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Lichens of Akkeshi and its Adjacent Areas, Northeastern Hokkaido, Japan

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Abstract A total of 223 lichen taxa representing 66 genera are reported from Akkeshi and its adjacent regions. Among them, *Lecanora kurokawae* is described as new to science. *Leptogium tenuissimum* is newly added to the Japanese lichen flora. *Collema callopismum*, *Hypotrachina incognita* and *Parmotrema tinctorum* are new to Hokkaido. Results of phytogeographical analysis show that the lichen flora of the present areas is characterized by high proportions of the Northeast Asiatic (25.1%) and Pantemperate (39.5%) elements. On the other hand, no taxon belonging to Bipolar, Pantropical, Indo-Malayan, Pacific, Circum-Pacific and Australian elements is found.
Key words : Akkeshi, *Lecanora kurokawae*, lichen, Kirittapu, Kushiro, phytogeographical elements.

Introduction

Lichens of Akkeshi and the adjacent areas will be repoted in the present paper. This region includes Kushiro-cho and Hamanaka-cho (about 70 km east to west and 40 km north to south; 42°56′–43°14′N, 144°18′–145°13′E, Fig. 1) and is situated on the Pacific Coast of Hokkaido. Even though there is no high mountain, the lichen flora of the present region is significantly notable from the phytogeographical point of view, since the area is located in northeastern edge of Hokkaido as well as of Japan. Lichens floras of certain mountains or areas have been studied quite well in Japan (Kashiwadani *et al.*, 1987, 1993, 1996, 1998, 2000, 2002; Kurokawa 1957). However, phytogeographical analysis of the floras in these areas is still insufficient. In the present paper, we will try to make a phytogeographical analysis in refernce to phytogeographical elements proposed by Kurokawa (2006).

Materials and Methods

About 2,000 lichen specimens were collected at various sites in the present area. This area is mostly covered with natural or secondary forests composed of deciduous or coniferous trees such as *Abies sachalinensis*, *Alnus japonica*, *Acer mono*, *Betula ermanii*, *B. platyphylla*, *Fraxinus lanuginosa*, *F. mandshurica*, *Larix leptolepis*, *Magnolia kobus*, *Picea glehnii*, *Prunus sargentii*, *Quercus crispula*, *Q. dentata*, *Salix bakko*, *Sorbus commixta*, etc. There are also Bekanbeushi and Kiritappu marshes and some rocky shores. The morphology of lichens was observed under dissecting microscope and light microscope with immersion lens. Sections of thalli and apothecia were prepared by hand-razor and mounted in GAW. Sections of thalli of *Lecanora* species were observed under polarized lens to find glanular crystals and those of apothecia were observed in concentrated nitric acid (HNO_3) and 10% potassium hydroxide (KOH) replaced for water (Brodo, 1984). Ascus structure was examined in

Lugol's solution. Secondary products were studied by means of thin-layer chromatography (Culberson and Johnson, 1982), employing only solvent B system. Micro-crystal tests were also made, if necessary. All specimens cited in the present paper are preserved in the Lichen Herbarium of the National Museum of Nature and Science (TNS).

Results

Through the morphological and chemical studies, 223 lichen taxa belonging to 66 genera have been recognized among the collections. In the following list, they are enumerated in alphabetical order of scientific names, followed by habit, collection site(s) and collector(s) with collection number(s). In order to reduce the space, the following abbreviations are used for collection sites and dates. Collectors are also abbreviated as follows: TS — T. Shiba, HK — H. Kashiwadani and KM — K.H. Moon. Morphological and/or phytogeographical notes are given, if any. Numbers after locality abbreviation refer to Fig. 1.

Aikappu (11) ... Around the Marine Laboratory of Hokkaido University, Cape Aikappu, Akkeshi, Akkeshi-gun, elevation 0 – 70 m. In forests dominated by *Acer*, *Abies*, *Alnus* and *Quercus*. August 4 – 8, 2002 and July 31, 2003.

Ayamegahara (20) ... Ayamegahara pastureland, Akkeshi, Akkeshi-gun. Elevation 5 – 20 m. August 6, 2002 and July 30 – 31 and August 1,

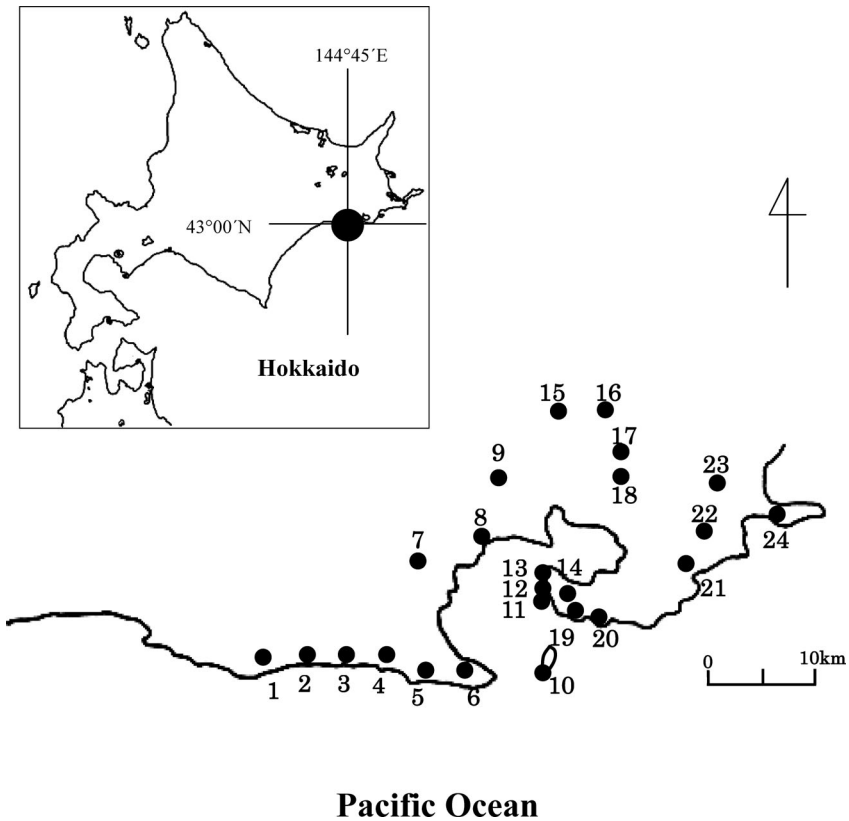

Fig. 1. Akkeshi and its adjacent areas showing collection sights for the present study. Aikappu (11), Ayamegahara (20), Bekanbeushi-bridge (15), Bekanbeushi marsh (18), Chirippu to Akkeshi (21), Chomin-no-mori (16), Daikokujima (10), Fukushima (22), Horonai (1), Kiritappu (24), Kitoushi (2), Kokutaiji (12), Konohi-park (14), Mabiro (19), Monshizu shurine (8), N shore of Kiritappu marsh (23), Ohbetsu (17), Ohoro (7), Ohta (9), Osonaeyama (13), Osyamai (5), Pontomari (4), Shiriba (6), Tomachise (3).

2003.

Bekanbeushi-bridge (15) ... Around the Bekanbeushi-bridge, Akkeshi, Akkeshi-gun, Exposed rocky area and mixed forest of *Abies*, *Alnus*, *Quercus* and *Salix*. Elevation about 70 m. August 9, 2002.

Bekanbeushi marsh (18) ... Bekanbeushi marsh, Akkeshi, Akkeshi-gun. Elevation 0 – 10 m. July 27, 2003, September 11, 2003 and August 5, 2004.

Chirippu to Akkeshi (21) ... En route from Chirippu to Akkeshi, Akkeshi-gun. Elevation about 50 – 70 m. September 3, 1999.

Chomin-no-mori (16) ... Akkeshi, Akkeshi-gun. Plantation of *Quercus* and *Acer*. Elevation about 70 m. August 7, 2002 and July 28, 2003.

Daikokujima (10) ... Daikokujima Island, about 8 km off from Aikappu cape. Akkeshi, Akkeshi-gun. Elevation about 0 – 50 m. July 31, 2003.

Fukushima (22) ... Vicinity of Fukushima, Biwase, Hamanaka, Akkeshi-gun. Elevation about 75 m. September 1, 1999.

Horonai (1) ... Around Horonai, Kushiro, Kushiro-gun. Elevation 0 – 100 m. August 7 and October 10 – 11, 2004.

Kiritappu (24) ... Cape Kiritappu, about 2.8 km south of Hamanaka, Akkeshi-gun. Elevation about 10 m. September 1, 1999.

Kitoushi (2) ... Around Kitoushi, Kushiro, Kushiro-gun. Elevation 0 – 100 m. August 10 and October 11, 2004.

Kokutaiji (12) ... Around Kokutaiji temple, Honmachi, Akkeshi, Akkeshi-gun. Elevation 5 – 20 m. August 4 – 6, 2002.

Konohi-park (14) ... Konohi-park, Akkeshi, Akkeshi-gun. Elevation about 2 m. July 28, 2003.

Mabiro (19) ... En route from Akkeshi to Kiritappu, Mabiro, Akkeshi, Akkeshi-gun. Cultivated forest of *Abies sachalinensis*. Elevation about 70 m. August 3 – 6, 2002, August 4 and October 10, 2004.

Monshizu shrine (8) ... Monshizu. Akkeshi, Akkeshi-gun. Elevation about 10 m. August 7, 2002.

N shore of Kiritappu marsh (23) ... Hillside faced to Kiritappu marsh, Hamanaka, Akkeshi-gun. Elevation about 20 – 40 m. September 2, 1999.

Ohbetsu (17) ... Around Mizudori-kansatukan, Ohbetsu, Akkeshi, Akkeshi-gun. Elevation about 2 – 10 m. July 27 – 30, 2003.

Ohoro (7) ... Around Ohoro, Akkeshi, Akkeshi-gun. Elevation about 50 m. October 11, 2004.

Ohta (9) ... Vicinity of Ohta, Akkeshi, Akkeshi-gun. Cattle farms and pasture land, with scattered trees of *Abies*, *Alnus*, *Fraxinus* and *Larix*. Elevation about 70 m. August 6, 2002.

Osonaeyama (13) ... Osonaeyama, Near Akkeshi Great Bridge, Akkeshi, Akkeshi-gun. Small hill with mixed forest of *Acer*, *Abies*, *Alnus* and *Quercus*. Elevation 30 – 70 m. August 7, 2002 and August 2, 2003.

Osyamai (5) ... Around Osyamai, Kushiro, Kushiro-gun. Elevation 0 – 100 m. August 6, 2004.

Pontomari (4) ... Around Pontomari, Kushiro, Kushiro-gun. Elevation 0 – 100 m. August 7 and October 10, 2004.

Shiriba (6) ... Cape Shiriba, Kushiro, Kushiro-gun. Elevation 0 – 100 m. August 6 and October 10, 2004.

Tomachise (3) ... Around Tomachise, Kushiro, Kushiro-gun. Elevation 0 – 100 m. August 9 and October 10 – 11, 2004.

Enumeration of lichens

1) *Agonimia pacifica* (H. Harada) Diederich. Rare, over mosses on bark of *Abies sachalinensis*. Mabiro, TS 1459; Tomachise, TS 2027.

The present species is also known from Central Honsyu (or main land of Japan).

2) *Anaptychia isidiza* (Zahlbr.) Kurok. Occasional, on bark of *Abies sachalinensis* and *Betula ermanii*. Aikappu, TS 1422; Ohta, TS 396.

3) *Anaptychia palmulata* (Michaux) Vain. Occasional, on bark of *Quercus crispula* and on rocks. Aikappu, TS 814 and TS 1423; Shiriba, HK 47529.

4) *Anzia colpota* Vain. Locally common, on bark of *Alnus japonica*, *Abies*, *Quercus* and *Acer* spp. Aikappu, TS 1426; Aikappu, HK 45836.

5) *Anzia japonica* (Tuck.) Müll. Arg. Occasional, on bark of decayed wood. Fukushima, KM 4089; Shiriba, TS 1945.

6) *Anzia opuntiella* Müll. Arg. Common, on bark of *Acer* sp., *Alnus japonica* and *Fraxinus lanuginosa*. Aikappu, TS 174 and TS 823.

7) *Brigantiaea ferruginea* (Müll. Arg.) Kashiw. et Kurok. Occasional, on bark of *Betula ermanii*, *Fraxinus lanuginosa* and *Quercus crispula* usually with mosses. N shore of Kiritappu marsh, KM 4392; Aikappu, TS 809 and TS 826.

8) *Bryoria asiatica* (Du Rietz) Brodo et D. Hawksw. Occasional, on bark of *Acer mono*. Tomachise, TS 1997.

9) *Bryoria confusa* (D.D. Awasthi) Brodo et D. Hawksw. Occasional, on bark. Shiriba, TS 1918.

10) *Bryoria furcellata* (Fr.) Brodo et D. Hawksw. Rare, on bark of *Abies sachalinensis*. Aikappu, HK 47513.

11) *Bryoria trichodes* Brodo et D. Hawksw. Common, on bark of *Abies sachalinensis* and *Salix subfragilis*. Chirippu to Akkeshi, KM 4508; Horonai, TS 2058; Kitoushi, HK 47413.

12) *Calicium abietinum* Pers. Occasional, on decayed wood of *Abies sachalinensis*. N shore of Kiritappu marsh, KM 4441; Tomachise, TS 2030.

13) *Candelaria concolor* (Dickson) B. Stein. Occacional, on rocks. Kokutaiji, TS 410.

14) *Candelariella vitellina* (Ehrh.) Müll. Arg. Occasional, on bark. Ohta, TS 395.

15) *Cetrelia braunsiana* (Müll. Arg.) W. L. Culb. et C.F. Culb. Very common, on barks of *Abies sachalinensis*, *Alnus japonica*, *Betula ermanii*, *Fraxinus lanuginosa* and *Sorbus commixta*. Chirippu to Akkeshi, KM 4453, KM 4475 and KM 4513; Fukushima, KM 4090 and KM 4101; Aikappu TS 272; Tomachise, HK 47420.

16) *Cetrelia cetrarioides* (Delise ex Duby) W.L. Culb. et C.F. Culb. Occasional, on bark. Shiriba, TS 1951.

17) *Cetrelia chicitae* (W.L. Culb.) W.L. Culb. et C.F. Culb. Common, on barks of *Abies sachalinensis* and *Alnus hirsuta*. N shore of Kiritappu marsh, KM 4433 and KM 4439; Aikappu, TS 274 and HK 45835.

18) *Cetrelia japonica* (Zahlbr.) W.L. Culb. et C.F. Culb. Occasional, on bark of *Abies sachalinensis*. Shiriba, TS 2033; Tomachise, HK 47418.

19) *Cetrelia olivetorum* (Nyl.) W.L. Culb. et C.F. Culb. Rare, on bark of *Alnus japonica*. N shore of Kiritappu marsh, KM 4382.

20) *Cetreliopsis asahinae* (M. Sato) Randlane et A. Thell. Occasional, on twigs of *Fraxinus lanuginosa* and *Sorbus commixta*. Bekanbeushi bridge, TS 828; Kitoushi, TS 1977.

21) *Chaenotheca burunneola* (Ach.) Müll. Arg. Occasional, on bark. Shiriba, TS 1937.

22) *Chrysothrix candelaris* (L.) J.R. Laundon. Occasional, on bark of *Larix leptolepis*. Kokutaiji, TS 2067.

23) *Cladonia alpina* (Asahina) Yoshim. Rare, restricted on high moor. Bekanbeushi marsh, TS 844.

24) *Cladonia arbuscula* (Wallr.) Rabenh. subsp. *beringiana* Ahti. Restricted on high moor, among mosses on soil. Bekanbeushi marsh, TS 1352.

25) *Cladonia caespiticia* (Pers.) Flörke. Occasional, on ground. Horoto, HK 47503.

26) *Cladonia chlorophaea* (Flörke ex Sommerf.) Spreng. Occasional, among mosses on rocks. Bekanbeushi bridge, TS 1276.

27) *Cladonia coniocraea* (Flörke) Spreng. Common, on trunk base of *Betula ermanii*, *Fraxinus mandshurica* or on soil. Aikappu, TS 835 and TS 1404.

28) *Cladonia cornuta* (L.) Hoffm. subsp. *cornuta*. Common, on soil, decayed wood and trunk base. Ohbetsu, TS 840.

29) *Cladonia farinacea* (Vain.) A.W. Evans. Occasional, on rocks, Aikappu, TS 832.

30) *Cladonia furcata* Hoffm. Common, on decayed wood and on soil. Fukushima, KM 4126 and KM 4165; Kiritappu, KM 4200.

31) *Cladonia glauca* Flörke. Occasional, on rocks. Bekanbeushi bridge, TS 1873.

32) *Cladonia grayi* G.K. Merr. ex Sandst.

Occasional, on soil. Bekanbeushi marsh, TS 848.

33) *Cladonia hondoensis* Asahina. Locally common, on soil. Kiritappu, KM 4204.

34) *Cladonia humilis* (With.) Laundon. Occasional, on soil. Aikappu, TS 849.

35) *Cladonia kurokawae* Ahti et Steenroos. Occasional, over humus on soil. Ohbetsu, HK 45816.

36) *Cladonia macilenta* Hoffm. Occasional, over humus on soil, trunk base of *Abies sachalinensis* and *Betula ermanii*. Aikappu, TS 854; Mabiro, TS 834; Bekanbeushi marsh, HK 45852.

37) *Cladonia ochrochlora* Flörke. Common, on barks of *Abies sachalinensis* and *Alnus japonica*, on decayed woods, trunk base and over humus on soil. Chirippu to Akkeshi, KM 450; N shore of Kiritappu marsh, KM 4931 and KM 4404; Aikappu, TS 346.

38) *Cladonia pleurota* (Flörke) Schaer. Locally common, on soil. Kiritappu, KM 4196.

39) *Cladonia ramulosa* (With.) Laundon. Common, on trunk base of *Larix leptolepis*, on soil and on rocks. Aikappu, TS 836 and HK 45829; Bekanbeushi bridge, TS 851.

40) *Cladonia rei* Schaer. Occasional, on rocks and over humus on soil. Aikappu, TS 830; Ohbetsu, HK 45821.

41) *Cladonia scabriuscula* (Delise in Duby) Leight. Occasional, on rocks. Aikappu, TS 854.

42) *Cladonia squamosa* (Scop.) Hoffm. var. *squamosa*. Occasional, on bark of *Abies sachalinensis*. Aikappu, HK 45811; Shiriba, TS 2001.

43) *Coccocarpia erythroxyli* (Spreng.) Swinscow et Krog. Rare, on bark of *Acer mono*. Kitoushi, HK 47409.

44) *Coccocarpia palmicola* (Spreng.) Arvids. et Gall. Occasional, on bark of *Abies sachalinensis* and on rocks. Mabiro, TS 964.

45) *Collema callopismum* A. Massal. Very rare, on concrete base, Aikappu, TS 868 and HK 45807.

Collema callopismum is a saxicolous species found in calcareous areas, being widely distributed in the Northern Hemisphere. It has been reported from Sweden, Scotland, England, France, Portugal, Germany, Poland, Italy, Yugoslavia, Greenland, Canada and Japan (Degelius, 1954, 1974). In Japan, however, it has been reported from only two localities; Mt. Myouhougatake and Mt. Buko, in Prov. Musashi, central Honshu (Degelius, 1954). In the present area, it was found on concrete base of marine laboratory of Hokkaido University, Akkeshi. This is the first record for this species in Hokkaido, and is the northern most locality in Japan. The specimen from the present area has non-isidiate and semi-crustose thallus with pulvinate lobes, subparaplectenchymatous proper exciples, ellipsoid and submuriform ascospores $25-32\times10-17\,\mu$m in size. These characters coincide well with those of authentic or exsiccata specimens of *C. callopismum* preserved in TNS.

Other Japanese specimens examined. Honshu. Prov. Musashi (Pref. Saitama): Mt. Buko, Chichibu. On rock (limestone), elevation about 1,000 m, November 3, 1969, H. Shibuichi 3993 (TNS); Mt. Myouhougatake, on summit of Mt. Myouhougatake, Mitsumine, Chichibu, on concrete, elevation about 1,332 m, June 25, 1967, S. Kurokawa 67001 and 67002 (TNS).

46) *Collema coccophyllum* Nyl. Rare, on bark of *Fraxinus mandshurica* var. *japonica*. Ohbetsu, HK 45805.

This is one of rare species of *Collema* distributed in East Asia, having been reported from Japan, India and Thailand (Degelius, 1974). In Japan, it was reported from two localities in Honshu by Degelius (1974) and Kashiwadani *et al.* (1996). In the present survey, we found the third locality for this species, where it grows on bark of *Fraxinus mandshurica* var. *japonica* at Ohbetsu, Akkeshi-gun. The specimen has membranous and fenestrate lobes, small apthecia to 1 mm in diam., paraplectenchymatous proper exciples and globose to subglobose ascospores with 4–5 cells $8-10\times7-8\,\mu$m in size. This is the northern most locality for this species in Japan.

Other Japanese specimens examined. Honshu. Prov. Etchu: Fukuno-cho, Higashitonami-gun, on bark, March 15, 1930, M. Nishijima 20 (TNS). Prov. Iwashiro (Pref. Fukushima) Mt. Yahazu, Azuma Mts., Yama-gun, on bark of *Fagus crena-*

ta, elevation 1,400 – 1,500 m, May 31, 1995, H. Kashiwadani 38418 (TNS); Wasezawa, Kitashiobara-mura, Yama-gun, on bark of *Juglans mandshurica* var. *sachalinensis*, elevation about 830 m, August 22, 1995, K.H. Moon. 468 (TNS).

47) *Collema complanatum* Hue. Occasional, on barks of *Alnus japonica* and *Salix subfragilis* or on rocks. Ohta, TS 297; Horoto, HK 47429.

48) *Collema japonicum* (Müll. Arg.) Hue. f. *japonicum*. Occasional, on barks of *Acer mono* and *Kalopanax pictus*. Shiriba, TS 1921; Kitoushi, TS 1975.

49) *Collema leptaleum* Tuck. var. *leptaleum*. Rare, among mosses on bark of *Picea glehnii*. Chirippu to Akkeshi, KM 4451.

50) *Collema subflaccidum* Degel. Occasional, on bark of *Alnus japonica* and *Fraxinus mandshurica* var. *japonica*. Chirippu to Akkeshi, KM 4454; Shiriba, TS 1625.

51) *Dibaeis baeomyces* (L. f.) Rambold et Hertel. On ground. Horoto, HK 47502.

52) *Dimerella lutea* (Dickson) Trevisan. Occasional, among mosses on bark of *Abies sachalinensis* in shaded condition. Mabiro, TS 907; Mabiro, HK 47444; Horonai, TS 1822.

53) *Dimerella pineti* (Ach.) Vězda. Occasional, on bark of *Picea glehnii*. Chirippu to Akkeshi, KM 4499; Shiriba, TS 1998.

54) *Dolichousnea diffracta* (Vain.) Articus. Abundant, on bark of *Abies sachalinensis*. Mabiro, TS 493; Kitoushi, HK 47416.

55) *Dolichousnea longissima* (Ach.) Articus. Occasional, on bark of *Abies sachalinensis*. Aikappu, TS 296.

56) *Dolichousnea trichodeoides* (Vain.) Articus. Occasional, on bark of *Abies sachalinensis*. Mabiro, TS 932.

The present species can be distinguished by branches flattened with longitudinal-furrows on the surface from *D. longissima*.

57) *Evernia mesomorpha* Nyl. Occasional, on bark of *Abies sachalinensis*. Kokutaiji, TS 290.

58) *Evernia prunastri* (L.) Ach. Rare, on bark of *Abies sachalinensis*. N shore of Kiritappu marsh, KM 4368; Kokutaiji, TS 409.

Although this species is widely distributed in the Northern Hemisphere, it has been collected at only few localities in Hokkaido (Provinces Ishikari, Kitami and Kushiro).

59) *Fissurina inabensis* (Vain.) M. Nakan. et Kashiw. in Nakanishi *et al.* Rare, on bark of *Abies sachalinensis*. Shiriba, TS 1648.

This species is endemic to Japan, having been reported from south of middle Honshu (Nakanishi, 1966).

60) *Flavoparmelia caperata* (L.) Hale. Frequent, on bark of *Larix leptolepis*. Kokutaiji, TS 485.

61) *Graphis cognata* Müll. Arg. Occasional, on bark of *Betula ermanii*. Aikappu, TS 920.

62) *Graphis rikuzensis* (Vain.) M. Nakan. Common, on barks of *Abies sachalinensis*, *Phellodendron amurense* and deciduous trees. Chirippu to Akkeshi, KM 4464; Kokutaiji, TS 414; Mabiro TS 1357.

63) *Graphis scripta* (L.) Ach. Common, on bark of *Abies sachalinensis*. Aikappu, TS 164.

64) *Graphis tenella* Ach. Occasional, on bark of *Abies sachalinensis*. Fukushima, KM 4116; Aikappu, HK 46261; Kokutaiji, TS 1217.

65) *Hafellina disciformis* (Fr.) Marbach et H. Mayrhofer (Marbach 2000). Very common, on barks of *Picea glehnii*, *Abies* sp. and *Quercus* sp. Fukushima, KM 4150; Kitoushi, HK 47404.

66) *Heterodermia boryi* (Fée) K.P. et S.R. Singh. Very rare, on bark. Kitoushi, TS 1971.

67) *Heterodermia diademata* (Taylor) D.D. Awasthi. Occasional, on bark of *Quercus crispula*. Aikappu, TS 422.

68) *Heterodermia hypochraea* (Vain.) Swinscow et Krog. Occasional, on bark of *Abies sachalinensis*. Aikappu, HK 45819; Horonai, TS 1820.

69) *Heterodermia hypoleuca* (Muhl.) Trevisan. Occasional, on bark of *Alnus* sp., *Abies* sp. or rarely on rocks. Aikappu, TS 819 and HK 45828.

70) *Heterodermia isidiophora* (Vain.) Skorepa. Occasional, on bark of *Fraxinus mandshurica* var. *japonica*. N shore of Kiritappu marsh, KM 4262.

71) *Heterodermia japonica* (Sato) Swinscow et Krog. Rare, among mosses on bark of *Abies* and on rocks. Shiriba, TS 2005.

72) *Heterodermia microphylla* (Kurok.) Swinscow et Krog. Common, on barks of *Betula ermanii* and *Larix leptolepis* and on rocks. Chirippu to Akkeshi, KM 4473; Fukushima, KM 4085; Aikappu, TS 802.

73) *Heterodermia obscurata* (Nyl.) Trevisan. Rare, among mosses on bark of *Salix* sp. Chirippu to Akkeshi, KM 4477.

74) *Heterodermia propagulifera* (Vain.) J.P. Dey. Rare, among mosses on bark of *Abies sachalinensis*. N shore of Kiritappu marsh, KM 4227.

75) *Heterodermia tremulans* (Müll. Arg.) W. L. Culb. Rare, once collected on bark of *Betula ermanii*. Aikappu, TS 805.

76) *Hypogymnia fragillima* (Hillm.) Rass. Occasional, on barks of *Abies sachalinensis* and *Sorbus commixta*. Fukushima, KM 4103 and KM 4125; Shiriba, TS 1634.

77) *Hypogymnia hokkaidensis* Kurok. Very rare, on bark of *Picea* sp. Shiriba, TS 1964.

This species is one of rare species in Japan, having been collected at five localities in Hokkaido (Provinces Hidaka, Ishikari, Kushiro and Tokachi).

78) *Hypogymnia pseudoenteromorpha* (Ach.) Nyl. f. *inactiva* (Asahina) Asahina. Locally common, on barks of *Abies sachalinensis* and decayed wood. Fukushima, KM 4901, KM 4124 and KM 4174.

79) *Hypogymnia pseudophysodes* (Asahina) Rass. var. *pseudophysodes*. Occasional, on bark of *Abies sachalinensis* and rocks. N shore of Kiritappu marsh, KM 4216; Aikappu, TS 1107 and TS 1138.

80) *Hypogymnia pulverata* (Nyl.) Elix. Occasional, on bark of *Picea glehnii*. Fukushima, KM 4148.

81) *Hypogymnia submundata* (Oxsner) Rass. f. *submundata*. Occasional, on bark of *Abies sachalinensis*. Aikappu, TS 251.

82) *Hypogimnia vitata* (Ach.) Parrique f. *vittata*. Occasional, on bark of *Abies sachalinensis*. Fukushima, KM 4098; Mabiro, TS 1381.

83) *Hypotrachyna incognita* (Kurok.) Hale. Rare, on bark of *Prunus yezoensis*. Kokutaiji, HK 45806.

This species is distinguished from allied species of the genus by having cylindrical isidia, dichotomously branched rhizines and white medulla containing gyrophoric and protolichesterinic acids. It is one of rare lichens in Japan, having been collected at only three localities in Nagano and Miyazaki Prefectures. This is the northern most locality for this species in Japan. New to Hokkaido.

Other Japanese specimens examined. Honshu. Prov. Shinano (Pref. Nagano): Mt. Takabottchi, Shiojiri-city, on bark of *Larix leptolepis*, elevation about 1,600 m, October 29, 1986. H. Kashiwadani 23783 and 34428 (TNS), Kyusyu. Prov. Hyuga (Pref. Miyazaki): Minamikata, Saito-city, on bark of *Quercus glauca*, elevation 670–765 m, February 23, 2004, K.H. Moon. 7346 (TNS); Shiratori, Ebino-shi, on trunk of *Pinus densiflora*, elevation about 900 m, July 9, 1994, H. Shibuichi 9546 (TNS).

84) *Japewia subaurifera* Muhr et Tonsberg. Occasional, on bark of *Picea* sp. Aikappu, TS 1342.

85) *Lecanora chionocarpa* Hue. Occasional, on bark of *Fraxinus mandshurica*. Ohbetsu, HK45804.

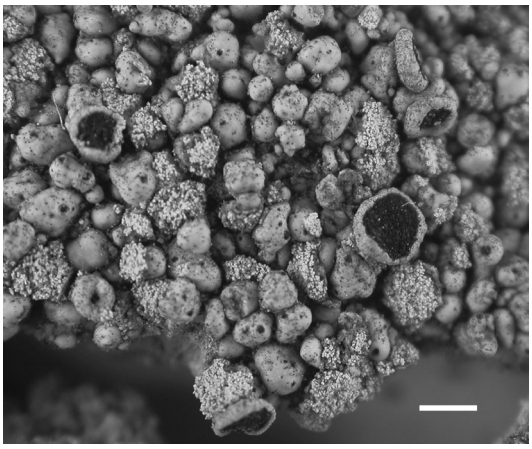

Fig. 2. *Lecanora kurokawae* Shiba, K.H. Moon & Kashiw. sp. nov. Scale bar = 1 mm

86) *Lecanora kurokawae* Shiba, K.H. Moon & Kashiw. sp. nov. (Fig. 2)

Thallus ut in *Lecanora cenisia* sed subfarinose-sorediatus et acidum porphyrilicum continentus, discis epruinosis et excipulis marginalibus cum crystalis minimis vel granularis differt.

Type collection. Japan, Hokkaido, Prov. Kushiro: Takoiwa, Pontomari, Kushiro-gun. On rocks, along coast; elevation about 2 m, October 10, 2004. T. Shiba 2055 (holotype in TNS).

Thallus saxicolous, whitish gray, consisting of hemispherical or globose verrucae (0.2 – 0.4 mm in diam., 0.2 – 0.5 mm high); verrucae covered with gelatinous cortex, cortex prosoplectenchymatous 12 – 15 μm thick, gonidial layer subcontinuous, 35 – 40 μm thick, gonidia 6 – 8 μm in diam., upper medulla composed of densely intertangled hyphae, lower medulla composed of loosely intangle hyphae, containing numerous granular crystals, verrucae are completely filled with HNO_3 soluble crystals together with loose hyphae towards the center but are composed of densely intangled hyphae and algal celles towards the cortex. Soredia subfarinose (0.02 – 0.03 mm in diam.), whitish-gray, formed near the top of verrucae (Fig. 2). Apothecia common, sessile, 1.0 – 1.3 mm in diam.; disc reddish brown, epruinose, margins of apothecia concolorous with the thallus; thalline margin containing small crystals which are scattered in medulla as well as inner cortex (allophana-type by Brodo, 1984); crystals are soluble by HNO_3 but insoluble by KOH; epihymenium not granulate, brown (glabrata type by Brodo, 1984); hymenium 80 – 100 μm high; hypothecium 40 – 50 μm thick; proper exciple 60 – 120 μm thick; asci clavate, 30 – 40 × 3 – 4 μm; ascospores ellipsoid, 17 – 18 × 5 – 6 μm. Pycnidia not seen.

Chemical substances: atranorin (minor), chloroatranorin (minor), porphyrilic acid (major), 1α-hydroxyporphyrilic acid (trace).

Lecanora kurokawae is unique in Japanese saxicolous species of *Lecanora* in having verrucose thalli with soredia. It resembles *L. cenisia* Ach., a species widely distributed in North America and Europe, because they both have saxicolous habitat, verrucose thalli and similar spores. However, it can be easily distinguished from the latter by the presence of soredia, epruinose disc, and by the presence of porphyrilic acid as a major chemical substance.

This species was collected on granites at water's edge along the coast. It covers widely on rock surface together with species of *Acarospora* and *Caloplaca*.

Other specimen examined. Pontomari, HK 47436 (TNS).

87) *Lecanora sibirica* Müll. Arg. Frequent, on bark of *Quercus crispula*. Aikappu, TS 159.

88) *Leptogium asiaticum* Jørg. Occasional, on bark of *Fraxinus lanuginosa*. Kitoushi, TS 1981.

89) *Leptogium azureum* (Sw.) Mont. Occasional, on barks of *Fraxinus mandshurica* var. *japonica* and *Juglans mandshurica* var. *sachalinensis* and on decayed wood. Chirippu-mura to Akkeshi, KM 4456; N shore of Kiritappu marsh, KM 4298, KM 4401 and KM 4409.

90) *Leptogium burnetiae* Dodge. Occasional, on bark of *Acer mono*. Aikappu, TS 893 and HK 45834.

91) *Leptogium pedicellatum* Jørg. Occasional, on barks of *Acer mono* and *Fraxinus mandshurica*. Aikappu, TS 355; Ohbetsu, HK 45803.

92) *Leptogium saturunum* (Ach.) Nyl. Occasional, on bark of *Quercus crispula*. Aikappu, TS 496.

93) *Leptogium tenuissimum* (Dickson) Körber. Rare, on soil. Pontomari, TS 2054; Tomachise, HK 47497.

Although *Leptogium tenuissimum* is widely distributed in the Northern Hemisphere, it has never been reported from Japan. In the present survey, we found this species at one locality along the coast, where it grows among mosses on ground. This is the first record for this species in Japan as well as in Eastern Asia.

Specimens from the present area have spreading lobes, forming grayish brown cushions; lobes up to 1.5 mm wide, 10 – 12 mm high, elongate and deeply incised with crenate margin; thulli are composed of paraplectenchymatous tissue with-

out fibrous hyphae. Although the Japanese specimen is sterile, it is quite identical with exsiccate specimens kept in TNS.

Kashiwadani *et al.* (2002) reported *Leptogium subtile* (Schrader) Torss. from Mt. Kasagatake in Prov. Kohzuke. However, the specimen has characteristic features written above and can be better identified with this species.

Other specimen examined. Honshu. Prov. Kohzuke: (Pref. Gunma): around the summit of Mt. Kasagatake, elevation 2,000 – 2,050 m, October 11, 2001, M. Inoue 30569 and 30570 (TNS).

Exsiccati examined. V. Räsanen: Lich. Fenn. Exs. Mus. Bot. Univ. Helsink. ed. 116 (TNS). J. P. Norrlin and W. Nylander: the same above, 356 (TNS).

94) *Leptogium trichophoroides* P.M. Jørg. et Wallace. Occasional, on bark of *Quercus crispula*. Aikappu, TS 496.

95) *Lobaria adscripturiens* (Nyl.) Hue. f. *adscripturiens*. Occasional, on bark of *Taxus cuspidata*. Shiriba, TS 1671.

96) *Lobaria crassior* Vain. Rare, on bark of *Alnus japonica*. N shore of Kiritappu marsh, KM 4381.

97) *Lobaria discolor* (Bory) Hue. var. *discolor*. Occasional, on barks of *Quercus* sp. and *Salix* sp. Aikappu, TS 960.

98) *Lobaria fuscotomentosa* Yoshim. Occasional, on barks of *Acer* sp. and *Quercus* sp. Aikappu, TS 328.

99) *Lobaria japonica* (Zahlbr.) Asahina. Common, on bark of *Quercus crispula*. Aikappu, TS 158.

100) *Lobaria linita* (Ach.) Rabenh. Occasional, on barks of *Betula ermanii*, *Quercus crispula* and *Salix* sp. Aikappu, TS 169 and TS 962; Ohbetsu, TS 965.

101) *Lobaria orientalis* (Asahina) Yoshim. Occasional, on bark of *Fraxinus mandshurica* var. *japonica*. Ohbetsu, HK 45832; Mabiro, TS 968.

102) *Lobaria quercizans* Michaux. Occasional, on bark of *Acer mono*. Chomin-no-mori, TS 184; Shiriba, TS 1672.

103) *Lobaria retigera* (Bory) Trevis. var. *retigera*. Occasional, on bark. Shiriba, TS 1917.

104) *Lobaria sachalinensis* Asahina. Occasional, on bark of *Acer mono*. Kitoushi, TS 1968.

105) *Lobaria spathulata* (Inum.) Yoshim. Occasional, on barks of *Alnus japonica* and *Quercus crispula*. Aikappu, TS 150, TS 909 and TS 1253.

106) *Lobaria tuberculata* Yoshim. Occasional, on bark of *Alnus japonica*. Aikappu, TS 326 and TS 966; Mabiro, HK 47445.

107) *Lopadium disciforme* (Flot.) Kulh. Occasional, on bark of *Abies sachalinensis*. Aikappu, HK 46260.

108) *Loxospora ochrophaea* (Tuck.) R.C. Harris. Occasional, on barks of *Alnus japonica* and *Fraxinus lanuginosa*. N shore of Kiritappu marsh, KM 4400 and KM4426; Osyamai, TS 1693.

109) *Megalospora tuberculosa* (Fée) Sipman. Occasional, on bark of *Quercus crispula*. Aikappu, TS 982.

110) *Melanelixia huei* (Asahina) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. et Lumbsh. Common, on barks of *Fraxinus lanuginosa* and *Fraxinus mandshurica* var. *japonica*. Aikappu, TS 974; Ohbetsu, HK 45849.

111) *Melanohalea olivacea* (L.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. et Lumbsh. Rare, on bark of *Salix subfragilis*. Horoto, HK 47522.

112) *Menegazzia primaria* Aptroot *et al.* Very rare, once reported from Kushiro (Moon *et al.*, 2006), on bark of *Abies sachalinensis*. Horonai, HK 47459.

113) *Menegazzia terebrata* (Hoffm.) A. Massal. Common, on bark of *Abies sachalinensis*. Aikappu, TS 267; Horoto, HK 47508.

114) *Myelochroa entotheiochroa* (Hue) Elix et Hale. Occasional, on barks of *Alnus japonica* and *Quercus crispula*. Aikappu, TS 152 and TS 973; Osonaeyama, TS 971.

115) *Myelochroa irrugans* (Nyl.) Elix et Hale. Occasional, on barks of *Alnus japonica* and *Fraxinus lanuginosa*. Aikappu, TS 899; Kitoushi, HK 47467.

116) *Myelochroa leucotyliza* (Nyl.) Elix et

Hale. Occasional, on barks of *Abies sachalinensis* and *Quercus crispula*. N shore of Kiritappu marsh, KM 4334; Aikappu, TS 975.

117) *Myelochroa metarevoluta* (Asahina) Elix et Hale. Occasional, on rocks and on bark of *Fraxinus lanuginosa*. Konohi-park, TS 1021; Ohbetsu, HK 45850.

118) *Nephroma bellum* (Spreng.) Tuck. Occasional, on rocks. Aikappu, TS 983.

119) *Nephroma resupinatum* (L.) Ach. Occasional, on bark of *Fraxinus lanuginosa*. N shore of Kirittapu marsh, KM 4396; Shiriba, TS 1684; Tomachise, TS 2034.

120) *Nephromopsis endocrocea* Asahina. Occasional, on barks of *Abies sachalinensis* and *Fraxinus lanuginosa*. Aikappu, TS 157, TS 228 and TS 301.

121) *Nephromopsis ornata* (Müll. Arg.) Hue. Occasional, on bark. Shiriba, TS 2008.

122) *Nephromopsis rugosa* Asahina. Occasional, on bark. Aikappu, TS 858.

123) *Normandina pulchella* (Borrer) Nyl. Occasional, on bark of *Alnus japonica*. Aikappu, TS 814b.

124) *Ochrolechia akagiensis* Yasuda. Occasional, on barks of *Abies sachalinensis* and *Quercus crispula*. Mabiro, TS 988; Shiriba, HK 47431.

125) *Ochrolechia parellula* (Müll. Arg.) Zahlbr. Occasional, on rocks. Bekanbeushi bridge, TS 1296.

126) *Ochrolechia trochophora* (Vain.) Oshio. Common, on barks of *Abies sachalinensis*, *Acer* sp. and *Fraxinus lanuginosa*. Aikappu, TS 991; Mabiro, TS 989 and TS 990.

127) *Ochrolechia yasudae* Vain. Ooccasional, on bark of *Quercus crispula*. Aikappu, TS 151.

128) *Oropogon asiaticus* Asahina. Rare, on bark. Shiriba, TS 1624.

129) *Pannaria lurida* (Mont.) Nyl. subsp. *lurida*. Occasional, on barks of *Acer mono* and *Alnus japonica* and on decayed wood. Aikappu, TS 1034; Kitoushi, HK 47480; Monshizu, TS 419.

130) *Parmelia fertilis* Müll. Arg. Common, on bark of *Abies sachalinensis* and on rocks. Kokutaiji, TS 1020; Monsizu, TS 477.

131) *Parmelia laevior* Nyl. Common, on bark of *Alnus japonica*. Aikappu, TS 224 and TS 1030.

132) *Parmelia praesquarrosa* Kurok. Very frequent, on barks of *Alnus japonica*, *Betula ermanii*. Aikappu, TS 1019 and TS 1029; Osonaeyama, TS 402.

133) *Parmelia squarrosa* Hale. Frequent, on barks of *Abies sachalinensis*, *Alnus japonica* and *Picea glehni*. Aikappu, TS 269; Mabiro, TS 1371 and TS 1190; Bekanbeushi marsh, TS 1356.

134) *Parmotrema chinense* (Osbeck) Hale et Ahti. Locally abundant, on twigs of *Betula* and on barks of *Alnus japonica* and *Quercus crispula*. Kiritappu, Arakawa 1472 and Arakawa 1573.

135) *Parmotrema clavuliferum* (Räsänen) Streimann. Rare, on bark. Kokutaiji, TS 1228.

136) *Parmotrema reticulatum* (Taylor) M. Choisy. Common, on barks of *Abies sachalinensis*, *Acer mono* and *Betula ermanii* and on rocks. Aikappu, TS 1453 and TS 1455; Kokutaiji, TS 1233 and HK 45813.

137) *Parmotrema tinctorum* (Nyl.) Hale. Very rare, on bark of *Abies sachalinensis*. N shore of Kiritappu marsh, KM 4234.

This species is widely distributed in tropical to temperate areas in the world. In Japan, it has been recorded from south of Aomori Prefecture but has not been reported from Hokkaido. In the present survey, we found this species at hillside of Kiritappu marsh. This is the northern most locality for this species in Japan.

138) *Peltigera collina* (Ach.) Schrad. Rare, on bark of *Quercus crispula*. Shiriba, HK 47515.

139) *Peltigera didactyla* (With.) J.R. Laundon. Occasional, on ground along trail. Pontomari, TS 1731.

140) *Peltigera dilacerata* (Gyeln.) Gyeln. Occasional, on soil or on trank base. Aikappu, TS 163 and TS 1069.

141) *Peltigera dolichorrhiza* Nyl. Occasional, on soil. Pontomari, TS 1881.

142) *Peltigera horizontalis* (Huds.) Baumg. Occasional, on soil. Aikappu, TS 1069.

143) *Peltigera leucophlebia* (Nyl.) Gyelnik.

Occasional, on soil in mixed forest dominated by *Acer*, *Abies*, *Alnus* and *Quercus*. Aikappu, TS 1070.

144) *Peltigera praetextata* (Flörke) Vain. Occasional, on soil. Aikappu, TS 1068.

145) *Peltigera rufescens* (Weiss.) Humb. Occassional, on soil. Aikappu, TS 1096.

146) *Pertusaria carneopallida* (Nyl.) Anzi ex Nyl. Rare, on bark of *Sorbus commixta*. Fukushima, KM 4189.

147) *Pertusaria commutata* Müll. Arg. Occasional, on bark of *Abies sachalinensis* and on rocks. N shore of Kiritappu marsh, KM 4247; Aikappu, TS 155 and HK 45825.

148) *Pertusaria composita* Zahlbr. Occasional, on bark of *Betula ermanii*. Aikappu, TS 1062.

149) *Pertusaria corallina* (L.) Arnold. var. *corallina*. Occasional, on bark of *Betula ermanii*. Aikappu, TS 972.

150) *Pertusaria ferruginea* (Müll. Arg.) Oshio. Rare, on bark of *Abies sachalinensis*. Fukushima, KM 4716.

151) *Pertusaria lactea* (L.) Arnold. (Räsänen 1940a, Oshio 1968). Occasional, on bark of *Abies sachalinensis* and on rocks. Mabiro, TS 1124; Aikappu, TS 1044.

152) *Pertusaria leucosora* Nyl. var. *leucosora*. Common, on barks of *Abies sachalinensis*, *Alnus japonica* and *Betula ermanii*. Aikappu, TS 1132 and TS 1133, Mabiro, TS 1061.

153) *Pertusaria mendax* Müll. Arg. Locally common, on bark of *Abies sachalinensis*. N shore of Kiritappu marsh, KM 4222.

154) *Pertusaria multipuncta* (Turner) Nyl. Occasional, on bark of *Alnus japonica*. Aikappu, TS 262.

155) *Pertusaria oshioi* J.C. Wei. Locally common, on barks of *Abies sachalinensis* and *Alnus japonica*. N shore of Kiritappu marsh, KM 4316 and KM 4318.

156) *Pertusaria pertusa* (L.) Tuck. Occasional, on bark of *Fraxinus lanuginosa*. Osonaeyama, TS 1059.

157) *Pertusaria pustulata* (Ach.) Duby. Rare, on bark of *Abies sachalinensis*. Chrippu to Akkeshi, KM 4458.

158) *Pertusaria quartans* Nyl. Rare, on rocks, Aikappu, HK 45826.

159) *Pertusaria subcomposita* Oshio. Occasional, on bark of *Alnus japonica*. Aikappu, TS 462; Daikokujima, TS 1055.

160) *Pertusaria subfallens* Vain. Occasional on bark of *Abies sachalinensis*. Aikappu, TS 1035.

161) *Pertusaria sublaeviganda* Vain. Occasional, on bark of *Betula ermanii*. Aikappu, TS 1145.

162) *Pertusaria submultipuncta* Nyl. Occasional, on rocks. Aikappu, TS 1038.

163) *Pertusaria variolina* Nyl. Occasional, on barks of *Quercus crispula* and *Salix* sp. and on rocks. Osonaeyama, TS 953; Ohbetsu, TS 1375; Horonai, TS 1786.

164) *Pertusaria velata* (Turner) Nyl. Occasional, on rocks. Aikappu, TS 1268 and HK 45818.

165) *Phaeographis fuscodisca* M. Nakan. Rare, on bark of *Abies sachalinensis*. Aikappu, HK 46270.

166) *Phaeophyscia hirtuosa* (Krempelh.) Essl. Occasional, on bark of *Fraxinus lanuginosa*. Aikappu, TS 1142.

167) *Phaeophyscia hispidula* (Ach.) Moberg. Occasional, on bark of *Salix subfragilis*. Horoto, HK 47501.

168) *Phaeophyscia imbricata* (Vain.) Essl. Occasional, on bark of *Quercus crispula*. Aikappu, TS 1378.

169) *Phaeophyscia limbata* (Poelt) Kashiw. Occasional, on rocks. Aikappu, TS 334; Kokutaiji, TS 1092.

170) *Phaeophyscia rubropulchra* (Degel.) Moberg. Occasional, on bark. Osonaeyama, TS 1135.

171) *Phaeophyscia trichophora* (Hue) Essl. Occasional, on bark of *Salix* sp. Aikappu, TS 1281; Ohbetsu, HK 45847.

172) *Physcia aipolia* (Ehrh. ex Humb.) Furnr. Rare, on bark of *Alnus japonica*. N shore of Kiritappu marsh, KM 4347.

173) *Physcia caesia* (Hoffm.) Hampe in

Furnr. Occasional, on concrete floor. Aikappu, HK 45808.

174) *Physcia dubia* (Hampe) Lettau. Occasional, on bark of *Larix leptolepis*. Ohta, TS 187.

175) *Physcia phaea* (Tuck.) Thomson. Occasional, on bark of *Alnus japonica*. Daikokujima, TS 1085.

176) *Physcia stellaris* (L.) Nyl. Occasional, on barks of *Alnus japonica* and *Salix* sp. Kokutaiji, 1093, Daikokujima, TS 1159; Ohbetsu, HK 45848 and TS 1110.

177) *Physciella melanchra* (Hue) Essl. Common, on bark of *Abies sachalinensis* and on rocks. Aikappu, HK 45810 and HK 45820.

178) *Physconia detersa* (Nyl.) Poelt. Occasional, on rocks. Osonaeyama, TS 1141.

179) *Physconia grumosa* Kashiw. et Poelt. Occasional, on bark of *Quercus crispula*. Aikappu, TS 1109; Kitoushi, HK 47477.

180) *Physconia hokkaidensis* Kashiw. Occasional, on bark. Aikappu, TS 1892.

181) *Platismatia interrupta* W.L. Culb. et C. F. Culb. Occassional, on bark of *Abies sachalinensis*. Aikappu, TS 287; Mabiro TS 490.

182) *Polychidium dendriscum* (Nyl.) Henssen. Occasional, among mosses on bark. Shiriba, TS 1924.

183) *Porpidia albocaerulescens* (Wulfen) Hertel et Knoph. var. *albocaerulescens*. Occasional, on rocks. Aikappu, TS 1270.

184) *Pseudocyphellaria crocata* (L.) Vain. Occasional, on bark of *Salix* sp. Shiriba, TS 1931.

185) *Punctelia borreri* (Sm.) Krog. Occasional, on bark of *Salix* sp. Ohta, TS 207.

186) *Punctelia rudecta* (Ach.) Krog. Occasional, on bark. Kokutaiji, TS 1072.

187) *Pyrenula japonica* Kurok. Common, on bark of *Abies sachalinensis*. Aikappu, TS 248.

188) *Pyxine sorediata* (Ach.) Mont. Occasional, on decayed wood and bark of *Acer mono*. Aikappu, TS 1077.

189) *Ramalina commixta* Asahina. Rare, on bark of *Fraxinus lanuginosa*. Horonai, HK 47464.

190) *Ramalina conduplicans* Vain. Common, on barks of *Abies sachalinensis* and *Salix subfragilis*, and on rocks. Aikappu, HK 45817; Kitoushi, HK 47411; Ohoro, HK 47424.

191) *Ramalina dilacerata* (Hoffm.) Hoffm. Occasional, on bark of *Quercus dentata*. Aikappu, TS 3912b.

192) *Ramalina geniculata* Hook. et Tayl. var. *globiformis* Räsänen. Rare, on bark of *Salix subfragilis*. Kitoushi, HK 47410.

193) *Ramalina hokkaidensis* Kashiw. Occasional, on barks of *Abies sachalinensis*, and *Salix subfragilis*. Ohoro, HK 47426 and HK 47430; Shiriba, TS 1262.

194) *Ramalina pertusa* Kashiw. Occasional, on barks of *Alnus japonica* and *Salix subfragilis*. Kiritappu, HK 47510; Ohoro, HK 47423.

195) *Ramalina pollinaria* (Wester.) Ach. Occasional, on rocks. Bekanbeushi bridge, TS 407.

196) *Ramalina roesleri* (Hochst.) Nyl. Occasional, on bark of *Abies sachalinensis*. Aikappu, HK 45833; Kitoushi, HK 47478.

197) *Ramalina shinanoana* Kashiw. Rare, on bark. Kokutaiji, TS 993.

198) *Ramalina sinensis* Jatta. Occasional, on bark of *Sorbus commixta*. Ohbetsu, HK 45822.

199) *Ramalina subbreviuscula* Asahina. Occasional, on concrete basses. Daikokujima, TS 1001.

200) *Sticta fuliginosa* (Dickson) Ach. Occasional, on bark of *Fraxinus lanuginosa*. Tomachise, TS 2036 and HK 47490.

201) *Sticta nylanderiana* Zahlbr. Occasional, on bark of *Taxus cuspidata*. Shiriba, TS 1670.

202) *Sticta weigelii* (Ach.) Vain. Rare, on bark. Shiriba, TS 1913.

203) *Sticta wrightii* Tuck. Occasional, on bark of *Abies sachalinensis*. Aikappu, TS 283.

204) *Sticta yatabeana* Müll. Arg. Occasional, on bark of *Acer mono*. Shiriba, TS 1909.

205) *Tephromela atra* (Huds.) Hafellner. Frequent, on bark of *Betula ermanii*. Aikappu, TS 1331.

206) *Thelotrema lepadinum* (Ach.) Ach. Rare, on bark of *Betula ermanii*. Kitoushi, HK 47473.

207) *Thelotrema nipponicum* Tat. Matsumo-

to. Occasional, on bark of *Abies sachalinensis*. Shiriba, TS 1645.

208) *Thelotrema similans* Nyl. Occasional, on bark of *Alnus japonica*. Daikokujima, TS 1053.

209) *Thelotrema subtile* Tuck. Occasional, on bark of *Abies sachalinensis*. Mabiro, HK 47478.

210) *Tuckneraria pseudocomplicata* (Asahina) Randlane et Saag. Occasional, on bark of *Quercus crispula*. Pontomari, TS 1740.

211) *Usnea cornuta* Körb. subsp. *cornuta*. Rare, on bark of *Abies sachalinensis*. Fukushima, KM 420.

212) *Usnea dasaea* Stirt. Occasional, on bark of *Abies sachalinensis*. Mabiro, TS 923.

213) *Usnea fragilescens* Lynge. Rare, on bark of *Abies sachalinensis*. Mabiro, TS 921.

This species has also been known from Western Europe and British Columbia. It is characterized by inflated branchs and excavated soraria with granular soredia.

214) *Usnea glabrata* (Ach.) Vain. Occasional, on bark of *Abies sachalinensis*. Kitoushi, TS 1703.

215) *Usnea mutabilis* Stirton. Occasional, on bark of *Abies sachalinensis*. Mabiro, 925.

216) *Usnea pangiana* Stirton. Occasional, on bark of *Abies sachalinensis*. Aikappu, TS 229.

217) *Usnea pygmoidea* (Asahina) Y. Ohmura. Rare, on bark of *Salix subfragilis*. Kitoushi, HK 47414b.

218) *Usnea rubicunda* Stirton. Occasional, on bark of *Abies sachalinensis*. Aikappu, HK 47512.

219) *Usnea rubrotincta* Stirton. Occasional, on bark of *Abies sachalinensis*. Aikappu, HK 45827.

220) *Usnea subfloridana* Stirton. Occasional, on bark of *Abies sachalinensi*s. Kokutaiji, TS 483.

221) *Usnea wasmuthii* Räsänen. Occasional, on bark of *Abies sachalinensis*. Kokutaiji, TS 484.

222) *Xanthoria fallax* (Hepp) Arnold. Rare, on rocks. Chirippu to Akkeshi, Arakawa 1360.

223) *Xantoria mandschurica* (Zahlbr.) Asahina. Occasional, on rock (conclete). Aikappu, HK 45809.

Phytogeographical features

As shown above, 223 taxa of lichens have been recognized. They certainly belong to different phytogeographical elements composing Japanese lichen flora. With regard to lichen flora of Japan, various phytogeographical elements have been proposed by Jørgensen (1983), Moon (1999), Kashiwadani *et al.* (2000), Harada (2001) and Kurokawa (2006). Among them, phytogeographical elements proposed by Kurokawa (2006) seem to be most reliable. According to him, 16 elements are recognized as composing lichen flora of Japan. In the present area, ten of them are recognized as shown below and taxa belonging each of those elements are also listed in the following list, referring their world distributions known at present.

1. Holarctic Element

Only one species (0.4%), *Cladonia alpina*, belongs to this element. Even though the present area situated in northeastern most Hokkaido, it is quite natural that the proportion of holarctic element is so low, since ther is no high mountain.

2. Alpine Element

One species (0.4%), *Cladonia farinacea*, belongs to the present element.

3. Boreal Element

According to Kurokawa (2006), lichens distributed in boreal zone in the Northern and Southern Hemispheres belong to the present element. The following 31 taxa (13.9%) are found in the present area: *Agonimia pacifica*, *Bryoria confusa*, *B. furcellata*, *B. trichodes*, *Cetrelia cetrarioides*, *Cladonia glauca*, *C. grayi*, *C. rei*, *Dibaeis baeomyces*, *Dolichousnea longissima*, *Evernia mesomorpha*, *Hafellia disciformis*, *Hypogimnia pseudophysodes* var. *pseudophysodes*, *H. submundata* f. *submundata*, *H. vitata*, *Japewia subaurifera*, *Leptogium tenuissimum*, *Lobaria*

linita, *Melanoholea olivacea*, *Nephromopsis rugosa*, *Pertusaria lactea*, *P. multipuncta*, *P. pertusa*, *Physcia aipolia*, *P. dubia*, *P. phaea*, *Ramalina roesleri*, *Sticta weigelii*, *Usnea fragilescens*, *U. subfloridana* and *Xanthoria fallax*.

4. Beringian element

One species (0.4%), *Cladonia arbuscula* subsp. *beringiana* belongs to the present element.

5. Eastern Asiatic-North American Disjunctive element

As shown by Kurokawa (2006), *Anaptychia palmulata*, *Cetrelia chicitae*, *Heterodermia hypoleuca*, *Lobaria quercizans*, *Loxsospora ochrophaea*, *Myerochroa metarevoluta*, *Ochrolechia trichophora*, *O. yasudae* and *Parmelia sqarrosa* belong to the present element. The following three species found in the present area can be also concidered to belong to the present element; *Cladonia humilis*, *Hypogimnia pseudoenteromorpha* and *Phaeophyscia rubropuchra*. In total, 12 taxa (5.4%) belong to the present element.

6. Northeast Asiatic Element

When he proposed 16 phytogeographical elements for the Japanese lichen flora, the following 18 taxa, which also occur in the present area, were enumerated as belonging to the present element. They are *Anzia japonica*, *A. opuntiella*, *Brigantiaea ferruginea*, *Cetreliopsis asahinae*, *Collema complanatum*, *Dolichousnea diffracta*, *Heterodermia microphylla*, *L. sachalinensis*, *Melanelixia huei*, *Myerochroa irrugans*, *M. leucotyliza*, *Nephromopsis endcrocea*, *Parmelia fertilis*, *P. laevior*, *P. praesqarrosa*, *Platismatia interrupta*, *Pyrenula japonica* and *Xanthoria mandshurica*. On the other hand, the following taxa found in the present area can be also considered to belong to the present element; *Anaptychia isidiza*, *Anzia colpota*, *Calicium abietinum*, *Cetrelia japonica*, *Cladonia kurokawae*, *Evernia prunastri*, *Hypogymnia fragillima*, *H. pulverata*, *Lecanora chionocarpa*, *L. sibirica*, *Lobaria japonica*, *Lobaria orientaris*, *L. tuberculata*, *Menegazzia primaria*, *Oropogon asiaticus*, *Peltigera didactyla*, *P. dolichorrhiza*, *Pertusaria composita*, *P. oshioi*, *P. quertans*, *P. subcomposita, P. subfallens*, *P. submultipuncta*, *Phaeophyscia imbricata*, *Physconia grumosa*, *Ramalina commixta*, *R. geniculata* var. *globiformis*, *R. pertusa*, *R. polinaria*, *R. shinanoana*, *R. subbreviuscula*, *Sticta wrightii*, *Sticta yatabeana*, *Tuckneraria pseudocomplicata*, *Usea dasaea*, *U. pangiana*, *U. pygmoidea* and *U. rubrotincta*. Thus, 56 taxa (25.1%) occurring in the present area belong to the Northeast Asiatic element.

7. Pantemperate Element

Among the taxa occurring in the present area, the following 10 taxa were reported as members of the present element by Kurokawa (2006); *Candelaria concolor*, *Chaenotheca brunneola*, *Cladonia furcata*, *C. scabriuscula*, *C. squamosa* var. *squamosa*, *Flavoparmelia caperata*, *Menegazzia terebrata*, *Porpidia albocaerulescens* var. *albocaerulescens*, *Punctelia borreri* and *Sticta fuliginosa*. The following 78 taxa, occurring in the present area, can be added to this element; *Candelariella vitellina*, *Cetrelia olivetorum*, *Chrysothrix candelaris*, *Cladonia caespiticia*, *C. chlorophaea*, *C. coniocraea*, *C. cornuta* subsp. *cornuta*, *C. hondoensis*, *C. macilenta*, *C. ochrochlora*, *C. pleurota*, *C. ramulosa*, *Coccocarpia erythroxyli*, *C. palmicola*, *Collema callopismum*, *C. cocophyllum*, *C. japonicum* f. *japonicum*, *C. leptaleum* var. *leptaleum*, *C. subflaccidum*, *Dimerella lutea*, *D. pineti*, *Dolichousnea trichodeoides*, *Graphis scripta*, *G. tenella*, *Heterodermia boryi*, *H. diademata*, *H. isidiophora*, *H. japonica*, *H. obscurata*, *H. propagulifera*, *H. tremulans*, *Hypotrachina incognita*, *Leptogium azureum*, *L. burrnetiae*, *Lobaria crassior*, *Lopadium disciforme*, *Megarospora tuberculosa*, *Myerochroa entotheiochroa*, *Nephroma respinatum*, *Normandina pulchella*, *Pannaria lulida*, *Parmotrema chinensis*, *P. clavriferum*, *P. reticulatum*, *P. tinctorum*, *Peltigera collina*, *P. dilacerata*, *P. horizontaris*, *P. leucophlebia*, *P. praetextata*, *P. rufescens*, *Pertusaria carneopallida*, *P. corallina*, *P. leucosora*, *P. pustulata*, *P. variolina*, *P. velata*,

Phaeophyscia hirtuosa, *P. hispidula*, *P. trichophora*, *Physcia caesia*, *P. stellaris*, *Physciella melanchra*, *Physconia deterusa*, *Polychidium dendriscum*, *Pseudocyphellaria crocata*, *Punctetia rudecta*, *Pyxne sorediata*, *Ramalina dilacerata*, *R. sinensis*, *Tephromela atra*, *Terotrema lepadium*, *T. subtile*, *Usnea cornuta* subsp. *cornuta*, *U. glabrata*, *Usnea mutabilis*, *U. rubicunda* and *U. wasmuthii*. In total, 88 taxa (39.5%) belong to the Panteperate element.

8. Sino-Japanese Element

Among taxa listed above, the following 14 taxa (6.3%) can be considered to the Sino-Japanese element. They are *Bryoria asiatica*, *Cetrelia braunsiana*, *Heterodermia hypochraea*, *Leptogium asiaticum*, *L. pedicellatum*, *L. saturunum*, *L. trichophoroides*, *Lobaria adscripturiens* f. *adscripturiens*, *L. fuscotomentosa*, *L. spathulata*, *Nephromopsis ornata*, *Phaeophyscia limbata*, *Ramalina conduplicans* and *Sticta nylanderiana.* Among them, only one species, *Bryoria asiatica*, was treated as a member of Sino-Japanese element by Kurokawa (2006).

9. Endemic Element

At present, following 17 taxa (7.6%) found in the present area are considered to be endemic to Japan: *Fissurina inabensis*, *Graphis cognata*, *G. rikuzensis*, *Hypogimnia hokkaidensis*, *Lecanora kurokawae*, *Nephroma bellum*, *Ochrolechia akagiensis*, *O. parellula*, *Pertusaria commutata*, *P. ferruginea*, *P. mendax*, *Pertusaria sublaeviganda*, *Phaeophyscia fuscodisca*, *Physconia hokkaidensis*, *Ramalina hokkaidensis*, *Thelotrema nipponicum* and *T. similans*. As pointed out by Kurokawa (2006), some of them are not neccessarily endemic to Japan and may be found in the adjacent areas such as China, Korea and eastern Siberia in future.

10. Paleotropical Element

Two taxa (0.9%), *Lobaria discolor* var. *discolor* and *L. retigera* var. *retigera*, belong to the present element, as stated by Kurokawa (2006).

The lichen flora of Akkeshi and the adjacent area is composed of the Holarctic, Alpine, Boreal, Beringian, Northeastern Asiatic-North American Disjunctive, Northeast Asiatic, Pantemperate, Sino-Japanese, Endemic and Paleotropical elements. It is characterized by high proportions of the Northeast Asiatic (25.1%) and Panteperate (39.5%) elements. Rather high propotion of Northeastern Asiatic-North American Disjunctive element is probably related to the geographical location of the present area which is situated on the midway of the southwards migration of Arcto-Tertiary flora. On the other hand, it is also noteworthy that none of the taxa belonging to the Bipolar, Pantropical, Indo-Malayan, Pacific, Circum-pacific and Austrarian elements is found in the present area.

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