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**M. G. Halıcı*, M. Kahraman**
Erciyes University, Kayseri, 38039, Turkey
*** Corresponding author:** mghalici@gmail.com

# DNA barcoding and morphological observations of three lichenized fungal species from James Ross Island (Antarctic Peninsula)

**Abstract.** Antarctica seems to many people to be a very remote, isolated, and mysterious place at the end of the world, and its name is hardly mentioned in normal life and conversation. However, considering that it plays a key role in the rapidly warming global climate system and its contribution to the continuing sea-level rise, its importance today is increasing day by day and it can be seen that it is of vital importance for humanity. There is increasing interest in the distribution of terrestrial organisms in Antarctica because of the potential use of biodiversity as a predictor or indicator of climate change. Lichenized fungi cover large areas of Antarctica that are not covered by ice and form precursor organisms that thrive in harsh environments. They are the largest contributors to biomass and diversity. The characteristic features of these organisms can be counted as developing certain protective mechanisms, adapting to temperature and radiation, and surviving even when the amount of water in their body is minimized. On the other hand, lichenized fungi are the most dominant components of Antarctic terrestrial vegetation, and their adaptation to extreme conditions; growth forms, reproduction, adaptation to environmental conditions can also be explained through mechanisms. Because of the lichens, dominant organisms of Antarctica, studying lichen biodiversity is very important. Although around 500 species of lichens were reported from Antarctica, the lichen biodiversity of the continent is far from being fully known; as in the last 5 years of our studies on Antarctic lichens, we and other scientists reported a significant number of undescribed or unreported species. So the lichen biodiversity of Antarctica is not fully known as there are still many undescribed or unreported species on the continent. In this paper, we deal with three lichenized fungal species: *Arthonia glebosa* Tuck., *Lecanora atromarginata* (H. Magn.) Hertel & Rambold and *Lecidea tessellata* Flörke which are common in James Ross Island, using nrITS, mtSSU, and RPB1 sequences. The lichen samples are studied by morphological and anatomical characters. In addition, to determine the phylogenetic positions of the species, we provide nrITS and mtSSU of these 3 species from Antarctica and additionally RPB1 sequences of *Lecidea tessellata*.

**Keywords:** Antarctica, biodiversity, *Arthonia glebosa*, *Lecanora atromarginata*, *Lecidea tessellata*

## 1 Introduction

The first collections of lichens from Antarctica were made in the early 1800's. Until the First World War, several national expeditions made significant collections of lichens. Because of the harsh environment and relative inaccesibility, and also the low species diversity compared with other parts of the world, professional lichenologists were not attracted by Antarctica. The lichen samples were mostly collected by non-specialists such as ecologists or geologists (Øvstedal & Lewis-Smith, 2001).

The terrestrial vegetation of Antarctica is dominated by lichens and mosses which are poikilohydric cryptogams. Today around 500 species of lichens are known from Antarctica, most of them from Antarctic Peninsula, and the number of species decreases gradually towards the continental parts of Antarctica (Øv-

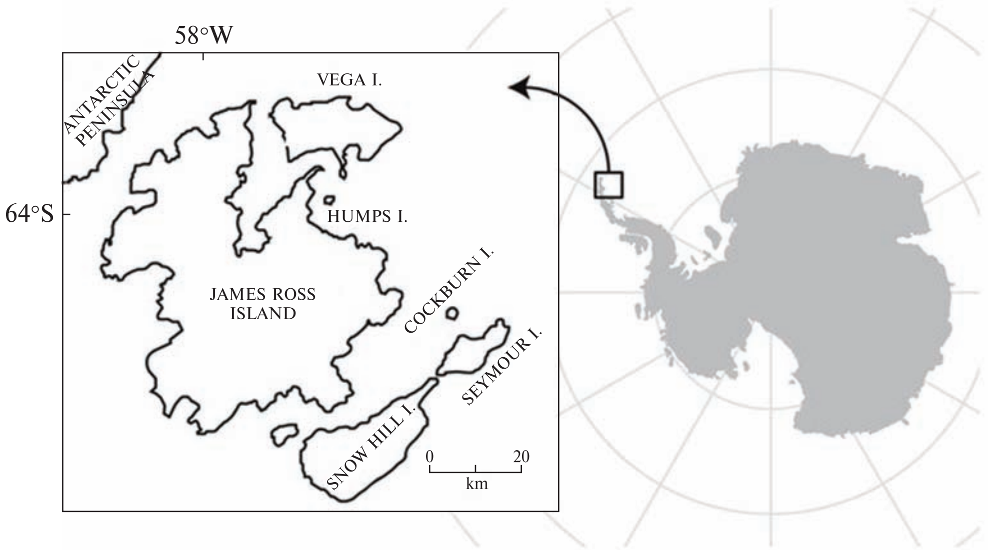


**Figure 1.** A map showing the James Ross Island in the Antarctic Peninsula

stedal & Lewis-Smith, 2011; Sancho et al., 2019). Unfortunately, today the lichen biodiversity of Antarctica is far from completely and truly known. Especially the publications of Caroll William Dodge between 1938–1973 in which 350 new taxa and 150 new combinations were made from Antarctic collections are discussed harshly and only 39 of these species are currently in use; most of the others were reduced to synonymy (Hertel, 1988; Castello & Nimis, 1995; Fryday, 2011).

Recently, molecular methods are being used more in determining the lichen biodiversity of the Antarctic (Lee et al., 2008; Halıcı et al., 2017; 2018; 2020; 2021). It is important to determine the lichen biodiversity of Antarctica truly, as the organisms can be excellent biomonitors of climate change and Antarctica is a natural laboratory for these studies (Sancho et al., 2019). In this study, 3 lichenized fungal species (7 samples) which have a wide distribution in James Ross Island located in the northeast of Antarctica (Fig. 1) are studied by morphological, anatomical and molecular methods.

## 2 Materials and methods

The collecting expedition was realized in James Ross Island in the austral summer of 2017 (January-March). Lichen samples were collected from 0–100 m altitude (the sites are listed in Appendix 1) by spatula on soil or by chisel and hammer on rock. They were wrapped in toilet paper and put in paper bags. When brought to the Mendel Polar Station, they were left to dry for three days in a room with air flow. The studied samples are stored in the lichen section of ERCH (Erciyes University Herbarium, Turkey).

Morphological examinations were all carried out under a stereo microscope (Leica EZ24). Sections were taken directly under the stereomicroscope by hand and anatomical characters were examined under a light microscope (Leica DM2500). Ascospores were measured in water. In addition, chemical reagents for spot tests were used to identify the species.

### 2.1 Lichen sampling

Two specimens of *Arthonia glebosa* Tuck.; three specimens of *Lecanora atromarginata* (H. Magn.) Hertel & Rambold and six specimens of *Lecidea tesselata* Flörke. were used for analysis (Appendix 1). We used three gene regions (nrITS, mtSSU, RPB1). For *Arthonia glebosa* the nrITS region was analyzed for both specimens and the mtSSU region only for one. For *Lecanora atromarginata* the nrITS region was ana-

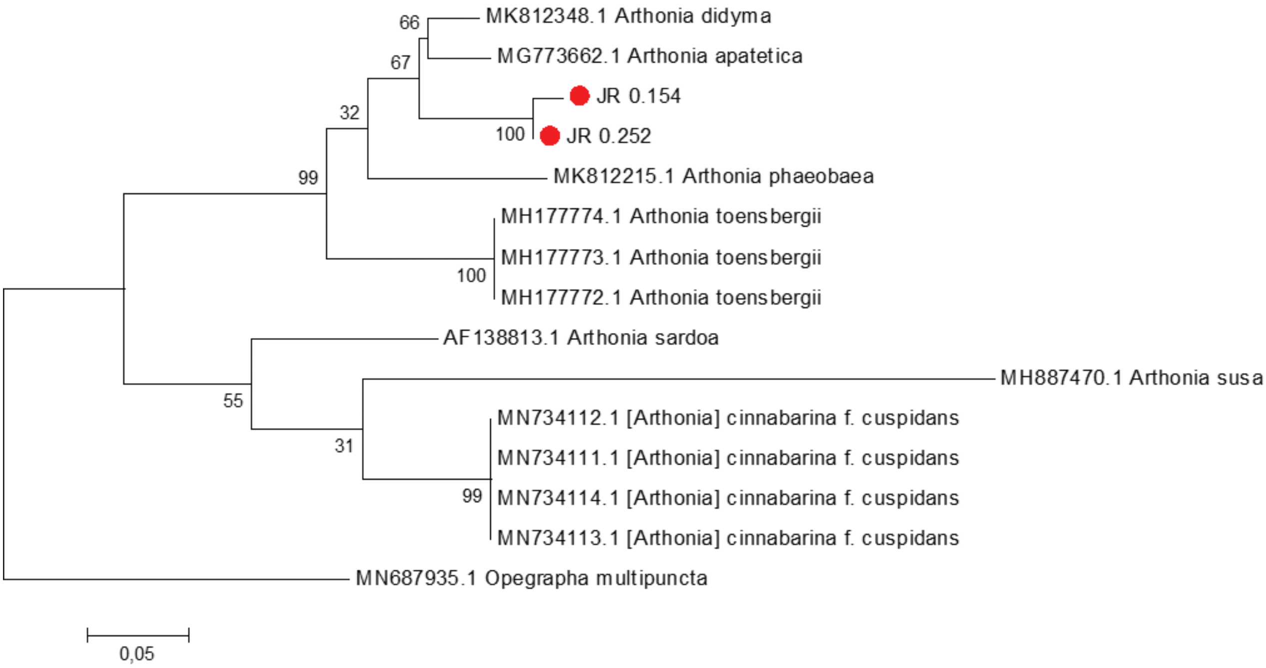


**Figure 2.** Maximum Likelihood (ML) analysis inferred from nrITS region sequences of the genus *Arthonia*

lyzed for one specimen and the mtSSU region for two specimens. For *Lecidea tessellata* nrITS region was analyzed for all six specimens, the mtSSU region for four specimens and RPB1 region for three specimens.

### 2.2 DNA isolation, PCR and sequencing

DNeasy Plant Mini Kit (Catalog No: 69104) produced by Qiagen company was used in the DNA isolation. The protocol given in the kit was followed. Amplification of all gene regions (nrITS, mtSSU, RPB1) from the isolated DNA was performed under appropriate PCR conditions. PCR reaction mixture applied for gene regions 5 µl of 200 ng DNA, 5µl of 10X reaction buffer, 5 µl of 25mM $MgCl_2$, 5 µl of 25µ dNTPs, 4 µl of 10 µM forward primer, 4 µl of 10 µM reverse primer, 0.5 U of Taq DNA polymerase. PCR reaction was performed by adding 21.5 µl PCR water to complement the total volume to 50 µl for all gene regions (nrITS, mtSSU and RPB1). PCR amplifications of nrITS were performed using fungal-specific primers nrITS4 (TCCTCCGCTTATTGATATGC, White et al., 1990) and nrITS1-F (CTTGGTCATTTAGAGGAAGTAA, Gardes & Bruns, 1993). PCR amplifications of mtSSU were performed using fungal-specific primers (mrSSU1-F AGCAGTGAGGAATATTGGTC; mrSSU3-R ATGTGGCACGTC TATAGCCC, Zoller et al., 1999) and PCR amplifications of RPB1 were performed using fungal-specific primers RPB1-aFasc (ADTGYCCYGGYCATTTYGGT, Hofstetter et al., 2007) and RPB1-cR (CCC GCATNTCRTTRTCCATRTA, Matheny et al., 2002).

PCR amplifications were carried out in a thermal cycler (Blue Rey-Biotech) equipped with a heated lid, in the following conditions for ITS: an initial heating step for 5 min. at 95 °C; 6 cycles with 1:30 min. at 94 °C, 1:30 min. at 55 °C, and 2 min. at 72 °C; and 33 cycles with 1 min. at 94 °C, 1 min. at 52 °C, and 2 min. at 72 °C. A final extension step of 8 min. at 72 °C was added, after which the samples were kept at 4 °C; for mtSSU and RPB1: an initial heating step for 5 min. at 94 °C; 35 cycles with 1 min. at 94 °C, 1 min. at 58 °C, and 1 min. at 72 °C. A final extension step of 10 min. at 72 °C was added, after which the samples were kept at 4 °C.

After the PCR, amplificated samples were loaded on a 1% agarose gel with ethidium bromide dye add-

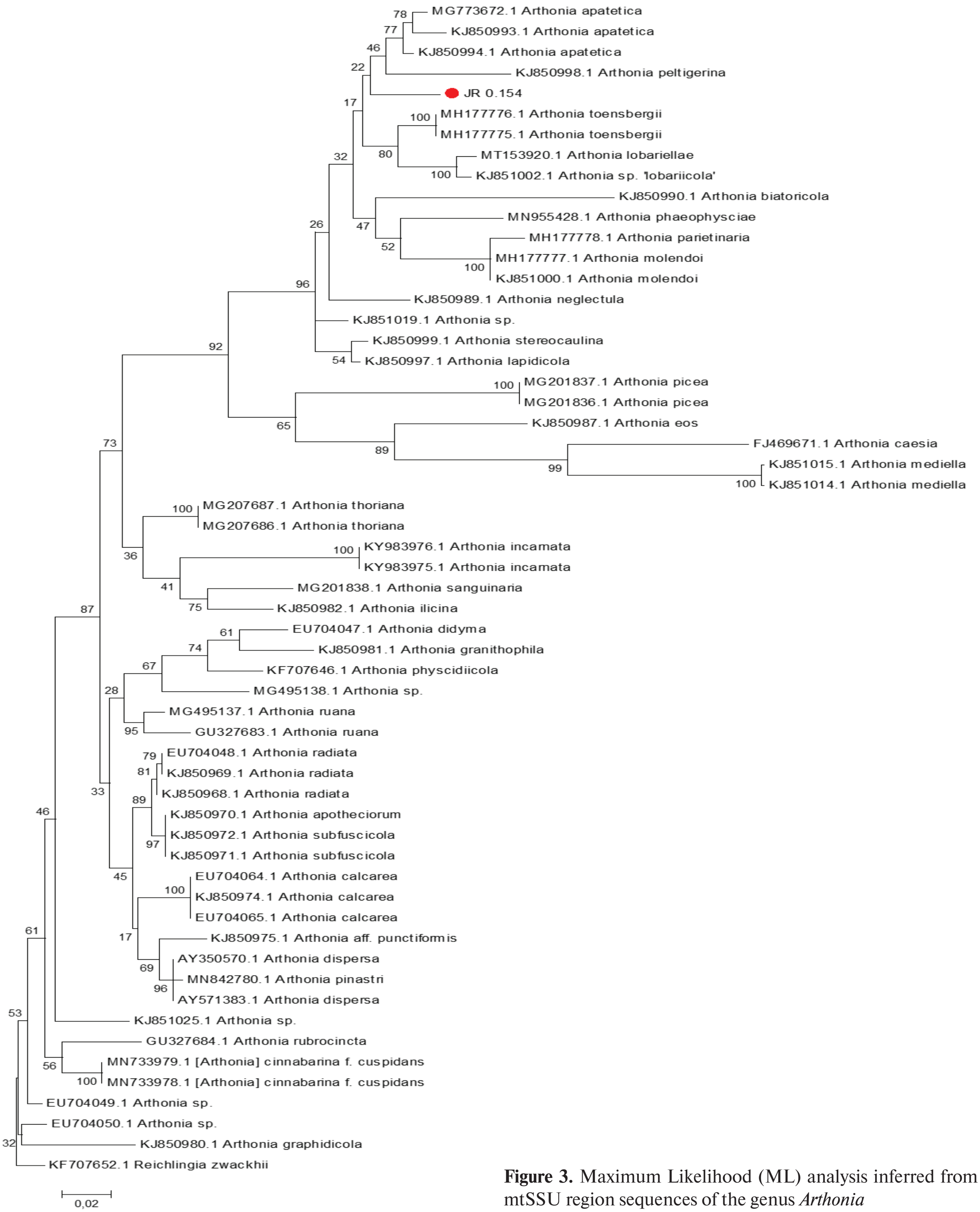


**Figure 3.** Maximum Likelihood (ML) analysis inferred from mtSSU region sequences of the genus *Arthonia*

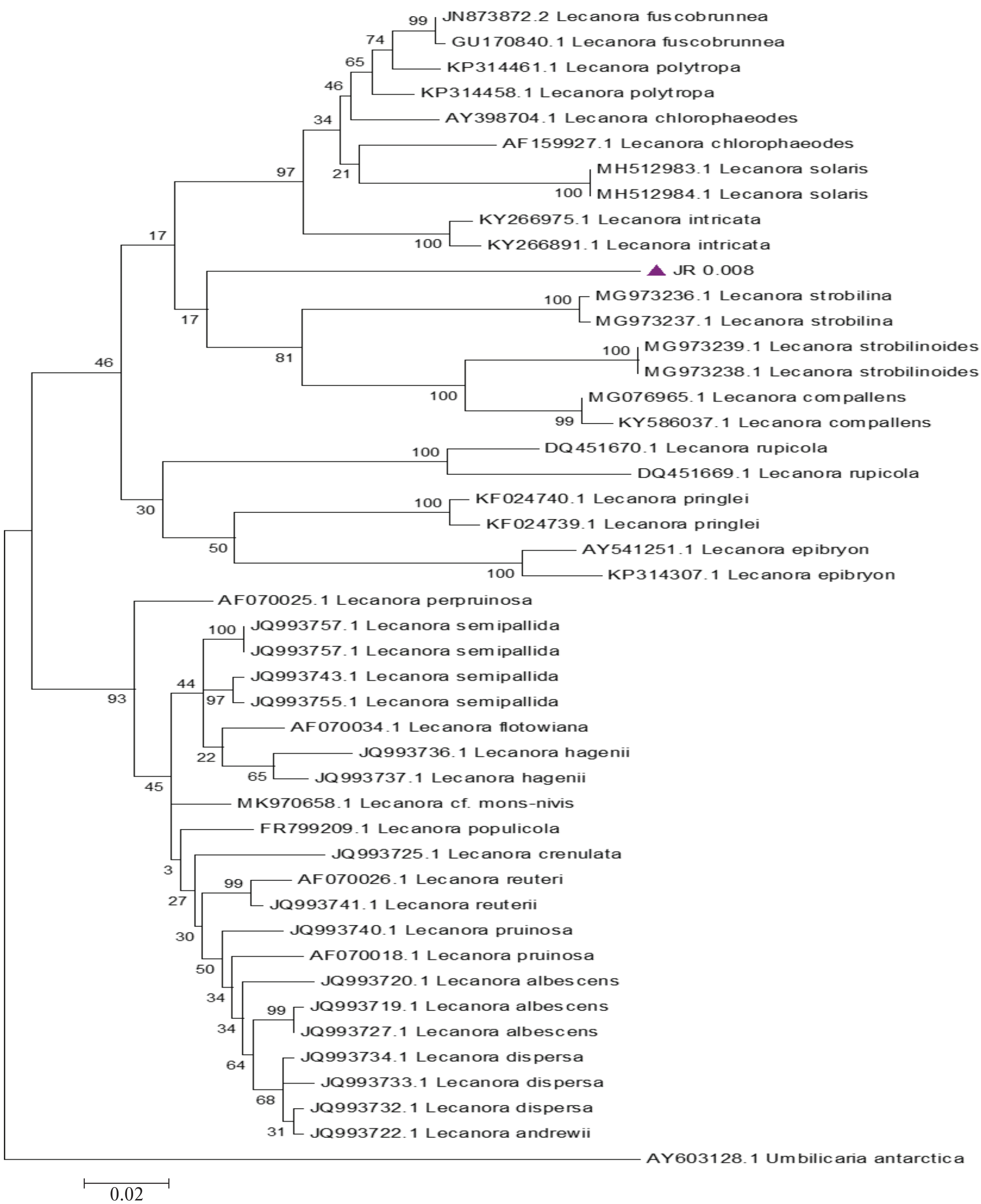


**Figure 4.** Maximum Likelihood (ML) analysis inferred from nrITS region sequences of the genus *Lecanora*

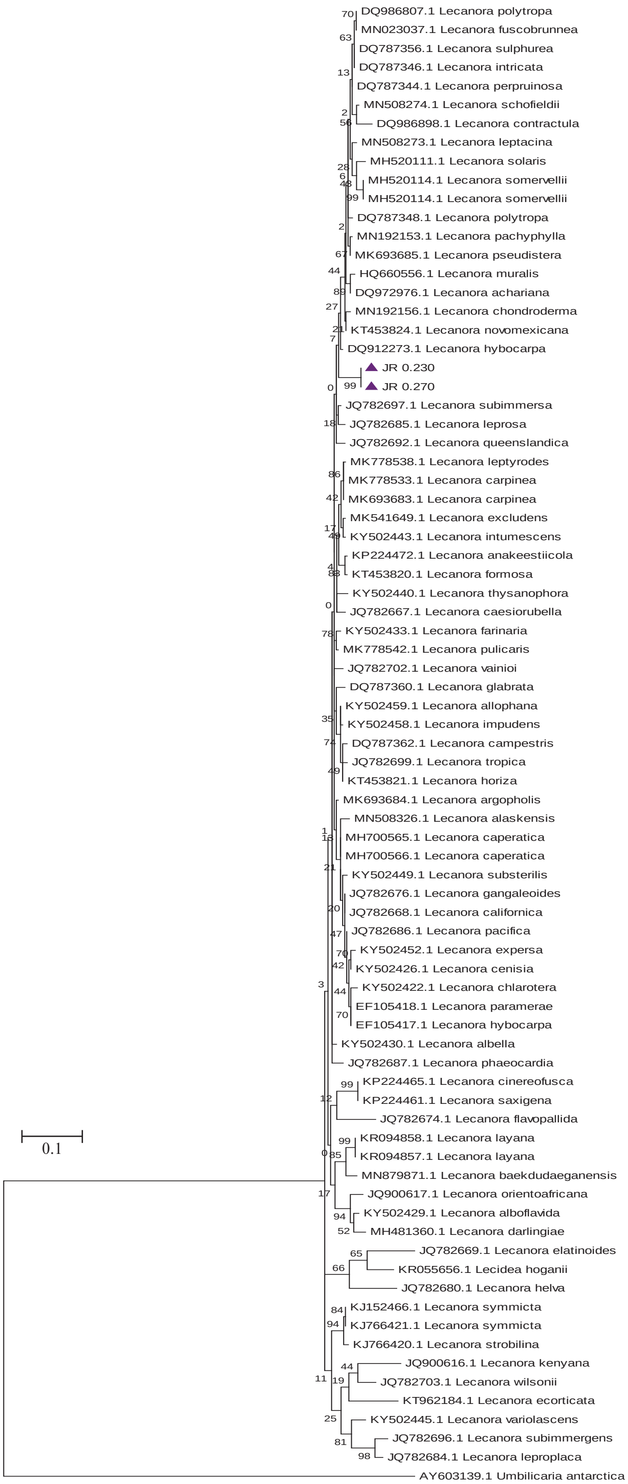


**Figure 5.** Maximum Likelihood (ML) analysis inferred from mtSSU region sequences of the genus *Lecanora*

ed (5mg/ml) for electrophoretic separation. The DNA bands were detected under UV light at 100 watt after 60 minutes.

### 2.3 Sequence alignment and phylogenetic analysis

The sequencing was performed by ABI 3730 XL sequencer (applied Biosystem). Possible reading errors were corrected with the Cluster X function of MEGA 6.0 program and the sequences of the species obtained from the research area and the sequences of the genes downloaded from the GenBank (Appendix 2) were analyzed with Mega 6.0 program. The dendrograms were obtained with ML method and Tamura 3-parameter model. Pairwise deletion was applied to gaps in data, and the reliability of the inferred tree was tested by 1000 bootstrap replications for control.

## 3 Results

### 3.1 Phylogeny

#### 3.1.1 *Arthonia glebosa* Tuck.

The nrITS alignment comprised 15 accessions with a length of 520 bp (Appendix 2). *Opegrapha multipuncta* MN687935 was used for the outgroup. According to nrITS analyses, both specimens (indicated with circles in Fig. 2), formed a clade with *Arthonia didyma* and *Arthonia apatetica*. There is no data in GenBank for *A. glebosa*. Two Antarctic specimens of *A. glebosa* studied here clearly belong to another clade than other *Arthonia* specimens (Fig. 2).

The mtSSU alignment comprised 57 accessions (Appendix 2) with a length of 818 bp. *Reichlingia zwackhii (Sandst.) Frisch & G. Thor* KF707652 was used as the outgroup. The Antarctic specimen of *A. glebosa* clearly belongs to another clade than the other *Arthonia* specimens (Fig. 3).

#### 3.1.2 *Lecanora atromarginata* (H. Magn.) Hertel & Rambold.

The nrITS alignment comprised 46 accessions with a length of 600 bp, and *Umbilicaria antarctica* AY603128 was used for the outgroup. The mtSSU alignment comprised 81 accessions with a length of 630 bp and

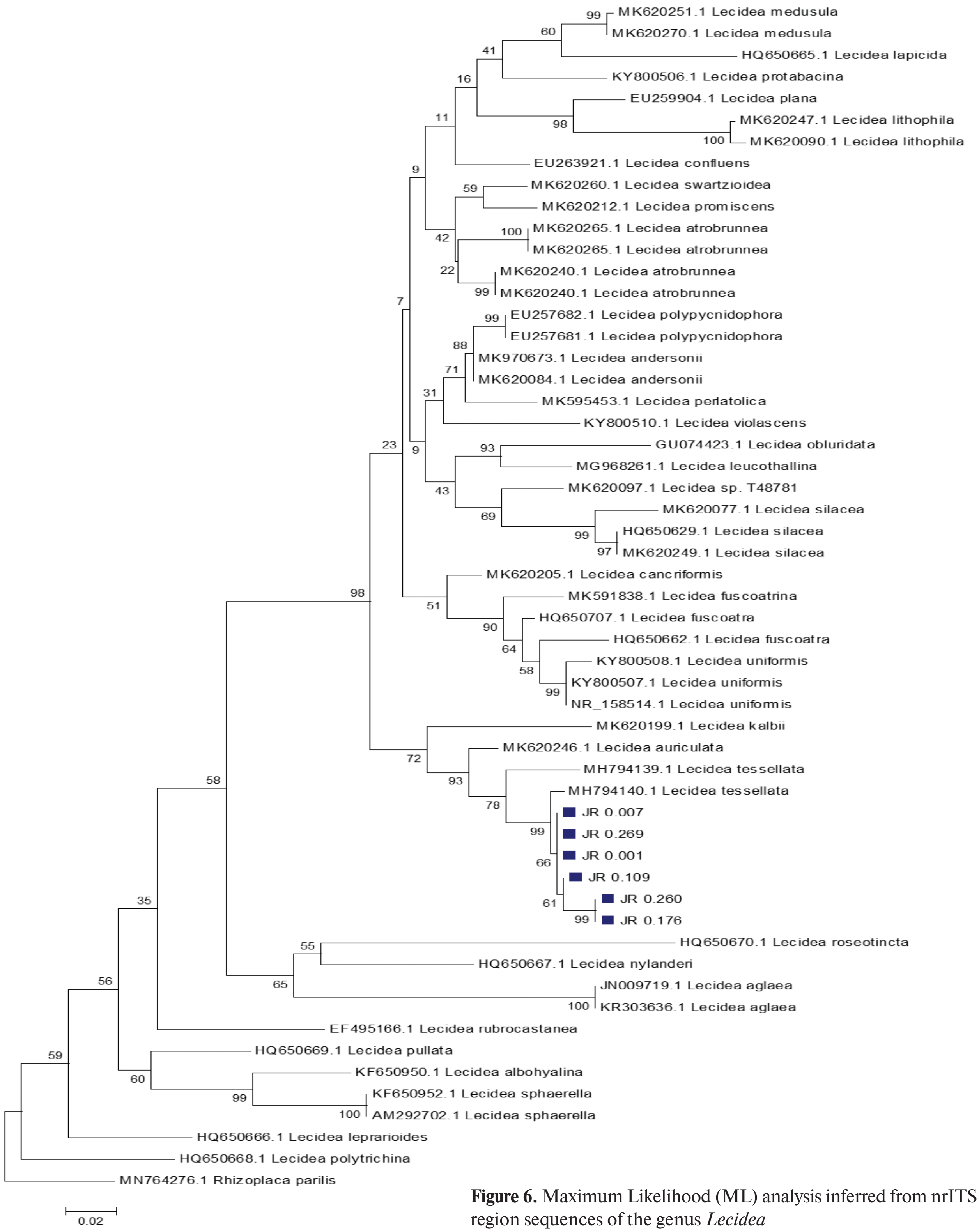


**Figure 6.** Maximum Likelihood (ML) analysis inferred from nrITS region sequences of the genus *Lecidea*

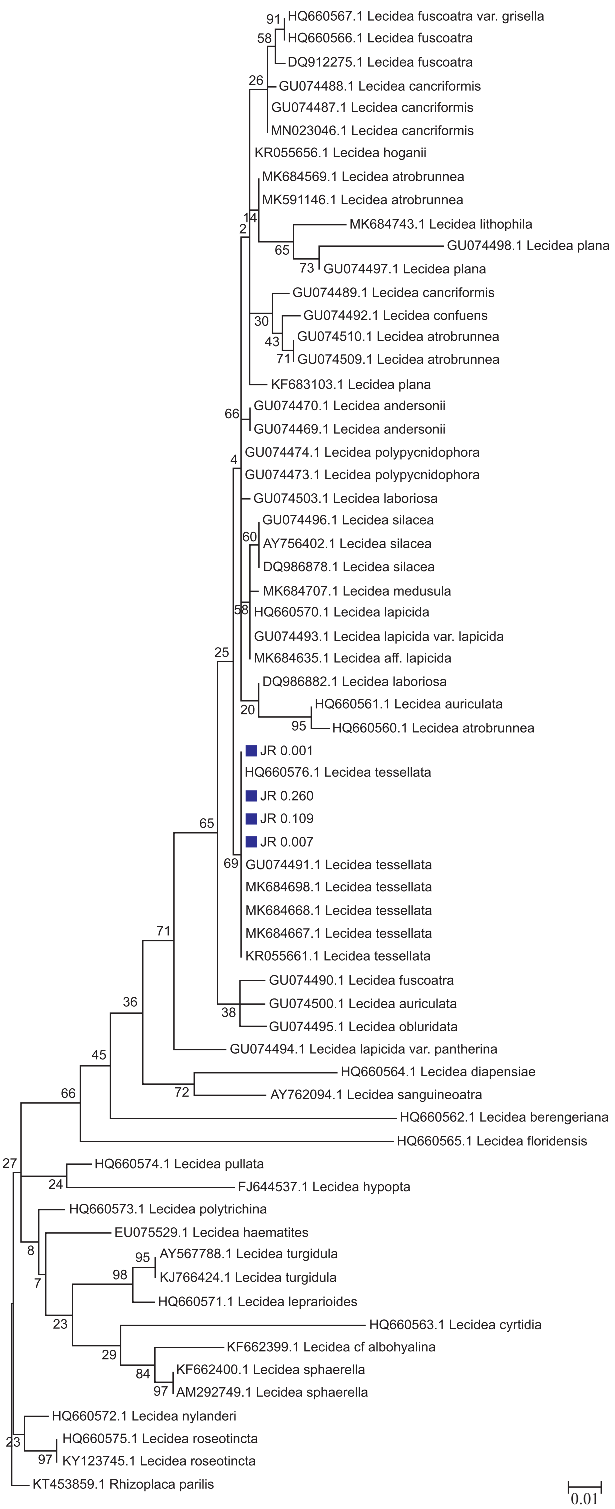


**Figure 7.** Maximum Likelihood (ML) analysis inferred from mtSSU region sequences of the genus *Lecidea*

*Umbilicaria antarctica* AY603139 was used as outgroup (Appendix 2). According to nrITS and mtSSU analyses of *L. atromarginata* specimens in Fig. 3 and Fig. 4 (triangle), formed a separate clade. There are no data of *L. atromarginata* in GenBank, but three specimens of this species clearly belong to another clade from the other *Lecanora* specimens (Figs. 4, 5).

### 3.1.3 *Lecidea tessellata* Flörke.

The nrITS alignment comprised 55 accessions with a length of 575 bp, mtSSU alignment comprised 65 accessions with a length of 610 bp and the RPB1 alignment comprised 40 accessions with a length of 755 bp (Appendix 2). *Rhizoplaca parilis* MN764276, KT453859 and KU935393 were used for the outgroups respectively.

According to nrITS, mtSSU and RPB1 analyses of *L. tessellata* specimens in Fig. 6, Fig. 7 and Fig. 8 with square, matched with *L. tessellata* specimens deposited in GenBank. So clearly all these specimens belong to *L. tessellata* (Figs. 6, 7 and 8).

## 3.2 Morphology and Anatomy

### 3.2.1 *Arthonia glebosa* Tuck.

*Morphology and Anatomy:* Thallus squamulose, brown, almost areolate or subeffigurate. Apotechium lecideine, black, usually aggregated, swollen, arcuated, convex, margin excluded, 0.1–0.35 mm (Fig. 9a). Epihymenium brown or blackish brown, 10–15 µm, N-, K-. Hymenium hyaline, sometimes with a brownish tinge and with oil droplets, 30–55 µm. Hypothecium hyaline or brown, 25–140 µm. Ascus 8-spored, 50 × 20 µm. Ascospores hyaline, elipsoid to subglobose, usually one septate, when septate, asymmetric, sometimes no septum present in young ascospores, (8–)10–12.5–15(–16) × 4–5 µm (n = 15), ascospore length/width ratio (1.6–)2.14–2.62–3.1(–3.5) µm (n = 15) (Fig. 9b). Paraphyses simple, unbranched, 3 µm. Algae green, chlorococcoid, more or less globose, ~15 µm diam. Thallus K-, C-, KI-, Pd-. Medulla K+ yellow and KI+ blue. Pycnidium not observed.

*Examined species*: JR 0.154, JR 0.252 (see Appendix 1).

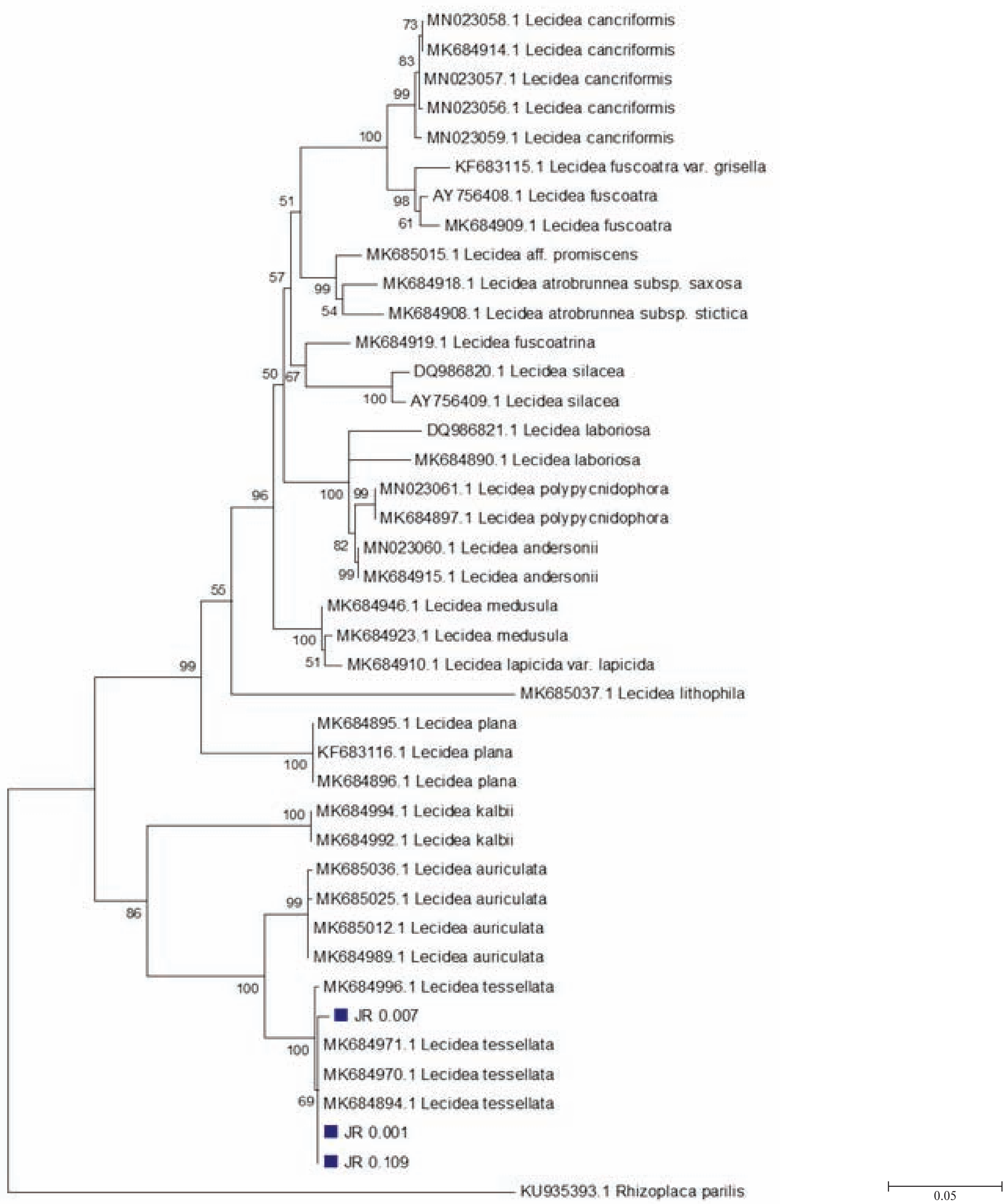


**Figure 8.** Maximum Likelihood (ML) analysis inferred from RPB1 region sequences of the genus *Lecidea*

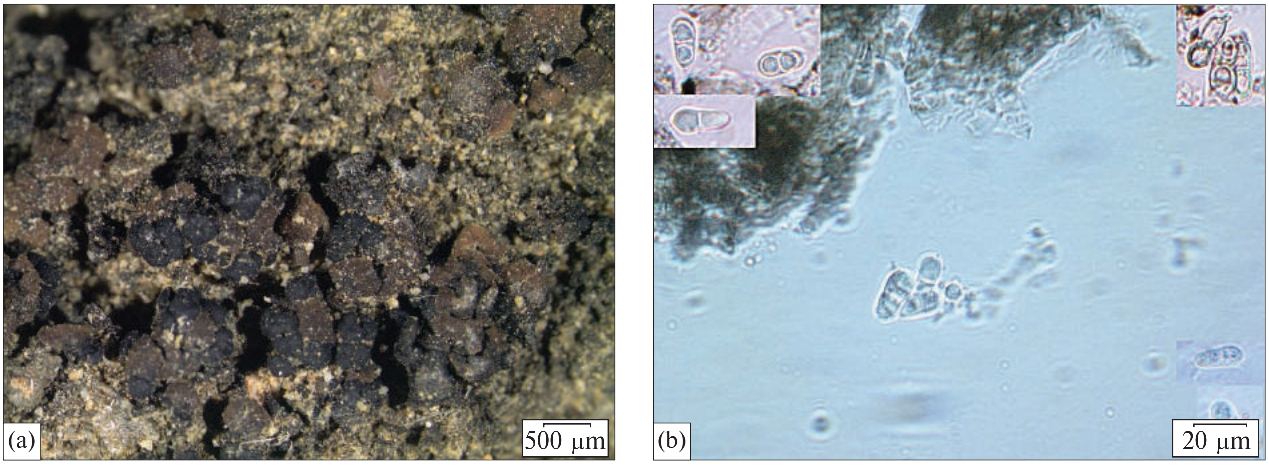


**Figure 9.** *Arthonia glebosa* Tuck.*,* (a) — thallus and apothecia; (b) — ascospores

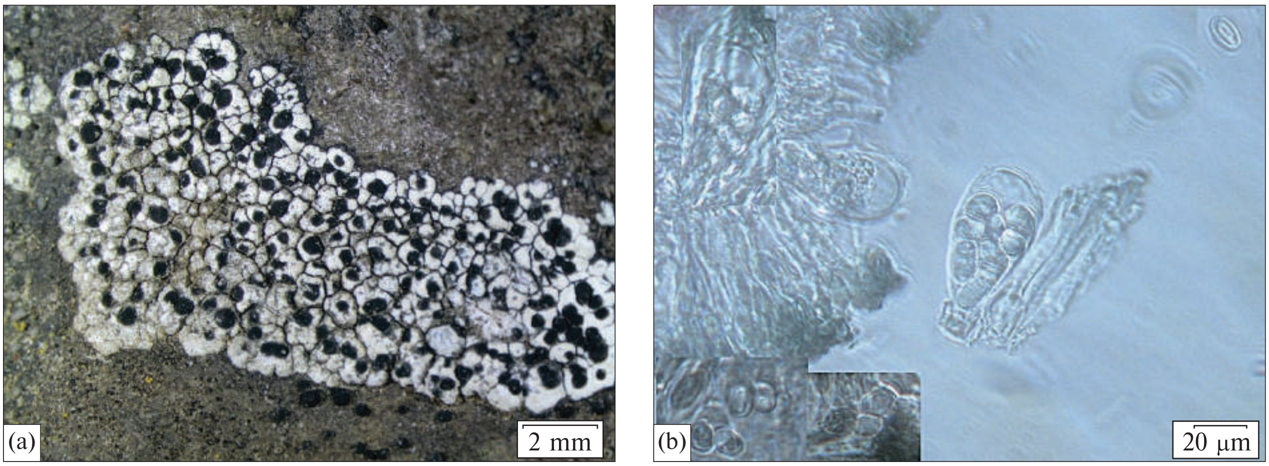


**Figure 10.** *Lecanora atromarginata* (H. Magn.) Hertel & Rambold*,* (a) — thallus and apothecia; (b) — ascus and ascospores

*Ecology and Distribution:* It occurs on soil (Freebury, 2014), on humus (DeBolt & McCune, 1993) and it is very common in dry or cold open habitats (McCune, 1997).

*Arthonia glebosa* is considered as rare on a global scale (Baldursson et al., 2003). It has been reported from Mongolia (Biazrov & Zhurbenko, 2004), Saskatchewan (Freebury, 2014), Arctic Iceland, Greenland (Kristinsson et al., 2010), USA, Russia (Zhurbenko, 2009), Ecuador (Sklenář et al., 2010), Tibet (Obermayer, 2004), Canada (Williston, 2000), China (Bilichenko, 2021) and South Orkney and James Ross Islands in Antarctic Peninsula (Øvstedal & Lewis-Smith, 2001). World-wide distribution of *Arthonia glebosa* is indicated by red circle in Figure 12.

### 3.2.2 *Lecanora atromarginata* (H. Magn.) Hertel & Rambold.

*Morphology and Anatomy:* Thallus crustose, continous or dispersed as unregular patches, up to 2 cm. Thallus chalky white or dirty white, rimose-areolate. Prothallus present around the thallus and margins of the areoles, black. Apothecium present, lecideine, roundish to angular, black, epruinose, immersed or subsessile, 0.2—0.55 mm (Fig. 10a). Margin present at the


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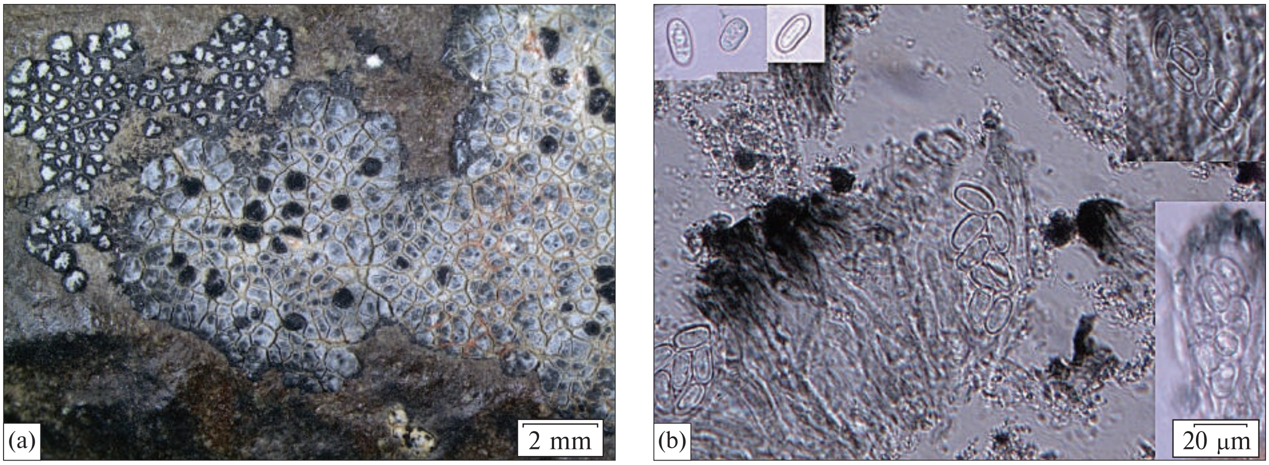


**Figure 11.** *Lecidea tessellata* Flörke., (a) — thallus with apothecia (the areolate thallus in the upper left belongs to *Lecanora atromarginata* which was detailed above); (b) — ascus and ascospores

young ones, very thick, black, excluded at the old ones. Epihymenium greenish black, 20—60 μm, N-. Hymenium hyaline, 40—100 μm. Hypothecium mostly hyaline, sometimes brownish hyaline, 20—40 μm. Ascus 8-spored, 38 × 17 μm. Ascospores simple, hyaline, elipsoid with oil droplets, 8—10.5 × (3—)—4.5—6 μm (n = 20), l/w ratio (1.33—)1.67—2.06—2.45(—2.67) μm (Fig. 10b). Paraphyses simple, unbranched, tips clavate or almost capitate, 2—4 μm. Algae green, chlorococcoid. Thallus and medulla K+ yellow, C+ yellow or C-, medulla I-. Pycnidium not observed.

*Examined species:* JR 0.008, JR 0.230, JR 0.270 (Appendix 1).

*Ecology and Distribution: Lecanora atromarginata* occurs on inland rocks at high altitudes in shaded sites. It is usually accompanied by *Rhizocarpon geminatum, Staurothele gelida*, *Usnea sphacelata, Lecidea tesselata*, *Rhizocarpon disporum* and *Rusavskia elegans* (Śliwa & Olech, 2002; Øvstedal & Lewis-Smith, 2001; Hansen, 2009). On James Ross Island it is usually found with *Lecidea tessellata* which is detailed below.

*Lecanora atromarginata* has a bipolar distribution and is found in portions of arctic Asia, Europe, Scandinavia, Arctic (Greenland, Svalbard, Canada) and Antarctica, where it occurs on calcareous, siliceous and other base-rich rock at high elevations (Kristinsson et al., 2010; Brinker, 2020). World-wide distribution of *Lecanora atromarginata* is indicated by purple triangle in Figure 12.

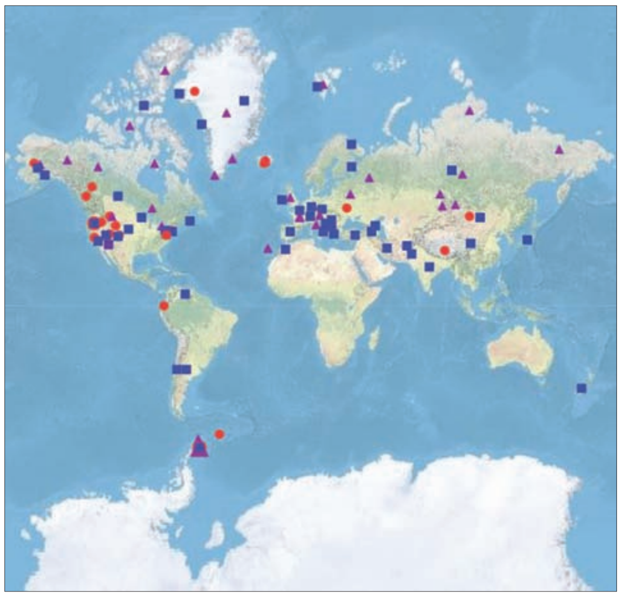

**Figure 12.** World-wide distribution of examined species (red circles: *Arthonia glebosa* Tuck.; blue squares: *Lecidea tessellata* Flörke; purple triangles: *Lecanora atromarginata* (H. Magn.) Hertel & Rambold.)

### 3.2.3 *Lecidea tessellata* Flörke.

*Morphology and Anatomy:* Thallus crustose, well developed, rimose-areolate, sometimes almost subeffigurate, greyish white, dirty white or ash-grey, centers of the areoles are blackish, sometimes between areoles there are rusty colored patches (Fig. 11a). Areoles contiguous, flat or weakly convex, regular or irregular. Prothallus sometimes present, black, very thin. Apothecium black, sessile or almost immersed, aggregated or dispersed, adnate or appressed, plane, weakly pruinose, roundish or angular, lecideine, (0.2–)0.25–0.4–0.55(–0.7) mm (n = 40). Apothecium margin prominent, black, concolorous with the disc, smooth or fissured especially at mature ones, pruinose or not. Epihymenium dark brown or black, 30–100 µm, N+ red, K-. Hymenium hyaline or blue-greenish hyaline, sometimes it has bluish tinge, 55–80 µm. Hypothecium brown or brownish hyaline, 30–110 µm. Asci 8-spored, 34–80 × 8–20 µm. Ascospores hyaline, simple, ellipsoid, almost oblong, (7–)8–8.5–9(–10.5) × (3–)–4.5–(–5.5) µm (n = 40) and ascospore length/width ratio (1.4–)1.66–2.12–2.57(–3) µm (n = = 40) (Fig. 11b). Paraphyses simple, thin, unbranched, sometimes septate, tips are slightly enlarged 3–5 µm. Pycnidium not observed. Thallus and medulla K- or K+ pale yellow, KI-, I-, C- or C+ yellow, Pd-.

*Ecology and Distribution: Lecidea tessellata* occurs on both calcareous and siliceous rocks (Hansen, 2017) as well as on sandstone (Lendemer, 2010); on basalt (Hansen, 2017) or on granite rocks (Knudsen & Kramer, 2007).

*L. tesselata* is a bipolar species. It has been reported from America (Mayrhofer et al., 2016), Iran (Moniri & Sipman, 2011), Turkey (Halici et al., 2007), Mongolia (Huneck et al., 1984), Armenia (Harutyunyan et al., 2011), Russia (Tarasova et al., 2015), Greenland (Hansen, 2017), Morocco (Egea & Rowe, 1988), Pakistan (Aptroot & Iqbal, 2010), New Zealand (de Lange et al., 2018), India (Upreti et al., 2006), Europe and the Antarctic (Øvstedal & Lewis-Smith, 2004). World-wide distribution of *Lecidea tessellata* is indicated by blue square in Figure 12.

## 4 Discussion

The lichens are the most dominant organisms of Antarctic terrestrial vegetation and important to understand the terrestrial biota of Antarctic which is under the effect of global warming. Although around 500 species of lichens were reported from Antarctica, the lichen biodiversity of the continent is far from being fully known; as in the last 5 years of our studies on Antarctic lichens, we and other scientists reported significant number of undescribed or unreported species (Halıcı et al., 2017; 2018; 2020; 2021; Cao et al., 2018; Park et al., 2018; Halıcı & Bartak, 2019; Sancho et al., 2020). In our opinion, if more lichens are examined with molecular techniques, the lichen biota of Antarctic will be known more detailed.

These 3 species detailed here were previously reported from James Ross Island (Øvstedal & Lewis-Smith, 2001; 2004) but they were never DNA-barcoded. According to our molecular studies (Figs. 1–7), the reports of these species are correct. All the specimens collected by us share the similar descriptions provided by Øvstedal and Lewis-Smith (2001; 2004).

It is important to know the accurate checklist of lichens in Antarctica as they can perfectly be used in biomonitoring the climate change in Antarctica (Sancho et al., 2019). As the molecular methods are used in determining the lichen biodiversity of Antarctica, we will have a more accurate checklist of the continent.

*Author contributions.* MGH — collected the samples from Antarctica; MGH, MK — has same contrubition to other parts of study and discussed the results and contributed to the final manuscript.

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*Conflicts of Interest.* The authors declare no conflict of interest.

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**М. Г. Халісі*, М. Кахраман**

Університет Ерджіес, м. Кайсері, 38039, Туреччина

*** Автор для кореспонденції:** mghalici@gmail.com

**ДНК-штрих-кодування та морфологічні спостереження за трьома ліхенізованими видами грибів з острова Джеймс Росс (Антарктичний півострів)**

**Реферат.** Антарктика багатьом видається дуже віддаленим, ізольованим, загадковим місцем в кінці світу, яке не згадують у звичайних розмовах. Однак враховуючи її ключову роль у глобальній кліматичній системі, що швидко нагрівається, і вклад у підйом рівня моря, що досі триває, важливість цього регіону зростає з дня на день. Зростає й інтерес у розподілі наземних організмів, що її населяють, адже використовуючи знання про біорізноманіття, можна передбачити або відслідкувати кліматичні зміни. Ліхенізовані гриби у складі піонерних угруповань покривають великі, вільні від льоду, області Антарктиди, і добре себе почувають у суворих умовах. Їм належить найбільша частка біомаси та різноманіття. Ліхенізовані гриби володіють властивістю виробляти певні захисні механізми, адаптуватися до температури й випромінювання, виживати навіть за мінімальної гідратації. З іншого боку, вони — найбільша група організмів-домінантів антарктичної рослинності, і їх адаптації до екстремальних умов — життєві форми, розмноження, адаптація — теж можна пояснити цими механізмами. Внаслідок того, що лишайники, організми-домінанти Антарктиди, вивчення їх біорізноманіття дуже важливе. Попри те, що з даного регіону відомо близько 500 видів, вважається, що різноманіття лишайників тут відоме далеко не сповна. За останні п'ять років і ми, й інші автори відзначали багато видів, раніше невідомих у регіоні або взагалі неописаних. У цій роботі, з використанням послідовностей nrITS, mtSSU та RPB1, розбирається три ліхенізовані види грибів: *Arthonia glebosa*, Tuck. , *Lecanora atromarginata* (H. Magn.) Hertel & Rambold та *Lecidea tessellata* Flörke, звичайні на острові Джемс Росс. У зразках лишайників вивчали морфологічні та анатомічні показники. Додатково, для визначення філогенетичного положення, наводяться послідовності nrITS та mtSSU цих трьох видів з Антарктиди та RPB1 — для *Lecidea tessellata*.

**Ключові слова:** Антарктика, біорізноманіття, *Arthonia glebosa*, *Lecanora atromarginata*, *Lecidea tessellata*

**Appendix 1.** The sites where lichens were collected

| | | |
|---|---|---|
| JR 0.154 | *Arthonia glebosa* Tuck. | Antarctica, Antarctic Peninsula, James Ross Island, Vega Island, 63°50′0″ S, 57°25′0″ W, on soil, alt. 5 m, Leg. M. G. Halıcı |
| JR 0.252 | *Arthonia glebosa* Tuck. | Antarctica, Antarctic Peninsula, James Ross Island, Solorina Valley, 63°52′39.0″ S, 57°46′51.6″ W, alt. 2 m., on soil, Leg. M. G. Halıcı |
| JR 0.008 | *Lecanora atromarginata* (H. Magn.) Hertel & Rambold | Antarctica, Antarctic Peninsula, James Ross Island, SE Tip of Johnson Mesa, 63°49′46.2″ S, 57°54′21.6″ W, alt. 292 m., on rock, Leg. M. G. Halıcı |
| JR 0.230, JR 0.270 | *Lecanora atromarginata* (H. Magn.) Hertel & Rambold | Antarctica, Antarctic Peninsula, James Ross Island, Solorina Valley, 63°52′39.0″ S, 57°46′51.6″ W, alt. 2 m., on soil, Leg. M. G. Halıcı |
| JR 0.001 | *Lecidea tessellata* Flörke. | Antarctica, Antarctic Peninsula, James Ross Island, "Dirty Valley" 63°48′38.1″ S, 57°51′36″ W, alt. 92 m., on rock, Leg. M. G. Halıcı |
| JR 0.007, JR 0.109 | *Lecidea tessellata* Flörke. | Antarctica, Antarctic Peninsula, James Ross Island, "Lachmann Lake", 63°48′36″ S, 57°48′29″ W, alt. 36 m., on rock, Leg. M. G. Halıcı |
| JR 0.176, JR 0.260, JR 0.269 | *Lecidea tessellata* Flörke. | Antarctica, Antarctic Peninsula, James Ross Island, Solorina Valley, 63°52′39.0″ S, 57°46′51.6″ W, alt. 2 m., on soil, Leg. M. G. Halıcı |


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**Appendix 2.** mtSSU, nrITS and RPB1 sequences used in the analyses; newly produced ones are in bold

| Arthonia | | | |
|---|---|---|---|
| Species | GenBank Number (nrITS) | Country | Year |
| **JR 0.154** | **MZ502374** | Antarctica, James Ross Island | 2021 |
| **JR 0.252** | **MZ502376** | Antarctica, James Ross Island | 2021 |
| *Arthonia apatetica* | MG773662 | the Carpathians | 2018 |
| *Arthonia cinnabarina* f. *cuspidans* | MN734112 | Norway | 2020 |
| *Arthonia cinnabarina* f. *cuspidans* | MN734111 | Norway | 2020 |
| *Arthonia cinnabarina* f. *cuspidans* | MN734114 | Norway | 2020 |
| *Arthonia cinnabarina* f. *cuspidans* | MN734113 | Norway | 2020 |
| *Arthonia didyma* | MK812348 | Norway | 2019 |
| *Arthonia phaeobaea* | MK812215 | Norway | 2019 |
| *Arthonia sardoa* | AF138813 | - | 1999 |
| *Arthonia susa* | MH887470 | USA | 2018 |
| *Arthonia toensbergii* | MH177774 | Norway | 2018 |
| *Arthonia toensbergii* | MH177773 | Norway | 2018 |
| *Arthonia toensbergii* | MH177772 | Norway | 2018 |
| *Opegrapha multipuncta* | MN687935 | United Kingdom | 2018 |
| Species | GenBank Number (mtSSU) | Country | Year |
| **JR 0.154** | **MZ502372** | Antarctica, James Ross Island | 2021 |
| *Arthonia punctiformis* | KJ850975 | Japan | 2014 |
| *Arthonia apatetica* | MG773672 | Carpathians | 2020 |
| *Arthonia apatetica* | KJ850993 | Sweden | 2014 |
| *Arthonia apatetica* | KJ850994 | Sweden | 2014 |
| *Arthonia apotheciorum* | KJ850970 | Sweden | 2014 |
| *Arthonia biatoricola* | KJ850990 | Japan | 2014 |
| *Arthonia caesia* | FJ469671 | Zambia | 2014 |
| *Arthonia calcarea* | EU704064 | France | 2014 |
| *Arthonia calcarea* | KJ850974 | Sweden | 2014 |
| *Arthonia calcarea* | EU704065 | France | 2014 |
| *Arthonia cinnabarina* f. *cuspidans* | MN733979 | Norway | 2020 |
| *Arthonia cinnabarina* f. *cuspidans* | MN733978 | United Kingdom | 2020 |
| *Arthonia dispersa* | AY350750 | — | 2005 |
| *Arthonia dispersa* | AY571383 | — | 2005 |
| *Arthonia eos* | KJ850987 | Japan | 2014 |
| *Arthonia graphidicola* | KJ850981 | Sweden | 2014 |
| *Arthonia graphidicola* | KJ850980 | Japan | 2014 |
| *Arthonia ilicina* | KJ850982 | USA | 2014 |

*Continuation of Appendix 2*

| Species | GenBank Number (mtSSU) | Country | Year |
|---|---|---|---|
| *Arthonia incarnata* | KY983976 | Japan | 2017 |
| *Arthonia incarnata* | KY983975 | Japan | 2017 |
| *Arthonia lapidicola* | KJ850997 | Sweden | 2014 |
| *Arthonia lobariellae* | MH177776 | Norway | 2018 |
| *Arthonia mediella* | KJ851015 | Sweden | 2014 |
| *Arthonia mediella* | KJ851014 | Sweden | 2014 |
| *Arthonia molendoi* | MH177777 | Norway | 2018 |
| *Arthonia molendoi* | KJ851000 | Sweden | 2014 |
| *Arthonia neglectula* | KJ850989 | Sweden | 2014 |
| *Arthonia parietinaria* | MH177778 | Norway | 2018 |
| *Arthonia peltigerina* | KJ850998 | Sweden | 2014 |
| *Arthonia phaeophysciae* | MN955428 | Japan | 2020 |
| *Arthonia physcidiicola* | KF707646 | Uganda | 2014 |
| *Arthonia picea* | MG201837 | Japan | 2018 |
| *Arthonia picea* | MG201836 | Japan | 2018 |
| *Arthonia pinastri* | MN842780 | Italy | 2020 |
| *Arthonia radiata* | EU704048 | Belgium | 2009 |
| *Arthonia radiata* | KJ850969 | Sweden | 2014 |
| *Arthonia radiata* | KJ850968 | Sweden | 2014 |
| *Arthonia ruana* | MG495137 | South Korea | 2017 |
| *Arthonia ruana* | GU327683 | Germany | 2009 |
| *Arthonia rubrocincta* | GU327684 | USA | 2009 |
| *Arthonia sanguinaria* | MG201838 | Japam | 2017 |
| *Arthonia sp.* | KJ851019 | Sweden | 2014 |
| *Arthonia sp.* | MG495138 | South Korea | 2017 |
| *Arthonia sp.* | KJ851025 | Uganda | 2014 |
| *Arthonia sp.* | EU704049 | Rwanda | 2009 |
| *Arthonia sp.* | EU704050 | Florida | 2009 |
| *Arthonia sp.* | MH177775 | Norway | 2018 |
| *Arthonia subfuscicola* | KJ850972 | Sweden | 2014 |
| *Arthonia subfuscicola* | KJ850971 | Sweden | 2014 |
| *Arthonia thoriana* | MG207687 | England | 2018 |
| *Arthonia thoriana* | MG207686 | England | 2018 |
| *Arthonia toensbergii* | MH177776 | Norway | 2018 |
| *Arthonia toensbergii* | MH177775 | Norway | 2018 |
| *Arthonia stereocaulina* | KJ850999 | Sweden | 2014 |
| *Reichlingia zwackhii* | KF707652 | Sweden | 2014 |

*Continuation of Appendix 2*

| *Lecanora* | | | |
|---|---|---|---|
| Species | GenBank Number (nrITS) | Country | Year |
| **JR 0.008** | **MZ502324** | Antarctica, James Ross Island | 2021 |
| *Lecanora albescens* | JQ993719 | Belgium | 2012 |
| *Lecanora albescens* | JQ993720 | Estonia | 2012 |
| *Lecanora albescens* | JQ993727 | Poland | 2012 |
| *Lecanora andrewii* | JQ993722 | Estonia | 2012 |
| *Lecanora chlorophaodes* | AY398704 | Sweden | 2003 |
| *Lecanora compallens* | MG076965 | Netherlands | 2017 |
| *Lecanora compallens* | KY586037 | Italy | 2017 |
| *Lecanora crenulata* | JQ993725 | Poland | 2012 |
| *Lecanora dispersa* | JQ993734 | Hungary | 2012 |
| *Lecanora dispersa* | JQ993733 | — | 2012 |
| *Lecanora dispersa* | JQ993732 | — | 2012 |
| *Lecanora epibryon* | AY541251 | Austria | 2004 |
| *Lecanora epibryon* | KP314307 | Svalbard | 2014 |
| *Lecanora flotowiana* | AF070034 | — | 1998 |
| *Lecanora fuscobrunnea* | JN873872 | | |
| *Lecanora fuscobrunnea* | GU170840 | | |
| *Lecanora hagenii* | JQ993743 | Estonia | 2012 |
| *Lecanora hagenii* | JQ993755 | Slovakia | 2012 |
| *Lecanora intricata* | KY266975 | Antarctica, Victoria Land | 2012 |
| *Lecanora intricata* | KY266891 | Norway | 2014 |
| *Lecanora perpruinosa* | AF070025 | — | 1998 |
| *Lecanora polytropa* | KP314461 | Svalbard | 2014 |
| *Lecanora polytropa* | KP314458 | Svalbard | 2014 |
| *Lecanora pringlei* | KF024740 | USA | 2013 |
| *Lecanora pringlei* | KF024739 | USA | 2013 |
| *Lecanora pruinosa* | JQ993740 | Poland | 2012 |
| *Lecanora pruinosa* | AF070018 | — | 1998 |
| *Lecanora reuteri* | AF070026 | — | 1998 |
| *Lecanora reuteri* | JQ993741 | Poland | 2012 |
| *Lecanora rupicola* | DQ451670 | Spain | 2007 |
| *Lecanora rupicola* | DQ451669 | Spain | 2007 |
| *Lecanora semipallida* | JQ993757 | Hungary | 2012 |
| *Lecanora semipallida* | JQ993743 | Estonia | 2012 |
| *Lecanora semipallida* | JQ993755 | Slovakia | 2012 |
| *Lecanora solaris* | MH512983 | Russia | 2019 |

*Continuation of Appendix 2*

| Species | GenBank Number (nrITS) | Country | Year |
|---|---|---|---|
| *Lecanora solaris* | MH512984 | Russia | 2019 |
| *Lecanora strobilina* | MG973236 | Spain | 2018 |
| *Lecanora strobilina* | MG973237 | Spain | 2018 |
| *Lecanora strobilinoides* | MG973239 | Spain | 2018 |
| *Lecanora strobilinoides* | MG973238 | Spain | 2018 |
| *Umbilicaria antarctica* | AY603128 | Antarctica, Lagoon Island | 2004 |
| Species | GenBank Number (mtSSU) | Country | Year |
| **JR 0.230** | **MZ502369** | Antarctica, James Ross Island | 2021 |
| **JR 0.270** | **MZ502367** | Antarctica, James Ross Island | 2021 |
| *Lecanora achariana* | DQ972976 | — | 2006 |
| *Lecanora alaskensis* | MN508326 | USA | 2020 |
| *Lecanora albella* | KY502430 | Austria | 2017 |
| *Lecanora alboflavida* | KY502429 | United Kingdom | 2017 |
| *Lecanora allophana* | KY502459 | Albania | 2017 |
| *Lecanora anakeestiicola* | KP224472 | USA | 2015 |
| *Lecanora argopholis* | MK693684 | Ukraine | 2019 |
| *Lecanora baekdudaeganensis* | MN879871 | Korea | 2020 |
| *Lecanora caesiorubella* | JQ782667 | Australia | 2012 |
| *Lecanora californica* | JQ782668 | USA | 2012 |
| *Lecanora campestris* | DQ787362 | Sweden | 2007 |
| *Lecanora caperatica* | MH700565 | USA | 2018 |
| *Lecanora caperatica* | MH700566 | USA | 2018 |
| *Lecanora carpinea* | MK778533 | Russia | 2019 |
| *Lecanora carpinea* | MK693683 | Ukraine | 2019 |
| *Lecanora cenisia* | KY502426 | Romania | 2017 |
| *Lecanora chlarotera* | KY502422 | Czech Republic | 2017 |
| *Lecanora chondroderma* | MN192156 | China | 2019 |
| *Lecanora cinereofusca* | KP224465 | USA | 2014 |
| *Lecanora darlingiae* | MH481360 | USA | 2019 |
| *Lecanora ecorticata* | KT962184 | United Kingdom | 2015 |
| *Lecanora elatinoides* | JQ782669 | Australia | 2012 |
| *Lecanora excludens* | MK541649 | Norway | 2019 |
| *Lecanora exspersa* | KY502452 | Slovakia | 2017 |
| *Lecanora farinaria* | KY502433 | Norway | 2017 |
| *Lecanora flavopallida* | JQ782674 | Australia | 2012 |
| *Lecanora formosa* | KT453820 | China | 2015 |

*Continuation of Appendix 2*

| Species | GenBank Number (mtSSU) | Country | Year |
|---|---|---|---|
| *Lecanora fuscobrunnea* | MN023037 | Antarctica, Victoria Land | 2019 |
| *Lecanora gangaleoides* | JQ782676 | USA | 2012 |
| *Lecanora glabrata* | DQ787360 | Sweden | 2007 |
| *Lecanora helva* | JQ782680 | Thailand | 2012 |
| *Lecanora horiza* | KT453821 | Spain | 2015 |
| *Lecanora hybocarpa* | DQ912273 | — | 2006 |
| *Lecanora hybocarpa* | EF105417 | Spain | 2007 |
| *Lecanora impudens* | KY502458 | Czech Republic | 2017 |
| *Lecanora intricata* | DQ787346 | Austria | 2007 |
| *Lecanora intumescens* | KY502443 | Ukraine | 2017 |
| *Lecanora kenyana* | JQ900616 | Kenya | 2012 |
| *Lecanora layana* | KR094858 | USA | 2015 |
| *Lecanora layana* | KR094857 | USA | 2015 |
| *Lecanora leproplaca* | JQ782684 | Fiji | 2012 |
| *Lecanora leprosa* | JQ782685 | Thailand | 2012 |
| *Lecanora leptacina* | MN508273 | USA | 2019 |
| *Lecanora leptyrodes* | MK778538 | Russia | 2019 |
| *Lecanora muralis* | HQ660556 | Germany | 2010 |
| *Lecanora novomexicana* | KT453824 | USA | 2015 |
| *Lecanora orientoafricana* | JQ900617 | Kenya | 2012 |
| *Lecanora pachyphylla* | MN192153 | China | 2019 |
| *Lecanora pacifica* | JQ782686 | USA | 2012 |
| *Lecanora paramerae* | EF105418 | Spain | 2007 |
| *Lecanora perpruinosa* | DQ787344 | Austria | 2007 |
| *Lecanora phaeocardia* | JQ782687 | Thailand | 2012 |
| *Lecanora polytropa* | DQ986807 | — | 2006 |
| *Lecanora polytropa* | DQ787348 | Austria | 2007 |
| *Lecanora pseudistera* | MK693685 | China | 2019 |
| *Lecanora pulicaris* | MK778542 | Russia | 2019 |
| *Lecanora queenslandica* | JQ782692 | Australia | 2012 |
| *Lecanora saxigena* | KP224461 | USA | 2014 |
| *Lecanora schofieldii* | MN508274 | USA | 2020 |
| *Lecanora solaris* | MH520111 | Russia | 2019 |
| *Lecanora somervellii* | MH520114 | Russia | 2019 |
| *Lecanora strobilina* | KJ766420 | — | 2006 |
| *Lecanora subimmergens* | JQ782696 | Thailand | 2012 |
| *Lecanora subimmersa* | JQ782697 | | |
| *Lecanora substerilis* | KY502449 | Australia | 2012 |

*Continuation of Appendix 2*

| Species | GenBank Number (mtSSU) | Country | Year |
|---|---|---|---|
| *Lecanora sulphurea* | DQ797356 | Ukraine | 2017 |
| *Lecanora symmicta* | KJ152466 | Germany | 2014 |
| *Lecanora symmicta* | KJ766421 | — | 2006 |
| *Lecanora thysanophora* | KY502440 | Czech Republic | 2014 |
| *Lecanora tropica* | JQ782699 | Thailand | 2012 |
| *Lecanora vainioi* | JQ782702 | Thailand | 2012 |
| *Lecanora variolascens* | KY502445 | Austria | 2017 |
| *Lecanora wilsonii* | JQ782703 | Australia | 2012 |
| *Umbilicaria antarctica* | AY603139 | Antarctica, Lagoon Island | 2004 |
| *Lecidea* | | | |
| Species | GenBank Number (nrITS) | Country | Year |
| **JR 0.001** | **MZ502279** | Antarctica, James Ross Island | 2021 |
| **JR 0.007** | **MZ502322** | Antarctica, James Ross Island | 2021 |
| **JR 0.109** | **MZ502373** | Antarctica, James Ross Island | 2021 |
| **JR 0.176** | **MZ502371** | Antarctica, James Ross Island | 2021 |
| **JR 0.260** | **MZ502375** | Antarctica, James Ross Island | 2021 |
| **JR 0.269** | **MZ502377** | Antarctica, James Ross Island | 2021 |
| Lecidea aglaea | JN009719 | Sweden | 2011 |
| Lecidea aglaea | KR303636 | — | 2015 |
| Lecidea albohyalina | KF650950 | Sweden | 2014 |
| Lecidea andersonii | MK970673 | Antarctica, Victoria Land | 2019 |
| *Lecidea andersonii* | MK620084 | Antarctica, Dronning Maud Land | 2019 |
| *Lecidea atrobrunnea* | MK620265 | Svalbard | 2019 |
| *Lecidea atrobrunnea* | MK620240 | Argentina | 2019 |
| *Lecidea auriculata* | MK620246 | Argentina | 2019 |
| *Lecidea cancriformis* | MK620205 | Argentina | 2019 |
| *Lecidea confluens* | EU263921 | Austria | 2010 |
| *Lecidea fuscoatra* | HQ650707 | — | 2011 |
| *Lecidea fuscoatra* | HQ650662 | — | 2011 |
| *Lecidea fuscoatrina* | MK591838 | China | 2019 |
| *Lecidea kalbii* | MK620199 | Argentina | 2019 |
| *Lecidea lapicida* | HQ650665 | — | 2011 |
| *Lecidea leprarioides* | HQ650666 | — | 2011 |
| *Lecidea leucothallina* | MG968261 | | |
| *Lecidea lithophila* | MK620247 | Norway | 2019 |
| *Lecidea lithophila* | MK620090 | Austria | 2019 |

*Continuation of Appendix 2*

| Species | GenBank Number (nrITS) | Country | Year |
|---|---|---|---|
| *Lecidea medusula* | MK620251 | Austria | 2019 |
| *Lecidea medusula* | MK620270 | Norway | 2019 |
| *Lecidea nylanderi* | HQ650667 | — | 2011 |
| *Lecidea obluridata* | GU074423 | Austria | 2009 |
| *Lecidea perlatolica* | MK595453 | China | 2019 |
| *Lecidea plana* | EU259904 | Sweden | 2007 |
| *Lecidea polypycnidophora* | EU257682 | Antarctica, Victoria Land | 2007 |
| *Lecidea polypycnidophora* | EU257681 | Antarctica, Victoria Land | 2007 |
| *Lecidea polytrichina* | HQ650668 | — | 2011 |
| *Lecidea promiscens* | MK620212 | Argentina | 2019 |
| *Lecidea protabacina* | KY800506 | USA | 2017 |
| *Lecidea pullata* | HQ650669 | — | 2011 |
| *Lecidea roseotincta* | HQ650670 | — | 2011 |
| *Lecidea rubrocastanea* | EF495166 | USA | 2017 |
| *Lecidea silacea* | MK620077 | Canada | 2019 |
| *Lecidea silacea* | MK620629 | Canada | 2019 |
| *Lecidea silacea* | MK620249 | Austria | 2019 |
| *Lecidea* sp. | MK620097 | Antarctica, Victoria Land | 2019 |
| *Lecidea sphaerella* | KF650952 | Czech Republic | 2014 |
| *Lecidea sphaerella* | AM292702 | — | 2007 |
| *Lecidea swartzioidea* | MK620260 | Austria | 2019 |
| *Lecidea tessellata* | MH794139 | China | 2017 |
| *Lecidea tessellata* | MH794140 | China | 2017 |
| *Lecidea uniformis* | KY800508 | USA | 2017 |
| *Lecidea uniformis* | KY800507 | USA | 2017 |
| *Lecidea uniformis* | NR158514 | USA | 2017 |
| *Lecidea violascens* | KY800510 | USA | 2017 |
| *Rhizoplaca parilis* | MN764276 | — | 2020 |
| Species | GenBank Number (mtSSU) | Country | Year |
| **JR 0.001** | **MZ502302** | Antarctica, James Ross Island | 2021 |
| **JR 0.007** | **MZ502323** | Antarctica, James Ross Island | 2021 |
| **JR 0.109** | **MZ502324** | Antarctica, James Ross Island | 2021 |
| **JR 0.260** | **MZ502375** | Antarctica, James Ross Island | 2021 |
| *Lecidea andersonii* | GU074470 | Antarctica, Dronning Maud Land | 2010 |
| *Lecidea andersonii* | GU074469 | Antarctica, Dronning Maud Land | 2010 |
| *Lecidea atrobrunnea* | MK684659 | Argentina | 2019 |

*Continuation of Appendix 2*

| Species | GenBank Number (mtSSU) | Country | Year |
|---|---|---|---|
| *Lecidea atrobrunnea* | MK591146 | China | 2019 |
| *Lecidea atrobrunnea* | GU074510 | Greenland | 2010 |
| *Lecidea atrobrunnea* | GU074509 | Antarctica, South Shetland Islands | 2010 |
| *Lecidea atrobrunnea* | HQ660560 | Canada | 2011 |
| *Lecidea auriculata* | HQ660561 | USA | 2011 |
| *Lecidea auriculata* | GU074500 | Sweden | 2010 |
| *Lecidea berengeriana* | HQ660562 | Sweden | 2011 |
| *Lecidea cancriformis* | GU074488 | Antarctica, Ross Dependency | 2010 |
| *Lecidea cancriformis* | GU074487 | Antarctica, Ross Dependency | 2010 |
| *Lecidea cancriformis* | MN023046 | Antarctica, Victoria Land | 2019 |
| *Lecidea cancriformis* | GU074489 | Antarctica, Ross Dependency | 2010 |
| *Lecidea albohyalina* | KF662399 | Czech Republic | 2014 |
| *Lecidea confluens* | GU074492 | Austria | 2010 |
| *Lecidea diapensiae* | HQ660564 | Sweden | 2011 |
| *Lecidea floridensis* | HQ660565 | USA | 2011 |
| *Lecidea fuscoatra* | HQ660566 | Sweden | 2011 |
| *Lecidea fuscoatra* | DQ912275 | Austria | 2006 |
| *Lecidea fuscoatra* | GU074490 | Sweden | 2010 |
| *Lecidea fuscoatra* var. *grisella* | HQ660567 | Austria | 2011 |
| *Lecidea haematites* | EU075529 | Brazil | 2008 |
| *Lecidea hoganii* | KR055656 | USA | 2015 |
| *Lecidea hypopta* | FJ644537 | USA | 2009 |
| *Lecidea laboriosa* | GU074503 | USA | 2010 |
| *Lecidea laboriosa* | DQ986882 | — | 2006 |
| *Lecidea lapicida* | MK684635 | Argentina | 2020 |
| *Lecidea lapicida* | HQ660570 | Canada | 2011 |
| *Lecidea lapicida* var. *lapicida* | GU074493 | Austria | 2010 |
| *Lecidea lapicida* var. *pantherina* | GU074494 | Austria | 2010 |
| *Lecidea leprarioides* | HQ660571 | Norway | 2011 |
| *Lecidea lithophila* | MK684743 | Austria | 2019 |
| *Lecidea medusula* | MK684707 | Argentina | 2019 |
| *Lecidea nylanderi* | HQ660572 | USA | 2011 |
| *Lecidea obluridata* | GU074495 | Austria | 2010 |
| *Lecidea plana* | GU074498 | Sweden | 2010 |
| *Lecidea plana* | GU074497 | Sweden | 2010 |
| *Lecidea plana* | KF683103 | USA | 2014 |
| *Lecidea polypycnidophora* | GU074474 | Antarctica, Mac Robertson Island | 2010 |
| *Lecidea polypycnidophora* | GU074473 | Antarctica, Victoria Land | 2010 |

*Continuation of Appendix 2*

| Species | GenBank Number (mtSSU) | Country | Year |
|---|---|---|---|
| *Lecidea polytrichina* | HQ660573 | Sweden | 2011 |
| *Lecidea pullata* | HQ660574 | Norway | 2011 |
| *Lecidea roseotincta* | HQ660575 | Norway | 2011 |
| *Lecidea roseotincta* | KY123745 | USA | 2016 |
| *Lecidea sanguineoatra* | AY762094 | Norway | 2008 |
| *Lecidea silacea* | GU074496 | Austria | 2010 |
| *Lecidea silacea* | AY756402 | Sweden | 2008 |
| *Lecidea silacea* | DQ986878 | — | 2006 |
| *Lecidea sphaerella* | KF662400 | Czech Republic | 2014 |
| *Lecidea tessellata* | HQ660576 | USA | 2011 |
| *Lecidea tessellata* | GU074491 | Austria | 2010 |
| *Lecidea tessellata* | MK684698 | Argentina | 2019 |
| *Lecidea tessellata* | MK684668 | Argentina | 2019 |
| *Lecidea tessellata* | MK684667 | Argentina | 2019 |
| *Lecidea tessellata* | KR055661 | USA | 2015 |
| *Lecidea turgidula* | AY567788 | Sweden | 2005 |
| *Lecidea turgidula* | KJ766424 | — | 2014 |
| *Lecidea sphaerella* | AM292749 | Slovakia | 2007 |
| *Rhizoplaca parilis* | KT453859 | USA | 2015 |
| Species | GenBank Number (RPB1) | Country | Year |
| **JR 0.001** | **MZ515495 (submitted to GenBank)** | Antarctica, James Ross Island | 2021 |
| **JR 0.007** | **MZ515496 (submitted to GenBank)** | Antarctica, James Ross Island | 2021 |
| **JR 0.109** | **MZ515497 (submitted to GenBank)** | Antarctica, James Ross Island | 2021 |
| *Lecidea andersonii* | MN023060 | Antarctica, Victoria Land | 2019 |
| *Lecidea andersonii* | MK684915 | Svalbard | 2019 |
| *Lecidea atrobrunnea* subsp. *saxosa* | MK684918 | USA | 2019 |
| *Lecidea atrobrunnea* subsp. *stictica* | MK684908 | Austria | 2019 |
| *Lecidea auriculata* | MK685036 | Argentina | 2019 |
| *Lecidea auriculata* | MK685025 | Argentina | 2019 |
| *Lecidea auriculata* | MK685012 | Argentina | 2019 |
| *Lecidea auriculata* | MK684989 | Argentina | 2019 |
| *Lecidea cancriformis* | MN023058 | Antarctica, Victoria Land | 2019 |
| *Lecidea cancriformis* | MK684914 | Antarctica, Victoria Land | 2019 |
| *Lecidea cancriformis* | MN023057 | Antarctica, Victoria Land | 2019 |
| *Lecidea cancriformis* | MN023056 | Antarctica, Victoria Land | 2019 |
| *Lecidea cancriformis* | MN023059 | Antarctica, Victoria Land | 2019 |

*End of Appendix 2*

| Species | GenBank Number (RPB1) | Country | Year |
|---|---|---|---|
| *Lecidea fuscoatra* | AY756408 | Sweden | 2019 |
| *Lecidea fuscoatra* | MK684909 | Austria | 2019 |
| *Lecidea fuscoatra* var. *grisella* | KF683115 | Scotland | 2014 |
| *Lecidea fuscoatrina* | MK684919 | USA | 2019 |
| *Lecidea kalbii* | MK684992 | Argentina | 2019 |
| *Lecidea kalbii* | MK684994 | Argentina | 2019 |
| *Lecidea laboriosa* | DQ986821 | — | 2006 |
| *Lecidea laboriosa* | MK684890 | USA | 2019 |
| *Lecidea lapicida* var. *lapicida* | MK684910 | Austria | 2019 |
| *Lecidea lithophila* | MK685037 | Austria | 2019 |
| *Lecidea medusula* | MK684946 | Argentina | 2019 |
| *Lecidea medusula* | MK684923 | Argentina | 2019 |
| *Lecidea plana* | MK684895 | Sweden | 2019 |
| *Lecidea plana* | KF683116 | USA | 2013 |
| *Lecidea plana* | MK684896 | Sweden | 2019 |
| *Lecidea polypycnidophora* | MN023061 | Antarctica, Victoria Land | 2019 |
| *Lecidea polypycnidophora* | MK684897 | Antarctica, Mac Robertson Land | 2019 |
| *Lecidea promiscens* | MK685015 | Argentina | 2019 |
| *Lecidea silacea* | DQ986820 | — | 2006 |
| *Lecidea silacea* | AY756409 | — | 2006 |
| *Lecidea tessellata* | MK684996 | Argentina | 2019 |
| *Lecidea tessellata* | MK684971 | Argentina | 2019 |
| *Lecidea tessellata* | MK684970 | Argentina | 2019 |
| *Lecidea tessellata* | MK684894 | Austria | 2019 |
| *Rhizoplaca parilis* | KU935393 | USA | 2016 |