TUCK.) ZAHLBR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Northern Cook Inlet area: Knik River; Rabbit Creek Rd. Kenai Peninsula: Portage Glacier Rd; Skilak Lake; Ninilchik; Salamatof; Seward. Richardson Highway: Mile 9.

First reported from Alaska by LLANO (1951) who cited the localities Chandler Lake in the Arctic Coast District and Bethel in the Bering Sea District. A sub-oceanic species with a disjunct distribution.

The original description of the species was based on material from Oregon. It is also known from British Columbia, Washington and the Rocky Mts. Outside of western North America it is known from central Scandinavia and south west Greenland.

This species was abundant in localities near Juneau. A few of the specimens reached as much as 17 cm in diameter; the same extreme development has been seen in specimens from Jämtland in Sweden. In more arctic localities the specimens are small, dark and poorly developed.

No lichen substances have been demonstrated by microcrystallization.

\**Lobaria isidiosa* (MÜLL. ARG.) VAIN. s. lat.  
Fig. 7a, b.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

Thallus reticulately ridged, upper surface dull, of a grayish brown colour, margins with scattered isidia, ridges with coralloid isidia of a darker colour than thallus, under surface with a brownish nap between naked spots. Gonidia *Nostoc*. Apothecia not seen. Corticolous. PD-, K-, C-, KC-.

The epithet *L. isidiosa* is at present used about a great variety of isidiate *Lobariae*. The specimens may vary from gray to dark brown, dull to shiny, the isidia may be marginal or laminal, simple or branched, clubshaped, coralloid or squamuliform, the nap on the under side may be brown or jet black, colour reaction PD + or PD-. It adds up to a complex badly in need of revision.

This group of species seems to belong to a tropical-subtropical, mainly Asiatic element extending into the temperate region. Not previously known from North America.

No lichen substances were demonstrated in this species.

*Lobaria limitata* (ACH.) RABENH.  
var. *limita*

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Government Peak; Independence Mine; Mabel Mine. Northern Cook Inlet area: Eagle River; Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Granite Creek Ridge. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 28, mountain ridge north of highway; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; Cache Mt.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

var. *tenuior* (HUE) ASAH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Granite Basin Rd; Montana Creek; Shrine of St Therese; Douglas Skibowl; Mt Roberts, lower part. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier; Marathon Mt, lower part. Prince William Sound: Fish Bay.

*L. limitata* was first reported from the islands of the Bering Strait by TUCKERMAN (1882), and from St Lawrence Island by ALMQUIST (1887). Var. *limita* has an arctic-alpine, circumpolar distribution, but var. *tenuior* has a temperate, sub-oceanic amph-Pacific distribution.

In contrast to var. *limita* which is commonly found on the ground among mosses and other lichens in arctic-alpine regions, var. *tenuior* grows on tree trunks in the coastal forest belt. It attains a much larger size than var. *limita*, and is always richly fertile. It is also commonly more reticulately ridged, with abundant pycnidia along the ridges. Chemically it agrees with var. *limita*. With its entirely different ecological requirements and limited distribution, being known from Japan and the

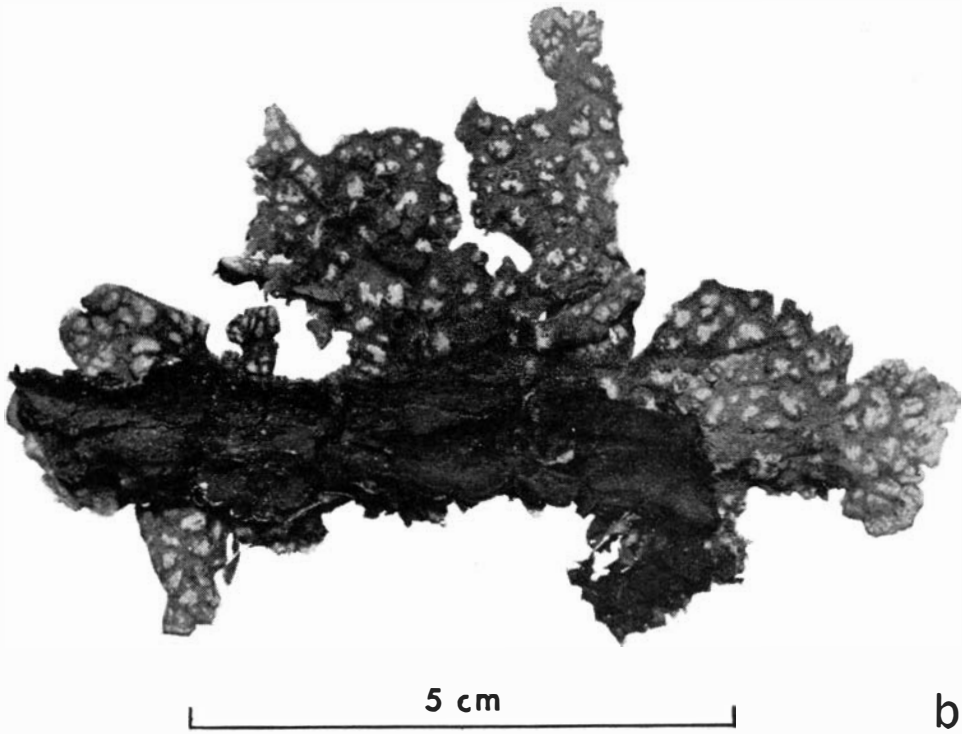
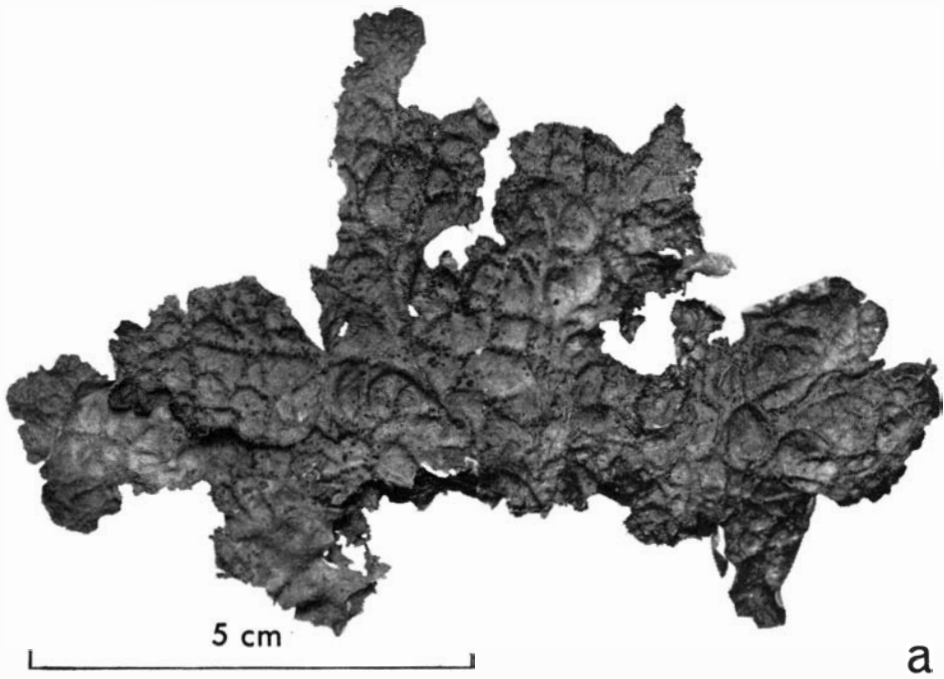


Fig. 7. *Lobaria isidiosa* (MÜLL. ARG.) VAIN. Eastern Pacific Coast District: Juneau: Loop Rd. Coll. H. KROG, 1957, no. 5062. Upper surface (a) and lower surface (b).

southern coasts of Alaska, British Columbia, and Washington, it seems at least to deserve the rank of variety.

In ACHARIUS' herbarium in Helsinki a lichen specimen labeled "Helvetia" seemed to be closely related to *L. linita* var. *tenuior*. It was named *Sticta* with the penciled remarks "*linita*" deleted and "*pulmonaria*" added. The specimen was well developed and richly fertile. A few specimens named *L. garowaglii* JATTA (S) have been seen from the Alps. They are apparently identical with the ACHARIUS specimen, and closely related to var. *tenuior*. According to ZAHLBRUCKNER (1925) the distribution range of *L. garowaglii* is southern Europe and western Africa. As I have not had the chance to study this species in the field, I do not want to draw any conclusion as to its identity with *L. linita* var. *tenuior* at present.

The determination of var. *tenuior* from Alaska has been confirmed by ASAHINA. PD-, K-, C-, KC-. Contains tenuiorin (ASAHINA 1957).

*Lobaria oregana* (TUCK.) MÜLL. ARG.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; lower part of Mt Roberts; Granite Basin Rd; Montana Creek. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Lower part of Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Ingram Creek camp ground; Seward. Richardson Highway: Mile 9. Prince William Sound: Fish Bay; Pigot Bay.

First reported from Alaska by CUMMINGS (1892a). An oceanic North American west coast species known from Oregon to south central Alaska. It grows on tree trunks in the coastal forest zone, where it is fairly common.

PD+, due to the presence of stictic and norstictic acids.

*Lobaria pulmonaria* (L.) HOFFM.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Granite Basin Rd.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Buffalo Mine. Northern Cook Inlet area: Eagle River Valley; O'Malley Rd; Rabbit Creek Rd; Potter. Kenai Peninsula: Portage Glacier Rd; Skilak Lake; Ninilchik; Salamatof; Seward. Richardson Highway: Mile 9.

First reported from Alaska by BABINGTON (1851). A slightly oceanic, circum-polar species.

Some of the older Alaskan records include *L. linita* var. *tenuior*.

*L. pulmonaria* reacts PD+ due to stictic and sometimes norstictic acid. Some specimens have a very dark nap on the under surface, containing the pigment telephoric acid.

*Lobaria retigera* (BORY) TREV.

Fig. 8.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; Boulder. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; Rainbow Creek.



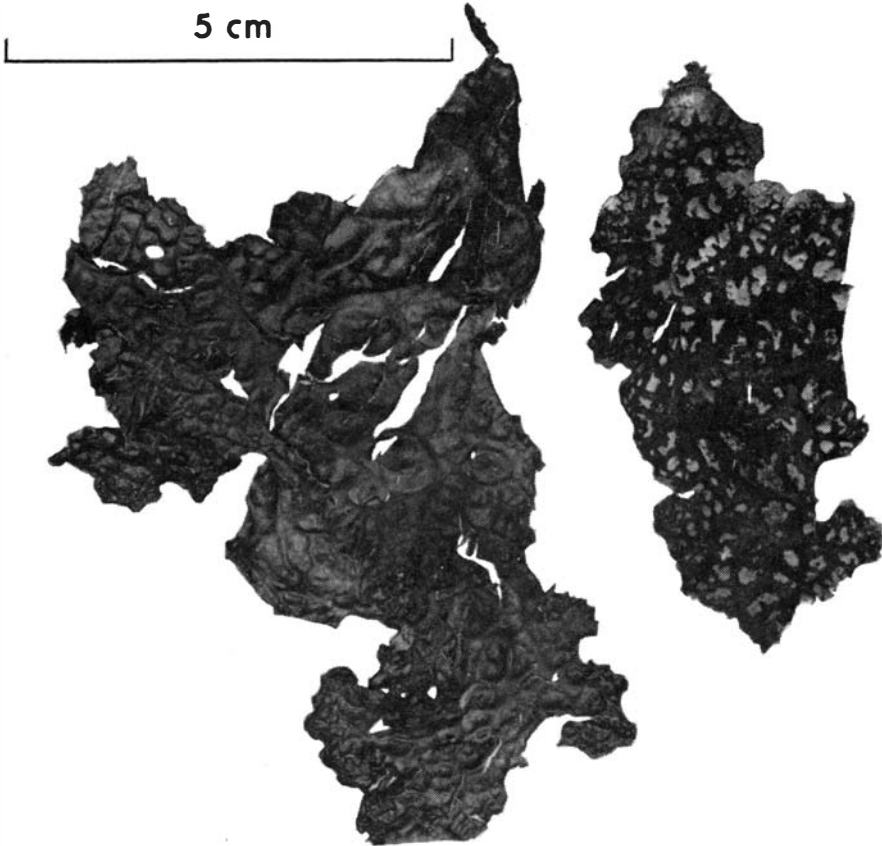


Fig. 8. *Lobaria retigera* (BORY) TREV. Bering Strait District: Seward Peninsula: Anvil Peak.  
Coll. H. KROG, 1957, no. 4016. Upper surface (left) and lower surface (right).

First reported from Alaska by WEBER & VIERECK (1967). A low arctic-tropical, predominantly Asiatic species extending into Alaska. Known from China, south-east Siberia and Japan. In Alaska *L. retigera* was found on the ground among mosses and other lichens in much the same way as *L. limita*. ZAHLBRUCKNER (1925) referred to it as a corticolous species found in tropical and subtropical regions, but several herbarium specimens from Asia have apparently been growing on the ground in alpine localities. Specimens from the more southern Asiatic localities display morphological as well as chemical variations, which may indicate the presence of more than one species.

PD+ due to stictic acid. The black nap on the under surface contains telephoric acid.

*Lobaria scrobiculata* (SCOP.) DC.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Knik River; Eagle River Valley; Eastchester Swamp; Rabbit Creek Rd; O'Malley Rd; Potter. Kenai Peninsula: Portage Glacier Rd; Skilak Lake; Ninilchik; Salamatof; Seward. Richardson Highway: Mile 9.

CENTRAL YUKON RIVER DISTRICT: White Mts: Fossil Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by ROTHROCK (1868). A low arctic-temperate, circumpolar species.

*L. scrobiculata* is quite variable chemically. All the Alaskan specimens reacted KC+ (easily observed on the under side) due to the presence of scrobiculin (CULBERSON 1967). In addition they might contain small amounts of usnic acid, and might react PD+ (stictic acid, norstictic acid) or PD-.

The entire material of *L. scrobiculata* in the Oslo herbarium was tested with PD. Only one specimen, from Mt McKinley National Park in Alaska, reacted PD-. The rest, comprising 184 specimens from Norway, 41 from other European countries, 10 from Greenland, and 6 from continental North America, all reacted PD+. This indicates that the PD+ strain has a circumpolar distribution, whereas the PD- strain may be limited to Alaska or perhaps to the west coast of North America.

Of the 14 specimens in my material reacting PD- one came from south east Alaska and the rest from the Central Pacific Coast District. Because of the chemical instability of this species, no attempt has been made to separate the different chemical strains.

#### *Pseudocyphellaria* VAIN.

In most older literature the species of this genus have been included in the genus *Sticta*. The *crocata*-group has been studied by MAGNUSSON (1940).

The chemistry in this genus is variable, and chemical reactions on the thalli are unreliable, as pointed out by MAGNUSSON (op.cit.).

#### *Pseudocyphellaria anomala* H. MAGN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier Rd; Salamatof; Seward. Richardson Highway: Mile 9.

Previously reported from Alaska by KROG (1962). An oceanic North American west coast species, known from California to the Pacific coast of Alaska.

In HERRE's opinion *P. anomala* is merely a sorediate form of *P. anthraspis*, not deserving specific rank (HERRE 1942). I cannot agree with this point of view, since even very young specimens of *P. anomala* develop soredia, and since the pseudocyphellae in *P. anomala* differ from those in *P. anthraspis*, the former being elongated and irregular, the latter being small, punctiform and regular.

*P. anomala* may react PD+, due to combinations of salazinic, stictic and norstictic acids, or PD-. In all specimens a substance was noticed which produced prisms of inclined extinction in most reagents.

#### *Pseudocyphellaria anthraspis* (ACH.) H. MAGN.

EASTERN PACIFIC COAST DISTRICT: Egg Harbour. - Coll. FOSTER (O). (HERRE 1919).

This species, referred to as sorediate and sterile, was reported from Alaska by CUMMINGS (1904), but the record is believed to represent *P. anomala* or *Sticta*

*limbata*. The next Alaskan record was by HERRE (1919). An oceanic North American west coast species, known from California to the Pacific coast of Alaska.

Chemically *P. anthraspis* corresponds to the PD- strain of *P. anomala*, containing a lichen substance which yields prisms of inclined extinction in most reagents.

*Pseudocyphellaria crocata* (L.) VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley; Eastchester Swamp; O'Malley Rd; Campbell Creek; Rabbit Creek Rd. Kenai Peninsula: Portage Glacier Rd; Salamatof. Richardson Highway: Mile 9.

First reported from Alaska by CUMMINGS (1904). A suboceanic species with a wide distribution in temperate and tropical regions.

The yellow substances of this species are, according to MAASS, TOWERS & NEISH (1964), a mixture of pulvic acid anhydrid and calycin.

\**Pseudocyphellaria* cf. *mallota* (TUCK.) H. MAGN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

Unfortunately the importance of this species was overlooked in the field, and consequently only a fragmentary specimen, mixed in with a collection of *P. crocata*, was obtained. The upper surface was of a grayish brown colour, distinctly tomentose, with a few maculiform yellow soralia partly with isidiate growths. The margins also had a tendency to form isidia. The under surface was pale brown, covered with a pale nap, and with a few yellow pseudocyphellae. It had *Nostoc* algae.

If this specimen should really prove to be *P. mallota*, known from the Strait of Magellan, it would be a most interesting case of disjunct distribution. The question cannot be settled until more material is studied.

*Sticta* SCHREB.

The genus *Sticta* is mostly composed of tropical and subtropical species, with a few representatives extending into the oceanic areas of the temperate and boreal zones. The only species which can be said to have a true arctic distribution is *S. arctica*.

No up to date monograph covers the genus.

Chemically the species of the temperate regions are of little interest. Most species contain no lichen substances which can be demonstrated microchemically. At most a few straight prisms of inclined extinction appear in GE, but always in negligible quantities.

*Sticta arctica* DEGEL.

Fig. 9

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine; Puritan Creek.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

The original description of this species (DEGELIUS 1937) was based on material from the Aleutian Islands. An arctic-alpine species known from Siberia (OXNER 1939), Alaska and the eastern Canadian Arctic (Fig. 10).

The present list of localities indicates that *S. arctica* is, if not common, at least widespread in Alaska. It is easily overlooked, since it usually is of small size and grows intermingled with mosses and other lichens. It seems to prefer high altitudes; 8 of the specimens cited above were collected between 3300 and 4500 ft elevation. The only specimen collected in a forested area was growing over mosses on the ground in an open black spruce population at an altitude of 2200 ft.

According to DEGELIUS (op. cit.) *S. arctica* attains a size of only a few cm. This is the way it is usually found in alpine heaths. However, in the Talkeetna Mts I found several large specimens growing on a steep slope, partly over rocks and partly over moss cover on the ground, reaching as much as 7 cm in diameter. The lobes were still small, not exceeding 1 cm.

No lichen substances have been demonstrated in this species.

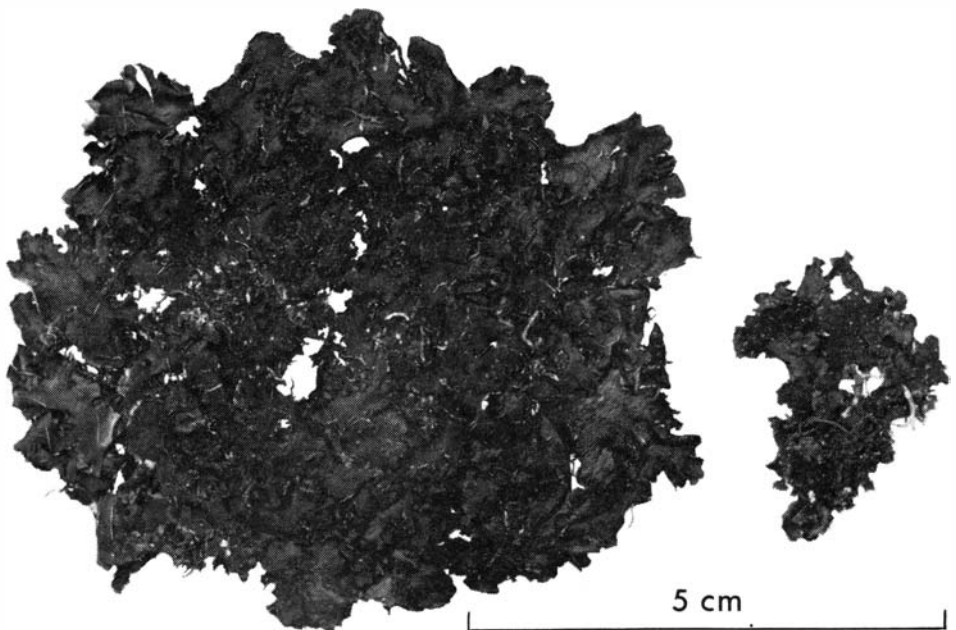


Fig. 9. *Sticta arctica* DEGEL. Central Pacific Coast District: Talkeetna Mts: Puritan Creek. Coll. H. KROG, 1957, no. 1016. Upper surface (left) and lower surface (right).

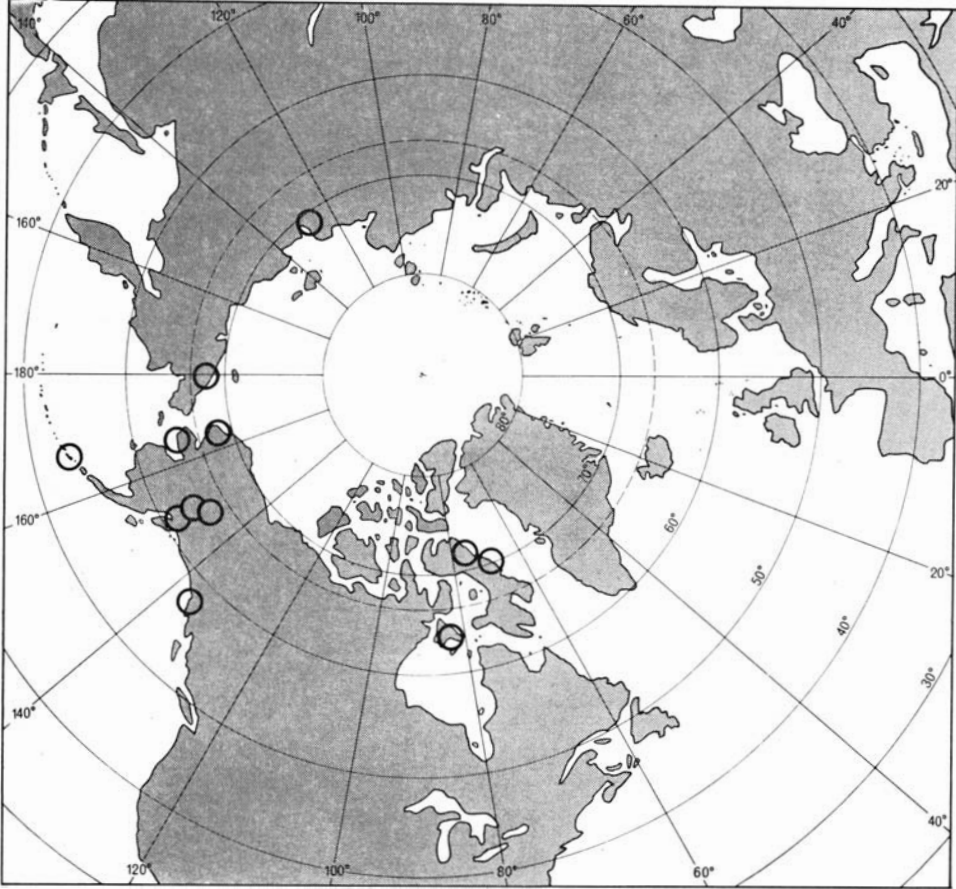


Fig. 10. Distribution of *Sticta arctica* DEGEL.

*Sticta fuliginosa* (DICKS.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Keetchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9. Kenai Peninsula: Seward.

Previously reported from Alaska by McCULLOUGH (1965). A suboceanic species, widely distributed in temperate regions.

No lichen substances have been demonstrated in this species.

*Sticta limbata* (SM.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek Rd. Kenai Peninsula: Salamatof.

First reported from Alaska by CUMMINGS (1892a). A suboceanic, temperate-subtropical species, widely distributed in Europe and on the west coast of North America. The record from Labrador by MACOUN (1902) needs verification. Not known from Asia.

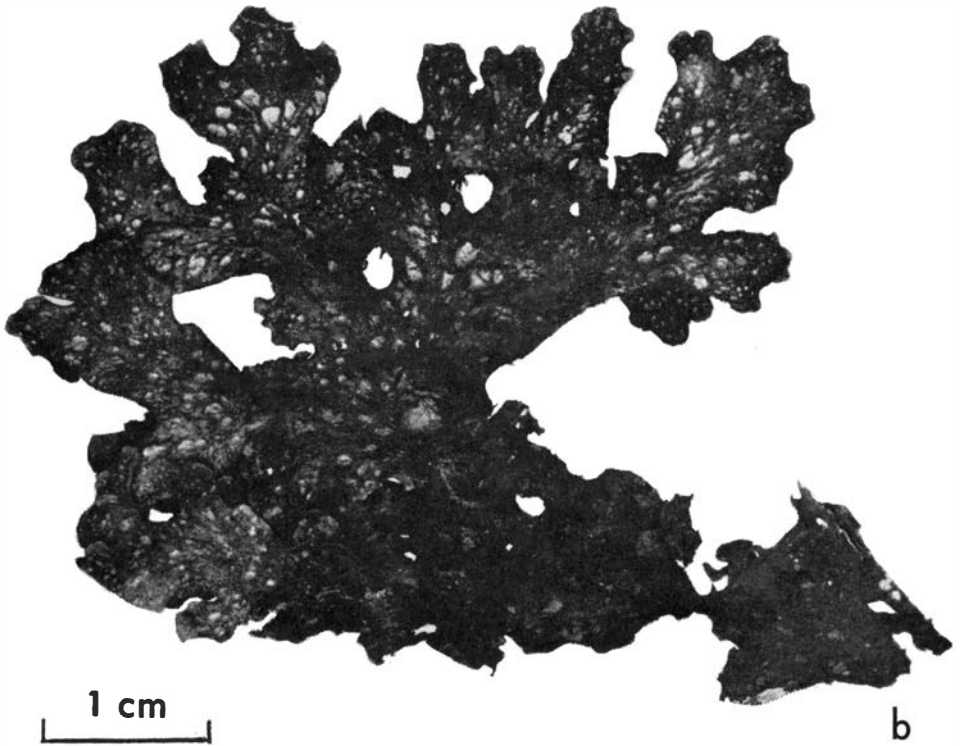
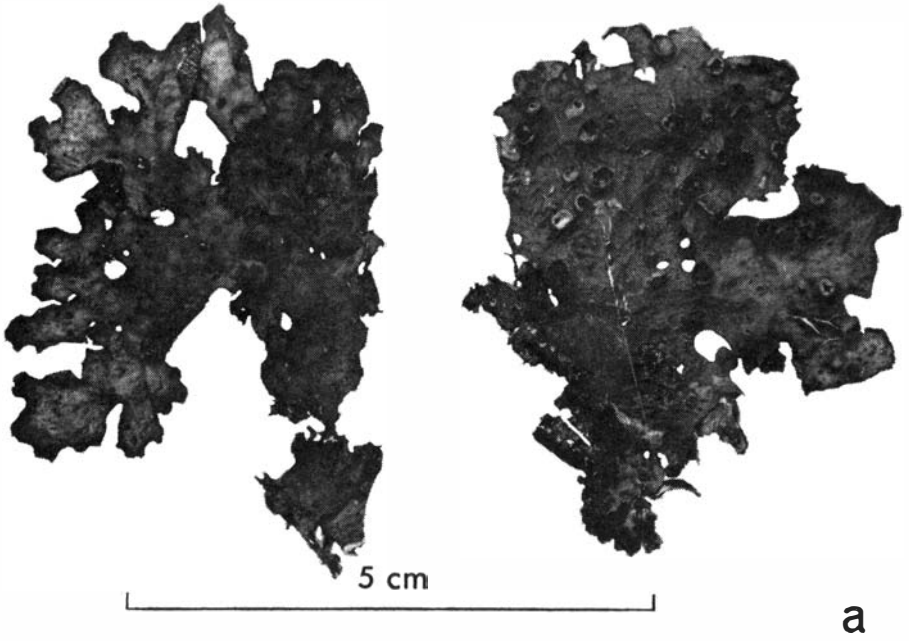


Fig. 11. *Sticta wrightii* Tuck. Eastern Pacific Coast District: Juneau: Loop Rd. Coll. H. Krog, 1957, no. 5009. Upper surface (a) and lower surface (b).

*S. limbata* is not common in Alaska. Cook Inlet seems to be on its northern limit of distribution.

No lichen substances have been demonstrated in this species.

*Sticta weigeli* (ISERT *ex* ACH.) VAIN.

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Ward Lake.

Previously reported from Alaska by McCULLOUGH (1965). A tropical-temperate species, widely distributed in Asia and North America.

No lichen substances have been demonstrated in this species.

\**Sticta wrightii* TUCK.

Fig. 11.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

New to North America. A mainly temperate species with a disjunct Eurasiatic-western North American distribution. TUCKERMAN, when describing this species from Japan in 1859, mentioned the possibility that it might occur also in North America.

*S. miyoshiana* MÜLL. ARG. and *S. yasudae* VAIN. are supposed to be synonyms of *S. wrightii*.

No lichen substances have been demonstrated in this species.

PELTIGERACEAE

*Polychidium* (ACH.) S. GRAY

*Polychidium umhausense* (AUERSW.) HENSS.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

First reported from Alaska by WEBER & VIERECK (1967). A boreal-temperate species known from Europe and North America. In Alaska it was found growing on twigs in an area with oceanic climate.

No lichen substances were demonstrated in the Alaskan specimens.

*Solorina* ACH.

The genus *Solorina* comprises several circumpolar species living on earth in arctic-boreal regions. Except for *S. crocea* they are more or less restricted to calcareous soil. In Alaska as elsewhere in northern countries, *S. bispora* is the most common representative of the *saccata* group.

Except for the orange pigment produced by *S. crocea* the genus is of little interest chemically.

*Solorina bispora* NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts; Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28. Mt McKinley National Park: Toklat.

CENTRAL YUKON RIVER DISTRICT: White Mts: Junction of Beaver Creek and Fossil Creek. Steese Highway: Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

Reported from Alaska by THOMSON as no. 8 in *Lichenes Arctici*. A high arctic-boreal, circumpolar species.

*Solorina crocea* (L.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Windy Point; Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 70. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; Cache Mt. Steese Highway: Cleary Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by TUCKERMAN (1882). A high arctic-alpine, circumpolar species, widespread in Alaska.

*Solorina octospora* ARN.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28; mile 70.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by WEBER & VIERECK (1967). A high arctic-alpine, circumpolar species.

*Solorina saccata* (L.) ACH.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Puritan Creek.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Toklat.

CENTRAL YUKON RIVER DISTRICT: White Mts: Junction of Beaver Creek and Fossil Creek; the limestone ridge.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by TUCKERMAN (1882). The older records may be expected to include *S. bispora* and *S. octospora*. A high arctic-temperate, circumpolar species.

[*Solorina spongiosa* (SM.) ANZI]

EASTERN PACIFIC COAST DISTRICT: Yakutat Bay: Disenchantment Bay. – Coll. TRELEASE. (CUMMINGS 1904).

ALASKA RANGE DISTRICT: Mt McKinley National Park: Mt Eielson. – Coll. WEBER & VIERECK. (WEBER & VIERECK 1967).

BERING STRAIT DISTRICT: Seward Peninsula: Port Clarence. – Coll. ALMQUIST. (NYLANDER 1888). Islands of Bering Strait. – Coll. WRIGHT. (TUCKERMAN 1882).

A high arctic-boreal, circumpolar species.



*Nephroma* ACH.

The genus *Nephroma* is treated monographically for North and Middle America by WETMORE (1960).

For taxonomic purposes chemical tests are of little value in this genus, the main substances being zeorin in mixture with undefined neutral compounds, in most species subject to some variation. Some of the species occasionally give a positive reaction with K, but this is constant only in *N. laevigatum* where the reaction is K + violet due to the presence of nephromin.

*Nephroma arcticum* (L.) TORSS.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine. Northern Cook Inlet area: Eagle River; Bird Creek Ridge. Kenai Peninsula: Granite Creek Ridge; Homer; Marathon Mt. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 70; mile 100. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by BABINGTON (1851). A high arctic-boreal, circumpolar species.

Contains usnic acid, zeorin, nephrin and a carotenoid (WETMORE 1960).

*Nephroma bellum* (SPRENG.) TUCK.  
(= *N. laevigatum* auct. non ACH.)

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts; Douglas Skibowl; Montana Creek. Sitka: Harbour Mt. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Northern Cook Inlet area: Rabbit Creek Rd; Eastchester Swamp. Kenai Peninsula: Portage Glacier Rd; Ninilchik. Richardson Highway: Mile 9. Prince William Sound: Fish Bay; Pigot Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28.

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge; lower Fossil Creek.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak.

First reported from Alaska by CUMMINGS (1904). A low arctic-temperate, circumpolar species.

May contain zeorin, other neutral substances, nephrin, or lichen substances may be absent (WETMORE 1960).

*Nephroma expallidum* (NYL.) NYL.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine; Puritan Creek. Northern Cook Inlet area: Rabbit Creek. Kenai Peninsula: Skilak Lake; Marathon Mt. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–37; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by NYLANDER (1888). A high arctic-alpine, circumpolar species.

Contains zeorin, nephrin and an unknown neutral substance (WETMORE 1960).

*Nephroma helveticum* ACH.

var. *sipeanum* (GYELN.) WETM.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley. Richardson Highway: Mile 9.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Circle Hot Springs.

First reported from Alaska by WETMORE (1960). A boreal-subtropical, incompletely circumpolar species. In North America var. *helveticum* is mainly an eastern lichen, whereas var. *sipeanum* is largely found west of the Rocky Mts.

*N. helveticum* may contain nephrin, various neutral substances, or lichen substances may be absent (WETMORE 1960).

*Nephroma isidiosum* (NYL.) GYELN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Kenai Peninsula: Portage Glacier Rd; Seward. Richardson Highway: Mile 9.

This species was first reported from Alaska by WETMORE (1960), who cited two localities on the north slope of Brooks Range and one near Valdez.

Known from the Onega region in Russia, from south west Siberia and Alaska.

*N. isidiosum* was abundant in the Juneau area, where it was found growing on twigs. In this locality it reached its best development, with broadlobed specimens with a diameter up to 10 cm. Most specimens were richly fertile. The apothecia had dark brown discs, and the spores were ellipsoid, straight to slightly curved, three-septate,  $21\text{--}23 \times 6.5\text{--}8.5 \mu$ .

Like *N. parile*, *N. isidiosum* is quite variable. The colour of the upper surface may vary from gray to chestnut brown, and the reticulation may be more or less pronounced. The lower surface is covered with a nap varying in colour from gray to sooty black. Thallus may be appressed or loosely attached, and the lobes may vary considerably in size. However, the character of the coralloid isidia is constant, and the variation in colour and shape seems mostly to be due to environment. Lack of light seems to produce the lighter colour, high moisture in connection with certain substrata, like small twigs, may cause the large lobed forms. Forms with smaller lobes and a dark brown colour were found among mosses in locations exposed to high light.

Contains three different neutral substances (WETMORE 1960).

*Nephroma laevigatum* ACH.  
(= *N. lusitanicum* SCHAER.)

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Ketchikan: Ward Lake.  
CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Seward.

Previously reported from Alaska by WETMORE (1960). A widely distributed boreal-subtropical, suboceanic species.

Contains nephromin (WETMORE op. cit.).

*Nephroma parile* (ACH.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Willow Rd; Buffalo Mine. Northern Cook Inlet area: Eagle River; O'Malley Rd; Eastchester Swamp; Potter; Rabbit Creek Rd; Bird Creek Ridge. Kenai Peninsula: Granite Creek Ridge; Cooper Creek camp ground; Skilak Lake; Niniichik; Seward; Marathon Mt. Richardson Highway: Mile 9; mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; lower Fossil Creek.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak.

First reported from Alaska by CUMMINGS (1904). A low arctic-temperate, circumpolar species, common and widespread in Alaska.

May contain zeorin, various other neutral substances, nephrin, or may be devoid of lichen substances (WETMORE 1960).

*Nephroma resupinatum* (L.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Kenai Peninsula: Portage Glacier Rd; Skilak Lake; Seward.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

First reported from Alaska by CUMMINGS (1892a). A circumpolar, boreal-temperate species.

Contains no lichen substances (WETMORE 1960).

*Peltigera* WILLD.

The genus *Peltigera* has been treated monographically for North America by THOMSON (1950b). His broad species concept differs from that of most European lichenologists, and his view, widely accepted in the United States, has not commonly been adopted in Europe. In the third checklist of North American lichens (HALE & CULBERSON 1966) a more conservative nomenclature has been followed, which indicates that also American lichenologists may be revising their opinion on this genus. Apart from the controversial species concept in THOMSON's monograph it gives valuable information on the distribution of North American *Peltigerae*.

KUROKAWA, JINZENJI, SHIBATA and CHIANG (1966) have studied the chemistry

of Japanese *Peltigerae*. Many of the substances found in this genus can be demonstrated only with chromatography, since they fail to produce characteristic crystals for microchemical identification.

*Peltigera aphthosa* (L.) WILLD.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts. Sitka: Indian River Trail.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Puritan Creek. Northern Cook Inlet area: O'Malley Rd. Kenai Peninsula: Cooper Creek; Homer. Richardson Highway: Mile 9.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek. Steese Highway: Cleary Summit.

BERING SEA DISTRICT: Nunivak Island: The lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-temperate, circumpolar species.

*P. aphthosa* and *P. leucophlebia* may at times be difficult to separate. *P. aphthosa* usually has a smooth, pitted or slightly veined under surface with few rhizinae. The apothecia are usually corticate on the under surface. *P. leucophlebia* has a distinctly veined under surface with rhizinae usually well developed. Apothecia may be decorticate or with cortex patches beneath. According to AHTI (1964) *P. leucophlebia* avoids highly acid habitats, whereas *P. aphthosa* is typical of such sites. Both species are widespread in Alaska, but *P. leucophlebia* seems to be more common.

Contains phlebin A and B, zeorin, tenuiorin, and substances IV and V (KUROKAWA et al. 1966).

*Peltigera canina* (L.) WILLD.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Shrine of St Therese. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Willow Rd. Northern Cook Inlet area: Rabbit Creek; Eastchester Swamp; Potter. Kenai Peninsula: Skilak Lake; Cooper Creek; Seward; Marathon Mt. Prince William Sound: Fish Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; the limestone ridge; lower Fossil Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by BABINGTON (1851). A low arctic-temperate, circumpolar species.

No lichen substances have been demonstrated in this species (KUROKAWA et al. 1966).

*Peltigera horizontalis* (HUDS.) BAUMG.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier Rd.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; lower Fossil Creek.

First reported from Alaska by BABINGTON (1851). A boreal-temperate, largely circumpolar species.

Without apothecia this species cannot with certainty be told apart from *P. polydactyla*.

KUROKAWA et al. (1966) found dolichorrhizin and substances I, II, IV, and V, along with zeorin and tenuiorin in European *P. horizontalis*. Japanese specimens produced scabrosin A and B, and lacked substances IV and V.

*Peltigera lepidophora* (NYL.) VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek. Steese Highway: Circle Hot Springs.

Previously reported from Alaska by WEBER & VIERECK (1967). A high arctic-temperate, circumpolar species. The chemistry of this species has not been studied.

*Peltigera leucophlebia* (NYL.) GYELN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Willow Rd; Puritan Creek. Northern Cook Inlet area: Eagle River; Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Granite Creek Ridge; Marathon Mt. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; junction of Beaver Creek and Fossil Creek; Lion Peak; granite outcrop close to the limestone ridge. Steese Highway: Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by DEGELIUS (1937). Older records of *P. aphthosa* may be expected to include *P. leucophlebia*. A high arctic-temperate, circumpolar species.

As to separation from *P. aphthosa*, see under that species. KUROKAWA et al. (1966) separated *P. nigripunctata* BITT. (endemic to eastern Asia) from *P. leucophlebia* by characters of the apothecia, which in the former were supposed to be horizontal with occasional cortex patches beneath, in the latter vertical and decorticate beneath. There were also chemical differences in that *P. nigripunctata* lacked phlebin A and produced substance III, whereas *P. leucophlebia* produced phlebin A and lacked substance III. In the Alaskan collection specimens were seen which on morphological characters could be classified as *P. nigripunctata*, but I hesitate to do so without further study of the problem in the field.

*P. leucophlebia* contains phlebin A and B, zeorin, tenuiorin, and substances IV and V (KUROKAWA et al. 1966).

*Peltigera malacea* (ACH.) FUNCK

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Richardson Highway: Mile 170; base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Beaver Creek east of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak.

First reported from Alaska by HEDRICK (1936). A high arctic-temperate, circumpolar species.

According to KUROKAWA et al. (1966) Canadian specimens of this species contained zeorin, dolichorrhizin, tenuiorin, and substances II, IV, and V.

*Peltigera membranacea* (ACH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eastchester Swamp. Prince William Sound: Fish Bay.

First reported from Alaska by MACOUN (1902). A widely distributed species in temperate regions.

There is no information on the chemistry of the species.

*Peltigera polydactyla* (NECK.) HOFFM.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin. Ketchikan: Deer Mt; Ward Lake; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Bald Mt Ridge. Kenai Peninsula: Portage Glacier Rd; Ingram Creek camp ground; Cooper Creek camp ground; Seward; Marathon Mt. Richardson Highway: Mile 9. Prince William Sound: Fish Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by ROTHROCK (1868). A high arctic-temperate, circumpolar species.

Contains zeorin, dolichorrhizin, tenuiorin, and substances I, II, IV, and V (KUROKAWA et al. 1966).

\**Peltigera praetextata* (FLÖRKE ex SOMMERF.) VAIN.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Niniilchik; Cooper Creek. Richardson Highway: Mile 9.

CENTRAL YUKON RIVER DISTRICT: White Mts: Fossil Creek; granite outcrop close to the limestone ridge.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek. Baldwin Peninsula: Kotzebue.

A low arctic-temperate, probably circumpolar species. KUROKAWA et al. (1966) found no lichen substances in this species.

*Peltigera rufescens* (WEIS.) HUMB.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Willow Rd. Northern Cook Inlet area: Eagle River Valley; Potter; Bird Creek Ridge. Kenai Peninsula: Granite Creek Ridge; south of Hidden Lake; Marathon Mt. Richardson Highway: Mile 24; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Camp ground near McKinley Park Hotel. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Lion Peak; the limestone ridge; granite outcrop close to the limestone ridge; lower Fossil Creek.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek.

First reported from Alaska by CUMMINGS (1904). A high arctic-temperate, circumpolar species. No lichen substances have been reported for this species.

*Peltigera scabrosa* TH. FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Mabel Mine; Bald Mt Ridge. Prince William Sound: Fish Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 70. Mt McKinley National Park: Wonder Lake. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by TUCKERMAN (1882). A high arctic-temperate, circumpolar species, common and widespread in Alaska.

KUROKAWA et al. (1966) found different chemical properties in Japanese and European material of *P. scabrosa*. While specimens of both populations produced zeorin, tenuiorin and substances I and II, the European specimens produced scabrosin A and B and the Japanese specimens produced dolichorrhizin and substance V in addition. American specimens were not studied.

*Peltigera scutata* (DICKS.) DUBY

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts; Mendenhall Lake; Granite Basin. Sitka: Indian River Trail.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Bald Mt Ridge. Northern Cook Inlet area: Knik River; Eagle River. Kenai Peninsula: Ingram Creek camp ground; Portage Glacier Rd; Windy Point; Skilak Lake; Ninilchik; Seward. Richardson Highway: Mile 9.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; lower Fossil Creek.

First reported from Alaska by HEDRICK (1936). A boreal-temperate, incompletely circumpolar species.

In Alaska *P. scutata* is frequently found fertile. It is rather variable, with laminal as well as marginal soredia and with colour varying from a shiny light gray to dull brown or black.

Contains zeorin, tenuiorin, and substances I, II, IV, and V (KUROKAWA et al. 1966).

*Peltigera spuria* (ACH.) DC.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Willow Rd between Little Susitna Lodge and Independence Mine; Puritan Creek. Northern Cook Inlet area: Rabbit Creek; Potter; Bird Creek Ridge. Kenai Peninsula: South of Hidden Lake; base of Portage Glacier; Marathon Mt; Windy Point; Skilak Lake. Richardson Highway: Mile 9; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Polychrome Pass; Toklat; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; Fossil Creek. Steese Highway: Circle Hot Springs. Alaska Highway: Mile 1450.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by TUCKERMAN (1882). A high arctic-temperate, circumpolar species.

No lichen substances have been reported for this species.

*Peltigera venosa* (L.) BAUMG.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Willow Rd; Bald Mt Ridge. Northern Cook Inlet area: Rabbit Creek.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Toklat.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek. Steese Highway: Circle Hot Springs.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by BABINGTON (1851). A calciphilous, high arctic-temperate, circumpolar species. In Alaska it is quite widespread, but scarce in each locality.

Contains phlebin A and B, zeorin, tenuiorin, and substances III, IV, and V (KUROKAWA et al. 1966).

CLADONIACEAE

*Pilophorus* (TUCK.) TH. FR.

No monograph covers this genus.

The lichen substances atranorin and zeorin are widely distributed in the genus, and stictic acid has been demonstrated in two species.

*Pilophorus acicularis* (ACH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts; Granite Basin; Douglas Skibowl. Sitka: Harbour Mt. Ketchikan: Deer Mt; Ward Lake.

First reported from Alaska by ROTHROCK (1868). Known from China, Japan, and western North America where I have seen material from Idaho, California, Oregon, Washington, British Columbia and south-east Alaska.

Contains atranorin and zeorin.

[*Pilophorus cereolus* (ACH.) TH. FR.]

EASTERN PACIFIC COAST DISTRICT: Prince of Wales Island: Deep Cove. — Coll. EYERDAM. (THOMSON 1950a).



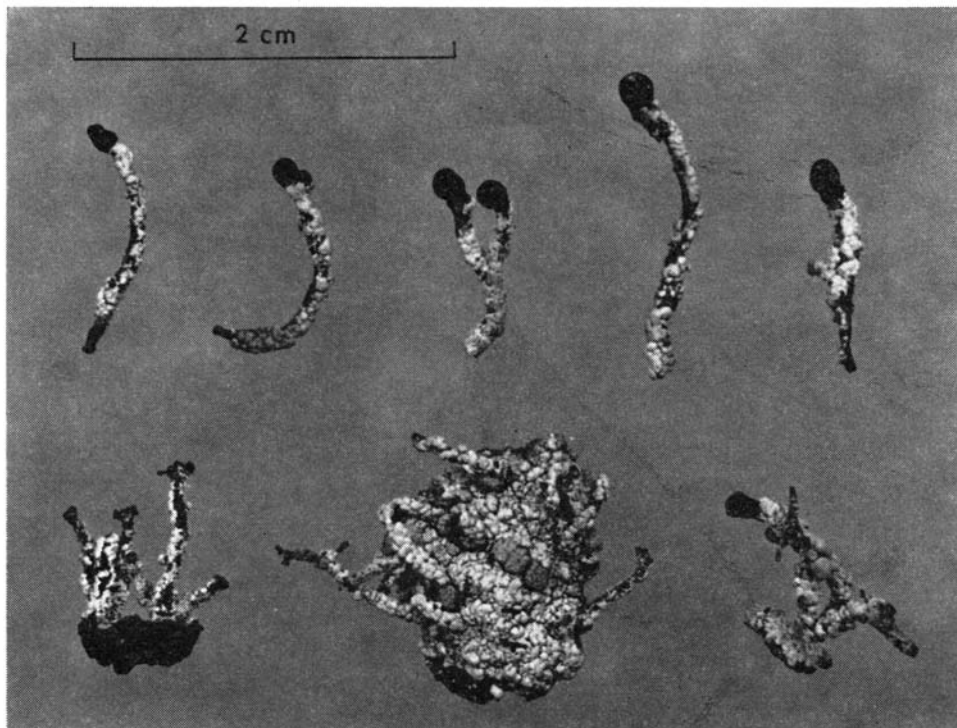


Fig. 12. *Pilophorus nigricaulis* SATÔ. Eastern Pacific Coast District: Ketchikan: Deer Mt. Coll. H. KROG, 1957, no. 6071.

There are also older records of this species from Alaska, but due to nomenclatural confusion and misidentifications these are left out. Personally I have seen no specimens of true *P. cereolus* from the west coast of North America. All the older records which I have had a chance to study represent *P. acicularis*.

Contains atranorin and zeorin, tested on European specimens.

*Pilophorus clavatus* TH. FR.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt. Ketchikan: Deer Mt.

First reported from Alaska by HERRE (1919). Known from Japan and the west coast of North America from Oregon to south-east Alaska.

This species has been known as *Pilophoron hallii* (TUCK.) VAIN. and *P. japonicum* ZAHLBR. However, *Pilophorus clavatus* is the older epithet, used by TH. FRIES in 1888 in his description of the species based on specimens collected by J. MACOUN on Vancouver Island.

Contains no lichen substances except perhaps traces of atranorin.

\**Pilophorus nigricaulis* SATÔ

Fig. 12.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt. Ketchikan: Deer Mt.

New to the American continent. Previously known only from Japan (SATÔ 1940).

Contains stictic acid, zeorin and atranorin.

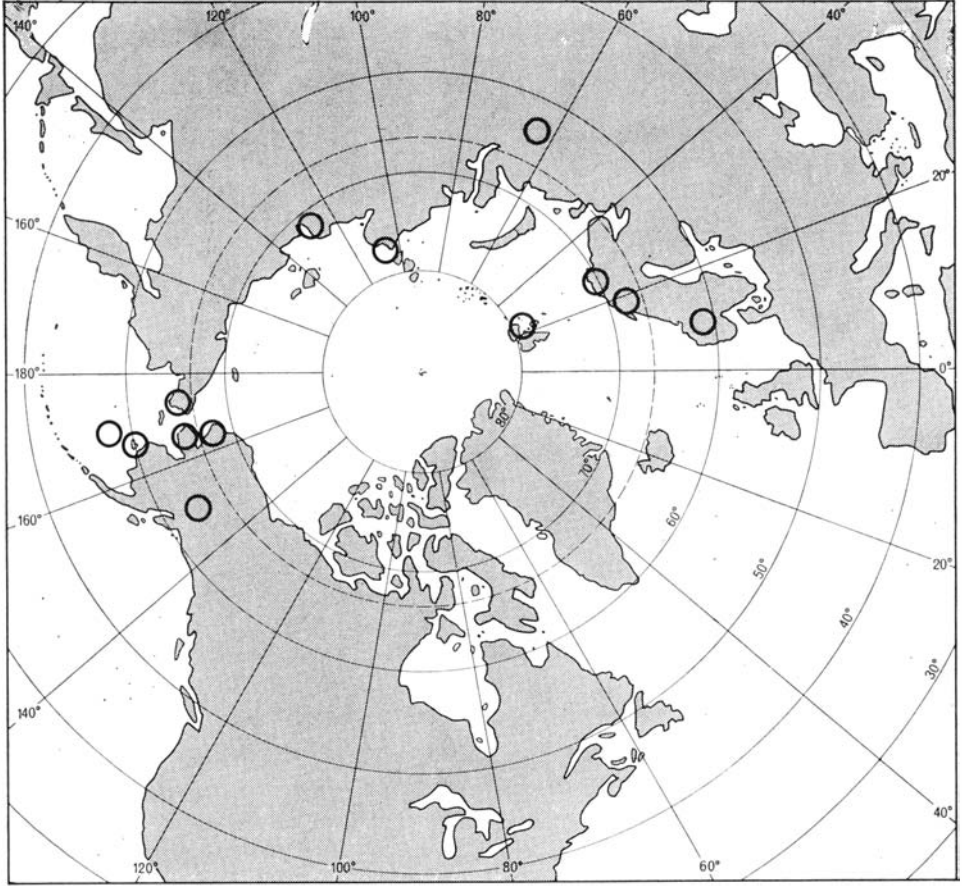


Fig. 13. Distribution of *Pilophorus robustus* TH. FR.

*Pilophorus robustus* TH. FR.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from islands of the Bering Strait by ROTHROCK (1868). A high arctic-boreal species with disjunct distribution, known from Scandinavia (bi-centric), Spitsbergen, Siberia and Alaska (Fig. 13). Old records from south-east Alaska apparently all represent *P. acicularis*.

Contains atranorin and zeorin.

*Pilophorus vegae* KROG sp. nov.

Fig. 14.

*Thallus saxicolus, crustaceus, areolatus, ± granulatus; podetia cylindrica, solida, simplicia vel apicem versus ramosa, ad 15 mm alta, primo cortice continuo tecta, dein partes basales sine cortice, nigrescentes, ad 3 mm latae, ramis cortice ± granuloso tectis; cephalodia subglobosa in podetiis sita, cum algis Nostoc.*

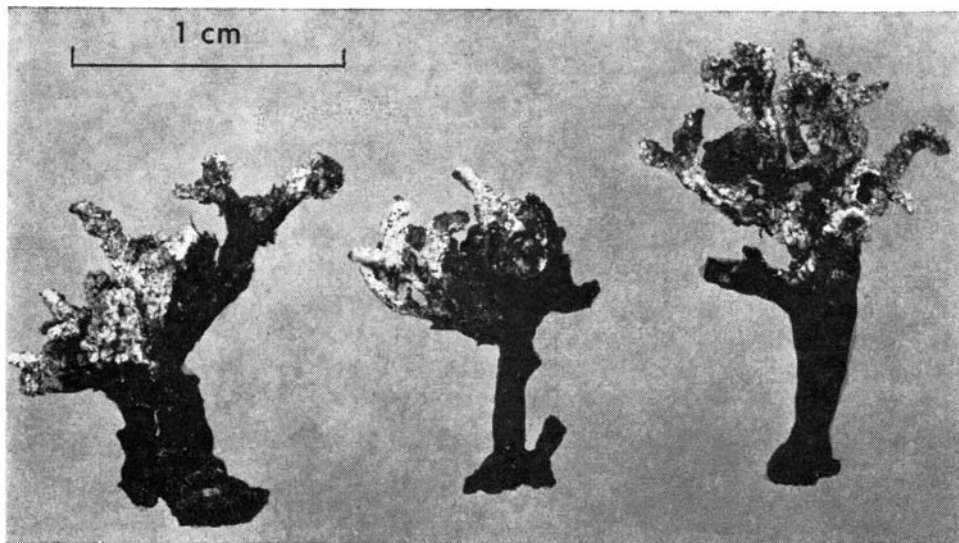


Fig. 14. *Pilophorus vegae* KROG. Bering Sea District: Nunivak Island: Robert's Mt. Coll. H. KROG, 1957, no. 2967. (Typus).

Thallus saxicolous, crustaceous, areolate, more or less granular, podetia cylindrical, compact, young podetia 0.5–1 mm wide, simple-sparingly branched, covered with a continuous cortex, the central column white or blackened at the base, older podetia up to 15 mm high, basal parts up to 3 mm wide, ecorticate, blackened, upper parts much branched, branches covered with a more or less granular cortex, central column often blackened to the very tips of the branches; cephalodia stipitate on podetia, subglobose, with *Nostoc* algae; mature apothecia not observed.

Chemical reactions: K + yellow, PD + orange, C–, KC–, contains stictic acid, atranorin and zeorin.

Type: Alaska.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt, growing on porous volcanic rock at the summit, el. 1700 ft. – Coll. H. KROG no. 2967 (O).

Additional specimens examined:

SIBIRIA SEPTENTRIONALIS: Sinus Konyam ad Fretum Bering, 64°50' lat. bor., 173° long. occid. Expeditio Vegae 1878–1880. Leg. E. ALMUIQST. 28–30. VII 1879. Det. NYLANDER as *Philophoron aciculare* (ACH.) (S).

ASIA ORIENTALIS: Peninsula Tschuktschorum, Sinus Emmae in sin. Providentiae, 64°45'N, 174°W. Leg. G. A. BORISOW no. 23. 1909. Det. SAVICZ as *P. cereolus* var. ? (O).

So far this species is only known from the three stations cited above, all in the Bering Sea and Bering Strait region. It seems to be most closely related to *P. nigricaulis* SATÔ.

*Pycnothelia* (ACH.) DUF.

[*Pycnothelia papillaria* (EHRH.) DUF.]

BERING SEA DISTRICT: Pribilof Islands: St Paul Island. – Coll. W. PALMER. (MACOUN 1899).

This record needs verification. *P. papillaria* seems to be a mainly eastern-southern species in North America.

Contains atranorin and protolichestic acid (ASAHINA 1942a).

*Cladonia* WIGG.

A world monograph of the genus *Cladonia* has been published by VAINIO (1887, 1894). The subgenus *Cladina* has been treated monographically by AHTI (1961). Other literature of importance is SANDSTEDE's *Cladonia* flora for Middle Europe (SANDSTEDE 1931), and EVANS' numerous publications on North American *Cladoniae*. Several publications by EVANS and ASAHINA deal with the chemical properties of the genus, and DAHL (1952) has given a survey of the chemical content of *Cladonia* species compiled from literature.

*C. foliacea* has been reported for Alaska, but according to HALE & CULBERSON (1966) North American records of this species are based on misidentifications. The record of *C. mitrula* TUCK. (= *C. capitata* (MICHX.) SPRENG.) by CUMMINGS (1892a) needs verification.

Dr. ASAHINA has kindly revised some doubtful specimens, especially in *Cocciferae*.

*Cladonia acuminata* (ACH.) NORRL.

Chemical strain I (var. *acuminata*):

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Toklat River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

Chemical strain II (var. *norrlinii* (VAIN.) H. MAGN.):

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Puritan Creek.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Circle Hot Springs.

First reported from Alaska by NYLANDER (1888). An arctic-temperate, circum-polar species.

Chemical strain I contains norstictic acid and atranorin, strain II psoromic acid (ASAHINA 1943) and atranorin.

*Cladonia alaskana* EVANS

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

*C. alaskana* was described by EVANS (1947) as an ascyphous species where the primary thallus was unknown and podetial squamules very scarce. With some hesitation he included it in subsection *Unciales*. However, I have found that the study of a larger and more varied material indicates a closer relationship with subsection *Furcatae*. The primary thallus may be either well developed with squamules crowded together in pulvinae, poorly developed or lacking all together. The podetia may be acuminate or cupbearing, with the membrane of the cups perforated. Proliferations appear from the margins of the cups. The upper parts of the podetia have a more or less arachnoid appearance.

Herbarium specimens of *C. paradoxa* (ELENK. & SAV.) H. MAGN. from Jenisejsk

apparently belong to the cupbearing form of *C. alaskana*. To my knowledge a description of MAGNUSSON's species was never published. ELENKIN & SAVICZ (1912) described *C. uncialis* var. *paradoxa* from Siberia. I have not studied this variety, but judging from the description it belongs to the *uncialis* complex rather than to *C. alaskana*.

Contains usnic and fumarprotocetraric acids.

*Cladonia alpestris* (L.) RABENH.

Chemical strain I (PD-):

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Bird Creek Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 100. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; the limestone ridge. Steese Highway: Cleary Summit.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

Chemical strain II (psoromic acid strain, PD+):

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Sitka: Indian River Trail.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine. Northern Cook Inlet area: Eagle River Valley; Eagle River, mountain area; Rabbit Creek. Kenai Peninsula: Skilak Lake; Marathon Mt. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Richardson Highway: Mile 170.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by NYLANDER (1888). Chemical strain I has an arctic-temperate, circumpolar distribution, strain II is known from east Asia and North America including south west Greenland.

Chemical strain II has been known under various names, viz. *C. alpestris* f. *aberrans* DES ABB., *C. aberrans* (DES ABB.) STUCK., and *C. alpestris* var. *aberrans* (DES ABB.) AHTI.

The lichen substances reported for this species include usnic, perlatolic, psoromic and pseudonorrangiformic acids and two unknown substances (EVANS 1943, 1955). Thallus may react PD+ bright yellow (psoromic acid) or PD-.

*Cladonia amaurocraea* (FLÖRKE) SCHAER.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Puritan Creek. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70; mile 100. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Mile 170; base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; lower Fossil Creek; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by ALMQUIST (1887). A high arctic-boreal, circumpolar species. It is common and widespread in Alaska, especially in inland and mountain areas.

Only the typical plants with a general *amaurocraea* appearance containing barbatic acid have been included here. In addition to the commonly accepted problem of separating *C. amaurocraea* and *C. uncialis* one has in Alaskan material to deal with related species with a somewhat different anatomy regarding the podetial wall, viz. *C. boryi*, *C. nipponica* and *C. pseudostellata*.

Contains usnic and barbatic acids.

*Cladonia arbuscula* (WALLR.) RABENH.  
ssp. *beringiana* AHTI

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts; Granite Basin. Sitka: Indian River Trail. Ketchikan: Base of Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge; Mabel Mine. Northern Cook Inlet area: Eagle River Valley; Eagle River, mountain area; Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Windy Point; Skilak Lake; south of Hidden Lake. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Mile 170; base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; the limestone ridge; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek. Baldwin Peninsula: Kotzebue.

*C. arbuscula* was first reported from Alaska by BABINGTON (1851). A high arctic-temperate, circumpolar species. The area of ssp. *arbuscula* approaches an amphi-Atlantic distribution while ssp. *beringiana* has an amphi-Beringian distribution from the Ural Mts to arctic Canada and possibly south-west Greenland.

PD+, K-. Contains usnic, fumarprotocetraric and ursolic acids (EVANS 1950).

*Cladonia bacillaris* (ACH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by HOWARD (1963). A boreal-temperate, circumpolar species.

The Alaskan specimens contained barbatic acid and sometimes small amounts of usnic acid. According to ASAHINA (1939c) and EVANS (1944) this species may also contain didymic acid and an undetermined substance.

*Cladonia bacilliformis* (NYL.) VAIN.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

Previously reported from Alaska by KROG (1962). A mainly boreal, probably circumpolar species, rare in Alaska, but possibly overlooked.

Contains usnic and barbatic acids.

*Cladonia bellidiflora* (ACH.) SCHAER.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts; Granite Basin; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine; Independence Mine. Kenai Peninsula: Portage Glacier; Granite Creek Ridge; Marathon Mt. Prince William Sound: Fish Bay; Pigot Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Eagle Summit; 12-Mile Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by ROTHROCK (1884). A high arctic-temperate, circumpolar species, in Alaska most common in coastal regions.

Contains usnic and squamatic acids and bellidiflorin. Bellidiflorin is an accessory substance in this species, and even usnic acid may be absent in some specimens, or may occur in too small quantities to be registered by microcrystallization.

*Cladonia boryi* TUCK.

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by NYLANDER (1888) as *C. lacunosa*. A low arctic-boreal, North American species. Asiatic records are supposed to represent *C. nipponica*.

Contains usnic acid.

*Cladonia botrytes* (HAG.) WILLD.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 32-37. Mt McKinley National Park: Wonder Lake. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek. Steese Highway: Circle Hot Springs.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from ALASKA by MERRILL (1929). A boreal-temperate, circumpolar species. Fairly widespread in Alaska, but scarce in each locality.

Contains usnic and barbatic acids.

*Cladonia cariosa* (ACH.) SPRENG.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Puritan Creek. Northern Cook Inlet area: Eagle River Valley. Kenai Peninsula: Skilak Lake; Windy Point; Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge; lower Fossil Creek. Steese Highway: Circle Hot Springs.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by CUMMINGS (1904). A high arctic-temperate, circumpolar species.

K+ (atranorin) and PD- or PD+ yellow (psoromic acid?). ASAHINA (1943) reported an undetermined substance, possibly rangiformic acid, in this species.

*Cladonia carneola* (FR.) FR.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Northern Cook Inlet area: Rabbit Creek. Kenai Peninsula: Ingram Creek camp ground; Hidden Lake; Skilak Lake; Marathon Mt. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Wonder Lake.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk village; Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by VAINIO (1894). A high arctic-temperate, circumpolar species.

Contains usnic acid and zeorin.

*Cladonia cenotea* (ACH.) SCHAER.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek Rd. Kenai Peninsula: Hidden Lake; Skilak Lake; Homer; Granite Creek Ridge. Richardson Highway: Mile 9; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37; mile 70; mile 100. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by ROTHROCK (1884). An arctic-temperate, circumpolar species.

Contains squamatic acid.

*Cladonia coccifera* (L.) WILLD.

var. *coccifera*

Barbatic acid strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Puritan Creek. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Skilak Lake; south of Hidden Lake. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70; mile 100. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Lion Peak; junction of Beaver Creek and Fossil Creek; the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

Zeorin strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 45.



ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 32-37 (u); mile 70; mile 100 (u).

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek (u).

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt; the lake where the geese don't fly (u).

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

var. *pleurota* (FLÖRKE) VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd (u).

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge (u); Little Nelchina. Kenai Peninsula: Granite Creek Ridge; Home1 (u). Richardson Highway: Mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28 (u); mile 32-37. Mt McKinley National Park: Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek (u); the limestone ridge. Steese Highway: Cleary Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour (u).

BERING STRAIT DISTRICT: Seward Peninsula: King Mt (u).

First reported from Alaska by BABINGTON (1851) as *C. cornucopioides*. A high arctic-temperate, circumpolar species.

The two varieties, often considered separate species, are here distinguished according to the presence or the absence of soredia. The Alaskan material of *C. coccifera* s. lat. seems to be more variable than European material.

The sorediose forms, var. *pleurota*, contained usnic acid and zeorin. In addition some specimens contained the undetermined lichen substance described by DAHL (1950) in Greenland material of this species. The presence of this substance is indicated by the letter (u) after the locality in the distribution list.

The esorediose forms, var. *coccifera*, may contain barbatic acid or zeorin besides usnic acid. Within the zeorin strain the above mentioned substance (u) may occur.

In some Greenland specimens DAHL (op.cit.) found squamatic acid, and in others he found only usnic acid. Corresponding cases have not been observed in the Alaskan material. ASAHINA (1939c) found bellidiflorin as an accessory substance in Japanese specimens of var. *pleurota*. The Alaskan specimens were not tested for this substance.

*Cladonia coniocraea* (FLÖRKE) SPRENG.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Granite Basin; Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Puritan Creek. Northern Cook Inlet area: Rabbit Creek Rd; headwaters of Rabbit Creek; Eastchester Swamp; O'Malley Rd. Kenai Peninsula: Hidden Lake; Homer; Portage Glacier; Seward; Marathon Mt. Prince William Sound: Fish Bay.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Camp ground near Mt McKinley Park Hotel; Wonder Lake. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

First reported from Alaska by HEDRICK (1936). A boreal-temperate, circumpolar species.

Contains fumarprotocetraric acid.

*Cladonia cornuta* (L.) HOFFM.

var. *cornuta*

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Northern Cook Inlet area: Bird Creek Ridge; O'Malley Rd. Kenai Peninsula: Hidden Lake; Skilak Lake; Windy Point; Portage Glacier. Richardson Highway: Mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 32–37; mile 100. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek. Steese Highway: Cleary Summit. Alaska Highway: Mile 1450.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

var. *groenlandica* DAHL

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Mt Roberts; Granite Basin; Shrine of St Therese; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Northern Cook Inlet area: Rabbit Creek Rd; headwaters of Rabbit Creek. Kenai Peninsula: Hidden Lake; Portage Glacier; Ingram Creek camp ground; Marathon Mt; Homer. Richardson Highway: Mile 9; mile 37. Prince William Sound: Pigot Bay; Fish Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 70. Mt McKinley National Park: Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek. Alaska Highway: Mile 1450.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by VAINIO (1894). An arctic-temperate, circumpolar species.

Contains fumarprotocetraric acid.

*Cladonia crispata* (ACH.) FLOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts. Sitka: Harbour Mt. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine; Puritan Creek. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 32–37; mile 70; mile 100. Mt McKinley National Park: Wonder Lake. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek. Steese Highway: Cleary Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by NYLANDER (1888). A high arctic-temperate, circumpolar species.

Contains squamatic acid.

*Cladonia cyanipes* (SOMMERF.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier; Salamatof. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Richardson Highway: Base of Rainbow Mts.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by NYLANDER (1888). A high arctic-temperate, circumpolar species. Widely distributed in Alaska, but scarce in each locality.

Contains usnic acid.

[*Cladonia decorticata* (FLÖRKE) SPRENG.]

WESTERN PACIFIC COAST DISTRICT: Kodiak Island. — Coll. J. M. MACOUN. (MACOUN 1902).

ALEUTIAN ISLANDS: Unalaska Island. — Coll. J. M. MACOUN. (MACOUN 1902). Atka Island. — Coll. McKECHNIE. (HOWE 1913a).

BERING SEA DISTRICT: Nunivak Island. — Coll. PALMER. (MERRILL 1929). St Paul Island. — Coll. J. M. MACOUN. (MACOUN 1899).

BERING STRAIT DISTRICT: Kobuk River. — Coll. PALMER. (MERRILL 1929).

These records need verification. Especially the more northern localities seem doubtful. However, the species does have a generally circumpolar distribution, and would be expected to occur in Alaska.

Contains perlatolic acid, tested on Scandinavian material.

*Cladonia deformis* (L.) HOFFM.

var. *deformis*

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

var. *gonecha* (ACH.) ARN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine. Kenai Peninsula: Granite Creek Ridge; south of Hidden Lake; Skilak Lake; Seward. Richardson Highway: Mile 9.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 70; mile 100. Mt McKinley National Park: Wonder Lake. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Lion Peak. Steese Highway: Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by BABINGTON (1851). A high arctic-temperate, circumpolar species, var. *deformis* with a more southern distribution, var. *gonecha* more northern.

The two varieties are often regarded as different species, because of chemical and slight morphological differences. However, at present I am inclined to agree

with PIŠŮT (1959) and only recognize the varieties, especially since I do not assign great importance to chemical characters in the segregation of species.

Both varieties contain usnic acid and bellidiflorin. In addition var. *deformis* contains zeorin and var. *gonecha* squamatic acid.

*Cladonia degenerans* (FLÖRKE) SPRENG.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake; Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek Rd. Kenai Peninsula: Skilak Lake; Granite Creek Ridge. Richardson Highway: Mile 9; mile 24; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 32–37; mile 70. Mt McKinley National Park: Savage River. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by ALMQUIST (1887). A high arctic-temperate, circumpolar species.

Contains fumarprotocetraric acid.

*Cladonia digitata* (L.) HOFFM.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Ingram Creek camp ground; Homer. Richardson Highway: Mile 9.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

First reported from Alaska by BABINGTON (1851). A boreal-temperate, circumpolar species.

Contains thamnolic acid and bellidiflorin.

*Cladonia ecmocyna* (ACH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts. Sitka: Harbour Mt. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Portage Glacier; Granite Creek Ridge; Marathon Mt. Richardson Highway: Mile 24; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 32–37; mile 70. Richardson Highway: Mile 170; base of Rainbow Mts.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

First reported from Alaska by VAINIO (1894). An arctic-temperate, circumpolar species. EVANS (1952) has discussed the synonymy of the species and given an account of its distribution in North America.

Contains fumarprotocetraric acid and atranorin.

\**Cladonia farinacea* (VAIN.) EVANS

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

According to EVANS (1950) this species is widely distributed in North America, and there is no evidence that it occurs in Europe. Originally described from South America (Straits of Magellan).

The Alaskan specimens contained fumarprotocetraric acid. According to EVANS (op. cit.) ursolic acid may be found as an accessory substance.

*Cladonia fimbriata* (L.) FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Puritan Creek. Northern Cook Inlet area: Rabbit Creek. Kenai Peninsula: Hidden Lake; Ninilchik; Windy Point; Portage Glacier; Ingram Creek camp ground; Marathon Mt. Richardson Highway: Mile 9; mile 24.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Camp ground near hotel; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by CUMMINGS (1892a). An arctic-temperate, circumpolar species.

Contains fumarprotocetraric acid.

\**Cladonia flabelliformis* (FLÖRKE) VAIN.

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail.

A boreal-temperate, possibly circumpolar species. Contains thamnolic acid.

*Cladonia furcata* (HUDS.) SCHRAD.

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt, lower part; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek. Alaska Highway: Mile 1450.

First reported from Alaska by MACOUN (1899). A high arctic-temperate, circumpolar species.

Contains fumarprotocetraric acid.

*Cladonia graciliformis* ZAHLBR.

ALEUTIAN ISLANDS: Little Sitkin Island. — Coll. O. MURIE. Det. ASAHINA (O).

First reported from Alaska by DEGELIUS (1937). Known only from Japan and Alaska.

In the single collection cited above two morphologically identical chemical strains were represented, one containing usnic and squamatic acids, the other usnic and thamnolic acids.

*Cladonia gracilis* (L.) WILLD.

var. *gracilis*

(= var. *chordalis* (FLÖRKE) SCHAER.)

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Nelchina. Northern Cook Inlet area: Bird Creek Ridge; headwaters of Rabbit Creek. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 32–37; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass; Wonder Lake. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; Cache Mt. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

var. *dilatata* (HOFFM.) VAIN.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine. Northern Cook Inlet area: Rabbit Creek Rd; headwaters of Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Skilak Lake; Windy Point; Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37; mile 100. Mt McKinley National Park: Wonder Lake. Richardson Highway: Mile 170; Darling Creek; base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek. Steese Highway: Circle Hot Springs. Alaska Highway: Mile 1450.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

var. *elongata* (JACQ.) FLÖRKE

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Nelchina. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; mile 32-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-temperate, circumpolar species.

Var. *gracilis* is in part represented by very slender specimens, corresponding to var. *gracillima* NORRL. Var. *elongata* seems to be a mainly arctic-alpine form with coarse, swollen podetia with the walls perforated by numerous holes and cracks.

Contains fumarprotocetraric acid. Small amounts of atranorin may be found as an accessory substance.

\**Cladonia granulans* VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Douglas Skibowl. Sitka: Harbour Mt. Ketchikan: Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; the lake where the geese don't fly. New to North America.

This species is previously known from Japan and Kamchatka. The Alaskan material was determined by ASAHINA.

Contains usnic and squamatic acids with bellidiflorin as an accessory substance.

\**Cladonia* cf. *japonica* VAIN.

f. *japonica*

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt.

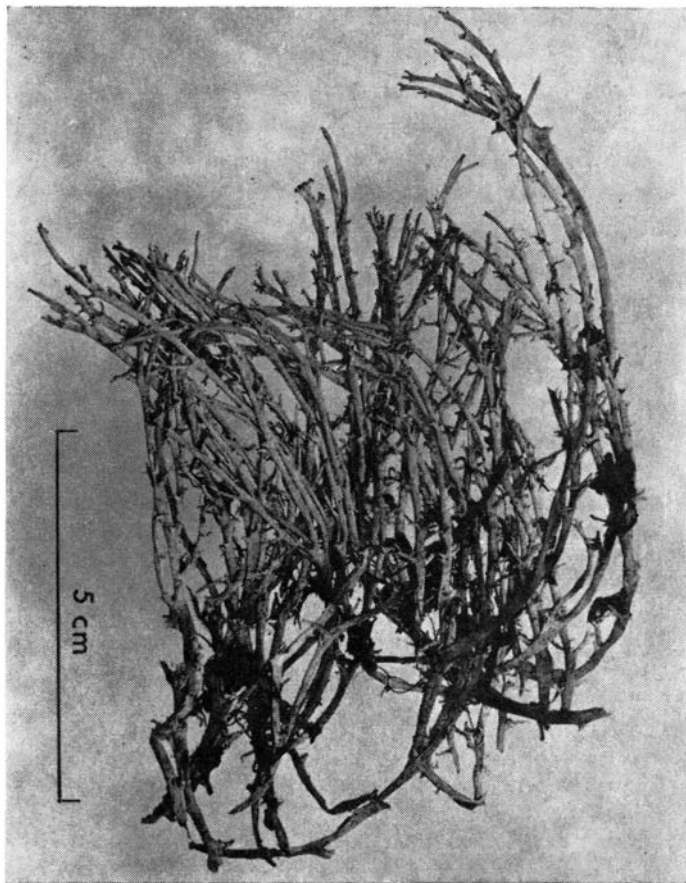


Fig. 15. *Cladonia* cf. *japonica* f. *tatrana* VAIN. Eastern Pacific Coast District:  
Ketchikan: Deer Mt. Coll. H. KROG, 1957, no. 6319.

f. *tatrana* VAIN.

Fig. 15.

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt.

The taxonomic position of this species is not clear. The entire *C. japonica*-*C. carassensis* complex is in need of revision.

The original description of *C. carassensis* was based on material from Brazil (VAINIO 1887). The species was later reported from eastern North America (ROBBINS 1924, EVANS 1935) and western North America (ASAHINA 1942d).

In 1898 VAINIO (*in* HUE) described *C. japonica* from Japan, and in 1930 (*in* GYELNIK) he described f. *tatrana* from the Tatra Mountains in Central Europe.

In 1942 ASAHINA expressed the opinion that the two species were synonymous. EVANS (1950) after studying material from Japan, the Tatra Mts, eastern North America and Brazil found a wide range of variation, but concluded that ASAHINA was justified in his viewpoint.

In 1959 ASAHINA changed the earlier *C. japonica* to *C. carassensis* subsp. *japonica* and at the same time described a new species, *C. pseudohondoensis*, and discussed its relationship to *C. carassensis* subsp. *japonica*. He mentioned that the new species resembled SANDSTEDT's *Cladoniae* Exs. no. 880 from Hohe Tatra.

I have personally seen material from eastern North America, a few specimens from Brazil, and nos. 880 and 1707 of SANDSTEDT's *Cladoniae* Exs. from the Tatra Mts. However, I have not had access to Japanese material.

In my opinion (based on insufficient material) the Brazilian specimens appear to be different from the North American specimens. In Brazilian material the inside of the podetial cylinder has a variegated appearance, and squamules are lacking. Within North America the eastern specimens differ markedly from the western specimens. The former are of a grayish colour, with fairly smooth, continuous cortex, partly squamulose, branching and typically cupforming. The latter are of a white to brown colour, short, stout, with discontinuous cortex making the podetia black checked at the base and variegated in the upper parts, branching is scarce, and cups are infrequent and indistinct. This form parallels certain forms of *C. crispata* var. *ceptrariaeformis*.

Without a study of Japanese material it is difficult to reach a satisfactory conclusion. However, it seems reasonable to assume that the species found on the east and west coasts of the Pacific Ocean are identical, but differ from the original *C. carassensis* and from the eastern North American species.

Contains thamnolic acid.

*Cladonia lepidota* NYL.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: South of Hidden Lake; Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; mountain ridge, mile 28; mile 32-37. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak. Steese Highway: Cleary Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak.

First reported from Alaska by NYLANDER (1888). A high arctic-boreal, circum-polar species.

Contains fumarprotocetraric acid and atranorin.

*Cladonia macilentata* HOFFM.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Ketchikan: Ward Lake. Sitka: Indian River Trail.

First reported from Alaska by CUMMINGS (1892a). Some of the older records probably include *C. transcendens*. A boreal-temperate, slightly oceanic, circum-polar species.

The Alaskan specimens contained thamnolic acid, bellidiflorin, and small amounts of usnic acid.

*Cladonia macrophylla* (SCHAER.) STENH.  
(= *C. alpicola* (FLOT.) VAIN.)

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine. Richardson Highway: Mile 9; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; mile 32-37; mile 70; mile 100. Mt McKinley National Park: Wonder Lake.



CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Cache Mt. Steese Highway: 12-Mile Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by MERRILL (1929). A high arctic-temperate, circumpolar species.

The nomenclature of this species has been discussed by AHTI (1967).

PD+ bright yellow. Contains psoromic acid and an unknown substance (ASAHINA 1943).

*Cladonia macrophyllodes* NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake; Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Granite Creek Ridge; Marathon Mt. Richardson Highway: Mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 70.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by HEUSSER (1954). An arctic-alpine, circumpolar species. Contains fumarprotocetraric acid and atranorin.

*Cladonia metacorallifera* ASAH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

First reported from Alaska by LLANO (1951). This species is only known from Japan and Alaska. The Alaskan specimens were determined by ASAHINA.

Contains usnic, didymic and squamatic acids, with bellidiflorin as an accessory substance.

*Cladonia mitis* SANDST.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine. Kenai Peninsula: Skilak Lake; Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by DEGELIUS (1937). A high arctic-temperate, circumpolar species.

This species has a complex chemistry, where usnic acid is constant, and rangiformic, pseudonorrangiformic, psoromic and fumarprotocetraric acids and some undetermined substances have been reported as accessory substances (ASAHINA 1941, 1958, EVANS 1943, 1950). According to AHTI (1961) rangiformic acid may be constant in this species, and the occurrence of psoromic and fumarprotocetraric acids is doubtful.

*Cladonia multiformis* MERR.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek. Steese Highway: Circle Hot Springs.

AHTI (1964) mentioned the occurrence of this species in Alaska, without citing any localities. A boreal-temperate species, widely distributed in North America. Contains fumarprotocetraric acid.

\**Cladonia nemoxyna* (ACH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier Rd.

A boreal-temperate, probably circumpolar species. The Alaskan specimens differ from European material in being regularly cupforming and having a black checked base.

According to SUOMINEN & AHTI (1966) the correct name for *C. nemoxyna* may be *C. rei* SCHAER. or *C. fibula* HOFFM.

Contains homosekikaic acid, with fumarprotocetraric acid as an accessory substance. All the Alaskan specimens reacted PD +.

*Cladonia nipponica* ASAH.

var. *aculeata* ASAH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake; Mt Roberts. Sitka: Harbour Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28–37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak. Steese Highway: Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

var. *sachalinensis* ASAH.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek. Baldwin Peninsula: Kotzebue.

Previously reported from Alaska by EVANS (1955). This species is known only from Japan and Alaska. It seems to be most common in mountain areas in the interior.

The Alaskan specimens were determined by ASAHINA.

Contains usnic acid.

[*Cladonia ochrochlora* FLÖRKE]

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Seward. – Coll. HULTÉN. (DEGELIUS 1937).

ALEUTIAN ISLANDS: Unalaska Island: Unalaska. – Coll. HULTÉN. (DEGELIUS 1937).

A boreal-temperate, possibly circumpolar species. Contains fumarprotocetraric acid.

*Cladonia pacifica* AHTI

Usnic acid strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake. Ketchikan: Deer Mt; Ward Lake.

Acid deficient strain:

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt.

Previously reported from Alaska by AHTI (1961). A North American west coast species known from Oregon to the Aleutian Islands.

Contains usnic acid, or in the acid deficient strain no substances which can be demonstrated microchemically.

*Cladonia pocillum* (ACH.) O. RICH.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Toklat River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge.

First reported from Alaska by VAINIO (1894). A high arctic-temperate, circum-polar species, preferring a calcareous substratum.

Contains fumarprotocetraric acid, with small amounts of atranorin as an accessory substance.

*Cladonia pseudevansii* ASAH.

EASTERN PACIFIC COAST DISTRICT: Nichols Bay. — Coll. FOSTER (O).

CENTRAL PACIFIC COAST DISTRICT: Prince William Sound: Evans Island; Knight Island. — Coll. EYERDAM (S). Crab Bay. — Coll. HULTÉN (UPS).

ALEUTIAN ISLANDS: Kishka. — Coll. MURIE (LD). Attu Island, East Canyon. — Coll. HARDY (S).

First reported from Alaska by AHTI (1960). An oceanic species known from Korea, Japan and Alaska.

Contains usnic and perlatolic acids (ASAHINA 1940).

[*Cladonia pseudomacilenta* ASAH.]

WESTERN PACIFIC COAST DISTRICT: Kodiak Island. — Coll. LLANO. (LLANO 1951).

Known from Japan and Alaska.

Contains usnic and squamatic acids (ASAHINA 1953).

*Cladonia pseudorangiformis* ASAH.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine. Kenai Peninsula: Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: 12-Mile Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by EVANS (1955). A low arctic-boreal species known from eastern Asia and northern North America from Alaska to Labrador.

The taxonomy and distribution of this species has been discussed by AHTI (1962).

Contains merochlorophaeic and psoromic acids and atranorin (ASAHINA 1942b, EVANS 1955).

\**Cladonia pseudostellata* ASAH.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River. Kenai Peninsula: Granite Creek Ridge; Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 70. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit; Circle Hot Springs.

Not previously reported for North America, but in EVANS' herbarium (US) there are several specimens from Alaska determined as *C. pseudostellata*, partly by EVANS, partly by ASAHINA. Previously known only from Japan. Judging from the Alaskan specimens it is a boreal species most common in the interior.

*C. pseudostellata* differs from *C. uncialis* mainly in the discontinuous outer cortex of the podetia, which has a tendency to form clear spots, finally disintegrating and leaving perforations in the podetial wall.

Contains usnic and hypothamnolic acids (ASAHINA 1942c).

*Cladonia pyxidata* (L.) HOFFM.

ssp. *pyxidata*

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine; Mabel Mine; Puritan Creek. Kenai Peninsula: Skilak Lake; Windy Point; Granite Creek Ridge. Richardson Highway: Mile 24; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Mt McKinley National Park: Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek. Steese Highway: Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Robert's Mt.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

ssp. *chlorophaea* (FLÖRKE) SPRENG.

Fumarprotocetraric acid strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake; Mt Roberts; Granite Basin; Shrine of St Therese; Douglas Skibowl. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-36. Mt McKinley National Park: Savage River. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek. Baldwin Peninsula: Kotzebue.

Cryptochlorophaeic acid strain (PD +):

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit.

Merochlorophaeic acid strain (PD + or -):

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake. Ketchikan: Deer Mt.

Grayaninic acid strain (PD-):

ALASKA RANGE DISTRICT: Denali Highway: Mile 28.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

Rangiformic acid strain (PD +):

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Ingram Creek camp ground; Seward.

*C. pyxidata* s. lat. was first reported from Alaska by HOOKER & ARNOTT (1841). A circumpolar, high arctic-temperate species.

The two subspecies *pyxidata* and *chlorophaea* are here distinguished on the basis of presence or absence of soredia. They are commonly recognized as different species, but because of their somewhat unclear status I prefer at the time to regard them as subspecies of *C. pyxidata*.

A further subdivision of the *chlorophaea* group into several chemospecies was attempted by ASAHINA (1940b) and EVANS (1944), and has been generally followed by believers in chemical species. AHTI (1966b) discussed the taxonomy of the *pyxidata-chlorophaea* complex in relation to chemistry, and reported certain correlations between morphological and chemical traits. However, his support of the chemical species on morphological grounds does not seem convincing. I prefer at present to refer to chemical strains, realizing that the epithet *C. pyxidata* in the present work is used in a very wide sense.

In Alaska the fumarprotocetraric, merochlorophaeic, cryptochlorophaeic and grayaninic acid strains are the least distinguished ones from a morphological point of view. The rangiformic acid strain corresponds to SANDSTEDT's *Cladonia* Exs. nos. 1008 and 1153, by ASAHINA (op. cit) referred to as doubtful specimens of *C. chlorophaea*. The specimens belonging to this chemical strain seem to occupy an intermediate position between *C. pyxidata* subsp. *chlorophaea* s. lat. and *C. fimbriata*, often forming tall slender podetia with narrow cups, producing soredia varying from granular to farinose. A close study of a larger material might prove this to be a new species.

In addition to the lichen substances mentioned above, atranorin has been observed as an accessory substance.

*Cladonia rangiferina* (L.) WEB.  
ssp. *rangiferina*

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Mt Roberts; Montana Creek. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine; Puritan Creek. Northern Cook Inlet area: Eagle River Valley; Rabbit Creek. Kenai Peninsula: Skilak Lake; Marathon Mt. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70, mile 100. Mt McKinley National Park: Wonder Lake. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; junction of Beaver Creek and Fossil Creek. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek. Baldwin Peninsula: Kotzebue.

ssp. *grisea* AHTI

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail.

*C. rangiferina* s. lat. was first reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-temperate, circumpolar species with a wide distribution range. The oceanic ssp. *grisea* is restricted to eastern Asia and western North America.

Contains fumarprotocetraric acid and atranorin. A few specimens from Nunivak Island and Seward Peninsula lacked atranorin and reacted K-.

*Cladonia scabriuscula* (DEL. ex DUBY) LEIGHT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake; Granite Basin; Shrine of St Therese. Sitka: Harbour Mt. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine. Kenai Peninsula: Marathon Mt.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by HEDRICK (1936). An arctic-temperate, circumpolar, slightly oceanic species.

In Alaskan material it is not always easy to distinguish between *C. furcata* and *C. scabriuscula*. The latter seems to be by far the most common.

Forms similar to *C. macroptera* Räs. (RÄSANEN 1940, ASAHINA 1940a) have been noted in the Alaskan material of the *C. furcata*-*C. scabriuscula* complex, but since I have not seen Japanese material of this species I have made no attempt to keep it separate.

Contains fumarprotocetraric acid.

*Cladonia squamosa* (SCOP.) HOFFM.

Squamatic acid strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Mt Roberts; Granite Basin; Montana Creek; Shrine of St Therese; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine; Puritan Creek. Kenai Peninsula: Skilak Lake; Portage Glacier Rd; Ingram Creek camp ground; Marathon Mt. Richardson Highway: Mile 37. Prince William Sound: Pigot Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; mile 32-37; mile 100. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

Thamnolic acid strain (= *C. subsquamosa*):

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt; Ward Lake; Saxman Village.

First reported from Alaska by ROTHROCK (1884). An arctic-temperate, circumpolar species. The thamnolic acid strain seems to be most common in coastal areas.

*Cladonia subfurcata* (NYL.) ARN.  
(= *C. delessertii* (NYL.) VAIN.)

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts; Mendenhall Lake. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Richardson Highway: Mile 24; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32–37. Mt McKinley National Park: Wonder Lake.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by MERRILL (1929). A high arctic-temperate, circumpolar species.

The nomenclature of this species has been discussed by AHTI (1967).

Several of the specimens listed above belonged to the atypical *C. subfurcata* mentioned by DAHL (1950) from south-west Greenland, with very slender podetia with an areolate cortex developing into squamules.

Contains squamatic acid.

*Cladonia subulata* (L.) WIGG.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Skilak Lake; Portage Glacier.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak.

First reported from Alaska by THOMSON (1950a). An arctic-temperate, circumpolar species.

Contains fumarprotocetraric acid.

*Cladonia symphy carpia* (FLÖRKE) ARN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28.

First reported from Alaska by ROTHROCK (1884). A calciphilous, boreal-temperate, circumpolar species.

Contains norstictic acid and atranorin.

*Cladonia tenuis* (FLÖRKE) HARM.

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail.

Previously reported from Alaska by AHTI (1961). A boreal-temperate, oceanic, incompletely circumpolar species.

Contains usnic and fumarprotocetraric acids.

*Cladonia transcendens* (VAIN.) VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Shrine of St Therese; Douglas Skibowl. Sitka: Indian River Trail. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Prince William Sound: Fish Bay.

First reported from Alaska by EVANS (1951) who discussed the nomenclature and distribution of this species. A North American west coast species known from California to Alaska.

In Alaska the form *squamulosa* EVANS is quite common.

Contains thamnolic acid, with bellidiflorin and usnic acid as accessory substances.

*Cladonia turgida* (EHRH.) HOFFM.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake; Mt Roberts.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32–37.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by COLLIER (1901). An arctic-temperate, circumpolar species.

Contains fumarprotocetraric acid and atranorin.

*Cladonia uncialis* (L.) WIGG.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine; Little Nelchina. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: South of Hidden Lake. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 100.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Cache Mt. Steese Highway: Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-temperate, circumpolar species.

Contains usnic and squamatic acids.

*Cladonia verticillata* (HOFFM.) SCHAER.

var. *verticillata*

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek. Kenai Peninsula: Skilak Lake; Windy Point. Richardson Highway: Mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 32–37. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak.

var. *cervicornis* (ACH.) FLØRKE

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; Lion Peak. Steese Highway: Cleary Summit; 12-Mile Summit; Circle Hot Springs. Alaska Highway: Mile 1450.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.



First reported from Alaska by CUMMINGS (1904). A high arctic-temperate, circumpolar species.

Some specimens from the Bering Strait region were very slender with abruptly widening cups. The cortex was discontinuous, giving the entire podetium a black checked appearance. This form recalls *C. calycantha* DEL., a species which in North America has an eastern and southern distribution. I have seen Icelandic material of *C. verticillata* which was quite similar to the unusual Alaskan specimens.

Contains fumarprotocetraric acid.

## UMBILICARIACEAE

### *Umbilicaria* HOFFM.

The family *Umbilicariaceae* has been treated for Middle Europe by FREY (1933) and in a monograph for the Western Hemisphere by LLANO (1950). Whereas FREY included all the European species in one single genus *Umbilicaria*, LLANO followed the suggestion made by SCHOLANDER (1934) and divided the family into five different genera based on the morphology of the apothecia. Other subdivisions of the family have also been attempted. A survey of the different views has been given by HAKULINEN (1962). In the present work I am following FREY's genus concept.

*U. papulosa*, *U. phaea* and *U. polyrrhiza* are known from the west coast of North America as far north as British Columbia, and may possibly be found also in Alaska.

Gyrophoric acid is a widespread lichen substance in the genus. Umbilicinic acid is found in several species, but seems to have a more accessory character. Norstictic and stictic acids have been demonstrated in a few species, and one species contains a hydroxyanthrachinonderivate.

### *Umbilicaria angulata* TUCK.

#### var. *angulata*

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Kenai Peninsula: Portage Glacier.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 70.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

#### var. *compacta* KROG var. nov.

Fig. 16.

*A var. angulata differt thallo crasso densoque, ad partem mediam valde rugoso, superficies inferior substratum pro parte maxima crustae adfixa.*

Differs from var. *angulata* in the thick, compressed thallus which is strongly wrinkled towards the centre, with most of the lower surface attached to the substratum in a crustlike fashion.

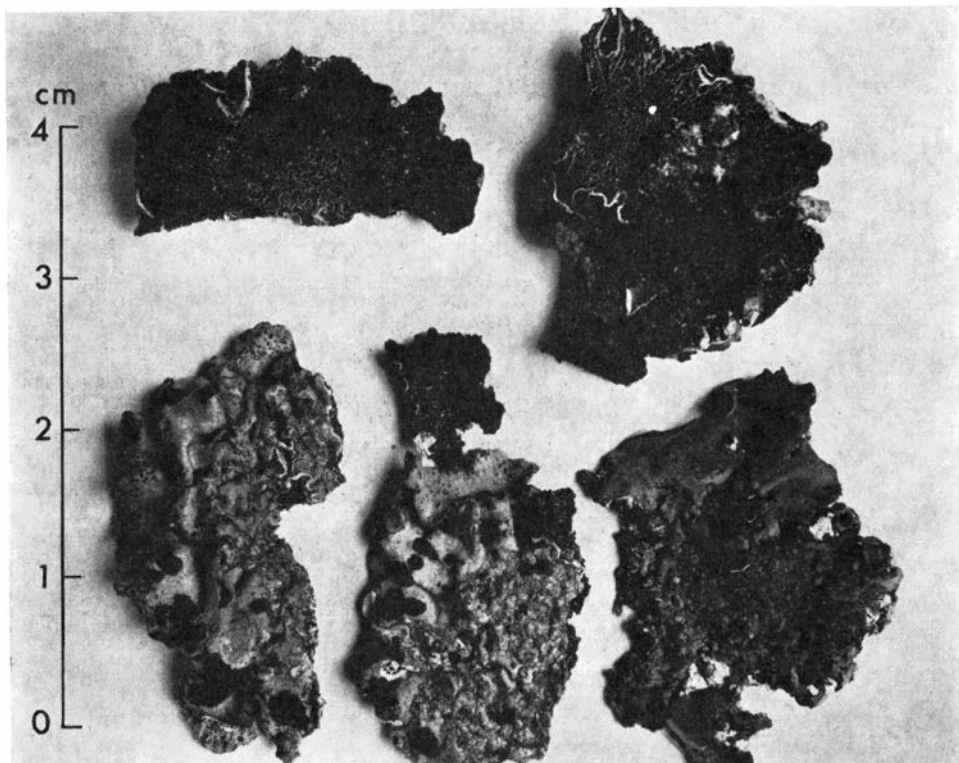


Fig. 16. *Umbilicaria angulata* var. *compacta* KROG. Eastern Pacific Coast District: Juneau: Granite Basin. Coll. H. KROG, 1957, no. 5203. (Typus). Ventral surface (upper specimens) and dorsal surface with apothecia (lower specimens).

Type: Alaska.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin, on rocks, el. 3000 ft. — Coll. H. KROG no. 5203, (O).

The habit of var. *compacta* recalls *U. pulvinaria* (SAV.) FREY and *U. lambii* IMSH., the former with actinodisc apothecia, the latter with leiodisc apothecia. It is a possibility that *U. pulvinaria* and *U. lambii* may represent growth modifications of an actinodisc and a leiodisc species respectively.

*U. angulata* was first reported from Alaska by LLANO (1950). A North American west coast species of alpine regions known from California to the Aleutian Islands and the Bering Strait.

The specimens from Talkeetna Mts, Denali Highway, and Seward Peninsula were included with some hesitation. They were very dark, often polyphyllous, and contained umbilicaric acid in addition to gyrophoric acid. The more southern specimens contained gyrophoric acid only.

#### *Umbilicaria arctica* (ACH.) NYL.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine; Mabel Mine. Northern Cook Inlet area: Eagle River. Kenai Peninsula: Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28; mile 70.

CENTRAL YUKON RIVER DISTRICT: White Mts: Cache Mt. Steese Highway: Eagle Summit; 12-Mile Summit.

First reported from Alaska by HOWE (1913a). A high arctic-alpine, circumpolar species.

Contains gyrophoric acid.

*Umbilicaria caroliniana* TUCK.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; 12-Mile Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by LLANO (1950). Known from Japan, south east Siberia, and North America where it has a disjunct distribution in the high mountains of North Carolina and the northern parts of Alaska.

Contains gyrophoric acid.

*Umbilicaria cinereorufescens* (SCHAER.) FREY

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine. Northern Cook Inlet area: Rabbit Creek.

ALASKA RANGE DISTRICT: Denali Highway: Mile 70. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; 12-Mile Summit.

First reported from Alaska by LLANO (1950). An arctic-alpine, probably circumpolar species.

In Alaskan material this species is at times difficult to separate from *U. vellea*. DAHL (1950) had the same problem with material from south-west Greenland.

Contains gyrophoric acid.

*Umbilicaria cylindrica* (L.) DEL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Mountain ridge, Eagle River; headwaters of Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Hidden Lake; Granite Creek Ridge; Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak; Cache Mt.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

First reported from Alaska by MACOUN (1899). A high arctic-temperate, circumpolar species.

No lichen substances could be demonstrated in this species by means of microcrystallization.

[*Umbilicaria decussata* (VILL.) ZAHLBR.]

ARCTIC COAST DISTRICT: Lake Chandler. - Coll. SCHOLANDER. (LLANO 1950). Anaktuvuk Pass. - Coll. LLANO. (LLANO 1950).

A high arctic-alpine, circumpolar species.

Comprises one acid deficient strain and one gyrophoric acid strain, tested on European material.

*Umbilicaria deusta* (L.) BAUMG.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Bald Mt Ridge; Mabel Mine; Independence Mine. Kenai Peninsula: Skilak Lake; Granite Creek Ridge. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Cache Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from the Bering Strait region by TUCKERMAN (1882). A high arctic-temperate, circumpolar species.

Contains gyrophoric acid.

[*Umbilicaria hirsuta* (Sw. ex WESTR.) ACH.]

EASTERN PACIFIC COAST DISTRICT: Muir Glacier. - Coll. TRELEASE. (CUMMINGS 1904).

ARCTIC COAST DISTRICT: Lake Schraeder. - Coll. SCHOLANDER. (LLANO 1950). Anaktuvuk Pass. - Coll. LLANO. (LLANO 1950).

A low arctic-temperate, possibly circumpolar species. Contains gyrophoric acid, tested on European material.

*Umbilicaria hyperborea* (ACH.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Headwaters of Rabbit Creek; Eagle River; Bird Creek Ridge. Kenai Peninsula: Portage Glacier Rd; Skilak Lake; Hidden Lake; Marathon Mt. Richardson Highway: Mile 24; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; Cache Mt; Lion Peak; headwaters of Sheep Creek. Steese Highway: Cleary Summit; 12-Mile Summit; Eagle Summit; Circle Hot Springs.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; King Mt; Rainbow Creek.

First reported from Alaska by ROTHROCK (1884). A high arctic-temperate, circumpolar species.

Contains gyrophoric acid with umbilicarinic acid as an accessory substance.

*Umbilicaria krascheninnikovii* (SAV.) ZAHLBR.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

First reported from Alaska by LLANO (1950). A predominantly arctic-alpine species known from Spitsbergen, Siberia, Kamchatka, Formosa, Greenland, and the west coast of North America from California, Arizona and New Mexico to Alaska.

Contains gyrophoric acid.

*Umbilicaria lyngei* SCHOL.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28, mountain ridge north of highway; mile 70. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Cache Mt.

First reported from Alaska by LLANO (1950). A high arctic-alpine, circumpolar species.

In some specimens small amounts of norstictic acid were found, but the majority of specimens contained no lichen substances.

[*Umbilicaria mammulata* (ACH.) TUCK.  
var. *magnaeva* LLANO]

BERING STRAIT DISTRICT: Diomedé Island. — Coll. PALMER. (LLANO 1950).

*U. mammulata* is a predominantly North American species with its main distribution area in the eastern regions. In the north west it is represented by var. *magnaeva*. LLANO (1950) also gave one locality for *U. mammulata* in Siberia: Arakamchatchene Island, coll. WRIGHT. This is assumed to represent the same variety as that recorded for Diomedé Island.

Contains gyrophoric acid, tested on east American specimens.

[*Umbilicaria muehlenbergii* (ACH.) TUCK.]

ALASKA, without locality. — Coll. TRELEASE. (CUMMINGS 1904).

ARCTIC COAST DISTRICT: Between Point Barrow and Mackenzie River. — Coll. PULLEN. (LLANO 1950).

A low arctic-temperate species known from Japan, Siberia, and North America where it is widely distributed, especially in the east.

Contains gyrophoric acid, tested on east American material.

*Umbilicaria pensylvanica* HOFFM.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; 12-Mile Summit.

First reported from Alaska by LLANO (1950). A low arctic-temperate species known from the southern Ural region, Formosa, Japan, the east and west coasts of North America, and the west coast of Greenland.

Contains gyrophoric acid.

*Umbilicaria polyphylla* (L.) BAUMG.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: 12-Mile Summit.

First reported from Alaska by MACOUN (1902). A low arctic-temperate, circumpolar species.

Contains gyrophoric and umbilicaric acids.

*Umbilicaria proboscidea* (L.) SCHRAD.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Mabel Mine; Bald Mt Ridge. Northern Cook Inlet area: Eagle River; headwaters of Rabbit Creek. Kenai Peninsula: Portage Glacier. Richardson Highway: Mile 24; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; 12-Mile Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by ROTHROCK (1884). A high arctic-alpine, circum-polar species.

In the Alaskan material all specimens contained gyrophoric acid. Colour reactions on the thalli showed some specimens reacting PD+ due to the presence of norstictic acid. On microchemical tests some of the PD-specimens showed small amounts of norstictic acid, while others did not. Outside of Alaska I have seen PD+ specimens (thallus tests only) from Taimyr and Novaya Zemlya.

### *Umbilicaria rigida* (DU RIETZ) FREY

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Northern Cook Inlet area: Mountain ridge, Eagle River.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28, mountain ridge north of highway; mile 70.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; Cache Mt.

Reported from Alaska by LLANO (1950). *Gyrophora anthracina* reported by CUMMINGS (1904) may have been this species. A high arctic-alpine species with a disjunct distribution, known from Fennoscandia, Novaya Zemlya, Greenland, Japan and northwestern North America from Washington to Alaska.

No lichen substances could be demonstrated by means of microcrystallization in the Alaskan specimens. I have seen one Norwegian specimen which contained norstictic acid.

### *Umbilicaria scholanderi* (LLANO) KROG comb. nov.

*Agyrophora scholanderii* LLANO, J. Wash. Acad. Sci. 46: 183 (1956).

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Savage River.

First reported from Alaska by LLANO (1956). Known from the higher interior mountains of Washington and Alaska.

Contains gyrophoric acid. In this respect it differs from most of the other species in the "*Agyrophora*" section.

### *Umbilicaria torrefacta* (LIGHTF.) SCHRAD.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Mabel Mine; Bald Mt Ridge. Northern Cook Inlet area: Eagle River; headwaters of Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Seward; Portage Glacier; Skilak Lake; south of Hidden Lake. Richardson Highway: Mile 24; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Mt McKinley National Park: Toklat River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; Cache Mt. Steese Highway: Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by MACOUN (1899). A high arctic-temperate, circumpolar species.

In Alaska as in Scandinavia there are two chemical strains of this species, one containing gyrophoric acid and one containing stictic acid. The gyrophoric acid strain was collected slightly more frequently, but there was no difference in geographical distribution of the two strains.

BACHMAN (1962) demonstrated by means of microchemical and paper chromatographical methods norstictic and  $\alpha$ -methyleter-salazinic acids in *U. torrefacta*. However, in the PD+ specimens of Norwegian as well as Alaskan material typical stictic acid crystals were formed in GAO-T, and no crystals were observed in  $K_2CO_3$ .

Some specimens from high mountains of the interior had a very thick, compact, polyphyllous appearance, the underside with wide umbilicus and prominent lamellae. Chemically these specimens differed in producing umbilicic acid in addition to gyrophoric acid.

#### *Umbilicaria vellea* (L.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine. Northern Cook Inlet area: Bird Creek Ridge; O'Malley Rd. Kenai Peninsula: Seward; Skilak Lake. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28; mile 70.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit; 12-Mile Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by CUMMINGS (1904). A high arctic-temperate, circumpolar species.

As pointed out by LLANO (1950) the western North American specimens show considerable variation in the colour of the upper surface and in development of rhizinae.

Contains gyrophoric acid.

#### *Umbilicaria virginis* SCHAER.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Mt Eielson. — Coll. WEBER & VIERECK, S 7094 (O, S).

Reported from Alaska by LLANO (1950). Records of *Gyrophora rugifera* (MACOUN 1899) may represent this species. A high arctic-alpine, probably circumpolar species.

Contains gyrophoric acid, tested on Norwegian material.

## STEREOCAULACEAE

### *Stereocaulon* HOFFM.

The boreal *Stereocaula* have been studied by MAGNUSSON (1926), and the European *Stereocaula* have been treated by FREY (1933) in RABENHORST's Kryptogamenflora. A world monograph on the genus is being prepared by LAMB.

The Alaskan record of *S. albicans* by HEUSSER (1954) needs verification. It probably represents *S. subalbicans*.

Alaskan records of *S. dactylophyllum* may be based on misidentifications, since this species is known to have an amphi-Atlantic distribution (LAMB 1951).

The genus displays a complex chemistry, and chemical strains are common. Chemical properties for many species have been given by LAMB (op.cit.), but several species have not yet been studied.

The Alaskan collection has been revised by LAMB.

### *Stereocaulon alpinum* LAUR.

#### var. *alpinum*

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts. Sitka: Indian River Trail.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine. Kenai Peninsula: Skilak Lake; Hidden Lake; Portage Glacier Road; Windy Point; Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Polychrome Pass. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Lion Peak; the limestone ridge; granite outcrop close to the limestone ridge. Steese Highway: Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

#### var. *erectum* FREY

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from islands of the Bering Strait by TUCKERMAN (1882). A high arctic-temperate, circumpolar species.

Two chemical strains are present in the Alaskan material, one containing lobaric acid and atranorin, the other stictic acid and atranorin.

### \**Stereocaulon arcticum* LYNGE

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Government Peak. Northern Cook Inlet area: Eagle River. Kenai Peninsula: Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak.

A high arctic-alpine, probably circumpolar species. I have seen no previous record of this species from North America, and it is not mentioned in the checklist (HALE & CULBERSON 1966). It may, however, have been included in *S. vesuvianum*.



According to LAMB (in litt.) all the specimens cited above are in the acid deficient phase (absence of stictic acid, PD + faint yellow reaction due to presence of atranorin only).

*Stereocaulon botryosum* ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Richardson Highway: Mile 9; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28–37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; Cache Mt; Lion Peak.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by DEGELIUS (1937). A high arctic-alpine, probably circumpolar species.

*Stereocaulon coniophyllum* LAMB

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake; Granite Basin. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Richardson Highway: Mile 9.

Previously reported from Alaska by LAMB (1961). A boreal-temperate, oceanic species with a wide range of distribution, at present known from Fennoscandia, Austria, northern North America, Japan and Nepal.

Contains lobaric acid and atranorin (LAMB op.cit.).

*Stereocaulon glareosum* (SAV.) H. MAGN.

var. *glareosum*

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Northern Cook Inlet area: Headwaters of Rabbit Creek. Kenai Peninsula: Portage Glacier; Granite Creek Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28. Richardson Highway: Darling Creek.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak.

var. *brachyphylloides* LAMB

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak.

First reported from Alaska by LLANO (1951). A high arctic-boreal, possibly circumpolar species.

*Stereocaulon grande* (H. MAGN.) H. MAGN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier Road.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28–37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek. Steese Highway: Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

Previously reported from Alaska by McCULLOUGH (1965). A mainly boreal, probably circumpolar species.

*Stereocaulon intermedium* (SAV.) H. MAGN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Granite Basin. Ketchikan: Deer Mt; Ward Lake.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

First reported from Alaska by DEGELIUS (1937). Known from Kamchatka and coastal areas in Alaska.

Contains lobaric acid and atranorin (LAMB 1951).

*Stereocaulon myriocarpum* TH. FR.

Stictic acid strain:

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier.

Lobaric acid strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin; Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9.

First reported from Alaska by McCULLOUGH (1965).

This species has also been regarded as a subspecies of *S. tomentosum*. According to LAMB (in litt.) it has an Asiatic-Central and West American distribution.

\**Stereocaulon octomerum* MÜLL. ARG.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier.

New to North America. Previously known from Japan.

According to LAMB (1951) this species comprises two chemical strains, one with lobaric acid and the other with dendroidin in addition to atranorin.

*Stereocaulon paschale* (L.) HOFFM.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts. Ketchikan: Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge; Puritan Creek; Little Nelchina. Northern Cook Inlet area: Eagle River; headwaters of Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 24; mile 37; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70; mile 100. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Mile 170; base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; lower Fossil Creek. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by HOOKER & ARNOTT (1841). An arctic-temperate, circumpolar species.

Contains lobaric acid and atranorin (LAMB 1951).

*Stereocaulon rivulorum* H. MAGN.

var. *rivulorum*

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Government Peak. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Mt McKinley National Park: Toklat River; Polychrome Pass.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; Lion Peak.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

var. *groenlandicum* DAHL

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Richardson Highway: Mile 45.

First reported from Alaska by McCULLOUGH (1965). A high arctic-alpine, circumpolar species.

\**Stereocaulon saviczii* DU RIETZ

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

New to North America. Previously known from Kamchatka (DU RIETZ 1929).

The Alaskan specimens grew on porous volcanic rock at the summit of Robert's Mt.

\**Stereocaulon spathuliferum* VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts. Sitka: Harbour Mt. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28-37.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

New to North America. Previously known from Scandinavia and Iceland. Contains stictic acid (LAMB 1961).

\**Stereocaulon sterile* (SAV.) LAMB comb. nov.

*Stereocaulon evolutum* f. *sterile* SAV., Bot. Mater. Inst. Spor. Rast. Gl. Bot. Sada 2: 165 (1923).

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Headwaters of Rabbit Creek. Kenai Peninsula: Portage Glacier; Seward. Richardson Highway: Mile 45.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

New to North America.

According to LAMB (in litt.) *S. sterile* is related to *S. subcoralloides* NYL. It occurs in Kamchatka and on the North American west coast from Alaska to California. A full description will be given in LAMB's world monograph on the genus *Stereocaulon* now in preparation.

\**Stereocaulon subalbicans* LAMB

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge; Mabel Mine.

This species is known from North and South America. According to IMSHAUG (1957) it comprises several chemical strains, strain I: psoromic and divaricatic acids and atranorin, strain II: thamnolic acid and an unidentified fatty acid, with or without the addition of atranorin, strain III: lecanoric acid, and strain IV: atranorin only.

*Stereocaulon subcoralloides* NYL.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Mabel Mine. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge; Lion Peak; Cache Mt. Steese Highway: Cleary Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

Previously reported from Alaska by HOWARD (1963). A low arctic-boreal species which, according to LAMB (1951), has a Eurasiatic distribution extending into North America.

*Stereocaulon symphycheilum* LAMB

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: 12-Mile Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

Previously reported from Alaska by LAMB (1961). A low arctic-alpine species with a disjunct distribution in Fennoscandia and Alaska.

Contains lobaric acid and atranorin (LAMB op. cit.).

According to LAMB (in litt.) several other Alaskan specimens may belong to this species. However, they exhibited a variability in stature, form of phyllocladia and in chemistry (stictic acid) which is not found in the European population. He therefore prefers to defer a discussion of the variability of *S. symphycheilum* in Alaska until more and better material can be obtained for study.

*Stereocaulon tomentosum* FR.

var. *tomentosum*

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Little Susitna River south of Fishhook Creek; Puritan Creek. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Skilak Lake; Granite Creek Ridge. Richardson Highway: Mile 9; mile 37; mile 45.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Mt McKinley Park camp ground; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek;

headwaters of Sheep Creek; Fossil Creek. Steese Highway: Circle Hot Springs. Alaska Highway: Mile 1450.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

var. *alpestre* FLOT.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 70.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; King Mt.

var. *simplex* RIDDLE

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley.

First reported from Alaska by BABINGTON (1851). A low arctic-temperate, circumpolar species.

In Alaska two chemical strains are present, one with stictic acid and atranorin, the other with lobaric acid and atranorin. According to LAMB (1951) the lobaric acid strain is northern amphi-Pacific in its distribution.

*Stereocaulon vesuvianum* PERS.

var. *vesuvianum*

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

var. *denudatum* (FLÖRKE) LAMB

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts. Sitka: Harbour Mt. Ketchikan: Deer Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

First reported from Alaska by MACOUN (1902). A high arctic-temperate, circumpolar species.

According to LAMB (1951) several chemical strains occur within this species. One strain containing stictic acid and one containing dendroidin were mentioned.

*Stereocaulon wrightii* TUCK.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by RIDDLE (1910). Known from Japan, Siberia and Alaska.

The species comprises two chemical strains, one with lobaric acid and atranorin, the other with stictic acid and atranorin. The specimens mentioned above belong to the lobaric acid strain (= *S. apocalypticum* NYL.).

PARMELIACEAE

*Parmeliopsis* (STIZENB.) NYL.

This genus is in Alaska represented by three circumpolar species. The chiefly eastern North American species *P. placorodia* was not collected in Alaska.

*Parmeliopsis aleurites* (ACH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Headwaters of Rabbit Creek. Kenai Peninsula: Skilak Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; Fossil Creek.

First reported from Alaska by ALMQUIST (1887). A boreal-temperate, circumpolar species.

Contains thamnolic acid.

*Parmeliopsis ambigua* (WULF.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley; Rabbit Creek Rd; O'Malley Rd; Eastchester Swamp. Kenai Peninsula: Hidden Lake; Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; the limestone ridge; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by ALMQUIST (1887). A high arctic-temperate, circumpolar species.

Contains divaricatic and usnic acids.

*Parmeliopsis hyperopta* (ACH.) ARN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts; Granite Basin; Douglas Skibowl. Sitka: Harbour Mt. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley. Kenai Peninsula: Ingram Creek camp ground; Marathon Mt. Richardson Highway: Mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; the limestone ridge; Fossil Creek. Steese Highway: Cleary Summit; 12-Mile Summit; Circle Hot Springs.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

Previously reported from Alaska by KROG (1962). A low arctic-temperate, circumpolar species.

Some specimens from oceanic localities in the eastern and central Pacific Coast districts differed in having a white colour, granular soredia, elongated, separated lobes, and a closely adnate thallus.

Contains divaricatic acid and atranorin.

*Cavernularia* DEGEL.

*Cavernularia hultenii* DEGEL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Shrine of St Therese; Douglas Skibowl. Ketchikan: Ward Lake; Saxman Village. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Portage Glacier Rd; Ingram Creek camp ground; Seward; Marathon Mt, lower part; Homer. Richardson Highway: Mile 9. Prince William Sound: Fish Bay; Pigot Bay.

Reported from Alaska by DEGELIUS (1937). A temperate, suboceanic species with a disjunct distribution, known from Scotland, central Scandinavia, New Foundland, and the North American west coast from California to south central Alaska. The distribution has been discussed by AHTI & HENSSEN (1965).

Contains physodic acid and atranorin.

*Cavernularia lophyrea* (ACH.) DEGEL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake; Shrine of St Therese; Douglas Skibowl. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Ingram Creek camp ground; Seward; Marathon Mt, lower part; Homer. Richardson Highway: Mile 9. Prince William Sound: Pigot Bay.

First reported from Alaska by DEGELIUS (1937). A temperate, suboceanic North American west coast species, known from Oregon to south central Alaska.

Contains physodic acid and atranorin.

*Hypogymnia* NYL.

The genus *Hypogymnia* has commonly been regarded as a subgenus in the genus *Parmelia*. However, the practice of treating *Hypogymnia* as a separate genus is becoming more widespread (cf. POELT 1962, HALE & CULBERSON 1966) and seems well founded.

ASAHINA (1932, 1951a) has discussed the genus *Hypogymnia* in Japan. For other literature references see under *Parmelia*.

The *Hypogymniae* of western North America are in need of revision. This is especially true for the *enteromorpha* complex, and species of this group should be compared to the east Asiatic species.

The chemistry of this genus has been studied by NUNO (1964).

*Hypogymnia austerodes* (NYL.) Räs.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Puritan Creek. Northern Cook Inlet area: Eagle River Valley; headwaters of Rabbit Creek. Kenai Peninsula: Hidden Lake; Skilak Lake. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37. Mt McKinley National Park: Toklat River. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; lower Fossil Creek. Steese Highway: Circle Hot Springs.

First reported from Alaska by NYLANDER (1888). A low arctic-temperate, circumpolar species.

Contains physodic acid and atranorin.

*Hypogymnia bitteri* (LYNGE) AHTI

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Bald Mt Ridge. Northern Cook Inlet area: Eagle River Valley; headwaters of Rabbit Creek; Eastchester Swamp; O'Malley Rd; Potter. Kenai Peninsula: Ninilchik.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Wonder Lake. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; granite outcrop close to the limestone ridge; Fossil Creek. Steese Highway: Cleary Summit; 12-Mile Summit.

First reported from Alaska by TUCKERMAN (1882). A low arctic-temperate, circumpolar species. Contains physodic acid and atranorin.

*Hypogymnia duplicata* (ACH.) RASS.

Fig. 17.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Shrine of St Therese; Montana Creek; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake.

There is no doubt that the specimen marked *P. duplicata* SM. in ACHARIUS' herbarium represents a distinct western North American species, different from *P. vittata* which is found on the same herbarium sheet. A validating description of *P. duplicata* was never published by SMITH, and ACHARIUS' description of the species (ACHARIUS 1803) probably refers to the specimen now preserved in Helsinki. It is reason to believe that this specimen represents the holotype. Even if ACHARIUS (1810, p. 493) later treated *P. duplicata* as a synonym of *P. vittata* it does not invalidate the species.

This species was first reported from Alaska by HILLMANN (1938) who described it as a new species under the name *P. elongata*. The type specimen of this species was, according to Dr. MATTICK (personal communication), destroyed during World War II, but HILLMANN's description is so clear that it leaves no doubt as to the identity of the species.

The substitution of *H. duplicata* for *H. vittata*, as is occasionally done, is incorrect.

HILLMANN (op.cit.) described *P. elongata* var. *stricta* from Japan. I doubt that this variety is referable to *H. duplicata*. Present information indicates that *H. duplicata* is a suboceanic North American west coast species known from Oregon to south-east Alaska.

Contains physodic and monoacetylprotocetraric acids and traces of atranorin.

*Hypogymnia enteromorpha* (ACH.) NYL. s. strict.

Fig. 18a.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts, lower part; Shrine of St Therese; Montana Creek. Sitka: Indian River Trail; Sitka National Monument. Ketchikan: Ward Lake; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Salamatof; Skilak Lake; Homer; Ingram Creek camp ground; Marathon Mt, lower part. Richardson Highway: Mile 9. Prince William Sound: Pigot Bay; Fish Bay.

The presence of this species in Alaska was first mentioned by TUCKERMAN (1882). A suboceanic species which belongs to the amphi-Pacific element.

*H. enteromorpha* was described by ACHARIUS (1803), based on material col-



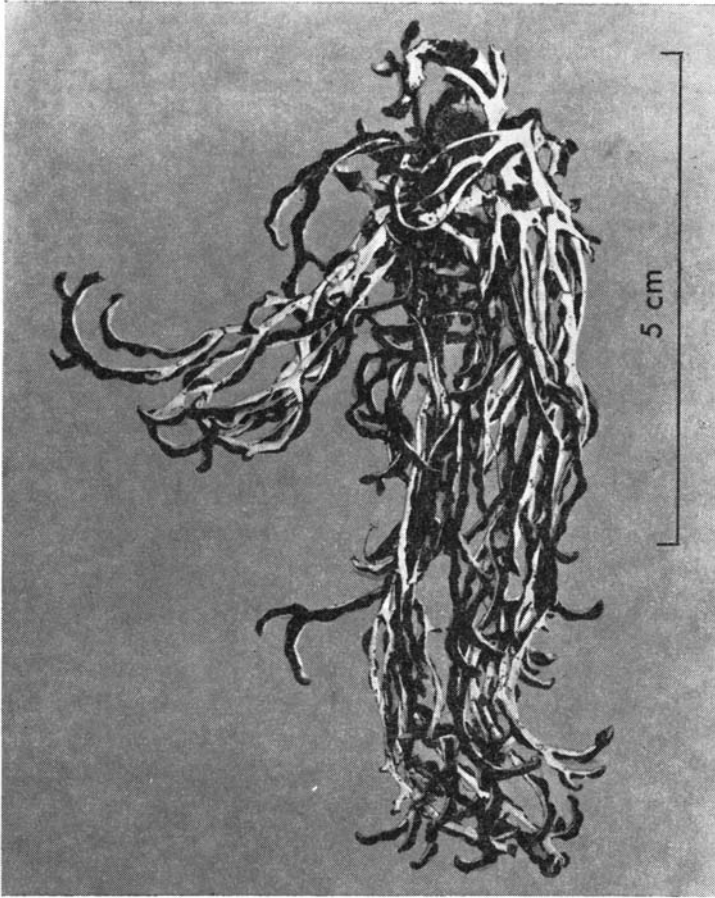


Fig. 17. *Hypogymnia duplicata* (ACH.) RASS. Eastern Pacific Coast District:  
Juneau: Douglas Skibowl. Coll. H. KROG, 1957, no. 5277.

lected on the North American west coast by MENZIES. The holotype in ACHARIUS' herbarium in Helsinki was collected in California. It reacts PD+ orange-red, and displays the characters typical of this species, viz. the irregular thallus which is sparingly branched with unevenly inflated laciniae, 3–6 mm wide, and large apothecia with tumid, urceolate basal parts.

Since ACHARIUS first described this species, the epithet has been indiscriminately applied to a variety of esorediate North American *Hypogymniae*. This practice has apparently been followed more for convenience than from conviction, since most lichenologists familiar with North American lichens have been aware of the fact that "*H. enteromorpha*" of the eastern United States represents a species different from that found on the west coast. The eastern type (Fig. 18b) forms effuse, imbricate thalli consisting of linear, much branched laciniae, 1–2 mm wide, slightly reflexed at the tips. The apothecia, which also in this species can attain a considerable size, have less conspicuous, only slightly inflated basal parts.

After the eastern species is excluded from the western *H. enteromorpha*, one is still left with an inhomogeneous complex comprising several taxa. One of these was recognized by IMSHAUG (1957), who erroneously identified it as *P. duplicata*

(SM. *in* ACH.) ACH. Material of this species was distributed to various European herbaria. Without venturing into description of new taxa, IMSHAUG called attention to the variation in colour of the medullary hyphae, and to the variable reaction with PD. The specimens of *H. duplicata* IMSH. non ACH. do represent a distinct taxon which will be described in the present work as a new species, *H. imshaugii* KROG (see under that species).

*H. enteromorpha* s. strict. as applied in this study (eastern *H. enteromorpha*, *H. duplicata* and *H. imshaugii* excluded), is still in need of revision. It shows considerable variation morphologically as well as chemically, and a subdivision into several taxa may be necessary. A close comparison with Japanese species is desirable in this connection.

*H. enteromorpha* is very variable chemically. Colour reactions on thalli indicated the presence of two chemical strains, one PD+ orange-red, the other PD+ yellow or PD-. Microchemical tests revealed a more complex chemistry. The typical specimens reacting PD+ orange-red contained monoacetylprotocetraric acid, physodic acid, barbatic acid and atranorin. Atranorin was present in varying quantities, and at times appeared to be lacking. Barbatic acid or physodic acid at times also appeared to be absent. This might be due to insensitivity of the microchemical tests. ASAHINA (1951a) found specimens lacking physodic acid in material from both Formosa and North America. However, NUNO (1964) who studied the chemistry of Asiatic and North American material by means of thin layer chromatography, reported physodic acid as being present in all specimens. The presence of barbatic acid in *H. enteromorpha* has not been reported previously. Mr. SOLBERG has confirmed the presence of this substance in the Alaskan specimens by means of chromatographical analysis.

The specimens reacting PD+ yellow usually contained fairly large amounts of atranorin. The PD+ yellow and PD- specimens might display any combination of physodic acid, barbatic acid and undetermined fatty substances of the protolichestic-rangiformic acid type.

*Hypogymnia imshaugii* KROG sp. nov.  
var. *imshaugii*

Fig. 19.

*Thallus diametro 3–5 cm, ad centrum adfixus; lobi lineares, teretes, 0.6–1.0 mm lati, parce dichotome ramosi, cortex superior cinereus, maculis nigris multis instructus, cortex inferior niger, rugosus vel foveatus, medulla alba; soredia vel isidia desunt, apothecia vulgaria, stipitata, partes basales vix tumidae, discus ad 15 mm latus, sporae 5–6.5 × 4–4.5 μ.*

Thallus 3–5 cm in diameter, corticolous, attached to the substratum only in the central parts, peripheral lobes free, radiating horizontally; lacinae linear, terete, 0.6–1 mm in diameter, sparingly dichotomously branched, upper cortex gray with numerous black spots, lower cortex dull, black, wrinkled or pitted, no soredia or isidia, medulla surrounding the central cavity white, forming a thick layer of loosely interwoven hyphae; apothecia common, stipitate, basal parts scarcely swollen, disk commonly 3–5 mm wide, up to 15 mm in old specimens, spores 5–6.5 × 4–4.5 μ, eight to the ascus.

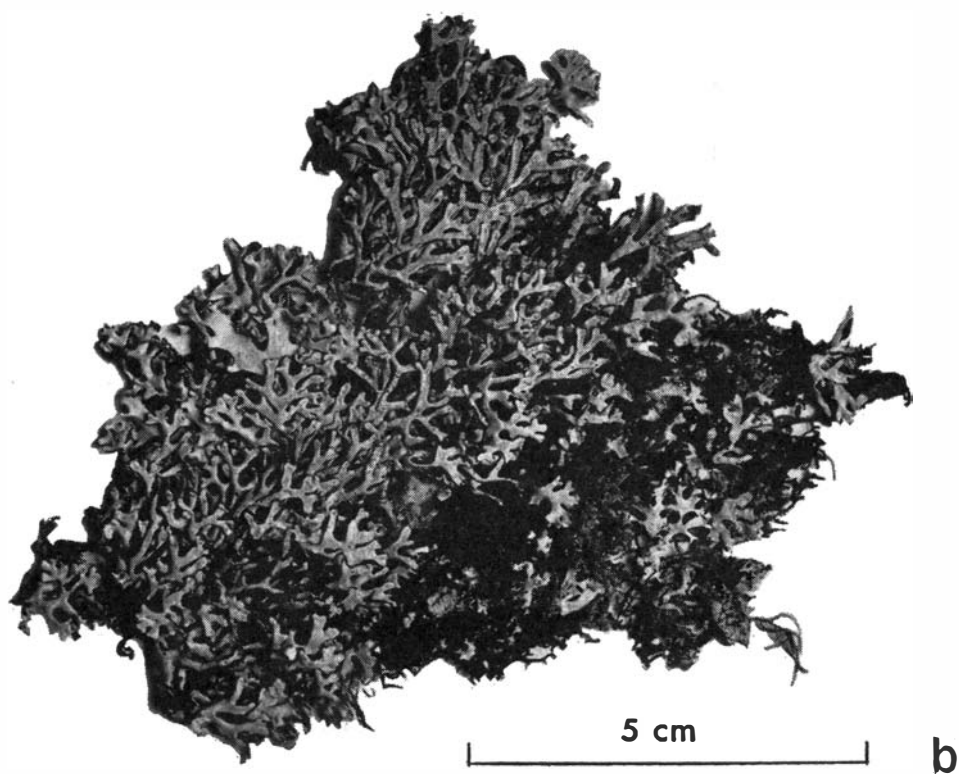
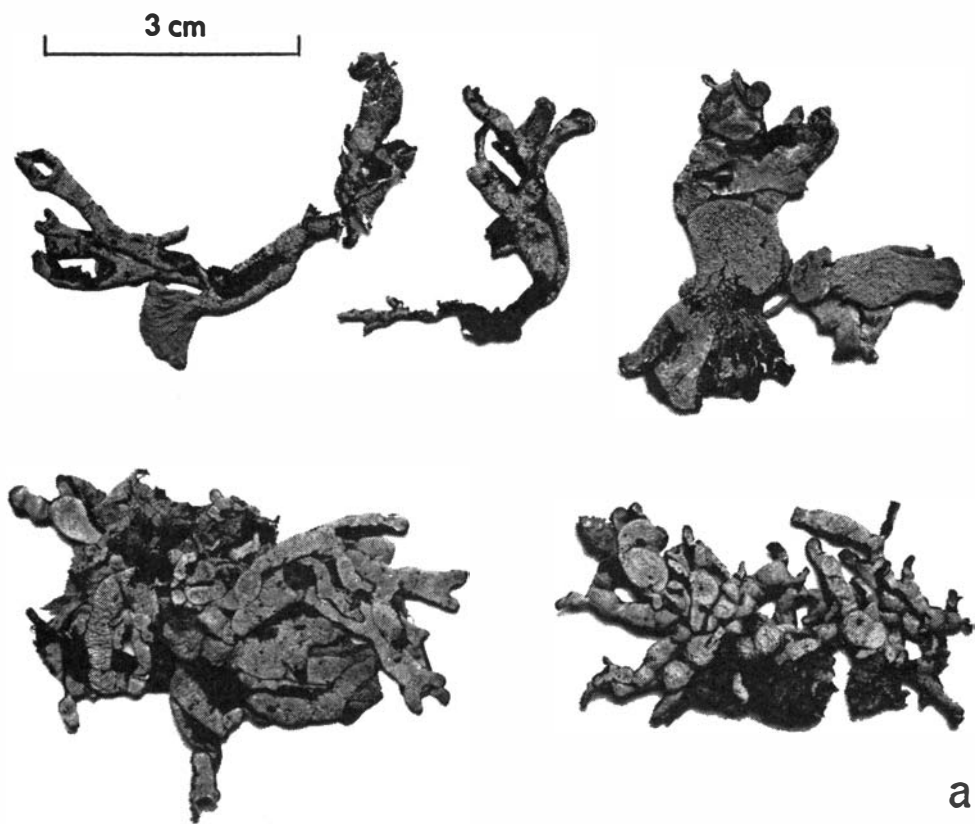


Fig. 18. a. *Hypogymnia enteromorpha* (ACH.) NYL. Eastern Pacific Coast District: Juneau: Loop Rd. Coll. H. KROG, 1957, no. 5259.

b. *Hypogymnia enteromorpha* auct. non ACH. North Carolina: Yancey Co.: Mt Mitchell. Coll. H. KROG, 1965.

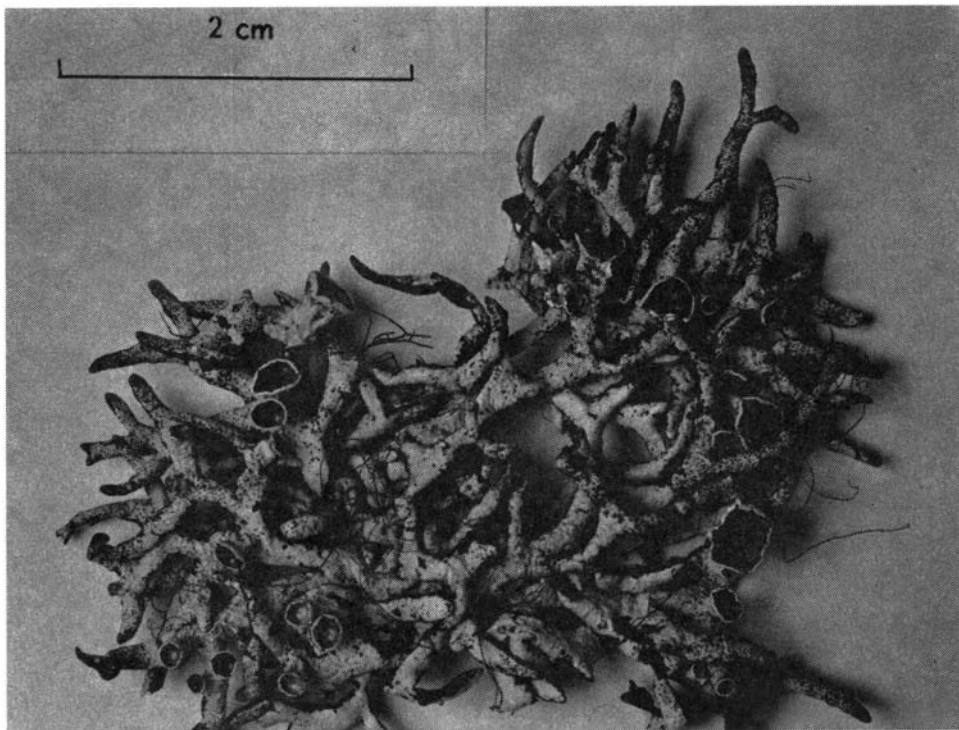


Fig. 19. *Hypogymnia imshaugii* KROG. Canada: British Columbia: North side of Tulameen, west slope of Mt Rabbit. Coll. T. АНТИ, 1958, no. 10345. (Typus).

Chemical reactions: PD + orange-red, K + yellow, C-, KC + red. Contains monoacetylprotocetraric acid, physodic acid, barbatic acid (found in part of the specimens only), and atranorin.

Named in honour of the American lichenologist H. IMSHAUG.

Type: Canada.

BRITISH COLUMBIA: N. side of Tulameen (c. 15 mi. NW of Princeton), on Lawless (Bear) Creek, W slope of Mt Rabbit, c. 3500 ft, on *Pseudotsuga* in arid forest. — Coll. T. АНТИ no. 10345 (H).

var. *inactiva* KROG var. nov.

*A var. imshaugii* differt hyphis medullosis denigratis; acidum monoacetylprotocetraricum deest.

Differs from var. *imshaugii* in the thinner, more compact medulla consisting of blackened hyphae, and in chemical properties.

Chemical reactions: PD-, K + yellow, C-, KC + red. Contains physodic acid and atranorin.

Type: Alaska.

EASTERN PACIFIC COAST DISTRICT: Juneau: Montana Creek, el. 300 ft. — Coll. H. KROG no. 5622 (O).

Further Alaskan material examined:

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Deer Mt.

A suboceanic North American west coast species known from California to south east Alaska.

*Hypogymnia intestiniiformis* (VILL.) Räs.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Mountain ridge, Eagle River; headwaters of Rabbit Creek; Bird Creek Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28–37; mile 70. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge. Steese Highway: 12-Mile Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

Previously reported from Alaska by KROG (1962). A high arctic-temperate, circumpolar species.

All specimens cited above reacted PD–. Contains physodic acid and atranorin.

*Hypogymnia lugubris* (PERS.) KROG comb. nov.

*Parmelia lugubris* PERS. in GAUDICH., Voyage Uranie, Bot., p. 196 (1826); *Imbricaria lugubris* JATTA, Nuov. G. Bot. Ital., nov. ser., 9:471 (1902); *Imbricaria physodes* var. *lugubris* JATTA, Nuov. G. Bot. Ital. 22:50 (1890); *Parmelia physodes* var. *vittata* f. *lugubris* WILSON, Pap. Proc. Roy. Soc. Tasmania, p. 174 (1893).

ssp. *beringiana* KROG ssp. nov.

Fig. 20.

*Thallus ad 5 cm altus, irregulariter ramosus, lobi 2–3 mm lati; cortex superior albus, colore brunneo tinctus, maculis nigris crebris, a cortice inferiore non distincte definitus, cortex inferior niger, nitidus, moderate rugosus recessibusque cavis, perforationibus nonnullis apicalibus instructus, cortice albo interdum maculatus; hyphis medullaribus ex omni vel aliqua parte nigratis; soredia vel isidia desunt; apothecia non observata.*

Thallus up to 5 cm high, 2–3 mm wide, irregularly branched, upper cortex white, tinged with brown, with numerous black patches, not sharply delimited from lower cortex, lower cortex black, shiny, moderately wrinkled and pitted, with occasional apical perforations, sometimes with white cortex patches; medulla forming a thin, rather compact layer with hyphae sometimes extending into the central cavity, medullary hyphae wholly or partly blackened; no soredia or isidia, apothecia not observed.

Chemical reactions: K–, PD–, C–, KC+ red. Contains physodic acid and atranorin.

Type: Alaska.

BERING SEA DISTRICT: St Paul Island. – Coll. J. M. MACOUN no. 71d (E).

Additional material studied:

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; the lake where the geese don't fly.

Superficially the Beringian material looks very much like a certain form of *H. lugubris* from the Southern Hemisphere (Fig. 21). However, the southern form has a more predominant dichotomic branching, the lower cortex is usually deeply and persistently wrinkled, the medulla consists of loosely interwoven hyphae forming an arachnoid layer more or less parallel to the cylinder wall, and the medullary hyphae may or may not be blackened. Like the Beringian form it contains physodic acid and atranorin, but differs in reacting PD+ yellow (probably caused by atranorin) or PD+ red. Monoacetylprotocetraric acid could not be

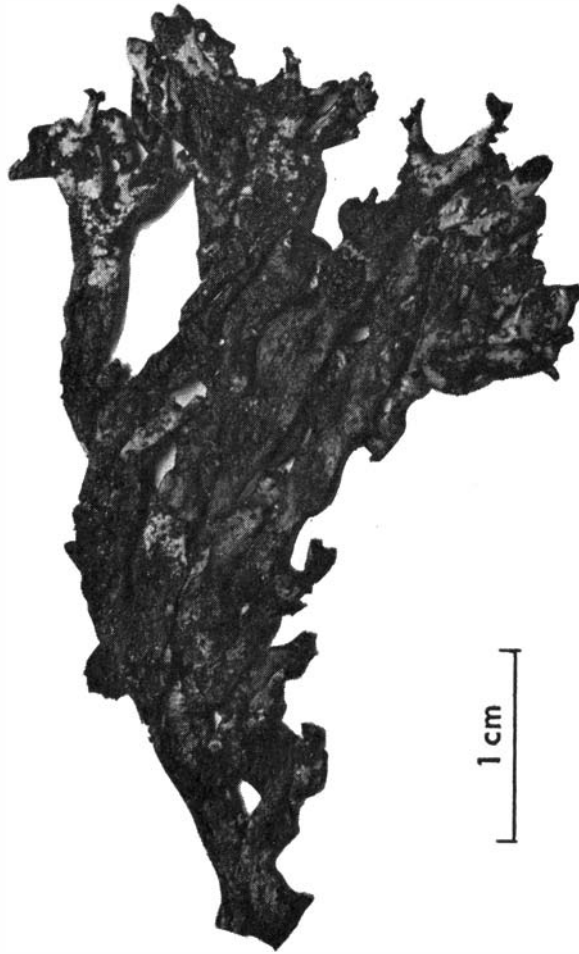


Fig. 20. *Hypogymnia lugubris* ssp. *beringiana* KROG. Bering Sea District: St. Paul Island. Coll. J. M. MACOUN, 1897, no. 71d. (Typus).

demonstrated in the PD + specimens. The reaction may be due to the presence of fumarprotocetraric acid.

NUNO (1964) cited *P. lugubris* PERS. from the Aleutian Islands, and also *P. lugubris* var. *sikkimensis* from Sikkim. There is reason to believe that the specimen from the Aleutian Islands (physodic acid, atranorin) is identical with the specimens from Nunivak Island and St Paul Island.

*Hypogymnia physodes* (L.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Sitka: Harbour Mt; Sitka National Monument. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Northern Cook Inlet area: Eagle River Valley; mountain ridge, Eagle River; O'Malley Rd; Rabbit Creek Rd; Eastchester Swamp; Potter. Kenai Peninsula: Skilak Lake; Ingram Creek camp ground; Cooper Creek camp ground; Marathon Mt. Prince William Sound: Fish Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Wonder Lake. Richardson Highway: Base of Rainbow Mts; Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek;

headwaters of Sheep Creek; Lion Peak; the limestone ridge; granite outcrop close to the limestone ridge; lower Fossil Creek. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs. Alaska Highway: Mile 1450.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by ROTHROCK (1884). A high arctic-temperate, circumpolar species.

Contains physodic and monoacetylprotocetraric acids and atranorin.

\**Hypogymnia pseudophysodes* (ASAH.) KROG comb. nov.

*Parmelia pseudophysodes* ASAH., J. Jap. Bot. 26:100 (1951).

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail. Ketchikan: Ward Lake.

Additional material seen:

Canada:

BRITISH COLUMBIA: Queen Charlotte Island: Graham Island. — Coll. H. PERSSON, no. 120 (*P. physodes* in WEBER & SHUSHAN (1959)).



Fig. 21. *Hypogymnia lugubris* (PERS.) KROG. Fuegia occid., Rio Bueno.

Coll. H. ROIVAINEN, 1928.

The two Alaskan specimens were with some hesitation named *P. pseudophysodes* f. *reagens* by ASAHINA. They resemble diminutive specimens of *H. enteromorpha*, with frequent apical perforations, and with the upper cortex more or less dissolved into diffuse soredia.

The species is previously known from east Asia where two chemical strains occur. The PD- strain is known from Japan, Formosa and Sakhalin, the PD + strain only from Japan. In the American material only the PD + strain is represented, containing monoacetylprotocetraric and physodic acids and atranorin.

New to North America.

*Hypogymnia subobscura* (VAIN.) POELT

ALASKA RANGE DISTRICT: Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Fossil Creek; granite outcrop close to the limestone ridge.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

Previously reported from Alaska by WEBER & VIERECK (1967). A high arctic-alpine, circumpolar species.

Contains physodic acid.

*Hypogymnia tubulosa* (SCHAER.) HAV.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt; Indian River Trail.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Ninilchik.

Previously reported from Alaska by KROG (1962). A boreal-temperate, probably circumpolar species.

Contains physodic acid and atranorin.

*Hypogymnia vittata* (ACH.) GAS.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts; Douglas Skibowl; Montana Creek. Sitka: Indian River Trail.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9. Prince William Sound: Pigot Bay; Fish Bay.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by CUMMINGS (1892a). A boreal-temperate, slightly oceanic, more or less circumpolar species.

Contains physodic acid and atranorin.

*Parmelia* ACH.

HILLMANN (1936) has studied the genus *Parmelia* (including *Hypogymnia*) in Middle Europe. The monograph by BERRY (1941) on the genus *Parmelia* in North America, north of Mexico, is of little value, being based solely on herbarium studies, with an old-fashioned species concept and numerous misunderstandings. HALE & KUROKAWA (1964) have published keys on a world wide base for the sub-genus *Parmelia*, with descriptions of many new species. HALE (1964) has studied the *P. conspersa* group in North America and Europe. He has also published a



world monograph of the subgenus *Amphigymnia* (HALE 1965). AHTI (1966a) has studied the *P. olivacea* group (restricted to non-sorediate and non-isidiate species) in the Northern Hemisphere. Otherwise the student of Alaskan *Parmeliae* has to depend on the numerous smaller publications in the genus.

BERRY's (op.cit.) record of *P. cetrata* from Alaska is believed to be erroneous since he described the species as sorediate, with only negative colour reactions. Judged by a specimen deposited in the Oslo herbarium HERRE's (1919) record of *P. perforata* represents *P. arnoldii*. The same may be the case with old records of *P. perlata*.

Chemically this large genus is very varied. A survey of the chemical properties of the Scandinavian species has been given by KROG (1951).

### *Parmelia almquistii* VAIN.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Mt McKinley National Park: Savage River. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak; Cache Mt. Steese Highway: Cleary Summit; 12-Mile Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

Previously reported from Alaska by KROG (1963). An arctic-alpine species known from north-west and north-east Siberia, Alaska and north-east Canada.

Contains olivetoric acid.

### *Parmelia alpicola* TH. FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine; Independence Mine. Northern Cook Inlet area: Headwaters of Rabbit Creek.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28-37. Mt McKinley National Park: Savage River; Polychrome Pass.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak. Steese Highway: 12-Mile Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

Previously reported from Alaska by HEUSSER (1954). A circumpolar, high arctic-alpine species.

*P. alpicola* is known to contain a substance which gives the colour reactions K + yellow, PD + intensely yellow, C + red, KC + red. This substance crystallizes from GE in clusters of straight needles, from GAo-T in bright yellow spindle-shaped crystals recalling unusually large crystals of norstictic acid in the same reagent (Fig. 22), and from GAQ in coarse yellow prisms. The same colour reactions and crystals are obtained from *Alectoria nigricans*, and the substance isolated from this species was by ZOPF (1907) referred to as alectorialic acid.

In some specimens of *P. alpicola* crystals of protolichesteric acid appear in GE together with the straight needles of alectorialic acid. If heated, the protolichesteric acid crystals may fail to appear. When protolichesteric acid is present, the alectorialic acid may fail to crystallize in GAo-T, and after heating mixed crystals of the two substances are formed.

The protolichesteric acid strain of *P. alpicola* has been observed both in Alaskan

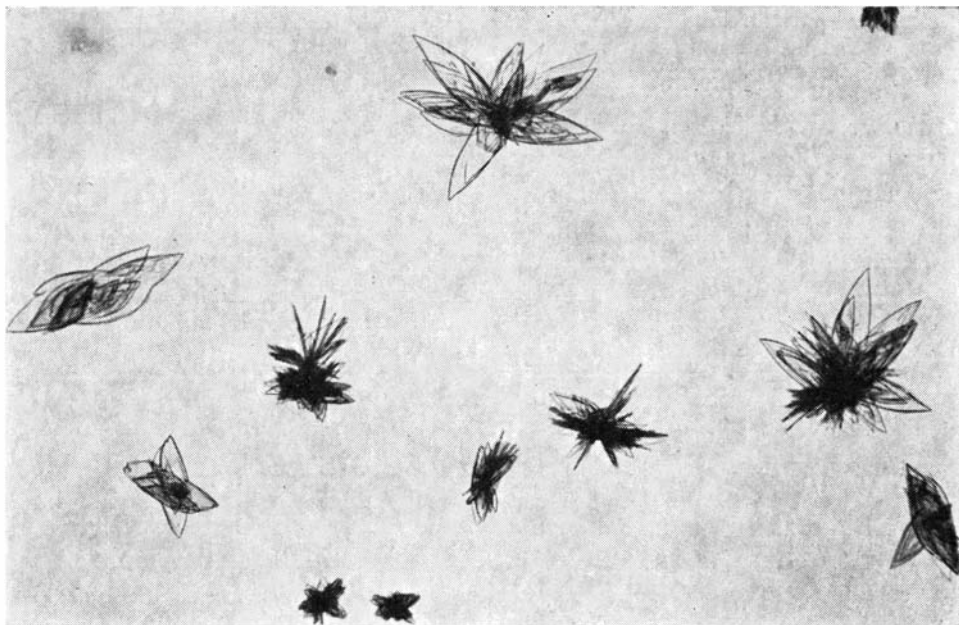


Fig. 22. Alectorialic acid, recrystallized in GAO-T. 180 $\times$ .

and Norwegian material. In the Alaskan material only one specimen from Lion Peak contained protolichestic acid. In Norwegian material the protolichestic acid strain seemed to be more common in specimens from the northern parts of the country.

SOLBERG (1967) found a trace of thamnolic acid, a tetrahydroxy fatty acid and several unidentified substances in this species in addition to alectorialic acid.

*\*Parmelia arnoldii* DU RIETZ

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail.

A suboceanic species distributed in temperate regions of Europe, eastern and western North America and Japan.

According to HALE (1965) there is no morphological difference between *P. arnoldii* and *P. margaritata*, a species of the east-central United States. ALMBORN (1966) therefore suggested that the alectoronic acid producing *P. arnoldii* should be treated as a chemical strain of *P. margaritata*, which produces salazinic acid.

Through the courtesy of Dr. CULBERSON I have had the opportunity to study two specimens of *P. margaritata*, one from Virginia and one from North Carolina. It is true that this species is closely related to *P. arnoldii*, but it seems to differ in a generally duller colour of the underside, and in producing rather short, simple cilia along the margins. *P. arnoldii* has a distinctly glossy under surface, and the marginal cilia are long and often bifurcate.

In Japanese material of *P. arnoldii* ASAHINA (1952a) found  $\alpha$ -collatolic acid instead of alectoronic acid. Atranorin is present in all specimens.

[*Parmelia aspera* MASS.]

CENTRAL PACIFIC COAST DISTRICT: Chugach Mts, Anchorage. — Coll. LEPAGE, no. 22359. (HERRE 1950a).

A boreal-temperate, possibly circumpolar species. Contains no lichen substances.

*Parmelia centrifuga* (L.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Bird Creek Ridge; mountain ridge, Eagle River. Kenai Peninsula: Hidden Lake. Richardson Highway: Mile 32–37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28–37. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by HERRE (1920). A high arctic-alpine, circumpolar species.

Contains alecortic and usnic acids and atranorin.

*Parmelia denalii* KROG sp. nov.

Fig. 23.

*Thallus foliaceus, adnatus, laciniatus, laciniis 0.8–1.2 mm latis, imbricatis; superficies superior brunnea, pseudocyphellata, ad centrum verrucis tenuibus crebris instructa, superficies inferior nigra, rhizinis brevibus, simplicibus vel bifurcatis nigris instructa; nonnulla soralia lateralialia globosa; apothecia non observata.*

Thallus saxicolous, foliaceous, adnate, lacinate, lacinae 0.8–1.2 mm wide, imbricate; upper surface brown, younger parts shiny, pseudocyphellate, older parts dull, with numerous low warts, the elongated pseudocyphellae often developing into cracks, lower surface black with short, simple or bifurcate black rhizinae; no isidia, a few lateral globular soralia, apothecia not observed.

Chemical reactions: K–, PD–, C–, KC+ indistinctly rose. Contains olivetoric and imbricatic acids (tested by Miss NUNO, Tokyo).

Type: Alaska.

ALASKA RANGE DISTRICT: Richardson Highway: Base of Rainbow Mts. — Coll. H. KROG no. 3821 (O).

This species appears to be closely related to *P. substygia*, but differs in the lacinate, imbricate lobes, the verrucose central parts of the thallus, and in chemical properties.

*Parmelia disjuncta* ERICHS.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine. Northern Cook Inlet area: Headwaters of Rabbit Creek. Kenai Peninsula: Skilak Lake.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28; mile 70. Mt McKinley National Park: Toklat River; Savage River; Polychrome Pass; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

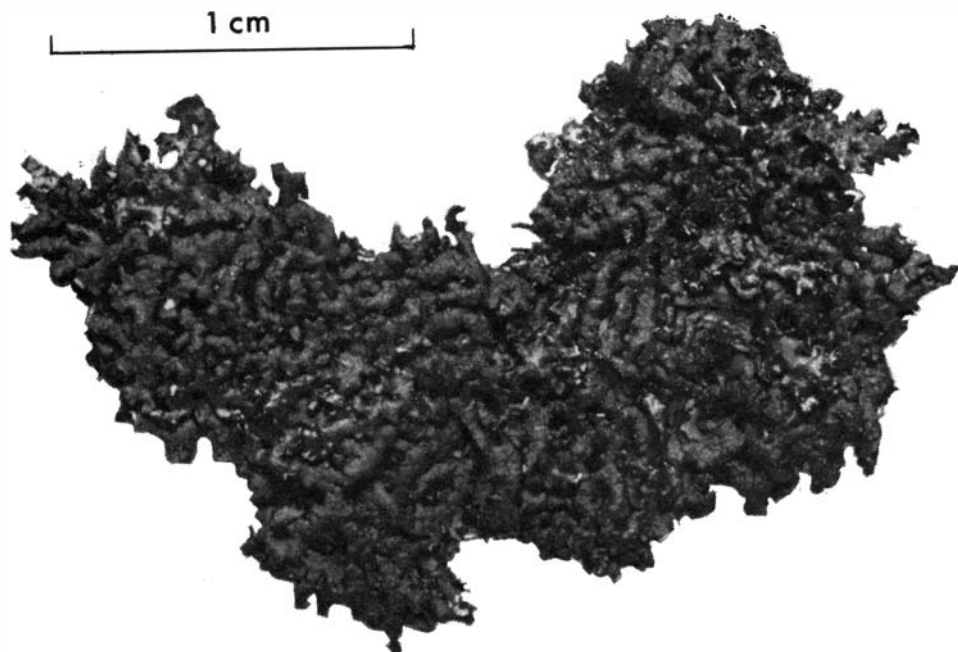


Fig. 23. *Parmelia denalii* KROG. Alaska Range District: Richardson Highway: Base of Rainbow Mts. Coll. H. KROG, 1957, no. 3821. (Typus).

Previously reported from Alaska by WEBER & VIERECK (1967). A high arctic-boreal, circumpolar species.

Contains olivetoric acid. Straight needles with inclined extinction in GAW may indicate imbricatic acid. Occasional crystals in GAO-T point towards small amounts of gyrophoric acid. One specimen from Kenai Peninsula was morphologically indistinguishable from *P. disjuncta* but differed in containing gyrophoric acid and atranorin.

*Parmelia exasperatula* NYL.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit; 12-Mile Summit. Alaska Highway: Mile 1450.

First reported from Alaska by McCULLOUGH (1965). A boreal-temperate, circumpolar species.

Contains traces of atranorin.

\**Parmelia fraudans* NYL.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Puritan Creek. Northern Cook Inlet area: Headwaters of Rabbit Creek. Kenai Peninsula: Hidden Lake; Skilak Lake.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37; mile 70. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Fossil Creek. Steese Highway: Cleary Summit; Circle Hot Springs.

MERRILL (1924) reported this species from Alaska, but according to LYNGE's notes this record represented a misidentification of *P. sulcata*. An arctic-temperate, somewhat continental circumpolar species.

Contains usnic, protolichestic and salazinic acids and atranorin.

*Parmelia glabratula* (LAMY) NYL.  
(= *P. fuliginosa* (DUBY) NYL.)

EASTERN PACIFIC COAST DISTRICT: Kosciusko Island: Shipley Bay. — Coll. FOSTER (O). (HERRE 1919).

From the same locality HERRE also reported *P. glabra*, but judging from the specimen of this species deposited in the Oslo herbarium it belongs to *P. glabratula*.

A boreal-temperate, probably circumpolar species. Contains lecanoric acid.

\**Parmelia* cf. *hypopsila* MÜLL. ARG.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Fossil Creek.

These specimens come very close to *P. conspersa* in general appearance, with adnate thalli and black under surface. They are distinctly different from *P. taractica* which is found in the same area, and despite the fact that isidia are completely lacking, and the main chemical substance is salazinic acid, the inclusion in *P. taractica* does not seem a satisfactory solution.

HALE (1964) indicated that the truly nonisidiate population of *P. conspersa*, rare in Europe, may be identical with *P. hypopsila* from South America. Without having studied South American material I am tentatively referring the Alaskan specimens to this species until HALE's monograph of *Xanthoparmelia* is completed.

This species was reported from the Arctic Coast District of Alaska by KROG (1962) under the name *P. conspersa*.

Contains usnic and salazinic acids and traces of atranorin.

*Parmelia incurva* (PERS.) FR.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine. Northern Cook Inlet area: Headwaters of Rabbit Creek. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32-37. Mt McKinley National Park: Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit.

First reported from Alaska by MERRILL (1924). A high arctic-alpine, circumpolar species.

Contains alectoronic and usnic acids and atranorin.

*Parmelia infumata* NYL.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine; Independence Mine.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28-37. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; granite outcrop close to the limestone ridge.

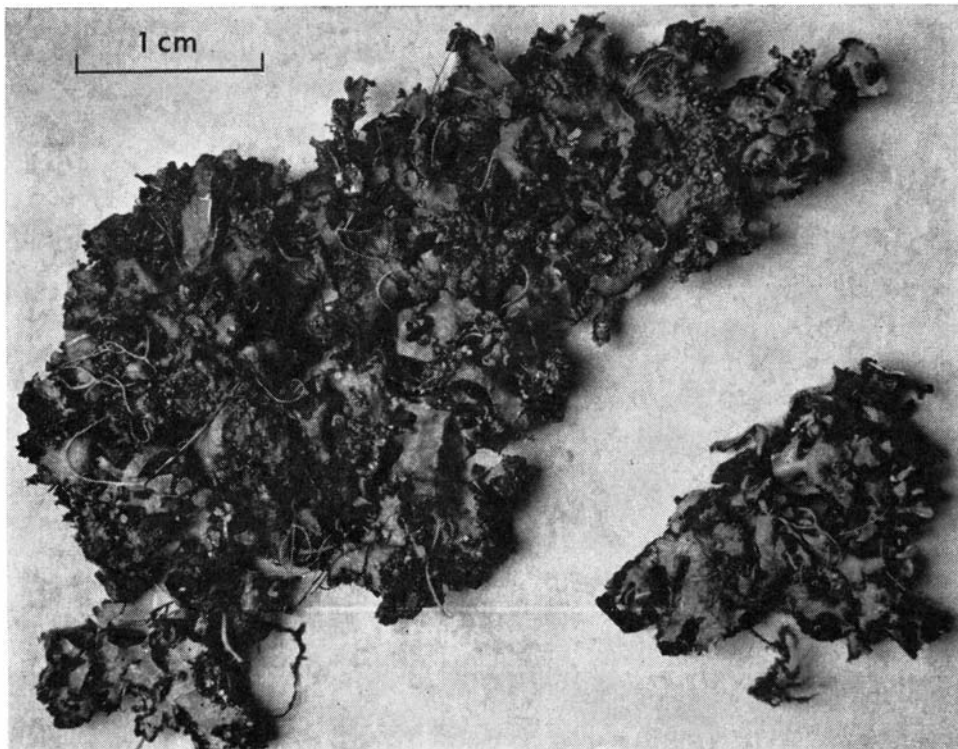


Fig. 24. *Parmelia* cf. *isidioclada* VAIN. Central Pacific Coast District:  
Richardson Highway: Mile 9. Coll. H. KROG, 1957, No. 2297.

Previously reported from Alaska by KROG (1962). A high arctic-boreal, circum-polar species.

One specimen from White Mts was fertile. The apothecia had dark brown disks, and the apothecial margin and underside was pruinose and isidiate. The spores were subglobose,  $6-8.5 \times 5-6.5 \mu$ , 8 to the ascus.

Contains small amounts of atranorin.

\**Parmelia* cf. *isidioclada* VAIN.

Fig. 24.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9.

*P. isidioclada* was originally described from Mimasaka, Japan by VAINIO (1921). I have seen the type specimen in Turku, a small lichen with isidiate and partly squamulose margins. The Alaskan specimen (det. as *P. isidioclada* by ASAHINA) recalls certain forms of *P. sulcata*, with narrow pseudocyphellae along the margins. The margins are dissolved into coarse soredia, with numerous lobules which in turn develop soredia of their own. The determination should be regarded as tentative until more material can be studied.

Contains salazinic acid and atranorin.

*Parmelia multispora* SCHNEID.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Knik River. Kenai Peninsula: Ninilchik.

Previously reported from Alaska by AHTI (1966a). The Alaskan record by KROG (1962) was a misidentification for *P. trabeculata*. An oceanic North American west coast species known from California to Alaska.

No lichen substances could be demonstrated by microcrystallization.

*Parmelia olivacea* (L.) ACH.  
var. *albopunctata* (ASAH.) AHTI

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Northern Cook Inlet area: O'Malley Rd; Rabbit Creek Rd. Kenai Peninsula: Skilak Lake; Ninilchik.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; lower Fossil Creek.

First reported from Alaska by CUMMINGS (1904). A boreal, circumpolar species. Var. *albopunctata* is known from Alaska, Japan and eastern Siberia.

Contains fumarprotocetraric acid.

*Parmelia olivaceoides* KROG sp. nov.

*Thallus tenuis, adnatus, lobis 2–3 mm latis, memoriam P. septentrionalis afferens, superficies superior isidiis granulosis sparsis, superficies inferior rhizinis paucis brevibus simplicibus; apothecia non observata.*

Thallus corticolous, thin, appressed, with lobes 2–3 mm wide, recalling *P. septentrionalis*; upper surface brown, dull to shiny, slightly pitted, with laminally scattered, dark brown, granular isidia which are easily broken, leaving white spots, lower surface brown, shiny, slightly ridged and wrinkled, with few short simple rhizinae; apothecia not observed.

Chemical reactions: K<sup>-</sup>, PD<sup>+</sup> red, C<sup>-</sup>, KC<sup>-</sup>. Contains fumarprotocetraric acid.

Type: Alaska.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Circle Hot Springs. – Coll. H. KROG no. 2552 (O).

According to AHTI (personal communication) the same species has been collected by J. M. MACOUN, 1902, at Hunker Creek, Yukon (CAN, s. n. *P. olivacea*).

*Parmelia omphalodes* (L.) ACH.

EASTERN PACIFIC COAST DISTRICT: Ketchikan: Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine; Puritan Creek. Northern Cook Inlet area: Mountain ridge, Eagle River; Potter; Bird Creek Ridge; Rabbit Creek. Kenai Peninsula: Skilak Lake; Seward. Richardson Highway: Mile 24; mile 45. Prince William Sound: Pigot Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by ROTHROCK (1884). A high arctic-temperate, circumpolar species.

Contains salazinic and lobaric acids and atranorin. According to ASAHINA (1951b) lobaric acid should be regarded as an accessory substance.

*\*Parmelia panniformis* (NYL.) VAIN.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine; Puritan Creek. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

A low arctic-boreal, circumpolar species.

Contains olivetoric acid (sometimes small amounts, difficult to crystallize) and a substance giving straight needles of inclined extinction in GE and GAW, possibly imbricatic acid.

*Parmelia saxatilis* (L.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Ketchikan: Deer Mt; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine. Northern Cook Inlet area: Mountain ridge, Eagle River; Bird Creek Ridge; headwaters of Rabbit Creek. Kenai Peninsula: Hidden Lake; Skilak Lake; Portage Glacier; Seward; Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Cache Mt. Steese Highway: 12-Mile Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

var. *divaricata* DEL. ex NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Granite Basin; Shrine of St Therese; Douglas Skibowl. Sitka: Harbour Mt; Sitka National Monument. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt, lower part. Richardson Highway: Mile 9.

First reported from Alaska by BABINGTON (1851). A high arctic-temperate, circumpolar species. Var. *divaricata* is restricted to oceanic areas.

Contains salazinic acid and atranorin.



*Parmelia separata* TH. FR.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine. Northern Cook Inlet area: Mountain ridge, Eagle River; headwaters of Rabbit Creek. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge. Steese Highway: Eagle Summit; Circle Hot Springs.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; Rainbow Creek.

First reported from Alaska by LLANO (1951) as *P. birulae*. An arctic-alpine species distributed from Novaya Zemlya across northern Siberia and northern North America to eastern Canada.

Contains alectoronic and usnic acids and atranorin.

*Parmelia septentrionalis* (LYNGE) AHTI

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake; Salamatof. Richardson Highway: Mile 45.

First reported from Alaska by AHTI (1966a). A boreal-temperate, circumpolar species, earlier usually included in *P. olivacea*.

Contains fumarprotocetraric acid.

*Parmelia sinuosa* (SM.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake. Sitka: Harbour Mt, lower part; Indian River Trail; Sitka National Monument. Ketchikan: Ward Cove.

Previously reported from Alaska by KROG (1962). A suboceanic species known from western Europe, the middle European mountains, USSR (where it according to RASSADINA (1960) is rare, being known from the Carpathians, Crimea and the west coast of Baikal), Japan, and the west coast of North America. The record from Northern Saskatchewan by THOMSON & SCOTTER (1961) seems doubtful.

Contains usnic and salazinic acids.

\**Parmelia solediosa* ALMB.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Hidden Lake. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

An arctic-temperate, circumpolar species. Contains olivetoric acid and an undetermined substance same as in *P. disjuncta* (imbricaric acid?).

*Parmelia stygia* (L.) ACH.

Chemical strain I (fumarprotocetraric acid strain):

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Mabel Mine. Northern Cook Inlet area: Mountain ridge, Eagle River; headwaters of Rabbit Creek. Kenai Peninsula: Hidden Lake; Skilak Lake. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28; mile 32-37. Mt McKinley National Park: Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

Chemical strain II (acid deficient strain):

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

Chemical strain III (caperatic acid strain):

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit.

Additional material of strain III:

JAPAN: Hokkaido: Mt Tomurausi. - Coll. M. M. SATŌ (UPS).

*P. stygia* was first reported from Alaska by CUMMINGS (1904). A high arctic-temperate, circumpolar species.

Chemical strains I and II are both circumpolar in their distribution, strain II probably more common in northern parts. Chemical strain III is so far known only from Japan and Alaska.

Small amounts of atranorin may occur as an accessory substance.

*\*Parmelia subaurifera* NYL.

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail. Ketchikan: Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek; Potter; Knik River. Kenai Peninsula: Salamatof; Skilak Lake; Ninilchik.

A boreal-temperate, circumpolar species. Contains lecanoric acid.

*\*Parmelia subolivacea* NYL.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower parts of Cache Mt.

The determination is based on a single, fragmentary specimen. However, the negative reaction with PD, the rather thick, partly pruinose thallus, the numerous apothecia up to 5 mm in diameter and the subglobose spores, 8 to the ascus, strongly point to *P. subolivacea*.

This species is known from the arid forest regions of western North America.

Due to scarcity of material the Alaskan specimen was not tested chemically, but according to AHTI (1966a) no lichen substances have been demonstrated in this species.

*Parmelia substygia* Räs.

(= *P. saximontana* R. ANDERSON & W. WEB.)

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28.

Previously reported from Alaska by KROG (1966). A continental, low arctic-temperate, probably more or less circumpolar species.

The nomenclature of this species has been discussed by KROG (1967).

Contains gyrophoric acid.

*Parmelia sulcata* TAYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Granite Basin; Shrine of St Therese; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail; Sitka National Monument. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Northern Cook Inlet area: Knik River; Eagle River Valley; Mountain ridge, Eagle River; O'Malley Rd; Potter; Rabbit Creek Rd; headwaters of Rabbit Creek; Eastchester Swamp; Bird Creek Ridge. Kenai Peninsula: Cooper Creek camp ground; Skilak Lake; Homer; Ninilchik; Ingram Creek camp ground. Richardson Highway: Mile 9; mile 45. Prince William Sound: Pigot Bay; Fish Bay.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Toklat River; Polychrome Pass; Wonder Lake. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek. Steese Highway: Cleary Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by NYLANDER (1888). A high arctic-temperate, circumpolar species.

Contains salazinic acid and atranorin.

*Parmelia taractica* KREMP.

(= *P. stenophylla* (ACH.) DU RIETZ)

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Puritan Creek. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 70. Mt McKinley National Park: Savage River. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Fossil Creek.

Previously reported from Alaska by KROG (1962). A boreal-temperate, probably circumpolar species.

The specimens cited above all lacked isidia, had narrow, elongated laciniae with light brown underside, and were loosely attached to the substratum.

Contains usnic and salazinic acids.

*Parmelia trabeculata* AHTI

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Knik River; Rabbit Creek Rd. Kenai Peninsula: Ninilchik.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

Previously reported from Alaska by AHTI (1966a). The record of *P. multispora* from Alaska by KROG (1962) represents this species. A mainly boreal North American species known from eastern and central Canada, Minnesota, Michigan and Alaska.

Contains norstictic acid.

*Asahinea* CULB. & CULB.

The genus *Asahinea*, proposed by CULBERSON & CULBERSON (1965), is in Alaska represented by two species previously referred to the genus *Cetraria*.

*Asahinea chrysantha* (TUCK.) CULB. & CULB.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge. Northern Cook Inlet area: Mountain ridge, Eagle River; headwaters of Rabbit Creek. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Savage River; Polychrome Pass. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; Fossil Creek; the limestone ridge; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek. Baldwin Peninsula: Kotzebue.

The first Alaskan record of this species seems to be by ALMQUIST (1887), as *Cetraria septentrionalis*. A high arctic-alpine species known from northern Fennoscandia, Siberia, Korea, Kamchatka, Japan, Alaska and northwestern Canada. Distribution maps have been published by OXNER & RASSADINA (1960), CULBERSON & CULBERSON (1965) and HAKULINEN & ULVINEN (1966).

Contains alectoronic and usnic acids and atranorin, with  $\alpha$ -collatolic acid as an accessory substance.

*Asahinea scholanderi* (LLANO) CULB. & CULB.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine. Northern Cook Inlet area: Mountain ridge, Eagle River; headwaters of Rabbit Creek. Kenai Peninsula: Seward. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

An arctic-alpine, amphi-Beringian species, described from Alaska by LLANO (1951) as *Cetraria scholanderi*. OXNER & RASSADINA (1960) described the same species as *C. saviczii* and published a map of its distribution in the USSR. CULBERSON & CULBERSON (1965) have given a distribution map including both Siberian and Alaskan localities.

Contains alectoronic and  $\alpha$ -collatolic acids and atranorin.

*Cetrelia* CULB. & CULB.

In the genus *Cetrelia* CULBERSON & CULBERSON (1968, in print) have brought together certain closely related species formerly classified as *Parmelia* or *Cetraria*. The genus is in Alaska represented by 2 species.

*Cetrelia alaskana* (CULB. & CULB.) CULB. & CULB.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt.

Previously reported from Alaska by CULBERSON & CULBERSON (1966). A low arctic species restricted to western Alaska.

Contains imbricatic acid and atranorin.

\**Cetrelia cetrarioides* (DEL. ex DUBY) CULB. & CULB.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

A temperate, circumpolar species. The previous Alaskan record of *Parmelia cetrarioides* by KROG (1962) represents *Cetrelia alaskana*.

*C. cetrarioides* comprises three different chemical strains, by some lichenologists interpreted as three different species. The Alaskan specimen belongs to the perlatolic acid strain which, according to W. L. CULBERSON (1958) is rare in North America, only being known from a few localities in the Appalachian Mts and the State of Washington. The olivetoric acid strain (*C. olivetorum* (NYL.) CULB. & CULB.) and alectoronic acid strain (*C. chicitae* (CULB.) CULB. & CULB.) are not known from the west coast of North America.

Atranorin is present in all three chemical strains.

*Platismatia* CULB. & CULB.

The genus *Platismatia* has been separated from the genus *Cetraria* by CULBERSON & CULBERSON (1968, in print).

*Platismatia glauca* (L.) CULB. & CULB.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mt Roberts; Shrine of St Therese; Montana Creek; Douglas Skibowl. Sitka: Harbour Mt; Sitka National Monument. Ketchikan: Deer Mt; Ward Lake; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: O'Malley Rd; Rabbit Creek Rd. Kenai Peninsula: Skilak Lake; Ingram Creek camp ground; Seward; Marathon Mt. Richardson Highway: Mile 9. Prince William Sound: Pigot Bay; Fish Bay.

First reported from Alaska by BABINGTON (1851). A low arctic-temperate, slightly oceanic, incompletely circumpolar species.

Contains caperatic acid and atranorin.

*Platismatia herrei* (IMSH.) CULB. & CULB.  
(= *Cetraria tuckermanii* HERRE non OAKES)

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Montana Creek; Shrine of St Therese. Sitka: Harbour Mt; Sitka National Monument. Ketchikan: Deer Mt; Ward Lake.

First reported from Alaska by CUMMINGS (1892b). A suboceanic, North American west coast species known from California to south-east Alaska.

The nomenclature of this species has been discussed by IMSHAUG (1954).

Contains caperatic acid and atranorin.

*Platismatia lacunosa* (ACH.) CULB. & CULB.  
var. *lacunosa*

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts, lower part; Shrine of St Therese; Montana Creek; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Prince William Sound: Fish Bay.

var. *macounii* (DU RIETZ) CULB. & CULB.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

First reported from Alaska by ROTHROCK (1884). A suboceanic North American west coast species known from Oregon to the Aleutian and Pribilof islands. Old records of this species from Siberia represent *Asahinea chrysantha*.

Contains caperatic and fumarprotocetraric acids and atranorin.

*Platismatia norvegica* (LYNGE) CULB. & CULB.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake; Shrine of St Therese; Montana Creek; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail; Sitka National Monument. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek Rd. Kenai Peninsula: Ingram Creek camp ground; Seward; Marathon Mt. Richardson Highway: Mile 9. Prince William Sound: Pigot Bay; Fish Bay.

First reported from Alaska by DEGELIUS (1937). A suboceanic, boreal-temperate species known from northwestern Europe and the east and west coasts of North America.

Contains caperatic acid and atranorin.

*Cetraria* ACH.

The genus *Cetraria* has been studied in Middle Europe by HILLMANN (1936), and in the USSR by RASSADINA (1950). DAHL (1952) has discussed the subdivision of the genus and given a table of the chemical properties of some species. CULBERSON & CULBERSON (1965) have separated the genus *Asahinea* from *Cetraria* s. lat., and in 1968 (in print) the same authors have separated the genera *Cetrelia* and *Platismatia* from *Cetraria*. A world monograph of *Cetraria* is being prepared by CULBERSON.

*C. aurescens* has been reported from Alaska by MACOUN (1902), and *C. juniperina* by HERRE (1950a, on bark of *Betula*). These records need verification.

*Cetraria andrejevii* OXN.

Fig. 30.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

Previously reported from Alaska by KROG (1962). Revision of herbarium material has shown this species to have a wide range of distribution (Fig. 25), with one group of localities in western and southern Greenland-eastern Canada, another group in the Bering Sea-Bering Strait region, and several localities in the USSR (RASSADINA 1950) in addition to the type locality in northern Siberia (OXNER 1940).

For separation from *C. simmonsii* see under that species.

Microchemical tests indicate the presence of rangiformic and norrangiformic acids, but as the latter could not be detected chromatographically (TIBELL, personal communication) it is supposed to be present in very small quantities.

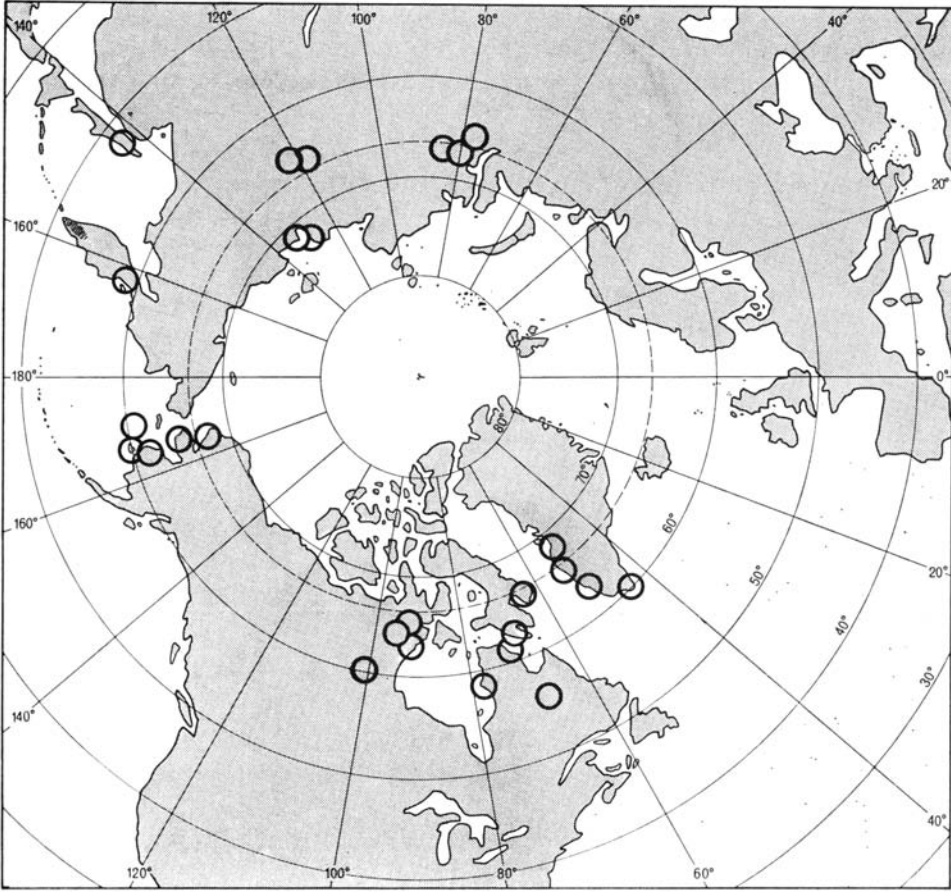


Fig. 25. Distribution of *Cetraria andrejevii* OXN.

*Cetraria chlorophylla* (WILLD.) VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Douglas Skibowl. Sitka: Harbour Mt; Sitka National Monument. Ketchikan: Ward Lake; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley; Rabbit Creek Rd; O'Malley Rd; Eastchester Swamp. Kenai Peninsula: Skilak Lake; Homer; Ingram Creek camp ground; Seward. Richardson Highway: Mile 9. Prince William Sound: Fish Bay.

First reported from Alaska by CUMMINGS (1904). A boreal-temperate, circumpolar species.

Contains protolichestic and rangiformic acids.

*Cetraria ciliaris* ACH.

var. *atropaca* TRASS

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; lower Fossil Creek.

First reported from Alaska by CUMMINGS (1904). A boreal-temperate, incompletely circumpolar species.

Var. *atropaca* differs from var. *ciliaris* mainly in the short, broad lobes and the dark colour (TRASS 1963). I have seen the same modification from Labrador-Ungava.

*C. ciliaris* is in North America represented by three chemical strains containing olivetoric and physodic acids, alectoronic acid, and protolichestic acid respectively (HALE 1963, C. F. CULBERSON 1964). CULBERSON & CULBERSON (1967) decided to regard the different strains as three different species, *C. ciliaris* ACH., *C. halei* CULB. & CULB., and *C. orbata* (NYL.) FINK. The Alaskan specimens, containing  $\alpha$ -collatolic acid and possibly small amounts of alectoronic acid but lacking atranorin, fall within the chemical variation range of *C. halei*.

*Cetraria commixta* (NYL.) TH. FR.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–37. Mt McKinley National Park: Toklat River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Eagle Summit.

First reported from Alaska by MACOUN (1899). A low arctic-temperate, circumpolar species.

Contains  $\alpha$ -collatolic acid.

*Cetraria cucullata* (BELL.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine. Northern Cook Inlet area: Rabbit Creek Rd; headwaters of Rabbit Creek. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 70; mile 100. Mt McKinley National Park: Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-temperate, circumpolar species.

Contains usnic, protolichestic and possibly rangiformic acids.

*Cetraria delisei* (BORY) TH. FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mountain ridge, mile 28; mile 32–37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Cache Mt.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by GRAY (1885). A high arctic-alpine, circumpolar species.

Contains hiascinic acid (ASAHINA & SHIBATA 1954) and gyrophoric acid.



*Cetraria elenkinii* KROG sp. nov.

*Cetraria nigricascens* auct. non NYL.: ELENK., Zap. Imp. Akad. Nauk, Fiz.-Mat. Otd., Ser. 8, 27:14 (1909); ELENK. & SAV., Tr. Imp. Bot. Sada 32:85 (1912); RASS., Bot. Zh. 33:23 (1948); Bot. Mater. Otd. Spor. Rast. Akad. Nauk SSSR 6:15–17 (1949); Tr. Bot. Inst. Akad. Nauk SSSR, Spor. Rast., Ser. 2, 5:275 (1950); HALE, Amer. Midl. Nat. 51:258 (1954); KROG, Ark. Bot., Ser. 2, 4:507 (1962).

Fig. 26.

*Thallus terricolus, ad 3–4 cm longus, olivaceus, in basi cinereus, tenuis, cum striis vel canalibus modicis, laciniae 1–2 mm latae, diffusae, lobis apice inaequaliter sectis, ut solet non rotundatis, cilia simplicia vel parce ramosa, 0.5–1.5 mm longa, in margine dispersa, pseudocyphellae indistinctae vel desunt; soredia et isidia desunt; apothecia non observata.*

Thallus up to 3–4 cm high, terricolous, olivaceous, light gray at the base, thin, slightly ridged or channelled, laciniae 1–2 mm wide, branching, ends of lobes unevenly cut, usually not rounded, cilia simple or sparingly branched, 0.5–1.5 mm long, scattered marginally, pseudocyphellae weak or absent; no soredia or isidia, apothecia not observed.

Chemical reactions: K–, PD–, C–, KC–. Contains rangiformic and norrangiformic acids.

Named in honour of the Russian lichenologist A. A. ELENKIN.

Type: Alaska.

BERING STRAIT DISTRICT: Ogotoruk Creek. – Coll. HULTÉN (S).

A high arctic species known from Franz Joseph Land, Wrangel Island, the New Siberian Islands, northern Alaska and Baffin Island (Fig. 32).

*Platysma nigricascens* was originally described from Kola Peninsula by NYLANDER in KIHLMAN (1891). In 1909 ELENKIN made the combination *Cetraria nigricascens* (NYL.) ELENK. and hesitantly applied it to a specimen from the arctic Siberian islands. The same year VAINIO cited *C. nigricascens* NYL. as a synonym of *C. hiascens* var. *fastigiata* (DEL.) VAIN. In 1912 ELENKIN & SAVICZ suggested that the Siberian specimen, differing from NYLANDER's description by the presence of cilia, should be regarded as an independent species. SAVICZ had formed the opinion, upon examination of NYLANDER's specimen no. 244 in herb. Petersb., that *C. nigricascens* NYL. really represented a disorganized form of *C. hiascens*. ELENKIN & SAVICZ therefore decided to refer to their Siberian species as *C. nigricascens* ELENK. non NYL.

This practice is untenable from a nomenclatural point of view. ELENKIN did not provide his new species with a Latin diagnosis, and even if he had done so the name *C. nigricascens* would be invalid, cf. art. 55 in the nomenclatural code.

I have had the opportunity to study *Platysma nigricascens* NYL. no. 244 in NYLANDER's herbarium, marked spec. origin. I do not know if NYLANDER's collection was inhomogeneous, but the specimen studied by me did not fall within the variation range of *C. delisei*, and was different from *C. hiascens* var. *fastigiata* VAIN. which does belong in the *C. delisei* complex (observation made on no. 1938 in VAINIO's herbarium, from Tjapka).

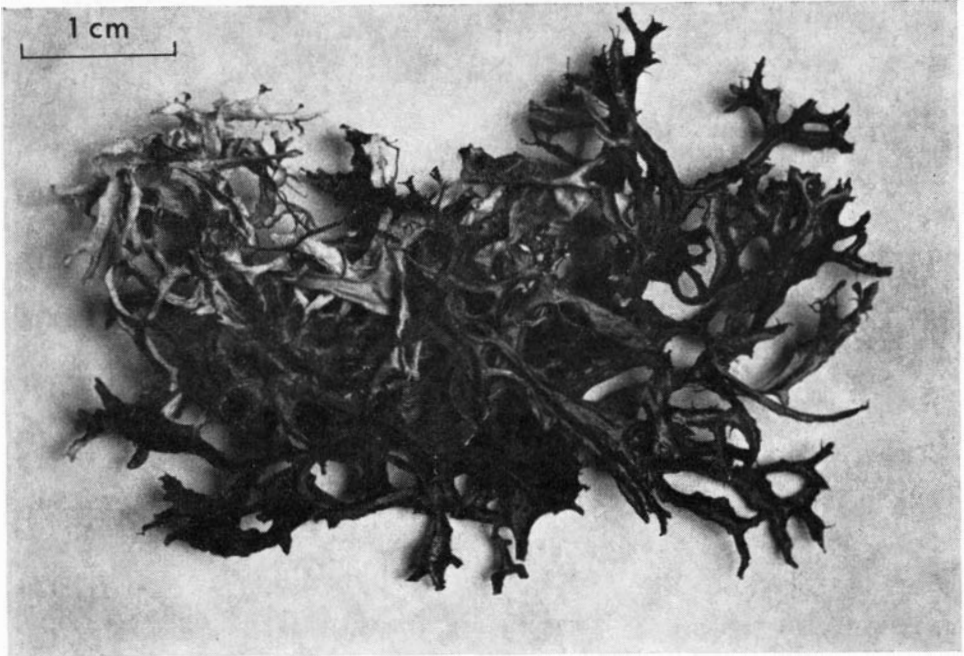


Fig. 26. *Cetraria elenkinii* KROG. Bering Strait District: Ogotoruk Creek.  
Coll. E. HULTÉN, 1960. (Typus).

*C. nigricascens* (NYL.) ELENK. differs from *C. elenkinii* in the slightly more brown colour, the short, much branched laciniae, the rounded lobe ends, and the absence of long cilia. It seems to be closer to (but probably not identical with) *C. rhizophora* (VAIN.) RASS.

*Cetraria ericetorum* OPIZ.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts.

ALASKA RANGE DISTRICT: Denali Highway: Mile 32–37.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Eagle Summit.

First reported from Alaska by NYLANDER (1888). A high arctic-temperate, circumpolar species.

As pointed out by AHTI (1964) *C. ericetorum* contains different races which may react PD+ or PD– and may display certain morphological variations. This group seems to be much more variable in eastern Asia – northern North America than it is in Europe. The specimens cited above were dark brown, narrow lobed, convolute, with narrow marginal pseudocyphellae, and reacted PD–.

Contains protolichestic acid.

*Cetraria hepatizon* (ACH.) VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Mt Roberts; Granite Basin. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine. Northern Cook Inlet area: Eagle River; headwaters of Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Marathon Mt; Hidden Lake; Skilak Lake. Richardson Highway: Mile 24; mile 45.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; granite outcrop close to the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; 12-Mile Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek.

First reported from Alaska by DEGELIUS (1937). A high arctic-temperate, circumpolar species.

The narrow lobed type, often referred to as *C. polyschiza* (NYL.) JATTA is present in Alaska. It appears to be a modification of little taxonomic value.

Contains stictic acid.

*Cetraria islandica* (L.) ACH.

Chemical strain I (fumarprotocetraric acid strain, PD +):

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine; Independence Mine. Northern Cook Inlet area: Headwaters of Rabbit Creek; Bird Creek Ridge. Richardson Highway: Mile 24; mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Mt McKinley National Park: Wonder Lake. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Lion Peak; the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

Chemical strain II (PD-):

EASTERN PACIFIC COAST DISTRICT: Juneau: Granite Basin. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-temperate, circumpolar species.

*C. islandica* s. lat. is in need of a thorough revision, correlating morphological and chemical characters.

All European specimens tested by me contained fumarprotocetraric and protolichesteric acids (the material tested was not large enough to be conclusive). In Alaskan material the PD- strain contained protolichesteric and rangiformic acids. The majority of the specimens in the PD+ strain contained only fumarprotocetraric acid, but six specimens contained protolichesteric acid (in accordance with the European specimens), and 4 specimens contained both protolichesteric and rangiformic acids in addition to fumarprotocetraric acid.

*Cetraria kamczatica* SAV.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

Previously reported from Alaska by KROG (1962). An arctic, amphi-Beringian species with a limited distribution restricted to Alaska, Kamchatka and eastern Siberia.

Contains protolichestic and rangiformic acids.

*Cetraria laevigata* RASS.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Northern Cook Inlet area: Mountain ridge, Eagle River. Richardson Highway: Mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; mile 100. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Lion Peak; lower Fossil Creek; the limestone ridge. Steese Highway: Cleary Summit; 12-Mile Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek. Baldwin Peninsula: Kotzebue.

Previously reported from Alaska by KROG (1962). An arctic-temperate species with its main area in Japan and through Siberia and northern North America from the Ural Mts to eastern Canada. A few scattered localities are also reported from the European USSR.

Contains fumarprotocetraric acid.

*Cetraria nigricans* (RETZ.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Bald Mt Ridge. Northern Cook Inlet area: Headwaters of Rabbit Creek. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 100. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Cache Mt; Lion Peak. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by NYLANDER (1888). A high arctic-alpine, circum-polar species.

Contains protolichestic and rangiformic acids.

*Cetraria nivalis* (L.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Independence Mine; Puritan Creek. Northern Cook Inlet area: Mountain ridge, Eagle River; headwaters of Rabbit Creek. Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Base of Rainbow Mts; Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Fossil Creek; the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; Eagle Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by ALMQUIST (1887). A high arctic-boreal, circumpolar species.

Contains usnic acid.

*Cetraria pinastri* (SCOP.) S. GRAY

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Little Susitna River south of Fishhook Creek; Puritan Creek. Northern Cook Inlet area: Eagle River Valley; O'Malley Rd; Potter; Rabbit Creek Rd. Kenai Peninsula: Cooper Creek camp ground; Skilak Lake. Richardson Highway: Mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Darling Creek; base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; the limestone ridge. Steese Highway: Cleary Summit; Circle Hot Springs.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by CUMMINGS (1904). A boreal-temperate, circumpolar species.

Contains usnic, vulpinic and pinastric acids (ZOPF 1907).

*Cetraria richardsonii* HOOK.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28; mile 70; mile 100. Mt McKinley National Park: Savage River. Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; Rainbow Creek.

First reported from Alaska by ALMQUIST (1887). A high arctic-alpine species known from both sides of the Bering Strait from the Lena River in Siberia eastwards to Hudson Bay. Distribution maps have been published by SAVICZ (1923b) and RASSADINA (1950).

Contains alectoronic acid.

*Cetraria sepincola* (EHRH.) ACH.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eastchester Swamp.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-28. Mt McKinley National Park: Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

First reported from Alaska by ALMQUIST (1887). A low arctic-temperate, circumpolar species.

Contains protolichestic acid.

*Cetraria sibirica* H. MAGN.

BERING STRAIT DISTRICT: Ogotoruk Creek Drainage. - Coll. VIERECK & BUCKNELL (4558) (O). (KROG 1962).

First reported from Alaska by LLANO (1951). This species is known only from a few scattered arctic localities in Siberia and north western North America.

In the type locality fertile specimens of *C. sibirica* were reported growing on twigs (MAGNUSSON 1936), and this was also the case with the specimen cited above. In the herbarium of Helsinki I have seen specimens from Northwest Territories, east of Anderson River, which appeared to have been growing over sandy soil. These specimens were sterile and better developed, but otherwise in agreement with *C. sibirica* both morphologically and chemically.

No lichen substances could be demonstrated by means of microcrystallization.

*Cetraria simmonsii* KROG sp. nov.

var. *simmonsii*

Fig. 27.

*Thallus fruticosus, caespitosus, partes basales irregulariter dilatatae, ad 20 mm latae, partes superiores erectae, parce ramosae ± convolutae, sinibus lobisque rotundatis, lobi terminales 5–10 mm lati, superficies superior laevis, superficies inferior ± reticulato-venosa et rugata pseudocyphellis indistinctis, lobuli marginales nonnumquam praesentes, colore basali luridofulvo, partibus superioribus castaneis; soredia, isidia vel cilia desunt; unum apothecium visum, pars inferior valde rugosa, sporae simplices, ellipsoideae, 8–10 × 4–5 μ.*

Thallus fruticose, caespitose, with complicately anastomosing basal parts, irregularly expanding, up to 20 mm wide, upper parts erect, moderately branched, more or less convolute, with rounded sinuses and lobes, terminal lobes 5–10 mm wide, upper side smooth, dull-shiny, underside more or less reticulately ridged and wrinkled with weak pseudocyphellae, margins dentate from the presence of short, partly bifurcate projections bearing pycnidia, marginal lobules at times present, colour at the base yellowish green-tan, in upper parts a rich chestnut brown; no soredia, isidia or cilia; only one apothecium seen, 12 mm in diameter, appearing terminally on a lobe which had grown together to form a cylinder in the upper part, under side of the apothecium strongly wrinkled, spores simple, ellipsoid, 8–10 × 4–5 μ.

Chemical reactions PD–, K–, C–, KC–, J–. Contains rangiformic and norrangiformic acids.

Named in honour of H. C. SIMMONS, the botanist of the Second Norwegian Arctic Expedition in the "Fram" 1898–1902.

Type:

GREENLAND: Egedesminde. – Coll. H. G. SIMMONS no. 116 (O).

Additional material examined:

Alaska:

ARCTIC COAST DISTRICT: Point Barrow. – Coll. HULTÉN (S). Do. – Coll. THOMSON, SHUSHAN & SHARP, no. 32 (O).

Canada:

ELLESMERE ISLAND: Jones Sound, Thal auf Sir Inglis Peak. – Coll. SIMMONS, no. 2315 (C).

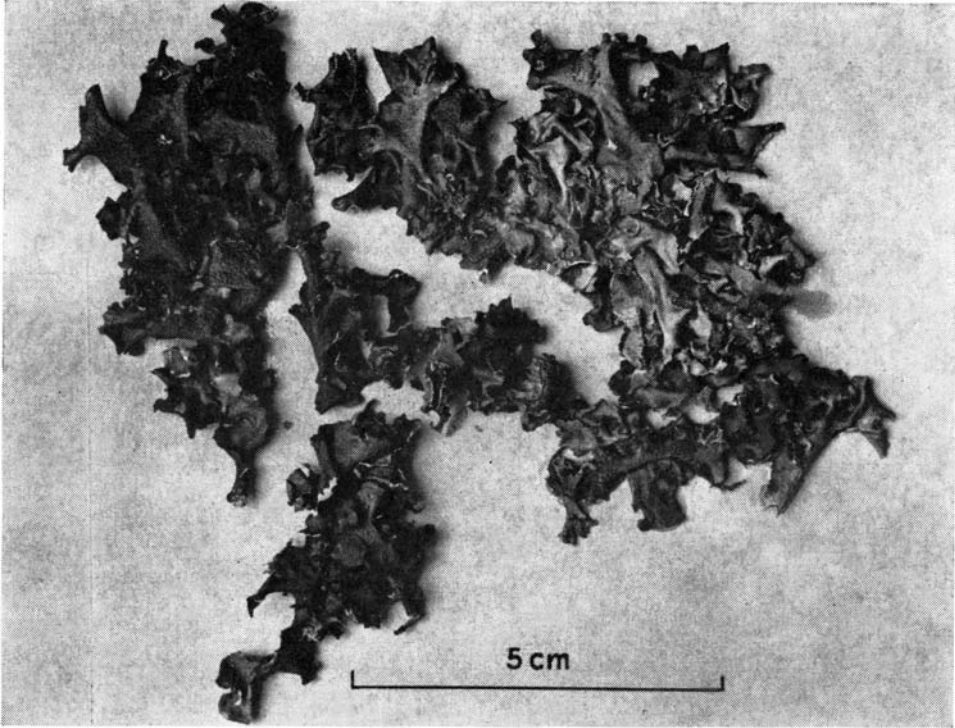


Fig. 27. *Cetraria simmonsii* KROG. Greenland: Egedesminde.  
Coll. H. G. SIMMONS, 1898, no. 116. (Typus).

var. *intermedia* KROG var. nov.

Fig. 28.

*Habitu inter C. simmonsii* var. *simmonsii* et *C. andrejevii* medio. *Characteres partium basalium* var. *simmonsii* minus exstantes, lobi *C. andrejevii* simulant, sed color, reticulatio superficiei inferioris, lobi ad dilatationem irregularem tendentes marginaliumque lobulorum formatio cum var. *simmonsii* congruentes; apothecia non visa.

Habitually intermediate between *C. simmonsii* var. *simmonsii* and *C. andrejevii*. The characters of the basal parts of var. *simmonsii* less pronounced, lobes imitating *C. andrejevii*, but colour, reticulation of under side, and tendency to irregularly dilatated lobes and formation of marginal lobules are in agreement with var. *simmonsii*.

Type:

SIBIRIA SEPTENTRIONALIS: Pitlekai. — Coll. E. ALMQUIST (S).

Additional material examined:

Alaska:

BERING SEA DISTRICT: St Lawrence Island. — Coll. ALMQUIST (S). St Paul Island.  
— Coll. J. M. MACOUN, no. 232 (O), no. 51 (S).

BERING STRAIT DISTRICT: Seward Peninsula: Port Clarence. — Coll. ALMQUIST (S).

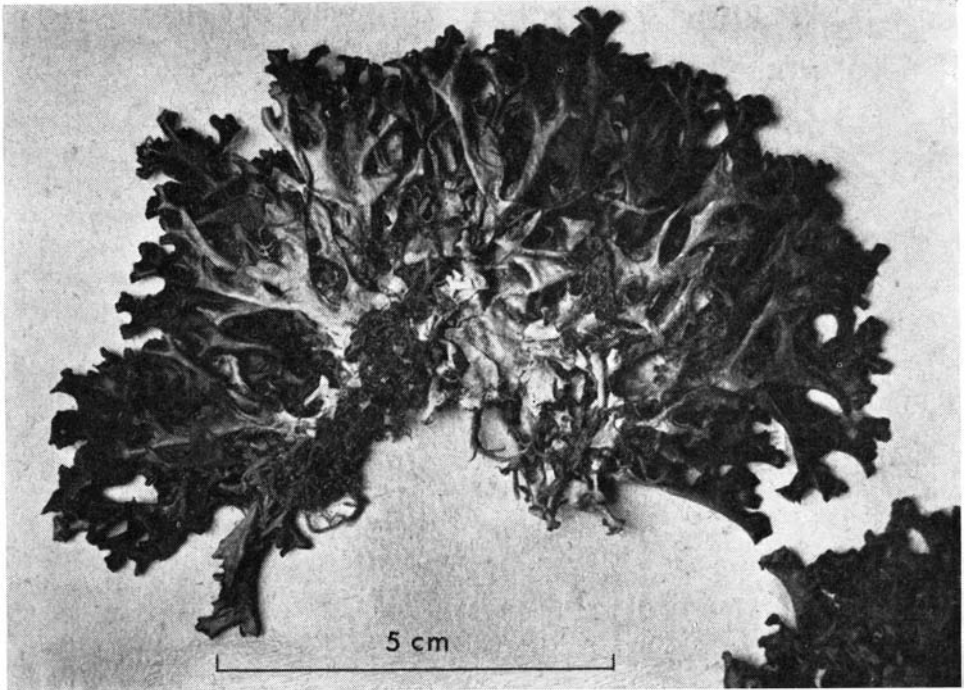


Fig. 28. *Cetraria simmonsii* var. *intermedia* KROG. Siberia: Pitlekai.  
Coll. E. ALMQUIST, 1879. (Typus).

Canada:

MANITOBA: West of Churchill River. — Coll. DUMAN, no. 2775 (O).

QUEBEC: Hudson Strait: Wolstenholme. — Coll. POLUNIN (O). Knob Lake, mountain between Ruth Lake and Bean Lake. — Coll. KALLIO (TUR).

KEEWATIN: Chesterfield Inlet. — Coll. DUTILLY, no. 6603 (O).

BAFFIN ISLAND: Clyde River. — Coll. POLUNIN, no. 2604 a-24 (O).

Greenland:

GODTHAAB DISTRICT: Bjørnesund. — Coll. KOLDERUP-ROSENVINGE (C). Mission Herinhut. — Coll. TH. FRIES (UPS).

DISKO DISTRICT: Toppen af Skansen. — Coll. PEDERSEN, no. 3386 (C). Rittenbenk. — Coll. SYLOW (C).

Siberia:

CHUKOTSKI POLUOSTROV: Tiapka. — Coll. ALMQUIST, no. 1929 (TUR).

OSTROV VRANGELYA: Insula Ljachow. — Coll. BUNGE (S).

JENISEJSK: Dudinka. — Coll. BRENNER, no. 1590a (S).

var. *lobulata* KROG var. nov.

Fig. 29.

*Lobi ad 30 mm lati, rotundi, rugis superficiei inferioris ad margines radiantibus, margines lobulis quae nonnumquam lobos novos evolvunt, obtecti; apothecia non visa.*

Lobes up to 30 mm wide, rotund, with the wrinkles on the under side radiating towards the margins, margins covered with lobules which sometimes develop into new lobes; apothecia not seen.



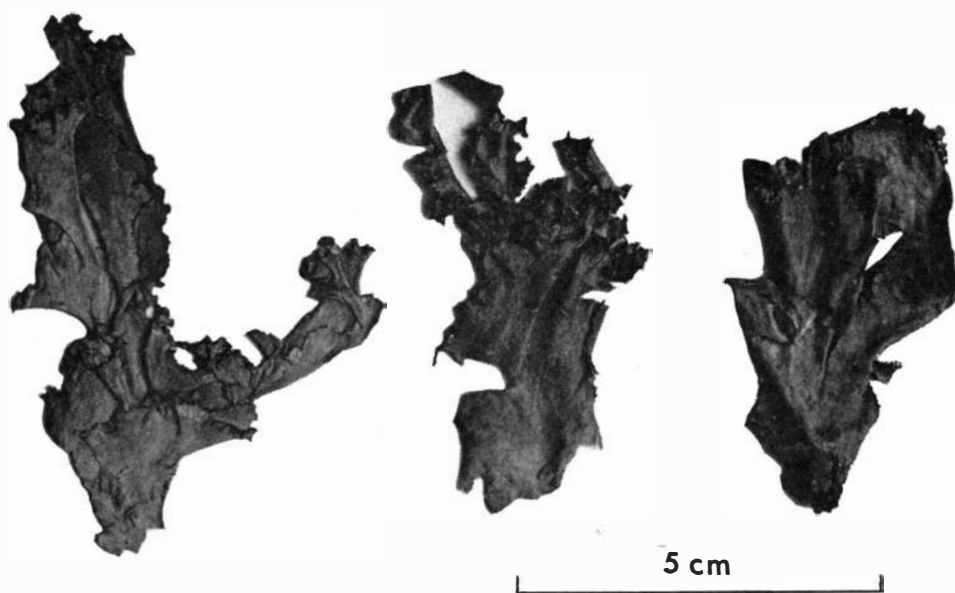


Fig. 29. *Cetraria simmonsii* var. *lobulata* KROG. Greenland: Godthaab District: Ameralik. Coll. J. VAHL. (Typus).

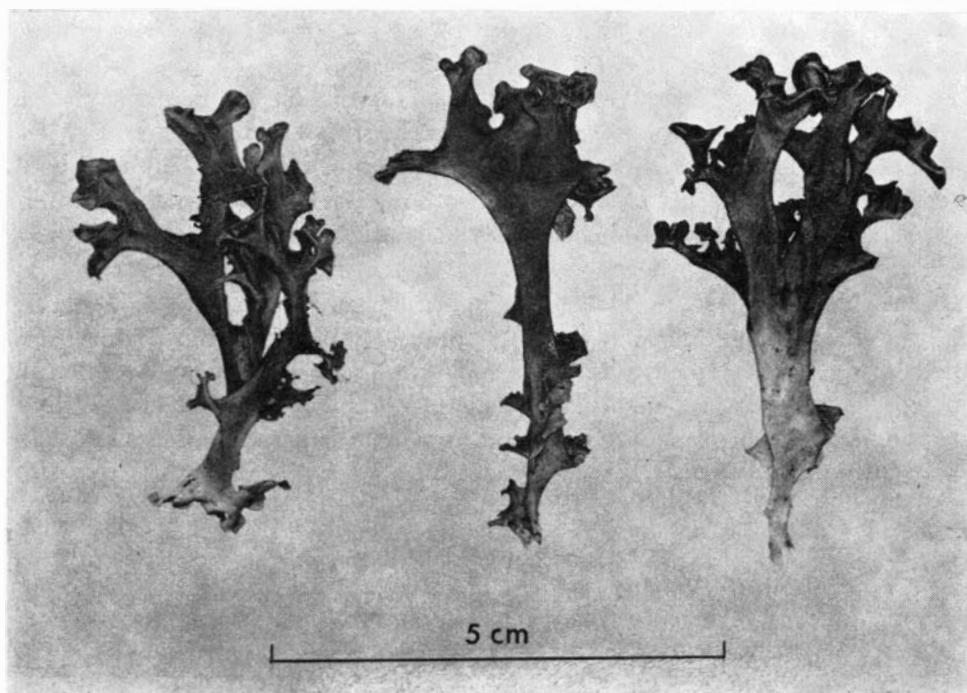


Fig. 30. *Cetraria andrejevii* OXN. Bering Sea District: Nunivak Island: Nash Harbour. Coll. H. KROG, 1957, no. 2879.

Type:

GREENLAND: Godthaab District: Ameralik. — Coll. J. VAHL (without date and number) (C).

Additional material examined:

Greenland:

DISKO DISTRICT: Jacobshavn. — Coll. VAHL (C).

*C. simmonsii* is most closely related to *C. andrejevii* (Fig. 30). Their main distinguishing features are listed below:

<i>C. simmonsii</i>	<i>C. andrejevii</i>
Colour tan in basal parts, chestnut brown in upper parts.	Colour gray-white in basal parts, dark olive brown in upper parts.
Basal parts persistent, spreading, anastomosing.	Basal parts slender, erect, gradually dying off, individual thalli easily separated.
Pycnidia on short, partly bifurcate projections.	Pycnidia on slightly longer, usually unbranched projections.
Marginal lobules common.	Marginal lobules not observed.
Underside strongly wrinkled.	Underside weakly wrinkled or pitted.

The position of *C. simmonsii* var. *intermedia* is subject to some doubt. Some of the specimens included in this variety come quite close to *C. andrejevii*. The problem can only be satisfactorily settled through studies of populations in the field.

*C. simmonsii* s. lat. has a wide distribution in Siberia and northern North America. There is one group of localities in western Greenland—eastern Canada, another group in the Bering Sea—Bering Strait region, and one single locality in Jenisejsk. Since the areas in western arctic Canada and Siberia are poorly investigated, there is reason to believe that this species may turn up also in these parts.

I am indebted to Mr. L. TIBELL in Uppsala for verifying chromatographically the presence of rangiformic and norrangiformic acids in this species. By the same method Mr. TIBELL failed to find norrangiformic acid in *C. andrejevii* although the species gives the crystals characteristic of norrangiformic acid in GE. This may indicate that norrangiformic acid is present in larger quantities in *C. simmonsii* than in *C. andrejevii*.

#### *Cetraria subalpina* IMSH.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge.

First reported from Alaska by IMSHAUG (1950). A North American west coast species known from mountain areas from Oregon to Point Barrow, Alaska.

The specimens from south east Alaska belong to the corticolous form, the specimen from Talkeetna Mts to the terricolous form.

Contains protolichestic acid.

*Cetraria tilesii* ACH.

ALASKA RANGE DISTRICT: Denali Highway: Mountain ridge, mile 28. Mt McKinley National Park: Savage River; Toklat River. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; the limestone ridge. Steese Highway: Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; Rainbow Creek.

First reported from Alaska by ALMQUIST (1887). A calciphilous, arctic-alpine, circumpolar species.

Contains usnic, rangiformic and pinastric acids.

*Cornicularia* (SCHREB.) HOFFM.

In my opinion the genus *Cornicularia* is very closely related to the genus *Cetraria*, and based on morphological as well as chemical characters its position in *Parmeliaceae* seems much more natural than in *Usneaceae*.

The *C. aculeata*-*C. odontella* group in the Alaskan material has been revised by SANTESSON.

*Cornicularia aculeata* (SCHREB.) ACH. s. strict.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Ketchikan: Deer Mt.

First reported from Alaska by ALMQUIST (1887). An arctic-temperate, circumpolar species.

*C. aculeata* s. strict. and *C. muricata* are obviously very closely related, but differ in several characters. *C. aculeata* has an open branch system, the branches are often irregularly flattened, and the pseudocyphellae are mostly deeply concave. *C. muricata* is densely branched, the branches are terete, and the pseudocyphellae are predominantly plane, as in *C. odontella*. There is also a chemical difference in that *C. aculeata* contains only protolichestic acid, *C. muricata* both protolichestic and rangiformic acids.

MITCHELL (1959) found only rangiformic acid in *C. aculeata*. However, both Alaskan and Scandinavian material tested by me contained protolichestic acid only.

*Cornicularia divergens* ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Mabel Mine. Northern Cook Inlet area: Bird Creek Ridge; Eagle River; Rabbit Creek. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Junction of Beaver Creek and Fossil Creek; headwaters of Sheep Creek; granite outcrop close to the limestone ridge; Cache Mt; Lion Peak; the limestone ridge.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Mekoryuk Village; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-alpine, circumpolar species.

Contains olivetoric acid.

*\*Cornicularia muricata* (ACH.) ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek. Kenai Peninsula: Skilak Lake; Marathon Mt.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

An arctic-temperate, circumpolar species. *C. muricata* is not included in the checklist (HALE & CULBERSON 1966); it is probably considered a variety of *C. aculeata*.

Contains protolichestic and rangiformic acids.

[*Cornicularia normoerica* (GUNN.) DU RIETZ]

EASTERN PACIFIC COAST DISTRICT: Muir Glacier. – Coll. KINCAID. (MACOUN 1902).

This species has been reported from Oregon and British Columbia, and its presence in Alaska is to be expected.

*C. normoerica* is a somewhat oceanic, boreal-temperate species known to occur in northern and middle Europe, Japan, and on the east og west coasts of North America.

No lichen substances have been demonstrated by means of microcrystallization.

*\*Cornicularia odontella* (ACH.) RÖHL.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge. Steese Highway: Eagle Summit.

New to North America. An arctic-temperate, somewhat continental species previously known from northern and middle Europe, Ural, south-east Siberia, and Japan.

Contains protolichestic and rangiformic acids.

The following specimens are included in *C. odontella* with some doubt:

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Cleary Summit.

These specimens differ from the typical *C. odontella* in having a more flattened thallus in parts up to 3 mm wide, in pseudocyphellae occurring exclusively on the underside (in *odontella* partly also along the margins on the upper surface), and in the red colour, which in normal *odontella* appears only at the base, spreading over most of the under surface. According to SANTESSON (personal communication) this may be an extreme form of *odontella* or possibly a different taxon. More material is needed before the question can be settled.

*Dactylina* NYL.

The taxonomy and distribution of the arctic representatives of the genus *Dactylina* have been thoroughly discussed by LYNGE (1933).

The taxonomic position of this genus has been unclear. By various authors it has been placed in *Parmeliaceae* as closely related to the genus *Cetraria*, or in *Usneaceae*, supposedly related to *Ramalina* or *Evernia*. LYNGE (op. cit.) pointed out that no difference of generic importance could be detected in the structures of the apothecia in the genus *Dactylina* and the genus *Cetraria*. He did, however, point to a difference in pycnides, which in *Dactylina* are immersed, in *Cetraria* protruding.

In my opinion the genus *Dactylina* clearly belongs in *Parmeliaceae*. The relationship with *Cetraria* is most obvious in *D. ramulosa*, where even protruding pycnides may at times be observed. The presence of monoacetylprotocetraric acid in the genus *Dactylina*, partly in combination with barbatic acid, recalls chemical properties met with in the genus *Hypogymnia*.

LYNGE placed *D. arctica* in Sect. *Dactylina* (NYL.) LYNGE and *D. madreporiformis*, *D. ramulosa* and *D. endochrysea* in Sect. *Dufourea* (ACH.) LYNGE. However, *D. arctica* and *D. ramulosa* are so closely related both morphologically (hollow thalli) and chemically (monoacetylprotocetraric acid) that it would seem more natural to include both in Sect. *Dactylina*.

According to LYNGE there are a few insufficiently labelled records of *D. madreporiformis* from Alaska, one from Zeller Mission, leg. PALMER, which could possibly be from Teller Mission on the Seward Peninsula, and another, leg. MACOUN, suspected to be from the Aleutians. Since *D. madreporiformis* often is confused with certain erect, epruinose forms of *D. ramulosa* these old records are very doubtful.

*Dactylina arctica* (HOOK.) NYL.

PD+ strain:

CENTRAL PACIFIC COAST DISTRICT: Cook Inlet area: Bird Creek Ridge.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37. Mt McKinley National Park: Toklat River; Savage River; Polychrome Pass. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; Rainbow Creek.

PD- strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Mabel Mine. Northern Cook Inlet area: Bird Creek Ridge. Richardson Highway: Mile 37.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; the limestone ridge; Cache Mt. Steese Highway: Eagle Summit.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-alpine, incompletely circumpolar species.

Both chemical strains contain usnic and gyrophoric acids and a substance which

judged by the crystals in GE and GAW appears to be perlatolic acid. In addition the PD+ strain contains monoacetylprotocetraric acid.

The PD- strain has a more or less circumpolar distribution. Specimens of the PD+ strain have been seen from Siberia, British Columbia, the Great Bear Lake region and Baffin Land. Since no such specimens were seen in the Greenland and Spitsbergen material, it is possible that the PD+ strain has a wide amphiberingian distribution.

PD+ strain: *Dactylina ramulosa* (HOOK.) TUCK.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine; Puritan Creek. Northern Cook Inlet area: Rabbit Creek.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Toklat River; Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; the limestone ridge. Steese Highway: Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak; Rainbow Creek.

PD- strain:

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge.

CENTRAL YUKON RIVER DISTRICT: Steese Highway: Eagle Summit.

First reported from Alaska by TUCKERMAN (1882). A high arctic-alpine, incompletely circumpolar species. This species has not been known to occur in Fennoscandia, but a recent record from Enontekis, Finland (AHTI, personal communication) has bridged part of that gap in the distribution.

Within *D. ramulosa* the PD+ strain is by far the most common. Specimens of the PD- strain have been seen from Greenland, eastern Canada, the Bering Strait region, Novaya Zemlya and Spitsbergen.

The PD+ strain contains monoacetylprotocetraric acid, perlatolic acid (?), barbatic acid, and usnic acid as an accessory substance. The PD- strain may contain usnic acid or may be devoid of lichen substances.

## USNEACEAE

### *Evernia* ACH.

HOWE (1911b) has studied the genus *Evernia* in North and Middle America. A survey of the chemistry of the genus has been given by C. F. CULBERSON (1963).

The Alaskan record of *E. divaricata* by WEBER & VIERECK (1967) needs verification.

### *Evernia esorediosa* (MÜLL. ARG.) DU RIETZ

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge.

Previously reported from Alaska by KROG (1962). A predominantly east Asiatic species extending into Alaska.

Contains divaricatic acid. The tips of the thalli and the dried residuum of the acetone extract reacted KC+. The substance causing this reaction was not determined. ASAHINA (1952b) also reported traces of usnic acid in this species.

*Evernia mesomorpha* NYL.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Wonder Lake. Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; junction of Beaver Creek and Fossil Creek; Cache Mt. Steese Highway: Cleary Summit; Circle Hot Springs. Alaska Highway: Mile 1450.

First reported from Alaska by NYLANDER (1888) as *E. thamnodes*. A boreal-temperate, continental, more or less circumpolar species.

Contains divaricatic acid and small amounts of usnic acid.

*Evernia perfragilis* LLANO

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak.

First reported from Alaska by LLANO (1951). An arctic, terricolous, calciphilous species known from Novaya Zemlya to Baffin Land.

Contains divaricatic acid and small amounts of usnic acid.

[*Evernia prunastri* (L.) ACH.]

ALASKA RANGE DISTRICT: Mt McKinley National Park: Stampede. — Coll. PILGRIM. (HOWARD 1958).

*E. prunastri* is a boreal-temperate species, widely distributed in Europe and on the west coast of North America. There are few records from Japan, and according to HALE (1961) this species is very rare in eastern North America. It is lacking in Siberia.

Contains evernic acid, atranorin, and usnic acid as an accessory substance (C. F. CULBERSON 1963).

*Letharia* (TH. FR.) HUE

According to the checklist (HALE & CULBERSON 1966) this genus is represented by two different species in North America, viz. *L. californica* (LÉV.) HUE and *L. vulpina* (L.) HUE. SCHADE has discussed the distribution of *L. vulpina* in the old world (SCHADE 1954) and in the new world (SCHADE 1955), with remarks on its relationship to *L. californica*. Because of the presence of intermediate forms he decided to regard *L. californica* as a subspecies of *L. vulpina*.

Since the species was not represented in my Alaskan collection I have not had the opportunity to study the problem personally. The literature records cited below represent *L. vulpina* s. lat., including *L. californica*.

[*Letharia vulpina* (L.) HUE s. lat.]

EASTERN PACIFIC COAST DISTRICT: White Pass. — Coll. HESS. (HERRE 1920). Shores of Lake Dewey, Skagway. — Coll. HESS. (SCHADE 1955).

According to SCHADE (1954, 1955) *L. vulpina* is quite widespread in Europe. It is cited from a few localities in the Caucasus and Asia Minor, but seems to be lacking in Siberia and Japan. In North America it is known only from the west coast.

Contains vulpinic acid and atranorin (ZOPF 1907).

*Alectoria* ACH.

The genus *Alectoria* in North America has been studied by МОТЫКА (1964). The publication was based on several different collections, my Alaskan material included. However, the Alaskan collection reached Dr. МОТЫКА at a late stage in his study, and he decided to publish his observations on this material separately, at the time only mentioning some of the new taxa with diagnosis in English. Since the proposed publication is not yet completed, the new taxa in question will be tentatively referred to by their preliminary names, even though not validly published.

The following treatment of the species largely follows МОТЫКА's determinations, with a few exceptions. *A. norstictica* is included in *A. subtilis*, *A. bicolor* var. *subbicolor* is included in *A. tenuis*, and *A. irvingii* is regarded as a synonym of *A. lanea*.

*A. implexa* s. lat. has been reported from Alaska by MACOUN (1902) and HOWE (1911a). There are several records of *A. jubata* in Alaska, but this species, as understood by МОТЫКА, is not supposed to occur in North America.

\**Alectoria americana* MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail; Mt Roberts, lower part; Montana Creek; Shrine of St Therese; Douglas Skibowl. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt, lower part. Richardson Highway: Mile 9. Prince William Sound: Fish Bay; Pigot Bay.

This species is widely distributed in North America, and is also known from eastern Asia (МОТЫКА 1960a). In Alaska it was collected only in southern, oceanic localities.

No lichen substances were demonstrated in this species.

*Alectoria bicolor* (EHRH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts, lower part; Montana Creek. Sitka: Harbour Mt; Indian River Trail; Sitka National Monument. Ketchikan: Deer Mt, lower part; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Prince William Sound: Pigot Bay.

First reported from Alaska by CUMMINGS (1904). A suboceanic, boreal-temperate species.

*A. bicolor* var. *subbicolor* MOT. nom. nud. is here included in *A. tenuis* DAHL. Contains fumarprotocetraric acid.

\**Alectoria canadensis* MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Prince William Sound: Fish Bay; Pigot Bay.

Previously known from Canada (Quebec, Ontario and British Columbia). In Alaska it was collected only in southern, oceanic localities.

Contains fumarprotocetraric acid.



*Alectoria cervinula* MOT. nom. nud.

var. *cervinula*

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Shrine of St Therese. Sitka: Harbour Mt, lower part. Ketchikan: Deer Mt; Saxman Village.

var. *eciliata* MOT. nom. nud.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9.

This species is so far known only from Alaska. According to MOTYKA (1964) it seems to be most closely related to certain Asiatic species.

Contains fumarprotocetraric acid.

*Alectoria chalybeiformis* (L.) S. GRAY

ALASKA RANGE DISTRICT: Denali Highway: Mile 28.

First reported from Alaska by MACOUN (1899). A high arctic-temperate, circumpolar species.

Soralia PD+ red. Contains small amounts of fumarprotocetraric acid.

*Alectoria delicata* MOT. nom. nud.

EASTERN PACIFIC COAST DISTRICT: Sitka: Sitka National Monument.

This species is known only from the locality cited. PD-, K-. Contains small amounts of an undetermined substance giving small clusters of straight needles in GE and GAO-T.

\**Alectoria fallacina* MOT.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt.

The original description of this North American species was based on material from the Smokey Mts. I have not seen the original material, but judged by the Alaskan specimens this species is very closely related to *A. sarmentosa*, and may belong in that complex.

KC+ red. Contains usnic acid and an undetermined substance.

*Alectoria fremontii* TUCK.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt, lower part.

First reported from Alaska by CUMMINGS (1892a). A boreal-temperate species known from Fennoscandia, the Caucasus, and western North America.

No lichen substances have been demonstrated in this species.

*Alectoria glabra* MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts, lower part. Ketchikan: Deer Mt.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River; Eastchester Swamp; O'Malley Rd. Kenai Peninsula: Skilak Lake; Marathon Mt, lower part; Ninilchik; Homer. Prince William Sound; Pigot Bay.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; headwaters of Sheep Creek; Lion Peak; lower Fossil Creek.

First reported from Alaska by MOTYKA (1964). A North American species with a wide distribution in Canada and the western United States.

Contains fumarprotocetraric acid.

*Alectoria haynaldii* GYELN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts, lower part; Shrine of St Therese. Sitka: Indian River Trail; Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt, lower part; Seward. Richardson Highway: Mile 9. Prince William Sound: Fish Bay.

First reported from Alaska by MOTYKA (1964). Widely distributed in Europe. The actual range of the species is little known since it has commonly been included in *A. implexa* s. lat.

Contains barbatolic acid and an undetermined substance giving clusters of straight needles in GAO-T.

*Alectoria lanea* (EHRH.) VAIN.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Eagle River.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–28; mile 70. Mt McKinley National Park: Savage River; Polychrome Pass; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge; granite outcrop close to the limestone ridge. Steese Highway: Cleary Summit; 12-Mile Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: Anvil Peak. Baldwin Peninsula: Kotzebue.

Previously reported from Alaska by KROG (1962). A high arctic-alpine, circum-polar species.

In my opinion *A. irvingii* LLANO is only a coarse modification of *A. lanea*.

Contains fumarprotocetraric acid.

*Alectoria minuscula* (NYL. ex ARN.) DEGEL.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Rabbit Creek. Kenai Peninsula: Skilak Lake.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28. Mt McKinley National Park: Savage River; Polychrome Pass.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; Cache Mt. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

First reported from Alaska by DEGELIUS (1937). A high arctic-alpine, circum-polar species.

No lichen substances have been demonstrated in this species.

[*Alectoria nadvornikiana* GYELN.]

ALASKA RANGE DISTRICT: Mt McKinley National Park: Wonder Lake.—Coll. CROASDALE.  
(WEBER & VIERECK 1967).

The previous record of this species from Alaska by KROG (1962) was based on a misidentification. A boreal-temperate, probably circumpolar species.

*Alectoria nana* MOT. nom. nud.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

Known only from the localities cited above. According to MOTYKA (1964) this species is closely related to *A. nidulifera*, and may turn out to be a variety of that species.

Contains fumarprotocetraric acid.

*Alectoria nigricans* (ACH.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Eagle River; Bird Creek Ridge. Kenai Peninsula: Marathon Mt; Skilak Lake. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–37; mile 70. Mt McKinley National Park: Savage River; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; lower Fossil Creek. Steese Highway: Cleary Summit; 12-Mile Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek. Baldwin Peninsula: Kotzebue.

First reported from Alaska by ROTHROCK (1884). A high arctic-alpine, circumpolar species.

Some of the Alaskan specimens differed from typical plants in having a shiny, black thallus with only a few lighter pseudocyphellae. This modification has also been seen in other arctic material, sometimes determined as *A. irvingii* or *A. subdivergens*. However, it differs from these species in the colour reactions which are typical for *A. nigricans*, viz. K + yellow, PD + intensely yellow, C + red, KC + red.

Contains alectorialic acid and traces of thamnolic acid (SOLBERG 1967).

*Alectoria ochroleuca* (HOFFM.) MASS.

var. *ochroleuca*

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine. Northern Cook Inlet area: Bird Creek Ridge. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0–37. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; lower Fossil Creek; the limestone ridge; Cache Mt. Steese Highway: Cleary Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt. Baldwin Peninsula: Kotzebue.

var. *tenuior* CROMB.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine. Northern Cook Inlet area: Eagle River; Rabbit Creek.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Mt McKinley National Park: Polychrome Pass; Wonder Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

var. *sulphurea* RÄS.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

First reported from Alaska by HOOKER & ARNOTT (1841). A high arctic-alpine, circumpolar species.

According to ZOPF (1907) *A. ochroleuca* contains usnic and barbatic acids. However, ASAHINA (1936b) found usnic and diffractaic acids in this species, and no barbatic acid.

Practically all the Alaskan specimens reacted KC + yellow (usnic acid). Two specimens reacted KC + red, but the substance causing this reaction was not identified. The characteristic crystals of barbatic acid in GE were frequently observed. Other crystals in the same reagent and in GAW may be due to diffractaic acid or undetermined substances. The chemistry of this species is in need of a closer investigation.

*Alectoria pubescens* (L.) R. H. HOWE

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Sitka: Harbour Mt.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Eagle River; Rabbit Creek. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 0-37; mile 70. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Lion Peak; the limestone ridge; Cache Mt. Steese Highway: 12-Mile Summit; Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Robert's Mt.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Rainbow Creek.

First reported from Alaska by CUMMINGS (1904). A high arctic-alpine, circumpolar species.

No lichen substances have been demonstrated in this species.

*Alectoria sarmentosa* (ACH.) ACH.

var. *sarmentosa*

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Marathon Mt, lower part. Prince William Sound: Pigot Bay.

var. *alaskana* MOT. nom. nud.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Lake; Montana Creek; Douglas Skibowl; Mt Roberts, lower part. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt, lower part; Ward Lake; Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Salamatof. Richardson Highway: Mile 9. Prince William Sound: Fish Bay.

var. *brevior* MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau. Loop Rd; Shrine of St Therese. Sitka: Harbour Mt. Ketchikan: Deer Mt.

var. *gigantea* RÄS.

CENTRAL PACIFIC COAST DISTRICT: Prince William Sound: Pigot Bay.

var. *macra* MOT. nom. nud.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Mendenhall Glacier Trail.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Ingram Creek Camp ground; Seward. Richardson Highway: Mile 9.

First reported from Alaska by ROTHROCK (1868). A boreal-temperate species, widely distributed in Europe and on the east and west coasts of North America.

*A. sarmentosa* s. lat. is quite variable chemically. All the Alaskan specimens reacted KC + red, but this reaction was only in part of the material caused by the presence of alectoronic acid. Var. *alaskana* contained large amounts of alectoronic acid. This was also the case for Norwegian specimens of var. *sarmentosa*, while var. *sarmentosa* in Alaska, as understood by MOTYKA, contained barbatic acid and an undetermined substance. Barbatic acid was also found in var. *brevior* and var. *gigantea* from Alaska in connection with undetermined substances which appeared different from those of var. *sarmentosa*.

The chemistry of this species is in need of a closer investigation.

*Alectoria sepiacea* MOT. nom. nud.

EASTERN PACIFIC COAST DISTRICT: Juneau: Montana Creek; Shrine of St Therese. Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake; Seward; Marathon Mt, lower part. Richardson Highway: Mile 9. Prince William Sound: Pigot Bay.

Known only from the localities cited above.

No lichen substances could be demonstrated in this species.

\**Alectoria setacea* (ACH.) MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Shrine of St Therese.

The Alaskan specimens lacked soredia, but otherwise they corresponded to European material in every way, according to MOTYKA. This species was also present in material of *A. implexa* s. lat. from Ontario (AHTI 1964).

Contains barbatolic acid.

*Alectoria subtilis* MOT. nom. nud.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eastchester Swamp; Eagle River Valley; O'Malley Rd. Kenai Peninsula: Skilak Lake; Windy Point; Ingram Creek camp ground; Homer; Marathon Mt, lower part; Seward.

This species together with *A. norstictica* MOT. nom. nud. was cited from Alaska, with English diagnosis only, by MOTYKA (1964). He pointed out the close

relationship of the two species, and mentioned the presence or absence of pseudocyphellae as the only distinguishing feature. However, a close investigation found weak pseudocyphellae to be present in all specimens in question, and they are therefore treated here as one species.

Contains norstictic acid.

*\*Alectoria tenerrima* MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Montana Creek. Sitka: Indian River Trail. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River; Rabbit Creek Rd. Kenai Peninsula: Seward.

ALASKA RANGE DISTRICT: Richardson Highway: Mile 170.

CENTRAL YUKON RIVER DISTRICT: Alaska Highway: Mile 1450.

A North American species previously known from British Columbia, Ontario and Idaho.

No lichen substances have been demonstrated in this species.

*Alectoria tenuis* DAHL

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Montana Creek; Mt Roberts; Douglas Skibowl; Shrine of St Therese. Sitka: Harbour Mt; Indian River Trail. Ketchikan: Deer Mt; Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9. Prince William Sound: Fish Bay; Pigot Bay.

The occurrence of this species in Alaska was mentioned by MOTYKA (1964). A suboceanic species previously known from Scandinavia, Greenland, and Northwest Territories in Canada.

*A. tenuis* is in Alaska represented by two different forms, a coarse PD- form mainly found in mountain areas, and a finer PD+ form usually found in oceanic coastal areas. The former corresponds to the type of *A. tenuis* from Greenland, the latter has been observed also in Norway where it is often found growing together with *A. bicolor*. MOTYKA (1964) regarded the slender PD+ form as a variety of *A. bicolor*, viz *A. bicolor* var. *subbicolor* MOT. nom. nud. However, after studying the Alaskan material where both forms occur, and where chemical reactions do not always coincide with morphological characters, I have decided to include both forms in *A. tenuis*.

The typical form of *A. tenuis* contains no lichen substances, the slender form contains fumarprotocetraric acid.

*Alectoria vexillifera* (NYL.) STIZENB.

ALEUTIAN ISLANDS: Amchitka Island: Infantry Rd northwest of Banjo Point. - Coll. SCHACKLETTE no. 7552, (O).

First reported from Alaska by CUMMINGS (1904). A high arctic-alpine, circum-polar species.

The taxonomic position of *A. vexillifera* is somewhat uncertain. AHLNER (1948) came to the conclusion that it was best regarded as a variety of *A. sarmentosa*, but he did point out that it occupies an intermediate position between *A. sarmentosa* and *A. ochroleuca*. When I choose to treat it as a separate species, it is mainly

because it has entirely different ecological requirements than *A. sarmentosa*, being a terricolous arctic-alpine species whereas *A. sarmentosa* is a boreal-temperate, corticolous species. Both morphological and chemical characters point towards its intermediate position between *A. sarmentosa* and *A. ochroleuca*.

In herbarium material one finds that two morphologically different types of *A. vexillifera* exist, one slender, pale yellow type, with only few slightly blackened parts mainly towards the base, and one very coarse, flattened plant with the blackened parts so typical of *A. ochroleuca*. These two types are different enough that one might be tempted to regard them as different species. However, in certain plants of the coarse type clusters of slender, pale yellow branches may be formed, indicating that the two types only represent different growth phases. The specimen from the Aleutian Islands belongs to the coarse type.

Chemically the species varies somewhat. Practically all the herbarium specimens tested were KC+ red, with one or two exceptions. The substance responsible for this reaction was not determined. Barbatic acid crystals in GE were observed in some specimens. The specimen from the Aleutian Islands reacted KC+ yellow (usnic acid). In older parts of the thallus a substance was excreted giving a bright red colour with K, a phenomenon also observed in *A. sarmentosa* by RÄSÄNEN (1939).

#### *Alectoria* sp.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

This saxicolous species was with some hesitation referred to *A. intricans* (VAIN.) MOT. by MOTYKA. However, it differs from this species in producing soralia which react PD+ red. The final determination must be postponed until more material can be studied.

#### *Ramalina* ACH.

The North American species of the genus *Ramalina* have been studied by HOWE (1913b, c, 1914a, b, c, d, e, f). These publications are now largely out of date. The world monograph on *Ramalina* planned by Dr. MAGNUSSON of Gothenburg was not completed before his death, and in various herbaria there are *Ramalina* species named by MAGNUSSON which have never been published. The genus is badly in need of revision.

Several *Ramalina* species have been recorded for Alaska in older literature. *R. geniculata* was reported by ROTHROCK (1884) and CUMMINGS (1904), *R. cuspidata* by MACOUN (1899), *R. polymorpha* by MACOUN (1899), CUMMINGS (1904) and HOWE (1913c), *R. subfarinacea* by HOWE (1913c), *R. rjabuschinskii* by OXNER (1929), *R. calicaris* by HEDRICK (1936), and *R. ceruchis* by HERRE (1950b). These records need verification. It may turn out that several of the species mentioned above in reality belong to the *almquistii-scoparia* complex.

The chemistry of this genus has mainly been studied by ASAHINA (1938e, 1939a) and C. F. CULBERSON (1965a, b). Usnic acid is supposed to be present in all species, but sometimes in too small quantities to be detected by microchemical methods. The presence of this substance is therefore not repeated for each species. Chemical strains seem to be common within the genus.

*Ramalina almqvistii* VAIN.

BERING SEA DISTRICT: Seward Peninsula: Anvil Peak. Baldwin Peninsula: Kotzebue.

First reported from Alaska by DEGELIUS (1937). A predominantly low arctic, amphi-Beringian species known from western Alaska, eastern Siberia and Japan.

The variability of this species and its relationship to *R. rjabuschinskii* SAV. has been discussed by DU RIETZ (1929), OXNER (1929) and DEGELIUS (op. cit.).

There are obviously two different taxa included in *R. almqvistii* s. lat. One is small, usually sterile, without pycnids, and with a more or less translucent cortex which is dull to slightly shiny. The other is coarse, with numerous lateral apothecia and light coloured pycnids, the cortex is opaque and glossy. Superficially the latter form has much in common with certain forms of *R. siliquosa*, but differs in belonging to the fistulous *Ramalinae*. It may be identical with *R. rjabuschinskii*, but since I have not seen material of that species I am tentatively including this form in *R. almqvistii* s. lat.

The specimens listed above belong to the small, sterile form, and contain divaricatic acid, in accordance with ASAHINA's findings (ASAHINA 1938e). The fertile form may contain divaricatic acid or other substances, one of which appears to be ramalinolic acid (tested on specimens from the Aleutian Islands).

*Ramalina farinacea* (L.) ACH.

Salazinic acid strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese. Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley; Rabbit Creek Rd; O'Malley Rd. Kenai Peninsula: Cooper Creek camp ground; Skilak Lake; Homer; Ninilchik; Seward.

Acid deficient strain, PD-, K-:

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese. Sitka: Indian River Trail; Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake; Homer.

First reported from Alaska by ROTHROCK (1884). A boreal-temperate, circum-polar species.

The chemical strains containing protocetraric or hypoprotocetraric acid (C. F. CULBERSON 1965a) were not observed in the Alaskan material.

*Ramalina minuscula* (NYL.) NYL.  
(= *R. dilacerata* (HOFFM.) VAIN.)

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River; O'Malley Rd.

CENTRAL YUKON RIVER DISTRICT: Alaska Highway: Mile 1450. White Mts: Beaver Creek east of Sheep Creek; junction of Beaver Creek and Fossil Creek.

First reported from Alaska by ALMQUIST (1887). A boreal-temperate, circum-polar species.

Contains divaricatic acid.



\**Ramalina obtusata* (ARN.) BITT.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Knik River; Eagle River; Rabbit Creek Rd. Kenai Peninsula: Skilak Lake; Cooper Creek camp ground.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek.

A boreal-temperate, somewhat continental, incompletely circumpolar species. Contains obtusatic and evernic acids (ASAHINA 1937c).

*Ramalina pollinaria* (WESTR.) ACH.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Cooper Creek camp ground.

First reported from Alaska by MACOUN (1902). A boreal-temperate, circumpolar species.

Contains obtusatic and evernic acids (ASAHINA 1937c).

*Ramalina reticulata* (NOEHD.) KREMP.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese.

First reported from Alaska by STIZENBERGER (1895). A euoceanic North American west coast species known from California to south-east Alaska.

Contains small amounts of usnic acid only.

*Ramalina roesleri* (HOCHST.) NYL.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese. Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek Rd; Eagle River. Kenai Peninsula: Salamatof; Skilak Lake; Ninilchik.

First reported from Alaska by STIZENBERGER (1895) as *R. pollinariella*. A boreal-temperate, probably circumpolar species.

Four of the specimens cited above contained divaricatic acid. The content of the others was not determined with certainty, but according to ASAHINA (1938e) sekikaic acid is found in a chemical strain of this species.

*Ramalina scoparia* VAIN.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

First reported from Alaska by DEGELIUS (1937). A low arctic species restricted to the Bering Sea and Bering Strait region.

Seems to contain sekikaic and ramalinolic acids.

\**Ramalina sinensis* JATTA

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Ninilchik.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

A boreal-temperate, continental, possibly more or less circumpolar species. The Alaskan specimens contained usnic acid and a substance which may be sekikaic acid.

\**Ramalina thrausta* (ACH.) NYL.  
(= *R. crinalis* (ACH.) GYELN.)

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese. Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake.

A boreal-temperate, circumpolar species.

Contains usnic acid and possibly small amounts of evernic acid.

*Usnea* ADANS.

HOWE (1914g, 1915) has published a monograph of the *Usneaceae* of the United States and Canada. This work is now largely out of date. A world monograph of the genus *Usnea* has been published by MOTYKA (1936–38, 1947). ASAHINA, in a larger publication in 1956 and several subsequent notes, has published on the taxonomy and chemistry of the genus *Usnea* in Japan.

The Alaskan collection has been determined by MOTYKA. I have made no attempt towards an independent evaluation of the species, and no chemical tests have been performed.

*U. barbata* and *U. plicata* have been reported from Alaska, but according to HALE & CULBERSON (1966) North American records of these species are based on misidentifications. Old records of *U. florida* in Alaska need verification.

According to KLINGSTEDT (1965) chemical strains are common within the genus.

*Usnea betulina* MOT.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt; Sitka National Monument. Ketchikan: Saxman Village.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Rabbit Creek Rd. Kenai Peninsula: Skilak Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; lower Fossil Creek.

Previously reported from Alaska by MOTYKA (1936–38). A mainly boreal species, known from Fennoscandia, Siberia, British Columbia and Alaska.

\**Usnea cavernosa* TUCK.  
ssp. *sibirica* (RÄS.) MOT.

CENTRAL YUKON RIVER DISTRICT: Alaska Highway: Mile 1450.

A boreal-temperate, circumpolar species. Subspecies *sibirica* is previously known from middle Europe and Siberia.

*Usnea comosa* (ACH.) ACH.

EASTERN PACIFIC COAST DISTRICT: Sitka: Harbour Mt; Sitka National Monument.

Previously reported from Alaska (Yukon?) by MOTYKA (1936–38). A widespread boreal-temperate, circumpolar species.

*Usnea dasygoga* (ACH.) SHIRL.

EASTERN PACIFIC COAST DISTRICT: Sitka: Sitka National Monument.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

First reported from Alaska by ROTHROCK (1884). A boreal-temperate, circumpolar species.

\**Usnea fibrillosa* MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese. Sitka: Sitka National Monument. Ketchikan: Ward Lake.

CENTRAL PACIFIC COAST DISTRICT: Prince William Sound: Fish Bay.

A boreal-temperate species, known from Scandinavia, the Alps and North America.

*Usnea glabrata* (ACH.) VAIN.

EASTERN PACIFIC COAST DISTRICT: Sitka: Sitka National Monument.

First reported from Alaska by HOWARD (1958). A boreal-temperate, probably circumpolar species.

\**Usnea glabrescens* (NYL. ex VAIN.) VAIN.  
ssp. *glabrella* MOT.

EASTERN PACIFIC COAST DISTRICT: Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley.

A widely distributed, boreal-temperate, probably circumpolar species.

\**Usnea hirta* (L.) WIGG.  
ssp. *minutissima* (MERESCHK.) MOT.

EASTERN PACIFIC COAST DISTRICT: Sitka: Indian River Trail.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Wonder Lake.

A widely distributed boreal-temperate, circumpolar species. The subspecies is previously known from Europe (MOTYKA 1936-38).

\**Usnea* cf. *implexa* ACH.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

The determination should be regarded as provisional. According to MOTYKA the Alaskan specimen comes very close to *U. implexa* which is previously known from Europe.

\**Usnea lapponica* VAIN.

EASTERN PACIFIC COAST DISTRICT: Sitka: Sitka National Monument.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Puritan Creek. Kenai Peninsula: Skilak Lake.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: Alaska Highway: Mile 1450. White Mts: Beaver Creek east of Sheep Creek; lower Fossil Creek. Steese Highway: Circle Hot Springs.

A boreal-temperate species known from Fennoscandia, European USSR and North America.

[*Usnea leucosticta* VAIN.]

EASTERN PACIFIC COAST DISTRICT: Wrangell. — Coll. FOSTER. (MOTYKA 1936–38).

A boreal species known from Finland, USSR and Alaska.

*Usnea longissima* ACH.  
var. *elegantissima* MOT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd. Sitka: Indian River Trail.  
CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9.

var. *corticata* HOWE

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd; Shrine of St Therese. Sitka: Indian River Trail. Ketchikan: Deer Mt, lower part.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9. Prince William Sound: Pigot Bay.

var. *tenuis* TH. FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 9.

First reported from Alaska by TUCKERMAN (1882). *U. longissima* is a boreal-temperate, widely distributed, largely circumpolar species. According to MOTYKA (1936–38) var. *elegantissima* is known from Poland and the Carpatians, var. *corticata* from the Pacific coast of North America, and var. *tenuis* from Asia and North America.

\**Usnea monstrosa* VAIN.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese. Sitka: Sitka National Monument.

A boreal-temperate species known from middle Europe, Fennoscandia, USSR, and western North America.

\**Usnea scabiosa* MOT.

EASTERN PACIFIC COAST DISTRICT: Sitka: Sitka National Monument.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; lower Fossil Creek.

A boreal-temperate species known from a few localities on the east and west coasts of North America (MOTYKA 1936–38).

\**Usnea scabrata* NYL.  
ssp. *nylanderiana* MOT.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek; junction of Beaver Creek and Fossil Creek. Steese Highway: Cleary Summit.

A boreal-temperate, possibly circumpolar species known from Europe, Siberia and North America.

[*Usnea scholanderi* LLANO]

ARCTIC COAST DISTRICT: Lake Peters. — Coll. SCHOLANDER. (LLANO 1951).

Known from Alaska only.

\**Usnea soreidifera* (auct.) MOT.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River Valley.

A widely distributed boreal-temperate, probably circumpolar species.

The correct name of this species may be *U. fulvovireagens* (Räs.) MOT. (JAMES 1965).

*Usnea subluxa* VAIN.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

First reported from Alaska by MOTYKA (1936–38). A boreal-temperate species known from Europe and North America.

[*Usnea substerilis* MOT.]

ALASKA RANGE DISTRICT: Mt McKinley National Park: McKinley Bar. — Coll. WEBER & VIERECK, det. HERRE. (WEBER & VIERECK 1967).

*Siphula* FR.

This genus, which has its main distribution in the Southern Hemisphere, is in Alaska represented by two species.

The distribution of *S. ceratites* has been discussed by ARWIDSSON (1926).

The chemistry of the genus has been studied by BENDZ, SANTESSON & WACHTMEISTER (1965) and BRUUN (1965).

*Siphula ceratites* (WAHLENB.) FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts. Sitka: Harbour Mt. Ketchikan: Deer Mt.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour; Robert's Mt.

First reported from Alaska by NYLANDER (1888). An arctic-alpine, probably suboceanic, widely distributed species.

Contains siphulin (BRUUN 1965).

[*Siphula dactyliza* NYL.]

BERING SEA DISTRICT: St Lawrence Island. — Coll. ALMQUIST. (NYLANDER 1885a). St Paul Island. — Coll. HULTÉN. (DEGELIUS 1937).

Known only from islands of the Bering Sea.

*Thamnolia* ACH. ex SCHAER.

The taxonomy and chemistry of the genus *Thamnolia* has been discussed by ASAHINA (1937a), MOTYKA (1960b), SATÔ (1962), and W. L. CULBERSON (1963).

*Thamnomia vermicularis* (Sw.) Ach. ex Schaer.

Baeomycic acid strain:

EASTERN PACIFIC COAST DISTRICT: Juneau: M<sup>r</sup> Roberts.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Puritan Creek. Kenai Peninsula: Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28–37. Mt McKinley National Park: Savage River; Wonder Lake. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge. Steese Highway: Eagle Summit.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village; Nash Harbour; Robert's Mt; the lake where the geese don't fly.

BERING STRAIT DISTRICT: Seward Peninsula: King Mt; Anvil Peak; Rainbow Creek.

Thamnolic acid strain:

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Headwaters of Rabbit Creek; Bird Creek Ridge. Kenai Peninsula: Skilak Lake; Marathon Mt. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 37. Richardson Highway: Darling Creek; base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Beaver Creek east of Sheep Creek. Steese Highway: Cleary Summit; Eagle Summit.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by ROTHROCK (1868). A high arctic-alpine, circumpolar species.

W. L. CULBERSON (1963) delimited *T. vermicularis* to represent only the thamnolic acid strain, while he referred the baeomycic acid strain (containing baeomycic and squamatic acids) to *T. subuliformis* (EHRH.) CULB. (= *T. subvermicularis* ASAH.)

Both chemical strains appear to have a circumpolar distribution, although the mixture ratio may vary (SATÔ 1962). In Alaska the areas of the two strains overlap almost completely.

The chemical strains were separated by means of fluorescence analysis in ultraviolet light (STEINER 1960).

PHYSICIACEAE

*Physcia* (SCHREB.) DC.

The genus *Physcia* has been treated monographically for North America by THOMSON (1963). POELT (1965), in a study of the taxonomy of the family *Physciaceae*, has separated the genus *Physconia* from the genus *Physcia*.

CUMMINGS (1904) reported *P. adglutinata* (= *P. elaeina*) from Alaska. This record needs verification.

No thorough chemical study has been made of this genus.

\**Physcia adscendens* (FR.) OLIV.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Knik River. Kenai Peninsula: Ninilchik.

A boreal-temperate, circumpolar species.

*Physcia aiipolia* (EHRH.) HAMPE

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Granite Basin.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Northern Cook Inlet area: Knik River; Rabbit Creek Rd; headwaters of Rabbit Creek. Kenai Peninsula: Hidden Lake; Skilak Lake; Ninilchik; Seward.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

BERING SEA DISTRICT: Nunivak Island: Mekoryuk Village.

First reported from Alaska by CUMMINGS (1904). A boreal-temperate, circumpolar species.

*Physcia caesia* (HOFFM.) HAMPE

EASTERN PACIFIC COAST DISTRICT: Juneau: Mt Roberts; Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Headwaters of Rabbit Creek. Kenai Peninsula: Skilak Lake; Seward.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28; mile 70. Mt McKinley National Park: Toklat; Polychrome Pass. Richardson Highway: Base of Rainbow Mts.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lion Peak; the limestone ridge.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

First reported from Alaska by CUMMINGS (1904). A high arctic-temperate, circumpolar species.

Contains atranorin and zeorin.

*Physcia ciliata* (HOFFM.) DU RIETZ

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

First reported from Alaska by ROTHROCK (1868). A boreal-temperate, circumpolar species.

[*Physcia constipata* (NYL.) NORRL. & NYL.]

ALEUTIAN ISLANDS: Umnak Island: Nikolski. — Coll. HULTÉN. (DEGELIUS 1937).

ALASKA RANGE DISTRICT: Mt McKinley National Park: Mt Eielson. — Coll. WEBER & VIERECK. (THOMSON 1963).

An arctic-boreal, widely distributed species on calcareous soil.

*Physcia dubia* (HOFFM.) LETT.

EASTERN PACIFIC COAST DISTRICT: Juneau: Mendenhall Glacier Trail; Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Independence Mine; Willow Rd between Little Susitna Lodge and Independence Mine; Bald Mt Ridge. Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Seward. Richardson Highway: Mile 24.

ALASKA RANGE DISTRICT: Denali Highway: Mile 28–37.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

BERING STRAIT DISTRICT: Seward Peninsula: Rainbow Creek.

First reported from Alaska by NYLANDER (1888). A high arctic-temperate, circumpolar species.

*Physcia endococcinea* (KÖRB.) TH. FR.

CENTRAL PACIFIC COAST DISTRICT: Richardson Highway: Mile 24.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek. Steese Highway: Circle Hot Springs.

First reported from Alaska by THOMSON (1963). An arctic-alpine, possibly circumpolar species.

*Physcia intermedia* VAIN.

ARCTIC COAST DISTRICT: Northern foothills of Brooks Range, Umiat. — Coll. HULTÉN. Det. THOMSON. (KROG 1962). (S).

An arctic-temperate, possibly circumpolar species.

*Physcia orbicularis* (NECK.) POETSCH

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Puritan Creek. Northern Cook Inlet area: Knik River. Kenai Peninsula: Skilak Lake; Ninilchik.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by WEBER & VIERECK (1967). A boreal-temperate, circumpolar species.

\**Physcia phaea* (TUCK.) THOMS.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Granite Creek Ridge. Richardson Highway: Mile 45.

An arctic-temperate, circumpolar species.

*Physcia sciastra* (ACH.) DU RIETZ

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek; Puritan Creek. Kenai Peninsula: Hidden Lake; Skilak Lake. Richardson Highway: Mile 45.

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge.

First reported from Alaska by ALMQUIST (1887). An arctic-temperate, circumpolar species.

*Physcia stellaris* (L.) NYL.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Knik River; Bird Creek Ridge.

First reported from Alaska by MACOUN (1902). A boreal-temperate, circumpolar species.

*Physcia tenella* (SCOP.) DC.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese.

First reported from Alaska by Llano (1951). A boreal-temperate, widely distributed, probably circumpolar species.



*Physcia teretiuscula* (ACH.) LYNGE

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

Previously reported from Alaska by LLANO (1951). A low arctic-temperate species which according to THOMSON (1963) is widely distributed in Europe and rare in northern and western North America.

*Physconia* POELT

The genus *Physconia* has been separated from the genus *Physcia* by POELT (1965). A further discussion of the genus with a key to the species of the old world has been given by POELT (1966).

CUMMINGS (1904) and WEBER & VIERECK (1967) reported *P. pulverulenta* from Alaska. These records need verification.

The Alaskan material (with the exception of *P. muscigena*) has been revised by POELT.

As pointed out by POELT (1966) the main distinguishing feature of *P. detersa* and *P. enteroxantha* is a difference in the K reaction of the medulla. If this is the only discrepancy the two species should be treated as chemical strains rather than separate taxa. However, POELT also indicated differences in certain morphological characters, which might justify the separation of the two species.

The chemistry of this genus has not been studied.

\**Physconia detersa* (NYL.) POELT

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Mabel Mine; Buffalo Mine. Kenai Peninsula: Ninilchik; Hidden Lake.

ALASKA RANGE DISTRICT: Denali Highway: Mile 70. Mt McKinley National Park: Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; Fossil Creek.

A boreal-temperate, probably circumpolar species.

\**Physconia enteroxantha* (NYL.) POELT

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake; Hidden Lake; Ninilchik; Seward.

A boreal-temperate species, possibly a chemical strain of *P. detersa*.

\**Physconia farrea* (ACH.) POELT

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake; Hidden Lake.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

A boreal-temperate, possibly circumpolar species.

*Physconia muscigena* (ACH.) POELT

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Bald Mt Ridge; Mabel Mine; Independence Mine. Northern Cook Inlet area: Eagle River; Bird Creek Ridge. Kenai Peninsula: Hidden Lake; Skilak Lake; Granite Creek Ridge; Marathon Mt.

ALASKA RANGE DISTRICT: Denali Highway: Mile 70. Mt McKinley National Park: Toklat River; Savage River.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge; Fossil Creek.

BERING STRAIT DISTRICT: Baldwin Peninsula: Kotzebue.

First reported from Alaska by NYLANDER (1888). An arctic-temperate, circumpolar species.

*Anaptychia* KÖRB.

A world monograph of the genus *Anaptychia* s. lat. (including *Heterodermia*) has been published by KUROKAWA (1962). The genus has been divided into two separate genera, *Anaptychia* and *Heterodermia*, by POELT (1965).

\**Anaptychia kaspica* GYELN.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

A boreal-temperate species, possibly with an incomplete circumpolar distribution. The Alaskan records of *A. ciliaris* by HOWARD (1963) and WEBER & VIERECK (1967) may represent this species. According to KUROKAWA (1962) *A. ciliaris* appears to be restricted to Europe.

No lichen substances were demonstrated in this species.

\**Anaptychia palmulata* (MICHX.) VAIN.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Little Susitna River south of Fishhook Creek. Kenai Peninsula: Skilak Lake.

ALASKA RANGE DISTRICT: Mt McKinley National Park: Toklat River.

A boreal-temperate species known from Asia and North America. The North American distribution of this species has been mapped by HALE (1956), showing a wide range in the eastern United States. According to KUROKAWA (1962) *A. palmulata* has a typical disjunct distribution in eastern Asia and eastern North America. The Alaskan records represent an interesting addition to its range.

No lichen substances were demonstrated in the Alaskan specimens, but according to W. L. CULBERSON (1966) atranorin was found in one third of the specimens tested by him.

*Heterodermia* TREV.

In a study of the taxonomy of the family *Physciaceae* POELT (1965) separated the genus *Heterodermia* from the genus *Anaptychia* mainly on differences in spore morphology. Based on a study of the genera *Heterodermia* and *Anaptychia* in North and South Carolina W. L. CULBERSON (1966) found that this view was strongly supported by chemical properties and general habit. The members of the genus *Heterodermia* were included in the world monograph of the genus *Anaptychia* (s. lat.) by KUROKAWA (1962).

The Alaskan material has been revised by KUROKAWA.

\**Heterodermia galactophylla* (TUCK.) CULB.

CENTRAL PACIFIC COAST DISTRICT: Talkeetna Mts: Buffalo Mine; Little Susitna River south of Fishhook Creek. Northern Cook Inlet area: Knik River. Kenai Peninsula: Skilak Lake; Cooper Creek camp ground; Ninilchik; Salamatof.

ALASKA RANGE DISTRICT: Richardson Highway: Darling Creek.

CENTRAL YUKON RIVER DISTRICT: White Mts: Junction of Beaver Creek and Fossil Creek.

A boreal-tropical species previously known from Canada, the eastern United States, Central and South America and the West Indies.

Contains atranorin and zeorin.

\**Heterodermia tremulans* (MÜLL. ARG.) CULB.

(= *Anaptychia pseudospeciosa* KUROK. var.  
*tremulans* (MÜLL. ARG.) KUROK.)

EASTERN PACIFIC COAST DISTRICT: Juneau: Loop Rd.

CENTRAL PACIFIC COAST DISTRICT: Kenai Peninsula: Skilak Lake; Seward. Richardson Highway: Mile 9.

A temperate-tropical species known from Asia and North, Central, and South America. The record of *Anaptychia pseudospeciosa* from southeast Alaska by McCULLOUGH (1965) may represent this species.

Contains atranorin and zeorin.

TELOSCHISTACEAE

*Xanthoria* (FR.) TH. FR.

*Xanthoria parietina* has been reported from Kotzebue Sound by BABINGTON (1851). This record seems improbable.

*X. elegans* and *X. sorediata* have often been referred to the genus *Caloplaca*

Chemically this genus is little studied. The orange colour is in all species supposed to be caused by the presence of parietin.

*Xanthoria candelaria* (L.) TH. FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Eagle River; Bird Creek Ridge. Kenai Peninsula: Skilak Lake.

CENTRAL YUKON RIVER DISTRICT: White Mts: Lower Fossil Creek.

BERING SEA DISTRICT: Nunivak Island: Nash Harbour.

First reported from Alaska by MACOUN (1899). A high arctic-temperate, circumpolar species.

*Xanthoria elegans* (LINK) TH. FR.

EASTERN PACIFIC COAST DISTRICT: Juneau: Shrine of St Therese.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Bird Creek Ridge. Kenai Peninsula: Seward.

CENTRAL YUKON RIVER DISTRICT: White Mts: Headwaters of Sheep Creek; the limestone ridge.

First reported from Alaska by ROTHROCK (1867). A high arctic-temperate, circumpolar species.

[*Xanthoria polycarpa* (EHRH.) OLIV.]

EASTERN PACIFIC COAST DISTRICT: Heceta Island. — Coll. FOSTER. (HERRE 1919). Muir Glacier. — Coll. TRELEASE. (CUMMINGS 1904).

WESTERN PACIFIC COAST DISTRICT: Alaska Peninsula: Kukak Bay. — Coll. COVILLE & KEARNEY. (CUMMINGS 1904).

ALASKA RANGE DISTRICT: Kantishna: Quigley Hill. — Coll. CROASDALE. (HOWARD 1963).

CENTRAL YUKON RIVER DISTRICT: Wiseman. — Coll. CROASDALE. (HOWARD 1963).

BERING SEA DISTRICT: St Paul Island. — Coll. TRELEASE. (CUMMINGS 1904).

. A boreal-temperate, circumpolar species.

\**Xanthoria sorediata* (VAIN.) POELT

CENTRAL YUKON RIVER DISTRICT: White Mts: The limestone ridge.

A high arctic-temperate, largely alpine, circumpolar species.

\**Xanthoria subramulosa* RÄS.

CENTRAL PACIFIC COAST DISTRICT: Northern Cook Inlet area: Knik River.

The Alaskan specimens were better developed than the original Finnish material, with laciniae up to 2 mm long, and to 0.3 mm wide. Rhizinae and short marginal fibrillae were present. Otherwise the specimens are in agreement with RÄSÄNEN's diagnosis (RÄSÄNEN 1931).

Previously known only from Finland.

### Plant geographical discussion

In the preceding chapter 348 species of Alaskan macrolichens have been enumerated, of which 22 species were based on literature records. This is a surprisingly high number for a region where few lichenologists have been at work and where large areas still remain unexplored. For comparison it can be mentioned that Fennoscandia, an extremely well explored region with old lichenological traditions, is known to have about 375 species of macrolichens in the sense applied in this study. While species new to the Fennoscandian macrolichen flora are few and far between, little more than one summer's field work resulted in more than 60 species new to Alaska. The two areas are comparable in size, are situated on the west coasts of their respective continents at about the same geographical latitudes, and both comprise oceanic as well as continental areas. The main difference is that Fennoscandia was heavily glaciated during the Pleistocene while large parts of Alaska remained unglaciated (cf. Fig. 1, p. 16), conditions which greatly influenced the composition of the floras of the two areas. More intensive

investigations will probably show that the number of Alaskan macrolichens considerably exceeds that of Fennoscandia.

In the following discussion all literature records are excluded. Because of uncertain taxonomical position or nomenclatural confusion I have decided to omit the following taxa: The 16 species in the genus *Usnea*, several species in the genus *Alectoria*, mainly in the *jubata-implexa* group, viz. *A. americana*, *A. canadensis*, *A. cervinula*, *A. delicata*, *A. fallacina*, *A. glabra*, *A. haynaldii*, *A. nana*, *A. sepiacea*, *A. setacea*, *A. subtilis* and *A. tennerrima*, the insufficiently known and poorly understood species *Cladonia japonica*, *Parmelia hypopsila*, *P. isidioclada*, *Polychidium umhausense*, *Stereocaulon spathuliferum* (often regarded as a variety of *S. botryosum*), and the two new species *Parmelia denalii* and *P. olivaceoides* (with as yet unknown areas).

Of the 348 species enumerated for Alaska this leaves 291 species as a basis for discussion.

An attempt to discuss the distribution of the lichen flora in northern regions meets with one main obstacle. Large areas in Siberia and central Canada are as yet practically unexplored from a lichenological point of view, and important regional studies on lichens in the USSR are not readily accessible to the western botanist unfamiliar with the Russian language. However, when information on the Alaskan lichen flora now can be added to what is already known from northern Europe, Greenland and eastern Canada, certain opinions on the distribution patterns of northern lichens may be formed.

Contrary to popular belief lichens possess distinct distribution areas comparable with those of vascular plants, and are well suited for phytogeographical studies. Also, they are slow growers, with slow evolutionary processes. Some relic species, believed to be remnants of old Tertiary floras, have remained undifferentiated in their highly disjunct areas up to the present time, giving valuable information on their past distribution.

Paleontological records of vascular plants indicate a fairly uniform Mesozoic flora. During the Tertiary epoch regional differences developed in response to a change towards a cooler and drier climate. Based on leaf-margin analyses of fossil floras WOLFE & HOPKINS (1967) have formed a theory on the climatic changes of the Tertiary in Alaska and the north-western United States. A slow climatic cooling was indicated from the late Cretaceous into the later part of the Paleocene. However, subtropical climates existed as far north as latitude 62° in Alaska, and no climate cooler than warm temperate was recorded. A warming trend persisted through the Eocene and culminated in the early Oligocene. A rapid cooling was indicated for middle Oligocene time, representing one of the major climatic deteriorations of the Tertiary. During this period latitudinal zonation of the vegetation became pronounced for the first time in the Paleocene. The older Paleocene floras were relatively uniform in floristic composition from Oregon to Alaska. Late Oligocene floras recorded a new warming, but the vegetation zonation still persisted, although not as pronounced as in the middle Oligocene. The warming continued into the middle Miocene. An abrupt cooling was recorded at the end of the Miocene, and slow cooling probably continued throughout the Pliocene and the Pleistocene.

Superimposed on the already differentiated floras of the Tertiary came the effects of the extreme climatological changes of the Pleistocene epoch. The major glaciations undoubtedly led to the extinction of many species. Others were destroyed in the glaciated regions, but survived in areas outside the continental ice-sheets, mainly south of the ice or in the large ice-free areas believed to have existed in eastern Siberia, north-western North America and the Canadian Archipelago.

A subject of dispute has been the existence of lesser ice-free refuges in the coastal areas of otherwise heavily glaciated regions. DAHL (1946) argued for the existence of ice-free refuges in regions where high mountains are situated near the border of a deep ocean (the coastal mountain type), and in regions with a strongly continental climate with low precipitation (the tundra type). Geological evidence which might indicate the existence of ice-free refuges of the coastal mountain type on the Norwegian west coast has been provided by DAHL (1954, 1955).

According to HEUSSER (1960) geological, botanical and palynological evidence strongly indicate the existence of unglaciated areas along the North American west coast in Vancouver Island, the Queen Charlotte Islands, probably in parts of the Alexander Archipelago, at places between Icy Point and the mouth of the Copper River, in Prince William Sound and on the Kenai Peninsula.

Phytogeographical observations indicate ice-free refuges in the British Isles, Iceland, northern Spitsbergen, parts of Bjørnøya, the north coast of the Kola Peninsula, parts of New Foundland, Labrador, Gaspé, Nova Scotia and Greenland. In most of these cases the botanical indications have not been supported by geological evidence.

Those opposed to the existence of such ice-free refuges have mainly resorted to the theory of long distance dispersal to explain the peculiar disjunct areas of many plants. This assumption seems acceptable in some cases, but as a rule fails to provide a logical explanation for a variety of distribution types.

### THE CIRCUMPOLAR ELEMENT'

What is commonly termed the northern circumpolar element consists of species with a wide distribution in the Northern Hemisphere. The species are scattered throughout their range, but very few have a continuous area. Disruptions are bound to occur due to local variations in temperature, precipitation, altitude, exposure and substrata. Especially in the boreal and temperate zones the influence of man greatly affects the natural vegetation.

With large unexplored regions still in existence there is really no proof of a species having a more or less continuous circumpolar range. It is commonly assumed that a species has a circumpolar range when it has a wide distribution in a well explored region, and its presence is indicated by scattered records in poorly investigated areas. This reasoning is fairly safe in most cases, but may occasionally be misleading. As an example can be mentioned *Cetraria ericetorum*, an arctic-alpine lichen which is quite widespread in northern Europe. A few records from Siberia, Alaska and northern Canada indicate that this is a circumpolar species. In reality the species is very rare in Siberia and North America, where

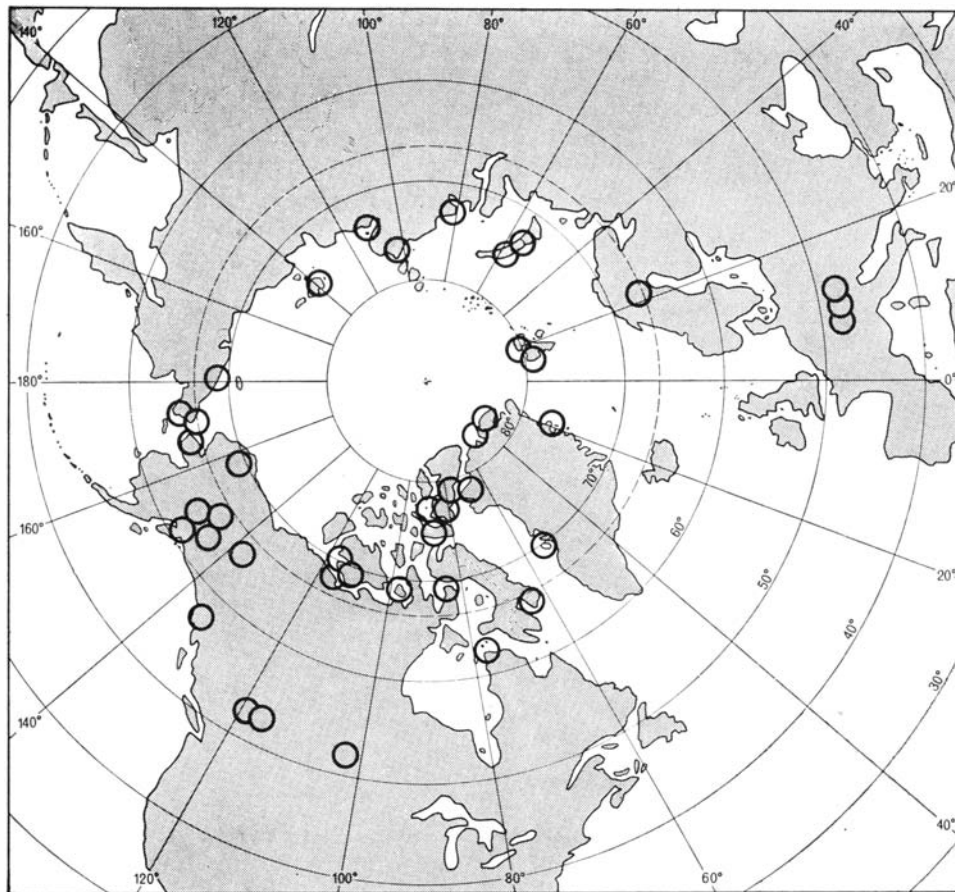


Fig. 31. Distribution of *Dactylina ramulosa* (Hook.) Tuck.

its place seems to be taken by a closely related species, *C. laevigata*. This may represent a case of vicariant species, apparently much less common among lichens than among vascular plants.

Based on the distribution maps given by RASSADINA (1950) *C. sepincola* and *C. chlorophylla* are practically absent from eastern Asia. I do not know if this is due to lack of investigation in the areas where these species would be expected to occur. The same applies to *Peltigera scutata*, which in North America has its main distribution range on the west coast, and which is only reported from a few localities in the east.

The circumpolar element is generally regarded as very old. HULTÉN (1962) expressed the opinion that the circumpolar plants possessed a circumpolar range already before the Pleistocene epoch. This theory is supported also by the distribution patterns of many circumpolar lichens. Climatological and geological changes of the past must account for the fact that many species with a fairly continuous northern range also occupy widely disjunct areas farther to the south. The distribution of *Dactylina ramulosa* (Fig. 31) indicates close correspondence with the extent of the Pleistocene glaciations, allowing for ice-free refuges in arctic coastal areas.

The circumpolar element can be divided into a northern and a southern group. The northern circumpolar group includes the arctic-alpine species and the northern ubiquitous species. This group is in Alaska represented by the following 132 species:

<i>Alectoria chalybeiformis</i>	<i>Cladonia scabriuscula</i>	<i>Peltigera leucophlebia</i>
<i>A. lanea</i>	<i>C. squamosa</i>	<i>P. malacea</i>
<i>A. minuscula</i>	<i>C. subfurcata</i>	<i>P. praetextata</i>
<i>A. nigricans</i>	<i>C. subulata</i>	<i>P. rufescens</i>
<i>A. ochroleuca</i>	<i>C. turgida</i>	<i>P. scabrosa</i>
<i>A. pubescens</i>	<i>C. uncialis</i>	<i>P. spuria</i>
<i>A. vexillifera</i>	<i>C. verticillata</i>	<i>P. venosa</i>
<i>Cetraria commixta</i>	<i>Collema glebulentum</i>	<i>Physcia caesia</i>
<i>C. cucullata</i>	<i>C. tenax</i>	<i>P. dubia</i>
<i>C. delisei</i>	<i>C. undulatum</i>	<i>P. endococcinea</i>
<i>C. hepatizon</i>	<i>Cornicularia aculeata</i>	<i>P. intermedia</i>
<i>C. islandica</i>	<i>C. divergens</i>	<i>P. phaea</i>
<i>C. nigricans</i>	<i>C. muricata</i>	<i>P. sciastra</i>
<i>C. nivalis</i>	<i>Dactylina arctica</i>	<i>P. teretiuscula</i>
<i>C. sepincola?</i>	<i>D. ramulosa</i>	<i>Physconia muscigena</i>
<i>C. tilesii</i>	<i>Dermatocarpon intestiniforme</i>	<i>Solorina bispora</i>
<i>Cladonia acuminata</i>	<i>D. miniatum</i>	<i>S. crocea</i>
<i>C. alpestris</i>	<i>Hypogymnia austerodes</i>	<i>S. octospora</i>
<i>C. amaurocraea</i>	<i>H. bitteri</i>	<i>S. saccata</i>
<i>C. arbuscula</i>	<i>H. intestiniformis</i>	<i>Sphaerophorus fragilis</i>
<i>C. bellidiflora</i>	<i>H. physodes</i>	<i>S. globosus</i>
<i>C. botrytes</i>	<i>H. subobscura</i>	<i>Stereocaulon alpinum</i>
<i>C. cariosa</i>	<i>Leptogium lichenoides</i>	<i>S. arcticum</i>
<i>C. carneola</i>	<i>L. saturninum</i>	<i>S. botryosum</i>
<i>C. cenotea</i>	<i>Lobaria linita</i>	<i>S. glareosum</i>
<i>C. coccifera</i>	<i>Nephroma arcticum</i>	<i>S. paschale</i>
<i>C. coniocraea</i>	<i>N. expallidum</i>	<i>S. rivulorum</i>
<i>C. cornuta</i>	<i>Parmelia alpicola</i>	<i>S. tomentosum</i>
<i>C. crispata</i>	<i>P. centrifuga</i>	<i>S. vesuvianum</i>
<i>C. cyanipes</i>	<i>P. disjuncta</i>	<i>Thamnolia vermicularis</i>
<i>C. deformis</i>	<i>P. fraudans</i>	<i>Umbilicaria arctica</i>
<i>C. degenerans</i>	<i>P. incurva</i>	<i>U. cinereorufescens</i>
<i>C. digitata</i>	<i>P. infumata</i>	<i>U. cylindrica</i>
<i>C. ecmocyna</i>	<i>P. omphalodes</i>	<i>U. deusta</i>
<i>C. fimbriata</i>	<i>P. panniformis</i>	<i>U. hyperborea</i>
<i>C. furcata</i>	<i>P. saxatilis</i>	<i>U. lyngei</i>
<i>C. gracilis</i>	<i>P. sorediosa</i>	<i>U. polyphylla</i>
<i>C. lepidota</i>	<i>P. stygia</i>	<i>U. proboscidea</i>
<i>C. macrophylla</i>	<i>P. sulcata</i>	<i>U. torrefacta</i>
<i>C. macrophyllodes</i>	<i>Parmeliopsis ambigua</i>	<i>U. vellea</i>
<i>C. mitis</i>	<i>P. hyperopta</i>	<i>U. virginis</i>
<i>C. pocillum</i>	<i>Peltigera aphthosa</i>	<i>Xanthoria candelaria</i>
<i>C. pyxidata</i>	<i>P. canina</i>	<i>X. elegans</i>
<i>C. rangiferina</i>	<i>P. lepidophora</i>	<i>X. sorediata</i>

Many of the northern circumpolar species are found in the boreal zone together with species not met with in the Arctic. Others may have a strictly arctic distribution, or may be found to the south only in the mountain ranges.



The major part of the species included in the southern circumpolar group have their main range of distribution in the boreal forest belt. They are often referred to as circumboreal species. This group is in Alaska represented by the following 45 species:

<i>Cetraria chlorophylla?</i>	<i>Lobaria scrobiculata</i>	<i>Physcia adscendens</i>
<i>C. pinastri</i>	<i>Nephroma bellum</i>	<i>P. aipolia</i>
<i>Cetrelia cetrarioides</i>	<i>N. parile</i>	<i>P. ciliata</i>
<i>Cladonia bacillaris</i>	<i>N. resupinatum</i>	<i>P. orbicularis</i>
<i>C. bacilliformis</i>	<i>Parmelia exasperatula</i>	<i>P. stellaris</i>
<i>C. flabelliformis</i>	<i>P. glabratula</i>	<i>P. tenella</i>
<i>C. macilenta</i>	<i>P. olivacea</i>	<i>Physconia detersa</i>
<i>C. nemoxyina</i>	<i>P. septentrionalis</i>	<i>P. enteroxantha</i>
<i>C. symphyrcarpia</i>	<i>P. subaurifera</i>	<i>P. farrea</i>
<i>Collema furfuraceum</i>	<i>P. taractica</i>	<i>Ramalina farinacea</i>
<i>Dermatocarpon fluviatile</i>	<i>Parmeliopsis aleurites</i>	<i>R. minuscula</i>
<i>Hypogymnia tubulosa</i>	<i>Peltigera horizontalis</i>	<i>R. pollinaria</i>
<i>H. vittata</i>	<i>P. membranacea</i>	<i>R. roesleri</i>
<i>Leptogium sinuatum</i>	<i>P. polydactyla</i>	<i>R. thrausta</i>
<i>Lobaria pulmonaria</i>	<i>P. scutata?</i>	<i>Stereocaulon grande?</i>

Altogether the circumpolar element accounts for 61% of the Alaskan macrolichens.

#### DISJUNCT SPECIES FOUND BOTH IN EURASIA AND NORTH AMERICA

Since minor disjunctions will always occur in the range of a circumpolar species, the circumpolar element gradually merges into a disjunct element where the discontinuity of the ranges appears more pronounced. Species now believed to have a circumpolar distribution may on closer investigation prove to be absent in large areas, while others may give the impression of having a disjunct distribution because their ranges are incompletely known.

As examples of species with incompletely circumpolar distributions can be mentioned *Alectoria sarmentosa*, *Anaptychia kaspica*, *Collema rysssoleum* and *Platismatia glauca*, which are widely distributed but appear to be lacking in eastern Asia, *Cetraria ericetorum*, which has a wide amphi-Atlantic distribution but is rare in the amphi-Beringian region, *Cetraria ciliaris* with gaps in Scandinavia and interior North America, and *Nephroma helveticum*, which is widely distributed in North America and perhaps in Asia, but has a more restricted range in Europe.

Some species have a distribution which is restricted by ecological factors. This applies to the oceanic species which are found on the east and west coasts of both continents:

<i>Alectoria bicolor</i>	<i>Leptogium cyanescens</i>	<i>Pseudocyphellaria crocata</i>
<i>Cladonia tenuis</i>	<i>Nephroma laevigatum</i>	<i>Stereocaulon coniophyllum</i>
<i>Collema subfurvum</i>	<i>Parmelia arnoldii</i>	<i>Sticta fuliginosa</i>

These species have special requirements regarding temperature and moisture. They may be the remnants of a flora with a wider distribution in a period when

the climatic conditions were more uniform around the globe than they are today. The same may apply to other oceanic species which for some reason are absent from the east coast of one of the continents, for example *Leptogium palmatum* and *Sphaerophorus melanocarpus*, absent in eastern North America, and *Platismatia norvegica*, absent in eastern Asia.

A less distinct group includes species which may have an incompletely circumpolar distribution because they avoid the coastal regions. The following species may possibly belong here:

<i>Cornicularia odontella</i> ?	<i>Ramalina obtusata</i>
<i>Evernia mesomorpha</i>	<i>R. sinensis</i> ?
<i>Parmelia substygia</i>	

Other species have disjunct distributions which appear to be determined by historical rather than ecological factors. This seems to be the case with a few Eurasiatic lichens extending into western North America. Of these *Nephroma isidiosum* and *Pilophorus robustus* have a northern range and *Parmelia sinuosa*, *Stereocaulon subcoralloides* and *Sticta wrightii* have a southern range. These species appear to have relic characters, and may be remnants of Tertiary circumboreal or circumpolar floras. The northern species may have survived the Pleistocene glaciations in northern coastal or tundra refuges, the southern species appear to have survived mainly south of the glaciated areas.

Based on present knowledge the following species appear to be strongly disjunctive, with limited areas of distribution:

<i>Alectoria fremontii</i>	<i>Dermatocarpon rivulorum</i>	<i>Umbilicaria krascheninnikovii</i>
<i>A. tenuis</i>	<i>Lobaria hallii</i>	<i>U. rigida</i>
<i>Cavernularia hultenii</i>	<i>Siphula ceratites</i>	<i>Xanthoria subramulosa</i>
<i>Collema multipartitum</i>	<i>Stereocaulon symphycheilum</i>	
<i>Dermatocarpon arnoldianum</i>	<i>Sticta limbata</i>	

This is an inhomogeneous group, containing arctic-alpine plants as well as lowland plants, and both oceanic and continental species, probably with different historical backgrounds. However, the relic character of most of these species indicates a high age.

## THE ASIATIC-NORTH AMERICAN ELEMENT

In the Alaskan lichen flora there is a strong element of species found in Asia and North America but not in Europe. This element can be divided into three major groups: The amphi-Beringian group, the amphi-Pacific group and a group of Asiatic species extending into western North America.

The amphi-Beringian group is largely composed of arctic-alpine plants which may have more or less corresponding areas on both sides of the Bering Sea and Bering Strait. Some of them may be restricted to a very limited area, for instance the islands of the Bering Strait, others may be found in a region from the Lena

River in the west to the Mackenzie River in the east, while some species may have a wide range of distribution from the Ural Mts to Davies Strait. A few species may also have scattered localities outside their main area in European USSR or in west Greenland. Several species radiate southwards on both sides of the northern Pacific Ocean. Since large areas between the Ural Mts and Davies Strait are lichenologically unexplored, we do not know with certainty whether the species found in this region have fairly continuous areas, or if they occur in limited disjunct areas.

The present knowledge of lichen distribution does not permit a detailed discussion of the different distribution types comparable to HULTÉN's classical studies of the distribution of the amphi-Beringian vascular plants (HULTÉN 1937, 1963). However, a few general traits seem to emerge from the limited data at hand.

The following species have distribution areas mainly centring around the northern Pacific Ocean and the Bering Sea. Some of them are distinctly oceanic species, others occur farther inland as well. They may roughly correspond to the element termed southern Beringian radiants by HULTÉN:

<i>Cetraria kamczatica</i>	<i>Cladonia pseudocansii</i>	<i>Ramalina scoparia</i>
<i>Cladonia graciliformis</i>	<i>C. pseudostellata</i>	<i>Stereocaulon intermedium</i>
<i>C. granulans</i>	<i>Leptogium parculum</i>	<i>S. saviczii</i>
<i>C. metacorallifera</i>	<i>Pilophorus vegae</i>	<i>S. sterile</i>
<i>C. nipponica</i>	<i>Ramalina almquistii</i>	<i>S. wrightii</i>

These species probably had a wider range of distribution before the Pleistocene epoch. They may have survived the Pleistocene glaciations in the southern part of the Beringian region. Some of them occupy very restricted or widely disjunct areas, and give the impression of having spread very little in postglacial time.

The following species may be termed northern Beringian radiants:

<i>Asahinea chrysantha</i>	<i>Cetraria richardsonii</i>	<i>Evernia perfragilis</i>
<i>A. scholanderi</i>	<i>C. sibirica</i>	<i>Parmelia almquistii</i>
<i>Cetraria andrejevii</i>	<i>C. simmonsii</i>	<i>P. separata</i>
<i>C. elenkinii</i>	<i>Cladonia alaskana</i>	<i>Sticta arctica</i>
<i>C. laevigata</i>	<i>C. pseudorangiformis</i>	<i>Umbilicaria caroliniana</i>

Except for *Sticta arctica*, which has been found in south east Alaska, none of the species mentioned above have been found south of the central Pacific coast, and half of them have not been found south of the Alaska Range. They generally seem to have a continental type of distribution. It seems reasonable to believe that they survived the Pleistocene glaciations in ice-free refuges of the tundra type. Even if such refuges existed also in the Atlantic region, the oceanic influence in interglacial or postglacial times may have become too pronounced for the species to persist in that area.

A few of these species have a wide range of distribution and seem to have spread effectively into the glaciated areas during postglacial time. Others have more or less limited areas of distribution, obviously related to the extent of the Pleistocene glaciations. Some species may have been able to spread considerably during the last interglacial period, and their present areas are determined by the extent of the last glaciation, together with the spreading capacity of the species

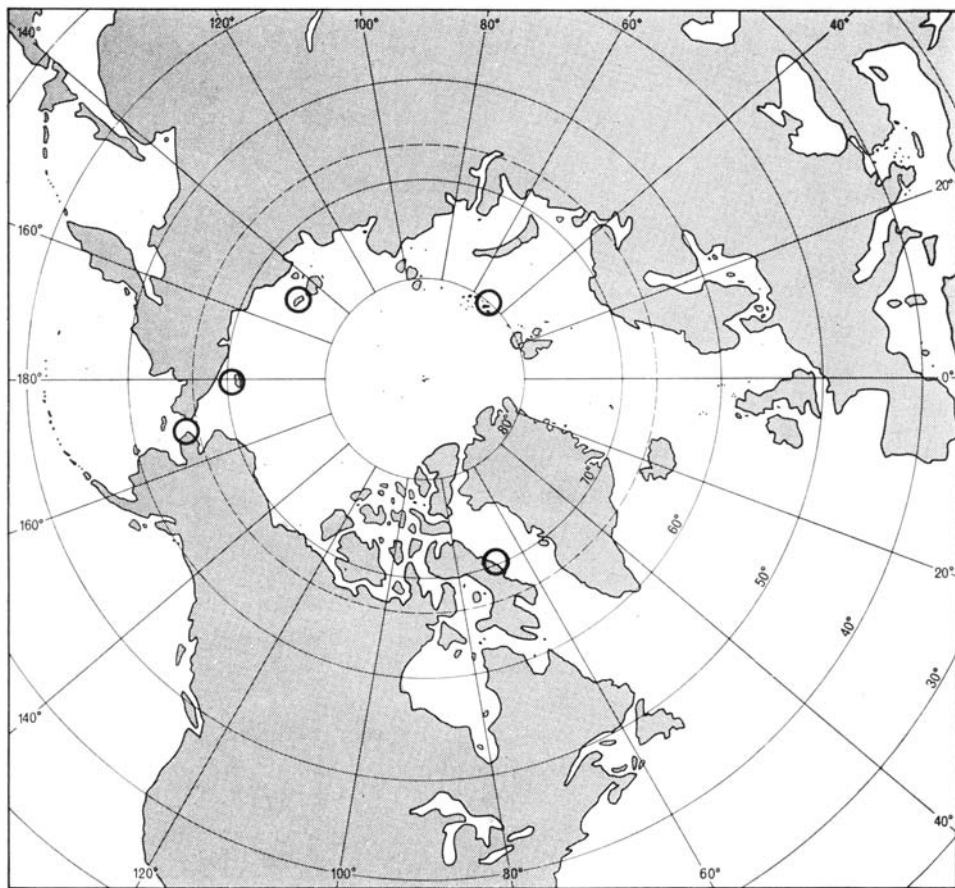


Fig. 32. Distribution of *Cetraria elenkinii* KROG.

in postglacial time. Other species appear as widely disjunct relic plants which may not have spread appreciably from the areas where they survived the maximum glaciation (cf. *Cetraria elenkinii*, Fig. 32). A detailed study of the distribution of such species may give important information on the location of possible ice-free refuges on the Siberian and Canadian coasts.

*Umbilicaria caroliniana* has a range that deviates somewhat from the areas of the regular amphi-Beringian species. It has a predominantly southern range in Siberia and Japan, suggesting survival south of the glaciated areas. In North America it has a disjunct distribution in northern Alaska and in the high mountains of North Carolina. It seems probable that this species occurs also on the west side of the Bering Strait. In that case we would have an amphi-Beringian parallel to the disjunct northern and southern distribution ranges demonstrated for many of the circumpolar plants.

The amphi-Pacific element consists mainly of temperate species confined to the Pacific coasts but absent in the Bering Sea and Bering Strait region. There

are not enough data available on their distribution to indicate whether they have an equal representation on both sides of the Pacific Ocean:

<i>Hypogymnia enteromorpha</i>	<i>Pilophorus nigricaulis</i>
<i>H. pseudophysodes</i>	<i>Stereocaulon myriocarpum</i>
<i>Pilophorus acicularis</i>	<i>S. octomerum</i>
<i>P. clavatus</i>	

These species are believed to be remnants of an already differentiated amphipacific Tertiary flora, which had its range disrupted in the northern Pacific region when it migrated southwards in response to the cooling climate of the Tertiary, perhaps in the middle Oligocene or the late Miocene. They may have survived the Pleistocene glaciations on the American coast either south of the glaciated areas, or in coastal refuges in British Columbia and Alaska.

The following species have a wide distribution in Asia and North America:

<i>Anaptychia palmulata</i>	<i>Sticta weigeli</i>
<i>Heterodermia tremulans</i>	<i>Umbilicaria pensylvanica</i>
<i>Leptogium hirsutum</i>	

These species apparently have a history different from that of the species restricted to the Pacific coasts. They do not form a homogeneous group, and may represent several different elements. Some of them occur also in the Southern Hemisphere.

The third group, the Asiatic species extending into western North America, is in Alaska represented by three species, *Evernia esorediosa*, *Lobaria isidiosa*, and *L. retigera*. These species may have their centres of distribution in Asia, and the Alaskan localities appear to be remnants of an earlier, wider distribution.

## THE AMERICAN ELEMENT

Some of the lichens found in Alaska are not known from either Europe or Asia. The major part of these species is restricted to the north-western coast of North America:

<i>Cavernularia lophyrea</i>	<i>Hypogymnia imshaugii</i>	<i>Pseudocyphellaria anomala</i>
<i>Cetraria subalpina</i>	<i>Leptogium californicum</i>	<i>P. anthraspis</i>
<i>Cetrelia alaskana</i>	<i>Lobaria oregana</i>	<i>Ramalina reticulata</i>
<i>Cladonia pacifica</i>	<i>Parmelia multispora</i>	<i>Umbilicaria angulata</i>
<i>C. transcendens</i>	<i>P. subolivacea</i>	<i>U. scholanderi</i>
<i>Dermatocarpon reticulatum</i>	<i>Platismatia herrei</i>	
<i>Hypogymnia duplicata</i>	<i>P. lacunosa</i>	

The North American west coast element of lichens was noticed and discussed already by HERRE (1910). Most of the species mentioned above are oceanic lichens known from south-east Alaska to Washington, Oregon or California, a few are alpine lichens known from the coastal mountains, and one species has a very limited range in north-western Alaska. Their different ecological requirements

indicate that the element is not a homogeneous one, and that the species may have different origins.

When the temperate amphi-Pacific flora was disrupted in the Bering Sea region during the climatic deterioration of the Tertiary it resulted in isolation of the oceanic flora of the North American west coast, already climatically isolated from the rest of the continent. Evolution along slightly different lines may have led to the development of different taxa on both sides of the Pacific Ocean. This seems especially to apply to the genus *Hypogymnia*, which is very rich in species in the Pacific region and contains Asiatic and American taxa which are obviously closely related but differ on the specific or infra-specific level. The unstable and complex chemical properties might possibly be an added indication of a genus in relatively rapid evolution.

Other North American west coast species may have belonged to an old circum-boreal flora, restricted by the changing climate of the Tertiary to an area with a favourable climate where they have been able to persist. Some species which at present have a disjunct distribution, for example *Cavernularia hultenii* and *Lobaria hallii*, are widely distributed on the North American west coast. Both of these species have another well established area of distribution in central Scandinavia. Outside of these areas *C. hultenii* is known from the British Isles and New Foundland, *L. hallii* from south-west Greenland and a few localities in arctic Alaska where it is scarce, poorly developed and apparently on its very limit of existence. The Scandinavian area of the two species is very small compared to the North American west coast area. It is easy to imagine that slightly less hardy species might have become extinct in Scandinavia and other less favourable areas during the Pleistocene, and one would be left with species endemic to the west coast of North America. This may give a clue to the past history of some of the North American west coast endemic species.

A much smaller group of lichens is widely distributed in North America; some of the species have a distribution range in the Southern Hemisphere as well:

<i>Cladonia boryi</i>	<i>Heterodermia galactophylla</i>
<i>C. farinacea</i>	<i>Parmelia trabeculata</i> ?
<i>C. multiformis</i>	<i>Stereocaulon subalbicans</i>

Among these species *Parmelia trabeculata* occupies an isolated position from a distributional point of view. According to AHTI (1966a) it appears to be a strictly North American species with a transcontinental boreal range. This seems to be a very unlikely explanation. As it is little more than a year since the species was described I can only regard its area as insufficiently known.

The other 5 species mentioned above may partly belong to elements dating back to a time when geological and climatological conditions permitted migration between the continents of the Southern and Northern Hemispheres.

With uncertain taxonomical position, but appearing to belong to the bipolar element:

<i>Pseudocyphellaria mallota</i> coll.	<i>Hypogymnia lugubris</i>
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The determination of these two species may be tentative, but there seems to be no doubt that they have close affinities to species of the Southern Hemisphere.

A bipolar element is not at all uncommon among lichens, cf. DU RIETZ (1926, 1940) and LYNGE (1941). It has been suggested that conditions during the Pleistocene would be favourable for migration of arctic-alpine species along the mountain ranges of the South and North American continents. However, as already pointed out by DU RIETZ (op. cit.) the early Tertiary or even the late Mesozoic seems a more plausible time for a wide distribution of a flora element which is now known only as a strongly disjunctive bipolar element. The high age of the bipolar element is indicated by the fact that the correspondence, even for lichens, is more often found on the genus level than on the species level.

### THE DISTRIBUTION PATTERNS OF CHEMICAL STRAINS

Many lichen species are represented by two or more chemical strains throughout their distribution areas. Others may display chemical strains with different distribution areas, usually one strain with a wide area and one strain with a restricted range within that area. Our present knowledge of the distribution of chemical strains is very limited, but based on available data the chemical strains seem to follow the same distribution patterns as lichens in general.

#### Northern circumpolar strain:

*Parmelia stygia* (acid deficient strain)

#### Oceanic strains:

*Cladonia squamosa* (thamnolic acid strain)

*Sphaerophorus globosus* (PD+ strain)

#### Northern Beringian radiant strains:

*Cladonia alpestris* (psoromic acid strain)

*Dactylina arctica* (monoacetylprotocetraric acid strain)

*Umbilicaria proboscidea* (norstictic acid strain)

#### Southern Beringian radiant strains:

*Cladonia graciliformis* (thamnolic acid strain)

*Parmelia stygia* (caperatic acid strain)

*Stereocaulon tomentosum* (lobaric acid strain)

#### North American west coast strain:

*Lobaria scrobiculata* (PD- strain)

The present observations indicate that the distribution ranges of chemical strains are determined by historical factors rather than by environmental factors. The detailed knowledge of the distribution areas of chemical strains may therefore be of a certain phytogeographical interest.

### Summary and conclusions

Based on personally studied material 326 species of macrolichens have been reported for Alaska.

The following new taxa have been described:

<i>Cetraria elenkinii</i>	<i>Hypogymnia lugubris</i> ssp. <i>beringiana</i>
<i>C. simmonsii</i>	<i>Parmelia denalii</i>
<i>C. simmonsii</i> var. <i>intermedia</i>	<i>P. olivaceoides</i>
<i>C. simmonsii</i> var. <i>lobulata</i>	<i>Pilophorus vegae</i>
<i>Hypogymnia imshaugii</i>	<i>Umbilicaria angulata</i> var. <i>compacta</i>
<i>H. imshaugii</i> var. <i>inactiva</i>	

The following new combinations have been made:

<i>Hypogymnia lugubris</i> (PERS.) KROG	<i>Stereocaulon sterile</i> (SAV.) LAMB
<i>Hypogymnia pseudophysodes</i> (ASAH.) KROG	<i>Umbilicaria scholanderi</i> (LLANO) KROG

Fourteen species are new to North America, and an additional 44 species are new to Alaska.

The Alaskan macrolichen flora has the following composition:

Circumpolar species	61 %
Disjunct species occurring both in Eurasia and North America	14 %
Asiatic-North American species	15 %
North American west species	7 %
North American species, in part with affinity to the flora of the Southern Hemisphere	3 %

The surprisingly weak representation of a general North American flora element in the Alaskan lichen flora can be explained by the geological and climatological changes during the Tertiary and the Quaternary, which worked towards a separation of the phytogeographical provinces of the east and west coasts of the continent.

The close affinity of the Asiatic and North American lichen floras can be explained by the climatic conditions of the Tertiary, by the presence of the Bering land bridge prior to the Pleistocene and during parts of the Pleistocene epoch, and by the existence of large unglaciated areas on both sides of this land bridge during the Pleistocene.

The distribution patterns of the northern lichen flora give strong indirect evidence in favour of ice-free refuges in heavily glaciated areas during the Pleistocene, as already indicated by distributional data for vascular plants and many animals.

The distribution of chemical strains may be historically determined, and their areas may be of phytogeographical interest.

The major part of the Alaskan macrolichen flora is composed of species belonging to flora-elements dating back to the Tertiary or even further. The following old elements can be traced:

A circumpolar element possibly differentiated in late Tertiary time, now repre-



sented by the present day circumpolar element and by glacial relics in northern regions.

A continuous amphi-Pacific element, probably disrupted in middle Oligocene or late Miocene time, which is now represented by the disjunct amphi-Pacific element.

A Tertiary circumboreal element, which can be traced through relic species with a southern range, appearing in Europe, Asia and North America, and through disjunctive species with ecologically determined areas.

A late Mesozoic or early Tertiary element with a wide distribution both in the Southern and Northern Hemispheres, now represented by the bipolar element.

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## Index to genera and species

- Agyrophora* 84  
  *scholanderi* 84  
*Alectoria* **134**, 155  
  *americana* **134**, 155  
  *bicolor* **134**, 140, 159  
  *canadensis* **134**, 155  
  *cervinula* **135**, 155  
  *chalybeiformis* **135**, 158  
  *delicata* **135**, 155  
  *fallacina* **135**, 155  
  *fremontii* **135**, 160  
  *glabra* **135**, 155  
  *haynaldii* **136**, 155  
  *implexa* 134, 136, 139  
  *intricans* 141  
  *irvingii* 134, 136, 137  
  *jubata* 134  
  *lanea* 134, **136**, 158  
  *minuscula* **136**, 158  
  *nadvornikiana* **137**  
  *nana* **137**, 155  
  *nidulifera* 137  
  *nigricans* 103, **137**, 158  
  *norstictica* 134, 139  
  *ochroleuca* 25, **137**, 138, 140,  
    141, 158  
  *pubescens* **138**, 158  
  *sarmentosa* 25, 135, **138**, 139,  
    140, 141, 159  
  *sepiacea* **139**, 155  
  *setacea* **139**, 155  
  *subdivergens* 137  
  *subtilis* 134, **139**, 155  
  *tenerrima* **140**, 155  
  *tenuis* 134, **140**, 160  
  *vexillifera* **140**, 141, 158  
*Anaptychia* **152**  
  *ciliaris* 152  
  *kaspica* **152**, 159  
  *palmulata* **152**, 163  
  *pseudospeciosa* 153  
*Asahinea* **113**, 116  
  *chrysantha* **114**, 116, 161  
  *scholanderi* **114**, 161  
*Caloplaca* 153  
*Cavernularia* **93**  
  *hultenii* **93**, 160, 164  
  *lophyrea* **93**, 163  
*Cetraria* 113, 114, 115, **116**,  
  129, 131  
  *andrejevii* **116**, 117, 125, 127,  
    128, 161  
  *aurescens* 116  
  *chlorophylla* **117**, 157, 159  
  *ciliaris* **117**, 118, 159  
  *commixta* **118**, 158  
  *cucullata* **118**, 158  
  *delisei* **118**, 119, 158  
  *elenkinii* **119**, 120, 161, 162,  
    166  
  *ericetorum* **120**, 156, 159  
  *halei* 118  
  *hepatizon* **120**, 158  
  *hiascens* 119  
  *islandica* 25, **121**, 158  
  *juniperina* 116  
  *kamczatica* **121**, 161  
  *laevigata* **122**, 157, 161  
  *nigricans* **122**, 158  
  *nigricascens* 119, 120  
  *nivalis* **122**, 158  
  *orbata* 118  
  *pinastri* **123**, 159  
  *polyschiza* 121  
  *rhizophora* 120  
  *richardsonii* **123**, 161  
  *saviczii* 114  
  *scholanderi* 114  
  *sepincola* **123**, 157, 158  
  *septentrionalis* 114  
  *sibirica* **123**, 124, 161  
  *simmonsii* 116, **124**, 125, 126,  
    127, 128, 161, 166  
  *subalpina* **127**, 163  
  *tilesii* **129**, 158  
  *tuckermanii* 115  
*Cetrelia* **114**, 116  
  *alaskana* **114**, 115, 163  
  *cetrarioides* **115**, 159  
  *chicitae* 115  
  *olivetorum* 115  
*Cladonia* **58**  
  *aberrans* 59  
  *acuminata* **58**, 158  
  *alaskana* **58**, 59, 161  
  *alpestris* **59**, 158, 165  
  *alpicola* 70  
  *amaurocraea* **59**, 60, 158  
  *arbuscula* **60**, 158  
  *bacillaris* **60**, 159  
  *bacilliformis* **60**, 159  
  *bellidiflora* **61**, 158  
  *boryi* 60, **61**, 164  
  *botrytes* **61**, 158  
  *calycantha* 79  
  *capitata* 58  
  *carassensis* 69, 70  
  *cariosa* **61**, 158  
  *carneola* **62**, 158  
  *cenotea* **62**, 158  
  *chlorophaea* 75  
  *coccifera* **62**, 63, 158  
  *coniocraea* **63**, 158  
  *cornucopioides* 63  
  *cornuta* **64**, 158  
  *crispata* **64**, 70, 158  
  *cyanipes* **65**, 158  
  *decorticata* **65**  
  *deformis* **65**, 158  
  *degenerans* **66**, 158  
  *delessertii* 77  
  *digitata* **66**, 158  
  *ecmocyna* **66**, 158  
  *farinacea* **66**, 164  
  *fibula* 72  
  *fimbriata* **67**, 75, 158  
  *flabelliformis* **67**, 159  
  *foliacea* 58  
  *furcata* **67**, 76, 158  
  *graciliformis* **67**, 161, 165  
  *gracilis* **67**, 158  
  *granulans* **68**, 161

- Cladonia* (cont.)  
*japonica* 68, 69, 155  
*lacunosa* 61  
*lepidota* 70, 158  
*macilenta* 70, 159  
*macrophylla* 70, 158  
*macrophyllodes* 71, 158  
*macroptera* 76  
*metacorallifera* 71, 161  
*mitis* 71, 158  
*mitrula* 58  
*multiformis* 72, 164  
*nemoxyna* 72, 159  
*nipponica* 60, 61, 72, 161  
*ochrochlora* 72  
*pacifica* 73, 163  
*paradoxa* 58  
*pocillum* 73, 158  
*pseudevansii* 73, 161  
*pseudohondoensis* 69  
*pseudomacilenta* 73  
*pseudorangiformis* 73, 161  
*pseudostellata* 60, 74, 161  
*pyxidata* 74, 75, 158  
*rangiferina* 75, 158  
*rei* 72  
*scabriuscula* 76, 158  
*squamosa* 76, 158, 165  
*subfurcata* 77, 158  
*subsquamosa* 76  
*subulata* 77, 158  
*symphyrcarpia* 77, 159  
*tenuis* 77, 159  
*transcendens* 70, 77, 163  
*turgida* 78, 158  
*uncialis* 59, 60, 74, 78, 158  
*verticillata* 78, 79, 158
- Collema* 32  
*ceraniscum* 32  
*crispum* 32  
*furfuraceum* 32, 159  
*glebulentum* 32, 158  
*multipartitum* 32, 160  
*polycarpon* 32  
*rysssoleum* 32, 159  
*subfurvum* 33, 159  
*tenax* 33, 158  
*tuniforme* 33  
*undulatum* 33, 158
- Cornicularia* 129  
*aculeata* 129, 130, 158  
*divergens* 129, 158  
*muricata* 129, 130, 158  
*normoerica* 130  
*odontella* 129, 130, 160
- Dactylina* 131  
*arctica* 131, 158, 165  
*endochrysea* 131  
*madreporiformis* 131  
*ramulosa* 131, 132, 157, 158
- Dermatocarpon* 29  
*arnoldianum* 29, 160  
*fluviale* 29, 159  
*intestiniforme* 29, 158  
*miniatum* 29, 158  
*reticulatum* 29, 163  
*rivulorum* 30, 160
- Evernia* 131, 132  
*divaricata* 132  
*esorediosa* 132, 163  
*mesomorpha* 133, 160  
*perfragilis* 133, 161  
*prunastri* 133  
*thamnodes* 133
- Gyrophora* 84  
*anthracina* 84  
*rugifera* 85
- Heterodermia* 152  
*galactophylla* 153, 164  
*tremulans* 153, 163
- Hypogymnia* 93, 102, 131, 164  
*austerodes* 93, 158  
*bitteri* 94, 158  
*duplicata* 94, 95, 96, 163  
*enteromorpha* 25, 94, 95, 96, 97, 102, 163  
*imshaugii* 96, 98, 163, 166  
*intestiniformis* 99, 158  
*lugubris* 99, 100, 101, 164, 166  
*physodes* 100, 158  
*pseudophysodes* 101, 163, 166  
*subobscura* 102, 158  
*tubulosa* 102, 159  
*vittata* 94, 102, 159
- Imbricaria* 99  
*lugubris* 99  
*physodes* 99
- Leptogium* 33  
*californicum* 34, 163  
*crenatum* 33  
*cyanescens* 33, 34, 159  
*hirsutum* 34, 163  
*lichenoides* 34, 158  
*minutissimum* 34  
*myochroum* 35  
*palmatum* 34, 160  
*parculum* 34, 161  
*saturninum* 34, 158  
*scotinum* 35
- sinuatum* 35, 159  
*tenuissimum* 33  
*tremelloides* 33
- Letharia* 133  
*californica* 133  
*vulpina* 133
- Lobaria* 35  
*garowaglii* 38  
*hallii* 35, 160, 164  
*isidiosa* 36, 37, 163  
*linita* 35, 36, 38, 39, 158  
*oregana* 38, 163  
*pulmonaria* 38, 159  
*quercizans* 35  
*retigera* 38, 39, 163  
*scrobiculata* 39, 40, 159, 165
- Nephroma* 47  
*arcticum* 47, 158  
*bellum* 47, 159  
*expallidum* 47, 158  
*helveticum* 48, 159  
*isidiosum* 48, 160  
*laevigatum* 47, 49, 159  
*lusitanicum* 49  
*parile* 48, 49, 159  
*resupinatum* 49, 159
- Parmelia* 93, 102, 114  
*almquistii* 103, 161  
*alpicola* 103, 158  
*arnoldii* 103, 104, 159  
*aspera* 105  
*birulae* 111  
*centrifuga* 105, 158  
*ceptrarioides* 115  
*ceptrata* 103  
*conspersa* 107  
*denalii* 105, 106, 155, 166  
*disjuncta* 105, 106, 111, 158  
*duplicata* 94, 95  
*elongata* 94  
*exasperatula* 106, 159  
*fraudans* 106, 158  
*fuliginosa* 107  
*glabra* 107  
*glabratula* 107, 159  
*hypopsila* 107, 155  
*incurva* 107, 158  
*infumata* 107, 158  
*isidioclada* 108, 155  
*lugubris* 99, 101  
*margaritata* 104  
*multispora* 109, 113, 163  
*olivacea* 109, 111, 159  
*olivaceoides* 109, 155, 166  
*omphalodes* 109, 158

- Parmelia* (cont.)  
*panniformis* **110**, 158  
*perforata* 103  
*perlata* 103  
*physodes* 99  
*pseudophysodes* 101, 102  
*saxatilis* **110**, 158  
*saximontana* 112  
*separata* **111**, 161  
*septentrionalis* 109, **111**, 159  
*sinuosa* **111**, 160  
*sorediosa* **111**, 158  
*stenophylla* 113  
*stygia* **111**, 112, 158, 165  
*subaurifera* **112**, 159  
*subolivacea* **112**, 163  
*substygia* 105, **112**, 160  
*sulcata* 107, 108, **113**, 158  
*taractica* 107, **113**, 159  
*trabeculata* 109, **113**, 164  
*vittata* 94
- Parmeliopsis* **92**  
*aleurites* **92**, 159  
*ambigua* **92**, 158  
*hyperopta* **92**, 158  
*placorodia* 92
- Peltigera* **49**  
*aphthosa* **50**, 51, 158  
*canina* **50**, 158  
*horizontalis* **50**, 51, 159  
*lepidophora* **51**, 158  
*leucophlebia* **50**, **51**, 158  
*malacea* **52**, 158  
*membranacea* **52**, 159  
*nigripunctata* 51  
*polydactyla* 51, **52**, 159  
*praetextata* **52**, 158  
*rufescens* **53**, 158  
*scabrosa* **53**, 158  
*scutata* **53**, 157, 159  
*spuria* **54**, 158  
*venosa* **54**, 158
- Physcia* **148**  
*adglutinata* 148  
*adscendens* **148**, 159  
*aipolia* **149**, 159  
*caesia* **149**, 158  
*ciliata* **149**, 159  
*constipata* **149**  
*dubia* **149**, 158  
*elaena* 148  
*endococcinea* **150**, 158  
*intermedia* **150**, 158  
*orbicularis* **150**, 159  
*phaea* **150**, 158
- sciastra* **150**, 158  
*stellaris* **150**, 159  
*tenella* **150**, 159  
*teretiuscula* **150**, 158
- Physconia* 148, **151**  
*detersa* **151**, 159  
*enteroxantha* **151**, 159  
*farrea* **151**, 159  
*muscigena* **151**, 158  
*pulverulenta* 151
- Pilophorus* **54**  
*acicularis* **54**, 55, 56, 163  
*cereolus* **54**, 55, 57  
*clavatus* **55**, 163  
*hallii* 55  
*japonicum* 55  
*nigricaulis* **55**, 57, 163  
*robustus* **56**, 160  
*vegae* **56**, 57, 161, 166
- Platismatia* **115**, 116  
*glauca* **115**, 159  
*herrei* **115**, 163  
*lacunosa* **115**, 163  
*norvegica* **116**, 160
- Platysma* 119  
*nigricascens* 119
- Polychidium* **45**  
*umhausense* **45**, 155
- Pseudocyphellaria* **40**  
*anomala* **40**, 41, 163  
*anthraspis* **40**, 41, 163  
*crocata* **41**, 159  
*mallota* **41**, 164
- Pycnothelia* **57**  
*papillaria* **57**
- Ramalina* 131, **141**  
*almquistii* **142**, 161  
*calicaris* 141  
*ceruchis* 141  
*crinalis* 144  
*cuspidata* 141  
*dilacerata* 142  
*farinacea* **142**, 159  
*geniculata* 141  
*minuscula* **142**, 159  
*obtusata* **143**, 160  
*pollinaria* **143**, 159  
*pollinariella* **143**  
*polymorpha* 141  
*reticulata* **143**, 163  
*rjabuschinskii* 141, 142  
*roesleri* **143**, 159  
*scoparia* **143**, 161  
*siliquosa* 142  
*sinensis* **143**, 160
- subfarinacea* 141  
*thrausta* **144**, 159
- Siphula* **147**  
*ceratites* **147**, 160  
*dactyliza* **147**
- Solorina* **45**  
*bispora* **45**, 46, 158  
*crocea* 45, **46**, 158  
*octospora* **46**, 158  
*saccata* **46**, 158  
*spongiosa* **46**
- Sphaerophorus* **30**  
*fragilis* **30**, 158  
*globosus* **31**, 158, 165  
*melanocarpus* **31**, 160  
*tuckermanii* 30, 31  
*turfaceus* 30, 31
- Stereocaulon* **86**  
*albicans* 86  
*alpinum* **86**, 158  
*apocalypticum* 91  
*arcticum* **86**, 158  
*botryosum* **87**, 155, 158  
*coniophyllum* **87**, 159  
*dactylophyllum* 86  
*evolutum* 89  
*glareosum* **87**, 158  
*grande* **87**, 159  
*intermedium* **88**, 161  
*myriocarpum* **88**, 163  
*octomerum* **88**, 163  
*paschale* **88**, 158  
*rivulorum* **89**, 158  
*saviczii* **89**, 161  
*spathuliferum* **89**, 155  
*sterile* **89**, 161, 166  
*subalbicans* 86, **90**, 164  
*subcoralloides* 89, **90**, 160  
*symphycheilum* **90**, 160  
*tomentosum* 88, **90**, 158, 165  
*vesuvianum* 86, **91**, 158  
*wrightii* **91**, 161
- Sticta* 38, 40, **41**  
*arctica* 41, **42**, 43, 161  
*fuliginosa* **43**, 159  
*limbata* 40, **43**, 45, 160  
*miyoshiana* 45  
*weigeli* **45**, 163  
*wrightii* 44, **45**, 160  
*yasudae* 45
- Thamnia* **147**  
*subuliformis* 148  
*subvermicularis* 148  
*vermicularis* **148**, 158

*Umbilicaria* **79**

*angulata* **79**, 80, 163, 166  
*arctica* **80**, 158  
*caroliniana* **81**, 161, 162  
*cinereorufescens* **81**, 158  
*cylindrica* **81**, 158  
*decussata* **81**  
*deusta* **82**, 158  
*hirsuta* **82**  
*hyperborea* **82**, 158  
*krascheninnikovii* **82**, 160  
*lambii* 80  
*lyngei* **82**, 158  
*mammulata* **83**  
*muehlenbergii* **83**  
*papulosa* 79  
*pensylvanica* **83**, 163  
*phaea* 79  
*polyphylla* **83**, 158  
*polyrrhiza* 79

*proboscidea* **83**, 158, 165  
*pulvinaria* 80  
*rigida* **84**, 160  
*scholanderi* **84**, 163, 166  
*torrefacta* **84**, 85, 158  
*vellea* 81, **85**, 158  
*virginis* **85**, 158  
*Usnea* **144**, 155  
*barbata* 144  
*betulina* **144**  
*cavernosa* **144**  
*comosa* **144**  
*dasyypoga* **145**  
*fibrillosa* **145**  
*florida* 144  
*fulvovireagens* 147  
*glabrata* **145**  
*glabrescens* **145**  
*hirta* **145**  
*implexa* **145**

*lapponica* **145**  
*leucosticta* **146**  
*longissima* **146**  
*monstruosa* **146**  
*plicata* 144  
*scabiosa* **146**  
*scabrata* **146**  
*scholanderi* **147**  
*sorediifera* **147**  
*sublaxa* **147**  
*substerilis* **147**  
*Xanthoria* **153**  
*candelaria* **153**, 158  
*elegans* **153**, 158  
*parietina* 153  
*polycarpa* **154**  
*sorediata* 153, **154**, 158  
*subramulosa* **154**, 160

ERRATA

P. 22, Fig. 4 — see Fig. 5, p. 23

» 23, » 5 — » » 4, » 22





A.W. BRØGGERS BOKTRYKKERI A/S - OSLO