
**The lichen genus *Catillochroma* (Ascomycota, Ramalinaceae)
Three new species and eight new combinations**

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Abstract

Three new species of *Catillochroma* are described, viz. *C. danfordianum* Kalb and *C. mareebaense* Kalb, both from Queensland, Australia, and *C. phayapipakianum* Kalb from Chiang Rai Province, Thailand. Eight species are transferred to *Catillochroma*, viz. *C. alleniae*, *C. alligatorensis*, *C. beechingii*, *C. bicoloratum*, *C. coralloideum*, *C. flavosorediatum*, *C. hainanense* and *C. yunnanense*. Habit photographs of the new and some other species, mentioned in the text are provided.

Introduction

In the course of some recent travels in Australia (from Sydney to Cooktown, 2015) and in the northern, central and southern provinces of Thailand (2015, 2016), many samples of the lichen genus *Catillochroma* were collected. This genus, described by Kalb (2007) was accepted by Lücking *et al.* (2017), but not by subsequent workers, e.g. Lendemer (2007), Lendemer *et al.* (2016), McMullin & Lendemer (2016), McCarthy & Elix (2016), Aptroot *et al.* (2021) after a critical paper by Fryday & Lendemer (2010). These authors reassessed the genera *Catillochroma* and *Lopezaria* and synonymized them with *Megalalaria*, applying a very broad concept of the latter. As I am still convinced that *Catillochroma* is a well circumscribed group within the Ramalinaceae, three new species are described and eight species are transferred to this genus.

Material and Methods

The material for this study was collected in Australia, Brazil, Costa Rica, Ecuador, Réunion, Tanzania and Thailand, mainly by the author together with the following companions: Harry Jonitz, Astrid, Daniel, Jutarat and Julia Kalb, Anna-Maria Mertens and Getrude Plöbst. Furthermore, type specimens from the following herbaria, FH, G, H-Nyl and M were studied.

At the Lichenological Institute Neumarkt, the lichens were examined with a Wild M3Z Plan stereomicroscope and an Olympus BH-A research microscope. Photographs were taken with a Nikon Coolpix 995 digital camera adapted to both microscopes. Sections were usually cut by hand, but for special purpose a Leitz Kryomat 1321 freezing microtome was used and the sections mounted in tap water and lactophenol cottonblue. Natural compounds were characterized by thin-layer chromatography (TLC) in solvents A, B' and C, according to the methods standardized for lichen products by Elix (2018). The spots on the TLC plates were identified by the computer program Wintab 64bit (Lafferty et al. 2021).

The holotypes of the new species from Australia are deposited in CANB, the new species from Thailand is deposited in RAMK.

Results

The study of the material recently collected from Australia and Thailand revealed further evidence to reinforce the integrity of the genus *Catillochroma*, viz. a different ascus type compared with *Megalaria s. str.* Three new species are described below, *Catillochroma danfordianum* Kalb from Queensland, Australia, which is similar to *C. alligatorensis* (Lendemer) Kalb, but differs in having larger ascospores and different pigments in the hypothecium, *Catillochroma mareebaense* Kalb, from Queensland, Australia, which is similar to *C. alligatorensis* (Lendemer) Kalb, but differs in having a hypothecium pigmented blue-black to violet-black, K–, and a thallus lacking fumarprotocetraric acid and *Catillochroma phayapipakianum* Kalb from Chang Rai Province, Thailand, which is similar to *C. yunnanensis* (C.X. Wang & L. Hu) Kalb, but differs in having narrower ascospores and a hyaline or slightly violet-brown to blue-grey hypothecium.

Eight species are transferred to *Catillochroma*: *Megalaria alleniae* McMullin & Lendemer, *Megalaria alligatorensis* Lendemer, *Megalaria beechingii* Lendemer, *Catillaria bicolorata* Vain., *Megalaria coralloidea* P.M. McCarthy & Elix, *Megalaria flavosorediata* Aptroot, *Megalaria hainanensis* Q. Ren and *Megalaria yunnanensis* C.X. Wang & L. Hu.



Fig. 1: *Catillochroma endochromum*; thallus and apothecia. Scale bar 1 mm.

Catillochroma Kalb, Bibliotheca Lichenologica 95: 298 (2007).

Type species: *Catillochroma endochromum* (Fée) Kalb

Fig. 1

A detailed description is presented in the protologue and will not be repeated here. In the meantime, a further character was found to be important for distinguishing *Catillochroma* species from *Megalaria* species **s. str.**, namely the alternative ascus types. In *Catillochroma* the ascus is similar to a *Biatora*-type (Hafellner 1984): with an amyloid tholus, \pm conical masse axiale, bordered by a more deeply amyloid zone, and a convex to conical ocular chamber, whereas the *Megalaria*-type also has an amyloid tholus, but differs in having a broad masse axiale without a more deeply amyloid zone and a broad ocular chamber (compare fig. 11 and fig. 48 in Hafellner 1984).

The species of *Catillochroma* can be distinguished by their alternative thallus shape (smooth, without vegetative propagules, or with soredia, isidia, granular or coralloid outgrowths, etc.), spore size and especially by different K- and N-reactions of the apothecial tissues. To achieve a consistent nomenclature, Fig. 2 should be consulted.

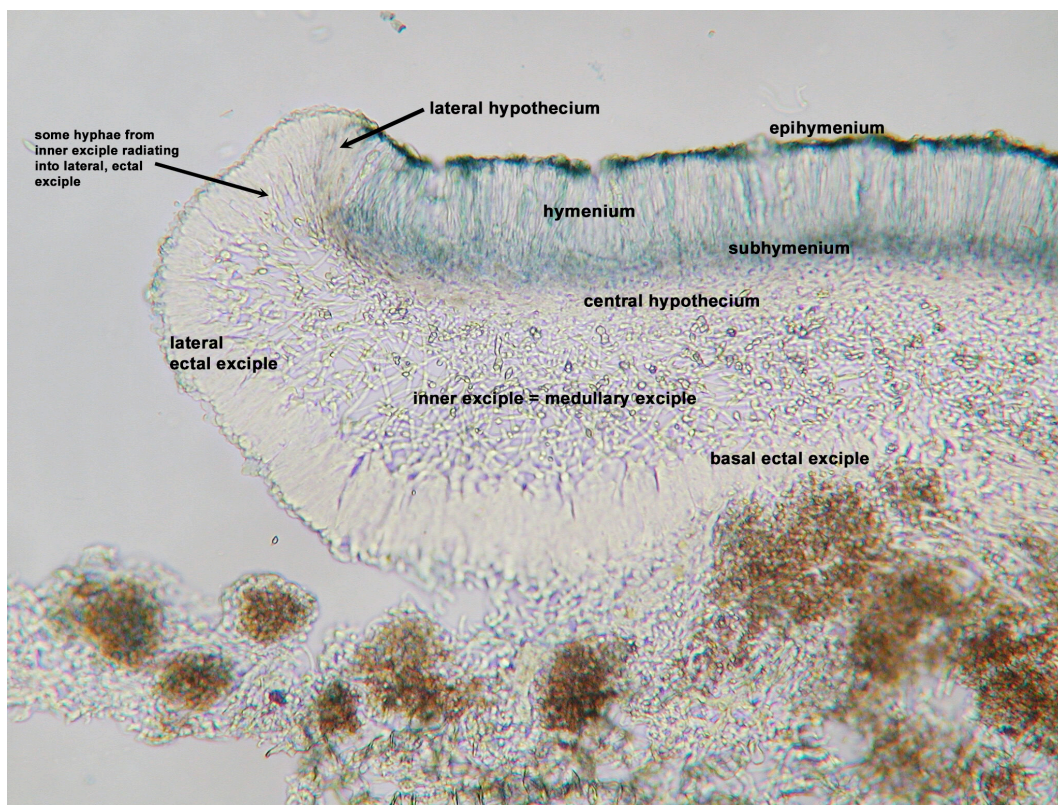


Fig. 2: *Catillochroma endochromum*; Section through apothecium to show the different layers.

New species

Catillochroma danfordianum Kalb sp. nov.

Fig. 3

Index Fungorum No.: IF 559522

Type. AUSTRALIA. Queensland: Atherton Tableland, surroundings of Cedar Park Rainforest Resort, 16°54'41" N, 145°36'06" E, 380 m elev., on bark of unidentified deciduous tree in tropical rainforest, 13 August 2012, K. Kalb 39720 & A. Mertens (CANB-holotype).

Diagnosis. Similar to *Catillochroma alligatorensis* (Lendemer) Kalb, but differs in having larger ascospores ($13\text{--}18 \times 6\text{--}8 \mu\text{m}$ vs. $12\text{--}14 \times 3.8\text{--}5.5 \mu\text{m}$ in *C. alligatorensis*) and different pigments in the hypothecium (upper portions

pigmented purple, K⁺ distinctly blue, lower portions pigmented brownish, K⁺ more intense brown in *C. alligatorensis*).

Etymology. The specific epithet refers to the owners of Cedar Park Rainforest Resort, Jane & Peter Danford, who provided a tropical haven with a lot of interesting lichens in a stunning ambience, and an escape from the rush of everyday life.



Fig. 3: *Catillochroma danfordianum*; Thallus and apothecia. Scale bar 0.5 mm.

Description. Thallus crustose, corticolous, grey to dark grey, up to 5 cm in diameter, continuous to areolate, formed from confluent flattened to convex areoles, without soredia or isidia. Apothecia biatorine, plane and flat, becoming convex with age, circular in outline or becoming deformed, sessile, up to 1.0 mm in diameter; margins pale, waxy white to light beige, contrasting with the coloration of the discs, becoming excluded with age; discs black, epruinose. Epihymenium 10–20 μm thick, dark brown to black pigmented, K⁻, N⁺ purple. Hymenium 50–60 μm thick, hyaline, not inspersed. Subhymenium 10–15 μm thick, hyaline, not distinctly separated. Central hypothecium 25–50 μm thick, upper portions pigmented red-brown, K⁺ purple, N⁺ blood-red, lower portions 10–15 μm thick, pigmented more intensely red-brown to black-brown, K⁺ purple, N⁺ blood-red; lateral hypothecium black-brown, K⁻, N⁻. Excipulum bilayered, comprised of a medullary excipulum 70–100 μm thick, of a textura intricata,

hyaline, opaque, densely filled with small crystals K⁻, N⁻, and an ectal excipulum 50–70 µm thick, comprised of thick, gelatinized hyphae densely interspersed with small crystals, K⁺ intense yellow, fading to hyaline, N⁻. Asci cylindrical to clavate, eight-spored; ascospores narrowly to broadly ellipsoid, hyaline, one-septate, thick-walled, not halonate, 13–18 × 6–8 µm. Pycnidia not seen.

Secondary metabolites. Atranorin (major), zeorin (major) and fumarprotocetraric acid (major).

Distribution and ecology. The new species was found growing on a deciduous tree at the margin of a tropical rainforest along a creek at 380 m.

Notes. *Catillochroma danfordianum* is similar to *C. alligatorensis*, but differs in having alternative apothecial pigments and thus shows different color reactions with K (see diagnosis above). Furthermore, it has larger ascospores. The same size of ascospores was found in *Catillochroma coralloideum* (P.M. McCarthy & Elix) Kalb which was also collected in the Atherton Tableland. The latter species is easily distinguished by the relatively large and peculiar isidia (McCarthy & Elix 2016).

Catillochroma mareebaense Kalb sp. nov.

Fig. 4

Index Fungorum No.: IF 559529

Type. AUSTRALIA. Queensland: ca. 12 km SE of Mareeba, along Davies Creek road, 17°00'08" S, 145°34'05" E, 450 m elev., on bark in a dry *Eucalyptus* forest, 21 August 2015, K. Kalb 40554 & D. Kalb (CANB-holotype).

Diagnosis. Similar to *Catillochroma alligatorensis* (Lendemer) Kalb but differs in having a blue-black to violet-black, K⁻, pigmented hypothecium (pigmented purple, K⁺ distinctly blue or brownish, K⁺ more intense brown in *C. alligatorensis*) and a thallus lacking fumarprotocetraric acid. It is also similar to *C. yunnanense* (C.X. Wang & L. Hu) Kalb, but this species has much larger ascospores (20–25 × 5–7.5 µm) and the thallus also lacks fumarprotocetraric acid.

Etymology. The specific epithet refers to the nearby city of Mareeba where the type material was collected.

Description. Thallus crustose, corticolous, grey to whitish grey, up to 6 cm in diameter, continuous to areolate, smooth or more often granulose to verrucose, verrucae up to 0.25 mm wide, without soredia or isidia. Apothecia biatorine, plane and flat, becoming convex with age, circular in outline or becoming deformed, sessile, up to 1.0 mm in diameter, 0.3 mm high; margins pale, waxy white,

contrasting strongly with the coloration of the discs, becoming excluded with age; discs black or bluish-black, epruinose. Epihymenium 10–20 μm thick, pigmented blackish-blue, K–, N+ purple. Hymenium 50–60 μm thick, hyaline, not interspersed. Subhymenium 10–15 μm thick, hyaline to slightly violet-brown. Central hypothecium 25–50 μm thick, upper portions pigmented black-blue, K–, N+ purple, lower portions 10–15 μm thick, pigmented purplish-brown, K–, N+ wine-red; lateral hypothecium slightly violet-brown, K–, N+ wine-red. Exciple bilayered, comprised of a medullary excipulum 70–100 μm thick, of textura intricata, hyaline to light purplish-brown, opaque, densely filled with small crystals K–, N–, and an ectal exciple 50–70 μm thick, comprised of thick, gelatinized hyphae, interspersed with crystals, without pigment and K–, N–. Asci cylindrical to clavate, eight-spored; ascospores narrowly ellipsoid to fusiform, hyaline, one-septate, thick-walled, not halonate, 11–16 \times 4–5 (–6) μm . Pycnidia not seen.



Fig. 4: *Catillochroma mareebaense*; Thallus and apothecia. Scale bar 0.5 mm

Secondary metabolites. Atranorin (major), zeorin (major).

Distribution and ecology. The new species was found corticolous in a dry *Eucalyptus* forest at 450 m elev.

Notes. The new species is similar to *Catillochroma alligatorensis* (Lendemer) Kalb, but the latter differs in having a pigmented hypothecium which reacts K+ blue, and in containing fumarprotocetraric acid. Also similar is the saxicolous *Catillochroma beechingii* (Lendemer) Kalb, but the thallus of this species bears coralloid isidia which become sorediate with age.

Catillochroma phayapipakianum Kalb sp. nov.

Fig. 5

Index Fungorum No.: IF 559530

Type. THAILAND. Chiang Rai Province: Khun Tan District; Tambon Yang Hom, Phaya Pipak Forest Park, 19°51'52" N, 100°20'04" E, 1185 m elev., on bark of unidentified deciduous tree in dry evergreen forest, 10 December 2016, J. & K. Kalb 41762 (RAMK-holotype).

Diagnosis. Similar to *C. yunnanense* (C.X. Wang & L. Hu) Kalb but differs in having narrower ascospores (5–6 μm vs. 5–7.5 μm wide in *C. yunnanense*) and a hyaline or weakly violet-brown to blue-grey hypothecium (black in *C. yunnanense*).



Fig. 5: *Catillochroma phayapipakianum*; Thallus and apothecia. Scale bar 0.5 mm

Etymology. The specific epithet refers to the locality (Phaya Pipak Forest Park) where the type specimen was collected.

Description. Thallus crustose, corticolous, grey to dark grey or greenish grey, up to 5 cm in diameter, continuous to areolate, smooth or more often granulose to verrucose, verrucae up to 0.2 mm wide, without soredia or isidia. Apothecia biatorine, plane and flat, becoming convex with age, circular in outline or becoming deformed, sessile, up to 1.0 mm in diameter; margins pale, waxy white, contrasting strongly with the coloration of the discs, becoming excluded with age; discs black, epruinose. Epihymenium 10–20 μm thick, blue-grey pigmented or slightly brownish, K+ blue, N+ wine-red. Hymenium 50–80 μm thick, hyaline with blue-green to violet or with brownish striations reaching from the epihymenium down to the subhymenium, not inspersed. Subhymenium 10–15 μm thick, hyaline to weakly violet-brown. Central hypothecium 25–50 μm thick, upper portions hyaline or pigmented weakly violet-brown, K–, N+ wine-red, lower portions 10–15 μm thick, pigmented blue-grey, K–, N+ wine-red; lateral hypothecium weakly violet-brown, K–, N+ wine-red. Excipulum bilayered, comprised of a medullary excipulum 70–100 μm thick, of a textura intricata, hyaline, opaque, densely filled with small crystals K–, N–, and an ectal excipulum 50–70 μm thick, comprised of thick, gelatinized hyphae not inspersed with crystals, without pigment and K–, N–. Asci cylindrical to clavate, eight-spored; ascospores narrowly ellipsoid to fusiform, hyaline, one-septate, thick-walled, not halonate, 16–26 \times 5 (–6) μm . Pycnidia not seen.

Secondary metabolites. Atranorin (major), zeorin (major) and fumarprotocetraric acid (major).

Distribution and ecology. The new species was found in a dry evergreen forest on free-standing deciduous trees in Northern Thailand in the Provinces Chiang Mai and Chiang Rai from 1185–1565 m elev.

Notes. The new species is morphologically and chemically very similar to *Catillochroma yunnanense* and was initially identified as that species. The two species differ mainly in the color of the central hypothecium, which is hyaline to weakly violet-brown to blue-grey in *C. phayapipakianum* but black in *C. yunnanense*. Vainio (1921) described *Catillaria bicolorata* from the peak of the mountain Doi Suthep in northern Thailand, and compared this species to *Lecanora endochroma* Fée = *Catillochroma endochromum*. From the description, it is evident that Vainio's species belongs in the genus *Catillochroma*, but unfortunately the type material was unavailable and absent from TUR-V (Alava 1988). It might well be that *Catillochroma phayapipakianum* is conspecific with

this specimen, but a final decision can only be made, when the type specimen is found.

Additional specimens examined. THAILAND. Chiang Mai Province: Fang District; Tambon Mae Nyon, Campsite area of Doi Angkhang, 19°53'42" N, 99°02'44" E, 1565 m elev., on bark of free-standing, unidentified deciduous trees, 3 December 2016, J. & K. Kalb 41877 and 41927 (hb. K. & J. Kalb) — Chiang Mai Province: Mae On district; descent from Doi Mon Lam to Mae Kham Pong village, 18°51'22" N, 99°22'02" E, ca. 1500 m, in an evergreen mountain forest dominated by *Lithocarpus*, *Quercus*, *Castanopsis*, on bark of an unidentified tree, 19 March 2008, K. Kalb (36955), W. Saipunkaew, K. Buaruang, W. Polyiam (RAMK s.n.) — Chiang Mai Province: Medicinal Garden near Doi Suthep-Pui National Park, 18°48'22" N, 98°54'53" E, 1085 m, in a ± open *Cinchona* plantation, 17 March 2008, K. Kalb (36947), W. Saipunkaew, K. Buaruang, S. Jariangpresert (RAMK s.n.) — Chiang Mai Province: foothills of Doi Suthep-Pui near Mae Rim, Queen Sirikit Botanic Garden, 18°54'33" N, 98°51'17" E, 870 m, in a dry, open *Dipterocarp* forest, on bark of an unidentified tree, 18 March 2008, K. Kalb (36821), W. Saipunkaew, K. Buaruang, S. Jariangpresert, W. Polyiam, T. Pooprang (RAMK s.n.) — Loei Province, Phuluang Wildlife Sanctuary, 17°20'35" N, 101°30'26" E, 925 m, in a hill evergreen forest, on bark of an unidentified tree, 12 November 2008, V. Sriprang (RAMK 10534).

New combinations

Catillochroma alleniae (McMullin & Lendemer) Kalb comb. nov.

Index Fungorum No.: IF 559531

Basionym: *Megalaria allenae* [sic!] McMullin & Lendemer, The Bryologist 119(3): 293 (2016).

Remarks: The authors compare this sterile species with *Catillochroma pulvereum* (Fig. 6) which differs in numerous nucleotide substitutions in ITS1 and a different distribution.

Catillochroma alligatorensis (Lendemer) Kalb comb. nov.

Index Fungorum No.: IF 559532

Basionym: *Megalaria alligatorensis* Lendemer, Castanea 81: 39 (2016).

Remarks: The author compares this species with *Catillochroma albocinctum* (Fig. 7) which differs in smaller and narrower ascospores.

Catillochroma beechingii (Lendemer) Kalb comb. nov.

Index Fungorum No.: 559533

Basionym: *Megalaria beechingii* Lendemer, Opuscula Philolichenum 4: 39 (2007).



Fig. 6: *Catillochroma pulvereum*: Thallus with soralia and apothecia. Scale bar 1 mm



Fig. 7: *Catillochroma albocinctum*: Thallus with soralia and apothecia. Scale bar 1 mm

Catillochroma bicoloratum (Vain.) Kalb comb. nov.

Index Fungorum No.: 559534

Basionym: *Catillaria bicolorata* Vain., *Annales Botanici Societatis Zoologicae-Botanicae Fennicae 'Vanamo' 1* (3): 48 (1921).

Remarks: As long as the type material is not available, Fig. 8 matches the description of this species (Vainio 1921) quite well.

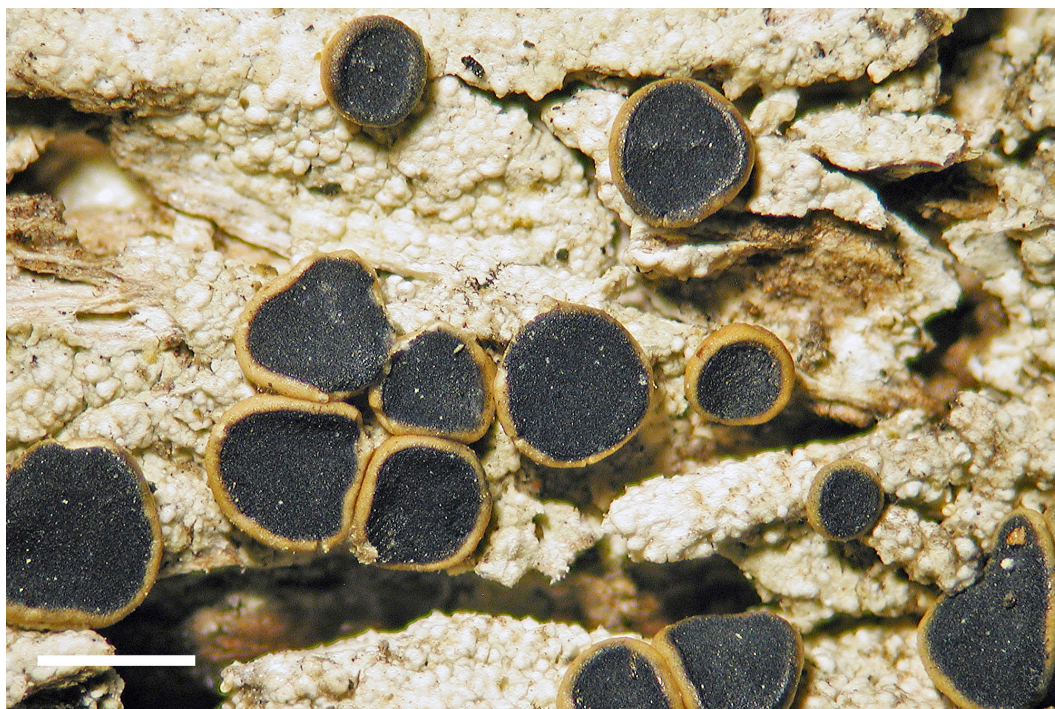


Fig. 8: *Catillochroma cf. bicoloratum*: Thallus and apothecia. Scale bar 1 mm

Catillochroma coralloideum (P.M. McCarthy & Elix) Kalb comb. nov.

Index Fungorum No.: 559536

Basionym: *Megalaria coralloidea* P.M. McCarthy & Elix, *Australasian Lichenology* 79: 20 (2016).

Catillochroma flavosorediatum (Aptroot) Kalb comb. nov.

Index Fungorum No.: IF 559535

Basionym: *Megalaria flavosorediata* Aptroot, *Archive for Lichenology* 23: 7 (2021).

Catillochroma hainanense (Q. Ren) Kalb comb. nov.

Index Fungorum No.: IF 559537

Basionym: *Megalaria hainanensis* Q. Ren, *Phytotaxa* 313(1): 147 (2017).

Catillochroma yunnanense (C.X. Wang & L. Hu) Kalb, comb. nov.

Index Fungorum No.: IF 559538

Basionym: *Megalalaria yunnanensis* C.X. Wang & L. Hu, Mycotaxon 134 (2): 290 (2019).

Acknowledgements

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