

NEW AND NOTEWORTHY LICHEN-FORMING AND LICHENICOLOUS FUNGI 8

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Six new for science species of lichen-forming fungi from Republic of Korea, Eastern Asia, i. e.: *Bacidina jasonhuri* J. P. Halda, S. Y. Kondr. et L. Lőkös, *Gyalidea koreana* J. P. Halda, S. Y. Kondr., L. Lőkös et Hur, *G. pisutii* J. P. Halda, S. Y. Kondr., L. Lőkös et Hur, *G. poeltii* S. Y. Kondr., L. Lőkös, J. P. Halda et Hur, *G. vezdae* S. Y. Kondr., L. Lőkös, J. P. Halda et Hur, and *Porpidia ulleungdoensis* S. Y. Kondr., L. Lőkös et J. P. Halda, as well as two new species from Japan (*Fauriea yonaguniensis* S. Y. Kondr., M. Moriguchi et Yoshik. Yamam. and *Laundonia ryukyuensis* S. Y. Kondr., M. Moriguchi et Yoshik. Yamam.), and one new species *Lecanora orlovii* S. Y. Kondr. et L. Lőkös from Ukraine are described, illustrated and compared with closely related taxa.

Key words: *Bacidina*, *Fauriea*, *Gyalidea*, Japan, *Laundonia*, *Lecanora*, new species, *Porpidia*, South Korea, Ukraine

INTRODUCTION

Part of novelties found in Ulleung-do and Geumoh-do islands, as well as in a number of localities of Gangwon-do and Jeollanam-do Provinces of South Korea during field studies in 2016–2017 was recently published (Kondratyuk *et al.* 2016*b*, *c*, *d*, 2017*a*, *b*, 2018). However, a number of still unnamed and unidentified specimens are also selected.

The aim of this paper is to present descriptions of new taxa of the genera *Bacidina*, *Gyalidea*, and *Porpidia*, discovered in areas mentioned above, as well as to provide data on a few new taxa discovered within comparative study during our revisions of recent and previous collections kept in the KoLRI, KW-L, OSA Li and BP.

MATERIAL AND METHODS

The specimens collected in various areas of South Korea in 2016–2017, as well as collections of previous years kept in KoLRI and other herbaria (BP, KW-L, OSA Li, VBI) included in comparative study were examined using standard microscopical techniques, hand-sectioned samples were prepared under a dissecting microscope (Nikon SMZ 645; Nikon, Tokyo, Japan). Anatomical descriptions were based on observations of these preparations under microscopes (Nikon Eclipse E200; Nikon, Tokyo, Japan, and Zeiss Scope, A1; Carl Zeiss, Oberkochen, Germany) equipped with digital camera AxioCam ERc 5s. Sections of apothecia were tested with water and with K (10% aqueous solution of potassium hydroxide) and Lugol's IKI test (10% aqueous potassium iodide with iodine) for identification.

Standard TLC and HPTLC methods in solvent C were applied (Arup *et al.* 1993, Orange *et al.* 2010) for identification of chemical substances at critical taxa.

RESULTS AND DISCUSSION

Species new to science

Bacidina jasonhuri J. P. Halda, S. Y. Kondr. et L. Lőkös, *spec. nova*
(Fig. 1)

Mycobank no.: MB 828225.

Differs from the closest species, Bacidina arvidssonii and Bacidina pseudohyphophorifera in shape of ascomata, size of ascospores, details of conidiomata and size of conidia.

Type: South Korea, Gyeongsangbuk-do, Ulleung-do, Ulleung-gun, Ulleung-eup, Jeodong-ri, site 40, saxicolous on a shaded volcanic rock in a virgin forest. Lat.: 37° 31' 07.99" N; Long.: 130° 54' 07.89" E; Alt.: 288 m a.s.l. Coll.: Halda, J., 09.07.2016 (holotype: KoLRI 39095; isotypes KoLRI 39092, KoLRI 39093).

Thallus saxicolous, in most places(/parts) inconspicuous, but reaching 1–8 cm in diam., sometimes almost absent, resembles appressed goniocysts 10–20 µm in diam., with a minutely rugose surface, green to greenish grey. Prothallus absent. Photobiont *Trebouxia* like, with cells 5–9 µm in diam.

Apothecia common, circular, dispersed, 200–350 µm in diam., 120–130 µm in height, with pale orange disc and prominent paler waxy margin up to 50 µm in width. Old ascomata of the same colour, deeply concave. Excipulum paraplectenchymatous, colourless, 40 µm thick under the hypothecium and

40–50 μm thick laterally. Epithecium colourless, indistinct. Hypothecium colourless to pale yellow, 35–40 μm thick. Hymenium hyaline, 35–40 μm high. Hamathecium of simple, rarely septate paraphyses (1 μm thick), suddenly swollen at apices, to 2 μm thick in water. Asci closely clavate, 25–35 \times 5–7 μm , close to the *Lecanora*-type, 8-spored. Ascospores narrowly fusiform, spirally arranged in the asci, slightly tapering towards proximal end, 3(–5)-septate, (24–)24.5–33.5(–39) \times (1–)1.5–1.9(–2) μm [$x = 29.1 \times 1.7 \mu\text{m}$; SD 4.7; 0.3 μm ; $n = 50$; l/w ratio = 17.7].

Conidiomata (campylidioid pycnidia according to Lücking (2008)) present, not common, dispersed on thallus, 90–120 μm long, waxy whitish, tubular, 40–50 μm diam., ended with a wavy peak without pedicel on the base. Conidiogenous cells not observed. Conidia numerous, invisible as a mass, externally produced on the lower side of the flattened peak, filiform-sigmoid, pointed at ends, without visible septa, 25–30 \times 0.5–1 μm .

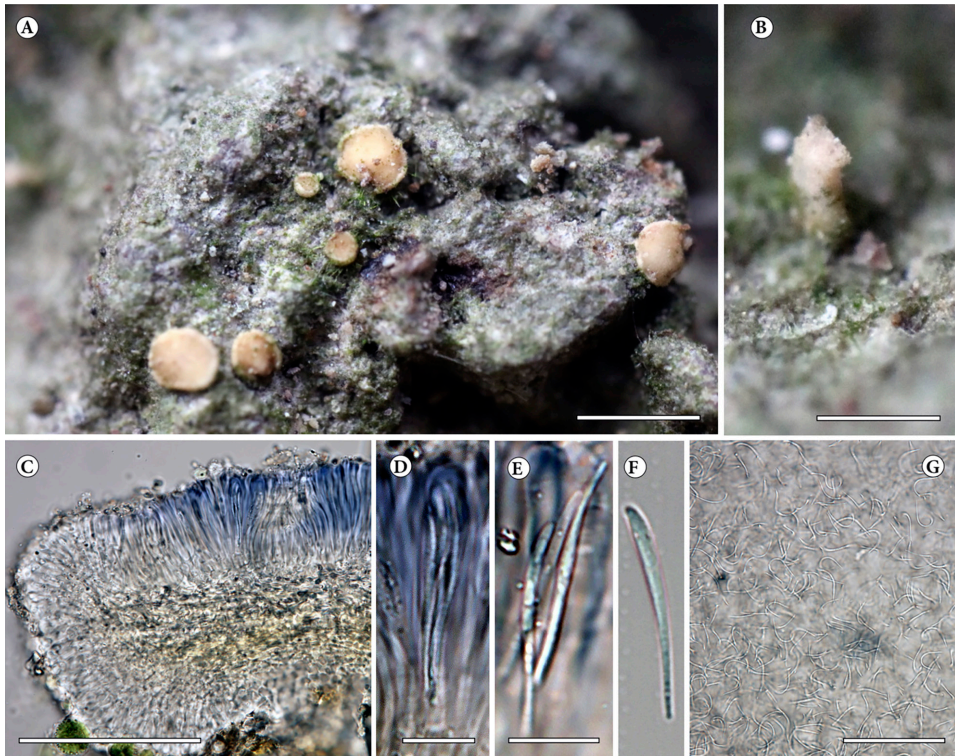


Fig. 1. *Bacidima jasonhuri* (isotype, KoLRI 039092): A = thallus with ascomata; B = campylidioid pycnidium; C = detail of exipulum; D = mature ascus; E, F = mature ascospores (mounted in Lugol); G = detail of a conidioma (mounted in water). Scales: A – 500 μm ; B, C – 100 μm ; D, E, F – 10 μm ; G – 50 μm (Photos of J. Halda)

Ecology: Growing on a shaded volcanic rock in a virgin forest.

Etymology: It is named after our friend and colleague Jae-Seoun Hur, well-known South Korean lichenologist, in recognition of his contributions in lichenology.

Distribution: It is hitherto known from two localities within the Ulleung-do Island, South Korea, Eastern Asia.

Taxonomic notes: There is another saxicolous *Bacidina pseudohyphophorifera* (Lücking et Sérus.) Lücking mentioned from Korea forming tubulose stipitate conidia (Aptroot and Moon 2014). It differs in shorter ascospores ($16\text{--}23 \times 1\text{--}1.5 \mu\text{m}$), longer conidia ($55\text{--}65 \times 1 \mu\text{m}$) and very long brush-shaped (up to 1.7 mm) stipitate conidiomata ended with a cupule of conidiogenous cells. The foliicolous *Bacidina arvidssonii* (Sérus.) Lücking differs in longer ascospores ($50\text{--}60 \times 1.5\text{--}2 \mu\text{m}$) and longer, up to 20-septate, filiform sigmoid conidia ($120\text{--}160 \times 1\text{--}1.5 \mu\text{m}$).

The foliicolous *Bacidia permira* Vězda (Vězda 1975) – having somewhat similar conidiomata – recently moved to another genus (*Szczawinskia permira* (Vězda) Farkas (Farkas 2015)) differs in stipitate and larger black ascomata (up to 1 mm in diam.) with black hypothecium and longer, 10–18-septate ascospores ($80\text{--}110 \times 2\text{--}2.5 \mu\text{m}$).

Additional specimen examined: South Korea, Gyeongsangbuk-do, Ulleung-do, Ulleung-gun, Ulleung-eup, Sadong-ri, site 31, on siliceous rock. Lat.: $37^\circ 29' 37.33''$ N; Long.: $130^\circ 52' 50.72''$ E; Alt.: 643 m a.s.l. Coll. Halda, J. P. (160890), 08.07.2016 [KoLRI 39035].

Fauriea yonaguniensis S. Y. Kondr., M. Moriguchi et Yoshik. Yamam.,
spec. nova
 (Figs 2–3)

Mycobank no.: MB 829830.

Similar to Caloplaca patwolseleyae, but differs in having thinner thalline margin, in having thicker hymenium, in having wider paraphysis tip; in having thinner subhymenium, as well as in having shorter ascospores and narrower ascospore septum.

Type: Japan, Okinawa Pref., Yonaguni-cho, Yonaguni Island, Nishizaki Point, on bark of evergreen palm tree *Livistona chinensis*. Lat.: $24^\circ 26' 59.09''$ N; Long.: $122^\circ 56' 04.44''$ E; Alt.: 50 m a.s.l. Coll.: Mitsuru Moriguchi (MM-28030311), 03.03.2018 (holotype: OSA [without number]; isotype: KW-L).

Thallus to 3–5 cm across, greyish or light grey, crustose, continuous, very thin in the peripheral zone and becoming thicker and somewhat worthy in

the centre, usually seen (better distinct) only in the peripheral zone, while in the centre almost completely covered by lecanoroid apothecia.

Apothecia 0.5–1(–1.3) mm in diam. (and to 0.35–0.42 mm thick in section), lecanorine, well distinct owing to dark brown or blackish brown disc with well contrasting light grey thalline margin, more or less rounded, somewhat semi-immersed at first to sessile later, thalline margin rather varying in thickness; in section lecanorine and more or less subconvex in the central portion; thalline exciple to 50–75 μm thick, with cortical layer to 15 μm thick, scleroplectenchymatous; true exciple rather thin, to 10–15 μm wide in lateral portion, and indistinct in the basal portion; hymenium to 70–100 μm high; epihymenium rather thick to 40–45 μm thick, dark brown or blackish brown; tips of paraphyses to 4 μm in diam., slightly swollen and to 15–20 μm long from tips becoming blackish brown; subhymenium 50–180 μm thick light brownish grey; asci 8-spored; ascospores more or less with attenuated ends, 11–13(–14) \times 4–6 μm in water, and (10–)12–14 \times 4.5–5(–5.5) μm in K; septum (2–)3–4 μm wide in water and 2–3 μm wide in K.

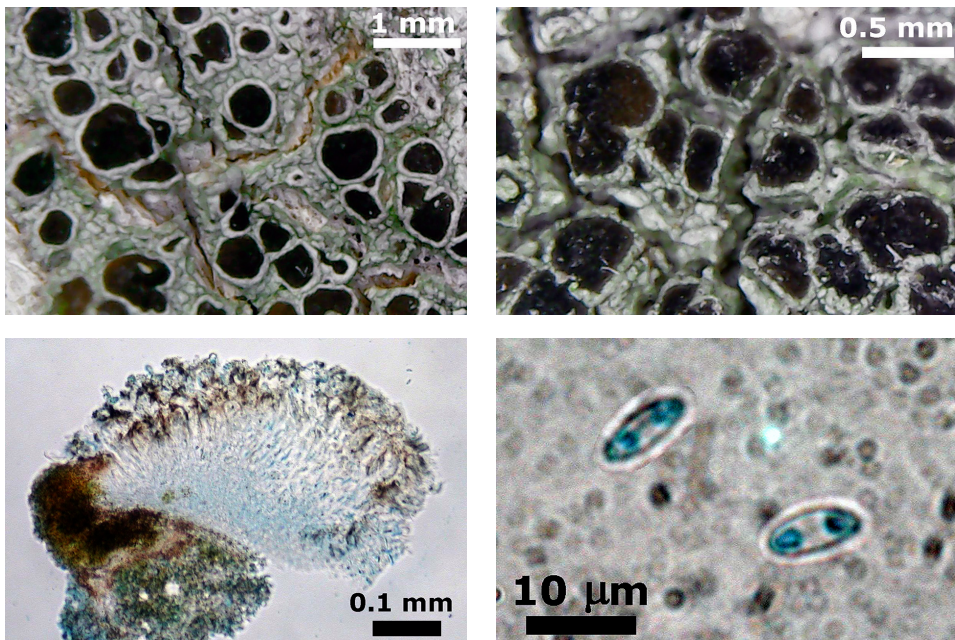


Fig. 2. *Fauria yonaguniensis* (holotype, OSA), general habit. Scale 1 mm. Enlarged portion of thallus with apothecia. Scale 0.5 mm. Section of apothecium. Scale 0.1 mm. Ascospores. Scale 10 μm (Photos of Y. Yamamoto)

Chemistry: Thallus and all elements of apothecium K– or the epihymenium becoming slightly greenish brownish or greenish blackish in K and the subhymenium becoming more brownish in K.

Ecology: It is growing on bark of the evergreen palm *Livistona chinensis*.

Etymology: Species is named after the Yonaguni Island of the Yaeyama archipelago (= Southwest Islands) of the Ryukyu Islands, Southwestern Japan, where type collection was done.

Distribution: So far known only from type collection in the Yonaguni Island (Yaeyama Islands), which is situated in southern part of the Ryukyu Islands, Okinawa Pref., Southwestern Japan (Eastern Asia).

Taxonomic notes: *Fauriea yonaguniensis* is characterised by light grey thallus with lecanorine apothecia with dark brown or blackish brown disc (*Lecanora subfusca* aggr. type apothecia), as well as in having narrow bipolar ascospores with rather wide ascospore septum.

Fauriea yonaguniensis is similar to *Caloplaca patwolseleyae* S. Y. Kondr., U. Jayalal et J.-S. Hur, an Eastern Asian taxon known so far from bark of evergreen trees of Geumoh-do island of South Korea, but differs in having thinner thalline margin (50–75 μm vs. to 150 μm thick), in having thicker hymenium (70–100 μm vs. 70–80(–100) μm high), in having wider paraphysis tips (to 4 μm vs. very slightly swollen, to 2–3 μm wide); in having thinner subhymenium (90–180 μm vs. to 200–250 μm thick) as well as in having shorter ascospores (11–13(–14) \times 4–6 μm vs. (12–)13–15(–16) \times 4–6 μm) and somewhat narrower ascospore septum ((2–)3–4 μm vs. (3.5–)4–6 μm wide) (Kondratyuk *et al.* 2016b).

Fauriea yonaguniensis is similar to *F. orientochinensis* S. Y. Kondr., X. Y. Wang et Hur, recently described from Eastern China, but differs in having thinner thallus not wrinkled in the centre (vs. to 250(–350) μm thick and dis-



Fig. 3. *Fauriea yonaguniensis* (isotype, KW-L), general habit. Scale 1 mm (left). Enlarged portion of thallus with apothecia. Scale 1 mm (right) (Photos of S. Kondratyuk)

tinctly wrinkled in the centre), in having slightly larger apothecia (to 1(–1.3) mm vs. 0.5–0.7(–1) mm in diam.), in having scleroplectenchymatous cortical layer of thalline exciple (vs. paraplectenchymatous), in having lower hymenium (70–100 μm vs. 100–110 μm high), in having thicker epihymenium (40–45 μm vs. 20–30 μm thick), in having wider paraphysis tips (to 4 μm vs. 2.5–3.5 μm in diam.), in having much wider variation of subhymenium measurements (50–180 μm vs. 100–130 μm thick), in having smaller and narrower ascospores (11–13(–14) \times 4–6 μm vs. (10–)12–15(–16) \times 5–6(–7) μm), and in having somewhat narrower ascospores septum ((2–)3–4 μm vs. 3–5 μm wide), as well as in having different ecology (on bark of evergreen palm tree (*Livistona chinensis*) vs. bark of coniferous tree (*Pinus*)) and distribution (Southwestern Japan vs. Eastern China) (Kondratyuk *et al.* 2016e).

Fauriea yonaguniensis is similar to *Caloplaca filsonii* Hafellner, S. Y. Kondr. et Kärnefelt, known from bark of *Avicennia marina* from several localities in Queensland, Australia, but differs in having only lecanorine (vs. lecanorine then zeorine) apothecia, in having slightly wider ascospores (11–13(–14) \times 4–6 μm vs. (11–)12–15(–16) \times 3–5.5 μm), and in having wider ascospore septum ((2–)3–4 μm thick vs. 1–2(–5) μm wide), in different chemistry (thallus K– vs. thallus K+ red, caloploicin (major), vicanicin (minor), atranorin (minor) and several unknown antraquinones), and in distribution (Eastern Asia vs. Australia) (Kondratyuk *et al.* 2007).

As other caloplacoid species without antraquinones, like *Fauriea yonaguniensis*, as well as other similar taxa, i.e.: *Caloplaca brebissonii* (Fée) R. Sant. ex Hafellner et Poelt, *C. homologa* (Nyl.) Hellb., *C. jatolensis* Y. Joshi et Upreti, *C. lecanorocarpa* Aptroot et M. Cáceres, *C. lecapustulata* Aptroot et M. Cáceres, *C. ochrolechioides* S. Y. Kondr. et Kärnefelt, *C. subdecadens* (Nyl.) Hafellner et Poelt, and *C. tomnashii* S. Y. Kondr., Elix et Kärnefelt (see Aptroot and Cáceres 2016, Galloway 2007, Joshi and Upreti 2008, Kondratyuk *et al.* 2007, 2011, 2015, 2016a) as well as species of the genus *Fauriea*, i.e.: *F. orientochinensis* S. Y. Kondr., X. Y. Wang et Hur and *F. chujaensis* (S. Y. Kondr., L. Lőkös et Hur) S. Y. Kondr., L. Lőkös, J. Kim, A. S. Kondratiuk, S.-O. Oh et J.-S. Hur (Kondratyuk *et al.* 2016b), and which resemble *Lecanora* species are commonly (and understandably) mistaken for a species of *Lecanora*, until the ascospores are checked.

It should be mentioned that position of these caloplacoid species mentioned above (i.e.: *C. brebissonii*, *C. filsonii*, *C. homologa*, *C. jatolensis*, *C. patwolsleyae*, and *C. subdecadens*) should be checked with molecular data if some of them are members of the genus *Fauriea* S. Y. Kondr., L. Lőkös et Hur. *Fauriea yonaguniensis* is placed to the genus *Fauriea* with some hesitations, as far we still do not have molecular data on this species. It should be mentioned that only nrITS data, provided for two recently described taxa, *C. lecanorocarpa*, and *C. lecapustulata* (Aptroot and Cáceres 2016), show that there is probably

one more monophyletic branch of the caloplacoid lecanoroid lichens within the phylogenetic tree of the Teloschistaceae. However, this hypothesis should be checked with data on nrLSU and mtSSU sequences of taxa mentioned.

Gyalidea koreana J. P. Halda, S. Y. Kondr., L. Lőkös et Hur, *spec. nova*
(Fig. 4)

Mycobank no.: MB 828232.

Similar to Gyalidea pacifica, but differs in having larger apothecia, much thicker true exciple, higher hymenium and longer ascospores. Bottom part of outer side of exciple covered by white, tomentose hyphae.

Type: South Korea, Jeju-do, Yeongcheon-dong, Seogwipo, Jeju-si, site 21/4621, on shaded volcanic rock, growing together with saxicolous *Porina* sp. and *Verrucaria* sp. Lat.: 33° 18' 02.18" N; Long.: 126° 34' 28.64" E, Alt.: 318 m a.s.l. Coll.: Halda, J. P., Oh, S.-O., Park, J. S. and Liu, D., 05.07.2016 (holotype: KoLRI 39025; isotype: KoLRI 39022).

Thallus epilithic, crustose, continuous, 5 cm (or more) across, film-like to finely granular, somewhat cracked, pale greenish grey with dark brown apothecia. Prothallus not observed. No goniocystangia (sensu Harada and Vězda 1999) has been observed. Photobiont green, cells 8–12 µm in diam.

Apothecia 0.5–1.8 mm in diam., to 0.2–0.25 mm thick in section, lecidine, mainly regularly rounded, sometimes aggregated in groups to 2–3, dark brown-violet with distinct, white tomentum on underside; disc plane, concolorous with margin, in young apothecia margin pale brown. True exciple to 0.1 mm wide, permanent, usually slightly arising above the level of disc; in section 60–80 µm thick in the uppermost lateral portion, 80–90 µm thick in lower lateral portion and 80–100 µm thick in basal portion, brown to dark brown. Single hyaline hairs on outer side forming by single hyphae directed downwards to (15–)20–35(–40) µm long gradually thickening towards the tips forming almost byssoid layer at the lowermost part of the lateral portion of exciple to 25–30 µm thick. Thalline exciple absent. Hymenium 100–120 µm high, hyaline; epihymenium pale brown to hyaline; subhymenium 30–40 µm thick, hyaline. Hypothecium brown, 100–110 µm thick. Paraphyses 1–1.5 µm in diam., branched, non-septate. Asci 8-spored, 90 × 15 µm, clavate; ascospores submuriform with 4–7 cells seen, with 3–4 transverse septa and one longitudinal septum, without a perispore, (23–)27–32.5(–35) × (9–)9.5–11.5(–12) µm [$x = 29.7 \times 10.2$ µm; SD 2.8; 1 µm; $n = 50$; l/w ratio = 3] in water.

Ecology: Growing on volcanic rock in very shaded and moisture conditions.

Distribution and habitat: It is so far known only from the type locality, Jeju-do Island, South Korea, Eastern Asia.

Etymology: It is named after the country of the type locality.

Taxonomic notes: *Gyalidea koreana* is similar to *G. kawanae* H. Harada et Vězda (Harada and Vězda 1999), but differs in having larger apothecia (0.5–1.8 mm vs. 0.3–0.5 mm diam.), higher hymenium (100–120 μm vs. 70–75 μm), longer and wider ascospores (27–32.5 \times 9.5–11.5 μm vs. 15–24 \times 5–8

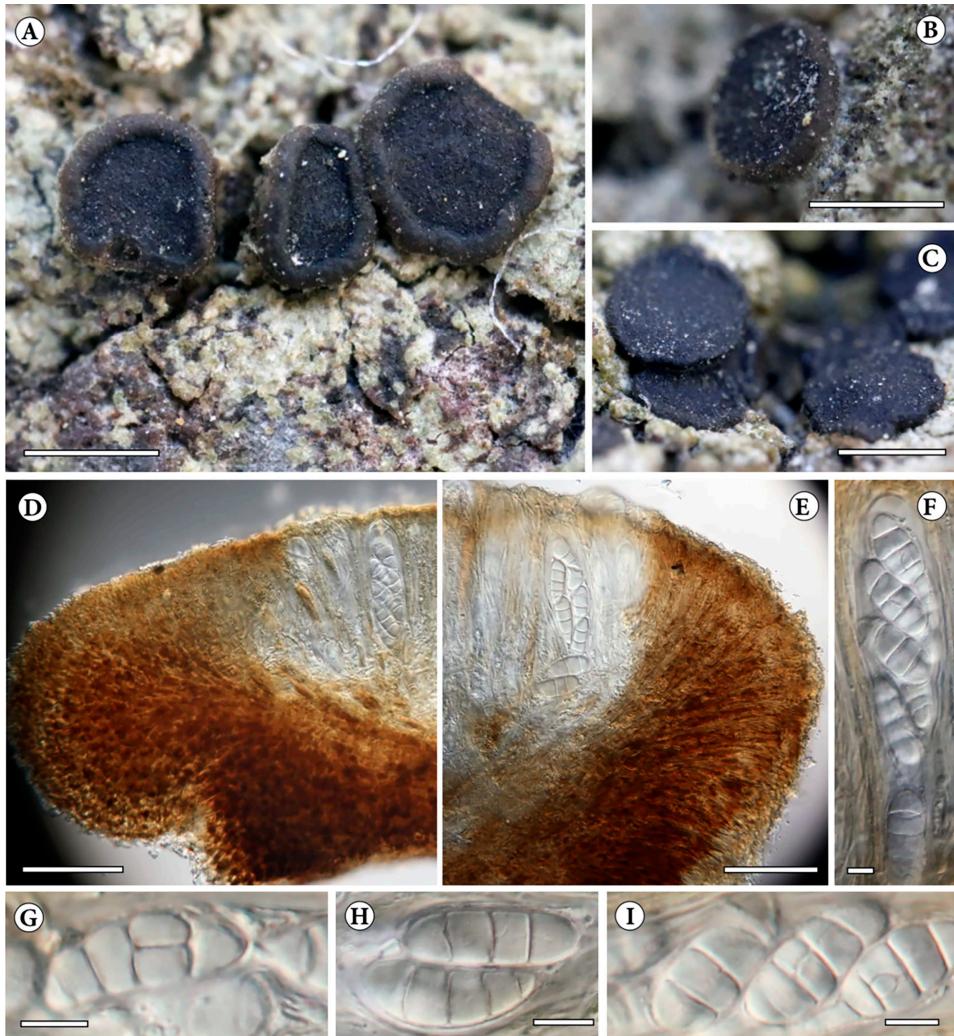


Fig. 4. *Gyalidea koreana* (KoLRI 039025, holotype): A, C = thallus with ascomata; B = detail of apothecium with tomentum on the bottom part; D, E = cross-section of excipulum; F = mature ascus and paraphyses; G, H, I = mature ascospores (mounted in water). Scales: A, B, C – 1 mm; D, E – 50 μm ; F, G, H, I – 10 μm (Photos of J. Halda)

μm). *Gyalidea koreana* differs from *G. pacifica* H. Harada et Vězda (Harada and Vězda 1996) in having larger apothecia (0.5–1.8 mm vs. 0.2–0.6 mm diam.), higher hymenium (100–120 μm vs. 55–75 μm high) and wider ascospores (27–32.5 \times 9.5–11.5 μm vs. 10–24 \times 5–7 μm).

Gyalidea pisutii J. P. Halda, S. Y. Kondr., L. Lőkös et Hur, *spec. nova*
(Fig. 5)

Mycobank no.: MB 828226.

Similar to Gyalidea culbersoniana, but differs in having brown-black, urceolate apothecia with black margin and ascospores slightly constricted at septum, as well as by its geographical distribution.

Type: South Korea, Jeju-do Province, Chuja-do, Chuja-myeon, Yecho-ri, front Road of Bokryusu, on basalt, growing together with *Lepraria* sp. Lat.: 33° 57' 8.89" N; Long.: 126° 19' 43.91" E, Alt.: 33 m a.s.l. Coll.: Halda, J. P., Oh, S.-O. and Hur, J.-S. (141112), 21.07.2014 (holotype: KoLRI 023673); the same locality, on rock, growing together with *Lepraria* sp. Coll.: Halda, J. P., Oh, S.-O. and Hur, J.-S. (141111), 21.07.2014 (isotype: KoLRI 023672).

Thallus 0.3–1 cm across, but probably may form larger spots to several cm in diam., crustose, continuous, very thin, greenish grey or greyish to somewhat indistinct and mosaic-like. Aggregations of blackish apothecia form darkish spots. Photobiont trebouxioid, algal cells to 8–12 μm in diam. At the contact of different thalli or with other crustose lichens a black line to 0.1 mm wide usually present in peripheral portion.

Apothecia 0.1–0.3(–0.35) mm in diam. (in section to 0.15–0.2 mm thick), usually immersed in thallus to somewhat sessile then, dark bluish black, black-brown with hardly differentiated disc and margin, if punctiform or only margin present (up to 0.2 mm diam.), disc concave. In apothecia bigger than 0.2 mm in diam., margin to 50–100 μm wide, somewhat whitish or seems to have white pruina. Disc plane, black-brown, in section biatorine, true exciple (20–)40–50 μm wide in the uppermost portion, with brownish outer layer and to 15–20 μm thick in lower lateral and basal portion, paraplectenchymatous, cells 5–6 \times 2–3 μm . Photobiont layer to 20–30 μm thick; hymenium 70–90 (–100) μm high. Epihymenium brownish, paraphyses simple or branched, 1.5–2 μm in diam., not or slightly swollen towards the tips. Asci 8-spored, 45 \times 15 μm , clavate; ascospores with one septum, hyaline, often with oil droplets, one cell is usually larger than the other (11–)13–16(–17) \times (4–)6–7(–8) μm [$x = 14.4 \times 6 \mu\text{m}$; SD 1.5; 1 μm ; $n = 69$; l/w ratio = 2.5] in water.

Chemistry: Thallus and all tissue of apothecium K–, N–.

Ecology: It grows on siliceous rocks.

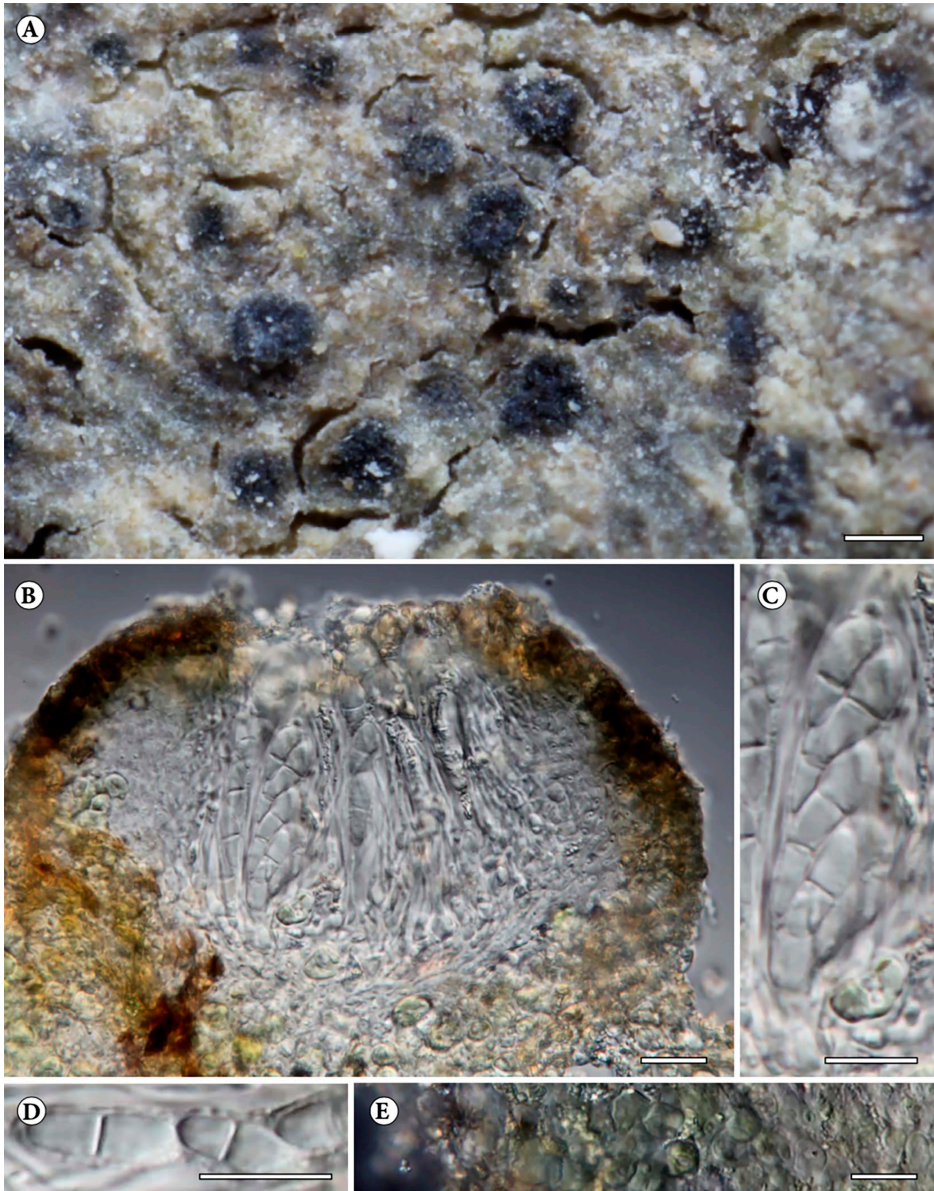


Fig. 5. *Gyalidea pisutii* (holotype, KoLRI 23673): A = thallus with ascomata; B = cross-section of excipulum; C = detail of mature ascus (mounted in water), D = detail of mature ascospores, E = photobiont cells. Scales: A – 250 μm ; B, C, D, E – 10 μm (Photos of J. Halda)

Etymology: It is named after our late friend and colleague Ivan Pišút (1935–2017), well-known Slovak lichenologist, in recognition of his contributions in lichenology.

Distribution: So far it is known from the type locality, Jeju-do Province: Chuja-do Island, South Korea.

Taxonomic notes: *Gyalidea pisutii* is characterised by very thin, continuous, greenish grey thallus and very small apothecia (0.1–0.3 mm in diam.) partly immersed in thallus, all elements have no reactions with K and N, as well as by having rather large 1-septate, hyaline ascospores. *Gyalidea culberstoniana* Vězda et Poelt differs by brown-black, urceolate apothecia with black margin and ascospores slightly constricted at septum. *G. praetermissa* Foucard et G. Thor forms fusiform ascospores with 4–5 transverse septa. Apothecia of the freshwater species *G. diaphana* (Nyl.) Vězda are larger (200–400 µm in diam.) and hyaline. *Gyalidea testacea* Vězda et Poelt known from Nepal is characteristic by 1–3-septate ascospores and larger apothecia (600–800 µm in diam.) (Vězda and Poelt 1991).

Gyalidea poeltii S. Y. Kondr., L. Lőkös, J. P. Halda et Hur, *spec. nova*
(Fig. 6)

MycoBank no.: MB 828227.

Similar to Gyalidea pacifica, but differs in having larger apothecia, much thicker true exciple, higher hymenium, halonate and much wider ascospores. Outer side of exciple covered by white, tomentose hyphae.

Type: South Korea, Jeju-do, Seogwipo-si, Donnaeko-ro, Donnaeko, on rock, growing together with *Verrucaria* sp. and mosses. Lat.: 33° 18' 04.3" N; Long.: 126° 34' 53.07" E; Alt.: ca. 330 m a.s.l. Coll.: Halda, J. P. (140420–2), 19.06.2014 (holotype: KoLRI 022815); (140414–1) (isotype: KoLRI 022807).

Thallus epilithic, crustose, continuous, 10 cm (or more) across, film-like, somewhat thicker and cracked with portions having tendency to be exfoliated, especially in the centre, pale greenish grey to whitish to dull green with dark brown to violet apothecia. Prothallus not observed, however black line to 0.1–0.15 mm wide in places of contact with other crustose lichens often present.

Apothecia 0.3–1 mm in diam., to 0.15–0.2 mm thick in section, lecideine, mainly regularly rounded, sometimes aggregated in groups to 2–3, dark brown-violet with distinct white tomentum on underside; disc plane, concolorous with margin. True exciple to 0.1 mm wide, permanent, usually slightly arising above the level of disc; in section 50–60 µm thick in the uppermost lateral portion, 60–70 µm thick in lower lateral portion and 80–100 µm thick in basal por-

tion, brown to dark brown. Single hyaline hairs on outer side formed by single hyphae directed downwards to (15–)20–35(–40) μm long gradually thickening



Fig. 6. *Gyalidea poeltii* (holotype, KoLRI 22815): A = thallus with ascomata; B = detail of apothecium; C = cross-section of excipulum; D = cross section of hymenium with mature asci and paraphyses; E, F = detail of mature ascospores (mounted in water); G = detail of mature ascus. Scales: A, B – 1000 μm , C, D – 25 μm , E, F, G – 10 μm (Photos of J. Halda)

towards the tips forming almost byssoid layer at the lowermost part of the lateral portion of exciple to 25–30 μm thick. Thalline exciple absent. Hymenium 85–95 μm high, hyaline; epihymenium indistinct, hyaline; subhymenium 20–25(–40) μm thick, somewhat brown. Paraphyses 1–1.5 μm in diam., branched and septate. Asci 8-spored, 75 \times 15 μm , clavate; ascospores submuriform with 7–8–9 cells seen, with 3–4 transverse septa and one longitudinal septum, halonate (halo to 1.5–1.8 μm thick), (18–)19–24(–26) \times (8–)9–11(–12) μm [$x = 21.4 \times 9.8 \mu\text{m}$; SD 2.4; 0.9 μm ; $n = 82$; l/w ratio = 2.2] in water.

Ecology: Growing on rock in very shaded and moisture conditions.

Distribution and habitat: It is so far known only from the type locality, Jeju-do Island, South Korea.

Etymology: It is named after Josef Poelt (1924–1995), well-known German lichenologist, in recognition of his numerous contributions in lichenology.

Taxonomic notes: *Gyalidea poeltii* is similar to *G. japonica* H. Harada et Vězda, but differs in having larger apothecia (0.3–1 mm vs. 0.1–0.3 mm diam.), much thicker true exciple (50–100 μm vs. to 30 μm thick), higher hymenium (85–95 μm vs. 60–85 μm high), halonate (halo to 1.5–1.8 μm thick) and longer and wider ascospores (19–23(–24) \times (8–)9–10(–12) μm vs. 15–20 \times 7–9 μm). *Gyalidea poeltii* differs from *G. pacifica* H. Harada et Vězda in having larger apothecia (0.3–1 mm vs. 0.2–0.6 mm diam.), much thicker true exciple (50–100 μm vs. to 40–75 μm thick), higher hymenium (85–95 μm vs. 55–75 μm high), halonate (halo to 1.5–1.8 μm thick) and much wider ascospores (19–23(–24) \times (8–)9–10(–12) μm vs. 10–24 \times 5–7 μm). From *Gyalidea kawanae* H. Harada et Vězda *G. poeltii* differs by transversely septate ascospores constricted at septa.

Additional specimen examined: South Korea, Jeju-do, Seogwipo-si, Mt Halla (Yeongsil Trail). Lat.: 33° 21' 20.93" N; Long.: 126° 30' 01.14" E; Alt.: 1388 m a.s.l. Coll.: Halda, J. P., Oh, S.-O. and Liu, D. (151728), 21.07.2015 (KoLRI 035421).

Gyalidea vezdae S. Y. Kondr., L. Lókös, J. P. Halda et Hur, *spec. nova*
(Fig. 7)

Mycobank no.: MB 815536.

Similar to Gyalidea polyspora, but differs in having paler thallus, smaller apothecia, lower hymenium, hyaline, indistinct epihymenium, smaller asci, as well as its distribution. It differs from Gyalidea saxicola by larger apothecia (0.3–0.5 mm), and ascospores with only 2–3 transverse septa, 8 in ascus.

Type: South Korea, Gyeongsangbuk-do, Gumi-si, Jangcheon-myeon, nearby Mountain of Baenam Valley, on rock, growing together with *Placynthiella* sp. Lat.: 36° 09' 08.21" N; Long.: 128° 30' 40.41" E; Alt.: ca. 158 m a.s.l.

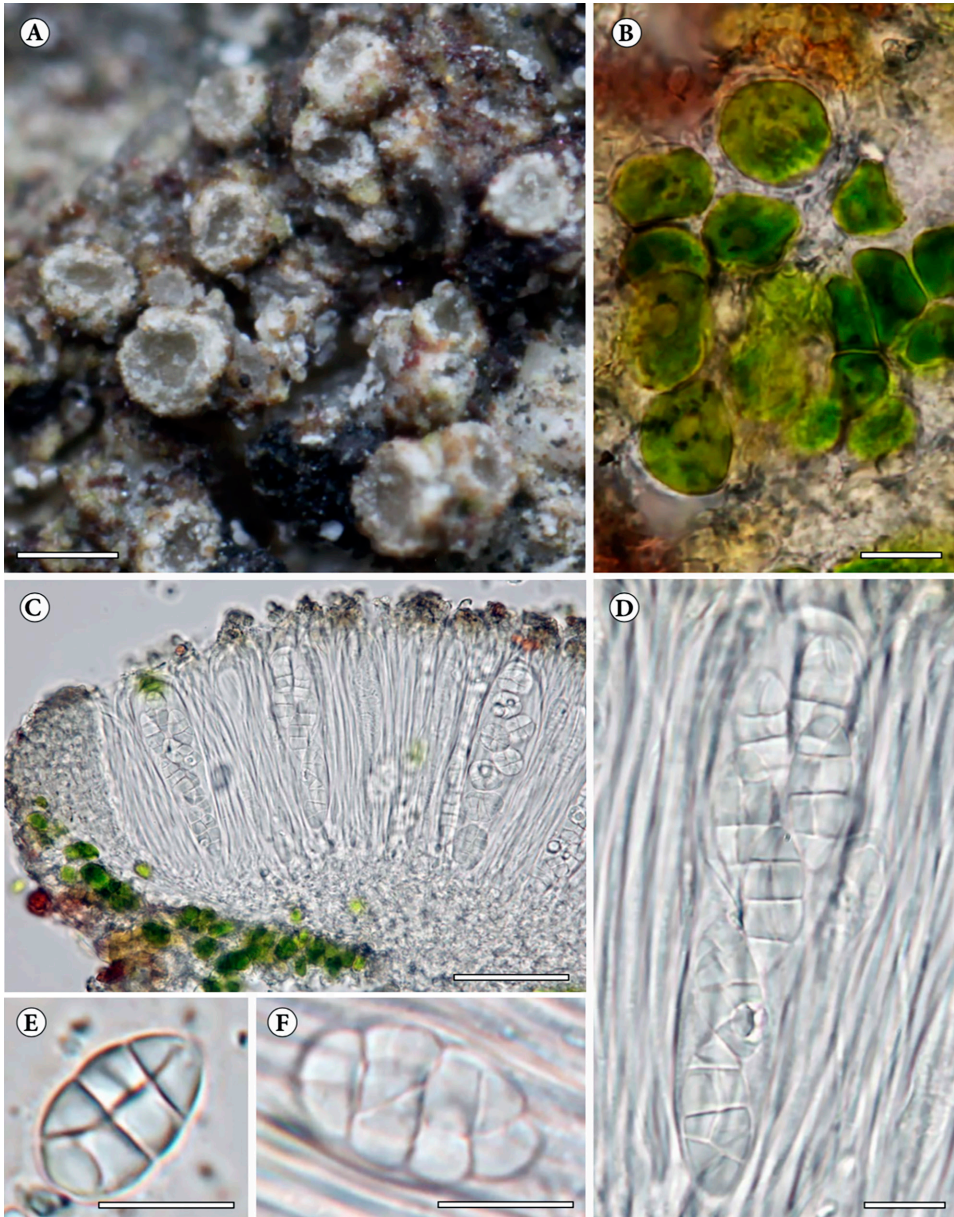


Fig. 7. *Gyalidea vezdae* (holotype, KoLRI 23872): A = thallus with ascomata; B = detail of apothecium; C = cross-section of excipulum; D = cross-section of hymenium with mature asci and paraphyses; E, F = detail of mature ascospores (mounted in water). Scales: A – 250 μm , B – 10 μm , C – 50 μm , D, E, F – 10 μm (Photos of J. Halda)

Coll.: Park, J. S. and Woo, J. J. (141418), 29.07.2014 (holotype: KoLRI 023872); the same locality, growing together with *Trapelia coreana*, *Placynthiella* sp., (141420) (isotype: KoLRI 023874 sub *Trapelia coreana*).

Thallus indistinct or absent, only of extremely small whitish portions to 25 µm across observed, usually seen as aggregations of numerous, very small grey apothecia with whitish margins. Hypothallus not observed.

Apothecia 0.1–0.25(–0.35) mm in diam., to 0.18 mm thick in section, lecanorine to zeorine, pale brownish or olive greyish, disc transparent hyaline or greyish, concave, margin arising above the level of disc, concolorous with disc or somewhat whitish or dirty whitish to hyaline, with whitish thalline fragments. Thalline exciple in sections to 30–60 µm thick, cortical layer to 20 µm thick; true exciple to 40 µm thick in the uppermost lateral portion, and to (10–)15–20 µm thick in lower lateral portion and basal portions, textura globosa with outermost greyish or blackish portion in lateral portions and paraplectenchymatous in basal portion. Hymenium 80–90 µm high, hyaline. Epihymenium slightly yellowish, 5–7 µm thick, paraphyses 1.5–2 µm thick, not branched, without septa, very gelatinised; subhymenium to 10–15 µm thick, hyaline; asci 8–12-spored, 75–90 × 14–16 µm; ascospores hyaline, ellipsoid, submuriform, with 3–4 transverse and 1–2 longitudinal septa with (6–)8–14(–15) cells seen, (12–)16–20(–21) × (7–)9–10(–11) µm [$x = 17.5 \times 8.9$ µm; SD 2.1; 0.8 µm; $n = 70$; l/w ratio = 2] in water.

Ecology: It grows on acidic conglomerate rock in deciduous forest together with *Trapelia coreana* S. Y. Kondr., L. Lőkös et Hur.

Distribution and habitat: It is so far known only from the type locality, Mountain of Baenam Valley, Jangcheon-myeon, Gumi-si, Gyeongsangbuk-do, South Korea.

Etymology: It is named after Antonín Vězda, well-known Czech lichenologist, in recognition of his numerous contributions in the genus *Gyalidea*.

Taxonomic notes: *Gyalidea vezdae* is similar to *G. polyspora* R. Sant., growing on hard acidic rock in the alpine and subalpine zones of Scandinavia, NE Europe, but differs in having whitish thallus (vs. pale greyish to brownish, often with greenish tinge, in the herbarium eventually often pinkish), in having smaller apothecia (0.1–0.25(–0.35) mm vs. (0.2–)0.4–0.7 mm in diam.), lower hymenium (80–90 µm vs. to 130 µm high), hyaline, indistinct epihymenium (vs. brown), smaller asci (75–90 × 14–16 µm vs. 120–125 × 30–33 µm), as well as its distribution, while ascospore measurements are rather similar and overlapping (12–18(–21) × 7–10(–11) µm vs. 14.5–22 × 7–11.5 µm) (Nordin *et al.* 2007, Vězda and Poelt 1991). The other *Gyalidea* species with more than eight spores per ascus, i.e. *G. asteriscus* (Anzi) Aptroot et Lücking and *G. multispora* Lumbsch et Vězda, differ in having 30–60 spores per ascus. *G. rivularis*

(Eitner) J. Novak et Tobol., on the other hand, is quite similar to *G. vezdae* and *G. polyspora*, but differs in having only eight spores per ascus and slightly smaller apothecia, and it does not seem to grow on cupriferous rock. *G. fritzei* (Stein) Vězda, *G. lecideopsis* (A. Massal.) Lettau ex Vězda and *G. roseola* (Arnold) Lettau ex Vězda are also similar, but have 8-spored asci and larger and more eumuriform spores. *G. saxicola* (Groenh.) Hafellner et Vězda forms very weakly transversely septate ascospores.

Laundonia ryukyuensis S. Y. Kondr., M. Moriguchi et Yoshik. Yamam.,
spec. nova
 (Figs 8–9)

Mycobank no.: MB 829831.

Similar to Gyalolechia flavorubescens, but differs in having whitish thallus, in having mostly biatorine often aggregated in clusters apothecia, in having lower hymenium, thinner subhymenium, as well as in having shorter ascospores.

Type: Japan, Okinawa Pref., [Ryukyu Islands], Ishigaki-shi, Ishigaki Island, Maezato, on bark of an evergreen hardwood. Lat.: 24° 20' 04.22" N; Long.: 124° 11' 19.87" E; Alt.: 8 m a.s.l. Coll.: Yoshikazu Yamamoto (YY-25070801), 08.07.2015 (holotype: OSA Li 2549; isotype: KW-L).



Fig. 8. *Laundonia ryukyuensis* (holotype): general habit in field (Photo of Y. Yamamoto)

Thallus to several cm across, crustose, continuous, whitish or whitish greyish, more or less smooth, with more or less scattered to sometimes aggregated in groups, somewhat indistinct, dull brownish orange apothecia; thallus in section (below apothecium) to 70–100 μm thick, cortical layer to 20–30(–40) μm thick, paraplectenchymatous, or somewhat irregular sclero-plectenchymatous(?); algal zone often of algal clusters to 40 μm across. Hypothallus blackish or bluish black, sometimes better seen in peripheral zone or in undulations of substrate.

Apothecia to 0.4–0.7(–0.9) mm in diam. [and to 0.16–0.23 mm thick in section], biatorine, scattered and distant and more or less rounded to sometimes aggregated in clusters (groups to 3–7 together) and irregular, often with very wavy own margin, disc dull brownish orange to dull orange or dark brown-

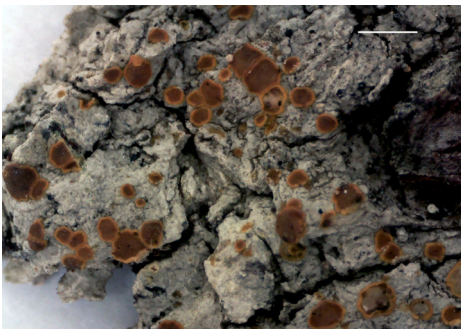
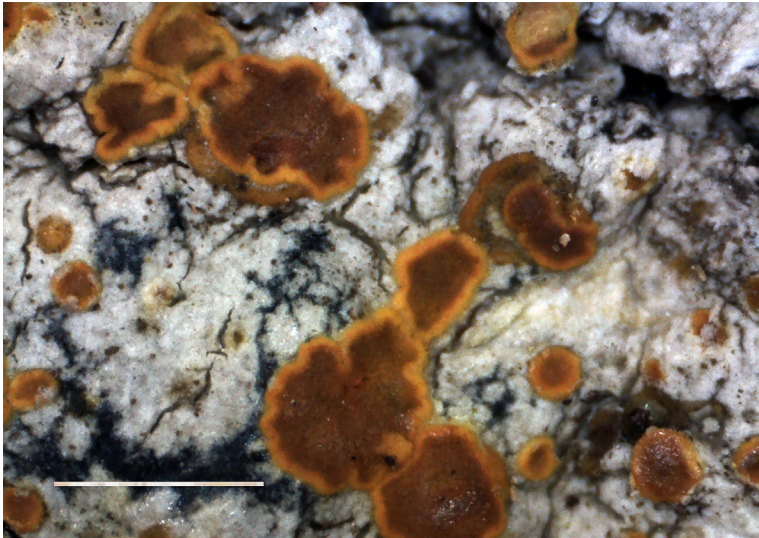


Fig. 9. *Laundonia ryukyuensis* (isotype, KW-L): enlarged portion of thallus with apothecia. Scale 1 mm (Photos of S. Kondratyuk)

orange in places, own margin bright yellow to dull yellow, sometimes whitish thalline portions seen on own margin in younger apothecia; in section biatorine (where no algae in apothecium section observed, algal cells present only in the lower portion of apothecium); true exciple rather thin, to (20–)40–50 (–70) μm wide in the uppermost lateral portion, to 35 μm thick in lower lateral portion with brownish orange outermost layer; hymenium to 50–55(–60) μm high; subhymenium 50–60 μm thick with oil droplets to 4–5 μm in diam., and irregular aggregations to 3–4 μm across; asci 8-spored; ascospores more or less with attenuated ends, sometimes rather wide or subspherical, in general very variable in shape and size, (10–)11–13(–17) \times (6–)7–10(–13) μm in water; septum (4–)5–7 μm wide in water.

Chemistry: Thallus K–, epihymenium K+ purple. Not studied.

Ecology: It grows on bark of an evergreen hardwood and on bark of *Diospyros vera* (Lour.) A. Chev. (sub *Diospyros ferrea* var. *buxifolia* (Rottb.) Bakh.).

Etymology: It is named after Ryukyu Islands, where the type collection was done.

Distribution: So far it is known from two distant localities (Ishigaki Island and Yonaguni Island) in Ryukyu Islands, Okinawa Pref. of Southwestern Japan (Eastern Asia).

Taxonomic notes: *Laundonia ryukyuensis* is characterised in having rather often aggregated in clusters biatorine apothecia of *Gyalolechia flavorubescens*-type, i.e. with somewhat greyish of oil inclusions lower portion of hymenium and subhymenium.

Laundonia ryukyuensis is similar to *L. flavovirescens* (Wulfen) S. Y. Kondr., L. Lőkös et Hur, but differs in having whitish thallus (vs. yellow-greyish, dull yellow to greenish yellow), in having smaller and thinner apothecia (vs. to 1.2 mm in diam. and to 0.3–0.6 mm thick in section), in having dull brown-orange to dull orange or dark brown-orange disc (vs. orange to reddish orange), in having lower hymenium (vs. 65–90 μm high) and in having shorter ascospores ((10–)11–13(–17) \times (6–)7–10(–13) μm vs. 13–17(–18) \times 6–9(–10) μm) (Khodosovtsev *et al.* 2004).

Laundonia ryukyuensis is similar to *Gyalolechia flavorubescens*, but differs in having whitish thallus, in having mostly biatorine apothecia (vs. lecanorine/zeorine), in having lower hymenium (50–55(–60) μm vs. 70–90 μm high), in having thinner subhymenium (50–60 μm vs. 80–110 μm thick), as well as in having shorter ascospores ((10–)11–13(–17) \times (6–)7–10(–13) μm vs. (13–)15–18 \times 7–10 μm) and somewhat shorter ascospores septum ((4–)5–7 μm vs. 6–9 μm wide) (Khodosovtsev *et al.* 2004).

In lack of molecular data the taxonomic position of *Laundonia ryukyuensis* is still questionable, as far species diversity and diagnostic characters of three genera *Mikhtomia* S. Y. Kondr., Kärnefelt, Elix, A. Thell et Hur, *Oxneriopsis* S. Y. Kondr., Upreti et Hur and *Laundonia* S. Y. Kondr., L. Lőkös et Hur, which are

especially abundant in the Eastern Asian region are still not clear. These genera were proposed mainly on the basis of results of three gene phylogeny of the subfamily Caloplacoideae of the Teloschistaceae (Kondratyuk *et al.* 2017a). *Laundonia ryukyuensis* is preliminary placed in the genus *Laundonia* including so far two mainly Northern Hemisphere taxa (i.e. *L. flavovirescens* (Wulfen) S. Y. Kondr., L. Lőkös *et Hur* and *L. persimilis* (Wetmore) S. Y. Kondr., L. Lőkös *et Hur* (Kondratyuk *et al.* 2017a) after morphological characters, while molecular data (i.e. nrITS, nrLSU and mtSSU data) should be obtained for the confirmation of its position in the genus mentioned.

Additional specimen examined (paratype): Japan, Okinawa Pref., [Ryukyu Islands], Yonaguni-cho, Yonaguni Island, Mantabaru Forest Park, on bark of [an evergreen tree] *Diospyros ferrea* var. *buxifolia*. Lat.: 24° 27' 27.01" N; Long.: 122° 58' 21.17" E; Alt.: 123 m a.s.l. Coll.: Mitsuru Moriguchi (MM-28030301), 03.03.2018 (OSA Li 2549, KW-L).

Lecanora orlovii S. Y. Kondr. *et* L. Lőkös, *spec. nova*
(Figs 10–11)

Mycobank no.: MB 829832.

Similar to Lecanora barkmaniana, but differs in having thinner thallus, smaller soredia, larger apothecia, larger ascospores, in having gyrophoric acid and PD+ orange-red reaction, and in having large crystal aggregations in amphithecium, as well as in the lack of chloratranorin, zeorin and atranorin.

Type: Ukraine, Zhytomyr oblast, Narodychi district, Drevlyany natural reserve, Narodychi forestry, 'quarter' 57, 'vydil' 10, in 109-year-old pine forest on station site number 3 "Old-growth Pineta motley grass with lily of the valley" (C₃), on the bark of trunk of young oak tree, growing together with *Hypogymnia physodes*, *Parmelia sulcata*, *Imshaugia aleurites*, *Haematomma* cf. *ochroleucum*. Coll.: Orlov, O. O., 23.09.2017 (holotype: KW-L 73946).

Thallus (0.7–)3–5 cm across, crustose, from minute areolate and very thin in peripheral zone to continuous and very thick and uneven, verruculose in the centre, with very irregular convex or vertically uplifted verruculae. Areoles *ca.* 0.1–0.2 mm across, very variegated from plane to soon becoming strongly convex, semiglobose to bullate, somewhat distant at first and more or less regularly rounded to irregular and more aggregated later; upper surface smooth, rarely somewhat cracked, whitish grey or pale grey. Soralia 0.2–0.3(–0.5) mm in diam./across at first regularly rounded in the upper portions of uplifted convex areoles (and soredious mass distinctly uplifted (torch-like) above thallus level) or among convex areoles where somewhat immersed into thallus, with convex sorediate mass, more or less greenish grey or whitish-greenish grey in the centre of soredious mass and more or less darker to dark

grey or blackish-greenish grey in the peripheral zone (similar to *Buellia griseovirens*), but soon becoming confluent to 0.7–1.5(–2) mm across or the centre of thallus becoming entirely sorediate (when sorediate mass observed among protuberances or convex thalline areoles it seems to be closely attached to the thallus). Soredia very small *ca.* 15–20 μm in diam./across, mostly irregular, whitish grey or whitish-greenish grey. Hypothallus indistinct or whitish, when visible between areoles in the peripheral zone.

Apothecia (0.3–)0.5–0.8 mm in diam., lecanorine, very indistinct sometimes, uplifted above the thallus level and constricted at the basis; discs more or less plane, dull brown or dull brownish grey, while rather often with blackish spots or entirely black (see taxonomic notes below); thalline exciple to 0.2(–0.3) mm wide often somewhat bullate or crenulate, not evenly developed, some-

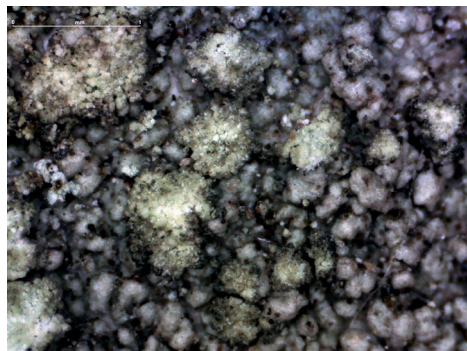
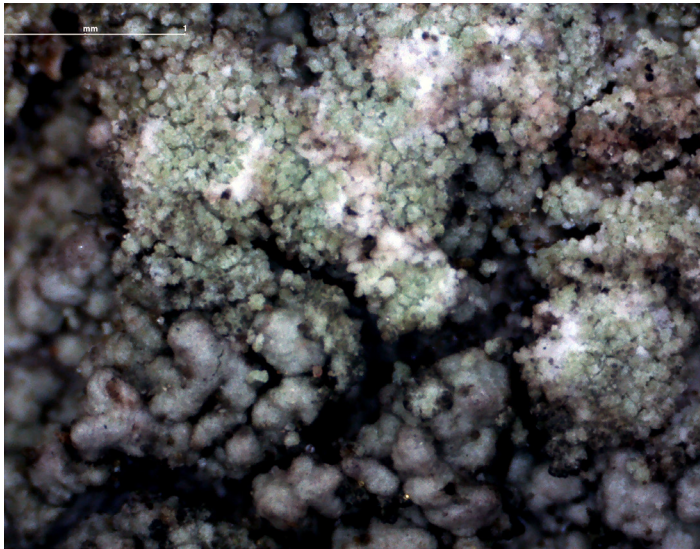


Fig. 10. *Lecanora orlovii* (holotype, KW-L 73946): general habit (left bottom); enlarged soralia (top and right bottom). Scale 1 mm (Photos of S. Kondratyuk)

times soresiate, concolorous with thallus, which grey or light grey. In section the apothecium to 0.8 mm in diam. and to 0.3 mm thick, lecanorine or zeorine, thalline exciple to 70–100(–130) μm wide with cortical layer to 20–25(–30) μm thick; with small crystals (?) and seem to be somewhat indistinct nature, dull, with in regularly spherical or rounded to sometimes ellipsoid and vertically elongated clumps or heaps of crystals to (80–)100–120 μm across in lower lateral and basal portions or often forming entire 'crystal zone' to 80–100 μm thick below the algal zone; separate crystals to (40–)60–80(–100) \times 40–50(–60) μm , sometimes single crystals occupy up to half of crystal clumps or heaps cavity; true exciple to 20–30(–50) μm thick in the uppermost lateral portion and lower lateral portion, and to 30–40(–50) μm thick in basal portion, sometimes developed only in lower lateral and basal portions, somewhat paraplectenchymatous; algal cells 9–17 μm in diam. with distinct oil droplets; hymenium to 70–100 μm high; epihymenium dull brownish yellow or dirty brownish yellow to 20 μm thick; subhymenium (30–)50–70(–90) μm thick, with rather rare

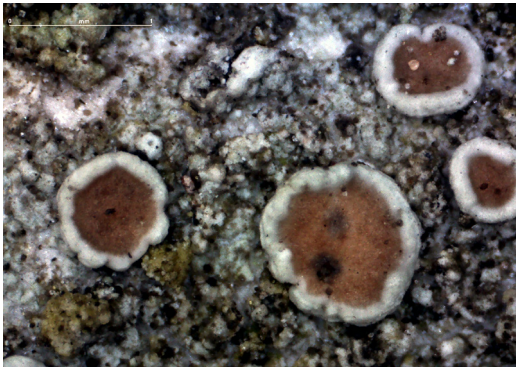


Fig. 11. *Lecanora orlovii* (holotype, KW-L 73946): enlarged apothecia. Scale 1 mm (Photos of S. Kondratyuk)

oil droplets to 3 μm in diam.; asci 8-spored, ascospores ellipsoid to almost spherical, 8–14(–17) \times (4.5–)5–7(–9.5) μm (more than 70 measurements!).

Chemistry: Thallus and thalline margin of apothecia K+ yellow, C+ pink, Pd+ orange-red. Probably gyrophoric acid is present.

Ecology: Growing on bark of stem of young oak (*Quercus robur*) tree.

Distribution: So far known from the type locality only, in the forest zone of Zhytomyr oblast (Northern part of Ukraine, Eastern Europe).

Etymology: It is named after the well-known Ukrainian botanist Olexandr Olexandrovych Orlov (Zhytomyr, Ukraine), who has collected this lichen and kindly provided it to our disposition.

Taxonomic notes: *Lecanora orlovii*, a member of the *L. chla-rotera* subgroup, where crystals

more than 10 μm in diam. are present in amphithecium, is characterised by the unique combination of the following characters: thin to verruculose, whitish grey thallus, soralia with convex sorediate mass often being confluent, the *chlarona*-type amphithecium with very large crystals, medium size ascospores and presence of gyrophoric acid, and Pd+ orange-red reaction of thalline margin of apothecium.

The shape and size of crystals in the thalline margin is of great importance in classification of the *Lecanora subfusca* group (Brodo 1984, Kofler 1956, Magnusson 1932, Miyawaki 1988, Poelt 1952).

Lecanora orlovii similarly to other members of the *Lecanora chlarotera* subgroup, contains crystals in the amphithecium (or thalline exciple) more than 10 μm in diam., which are not soluble in KOH. The latter type of apothecium or amphithecium is called as the *pulicaris*-type of amphithecium after Brodo (1984), or the *chlarona-subrugosa*-type of amphithecium after Magnusson (1932). In this case very large, irregular crystals, usually in clumps or 'heaps', especially in the lateral portion of the amphithecium are present.

Unfortunately we could not find any data in literature on measurements of crystals in various taxa of the *Lecanora chlarotera* subgroup. *Lecanora orlovii* is characterised by especially large size of crystals. Separate crystals can be to (40–)60–80(–100) \times 40–50(–60) μm , while they are aggregated or forming more or less regularly spherical or rounded to somewhat elliptical and vertically elongated clumps or heaps to 100–120 μm in diam./across. So *Lecanora orlovii* has so far the largest crystals within this group.

Lecanora orlovii is the closest to *L. sorediomarginata* S. A. Rodrigues, A. Terón et Elix, recently described from Portugal, after having soralia and C+ red reaction of thallus, but differs in having smaller and thicker verruculose thallus (vs. to 8 cm wide, endosubstratal or very thin thallus, or has a granular-sorediate appearance), in having true soralia in upper portion of thallus (vs. soredia arising from rupture of episubstratal warts), in having smaller soredia and in the lack of consoredia (vs. soredia 16–40 μm in diam., and consoredia 22–140 \times 35–150 μm), in having smaller apothecia (vs. 0.37–1.25 mm diam.), in having larger ascospores (vs. 6.5–11.5 \times 4–8.5 μm), in the lack of sorediate apothecial margin (vs. margin of apothecia completely sorediate at maturity), as well as in different ecology (vs. on bark of trunks and branches of *Pinus pinaster* and *P. pinea* in coastal pine forests) and distribution (vs. Portugal) (Malíček *et al.* 2017, Rodrigues *et al.* 2011). Furthermore, the Ukrainian material probably differs in chemistry too, while chemistry of this collection was not so far especially studied. So after our suggestion that *Lecanora orlovii* has gyrophoric acid, while *Lecanora sorediomarginata* has C+ red reaction due to the presence of 3,5-dichloro-2'-O-methylnorstenosporic acid as major compound, while 3,5-dichloro-2'-O-methylnordivaricatic acid [minor], 5-chloro-2'-O-

methylantraic acid [trace], atranorin and chloratranorin and usnic acid are present only as minor substances, in *L. solediomarginata* (Rodrigues *et al.* 2011).

After studying the Key to species of the *Lecanora subfusca* group in North America (Brodo 1984) *L. orlovii* is the closest to *L. farinaria* Borrer in Hooker, a rare North American and northwestern European species, in having the *pulicaris*-type of apothecium and finally coalescing, large soralia, 0.5–1.5 mm in diam., but differs in having light whitish grey, continuous thallus (vs. thallus dark greyish yellow, areolate) and in having epiphytic habit (vs. on lignum), and in having gyrophoric acid (and may be in the lack of roccellic acid). However, Brodo (1984) has provided the following notes: “The report of this European species for North America is based on a single specimen from New Bedford, Massachusetts. Although agreeing with the type in most respects, it is not a perfect match, and the determination should be regarded as tentative. For example, the holotype lacks a well-developed cortex, has no amphithecial crystals, and has much larger spores. It remains to be seen if these differences remain constant as more material is discovered on both sides of the Atlantic”.

According to Brodo’s key *Lecanora orlovii* is similar to *L. impudens* Degel., a European and North American widely distributed lichen species growing on bark of deciduous trees, rarely conifers, especially in light forests, and growing on trees with neutral bark, but differs in having soralia usually becoming confluent (vs. soralia 0.5–1 mm in diam.), in having white-grey or greenish grey soledious mass (vs. sulphur-yellow or yellow), in having farinose soledia (vs. granular, in excavate roundish patches coalescing into larger, continuous patches), in having *pulicaris*-type of apothecium (vs. *allophana*-type after Brodo (1984), consisting of small crystals almost filling the amphithecial medulla), in having gyrophoric acid (C+ pink vs. C–), in having Pd+ orange-red reaction (vs. Pd+ yellow then orange or cinnabar-red), while apothecia are the same (vs. 0.5–1 mm diam.) and ascospores are almost the same (vs. 10–14(–16) × 5.5–8(–9.5) μm) (Makarevych 1971) sub *Lecanora chloropolia* (Erchs.) Almb.; Brodo (1984) sub *Lecanora impudens* Degel.).

Regarding Brodo’s key *Lecanora orlovii* is also similar to *L. allophana* f. *solediata* (Schaerer) Vain. [(1878) after Index Fungorum nom. illegit., Art. 53.1; Syn.: *Lecanora solediata* Vain. (1928); replaced syn. *Lecanora pseudosolediata* Motyka (1996), nom. inval., Art. 34.1 (Melbourne)], growing on deciduous trees, including *Populus*, *Fraxinus*, *Carya*, and *Nyssa*; and rarely on lignum rather widely distributed species, but differs in having thicker and verruculose thallus (vs. thin and more or less smooth), in having smaller and being often confluent soralia (to 3 mm in diam./wide), in the lack of yellowish colour of soledious mass, in the lack of black hypothallus, in having smaller and different type of apothecia (vs. to 1.3 mm in diam.), in having wider thalline margin (to 0.05 mm wide), in having paler apothecium disc (vs. dark brown or chestnut brown),

in having *pulicaris*-type of amphithecium (vs. *allophana*-type of amphithecium with very small grains), as well as in having gyrophoric acid and in having different spot tests (thallus C+ pink, Pd+ red, vs. C-, Pd-) (Motyka 1996).

It should be emphasised that the sorediose material of *Lecanora allophana* species, usually considered at the infraspecific level (i.e. form). However, there are a lot of mistakes in citing authors of these forms of *L. allophana* species. So the Schaerer's epithet *Lecanora subfusca* α . *vulgaris* β . *sorediata* Schaer., Enum. Crit. Lich. Europ. 74 (1850) is the earliest one. However, according to Motyka (1996) this material is not conspecific with Vainio's material and with *L. pseudosorediosa*, as well as *L. allophana* f. *sorediata* Vain. and *L. sorediata* Vain. All these three names are based on the same type specimens, now holotype of *Lecanora pseudosorediata*. So citing of the *Lecanora allophana* f. *sorediata* (Schaer.) Vain. (as it was cited in Makarevich (1971), and it is recommended by Index Fungorum) is not correct. Vainio's specimen, which was selected by Motyka (1996) as holotype for *Lecanora pseudosorediata* later is different from Schaerer's material. Thus status of the Schaerer's material is still unclear.

Similar situation is with some other taxa, i.e. *Lecanora subfusca* var. *allophana* f. *sorediata* Müll. Arg., Bull. Soc. Imp. Natur. Moscou 53: 104 (1878), and *L. subfusca* var. *sorediifera* f. *sorediata* Blomb et Forss., Enum. Plant. Scand. 74 (1880), as well as *L. schaeereri* Gyeln., Acta Fauna Flora Univ. ser. 2, 1, 5–6: 10 (1933), which were unknown to Motyka (1996) and they were not compared with *Lecanora pseudosorediata*.

Lecanora orlovii is similar to *L. allophana* (Ach.) Röhl., widely distributed in the Northern Hemisphere on bark of deciduous trees after having wrinkled/warty (= verruculose) thallus, but *L. orlovii* differs in having smaller and being not so distinctly attenuated apothecia at the basis (vs. 1–3 mm in diam., very distinctly attenuated at the basis), in having dull brownish or brownish grey disc (vs. chestnut brown to dark brown or black-brown), in having thinner cortical layer (vs. to 60–80 μ m thick in lower portion of apothecium; in having much larger crystals in medullary (vs. very small crystals in medullary and cortex), in having smaller and especially narrower ascospores (vs. 14–20 \times 8–10 μ m), in having gyrophoric acid (thallus C+ pink), and in having Pd+ reaction of thalline margin of apothecia (vs. C-, Pd-), and in the lack of yellowish tinge of thallus (vs. sometimes with yellowish tinge, especially after storing in herbarium) (Makarevych 1971, Makarevych *et al.* 2010).

After Brodo's key *Lecanora orlovii* is similar to the rare morphotype of *L. cinereofusca* H. Magn., a North American species growing on bark of deciduous trees or rarely conifers, in having apothecia *pulicaris*-type of amphithecium, but differs in having a well-developed thallus (vs. effuse granular sorediate), in the lack of epihymenium reaction (vs. epihymenium Pd+ orange with crystal formation), in having gyrophoric acid, in the lack of atranorin,

pannarin and placodialic acids, in having different spot tests of thalline margin (vs. Pd+ orange), as well as in having longer ascospores (vs. (7.5–)9–14 × (6–)7–8.5(–9.5) μm) (Brodo 1984).

Lecanora orlovii is similar to the rare sorediate morphotype of *L. insignis* Degel., growing on bark of *Abies* and *Sorbus* in North America and in the Alps, but differs in having thicker verruculose thallus (vs. thin and continuous), in having larger soralia (vs. soralia punctiform, 0.3–0.5 mm in diam.), in having smaller farinose soredia (vs. white granular), in having gyrophoric acid (thallus C+ pink), in the lack of epihymenium reaction (vs. epihymenium Pd+ orange) in the lack of pannarin, in having smaller and especially narrower, thin-walled ascospores (vs. (14–)15–20 × (8–)10–12(–15) μm, thick-walled) (Brodo 1984).

From *Lecanora pachycheila* Hue, rather widely distributed in Eastern Asia on smooth bark of deciduous trees to which *Lecanora orlovii* can be keyed out from the key to Eurasian Lecanoras (Makarevych 1971), but it differs in having well-developed, whitish grey thallus (vs. often being leprose and yellowish white or indistinct), in the lack of lax whitish hypothallus, in having smaller and usually regularly rounded apothecia (vs. 1–2 mm diam., and often deformed of mutual pressure), in the lack of pruina on apothecium disc (vs. white pruina), in having brownish yellow epihymenium (vs. reddish brown), in having smaller and narrower ascospores (vs. 15–24 × 7–12 μm), in having gyrophoric acid (thallus C+ pink), and in having Pd+ reaction of thalline margin of apothecia (vs. C–, Pd–) (Makarevych 1971).

Lecanora orlovii can be similar to *L. umbilicata* (Hoffm.) Röhl., a very rare species in Europe (known only from Finland) living on bark of *Betula* tree, but it differs in having plane epruinose apothecium disc (vs. convex disc with C– pruina), in having gyrophoric acid (thallus C+ pink), and in having Pd+ orange-red reaction of thalline margin of apothecia (vs. Pd+ red reaction) (Makarevych 1971).

Lecanora orlovii can be also similar to *L. räsäneni* Gyeln. (= *Lecanora coilocarpa* var. *sorediata* Räsänen, *L. sorediata* Räsänen), a very rare species in Europe (known only from Finland) living on naked or treated wood, especially on fences, but it differs in having only whitish grey or greenish grey soredia (vs. whitish yellow soredia), in having more common apothecia, in having paler epihymenium (vs. brownish black), in having smaller ascospores (vs. 13–19.5 × 5–9 μm), in having gyrophoric acid (thallus C+ pink), and in having Pd+ orange-red reaction of thalline margin of apothecia (vs. thallus C– and Pd–, thalline margin of apothecia Pd–), as well as in its ecology and distribution (Makarevych 1971).

Lecanora orlovii is similar to *L. chlarotera* Nyl., a rather common species in the Northern Hemisphere living on bark of deciduous trees, especially

Populus trees, similar in having rather thick thallus, but it differs in having thinner thalline roughness (vs. to 1.5 mm high thalline granules distinctly attenuated at the basis), in having another type of soralia being often confluent (vs. soralia only in uppermost portion of thalline granules), in having smaller apothecia (vs. to 2.5 mm in diam.), often deformed from mutual pressure, especially aggregated in the centre, in having narrower ascospores (vs. 12–18 × 6–8.5 µm), in having gyrophoric acid (thallus C+ pink), and in having Pd+ orange-red reaction of thalline margin of apothecia (vs. thallus C– and Pd–, thalline margin of apothecia Pd–) (Makarevych 1971).

To check the hypothesis that some specimens of *Lecanora orlovii* were deposited to lichen herbarium of KW-L under the names *L. allophana* or *L. subfuscata*, all hitherto available specimens of these two taxa have been revised. Totally among 145 specimens of *L. allophana* (Ach.) Röhl., deposited in KW-L investigated within this study only 2 specimens were sorediate (one specimen from France “[France]: Hautes Alpes, entre Mause et Le Forest. St. Tullen 1200 m. sur tronc de *Fraxinus excelsior*, 6.ix.1960 George Clauzade (KW-L 40122 sub *Lecanora allophana* (Ach.) Röhl. f. *sorediata* (Schaer.) Vain.” (Syn. *Lecanora impudens* Degel.), as well as “Ukraine: Krym, Yalta district, old name ‘Kuybysheva zapovednik’, clearing ‘Kamyana kunytsya’ (= ‘Stone-marten’), on *Acer*, 1280 m a.s.l., 30.vii.1957 Ye. Kopachevska” (KW-L 40109 sub *Lecanora allophana*); and one more specimen of *L. allophana* found to be growing side by side with unidentified sorediate crust lichen with whitish continuous thallus and widely open, crater-like soralia with white sorediate mass, which is not uplifted within the soralia. Sometimes it seems to belong to *L. allophana* (for example, specimen: “Ukraine: Krym, Alushtynsky district, old name ‘Kuybysheva zapovednik’, ridge Muflonnyy, on old *Juniperus*, 1000 m a.s.l., 22.x.1956 Ye. Kopachevska” (KW-L 28094 sub *Lecanora argentata*)). Although the taxonomic status of *Lecanora allophana* f. *sorediata* (syn. *L. pseudosorediata* Motyka (Motyka 1996)) is still in urgent need of further special study, this material differs in having crater-like soralia with rather thin (not convex) and concolorous with thallus (i.e. whitish or whitish grey) soredious mass, as well as in different spot tests (K+ yellow or weak yellow (which becoming reddish after long time keeping in herbarium, our own observation on the basis of KW-L specimens)).

Among specimens of the *Lecanora argentata* (or *L. subfuscata*) deposited in KW-L (total number of specimens investigated above 250) none soredious specimen was found. This species (*L. argentata*) also differs from *L. orlovii* in having more or less thinner thallus with more or less smooth and even surface (which becoming darker to brownish grey after storage in herbarium), in having apothecia distinctly attenuated at the basis with thalline margin being much higher uplifted and often becoming undulating at overmaturity, in having much darker (i.e. dull or shiny dark brown to blackish brown or

chestnut-brown) disc, which well contrasting to brighter and lighter white thalline exciple. The latter (i.e. whitish or whitish grey thalline exciple) usually well contrasting to both: disc (dark brown) and to dark grey or brownish grey thallus.

Lecanora orlovii is similar to *L. panticapaensis* Khodos., Naumovich, Elix et S. Y. Kondr., a sorediate species of the *Lecanora frustulosa* (Dickson) Ach. group recently described from vertically exposed surfaces of siliceous schist outcrops of Ukraine, in having verruculose greyish thallus and more or less convex soralia and apothecia within the same thallus, but differs in having smaller and whitish thallus without yellowish tinge (vs. thallus to 10 cm across, grey to greyish yellowish or yellow-green), in having much smaller thalline areoles (areolate to lobate thallus, areoles (0.3–)1.2–1.6(–1.8) mm in diam./across and forming small lobules to 2 mm long in peripheral zone), in having white-greenish and smaller soralia (vs. soralia yellowish green, (0.5–)1.2–2.5(–3.5) mm in diam./across), in having smaller soredia (vs. (30–)50–60(–70) μm in diam. aggregated in consoredia to 80–150 μm in diam.), in having smaller apothecia (vs. 0.8–1.5(–1.5) mm in diam.), in having crystals in thalline exciple (i.e. the *pulicaris*-type of apothecium, see above), in another chemistry of thallus (vs. thallus contains high concentration of atranorin, epanorin, roccellic acid, and zeorin, as well as muronic acid, isomuronic acid and rhizocarpic acid) and in having another spot test reactions (vs. thallus K–, C–, Pd– or Pd+ pale yellow), in having somewhat longer and wide ascospores (vs. (9–)10.5–13.5(–14.5) \times (4.5–)5.2–6.8(–7.2) μm) and in epiphytic habit (Khodosovtsev *et al.* 2009).

Lecanora orlovii is similar to *Buellia griseovirens* (Turner et Borrer ex Sm.) Almb., especially in having regularly rounded soralia with more or less light, whitish-greyish soredious mass in the centre of soralia and somewhat darker, dark grey or blackish grey peripheral portions of soredious mass, but differs in having white hypothallus (vs. black hypothallus or usually black line in peripheral zone of thallus observed), in having soralia soon becoming confluent and the thallus often becoming entirely sorediate, as well as in having lecanorine apothecia and simple hyaline ascospores.

Lecanora orlovii has both types of reproduction: fertile thalli with numerous apothecia (mostly or sometimes without soredia at all) and sorediate thalli, where apothecia not so common or observed only in places. Richly fertile thalli to 0.7 cm across and without soredia observed in type collection, as well as in much larger thalli (to 3–5 cm across) both fertile and sorediate portions are present. Probably this species may develop one of these stages depending of conditions available.

Material of *Lecanora orlovii* was mainly collected in field with aim to check presence of lichenicolous fungi causing blackening of apothecium discs (see Fig. 11). However, after revision of material in the lab conditions presence of

dyeing portions of the apothecium disc found to be correlating with presence of the entire layer of crystals below the true exciple layer. So suggestion that dead portions of thallus were caused by extremely large portion of light from external light and addition portion of light irradiation caused by presence of large crystals below hymenium was done.

Porpidia ulleungdoensis S. Y. Kondr., L. Lőkös et J. P. Halda, *spec. nova*
(Figs 12–13)

Mycobank no.: MB 828230.

Similar to Porpidia chungii, but differs in having thinner and indistinctly greyish-greenish thallus, in having evenly coloured, dark brown, K–, and with lighter outermost portion true exciple, in having mostly undifferentiated or slightly yellowish epihymenium, and black or blackish brown hypothecium, K–, and in having smaller, especially narrower ascospores.

Type: South Korea, Jeju-do, Seogwipo-si, Mt. Halla (Yeongsil Trail), on siliceous rock growing together with *Psoroglaena coreana**, *Caloplaca* aff. *flavorubescens* and species of the genera *Bacidina*, *Leptogium* and *Verrucaria*. Lat.: 33° 21' 12.19" N; Long.: 126° 29' 51.54" E; Alt.: ca. 1308 m a.s.l. Coll.: Halda, J. P. (151671), 21.07.2015 (holotype: KoLRI 035364).

Thallus 3–5 cm across or may form larger aggregations, crustose, continuous, film-like, very thin and repeating all undulations of the rock surface, and very indistinct (hardly differentiated from substrate), light grey to dark greyish or greenish grey in places, K–, Pd–.

Apothecia 0.3–0.7(–1.1) mm in diam., (0.2–)0.3–0.4 mm thick in section, lecideine or biatorine, sessile but not attenuated at the basis, from concave dull greyish brown or dull light brown disc and thick distinctly arising above the level of disc, own margin dark brown somewhat blackish brown, to 60–80 µm wide, apparently convex where edges closely attached to the substrate, becoming somewhat semiconvex and the exciple disappearing in lateral portion or indistinct, own margin especially at first mainly distinct, somewhat darker of disc, dull dark brown or blackish brown, disc dull light brown, greyish or brownish grey; in section biatorine, true exciple to 40–50(–80)[–120] µm in the uppermost lateral portion and to (50–)70–90(–100) µm thick in the lower later-

* Specimen of *Psoroglaena coreana* S. Y. Kondr., L. Lőkös et Hur differs in having very small measurements of ascomata (60–120(–150) µm vs. (110–)120–180(–220) µm in diam., as mentioned in the protologue, Kondratyuk *et al.* 2016b), but other data on anatomical characters of ascomata, asci and ascospores fit very well to original description.

al portion, where outermost zone to 15–20(–30) μm thick yellowish or hyaline, N- and to (50–)70–100(–120) μm thick in basal portion, sometimes thinner to 40–60 μm thick, in lateral portion consisting of radiating hyphae 5–7 μm in diam. (lumina to 3–4 μm in diam.), dark brown or light brown to yellowish brown or greyish brown in thin section, somewhat darker to blackish brown in the centre, with outermost layer to 15–20(–30) μm thick somewhat lighter

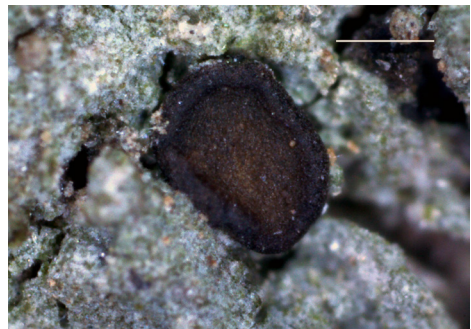
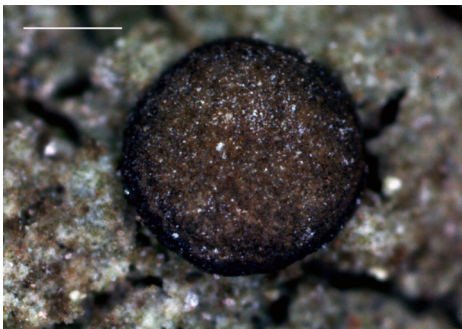
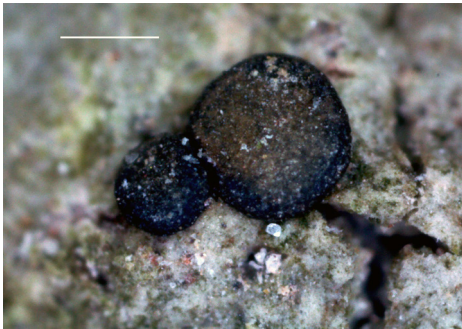
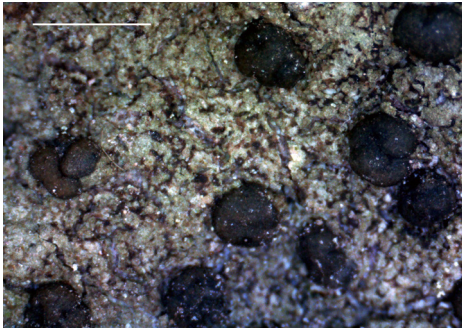


Fig. 12. *Porpidia ulleungdoensis* (holotype, KoLRI 035364): general habit (top) and enlarged apothecia (the others). Scale 2 mm (top), and 0.5 mm (the others) (Photos of S. Kondratyuk)

Fig. 13. *Porpidia ulleungdoensis* (KoLRI 039185): general habit (top) and enlarged apothecia (the others). Scale 1 mm (top), and 0.5 mm (the others) (Photos of S. Kondratyuk)

or hyaline or somewhat yellowish, sometimes in lateral portions more or less bluish blackish, N+ purple; algal cells are not present in apothecium, in thal-line portion to (7–)10–16 μm in diam./across. Hymenium to (50–)70–100 μm high, epihymenium mostly not differentiated or to yellowish to 10 μm thick observed; paraphyses not swollen towards the tips to 2–2.5(–4) μm in diam., branched; subhymenium to 20–40(–50) μm thick, from yellow brown to dark brown, dark greyish or blackish bluish, or dull blackish-bluish-greenish, when bluish N+ purple then becoming reddish or orange brown, in places with oil droplets to 3 μm in diam. (better seen in K); hypothecium 80–120(–150) μm thick blackish or blackish brown, N+ purple then reddish brown or orange-brown; asci 8-spored, of the *Porpidia*-type, 70–77 \times 12–15 μm ; ascospores simple, hyaline, widely ellipsoid to ovoid, with more or less attenuated ends, often with central oil droplets, (12–)13–16(–20)[–22] \times (5–)5.5–7(–8) μm .

Chemistry: Thallus K–, Pd–; epihymenium in K– or becoming somewhat yellowish, bluish portions of subhymenium and hypothecium K+ becoming greenish; black hypothecium and brown exciple in basal portion K–, only outermost portions of true exciple in basal portion becoming more yellowish; bluish portions of subhymenium and lateral portions of exciple N+ purple, becoming reddish or orange brown with time.

Ecology: It grows on siliceous rocks.

Etymology: It is named after Ulleung-do Island of South Korea, Eastern Asia, where this taxon found to be especially abundant.

Distribution: It is hitherto known from Ulleung-do and Jeju-do Islands of South Korea, Eastern Asia.

Taxonomic notes: Characteristic features of this species: the hyaline hymenium with indistinct or hardly differentiated (or somewhat yellowish) epihymenium, the bluish black subhymenium, N+ purple with much lighter to colourless in outermost portion, the convex or thick apothecia (like *Mycobilimbia*), but differs in colour and in having *Porpidia*-type asci and simple hyaline ascospores.

Variation of characters in the section: epihymenium from indistinct to well developed, yellowish, subhymenium from pale yellow to brown and bluish-blackish; true exciple from dark brown or dark brown with violetish tinge to bluish-blackish portion in lateral or uppermost portion or blackish brown in uppermost central portion; ascospores from narrow and long to wider and shorter.

Porpidia ulleungdoensis is similar to *P. chungii* (Zahlbr.) Hertel, known from Japan and China only, in having epruinose, sometimes convex apothecia and more or less obliterated margin. *Porpidia ulleungdoensis* differs in having thinner (vs. medium to thick, irregularly areolate-verrucose, verrucose-granulose or subtartareous), and indistinctly greyish-greenish (vs. ash-grey with green tinge) thallus, in having evenly coloured dark brown K–, and with

lighter outermost portion (vs. becoming gradually paler towards the centre, K+ reddish) true exciple, in having mostly undifferentiated or slightly yellowish (vs. with greenish tinge) epihymenium, and black or blackish brown hypothecium K- (vs. dark reddish brown, and K+ reddish), and in having smaller, especially narrower ascospores ($13\text{--}16\text{--}(20) \times 5.5\text{--}6.5\text{--}(7.5) \mu\text{m}$ vs. $(12\text{--})14\text{--}20 \times 7\text{--}10 \mu\text{m}$).

Porpidia ulleungdoensis is similar to *Mycobilimbia carnealbida* (Müll. Arg.) S. Ekman et Printzen, but differs in having more or less smooth continuous thallus (vs. granular to verrucose), in having dark apothecia (vs. whitish to pale orange brown), in having dark brown true exciple (vs. colourless), in having thicker subhymenium (vs. $35\text{--}55 \mu\text{m}$ high), in having somewhat thinner dark brown or black-brown hypothecium (vs. hyaline, and $120\text{--}210 \mu\text{m}$ thick), as well as in having simple ascospores (vs. (0)3-septate) and in having wider ascospores ($13\text{--}16 \times 5.5\text{--}6.5 \mu\text{m}$ vs. $13\text{--}22 \times 4\text{--}6 \mu\text{m}$).

After having hyaline hymenium and mostly non-differentiated epihymenium, as well as in having subhymenium with bluish tinge, and hypothecium bluish-blackish or bluish dark brown *Porpidia ulleungdoensis* is similar to *Ropalospora chirisanensis* S. Y. Kondr., L. Lökös et Hur and *Gyalidea ropalosporoides* S. Y. Kondr., L. Lökös et Hur (Kondratyuk *et al.* 2016a, b), but differs in having *Porpidia*-type ascus and simple ascospores, as well as in other anatomical characters.

Similar to *Lecidea confluentula* (Müll. Arg.), a rare lichen species known from France and some other European countries and Australia, in having somewhat similar combination of colour of anatomical details in apothecium (see key in Hertel 2009), but *Porpidia ulleungdoensis* differs in having dark brown (vs. hyaline) true exciple in lateral and basal portion, as well as in the lack of green epihymenium, in having black hypothecium (vs. dark brown or brown-black), and in having larger ascospores ($13\text{--}16\text{--}(20) \times (5\text{--})5.5\text{--}6.5\text{--}(7.5) \mu\text{m}$ vs. $10\text{--}13 \times 3.5\text{--}5 \mu\text{m}$), as well as in the lack of confluent acid.

Additional specimens examined: South Korea, Gyeongsangbuk-do, Ulleung-gun, Ulleung-eup, Jeodong-ri, site 40, on rock growing together with *Bacidina jasonhuri*. Lat.: $37^\circ 31' 07.99''$ N; Long.: $130^\circ 54' 07.89''$ E; Alt.: ca. 288 m a.s.l. Coll.: Halda, J. P., 09.07.2016. (KoLRI 039092, isotype of *Bacidina jasonhuri*); the same locality, growing together with *Porrina* sp. (KoLRI 039102 sub *Porpidia*); the same locality, (KoLRI 039104). – Gyeongsangbuk-do, Ulleung-gun, Ulleung-eup, Sadong-ri, site 29, on rock growing together with *Verrucaria* sp. Lat.: $37^\circ 29' 31.64''$ N; Long.: $130^\circ 53' 06.46''$ E; Alt.: ca. 583 m a.s.l. Coll.: Halda, J. P., 08.07.2016. (KoLRI 039190 sub *Porpidia*); the same locality, growing together with *Leptogium* sp. (KoLRI 039185 sub *Porpidia*). – Gyeongsangbuk-do, Ulleung-gun, Ulleung-eup, Sadong-ri, site 30, on rock growing together with *Verrucaria* sp. Lat.: $37^\circ 29' 34.55''$ N; Long.: $130^\circ 52' 55.05''$ E; Alt.: ca. 612 m a.s.l. Coll.: Halda, J. P., 08.07.2016. (KoLRI 039043 sub *Verrucaria*); the same place, site 31, on rock growing together with *Verrucaria* sp. Lat.: $37^\circ 29' 37.33''$ N; Long.: $130^\circ 52' 50.72''$ E; Alt.: ca. 643 m a.s.l. Coll.: Halda, J. P., 08.07.2016.

(KoLRI 039033 sub *Porpidia*); the same place, site 32, on rock growing together with *Porina* sp. Lat.: 37° 29' 42.14" N; Long.: 130° 52' 37.78" E; Alt.: ca. 769 m a.s.l. Coll.: Halda, J. P., 08.07.2016 (KoLRI 039212 sub *Porpidia*). – Jeju-do, Seogwipo-si, Mt. Halla (Yeongsil Trail), on siliceous rock. Lat.: 33° 21' 16.27" N; Long.: 126° 29' 57.64" E; Alt.: ca. 1337 m a.s.l. Coll.: Halda, J. P. (151566), 21.07.2015 (KoLRI 035259).

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