RESEARCH ARTICLE

Lichenosticta antarctica sp. nov. (Lecanorales, Ascomycota) and six noteworthy lichenicolous fungi from the Sør Rondane Mountains, Dronning Maud Land, Antarctica

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Abstract

Lichenosticta antarctica, a lichenicolous fungus, is described as a new species, collected from the Sør Rondane Mountains, inland eastern Antarctica. It is characterized by small conidiomata, irregularly branched conidiophores, chained conidiogenous cells and lacriform conidia. In addition, six other noteworthy lichenicolous fungi—*Bryostigma* cf. *molendoi*, *Carbonea aggregantula*, *Intralichen lichenicola*, *Lichenoconium usneae*, *Muellerella pygmaea* and *Tetramelas phaeophysciae*—are reported from the same site, representing new distribution records for inland eastern Antarctica. A new key to the known species of *Lichenosticta* is presented.

Keywords

Bryostigma cf. *molendoi*; *Tetramelas phaeophysciae*; lichen; parasite; polar regions; key

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Abbreviations

I: treatment with Lugol's iodine solution
K/I: pre-treatment with 10% KOH
KOH: potassium hydroxide
NIPR: National Institute of Polar Research (Japan)
TNS: National Museum of Nature and Science (Japan)

Introduction

Lichenicolous fungi, which are either parasitic or saprophytic on lichens, comprise a diverse group of over 2400 species that have been reported (Diederich et al. 2025). Many species can be recognized by the formation of galls, lesions or discolourations on the host lichen. However, only a few cause severe damage by killing and destroying the host (Hawksworth 1982; Diederich et al. 2018; Diederich et al. 2025).

Approximately 100 species of lichenicolous fungi have been recorded in Antarctica, most of them from the Antarctic Peninsula and South Shetland Islands in western Antarctica (Alstrup et al. 2018; Etayo et al. 2023). A few species have been reported from Marie Byrd Land in western Antarctica, the Transantarctic Mountains and around Syowa Station in eastern Antarctica (Olech & Alstrup 1996; Ertz et al. 2014; Tadome & Ohmura 2023).

The Sør Rondane Mountains are in the eastern part of Dronning Maud Land, East Antarctica and run along the 72°S parallel from 22° to 28°E. The mountain range is composed of various metamorphic and plutonic rocks (Kojima & Shiraishi 1986). The altitude of the northern foot is ca. 1000 m a.s.l. and the southern foot reaches up to ca. 3000 m a.s.l. (Kojima & Shiraishi 1986; Ohyama et al. 1991; Ertz et al. 2014). They have been poorly investigated due to the difficulty in reaching the area and only a few species of lichenicolous fungi have been reported from there (Ertz et al. 2014). Dodge (1962) was the first to report lichens from the Sør Rondane Mountains, describing 10 species, and Ertz et al. (2014) reported that 26 lichens and two lichenicolous fungi have been identified in this area. A recent field survey conducted in 2020 in this region by the first author revealed seven noteworthy lichenicolous fungi, including one undescribed species. This study aims to describe the new species, *Lichenosticta antarctica*, and documents six additional taxa, with notes on aspects of their morphology, ecology and biogeography.

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Materials and methods

Lichen specimens were collected from the Sør Rondane Mountains, Dronning Maud Land, inland eastern Antarctica, in 2020. Subsequent microscopic examination of these specimens revealed the presence of lichenicolous fungi, which form the basis of this study.

Morphological observations were conducted using a dissecting microscope (Olympus SZX12) and a differential interference contrast microscope (Olympus BX51). Anatomical structures were examined on hand-cut sections mounted in water. Measurements of ascospores and conidia are given as (minimum–) range including mean ± standard deviation (–maximum) (n = number of measurements), using the software Photo-ruler (Japanese only). The epihymenium was applied with 10% KOH. The amyloidity of the hymenial gel was tested with 1.5% Lugol's iodine solution directly (I) or following a pre-treatment with 10% KOH (K/I).

All voucher specimens are housed in the herbarium of the NIPR in Tachikawa, Japan. Some duplicate specimens are housed separately at the herbarium of the TNS in Tsukuba, Japan.

Results and discussion

New species

Lichenosticta antarctica Tadome & Y. Ohmura, sp. nov.
(Fig. 1)
MycoBank # MB863681

Diagnosis: Similar to *Lichenosticta lecanorae* but growing on the underside of the thallus of *Candelaria murrayi*, distinguished by smaller conidiomata (30–70 µm diameter for *Lichenosticta antarctica* compared to 50–120 µm diameter for *L. lecanorae*) and shape of conidia (lacriform for *L. antarctica* in contrast to ellipsoid to oblong for *L. lecanorae*).

Type: Antarctica, Sør Rondane Mountains, Mt. Yukidori-toride, 72°6′13.94″S, 22°41′47.26″E, on *Candelaria murrayi* (underside of the host thallus), elevation ca. 1600 m, 19 January 2020, K. Tadome 126 (NIPR-KT61-126, holotype; TNS-L-KT61-126, isotype).

Description: Conidiomata pycnidial, developing on the underside of the host thallus, sessile to partially immersed, solitary, scattered, subglobose to broadly pyriform, ostiolate, dark brown to black, shiny, (30–)33–55(–70) µm diameter; conidiomatal wall 6–10 µm thick, composed of 2–4 irregular layers of cells; outer cells brown to reddish brown, epidermoid, 3–6 µm wide; inner cells subhyaline, forming pseudoparenchymatous tissue, 2–7 µm wide. Conidiophores flexuous, irregularly branched, 1–4 septate, hyaline, 8–19 × 2–3 µm, arising from the inner cells of the conidiomatal wall. Conidiogenous cells integrated into chains, mono- to sometimes polyphialidic, cylindrical to ampulliform or doliiform, hyaline, 4–9 × 2–3 µm. Conidia acropleurogenous, slightly curved, lacriform, simple, hyaline, rounded at the tip, sometimes slightly truncated at the base, smooth on the surface, usually 2–4 guttulate, (2.7–)3.8–4.9(–6.5) × (1.5–)1.9–2.3(–2.8) µm (n = 757).

The new species is characterized by dark brown to black, small pycnidial conidiomata (30–70 µm in diameter), flexuous and irregularly branched conidiophores, slightly curved and lacriform, small conidia (3.8–4.9 × 1.9–2.3 µm). The combination of these characteristics is distinctive among other *Lichenosticta* species and supports its recognition as an independent species (see Table 1). There are two similar species to *L. antarctica*: *L. lecanorae* is distinguished from *L. antarctica* by larger conidiomata, and another shape of conidia (lacriform for *L. antarctica* in contrast to ellipsoid to oblong for *L. lecanorae* [H. Kashiwadani 52029, TNS!]). According to Zhurbenko et al. (2015), conidiomata of *L. lecanorae* are 50–120 µm in diameter, which overlaps with that of *L. antarctica*, which is (30–)33–55 (–70) µm. However, conidiomata of *L. lecanorae* from a Japanese specimen (H. Kashiwadani 52029, TNS) measured 90–110 µm in diameter, without overlap with *L. antarctica*. Thus, *L. lecanorae* tends to have larger conidiomata than *L. antarctica*. *Lichenosticta wirthii* is distinguished from *L. antarctica* by the blue-green outer wall of the conidiomata (Brackel & Wirth 2023).

Etymology: The epithet refers to Antarctica, where the species was found.

Taxonomic notes: Pino-Bodas et al. (2017) confirmed the phylogenetic placement of *Lichenosticta* within *Lecanorales* and showed the close relationship with *Gypsoplaca* (*Gypsoplacaceae*, *Lecanorales*), based on molecular data from four loci (LSU rDNA, SSU rDNA, ITS rDNA and mtSSU). However, *Gypsoplaca* and *Lichenosticta* differ morphologically: in *Gypsoplaca*, conidia are produced apically, whereas in *Lichenosticta* they are formed both at the tip and along the sides of the conidiophore (i.e., acropleurogenous). These morphological differences make it unlikely that *Lichenosticta* belongs to the Gypsoplacaceae. Although current phylogenetic data indicate that *Scutula* (Ramalinaceae, Lecanorales) is not closely related to *Lichenosticta*, they show morphological similarities, such as irregularly branched conidiophores and conidia that develop either laterally or terminally from the conidiophores. The classification of *Lichenosticta* at the family level requires more data and further investigation.

Specimen of *L. lecanorae* examined: Japan, Hokkaido, Teshio Province, Shimokawa-machi, Kamikawa-gun (44°24′59.9″N, 142°39′36.8″E). On *Lecanora cinereofusca* (apothecia and thallus) on bark of *Picea yezoensis*, elevation ca. 305 m. On 13 September 2017, H. Kashiwadani 52029 (TNS).

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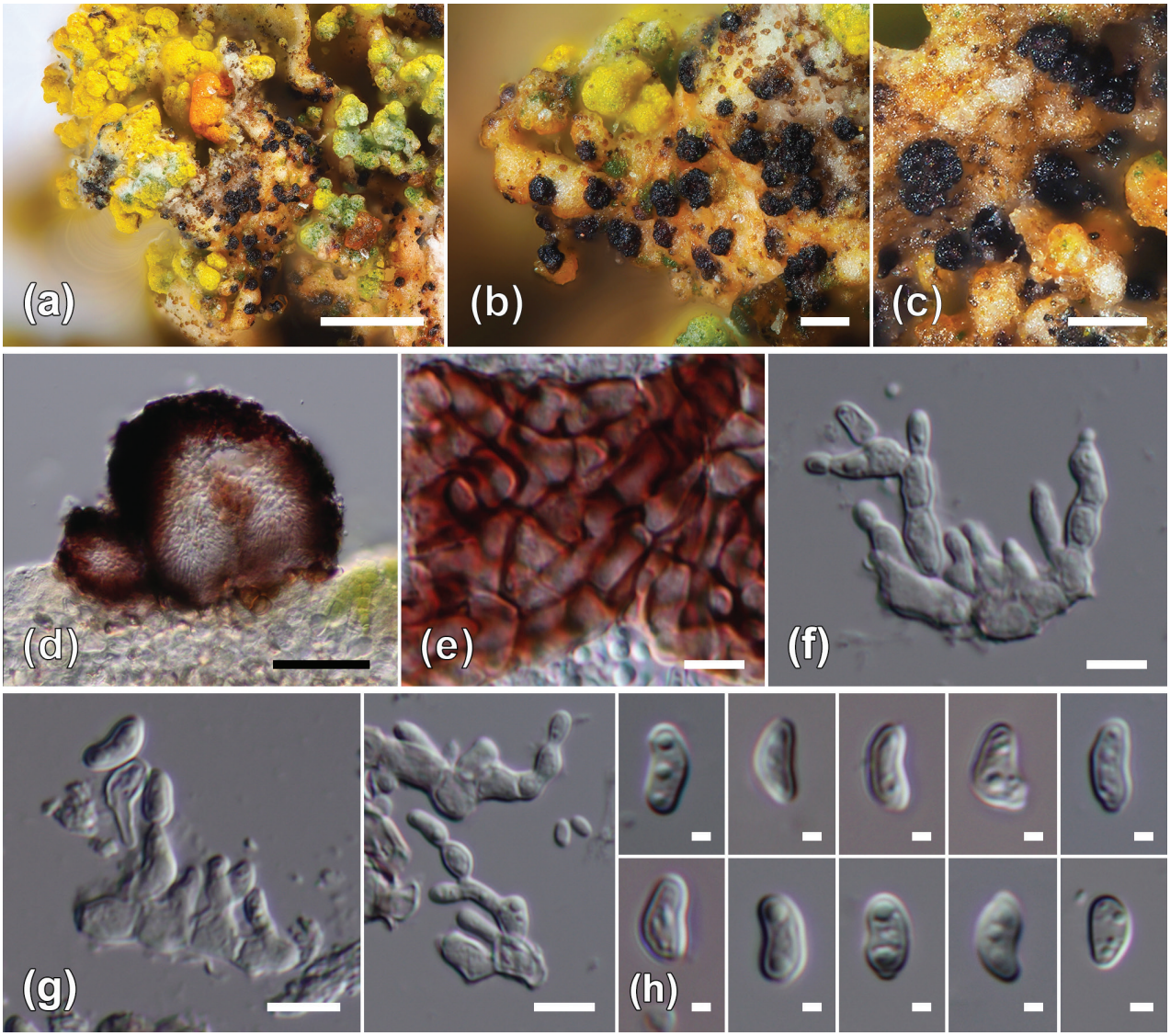

Fig. 1 *Lichenosticta antarctica* (holotype, NIPR). (a) Growth habit on *Candelaria murrayi*. (b–c) Conidiomata. (d) Cross-section of conidiomata. (e) Conidiomatal wall. (f–g) Conidiophores and conidiogenous cells. (h) Conidia. Scales: (a) 500 µm; (b–c) 100 µm; (d) 30 µm; (e–g) 5 µm; (h) 1 µm.

Key to the species of Lichenosticta

1 Conidia mostly > 5 µm in length 2
Conidia mostly < 5 µm in length 5

2(1) Conidia ellipsoid to oblong 3
Conidia bacilliform, fusiform, or lacriform.....4

3(2) Conidia ellipsoid to oblong, 5–6 × 2.5–3 µm, on *Lecanora*.....*L. jurgae*
Conidia oblong, 6.5–8.5 × 4.0–4.5 µm, on *Stereocaulon* ..... *L. dombrovskae*

4(2) Conidia bacilliform to fusiform, 9–10 × 2.1–2.3 µm; conidiogenous cells 6.5–11.5 × 1.5–2.5 µm, on *Cladia* .....*L. hoegnabbae*
Conidia lacriform, 6.5–10 × 3–4.5 µm; conidiogenous cells 4–6 × 2.5–4 µm, on *Cladonia*..... *L. alcicorniaria*

5(1) Conidiomata ≤ 50 µm in diameter; conidiomatal outer wall black to blue-green, on *Loxospora* ..... *L. wirthii*
Conidiomata 30–120 µm (usually > 50 µm) in diameter; conidiomatal outer wall brown to reddish brown 6

6(5) Conidiomata black, 50–120 µm diameter; conidia ellipsoid to oblong, on *Lecanora* ..... *L. lecanorae*
Conidiomata dark brown to black, 30–70 µm diameter; conidia lacriform, on *Candelaria* .....*L. antarctica*

Table 1 Comparison of new species of *Lichenosticta* with closely related species.

Species	Conidiomata colour diameter (µm)	Conidiophores size (µm)	Conidiogenous cells size (µm)	Conidia shape size (µm)	Host	Distribution	References
Lichenosticta antarctica	dark brown to black (30-)33–55(-70)	8–19 × 2–3	4–9 × 2–3	lacriform 3.8–4.9 × 1.9–2.3	*Candelaria murrayi*	Antarctica	this study
L. alcicorniaria[a]	brown to black 50–150	10–24 × 2.5–3 (Santesson: Fungi Lichenicoli Exs. 268 [TNS!])	4–6 × 2.5–4	lacriform 6–11 × 2–6	*Cladonia* sp.	Asia, Europe, North America, South America	Hawksworth 1981; Pino-Bodas et al. 2017; Zhurbenko & Pino-Bodas 2017; Zhurbenko & Ohmura 2019
L. dombrovskae	black 50–125	–	–	oblong 4.5–11 × 3–5.5	*Stereocaulon* sp.	Russia	Zhurbenko 2010
L. hoegnabbae	brown to black 100–200	2–2.5	6.5–11.5 × 1.5–2.5	bacilliform to fusiform 7.8–12.6 × 1.9–2.7	*Cladia* sp.	New Zealand	Zhurbenko & Pino-Bodas 2015
L. jurgae	black 60–110	–	5–7 × 2–2.5	broadly ellipsoid to oblong 4–8 × 2–3.5	*Lecanora* sp.	Bolivia	Flakus & Kukwa 2012
L. lecanorae	black 90–110	6–25 × 2–3.5	3.8–4.6 × 1.6–2.4	ellipsoid to oblong 2.7–5.5 × 1.5–2.2	*Lecanora* sp.	Denmark, France, Italy, Japan	this study, Zhurbenko et al. 2015
L. wirthii	blackish blue to green 15–50	12–20 × 2–3.5	–	narrowly ellipsoid 2.6–3.5 × 1.2–2	*Loxospora cismonica*	Germany	Brackel & Wirth 2023

[a]Exsiccatum of *L. alcicorniaria* examined. Sweden, Uppland Province, Osterlovsta par. Lovstabruk. ca. 5 km south-east of Österlövsta, just east of the castle. 60:24'30"N 17:58'30"E. Alt. 20 m. Open mixed forest, on bark of *Ulmus*, near the base. On *Cladonia fimbriata* (thallus), 10 May 1996. (Santesson: Fungi Lichenicoli Exs. 268 TNS).

Other noteworthy species from the same location

Bryostigma cf. *molendoi* (Heufl. ex Arnold) S.Y. Kondr. & Hur, in Kondratyuk et al., Acta Bot. Hung. 62(1–2): 100 (2020) (Fig. 2a–d)

Ascomata developed on upper surface of thallus, scattered or aggregated, round, convex, black, 0.1–0.15 mm diameter. Epihymenium brown to dark brown, 9–15 µm tall, K–. Hymenium hyaline, without inspersion, 27–32 µm tall, I+ red, K/I+ blue; paraphysoids branched and anastomosed, brown at the tips, slightly enlarged, extending above the asci, 1.4–3 µm wide. Hypothecium brown, 18–40 µm tall. Asci clavate, 25–28 × 11–14 µm, 8-spored, K/I+ blue at apical dome (*Arthonia*–type). Ascospores ellipsoid to oblong, 1-septate, not or slightly constricted at the septum, hyaline, (8.4–)9.3–11.3(–12.6) × (3.3–)3.8–4.6(–5.3) µm (n = 71).

In the Sør Rondane Mountains, this species was tentatively reported from *Gallowayella borealis* (R. Sant. & Poelt) S.Y. Kondr. et al. (as *Xanthomendoza borealis* (R. Sant. & Poelt) Søchting, Kärnefelt & S.Y. Kondr.), collected from Utsteinen Nunatak (Ertz et al. 2014; as *Arthonia* cf. *molendoi* [Heufl. ex Arnold] R. Sant. 1986). The specimen reported by Ertz et al. (2014) has the characteristics of ascomata black, convex, 0.08–0.13 mm in diameter, not forming galls; epihymenium pale brown, asci *Arthonia*-type, ascospores hyaline, 1-septate, 10.5–13 × 4–5 µm, and is generally consistent with this species. However, because the hypothecium is colourless to pale yellow, it differs from the usual *B. molendoi*, and the specimen was therefore referred to as *B.* cf. *molendoi*. The specimens examined in this study have morphological and anatomical features that closely resemble those described in the protologue, the diagnostic features provided by Fleischhacker et al. (2016), and those observed in an exsiccatum specimen of *Arthonia molendoi* (Santesson: Fungi Lichenicoli Exs. 54 [TNS!]).

Bryostigma molendoi is widely distributed in temperate to Arctic-alpine zones of both hemispheres (Fleischhacker et al. 2016), and *Rusavskia elegans* (Link) S.Y. Kondr. & Kärnefelt (=*X. elegans* [Link] Th. Fr. 1860) is the type host (Fleischhacker et al. 2016). In the Sør Rondane Mountains, however, *B. molendoi* was not found on *R. elegans*, not even on thalli occurring in close proximity to infected thalli of *Gallowayella borealis* (R. Sant. & Poelt) S.Y. Kondr. et al. (= *X. borealis* R. Sant. & Poelt). The lichenicolous fungi of the genus *Arthonia* s. lat. are highly host specific and there are more than 160 species recorded from a wide variety of hosts (Diederich et al. 2025). Currently, it parasitizes species of *Xanthoria* s. lat., including *Rusavskia*, and was also

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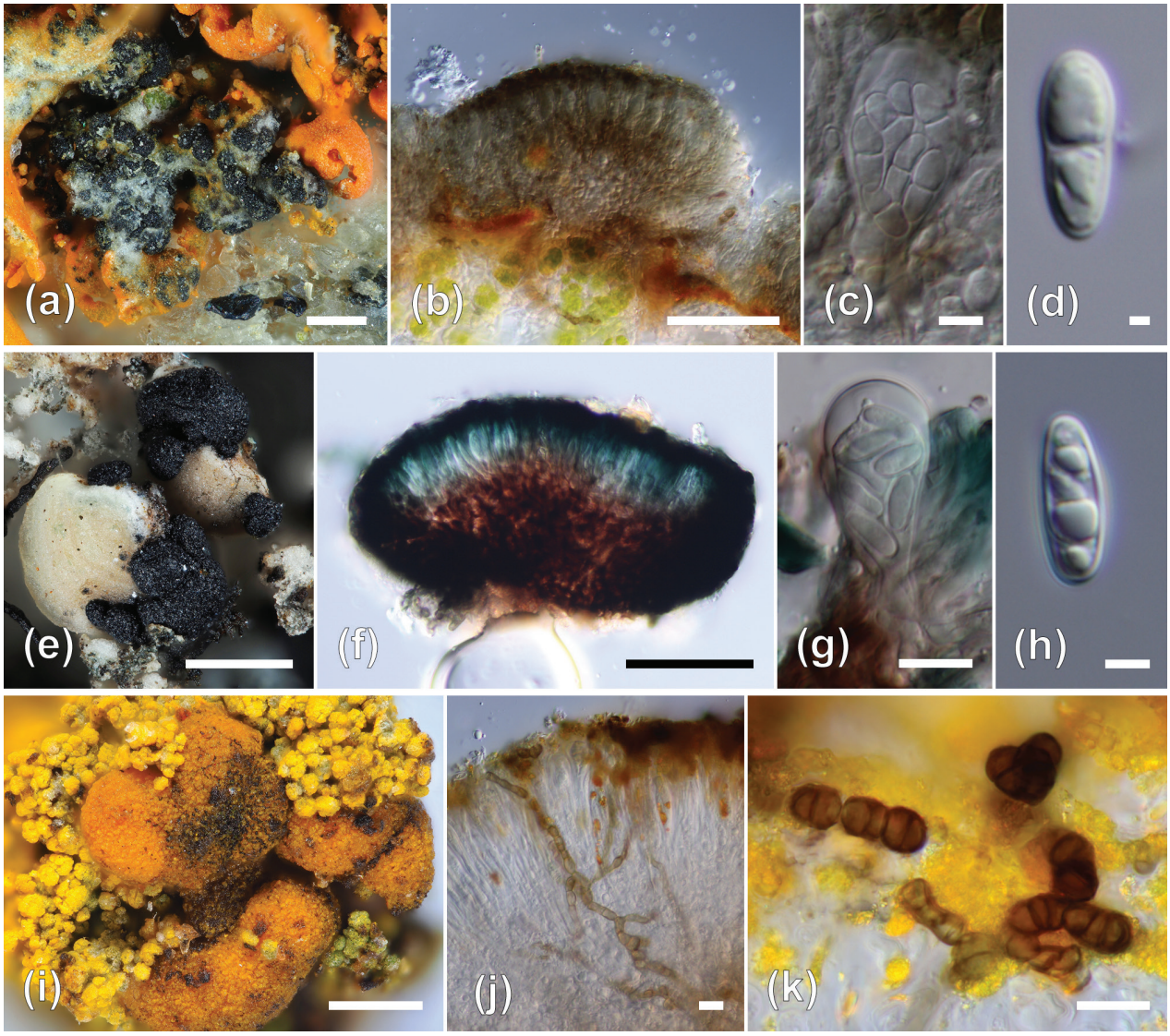

Fig. 2 Taxon 1: (a–d) *Bryostigma* cf. *molendoi* (K. Tadome 115, NIPR), Taxon 2: (e–h) *Carbonea aggregantula* (K. Tadome 391, NIPR) and Taxon 3: (i–k) *Intralichen lichenicola* (K. Tadome 356, NIPR). (a) Growth habit on *Gallowayella borealis*. (b) Cross-section of ascoma. (c) Asci. (d) Ascospores. (e) Growth habit on *Lecanora* sp. (f) Cross-section of ascomata. (g) Asci. (h) Ascospores. (i) Growth habit on *Candelariella flava*. (j) Internal mycelium and conidiophores. (k) Conidia. Scales: (a, e, i) 500 µm; (f) 100 µm; (b) 50 µm; (g, j, k) 10 µm; (c, h) 5 µm; (d) 1 µm.

reported on *Calogaya* sp. (Diederich et al. 2025), but future research may limit the host to *Rusavskia*. Therefore, although this specimen is morphologically identical to the known *B. molendoi*, it could represent a different species. As further investigation, including genetic analysis, will be necessary for precise distinction of the involved material, we assign it to *B.* cf. *molendoi* in this article.

Specimen examined: Antarctica, Sør Rondane Mountains, Mt. Yukidori-toride, 72°6′13.94″S, 22°41′47.26″E, on *Gallowayella borealis* (thallus), elevation ca. 1600 m, 19 January 2020, K. Tadome 115 (NIPR).

Exsiccatum examined: Austria, Oberösterreich, Nördliche Kalkalpen, Dachstein-Gruppe, Lackenmoosalm north of Feisterscharte, elevation ca. 2000 m, on horizontal and vertical surfaces of a bird-rock (a rock affected by bird activity), on *Rusavskia elegans* (=*X. elegans* [Link] Th. Fr. 1860) (thallus and apothecia) (Santesson: Fungi Lichenicoli Exs. 54, TNS).

Carbonea aggregantula (Müll. Arg.) Diederich & Triebel, in Diederich, Herzogia 16: 51 (2003)
(Fig. 2e–h)

This species is widely distributed in Asia, Europe and North America (e.g., Diederich 2003; Zhurbenko & Brackel 2013; Pirogov et al. 2014; Joshi et al. 2020; Hafellner 2021). Our specimen extends the known distribution to inland eastern Antarctica.

Specimen examined: Antarctica, Sør Rondane Mountains, Utsteinen, 71°57′24.55″S, 23°20′46.65″E, on *Lecanora* spp. (apothecia), elevation ca. 1400 m, 25 January 2020, K. Tadome 391 (NIPR).

Intralichen lichenicola (M.S. Christ. & D. Hawksw.) D. Hawksw. & M.S. Cole, Fungal Diversity 11: 93 (2002)
(Fig. 2i–k)

Intralichen lichenicola parasitizes not only the hymenium of the host apothecia but also its thallus (Diederich 2021; Diederich 2024).

Diederich (2021) reported that this species may be confined to *Candelariella*, which supports this identification. This species is widely distributed in the world (Diederich 2024). In the Antarctic region, this species was found on *Candelariella vitellina* (Hoffm.) Müll. Arg. (Alstrup et al. 2018). Our finding extends its known distribution to inland eastern Antarctica.

Specimen examined: Antarctica, Sør Rondane Mountains, Utsteinen, 71°57′24.55″S, 23°20′46.65″E, on *Candelariella flava* (apothecia and thallus), elevation ca. 1400 m, 25 January 2020, K. Tadome 356 (NIPR).

Lichenoconium usneae (Anzi) D. Hawksw., Persoonia 9(2): 185 (1977)
(Fig. 3a–d)

This species has previously been reported on various lichens from worldwide, such as *Bryoria*, *Cladonia*, *Lecanora*, *Melanohalea*, *Parmelia*, *Physcia*, *Rhizoplaca*, *Usnea* and *Xanthoparmelia* (Hawksworth 1977; Kukwa 2004; Hawksworth et al. 2010; Lawrey et al. 2011; Darmostuk 2019; Brinker 2020). In the Antarctic region, it has been reported from King George Island and Livingston Island on *Cladonia*, *Lecanora*, *Parmelia* and *Rhizoplaca* (Alstrup et al. 2018). In East Antarctica, it has also been reported from Bunger Oasis on *Rhizoplaca* (Olech & Alstrup 1996). Its known distribution is now extended to inland eastern Antarctica.

Specimen examined: Antarctica, Sør Rondane Mountains, Utsteinen, 71°57′24.55″S, 23°20′46.65″E, on *Usnea* sp. (thallus), elevation ca. 1400 m, 25 January 2020, K. Tadome 357 (NIPR).

Muellerella pygmaea (Körb.) D. Hawksw., Bot. Notiser 132(3): 289 (1979)
(Fig. 3e–h)

This species is one of the most common lichenicolous fungi on *Lecidea* in Holarctic mountain regions (Hafellner 2020). However, its host range extends to several other genera, including *Lecanora*, *Rhizoplaca*, *Rhizocarpon*, *Tephromela* and *Xanthoria* (Triebel 1989; Svane & Alstrup 2004; Zhurbenko 2013; Diederich et al. 2018).

Muellerella pygmaea has previously been reported from various parts of the world (Aptroot 1996; Svane & Alstrup 2004; Hafellner & John 2006; Hafellner & Mayrhofer 2007; Seaward et al. 2008; Zhurbenko 2009, 2013; Hawksworth et al. 2010; Fleischhacker et al. 2015; Alstrup et al. 2018; Hafellner 2020). In the Antarctic region (King George Island and Livingston Island) it was found on *Candelariella aurella*, *Carbonea assentiens* and *Lecanora alpigena* (Alstrup et al. 2018). Hawksworth & Iturriaga (2006) showed that other taxa described from the Antarctic Peninsula and Victoria Land (East Antarctica)—*Thelidiola eklundii* C.W. Dodge and *Thelidium minutum* C.W. Dodge—are synonymous with *M. pygmaea*. Its known distribution is now extended to inland eastern Antarctica.

In Antarctica, not only *M. pygmaea* but also *M. lichenicola* (Sommerf.) D. Hawksw. is known as a species growing on Teloschistaceae. *Muellerella pygmaea* is distinguished from *M. lichenicola* by ascospore size (6–10 × 4–5.5 µm for *M. pygmaea* vs 5–8 × 2–4 µm for *M. lichenicola*) (Alstrup et al. 2018).

Specimen examined: Antarctica, Sør Rondane Mountains, Tanngarden, 72°1′21.65″S, 22°47′8.19″E, on *Rusavskia elegans* (apothecia and thallus), elevation ca. 1600 m, 20 January 2020, K. Tadome 160 (NIPR).

Tetramelas phaeophysciae A. Nordin & Tibell, Lichenologist 37(6): 495 (2005)
(Fig. 3i–l)

Ascomata lecideoid, black, superficial on host thallus, scattered, sessile, 0.3–0.5 mm diameter; disc flat to convex. Epihymenium dark brown, inner part slightly pale, 12–20 µm thick, K/I+ blue. Hymenium hyaline, 60–80 µm thick. Paraphyses infrequently branched above, septate, 2.0–2.5 µm wide, brown at the apex, enlarged, 3.3–5.4 µm wide. Hypothecium brown, 47–83 µm thick. Asci obovoid, 38–50 × 20–25 µm, 8-spored, K/I+ blue at the apical dome (*Lecanora*-type). Ascospores brown, ellipsoid to reniform, slightly verrucose on the surface, 1-septate, (14–)14–15.4(–16.4) × (6.2–)6.8–8.2(–9.2) µm (n = 40).

This species is characterized by black lecideoid ascomata parasitizing on the thallus of *Phaeophyscia* and *Physcia* (Fig. 3i), K/I+ blue at apical dome (*Lecanora*-type), and the transversely 1-septate, brown reniform ascospores (Fig. 3k–l). The ascospore size of the present material is smaller than those reported in protologue and description ([16.5–]19–21[–22] × [6.5–]6.5–7.5[–9] µm; Nordin & Tibell [2005]). Although this size difference could indicate a distinct taxon, the overall morphological characteristics remain consistent with *T. phaeophysciae*.

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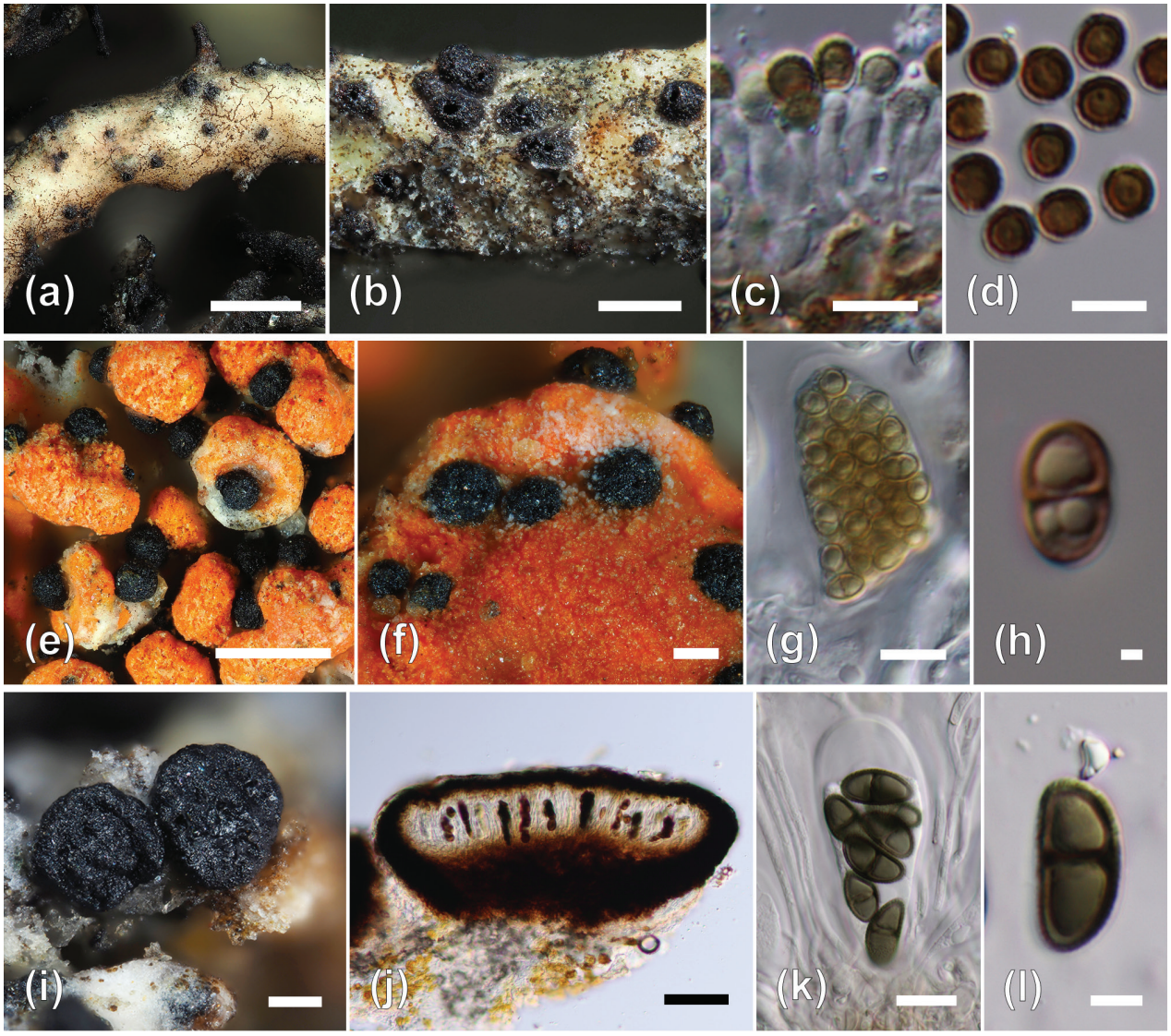

Fig. 3 Taxon 1: (a–d) *Lichenoconium usneae* (K. Tadome 357, NIPR), Taxon 2: (e–h) *Muellerella pygmaea* (K. Tadome 160, NIPR) and Taxon 3: (i–l) *Tetramelas phaeophysciae* (K.Tadome 382, NIPR). (a) Growth habit on *Usnea* sp. (b) Conidiomata. (c) Conidiogenous cells. (d) Conidia. (e) Growth habit on *Rusavskia elegans*. (f) Ascomata. (g) Asci. (h) Ascospores. (i) Growth habit on *Physcia caesia*. (j) Cross-section of ascoma. (k) Asci. (l) Ascospores. Scales: (a) 1 mm; (b, e) 500 µm; (f, i, j) 100 µm; (g, k) 10 µm; (c, d, l) 5 µm; (h) 1 µm.

Therefore, we tentatively regard the Antarctic specimen as an infraspecific variant. The size of the ascospores of specimens collected near Syowa Station, East Antarctica, is 16–22 × 6–10 µm, which is almost the same as that of the protologue (Tadome & Ohmura 2023).

This is the second record of *T. phaeophysciae* from eastern Antarctica, the first being a specimen collected near Syowa Station on the thallus of *Physcia caesia* (Hoffm.) Fürnr. (Tadome & Ohmura 2023). As *T. phaeophysciae* is known from Arctic, Antarctic, and parts of Asia (Zhurbenko et al. 2020), its presence in continental Antarctica suggests a polar-adapted distribution. In contrast, its host, *Physcia caesia*, is worldwide distributed from polar to temperate region (Nakanishi & Kashiwadani 1976) and was found in abundance in the Sør Rondane Mountains.

Specimen examined: Antarctica, Sør Rondane Mountains, Utsteinen, 71°57′24.55″S, 23°20′46.65″E, on *Physcia caesia* (thallus), elevation ca. 1400 m, 25 January 2020, K. Tadome 382 (NIPR).

Conclusion

This study reports seven noteworthy lichenicolous fungi from the Sør Rondane Mountains, a region that

has remained largely unexplored in terms of lichenicolous diversity. This includes one new species, *Lichenosticta antarctica*, and six taxa of particular ecological and biogeographical interest: *Bryostigma* cf. *molendoi*, *Carbonea aggregantula*, *Intralichen lichenicola*, *Lichenoconium usneae*, *Muellerella pygmaea* and *Tetramelas phaeophysciae*.

These lichenicolous fungi appear to be well adapted to the harsh environmental conditions of the continental interior of Antarctica. The Sør Rondane Mountains are characterized by extremely cold and arid conditions, with an average annual temperature of −18°C. Even in summer, the daily maximum temperature does not exceed zero, while winter minima can drop to −36°C (Belgian Science Policy 2007). Most of the Antarctic lichenicolous fungi that have been recorded have been found in the maritime western part of the continent, where summer temperatures exceed 0°C and winter lows rarely drop below −10°C (Bañón et al. 2013).

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Disclosure statement

The authors declare no conflict of interest.

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