

## Japanese Species of *Lecidella* (Lichenes, Lecanoraceae) (I)

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**Abstract** Three species of *Lecidella* are reported for Japan. *L. asema* (Nyl.) Knoph & Hertel and *L. carpathica* Körb. are new to the flora of Japan. Taxonomic and chemical data are provided.

**Key words:** lichens, taxonomy, *Lecidella*, Japan.

*Lecidella* was established by Körber in 1855. However, most lichenologists have ignored this genus because Th. Fries (1874) reduced it to a synonym of *Lecidea* D. *Eulecidea* Th. Fr. and Zahlbruckner (1926) followed Th. Fries in compiling the Lichenes in “Die Natürlichen Pflanzenfamilien.” No further significant contributions relating to *Lecidella* were made until 1950, when Choisy resurrected and delimited the genus, adding pycnospore characters to Körber’s original defining features. Later Hertel (1967) and Hertel & Leuckert (1969) approached this assemblage on the basis of modern information, and the latter raised it again to an autonomous genus, as here accepted. More recently Leuckert and his co-authors (Leuckert & Knoph, 1992, 1993; Leuckert *et al.*, 1990, 1992; Knoph & Leuckert, 1994; Knoph *et al.*, 1995) made noteworthy contributions to the chemotaxonomy of *Lecidella*.

Inoue (1982) reported Japanese species of *Lecidea* (s. str.) with details of their morphological and anatomical characters and the taxonomic significance concerning *Lecidea* Ach., *Lecidella* Körb. and *Porpidia* Körb. (syn. *Huilia* Zahlbr.) were discussed there, however, there was little available information on Japanese species of *Lecidella*.

This paper lists three Japanese species of *Lecidella* and provides taxonomic notes on these.

In the list of specimens examined, the locality is followed by the altitude, accession number and the date collected. The specimens listed here are preserved in the herbarium of Akita University and in the herbarium of the National Science Museum, Tokyo (TNS).

### **LECIDELLA** Körb. emend. Hertel & Leuckert

Willdenowia 5: 373 (1969). — *Lecidella* Körb. pro parte, Syst. Lich. Germ. 233 (1855). Type species: *Lecidella viridans* (Flot.) Körb. (Lectotype, Hertel, 1967: 26).

Thallus crustose, areolate, or verrucose, or granulose, or rimose, ecorticate

below; upper cortical layer composed of vertically aligned hyphae; algal layer more or less uniform, mostly continuous; medulla I-. Algae protococcoid. Hypothallus distinct or indistinct, black or white.

Apothecia round, adnate or subimmersed in the thallus, usually constricted at the base or not constricted; disc plane or convex, naked or pruinose, with a concolorous or rarely paler margin. Excipulum without thalline margin, originating laterally from the under part of subhymenium, distinct from the subhymenium, non-carbonaceous, colorless or brown with various tinge (dark-, violet-, or greenish); hyphae usually thickish and pachydermatous, radiating, more or less perpendicular to surface. Epithecium tinged with various colors. Hymenium usually colorless or rarely suffused with pigment of epithecium in the upper part, with variable heights. Subhymenium varying from colorless (or rarely sordid yellowish-cloudy) to pigmented (various shades of brown, chiefly violet brown or golden brown), usually with irregularly shaped cavities. Hypothecium indistinct. Paraphyses simple or branched (the branches few in number for the most part), discrete, swollen towards their apices. Asci clavate; tholus well developed, I+ intensive blue. Spores hyaline and simple, ellipsoidish, without a halo.

The genus *Lecidella* is separated from *Lecidea* (s. str.) by the excipulum originating from the under part of subhymenium, the intensively amyloid thick tholus, the subhymenium with irregularly-shaped cavities (Fig. 1a), and the discrete paraphyses. The genus *Porpidia* is clearly separated from this genus chiefly by the carbonaceous excipulum originating from the well-developed hypothecium and richly branched

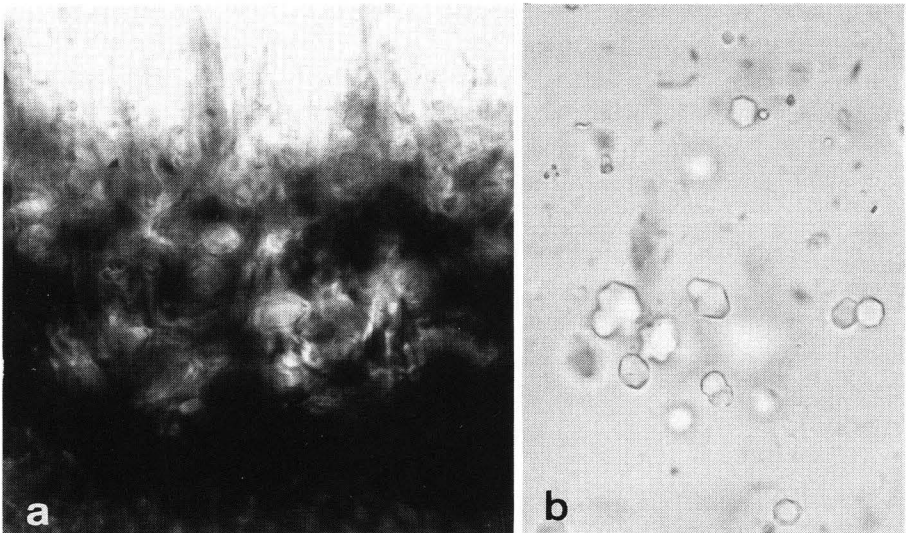


Fig. 1. a. Cross-section of a subhymenium showing "irregularly shaped cavities", *Lecidella elaeochroma* (M. Inoue no. 9061),  $\times 880$ . b. Zeorin in An-solution (a mixture of one part anilin, 2 parts ethyl alcohol, and 2 parts glycerol), obtained from *Lecidella bullata*,  $\times 880$ .

anastomosing paraphyses. The genus *Carbonea*, of which hyphal structure of the excipulum is similar, chiefly distinguished from *Lecidella* by having coherent paraphyses and carbonaceous excipulum.

The genus *Lecidella* occurs from lower to higher altitudes or from warm temperate to boreal zone of Japan (Inoue 1994).

### Enumeration of species

- 1) *Lecidella asema*** (Nyl.) Knoph & Hertel (Fig. 2a)  
 in Knoph, Bibl. Lich. 36: 66 (1990).—*Lecidea asema* Nyl., Flora 55: 356 (1872). Type: Great Britain, Jersey, — holotype in H (H-Nyl. 19663), non vidi. — *Lecidea parasema*\*\* *L. subincongrua* Nyl., Bull. Soc. Linn. Normand., ser. 2, 6: 291 (1872), — *Lecidea subincongrua* (Nyl.) Zahlbr., Cat. Lich. 3: 701 (1925), — *Lecidella subincongrua* (Nyl.) Hertel & Leuckert, Willdenowia 5: 375 (1969). Type: France, “Pyren. orient. prope Tour de La Massane, leg. W. Nylander, — holotype in H (H-Nyl. 20143), vidi.

Thallus effuse, thin to medium, granulose-diffract or granulate-subareolate, white with yellow tinge; medulla I-. Hypothallus indistinct.

Apothecia up to 1 mm in diameter, adnate, black, moderately constricted at the base; disc epruinose, plane with a prominent entire margin at the juvenile stage, then becoming convex with an obliterated margin. Excipulum 40–60  $\mu\text{m}$  thick, violet-brown externally, the interior part sordid golden-brown; hyphae perpendicularly radiating, 4–5.5  $\mu\text{m}$  thick, with a thick wall. Epithecium deep-green or paler. Hymenium 60–80  $\mu\text{m}$  high. Subhymenium 100–120  $\mu\text{m}$  high, with irregularly shaped cavities, golden brown. Paraphyses simple or rarely branched, lax, slender, 1.5–2  $\mu\text{m}$  thick; apices not clavate. Asci 50–75  $\times$  12–16  $\mu\text{m}$ , clavate; tholus somewhat thick, I+ intensive blue. Spores with obtuse ends, 10–15  $\times$  5–8  $\mu\text{m}$ .

Reaction: thallus P-, K+yellow, KC-, C-; medulla P-, K-, KC-, C+orange. Chemical substances: atranorin, thiophanic acid, and an unidentified minor constituent (+/-) (TLC).

Habitat: on non-calcareous rocks, serpentines and stone walls in the lowlands to mountain regions.

Range: Japan; China (Hertel & Zhao, 1982); Europe (Knoph, 1990; Leuckert *et al.*, 1992); Cape Verde Isls. (Knoph & Mies, 1995); North America (Knoph & Leuckert, 1994).

I have not seen the type of *L. asema*, but examined the holotype of *L. subincongrua* which Knoph (1990) proposed as a synonym. The Japanese representatives agree well, both morphologically and anatomically. The type (Fig. 2b) of *L. subincongrua*, on which the following description was based, is very meager and bears only 3 apothecia: apothecia 0.5, 0.6, and 0.7 mm in diameter; epithecium blue-green; hymenium 50–60  $\mu\text{m}$ ; subhymenium 150  $\mu\text{m}$  high, with irregularly shaped cavities,

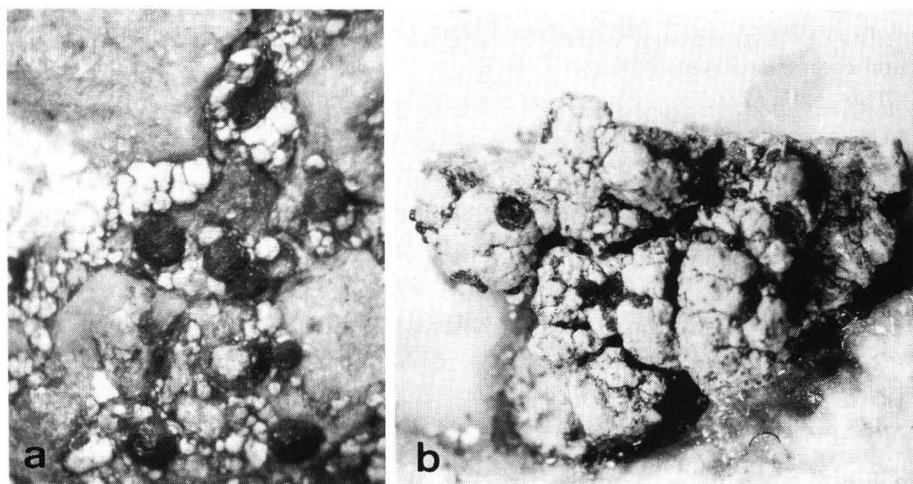


Fig. 2. a. *Lecidella asema* (Nyl.) Knoph & Hertel (M. Inoue no. 9014),  $\times 10$ . b. Holotype of *Lecidea parasema*\*\* *L. subincongrua* Nyl. (H-Nyl. 20143),  $\times 10$ .

golden brown; excipulum violet-brown externally, the interior part dark golden-brown; hyphae of excipulum  $6-7\ \mu\text{m}$  thick, pachydermatous; spores  $10-12 \times 5-6$  ( $10 \times 5$ ,  $12 \times 6$ ,  $11 \times 5$ )  $\mu\text{m}$ . TLC not performed.

This species is morphologically similar to *Lecidella carpathica*, but differs in that it produces thiophanic acid (C+) while the latter produces diploicin (C-). Japanese representatives of *L. carpathica* are, at present, not known to occur in SW Japan while those of *L. asema* do occur there (Figs. 3, 5). Thus, these species may have different distributional ranges.

*Lecidella elaeochroma*, which is one of the common corticolous lichens of Japan, is closely allied to *L. asema*, but is distinguished in having a violet-brown subhymenium while that of *L. asema* is golden brown.

This species had been known from Europe and North America, but the range was extended to China by Hertel & Zhao (1982, as *L. subincongrua*). This is the second report from Asia.

Specimens examined. HOKKAIDO. Prov. Sôya: Rebun Island, Momoiwa, 200-250 m, M. Inoue no. 9014 (19 Aug., 1974). Prov. Rumoi: Mt. Shokanbetsu, 610 m, M. Inoue no. 8288 (21 Aug., 1974). Prov. Ishikari: Mt. Tengu near Sapporo, 1000 m, M. Inoue no. 8076 (3 Sept., 1974). Prov. Hidaka: Mt. Apoi, 770 m, M. Inoue no. 4047 (5 July, 1973). HONSHU. Pref. Akita: a lakeside of Lake Towada, 400 m, M. Inoue no. 16596; Oga Peninsula, 550 m, M. Inoue no. 16871 (13 June, 1982) & 570 m, M. Inoue no. 16862 (5 Aug., 1983). Pref. Gunma: Tone-gun, coll. A. Tsunoda, s.n. (9 March, 1918), TNS (Yasuda-collection). Pref. Nagano: Uchiyama Gorge, 770 m, M. Inoue no. 543 (29 July, 1972) & 810 m, M. Inoue no. 10782 (16 July, 1975). Pref. Hi-

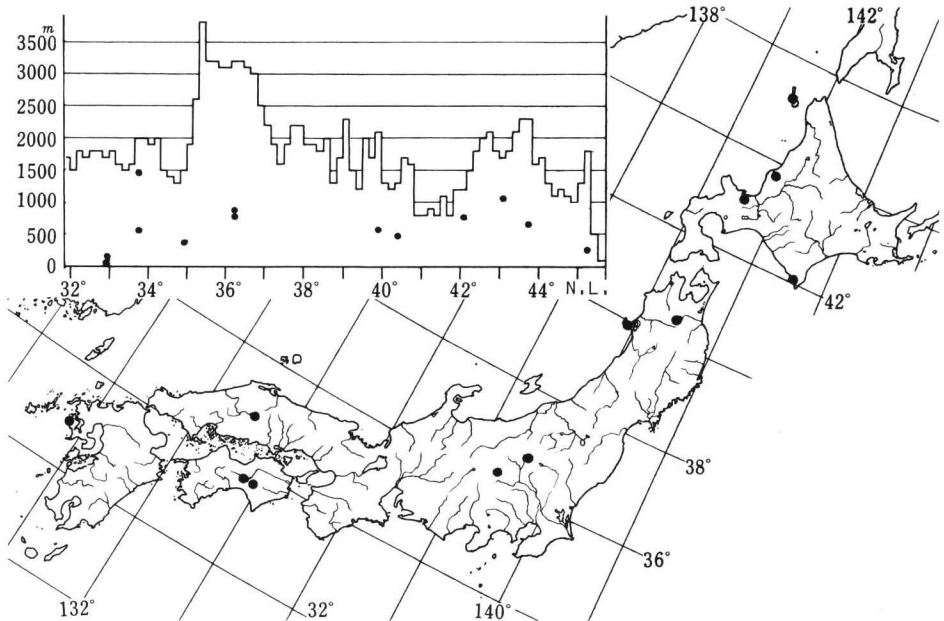


Fig. 3. Distribution of *Lecidella asema* in Japan.

roshima: Taishaku Gorge, 350 m, M. Inoue 11666 (22 Oct., 1976). SHIKOKU. Pref. Kochi: Mt. Kajigamori, 550 m, M. Inoue no. 11230 (18 July, 1976); Mt. Shiraga, 1460 m, M. Inoue nos. 11213, 11214, 11218, 11219 & 11220 (17 July, 1976). KYUSHU. Pref. Nagasaki: Nishisonogi Peninsula, 35 m, M. Inoue no. 9435 (8 Dec., 1974) & 140 m, M. Inoue no. 9357 (8 Dec., 1974).

## 2) *Lecidella bullata* Körb.

(Fig. 4a)

Parerg. Lich. 200 (1861); Hertel, Khumbu Himal. 6: 321 (1977). Type: Poland, "am Basalt der kl. Schneegrube in den Sudeten", leg. G. W. Körber in 1856, — holotype in L, non vidi; topotype in w, wu (Körb. Li ch. Sel. Germ. no. 252, leg. Körber in 1863), vidi. — *Lecidea subtessellata* Nyl., Lich. Jap. 73 (1890). Type: Japan, Honshu Mt. Fuji, leg. E. Almquist, — lectotype (Hertel 1977) in s, vidi; — isolectotype in H (H-Nyl. 16331), vidi. — *Lecidea alboradicata* de Lesd., Bull. Soc. Bot. France, ser. 4, 12: 688 (1912). Type: Italy, Valpelline, ca. 2800 m alt., leg. A. Henry, — isolectotype in w, vidi.

Thallus effuse, thin to medium, sometimes thickened, continuous or in part evanescent, bullate areolate, white or dull white; areolae crowded or at times subscattered; medulla I-. Hypothallus indistinct.

Apothecia up to 1.5 (-1.8) mm in diameter, adnate, blue-black, markedly constricted at the base; disc frequently with white pruina, plane with a prominent entire

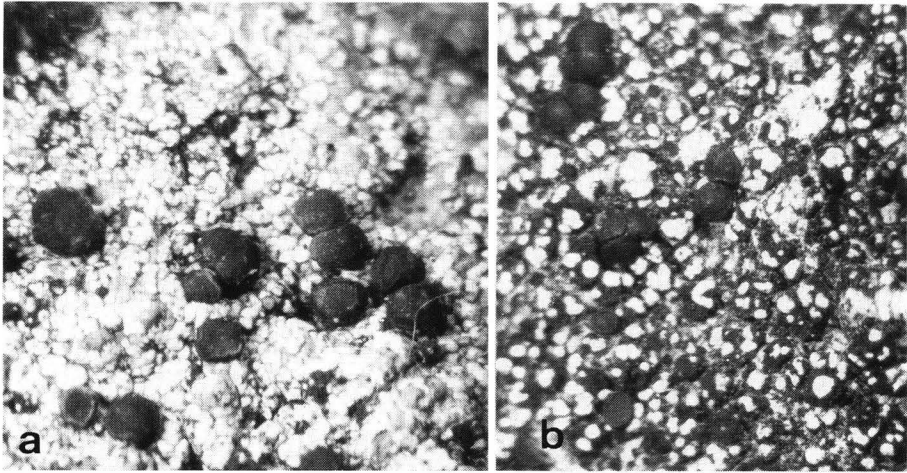


Fig. 4. a. *Lecidella bullata* Körb. (M. Inoue no. 8529),  $\times 10$ . b. *Lecidella carpathica* Körb.,  $\times 10$ .

margin at the juvenile stage, then becoming convex with a +/- obliterated margin. Excipulum 80–100  $\mu\text{m}$  thick, at times containing algal cells, dark greenish-brown or violet-brown externally, the interior part colorless; hyphae perpendicularly radiating, 5–6  $\mu\text{m}$  thick, with a thick wall. Epithecium deep green or blue-green, or at times with brown tinge. Hymenium (40–)50–70  $\mu\text{m}$  high. Subhymenium up to 100  $\mu\text{m}$  high, with irregularly shaped cavities, colorless, composed of perpendicularly running hyphae. Paraphyses simple or rarely branched, 1–1.5  $\mu\text{m}$  thick, apices slightly clavate. Asci clavate, 45–60  $\times$  10–13  $\mu\text{m}$ ; tholus thick, I+ intensive blue. Spores ellipsoid with obtuse ends, 8–14  $\times$  4–8  $\mu\text{m}$ .

Reaction: thallus & medulla P+yellow, K+yellow, KC-, C-. Chemical substances: atranorin, psoromic acid, and zeorin (+/-) (TLC).

Habitat. On non-calcareous rocks in subalpine and alpine regions.

Range. Japan; Himalaya (Hertel, 1977); central Asia, Europe, Svalbard & U.S.A. (Hertel & Ullrich, 1976); Sweden & Norway (Santesson, 1993).

This species is characterized by the bullate-areolate thallus, the apothecia markedly constricted basally, and colorless internal excipulum and subhymenium.

Knoph et al. (1995) reported zeorin in addition to atranorin and psoromic acid as a major constituent from *L. bullata*, but this substance was not detected in the representatives from Asia (Hertel, 1977) or from America (Knoph & Leuckert, 1994). Japanese representatives, however, show abundant occurrence of zeorin (Fig. 1b).

*L. bullata* is very similar to *Lecidella stigmatea* (Ach.) Hertel & Leuckert in that the coloring of the excipulum and the subhymenium is the same. However, *L. stigmatea* has very thin, rimulose or scattered verrucose-leprose thallus and no psoromic acid (lectotype of *L. stigmatea*: Switzerland "Helvetia", J. Schleicher 696-a, H-Ach. 110 C, vidi; additional specimens examined: Germany, "Bayerische Alpen", ca.



1620 m, H. Hertel no. 16770, in M; Sweden, Södermenland, A. H. Magnusson, s. n. (Aug., 1913), in TNS).

Specimens examined. HOKKAIDO. Prov. Soya: Rishiri Island (Mt. Rishiri), 1700 m, M. Inoue no. 8169 (18 Aug., 1974). Prov. Kamikawa: Goshikigahara in Mts. Daisetsu, 1680 m, M. Inoue no. 8675 (11 Aug., 1974); Mt. Hakuun in Mts. Daisetsu, 2220 m, M. Inoue no. 8604 (10 Aug., 1974). Prov. Kushiro: Mt. Oakan, 1340 m, M. Inoue no. 8776 (26 July, 1974). Prov. Abashiri: Mt. Rausu, 1450 m, M. Inoue no. 7773 (24 July, 1974) & 1620 m, M. Inoue no. 7785 (24 July, 1974). Prov. Tokachi: Mt. Furano, 1830 m, M. Inoue no. 7964 (23 Aug., 1974). Prov. Ishikari: Mt. Tengu near Sapporo, 1140 m, M. Inoue no. 8035 (3 Sept., 1974). HONSHU. Pref. Yamagata: Mt. Chokai, 2040 m, M. Inoue no. 16949 (21 Aug., 1984) & 2070 m, M. Inoue no. 16939 (21 Aug., 1984). Pref. Niigata: Mt. Myoko, coll. Nakamura, s.n. (28 Aug., 1910), TNS (Miyoshi-collection). Pref. Nagano: Mt. Kurofu near Mt. Asama, 2000 m, M. Inoue no. 1382 (27 July, 1972); Mt. Asama, 2380 m, M. Inoue no. 11344 (23 Aug., 1976); Mt. Tateshina, 2480 m, M. Inoue no. 11599 (30 Aug., 1976), 2500 m, M. Inoue no. 11581 (30 Aug., 1976) & 2520 m, M. Inoue no. 11592 (30 Aug., 1976); Mt. Momisawa near Mt. Yari, 2630 m, M. Inoue no. 4828 (21 Aug., 1973); Mt. Ontake, 2950 m, M. Inoue no. 4740 (7 Aug., 1973), 3010 m, M. Inoue nos. 11547 & 11568 (19 Aug., 1976). Pref. Yamanashi: Sensui Pass in Mt. Kaikoma, 2200–2250 m, M. Inoue no. 12322 (20 Aug., 1978).

### 3) *Lecidella carpathica* Körb.

(Fig. 4b, 5)

Parerg. Lich. 212 (1861). Type: Czechoslovakia, “bei Eperies in Ungarn”, leg. Hazslinsky, — holotype in L (910. 188. 726), vidi; — isotype in L (910. 188. 752 & 910. 188. 749), vidi.

Thallus effuse, thin to medium, areolate; areolae bullate or rarely subgranulate-conglomerate, subsparse; surface somewhat polished, white with gray tinge or dull white; medulla I-. Hypothallus indistinct.

Apothecia up to 1 mm in diameter, adnate, blue-black, moderately constricted at the base; disc epruinose, plane with a prominent entire margin at the juvenile stage, then becoming convex with an obliterated margin. Excipulum 60–100  $\mu\text{m}$  thick, violet with green tinge externally, the interior part dark golden-brown; hyphae perpendicularly radiating, 5–7  $\mu\text{m}$  thick, with a thick wall. Epithecium blue-green. Hymenium 50–90  $\mu\text{m}$  high, not interspersed. Subhymenium 100–120  $\mu\text{m}$  high, with irregularly-shaped cavities, golden-brown, composed of perpendicular hyphae. Paraphyses simple or with a few branches, lax, 1.5–2  $\mu\text{m}$  thick; apices not or slightly clavate. Asci 45–75  $\times$  9–13  $\mu\text{m}$ , clavate; tholus rather thin, I+ intensive blue. Spores with obtuse ends, 10–13  $\times$  6–8  $\mu\text{m}$ .

Reaction: thallus & medulla P+ yellow (faintly), K+ yellow, KC-, C-. Chemical substances: atranorin, diploicin, and an identified minor constituent (TLC).

Habitat: on non-calcareous rocks in the lowlands of Hokkaido and in mountain

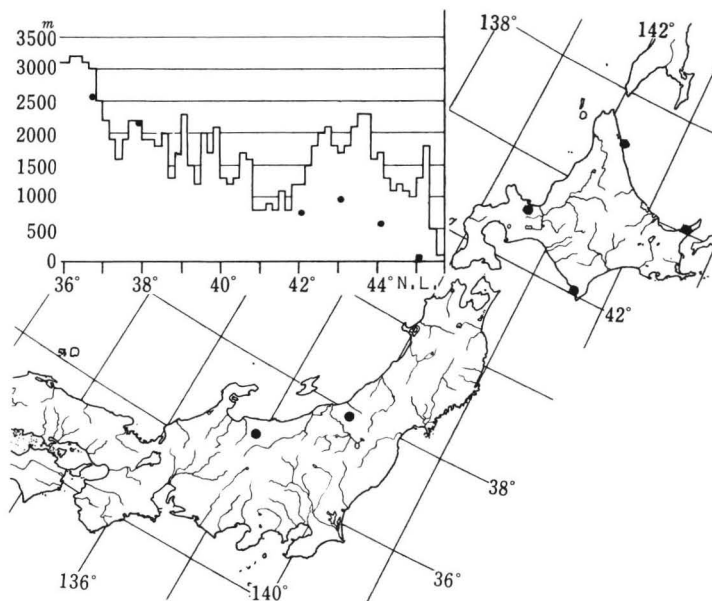


Fig. 5. Distribution of *Lecidella carpathica* Körb.

regions of Honshu.

Range: Japan; China, Mongolia, India, Nepal, Afghanistan, Russia & Hungary (Hertel, 1977); New Zealand (Hertel, 1984); Rumania, Spain, Turkey, Pakistan, Algeria & Tunisia (Knoph, 1990); Europe (Leuckert *et al.*, 1990); Norway & Sweden (Santesson, 1993); Canada, U.S.A., Mexico & Venezuela (Knoph & Leuckert, 1994); Cape Verde Isls. (Knoph & Mies, 1995).

Diagnostic characteristics for this species are: bullate-areolate thallus which has negative reaction with calcium hypochlorite (C), the minute adnate apothecia, the excipulum in which the external tissue is violet with green tinge, and the golden-brown subhymenium. The Japanese representatives agree very well with the types, both morphologically and chemically, which, however, differ although spores are somewhat narrower than in the types ( $9\text{--}13 \times 5\text{--}7 \mu\text{m}$  in the types).

*L. carpathica* resembles *L. latypiza* (Nyl.) M. Choisy, which is still unknown in Japan despite a wide distribution in both hemispheres (Knoph & Leuckert, 1994). However, it is distinguished from *L. carpathica* by having a colorless subhymenium and smaller apothecia (0.2–0.4 mm wide in the type, a lectotype of *L. latypiza*: France, "Pyrenees orientalis", H-Nyl. 19532).

Specimens examined. HOKKAIDO. Prov. Soya: Kamui Point near Hamatonbetsu, 10 m, M. Inoue no. 9027 (16 Aug., 1974). Prov. Ishikari: Mt. Tengu near Sapporo, M. Inoue no. 8072 (3 Sept., 1974). Prov. Shiribeshi: Mt. Niseko, M. Inoue no. 24668 (16 July, 1984). Prov. Abashiri: Mt. Rausu in Shiretoko Peninsula, 560 m, M.



Inoue no. 7780 (24 July, 1974) & 580 m, M. Inoue no. 7768 (24 July, 1974). HON-SHU. Pref. Aomori: Aoiwa near Kodomari, 2 m, coll. K. Sasaki no. 4745 (1 May, 1984). Pref. Yamagata: Mt. Iide, 2100 m, M. Inoue no. 10901 (10 Aug., 1975). Pref. Nagano: Mt. Shirouma, 2440 m, M. Inoue no. 14068 (22 Aug., 1980) & 2530 m, M. Inoue no. 14082 (22 Aug., 1980).

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