Lichens of Mt. O-akan and Its Adjacent Areas,
Hokkaido, Japan

Yoshihito Ohmura\textsuperscript{1} and Hiroyuki Kashiwadani\textsuperscript{2}

\textsuperscript{1}Department of Biological Sciences, Graduate School of Science,
The University of Tokyo, Hongo 7–3–1, Bunkyo-ku, Tokyo, 113 Japan
\textsuperscript{2}Department of Botany, National Science Museum, 4–1–1 Amakubo,
Tsukuba, Ibaraki, 305 Japan

Abstract In Mt. O-akan and its adjacent areas, 220 taxa of lichens are recognized as the results of taxonomic study of 950 specimens collected there. Most of them are common in other areas of Hokkaido and on various mountains especially of northern Japan. \textit{Japewia subaurifera} and \textit{Ochrolechia androgyna} are newly recorded for Japan and \textit{Anisomeridium nyssaegenum}, \textit{Calicium trabilellum}, \textit{Chaenotheca brunneola}, \textit{Chaenothecopsis pusilla}, \textit{Hypocenomyces friesii}, \textit{Lecanora imshaugii}, \textit{Lecidea brachyspora}, \textit{Ochrolechia akagiensis}, \textit{Pannaria conoplea}, \textit{Parmeliella grisea}, and \textit{Placynthiella uliginosa} are new to Hokkaido. In addition, \textit{Cladonia norikurensis}, \textit{Glossodium japonicum}, \textit{Lethariella togashii}, and \textit{Tuckermannopsis microphylla} have been known to be rare or endemic to Japan and are also found in the present area.

Key words: lichen, taxonomy, Mt. O-akan, Hokkaido, Japan.

Mt. O-akan (1371 m), a volcanic mountain, is located within the Akan National Park in eastern Hokkaido. Lake Akan, famous for the habitat of \textit{Cladophora aegagropila}, is situated west of it and Mt. Me-akan (1449 m), an active volcano, is located further west of it. The present area includes also Mts. Akan-fuji (1476 m), Fuppushi (1226 m), Furebetsu*(1098 m), and Hakuto-san (950 m). The fumaroles or \textit{Bokke} in Japanese are distributed scatteringly in the present area (e.g. Akankohan, Mt. Hakuto-san and Mt. Furebetsu).

According to Igarashi (1986), the vegetation of the present area is composed of upper subalpine forest (\textit{Pinus pumila} forest), upper broad-leaved forest (\textit{Betula ermanii} forest), coniferous forest, mixed forest, and lower broad-leaved forest. The \textit{Pinus pumila} forest is located at 1000 to 1371 m on Mt. O-akan, at 1000 to 1200 m on Mt. Me-akan and at 900 to 1200 m on Mt. Akan-fuji. Although the \textit{Betula ermanii} forest usually exist just below the \textit{Pinus pumila} forest in Hokkaido, it is found neither on Mt. Me-akan nor on Mt. Akan-fuji. Mountainside of Mt. O-akan (800–1000 m) is covered with the \textit{Betula ermanii} forest. The NW base of Mt. Me-akan (710–920 m) and hilly areas around Mt. Akan-fuji and Mt. Fuppushi are covered with the \textit{Picea glehnii} forests. The base of Mt. O-akan (430–
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800 m) is covered with mixed forest dominated by *Abies sachalinensis*. Hills around Lake Akan (420–500 m) are covered with broad-leaved forests composed of *Acer mono* var. *glabrum*, *Alnus hirsuta*, *Fraxinus mandshurica* var. *japonica*, *Picea jezoensis* and so on.

Lichens of the present area have been very poorly explored and only a few of them were recorded in scattered papers by Japanese lichenologists such as Nakanishi (1966), Oshio (1968), Kashiwadani (1975), Inoue (1982), etc.

**Materials and Methods**

In September 1995, the authors carried out a field survey of lichens on Mt. O-akan and its adjacent areas. Collection of lichens was made along mountain trails and road crossing in this area and in forests around Lake Akan. The collection sites of the present study are shown in Fig. 1. Total 950 specimens of lichens were collected through the survey and the results of the taxonomic studies are presented in this paper. All the specimens examined are kept in the herbarium of the National Science Museum, Tokyo (TNS). Most specimens of *Acarospora*, *Arthonia*, *Arthothelium*, *Bacidia*, *Bactrospora*, *Biatora*, *Buellia*, *Caloplaea*, *Catillaria*, *Clistostomum*, *Diploschistes*, *Lepraria*, *Leproloma*, *Leptotrema*, *Micarea*, *Opegrapha*, *Rinodina*, *Schismatoma*, and *Thelotrema*, however, are excluded from the present study as further taxonomic revisions are required for identification of Japanese species of these genera. Chemistry of specimens was studied by means of thin layer chromatography (Culberson & Johnson, 1982) or micro-crystal tests if necessary. Only the solvent B system (Hexan : methyl tert.-butyl ether : formic acid = 140 : 72 : 18) was employed for TLC tests. Sections of apothecia and thalli for anatomical studies were cut by hand-razor and mounted in GAW or lactophenol cotton-blue solution. The ascus structure was examined using by Lugol’s iodine solution (Purvis et al., 1992).

**Results**

**Explanation of collection sites**

The abbreviations of collection sites are listed below. Numbers in parenthesis after the abbreviations show the numbers in Fig. 1.

**Akan-fuji I (1):** Prov. Kushiro: 2.8 km SE of Mt. Akan-fuji, Akan-cho, Akan-gun (43°21’N, 144°03’E). *Abies sachalinensis* dominated forest mixed with *Sorbus commixta* and *Alnus hirsuta*. Elevation about 780 m. September 4, 1995.


(43°24′N, 144°05′E). *Picea glehnii* dominated forest mixed with *Abies sachalinensis*, *Acer ukurunduense*, *Betula ermanii* and *Picea jezoensis*; the soil temperature is higher than other area by volcanic activity. Elevation 790–950 m. September 9, 1995.


**Me-akan middle (8):** Prov. Tokachi: Along the trail from Me-akan hot spring to the top of Mt. Me-akan, Ashoro-cho, Ashoro-gun (43°23′N, 144°00′E). Rocky place with *Pinus pumila*. Elevation 920–1050 m. September 7, 1995.


**O-akan base (4):** Prov. Kushiro: Along the trail from Taro-ko to the top of Mt. O-akan, Akan-cho, Akan-gun (43°26′N, 144°08′E). *Abies sachalinensis* dominated forest with *Acer*, *Alnus hirsuta*, *Betula* and *Picea glehnii*. Elevation 430–700 m. September 5, 1995.

**O-akan middle (5):** Prov. Kushiro: Along the trail from Taro-ko to the top of Mt. O-akan, Akan-cho, Akan-gun (43°27′N, 144°09′E). *Abies sachalinensis*, *Picea glehnii*, *Betula ermanii* and *Sorbus commixta* mixed forest. Elevation 700–1180 m. September 6, 1995.

**O-akan top (6):** Prov. Kushiro: Along the trail from Taro-ko to the top of
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**List of lichens of Mt. O-akan and its adjacent areas**

Numerals following abbreviations of localities indicate the collection numbers of the authors, unless otherwise indicated.

1) *Alectoria lata* (Taylor) Linds.; common on barks of *Abies sachalinensis* and *Picea glehnii*. O-akan base: 1330, 1419; O-akan middle: 1439; Seinen: 1746.

2) *Anaptychia hypoleuca* (Ach.) A. Massal.; occasional on bark of *Fraxinus mandshurica* var. *japonica*. Seinen: 1755; Chuurui: 1818, 1823.

3) *A. isidiophora* (Nyl.) Vain.; common on barks of deciduous trees. Seinen: 1738; Chuurui: 1831, 1837; Shimokomabetsu: 2027.

4) *A. isidiza* (Kurok.) Kurok.; common on barks of deciduous trees. O-akan base: 1335, 1373; Seinen: 1756, 1757; Chuurui: 1811, 1834.


6) *Anisomeridium nysaegenum* (Ellis & Everh.) R. C. Harris; occasional on barks of deciduous trees. Kashiwadani & Thor (1995) first reported this species from Japan, based on a single collection in Pref. Okayama. The specimens
from the present area are quite identical in morphological and chemical characters with that from Okayama (G. Thor 12222, tns). Although they (1995) reported only one fertile specimen from Japan, all specimens from the present area are well fertile. This is the second locality for this species in Japan, and new to Hokkaido. Kohan Bokke: 1140; O-akan base: 1292, 1357.

7) *Anzia colpota* Vain.; rare, only collected at one locality where it grows on bark of *Acer ukurunduense*. O-akan middle: 1518.


10) *Arctoparmelia incurva* (Pers.) Hale; locally abundant where it grows on rocks at the summit area of Mt. O-akan. O-akan top: 1611, 1615, 1617; Hakuto: 1972.

11) *Baeomyces absolutus* Tuck.; rare, collected at only one locality on Mt. Me-akan where it grows on rocks in somewhat shaded condition. Me-akan base: 1682.

12) *B. fungoides* (Sw.) Ach.; common on soil at higher elevations (ca. 1000 m) where it grows at open places under more or less humid condition. O-akan top: 1563, 1619; Me-akan middle: 1699.


14) *B. rufus* (Huds.) Rebent.; common on rocks. O-akan middle: 1442; Hyotan marsh: 2052.


17) *Callicium abietinum* Pers.; occasional on dry and weathered woods of *Abies sachalinensis* and *Picea glehniī*. O-akan base: 1385; O-akan middle: 1435; Me-akan base: 1689.

18) *C. lenticulare* Ach.; common on dry and weathered woods of coniferous trees. This species has been known by Japanese lichenologists as *C. subquercinum* Asahina, which was reduced to a synonym of the present species by Tibell (1987b). O-akan base: 1181, 1253, 1257, 1278, 1281, 1383; O-akan middle: 1513; Me-akan base: 1653, 1665, 1686; Taro-ko: 1856b, 1888; Hyotan: 2065a.

19) *C. trabinellum* (Ach.) Ach.; rare, collected at only one locality where it grows on decayed wood of *Abies sachalinensis* in dry condition at lakeside of
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Lake Akan. Although this species has wide distribution in the world, occurring in Europe, Africa, Australia, Tasmania, New Zealand, Sakhalin, Asia and North America (Tibell, 1987a; Asahina, 1939), only one locality (Ō-yama in Pref. Kanagawa) has been known in Japan (Asahina, 1932). This is the second locality for this species in Japan, and new to Hokkaido. Tarō-ko: 1889.

20) Candelaria concolor (Dicks.) Stein; common on bark of Ulmus lacinia. Shimokomabetsu: 2014; Shrine: 2032.


22) Cetraria laevigata Rass.; common on soil with humus in alpine meadow, where Empetrum nigrum var. japonicum is dominated. O-akan top: 1570, 1574.


26) Chaenotheca bruneola (Ach.) Müll. Arg.; common on dry and weathered woods, occasionally growing mixed with Calicium lenticulare. Although this species has been known from Honshu (Kashiwadani et al., 1996), it has not been reported from Hokkaido. New to Hokkaido. O-akan middle: 1514, 1516; Hakuto: 1968; Hyotan: 2065b.

27) C. furfuracea (L.) Tibell; rare, collected at only one locality where it was found on roots of a fallen but still living wood in marsh along Ishibetsu River. Ishibetsu marsh: 1936.

28) Chaenotheopsis pusilla (Ach.) A. F. W. Schmidt; rare, collected at only one locality where it grows on bark of Picea glehni at mountainside of Mt. O-akan. This species has been known by Japanese lichenologists as Calicium pusillum Flörke, which was reduced to a synonym of the present parasitic or parasymbiotic species by Tibell (1987a). Although this species is widely distributed in the Northern Hemisphere, occurring in Europe, Asia and North America (Tibell, 1987a), only one locality has been reported at Nikko in Pref. Tochigi in Japan (Asahina, 1932). This is the second locality for this species in Japan, and new to Hokkaido. O-akan middle: 1501.


31)  *C. chlorophaea* (Flörke) Spreng.; occasional, collected on rocks often with mosses. Taroko: 1872, 1881.
34)  *C. cyanipes* (Somm.) Nyl.; occasional on soil. O-akan middle: 1525.
36)  *C. gracilis* (L.) Willd. ssp. *nigripes* (Nyl.) Ahti; rare, collected at only one locality where it grows on rocks with humus at the summit area of Mt. O-akan. O-akan top: 1566.
38)  *C. granulans* Vain.; common on rocks and soil. O-akan middle: 1529; O-akan top: 1568, 1586, 1596; Me-akan base: 1659, 1661.
40)  *C. macilenta* Hoffm.; common on soil and trunk base of *Picea glehnii*. This species has been reported by Japanese lichenologists under the name of *C. bacillaris* Nyl. Stenroos & Ahti (1994) revised Japanese taxa of *Cladonia* section *Cocciferae* and considered so-called *C. bacillaris* in Japan to be identical with *C. macilenta*. Akan-fuji I: 1126; Akan-fuji II: 1128; Kohan Bokke: 1155.
41)  *C. meroclorophora* Asahina; common on soil and decayed woods. O-akan middle: 1522; Taroko: 1874; Ishibetsu marsh: 1928; Furebetsu: 1946.
42)  *C. metacoralifera* Asahina; collected on trunk base of *Picea glehnii*. O-akan middle: 1530.
43)  *C. norikurensis* Asahina; rare, only collected on decayed wood at lakeside of Lake Akan. This species has been known as one of rare species endemic to Japan (Kashiwadani et al., 1996). This is the fourth locality in Japan. Taroko: 1855.
45)  *C. pleurota* (Flörke) Schaeer.; occasional on soil. O-akan middle: 1523.
46)  *C. pleurota* (Flörke) Schaeer. var. *dahlii* Asahina; rare, collected at only one locality where it grows on soil at the summit area of Mt. Oakan. O-akan top: 1569.
47)  *C. ramulosa* (With.) J. R. Laundon; common on soil and rocks often among mosses. O-akan base: 1238a; Taroko: 1870, 1878.
48)  *C. rangiferina* (L.) Weber; locally abundant where it grows on soil in
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49) C. rei Schaer.; occasional on rocks, often mixed with mosses. This species has been known by Japanese lichenologists as C. nemoxyna (Ach.) Nyl., which was reduced to a synonym of the present species by Østhagen (1976). Taro-ko: 1885; Hyotan marsh: 2046.

50) C. scabriuscula (Delise) Nyl.; common on soil and rocks, often mixed with mosses. O-akan base: 1238b, 1322, 1380; O-akan middle: 1521; Taro-ko: 1875.


52) C. squamosa (Scop.) Hoffm. var. subsquamosa (Nyl.) Vain.; rare, collected at only one locality where it grows on soil in alpine meadow of Mt. O-akan. O-akan top: 1562.

53) C. stellaris (Opiz) Pouzar & Vëzda; locally abundant where it grows on soil in alpine meadow of Mt. O-akan. O-akan top: 1553, 1554, 1561, 1564, 1620.

54) C. vulcani Savicz; common on soil, humus and trunk base of Picea glehnie in the areas rich in sulfur. This species has been known by Japanese lichenologists as C. theiophila Asahina, which was reduced to a synonym of the present species by Ahti (1974). Akan-fuji II: 1132, 1134, 1135; Me-akan base: 1654, 1655, 1658; Furebetsu: 1947.


56) Collema complanatum Hue; occasional on barks of Fraxinus mandshurica var. japonica and Salix. Chuurui: 1821c; Hyotan marsh: 2043.

57) C. japonicum (Müll. Arg.) Hue; occasional on bark of Acer mono var. glabrum. Hyotan: 2061.

58) C. leptaleum Tuck.; common on barks of Acer japonicum, Fraxinus mandshurica var. japonica and Salix. O-akan middle: 1544; Chuurui: 1821b, 1829; Ishibetsu marsh: 1930.

59) C. leptaleum Tuck. var. biliosum (Mont.) Degel.; rare, collected at only one locality where it grows on bark of Acer japonicum. O-akan middle: 1543.

60) C. pulcellum Ach. var. subnigrescens (Müll. Arg.) Degel.; occasional on bark of Acer mono var. glabrum. O-akan base: 1366.


62) Dimerella lutea (Dicks.) Trevis.; common on mosses and occasionally on tree barks. O-akan base: 1243, 1342; Taro-ko: 1879.

64) *Flavoparmelia caperata* (L.) Hale; occasional on bark of *Abies sachalinensis* and decayed woods. O-akan base: 1376, 1391; Taro-ko: 1887.


69) *Graphis proserpens* Vain.; occasional on barks of *Betula*. O-akan middle: 1532


72) *G. tenella* Ach.; rare, collected at only one locality where it grows on bark of *Tilia japonica* at lakeside of Lake Onneto. Seinen: 1780.

73) *Haematomma lapponicum* Räsänen; common on rocks but seems to be restricted to the summit area of Mt. O-akan. O-akan top: 1598.

74) *H. ochrophaeum* (Tuck.) A. Massal.; occasional on barks of *Picea*. O-akan base: 1273, 1348, 1356.

75) *Hypocenomyce fiesii* (Ach.) P. James & Gotth. Schneid.; occasional on barks of Picea glehni. In Japan, three localities have been known for the present species; Mt. Moriyoshi in Pref. Akita, Nikko and Sannoh Pass in Pref. Tochigi (Inoue, 1988). This is the fourth locality in Japan, and new to Hokkaido. Akan-fuji II: 1137; Me-akan base: 1667.

76) *Hypogymnia fragillima* (Hillmann) Rass.; rare, collected at only one locality where it grows on rock at the base of Mt. O-akan. O-akan base: 1282.

77) *H. hokkaidensis* Kurok.; rare, collected at only one locality where it grows on bark of *Picea glehni* at the base of Mt. O-akan. O-akan base: 1251.

78) *H. hypotrypella* (Asahina) Rass.; rare, collected at only one locality where it grows on bark of *Abies sachalinensis* at the summit area of Mt. O-akan. O-akan top: 1630.


80) *H. physodes* (L.) Nyl.; occasional on barks of *Abies sachalinensis* and *Picea glehni*. O-akan base: 1320; Seinen: 1744.


83) *H. vittata* (Ach.) Parrique; occasional on barks of *Picea*. O-akan base: 1245, 1365.

84) *Icmadophila ericetorum* (L.) Zahlbr.; common on decayed woods and occasionally on moist soil. O-akan base: 1280, 1311, 1314; O-akan top: 1556; Me-akan base: 1664.


86) *Japewia subaurifera* Muhr & Tønsberg (Fig. 2). This species has been reported from north-west Europe and western North America (Tønsberg, 1990). In the present survey, however, it was found on trunks of coniferous trees, such as *Abies sachalinensis*, *Picea glehni* and *Pinus pumila* at elevations between 700 and 1370 m. Japanese specimens were quite identical with the authentic speci-
mens collected in Europe (T. Tønsberg 6589a, 6954a, 17228, BG) both in morphological and chemical characters. The description based on Japanese materials is as follow:

Thallus green-brown to brown, more or less rimose with brown-yellow to golden yellow soralia. Apothecia bitorine, chestnut-brown, up to 0.9 mm in diameter; disc convex, flat to uneven when aged. Ascii subglobose to broadly ellipsoid, 8-spored. Spores colorless, simple, ellipsoid to globose, 8.0–14.0 × 7.5–9.0 μm, spore walls thick, ca. 1.0 μm thick. Pycnidia not seen. Chemistry: subaurifera unknown 1, 3, 4 (Tønsberg, 1992), and lobaric acid.

Although Tønsberg (1990) was of opinion that lobaric acid was as an accessory substance in the European and North American specimens, it was found in all specimens collected in Japan.

Even though this is rarely fertile (7%) in Europe and North America (Tønsberg, 1990), ten of eighteen specimens from the present area bear apothecia. Akan-fuji II: 1131, 1136; O-akan middle: 1536; O-akan top: 1635; Me-akan base: 1675, 1676, 1678, 1680, 1681, 1684, 1687, 1694, 1695; Me-akan middle: 1709; Furebetsu: 1949, 1954, 1956, 1959.

87) Lecanora chionocarpa Hue; common on tree barks. O-akan base: 1422; Seinen: 1774, 1775, 1779; Taro-ko: 1899; Shimokomabetsu: 2022; Shrine: 2037.

88) L. cinereofusca H. Magn.; common on tree barks. Two chemical races are known in the present species (Kashiwadani et al., 1996); race 1 with atranorin and pannarin and race 2 with atranorin, pannarin and placodialic acid. In the present area, both races were found, and the race 2 was more common than the race 1. O-akan base: 1180, 1412; O-akan middle: 1473, 1489, 1497, 1547; Seinen: 1782, 1790; Fuppushi: 1996.

89) L. fuliginosa Brodo; common on rocks. O-akan base: 1355; O-akan middle: 1507; Taro-ko: 1911.

90) L. imshaugii Brodo; rare, collected at only one locality where it grows on bark of Fraxinus mandshurica var. japonica at lakeside of Lake Akan. This species is widely distributed in Honshu, Shikoku and Kyushu (Miyawaki, 1988 & 1994). New to Hokkaido. Chuurui: 1812.

91) L. megalolechea (Hue) H. Miyaw.; occasional on bark of Sorbus commixta. Seinen: 1723.


95) L. plana (J. Lahm) Nyl. Although Inoue (1982) reported this species
from Mt. O-akan (1340 m, mi-8763, herb. Akita Univ.), we could not collect it in the present area.

96) *Leprocaulon arbuscula* (Nyl.) Nyl.; occasional on rocks in shaded condition. O-akan base: 1427.


98) *L. azureum* (Sw.) Mont.; common on barks of deciduous trees and occasionally over mosses on rocks. O-akan base: 1317, 1327; Seinen: 1749.

99) *L. burnetiae* C. W. Dodge; occasional on barks of *Cercidiphyllum japonicum* and *Fraxinus mandshurica* var. *japonica*. O-akan base: 1321; Hyotan: 2053.


101) *Lethariella togashii* (Asahina) Krog; rare, only collected on barks of *Abies sachalinensis* and *Picea glehnii* at the base of Mt. O-akan. This species has been known by Japanese lichenologists as *Letharia togashii* Asahina, which was treated under the genus *Lethariella* by Krog (1976). This species has been recorded from only four localities in Japan, including Mt. O-akan (Kurokawa, 1969). O-akan base: 1258, 1260, 1262, 1375; Taro-ko: 1854.


106) *L. kurokawae* Yoshim.; occasional on bark of *Quercus crispula*. O-akan middle: 1509.


108) *L. sachalinensis* Asahina; common on barks of *Fraxinus mandshurica* var. *japonica* and *Quercus crispula*. O-akan base: 1279; Seinen: 1764, 1767; Chuurui: 1824; NW Akan-kohan: 2030.

109) *L. spathulata* (Inumaru) Yoshim.; occasional on barks of *Alnus hirsuta* and *Betula ermanii*. O-akan base: 1291, 1368.

110) *L. tuberculata* Yoshim.; occasional on barks of *Salix*. Chuurui: 1808.

111) *Lopadium disciforme* (Flot.) Kull.; common on tree barks. Kashiwadani & Thor (1995) reported this species from north of middle Honshu.

113) *Melanelia huei* (Asahina) Essl. Although Kashiwadani & Inoue (1993) reported this species to be common and locally very abundant on barks of *Alnus* and *Betula* in Kushiro Marsh, ca. 50 km south of the present area, only one specimen from the present area was collected on bark of *Salix*. It should be noted here that all specimens collected on barks of *Alnus* and *Betula* were identified with *M. olivacea* which is distinguished mainly by the absence of lecanoric acid. Sennen: 1770.


120) *Myelochroa entotheciochroa* (Hue) Elix & Hale; occasional on bark of *Tilia japonica*. Kohan Bakke: 1146, 1167.

121) *M. irregans* (Nyl.) Elix & Hale; common on barks of deciduous trees and rarely on rocks. Kohan Bakke: 1158; Sennen: 1785; Taro-ko: 1908; Ishibetsu marsh: 1937.

122) *Nephroma bellum* (Spreng.) Tuck.; occasional on barks of *Abies sachalinensis* and *Sorbus commixta*. O-akan middle: 1450, 1462.


125) *Nephromopsis endocroccea* Asahina; common on barks of *Abies sachalinensis* and *Quercus crispula*. O-akan base: 1337, 1395; O-akan middle: 1453.

126) *N. ornata* (Müll. Arg.) Hue; common on barks of *Abies sachalinensis*
and *Sorbus commixta*. O-akan middle: 1464, 1517; Seinen: 1784; Hyotan: 2063.

127) *N. pallescens* (Schaer.) Y. S. Park; occasional on bark of *Abies sachalinensis*. Taro-ko: 1920; Ishibetsu marsh: 1925.


129) *Ochrolechia akagiensis* Yasuda; occasional on barks of *Abies sachalinensis* and *Betula ermanii* with mosses. Although this species is common in Honshu and Shikoku (e.g. Kashiwadani, 1981; Harada & Ando, 1987; Okamoto & Iwatsuki, 1990; Matsumoto & Iwatsuki, 1996), it has not been reported from Hokkaido. New to Hokkaido. O-akan base: 1208, 1340.

130) *O. androgyna* (Hoffm.) Arnold (Fig. 3). Although this species is widely distributed in North America and Europe (Howard, 1970), it has not been reported from Japan. In the present survey, this species was found at Mt. O-akan where it grows on bark of *Abies sachalinensis*. The specimen was quite identical with Lich. Polon. Merid. Exs. 17 (TNS), Plantae Graecenses, Graz (lich.). 322 (TNS), Schade, Stolle & Riehmer: Lich. Sax. Exs. 491 (TNS) and Räsänen: Lichens Fenniae Exscicati 887 (TNS) both in morphological and chemical characters.

*Ochrolechia androgyna* is distinguished from other Japanese species of

![Fig. 3. *Ochrolechia androgyna* (Hoffm.) Arnold, Y. Ohmura 1493, TNS. Scale = 2 mm.](image-url)
Ochrolechia in having sorediate thalli. This species might be confused with granular sorediate species of Pertusaria, from which it can be distinguished by the presence of gyrophoric and lecanarian acids (C + red). O-akan middle: 1493.


132) O. trochophora (Vain.) Oshio; common on bark of Abies sachalinensis. O-akan base: 1197; O-akan middle: 1457; Seinen: 1747.


135) P. laevior Nyl.; common on tree barks. O-akan base: 1176, 1369, 1396; O-akan middle: 1458, 1468, 1520.


137) P. praesquarroso Kurok.; common on barks of Abies sachalinensis, Betula ermanii and Sorbus commixta. O-akan base: 1185; Seinen: 1730; R241: 1802.

138) P. saxatilis (L.) Ach.; rare, only collected on bark of Abies sachalinensis at the base of Mt. Me-akan. Me-akan base: 1673.

139) P. shinanoana Zahlbr.; occasional on rocks, growing with or without mosses. Taro-ko: 1873, 1883.


141) Parmeliella grisea (Hue) Kurok.; rare, collected at only one locality where it grows on rocks with mosses at lakeside of Lake Akan. Although this species has been known from Honshu, Shikoku and Kyushu (Kurokawa, 1958), it has not been reported from Hokkaido. New to Hokkaido. Taro-ko: 1866.

142) P. incisa Müll. Arg.; common on barks of Abies sachalinensis and Quercus crispula, and over mosses on rocks. O-akan base: 1296, 1308, 1323.

143) P. subincisa Zahlbr.; occasional on decayed woods. O-akan base: 1209.

144) Parmeliopsis hyperopta (Ach.) Arnold; common on barks of Abies
Sachalinensis and Pinus pumila, and rarely on rocks. Me-akan base: 1668, 1670; Me-akan middle: 1703, 1711; Furebetsu: 1957.

145) Parmotrema chinense (Osbeck) Hale & Ahti; rare, collected at only one locality where it grows on bark of Salix. Chuurui: 1806.


150) P. dolichorrhiza (Nyl.) Nyl.; common on decayed woods, mosses and soil. O-akan base: 1186, 1252, 1285.


152) P. leucophlebia (Nyl.) Gyeln.; occasional on soil. O-akan base: 1237.


154) P. polydactyla (Neck.) Hoffm.; common on humus, soil, and rocks with mosses. O-akan base: 1192, 1287; O-akan middle: 1524.

155) P. praetextata (Flörke) Zopf; occasional on bark of Fraxinus mandshurica var. japonica. Chuurui: 1814.


158) P. lactea (L.) Arnold. Although the present species has been known as saxicolous, this was occasionally found on bark of Picea glehnii in the present area. The specimen is identical with Kurokawa, S.: Lich. Rariores et critici exsiccati 377 (TNS). Taroko: 1856.


163) P. subfallens Vain.; common on tree barks and on rocks. Although two chemical substances, fumarprotocetraric acid and unknown-Pert-1, were
reported by Oshio (1976), the results of the TLC tests indicate that unknown-Pert-1 is identical with succinprotocetraric acid. O-akan base: 1173, 1174, 1194, 1201, 1204b, 1246, 1256, 1304; O-akan middle: 1481, 1486, 1498, 1515, 1534; Seinen: 1722, 1728; Taro-ko: 1857, 1915.

164) *P. submultipuncta* Nyl.; rare, collected at only one locality where it grows on bark of *Sorbus commixta* at lakeside of Lake Onneto. Seinen: 1732.

165) *P. subobductans* Nyl.; occasional on barks of *Acer japonicum* and *Betula*, and rarely on rocks. O-akan base: 1191a, 1205, 1428; O-akan middle: 1472.

166) *P. velata* (Turn.) Nyl.; occasional on barks of *Abies sachalinensis* and *Tilia japonica*. O-akan base: 1416; Seinen: 1787.


169) *Phaeophysea endococcinodes* (Poelt) Essl. Although the present species has been known as saxicolous, this was occasionally found on barks of *Fraxinus mandshurica var. japonica* in the present area. Chuurui: 1842.

170) *P. hirtuosa* (Kremp.) Essl.; common on barks of *Fraxinus mandshurica var. japonica* and *Ulmus davidiana var. japonica*, and on concrete. Seinen: 1778; Chuurui: 1830, 1835, 1840, 1844; Taro-ko: 1897; Ishibetsu marsh: 1938; Shimokomabetsu: 2028.

171) *P. imbricata* (Vain.) Essl.; occasional on bark of *Ulmus laciniata*. Shrine: 2036.

172) *P. limbata* (Poelt) Kashiw.; common on barks of *Fraxinus mandshurica var. japonica*, *Tilia japonica* and *Ulmus laciniata*. Kohan Bokke: 1149; Seinen: 1797; Shimokomabetsu: 2024; Shrine: 2035.

173) *P. rubropulchra* (Degel.) Essl.; occasional on bark of *Fraxinus mandshurica var. japonica*. Ishibetsu marsh: 1938 (pr.p.).

174) *P. squarrosa* Kashiw.; common on barks of *Fraxinus mandshurica var. japonica* and *Ulmus laciniata*. Seinen: 1777; Chuurui: 1845, 1846; Ishibetsu marsh: 1934; Shimokomabetsu: 2023, 2025; NW Akan-kohan: 2031; Shrine: 2033.

175) *Physcia aipolia* (Ehrh.) Hampe; occasional on barks of *Fraxinus mandshurica var. japonica* and *Ulmus davidiana var. japonica*. Chuurui: 1838, 1843.

176) *P. stellaris* (L.) Nyl.; occasional on barks of *Fraxinus mandshurica var. japonica* and *Salix*. Chuurui: 1826, 1849.

177) *Physciella denigrata* (Hue) Essl.; collected on bark of *Acer mono var. glabrum*. Chuurui: 1825.

178) *Physcosia detersa* (Nyl.) Poelt; occasional on bark of *Fraxinus mandshurica var. japonica*. Chuurui: 1847.
179) *P. grumosa* Kashiw. & Poelt; common on barks of *Fraxinus mandshurica* var. *japonica* and *Ulmus*. Chuurui: 1833; Shimokomabetsu: 2021; Shrine: 2034; Hyotan: 2055.


181) *P. kurokawae* Kashiw.; common on barks of *Fraxinus mandshurica* var. *japonica* and *Ulmus davidiana* var. *japonica*. Chuurui: 1836, 1848; Shimokomabetsu: 2010, 2026.


188) *P. macrocarpa* (DC.) Hertel & A. J. Schwab. The present species has been reported from Hokkaido and central Honshu, including Mt. O-akan (mi-8771, 8798) by Inoue (1983), though we could not collect it in the present area.

189) *Pseudopyrenula concatervata* (Nyl.) Vain.; occasional on barks of *Abies sachalinensis* and *Acer japonicum*. O-akan base: 1227, 1351, 1402.


193) *Ramalina conduplicans* Vain.; common on tree barks and twigs. Although three chemical races were reported by Kashiwadani (1986), two chemical races were found in the present survey; the homosekikai acid race (=Race 1; Kashiwadani, 1986) and the stenosporic acid with divaricatic acid (±) race, whereas a race which has not been known before. The former race has wider branches (1.5–3.0 mm wide) and is very common throughout the present
area, the latter race has narrow and attenuate branches. It resembles *R. hokkaidensis* Kashiw., but can be distinguished by the absence of perlatolic acid, a constant component in *R. hokkaidensis*. O-akan base: 1306, 1333; Seinen: 1725, 1766; Chuurui: 1804, 1813, 1822; Taro-ko: 1864; Ishibetsu marsh: 1923, 1926.

194) *R. dilacerata* (Hoffm.) Hoffm.; common on barks of *Alnus hirsuta* and *Acer mono* var. *glabrum*. Two chemical races are known in this species (Kashiwadani & Inoue, 1986); the sekikaic acid race and the divaricatic acid race. The latter race is more common than the former in the present area. In addition, salazinic acid was detected along with divaricatic acid in one specimen. Kohan Bokke: 1141, 1154; Seinen: 1716, 1718; R241: 1800.

195) *R. roesleri* (Hochst.) Nyl.; common on tree barks and occasionally among mosses on rocks. Although two chemical races were reported by Kashiwadani (1986), only the sekikaic acid containing race was found in the present area. O-akan base: 1254, 1363; Seinen: 1715, 1721, 1762; Taro-ko: 1868; Ishibetsu marsh: 1927.

196) *R. sinensis* Jatta; occasional on bark of *Fraxinus mandshurica* var. *japonica*. Seinen: 1768.

197) *R. yasudae* Räsänen; locally abundant where it grows on rocks at lakeside of Lake Akan. O-akan base: 1324, 1379.


199) *Sphaerophorus fragilis* (L.) Pers.; common on rocks but restricted to the summit area of Mt. O-akan. O-akan top: 1602, 1614.

200) *Stereocaulon exutum* Nyl.; common on rocks. O-akan base: 1303; O-akan middle: 1445, 1446, 1447, 1448; O-akan top: 1588; Taro-ko: 1880; Hyotan marsh: 2041.


203) *S. sasakii* Zahlbr.; occasional on rocks. O-akan base: 1305; O-akan top: 1595.

204) *S. tomentosum* Fr.; occasional on rocks. Hyotan marsh: 2044.


206) *Sticta nylanderiana* Zahlbr.; common on barks of *Abies sachalinensis*, *Acer mono* var. *glabrum* and *Quercus crispula*. O-akan base: 1316; Seinen: 1742; Ishibetsu: 1940.

207) *Tephromela atrata* (Huds.) Hafellner; occasional on barks of deciduous trees. Kohan Bokke: 1142; O-akan base: 1432; Seinen: 1792; Taro-ko: 1892.
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208) _Trapelia coarctata_ (Sm.) M. Choisy; occasional on rocks. Taro-ko: 1909.

209) _Tuckermannopsis gilva_ (Asahina) M. J. Lai; common on bark of _Abies sachalinensis_ and twigs of _Pinus pumila_. Kashiwadani et al. (1996) reported the presence of microphyllinic acid and alectoronic acid in this species. Although microphyllinic acid was detected in all specimens examined, alectoronic acid was not found in them. O-akan middle: 1494, 1495, 1512; O-akan top: 1652.

210) _T. microphyllica_ (W. L. Culb. & C. F. Culb.) M. J. Lai; common on bark of _Abies sachalinensis_, and twigs of _Pinus pumila_. Only three localities are known; Mt. Ashibetsu, Mt. Daisetsu (Culberson & Culberson, 1967) and Mt. Petegari (Kurokawa & Nakanishi, 1971). All of localities are restricted to Hokkaido. This is the fourth locality for the species. O-akan top: 1649, 1650, 1651.

211) _Umbilicaria caroliniana_ Tuck.; locally abundant where it grows on rocks at the summit area of Mt. O-akan. O-akan top: 1584, 1590, 1597.

212) _U. exasperata_ Hoffm.; locally abundant where it grows on rocks at the summit area of Mt. O-akan. This species has been known by Japanese lichenologists as _U. hyperborea_ (Ach.) Hoffm., which was reduced to a synonym of the present species by Wei & Jiang (1993). O-akan top: 1575, 1589, 1592.

213) _Usnea diffracta_ Vain.; common on trunks of _Abies sachalinensis_ and _Prunus ssiori_. O-akan base: 1387; Hyotan: 2064.

214) _U. longissima_ Ach.; collected on barks of _Abies sachalinensis_, _Fraxinus mandshurica_ var. _japonica_ and _Prunus ssiori_. O-akan base: 1297; Seinen: 1790; Chuurui: 1805; Hyotan: 2060.

215) _U. longissima_ Ach. ssp. _jezoensis_ Asahina; collected on bark of _Acer mono_ var. _glabrum_. Hyotan: 2059.

216) _U. longissima_ Ach. ssp. _sensibilis_ Asahina; collected on twigs of _Abies sachalinensis_. Taro-ko: 1853.


218) _V. pinastri_ (Scop.) Mattson & Lai; common on twigs and bark of _Pinus pumila_. O-akan middle: 1511, 1625.

219) _Xanthoparmelia hirosakiensis_ (Gyeln.) Kurok.; locally abundant where it grows on rocks close to the fumaroles at lakeside of Lake Akan. Kohan Bokke: 1169.

220) _X. tuberculiformis_ Kurok.; locally abundant where it grows on rocks, growing mixed with _X. hirosakiensis_ close to the fumaroles at lakeside of Lake Akan. Kohan Bokke: 1168.
Discussion

In Japan, lichens of definite small areas have been studied in recent years: e.g., 169 lichens from Hidaka Mts. (Kurokawa & Nakanishi, 1971), 205 from Mt. Fuji (Kashiwadani, 1981), 176 from Mt. Hakkoda (Kashiwadani & Sasaki, 1987), 131 from Kushiro Marsh (Kashiwadani & Inoue, 1993), 212 from Mt. Nishi-Azuma (Kashiwadani et al., 1996). In the present paper, 220 taxa of lichens, largest in number of taxa in restricted areas, are reported from Mt. O-akan and its adjacent areas. Some of the following reasons may be justifiable for the finding of such large number of lichens in the present area. At first, the nature in the present area has been well preserved and/or protected from the environmental disruption. Consequently, lichens of this area have well preserved and/or protected. The topographies of the present area are variable and complicated, for example, we could investigate lichens in some primary forests, alpine zone, lakeside, active volcanic mountains, fumarole areas, marsh, shrine, and so on, which give different environmental habitats to lichens. In addition, many monographs of lichen genera and regional studies on lichens have been published in the last decades. A number of sorediate or isidiate lichens in sterile condition, in addition, can also be identified following studies by Tønsberg (1992) at present.

Most species reported in this paper are commonly found in other areas of Hokkaido and on mountains especially of northern Japan. It is noteworthy that two species are new to Japan, eleven species are new to Hokkaido, and four rare species are found in the present area. Japewia subaurifera, a species new to Japan, is commonly found on barks of Abies sachalinensis, Picea glehnii and Pinus pumila in the present area. It is assumed that this species is widely distributed in Hokkaido and on mountains of northern Japan. Ochrolechia androgyna, another species new to Japan, resembles sorediate species of Pertusaria, but is easily distinguished by the production of gyrophoric acid. Although Anisomeridium nyssaegeunum, Calicium trabinellum, Chaenotheca brunneola, Chaenothecopsis pusilla, Hypocenomyce friesii, Lecidea brachyspora and Placynthiella uliginosa were newly found in Hokkaido. They may have been overlooked by Japanese lichenologists since they are small and inconspicuous. Lecanora imshaugi, Ochrolechia akagensis, Pannaria conoplea and Parmeliella grisea are found in Hokkaido, and their ranges have been extended to northward to Hokkaido. Cladonia norikurenensis, Glossodium japonicum, Lethariella togashii and Tuckermannopsis microphyllica have been known as rare and endemic to Japan but they are rather common in Hokkaido.
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