

## NEW AND NOTEWORTHY LICHEN-FORMING AND LICHENICOLOUS FUNGI 7

S. Y. KONDRATYUK<sup>1#2</sup>, L. LŐKÖS<sup>3</sup>, J. P. HALDA<sup>4</sup>, E. FARKAS<sup>5</sup>, D. K. UPRETI<sup>6</sup>  
A. THELL<sup>7</sup>, J.-J. WOO<sup>2</sup>, S.-O. OH<sup>8</sup> and J.-S. HUR<sup>2</sup>

<sup>1</sup>M. H. Kholodny Institute of Botany, Tereshchenkivska str. 2, 01004 Kiev, Ukraine;

<sup>#</sup>E-mail: ksya\_net@ukr.net

<sup>2</sup>Korean Lichen Research Institute, Suncheon National University, Suncheon 540–742  
Republic of Korea; E-mail: jshur1@suncheon.ac.kr

<sup>3</sup>Department of Botany, Hungarian Natural History Museum  
H-1431 Budapest, Pf. 137, Hungary; E-mail: lokos.laszlo@nhmus.hu

<sup>4</sup>Muzeum a Galerie Orlických hor, Jiráskova 2, 516 01 Rychnov nad Kněžnou, Czech Republic

<sup>5</sup>Institute of Ecology and Botany, Centre for Ecological Research  
Hungarian Academy of Sciences, H-2163 Vácrtót, Alkotmány u. 2–4, Hungary

<sup>6</sup>CSIR-National Botanical Research Institute

Rana Pratap Marg, Lucknow–226001 Uttar Pradesh, India; E-mail: upretidknbri@gmail.com

<sup>7</sup>Botanical Collections, Biological Museum, Lund University, Box 117, SE-221 00 Lund, Sweden;  
E-mail: arne.thell@biol.lu.se

<sup>8</sup>Korea National Arboretum

Gwangneungsumogwon-ro 415, Pocheon-si, Gyeonggi-do 11186, Republic of Korea

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Nineteen new to science species of lichen forming fungi, i.e.: *Agonimia ascendens* S. Y. Kondr., L. Lőkös et J.-S. Hur, *A. suncheonensis* S. Y. Kondr. et J.-S. Hur, *A. yongsangensis* S. Y. Kondr. et J.-S. Hur, *Biatora loekoessiana* S. Y. Kondr. et J.-S. Hur, *Caloplaca ivanpisutii* S. Y. Kondr., L. Lőkös et J.-S. Hur, *Candelariella makarevichiae* S. Y. Kondr., L. Lőkös et J.-S. Hur, *Huriella pohangensis* S. Y. Kondr., L. Lőkös et J.-S. Hur, *H. salyangiana* S. Y. Kondr. et J.-S. Hur, *Hyperphyscia oxneri* S. Y. Kondr. et J.-S. Hur, *Nectriopsis gangwondoensis* S. Y. Kondr., L. Lőkös et J.-S. Hur, *Porina ulleungdoensis* S. Y. Kondr., L. Lőkös, J. Halda et J.-S. Hur, *Psoroglaena gangwondoensis* S. Y. Kondr., L. Lőkös, J.-J. Woo et J.-S. Hur, *Pyrenopsis cavernicola* S. Y. Kondr., L. Lőkös et J.-S. Hur, *Rhizocarpon suncheonense* S. Y. Kondr. et J.-S. Hur, *Rufoplaca ulleungensis* S. Y. Kondr., L. Lőkös et J.-S. Hur, *Sarcogyne ulleungdoensis* S. Y. Kondr., L. Lőkös et J.-S. Hur, *Skyttea bumyoungsungii* S. Y. Kondr. et J.-S. Hur, *Thelopsis gangwondoensis* S. Y. Kondr., L. Lőkös, J.-J. Woo et J.-S. Hur, *Topelia loekoessiana* S. Y. Kondr., J.-J. Woo et J.-S. Hur, all from South Korea, as well as *Gallowayella awasthiana* S. Y. Kondr. et D. K. Upreti from India and *Franzilsia skottsbergii* S. Y. Kondr., A. Thell, S.-O. Oh et J.-S. Hur from Chile are described, illustrated and compared with closely related taxa. A key to *Agonimia* species known from Eastern Asia is also included.

*Lecanora helicopsis* is recorded for Korea for the first time, as well as a number of new to Jeju-do Island species (i.e.: *Agonimia loekoessii*, *Biatora pseudosambuci*, *Buellia extremorientalis*, and *Ivanpisutia oxneri*) are recorded. Additional data on conidiomata and morphological characters of thallus and apothecia and illustrations as well as data on newly located isotype specimens recently described from Canary Islands, Spain *Fominiella tenerifensis* are provided.

Two new combinations, i.e.: *Phaeophyscia saxatilis* (for *Physcia saxatilis* Kashiw.), and *Xanthoparmelia umezuana* (for *Karooowia umezuana* Moon K. H. et Kashiw.) are also proposed.

Key words: Chile, India, key, new species, phylogenetic analysis, revision, South America, South Korea, taxonomy

## 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 was recently published (Kondratyuk *et al.* 2016*b, c, d*, 2017*a, b*). However, a number of still unnamed and unidentified specimens are also selected.

The aim of this communication to present legal descriptions of new set of taxa of the genera *Agonimia*, *Caloplaca*, *Candelariella*, *Gallowayella*, *Hyperphyscia*, *Huriella*, *Porina*, *Psoroglaena*, *Rhizocarpon*, *Thelopsis*, and *Topelia*, discovered in areas mentioned as well as to provide data on novelties and rare taxa found during revision as recent as previous collections kept in the KoLRI, KW-L, LWG and BP. Furthermore a number of taxa of the families Teloschistaceae, Candelariaceae, Physciaceae, Trapeliaceae appeared to be new from phylogenetic analysis of families mentioned are also included and discussed.

## MATERIAL AND METHODS

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

For identification chemical substances of critical taxa standard TLC and HPTLC methods with solvent C were carried out (Arup *et al.* 1993, Orange *et al.* 2001).

## NEW SPECIES FOR SCIENCE

*Agonimia ascendens* S. Y. Kondr., L. Lókös et J.-S. Hur, *spec. nova*

Mycobank no.: MB 824382.

*Similar to Agonimia opuntiella, but differs in having microfruticose thallus consisting of mostly distant and scattered erect or ascending thalline lobes (not aggregated in compact thallus), in having usually longer and distinctly branched strip-like or finger-like lobes, and in having much longer spinulose hairs.*

Type: Republic of Korea. Jeollanam-do, Suncheon-si, Samsan-dong, along river bank, on *Metasequoia* bark, growing together with *Dirinaria appplanata* and *Buellia* aff. *melaxanthella*. Lat.: 34° 58' 46.49" N; Long.: 127° 29' 10.35" E; Alt.: 23 m a.s.l. Coll.: Kondratyuk, S. Y. (163349), 02.10.2016 (KoLRI 041594 sub *Agonimia* – holotype).

Thallus very indistinct, microfruticose, consisting of rather scattered and distant small groups of ascending narrow thalline lobes, brown or brownish grey, with distinct whitish long hairs well contrasting darker thalline lobes (up to 1.5 mm diam., rarely aggregated to form a mat *ca* 1 cm diam. or more see after Harada *et al.* 2016). Thalline lobes to 0.6–0.8 mm long, and to (0.1–)0.12–0.18(–0.3) mm wide at the basis and somewhat slightly or distinctly widened and forming more or less rounded or spherical tips to 0.15–0.25(–0.3) mm, distinctly ascending or erect, with long, to 40–60(–80)  $\mu$ m long, (mostly 0.04–0.08 mm long, colourless, or dark near the apices after Harada *et al.* 2016), white well contrasting to darker thalline lobes hairs, rather abundant especially on the tips of thalline lobes.

Thalline lobes in section 60–80  $\mu$ m thick, lacking a distinct algal layer. Upper cortex 5–20(–25)  $\mu$ m thick, euparaplectenchymatous, colourless or slightly brownish, lumina of the hyphae mostly isodiametric, roundish or polygonal, mostly 4–7  $\mu$ m diam. (but 2–3  $\mu$ m diam. near the apices of lobes), lacking distinct interhyphal spaces; walls of the hyphae 0.5–1  $\mu$ m thick; papillae first *ca* 1  $\mu$ m diam. and 2–3  $\mu$ m long, later extended and broadened (*ca* 2.5  $\mu$ m diam.) then adhering together throughout the length to form a spinulose hair. Medulla containing phycobiont cells, similar to upper cortex particularly in the upper parts, with hyphal cells becoming slightly separated (with interhyphal spaces) below; lumina of the hyphae mostly roundish; phycobiont cells of trebouxoid algae, 5–7  $\mu$ m diam., relatively dense in the upper parts of medulla, scattered below. Lower side of the thallus lacking cortex, rough, composed of roundish hyphal cells.

Upper surface of thalline lobes more or less slightly convex, with spinulose hairs, pale to somewhat dark brown or dirty brown, but greenish grey in shade, smooth, slightly glossy; underside usually flat to concave, generally paler than the dorsal surface, matt, lacking spinulose hairs, lacking rhizines (unfortunately we cannot confirm data of Harada *et al.* 2016 that it “soon becoming granulose and finally granulose-sorediate”). Soredia-like formations to 60 µm diam., with the same long white hairs sometimes observed near or among thalline lobes, probably they are spherical tips of very short lobes, usually very scarce and not forming abundant mass (as in *Agonimia opuntiella*).

Perithecia and pycnidia not seen.

Chemistry: not studied, all reactions negative.

Ecology: On bark of coniferous trees and among mosses over siliceous rock, where often associated with *Hyperphyscia crocata*, *Phaeophyscia adiastrata*, as well as species of the genera *Dirinaria*, *Lepraria* and *Endocarpon*.

Etymology: Species name reflects characteristic ascending thalline lobes of this taxon.

Distribution: So far confirmed by specimens from scattered localities of South Korea (E Asia), while some records of *A. opuntiella* from China (Yunnan, see Harada *et al.* 2016 and notes below) may belong to this taxon, too.

Taxonomic notes: From all *Agonimia* species *A. ascendens* differs in having microfruticose thallus consisting of very long strip-like thalline lobes and in having very long spinulose hairs. The closest species are the almost cosmopolitan *A. opuntiella* (Buschardt et Poelt) Vězda and *A. cavernicola* S. Y. Kondr., L. Lókös et J.-S. Hur, which known so far only from E Asia.

*Agonimia ascendens* is similar to *A. opuntiella*, known also from Asia (mainland China (Yunnan), Taiwan, Korea), Australia, Europe, Africa, N and S Americas (see Harada *et al.* 2016), but differs in having microfruticose thallus consisting of mostly distant and scattered erect or ascending strip-like thalline lobes or small groups of thalline lobes (not aggregated in compact thallus *vs.* minutely squamulose forming mat of densely aggregated and overlapping squamules to 1 cm across or more, with entire or lobed margin), in having usually longer and distinctly branched strip-like or finger-like lobes (*vs.* squamules 0.1–0.3 mm diam.), in having much longer spinulose hairs (mostly 40–80 µm long *vs.* to 20 µm long), as well as in the lack of ellipsoid or subglobose blastidia forming abundant mass.

*Agonimia ascendens* is similar to *A. cavernicola*, in having somewhat finger-like or isidia-like lobes with hyaline or whitish hairs, but differs in having thicker thalline lobes (0.2–0.3 mm diam. *vs.* 0.1–0.15 mm diam.), in having longer hairs (40–80 µm long *vs.* to 15 µm long), in having usually branched with somewhat to hemispherical thickened tips (*vs.* straight, without secondary lobules and the same thickness throughout), and in different substrate (bark of mostly coniferous trees *vs.* rock).

*Agonimia ascendens* is similar to *A. koreana* Kashiw. et K. H. Moon, but differs in having distinctly ascending narrow lobes (*vs.* convex to 0.2–0.4 mm wide segments), in having cortical hairs (*vs.* cortical hairs absent), as well as in the lack of 0.8–1.2 mm thick paraplectenchymatous throughout thallus, and in the lack of papillate underside of lobes.

It is supposed that Harada *et al.* (2016) have investigated the same material, but they used the name *Agonimia opuntiella* for their specimens, while they emphasised about differences in the lack of blastidia in Eastern Asian material. Furthermore Harada *et al.* (2016) did not recognise important taxonomic characters as length of spinulose hairs (to 0.04–0.08 mm long, colourless or dark near the apices, after Harada *et al.* 2016). See also illustrations of this material in cited paper (Harada *et al.* 2016).

Other specimens examined: Republic of Korea. Jeollanam-do, Suncheon-si, Samsandong, along river bank, on *Metasequoia* bark, growing together with *Amandinea punctata* and *Phaeophyscia* sp. Lat.: 34° 58' 46.49" N; Long.: 127° 29' 10.35" E; Alt.: 23 m a.s.l. Coll.: Kondratyuk, S. Y. (163759), 30.10.2016 (KoLRI 042027 sub *Amandinea punctata*). – Jeollanam-do, Suncheon-si, Yongsang-dong, on bark of pine trees and on siliceous rocks in pine forest, on rock growing together with *Rinodina* sp. and *Lepraria* spp. Lat.: 34° 58' 10.8" N; Long.: 127° 30' 10.1" E; Alt.: 189 m a.s.l. Coll.: Kondratyuk, S. Y. (163914), 4.12.2016 (KoLRI 042182 sub *Rinodina*), the same locality, growing together with *Rinodina* sp., *Collema* sp. and *Phaeophyscia* sp. (163916), (KoLRI 042184 sub *Collema*); the same locality, growing together with *Lepraria* sp. and *Phaeophyscia* sp. (163917), (KoLRI 042185 sub *Lepraria*); growing together with *Physciella* sp. (163918), (KoLRI 042186 sub *Physciella*). – China. Yunnan, en route from Kunming to Luquan, 5 km to Luquan, [25.3833° N, 102.4522° E], 2,150 m elev. On limestone with mosses, 17.04.2014 Harada 28987 (CBM-FL-37590; KUN-L) [not seen].

*Agonimia sunchonensis* S. Y. Kondr. et J.-S. Hur, *spec. nova*  
(Fig. 1)

Mycobank no.: MB 824383.

*Similar to Agonimia blumii, but differs in having granular thallus consisting of soredia sometimes aggregating in semi- or convex lax soredious aggregations of isidious to microcoralloid aggregations and in the lack of primary thalli areoles and not forming very thick soredious (Lepraria-like) thalline portions.*

Type: Republic of Korea. Jeollanam-do, Suncheon-si, Yongsang-dong, along small stream, near water fall close to tourist point, on siliceous rocks, growing together with *Endocarpon* sp. Lat.: 34° 57' 55.88" N; Long.: 127° 30' 03.98" E; Alt.: 110 m a.s.l. Coll.: Kondratyuk, S. Y. (163851), 20.11.2016 (KoLRI 042119 sub *Agonimia* – holotype).

Thallus from 0.5–1 mm across or larger aggregations to several cm across, fine granular or microgranular, sometimes to continuous crust in places with hardly distinct areoles to 0.2–0.3(–0.4) mm across, very irregular and better seen at the edges, consisting of soredia sometimes aggregating in semi- or convex lax soredious aggregations or ascending isidious to microcoralloid aggregations, with microlobules or isidia-like formations to 0.4–0.5 mm long and 0.1–0.15 mm wide; from dull green to grey, dark-lead-grey or tessellate dark grey and whitish grey to brownish grey or bluish lead-grey, in case of development of semiconvex aggregations and highly uplifted confluent soredious mass sometimes upper portion/part of soredious mass is lighter coloured than base (light whitish grey in contrast to somewhat dark lead-grey); fine granular, from sorediate where soredia form rather uplifted hemispherical or spherical mass to 0.2–0.3(–0.5) mm across to somewhat confluent completely granular along several cm across (see holotype); initially small groups of soredia to (50–)70–150(–250)  $\mu\text{m}$  wide and almost the same high, very lax and highly uplifted, somewhat conical or hemispherical on substrate or thalli of other crustose lichens (see below ecology), rather scattered and distant, soon becoming aggregated in confluent mass. In section thallus to (100–)200–300  $\mu\text{m}$  thick, no structural differences in upper and lower portion of thallus, and no hyphal structures, and no medulla tissue observed, only very lax aggregations of soredia found.

Soredia (15–)17–22(–25)  $\mu\text{m}$ , regularly rounded or slightly elongated, hyphal wall more or less regularly even, to 2(–3)  $\mu\text{m}$  thick, hyaline or sometimes greyish or light brownish; often aggregated in very irregular thalline portions to (30–)40–55  $\mu\text{m}$  across (better seen in K), which difficult to call as conblastidia or consoredia as far they are very irregular and do not have certain shape, if they more than 30  $\mu\text{m}$  across outer layer usually darker coloured, in K it is better seen that in some places the outermost cells have one side to 4–5  $\mu\text{m}$  across somewhat darker making appearance of outer layer soredia aggregations somewhat darker; sometimes isidioid-like coralloid formation with separate fragments to (60–)80–100  $\mu\text{m}$  wide observed, with very irregular thickness and in case when soredious mass seem to be more isidious and coralloid, in section the same aggregation of soredia observed, but darker outermost layers of hyphal walls of soredia in such sections present not regularly (probably corresponding only exposed portions of branches/twigs of coralloid formations; coralloid formations are very crumble and easily broken in irregular fragments/portions (at any touch or sectioning/cutting).

Perithecia and pycnidia not seen.

Chemistry: No reactions observed, K– in thallus and in section, but hyphal wall of soredia becoming somewhat lighter to hyaline in K, as well as that phenomenon that the larger aggregations consisting of small soredia better seen in K.

Ecology: Growing on bark of both deciduous (especially *Salix*) and coniferous trees (*Pinus* spp., *Metasequoia*) in rather shaded and wet conditions of bark *Salix alba* at the edge of river, as in rather exposed conditions of road side tree, as well as in rather dry conditions of southeastern slopes of mixed forest and open areas on bark of *Pinus* trees.

Etymology: It is named after Suncheon city, Jeollanam-do Province of South Korea (E Asia), where the type collection was done.

Distribution: So far known from scattered localities in Jeollanam-do Province of South Korea (E Asia).

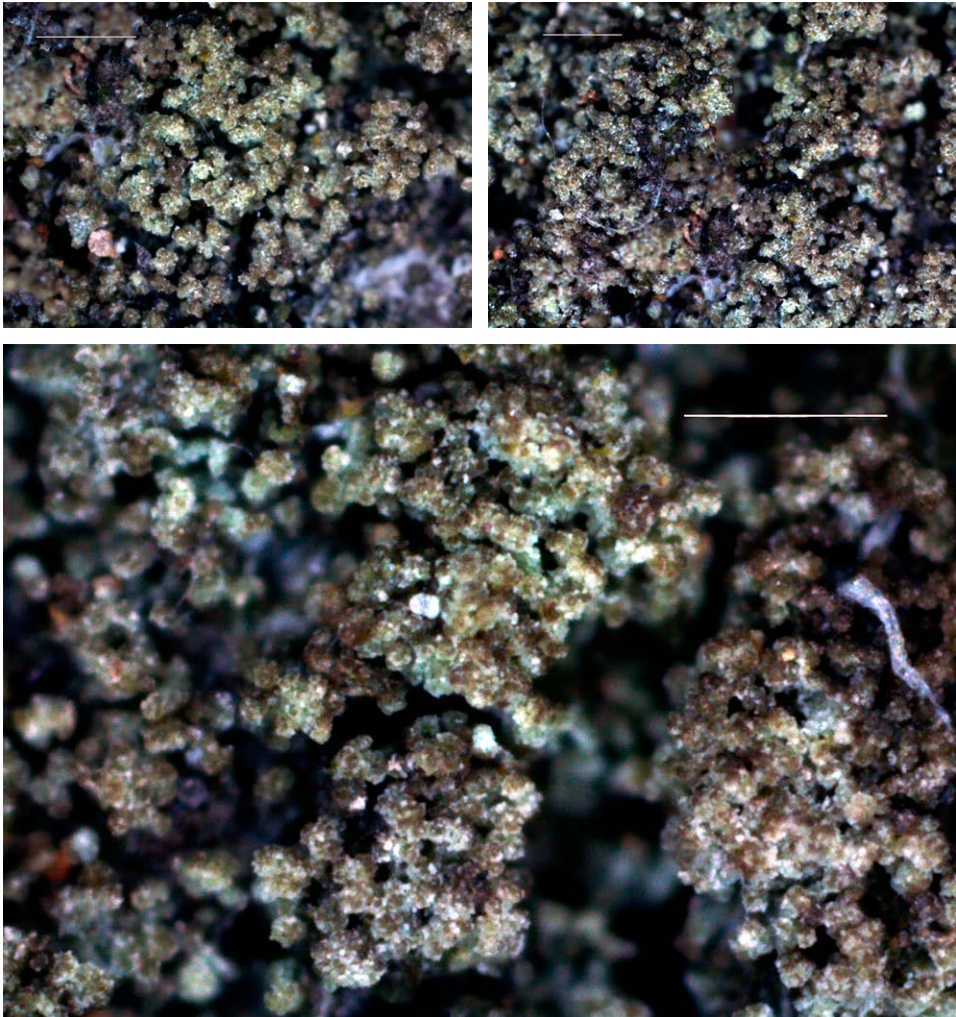


Fig. 1. *Agonimia sunchonensis* (holotype), general habit. Scale 0.5 mm. (Photos of S. Kondratyuk)

Taxonomic notes: We do not think that this material belong to *Lepraria*, while it is positioned in *Agonimia* rather preliminary now. However, this material differs from *Lepraria* species in having very spectacular coralloid formations, as well as in the lack of any hyphal projections of hyphal cells, as well as in another colouration of thallus and in the lack of any chemical substances.

Of course the further, especially molecular study should solve this problem. Unfortunately we have had rather poor collection in our disposition to use them for extracting DNA according to the current technology. We do hope that this step will be done by the next generation of Korean lichenologists.

From dark green crustose lichen *Sculptolumina* aff. *japonica*, with which it grows very often side by side, or above thallus of which it often was observed (see nos. 163942, 163943, 163944, 163945 in list of specimens examined below) it differs in distinctly soredious/isidious appearance being fine granular and in having grey or somewhat tessellate greyish-whitish colour (well contrasting to dark green thallus of *Sculptolumina* aff. *japonica*, as well as in having very lax and uplifted soredious mass in semi- or convex aggregations or in isidia-like coralloid hemispherical formations (and in the lack of distinct continuous thallus) and being hitherto known only in sterile conditions.

It is difficult to make suggestion that it is sorediate or isidiate form of *Sculptolumina* aff. *japonica* because this soredious mass very often growing independently of thallus of *Sculptolumina* or other lichens, as well as that colour of thalli are rather different and well contrasting each other.

After having somewhat tessellate grey or dark grey and whitish grey as well as very uplifted, semiconvex to convex soredious mass this species of *Agonimia* is very similar to soredious mass of *Phaeophyscia* aff. *adiastola*. However *Agonimia* differs in the lack of lobate portion of thallus, as well as in having much smaller soredious mass aggregations (to 0.2–0.3 mm across *vs.* 1–2 mm or to completely confluent upper surface in several cm across) and in having much smaller soredia (to 25 µm diam. *vs.* 25–40 µm diam. soredia and 40–55 µm across conblastidia).

It should be mentioned that soredious mass has somewhat water repelling property it is somewhat better to observe thallus details in K solution (than in water), because it was difficult to observe sections of thallus in water during our study.

Other specimens examined: Republic of Korea. Jeollanam-do, Suncheon-si, Maegok-dong, WSW of university area, on bark of trees in pine forest. Lat.: 34° 58' 01.96" N; Long.: 127° 28' 17.4" E; Alt.: 269 m a.s.l. Coll.: Kondratyuk, S. Y. (163942), 11.12.2016 (KoLRI 042210 sub *Sculptolumina* aff. *japonica*); the same locality, growing together with *Buellia* aff. *melaxanthella* and *Agonimia*, (163943, 163944), (KoLRI 042211, KoLRI 042212 sub *Sculptolumina* aff. *japonica*); the same locality, growing together with *Sculptolumina* aff. *japonica*, *Buellia* aff. *melaxanthella* and *Agonimia*, (163945), (KoLRI 042213 sub *Agonimia*). – Jeollanam-do, Suncheon-si, Samsan-dong, along river bank, on *Metasequoia*?/*Cryptomeria* bark, growing



together with *Endocarpon* sp. Lat.: 34° 58' 46.49" N; Long.: 127° 29' 10.35" E; Alt.: 23 m a.s.l. Coll.: Kondratyuk, S. Y. (163761), 30.10.2016 (KoLRI 042029 sub *Agonimia*); the same locality, growing together with *Agonimia* sp. and green soredious crust, (163800, 163803), (KoLRI 042068, KoLRI 042071 sub *Agonimia*); the same locality, growing together with *Agonimia* sp. 163806 (KoLRI 042074 sub *Agonimia*). – Jeollanam-do, Suncheon-si, Songgwang-myeon, Jogyesan Mts, Sinpyeong-ri, near Songgwangsa Temple, along stream valley, on bark. Lat.: 35° 00' 18.55" N; Long.: 127° 15' 53.68" E; Alt.: 170 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (163211, 163212, 163213), 24.09.2016 (KoLRI 041456, KoLRI 041457, KoLRI 041458 as *Bacidia* (green isidiate)).

*Agonimia yongsangensis* S. Y. Kondr. et J.-S. Hur, *spec. nova*  
(Fig. 2)

Mycobank no.: MB 824384.

*Similar to Agonimia koreana in the lack of hairs on upper surface of thalline lobes but differs in having plane or concave (vs. more or less convex 0.2–0.4 mm wide, while the width of segment at the basis the same), and in having gradually becoming thinner and narrower towards the tips thalline lobes.*

Type: Republic of Korea. Jeollanam-do, Suncheon-si, Yongsang-dong, Mt top behind artificial lake, on siliceous rocks in pine forest or in open areas, growing together with *Endocarpon* sp. and *Lepraria* sp. Lat.: 34° 58' 22.11" N; Long.: 127° 30' 21.79" E; Alt.: 277 m a.s.l. Coll.: Kondratyuk, S. Y. (164036), 17.12.2016 (KoLRI 042304 – holotype); the same locality, growing together with *Endocarpon* sp. (164037), (KoLRI 042305 – isotype); the same locality, (164038), (KoLRI 042306 – isotype); the same locality, growing among mosses together with *Lecania* sp. (164035), (KoLRI 042303 sub *Lecania* – isotype).

Thallus consisting of microfruticose lobes, usually indistinct only sometimes can be seen as fragments to 15–18(–25) mm across. Thalline lobes to 0.4–0.8 mm long, somewhat isidia-like, distinctly widened at the basis to 0.2–0.3(–0.4) mm wide, and gradually becoming narrower towards the tips, often branched or dissected into narrower terminal portions to 40–50 µm across; sometimes secondary lobules to 0.2–0.3(–0.4) mm long and (0.–06)0.08–0.15 (–0.2) mm wide distinctly developed, becoming gradually narrower towards the tips and dissected into smaller portions (resembling *Candelaria*-type of phyllidia or blastidia formations see Kondratyuk 1997); total width of lobe with all secondary lobules to 0.3–0.6(–0.8) mm wide; lobes horizontally orientated, dorsiventral, edges somewhat slightly folded downwards, and lobe seem to be slightly subconvex. Upper surface without hairs. No soredia or blastidia observed.

Perithecia and pycnidia not known.

Chemistry: not studied, all reactions negative.

Ecology: often growing among mosses as very close to moss mats, rather indistinct and can be easily overlooked (recorded from bark of pine tree see below\* and rock).

Etymology: It is named after the type locality, i.e. Yongsang-dong in southern part of South Korea (E Asia).

Distribution: So far known from scattered localities in southern part of South Korea (E Asia).

Taxonomic notes: *Agonimia yongsangensis* is similar to *A. koreana* in the lack of hairs on upper surface of thalline lobes but differs in having plane or concave (*vs.* more or less convex 0.2–0.4 mm wide, while the width of segment at the basis the same), and in having gradually becoming thinner and narrower towards the tips thalline lobes, as well as in having thalline lobes often dissected into narrower secondary lobules towards the tips.

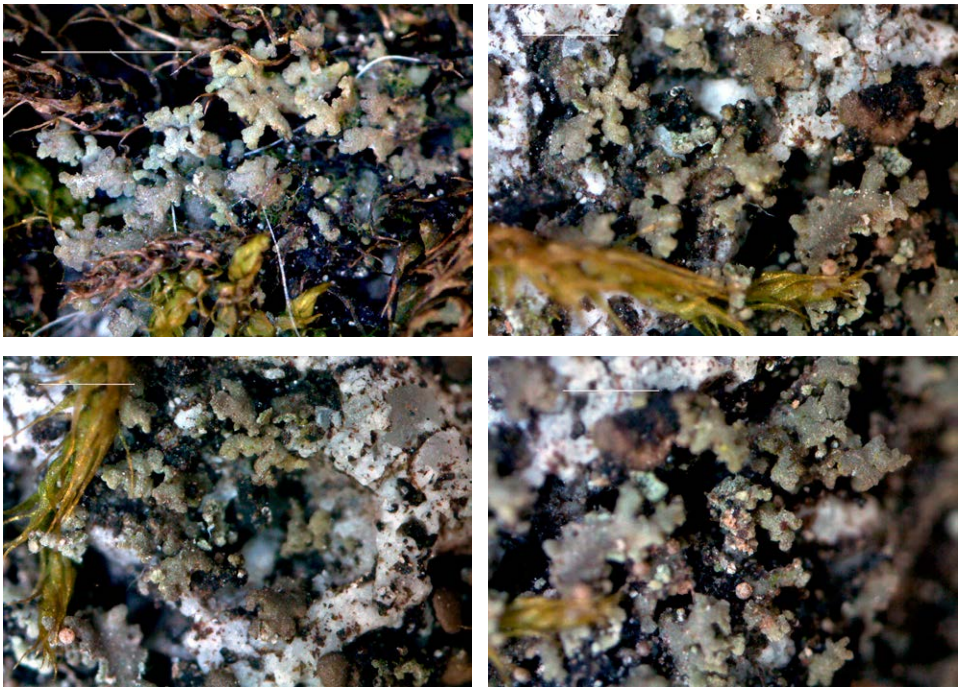


Fig. 2. *Agonimia yongsangensis* (holotype), general habit. Scale 1 mm (top left) and 0.5 mm (the others). (Photos of S. Kondratyuk)

\* It is still heterogeneous as far recorded from bark of pine tree and on rock. The specimen no. 164038 may resemble *Phyllopsora loekoessii*, but they have very large differences of measurements of thallus, thalline lobes and in character of dissection of thalline lobes in secondary lobules.

In contrast to *Agonimia cavernicola* *Agonimia yongsangensis* has much wider at the basis isidia-like lobes (0.2–0.3(–0.4) mm *vs.* 0.1–0.15 mm wide/diam.), and in having distinctly becoming narrower towards the tips and often branched or dissected into secondary lobules (*vs.* more or less cylindrical and scarcely branched), in having terminal portions dissected into smaller portions to 40–50 µm across.

When secondary thalline lobules of *Agonimia yongsangensis* are very small, to 0.1 mm diam. and somewhat isidia-like, they can be accepted as isidia-like formations of *A. cavernicola*, but *A. yongsangensis* differs in having rather larger, wider thalline lobes usually aggregated in wider thalline lobes, which are also only as part of more complex larger thallus, i.e.: small secondary lobules of *A. yongsangensis* are only parts of much wider (to 0.2–0.3(–0.4) mm wide) thalline lobes, as well as *A. yongsangensis* differs in having shorter (to 0.3–0.5 mm long) and without hairs secondary thalline lobules.

When it is small, thallus has only to 0.4 mm long weakly branched thalline lobes it can be accepted as young *Cladonia* thalli, but differs in having dull brownish green thallus and in having much smaller size.

Sometimes *Agonimia yongsangensis* growing side by side with *Endocarpon* sp., and can be similar to this lichen after having dull brownish green colour of thallus. However, *A. yongsangensis* differs in having usually smaller, especially narrower towards the tips lobes (*vs.* areoles 0.8–1 mm or more across), and in having ascending and somewhat hanging above substrate level lobes, while *Endocarpon* areoles are closely attached to the substrate by the whole surface.

#### KEY TO EASTERN ASIAN AGONIMIA SPECIES

- 1a Thallus of squamules up to 4 mm diam. or microfruticose of erect or ascending lobules, with a minutely hairy surface 2
- 1b Thallus of smaller squamules up to 1 mm long or granular, surface at most with minute papillae, rarely with hairs 3
- 2a Thallus microfruticose, mostly of distant and scattered erect or ascending thalline lobes; spinulose hairs 40–80 µm long; ellipsoid blastidia very rare *A. ascendens*
- 2b Thallus minutely squamulose forming mat of densely aggregated and overlapping squamules; spinulose hairs to 20 µm long; ellipsoid or subglobose blastidia often forming abundant mass *A. opuntiella*
- 3a With perithecia 10
- 3b Without perithecia 4

- 4a Thallus without hairy surface 5
- 4b Thallus of distinctly ascending branched lobes or finger-like isidia, upper surface with hairs from abundant to scarce 8
- 5a Thallus sorediate, continuous or isidiate areolate 7
- 5b Thallus squamulose or microfruticose, without soredia or isidia 6
- 6a Thallus squamulose, thalline lobes convex, a. 0.2–0.4 mm wide throughout *A. koreana*
- 6b Thallus microfruticose, thalline lobes plane, gradually becoming narrower and thinner, as well as dissected into narrower secondary lobules towards the tips *A. yongsangensis*
- 7a Thallus continuous with convex soredious mass *A. loekoesii*
- 7b Thallus areolate and isidious at first, then becoming sorediate and *Lepraria*-like *A. blumii*
- 8a Thallus mostly finger-like isidia *ca* 0.1 mm diam., and to 0.5–1 mm long, primary plane areoles often soon disappearing, hairs short, seen only at the largest magnification *A. cavernicola*
- 8b Thallus granular or with distinct thalline lobes 9
- 9a Thallus granular, usually of tessellate coloration, granules often forming isidia-like uplifted aggregations *A. sunchonensis*
- 9b Thallus of separate, scattered ascending branched lobes; upper surface with distinct hairs more than 40  $\mu\text{m}$  long *A. ascendens*
- 10a Ascospores (25–)29–55  $\mu\text{m}$  long; thallus finely verruculose or with minute coralloid or finger-like squamules at most  $0.24 \times 0.1$  mm; asci 8-spored 11
- 10b Ascospores (42–)57–120  $\mu\text{m}$  long; thallus distinctly squamulose, squamules  $0.05\text{--}1 \times 0.05\text{--}0.3$ (–0.5) mm; asci (1–)2-spored or 8-spored 14
- 11a Perithecia rough, upper part with vertical cracks or furrows *A. repleta*
- 11b Perithecia smooth, not cracked in upper part 12
- 12a Perithecia 0.12–0.22 mm diam.; ascospores (25–)29–35(–44)  $\mu\text{m}$  long; usually on bark *A. allobata*
- 12b Perithecia 0.25–0.6 mm diam.; ascospores 31–55  $\mu\text{m}$  long; on soil or on mosses over soil and rock 13

- 13a Thallus usually with glossy, sterile black globules; thallus grey-green, cortical cells without pigment *A. globulifera*
- 13b Sterile black globules absent; thallus brown, cortical cells brown-pigmented *A. gelatinosa*
- 14a Asci (1–)2-spored; squamules sometimes elongate and terete, but often distinctly flattened, 0.1–1 × 0.1–0.3(–0.5) mm, green-fawn to brown *A. tristicula*
- 14b Asci 8-spored; squamules often elongate, branched, terete or slightly flattened or globular, 0.05–0.25 × 0.05–0.12 mm, grey-green *A. octospora*

***Biatora loekoesiana*** S. Y. Kondr. et J.-S. Hur, *spec. nova*  
(Fig. 3)

Mycobank no.: MB 824385.

*Similar to Biatora pseudosambuci, but differs in having darker greenish thallus, somewhat smaller, from immersed in thallus to sessile, and much darker brown to blackish brown apothecia, more or less abundant pruina on apothecium disc, narrower true exciple in the uppermost lateral portion, lower hymenium, as well as 8-spored asci and wider ascospores.*

Type: Republic of Korea. Jeollanam-do, Suncheon-si, Maegok-dong, WNW of university area, on bark of fruit trees in old fruit garden, growing together with *Biatora pseudosambuci*, *Phaeophyscia* and *Lecanora* spp. Lat.: 34° 58' 18.16" N; Long.: 127° 28' 03.8" E; Alt.: 203 m a.s.l. Coll.: Kondratyuk, S. Y. (163874), 27.11.2016 (KoLRI 42142 sub *Biatora loekoesiana* – holotype, BP – isotype); the same locality, growing together with *Buellia* aff. *pseudosubnexa*, (163886), (KoLRI 42154 sub *Buellia* – isotype); the same locality, growing together with *Dimerella*, (163884), (KoLRI 42152 sub *Dimerella* – isotype).

Thallus crustose, continuous, irregularly rounded [Note: Status of sorediate material sometimes growing side by side with *Biatora loekoesiana* (see nos. 163996, 163994 and 163995 in KoLRI on *Alnus*) is still under revision.], greenish or greyish greenish. Thallus in section to 60–70 µm thick of densely packed algal cells, and cortical layer indistinct or to 10 µm thick, algal layer to 50(–70) µm thick, and medulla indistinct.

Apothecia 0.2–0.4(–0.45) mm diam., to 60(–90) µm thick in section, seem to be lecideine or biatorine, very small, dark brown, sometimes seem to be with abundant whitish pruina, while at highest magnification apothecia without pruina are observed too; in section apothecia distinctly biatorine, mostly

no algal cells in section, true exciple to 20–25(–30)  $\mu\text{m}$  thick in uppermost lateral portion and to 20–30(–40)  $\mu\text{m}$  wide in lower lateral and basal portions or basal portion becoming narrower in the centre to 10–15  $\mu\text{m}$  thick or disappearing, more or less scleroplectenchymatous with matrix and hyphae lumina a. 1  $\mu\text{m}$  diam.; hyaline to light brown in inner lateral and inner basal portions and dull yellow-brownish to medium brown in outermost layers; hymenium to 50–55  $\mu\text{m}$  high; epihymenium to 10–15  $\mu\text{m}$  thick, dark greyish brown to blackish brown, or dull greyish brown; tips to 15  $\mu\text{m}$  long becoming distinctly brownish, often curved above ascus tips, scarcely branched, tips to 2.5–3(–4)  $\mu\text{m}$  diam.; subhymenium 10–15(–30)  $\mu\text{m}$  thick, hyaline, sometimes with oil droplets to 2(–3)  $\mu\text{m}$  diam.; algal cells 7–13(–17)  $\mu\text{m}$  diam. below true exciple sometimes observed; asci 8-spored, sometimes seem to contain more of 8 ascospores owing to guttulae of ascospores (young ascospores usually bi-guttulate), but after careful checking ascospores simple and per 8 in ascus; ascospores hyaline, simple sometimes seem to be 1-septate, ovoid, rather wide, to widely ellipsoid or hemispherical, distinctly guttulate, with one large to 5  $\mu\text{m}$  diam. guttulae rarely 2–3-guttulate, (8–)9–13  $\times$  (5–)5.5–7(–8)  $\mu\text{m}$  [50 measurements].

Ecology: Material was collected from many localities but very often was overgrowing by *Biatora pseudosambuci*, and it was several times made wrong conclusion that material is conspecific with *Biatora pseudosambuci*. After secondary revision of all collections of *Biatora pseudosambuci* it was shown that *Biatora loekoessiana* is presented among these collections, too. Several time it was observed that apothecia of *Biatora loekoessiana* and *B. pseudosambuci* can grow side by side. So suggestion that *B. loekoessiana* as earlier stage of development of *Biatora pseudosambuci* colonies is made. And in nature *Biatora pseudosambuci* replaces thalli of *B. loekoessiana* very fast.

From our field experience we may make suggestion that *Biatora loekoessiana* is very short living lichen, which very soon is replacing by *Biatora pseudosambuci*.

The latter species is probably especially successful in well-lit (well illuminated) and rich on nitrates conditions. So *Biatora loekoessiana* can be rather rarely observed in conditions of road-side *Prunus* tree bark or in fruit gardens on bark of branches of fruit trees. In these conditions *Biatora pseudosambuci* can be mostly found. In contrast to this *Biatora loekoessiana* was rather abundant especially in shaded conditions of mixed mountain forest with small stream valleys at small waterfall on bark of *Alnus* trees.

Etymology: It is named after the well-known Hungarian lichenologist László Lőkös (1959–) (BP, Budapest, Hungary) in recognition of his contribution, as well as with thanks for friendly support and help during joint work in South Korea.

Distribution: It is known hitherto from scattered localities in mainland and islands of South Korea (E Asia).

This material several times was especially collected in the vicinities of Sunchon city, in Ulleung-do Island, in Gangwon-do province as type collections. But after revision unfortunately wrong conclusion that it is conspecific with *Biatora pseudosambuci* was done several times (see also above).

Taxonomic notes: *Biatora loekoessiana* is similar to *B. pseudosambuci* (S. Y. Kondr., L. Lőkös et J.-S. Hur) S. Y. Kondr., L. Lőkös et J.-S. Hur, described

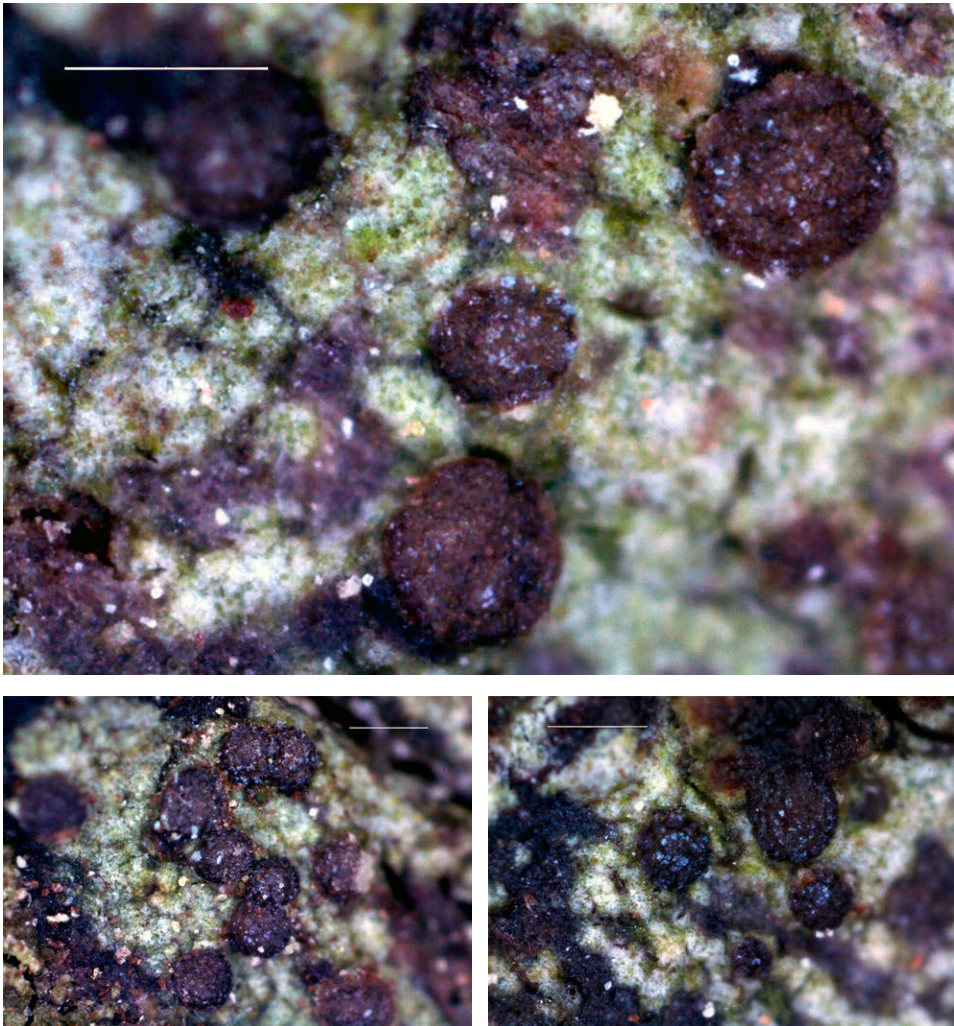


Fig. 3. *Biatora loekoessiana* (holotype), general habit. Scale 0.5 mm. (Photos of S. Kondratyuk)

recently from eastern Asia, with which often growing side by side, but differs in having darker greenish thallus (*vs.* grey or light grey), in having somewhat smaller, from immersed in thallus to sessile, and much darker brown to blackish brown apothecia (*vs.* dark brown where own margin slightly lighter of disc, yellowish brown), in having more or less abundant pruina on apothecium disc, in having narrower true exciple in the uppermost lateral portion (20–25(–30)  $\mu\text{m}$  *vs.* 25–50(–60)  $\mu\text{m}$  wide), in having lower hymenium (50–55  $\mu\text{m}$  *vs.* 70–80  $\mu\text{m}$  high), as well as in having 8-spored asci (*vs.* (15–)16-spored) and in having wider ascospores ((8–)10–13  $\times$  (5–)6–7(–8)  $\mu\text{m}$  *vs.* (7–)8–11(–12)  $\times$  4.5–5(–8)  $\mu\text{m}$  (Kondratyuk *et al.* 2016a, b).

Furthermore when *B. pseudosambuci* and *B. loekoiesiana* growing side by side (see 163874 holotype and BP isotype), apothecia of both fungi can be on the same thallus, but thallus of *B. pseudosambuci* is much thinner, and apothecia are much larger and more shiny, with somewhat yellowish own margin of apothecia (like somewhat golden own margin as in apothecia of *Lecidella mandshurica*) (see Kondratyuk *et al.* 2015a).

*Biatora loekoiesiana* cannot be simple juvenile stage of *Biatora pseudosambuci*, as far these two taxa differs additionally to presence/absence pruina on apothecium disc, by measurements and structure of exciple (true exciple in *Biatora pseudosambuci* greyish or lightly brownish in outermost portion, where outermost portion to 15–20 thick of palisade plectenchyma with very thick 6–7  $\mu\text{m}$  wide hyphae with lumina 1–1.2  $\mu\text{m}$  diam.), in having 8 and 16-spored asci consequently, as well as in size of ascospores (see above).

Other specimens examined: Republic of Korea. Jeju-do, Jeju-si, Sangumbari Crater, around parking place at entrance, on bark of cherry trees, growing together with *Buellia extremorientalis* and *Scoliosporum chlorococcum*. Lat.: 33° 26' 7.08" N; Long.: 126° 41' 22.07" E; Alt.: 408 m a.s.l. Coll.: Kondratyuk, S. Y., Kondratiuk, T. O., Yang, J.-H. (170153), 14.03.2017 (KoLRI 044277 sub *Buellia extremorientalis*). – Jeollanam-do, Suncheon-si, Yongsang-dong, on bark of trees in pine forest, growing together with *Lecanora*, *Amandinea* and *Buellia*. Lat.: 34° 58' 10.8" N; Long.: 127° 30' 10.1" E; Alt.: 189 m a.s.l. Coll.: Kondratyuk, S. Y. (163924), 4.12.2016 (KoLRI 42192 sub *Biatora loekoiesiana*); the same locality, growing together with *Biatora pseudosambuci*, *Sculptolumina* aff. *japonica*, (163925), (KoLRI 42193). – Jeollanam-do, Suncheon-si, Yongsang-dong, along small stream, near water fall close to tourist point, on *Alnus* bark in mixed forest, growing together with *Biatora pseudosambuci* and *Buellia* aff. *melanoxanthella*. Lat.: 34° 57' 55.88" N; Long.: 127° 30' 03.98" E; Alt.: 110 m a.s.l. Coll.: Kondratyuk, S. Y. (163861), 20.11.2016 (KoLRI 42214); the same locality, (163855, 163867), (KoLRI 42123, KoLRI 42135). – Jeollanam-do, Suncheon-si, Yongsang-dong, Mt top behind artificial lake, on *Alnus* bark, growing together with dull green punctiform soredious lichen. Lat.: 34° 58' 20.69" N; Long.: 127° 30' 02.58" E; Alt.: 194 m a.s.l. Coll.: Kondratyuk, S. Y. (163994, 163995, 163996), 17.12.2016 (KoLRI 44262, KoLRI 44263, KoLRI 42264).



*Caloplaca ivanpisutii* S. Y. Kond., L. Lőkös et J.-S. Hur, *spec. nova*  
(Fig. 4)

Mycobank no.: MB 824386.

*Similar to Caloplaca fuscoatroides, but differs in having thin continuous and grey cracked thallus, in having smaller apothecia, and in having dark brown apothecium disc, as well as in the lack of thick convex or semiconvex areoles, of warty formations on thalline squamules, of cortical layer with cells containing brown pigment, of hyaline epinecral layer, and of orange-red own margin of apothecia.*

Type: Republic of Korea: Mt Baekseokbong, Bukpyeong-myeong, Jeongseon-gun, Gangwon-do, on rock. Lat.: 37° 28' 44.34" N; Long.: 128° 39' 45.60" E; Alt.: ca 494 m a.s.l. Coll.: Joshi, Y., Wang, X. Y., Ryu, J. A., Hur, J. Y. (090453), 16.05.2009 (KoLRI 010157 – holotype, KW-L and BP – isotype).

Thallus to 1–5 cm across, or more larger, brownish grey or grey, from whitish grey to brownish grey, continuous, only slightly cracked, but not distinctly areolate in most cases, in some thalli areoles to 0.4–0.8 mm can be observed; hypothallus not observed while black line to 0.1 mm wide between thalli of this species as well as other crustose lichens often observed.

Apothecia 0.3–0.8 mm diam., and 0.15 mm thick in section, rather numerous, abundant, dark brown to blackish brown or black, sometimes with bluish black tinge; at first completely immersed, than sessile, lecidine or biatorine to zeorine or rarely lecanorine; in biatorine own margin to 0.05 mm wide slightly arising level of apothecium, somewhat shiny in contrast to matt disc; thalline margin (if observed) concolorous with thallus, from whitish grey to dark brown (and in this case concolorous with disc); only rarely distinctly zeorine, where true exciple slightly darker of disc, dark brown to blackish brown or medium brown to light brown in places as circle between thalline margin and disc observed; disc mostly flat; apothecia in section mainly zeorine and biatorine; true exciple (30–)50–70 thick in uppermost lateral portion, in outermost portions to 15–20(–40)  $\mu\text{m}$  thick darkish/blackish or bluish blackish (and first impression that section of *Lecidea/Lecidella* type of apothecium) while inner portion hyaline; to 40–80  $\mu\text{m}$  thick in lower lateral portion and to 50–80  $\mu\text{m}$  thick in basal portion, palisade paraplectenchymatous with rounded cells, cell lumina to 4–5  $\mu\text{m}$  diam.; thalline exciple often better developed at basis or if present in lateral portion to 60(–120)  $\mu\text{m}$  thick; hymenium 60–70  $\mu\text{m}$  high; epihymenium to 12–15  $\mu\text{m}$  thick, dull blackish olive or brownish yellowish, epihymenium and uppermost cells of paraphyses bluish to dark aeruginose, N+ purple, paraphyses to 4–5  $\mu\text{m}$  diam. in the uppermost portions [in water, and to 2–3.5  $\mu\text{m}$  thick in K], becoming bluish-greenish or dark bluish green,

thick-walled; epihymenium K+ violetish tinge, while outermost layers of true exciple and aeruginose portions of epihymenium K- becoming slightly lighter but colour is the same; subhymenium 60–70 µm thick, hyaline, without oil; asci with 4–8 bipolar and small size abortive ascospores, bipolar ascospores widely ellipsoid, distinctly attenuated towards the tips, often becoming orange with overmature, (11–)12–14(–16) × (4.8–)5.5–6.5 µm in water and 9–13 (–15) × (5.5–)6–7(–8) µm in K; ascospore septum wide, to (3–)4–5 µm wide in water and almost the same, (3.5–)4–5(–7) µm wide in K.

Conidiomata especially numerous at edge of thallus, in places of contact with other crust lichens, blackish or greenish dark brown, in section to 100–150 µm diam. with blackish or brownish cells at ostiole; conidia long bacilliform, (2.5–)3–5 × 0.8–1 µm.

Chemistry: True exciple N+ purple, thallus K+ yellow, KC-, C-, Pd- or slightly yellowish green.

Ecology: Growing on siliceous rock.

Etymology: It is named after the well-known Slovak lichenologist and our friend Ivan Pišút (1935–2017) (BRA, Bratislava, Slovakia), as well as after somewhat similarities with members of the genus *Ivanpisutia* (Ramalinaceae) when own margin of biatorine apothecia has lighter colour than apothecium disc.

Distribution: So far known from several scattered localities in South Korea (E Asia).

Taxonomic notes: *Caloplaca ivanpisutii* is characterised by the following characters: grey to white-grey (as in *Loekoesia austrocoreana*) to brownish grey [as in some species of the genus *Fuscidea*], epihymenium and uppermost cells of paraphyses bluish to dark aeruginose, N+ purple, true exciple in outer portions darkish/blackish (and first impression after section of apothecium that section of *Lecidea/Lecidella* type apothecium), as well as narrow ascospores and wide ascospore septum.

*Caloplaca ivanpisutii* is similar to '*Caloplaca fuscoatroides* J. Steiner, saxicolous species known from Europe (Italy, Greece and Ukraine) and Asia (Turkey), but differs in having thin continuous and grey cracked thallus (*vs.* areolate to squamulose, thick, blackish brown to black), in having smaller apothecia (to 0.8 mm diam. *vs.* 0.8–1.5 mm diam.), in having dark brown apothecium disc (*vs.* rusty red to rusty brown), in the lack of thick convex or semiconvex areoles (*vs.* 0.4–0.7 mm thick and 0.7–1.8 mm diam.), in the lack of warty formations to 0.2–0.3 mm diam. on thalline squamules, in the lack of cortical layer with cells containing brown pigment, and in the lack of hyaline epinecral layer, as well as in the lack of orange-red own margin of apothecia, while ascospores are of the same range of variation (12–14 × 5.5–6.5 µm *vs.* 12–14(–16) × 5–7 µm), and the same septum ((3–)4–5 µm *vs.* 3–6 µm wide).

Status of '*Caloplaca fuscoatroides*' is still not checked with molecular data, but it is mentioned that this species is similar to *Blastenia crenularia* (With.) Arup, Søchting et Frödén, but differs by darker and almost squamulose thallus, short ascospores and brownish tips of conidiomata.

*Caloplaca ivanpisutii* is similar to *C. fuscoatra* (Bayrh.) Zahlbr. (which sometimes considered to be synonym to *C. aractina* (Fr.) Häyrén), but differs in having thinner and light grey thallus (*vs.* rather thick to areolate, worthy, brownish black, greenish black, usually dark), in having wider range of vari-

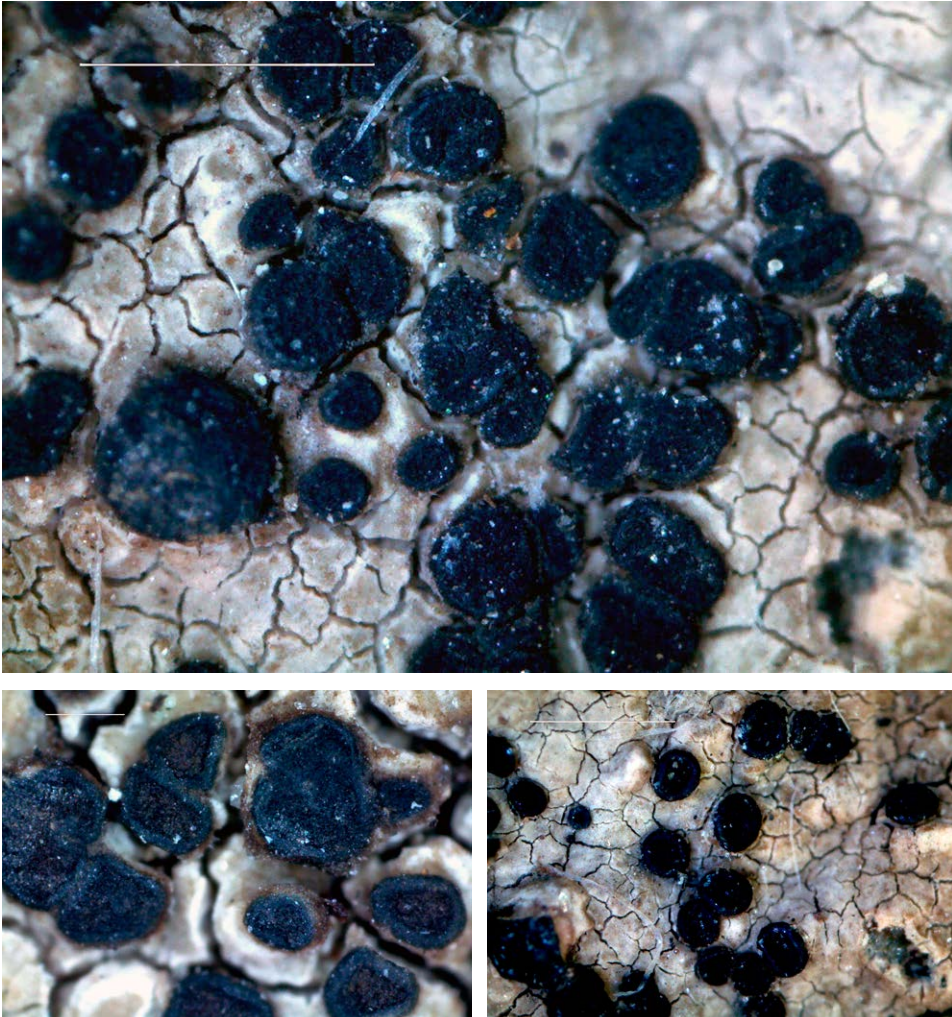


Fig. 4. *Caloplaca ivanpisutii* (holotype), general habit. Scale 0.5 mm (top) and 1 mm (bottom). (Photos of S. Kondratyuk)

ation of apothecia (*vs.* lecanorine or zeorine) apothecia, in having dark brown apothecium disc (*vs.* rusty red, dirty rusty red or rusty brick to black), in having true exciple N+ purple, while lack of matrix in true exciple, in having narrower ascospores ( $12\text{--}14 \times 5.5\text{--}6.5 \mu\text{m}$  *vs.*  $(7.6\text{--})10\text{--}15(-17) \times 5\text{--}9 \mu\text{m}$ ), and in having wider septum ( $(3\text{--})4\text{--}5 \mu\text{m}$  *vs.*  $2\text{--}4 \mu\text{m}$  wide).

After having whitish-greyish thallus and thalline margin, and dark brown to blackish apothecium disc *Caloplaca ivanpisutii* may be similar to *Fuscidea coreana* S. Y. Kondr., L. Lőkös et J.-S. Hur, and to *Gyalidea austrocoreana* S. Y. Kondr., L. Lőkös et J.-S. Hur, but differs from both taxa in the lack of N+ reaction of epihymenium, as well as in having not constricted at the basis apothecia, in having *Teloschistes*-type of asci and bipolar ascospores.

Material of *Lecanora spodoplacoides* (= *Lecanora viridirufa* Ach. var. *scotoplacoides* Nyl.) as well as *Placodium haematites* var. *ussuriense* Tomin, both taxa described based on eastern Asian material should be compared in future with this taxon, too.

*Caloplaca ivanpisutii* may belong to the *Loekoesia* branch of the subfamily Caloplacoideae (see Kondratyuk *et al.* 2014, 2015b). However, freshly collected material of this taxon was not available for molecular study within this study.

***Candelariella makarevichiae*** S. Y. Kondr., L. Lőkös et J.-S. Hur, *spec. nova* (Fig. 5)

Mycobank no.: MB 824387.

*Similar to Candelariella reflexa, but differs in having well-developed, distinct, minute areoles or squamules, and thalli usually consist of discrete, scattered areoles and do not form continuous leprose crust, in having mostly smaller thalline areoles/squamules, in having well-developed soralia with uplifted soredious mass, in having smaller soredia.*

Type: Republic of Korea. Gangwon-do, Sacheon-myeon, Gadunji-gill, small pine plantation along the seashore road (Halan-ro) at Sacheon Beach, on bark of *Pinus densiflora* and *P. thunbergii*, growing together with *Agonimia* sp. Lat.:  $37^{\circ} 49' 43.21''$  N; Long.:  $128^{\circ} 52' 41.50''$  E; Alt.: *ca* 5 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (150828/A), 09.07.2015 (KoLRI 034061/A – holotype); the same locality, growing together with *Agonimia* sp. and *Amandinea* sp. (150828/B, 150829), (KoLRI 034061/B, KoLRI 034062 – isotypes).

Thallus mostly macroscopically somewhat indistinct, dull yellow or dull citrine yellow spots, which consisting of very small scattered and distant small areoles, and often seem to leprose or consisting of confluent soredious mass, but at high magnification ( $\times 100$  and more) consisting of small soredi-

ate areoles/squamules rarely aggregated in groups a. 2–3 mm across, while dispersed scattered minute areoles may cover spots to several cm across. Thalline areoles 0.15–0.3(–0.5)[–0.8] mm diam./across, very distant each other, more or less rounded at first to irregular and somewhat semiconvex [on bark of deciduous trees sometimes to 1–1.5(–2) mm across in overmature thalli (see Taxonomic notes below)], from very thin, closely attached to the substrate and with very closely attached to the substrate peripheral portions, somewhat dissected in smaller portions to 0.04–0.06 mm wide, dull citrine; central portions usually with soredious mass more or less uplifted above substrate and thalline areoles level, brighter yellow; thalline areoles/squamules becoming somewhat thicker at the overmature or among thalli of other crustose lichens, when they do not have possibility to grow or occupy new surface, and mostly completely covered by soredia.

Soralia (0.1–)0.15–0.2(–0.3) mm diam. at first very well distinct as regularly rounded or slightly elongated, in the centre of thalline areole or close to the edge, but on the upper surface of areole, and with distinctly uplifted above thalline areole level, with somewhat semiconvex or convex soredious mass; however with time soralia becoming aggregated and indistinct while upper surface of thalline areoles/squamules becoming completely covered by soredious mass. Soredia regularly rounded and usually evenly sized, *ca* 20–30  $\mu$ m diam. in uplifted hemispherical soredious mass in soralia or to 20–40  $\mu$ m diam./across in case when upper surface of thalline areoles almost completely covered by soredious mass [spherical formations to 80(–100)  $\mu$ m across, probably future soralia, especially along the edges of thalline areoles, can be observed on bark of deciduous trees sometimes (see Taxonomic notes below)].

Apothecia and conidiomata not observed.

Chemistry: Thallus contains calycin (HPLC).

Ecology: It is common on bark of pine trees (*Pinus densiflora* and *P. thunbergii*), while was collected on broad leaved trees in well-lit conditions, on road side deciduous trees (see also below). Growing together with *Kashiwadia orientalis*, *Dirinaria applanata*, *Biatora* cf. *pseudosambuci* and species of the genera *Agonimia*, *Lecanora*, *Lepraria*.

Etymology: It is named after the well-known Ukrainian lichenologist Maria Florianivna Makarevich (1906–1989) who has provided important key to northern Eurasian *Candelariella* in the 1970s.

Distribution: It is so far known from South Korea (E Asia).

Taxonomic notes: *Candelariella makarevichiae* is similar to *C. reflexa* (Nyl.) Lettau, epiphytic lichen in nutrient enriched habitats such as the base of trees fouled by dogs, rough-barked trees around farm steads and village, on sloping trunks and boughs of large *Salix* and *Sambucus*, also as tiny thalli amongst other lichens on slightly nutrient-enriched broad-leaved trees in woodland; shade and moderately pollution-tolerant, cosmopolitan taxon, as after ecol-

ogy (growing mainly on road side broad-leaved trees or in open conditions in woodlands) but differs in having well-developed distinct minute areoles or squamules (*vs.* granules or minute squamules), in having wide range of variation, but mostly smaller thalline areoles/squamules (0.2–0.3 mm or to 1–1.5(–2) mm across *vs.* to 1 mm diam.), in having well-developed soralia with uplifted soresidious mass (*vs.* the margins of thalline squamules usually rapidly breaking down into fine-granular soredia), in having smaller soredia (20–30  $\mu\text{m}$  diam. *vs.* 50–70  $\mu\text{m}$  diam.), and usually consisting of discrete scat-

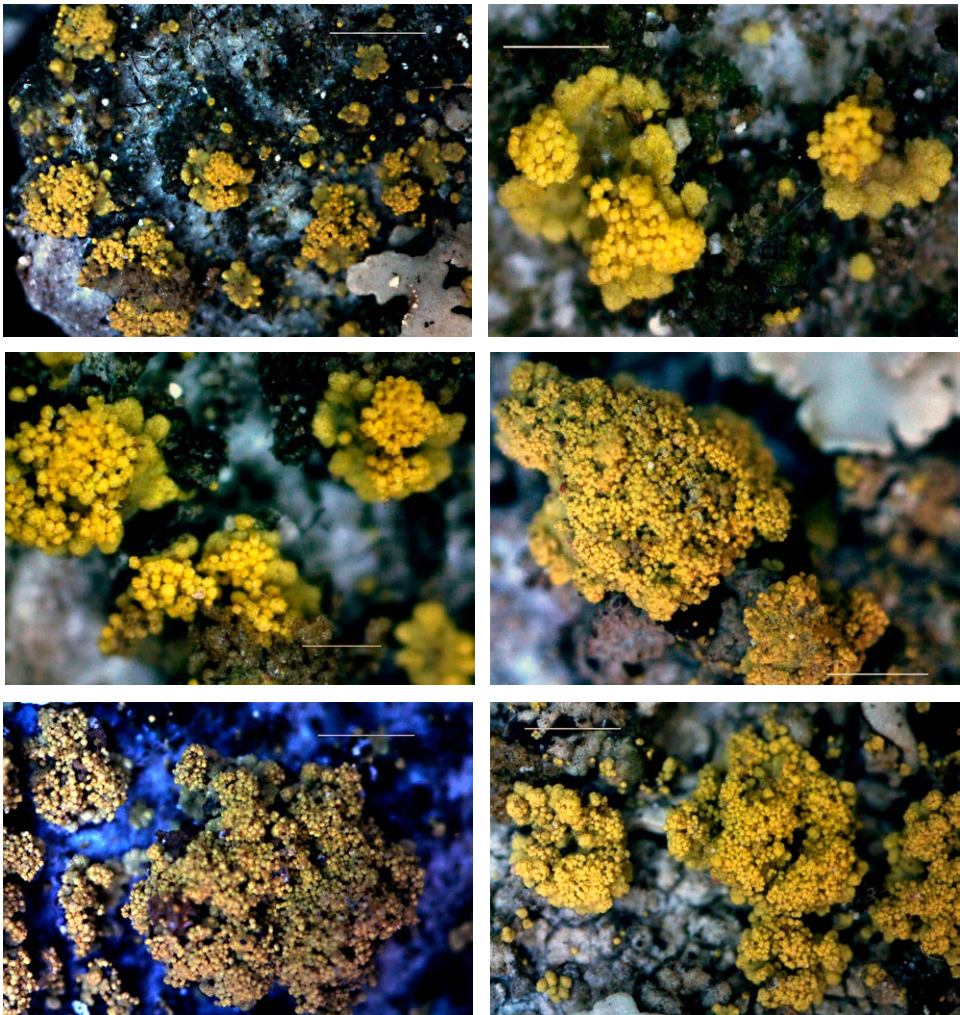


Fig. 5. *Candeliariella makarevichiae* (holotype), general habit (top left) and enlarged thalline fragments with soralia. Scale 0.5 mm. (Photos of S. Kondratyuk)

tered areoles and do not forming continuous leprose crust, as well as in positioning in separate from the *C. reflexa* subbranch in the phylogenetic tree after ITS nrDNA (Gilbert and James 2009).

Korean material of *Candelariella makarevichiae* can be keyed to *Candelariella efflorescens* R. C. Harris et W. R. Buck, known from mostly bark of broad-leaved trees of North America and Europe (Westberg 2004, 2007), but differs in having distinctly areolate to squamulose thallus, not being granular (*vs.* from granular to areolate or minutely squamulose), in having plane areoles (*vs.* convex areoles to 0.4 mm wide), in having smaller soredia (20–30 µm diam. *vs.* 20–50 µm diam.), in having distinct rounded, somewhat uplifted soralia (*vs.* soredia on margin of the areoles and spreading inwards).

After having closely attached to substrate areoles and highly uplifted soredious mass material of *Candelariella makarevichiae* may resemble *Mikhtomia geumohdoensis*, S. Y. Kondr., Liu D. et J.-S. Hur, but differs in having bright citrine, well distinct thallus, in having usually very distant scattered thalline areoles, and in having somewhat dissected peripheral zone of areoles (Kondratyuk *et al.* 2017a).

After ITS phylogeny *Candelariella makarevichiae* represented by three voucher specimens, i.e.: nos. 110993, 150828, 150829 forms separate clade which is positioning in rather distant position as from *C. reflexa*, as from *C. efflorescens*.

So far voucher specimens included in the phylogenetic analysis based on ITS nrDNA sequences were collected only on bark of pine trees. Material of *Candelariella makarevichiae* from bark of *Zelkova serrata* or cherry trees (*Prunus avium*) (see below) are included in this taxon with some hesitation. May be the latter belong to another taxon.

On bark of pine tree it is seen that thallus mainly consisting of scattered and distant, very small areoles, which may be accepted at first look as granules or soredious portions.

Other specimens examined: Republic of Korea. Jeollanam-do, Jangheung-gun, Gwansan-eup, Okdang-ri, Cheongwansan Mts, near the entrance, on bark of *Zelkova serrata*, growing together with *Kashiwadia orientalis*, *Dirinaria applanata*, *Biatora cf. pseudosambuci* and *Lecanora* sp. Lat.: 34° 32' 54.91" N; Long.: 126° 55' 59.88" E; Alt.: ca 91 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (150412), 23.06.2015 (KoLRI 034007). – Jeollanam-do, Suncheon-si, Mageok, Sunchon National University territory, near the Humanitarian Faculty, on bark of *Pinus*, growing together with *Sculptolumina aff. japonica*, *Amandinea* sp., *Lecanora* sp. and *Lepraria* sp. Lat.: 34° 58' 10.8" N; Long.: 127° 28' 36.7" E; Alt.: ca 180 m a.s.l. Coll.: Kondratyuk, S. Y. (110993), 04.10.2015 (KoLRI 014068). – Jeollanam-do, Suncheon-si, along Jobi-gil road, on bark of *Prunus avium*. Lat.: 34° 58' 34.68" N; Long.: 127° 28' 16.78" E; Alt.: 72 m a.s.l. Coll.: Kondratyuk, S. Y. (163430), 09.09.2016 (KoLRI 41675). – Jeollanam-do, Suncheon-si, Songgwang-myeon, Jogyesan Mts, Hugok-ri, along Hugogan-gil road in the settlement, on bark on *Prunus avium*, growing together with species of the genera *Leprocaulon* and *Sculptolumina*. Lat.: 35° 00' 47.17" N; Long.: 127° 12' 34.08" E; Alt.: 135 m a.s.l. Coll.: Kondratyuk, S. Y. (163458), 15.10.2016 (KoLRI 41703 sub *Candelariella*).

*Franwilsia skottsbergii* S. Y. Kondr., A. Thell, S.-O. Oh et J.-S. Hur, *spec. nova*  
(Fig. 6)

Mycobank nr. 824388.

*Similar to Franwilsia renatae, but differs in having richly oil (Franwilsia-type plectenchyma) cortical layer of thallus and thalline margin of apothecium, in having mostly zeorine apothecia, in having much thicker thalline margin, in having Franwilsia-type plectenchyma in true exciple, in having lower hymenium, in having shorter and wider ascospores, and in having black conidiomata, as well as in its distribution.*

Type: Chile: Caleta Tototal Baja, on bark of tree [on small twigs], growing together with *Xanthoria ascendens*, *Caloplaca* sp., *Chrysotrix* sp., and other crustose lichens; *Franwilsia skottsbergii* and *Caloplaca* sp. both damaged by lichenicolous fungus *Endococcus* aff. *parietinarius*. Lat.: 28° 17' 15.6" S; Long.: 71° 10' 37.6" W; Alt.: ca 203 m a.s.l. Coll.: Oh, S.-O., Hur. J.-S. (CL 130516), 14.11.2013 (KoLRI 020652 – holotype; for DNA SK H69 (=J69)).

Thallus 2–3 cm across, crustose, grey or whitish grey, continuous to somewhat cracked, with portions 0.5–1 mm across, from rather thin to very thick and irregularly uneven to verruculose in the centre, often covered by highly uplifted apothecia with dull brownish orange discs as well as by blackish conidiomata. Hypothallus not observed. Thallus to 200–300 µm thick in section. Cortical layer of thallus to 30–50 µm thick, with numerous oil agglomerations (not dissolved in K becoming somewhat yellowish or brownish and better seen in K, irregular, 3–7 µm across; oil of the *Franwilsia*-type), somewhat greyish, in places somewhat greyish or dirty in the upper portion owing to numerous small oil droplets; in lower portion more or less hyaline (lighter) with more or less scarce oil agglomerations; in some places seem to consist of two distinctly different portions: the upper to (7–)10–15 µm thick of epinecral layer or of hyphae parallelly orientated to surface and without oil conglomerates), and the lower portion to 50–70 µm thick, somewhat brownish or greyish owing to numerous oil agglomerations (3–)5–7 µm diam./across; algal zone to 80–160(–180) µm thick.

Apothecia 0.7–1.5(–2) mm diam., and to 0.4–0.45 mm thick in section, zeorine or lecanorine, mostly highly uplifted above thalline level and distinctly constricted at the basis, own margin/true exciple very thin, to 40–50 µm thick, from light yellowish or yellowish orange (lighter of disc) to bluish or bluish black (similar as in *Franwilsia bastowii*) to concolorous with disc, dull orange; thalline margin entire or crenulate to developed only a side or at basis, greyish with whitish short line-like pseudocyphellae, somewhat eroded surface, sometimes with blackish conidiomata, often overgrowing by young smaller size apothecia; disc dull orange or dull brownish orange, sometimes dead,



colourless or greyish/concolorous with thalline margin or blackish in places and apothecia seem to be similar to *Lecanora*- or *Rinodina*-type; in section zeorine, where thalline exciple to 170  $\mu\text{m}$  thick, with distinct cortical layer to 50 (–80)  $\mu\text{m}$  thick, distinctly *Franwilsia*-type, interspersed with oil agglomerations to 6–10  $\mu\text{m}$  across; cortical layer of thalline exciple to 70(–100)  $\mu\text{m}$  thick (especially on underside of apothecia, or in ‘conus’-like formations to 100(–120)  $\mu\text{m}$  thick, with numerous irregular oil agglomerations (oil of the *Franwilsia*-type); true exciple to (30–)40–100(–120)  $\mu\text{m}$  thick in the uppermost lateral portion, to 20–40(–60)  $\mu\text{m}$  thick in lower lateral portion and especially not distinct in the basal portion where completely covered by oil agglomerations, probably to 40–50(–70)  $\mu\text{m}$  thick; true exciple with numerous oil agglomerations (oil of the *Franwilsia*-type) in both lateral and basal portion; algal zone continuous or of clusters to (50–)60–80(–100)  $\mu\text{m}$  diam. across, without oil; algal cells to (7–)12–18  $\mu\text{m}$  diam./across, algae probably of the genus *Asterochloris*, richly interspersed with yellow drops of oil inside of algal cells (seen also in K); hymenium very thin, to (60–)70–80  $\mu\text{m}$  high; epihymenium to 10–15  $\mu\text{m}$  thick, dark brownish orange; subhymenium 150–230  $\mu\text{m}$  thick, somewhat dirty, greyish or brownish, of the *Franwilsia*-type, with irregular oil agglomerations to 7–10

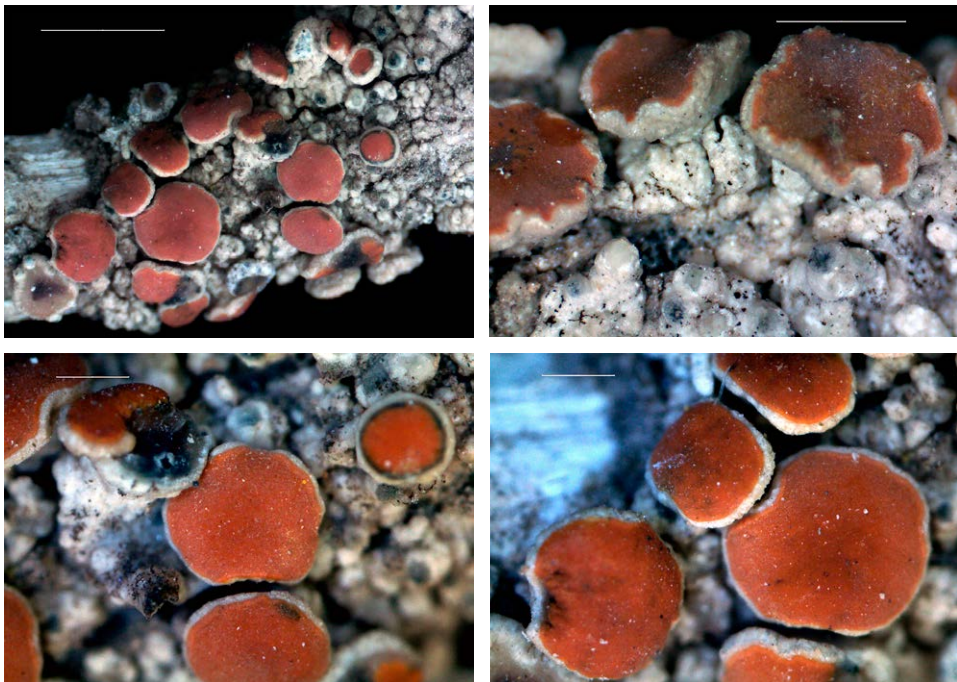


Fig. 6. *Franwilsia skottsbergii* (holotype), general habit (top left) and enlarged apothecia and thallus. Scale 2 mm (top left) and 1 mm (the others). (Photos of S. Kondratyuk)

$\mu\text{m}$  diam./across in water (in K to 5–12 across or droplets to 7  $\mu\text{m}$  diam.); paraphyses slightly swollen towards the tips to 3.5  $\mu\text{m}$  diam., poorly branched in the upper portion; asci 8-spored, often with ascospores of variegated size within the same ascus; ascospores elongated, slightly widened at the septum, and more or less attenuated to both ends; 9–13  $\times$  (4.5–)5–6  $\mu\text{m}$  in water (25 measurements) and (8–)9–13(–14)  $\times$  (4–)5–6(–7.5)  $\mu\text{m}$  in K (35 measurements); ascospore septum to (2–)3–4  $\mu\text{m}$  wide in water and (2–)3–4  $\mu\text{m}$  wide in K.

Conidiomata to 0.1–0.2(–0.3) mm diam., blackish, often very abundant and making variegated black grey aspect of thallus; in section with blackish-bluish outermost cells of the upper half of exciple (in lower half usually hyaline), to 220–250(–280)  $\mu\text{m}$  diam. mostly regularly rounded; conidia narrowly bacilliform, 2.7–4  $\times$  0.7–0.9(–1.2)  $\mu\text{m}$ .

Chemistry: Epithylenium and uppermost portion of lateral true exciple K+ purple with time becoming crimson, ascospore content becoming purple, too. Cortical layer of thallus, and thalline cortex of apothecium K–.

Ecology: Growing on bark of trees and twigs.

Etymology: This species is named after a Swedish botanist and explorer of Antarctica Carl Johan Fredrik Skottsberg (1880–1963).

Distribution: So far known from type collection in Chile, South America.

Taxonomic notes: This species is characterised by richly inspersion by oil subhymenium (with numerous irregular oil agglomerations, hereafter of *Franwilsia*-type (see also illustrations in Kondratyuk *et al.* 2009a, b), richly inspersion true exciple (in both lateral and basal portions), as well as cortical layer of thallus and thalline exciple.

*Franwilsia skottsbergii* is similar to *Franwilsia renatae* (Wirth et S. Y. Kondr.) S. Y. Kondr., Kärnefelt, A. Thell, Elix, J. Kim, A. S. Kondratiuk et J.-S. Hur in having greyish thallus and large zeorine apothecia with grey thalline margin and whitish pseudocyphellae, as well as in having richly oil exciple, and subhymenium, but differs in having richly oil cortical layer of thallus and thalline margin of apothecium, in having mostly zeorine apothecia (*vs.* lecanorine), in having much thicker thalline margin (in section to 170  $\mu\text{m}$  *vs.* 60–10  $\mu\text{m}$  thick), in having thicker and *Franwilsia*-type plectenchyma in cortical layer (*vs.* 20–30  $\mu\text{m}$  thick and palisade), in having *Franwilsia*-type plectenchyma in true exciple (*vs.* leptodermatous paraplectenchymatous), in having lower hymenium (70–80  $\mu\text{m}$  *vs.* 80–100  $\mu\text{m}$  high), in having somewhat shorter and wider ascospores (9–13  $\times$  5–6  $\mu\text{m}$  *vs.* (10–)11–14(–15.5)  $\times$  (3.5–)4–5  $\mu\text{m}$ ), as well as in its distribution (*vs.* African taxon), and in having black conidiomata (Wirth and Kondratyuk 2010).

*Franwilsia skottsbergii* is similar to *F. bastowii* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr., Kärnefelt, A. Thell, Elix, J. Kim, A. S. Kondratiuk et J.-S. Hur in having crustose thallus and zeorine apothecia often with bluish black own mar-

gin/true exciple, but differs in having rather thick grey or dull grey-whitish thallus (*vs.* whitish from endolithic to thick), in the lack of bluish or brownish black *Rinodina*-type apothecia, in having larger apothecia, in having much thicker and often more crenulate thalline margin, in having whitish pseudocypbellae especially well seen on thalline exciple, in having *Franwilsia*-type plectenchyma in cortical layer of thalline margin (*vs.* palisade), and in true exciple (*vs.* leptodermatous paraplectenchyma), in having narrower paraphyses tips (*vs.* 3–6(–7)  $\mu\text{m}$ ) and poorly ramified (*vs.* richly ramified with 5–7(–10) long secondary branches, in having shorter and narrower ascospores (11–13  $\times$  5–6  $\mu\text{m}$  *vs.* (8–)10–15(–16)  $\times$  (4.5–)5.5–7(–8)  $\mu\text{m}$  in water and much wider (10–)11–16(–18)  $\times$  (5.5–)6–9(–11)  $\mu\text{m}$  in K), in having wider ascospore septum (3–4  $\mu\text{m}$  *vs.* 2–3  $\mu\text{m}$  wide), as well as in another substrate (*vs.* epilithic) and distribution (*vs.* Australian taxon), and in having black conidiomata (Kondratyuk *et al.* 2009a).

*Franwilsia skottsbergii* differs also from another Australian epilithic lichen *F. kilcundensis* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr., Kärnefelt, A. Thell, Elix, J. Kim, A. S. Kondratiuk et J.-S. Hur in having shorter ascospores (9–13  $\mu\text{m}$  *vs.* 13–18(–21)  $\mu\text{m}$  long), and in having black conidiomata (Kondratyuk *et al.* 2009b).

Unfortunately data on conidiomata of all species of the genus *Franwilsia* are hitherto missing.

Lichenicolous fungus *Endococcus* aff. *parietinarius* (Linds.) Clauzade et Cl. Roux was identified preliminary because it differs in having longer and somewhat narrower ascospores ((10–)13–14  $\times$  (3–)4–4.5(–5)  $\mu\text{m}$  *vs.* 10.5–12(–14)  $\times$  (3.5–)4–5.5  $\mu\text{m}$ ). After ascospore measurements this material is closer to *E. ramalinarius* (Linds.) D. Hawksw., but differs in having different host (member of the Teloschistaceae *vs.* Ramalinaceae) and in having semi-immersed ascomata (*vs.* immersed).

After ITS1/ITS2 nrDNA *Franwilsia skottsbergii* is positioned in outermost out position to the *Franwilsia* branch. However, we do hope that the further molecular data (i.e. on the 28S nrLSU and 12S mtSSU) will confirm closer position of this taxon to the *Franwilsia* clade.

***Gallowayella awasthiana*** S. Y. Kondr. et D. K. Upreti, *spec. nova*  
(Figs 7–9)

Mycobank nr. 824389.

*Similar to Gallowayella sogdiana but differs in having smaller thallus, much longer thalline lobes, wider and mostly horizontally orientated thalline lobes, very long and easily distinct rhizines, smaller soredia, larger apothecia, much narrower ascospores, and narrower ascospore septum.*

Type: India, Uttaranchal, Chamoli distr., Badrinath, Mana village, on twigs, growing together with *Candelaria* cf. *concolor*, *Physcia*, *Phaeophyscia*, *Caloplaca* aff. *cerina* aggr., *Lecidella* spp. Coll.: Shukla, V., Joshi, Y., 21.06.2005 (LWG 05–005210/B – holotype; voucher for DNA SK E15), (LWG 05–005210–isotype; voucher for DNA SK E16).

Thallus 0.8–1(–3) mm across, but may form larger aggregations, foliose, deep yellow to reddish orange, often central portion dark reddish, or dark reddish orange to dark brownish reddish orange, deep brick orange or dark brownish yellow, while terminal portions of lobes much brighter yellowish, with punctiform to fissure-like yellowish-whitish or whitish yellow soralia along the thalline lobe edges well contrasting to dark upper surface of thallus. Lobes to 2–4 mm long and (0.3–)0.5–0.7(–1) mm wide, more or less the same width throughout, neither becoming narrower, or becoming sometimes distinctly widened towards the tips, scarce to richly branched; secondary lobules to 2–2.5(–3) mm long and 0.4–0.5 mm wide, mainly strip-like; often terminal and marginal portions of thalline lobes and lobules dissected into narrower portions 0.2–0.3(–0.5) mm wide and 0.4–0.7(–1) mm long; total width of the single lobe with all dissected portions and secondary lobules to 1.5 mm wide. Underside white, usually with well distinct, very numerous (0.5–)0.8–1(–1.5) mm long *Oxneria*-type rhizines (see illustrations in Kondratyuk and Poelt 1997), yellow or white, especially well seen in overlapping portions of thallus.

Soralia punctiform at first (0.17–)0.2–0.3 mm long along the thalline lobe edge and gaped to 0.1–0.15(–0.2) mm wide (or to 0.2(–0.3) mm across), mostly marginal, of ‘micro-*huculica*’-type (i.e. with uplifted portions of upper cortex, somewhat micro-helmet, similar to *Oxneria huculica*, but smaller in size) (see illustrations in Kondratyuk *et al.* 2010), slightly brighter of thallus, yellowish white owing to naked medulla (similarly as in *Oxneria ullophyllodes* subsp. *subsorediosa* (Räs.) ad int.), later in overmature thalli becoming somewhat larger to 0.3–0.6(–0.7) mm long (along the lobe edge) and to 0.15–0.2(–0.3) mm wide, usually very scarce and commonly empty, without soredia (seem to be washed or eaten). Soredia very small, to 20 µm diam., usually hardly seen, sometimes becoming isidious to 25–30 µm diam., and forming characteristic chains to 0.2(–0.3) mm long along the edge of lobes and the same wide; often seen among the rhizines, which are very close to lobe edges on underside, too.

Apothecia (0.5–)0.7–2(–2.5) mm diam., 0.28 mm thick in section, lecanorine, often with rhizines on thalline margin (what is characteristic for members of the genera *Gallowayella* and *Oxneria* (see illustrations in Kondratyuk 2004, Kondratyuk and Poelt 1997)), plane to somewhat undulating, constricted at basis, scattered to crowded, disc dark brownish yellow to brown, thalline margin to 0.1 mm wide mostly entire, rarely with soredious mass or rhizines; in section zeorine, thalline exciple to 110–120 µm with well distinct to 30–35

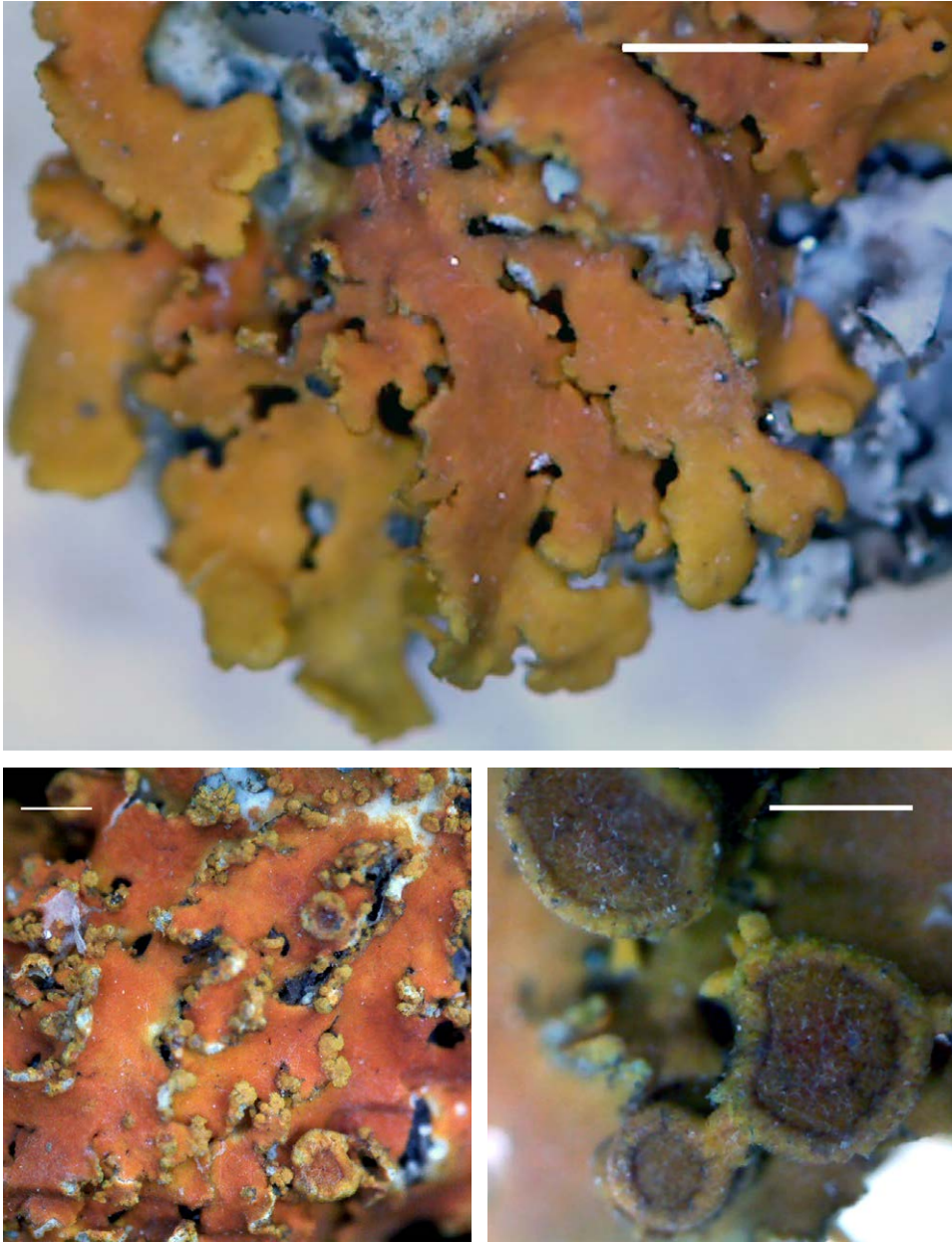


Fig. 7. *Gallowayella awasthiana* (holotype), general habit (top) and enlarged fragments with apothecia (bottom). Scale 1 mm (top) and 0.5 mm (bottom). (Photos of S. Kondratyuk)

(–40)  $\mu\text{m}$  thick cortical layer especially well developed on underside, mesodermatous paraplectenchymatous, cell lumina 6–10  $\mu\text{m}$  diam./across, somewhat vertically elongated; true exciple 70–80  $\mu\text{m}$  thick in the uppermost lateral portion, to 30–40  $\mu\text{m}$  thick in lower lateral and basal portions, mesodermatous paraplectenchymatous especially in the centre of apothecium; hymenium to 70  $\mu\text{m}$  high; uppermost cells of paraphyses swollen to 4–5  $\mu\text{m}$  diam. (in water and to 4(–5)  $\mu\text{m}$  diam. in K); subhymenium to 50–60  $\mu\text{m}$  thick; algal zone entire, medulla more or less compact; asci 8-spored; ascospores fusiform to somewhat cylindrical, slightly widened at the septum and with more or less attenuated ends, very often only young ascospores seen in one section, (13–) 14–18(–23)  $\times$  (5.5–)6–7.5(–9)  $\mu\text{m}$  in water and becoming slightly longer but the same narrow to (12–)16–20(–21)  $\times$  (5–)6–9  $\mu\text{m}$  in K; ascospore septum (2–) 3–5(–7)  $\mu\text{m}$  wide in water and becoming wider, to (3–)4–8(–9)  $\mu\text{m}$  wide in K.

Chemistry: It contains parietin (major), fallacinal (major), emodin, teloschistin (major), and parietinic acid.

Ecology: Growing on twigs of various shrubs and trees.

Distribution: It is known so far from scattered localities in India, Asia.

Etymology: It is named after the well-known Indian lichenologist Dhara ni Dhar Awasthi (1922–2011) in recognition of his contribution to our knowledge on Indian and Asian lichen flora.

Taxonomic notes: *Gallowayella awasthiana* is similar to Middle Asian taxon *G. sogdiana* (S. Y. Kondr. et I. Kudratov) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell, known from Tajikistan, Afghanistan, Turkmenistan, Uzbekistan and Iran, in having small thallus and small narrow thalline lobes, but differs in having smaller thallus (0.8–1 mm *vs.* 1.5–2.5(–5) mm diam./across), and in having much longer thalline lobes (3–4 mm *vs.* 0.5–1.7(–3) mm long), in having wider and mostly horizontally orientated thalline lobes (0.5–0.7 mm *vs.* 0.15–0.3 mm wide, richly ramified, usually both erect or horizontally orientated), in having very long and easily distinct rhizines, in having smaller soredia (to 20  $\mu\text{m}$  *vs.* 30–45  $\mu\text{m}$  diam. soredia and 40–75  $\mu\text{m}$  diam. consoredia/conblastidia), in having larger apothecia (1–2.5 mm *vs.* 0.4–0.8 mm diam.), and in having much narrower ascospores (14–18(–23)  $\times$  (5.5–)6–7.5(–9)  $\mu\text{m}$  *vs.* (12–)14–18  $\times$  8.4–12.2  $\mu\text{m}$ ), and narrower ascospore septum (3–5  $\mu\text{m}$  *vs.* 7.2–9.6  $\mu\text{m}$  wide) (Kondratyuk 2004, Kondratyuk *et al.* 2010).

*Gallowayella awasthiana* is also likely to be confused with *G. weberi* (S. Y. Kondr. et Kärnefelt) L. Lindblom after having almost the same narrow thalline lobes, but differs in the lack of 'ulophyllodes'-type soralia (blastidious zone on underside of thalline lobes), and in having mainly darker orange (*vs.* poorly yellow) thallus, in having 'micro-huculica'-type soralia, as well as in distribution (*vs.* South American taxon), and in the lack of uplifted (bent upwards) and distinctly widened towards the tips terminal portions with soredious underside (somewhat unique 'weberi'-type of soralia).

*Gallowayella awasthiana* is also likely to be confused with *G. gallowayi* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell after almost the same dark reddish orange, narrowly lobed, soresidious thallus, but differs in having wider thalline lobes (0.5–0.7 mm *vs.* 0.14–0.25(–0.4) mm wide), and in having narrower ascospores (14–18(–23) × (5.5–)6–7.5(–9) μm *vs.* 13–17(–18) × (6–)8–10 μm) and in having narrower ascospore septum (3–5 μm *vs.* 6–7(–9) μm wide), as well as in the lack of 'ulophyllodes'-type soralia (blastidious soredia produced from the lower surface of thalline lobes).



Fig. 8. *Gallowayella awasthiana* (holotype), enlarged fragments with soralia (top), dissected marginal fragments (bottom left) and apothecia (bottom right). Scale 0.5 mm. (Photos of S. Kondratyuk)

*Gallowayella awasthiana* is similar to the Northern Hemisphere taxa *G. fulva* (Hoffm.) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell, and *G. borealis* (R. Sant. et Poelt) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell, but differs from the latter taxa in having much longer thalline lobes (3–4 mm *vs.* 0.5–0.7 mm long in *G. fulva* and 1.5–2.5(–4) mm long in *G. borealis*), in having much narrower thalline lobes (0.5–0.7 mm *vs.* 1–2 mm wide in *G. fulva*, and 0.3–0.4 mm wide at the basis and widened to (1–)1.5–2.5 mm wide towards the tips in *G. borealis*), in having horizontally orientated thalline lobes (*vs.* vertically orientated or ascending/erect in both taxa), in having ‘micro-*huculica*’-type of soralia, as well as in the lack of ‘ulophyllodes’-type of soralia.

*Gallowayella awasthiana* is similar to North American taxon *G. tibellii* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell (= *Oxneria tibellii* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr. et Kärnefelt) in having small thallus, small narrow thalline lobes forming somewhat multistore thallus where mosaic of whitish yellow rhizines and dark orange thalline lobes are observed, but differs in having longer and wider thalline lobes (3–4 mm *vs.* 0.1–1.5(–2) mm long, and 0.5–0.7 mm *vs.* 0.2–0.3 mm wide), in the lack of dissections into the very narrow (to 0.1–0.2 mm wide/across) secondary lobules, and in having ‘micro-*huculica*’-type of soralia, as well as in having larger apothecia (0.7–2 mm *vs.* 0.3–0.5 mm diam.), and in having larger (much longer and wider) ascospores (14–18(–23) × (5.5–)6–7.5(–9) μm *vs.* 10–13 × 5–6.5 μm) (Kondratyuk 2004).

*Gallowayella awasthiana* is also likely to be confused with the North American taxon *Honeggeria rosmariae* (S. Y. Kondr. et Kärnefelt) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell, but differs in having wider thalline lobes (0.5–0.7 mm *vs.* 0.1–0.2 mm wide), in having narrower (*ca* 50–60 μm *vs.* 90–100 μm wide) and longer (0.8–1(–1.5) mm *vs.* 0.3–0.4 mm long) rhizines, in having mesodermatous paraplectenchymatous true exciple (*vs.* often indistinct or poorly developed, of ‘*textura intricata*’), in having longer and narrower ascospores (14–18(–23) × (5.5–)6–7.5(–9) μm *vs.* 11–14 × 7–10 μm), and in having narrower ascospore septum (3–5(–7) μm *vs.* (3–)5–8 μm wide), in having smaller soredia (to 20 μm *vs.* 35–50(–60) μm diam.) (Fedorenko *et al.* 2012, Lumbsch *et al.* 2011).

*Gallowayella awasthiana* is similar to the Northern Hemisphere species *Oxneria ulophyllodes* (Ras.) S. Y. Kondr. et Kärnefelt in having richly presented rhizines on underside well seen along the lobe edges and the well-developed cortex on underside, and in having highly uplifted thallus above the substrate level owing to abundant layer of rhizines, but differs in having much smaller thallus, in having much narrower and strip-like thalline lobes (0.5–0.7 mm *vs.* 0.3–0.4(–0.7) mm wide in the narrowest and to 2.5–3.5 mm wide towards the tips), in having very small, ‘micro-*huculica*’-type of soralia, i.e. with uplifted



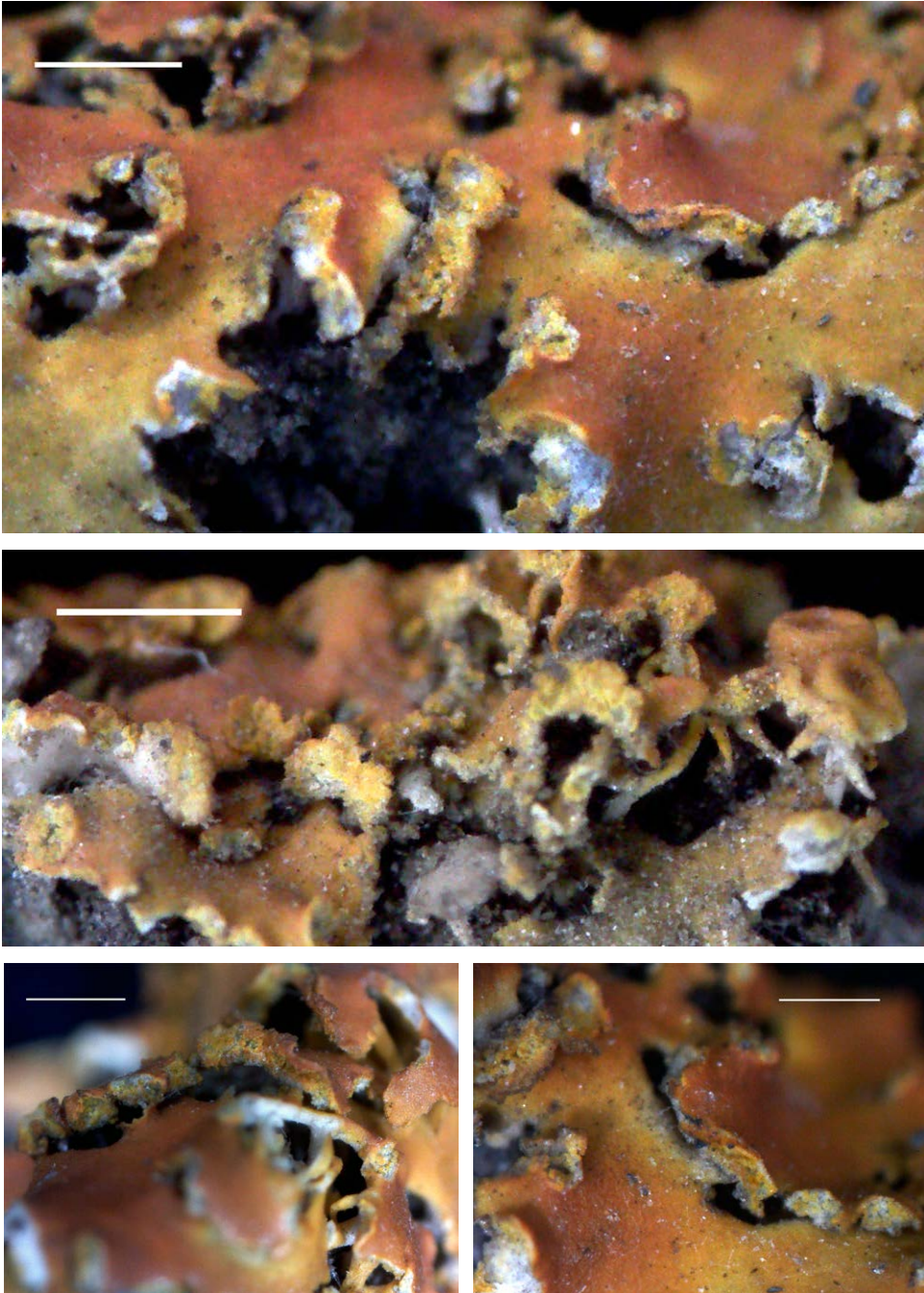


Fig. 9. *Gallowayella awasthiana* (holotype), enlarged fragments with soralia. Scale 0.5 mm. (Photos of S. Kondratyuk)

portions of upper cortex, somewhat micro-helmet, similar to *Oxneria huculica*, but smaller in size), in having smaller soredia (to 20  $\mu\text{m}$  diam. *vs.* 25–35  $\mu\text{m}$  diam., while isidioid soredia to 50–80(–125)  $\mu\text{m}$  diam./across), in having much longer and narrower ascospores ((13–)14–18(–23)  $\times$  (5.5–)6–7.5(–9)  $\mu\text{m}$  *vs.* 10.5–12.5(14.5)  $\times$  (5.5–)7–8  $\mu\text{m}$ ), and in having much narrower ascospore septum (3–5  $\mu\text{m}$  *vs.* 5.5–6.5(–7)  $\mu\text{m}$  wide) as well as in the lack of ‘*ulophyllodes*’-type of soralia (*vs.* blastidious zone on underside).

From *Oxneria alfredii* (S. Y. Kondr. et Poelt) S. Y. Kondr. et Kärnefelt, which is the esorediate counterpart species of *O. ulophyllodes*, known from deciduous trees in eastern Asia (Japan, Russia, China, South Korea), *Gallowayella awasthiana* differs in having much smaller thallus and thalline lobes, in having soralia (*vs.* esoredious and not isidious taxon), as well as in having longer and wider ascospores ((13–)14–18(–23)  $\times$  (5.5–)6–7.5(–9)  $\mu\text{m}$  *vs.* 11–14(–15.5)  $\times$  (4.5–)5–6  $\mu\text{m}$ ) (Kondratyuk 2004, Kondratyuk and Poelt 1997).

*Gallowayella awasthiana* is similar to *Oxneria huculica* S. Y. Kondr., widely distributed epiphytic species in the Northern Hemisphere, but differs in having smaller and not forming rosette-like thallus (0.8–1 cm *vs.* 1–2(–3) cm across), in having narrower (0.5–0.7 mm *vs.* 1–1.5 mm wide in the narrowest portions and 2–4(–5) mm total width with all marginal secondary lobules), in having highly uplifted above substrate level apothecia, in having ‘*microhuculica*’-type of soralia (0.2–0.3 mm across *vs.* (0.3–)0.5–0.8 mm across/wide, often coalescing in slit 0.3–0.5 mm wide and 0.5–1(–1.7) mm long), in having slightly longer and much wider ascospores ((13–)14–18(–23)  $\times$  (5.5–)6–7.5(–9)  $\mu\text{m}$  *vs.* (10–)12–16(–17)  $\times$  5–6(–7)  $\mu\text{m}$ ), and in having almost the same in water but wider in K ascospore septum ((3–)4–8(–9)  $\mu\text{m}$  *vs.* 4–6(–7)  $\mu\text{m}$  wide in K).

*Gallowayella awasthiana* is similar to *Oxneria fallax* (Hepp) S. Y. Kondr. et Kärnefelt, mainly epilithic European lichen, but differs in having smaller thallus, in having shorter thalline lobes (3–4 mm *vs.* 2.5–5(–7) mm long), in having thallus with well-developed and easily noticeable rhizines of *Oxneria*-type, in having well developed helmet-shaped soralia, in having narrower ascospore septum ((2–)3–5(–7)  $\mu\text{m}$  *vs.* 5–7  $\mu\text{m}$  wide), as well as in the lack of marginal lip-like soralia.

*Gallowayella awasthiana* is also similar to *Oxneria soechtingii* (S. Y. Kondr.) S. Y. Kondr. et Kärnefelt, epiphyte Asian lichen, in having elongated chains of isidious soredia, but differs in having much shorter soredious chains (to 0.3 mm long *vs.* 0.7–0.8 mm long and 50–70  $\mu\text{m}$  wide), as well as in having ‘*microhuculica*’-type of soralia.

The genus *Oxneria* S. Y. Kondr. et Kärnefelt was introduced for rather large group of xanthorioid lichens widely distributed in the Northern Hemisphere and New Zealand in premolecular era, i.e. in 2003 (Kondratyuk and Kärnefelt 2003). However, after molecular data such group as ‘*Oxneria*’ *gallowayi* and ‘*O.*’ *novozelandica* found to be positioned in separate monophyletic

branches, and they were segregated in new genera *Gallowayella* S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell and *Jesmurraya* S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur et A. Thell (Fedorenko *et al.* 2012). The genus *Oxneria* s. str. after three gene phylogeny includes only *O. alfredii* (type species), *O. afrodites*, *O. fallax*, *O. huculica*, and *O. ulophyllodes*. Taxonomic status of *O. hermonii* is still not confirmed in the *Oxneria* clade by molecular data.

Unfortunately our attempts to extract DNA from Indian specimens of *Gallowayella awasthiana* as well as *Oxneria ulophyllodes* subsp. *subsorediosa* ad int. were so far unsuccessful, and we plan to repeat this attempt with freshly collected specimens, when they will be available.

Other specimens examined: India, Uttarakhand, on [fallen] twigs together with many other genera, and *Caloplaca flavorubescens* aggr. Lat.: 30° 30' 43.4" N; Long.: 79° 33' 48.3" E; Alt.: 3,301 m a.s.l. Coll.: Himanshu Rai *et al.* [date not mentioned], (LWG, 022517). – Uttarakhand, Chamoli district, Lala, 2,000 m, on bushes [on twigs] Coll.: Shoba Rawat, 8.10.2008, (LWG); growing together with *Candelaria concolor*, *Caloplaca* aff. *pyracea*, as well as species of the genera *Phaeophyscia* and *Physcia*. Coll.: Shukla, V., Joshi, Y., 21.06.2005 [without number] (LWG, voucher SK E17); the same locality, associated with *Candelaria concolor*, *Caloplaca* aff. *pyracea*, *Phaeophyscia* spp., and *Physcia* spp. Coll.: Shukla, V., Joshi, Y., 21.06.2005 (LWG 05-005209, voucher SK E17); the same locality, on rock. Coll.: Shukla, V., Joshi, Y., 21.06.2005 (LWG 05-005381); no data in label provided (LWG 07-011179). – Kashmir, Pahalgoon, on bark of tree growing together with *Xanthoria parietina*, alt. 2,000 m a.s.l. Coll.: Awasthi, D. D. (2633), 1.11.1953 (LWG ex D. D. Awasthi herb. 2633). – Jammu and Kashmir, Doda district, Bhalla, on bark. Coll.: Reema Gani, 04.06.2012 (LWG 012-019753).

*Huriella pohangensis* S. Y. Kondr., L. Lőkös et J.-S. Hur, *spec. nova*  
(Fig. 10)

Mycobank no.: MB 824390.

*Similar to Huriella loekoesiana, but differs in having larger thalline areoles, larger and many apothecia per thalline areole; in having wider thalline exciple, and larger cell lumina of paraplectenchymatous true exciple, in having less swollen paraphyses tips, longer and wider ascospores, as well as narrower ascospore septum.*

Type: Republic of Korea. Gyeongsangnam-do, Pohang, Nam-gu, Guryongpo-eup, Guryongpo-ri, on siliceous seashore rock. Lat.: 35° 59' 39.36" N; Long.: 129° 33' 59.91" E; Alt.: 5 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (170207), 29.05.2017 (KoLRI 044331 sub *Huriella* – holotype).

Thallus 5–8(–12) mm diam./across, crustose, areolate, not squamulose, sometimes rather indistinct, consisting mainly of scattered and distant squamules and mostly seen owing to aggregated apothecia, dull greenish yellow

to dull yellowish-brownish or yellowish greenish; thalline areoles mainly with horizontally orientated edges. Areoles usually rather larger (0.4–)0.8–1.7 mm diam./across, even very small areoles *ca* 0.4 mm across with apothecia, soon becoming completely covered by numerous apothecia.

Apothecia very small, 0.3–0.7(–0.8) mm diam., in section 0.22–0.27 mm thick, lecanorine or zeorine to biatorine, where thalline margin seen only at sides or at the basis concolorous with thallus, greenish yellow; disc and own margin darker of thallus, dull brownish yellow to reddish orange, own margin to 40–60  $\mu$ m wide, slightly arising level of disc; usually (1–)4–7(–12) apothecia per thalline areole; in section zeorine, thalline exciple to 100  $\mu$ m thick, developed in lower part of apothecia (or at its basis), cortical layer to 15  $\mu$ m thick, paraplectenchymatous, often much thinner or indistinct; algal cells to 11–16  $\mu$ m diam.; true exciple to (40–)70–90  $\mu$ m thick in the uppermost lateral portion, to (15–)20–25  $\mu$ m thick in lower lateral and basal portions, leptodermatous paraplectenchymatous, cell lumina to 5–9(–12)  $\mu$ m across, in basal portion more or less to mesodermatous paraplectenchymatous; hymenium to 65  $\mu$ m high; paraphyses distinctly swollen towards the tips, to 4  $\mu$ m diam.; subhymenium 40–50  $\mu$ m thick, paraplectenchymatous, hyaline, without oil; ascospores widely ellipsoid, sometimes with more or less attenuated ends, (9–)12–14(–15)  $\times$  (5.8–)6–7(–7.5)  $\mu$ m in water (45 measurements), and (9–)11–14(–15)  $\times$  (6–)6.5–9  $\mu$ m in K (50 measurements); ascospore septum to (1.5–)2–3(–4)  $\mu$ m wide in water, and to (3.5–)4–6(–7)  $\mu$ m wide in K.

Chemistry: Epihymenium, true exciple and cortical layer of thalline exciple as well as of thallus K+ purple.

Ecology: Growing on siliceous and calcium containing rocks, including concrete walls and surfaces, as well as plastic surfaces. Probably one of the most widely distributed species playing role of the pioneer of lichen cover on man-made substrates in South Korea.

Etymology: This species is named after the type locality, i.e. Pohang city in eastern coastal part of South Korea (E Asia).

Distribution: It is known from scattered localities of South Korea (E Asia), where often locally represented very abundantly.

Taxonomic notes: *Huriella pohangensis* is similar to *H. loekoesiana* S. Y. Kondr. et D. K. Upreti, recently described from coastal siliceous rocks of South Korea (E Asia), but differs in having much larger thalline areoles ((0.4–)0.8–1.7 mm *vs.* (0.2–)0.3–0.8(–1) mm across), in having larger apothecia (0.3–0.7(–0.8) mm *vs.* 0.2–0.4(–0.5) mm diam.), in having many (7–11 *vs.* 1–2) apothecia per thalline areole; in having wider thalline exciple (to 100  $\mu$ m *vs.* 40–50  $\mu$ m thick), in having much larger cell lumina of paraplectenchymatous true exciple (5–9(–12)  $\mu$ m *vs.* 3–5  $\mu$ m diam./across), in having less swollen paraphyses tips (to 4  $\mu$ m *vs.* to 5(–6)  $\mu$ m wide), in having longer and wider ascospores (12–14(–15)  $\times$  (5.8–)6–7(–7.5) *vs.* (8.5–)9–11(–12)  $\times$  (4.5–)5–6  $\mu$ m), as well as in

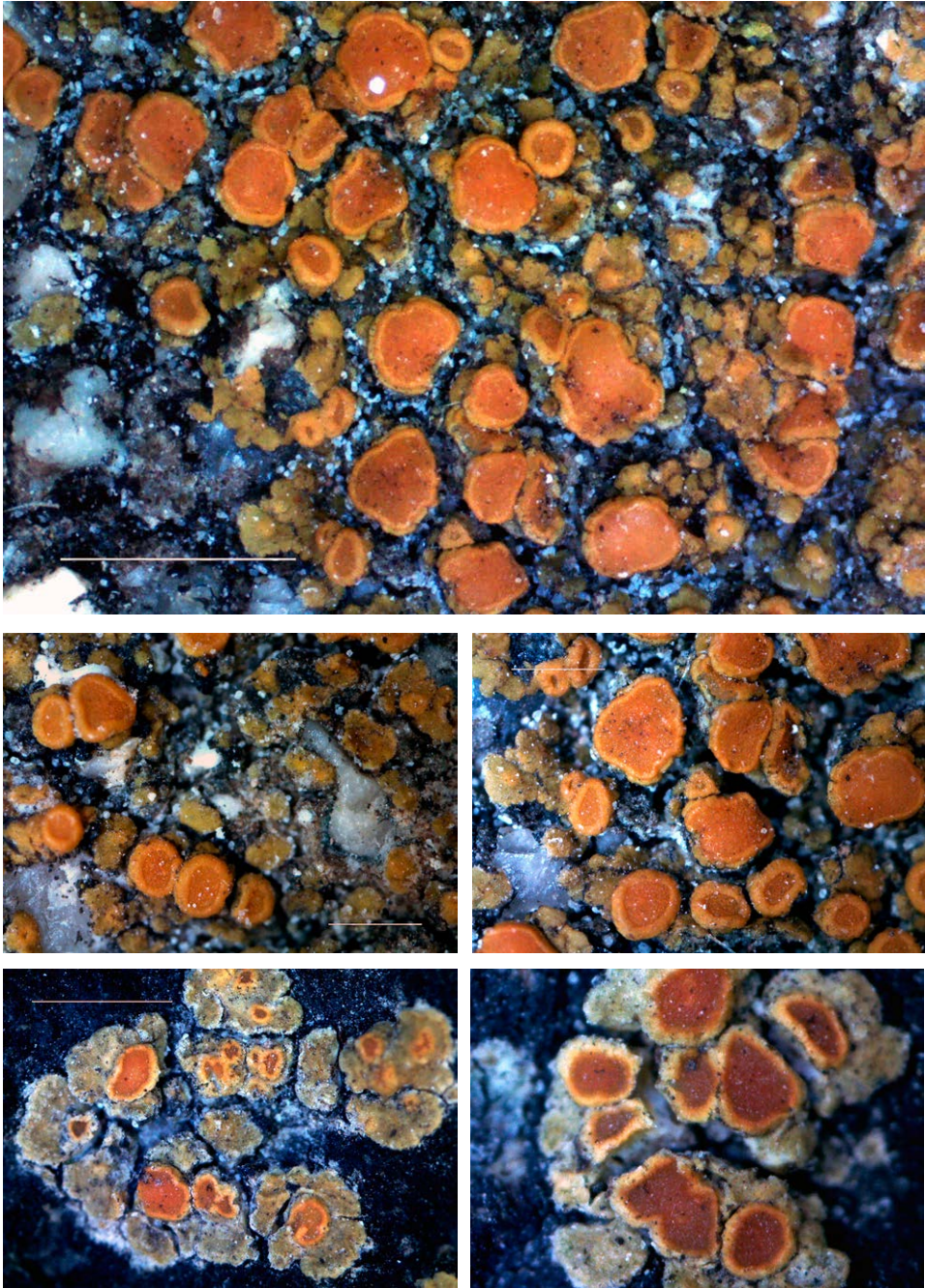


Fig. 10. *Huriella pohangensis* (holotype, centre and bottom; no. 160473, top), general habit. Scale 1 mm (top left), 2 mm (centre) and 0.5 mm (the others). (Photos of S. Kondratyuk)

having narrower ascospore septum ((1.5–)2–3(–4)  $\mu\text{m}$  *vs.* (3.5–)4–5(–6)  $\mu\text{m}$  wide) (see also Kondratyuk *et al.* 2017a).

*Huriella pohangensis* is similar to *Squamulea subsoluta* (Nyl.) Arup, Søchting et Frödén, but differs in having areolate thallus (*vs.* squamulose), in having many apothecia (7–11 *vs.* 1–4) per thalline areole, in having longer ascospores (12–14(–15)  $\times$  (5.8–)6–7(–7.5)  $\mu\text{m}$  *vs.* 9.5–12.5(–14)  $\times$  5.5–7  $\mu\text{m}$ ), and in having narrower ascospore septum (2–3  $\mu\text{m}$  *vs.* 3–4  $\mu\text{m}$  wide) (Wetmore 2003).

*Huriella pohangensis* is similar to *Squamulea squamosa* (B. de Lesd.) Arup, Søchting et Frödén, but differs in having longer ascospores ((9–)12–14(–15)  $\times$  (5.8–)6–7  $\mu\text{m}$  *vs.* (9.5–)11–12.5  $\times$  5.5–7  $\mu\text{m}$  after Wetmore 2003).

After having very small thalline areoles, seen as 0.2–0.3 mm portions around apothecia may be accepted as *Squamulea micromera* (Hue) S. Y. Kondr., L. Lőkös et J.-S. Hur, but differs in having areolate thallus (*vs.* squamulose), in having plane (*vs.* more or less subconvex) and larger thalline areoles ((0.4–)0.8–1.7 mm *vs.* 0.2–0.3 mm diam./across), in having many apothecia (7–11 *vs.* 1–2) per thalline areole, in having larger and being zeorine or lecanorine apothecia (0.3–0.7(–0.8) mm *vs.* 0.2–0.3(–0.4) mm diam., mostly biatorine), in having thinner true exciple in basal portion (20–25  $\mu\text{m}$  *vs.* 40–60  $\mu\text{m}$  thick), and in having longer ascospores (12–14(–15)  $\times$  (5.8–)6–7(–7.5)  $\mu\text{m}$  *vs.* 9–12  $\times$  6–7(–7.5)  $\mu\text{m}$ ).

It should be emphasised that taxonomic status of *Huriella pohangensis* (in the *Huriella* branch of the subfamily Xanthorioideae) is waiting for confirmation by molecular data from freshly collected specimens.

Additional specimens examined: Republic of Korea. Jeju-do, Seogwipo-si, Gangjeong-dong, Yeongtto waterfall, on rock, growing together with *Acarospora ulleungdoensis*. Lat.: 33° 16' 01.7" N; Long.: 126° 29' 49.00" E; Alt.: ca 210 m a.s.l. Coll.: Joshi, Y., So, J.-E. (140595), 19.06.2014 (KoLRI 022989 sub *Huriella*). – Jeju-do, Seogwipo-si, Seongsan-eup, Goseong-ri, Seokjicoji, rock. Lat.: 33° 19' 21.0" N; Long.: 126° 50' 49.03" E; Alt.: ca 69 m a.s.l. Coll.: Gagarina, L. (140355), 19.06.2014 (KoLRI 022723 sub *Huriella*); the same locality and collector, growing together with *Agonimia cavernicola* and *Buellia stellulata*, (140363), (KoLRI 022729 sub *Huriella*). – Jeju-do, Seogwipo-si, Seongsan-eup, Ojo-ri, Mt Siksangbong, on rock. Lat.: 33° 28' 0.16" N, Long.: 126° 55' 09.36" E; Alt.: 12 m a.s.l. Coll.: Woo, J.-J. (163683), 03.07.2016 (KoLRI 041928 sub *Squamulea micromera*). – Jeollanam-do, Yeosu-si, Nam-myeon, Simjang-ri, Geumo-do, on rock, growing together with *Thelidium japonicum*. Lat.: 34° 28' 59.20" N; Long.: 127° 48' 15.48" E; Alt.: ca 4 m a.s.l. Coll.: Halda, J. P. (160440, 160442, 160443, 160446, 160448, 160449, 160450), 10.06.2016 (KoLRI 038585, KoLRI 038587, KoLRI 038587, KoLRI 038591, KoLRI 038593, KoLRI 038594, KoLRI 038595, sub *Thelidium japonicum*). – Jeollanam-do, Yeosu-si, Nam-myeon, Simjang-ri, Geumo-do, on rock, growing together with *Rinodina fimbriata*, and *Buellia* sp. Lat.: 34° 30' 52.57" N; Long.: 127° 43' 36.19" E; Alt.: ca 51 m a.s.l. Coll.: Halda, J. P. (160473), 10.06.2016 (KoLRI 038618 sub *Huriella*). – Jeollanam-do, Yeosu-si, Nam-myeon, Simjang-ri, Geumo-do, on rock. Lat.: 34° 30' 52.5" N, Long.: 127° 43' 36.6" E; Alt.: 71 m a.s.l. Coll.: Woo, J.-J. (163681), 10.06.2016 (KoLRI 041926 sub *Caloplaca*). – Jeollanam-do, Yeosu-si, Nam-myeon, Simjang-ri, Geumo-do, roadside from Yeosan Elementary School, on rock. Lat.: 34° 28' 58.9" N, Long.: 127° 48' 15.4" E; Alt.: 18 m a.s.l. Coll.: Woo, J.-J. (163674), 10.06.2016 (KoLRI 041919 sub *Caloplaca*).

*Huriella salyangiana* S. Y. Kondr. et J.-S. Hur, spec. nova

Mycobank no.: MB 824391.

*Similar to Huriella loekoesiana, but differs in having smaller thalline areoles, in having thicker cortical layer of thalline exciple, in having larger cell lumina in cortical layer and in true exciple, as well as in having smaller ascospores and in having narrower ascospore septum.*

Type: Republic of Korea. Gyeongnam Prov., Salyang Island, Tongyeong City, on rock, growing together with *Lecidella enteroleucella* and *Caloplaca* sp. Lat.: 34° 50' 33.30" N; Long.: 128° 12' 10.74" E; Alt.: ca 25 m a.s.l. Coll.: Wang, X. Y., Joshi, Y., Han, J. H. (110011), 20.04.2011 (KoLRI 012954 sub *Lecidella enteroleucella* – holotype).

Thallus 5–8(–12) mm diam./across, crustose, areolate to somewhat squamulose. Areoles usually very small and indistinct in the centre, mainly seen as numerous small 0.2–0.3 mm diam./across secondary overgrowth, in peripheral zone mainly larger to 0.3–0.5 mm across, sometimes seem to make radiating peripheral zone; areoles seem to be more or less semiconvex (especially in contrast to the other *Caloplaca* sp. with immersed apothecia growing side by side).

Apothecia very small, 0.25–0.4(–0.5) mm diam., in section 0.25 mm thick, lecanorine, thalline margin concolorous with thallus, yellow; disc darker, orange-yellow, to dark brownish orange or blackish-brownish; in section zeorine, thalline exciple to 60–70(–90) µm thick, developed in lower part of apothecia (or at its basis), cortical layer to 20–30 µm thick, paraplectenchymatous, cell lumina rounded to 7–11 µm diam.; true exciple to 60–70(–80) µm thick in the uppermost lateral portion, to 15–20 µm thick in lower lateral portion and to 20–25 µm thick in basal portion, paraplectenchymatous (of *Massjukiella* type), cell lumina to (4–)6–11 µm diam./across, rounded or radially elongated; hymenium to 50–55 µm high; paraphyses distinctly swollen towards the tips to 3–5(–5.5) µm diam.; subhymenium 20–30 µm thick; asci 8-spored, but usually with (1–)2–4(–6) adult bipolar ascospores in the same ascus with young undeveloped ascospores; ascospores rather small, widely ellipsoid to very wide and almost spherical, (6–)7–9(–10) × (4–)4.5–6.5 µm in water (24 measurements) and (6–)7–10(–11) × (4–)5.5–7(–8) µm in K (25 measurements); ascospore septum rather narrow, 2–3(–4.5) µm wide in water and becoming wider to (2–)3–6 µm wide in K.

Ecology: Growing on siliceous rocks.

Etyymology: It is named after the type locality, i.e. Salyang Island in South Korea (E Asia).

Distribution: So far known from type locality in South Korea (E Asia).

Taxonomic notes: *Huriella salyangiana* is similar to *H. loekoesiana* S. Y. Kondr. et D. K. Upreti, recently described from siliceous rocks of South Korea (E Asia), but differs in having smaller thalline areoles (0.3–0.5 mm *vs.* 0.3–0.8(–1.0) mm across), in having thicker cortical layer of thalline exciple (20–30  $\mu\text{m}$  *vs.* 10–15  $\mu\text{m}$  thick) and in having larger cell lumina of paraplectenchymatous cortical layer (7–11  $\mu\text{m}$  *vs.* 5–7  $\mu\text{m}$  diam./across), in having much larger cell lumina in paraplectenchymatous true exciple (6–11  $\mu\text{m}$  *vs.* 3–5  $\mu\text{m}$  diam./across), in having smaller ascospores ((6–)7–9(–10)  $\times$  (4–)4.5–6.5  $\mu\text{m}$  *vs.* (8.5–)9–11(–12)  $\times$  (4.5–)5–6  $\mu\text{m}$ ) and in having narrower ascospore septum (2–3(–4.5)  $\mu\text{m}$  *vs.* 4–5(–6)  $\mu\text{m}$  wide).

It should be emphasised that similarly to *Huriella pohangensis* taxonomic status of *Huriella salyangiana* is waiting for confirmation by molecular data from freshly collected specimens.

***Hyperphyscia oxneri*** S. Y. Kondr. et J.-S. Hur, *spec. nova*  
(Fig. 11)

Mycobank no.: MB 824392.

*Similar to Hyperphyscia adglutinata, but differs in having smaller and indistinct thallus, in having smaller and rather indistinct thalline lobes, in having whitish grey thallus, in having mostly indistinct soralia often covered by abundant confluent soledious mass, as well as in the lack of rhizines.*

Type: Republic of Korea. Jeollanam-do, Suncheon-si, Seokhyeon-dong, on bark of road side *Metasequoia glyptostroboides*. Lat.: 34° 58' 03.68" N; Long.: 127° 29' 20.83" E; Alt.: 18 m a.s.l. Coll.: Kondratyuk, S. Y. (160153), 01.05.2016 (KoLRI 038298 – holotype); the same locality, (160149, 160150, 160151, 160152, 160154, 160155, 160170, 160171, 160172, 160173, 160174, 160175, 160178) (KoLRI 038294, KoLRI 038295, KoLRI 038296, KoLRI 038297, KoLRI 038299, KoLRI 038300, KoLRI 038315, KoLRI 038316, KoLRI 038317, KoLRI 038318, KoLRI 038319, KoLRI 038320, KoLRI 038323 – isotypes).

Thallus to 0.5(–1) mm across/diam., consisting of very badly developed and irregularly seen mostly only at one side thalline lobes and crater-like soralia soon forming almost entire soledious mass. Thalline lobes to 0.2–0.3(–0.4) mm long and 0.2 mm wide usually irregularly developed or present only at one side, rarely seen in three or more directions from the same soralia, mostly plain, rarely to somewhat subconvex, whitish grey or light grey to slightly brownish grey especially along the edges (seen only at highest magnification, i.e. more than  $\times 100$ ), soon becoming indistinct owing to abundant soledious mass.



Soralia [0.1–](0.15–)0.2–0.25(–0.4) mm across, crater-like, very soon becoming irregular and not distinct owing to abundant confluent soredious mass, with somewhat uplifted thalline edges, sometimes somewhat whitish, with more or less semiconvex soredious mass, soon becoming indistinct owing to overcovered by abundant soredious mass, often originate at tips of slightly uplifted portions of thalline lobes *ca* 0.1 mm diam. Soredia *ca* 20–30  $\mu$ m diam., regularly rounded from scattered to forming almost entire and more or less rather thick soredious mass making main aspect of the whole thallus, mostly greenish or whitish-greenish (latter at large magnification), well contrasting to whitish grey thalline lobes. Usually without rhizines on

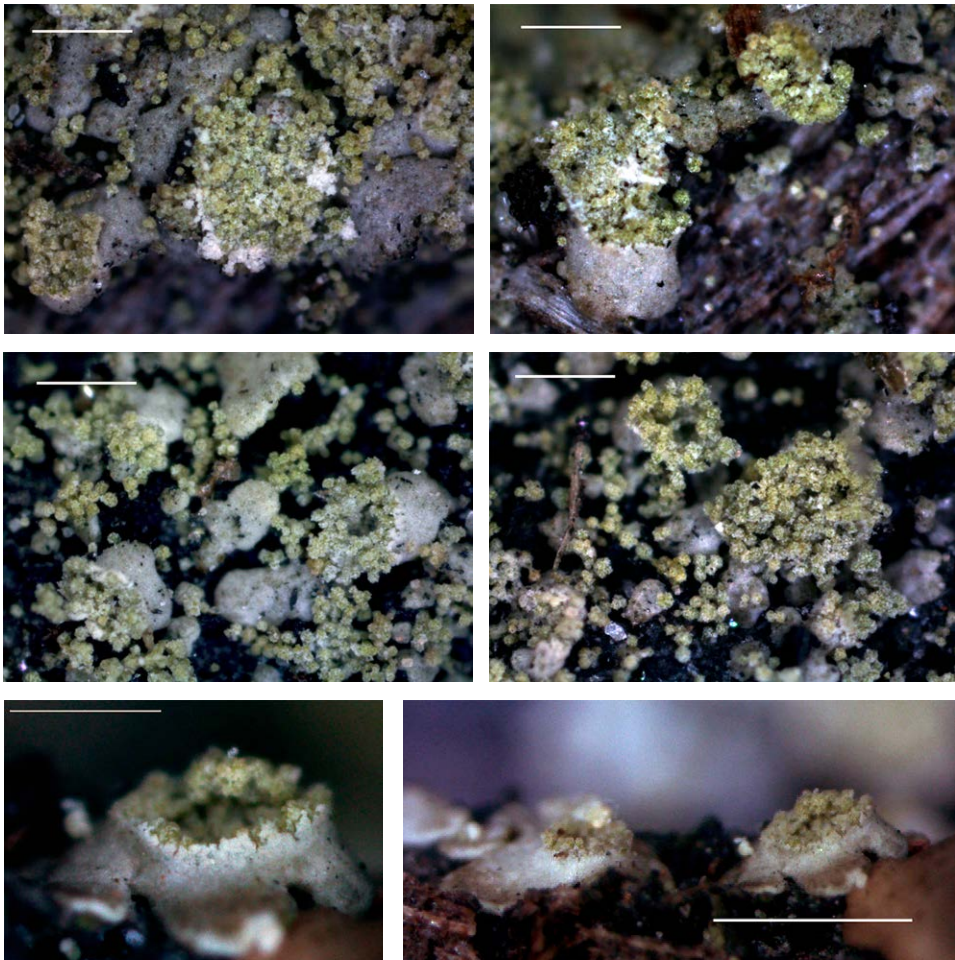


Fig. 11. *Hyperphyscia oxneri* (holotype), general habit (top and centre) and enlarged soralia (bottom). Scale 0.5 mm. (Photos of S. Kondratyuk)

underside or extremely rarely short to 0.05 mm long white rhizines were observed. Hypothallus absent.

Apothecia and conidiomata unknown.

Chemistry: All reactions negative, no substances detected by TLC and HPLC.

Ecology: On bark of road-side *Metasequoia glyptostroboides* trees, where often growing together with *Phaeophyscia adiastrata*.

Distribution: So far known from scattered localities in South Korea (E Asia), where sometimes rather abundant.

Etymology: It is named after the well-known Ukrainian lichenologist Alfred Mykolajovych Oxner (1898–1973) who has provided important revision of Eurasian lichen taxa including members of the Physciaceae (see also Oxner 1956, 1968, 1993, 2010).

Taxonomic notes: *Hyperphyscia oxneri* is similar to *H. adglutinata* (Flk.) H. Mayrhofer et Poelt known from bark of various deciduous trees and *Juniperus* trees of Europe, Asia, North America, islands of Pacific Ocean, Australia and New Zealand, but differs in having smaller and indistinct thallus (to 0.5(–) mm *vs.* to 1–2 cm across /diam.), in having smaller and rather indistinct thal-line lobes (to 0.2 mm wide *vs.* 0.25–0.5 mm wide), in having whitish grey thallus (*vs.* dark brownish grey), in having mostly indistinct soralia often covered by abundant confluent soredious mass, as well as in the lack of rhizines (with short rhizines).

*Hyperphyscia oxneri* is similar to *Mikhtomia geumohdoensis* S. Y. Kondr., Liu D. et J.-S. Hur known from South Korea in having light greyish thallus and abundant somewhat greenish grey soredious mass and being usually in sterile conditions, but differs in having lobate (not crustose) and dispersed (not forming entire film) thallus, in having crater-like soralia very soon becoming irregular and not distinct owing to abundant confluent soredious mass (*vs.* soralia regularly rounded, well constricted at the basis, torch-like and with hemispherical soredious mass), as well as in different ecology (on bark of *Metasequoia glyptostroboides* *vs.* on bark of *Zelkova serrata*) (Kondratyuk *et al.* 2017a).

*Hyperphyscia oxneri* is similar to *Phaeophyscia adiastrata* (Essl.) Essl. with which it often growing side by side but differs in having much smaller thallus and thal-line lobes, as well as in having smaller soralia and soredia and in having often scarce (not very thick and massive) soredious mass.

As far it was collected on bark of road-side *Metasequoia glyptostroboides* trees dust particles or crystals above or among soredious mass are often observed.

Other specimens examined (paratypes): Republic of Korea. Jellanam-do, Suncheon-si, Seokhyeon-dong, on bark of road side *Metasequoia glyptostroboides*, growing together with *Endocarpon* sp. Lat.: 34° 58' 03.68" N; Long.: 127° 29' 20.83" E; Alt.: 18 m a.s.l. Coll.: Kondratyuk, S. Y. (160162), 01.05.2016 (KoLRI 038307 sub *Hyperphyscia*); the same locality, growing together with *Rinodina* sp. and *Amandinea* sp. (160163), (KoLRI 038308 sub *Rino-*

dina), the same locality, growing together with *Phaeophyscia* sp. (160164), (KoLRI 038309 sub *Phaeophyscia*); the same locality, growing together with *Phaeophyscia adiastrata*, (160165), (KoLRI 038310 sub *Phaeophyscia adiastrata*); the same locality, growing together with *Amandinea punctata*, (160166, 160177), (KoLRI 038311, KoLRI 038322 sub *Amandinea punctata*); the same locality, growing together with *Candelaria concolor*, (160167, 160176), (KoLRI 038312, KoLRI 038321 sub *Candelaria concolor*); the same locality, growing together with *Phaeophyscia* sp. (160168), (KoLRI 038313 sub *Phaeophyscia*); the same locality, growing together with *Physcia* sp. and *Phaeophyscia* sp. (160169), (KoLRI 038314 sub *Physcia*); the same locality, growing together with *Mycoporum* sp. (160159), (KoLRI 038304 sub *Hyperphyscia*).

***Nectriopsis gangwondoensis*** S. Y. Kondr., L. Lőkös et J.-S. Hur, *spec. nova*

Mycobank no.: MB 824393.

*Similar to Nectriopsis physciicola, but differs in having smaller ascomata, in having much lighter, i.e.: hyaline or slightly yellowish peridium, in having larger cells of peridial wall, in having smaller ascospores, and in the lack of peridial hairs.*

Type: Republic of Korea. Gangwon-do, Jeongseon-gun, Nam-myeon, Nakdong-ri, Seonpyeong-gil, roadside trees along river, on bark of *Robinia pseudoacacia*, on thalli of *Phaeophyscia adiastrata*, growing together with *Endocarpon* with *Zwackhiomyces* sp. and *Candelaria concolor*. Lat.: 37° 19' 16.28" N; Long.: 128° 42' 53.84" E; Alt.: 360 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L., 16.09.2016. 163127 (KoLRI 041368 sub *Nectriopsis* – holotype), the same locality, 163118 (KoLRI 041359 sub *Nectriopsis* – isotype), the same locality, 163121 (KoLRI 041362 sub *Nectriopsis* – isotype), the same locality, 163123 (KoLRI 041364 sub *Nectriopsis* – isotype), the same locality, 163125 (KoLRI 041366 sub *Nectriopsis* – isotype), the same locality, 163131 (KoLRI 041372 sub *Nectriopsis* – isotype), the same locality, 163139 (KoLRI 041380 sub *Nectriopsis* – isotype).

Lichenicolous fungus growing in thalli of *Phaeophyscia adiastrata*.

Ascomata perithecioid, to 180–250 µm diam. and 150–240 µm thick, hyaline or dull yellowish, spherical, scattered or in small groups, ostiolate; exciple wall to 30–45(–50) µm thick at ostiole and to 25–30 µm thick at sides and base, hyaline or outer portion somewhat yellowish, and inner hyaline, paraplectenchymatous, cell lumina in outer layer almost spherical to 7–17 µm across while mostly 8–10(–12) µm diam., in inner layer to 6–13 × 3–6 µm; interascal tissue absent./hamathecium absent. Asci not seen in three sections! (Asci arising from the base of ascomatal cavity, 48–63 × 7–9 µm, cylindrical clavate, thin-walled, not fissitunicate, lacking any visible apical structures, 8-spored. Ascospores hyaline, 1-septate, broadly or elongate ellipsoid, the ends rounded, smooth-walled, mostly 1–2 guttulate, septum more or less median, often uneven (lens-like), (9–)11–13(–14) × (4–)6–7(–8) µm (41 measurements).

Ecology: Growing in thalli of *Phaeophyscia adiastrata*, which was found on bark of *Robinia pseudoacacia*, sometimes growing together with *Candelaria concolor*.

Distribution: So far known only from type locality, Gangwon-do Province of South Korea (E Asia), where found to be rather abundant.

Etymology: It is named after the type locality in Gangwon-do Province of South Korea (E Asia).

Taxonomic notes: *Nectriopsis gangwondoensis* is similar to *N. physciicola* D. Hawksw. et Earl.-Benn., lichenicolous fungus parasitic on bleached thalli and ascomata of *Physcia stellaris* (and *P. aipolia*?) (though not confirmed as pathogenic due to the presence of other fungi), known so far from Europe (Spain and Ireland), but differs in having smaller ascomata (*vs.* (150–)200–300(–350)  $\mu\text{m}$  wide, subglobose to discoid when fresh but collapsing centrally when dry and then appearing cupuliform or doughnut-shaped and *Lachnum*-like), in having much lighter peridium (hyaline or slightly yellowish, *vs.* pinkish, dark red around the ostiole, the colour largely obscured by a tomentum of glistening white peridial hairs); in having larger cells of peridial wall (7–17  $\mu\text{m}$  across *vs.* 7–8  $\times$  5.5–8  $\mu\text{m}$ ), and in having smaller ascospores ((9–)11–13(–14)  $\times$  (4–)6–7(–8)  $\mu\text{m}$  *vs.* (14–)14.5–18(–22.5)  $\times$  5.5–8  $\mu\text{m}$  in K becoming wider to 9  $\mu\text{m}$  wide), and in the lack of peridial hairs (*vs.* hairs to 70(–95)  $\mu\text{m}$  long and 2–4(–5)  $\mu\text{m}$  diam., unbranched, septate especially in the lower part, uneven in diameter and often swollen and broadly clavate at apices, more or less smooth-walled below but finely warted above ( $\times$ 1600)) (Earland-Bennett *et al.* 2006 see also BLS Bulletin 106: 67 (2010)).

***Porina ulleungdoensis*** S. Y. Kondr., L. Lökös, J. Halda et J.-S. Hur, *spec. nova*  
(Fig. 12)

Mycobank no.: MB 824394.

*Similar to Porina kantvilasii, but differs in having continuous (not areolated) thallus, in having smaller and hyaline, and regularly rounded perithecia, in the lack of involucrellum, in having smaller centrum of perithecium and in having less number of septa in ascospores, and in having wider ascospores, as well as in its distribution.*

Type: Republic of Korea. Gyeongsangbuk-do, Ulleung-do Island, Ulleung-gun, Ulleung-eup, Dodong-ri, Seonginbong trail, on siliceous rock, growing together with *Ionaspis* sp. and soredious crust. Lat.: 37° 29' 29.25" N; Long.: 130° 53' 12.31" E; Alt.: 560 m a.s.l. Coll.: Kondratyuk, S. Y., Lökös, L. (161386), 08.07.2016 (KoLRI 039594 – holotype); the same locality, growing together with *Ionaspis* sp. and *Dictyocatenuclata alba*, (161387), (KoLRI 039595 – isotype).

Thallus epilithic, pale to dark greenish grey, matt, uneven, continuous to slightly cracked, colour unchanging or becoming somewhat greenish when wetted, surface more or less smooth to irregularly uneven or verruculose. Hypothallus usually not apparent.

Perithecia to 220  $\mu\text{m}$  diam., usually solitary, superficial, rarely slightly immersed into the substratum, but immersed in hemispherical to subglobose thalline verrucae, usually regularly rounded. Ostiole inconspicuous or sometimes seen. Thalline portion to 35–45  $\mu\text{m}$  thick, except to 25–35  $\mu\text{m}$  thick while at the ostiole to 50–60  $\mu\text{m}$  thick, hyaline throughout, centrum to 100–200  $\mu\text{m}$  in diam., asci 90–110  $\times$  14–20  $\mu\text{m}$ , elongate cylindrical, with truncate or rounded apices; paraphyses to 1–1.4  $\mu\text{m}$  diam., simple to sparingly branched, lax; ascospores 5–6–7-septate, elongate-fusiform, straight or gently curved, with subacute ends or somewhat attenuated ends, 35–48(–55)  $\times$  (6–)7–10(–15)  $\mu\text{m}$ .

Conidiomata and conidia not seen.

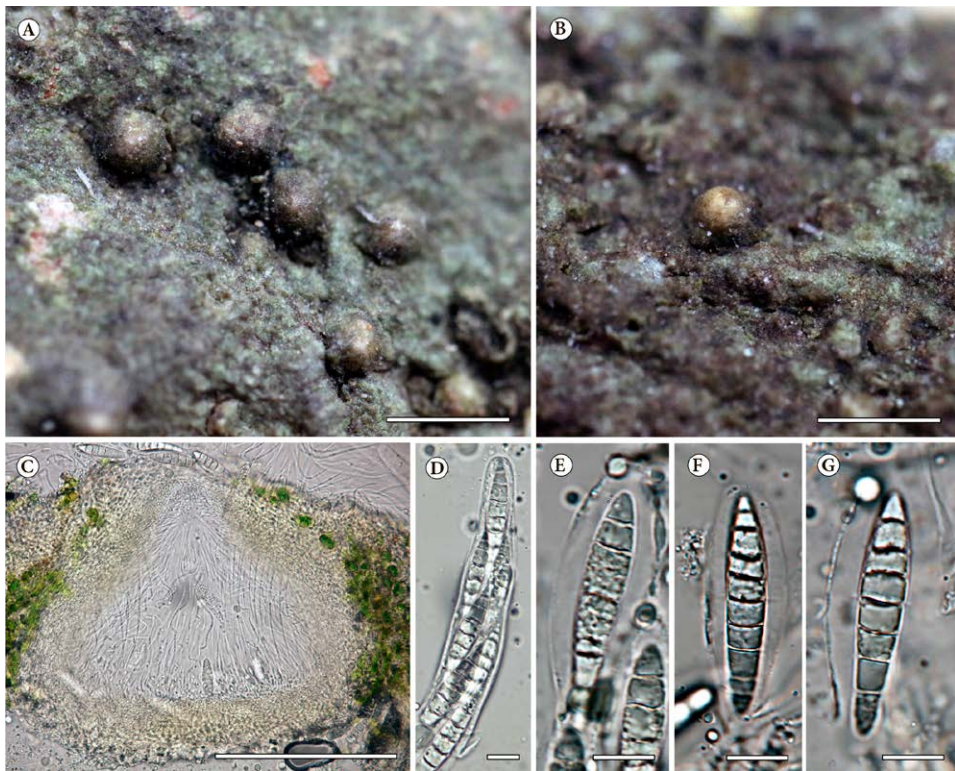


Fig. 12. *Porina ulleungdoensis* (KoLRI 39135, isotype); A, B = thallus with ascomata; C = vertical section of an ascoma; D = mature ascus; E, F, G = mature ascospores with perispore (mounted in water); Scales: A, B – 500  $\mu\text{m}$ , C – 100  $\mu\text{m}$ , D, E, F, G – 10  $\mu\text{m}$

Ecology: Growing on siliceous rocks.

Distribution: So far known from scattered localities in Ulleung-do Island, South Korea (E Asia).

Etymology: It is named after the type locality, Ulleung-do Island, South Korea (E Asia).

Taxonomic notes: *Porina ulleungdoensis* is similar to *P. kantvilasii* McCarthy, known from maritime granite, dolerite and sandstone in eastern Tasmania, islands in the Bass Strait, between Tasmania and the Australian mainland, the temperate south-western corner of Western Australia, south-western New Zealand and Campbell I, but differs in having continuous (not areolated) thallus (*vs.* with areoles (0.1–)0.3(–0.6) mm across), in having smaller and hyaline (to 220  $\mu\text{m}$  diam. *vs.* (0.22–)0.38(–0.65) mm diam.), and regularly rounded (*vs.* often constricted at the bases) perithecia, in the lack of involucrellum (*vs.* (40–)60–70(–100)  $\mu\text{m}$  thick, with an smooth to minutely rugulose-verruculose surface, uniformly medium to dark orange-brown or with an 8–15(–25)  $\mu\text{m}$  thick brown-black outer layer), in having smaller centrum of perithecium (100–200  $\mu\text{m}$  *vs.* 0.17–0.35 mm diam.) and in having less number of septa (5–7-septate *vs.* 7(–9)-septate) of ascospores, and in having wider ascospores (35–48(–55)  $\times$  (6–)7–10(–15)  $\mu\text{m}$  *vs.* (33.5–)44.5(–61.5)  $\times$  (2–)3(–4.5)  $\mu\text{m}$ ), as well as in its distribution.

*Porina ulleungdoensis* is similar to *P. simulans* Müll. Arg., known from bark in Costa Rica and from bark and siliceous rocks in southern Brazil, but differs in having greenish grey (*vs.* buff-brown to grey-brown), and K– (*vs.* K+ orange-brown) thallus, in the lack of whitish prothallus, in the lack of involucrellum (*vs.* medium to dark brown, (20–)40–80(–100)  $\mu\text{m}$  diam., while in illustration prepared by McCarthy (1993: 100, Fig. 30B, Vertical section of perithecial verruca) on the basis Malme 2717 specimen, it was not shown, or was absent, too), in having smaller and regularly rounded centrum (0.1–0.2 mm diam. *vs.* obpyriform to depressed-ovate, 0.17–0.26 mm diam.), in having less number of septa in ascospores (5–6–7-septate *vs.* (5–)7–9(–11) septate), in having ascospores without gelatinous sheath (*vs.* usually with gelatinous sheath to 2  $\mu\text{m}$  thick), and in having longer and wider ascospores (35–48(–55)  $\times$  (6–)7–10(–15)  $\mu\text{m}$  *vs.* (28–)40(–50.5)  $\times$  (5.5–)7.5(–9.5)  $\mu\text{m}$ ).

Other specimens examined: Republic of Korea. Ulleung-do, Gyeongsangbuk-do, Ulleung-gun, Seo-myeon, Sadong-ri, site 29, on rock, growing together with *Porpidia* sp. and "*Acrocordia*" sp. Lat.: 37° 29' 31.64" N; Long.: 130° 53' 06.46" E; Alt.: ca 583 m a.s.l. Coll.: Halda, J. (f. n. 336) (161044), 08.07.2016 (KoLRI 039189 sub *Porina*); the same locality, growing together with *Micarea* sp. (f. n. 342) (161050), (KoLRI 039195 sub *Micarea*). – Sadong-ri, site 30, on rock, growing together with *Verrucaria* sp. (as *Porina*). Lat.: 37° 29' 34.55" N; Long.: 130° 52' 55.05" E; Lat.: ca 612 m a.s.l. Coll.: Halda, J. (f. n. 188) (160896), 08.07.2016 (KoLRI 039041 sub *Verrucaria*); the same locality, growing together with *Dimerella* and *Verrucaria* spp. (f. n. 191) (160899), (KoLRI 039044 sub *Porina*). – Jeodong-ri, site 39, on rock. Lat.: 37°

31' 06.07" N; Long.: 130° 54' 11.03" E; Lat.: ca 264 m a.s.l. Coll.: Halda, J. (f. n. 188) (160927), 09.07.2016 (KoLRI 039072 sub *Porina*). – Taeha-ri, site 45, on rock. Lat.: 37° 30' 13.44" N; Long.: 130° 49' 49.45" E; Lat.: ca 264 m a.s.l. Coll.: Halda, J. (f. n. 282) (160990), 10.07.2016 (KoLRI 039135 sub *Porina*); the same locality, (f. n. 283) (160991), (KoLRI 039136 sub *Porina*).

*Psoroglaena gangwondoensis* S. Y. Kondr., L. Lőkös,  
J.-J. Woo et J.-S. Hur, *spec. nova*

Mycobank no.: MB 824395.

*Similar to Psoroglaena dictyospora, but differs in having more or less continuous thallus, in the lack of papillae on exposed surface of thallus, in having much larger algal cells, in having much thicker exciple and not consisting of two distinct layers, in having less distinct periphyses, in having larger ascospores with 3–5–7 transverse septa and (0–)1–2 cells with a single longitudinal septum.*

Type: Republic of Korea. Gangwon-do, Jeongseon-gun, Nam-myeon, Nakdong-ri, Seonpyeon-gil, roadside trees along river, on bark of *Robinia pseudoacacia*, growing together with species of the genera *Candelaria* and *Phaeophyscia*. Lat.: 37° 19' 16.28" N; Long.: 128° 42' 53.84" E; Alt.: 360 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (163149), 16.09.2016 (KoLRI 041392 sub *Psoroglaena* – holotype); the same locality, growing together with sterile green isidiate crust (163147) (KoLRI 041389 sub *Psoroglaena* – isotype).

Thallus epiphytic, film-like, to 60 µm thick in section, granules if present to 60–80(–90) µm across, cortical layer to 5–7(–10) µm thick.

Ascomata perithecioid, to 0.45 mm diam. and to 0.25–0.3 mm high, almost superficial on bark, light brownish in outer layer and hyaline / colorless in inner half of exciple; exciple wall to 80–90 µm thick at ostiole, where outermost layer to 30–35 µm thick dull yellow-brownish, and hyaline in inner portion, and to 30 µm thick at sides and base, hyaline; algal layer to 8–14(–17) µm diam., asci (6?)8-spored, with variegated size of ascospores, ca 80 × 13–17 µm; ascospores elongated ellipsoid, one end often wider, another end somewhat elongated (tile-like), with constrictions at the septum, one of the central cell especially wide, with 3–5–7 transverse septa and (0–)1–2 cells with a single longitudinal septum, (21–)22–29(–30) × 7–9(–10.5) µm.

Ecology: Growing on bark of deciduous tree (*Robinia pseudoacacia*), where growing together with species of the genera *Candelaria* and *Phaeophyscia*, as well as other crustose lichens.

Distribution: So far known only from type locality, Gangwon-do Province of South Korea.

Etymology: It is named after the type locality in Gangwon-do Province of South Korea (E Asia).

Taxonomic notes: After having epiphloeodal (or partly immersed) thallus, in having pale orange-brown when dry, broadly ovoid ascomata, in the lack of involucrellum, in the lack of paraphyses and in having submuriform ascospores *Psoroglaena gangwondoensis* is similar to *Psoroglaena dictyospora* (A. Orange) H. Harada, originally described from England (UK), Europe, and now known from Europe (UK, Switzerland, Sweden, Spain, Czech Republic, Germany and Ukraine), and North America (USA), but differs in having more or less continuous thallus (*vs.* consisting of more or less isodiametric goniospores 14–23 µm diam.), in the lack of papillae on exposed surface of thallus, in having much larger algal cells (8–14(–17) µm *vs.* 4–8 µm diam.), in having much thicker exciple and not consisting of two more or less distinct layers, in having less distinct periphyses (*vs.* 30 × 2 µm), in having 3–5–7 transverse (*vs.* 5(–6)) and (0–)1–2 cells with a single longitudinal septum (*vs.* (0–)1–3(–4) cells with a single longitudinal septum and larger ascospores ((21–)22–29(–30) × 7–9(10.5) µm *vs.* 17–21(–25) × (6–)6.5–8 µm).

***Pyrenopsis cavernicola*** S. Y. Kondr., L. Lőkös et J.-S. Hur, *spec. nova*  
(Fig. 13)

Mycobank no.: MB 824396.

*Similar to Pyrenopsis chejudoensis, but differs in having larger, and distinctly areolate thallus, consisting mainly of scattered, distant and smaller thalline areole, in having mostly well-developed and uplifted lecanorine apothecia, in having 8-spored asci, and in having much larger ascospores.*

Type: Republic of Korea. Jeju-do, Seogwipo-si, Seongsan-eup, Goseong-ri, Seopjicoji, on rock growing together with *Squamulea micromera*, and *Verrucaria* sp. Lat.: 33° 19' 21.0" N; Long.: 126° 50' 49.03" E; Alt.: ca 69 m a.s.l. Coll.: Gagarina, L. (140366), 19.06.2014 (KoLRI 022731 sub *Squamulea micromera* – holotype); the same locality, growing together with *Squamulea micromera*, *Orientophila leucorythrella*, *Buellia ulleungdoensis*\*, *Rinodina oxydata* and *Verrucaria* sp. (140353), (KoLRI 022721 sub *Squamulea micromera* – isotype); the same locality, growing together with *Squamulea micromera* and *Buellia/Aspicilia* sp. (140357), (KoLRI 022725 sub *Squamulea micromera* – isotype).

Thallus (0.2–)0.5–2 cm across, blackish or blackish brown, crustose, distinctly areolate, consisting of distant and scattered areoles (0.075–)0.1–0.3 mm diam./across very variegated in shape, from very thin and plane to semiconvex, mostly distant and scattered (distance between areole is equal with size

\* *Buellia ulleungdoensis* is new to Jeju-do Island.



of areole), rarely more closely aggregated; sterile areoles to 0.15–0.2 mm thick or more, fertile areoles twice or more thicker of sterile ones. Prothallus absent.

Apothecia to 0.15–0.2 mm diam., lecanorine, sitting above rounded thal-line areoles and well distinct, highly uplifted above thallus level, to 0.2 mm high, and widely open, sometimes seem to be overmature/apothecia with empty content, or immersed in convex thalline warts to 0.2–0.3 mm diam. and similar to perithecium (somewhat similar to *Psoroglaena*), with very narrow 40–60  $\mu\text{m}$  wide 'ostiole' like formation, concolorous with thallus, very variegated in shape; exciple or outermost hyaline paraphyses I+ blue; hymenium 70–80  $\mu\text{m}$  high, IKI+ blue; paraphyses to 7–8  $\mu\text{m}$  diam., while lumina to 1.5–2

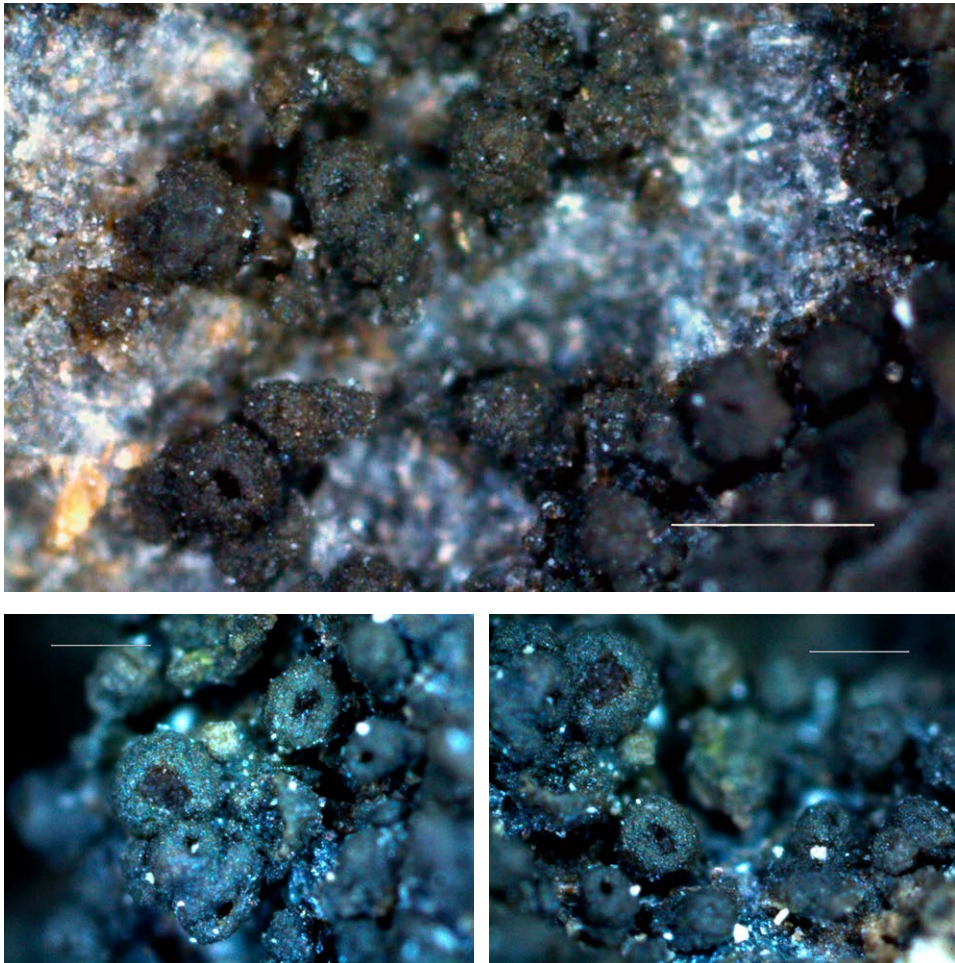


Fig. 13. *Pyrenopsis cavernicola* (140366, holotype), general habit (top) and enlarged apothecia. Scale 0.5 mm. (Photos of S. Kondratyuk)

$\mu\text{m}$  diam. (in K paraphyses to  $3.5 \mu\text{m}$  thick at tips); asci 8-spored,  $50\text{--}55 \times 12\text{--}16 \mu\text{m}$ ; ascospores elongated ovoid or ellipsoid, from hyaline to slightly brownish or yellow ochre,  $(9\text{--})10\text{--}16(\text{--}17) \times (5.5\text{--})6\text{--}8(\text{--}10) \mu\text{m}$  (40 measurements).

Ecology: Growing on volcanic rocks in coastal zone sometimes associated with *Squamulea* cf. *micromera*, *Orientophila leucorythrella*, *Buellia ulleungdoensis*, *Rinodina oxydata*, as well as species of the genera *Aspicilia*, *Buellia* and *Verrucaria*.

Etymology: Species name reflects preference of this taxon to small cavities, cavernulas of volcanic rocks.

Distribution: It is known from type locality from Jeju-do Island, South Korea (E Asia).

Taxonomic notes: *Pyrenopsis cavernicola* is similar to recently described South Korean lichen *P. chejudoensis* L. Lökös, S. Y. Kondr. et J.-S. Hur, but differs in having larger ( $0.5\text{--}2 \text{ cm}$  vs. to  $0.5 \text{ cm}$  across), and distinctly areolate thallus, consisting mainly of scattered, distant and smaller thalline areole ( $0.1\text{--}0.3 \text{ mm}$  vs.  $0.2\text{--}0.7 \text{ mm}$  across), in having mostly well-developed and uplifted lecanorine apothecia (vs. immersed into thalline warts), in having 8-spored asci (vs. asci with 16 or more ascospores), and in having much larger ascospores ( $(9\text{--})10\text{--}16(\text{--}17) \times (5.5\text{--})6\text{--}8(\text{--}10) \mu\text{m}$  vs.  $5\text{--}6(\text{--}7) \times 3.5\text{--}4(\text{--}4.5) \mu\text{m}$  (Kondratyuk *et al.* 2016a).

*Pyrenopsis cavernicola* is similar to *P. impolita* (Th. Fr.) Forssell, a very rare European lichen growing on water-flushed, upland, siliceous rocks, but differs in having much thinner hymenium ( $70\text{--}80 \mu\text{m}$  vs.  $100\text{--}125 \mu\text{m}$  high), as well as in having larger ascospores ( $(9\text{--})10\text{--}16(\text{--}17) \times (5.5\text{--})6\text{--}8(\text{--}10) \mu\text{m}$  vs.  $(5\text{--})8\text{--}10 \times (5\text{--})7\text{--}8 \mu\text{m}$ ).

*Pyrenopsis cavernicola* is similar to *P. grumulifera* Nyl., a rare lichen species known from moist mica-schist rocks usually above  $700 \text{ m}$  alt., recorded also from sea-level basalt damp in Europe and North America, but differs in having 8-spored asci (vs. 64 or more), and in having larger ascospores ( $(9\text{--})10\text{--}16(\text{--}17) \times (5.5\text{--})6\text{--}8(\text{--}10) \mu\text{m}$  vs.  $4.5\text{--}7 \times 2\text{--}3 \mu\text{m}$ ) and in having chlorococcoid, single or clustered photobiont cells (vs. *Gloeocapsa* enclosed in red-brown sheaths).

*Pyrenopsis cavernicola* can be compared with *Pterygiopsis cava* M. Schultz, growing on inclined acidic rock surfaces and seepage tracks of North America, but differs in having crustose thallus (vs. dwarf-fruticose thallus), in having smaller apothecia ( $0.15\text{--}0.2 \text{ mm}$  vs.  $0.35\text{--}0.55 \text{ mm}$  wide), in having thinner hymenium ( $70\text{--}80 \mu\text{m}$  vs.  $125\text{--}150 \mu\text{m}$ ), in having 8-spored asci (vs. 24–32-spored), and in having larger ascospores ( $(9\text{--})10\text{--}16(\text{--}17) \times (5.5\text{--})6\text{--}8(\text{--}10) \mu\text{m}$  vs.  $4\text{--}6 \times 4\text{--}5 \mu\text{m}$ ).

The best developed fertile areoles of *Pyrenopsis cavernicola* are located in small cavernulas of volcanic rocks and difficult for section and photo accession. Sometimes thalline areoles with widely gaped apothecia seem to be with empty ascomata among much younger apothecia observed.

*Rhizocarpon sunchonense* S. Y. Kondr. et J.-S. Hur, *spec. nova*  
(Fig. 14)

Mycobank no.: MB 824397.

*Similar to Rhizocarpon norvegicum, but differs in having larger thallus, smaller and thinner plane thalline areoles, dull greenish thallus, narrower cortical layer, smaller and thinner, mostly plane apothecia, brown epihymenium, lower hymenium, thinner and hyaline subhymenium, widely swollen paraphyse tips, medulla I–, and in having K– epihymenium and exciple.*

Type: Republic of Korea. Jeollanam-do, Suncheon-si, Yongsang-dong, Mt top behind artificial lake, on siliceous rocks in pine forest or in open areas, on rock, growing together with *Xanthoparmelia coreana*, *Rhizocarpon* sp. Lat.: 34° 58' 22.11" N; Long.: 127° 30' 21.79" E; Alt.: 277 m a.s.l. Coll.: Kondratyuk, S. Y. (164018), 17.12.2016 (KoLRI 042286 sub *Rhizocarpon sunchonense* – holotype); the same locality and collector, growing together with *Xanthoparmelia coreana*, (164017), (KoLRI 042285 sub *Rhizocarpon sunchonense* – isotype).

Thallus 4–5 cm across or in larger aggregations (at larger marginification citrine or yellow-green), and dull green or dark greenish without lens owing to numerous small black apothecia making darker general habit; areolate, without lobate portions in the peripheral portion; areoles very small, 0.1–0.3 (–0.4) mm diam./across, slightly distant to densely aggregated, divided by very thin (to 20 µm wide) cracks. Hypothallus absent.

Apothecia (0.15–)0.2–0.3(–0.4) mm diam. (in section to 0.18 mm thick), very numerous and making darker aspect of the whole thallus, mostly distant, regularly rounded, lecideine, own margin usually distinct, black concolorous with disc, sometimes somewhat greenish black or citrine-black, to 40 µm thick; in section lecideine, but true exciple well developed only in lateral portion; true exciple to 20 µm thick in the uppermost and lower lateral portions, and to 20–35 µm thick in lateral-basal portion, dark brown to blackish brown, while in the centre not developed; hymenium to 40 µm high, more or less greyish or brownish; epihymenium to 10–15 µm thick, medium to dark brown; paraphyses distinctly swollen to 3–5(–6) µm wide; subhymenium to 50 µm thick, hyaline, without oil; asci 8-spored, 30–35 × 13–18 µm; ascospores 1-septate dark greenish black or dark brown, widely ellipsoid, with more or less rounded ends, not constricted at septum, straight to slightly curved, 9–12 × 5–6(–6.5) µm (20 measurements).

Chemistry: All elements of apothecium and thallus K–. Chemistry not studied.

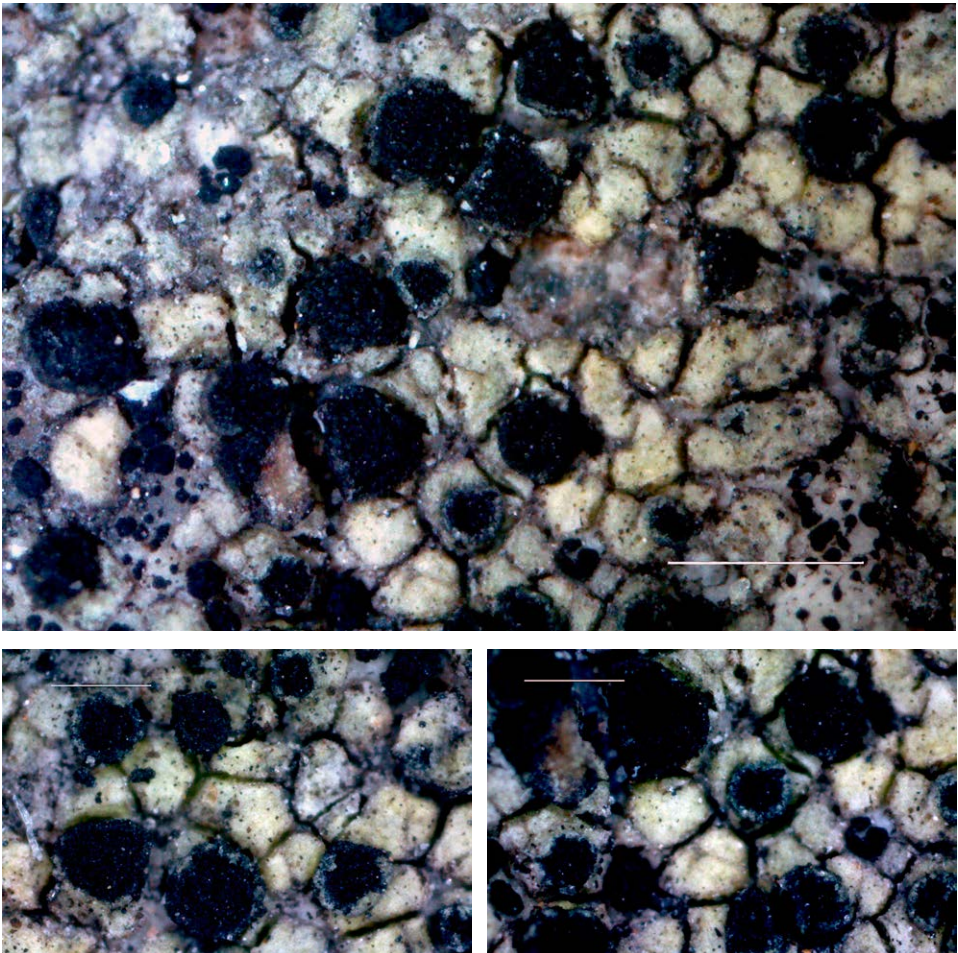
Ecology: Growing on siliceous rocks.

Distribution: So far known from South Korea (E Asia).

**Etymology:** It is named after the type locality, i.e. Sunchon city of Jeollanam-do Province of South Korea (E Asia).

**Taxonomic notes:** *Rhizocarpon sunchonense* is similar to *R. superficiale* (Schaer.) Malme, but differs in having smaller ascospores, smaller apothecia and all elements of apothecium as well as in the lack K<sup>+</sup> reaction and in the lack of norstictic acid.

*Rhizocarpon sunchonense* is similar to *Rhizocarpon norvegicum* Räsänen growing on schist and calcium containing rocks in Arctic and alpine regions of Eurasia, North America and Greenland, but differs in having larger thallus (4–5 cm across *vs.* 0.2–0.5 cm in diam., as separate groups of areoles and apothecia), in having smaller and thinner plane thalline areoles (0.1–0.3(–0.4)



**Fig. 14.** *Rhizocarpon sunchonense* (164018, holotype), general habit (top) and enlarged apothecia. Scale 0.5 mm. (Photos of S. Kondratyuk)

diam./across *vs.* 0.3–0.7 mm diam., and to 0.5 mm thick, strongly convex), in having dull greenish thallus (*vs.* yellow to bright yellow), in having smaller and thinner, mostly plane apothecia ((0.15–)0.2–0.3(–0.4) mm diam., and to 0.18 mm thick *vs.* 0.3–0.7 mm diam., and 0.2–0.5 mm thick, mostly convex to strongly convex), in having brown epihymenium (*vs.* reddish), in having lower hymenium (to 40  $\mu\text{m}$  high *vs.* 60–90  $\mu\text{m}$  high), in having thinner and hyaline subhymenium (to 50  $\mu\text{m}$  thick *vs.* 100–200  $\mu\text{m}$  thick, dark brown), in having widely swollen paraphyse tips (to 3–5(–6)  $\mu\text{m}$  wide *vs.* to 2–3  $\mu\text{m}$  wide, slightly clavate), in having medulla I– (*vs.* I+ blue), in having K– epihymenium and exciple (*vs.* K+ red), while ascospore measurements of these two taxa overlapping (9–12  $\times$  5–6(–6.5)  $\mu\text{m}$  *vs.* 9–15  $\times$  4–8  $\mu\text{m}$ ).

*Rhizocarpon sunchonense* is similar to *R. effiguratum* (Anzi) Th. Fr. (especially after measurements of ascospores), known from siliceous rock of Eurasia, North America and Greenland, but differs in having larger thallus, in the lack of lobate-like areoles in peripheral zone and in the lack of somewhat uplifted hypothallus, in having plane and thin thalline areoles (*vs.* very thick to 0.5 mm thick, convex), in the lack of white colour of upper surface of areoles, in having smaller ((0.15–)0.2–0.3(–0.4) mm diam., *vs.* 0.3–0.8 mm diam.) and thinner and plane (to 0.18 mm thick *vs.* 0.2–0.5 mm thick, convex) apothecia, in having lower hymenium (to 40  $\mu\text{m}$  *vs.* 60–90  $\mu\text{m}$  high), in having lower and hyaline subhymenium (to 50  $\mu\text{m}$  *vs.* 100–200  $\mu\text{m}$  thick, dark brown), in having well developed and wide caps in paraphyses (*vs.* 2–3  $\mu\text{m}$  wide slightly clavate towards the tips), in having I– medulla (*vs.* I+ blue), and in the lack K reaction of epihymenium and exciple (*vs.* K+ red), while ascospore measurements of these two taxa overlapping (9–12  $\times$  5–6(–6.5)  $\mu\text{m}$  *vs.* 9–14  $\times$  4–8  $\mu\text{m}$ ).

Other specimens examined: Republic of Korea. Jeollanam-do, Suncheon-si, Yong-sang-dong, Mt top behind artificial lake, on siliceous rocks in open areas, growing together with *Lecanora oreinoides*, *Aspicilia* sp. and *Diploschistes* sp. Lat.: 34° 58' 22.11" N; Long.: 127° 30' 21.79" E; Alt.: 277 m a.s.l. Coll.: Kondratyuk, S. Y. (164021), 17.12.2016 (KoLRI 042289 sub *Diploschistes*).

***Rufoplaca ulleungensis*** S. Y. Kondr., L. Lőkös et J.-S. Hur, *spec. nova*  
(Fig. 15)

Mycobank no.: MB 824399.

*Similar to Rufoplaca kaernefeltiana, but differs in having smaller and somewhat indistinct thalline areoles, which more often forming more or less compact areolate, light grey thallus, in having more numerous and biatorine apothecia, in having much narrower ascospores, in having narrower ascospore septum, and in growing in more arid conditions.*

Type: Republic of Korea. Gyeongsangbuk-do, Ulleung-do Island, Ulleung-gun, Seo-myeon, Taeha-ri, on siliceous rocks along tourist path, on exposed siliceous rock, growing together with *Buellia ulleungdoensis*, *Acarospora* cf. *nitrophila*, *Buellia/Aspicilia* sp. (too small). Lat.: 37° 30' 48.46" N; Long.: 130° 48' 0.05" E; Alt.: 85 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (170473), 02.06.2017 (KoLRI 044597 sub *Rufoplaca* – holotype); the same locality, growing together with *Squamulea* aff. *squamosa*, *Buellia ulleungdoensis*, *Diploschistes* sp., *Caloplaca pelodella*, *Acarospora* sp. (170474), (KoLRI 044598 sub *Rufoplaca* – isotype); the same locality, (170475), (KoLRI 044599 sub *Rufoplaca* – isotype).

Thallus to 1–3 cm across, crustose, very indistinct owing thalline colour light grey and concolorous with rock surface, consisting of distant and separate areoles to compact areolate, areoles 0.3–0.7(–1.3) mm across, very irregular, from plane to semiconvex, often aggregated in small groups among other crustose lichens, whitish grey to medium grey usually with numerous light yellow-orange apothecia.

Apothecia (0.2–)0.3–0.8 mm diam. and to 0.18–0.25(–0.35) mm thick in section, usually very numerous, often aggregated in group with 3–5 or more apothecia together, biatorine, own margin 60–80 µm thick, concolorous or slightly lighter of disc, dull yellowish orange while disc dull brownish orange; in section zeorine to lecanorine, true exciple to 80–90(–100) µm thick in the uppermost lateral portion and to (10–)20–30 µm thick in lower lateral portion and to (10–)30–50(–80) µm thick in basal portion, scleroplectenchymatous or *textura intricata*, hyphae lumina to 1–1.5 µm diam.; thalline exciple if developed (mostly at base) to 60–70 µm thick, cortical layer very thin to 7–8 µm thick; hymenium to 70–80 µm high, epihymenium to 20 µm thick, dark brown to dark brown orange; paraphyses slightly swollen towards the tips to 4 µm diam.; subhymenium to 70–100(–150) µm thick, hyaline, without oil, more or less paraplectenchymatous (*sensu* Wetmore); asci 8-spored, mainly narrowly cylindrical, *ca* 60 × 15–17 µm; ascospores (13–)14–16(–18) × 4–5.5(–6) µm in water (70 measurements) and (13–)14–17(–23) × (4–)5–6(–6.5) µm in K (30 measurements); ascospore septum 1–2.5 µm wide in water and (3.5–)4–5(–6) µm wide in K.

Chemistry: Epihymenium and outermost layer of the lateral portion of true exciple K+ purple.

Ecology: Growing on rocks in rather arid conditions of south or south-eastern faced slopes of mountain.

Etymology: It is named after the type locality, i.e. Ulleung-do Island, South Korea (E Asia).

Distribution: It is so far known from type locality in Ulleung-do Island of South Korea (E Asia), where was presented rather abundantly.

Taxonomic notes: *Rufoplaca ulleungensis* is similar to recently described South Korean lichen *R. kaernefeltiana* S. Y. Kondr., L. Lőkös et J.-S. Hur, but dif-

fers in having smaller and somewhat indistinct thalline areoles, which more often forming light grey more or less compact areolate thallus (not so thick and not consisting of discrete and distant areoles), in having more numerous and biatorine apothecia, in having much narrower ascospores ((13–)14–16(–18) × 4–5.5(–6) μm *vs.* (10–)12–15(–16) × 7–8 μm), and in having narrower ascospore septum (1–2.5 μm *vs.* (4–)5–6(–7) μm), and in growing in more arid conditions (*vs.* in coastal zone).

*Rufoplaca ulleungensis* is similar to *R. oxfordensis* (Fink) Arup, Søchting et Frödén, but differs in having much narrower ascospores ((13–)14–16(–18) × 4–5.5(–6) μm *vs.* (11–)12–13(–16) × (4–)5–7 μm) and in having narrower ascospore septum (1–2.5 μm *vs.* 2–3 μm wide).

*Rufoplaca ulleungensis* is similar to '*Caloplaca*' *atroflava* (Turner) Mong., but differs in having longer and narrower ascospores (13–18 × 4.5–6 μm *vs.* (9–)11–13(–17) × (5.5–)7–9(–10) μm) and in having narrower ascospore septum (1.5–2.5 μm *vs.* 4–6 μm wide).



Fig. 15. *Rufoplaca ulleungensis* (170473, holotype), general habit (top) and enlarged apothecia. Scale 0.5 mm. (Photos of S. Kondratyuk)

Other specimens examined: Republic of Korea. Gyeongsangbuk-do, Ulleung-do Island, Ulleung-gun, Ulleung-eup, between Naesujeon and Soekpo waterfall, on siliceous rock. Lat.: 37° 31' 29.41" N; Long.: 130° 54' 13.08" E; Alt.: 395 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (170351), 31.05.2017 (KoLRI 044475 sub *Rufoplaca*); the same locality, (170352), (KoLRI 44476 sub *Rufoplaca*).

*Sarcogyne ulleungdoensis* S. Y. Kondr., L. Lőkös et J.-S. Hur, *spec. nova*  
(Fig. 16)

Mycobank no.: MB 824400.

*Similar to Sarcogyne privigna, but differs in having crenulate exciple, in having higher hymenium, in having larger asci, in having bigger number of ascospores in ascus, and in having smaller ascospores.*

Type: Republic of Korea. Gyeongsangbuk-do, Ulleung-do Island, Ulleung-gun, Seo-myeon, Taeha-ri, on siliceous rocks along tourist path, on exposed siliceous rock, growing together with *Buellia ulleungdoensis*, *Acarospora cf. nitrophila* and *Diploschistes actinostomus*. Lat.: 37° 30' 48.46" N; Long.: 130° 48' 0.05" E; Alt.: 85 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (170457), 02.06.2017 (KoLRI 044581 sub *Sarcogyne* – holotype).

Thallus (2–)4–10 mm diam./across, endolithic or absent, very indistinct, sometimes apothecia developed among or above thalline portions of other lichens (i.e.: *Acarospora* in holotype specimen); hypothallus not observed.

Apothecia 0.3–0.4(–0.5) mm across, and 0.2 mm thick in section, black, with thick to 0.1 mm wide own margin, highly uplifted above disc level and often totally covered disc, irregular from more or less elongated to more or less rounded (similar to *Polysporina golubkova*), disc concave, mostly badly seen, dark brown to blackish brown (seen at the highest magnification (more of  $\times 100$ )), own margin somewhat shiny, coal-black with cracked surface, crenulate or consisting of 5–7 portions; in section biatorine, true exciple to 50  $\mu\text{m}$  thick in the uppermost lateral portion with black outermost portion, to 10–15  $\mu\text{m}$  thick in lateral portion and disappearing in basal portion; hymenium to 100–110  $\mu\text{m}$  high, epihymenium 10–20  $\mu\text{m}$  thick yellowish brown to coal blackish in places, with epinecral/gelatine layer above epihymenium, paraphyses distinctly swollen towards the tips, tips to 4  $\mu\text{m}$  diam.; subhymenium 20–30(–40)  $\mu\text{m}$  thick, hyaline; asci 75–80  $\times$  16–18  $\mu\text{m}$ , 300–400-spored; ascospores bacilliform, (2–)2.5–3(–3.5)  $\times$  1.2–1.5(–1.7)  $\mu\text{m}$ .

Ecology: Growing on rocks.

Etymology: It is named after the type collection, i.e. Ulleung-do Island, South Korea (E Asia).



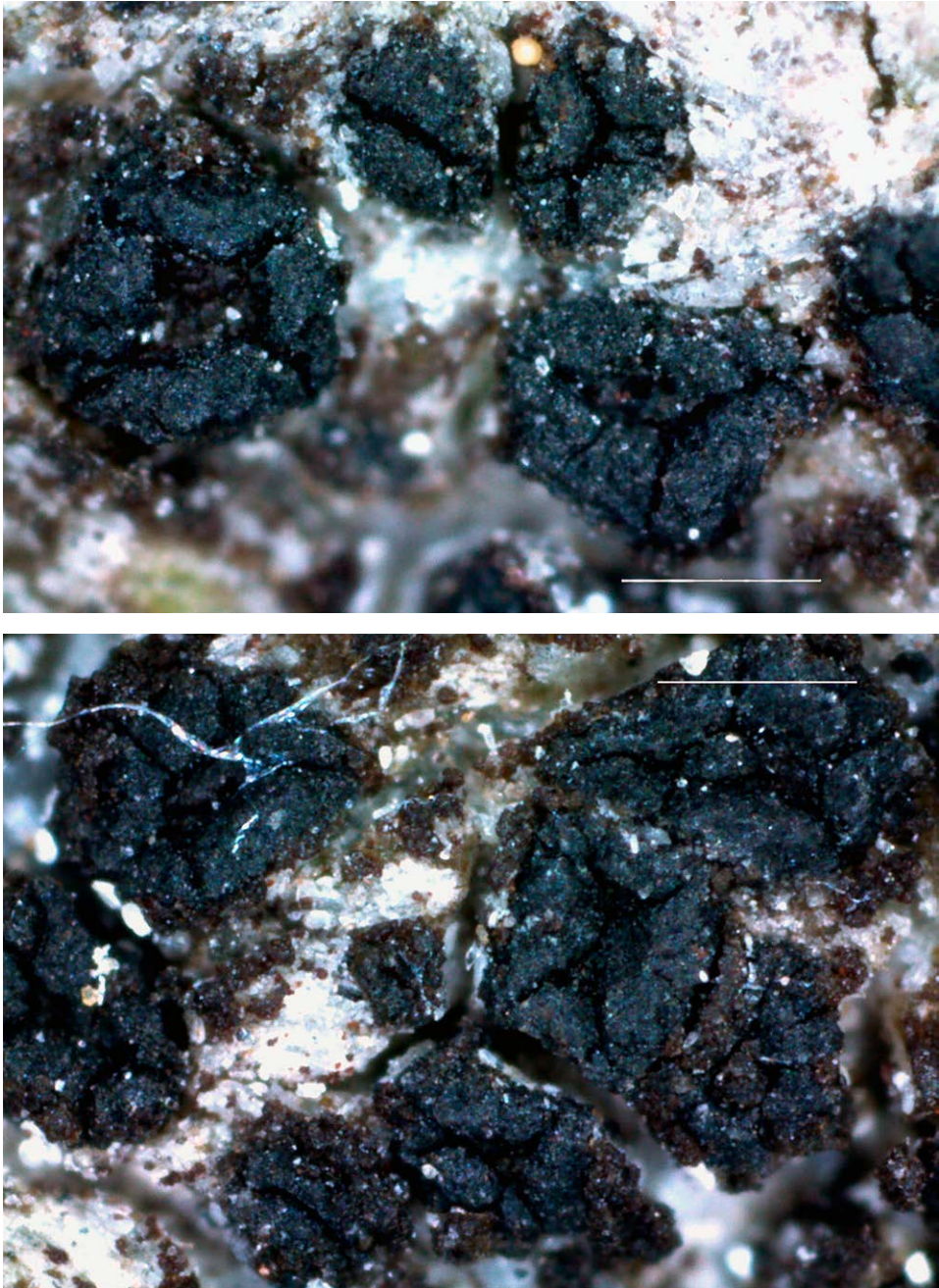


Fig. 16. *Sarcogyne ulleungdoensis* (170457, holotype), general habit (top) and enlarged apothecia. Scale 0.5 mm. (Photos of S. Kondratyuk)

Distribution: It is hitherto known from scattered localities in Ulleung-do Island, South Korea (E Asia).

Taxonomic notes: *Sarcogyne ulleungdoensis* is similar to *S. privigna* (Ach.) A. Massal., but differs in having crenulate exciple, in having higher hymenium (100–110  $\mu\text{m}$  *vs.* 60–85  $\mu\text{m}$  high), in having larger asci (75–80  $\times$  16–18  $\mu\text{m}$  *vs.* 45–55  $\times$  10–12  $\mu\text{m}$ ), in having bigger number of ascospores (300–400-spored *vs.* *ca* 100-spored per ascus), and in having smaller ascospores ((2–)2.5–3(–3.5)  $\times$  1.2–1.5(–1.7)  $\mu\text{m}$  *vs.* 3.5–5  $\times$  1–1.5(–2)  $\mu\text{m}$ ).

In having taller hymenium (i.e. more of 85  $\mu\text{m}$  high) and a crenulate true exciple *Sarcogyne ulleungdoensis* is similar to *S. clavus* (DC.) Kremp., but differs in having smaller apothecia (0.3–0.4(–0.5) mm *vs.* 1–3(–6) mm diam.), in having narrower true exciple (to 0.1 mm *vs.* 0.3–0.7(–1) mm thick), in having hyaline and lower subhymenium (20–30(–40)  $\mu\text{m}$  *vs.* 60–100  $\mu\text{m}$  thick), in having 300–400-spored asci (*vs.* 200-spored), in having smaller ascospores ((2–)2.5–3(–3.5)  $\times$  1.2–1.5(–1.7)  $\mu\text{m}$  *vs.* 4–5(–6)  $\times$  (1–)1.5–2  $\mu\text{m}$ ).

*Sarcogyne ulleungdoensis* is similar to recently described South Korean lichen *Polysporina golubkova* S. Y. Kondr., L. Lőkös, J. S. Park et J.-S. Hur after having widely ellipsoid ascospores, and asci having more than 200 spores, in having high hymenium, but differs in having smaller (0.3–0.4(–0.5) mm *vs.* to (0.6–)0.7–1(–1.2) mm diam./ across), and irregular from more or less elongated to rounded (but not lirellae-like) apothecia (Kondratyuk *et al.* 2016a).

*Sarcogyne ulleungdoensis* is similar to *Polysporina simplex* (Taylor) Vězda, but differs in having shorter and narrower ascospores (2.5–3(–3.5)  $\times$  0.2–1.5  $\mu\text{m}$  *vs.* 3–5  $\times$  1.5–1.9  $\mu\text{m}$ ).

***Skyttea bumyoungsungii*** S. Y. Kondr. et J.-S. Hur, *spec. nova*  
(Figs 17–19)

Mycobank no.: MB 824401.

*Similar to* *Skyttea groenlandiae*, *but differs in having scattered and smaller ascomata, mostly sessile, not shining ascomata, greenish-bluish blackish exciple, long excipular hairs, lower hymenium, and much longer ascospores.*

Type: Republic of Korea. Jeju-do, Jeju-si, Bijarim Forest on siliceous rock of wall, on greenish grey sterile crustose lichen. Lat.: 33° 29' 08.09" N; Long.: 126° 48' 30.25" E; Alt.: 148 m a.s.l. Coll.: Kondratyuk, S. Y., Kondratiuk, T. O., Yang, J.-H. (170149), 14.03.2017 (KoLRI 044273 sub *Skyttea* – holotype).

Lichenicolous fungus growing on more or less continuous or cracked steril crustose thallus of grayish green epilithic lichen (probably *Gyalidea* sp. or *Porpidia* sp.).

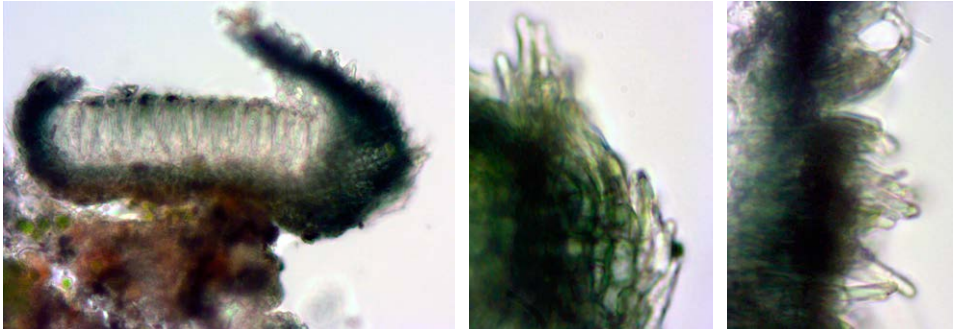


Fig. 17. *Skyttea bumyoungsungii* (170149, holotype), general habit (top) and enlarged portions of apothecia with excipular hairs. (Photos of S. Kondratyuk)

Ascomata 0.1–0.15(0.18) mm diam., scattered, not aggregated in groups, arising in the host thalline areoles (or continuous host thallus), at first slightly immersed but soon becoming and mostly seen as erumpent/sessile, distinctly attenuated at basis, blackish with whitish circle of hairs of exciple, dull, not shining, disc more or less regularly rounded, finally more open, exciple persistent; in section apothecia to 0.35 mm diam. and to 0.1 mm thick, disk more or less plane (in section hymenium like horizontal line), exciple greenish-bluish,

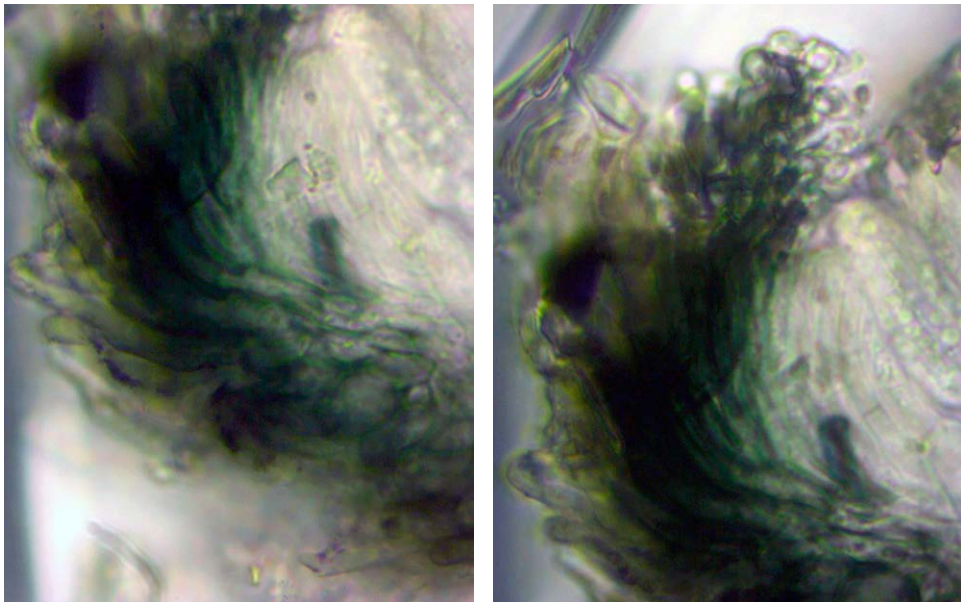


Fig. 18. *Skyttea bumyoungsungii* (170149, holotype), enlarged lateral and basal portions of true exciple of apothecia. (Photos of S. Kondratyuk)

to 20  $\mu\text{m}$  thick in lateral and basal portions, paraplectenchymatous in basal portions, cell lumina to 5–8(–12)  $\mu\text{m}$  across, somewhat brownish in the lowest basal portion; excipular hairs hyaline to 20  $\mu\text{m}$  long and 2.5–3  $\mu\text{m}$  diam./thick at the base and becoming thinner towards the tips, but with rounded cells in the uppermost lateral portion; hymenium to 30–35  $\mu\text{m}$  high; epihymenium somewhat greenish-bluish (concolorous with true exciple), not well distinct, to 10–15  $\mu\text{m}$  thick; subhymenium 15–20  $\mu\text{m}$  thick, hyaline; ascospores long, bacilliform with 3–5 guttulae, 23–25  $\times$  2.2–2.8  $\mu\text{m}$ .

Ecology: Growing on thallus of unidentified crustose lichen, probably *Gyalidea* sp. or *Porpidia* sp. on shaded vertical surface of siliceous rocks.

Etymology: It is named after Mr Bum-Young Sung, a creator of world-class bonsai garden, the Spirited Garden in Jeju-do Island located at Jeoji, Haukyeong, Jeju-si, Jeju-do.

Distribution: So far known only from type locality in Jeju-do Island, South Korea (E Asia).

Taxonomic notes: *Skyttea bumyoungsungii* is similar to *Unguiculariopsis groenlandiae* (Alstrup et D. Hawksw.) Etayo et Diederich known from *Flavoplaca citrina* (Hoffm.) Arup, Frödén et Søchting and *Lepraria neglecta* from Greenland, but differs in having scattered (not aggregated in groups) and smaller ascomata ((0.1–0.15(–0.18) mm *vs.* to 0.2–0.3 mm diam.), in having mostly sessile (*vs.* from immersed to erumpent), not shining ascomata, in having greenish-bluish blackish exciple (*vs.* reddish brown), in having long excipular hairs (lacking excipular hairs), in having lower hymenium (to 30–35  $\mu\text{m}$  *vs.* 60–90  $\mu\text{m}$  tall), and in having much longer ascospores (23–25  $\times$  2.2–2.8  $\mu\text{m}$  *vs.* 8.5–10(–11)  $\times$  2.5–3(–3.5)  $\mu\text{m}$ ).

After long ascospores (more than 18  $\mu\text{m}$  long) *Skyttea bumyoungsungii* is similar to *S. caesii* Diederich et Etayo and *S. cismonicae* Hafellner. But in contrast to *S. caesii* it has narrower ascospores (23–25  $\times$  2.2–2.8  $\mu\text{m}$  *vs.* 18–28(–42)

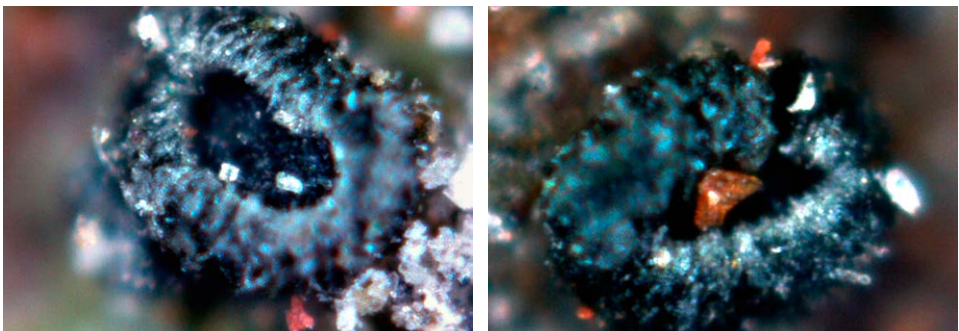


Fig. 19. *Skyttea bumyoungsungii* (170149, holotype), general habit of enlarged apothecia. (Photos of S. Kondratyuk)

× 3–3.5 µm), and longer excipular hairs (to 20 µm long *vs.* 7.5–10 µm long), as well as it is characterised by different host (*vs.* *Mycoblastus caesius*).

*Skyttea bumyoungsungii* differs from *S. cismonicae* Hafellner in having shorter and narrower ascospores (23–25 × 2.2–2.8 µm *vs.* 30–38 × 3–3.5 µm), in having longer excipular hairs (to 20 µm long *vs.* 10–12 µm long) and in having different host (*vs.* *Loxospora cismonica*).

***Thelopsis gangwondoensis*** S. Y. Kondr., L. Lőkös, J.-J. Woo  
et J.-S. Hur, *spec. nova*

Mycobank no.: MB 824402.

*Similar to Thelopsis flaveola, but differs in having much larger hyaline perithecia, in having much larger ascospores, in having much thicker exciple, in having mainly shorter and wider periphyses, in having thicker paraphyses, and in having 50–80-spored asci.*

Type: Republic of Korea. Gangwon-do, Jeongseon-gun, Nam-myeon, Nakdong-ri, Seonpyeon-gil, roadside trees along river, on bark of *Hemiptelea davidii*. Lat.: 37° 19' 16.28" N; Long.: 128° 42' 53.84" E; Alt.: 360 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (163148\_1), 16.09.2016 (KoLRI 041390 – holotype).

Thallus often endophloidal only sometimes developed above bark surface to 40–50 µm thick in section, completely filled out by algal cells, algal cells to 12–17 µm across, *Trentepohlia*, greenish grey, dull greenish, very thin, probably endophloidal.

Ascomata perithecioid to (0.4–)0.6–0.7(–0.8) mm diam. and to 0.5–0.6 mm thigh, semi-immersed, pale brown rarely whitish or dull pale brownish ostiolar portion to 0.2–0.3 mm diam., rarely ostiolar channel observed. In section exciple wall to 80–90(–100) µm thick at ostiole, hyaline while outermost layer at ostiole yellowish, to 60–65 µm thick at sides and at the basis, paraplectenchymatous, cell lumina 5–8 × 5–6 µm or elongated along the wall; subhymenium to 40 µm thick, more or less greyish; hymenium to 250 µm high; periphyses 6–15(–20) µm long, 2–3 septate, 2–5(–6) µm wide; paraphyses to 4 µm diam. in lower half and to 2 µm diam. towards the tips, septated, distinctly constricted at septum; asci 50–80 spored, a. 160 × 28 µm; ascospores with single oil droplet, or 1 or 2 guttulate, rounded ellipsoid, sometimes komma-like, 8–12(–13) × 6–8 µm.

Ecology: Growing on bark of deciduous tree (*Hemiptelea davidii*).

Distribution: So far known only from type locality, Gangwon-do Province of South Korea.

**Etymology:** It is named after type locality in Gangwon-do Province of South Korea (E Asia).

**Taxonomic notes:** In having simple ascospores *Thelopsis gangwondoensis* is similar to *T. flaveola* Arnold, growing on bark of deciduous trees (*Salix*, *Acer* and *Fagus*) and *Rhododendron hirsutum*, and known from Europe (Austria, Germany, Slovak Republic, and Herzegovina) and North America (USA: Virginia), but differs in having much larger hyaline perithecia (0.6–0.7 mm diam., *vs.* 0.2–0.3 mm diam.), in having much larger ascospores (8–12(–13) × 6–8 μm *vs.* 4–6 × 3–4 μm), in having much thicker exciple (60–80 μm *vs.* to 30 μm thick), in having mainly shorter (5–15 μm *vs.* to 20 μm long) and wider (3–5(–6) μm *vs.* 2 μm wide) periphyses, in having thicker paraphyses (especially in lower portion (to 4 μm wide *vs.* 1.5–2 μm wide), and in having 50–80 spored asci (*vs.* up to 300 ascospores per ascus).

***Topelia loekoესiana*** S. Y. Kondr., J.-J. Woo et J.-S. Hur, *spec. nova*

Mycobank no.: MB 824403.

*Similar to Topelia jasonhurii, but differs in having smaller ascomata, in having scleroplectenchymatous thicker exciple wall, in having shorter and wider periphyses, in having submuriform ascospores with 3 transverse and a single longitudinal septum.*

**Type:** Republic of Korea. Gangwon-do, Jeongseon-gun, Nam-myeon, Nakdong-ri, Seonpyeon-gil, roadside trees along river, on bark of *Hemiptelea davidii*. Lat.: 37° 19' 16.28" N; Long.: 128° 42' 53.84" E; Alt.: 360 m a.s.l. Coll.: Kondratyuk, S. Y., Lókös, L. (163148\_2), 16.09.2016 (KoLRI 041391 – holotype).

Thallus corticolous, crustose, indistinct, more or less epiphloeodic, ecorticate. Photobiont coccoid, up to 5–10 μm diam., belonging to *Trentepohlia*.

Ascomata perithecioid to 0.4 mm diam., and to 0.45 mm high, somewhat pear-like shape where narrower to 0.2 mm wide at the ostiole; exciple hyaline throughout, only in the outermost portion at ostiole somewhat yellowish brown or reddish-brown, to 60–80(–100) μm thick at the ostiole, outer layer to 20–30 μm thick dull yellow brown, inner portion hyaline, to 35–50 μm thick at sides and the basis, hyaline throughout, scleroplectenchymatous with distinct matrix (especially in the upper half of the ascomata) or hyphae orientated along the wall, cell lumina to 2–3 μm diam.; subhymenium to 50–60 μm thick more or less yellowish in upper half and hyaline in the lower portion, hymenium to 200 μm high, paraphyses to 2.8 μm diam. in the lower portion and to 2 μm diam. in the upper half, simple, not branched; periphyses to 3–4(–5) μm diam., very short to 7–12 μm long; asci 8-spored, with uniseriate ascospores,

often ascospores of variegated size within the same ascus; ascospores widely to elongated ellipsoid with more or less attenuated ends, to almost spherical or more or less quadric, submuriform, with 3 transversal and a single longitudinal septum, without constrictions at the septum overmature ascospores often with somewhat collapsed content of some ascospore cells (12–)13–18(–20) × (7–)8–13(–14) μm.

Ecology: Growing on bark of tree at the bank of river in rather well-ventilated conditions.

Distribution: Known so far only from type locality in Gangwon-do Province of South Korea (E Asia).

Etymology: It is named after our friend and colleague, the known Hungarian lichenologist László Lőkös (1959–) (BP, Budapest, Hungary) in recognition of his efforts to study lichen diversity of Korea, as well as for providing type collection.

Taxonomic notes: *Topelia loekoesiania* is sometimes well distinct owing to aggregated ascomata remnants (as empty lower half portions of eaten or damaged perithecia).

*Topelia loekoesiania* is similar to *T. jasonhurii* L. Lőkös, E. Farkas et S. Y. Kondr., recently described from Jeju-do Island of South Korea, growing on bark of *Machilus thunbergii*, but differs in having smaller ascomata (to 0.4 mm diam., vs. 0.5–0.6 mm diam.), in having scleroplectenchymatous (vs. paraplectenchymatous), and thicker exciple wall (to 60–80(–100) μm thick vs. 40–55(–60) μm wide) in upper portion/at ostiole, and to 35–50 μm thick at sides and basis vs. to 30 μm thick), in having shorter and wider periphyses (10–15 × 2.5–3 μm vs. 20–35 × 2–2.5 μm), in having submuriform ascospores with 3 transverse and a single longitudinal septum (vs. richly muriform), while ellipsoid to somewhat spherical or more or less quadric shape and measurements are almost the same ((12–)13–18(–20) × 8–13(–14) μm vs. (11–)12–15(–17) × 9–11 μm) (Kondratyuk *et al.* 2013).

Material of *Topelia loekoesiania* can be keyed to *Topelia aperiens* P. M. Jørg. et Vězda, hitherto only known from type locality in subtropical part of North America (Louisiana) where grows on bark of *Taxodium*, but *Topelia loekoesiania* differs in having epiphloedic thallus (vs. mostly endocorticolous), in having smaller and more indistinct pale brownish ascomata (to 0.4 mm diam. vs. 0.4–0.6 mm diam., pale carneus when young, brownish when older, erupting singly through the fibrous bark of the tree, with a distinct depressed dark pore), in having submuriform and somewhat smaller ascospores ((12–)13–18(–20) × 8–13(–14) μm vs. richly muriform ((12–)15–20(–22) × 10–12(–15) μm), and in the lack of fruit-bodies opening by the expanding pore.

*Topelia loekoesiania* is similar to *Topelia nimisiana* Tretiach et Vězda known from bark of various deciduous trees (*Quercus* spp.) in the Mediterranean Europe and Asian Near East (Italy and Israel) (Kondratyuk *et al.* 2005, Tretiach

and Vězda 1992), but differs in having smaller and submuriform ascospores ((12–)13–18(–20) × 8–13(–14) μm *vs.* richly muriform 20–30 × 8–12 μm) as well as in having excipulum not covered by thallus and in having hypothecium not interspersed by numerous oil droplets.

*Topelia loekoesian* especially after having pale yellow-brownish periphery of exciple is also similar to *T. gyalectoides* (Nyl.) B. D. Ryan et H. T. Lumbsch (Ryan and Lumbsch 2007) growing on calcareous rock in North America, but differs in the lack of pale orange to rose red ascomata and pale orange to pale red apothecia pore, as well as in having smaller ascospores ((12–)13–18(–20) × 8–13(–14) μm *vs.* 20–26(28) × 11–14 μm).

### RARE OR NOTEWORTHY SPECIES

*Acarospora ulleungdoensis* S. Y. Kondr., L. Lőkös et J.-S. Hur – Republic of Korea. Jeju-do, Seogwipo-si, Seongsan-eup, Ojo-ri, Mt Siksangbong, on rock, growing together with *Agonimia loekoessii*, *Huriella pohangensis* and *Squamulea micromera*. Lat.: 33° 28' 0.16" N; Long.: 126° 55' 09.36" E; Lat. ca 12 m a.s.l. Coll.: Woo, J.-J. (163683), 03.07.2016 (KoLRI 041928 sub *Squamulea micromera*). – Another record of the recently described species from the eastern part of Jeju-do Island of South Korea.

*Agonimia loekoessii* S. Y. Kondr., J. Halda et J.-S. Hur – Republic of Korea. Jeju-do, Seogwipo-si, Seongsan-eup, Ojo-ri, Mt Siksangbong, on rock, growing together with *Acarospora ulleungdoensis*, *Huriella pohangensis* and *Squamulea micromera*. Lat.: 33° 28' 0.16" N; Long.: 126° 55' 09.36" E; Alt.: ca 12 m a.s.l. Coll.: Woo, J.-J. (163683), 03.07.2016 (KoLRI 041928 sub *Squamulea micromera*). – The recently described species was known only from mainland Korea. New to Jeju-do Island of South Korea!

*Biatora ivanpisutii* S. Y. Kondr., L. Lőkös et J.-S. Hur – Republic of Korea. Gyeongsangbuk-do, Ulleung-do Island, Ulleung-gun, Ulleung-eup, between Naesujeon and Soekpo waterfall, on bark. Lat.: 37° 31' 23.14" N; Long.: 130° 54' 11.99" E; Alt.: 480 m a.s.l. Coll.: Kondratyuk, S. Y., Lőkös, L. (170396), 31.05.2017 (KoLRI 044520 sub *Biatora ivanpisuti*). – Additional specimen of the recently described species collected very close to type locality.

*Biatora pseudosambuci* (S. Y. Kondr., L. Lőkös et J.-S. Hur) S. Y. Kondr., L. Lőkös et J.-S. Hur – Republic of Korea. Jeju-do, Jeju-si, Sangumbari Crater, around parking place at entrance, on bark of cherry trees, growing together with *Bacidina* sp. and *Scoliciosporum chlorococcum*. Lat.: 33° 26' 7.08" N; Long.: 126° 41' 22.07" E; Alt.: 408 m a.s.l. Coll.: Kondratyuk, S. Y., Kondratiuk, T. O., Yang, J.-H. (170152), 14.03.2017 (KoLRI 044276 sub *Bacidina*); the same locality, (170151), (KoLRI 044275 sub *Biatora pseudosambuci*). – New to Jeju-do Island of South Korea!



*Buellia extremoorientalis* (S. Y. Kondr., L. Lőkös et J.-S. Hur) S. Y. Kondr., L. Lőkös et J.-S. Hur – Republic of Korea. Jeju-do, Jeju-si, Sangumbari Crater, around parking place at entrance, on bark of cherry trees, growing together with *Biatora loekoessiana* and *Scoliciosporum chlorococcum*. Lat.: 33° 26' 7.08" N; Long.: 126° 41' 22.07" E; Alt.: 408 m a.s.l. Coll.: Kondratyuk, S. Y., Kondratiuk, T. O., Yang, J.-H. (170153), 14.03.2017 (KoLRI 044277). – New to Jeju-do Island of South Korea!

*Fominiella tenerifensis* S. Y. Kondr., Kärnefelt, A. Thell et T. Feuerer – (Fig. 20) – [KWL 72437] – Data on conidiomata of the *Fominiella tenerifensis* for the first time are provided. Wider variation of thallus to forming whitish spots/portions to several mm across, as well as presence of zeorine apothecia with white thalline exciple at sides or at the base also found. Conidiomata yellow at ostiole, to 100 µm diam. in section; conidia short bacilliform 2.2–2.7(–3) × 0.9–1.1 µm. – Additionally to holotype [KW-L 72475] cited in original description (Kondratyuk et al. 2017a) the following five isotype specimens are located during revision of KW-L collection in 2017: Type: Spain, Canary Islands, Tenerife Island, Santiago del Teide, on bark of *Spartocytisus*

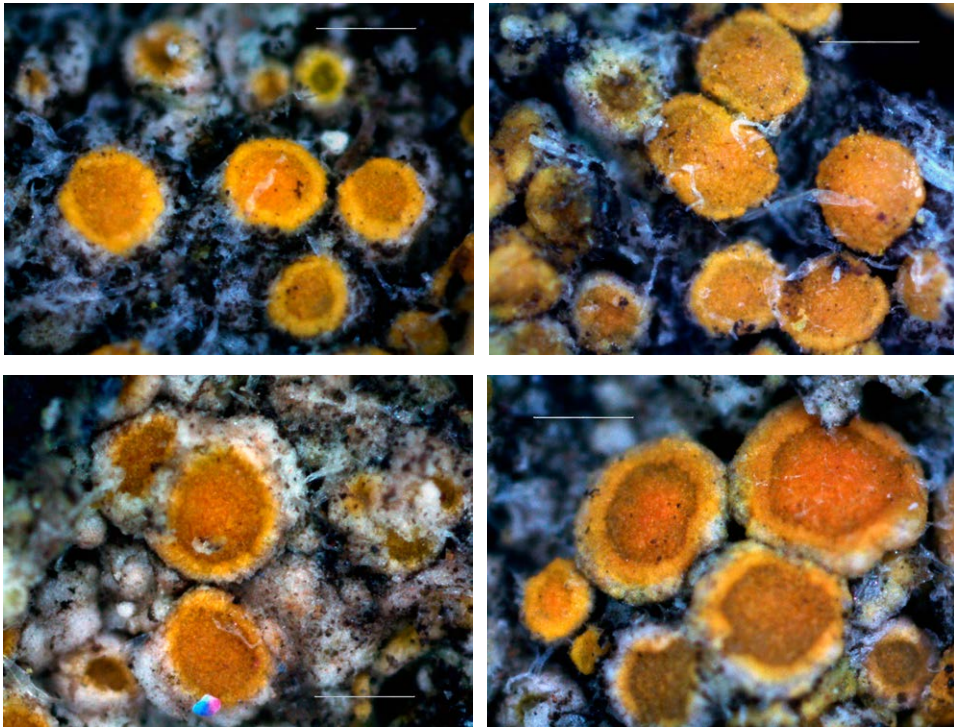


Fig. 20. *Fominiella tenerifensis* (KWL 72437), general habit and enlarged portions with apothecia and whitish fragments of thallus. Scale 0.5 mm. (Photos of S. Kondratyuk)

shrubs, growing together with *Xanthoria monofoliola* and *Ikaeria aurantiella*. Lat.: 28° 17.631' N; Long.: 16° 48.989' W. Alt.: 920 m a.s.l. Coll.: Kondratyuk, S. Y. (20917), 15.01.2009 (KW-L 72475 sub *Fominiella tenerifensis* – holotype [voucher for DNA extraction SK 547], LD, BP, B – isotypes); the same locality, growing together with *Xanthoria monofoliola* and *Lecanora* sp. (KW-L 72473 sub *Xanthoria monofoliola* – isotype); the same locality, growing together with *Lecanora* sp. (KW-L 72474 sub *Fominiella tenerifensis* – isotype); the same locality, growing together with *Ikaeria aurantiella* (KW-L 72477 sub *Ikaeria aurantiella* – isotype, voucher for DNA extraction SK 541, voucher of *Fominiella tenerifensis* for DNA extraction SK 542); the same locality, growing together with *Xanthoria monofoliola* damaged by *Xanthoriicola* sp. and *Athelia* sp. (KW-L 72478 sub *Xanthoria monofoliola* – isotype, voucher of *Fominiella tenerifensis* for DNA extraction SK 545); the same locality, (KW-L 72480 sub *Fominiella tenerifensis* – isotype, voucher for DNA extraction SK 551). Other specimens examined: Spain, Canary Islands, Tenerife Island, Santiago del Teide, on bark of *Spartocytisus* shrubs, growing together with *Xanthoria monofoliola* and *Ikaeria aurantiella*. Lat.: 28° 17.631' N; Long.: 16° 48.989' W. Alt.: 920 m a.s.l. Coll.: Kondratyuk, S. Y. (20917), 15.01.2009 (KW-L 72476 sub *Xanthoria monofoliola*); the same locality, growing together with *Xanthoria monofoliola* (KW-L 72479 sub *Xanthoria monofoliola*, voucher of *Fominiella tenerifensis* for DNA extraction SK 544); the same locality, growing together with *Xanthoria monofoliola* (KW-L 72481 sub *Xanthoria monofoliola*).

***Ivanpisutia oxneri*** S. Y. Kondr., L. Lőkös et J.-S. Hur – Republic of Korea. Jeju-do, Jeju-si, Haean-dong, Mt Halla, on smooth bark, growing together with *Mikhtomia gordejevii*. Lat.: 33° 21' 15.3" N; Long.: 126° 29' 56.4" E; Alt.: ca 1,334 m a.s.l. Coll.: Woo, J.-J. (163685), 04.07.2016 (KoLRI 041930 sub *Mikhtomia gordejevii*). – New to Jeju-do Island of South Korea!

***Lecanora helicopsis*** (Wahhlenb.) Ach. – Republic of Korea. Gyeongsangbuk-do, Ulleung-gun, Ulleung-eup, Ulleung-do Island, [J. Halda's site 41], on rock, growing together with *Flavoplaca laszloana*. Lat.: 37° 31' 15.91" N; Long.: 130° 54' 37.99" E; Alt.: ca 31 m a.s.l. Coll.: Halda, J. (160935), 09.07.2016 (KoLRI 039080 sub *Lecanora*). – Ulleung-do Island, [J. Halda's site], on rock, growing together with *Agonimia loekoesiana*, *Caloplaca* sp. 99 and *Verrucaria* sp. Lat.: 37° 32' 28.88" N; Long.: 130° 54' 47.93" E; Alt.: ca 40 m a.s.l. Coll.: Halda, J. (161033), 07.07.2017 (KoLRI 039178 sub *Agonimia*). – New to Korea and to Asia!

***Squamulea micromera*** (Hue) S. Y. Kondr., L. Lőkös et J.-S. Hur – Republic of Korea. Jeju-do, Seogwipo-si, Seongsan-eup, Ojo-ri, Mt Siksangbong, on rock, growing together with *Acarospora ulleungdoensis* and *Agonimia loekoesii* and *Huriella pohangensis*. Lat.: 33° 28' 0.16" N; Long.: 126° 55' 09.36" E; Alt.: ca 12 m a.s.l. Coll.: Woo, J.-J. (163683), 03.07.2016 (KoLRI 041928 sub *Squamulea micromera*). – The second record for Jeju-do Island of South Korea.

## New combinations

*Phaeophyscia saxatilis* (Kashiw.) S. Y. Kondr., *comb. nova* – MycoBank no.: MB 824404. – Basionym: *Physcia saxatilis* Kashiw., *Ginkgoana* 3: 52 (1975).

*Xanthoparmelia umezuana* (Moon K. H. et Kashiw.) S. Y. Kondr., *comb. nova* – MycoBank no.: MB 824405. – Basionym: *Karoowia umezuana* Moon K. H. et Kashiw., *J. Jap. Bot.* 84(5): 279 (2009).

\*

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