Notes on the Existence of *Leucodecton desquamescens* (Thelotrema) in South Korea

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This study describes a new record of a thelotremoid lichen (*Leucodecton desquamescens*) from South Korea. The taxon is characterized by thick, bulging thallus with many calcium oxalate crystal inclusions; an immersed, round to irregular ascomata with free exciple, ellipsoid to $\pm$ roundish submuriform, brown ascospores, and lack of secondary metabolites. A detailed taxonomic description and comments are presented for this taxon. The lichen genus *Leucodecton* is reported for the first time in South Korea.

KEYWORDS : *Leucodecton desquamescens*, Lichens, Thelotrema, Graphidaceae, Taxonomy

Mt. Sorak (38°5'~38°13' N, 128°18'~128°40' E), one of the highest mountains in South Korea located in the northernmost part of the Taebaek Mountains, is composed of several granite peaks and is covered with plantation and secondary forests, which include *Acer mono*, *Abies mariesii*, *A. koreana*, *Betula costata*, *B. ermanii*, *Carpinus laxiflora*, *Pinus densiflora*, *P. pumila*, *Populus maximowiczii*, *Prunus yedoensis*, *Quercus serrata*, *Q. crispula*, *Rhododendron mucronulatum*, *R. yedoense*, and *Zelkova serrata* [1]. The mountain was explored by Moon in 1995~1996, and she reported 240 lichen taxa [1]. During a recent field trip to that area, organized by Prof. Hur in May 2009, we (Y. Joshi and X. Y. Wang) collected lichens from localities unexplored by Moon [1].

Among those lichens there was a *Leucodecton* characterized by thick, bulging thallus with many calcium oxalate crystal inclusions, an immersed, round to irregular ascomata with free exciple, ellipsoid to $\pm$ roundish submuriform, brown ascospores, and a thallus lacking secondary metabolites. Careful examination of these specimens leads to the identification of *L. desquamescens* (Vain.) Rivas Plata & Lücking, which is new to South Korea. A detailed taxonomic description along with the chemistry, ecology, and illustrations is provided for the taxon.

The specimens examined from the study area collected by the authors have been deposited in the herbaria of the Korean Lichen Research Institute (KoLRI), Sunchon National University, Korea and Korean National Herbarium.

The specimens were examined using standard microscopical techniques and were hand-sectioned under a NIKON C-PS 1068908 dissecting microscope (Tokyo, Japan). All measurements were made on material mounted

in water, and lactophenol cotton blue was used only as a stain. The anatomical descriptions are based on these preparations under a microscope (NIKON Eclipse E 200). Measurements of thallus layers, apothecia, pores and ascospores were made at $\times 400$ and $\times 1,000$ magnification. Five measurements were recorded for each specimen for characters such as the size of thallus and apothecia and the thickness of the epihymenium, hymenium, and subhymenium. The ascospore dimensions are generally presented as (the smallest single value recorded-) the smallest mean recorded the largest mean recorded (- the largest single value recorded). Spot test reactions were performed on hand sections of thalli and apothecia under a microscope (OLYMPUS BX 50, Tokyo, Japan). For submuriform ascospores, the number of rows of transverse locules is expressed first, followed by the number of rows of longitudinal locules. Secondary metabolites were identified by standard thin layer chromatography, as described by Elix *et al.* [2] and White and James [3], mainly using solvent system C. Terminology for tissues generally followed that of Frisch *et al.* [4] and Plata *et al.* [5].

Taxonomic treatment of the species

Leucodecton desquamescens (Vain.) Rivas Plata & Lücking (Fig. 1A~1E)
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Diagnostic characters. *Thallus* crustose, epiphloeodal, thick, up to 1 mm high, bulging and partly flaking away from the substratum, gray. Surface dull to rarely slightly shiny, smooth to somewhat mealy, continuous, unfissured. True cortex absent, thallus covered by continuous

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Fig. 1. A, Habit of *Leucodecton desquamescens* (Vain.) Rivas Plata & Lücking (scale bar = 1 cm); B, Vertical longitudinal section of apothecia (not according to scale); C, Vertical longitudinal section of apothecia (scale bar = 100 μ m); D, Spores (scale bar = 20 μ m); E, a) Mature, brown submuriform spores (scale bar = 20 μ m), b) Immature, hyaline transversely septate spores (scale bar = 20 μ m).

phenocortex up to c. 40 μ m high, hyaline, dense, conglutinated, formed from irregular hyphae. Photobiont layer usually continuous and well developed, sometimes becoming inconspicuous due to crystal inclusions, 70–120 (~210) μ m high, calcium oxalate crystals abundant, small to large, scattered or clustered, sometimes forming column-like structures, distinct. Medulla well developed, hyaline, not clearly separated to separated from the photobiont, of tightly packed interwoven hyphae with narrow lumina.

Prothallus line thin, brownish black. Vegetative propagules absent.

Ascomata apothecia (*Lepadinoi*d-type), abundant, conspicuous, 0.5–1 (~2) mm diam., round to irregular to $\pm$ angular, solitary, immersed. Disc entirely visible from surface, grayish black, covered by white pruina. Pores wide, 0.3–0.8 (~1.8) mm in diam., formed by proper exciple, proper exciple apically or in upper parts becoming visible from surface, rounded to $\pm$ irregular or angular,

with an entire to indistinctly split, free, whitish to off-white, incurved to erect. Thalline rim margin moderately thin to thick, roundish to $\pm$ irregular or angular, entire, concolorous with thallus or brighter than thallus. Phenocortex, 12.5–30 μ m thick. Photobiont layer, 75–100 μ m thick. Periderm layer absent. Proper exciple *Leucodecton*-type, cupular, becoming partly to entirely free, thin, c. 10–25 μ m deep at base, 20–35 μ m wide laterally, comprising hyaline to pale yellowish or pale brownish conglutinated prosoplectenchymatous hyphae, with a darker brown pigmentation or carbonization towards the apex, non-amyloid. Subhymenium 15.4–28.2 μ m high, hyaline. Hymenium 100–150 μ m high, non-inspersed, moderately conglutinated. Paraphyses simple, straight, $\pm$ interwoven, tips slightly thickened, adspersed with fine grayish to brownish granules. Lateral paraphyses and true columella absent. Epihymenium thin, up to 3–4 μ m, hyaline, with grayish to pale brown granules; small calcium oxalate crystals are found in the pruina of the hymenium. Asci *Thelotrema*-type, narrowly clavate, 90–135 $\times$ 10–15 μ m; 4–8 spored, uniseriate, transversely septate (immature) to submuriform (mature), cell walls moderately thick, endospore thin, non-halonate, hyaline (young) (Fig. 1C) to brown (mature) (Fig. 1B), non-amyloid, ellipsoid to subglobose to oblong, with roundish to narrowed-roundish ends, loci roundish to angular, subglobose to oblong, with same shaped end cells, (19–) 20–22.5 (–23.3) $\times$ (9.2–) 10–12.5 (–13.5) μ m with 4–5 $\times$ 1–3 loci. Pycnidia not seen.

Chemistry. Spot test: thallus K-, C-, Pd-. Secondary metabolites: absent, but traces of a pale spot at Rf 36 (UV+ rose red), pale brown spot at Rf 25 (UV–), and an unknown fluorescent green (UV+ red) were reported out which may be chemical constituents of bark.

Ecology. The species is reported in and around Shinhung temple and is found growing over *Carpinus laxiflora* bark at an altitude ranging from 750–884 m. The forest in route from Shinhung temple to Ulsan Cliff and Sejon-bong is dominated by *Abies firma* and *Carpinus laxiflora* mixed with *Prunus yedoensis* and other deciduous trees.

Geographical distribution. Japan [6].

Remarks. The species is characterized by thick, bulging thallus with many calcium oxalate crystal inclusions, the immersed, round to irregular ascomata with free exciple, ellipsoid to $\pm$ roundish submuriform, brown ascospores and lack of secondary substances. It is often confused with *L. glaucescens* (Nyl.) A. Frisch, *L. occultum* (Eschw.) A. Frisch, *L. fissurinum*, and *L. subcompunctum* (Nyl.) A. Frisch, which generally differs from *L. desquamescens* by having smaller ascomata and other characters described below.

Presence of stictic acid chemosyndrome separates *L. desquamescens* from *L. glaucescens*, *L. fissurinum*, and *L.*

Table 1. Characters discriminating *Leucodecton desquamescens* and other closely related species

	<i>L. desquamescens</i>	<i>L. glaucescens</i>	<i>L. occultum</i>	<i>L. fissurinum</i>	<i>L. subcompunctum</i>
Thallus thickness (μ m)	c. 1000	c. 1000	c. 500	c. 200	c. 400
Thallus texture	Continuous to verruculose	Continuous to verruculose	Continuous to rugose or somewhat verruculose	Fissured to fissured areolate	Continuous to verruculose or verruculose
Apothecia size (mm)	0.5–1 (–2)	c. 0.4	c. 0.6	c. 0.4	c. 0.4
Pore size	0.3–0.8 (–1.8)	c. 0.35	c. 0.2	c. 0.08–0.3	c. 0.3
Carbonization of proper exciple	Occasionally slightly carbonized or dark brown apically	Not	Occasionally slightly carbonized or dark brown apically	Occasionally slightly carbonized or dark brown apically	Occasionally slightly carbonized or dark brown apically
Paraphyses	Straight	Straight to slightly bent	Straight with $\pm$ distinct septation	Straight	$\pm$ Bent to often distinctly curled in apical parts
Ascospores arrangement	1 (–2) seriate	2 (–3) seriate	2 (–3) seriate	2 (–3) seriate	2 (–3) seriate
Ascospores size (μ m)	(19–) 20–22.5 (–23.3) $\times$ (9.2–) 10–12.5 (–13.5)	7–17 $\times$ 5–9	20–35 (–40) $\times$ 10–17	19–34 (–40) $\times$ 9–13	10–45 (–50) $\times$ 7–20
No. of locules	4–5 $\times$ 1–3	4–6 $\times$ 1–3	6–8 (–10) $\times$ 1–5 (–6)	(4–) 5–11 $\times$ 2–3	(4–) 6–10 (–12) $\times$ 1–6
Pycnidia	Absent	Present	Absent	Present	Present
Chemistry	No chemicals or traces of pale brown spot at Rf 25 and an unknown fluorescent green compound turning red in UV at Rf 65.	Stictic acid complex	Norstictic acid (major), stictic and connorstictic acid in minority or traces	Stictic acid complex	Stictic acid complex
Reference	Rivas Plata <i>et al.</i> [5]	Mangold <i>et al.</i> [7]	Mangold <i>et al.</i> [7]	Frisch <i>et al.</i> [4]	Mangold <i>et al.</i> [7]

subcompunctum, while the presence of norstictic acid separates *L. occultum* from *L. desquamescens*. Furthermore, the thallus of *L. occultum* is ecorticate, while that of *L. fissurinum* and *L. subcompunctum* is fissured to fissured-areolate. For further differentiation between these species see Table 1.

Specimens examined. South Korea, Kangwon Prov., Mt. Sorak, 38°05'433" N, 128°24'643" E, alt. 750 m, on *Caprinus* bark, 25 May 2009, Y. Joshi & party, 090873 (KoLRI); 38°05'36" N, 128°25'176" E, alt. 884 m, on *Caprinus laxiflora* bark, 25 May 2009, Y. Joshi & party 090934 (KoLRI).

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References

1. Moon KH. Lichens of Mt. Sorak in Korea. J Hattori Bot Lab 1999;86:187-220.
2. Elix JA, Johnston J, Parker JL. A catalogue of standardized thin layer chromatographic data and biosynthetic relationships for lichen substances. Canberra: Australian National University; 1987.
3. White FJ, James PW. A new guide to microchemical techniques for the identification of lichen substances. Br Lichen Soc Bull (Suppl) 1985;57:1-41.
4. Frisch A, Kalb K, Grube M. Contributions towards a new systematics of the lichen family Thelotremataceae. Bibl Lichenol 2006;92:1-556.
5. Rivas Plata E, Lücking R, Sipman HJ, Mangold A, Kalb K, Lumbsch HT. A world-wide key to the thelotremoid *Graphidaceae*, excluding the *Ocellularia-Myriotrema-Stegobolus* clade. Lichenologist 2010;42:139-85.
6. Zahlbruckner A. Additamenta ad lichenographiam japoniae. Bot Mag (Tokyo) 1927;41:313-64.
7. Mangold A, Elix JA, Lumbsch HT. Thelotremataceae. In: McCarthy PM, editor. Flora of Australia, Vol. 57, Lichens 5. Melbourne: CSIRO Publishing; 2009. p. 195-420.