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A new species and a new record of the lichen genus *Coenogonium* (*Ostropales*: *Coenogoniaceae*) from South Korea, with a world-wide key to crustose *Coenogonium* having prothalli

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Abstract

Coenogonium lueckingii, a new corticolous species characterized by a greenish-gray thallus with a white prothallus and 1-septate fusiform ascospores, is described from South Korea. A description of the species is provided together with notes on its chemistry, distribution, ecology and taxonomy. Possible related lichen taxa are discussed briefly, and a worldwide key to the crustose *Coenogonium* species having a prothallus is also provided. Besides this, *Coenogonium pineti* is also reported for the first time for the lichen flora of South Korea.

Key words – Biodiversity – Chuja Island – Jeju Island – taxonomy

Introduction

The lichen genus *Coenogonium* described by Ehrenberg (1820) is represented by more than 80 species worldwide (Ferraro & Michlig 2013), among which *C. luteum* (Dicks.) Kalb & Lücking (2000) is so far known from South Korea (Moon 1999 as *Dimerella lutea*, Kondratyuk *et al.* 2013). *Coenogonium*, which is the only genus in the family *Coenogoniaceae* (Sitzenberger 1862), is characterized by a crustose or filamentous thallus with a trentepohlioid photobiont, biatorine (rarely zeorine), yellow to orange or brown apothecia with paraplectenchymatous excipulum, sometimes with pilose margins, partially amyloid hymenium, thin-walled unitunicate asci, and generally small, simple to 1-septate ascospores (Rivas-Plata et al. 2006; Lücking 2008).

During a stay in South Korea between 2009-2011, one of the authors (YJ) identified a small specimen of an interesting corticolous species as *Biatora* sp., which was later rectified as *Coenogonium* sp. by Sergey Kondratyuk. On a recent field trip to Jeju and Chuja Islands in 2014, additional collections of the same specimen were made by the authors, and all of them were apparently an undescribed *Coenogonium* species. These specimens are described here as new to science. Besides this, the excursion revealed the occurrence of *Coenogonium pineti* (Schrad. ex

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Ach.) Lücking & Lumbsch (Lücking et al. 2004) in South Korea, and that species is hereby reported for the first time as additional record to South Korean lichen flora.

This work is a further contribution to the knowledge of the lichenized fungi of South Korea, which is the result of our current study focusing on the taxonomy and diversity of lichens and allied fungi in that country. The results demonstrate that the biodiversity of crustose lichens is still incompletely known in the region, indicating that further study is warranted.

Materials & Methods

The specimens were examined at the Korean Lichen Research Institute, Sunchon National University (KoLRI), using a Motic SMZ-168 stereomicroscope at magnifications of 7.5–50X and an Olympus BX-50 compound microscope at magnifications of 10–1000X. The anatomical features were investigated by preparing sections of thalli and ascomata and then mounting them in water and 10% KOH. Only free ascopsores lying outside the asci were measured. Images of anatomical and morphological characters were taken using an HD-Measure LTHS-300 (Leetech Co.) microscope connected to a computer. Thin layer chromatography was performed as per Orange et al. (2001).

Results and Discussion

Coenogonium lueckingii Y. Joshi, Gagarina, Halda & Hur, **sp. nov.** (Fig. 1 a-c)
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Type: South Korea, Jeju-do province, Seogwipo-si, Donneako valley, Wonang fall, 33°18'04.3" N, 126°34'53.7" E, 330 m, on bark of tree, 19 June 2014, Y. Joshi and party, 140561 (Holotype KoLRI, Isotype BP).

The new species is characterized by a greenish-gray thallus with a white prothallus, apothecia 0.4–0.9 mm diam., with pale yellowish orange to deep orange disc and cream-colored margin, 1-septate spores, 7.5–10 µm long and 2–2.5 µm wide.

Thallus corticolous or plasticolous (KoLRI 022458), crustose, continuous, thin, smooth, greenish-gray to pale gray, 30–50 mm diam. (Fig. 1a). *Prothallus* whitish to silvery gray, shiny, conspicuous (Fig. 1b). Photobiont *Trentepohlia*, cells rectangular to angular-rounded or globose, in irregular plates or short threads, 5–10 µm diam.

Apothecia single or crowded, sessile with strongly constricted base, biatorine, rounded, rarely slightly irregular in outline, 0.4–0.9 mm diam., 185–250 µm high; disc cartilaginous, appearing waxy, pale yellowish orange to deep orange, usually slightly translucent, flat to slightly convex. Margin thick, usually distinct, not prominent, rarely evanescent, smooth, cream colored, paler than the disc. *Excipulum* well developed, paraplectenchymatous with radiating cell rows, colorless, I+ sordid orange-brown 75–125 µm; algal cells in basal excipulum. *Hypothecium* 25–40 µm high, colorless, I–. *Hymenium* 50–75 µm high, colorless, I+ blue then quickly sordid green then reddish brown, KI+ blue. *Paraphyses* unbranched, usually with thickened apices 2–4.5 µm. *Asci* cylindrical, completely thin walled without tholus, I–, KI–. *Ascospores* irregularly biseriate, eight per ascus, ellipsoid to fusiform, transversely 1-septate, colorless, 7.5–10 × 2–2.5 µm, 3–4 times as long as broad (Fig. 1c).

Pycnidia not seen.

Chemistry – Thallus and ascomata K–, C–, KC–, P–, UV–. TLC: no substances detected.

Etymology – The new species is dedicated to Robert Lücking, renowned lichenologist formerly at The Field Museum Chicago, now at the Botanical Garden and Botanical Museum Berlin, for his enormous contributions to the field of lichenology.

Distribution and Ecology – To date, the new species has only been reported from two localities in South Korea, Chuja Island and Mt. Jogye, where it is found growing on the bark of trees in humid habitats. The type locality has a very poor lichen diversity, and the new species was found with fragments of *Bacidia* sp. and *Lecanora* sp.

Notes – The new species is characterized by greenish-gray thallus with a white prothallus, apothecia 0.4–0.9 mm diam., apothecia with pale yellowish orange to deep orange disc and cream colored margin, 1-septate spores, 7.5–10 µm long and 2–2.5 µm wide. Other known *Coenogonium* species with prothalli that are either corticolous or foliicolous include: *C. albomarginatum* Michlig & L.I. Ferraro (2013), *C. atroluteum* (Vain.) Lücking, Aptroot & Sipman (2006), *C. kawanae* (H. Harada & Vězda) H. Harada & Lumbsch (2004), *C. magdalenae* Rivas Plata, Lücking & Lizano (2006), *C. persistens* (Malme) Lücking, Aptroot & Sipman (2006), *C. roumeguerianum* (Müll. Arg.) Kalb (2001), *C. siquirrense* f. *siquirrense* (Lücking) Lücking (2008), *C. siquirrense* f. *denticulatum* Rivas Plata & Lücking (2006), *C. strigosum* Rivas Plata, Lücking & Chavas (2006), *C. subsquamosum* (Aptroot & Seaward) Lücking, Aptroot & Sipman (2006), *C. subzonatum* (Lücking) Lücking & Kalb (2001), *C. verrucosum* Michlig & L.I. Ferraro (2013) and *C. zonatum* (Müll. Arg.) Kalb & Lücking (2000). These taxa are all clearly distinguished from the new species.

Coenogonium subzonatum and *C. zonatum* are strictly foliicolous, contain wart shaped pycnidia, and have smaller apothecia (0.2–0.5 mm) and uniseriate, relatively broader ascospores. The yellowish gray-green *C. albomarginatum* never has an I+ exciple and the ascospores are uniseriate. Large apothecia (0.7–1.3 mm) with high hymenia (70–90 µm), uniseriate ascospores and neotropical distribution separate *C. magdalenae* from the new taxon. Both *C. siquirrense* f. *siquirrense* and *C. siquirrense* f. *denticulatum* differ from the new taxon in having deeply orange apothecia with orange margin. *Coenogonium strigosum* differs from the new taxon in having a ± setose thallus, larger apothecia (0.8–1.5 mm) with a denticulate margin, uniseriate ascospores, and a neotropical distribution. *Coenogonium persistens* is another neotropical species that differs from the new taxon in having larger apothecia (0.8–1.5 mm). *Coenogonium roumeguerianum* differs in having broader spores (4–6 µm). The presence of yellow prothalli in *C. verrucosum* and *C. atroluteum* separates them from the new taxon. *Coenogonium kawanae* differs in having a denticulate margin, uniseriately arranged larger ascospores (10–14 µm), while *C. subsquamosum* differs in lacking algal cells in the basal excipulum and having larger apothecia (0.8–1.2 mm).

When the prothallus is lacking or unclear (poor material, for example), the new taxon looks like *C. luteum* and is often confused with it. However, *C. luteum* differs from it in having much bigger apothecia (0.8–2 mm), a narrow excipulum (50–100 µm) and uniseriately arranged wider spores (2.5–3.5 µm).

The new species has a very thick hypothecium (25–40 µm) which separates it from two similar species – *Coenogonium nepalense* and *C. geralense* – both having hypothecium less than 25 µm. The hypothecium of *C. nepalense* is 10–13 µm and that of *C. geralense* is 10–15 µm. Besides this, *C. nepalense* and *C. geralense* have not cartilaginous disc of apothecia.

Materials examined – SOUTH KOREA. Jeju-do province: Jeju-si, Hangyeong-myeon, Yongsu-ri, Seashore road, 33°20’31.6”N, 126°10’12.08”E, alt. 82 m, on bark and on plastic, 18 June 2014, J. Halda, 140398 (KoLRI 022458); Jeollanam-do: Sunchon-si, Seungju-eup, Mt. Jogye, Seonam-sa, N34°59’33.7” E127°20’22.7”, alt. 210 m, on bark, 2005, L. Lőkös, 050679 (KoLRI 003583).

Coenogonium pineti (Schrad. ex Ach.) Lücking & Lumbsch

Thallus corticolous, crustose, superficial, continuous, thin, smooth to fine-grained, grayish-green. Prothallus absent. Photobiont *Trentepohlia*, cells globose, 6–13 µm diam. Apothecia single or crowded, sessile; 0.1–0.5 mm diam.; disc whitish to pinkish yellow, concave to flat, with concolorous or paler exciple. Excipulum well developed, paraplectenchymatous, 30–110 µm. Hypothecium 10–36 µm high, colorless. Hymenium 70–90 µm high, I+ blue then quickly sordid green then reddish brown, KI+ blue. Paraphyses simple, unbranched, with thickened apices to 4 µm. Asci numerous, cylindrical, without tholus, I–, KI–. Ascospores uniseriate, eight per ascus, fusiform to ellipsoid, transversely 1-septate, colorless, 9–13 × 2–3(–4) µm.

Distribution and Ecology – The species is so far known from Jeju Island where it is found growing on the bark of unknown tree in humid habitat in association with *Graphis* sp.

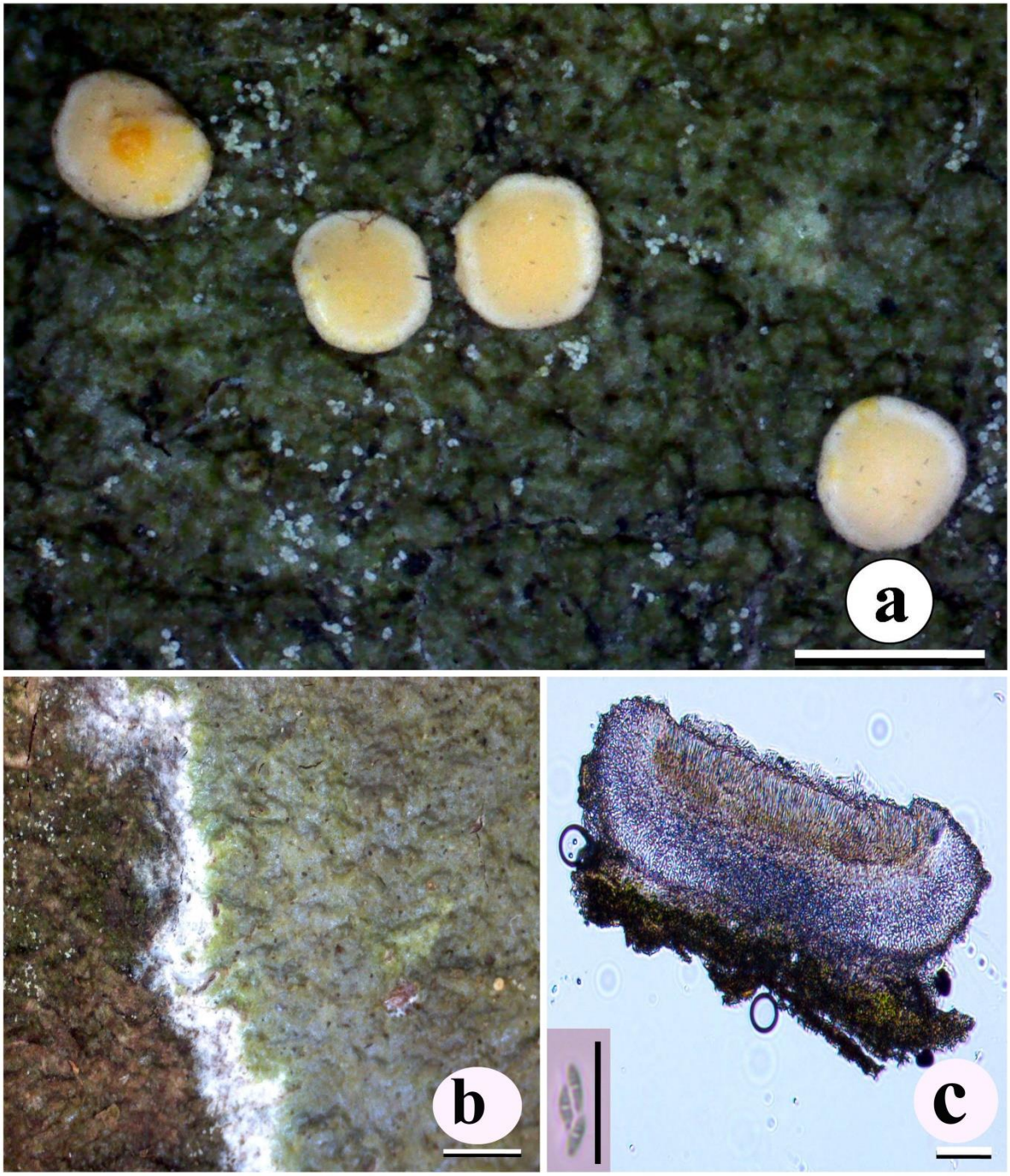

Fig. 1 – Habit of *Coenogonium lueckingiii* (holotype) a) Thallus (Scale = 2 mm); b) Prothallus (Scale = 3 mm); c) Transverse section of apothecia along with spores (Scale = 100 & 20 µm, respectively).

Remarks – *Coenogonium pineti* is similar to *C. dilucidum* (Kremp.) Kalb. & Lücking (2000), *C. kawanae* and *C. luteum*. *Coenogonium dilucidum* differs in having pale wax-colored apothecia and larger ascospores (14–18 µm long), *C. kawanae* has pale yellow-brownish apothecia and white prothallus, while *C. luteum* has larger (0.8–2 mm), more bright orange color apothecia and thickened paraphyses up to 4.5 µm.

Material examined – SOUTH KOREA. Jeju-do province: Seogwipo-si, Donneako valley, Wonang fall, 33°18’04.3”N, 126°34’53.7”E, alt. 330 m, on bark, 19 June 2014, L. Gagarina, 140611 (KoLRI 022470).

Key to worldwide crustose *Coenogonium* species having prothalli

1. Prothallus yellow.....2
- Prothallus white.....3

2. Thallus verrucose; apothecia orange……..*C. verrucosum*
- Thallus smooth; apothecia pale yellow brown.....*C. atroluteum*

3. Thallus yellow……...*C. subsquamosum*
- Thallus green-gray……...4

4. Ascospores 12–20 µm long…….....5
- Ascospores 6–12 µm long.....6

5. Thallus greenish gray; apothecia 0.3–0.5 mm diam., margin denticulate.....*C. kawanae*
- Thallus yellow; apothecia 0.8–1.2 mm, margin not denticulate.....*C. squamosum*

6. Ascospores 4–6 µm broad…….....*C. roumeguerianum*
- Ascospores 1.5–4 µm broad.....7

7. Ascospores 3–4 µm broad.....……..8
- Ascospores 1.5–2.5 µm broad.....11

8. Apothecia medium sized, 0.3–0.8 mm diameter.....9
- Apothecia large, 0.8–2 mm diameter.....10

9. Apothecial margin denticulate; neotropical distribution……*C. subzonatum*
- Apothecial margin not denticulate; pantropical distribution……...*C. zonatum*

10. Disc orange yellow to orange, thallus sometimes with setae, margin not denticulate……..*C. strigosum*
- Disc pale yellow to yellow, thallus without setae, margin denticulate……..*C. magdalenae*

11. Exciple with very large peripheral cells....……12
- All cells of the exciple of similar size...……13

12. Apothecial margin denticulate.....*C. siquirrense* f. *denticulatum*
- Apothecial margin never denticulate.....*C. strigosum*

13. Thallus glabrous, apothecia medium sized (0.8–1.5 mm diam.)..... *C. persistens*
- Thallus not glabrous, apothecia small sized (0.4–0.8 mm diam.)…….....14

14. Corticolous or plasticolous.....*C. lueckingii*
- Strictly foliicolous…….....15

15. Ascospores 8–12 µm long, disc cartilaginous, conidia 13–16 × 1–1.5 µm. Palaeotropical distribution…….....*C. pocsii*
- Ascospores 6–9 µm long, disc not cartilaginous, conidia 3–3.5 × 1.2–1.5 µm. Neotropical distribution …….....*C. siquirrense* f. *siquirrense*

16. Ascospores 8–12 µm long; thallus without setae……..*C. persistens*
- Ascospores 6–9 µm long; thallus sometimes with setae……...*C. strigosum*

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References

Ferraro LI, Michlig A. – 2013 New species and additional records of *Coenogonium* (*Ostropales: Coenogoniaceae*) from southern South America. Lichenologist 45, 497–504.

Harada H, Okamoto T, Yoshimura I. – 2004 A Checklist of Lichens and Lichen-allies of Japan. Lichenology 2, 47–166.

Kondratyuk S, Lőkös L, Tschabanenko S, Haji Moniri M, Farkas E, Wang XY, Oh S-O, Hur J-S. – 2013 New and noteworthy lichen forming fungi and lichenicolous fungi. Acta Botanica Hungarica 55, 275–349.

Lücking R. – 2008 Foliicolous lichenized fungi. Flora Neotropica Monograph 103, 1–866.

Lücking R, Kalb K. – 2000 Foliikole Flechten aus Brasilien (vornehmlich Amazonien), inklusive einer Checkliste und Bemerkungen zu Coenogonium und Dimerella (*Gyalectaceae*). Botanische Jahrbücher für Systematik Pflanzengeschichte und Pflanzengeographie 122, 1–61.

Lücking R, Kalb K. – 2001 New Caledonia, foliicolous lichens and island biogeography. Bibliotheca Lichenologica 78, 247–274.

Lücking R, Stuart BL, Lumbsch HT. – 2004 Phylogenetic relationships of Gomphillaceae and Asterothyriaceae: evidence from a combined Bayesian analysis of nuclear and mitochondrial sequences. Mycologia 96, 283–294.

Moon KH. – 1999 Lichens of Mt. Sorak in Korea. Journal of the Hattori Botanical Laboratory 86, 187–220.

Nees von Esenbeck CDG. – 1820 Horae Physicae Berolinenses. 1820, 1–120.

Orange A, James PW, White FJ. – 2001 Microchemical methods for the identification of lichens. British Lichen Society, London, 101 pp.

Rivas Plata E, Lücking R, Aptroot A, Sipman HJM, Chaves JL, Umana L, Lizano D. – 2006 A first assessment of the Ticolichen biodiversity inventory in Costa Rica: The genus *Coenogonium* (*Ostropales*: *Coenogoniaceae*), with a world-wide key and checklist and a phenotype-based cladistic analysis. Fungal Diversity 23, 255–321.

Stizenberger E. – 1862 Beitrag zur Flechtensystematik. Bericht über die Tätigkeit der St. Gallischen Naturwissenschaftlichen Gesellschaft 1861-1862, 124–182.