



<https://doi.org/10.11646/phytotaxa.316.3.9>

Taxonomy and nomenclature of seven names in *Bacidia* (Ramalinaceae, Lecanorales) described from Russia

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Abstract

We aim to increase understanding and improve taxonomy of seven names currently treated in *Bacidia* that were described from Russian territory based on material collected during 19th-century expeditions: *Bacidia alborussula*, *B. freshfieldii*, *B. graminum*, *B. indigens*, *B. primigenia*, *B. subabbrevians*, and *B. xylophila*. *B. alborussula*, *B. graminum*, and *B. indigens* are transferred here to *Haematomma*, *Lecania*, and *Bacidina*, respectively. *Bacidia freshfieldii* and *B. subabbrevians* belong in the Ramalinaceae and are provisionally kept in *Bacidia* even though none of them is congeneric with the type of that genus. *B. primigenia* belongs in *Arthrorhaphis*, but we refrain from making any new combination owing to its questionable status as a species distinct from *A. grisea*. *B. xylophila* is a younger synonym of *Lecania subfuscula*. We designate lectotypes for names previously not typified and for which syntypes exist: *Lecidea alborussula*, *L. graminum*, *L. indigens*, and *L. subabbrevians*.

Key words: *Bacidia*, *Haematomma*, *Lecania*, *Bacidina*, new combinations, Russia, Arctic, Caucasus

Introduction

The genus *Bacidia* accommodates a wide variety of lichens from around the world. Currently, 968 names at species level have been referred to the genus (MycoBank query on 4 April 2017, subtracting orthographic name variants). Historically, the genus name has been used for crustose lichens with a chlorococcoid photobiont, biatorine apothecia, and ascospores with three or more transverse septa (Zahlbruckner 1905). This circumscription is apparently unnatural, including numerous taxa that are not closely related to the type species, *B. rosella* (Pers.) De Not. Although work is underway to circumscribe monophyletic entities, many names in *Bacidia* remain understudied and poorly understood. This includes several names described from Russia and listed in the lichen checklists of Urbanavichus (2010) and, when applicable, Kristinsson *et al.* (2010).

The aim of this paper is to increase understanding and improve taxonomy of seven names in *Bacidia* that were described from Russian territory based on material collected during 19th-century expeditions. This includes material collected by Ernst Almquist during the Vega expedition headed by Adolf Erik Nordenskiöld 1878–1880 to the Russian Arctic, Edvard August Vainio during the journey led by August Engelbrekt Ahlqvist to western Siberia in 1880, and by Hugo Lojka, who travelled with Moriz von Déchy to Caucasus in 1885. Because of this particular historical background of the collections, the type material of all names is housed in herbaria outside Russia, *viz.* Helsinki (H) and Turku (TUR), Finland, and Stockholm (S), Sweden. Common to all seven names is that the original material, including one or a few specimens, is the only material available, with all the problems that entails in terms of evaluating morphological variation for determining species boundaries and relationships. Our assessment of the seven names indicates that none belongs to *Bacidia s. str.* In the end, five of the names appear to represent distinct species, one is of uncertain status, and the seventh is a synonym.

Taxonomy and nomenclature

Haematomma alborussulum (Nyl.) S. Ekman & J. Gerasimova, *comb. nov.*

Mycobank no.: MB820116

Lecidea alborussula Nyl. (1884: 213). *Bacidia alborussula* (Nyl.) Zahlbr. (1926b: 173). Type:—RUSSIA. Chukotka Peninsula: “sinus Konyam ad fretum Bering, 64° 50 lat. bor., 173° long. occid. (Greenw.)”, 28–30 July 1879, *E. Almquist s. n.* (lectotype, designated here: S L32108!); [in Nylander’s handwriting:] “Fret. Behringii, Konyambay”, undated, *E. Almquist s. n.* (isolectotype: H-NYL 17561!).

Lecidea alborussula var. *callosynopsis* Nyl. (1887: 228). *Bacidia alborussula* var. *callosynopsis* (Nyl.) Zahlbr. (1926b: 173). Type:—RUSSIA. Chukotka Peninsula: “sinus Konyam ad fretum Bering, 64° 50 lat. bor., 173° long. occid. (Greenw.)”, 28–30 July 1879, *E. Almquist s. n.* (syntype: S L32114!).

Bacidia alborussula, including its var. *callosynopsis*, was described from the Chukotka Peninsula at the Bering Strait, where it was collected on siliceous rock. The thallus is yellowish white and areolate, with a white cobwebby prothallus along the edge and between discontinuous areoles. The areoles have a soft, powdery, almost sorediate surface. Apothecia are up to 1 mm diam., dark red and become strongly convex with a suppressed proper exciple (no obvious thalline margin), sometimes aggregated and tuberculate. Paraphyses are strongly branched and set with orange-brown crystals, mostly in the upper part. These crystals dissolve into a K⁺ violet solution, not forming any needles. Ascospores are filiform to bluntly acicular, straight to ± curved or helical, 25–40 × 2.5 µm (26–48 × 3.0 µm according to Nylander 1884), with 3 thin septa. Asci are *Haematomma*-type sensu Staiger & Kalb (1995), including a narrow axial body.

Bacidia alborussula clearly belongs in the genus *Haematomma* and does not seem to correspond to any of the currently recognized taxa (Staiger & Kalb 1995, Brodo *et al.* 2008). The apothecial pigment crystals seem to correspond to haematommone, as characterized by Staiger & Kalb (1995). The combination of the saxicolous substrate, the characteristics of the pigment crystals, long and narrow ascospores, and convex apothecia without visible thalline margin seems to be unique within the genus. The var. *callosynopsis* described by Nylander (1887), judging from the type material in S, is a morph with young and aggregated apothecia that otherwise corresponds well with the nominal variety. It should be pointed out that the close relationship with *Haematomma ochroleucum* (as ‘*Lecanora haematomma*’) was pointed out already in the original description.

Bacidia freshfieldii (Vain.) Zahlbr. (1926a: 112)

Lecidea freshfieldii Vain. (1899: 318). Type:—RUSSIA. Caucasus: “Ardonthal, kieselh. Gest.”, 1885, *H. Lojka, Iter Caucasicum 122* (holotype or possibly syntype: TUR-V 21241!).

Bacidia freshfieldii was described from Northern Caucasus, where it was collected on siliceous rock. This species appears to be closely related to *Catillaria scotinodes* (Nyl.) Coppins and *C. aphanata* (Nyl.) Coppins. Like in *C. scotinodes*, the thallus is rimose, well developed and spreading over the substrate, although thicker and with a warted to almost tuberculate surface. Similarly to *C. aphanata*, apothecia are dominated by a brown (K⁺ purplish) pigment and by smaller ascospores than *C. scotinodes*, 9–11 × 3.5–4 µm (according to our own measurements) or 8–12(–16) × 3.0–4.0 µm according to Vainio (1899). Unlike both species, *B. freshfieldii* has a thick, brownish thallus, relatively large apothecia (up to 0.7 mm diam., many c. 0.5 mm), and a well-developed, thick and persistent proper exciple. Vainio (1899) described ascospores as mainly 1-septate, occasionally 3-septate. We observed only 1-septate ascospores, however. Vainio’s report of 3-septate ascospores is likely to be the reason why Zahlbruckner transferred the species to *Bacidia* and not to *Catillaria*.

Although *B. freshfieldii* is clearly not a member of *Bacidia s. str.*, a reclassification must await the clarification of generic boundaries in the Ramalinaceae.

Lecania graminum (Vain.) J. Gerasimova & S. Ekman, *comb. nov.*

Mycobank no.: MB820741

Lecidea graminum Vain. (1909: 103). *Bacidia graminum* (Vain.) Zahlbr. (1926b: 203). Type:—RUSSIA. Chukotka Peninsula: “Sibiria: Peninsula Jinretlen. 67° lat. bor., 173° long. occid. (Greenw.)”, 1878, *E. Almquist s. n.* (lectotype, designated here: S L32117!; isolectotype: TUR-V 20778!).

Lecania graminum, like *Lecidea alborussula*, was described from the Chukotka Peninsula, where it was collected on decaying plant debris, seemingly on sandy soil. Its thallus appears whitish (but may have been discoloured by age) and encrusts the substrate by forming coalescing irregular granules. Apothecia are abundant, brownish yellow to more or less brown to black, often piebald, soon becoming strongly convex, 0.4–0.75 mm diam. The proper exciple is poorly developed, paraplechtenchymatous, visible as a thin rim in young apothecia but soon excluded. Excipular hyphae are moderately gelatinized and have narrowly to widely ellipsoidal cell lumina that become up to c. 20 µm long and are strongly constricted at the septa. The hypothecium and medulla are poorly differentiated and form a strongly developed cushion of hyphae. The hymenium is 35–40 µm thick, containing clavate, stout (3–4 µm wide at half their length), unbranched paraphyses with apices up to 6 µm wide and clavate asci with 8 or more helically arranged ascospores (possibly 12 or 16, difficult to count; our highest count is 14 clearly visible ascospores). Ascospores are acicular 27–41 × 2.0–2.5 µm (28–41 × 2.0 µm according to Vainio 1909), mostly with 4 thin septa. The upper part of the hymenium and proper exciple are often diffusely coloured by a brown, K⁺ purplish pigment; all other parts of the apothecium are unpigmented.

Lecania graminum is externally similar and apparently closely related to *Lecania subfuscata* (Nyl.) S. Ekman, but differs primarily in the longer and narrower acicular spores and by occasionally forming more than 8 ascospores per ascus. The similarity with *L. subfuscata* was pointed out by Vainio in his description (1909). Another close relative of *L. subfuscata*, named *L. granulata* Coppins & Fryday, was recently described from Scotland (Fryday & Coppins 2012). It differs from *L. subfuscata* primarily in the crenulate thalline margin in young apothecia.

Bacidina indigens (Vain.) S. Ekman & J. Gerasimova, *comb. nov.*

MycoBank no.: MB819011

Lecidea indigens Vain. (1909: 104). *Bacidia indigens* (Vain.) Zahlbr. (1926b: 208). Type:—RUSSIA. Chukotka Peninsula: “Sibiria: Pitlekai, 67° 7' lat. bor., 173° 24' long. occid. (Greenw.)”, 1879, *E. Almquist s. n.* (lectotype, designated here: S L31730!; isolectotype TUR-V 20776!).

Bacidia viridescens auct., non (A. Massal.) Th. Fr. [“(A. Massal.) Norman”, “(A. Massal.) Hellb.”].

The name *Lecidea indigens* and its combination in *Bacidia* have so far only been applied to the type material, which was collected on sandy soil on the Chukotka peninsula (although the protologue indicates that it was also observed on weathered bones). The type material of *Bacidia indigens* is characterized by an esorediate thallus consisting of coalescing granules (pale bluish to bluish grey according to Vainio 1909), flat to moderately convex, brown-black, mostly 0.4–0.8 mm wide apothecia possessing a concolorous, thin margin level with the disk. The proper exciple is paraplechtenchymatous and has red-brown and olivaceous brown pigmentation above, gradually fading to yellow-brown below. The hypothecium is pale yellowish brown (K⁻), and the hymenium is olivaceous green above, 50–55 µm tall and with abundant paraphyses with clavate apices. Ascospores are acicular, almost straight to more or less helical, 25–40 × (1.5–)2.0 µm, thinly septate (4–5 according to Vainio 1909).

Bacidina indigens turns out to be the earliest available name for the taxon currently known as *Bacidia viridescens* auct., which is based on *Raphiospora viridescens* (Massalongo 1853). The holotype of the latter name in herbarium VER belongs to the taxon known as *Bacidia bagliettoana* (A. Massal. & De Not.) Jatta. A full description of this taxon (under the name *Bacidia viridescens*) was provided by Coppins & Aptroot (2009). *Bacidina indigens* is similar to *B. egenula* (Nyl.) Vězda, which was pointed out by Vainio (1909). The latter has a brown, K⁺ greenish hypothecium and a finely granular thallus.

Bacidia primigenia Vain. (1928: 95)

Type:—RUSSIA. Khanty-Mansiysk Autonomous Okrug: “Sibiria occ.: Amensk”, [23–24 July acc. to Alava (1988)] 1880, *E. Vainio s. n.* (holotype: TUR-V 20803!).

The type material of *Bacidia primigenia* was collected on sandy soil covering pine roots along Konda River, a tributary to the Irtysh River in western Siberia. The specimen is, unfortunately, not well preserved, consisting of three smaller envelopes of loamy sand, only some coherent and with observable lichen thalli. Vainio (1928) described it as (in translation) ‘closely related to *Arthrorhaphis flavovirescens*’ (a synonym of *A. citrinella*), having black, sessile, urceolate apothecia that are hardly constricted at the base and measure 0.15–0.2(–0.4) mm across. Spores were described as narrowly fusiform, 17–28 × (2.5–)3–4 µm and with 3–5 septa. We have confirmed that Vainio’s observations were indeed correct. The apothecia are attached to a thin, pale (pale bluish according to Vainio), areolate thallus that may very well belong to a member of *Baeomyces*.

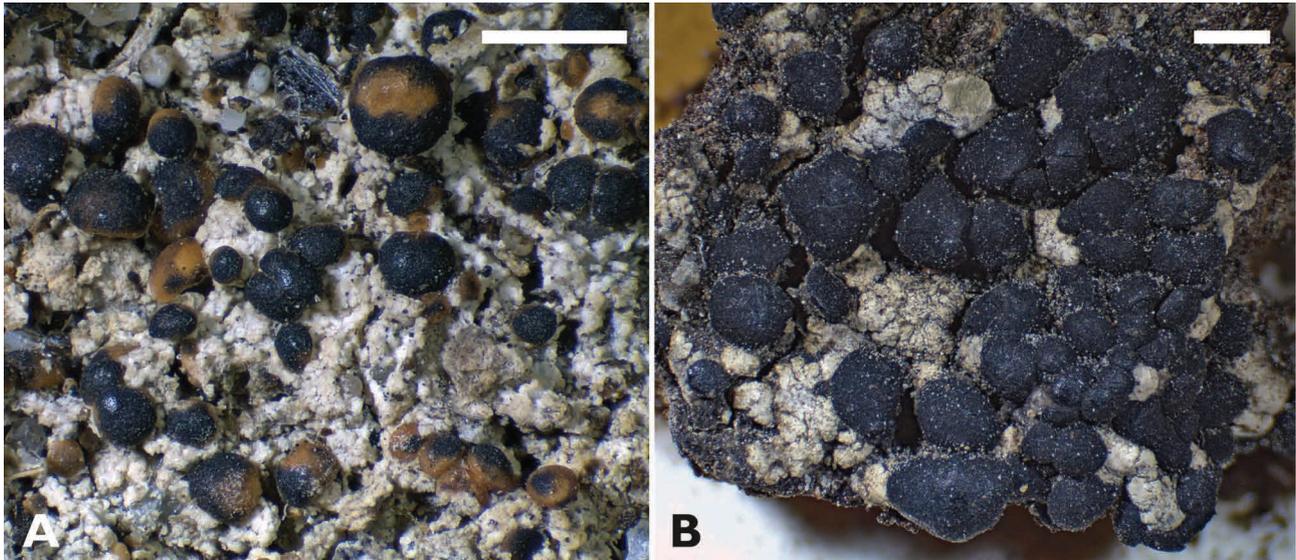


FIGURE 1. *Lecania graminum* and *Bacidia subabbrevians*, thalli with apothecia. **A.** *L. graminum* (TUR-V 20778, isolectotype). **B.** *B. subabbrevians* (H-NYL 17446, isolectotype).—Scales = 1.0 mm.

Bacidia primigenia belongs, as predicted by Vainio (1928), to the genus *Arthrorhaphis*. Although spores are somewhat on the short side and have fewer septa than normally expected, we cannot exclude the possibility that *B. primigenia* is conspecific with *A. grisea* Th. Fr.

Bacidia subabbrevians (Nyl.) Zahlbr. (1926b: 241) (Fig. 1)

Lecidea subabbrevians Nyl. (1884: 221). Type:—RUSSIA. Chukotka Peninsula: “sinus Konyam ad fretum Bering, 64° 50 lat. bor., 173° long. occid. (Greenw.)”, 28–30 July 1879, *E. Almqvist s. n.* (lectotype, designated here: S L4654!); [in Nylander’s handwriting] “Fretum Behring, Konyambay”, undated, *E. Almqvist s. n.* (isolectotype: H-NYL 17446!).

The type material of *Bacidia subabbrevians* was collected on the Chukotka Peninsula, where it inhabited soil consisting of fine-grained sand and decaying plant or bryophyte parts. *B. subabbrevians* is closely related to *Toninia coelestina* (Anzi) Vězda, *T. cretica* Timdal, and *Bacidia illudens* (Nyl.) H. Olivier. It differs from all of these species in having larger and more distinctly placodioid squamules, which are closely adnate to the substrate surface (thallus a thick, warty crust of coarse, fused granules in *T. coelestina* and *T. cretica*, filmy in *B. illudens*). Unlike *T. coelestina*, ascospores are consistently 3-septate, and somewhat wider than in both *T. coelestina* and *T. cretica* (3.5–4 µm). *B. subabbrevians* is also set apart by the distinct, green pigment hoods over the apices of the paraphyses. Awaiting clarification of generic delimitations in the Ramalinaceae, *B. subabbrevians* is kept here in *Bacidia* for the time being.

Bacidia xylophila Malme (1932: 17)

Type:—RUSSIA. The Sakha Republic (Yakutia): “Sibiria Arctica, Insula Preobraschenie”, 24 August 1878, *E. Almqvist s. n.* (lectotype S L2810!, selected by Printzen 1995: 234 as “holotype”, ICN Art. 9.9; isolectotypes S L31737!, F270797!, F270798!).

The lectotype of *Bacidia xylophila* was collected on wood on Preobrazhenia Island in the Khatanga Gulf of the Laptev Sea. Other original material cited by Malme (1932) was collected on Minin Island west of the Taymyr Peninsula and on one site on the north side of that peninsula. *B. xylophila* represents typical *Lecania subfuscula* and adds to the list of younger synonyms of that name (see Dillman *et al.* 2012).

Malme discussed the close relationship with *L. subfuscula* (as *Bacidia subfuscula*), but separated it on account of the substrate, darker apothecia, and narrower ascospores. Ascospores size (14–18 × 2.5–3.0 µm according to our measurements; 15–20 × 2.5–3 µm according to Malme), however, is in the range normal for *L. subfuscula*, and apothecia in that species vary in colour from pinkish to brownish to black. *L. subfuscula* is also quite nonspecific about its substrate choice, inhabiting peat, decaying plant material, wood, bones, or sometimes rock in nutrient-enriched habitats. The type locality was specifically mentioned by Almqvist (1882: 207) to be heavily manured by birds.

Additional specimens seen (all part of the original material): RUSSIA. Krasnoyarsk Krai, Taymyrsky Dolgano-Nenetsky District: “Siberia Arctica, Insula Tajmyr, Portus Actinae”, 14–18 August 1878, *Ernst Almquist s. n.* (S F300360, F300361); “Siberia Arctica, Insula Minin”, 11 August 1878, *Ernst Almquist s. n.* (S F300362).

Acknowledgements

We are grateful to the curators of H and TUR for arranging loans. S.E. thanks Francesco Di Carlo for hospitality during a visit to herbarium VER. The study was supported by the Russian Foundation for Basic Research (grant no. 14-04-01411) and the Swedish Taxonomy Initiative for financial support (grant no. 146/07 1.4).

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