New lichens from Africa

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Abstract: The following species are described as new to science, mostly based on specimens collected by the first author: *Candelariella flavosorediata* from Réunion, *Chiodecton leprarioides* from Réunion, *Lecanactis leprarica* from Cameroon, *Multisporidea nitida*, which is a new species and a new, monotypic genus in the *Malmideaceae* from Réunion, *Neoprotoparmelia fuscosorediata* from Kenya, *Pyrrhospora endaurantia* from Kenya, and *Tapellaria isidiata* from Cameroon.

Key words: *Candelariella*, *Chiodecton*, *Lecanactis*, *Malmideaceae, Multisporidea*, *Neoprotoparmelia*, *Pyrrhospora*, *Tapellaria,* Cameroon, Kenya, Réunion

Introduction

Although lichens are most abundant in boreo-alpine regions, the species diversity is highest in the tropics. Much of the lichen diversity in the tropics is still unexplored. To date, fewer lichen species are known from tropical Africa than from East Asia or South America (Lücking 2020).

The first author made several collecting trips in Africa (Kenya and Réunion), and came across some species that seem to be undescribed. All are characterized by a set of morphological characters that is as yet unknown; they are not cryptic species, or species that only can be detected after phylogenetic reconstructions, for which this material is by now too old anyways. One is so aberrant that it is here described in a new genus. Some others are described as new species, including some that were collected by his student A. Frisch in Cameroon. Altogether, this paper shows an insight into the vast still unexplored diversity of the African lichens.

Material and methods

Descriptions use and follow generally used terms and patterns; ascospores were observed and measured in tap water. The following microscopes and cameras were used: 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.

The chemistry of all specimens was investigated by thin-layer chromatography (TLC) using solvents A, B' and C (Elix 2018). The spots on the TLC plates were identified by the computer program Wintab 64bit (Lafferty *et al.* 2021).

Results: the new species

Candelariella flavosorediata Kalb & Aptroot, sp. nov. Fig. 1

IF 559328

Candelariella with thallus consisting of isolated areoles that are mostly covered by farinose soredia, ascospores 8/ascus, hyaline, fusiform to rhomboidal, with rounded ends, (14–)18–21 × 5–6 µm.

TYPE: RÉUNION. Piton Maïdo, just below summit, on tree bark in scrub, 21°03′ S, 55°23′ E, alt. *c*. 2100 m, 30 August 1991, K. Kalb & A. Kalb 26141 (B—holotype).

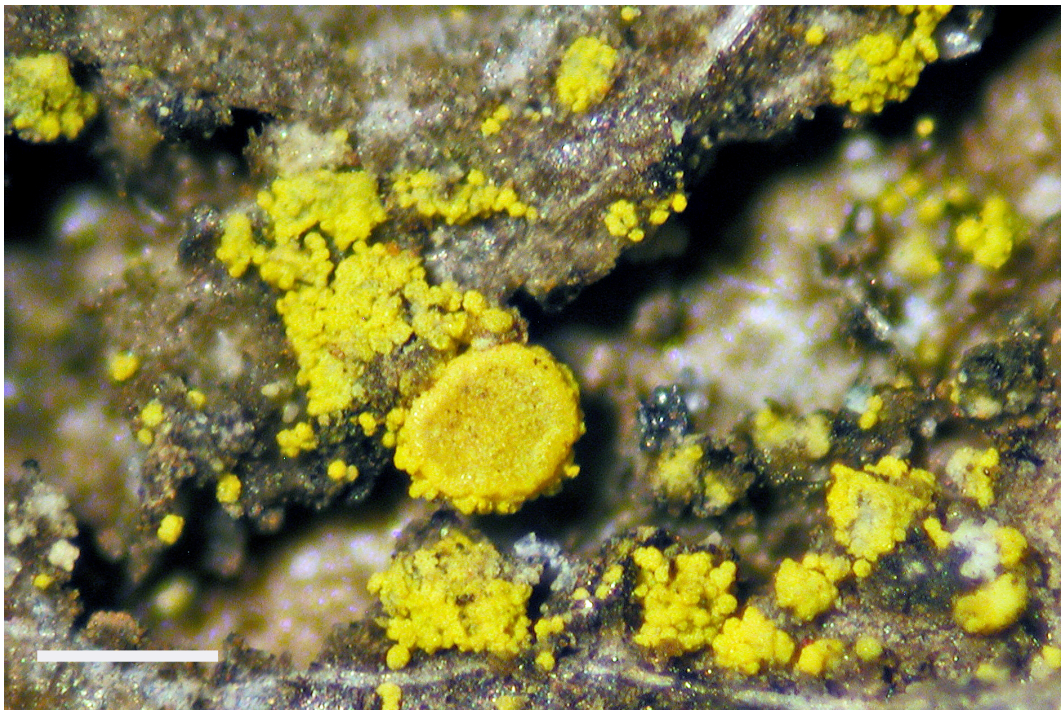

Fig. 1: ***Candelariella flavosorediata*** (holotype), thallus with soredia and apothecium, bar 0.3 mm

Thallus consisting of isolated areoles of c. 0.1–0.3 mm diam., smooth, irregular in outline and surface, bright yellow, usually mostly obscured by bright yellow powdery soredia of c. 25 µm diam., without hypothallus. Algae chlorococcoid, 5–7 µm diam.

Apothecia sparse, sessile, bright yellow with slightly darker disc, flat, 0.2–0.4 mm diam.; margin not higher than the disc, c. 0.05 mm wide. Ascospores 8/ascus, hyaline, fusiform to rhomboidal, with rounded ends, (14–)18–21 × 5–6 µm.

Pycnidia not observed.

Chemistry. Thallus and apothecia K+ pale red. TLC: pulvinic acid present.

Etymology. The specific epithet refers to the yellow soredia covering most parts of the thallus.

Notes. There are only few truely sorediate *Candelariella* species known (Westberg *et al.* 2011). This species is rather close to tiny, almost fully sorediate specimens of *C. reflexa* (Nyl.) Lettau, which differs by the smaller ascospores of 10–16 × 4.5–5.5 µm.

Chiodecton leprarioides Kalb & Aptroot, sp. nov. Fig. 2

IF 559329

Chiodecton with thallus almost totally covered by farinose soredia, ascomata almost globose, immersed in stromata, in irregular lines, only visible by punctiform black ostioles, ascospores curved, 5–septate, 48–52 × 3.5–4.5 µm.

TYPE: RÉUNION. Cirque de Cilaos, climb towards Col du Taïbit, on tree bark in secondary scrub forest, 21°07′ S, 55°28′ E, alt. c. 1300 m, 22 August 1991, K. Kalb & A. Kalb 33256 (B—holotype).

Fig. 2: ***Chiodecton leprarioides*** (holotype), thallus and ascomata, bar. 0.3 mm

Thallus dull, continuous, pale ochraceous, c. 0.2–0.8 mm thick, rather irregular in thickness, almost completely covered by soredia, surrounded by a dark chocolate brown hyphal prothallus line of c. 1–2 mm wide. Soredia farinose, pale ochraceous to pale brown, partly dark brown and spotting the surface. Algae trentepohlioid. Stromata sessile, round to usually irregularly lobate, c. 1–4 mm diam., sides gently sloping, not constricted, pale ochraceous to pale brown, rather dark brown at the centres, with c. 10–100 fully immersed ascocarps.

Ascomata almost globose, c. 0.1–0.2 mm, immersed in stromata, in irregular lines, only visible by punctiform black ostioles. Excipulum c. 30 µm thick, mostly dark brown. Hypothecium c. 200 µm high dark grey brown layer below several ascomata. Hymenium c. 100 µm high, IKI+ deep blue. Ascospores curved, slightly clavate with rounded ends, 5–septate, hyaline, 48–52 × 3.5–4.5 µm, without gelatinous sheath.

Pycnidia not observed.

Chemistry. No spot reactions. TLC: No secondary substances.

Etymology. The specific epithet refers to the farinose soredia covering the thallus.

Notes. There is only one other sorediate *Chiodecton* species known, viz. *C. sorediatum* G. Thor & Frisch (Frisch *et al.* 2014), but this has small discrete soralia, strongly resembling the pustules in *Chiodecton pustulatum* Aptroot (in Lumbsch *et al.* 2011). The punctiform ostioles in lines resemble some species of *Enterographa* or *Sclerophyton*, but the excipulum and hypothecium of the new species are dark, suggesting that the species belongs to *Chiodecton*. In case it would turn out to belong in another genus of the Roccellaceae, it is still new, as no similar species has been described.

Lecanactis leprarica Kalb & Aptroot, sp. nov. Fig. 3

IF 559330

Lecanactis with thallus with lepraric acid (major) & norstictic acid (minor), densely pruinose, lobate apothecia with a white, hyphal/floccose margin, and ascospores clavate with pointed ends, 3-septate, 18–20 × 2.5–3.0 µm.

TYPE: CAMEROON. EAST PROVINCE: Bewala Campala Village, on tree bark in forest clearing, 3°12′ N, 14°53′ E, alt. *c*. 700 m, 30 March 1999, A. Frisch & T. Idi 42127 (B—holotype).

Thallus dull, continuous, pale mint green, c. 0.1–0.4 mm thick, rather irregular in thickness, locally whitish pruinose, surrounded by a pale brown hyphal prothallus line of c. 0.6–1.2 mm wide. Algae trentepholioid.

Apothecia sessile but not constricted, round to usually irregularly lobate, 0.4–1.8 mm diam.; margin c. 0.1 mm wide, white, hyphal/floccose, slightly higher than the disc; disc flat, chocolate brown, densely very pale brown pruinose. Hymenium c. 125 µm high, epihymenium dark brown. Excipulum hyphal. Hypothecium dark brown to black, up to c. 150 µm high. Ascospores clavate with pointed ends, 3-septate, hyaline, 18–20 × 2.5–3.0 µm, without gelatinous sheath.

Pycnidia not observed.

Fig. 3: ***Lecanactis leprarica*** (holotype), thallus and apothecia, bar 0.5 mm

Chemistry. Thallus and apothecia K+ becoming red. TLC: Lepraric acid (major) and norstictic acid (minor).

Etymology. The specific epithet refers to lepraric acid which is the major metabolite.

Notes. This is a *Lecanactis* with densely pruinose, lobate apothecia with a white, hyphal/ floccose margin. It superficially resembles some species of *Syncesi*a, but misses the fused hypothecia ('in pluricarpocentral, pseudomonocarpocentral synascomata' fide Tehler 1997) of the latter genus.

Multisporidea nitida Kalb & Aptroot, gen. et sp. nov. Fig. 4

IF 559331 (genus); IF 559332 (species)

Malmideaceae with ascus with thickened tip with small central tubular amyloid structure (Malmideaceae-type), ascospores 16–32/ascus, almost globose, hyaline, 4–5 × 4–6 µm, apothecia glossy, chocolate brown, not pruinose, margin dark chocolate brown to black, conspicuously warty ornamented.

TYPE: RÉUNION. Cirque de Cilaos, road from Thermales to Roche Mervilleuse, on tree bark in rain forest remnant, 21°07′ S, 55°28′30" E, alt. *c*. 1450 m, 20 August 1991, K. Kalb & A. Kalb 25087 (B—holotype; ABL—isotype).

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Thallus dull, whitish to pale pinkish brown, continuous, minutely indistinctly rimose, c. 0.05–0.1 mm thick, occasionally surrounded by an up to 0.3 mm wide black hypothallus. Algae chlorococcoid.

Apothecia sessile with strongly constricted base, turbinate to almost stalked, round to variably irregularly lobate, solitary or in dense groups with partly joining discs, c. 0.3–1.7 mm diam; disc flat and glossy, later somewhat convex, chocolate brown, not pruinose; margin dark chocolate brown to black, somewhat higher than the disc, glossy, rather wavy, conspicouously warty ornamented, c. 0.1–0.2 mm wide. Excipulum dark brown, contiguous with thin dark brown hypothecium. Epihymenium brown, up to c. 15 µm high. Hymenium a bit tinted brownish, c. 125 µm high. Ascus with thickened tip with small central tubular amyloid structure above the ascospores (Malmideaceae-type). Ascospores 16–32/ascus, almost globose, hyaline, 4–5 × 4–6 µm, wall c. 0.5 µm thick, without appendices or gelatinous sheath.

Pycnidia not observed.

Chemistry. No spot reactions. TLC: No secondary substances.

Etymology. The generic epithet refers to the polyspored asci and the specific epithet refers to the glossy apothecia.

Fig. 4: ***Multisporidia nitida*** (holotype), thallus and apothecia, bar 0.5 mm

Notes. This polysporous lichen does not fit any described genus well. At first sight it seems to be a *Piccolia*, but it misses all anthraquinones. Careful observation of the ascus revealed structures similar to the Malmideaceae, an until recently monotypic family of chiefly tropical corticolous lichens that now comprises five genera with in total around 60

known species (Cáceres *et al.* 2017, Kalb 2021). The genera in this family differ markedly between each other in ascospore shape (if known) and although polyspory is not yet reported, paucispory is fairly common in *Malmidea*. Polyspory occurs in more unrelated groups of lichenized fungi than commonly believed; Aptroot & Schumm (2012) mention at least 57 unrelated groups of polysporous lichenized fungi, to which the genus *Amandinea* should still be added.

Additional material examined: RÉUNION. Cirque de Cilaos, ascent from Thermales to Col du Taïbit, in a coppice, 21°07' S, 55°28' E, alt. 1300 m, 22. August 1999, K. Kalb & A. Kalb 33482 (Hb. K. Kalb).

Neoprotoparmelia fuscosorediata Kalb & Aptroot, sp. nov. Fig. 5

IF 559333

Neoprotoparmelia with soredia in rounded, excavate to rather sessile soralia that remain discrete and ascospores ellipsoid with rather pointed ends, 4.5–5.5 × 9–11 µm.

TYPE: KENYA. CENTRAL PROVINCE: Nanyuki District, between Nanyuki and Naro Moro, on wood in savannah, alt. *c*. 2050 m, August 1985, K. Kalb & A. Schrögl 13376 (B—holotype).

Fig. 5: ***Neoprotoparmelia fuscosorediata*** (holotype), thallus with soredia and apothecium, bar 0.3 mm

Thallus shiny, pale brown, continuous, c. 0.05–0.1 mm thick, almost completely covered by soredia, surrounded by a black prothallus line of c. 0.1–0.2 mm wide. Soralia abundant, initially punctiform, becoming rounded, excavate to rather sessile with central depression, remaining discrete, up to 0.5 mm diam. Soredia farinose, pale ochraceous to pale brown, partly dark brown at the outside of soralia. Algae chlorococcoid, c. 5–12 µm diam.

Apothecia sessile, strongly constricted, turbinate to almost stalked, round, 0.2–2.0 mm diam.; disc glossy brown, initially flat, later somewhat concave; margin pale brownish, dull, always higher than the disc, with rather irregular surface, often also with deep fissures, c. 0.1–0.3 mm wide. Excipulum pale pinkish brown outside due to copious crystals of secondary metabolites, hyaline inside, throughout with algae, continuous below hypothecium (cupular excipulum). Hypothecium hyaline. Epihymenium brown, up to c. 10 µm high. Hymenium c. 125 µm high. Ascospores 8/ascus, hyaline, ellipsoid with rather pointed ends, 4.5–5.5 × 9–11 µm, wall c. 0.7 µm thick, without appendices or gelatinous sheath.

Pycnidia not observed.

Chemistry. medulla KC+ pink. TLC: 5-O-Methylhiascic (major), gyrophoric (minor) and lecanoric (trace) acids.

Etymology. The specific epithet refers to the pale ochraceous to pale brown soredia.

Notes. This is the second species in the genus *Neoprotoparmelia* with soredia. The already described one, *N. capitata* (Lendemer) Garima Singh, Lumbsch & I. Schmitt (Singh *et al.* 2018), differs markedly by the large capitate soralia and the different chemistry.

Pyrrhospora endaurantia Kalb & Aptroot, sp. nov. Figs. 6 and 7

IF 559334

Pyrrhospora with black apothecia with yellow hymenium, orange-red subhymenium, orange hypothecium and older ascospores filled with orange oil, 7.5–12.5 × 5–5.5 µm.

TYPE: KENYA. CENTRAL PROVINCE: Tsavo West National Park, Roaring Rocks, on tree twigs in savannah, alt. *c*. 1300 m, 28 August 1985, K. Kalb & A. Schrögl 13273 (B— holotype).

Thallus dull, pale ochraceous grey, continuous, minutely rimose, c. 0.05–0.1 mm thick, surrounded by a 0.1 mm wide black hypothallus. Algae chlorococcoid.

Apothecia sessile with constricted base, round, 0.3–0.9 mm diam.; disc black, initially flat and dull to glossy, later somewhat convex and glossy; margin initially black, later rather pale brown to black, initially somewhat ligher than the disc, much lower to almost evanescent with age, c. 0.1 mm wide; occasionally in addition a low, rather warty to coronate, thalline margin of thallus colour and structure may be present; abraded apothecia reveal the orange pigmented hypothecium. Excipulum hyaline, very gelatinous, lumina thin, radial. Hypothecium orange, KOH+ blood red, with pink effluent. Epihymenium brown, granular, gel in KOH greenish, granules dissolving in KOH.

Hymenium hyaline or mostly yellow, red or orange-red towards the orange hypothecium. Ascus with thickened tip with wide tubular amyloid structure around the upper ascospores (Lecideaceae-type). Ascospores 8/ascus, ellipsoid, hyaline but older ascospores filled with orange oil, 7.5–12.5 × 5–5.5 µm.

Pycnidia not observed.

Chemistry. Thallus K+ yellow. TLC: Atranorin in thallus, pigment in hypothecium (Rf 38/46/27, possibly related to but not identical to 7-chloroemodin).

Etymology. The specific epithet refers to the orange-red subhymenium and orange hypothecium.

Fig. 6: ***Pyrrhospora endaurantia*** (holotype), thallus and apothecia, bar 0.5 mm

Notes. This is a curious species with the black apothecia with hyaline to yellow hymenium, red hypothecium and older ascospores filled with orange oil. Especially the latter character reminds of the genus *Pyrrhospora*, with which the ascus type conforms perfectly well. The new species is therefore described in this genus, which by now contains only a handful probably not closely related species, after the recent removal of most previous species to other genera.

Fig. 7: ***Pyrrhospora endaurantia*****,** sections through apothecia, showing the orange-red subhymenium and orange hypothecium, bar 0.2 mm

Tapellaria isidiata Kalb & Aptroot, sp. nov. Fig. 8

IF 559335

Corticolous Tapellaria with isidia and ascospores 2/ascus, densely muriform, 33–36 × 13.5–15.5 µm.

TYPE: CAMEROON. SOUTH PROVINCE: Campo, on tree bark on beach, 2°20′30" N, 10°15′10" E, alt. *c*. 3 m, 28 February 1999, A. Frisch & T. Idi 42134 (B—holotype).

Thallus glossy, mineral grey with occasional almost white patches, c. 0.05–0.1 mm thick, surrounded by a 0.2–0.6 mm wide black hypothallus, with isidia. Isidia dispersed, most abundant in the marginal regions, of thallus colour with paler tips, long conical, rarely branched, c. 50 µm wide and c. 100 µm high. Algae chlorococcoid.

Apothecia sessile, constricted but attached with a broad base, black, round to lobate, 0.2–0.8 mm diam.; disc mostly flat, dull to somewhat glossy, granular; margin black, not higher than the disc, c. 0.1 mm wide. Excipulum mottled purplish brown inside, contiguous with purplish brown hypothecium. Epihymenium almost black. Ascospores 2/ascus, densely muriform, hyaline, 33–36 × 13.5–15.5 µm. Pycnidia not observed.

Chemistry. No spot reactions. TLC: No secondary substances.

Etymology. The specific epithet refers to the isidiate thallus.

Notes. This is the first *Tapellaria* reported with vegetative propagules (Neuwirth & Stocker-Wörgötter 2017). The isidia seem to be clearly belong to the thallus, and the apothecia seem to belong to the thallus as well. the internal structure and pigmentation confirms well with some other species of *Tapellaria*.

Fig. 8: Tapellaria isidiata (holotype), thallus with apothecia and isidia, bar 0.4 mm

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