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Notes on Four Lecideoid Lichens New to Japan

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Abstract

Four species of lecideoid lichens are reported as new additions to the flora of Japan; *Amygdalaria continua* Brodo & Hertel, *Anamylopsora pulcherrima* (Vainio) Timdal, *Lecidea promiscens* Nyl. and *Porpidia zeoroides* (Anzi) Knoph & Hertel. The genus *Anamylopsora* is new to Japan. Taxonomic and chemical data of each species are provided.

Key words: lecideoid lichens, *Amygdalaria, Anamylopsora, Lecidea, Porpidia*, new to Japan

In the course of my investigations on Japanese lecideoid lichens, I have been detecting four newly recognized species from Japan. I will present some taxonomic notes on them.

In the list specimens examined the locality name is followed by the citation of altitude, herbarium 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**).

1) Amygdalaria continua Brodo & Hertel (Fig.1)

HERZOGIA **7**: 505 (1987). Type: Canada, British Columbia: Queen Charlotte Islands, Moresby Island, Takakia Lake, elev. 590 m, coll. I.M. Brodo 10880A (4 July 1967), – holotype in **CANL**, non vidi; – isotype in **TNS**, vidi.

Thallus sordid gray or gray with purple-brown tinge, continuous, smooth, plane, thin to medium, rimulose; cephalodia reddish-gray, inconspicuous or sometimes absent. Hypothallus blackish, sometimes very conspicuous at the circumference.

Apothecia up to 0.8–1 mm wide, immersed, solitary or congregated; disc naked, concave, with +/- obliterated slender margin. Excipulum thin, 40-70 μm thick, reddish-brown to dark brown, sometimes paler; hyphae obliquely subradiating, glued together. Epithecium brown or paler. Hymenium 120-170 μm high. Subhymenium 30-40 μm high, colorless. Hypothecium dark reddish-brown, reaching to 100 μm high. Paraphyses slender, 1.5-2 μm thick, coherent, anastomosed, branched, submoniliformed at the apical part; apices not thickened, or slightly. Asci clavate, 100-130 x 25-35 μm. Spores hyaline, ellipsoid, simple, (23-)25-30 x 12-15 μm, with a halo; walls rather thickish, reaching 2 μm thick.

Reaction: thallus & medulla P+ brick red, K+ yellow, C-, KC-. Chemical substances: stictic acid, constictic acid, and unidentified minor constituents.

Habitat: on rocks close to stream and are temporary inundated sites.

Range: Alaska (Geiser et al., 1998); Canada (Brodo and Hertel, 1987); Russia (Andreev et al., 1998).

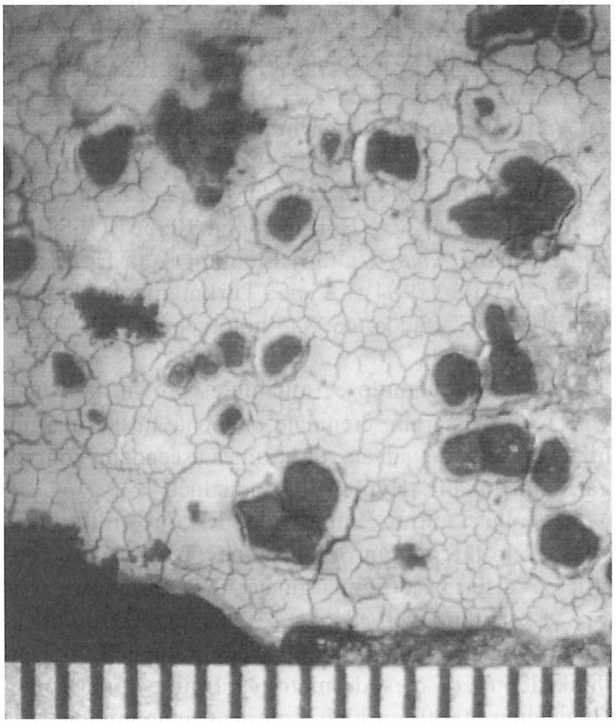

Fig.1. *Amygdalaria continua* Brodo & Hertel. (M.Inoue no. 30681), the ruler is graduated in 0.5 mm units.

Diagnostic characteristics for this species are: the smooth continuous thallus which is rimulose, reddish-gray cephalodia, paraphyses which are submoniliform at the apical part, thick-walled larger spores with a "halo",

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blackish hypothalline lines at the circumference, and the presence of stictic acid as a chemical substance. *Amygdalaria consentiens* var. *japonica,* which has a same chemistry, differs in having more or less uniformely cracked-areolate thallus.

Amygdalaria continua is known as a stream or fall-side species (Brodo and Hertel, 1987; Geiser et al., 1998). The Japanese representatives are also occurring in the similar habitat; especially the site of Mts. Shirakami, where is one of the World Heritage, is near the waterfalls at the base of a steep rock cliff.

This species was previously known only from North Western America and Russian Far East, however, the range now extends to Japan.

Specimens examined. **HONSHU**. Pref. Aomori: Mts. Shirakami (Tomari-no-tai, northern slope of Mt. Futatsumori), 750 m, M.Inoue no. 29320 (23 Sept., 2001); 770-790 m, M.Inoue nos. 30680-30682 (18 Sept., 2002). Pref. Akita: Mt. Chokai, near Jomon-no-ike (pond) of Nakajimadai, 780 m, M.Inoue no. 31978 (1 Oct., 2006), Sainokawara (close to stream), 1480 m, M.Inoue no. 16516 (6 Aug., 1983), Onta (close to stream), 1600 m, M.Inoue no. 15887 (12 Aug., 1982). Pref. Yamagata: Mt. Chokai, near Karajishidaira (close to stream), 1250-1610 m, M.Inoue nos. 16907 & 16917 (21 Aug., 1984), Chokai-ko (pond), 1650-1700 m, M.Inoue nos. 16364, 16367 & 16408 (14 Aug., 1983); Mts. Asahi, 1780 m, M.Inoue no. 10552 (1 Sept., 1975). Pref. Nagano: Mt. Hakubayari, near Yari Spa (close to stream), 2250 m, M.Inoue no. 14109 (23 Aug., 1980).

2) Anamylopsora pulcherrima (Vainio) Timdal

(Fig.2)

MYCOTAXON **42**: 250 (1991). — *Lecidea pulcherrima* Vainio, Acta Horti petpolit. **10**: 561 (1889). — *Psora pulcherrima* (Vainio) Elenkin, Acta Horti petpolit. **24**: 105 (1904). Type: Turkmenistan, Kopet-Dagh, Coll. G. Radde, no. 3, – holotype in **TUR**, TUR-Vain. 22644, vidi.

Thallus squamulose; squamules brown, polished, with whitish margin, crenulate or lobate at the margin, up to 4 mm wide, adnate, or at times ascendent, congregated; medulla I-. Hypothallus indistinct.

Apothecia up to 2 mm wide, dark brown to black, attached to the margin of squamules, prominently constricted at the base, immarginate; disc epruinose, convex. Excipulum well advanced, reaching 100 μm thick, violet brown; hyphae radiating, conglutinated, 4-5 μm thick, lepto- or mesodermatous. Epithecium brown. Hymenium 60-90 μm high, colorless, non-amyloid, K-. Subhymenium reaching 100 μm high, colorless, K-. Hypothecium reaching 300 μm high, pale violet brown, K-. Paraphyses simple or rarely branched, 2.5-3.5 μm thick; apices slightly swollen, 4-5 μm thick. Asci clavate to subcylindrical, 35-50 x 13-15 μm; tholus thin, I-. Spores simple with obtuse ends, colorless, 10-13 x 7-9 μm. Pycnidia sessile at the margin of the squamules, globose, minute, dark brown to blackish.

Reaction: upper cortex P+ yellow, K+ yellow, UV+ distinctly blue white. Chemical substances: alectrialic acid and unidentified minor substances demonstrated on TLC.

Range: Alaska (Timdal, 1991), Russia (Hertel, 1977a; Timdal, 1991; Zhurbenko, 2003), Tajikistan (Kudratov, 2004), Turkmenistan (Vainio,1889), Mongolia (Hertel, 1977a; Huneck et al., 1987; Timdal, 1991), China (Timdal, 1991; Obermayer, 2004), Nepal (Timdal, 1991).

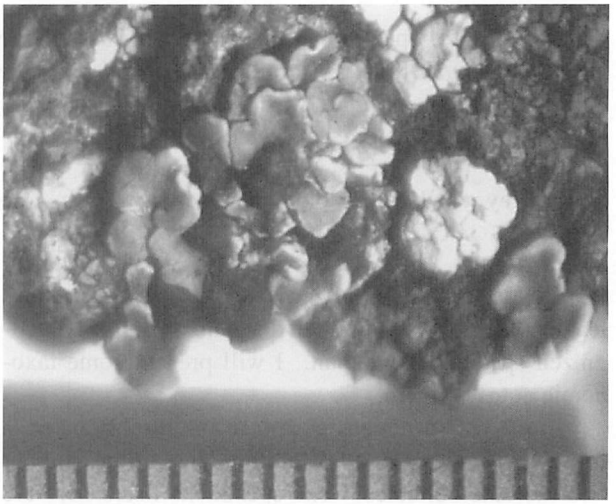

Fig.2. *Anamylopsora pulcherrima* (Vainio) Timdal. (M.Inoue no. 16948), the ruler is graduated in 0.5 mm units.

In general appearance *Anamylopsora pulcherrima* is most reminiscent of *Psora decipiens*, which is the type species of the genus *Psora* and still not known from Japan, because of the polished-brown crenulate squamules with whitish margin. *P. decipiens*, however, is easily distinguished by the ascus which has a well developed amyloid tholus, K+ positive reaction in the upper part of hymenium (antraquinones), and by the production of no lichen substances.

This species was previously known from Asia (China, Russia, Turkmenistan, Nepal, Mongolia) including North America (Alaska). However, the range has now extended to Japan.

Specimens examined. **HONSHU**. Pref. Yamagata: Mt. Chokai, near Takinokoya, 1270 m & 1370 m, M.Inoue nos. 16902 & 16948 (20 Aug., 1984). Pref. Nagano: Mt. Washiu in Mts. Hida, 2880 m, M.Inoue no. 5977 (20 Aug. 1973); Mt. Asama, 1870 m, M.Inoue nos. 1438 & 1439 (21 July, 1972); Mt. Nishi-Kagonoto western site of Mt. Asama, 2130 m, M.Inoue no. 621 (2 Aug., 1972).

3) Lecidea promiscens Nyl. (Fig.3, 4)

Flora **55**: 358 (1872). Type: France, Pyrenee, Bareges, coll. W. Nylander, – holotype in **H** (H-Nyl. 15927A), vidi.

Thallus contiguous, cracked-areolate, grayish; areolae minute, plane or in part swollen, ash-white; medulla I+ violet-blue. Hypothallus indistinct.

Apothecia black, adnate, constricted at the base, 0.5-1 mm in diameter; disc plane, non-pruinose, surrounded by irregularly flexuose, slender, concolorous margin. Excipulum 50-100 μm thick, not so developed, pale violet-brown externally, while in the interior part paler; hyphae 3-4 μm thick, intricate-radiating, leptodermatous. Epithecium emerald green to blue green. Hymenium 40-50 μm high, amyloid. Subhymenium 50-60 μm high, colorless or dull, amyloid. Hypothecium violet-brown or paler, amyloid. Paraphyses simple, 2-2.5 μm thick, somewhat thickened at the apices. Asci clavate, 40-45 x 10-11 μm. Spores ellipsoid, simple, pseudodiblastic, colorless, 9-13 x 4-5 μm.

Reaction: thallus & medulla P-, K-, KC-, C-. Chemical substances: confluentic acid and unidentified minor substances.

Habitat: on volcanic rocks in alpine region.

Range: Greenland (Hertel, 1977b; Thomson, 1997); Sweden (Hertel, 1977b); Austria, Switzerland, Greece & Spain (Hertel, 2001); Afghanistan (Hertel, 1977a); Russia (Hertel, 1977a; Andreev et al., 1998); Russian Far East (Hertel & Andreev, 2003); Canada (Hertel, 1977b; Thomson, 1997); U.S.A. (Hertel, 1991; Nash III et al. (eds.), 2004); Argentina & Chile (Hertel, 1997b); Australia (Rambold, 1981).

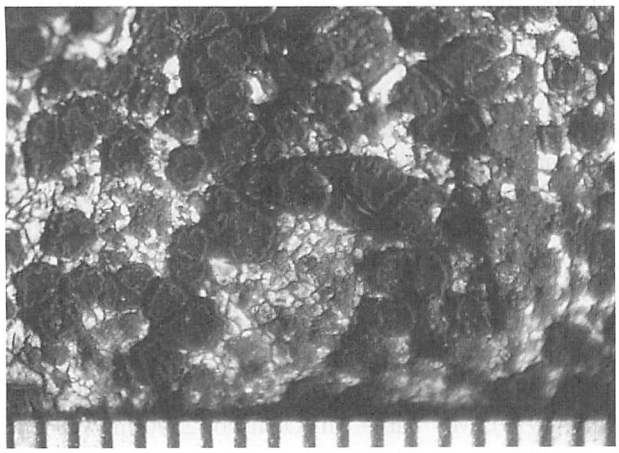

Fig.3. *Lecidea promiscens* Nyl. (M.Inoue no. 11338), the ruler is graduated in 0.5 mm units.

Lecidea promiscens is known in Japan only from two gatherings in spite of having rather world-wide distribution, but the Japanese materials are well developed. Since Japanese representatives agree well with the holotype specimen anatomically and chemically, the identification as this species seems justifiable. *Lecidea auriculata*, which is one of the common alpine species in Japan and is closely related to *L. promiscens* by having thinner hymenium, emerald green epithecium, violet-brown hypothecium and the spores which are smaller dimension, can be distinguished by the excipulum which

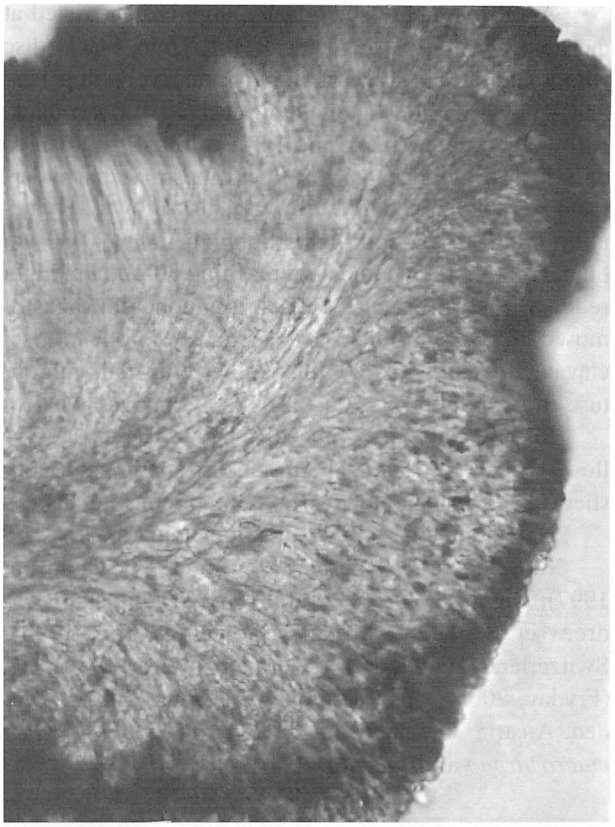

Fig.4. Cross-section of an excipulum of *Lecidea promiscens* Nyl. (M.Inoue no. 11338), x 710.

is well advanced and developed far in below the apothecium and the spore dimension 6-11 x (2)2.5-4 μm in the Japanese representatives; Inoue 1982).

This species was previously known from Arctic, Europe, North & South America, and Asia (Afghanistan, Russian Far East). However, the range has now extended to Japan.

Specimens examined. **HOKKAIDO**. Prov. Shiribeshi: Mt. Niseko, 1030 m, on rock, M.Inoue no 24667 (16 July, 1984). **HONSHU**. Pref. Nagano: Mt. Asama, 2400 m, on rock, M.Inoue no. 11338 (23 Aug., 1976).

4) Porpidia zeoroides (Anzi) Knoph & Hertel

(Fig.5, 6)

in Hertel & Knoph, Mitt. Bot. München **20**: 477 (1984). — *Lecidea zeoroides* Anzi, Comment. Soc. Critt. Ital., **2**: 17 (1864). Type: Italy (Anzi: Lich. Lang. 357), - isotype in **M**, non vidi. — *Lecidea platycarpa* f. *trullisata* Arnold, Flora **54**: 154 (1871). — *Huilia macrocarpa* var. *trullisata* (Arnold) Hertel, Herzogia 3: 374, 1975. Type: Germany, Bavarian Alps, Hochgern über Wossen, 1868. coll. Arnold, Arnold: Lich exs. 386, non vidi.

Thallus effuse, thin to medium, contiguous, irregularly cracked-areolate; areolae plane or at times slightly bullate, chalky white to white with gray tinge; medulla I-. Hypothallus indistinct.

Apothecia appressed-adnate, slightly constricted at the base, reaching a diameter of 1-1.2 mm, black; disc with white pruina, plane or slightly concave with persistent slender margin. Excipulum reaching 100 μm thick, carbonaceous, at times poorly developed, reddish to dark brown; hypahe 4-6 μm thick, meso- to pachydermatous, radiating. Epithecium greenish brown. Hymenium 60-80 (-100) μm high. Subhymenium 20-30 μm high, colorless. Hypothecium reaching 80-100 μm high, reddish to dark brown. Paraphyses coherent, anastomosed, 1.5 - 2 μm thick, apices slightly swollen. Asci clavate 50 - 70 x 15 - 20 μm. Spores ellipsoid with obtuse ends, simple, 15 - 20 (- 22) x 6 - 9 μm, with a halo.

Reaction: thallus & meculla P+ brick red, K+ yellow, C-, KC-. Chemical substances: stictic acid, constictic acid (+/-), and unidentified minor constituents.

Habitat. On basic rocks in alipine regions.

Range. Arctic America (Gowan, 1989; Thomson, 1997); Russia (Andreev et al., 1998); Tadjikistan (Andreev et al., 1998); Finland (Gowan & Ahti, 1993); Switzerland (Hertel, 2001); Germany (Wirth, 1987); UK (Fryday, 2005); Spain (Llimna & Hladun, 2001); Sweden, Austria, Germany, Italy (Hertel, 1967, as *Lecidea macrocarpa* var. *trullisata*).

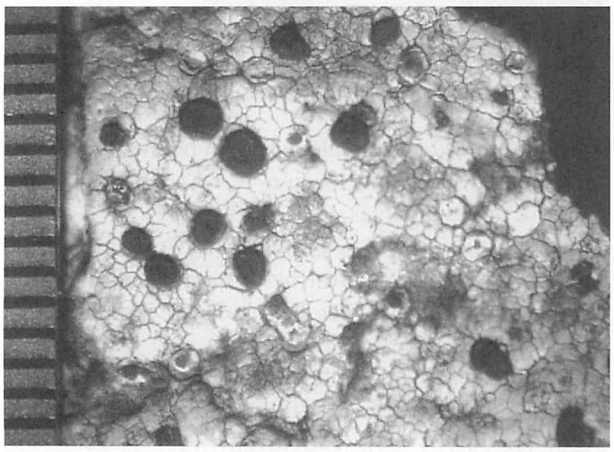

Fig.5. *Porpidia zeoroides* (Anzi) Knoph & Hertel (M.Inoue no. 7867), the ruler is graduated in 0.5 mm units.

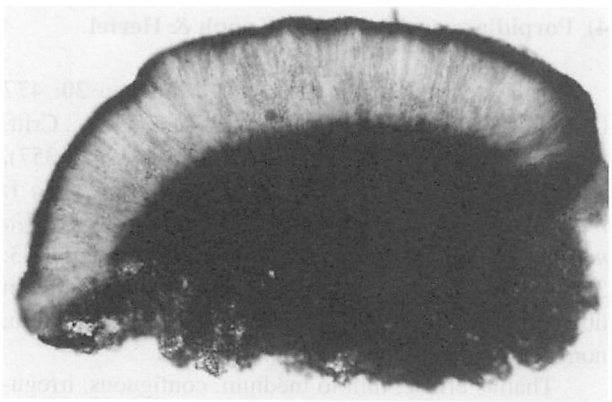

Fig.6. Cross-section of an apothecium of *Porpidia zeoroides* (Anzi) Knoph & Hertel (M.Inoue no. 7867), x 170.

Unfortunately I have not reexamined the type of *Porpidia zeoroides*. However, I could reexamine the authentic specimens cited by Hertel (1967, as *Lecidea macrocarpa* var. *trullisata*) and the specinen distributed by Vězda (Lich. Sel Exs. No. 63). Japanese specimens agree with these authentic specimens in morphological as well as chemical respects. This species is most reminiscent of *Porpidia cinereoatra* (Ach.) Hertel & Leuckert (Inoue et al., 2007) on account of having persistently marginate and pruinose apothecia which are appressed-adnate. However, *P. cinereoatra* can be distinguished from *P. zeoroides* by the excipulum consisting of leptodermatous conglutinating hyphae, and a production of confluentic acid as a chemical substance. This species was previously known only from Arctic America, Europe and Russia including Central Asia. However, the range is now extended to include East Asia.

Representative specimens examined: **HOKKAIDO**. Prov. Soya: Mt. Rishiri, 1210 m, M.Inoue no. 8167 (18 Aug., 1974). Prov. Kamikawa: Mt. Ashibetsu, 1720 m, M.Inoue nos. 8799 & 8819 (31 July, 1974). Prov. Hidaka: Mt. Hidakaporoshiri, 1260 m, M.Inoue no. 7867 (28 Aug., 1974). **HONSHU**. Pref. Akita: Mt. Chokai, 980 m, M.Inoue no. 16498, coll. K. Ishibashi (19 Sept., 1983), 1380 m, M.Inoue no. 16513 (6 Aug., 1983), 1550 m, M.Inoue no. 31559 (12 Aug., 1982). Pref. Iwate: Mt. Yakeishi, 1300 m, M.Inoue no. 16646 (Aug., 1983). Pref. Yamagata: Mt. Chokai, 1740 m, M.Inoue no. 16897 (20 Aug., 1984), 1850 m, M.Inoue nos. 16432 & 16443 (15 Aug., 1983), 1960 m, M.Inoue no. 16947 (20 Aug., 1984); Mt. Asahi, 1370 m, M.Inoue no. 10683 (30 Aug., 1975), 1720 m, M.Inoue no. 10566 (31 Aug., 1975); Mt. Itou, 1590m, M.Inoue no. 10437 (14 Aug., 1975), 1670 m, M.Inoue no. 10878 (14 Aug., 1975). Pref. Miyagi: Mt. Kurikoma, 1150 m, M.Inoue no. 19416 (27 Aug., 1975). Pref. Niigata: Mt. Dainichi, 2070 m, M.Inoue no. 10661 (9 Aug., 1975). Pref. Toyama: Mt. Hachidake near Mt. Shirouma, 2620 m, M.Inoue no. 14139 (21 Aug., 1980). Pref. Nagano: Mt. Hakubayari, 2330 m, M.Inoue no. 14075 (23 Aug., 1980); Mt. Kashimayari, 2610 m, M.Inoue no. 5635 (30 July, 1973); Mt. Yari - Mt. Otensho, 2590 m, M.Inoue no. 4899 (22 Aug., 1973); Mt. Johnen, 2820 m, M.Inoue no. 14198 (15 Aug., 1980); Mt. Asama, 1880 m, M.Inoue no. 11639 (22 Aug., 1976); Mt. Kinpu, 2580 m, M.Inoue no. 10723 (19 July, 1975); Mt. Utsugi, 2810 m, M.Inoue no. 6892 (10 Aug., 1973). Pref. Yamanashi: Mt. Kaikoma (Sensui Pass), 2250 m, M.Inoue no. 12299 (20 Aug., 1978).

Additional specimens examined: Switzerland, Graubünden, vallis Feuga, coll. Poetl et al. in 1967 (Vězda , Lich. sel. Exs. no. 636, as *Lecidea macrocarpa* var. *trullisata*), in **TNS**; Alpen, Berner Alpen, Rosenlavi, coll. Metzler in 1870, as *Lecidea macrocarpa* var. *trullisata*, in **M**.

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井上正鉄[1]：ヘリトリゴケ地衣類 lecideoid lichens の日本新産4種について

広義のヘリトリゴケ属 *Lecidea* s. lat. は最新の分類学的知見によって細分され，多くの属が提唱されている。これらは lecideoid lichens（ヘリトリゴケ地衣類）と総称される。本論文では基準標本及び範型標本との比較や地衣成分 lichen substance を検討するなどして，これまでの筆者の研究で明らかになった，*Amygdalaria continua* Brodo & Hertel, *Anamylopsora pulcherrima* (Vainio) Timdal, *Lecidea promiscens* Nyl. 及び *Porpidia zeoroides* (Anzi) Knoph & Hertel を日本新産種として報告するとともに，各々の種類の形態・地衣成分・分布を報告した。*Anamylopsora* 属は日本新産属である。

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