

Japanese Species of *Lecidella* (Lichenes, Lecanoraceae) (II)¹⁾

Masakane Inoue

Department of Natural and Environmental Sciences,
Faculty of Education and Human Studies, Akita University,
Akita 010–8502, Japan
E-mail: ebinoue@ipc.akita-u.ac.jp

Abstract Five species of *Lecidella* are reported for Japan. *L. elaeochroma* var. *caesitia* (Vain.) Mas. Inoue is a new combination. *L. elaeochromoides* and *L. euphorea* are new to the flora of Japan. Taxonomic and chemical data are provided.

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

4) *Lecidella elaeochroma* (Ach.) Házsl., Magy. Birod. Zuzmo-Flor, 197 (1884)

Lecidella elaeochroma has a world-wide distribution, but has never been adequately typified. Three sheets of *Lecidea elaeochroma*, which together consist of 13 fragments collected from Gallia, Svecia and Lapponia, are preserved in the Acharian Herbarium at Helsinki (**H-Ach.**). In the original description, Acharius (1803) did not cite any locality except “Habitat in cortice Alni”, so I could not select any relevant type specimen from the Herbarium in 1977 and 1994.

Poelt & Vězda (1981) recognized two varieties under this species on the basis of thallus color; one is var. *elaeochroma* which is “Lager weisslich bis grau oder gelblichgrau, graugrün ohne mit gelblichen Ton”, and the other is var. *flavicans* which is “Lager schwefelgelb bis gelbgrün”. On the basis of such a distinction, Japanese specimens were the latter variety. An examination of the holotype of var. *flavicans* (as *Lecidea anomala* v *L. flavicans* (**H-Ach.** 326D, in **H**, vidi), however, revealed another important character, that is, var. *flavicans* has rimulose thalli (Fig. 1-1). In contrast, Japanese representatives have a verrucose-granulate or verrucose-lep-rose thallus (Fig. 1-2a, 2b), and therefore, they are not assignable to var. *flavicans*.

Since careful typification of *L. elaeochroma* and much more understanding of the many other infra specific taxa would be necessary before a final decision could be made, I have considered it preferable to maintain the var. *caesitia* described from Hokkaido, Japan by Vainio (1921).

¹⁾Continued from Bull. Natn. Sci. Mus., Tokyo, Ser. B, 23(4): pp. 127–136, 1997.

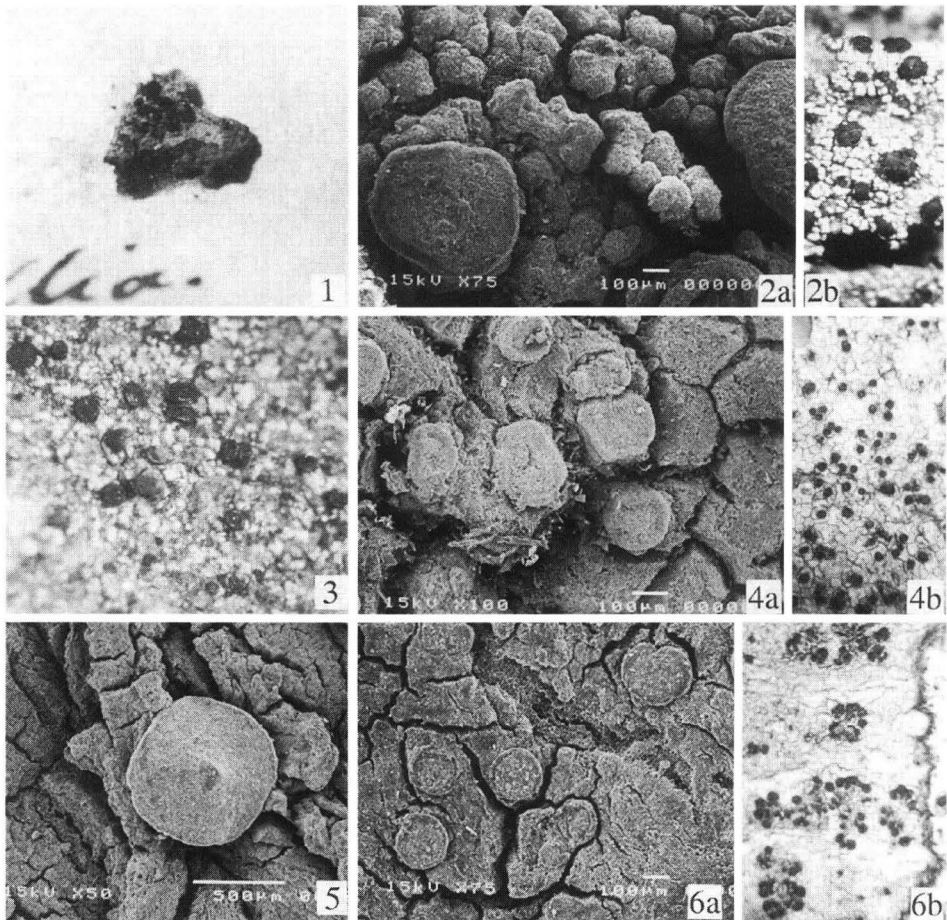


Fig. 1. 1. Holotype of *Lecidea anomala* v *L. flavicans* Ach. (H-Ach. 326D), ca. $\times 10$. 2a & 2b. *Lecidella elaeochroma* var. *caesitia* (Vain.) Mas. Inoue (M. Inoue no. 9061). b. $\times 10$. 3. *Lecidella elaeochromoides* (Nyl.) Knoph & Hertel (M. Inoue no.16870), $\times 20$. 4a & 4b. *Lecidella enteroleucella* (Nyl.) Hertel. a. (M. Inoue no. 7469). b. (M. Inoue no. 3444), $\times 10$. 5. *Lecidella euphorea* (Flörke) Hertel (M. Inoue no. 8211). 6a & 6b. *Lecidella sendaiensis* (Zahlbr.) Knoph & Leuckert (M. Inoue no. 14833). b. $\times 10$.

Lecidella elaeochroma* (Ach.) Choisy var. *caesitia* (Vain.) Mas.Inoue, **comb. nov.*

(Fig. 1-2)

Basionym. *Lecidea olivacea* var. *caesitia* Vain., Bot. Mag., Tokyo **35**: 69 (1921).
 Type: Japan, Hokkaido, Prov. Kushiro, Akkeshi, leg. A. Yasuda 334,—holotype in **TUR** (H-Vain. 23755), vidi.—*Lecidea elaeochroma* var. *caesitia* (Vain.) Zahlbr., Cat. Lich. **3**: 571 (1925).—*Lecidea parasema* auct. non (Ach.) Ach.; Müll. Arg., Nuov. Giorn. Bot. Ital. **24**: 197 (1892).—*Lecidea olivacea* var. *euphoreoides* auct. non

(Vain.) Vain.; Vain., Bot. Mag., Tokyo **32**: 160 (1918), **35**: 68 (1921).—*Lecidea spumosula* Zahlbr., Ann. Mycol. **14**: 51 (1916), **nom. illegit.**, Art. 64, non *Lecidea spumosula* Yasuda 1915 (= *Bacidia spumosula* (Yasuda) Yasuda 1925).

Thallus effuse, thin to medium, continuous, verrucose-granulate or verrucose-leprose, sometimes granulose-diffracted, greenish gray with yellow or sulfurous tinge, bordered by a +/- distinct black hypothalline line; medulla I-.

Apothecia up to 1.5 mm in diameter, adnate, black, moderately or prominently constricted at the base; disc epruinose, plane with a prominent entire margin at the juvenile stage, then becoming convex with an obliterated flexuous margin; margin sometimes polished and paler than the disc. Excipulum 50–80(–100) μm thick, dirty violet externally, the interior part violet-brown; hyphae perpendicularly radiating, 5–6 μm thick, with a thick wall. Epithecium blue-green or pale blue green. Hymenium (60–)80–100(–120) μm high, sometimes interpenetrated with oily granules. Subhymenium reaching to 250 μm high, with irregularly shaped cavities, violet-brown, composed of perpendicular hyphae. Paraphyses simple or rarely branched, lax, slender, 1.5–2 μm thick; apices not or slightly clavate. Asci 50–80(–100) \times 13–15 μm , clavate; tholus well advanced, I+ intensive blue. Spores with obtuse ends, (8–)10–16 \times 5–9(–10) μm .

Reaction: thallus P+ yellow (faintly), K+ yellow, KC–, C–; medulla P+ yellow (faint), K+ yellow, KC–, C+ orange. Chemical substances: atranorin, arthothelin (+/–), and thiophanic acid.

Habitat: On bark in the lowlands to mountain regions.

Range: Known only from Japan.

Lecidella elaeochroma var. *caesitia* is characterized by a verrucose-granulate or verrucose-leprose thallus, violet-brown excipulum as in the case of subhymenium, and atranorin and xanthonones (c+).

This variety is certainly very near to saxicolous *L. asema*, but is distinguished from it by a violet-brown subhymenium, since that of *L. asema* is golden brown.

Vainio (1918, 1921) reported *Lecidea olivacea* var. *euphoreoides* from Mt. Akagi (A. Yasuda no. 71, in **TNS**, vidi) and Gunma Prefecture (A. Yasuda no. 196, in **TNS**, vidi). However, the above cited collections are not var. *euphoreoides* but var. *caesitia*; the thalline morphology of var. *euphoreoides* is similar to that of var. *caesitia* but var. *euphoreoides* (holotype, Finland, Lapponia Kemensis, leg. Vainio, H-Vainio 23746, in **TUR**, vidi) lacks atranorin and has a colorless subhymenium.

Yasuda (1915) validly published *Lecidea spumosula* “Zahlbr.” based on the private communication from Zahlbruckner that was mentioned in the description. Perhaps the Zahlbruckner’s publication might have been delayed due to disorder caused by World War I (1914–1918), and unfortunately Zahlbruckner’s proposal of a new species appeared the next year. In the envelope of the syntype of *Lecidea spumosula* “Zahlbr.” preserved in **TNS** (Yasuda no. 100), the number of which was cited by Zahlbruckner (1916), there are six fragments of which external morphology is quite

similar. However, three fragments (Yasuda no. 100 A–C) bear acicular septated spores and are assignable to *Bacidia* sensu lato and the others (Yasuda no. 100 D–F) bear ellipsoid simple spores assignable to *Lecidella*. Even from the original descriptions, it is obvious that their proposals were based on different fragments; Yasuda (1915) proposed *Bacidia* and Zahlbruckner (1916) proposed *Lecidella*. Unfortunately *Lecidea spumosula* Zahlbr. (Zahlbruckner 1916) should be regarded as a later homonym of *Lecidea spumosula* “Zahlbr.” Yasuda (Yasuda 1915)²⁾.

Specimens examined. HOKKAIDO. Prov. Kamikawa: Mt. Yubari, M. Oshio no. 12277 (13 Aug., 1965); Mt. Ashibetsu, M. Inoue no. 8842 (31 July, 1974). Prov. Nemuro: Sashirui of Shiretoko Peninsula, 10 m, M. Inoue no. 9176 (21 July, 1974); Kunbetsu of Shibetsu-cho, 80 m, M. Inoue no. 9091 & 9096 (21 July, 1974). Prov. Kushiro: Forests around the Kushiro Marsh, M. Inoue no. 22180, 22188, 22198, 22205, 22210, 22212–13, 22216–17, 22230, 22235, 22241, 22249, 22264, 22273, 22275–76, 22279–22281, 23823, 23942 & 24048 (2–6 Sept., 1992); Beppo of Kushiro-mura, 80 m, M. Inoue no. 9057 (20 July, 1974); Miyama of Kushiro-mura, 110 m, M. Inoue no. 9058, 9061, 9069 & 9070 (20 July, 1974); Tenpoku Pass, 580 m, Y. Takahashi no. 6109 (5 Aug., 1981). Prov. Shiribeshi: Kamoenai, 150 m, M. Inoue no. 9126 & 9128 (2 Sept., 1974); Tomaru Pass, 800 m, M. Inoue no. 9142 (2 Sept., 1974). Prov. Tokachi: Taiki-cho, 80 m, M. Inoue no. 4009 (4 July, 1973). Prov. Hidaka: Mt. Hidakaporoshiri, 750 m, M. Inoue no. 7862 (29 July, 1974); Mt. Apoi, 10 m, M. Inoue no. 4127 (5 July, 1973). Prov. Iburi: Noboribetsu, 250 m, M. Inoue no. 24734 (July, 1984); Horonai of Tomakomai-shi, 50 m, H. Kashiwadani no. 9461 (28 Oct., 1971), TNS. Prov. Hiyama: Okushiri Island, 50 m, M. Inoue no. 26138 (28 Sept., 1987). Prov. Oshima: Mt. Yokotsu, M. Oshio no. 11485 & 11540 (6 Aug., 1965). HONSHU. Pref. Aomori: Asamushi Seashore, coll. Y. Asahina no. 9 (5 Aug., 1924), TNS; Mt. Iwaki, M. Oshio no. 8661 (2 Aug., 1962); River side of Akaishi, 570 m, Mts. Shirakami, M. Inoue no. 22954 (2 July, 1983). Pref. Iwate: Yakebashiri, Mt. Iwate, 680 m, M. Inoue no. 21862 (3 Sept., 1991), 960 m, M. Inoue no. 21896–97 (3 Sept., 1991). Pref. Akita: Mt. Futatumori, Mts. Shirakami, 970 m, M. Inoue no. 22587 (17 Sept., 1993); Mt. Kodake, Mts. Shirakami, 770 m, M. Inoue no. 22464 (5 Sept., 1993); Mt. Moriyoshi, 650 m, M. Inoue no. 19843 (8 Oct., 1987); Mt. Akitakoma, 450 m, M. Inoue no. 15868 (30 Aug., 1982); near Tsurunoyu Spha, 700 m, M. Inoue no. 16552, 16554 & 16550 (7 Aug., 1983); Mt. Honzan of Oga Peninsula, 570 m, M. Inoue no. 16855, 16859, 16861 & 16863 (5 Aug., 1983), 640 m, K. Sasaki no. 258 (25 Oct., 1991), 650 m, K. Sasaki no. 211, 212 & 214 (10 Aug., 1991); Mt. Kenashi of Oga Peninsula, 640 m, M. Inoue no. 24224 (1 June, 1991), 650 m, M. Inoue no. 24379 (27 March, 1994); Nibetsu of Akita-shi, coll. T. Makino, s. n. (10

²⁾*Bacidia spumosula* (Yasuda) Yasuda, Flechten Japans 28, 1925.—*Lecidea spumosula* Yasuda, Bot. Mag., Tokyo 29: 319, 1915. Type: Japan, Pref. Gunma, Mt. Akagi, Yasuda 100A—lectotype in TNS, selected here.

Sept., 1927), **TNS**; Mt. Ootakiyama of Akita-shi, 70 m, M. Inoue no. 16583 (Apr., 1983); Mt. Chokai, 610 m, M. Inoue no. 16507, 16509 & 16523 (3 May, 1983), 910 m, M. Inoue no. 16511 (3 May, 1983); Mt. Yamabushi, 1060 m, M. Inoue no. 16563 (8 Oct., 1983); Takamatsu of Yuzawa-shi, 820 m, M. Inoue no. 16564 (8 Oct., 1983); Mt. Kurikoma, 1400 m, M. Inoue no. 16700 & 16709 (22 Aug., 1983). Pref. Yamagata: Mts. Asahi, 600 m, M. Inoue no. 10612 (30 Aug. - 2 Sept., 1975), 940 m, M. Inoue no. 10616 (30 Aug.-2 Sept., 1975), 1150 m, M. Inoue no. 10496 (12-15 Aug., 1975), 1360 m, M. Inoue no. 10605 (30 Aug.-2 Sept., 1975) & 1410 m, M. Inoue no. 10592 (30 Aug.-2 Sept., 1975); Mt. Gassan, M. Oshio no. 3969 (26 July, 1960); Mt. Iide, 730 m, M. Inoue no. 10874 (7-10 Aug., 1975), 1030 m, M. Inoue no. 10864 (7-10 Aug., 1975), 1430 m & M. Inoue no. 10886 (7-10 Aug., 1975). Pref. Miyagi: Mt. Kurikoma, 850 m, M. Inoue no. 11750 (27 Aug., 1975) & 1350 m, M. Inoue no. 10414 (28 Aug., 1975). Pref. Tochigi: Nikko, Yatabe no. 292 (13 Aug., 1890), as *Lecidea parasema* (Müll. Arg. 1892), **TNS**. Pref. Gunma: Mt. Akagi, coll. A. Tsunoda s. n. (17 Dec., 1912, Yasuda no. 71), as *Lecidea olivacea* var. *euphoreoides* (Vainio 1918), **TNS**; Mt. Akagi, coll. A. Tsunoda no. 512 (19 Sept., 1912 & 20 Dec., 1917, Yasuda no. 100 D-F), as *Lecidea spumosula* "Kouzuke", coll. A. Tsunoda s. n. (10 Dec., 1917, Yasuda no. 196), as *Lecidea olivacea* var. *euphoreoides* (Vainio 1918), **TNS**; Mt. Myogi, 720 m, M. Inoue no. 11252 (10 Aug., 1976). Pref. Niigata: Mt. Myoko, M. Oshio no. 4109 & 4114 (28-31 July, 1960); Pref. Toyama: Mt. Shirakimine, 1410 m, M. Inoue no. 25788 (13 Oct., 1997) & 1430 m, M. Inoue no. 25782 (13 Oct., 1997). Pref. Ishikawa: Mt. Hakusan, 740 m, S. Nakanishi no. 66209, 1280 m, S. Nakanishi no. 67042 (2 June, 1967); Fujidaira-dani-guchi of Noto Peninsula, 10 m, M. Inoue no. 12011 (8 Oct., 1976). Pref. Nagano: Mt. Jii, 1210 m, M. Inoue no. 5505-06, 1330 m, M. Inoue no. 5558 (1 Aug., 1973); Mt. Harinoki, 1600 m, M. Inoue no. 6041 & 6067 (17 Aug., 1973); Mt. Togakushi, 1180 m, M. Inoue no. 719 (28 July, 1972), 1200 m, M. Inoue no. 9201-03 (29 May, 1974), 1220 m, M. Inoue no. 708 & 739 (28 July, 1972); Mt. Arafune, 1220 m, M. Inoue no. 5226 & 5191 (24 July, 1973); Mt. Hiraofuji, 1150 m, M. Inoue no. 1717 (29 July, 1972); Mt. Akarusan, 1000 m, M. Inoue no. 11273 (13 Aug., 1976); Utsukushigahara Heights, M. Inoue no. 24652, 24657 & 24658 (20 May, 1976); Mt. Anpeiji, 1480 m, M. Inoue no. 13125, 13144 & 1210 m, M. Inoue no. 13479 (2-10 Aug., 1979); Mt. Utsugi, 1700 m, M. Inoue no. 6896 (11 Aug., 1973); Mt. Ise of Nagiso-cho, 1280 m, M. Inoue no. 439 (19 Aug., 1972). Pref. Yamanashi: Mt. Kitadake, 1730 m, M. Inoue no. 12418 (19 Aug., 1978). Pref. Kanagawa: Hakone, coll. Y. Asahina no. 98 (31 Aug., 1926), **TNS**. Pref. Shizuoka: Kagosaka Pass, coll. Y. Asahina, s. n. (4 June, 1926); Subashiri-guchi, Mt. Fuji, coll. Y. Asahina, s. n. (21 Aug., 1929), **TNS**. Pref. Shiga: Mt. Ryozen, 400 m, M. Oshio no. 10770 (16 June, 1965), 660 m, M. Oshio no. 10844 (16 June, 1965), 750 m, M. Oshio no. 10824 (16 June, 1965). Pref. Mie: Mt. Fujiwara, M. Oshio no. 4921 (5 Aug., 1960). Pref. Tottori: Mt. Hyonosen, 860 m, M. Inoue no. 7649 (11 May, 1974), 1210 m, M. Inoue no. 7620 (11 May, 1974); Mt.

Daisen, 1140 m, M. Inoue no. 7683 (13 May, 1974), 1180 m, M. Inoue no. 7677 & 7694 (13 May, 1974), 1210 m, M. Inoue no. 7700 (13 May, 1974). Pref. Hiroshima: Taishaku Gorge, 520 m, M. Inoue no. 7066 (18 Apr., 1973); Nakayama Pass near Taishaku Gorge, 600 m, M. Inoue no. 7094 & 7106 (18 Apr., 1973); Mt. Osorakan, 1030 m, M. Inoue no. 11125 (27 June, 1976), 1180 m, M. Inoue no. 11120 (27 June, 1976), 1250 m, M. Inoue no. 11110 (27 June, 1976), 1400 m, M. Inoue no. 11134 (27 June, 1976); Mt. Togo, M. Oshio no. 6476 (11 June, 1961); Mt. Kanmuri, 720 m, M. Inoue no. 11843, 11857 & 11860 (28 May, 1977), 790 m, M. Inoue no. 11861 (28 May, 1977), 950 m, M. Inoue no. 11850 (28 May, 1977); Uchiguro Pass of Togauchi-cho, 980 m, M. Inoue no. 11094 (26 June, 1976); Mt. Hiba, 870 m, M. Inoue no. 7576 (12 Oct., 1973), 1000 m, M. Inoue no. 7558 (12 Oct., 1973), 1090 m, M. Inoue no. 7531 (12 Oct., 1973), 1250 m, M. Inoue no. 7600 (12 Oct., 1973). SHIKOKU. Pref. Ehime: Mt. Saragamine, M. Oshio no. 8006 (4 May, 1962); Himetsuru-daira, 1280 m, M. Inoue no. 11105 (16 July, 1976). Pref. Kochi: Masakinomori of Niyodomura, 1400 m, K. Une no. 1512 & 1521 (24 Aug., 1978). KYUSHU. Pref. Fukuoka: Mt. Hiko, M. Oshio no. 5101 (4 Sept., 1960). Pref. Nagasaki: Mt. Ariake of Tsushima Island, 330 m, K. Terada (6 May, 1975, M. Inoue no. 10970); Mt. Nagaura of Nishisonogi Peninsula, 560 m, M. Inoue no. 9681, 9684, 9685 & 9707 (9 Dec., 1974); Mt. Unzen, 1070 m (Nodake), M. Inoue no. 9804 (11 Dec., 1975), 1100 m (Nodake), M. Inoue no. 9802 (11 Dec., 1975), 1290 m (Kunimi), M. Inoue no. 9822 (11 Dec., 1975), 1330 m (Myoken), M. Inoue no. 9802 (11 Dec., 1975). Pref. Miyazaki: Mt. Ishido, 1070 m, M. Inoue no. 10206 (22 March, 1975), 1100 m, M. Inoue no. 10213 (22 March, 1975), 1170 m, M. Inoue no. 10168 (22 March, 1975), 1250 m, M. Inoue no. 10184 (22 March, 1975). Additional specimens examined: (as *Lecidella elaeochroma*). Canada, British Columbia, Moresby Island, I. M. Brodo no. 17251 in 27 June, 1971 (Lich. Can. Exs. no. 126, TNS); U.S.A., Colorado, Boulder County, W. A. Weber & M. Klackenbrink in 29 June, 1976 (Lich. Exs. Univ. Colorado Mus. no. 520, TNS).

5) ***Lecidella elaeochromoides*** (Nyl.) Knoph & Hertel in Knoph (Fig. 1-3)

Bibl. Lich. **36**: 103 (1990).—*Lecidea parasema* (Ach.) Ach. var. *elaeochromoides* Nyl., Bull. Soc. Linn. Normandie, ser. 2., **6**: 310 (1873). Type: France, "Pyrenees orientales", east from Port Vendres, non vidi.—*Lecidea elaeochromoides* (Nyl.) Flag., Lich. alg. 258 (1895).

Thallus dark greenish gray, thin to medium, effuse, continuous, irregularly cracked-areolate or rimose-areolate, or at times granulose-diffract. Hypothallus indistinct.

Apothecia minute, black, up to 0.4–0.5 mm in diameter, adnate, moderately to well constricted at the base; disc epruinose, plane with a prominent entire margin. Excipulum 30–40(–50) μm thick, violet or reddish brown with green tinge externally, the interior part golden-brown; hyphae perpendicularly radiating, 5–6 μm thick, with

a thick wall. Epithecium blue-green. Hymenium 50–60(–80) μm high, not interspersed. Subhymenium golden brown, up to 100 μm high, with irregularly-shaped cavities, composed of perpendicular hyphae. Paraphyses lax, simple with a few branches; apices slightly clavate. Asci clavate, 45–65 \times 12–18 μm ; tholus rather thin, I+ intensive blue. Spores with obtuse ends, 11–15 \times 6–8 μm .

Reaction: thalus & medulla P–, K–, C+ orange (faint), KC+ orange. Chemical substances: atranorin, arthothelin, thuringione (+/–).

Habitat: on non-calcareous rocks in lower mountains of Honshu.

Range: Japan; Europe, Canary Isls., Algeria, Morocco, Nepal, China, North America (Knoph 1990, Knoph et al. 1995b).

Lecidella enteroleucella, which is one of the common representatives of *Lecidella* in lowlands of Japan, is most reminiscent of *L. elaeochromoides*, in that it has a similar thallus, apothecial size and chemistry. *Lecidella enteroleucella*, however, has subimmersed to appressed-adnate apothecia and colorless subhymenium.

Lecidella carpathica, which has a golden-brown subhymenium, is distinguished from *L. elaeochromoides* by having areolae which are bullate or subgranulate-conglomerate, wider apothecia (up to 1 mm in diameter), and a different chemistry (C+).

Lecidella elaeochromoides has previously been reported only from Nepal and China in Asia; its range is now extended to Japan.

Specimens examined. HONSHU. Pref. Akita: Mt. Ganmori, Shirakami Mts., 950 m, coll. K. Ogasawara (25 July, 1983), M. Inoue no. 22828; Lake side of Towadako, 400 m, M. Inoue no. 16595 & 16600 (Oct., 1981); Mt. Honzan, Oga Pen., 550 m, M. Inoue no. 16870 (13 June, 1982). Pref. Gunma: Iwamoto, Tone-gun, coll. A. Tsunoda (14 Feb., 1921), Yasuda no. 528, **TNS**. Pref. Ibaraki: Mt. Tsukuba, coll. Y. Asahina no. 34 (March, 1924), **TNS**. Pref. Shizuoka: Mishima, coll. Y. Asahina, s. n. (7 Jan., 1931), **TNS**. Additional specimens examined. France, Ollioulas, coll. G. Clauzade in 19 May, 1966 (Vězda, Lich. sel. Exsic. no. 488, **TNS**); Romania, Dobrogea, distr. Constanta, coll. A. Vězda in 5th Aug., 1970 (Vězda, Lich. sel. Exs. no. 906, **TNS**); U.S.A., California, Santa Barbara County, Channel Isls, coll. Weber & Bratt in 8th Jan., 1986 (Weber, Lich. Exs. no. 655, **TNS**).

6) *Lecidella enteroleucella* (Nyl.) Hertel (Fig. 1-4)

Khumbu Himal **6**: 330 (1977). —*Lecidea enteroleucella* Nyl. in Nyl. & Cromb., Journ. Linn. Soc. Lond., Bot. **20**: 67 (1884). Type: Japan, Kyushu, Pref. Nagasaki, Nagasaki, leg. A. C. Maingay, s. n., —isotype in **FH**, vidi. —*Lecidea nagasakensis* Nyl., Lich. Jap. **62** (1890). Type: Japan, Kyushu, Pref. Nagasakiz Nagasaki, leg. E. Almquist, —holotype in **H** (H-Nyl. 20933), vidi; —isotype in **S**, vidi. —*Lecidea adpressula* Müll.Arg., Nuov. Giorn. Bot. Ital. **22**: 126 (1891). Type: Japan, “Enoura” in July 1886, no. 153, —holotype in **G**, non vidi; —isotype in **TNS**, vidi. —*Lecidea tapetiformis* Zahlbr. in Handel-Mazzetti, Symbol. Sinic. **3**: 107 (1930). Type: China, Setshwan, 2125 m alt., leg. Handel-Mazz. no. 2699, —lectotype in **W**, —isolectotype

in **WU**, vidi. —*Lecidea setschwanensis* Zahlbr., in Handel-mazzetti, Symbol. Sinic. **3**: 108 (1930). Type: China, Setschwan, 1450 m alt., leg. Handel-Mazz. no. 1170, —holotype in **W**, vidi; —isotype in **WU**, vidi.—*Lecidea kelungana* Zahlbr., Feddes Repertorium **33**: 36 (1933). Type: Taiwan, Kelung, leg. U. Faurie no. 257, vidi; —isolecotype in **KYO**, vidi. —*Lecidea lentigerella* Zahlbr., Feddes Repertorium **33**: 36 (1933). Type: Taiwan, Pahiran, leg. U. Faurie no. 277, —holotype in **W**, vidi; —isotype in **KYO**, vidi.

Thallus effuse, continuous, white with yellow or brown tinge, rimose to irregularly rimose-areolate; areolae minute, plane. Hypothallus black, or sometimes indistinct.

Apothecia minute, up to 0.4(–0.5) mm in diameter, immersed at the juvenile stage, later appressed-adnate or subimmersed, sometimes almost level with thalline surface, usually with a distinct margin, not constricted basally, dark brown to blackish-brown; disc epruinose, plane or somewhat convex in old apothecia. Excipulum brown with dark blue-green tinge, 30–50 μm thick, composed of radiating hyphae; hyphae 4–7 μm thick, pachydermatous. Epithecium pale brown or greenish brown. Hymenium 40–60(–70) μm high, colorless. Subhymenium (50–)60–80(–100) μm high, with irregularly shaped cavities, colorless. Paraphyses simple or with a few branches, lax, 2–3 μm thick; apices slightly capitate, 4–6 μm thick. Asci clavate, 35–55 \times 10–15 μm ; tholus 4–6 μm thick, I+ blue. Spores with obtuse ends, 8–13(–15) \times 5–8(–10) μm .

Reaction: thallus & medulla P–, K+ yellow (faintly), KC–, C+ orange. Chemical substances: atranorin, arthothelin, thuringione

Habitat: on non-calcareous rocks in the lowlands.

Range: Japan; China, India, Indonesia, Korea, and Taiwan; eastern Australia (Rambold 1989), South Africa (Knoph 1990); U.S.A., Mexico, Puerto Rico, Venezuela & Brazil (Knoph & Leuckert 1994).

The diagnostic features of this species include the rimose to irregularly rimose-areolate thallus, minute apothecium which is adnate or subimmersed, colorless subhymenium, and the production of atranorin and xanthonones (C+).

Zahlbruckner (1930, 1933) proposed four new species from Asia; *Lecidea kelungana* and *L. lentigerella* from Taiwan, *L. setschwanensis* and *L. tapetiformis* from China. After a detailed and careful examination of type specimens, it can be now stated that they all belong to one species despite the divergence in diagnostic statements, as Hertel (1977) correctly concluded. Superficial examination of the materials may be certainly the reason why *Lecidella enteroleucella* was redescribed as these different species. For example, in the type specimens of *L. tapetiformis*, hymenia were observed to be less than 70 μm high, though they were stated by Zahlbruckner to be 90–100 μm . He stated, that for *L. setschwanensis* the spore dimensions were 9–11 \times 3–4 μm , but according to my re-examination of the type specimen, spores are larger, measuring 10–12 \times 5–7 μm .

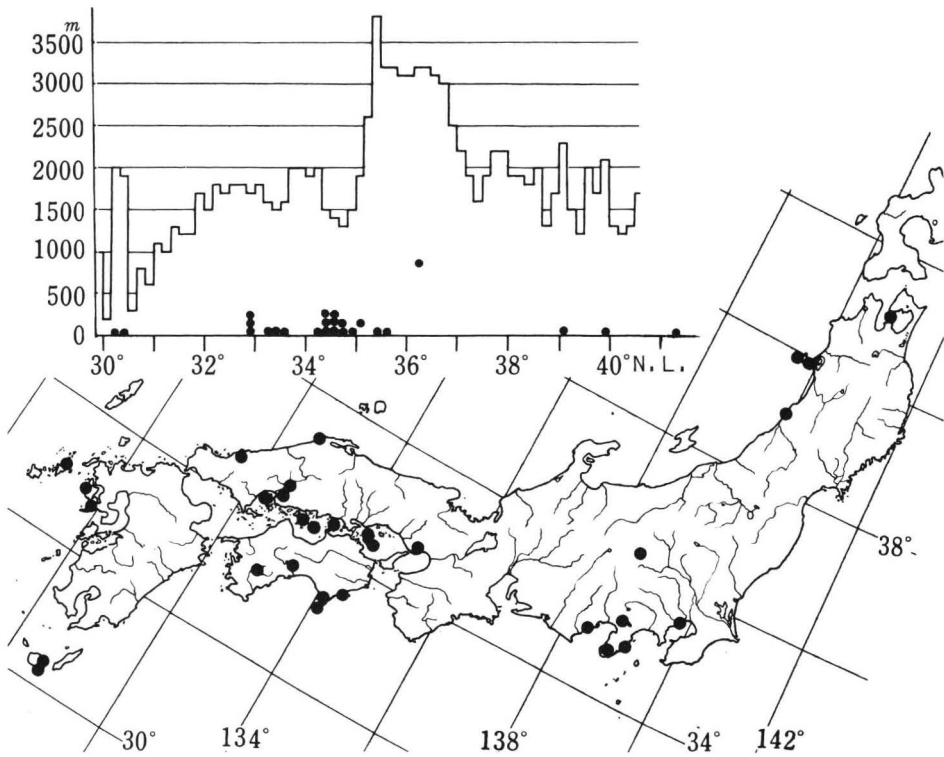


Fig. 2. Distribution of *Lecidella enteroleucella* (Nyl.) Hertel.

Lecidella enteroleucella is closely related to *Lecidella viridans* (Flotow) Körb., which is one of well-known species from both Europe and America. I have not had a opportunity to re-examine any syntypes of *L. viridans*, but from an examination of European specimens (Heiderberg, leg. Ahles, Hepp 726, in TNS; Italy, Vinschgau, coll. M. Inoue & H. Hertel, M. Inoue no. 11959 (19 Sept., 1977); "Sudeten", Herb. Körb. s. n., in W) and from some descriptions given by Körber (1855), Lighton (1879), Jatta (1911), Poelt & Vězda (1981), Knoph (1990), and Thomson (1997) it seems clear that *L. enteroleucella* is distinguished from *L. viridans*, in which the thallus is minutely granulate, by the plane areolae (Fig. 1-4a, 4b).

Hertel & Leuckert (1969), Knoph & Leuckert (1994), Knoph et al. (1995b) and Thomson (1997) reported that *L. viridans* did not produce atranorin and my analysis proves that above mentioned european representatives also do not. In contrast, Japanese *L. enteroleucella* produces atranorin.

Lecidella enteroleucella is common from seacoast to the lowlands of Japan, and is not known from Hokkaido situated in northern Japan (Fig. 2).

Specimens examined. HONSHU. Pref. Aomori: Kusoudomari coast, Wakino-

sawa, Shimokita Pen., 1–2 m, M. Inoue no. 25609 (18 Oct., 1996). Pref. Akita: Nyudo Point, Oga Pen., 20 m, M. Inoue no. 16853 (5 Aug., 1983), M. Inoue no. 24384 & 24385 (27 March, 1994); Monzen. Oga Pen., 0–5 m, M. Inoue no. 16614 (15 May, 1983). Pref. Yamagata: Fukura coast, Yuza-machi, 0–5 m, M. Inoue no. 16605 (1 June, 1983). Pref. Nagano: Mt. Akarusan, Saku-shi, 850 m, M. Inoue no. 11280 (13 Aug., 1976). Tokyo Metropolis: The Imperial Palace, coll. G. Thor no. 14908 (20 June, 1995), **TNS**. Pref. Shizuoka: Kisegawa River, Sunto-gun, coll. Y. Asahina no. 154 (14 Aug., 1929), **TNS**; Enoura, Sunto-gun, coll. Y. Asahina, s. n. (5 Jan., 1937), **TNS**; Johgasaki coast, 2–5 m, M. Inoue no. 11440 (25 Aug., 1976); Kumomi, Matsuzaki-machi, 50 m, M. Inoue no. 11438 (25 Aug., 1976); Sunpu Ruins of a Castle in Shizuoka City, coll. S. Kurokawa no. 72006-8 (8 Feb., 1972), **TNS**. Pref. Hyogo: Nunobiki Fall, Kobe-shi, 150 m, M. Inoue no. 11784 & 11785 (8 May, 1977). Pref. Shimane: Hinomisaki Point, 1 m, H. Miyawaki no. 5219 (31 Dec., 1981). Pref. Yamaguchi: Coast of Susa Bay, 1–2 m, M. Inoue no. 7449, 7466 & 7469 (9 June, 1973). Pref. Hiroshima: Shiwa-machi, 270 m, M. Inoue no. 7000 (8 March, 1974); Togouchi, Hiroshima-shi, 80 m, M. Inoue no. 12059 (25 Apr., 1978); Itsukushima Isl., 1 m, M. Inoue no. 3444 (26 Apr., 1973) & many. **SHIKOKU**. Pref. Kagawa: (Shodo-shima Isl.) Myokenzaki, 2–3 m, M. Inoue no. 26077 (18 Dec., 1998), Kaburazaki, 10 m, M. Inoue no. 26091 (18 Dec., 1998), Kurosaki, 0–1 m, M. Inoue no. 26121 (19 Dec., 1998), Mt. Toun-san, 300 m, M. Inoue no. 26009 (17 Dec., 1998). Pref. Tokushima: Takegashima Isl., Shishikui-machi, 1–5 m, M. Inoue no. 11241 (19 July, 1976). Pref. Ehime: Yuge isl, Inland sea, 3 m, M. Inoue no. 7189 (11 Nov., 1973). Pref. Kochi: Isa, Hata-gun, coll. F. Fujikawa, s. n. (25 Aug., 1931), **TNS**; Mizushiri, Aki-gun, 5 m, M. Inoue no. 11245 (19 July, 1976); Muroto Point, 2–10 m, M. Inoue no. 11234 (19 July, 1976); Seiryuji temple, Tosa-shi, 10 m, coll. H. Matsui (M. Inoue no. 11753, 23 Apr., 1977). **KYUSHU**. Pref. Nagasaki: Gongen-iwa, Ooseto-machi, 110 m, M. Inoue no. 9458 (8 Dec., 1974), Uchigo, Ooseto-machi, M. Inoue no. 9437 (8 Dec., 1974); Matsushima Isl, Ooseto-machi, 3 m, M. Inoue no. 9299 (7 Dec., 1974); Kozera, Minamimatsuura-gun, 3 m, H. Miyawaki no. 4848 (15 Sept., 1981). Pref. Kagoshima: Miyanoura, 1–2 m, M. Inoue no. 10055 & 10063 (25 March, 1975); Tashiro near Anbo, 1–3 m, H. Kashiwadani no. 38577 (27 Oct., 1994), **TNS**.

7) *Lecidella euphorea* (Flörke) Hertel

(Fig. 1-5)

Lichenologist **12**: 107 (1980). —*Lecidea sabuletorum* var. *euphorea* Flörke, Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk. **3**: 311 (1808). Type: Austria, Salzburg, coll. Wittmann in 21 Sept., 1985, (**SZU** no. 4161), by Knoph & Leuckert (1999), non vidi. —*Lecidea euphorea* (Flörke) Nyl, Mem. Soc. Sci. Nat. Cherbourg **5**: 126 (1858).

Thallus thin, effuse, irregularly rimulosed, or rarely subleprosed, whitish to dark gray; medulla I-. Hypothallus indistinct.

Apothecia up to 0.8 mm in diameter, adnate, black, moderately constricted at the base; disc epruinose, plane with a prominent entire margin, at times becoming somewhat convex with an obliterated margin. Excipulum 40–60 μm thick, dark blue-green externally, the interior part golden-brown or reddish brown; hyphae perpendicularly radiating, 6–8 μm thick, pachydermatous. Epithecium blue-green or paler. Hymenium 60–90 μm high, not interspersed. Subhymenium golden-brown, up to 10 μm high, with irregularly shaped cavities. Paraphyses simple or slightly branched, lax, 1.5–2.5 μm thick; apices not clavate or slightly. Asci clavate, 50–70 \times 12–15 μm ; tholus thick, I + intensive blue. Spores with obtuse ends, 10–15 \times 6–9 μm .

Reaction: thallus & medulla P+ yellow (faint), K+ yellow, KC–, C–. Chemical substances: atranorin and unidentified minor constituents (TLC). (Knoph & Leuckert (1999) reported atranorin, aotearone, and 2,5,7-trichloro-3-O-methylnorlichexanthone as major compounds from *L. euphorea*.)

Habitat: on bark in mountain regions.

Range: Japan; Europe (Poelt & Vězda, 1981); Svalbard (Elvebakk & Hertel, 1997); Sardinia, Italy (Nimis & Poelt, 1987); India (Schubert & Klement, 1966); Mongol (Huneck et al., 1987); American arctic region (Thomson, 1997).

Knoph & Leuckert (1999) correctly proposed conservation of the name *Lecidea euphorea* with a conserved type.

Lecidella euphorea is closely related to *L. elaeochroma*, which is one of the well-known lichens in both the Northern and the Southern Hemispheres. The moderate-sized apothecia with prominent margin and the blue green epithecium as well the golden-brown or reddish brown subhymenium are common characters in these two corticolous lichens. However, *L. euphorea* differs in that the rimulose thallus (Fig. 1-5) is C-negative reaction and it lacks a black hypothalline line. This species is not as common as *L. elaeochroma* in Japan.

This species was previously known from India and Mongol in Asia, however, the range now extended to Japan.

Specimens examined. HOKKAIDO. Prov. Tokachi: Mt. Tsurugi, 560 m, M. Inoue no. 8211 (28 July, 1974). HONSHU. Pref. Akita, Mts. Shirakami, 650 m, M. Inoue no. 22409 (14 Sept., 1993). Pref. Nagano, Mts. Yatsu, 890 m, M. Inoue no. 864 (22 July, 1972). Additional specimens examined. Canada, British Columbia, Northern Rocky Mountains, leg. Brodo in 1977 (Brodo, Lich. Can. Exsic. no. 188, TNS).

8) *Lecidella sendaiensis* (Zahlbr.) Knoph & Leuckert (Fig. 1-6)

Bibl. Lich. **68**: 131 (1997). —*Lecidea sendaiensis* Zahlbr., Ann. Mycol. **14**: 52 (1916). Type: Japan, Honshu, Pref. Miyagi, Sendai, on bark of *Tilia miqueliana*, leg. A. Yasuda no. 126, June 10, 1913, —holotype in **W**, vidi. —*Lecidea pruni* Vain., Bot. Mag., Tokyo **32**: 159 (1918). Type: Japan, Honshu, Pref. Miyagi, Sendai, on bark of *Prunus* sp., leg. A. Yasuda no. 94, June 10, 1913, —isotype in **TNS**, vidi. —*Lecidea tiliae* Vain., Bot. Mag., Tokyo **32**: 161 (1918). Type: Japan, Honshu, Pref.

Miyagi, Sendai, on bark of *Tilia miqueliana*, leg. A. Yasuda no. 93, June 10, 1913, holotype in **TUR** (H-Vain. 24216), vidi; —isotype in **TNS**, vidi. —*Lecidea exigua* auct. non Chaub.; Müll.Arg., Flora **63**: 484 (1879).

Thallus subdeterminate, thin, continuous or in part evanescent, rimulose, plane, tartareous, ash-white with yellow tinge, surrounded by a blackish hypothalline line, and sometimes forming a mosaic; medulla I—.

Apothecia minute, up to 0.3(–0.4) mm in diameter, adnate, moderately constricted at the base; disc brown to blackish-brown, epruinose, plane with a prominent entire margin at the juvenile stage, then becoming convex with an obliterated margin; margin somewhat paler than the disc. Excipulum 30–50 μm thick, pale brown or concolorous to the epithecium externally, the interior part colorless; hyphae perpendicularly radiating, 3–4 μm (4–5 μm in outer most) thick, with a thick wall. Epithecium pale brown with green tinge. Hymenium 50–70(–80) μm high. Subhymenium reaching to 100 μm high, colorless or rarely pale brown, with irregularly shaped cavities. Paraphyses simple or rarely branched, lax, 1.5–2.5 μm thick; apices moderately swollen, 3–4 μm thick. Asci 45–65 \times 10–18 μm , clavate; tholus rather thin, I+ blue. Spores with obtuse ends, 9–13(–15) \times 6–8(–10) μm .

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

Habitat: on bark in the lowlands.

Range: known only from Japan and Korea.

Lecidella enteroleucella, which is the saxicolous assemblage and resembles *L. sendaiensis* in terms of thallus morphology and apothecial size, is distinguished from *L. sendaiensis* by somewhat wider apothecia which are appressed-adnate or subimmersed and by different xanthones (arthothelin and thuringione).

Lecidella sendaiensis and *L. tiliae* were proposed by Zahlbruckner (1916) and Vainio (1918) respectively based on Japanese materials which A. Yasuda collected. Reexamination of the syntypes of both species, however, revealed that they are based on the same collections (the same origin, with a citation of the same locality, collecting date and substrate), and that the two species are actually identical with each other.

Vainio (1918) proposed *L. pruni* and *L. tiliae* in the same paper, but they should be assigned to one species from both morphological and chemical points of view, despite the diverging statements in their diagnoses. Vainio (1918) described the spores of *L. pruni* as 1-septated, but reexamination of the type specimen revealed they are simple. They could appear otherwise due to having 2 oil drops or, alternatively, a plasmatic cell structure.

Müller (1879) reported *Lecidea exigua* Chaub. from Japan. But the Japanese collection cited is referable to *L. sendaiensis* since morphological and chemical features are similar.

Specimens examined. HOKKAIDO. Prov. Soya: Rishiri Is., M. Oshio no. 12915

(17 Aug., 1965). Prov. Kushiro: Kushiro Marsh, 5–10 m, M. Inoue no. 24171 & 4 others (4–6 Sept., 1992). Prov. Iburi: Mt. Usu, H. Kashiwadani no. 14166 (11 Nov., 1977), **TNS**. HONSHU. Pref. Akita: Lake side of Towada-ko, 400 m, M. Inoue no. 16589 & 16593 (Oct., 1981); Oga Pen. (Mt. Shinzan), coll. K. Sasaki (M. Inoue no. 25202; Aug., 1991); Mt. Akitakoma, 650 m, M. Inoue no. 14833 (9 May, 1982); Tooshi Hieghts, Nigaho, 200 m, M. Inoue no. 24523 (14 Aug., 1981). Pref. Ishikawa: Kanazawa-shi, 90 m, coll. H. Kashiwadani no. 39585 (11 Dec., 1995), **TNS**. Pref. Nagano: Utsukushigahara, 1700 m, M. Inoue no. 24636 (20 May, 1976); Mt. Anpeiji, 1250 m, M. Inoue no. 13339 (5 Aug., 1979), 960 m, M. Inoue no. 13528 (9 Aug., 1979); Iida-shi, 550 m, M. Inoue no. 14483 (7 Aug., 1980). Pref. Shizuoka: Mito Seashore, Tagata-gun, coll. Y. Asahina s. n. (5 Jan., 1931), **TNS**. Pref. Shiga: Mt. Ryozen, 285 m, M. Oshio no. 10746 (16 June, 1965); Hikone-shi, 150 m, M. Inoue no. 9218 (26 June, 1974). Pref. Hyogo: “J Kouno”, coll. A. Henon in 1876, as *Lecidea exigua* Chaub. (Müll.Arg., 1879), G. Pref. Hiroshima: Yasaka Gorge, 100 m, M. Inoue no. 11765 (29 Apr., 1977); Koshigahara near Yasaka Gorge, 750 m, M. Inoue no. 12437 (18 June, 1978); Mt. Oomine near Yasaka Gorge, 800 m, M. Inoue no. 12595 (Nov., 1977); Mt. Kanmuri, 860 m, M. Inoue no. 11846 (28 May, 1977). SHIKOKU. Pref. Kagawa: Shodo-shima Isl., around Emon-no-taki, 270 m, M. Inoue no. 26026 (18 Dec., 1998). KYUSHU. Pref. Ooita: Mt. Kuju, 950 m, M. Inoue no. 24240 & 24241 (7 May, 1989). Pref. Nagasaki: Nishisonogi Pen. (Seikai), 100 m, M. Nakanishi no. 9699 (4 Aug., 1963); Nishisonogi Pen. (Ooseto), 20 m, M. Inoue no. 9253 (7 Dec., 1974); Mt. Nagaura, 560 m, M. Inoue no. 9695 (9 Dec., 1974); Mt. Tohmi, 210 m, M. Inoue no. 9276 & 9277 (7 Dec., 1974). Pref. Miyazaki: Mt. Ishido, 850 m, M. Inoue no. 10149 (22 March, 1975). Pref. Kagoshima: Mt. Takakuma, coll. M. Oshio no. 683 (15 Apr., 1965); Yakusima Is. (Nagata), 1 m, M. Inoue no. 9981 (30 March, 1975), Yakushima Is. (Isso), 30 m, M. Inoue no. 10075 (25 March, 1975). Additional specimen examined. Korea. Prov. Kyonggi: Mt. Pukhan-san, Koyang city, about 780 m. M. Inoue no. 25659 (24 Aug., 1997), **TNS**.

Acknowledgements

I wish to express my heartily gratitude to the directors and curators of the following herbaria who kindly sent me type and authentic specimens on loan: Drs. T. Ahti & O. Vitikainen of Helsinki University (**H**), Dr. F. Ehrendorfer of Wien University (**WU**), Dr. H. Kashiwadani of the National Science Museum, Tokyo (**TNS**), Dr. J. Miegé of the Conservatoire et Jardin Botaniques, Geneve (**G**), Dr. D. H. Pfister of Farlow Herbarium (**FH**), Dr. H. Riedle of the Naturhistorisches Museum, Wien (**W**), Dr. R. Santesson of the Museum of Natural History, Stockholm (**S**), and Dr. J. Takeuchi of Kyoto University (**KYO**). This study was partly supported by a Grant-in Aid for Scientific Research from the ministry of Education, Science, Sports and Culture of Japan to M. Inoue no. 05640782 and no. 10640676. Last but not least, I

heartily thank Prof. Dr. Dianne Fahselt of the University of Western Ontario who kindly read the manuscript and gave critical suggestions.

References

- Acharius, E. 1803. *Methodus qua omnes detectos Lichenes 1 & 2*. LV+393 pp. Stockholm.
- Elvebakk, A., & H. Hertel, 1997. A catalogue of Svalbard lichens. In Elvebakk & Prestrud (eds.): A catalogue of Svalbard plants, fungi, algae, and cyanobacteria. *Norsk Polarinstitutt Skrifter*, **198**: 271–359.
- Hertel, H., 1977. Gesteinsbewohnende Arten der Sammelgattung *Lecidea* (Lichenes) aus zentral-, ost-, und sudasien. *Khumbu Himal*, **6**: 145–458.
- Hertel, H. & Ch. Leuckert, 1969. Über Flechtenstoffe und Systematik einiger Arten der Gattung *Lecidea*, *Placopsis* und *Trapelia* mit C+ rot reagierendem Thallus. *Wilidenowia*, **5**: 369–383.
- Huneck, S., J. Poelt, T. Ahti, O. Vitikainen, & U. Oogt, 1987. Zur Verbreitung und Chemie von Flechten der Mongolischen Volksrepublik. II. Ergebnisse der Mongolisch-Deutschen Biologischen Expeditionen seit 1962 Nr. 177. *Nova Hedwigia*, **44**: 189–213.
- Jatta, A. 1911. *Flora Italica Cryptogama, pars III, Lichenes* 958 pp. Rocca Sc Casciano.
- Knoph, J.-G., 1990. Untersuchungen an gesteinsbewohnenden xanthonhaltigen Sippen der Flechtengattung *Lecidella* (Lecanoraceae, Lecanorales) unter besonderer Berücksichtigung von aussereuropäischen Proben exklusive Amerika. *Bibl. Lich.*, **36**: 1–183.
- Knoph, J.-G. & Ch. Leuckert, 1994. Chemotaxonomic studies in the saxicolous species of the lichen genus *Lecidella* (lecanorales, lecanoraceae) in America. *Nova Hedwigia*, **59**: 455–508.
- Knoph, J., R. Schmidt, & J. Elix, 1995a. Untersuchungen einiger Arten der Gattung *Lecidella* mit Hochdruckflussgeschichtschromatographie unter besonderer Berücksichtigung von epiphytischen Proben. *Bibl. Lichenol.*, **57**: 307–326, 1995.
- Knoph, J.-G., Ch. Leuckert & H. Hertel, 1995b. Chemotypes and distribution patterns of saxicolous species of *Lecidella* (Lecanoraceae, Lecanorales). *Cryptogamic Botany*, **5**: 45–54.
- Knoph, J.-G. & Ch. Leuckert, 1999. Proposal to conserve the name *Lecidea euphorea* (lichenised Ascomycota) with a conserved type. *Taxon*, **48**: 567–568.
- Körber, G. W., 1855. *Systema Lichenum Germaniae*. pp. 458, Breslau.
- Leuckert, Ch., J.-G. Knoph, G. Ziegler & H. Hertel, 1990. Chemotaxonomische Studien in der Gattung *Lecidella* (Lecanorales, Lecanoraceae) I. *Herzogia*, **8**: 265–272.
- Leighton, W. A. 1879. *The lichen-flora of Great Britain, Ireland, and the Channel Islands* (3rd ed.). 547 pp., Shrewsbury.
- Müller-A., J. 1879. *Lichens Japonici*. *Flora*, **62**: 481–487.
- Nimis, P. & J. Poelt, 1987. The lichens and lichenicolous fungi of Sardinia (Italy). *Studia geobotanica*, **7** (Suppl.) : 1–269.
- Poelt, J. & A. Vězda, 1981. *Lecidella* in Bestimmungsschlüssel europäischer Flechten Erg. II. pp. 390, Cramer, Vaduz.
- Rambold, G. A., 1989. A monograph of the saxicolous lecideoid lichens of Australia (excl. Tasmania). *Bibl. Lich.*, **34**: 1-345.
- Schubert, R. & O. Klement, 1966. Beitrag zur Flechtenflora von Nord- und Mittelindien. *Nova Hedwigia*, **11**: 1–73.
- Thomson, J. W., 1997. *American Arctic Lichens. 2. The Microlichens*. The University of Wisconsin Press, pp. 675, Madison, Wisconsin.
- Vainio, E. A. 1918. Lichenes ab A. Yasuda in Japonia collecti. *Bot. Mag., Tokyo*, **32**: 154–163.
- Vainio, E. A. 1921. Lichenes ab A. Yasuda in Japonia collecti, continuatio I. *Bot. Mag., Tokyo*, **35**:

45–79.

Yasuda, A. 1915. Fünf neue Arten der Flechten. (In Japanese). *Bot. Mag., Tokyo*, **29**: 317–322.

Zahlbruckner, A. 1916. Neue Flechten VIII. *Ann. Mycol.*, **14**: 45–61.

Zahlbruckner, A. 1930. Lichenes, in H. Handel-Mazzetti, *Symbolae Sinicae. Botanische Ergebnisse der Expedition der Akademie der Wissenschaften in Wien nach Südwest-China 1914/1918*. **3**: 1–254, 1930.

Zahlbruckner, A. 1933. Flechten der Insel Formosana. *Feddes Repatrium*, **31**: 194–224.

