

Four Arctic-alpine or Bipolar Species of *Lecidea* (Lichenes) New to the Hawaii Islands

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Abstract Four arctic-alpine or bipolar species of *Lecidea* are reported as new additions to the flora of the Hawaii Islands; *Lecidea atrobrunnea* (Ramond ex Lam. et DC) Schaerer, *L. auriculata* Th. Fr., *Lecidea fuscoatra* (L.) Ach. and *Lecidea paupercula* Th. Fr.

Key words: lichens, *Lecidea*, new to the flora of Hawaii Islands.

Hawaii Island is situated on Pacific Ocean and lying between the Tropic of Cancer and the equator. However, the summit range of Mt. Mauna Kea (4205m) is characterized by lower precipitation and lower temperature and is called “Alpine desert” (Juvik & Juvik, 1998). *Umbilicaria aprina* Nyl., *U. decussata* (Vill.) Zahlbr. and *Rhizocarpon geographicum* (L.) DC., which are well known arctic-alpine or bipolar lichens, has been known to occur in the range (Elix & McCarthy, 1998; Smith, 2001).

In the course of my investigation on Hawaiian lecideoid lichens I collected about 600 herbarium packets. In this paper four species of *Lecidea*, which are known from arctic-alpine or antarctic regions and new to the Hawaiian Islands, are reported.

The specimens listed here are preserved in the herbarium of the National Science Museum, Tokyo (TNS).

Many thanks are extended to Prof. C. Smith of the University of Hawai'i who was the co-operative scientist and to Dr. H. Kashiwadani who was the leader of our expedition.

1) *Lecidea atrobrunnea* (Ramond ex Lam. et DC.) Schaerer (Fig. 1)

Lich. Helv. Spic., sect 3, 134 (1828).—*Rhizocarpon atrobrunneum* Ramond ex Lam. et DC.,

Flora Franc. ed. 3, 2: 367 (1805). Type: “Alpes” (without precise locality),—holotype in G-DC., vidi.

Thallus dark brown, polished, with an epinecral layer, areolate; medulla I+ intensively violet-blue. Hypothallus black, visible between the areolae. Apothecia black, up to 1 mm in diameter, adnate, between or partly on the areolae, moderately constricted at the base; disc epruinose, with somewhat prominent margin. Epithecium emerald green. Hymenium 40–60 μm high. Subhymenium 40–50 μm high, pale or pale brown. Hypothecium brown. Spores colorless, ellipsoid, simple, 7–10 \times 3–4.5 μm . Chemical substances: confluent acid and unidentified minor constituents. Distribution: bipolar, widely distributed in alpine or higher latitudes of both Hemisphere including arctic and antarctic regions.

Lecidea atrobrunnea is known in Hawaii Island only from two gatherings, one of which is sterile, but the material is well developed. This species is characterized by the polished-brown thallus with epinecral layer, amyloid medulla, adnate apothecia with prominent margin and the rather minute spores.

Specimen examined. Hawaii Island, Hamakua Mauna Kea Forest Reserve, elevation 3820 m, on rock, M. Inoue no. 27060 (June 2, 1999); elevation 3030–3300 m, on rock, “sterile”, M. Inoue



Fig. 1. *Lecidea atrobrunnea* (Ramond ex Lam. et DC.) Schaerer (M. Inoue no. 27060), $\times 30$.

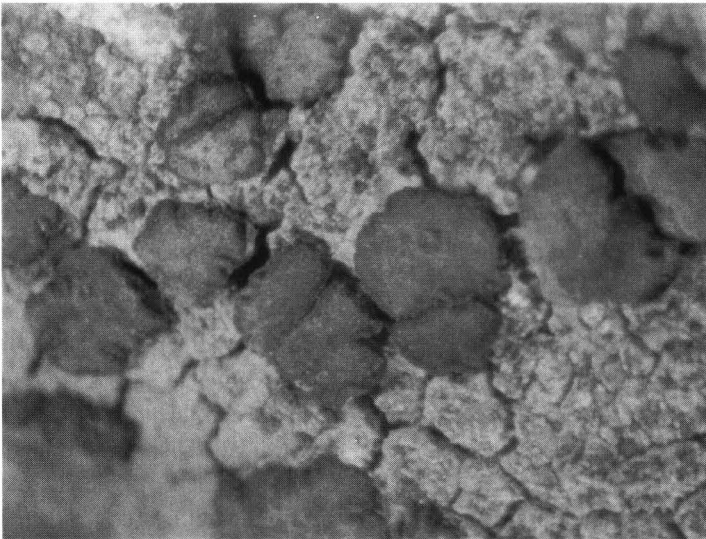


Fig. 2. *Lecidea auriculata* Th. Fr. (M. Inoue no. 27354), $\times 10$.

no. 27427 (June 17, 1999).

2) *Lecidea auriculata* Th. Fr. (Fig. 2)

Nova Acta Reg. Soc. Sci. Upsal., Ser. 3, 3: 213 (1860). Type: Greenland, Holsteinborg, leg. J. Vahl,—lectotype in UPS, non vidi.

Thallus ash-white, or rusty orange, irregularly cracked-areolate; areolae flat or subconvex,

smooth. Hypothallus indistinct. Apothecia black, up to 2 mm in diameter, adnate, constricted at the base; disc plane, with white pruina, surrounded by irregularly flexuose margin. Excipulum well advanced. Epithecium blackish-green. Hymenium 30–40 μm high. Subhymenium 30–40 μm high, dark brown. Hypothecium concolorous to the subhymenium. Spores colorless, ellipsoid,

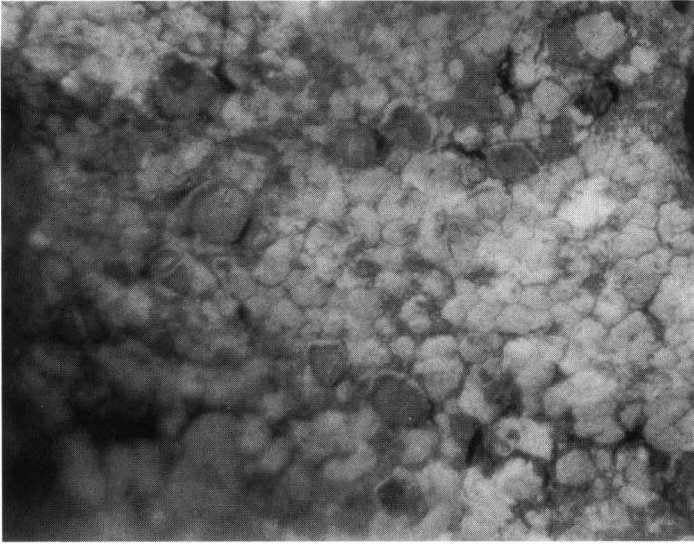


Fig. 3. *Lecidea fuscoatra* (L.) Ach. (M. Inoue no. 27363), $\times 10$.

simple, $7-9 \times 3-4 \mu\text{m}$. Chemical substances: confluent acid and unidentified minor constituents. Distribution: widely distributed in alpine or higher latitudes of both Hemisphere

Lecidea auriculata is easily recognized from other species, including closely related *L. diducens* and *L. brachyspora*, by the well-developed and excipulum far in below the apothecium, thinner hymenium, minute oblong spores and the production of confluent acid as a major substance.

Specimen examined. Hawaii Island, North Hilo Mauna Kea Forest Reserve, 2 km E of Puu Kaupakuhale, elevation 2630 m, among Sophora-community in small valley, M. Inoue no. 27354 (June 15, 1999).

3) *Lecidea fuscoatra* (L.) Ach. (Fig. 3)

Method. Lich. 44 (1803).—*Lichen fuscoater* L., Spec. Plant. 1140 (1753). Type: Sweden, Upland, Uppsala, Vårdätra, 100–300 m, 17.V.1964, coll. R. Santesson no. 16299,—neotype in UPS, *vidi*.

Thallus whitish-gray with brown tinge, irregularly areolate; areolae more or less dispersed, or in part, contiguous, surface subtartareous, plane or slightly convex; medulla I—. Hypothallus in-

distinct. Apothecia black, adnate, up to 1 mm in diameter, moderately constricted at the base; disc with white pruina; margin prominent, thin, flexuose. Epithecium blackish brown. Hymenium 50–60 μm high. Subhymenium 10–20 μm high, colorless or pale. Hypothecium reaching 100 μm high, dark brown. Spores colorless, ellipsoid, simple, $10-12 \times 5-6 \mu\text{m}$. Chemical substances: gyrophoric acid. Distribution: widely distributed in alpine or high latitudes of both Hemisphere including arctic and subantarctic regions.

The specimens studied agree well morphologically and chemically with the neotype designated by Hertel (1977), however, the epinecral layer on upper parts of the thallus lacks in the present representatives. Several authors such as Kümmerling (1991) proposed *L. fuscoatra* var. *grisella* to this epinecral layer free assemblage, but well-developed excipulum, dark brown hypothecium, well developed subhypothecial medulla and a production of gyrophoric acid do not exceed the category of *L. fuscoatra*.

Specimens examined. Hawaii Island, North Hilo Mauna Kea Forest Reserve, 2 km NE of Puu Kanakaleonui, elevation 2450 m, on rock, among Sophora-community in small valley, M. Inoue nos. 27363, 27364, 27374 (June 15, 1999).

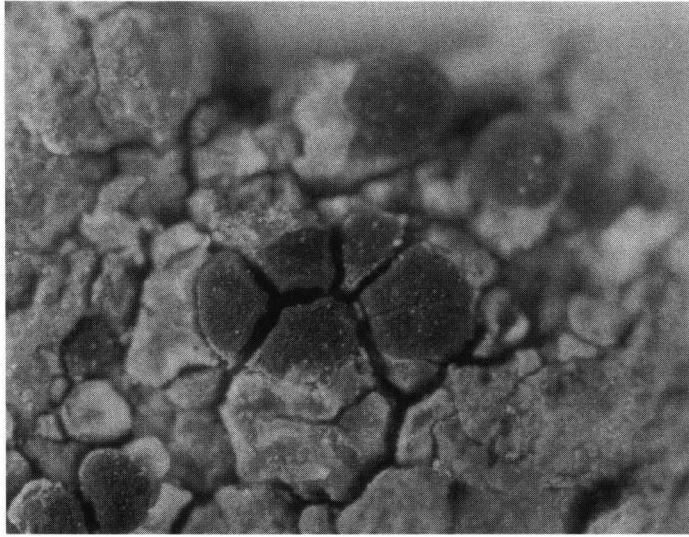


Fig. 4. *Lecidea paupercula* Th. Fr. (M. Inoue no. 27061), $\times 30$.

Hamakua Mauna Kea Ice Age Nat. Area Reserve, elevation 3030–3300 m, on rock, M. Inoue nos. 27414, 27417, 27425, 27431 (June 17, 1999).

4) *Lecidea paupercula* Th. Fr. (Fig. 4)

Lich. Scand. 482 (1874). Type. Norway, Troms: ad partem borealem insula Tromsö, J. M. Norman 377,—lectotype in O, vidi.

Thallus dark brown, polished, with an epinecral layer, areolate; areolae with paler margin; medulla I+ intensively violet-blue. Hypothallus visible between the areolae. Apothecia black, up to 0.8 mm in diameter, subimmersed to appressed-adnate; disc plane, epruinose, with somewhat entire margin. Epithecium emerald green. Hymenium $50\text{--}60\ \mu\text{m}$ high. Subhymenium $10\text{--}15\ \mu\text{m}$ high, colorless or pale. Hypothecium dark brown. Spores colorless, ellipsoid, simple, $10\text{--}14 \times 5\text{--}7\ \mu\text{m}$. Chemical substances: no lichen substances demonstrated on TLC. Distribution: Europe, Arctic regions, North America.

The Hawaiian specimens studied agree well with the lectotype of *Lecidea paupercula* except for the production of no lichen substances as op-

posed to the production of stictic acid in the type.

Lecidea paupercula is closely related to *L. atrobrunnea*, which is, however, distinguished by having a smaller spores ($7\text{--}10 \times 3\text{--}4.5\ \mu\text{m}$) and by the chemistry.

Specimens examined. Hawaii Island, Hamakua Mauna Kea Forest Reserve, elevation 3790 m, on rock, M. Inoue no. 27094 (June 4, 1999); elevation 3820 m, on rock, M. Inoue nos. 27058, 27061 (June 2, 1999).

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