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Two new species of *Syncesia* (*Arthoniales*, *Roccellaceae*) from Africa

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Abstract: Two new species of *Syncesia* are described, which differ from all other species of the genus by having more than 3-septate ascospores. *Syncesia afromontana* is characterized by a byssoid thallus and 7-septate ascospores, and is known only from the type locality in the Nyungwe Forest in Rwanda where it might be endemic. *Syncesia madagascariensis* is characterized by a crustose thallus and 5-septate ascospores, and is known only from the type locality in a montane forest in central Madagascar.

Key words: endemism, *Erica*-forest, Nyungwe National Park, Rwanda, Ambalamanakana Forest, Madagascar

Introduction

The lichen genus *Syncesia* was monographed by Tehler (1996) who recognized 17 species, including two new to science. No further new species has been described since then. The genus is recognized by stromatoid ascomata with exposed, pruinose and/or tomentose discs, carbonized hypothecium, fusiform 3-septate ascospores and by usually producing protocetraric and roccellic acids. It is most diverse in tropical and subtropical regions of Latin America. Only two species occur in continental Africa, *S. intercedens* (Müll. Arg.) Tehler known only from the type collection in Tanzania and from a second specimen in southern Africa, and *S. mollis* (Müll. Arg.) Tehler known only from the type collection in Tanzania. Species of *Syncesia* usually grow on bark, but some are also found on rock. As part of on-going projects on the lichen mycota of Madagascar and Rwanda, two conspicuous and characteristic species of *Syncesia* have been collected in montane forests and are here described as new.

Madagascar is a large island situated in the Indian Ocean about 12–25·5° south of the equator, well-known for its extraordinary biodiversity (Goodman & Benstead 2003). Its lichen mycota remains very poorly studied and only *c.* 250 lichen species have been reported from the island so far (see Aptroot 2008 for an exhaustive list of relevant publications).

Rwanda is a small East African country situated about 1–2° south of the equator. Due to its diverse geomorphology and altitudinal range, it harbours a species-rich mosaic of montane rainforests, afroalpine vegetation, dry forests and savannas (Fischer & Hinkel 1991; 1992; Fischer & Killmann 2008). The lichen mycota includes 178 lichen species recorded so far (Killmann & Fischer 2005; Bock *et al.* 2007), but several new taxa have been described recently from that country suggesting a very rich and

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original mycota (Elix *et al.* 2005; Sérusiaux *et al.* 2006, 2009; Fischer *et al.* 2007; Ertz *et al.* 2008; Archer *et al.* 2009).

Material and Methods

Microscopic examination was carried out using hand-cut sections mounted in water, 5% KOH (K), or Lugol's reagent (1% I_2) without (I) or with KOH pre-treatment (K/I). Measurements and drawings of asci and ascospores were all made on material examined in KOH. Drawings were prepared using a drawing tube. Ascospore measurements are recorded as (minimum–) $\bar{x}-\sigma_x$ – $\bar{x}+\sigma_x$(–maximum) with all values rounded to the nearest multiple of 0·5 µm, followed by the number of measurements (*n*); the length/breadth ratio of the ascospores is indicated as l/b and given in the same way. For other characters, the minimum and the maximum values are recorded and are based on the examination of at least three different ascomata.

Thin-layer chromatography (TLC) of acetone extracts was performed using solvent systems B, C and G on silica gel 60 F_{254} layer 20 × 20 cm glass plates; 10% sulphuric acid was used as a reagent for the visualization of the spots (Orange *et al.* 2001).

The following specimens of related species were examined: *Sagenidiopsis merrotsyi* R.W. Rogers & Hafellner: Australia (S, isotype); *S. undulatum* (Fée) Egea, Tehler, Torrente & Sipman: Brazil, Estado São Paulo, *Tehler* 7953 (S); *Sagenidium molle* Stirt.: Australia, Tasmania, *Kantvilas* 652/84 (S); *Syncesia glyphysoides* (Fée) Tehler: USA, Florida, *Ertz* 9084 & 9104 (BR); *S. mollis* (Müll. Arg.) Tehler: Tanzania (G, lectotype).

The Species

Syncesia afromontana Ertz, Killmann, Sérus. & Eb. Fisch. sp. nov.

Mycobank No.: MB 512924

Syncesia cum thallo byssoideo, disco 0·2–1·0 mm diam., excipulo textura intricata; hypothecio brunneo, hymenio hyalino 80–120 µm in iodo rubescenti. Ab omnibus speciebus generis *Syncesiae* ascosporis fusiformibus 7-septatis hyalinis (42–)46–52(–55) × (4–) 4·5–5·5 (–5·5) µm valde differt.

Typus: Rwanda. Southern Province, Nyungwe National Park, Rwasenkoko swamp, 2335 m, 2° 31′S, 29° 20′E, 31 March 2005, *Ertz* 7893, *Killmann, Sérusiaux & Fischer* (BR—holotypus).

(Fig. 1–2)

Thallus up to 10 cm diam., byssoid, matt, continuous, greyish or greyish green, water-repellent, 150–400 µm thick, ecorticate, with an algal layer of 35–55 µm in the upper part, hyphae 2–3(–4) µm diam., covered by small and numerous crystals dissolving in K. Photobiont *Trentepohlia*; cells 15–20 × 9–13 µm. *Prothallus* pale to dark brown, byssoid, (1–)2–4 mm wide.

Ascomata tomentose, sessile, not or slightly constricted at the base, solitary and rounded or more often slightly to strongly sinuate, 0·2–0·8(–1·0) mm diam. when young, usually in large numbers covering areas of 0·5–6 mm diam., or sometimes when mature a larger part of the thallus, thus forming stromatoid structures with discoid individual ascomata; margin white, 50–110 µm thick, not protruding above the disc; hymenial disc pale brown, flat, slightly white pruinose. *Excipulum* of textura intricata, pale brown above, dark brown below where it is indistinguishable from the hypothecium, I+ orange, K+ slightly olivaceous, 10–20 µm thick; hyphae 2–3 µm thick. *Hypothecium* dark brown to black, K+ olivaceous, very variable in thickness (20–170 µm). *Hymenium* hyaline, not inspersed with oil droplets, 80–120 µm; hymenial gel I+ orange reddish, K/I+ blue; *epihymenium* pale to dark brown, I+ orange reddish, covered by a dense layer of crystals; crystals irregular, *c.* 0·5–3 µm diam., dissolving in K. *Paraphyses* branched, especially in the epihymenium, anastomosing, 1·5–2 µm, apically slightly enlarged to 2–3 µm, and covered by dark brown granules. *Asci* clavate, 8-spored, 70–105 × 18–19 µm, K/I−, except for a distinct K/I+ blue apical ring surrounding a small ocular chamber. *Ascospores* curved, ± fusiform, (6–)7-septate, microcephalic, not constricted at septa, cells square or rectangular, (42–)46–52(–55) × (4–)4·5–5·5(–5·5) µm, l/b ratio 9–11 ($n = 50$), becoming evenly dark brown when very over-mature; perispore indistinct.

Pycnidia not observed.

Chemistry. Thallus and apothecia K−, C−, KC−, P+ orange, UV+ dark brown; TLC: protocetraric acid (major) and traces of roccellic acid (type collection and specimen *Ertz* 10961 & *Fischer* tested).

Distribution and ecology. Known only from the type locality in Rwanda where it is

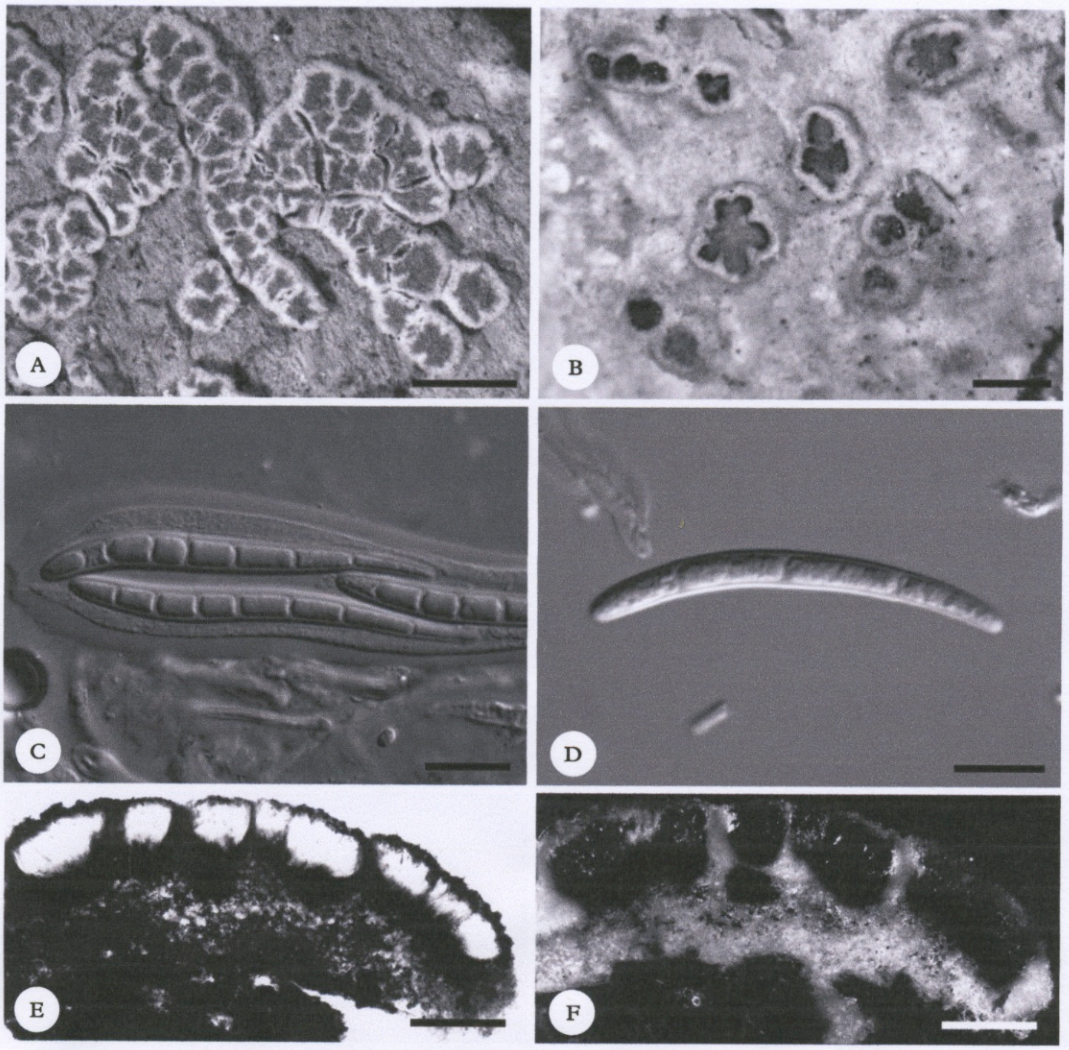

FIG. 1. *Syncesia* species, morphology. A, C, E & F, *S. afromontana* (holotype); A, thallus and apothecia; C, ascospores in a broken ascus; E, section through apothecia in water; F, same section, viewed in polarized light. B & D, *S. mollis* (lectotype).; B, thallus and apothecia; D, ascospore. Scales: A & B = 1 mm; C & D = 10 μm; E & F = 0·2 mm.

abundant on several trunks of *Erica* in pristine *Erica johnstonii* thickets and low forest with *Hagenia abyssinica* and *Rapanea melanophloeios*, in the Rwasenkoko swamp, at *c.* 2330 m alt. The Nyungwe Forest in Rwanda, now protected under National Park status, represents one of the most species-rich montane forests in Africa (Ewango 2002; Fischer *et al.* 2003; Fischer & Killmann 2008). Rwasenkoko is one of the lowermost *Erica* forests in Rwanda due to a night cold air-lake where temperatures sometimes go below 0°C (Killmann & Fischer 2005). The lichen mycota harbours cosmopolitan species such as *Menegazzia subsimilis* (Bjerke *et al.* 2007) or *Hypogymnia physodes* that are restricted to montane habitats in the tropics, or near endemics such as *Melanotopelia africana* (Sérusiaux *et al.* 2009). The last species is known only from Rwanda (Rwasenkoko, Mt. Bigugu) and the Indian Ocean island of La Réunion. We visited

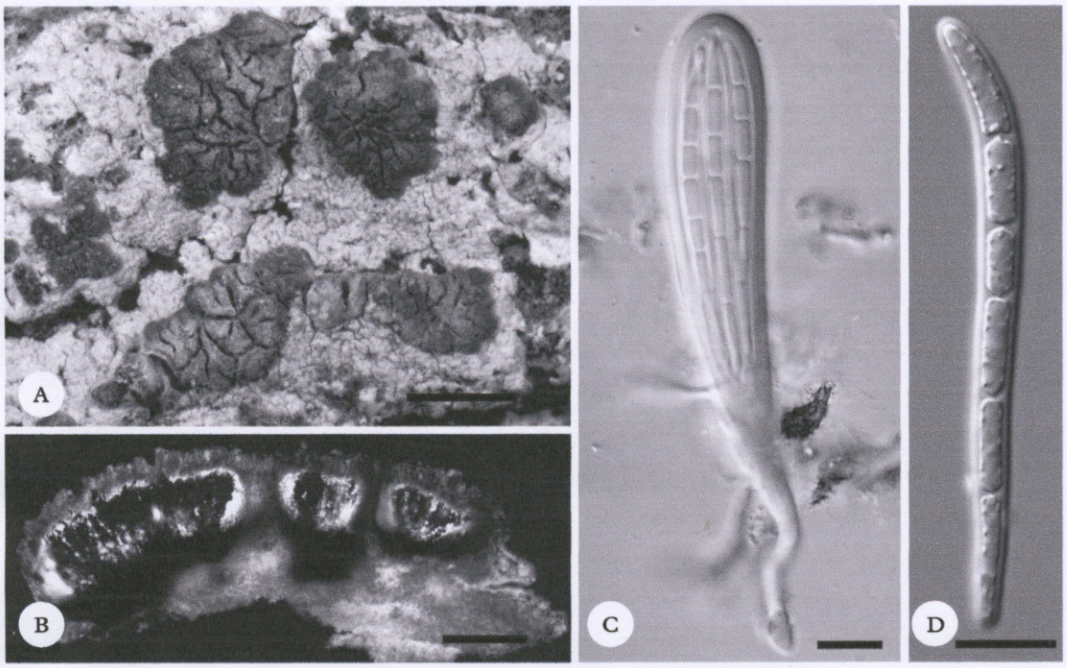

FIG. 2. *Syncesia madagascariensis* (holotype). A, thallus and apothecia; B, section through apothecia in water, viewed in polarized light; C, ascus; D, ascospores. Scales: A = 2 mm; B = 200 μm; C & D = 10 μm.

many localities in the three National Parks in Rwanda during several collecting trips, but we were not able to find this new, rather conspicuous and easily recognized species in other localities. It seems, therefore, to be a very rare species in Rwanda, and might be endemic to the Nyungwe Forest. As mentioned by Tehler (1996), most species of *Syncesia* are rare and serious attention with regard to conservation aspects should be paid to the biotopes in which the genus occurs.

Discussion. The new species fits well in the genus *Syncesia* by the tomentose stromatoid structures with discoid individual ascomata, the black hypothecium and by the presence of protocetraric acid in the thallus. It is easily recognized by the 7-septate ascospores, as all currently described species of *Syncesia* have 3-septate ascospores (Tehler 1996). The recently described lichenized species *Plectocarpon syncesioides* Cáceres & Lücking is similar to *Syncesia* but was assigned to the genus *Plectocarpon* because of its entirely carbonized ascomata and more than 3-septate ascospores (Cáceres 2007). Otherwise this genus is only known as lichenicolous (Ertz *et al.* 2005). Despite the fact that it has more than 3-septate ascospores, *Syncesia afromontana* is much closer to *Syncesia* than *Plectocarpon* because its ascomata are only partially carbonized.

In addition to the 7-septate ascospores, the new species is also characterized by a byssoid thallus that is a rare character state in the genus being known only in *S. mollis* and *S. leprobola* Nyl. ex Tehler (only slightly byssoid in the latter). *Syncesia mollis* differs from the new species mainly by the 3-septate ascospores (three ascomata of the lectotype were examined, with more than 150 mature ascospores seen, all being 3-septate), by its white thallus, mostly solitary and slightly larger ascomata (Fig 1) and by a slightly different chemistry (presence of atranorin in addition to protocetraric and roccellic acids, according to Tehler 1996).

The stromatoid ascomata, the byssoid thallus, the chemistry and the 7-septate asco-

spores resemble the genus *Dichosporidium* Pat., but this genus differs by having perithecioid and epruinose ascocarps with more or less closed discs and hooked or biclavate ascospores (Thor 1990). Within the *Arthoniales*, the genera *Tania*, *Sagenidiopsis* and *Sagenidium* are also characterized by a byssoid thallus, but they all have solitary, rarely aggregated ascomata (Henssen *et al.* 1979; Rogers & Hafellner 1987; Egea *et al.* 1995).

Additional specimens examined. **Rwanda:** same locality and date as the type, *Sérusiaux* s. n. (LG); *ibid.*, 2007, *Ertz* 10961 & *Fischer* (BR).

Syncesia madagascariensis Ertz, Killmann, Razafin., Sérus. & Eb. Fisch. sp. nov.

Mycobank No.: MB 515020

Syncesia cum thallo crustaceo, excipulo textura intricata; hypothecio brunneo, hymenio hyalino 100–150 µm in iodo rubescenti. Ab omnibus speciebus generis *Syncesiae* ascosporis fusiformibus 5-septatis hyalinis (50–)57·5–68(–80) × (3·5–)4–4·5(–5·5) µm valde differt.

Typus: Madagascar, Ambalamanakana, Ankazomivady, S of Ambositra, 1704 m, 20° 46′S, 47° 10′E, 4 October 2008, *Ertz* 12966, *Fischer, Killmann, Razafindrahaja & Sérusiaux* (BR—holotypus; KOBL; TAN—isotypi).

(Fig. 2)

Thallus up to 15 cm diam., crustose, matt, continuous to rimose with a verrucose surface, sometimes almost minutely subsquamulose, creamy with a greenish tinge, water-repellent, *c.* 50–250 µm thick, ecorticate, homoiomerous, hyphae 2–3 µm diam., covered by small and numerous crystals dissolving in K. Photobiont *Trentepohlia*; cells 7–14 × 6–10 µm. *Prothallus* pale to dark brown, byssoid, 2–4(–5) mm wide.

Ascomata tomentose, sessile, not or slightly constricted at the base, first solitary and rounded, eventually becoming strongly sinuate, 0·6–1·0 mm diam. when young, then forming stromatoid structures of 1–4(–5) mm diam. with discoid individual ascomata when mature; margin of the same colour as the hymenial disc or sometimes white, *c.* 70–150 µm thick, not protruding above the disc; hymenial disc pale brown, flat, sometimes slightly white pruinose. *Excipulum* very reduced, of textura intricata, pale to dark brown above, usually dark brown below where it is indistinguishable from the hypothecium, K+ slightly olivaceous, 10–20 µm thick; hyphae 2–3 µm thick. *Hypothecium* dark brown to black, K+ olivaceous, very variable in thickness (25–90 µm). *Hymenium* hyaline, not inspersed with oil droplets, 100–150 µm; hymenial gel I+ orange reddish, K/I+ blue; *epihymenium* pale to dark brown, I+ persistently blue, covered by a dense layer of crystals; crystals irregular, *c.* 1–4 µm diam., dissolving in K. *Paraphyses* richly branched, sometimes anastomosing, 1–1·5 µm, apically slightly enlarged to 2–2·5 µm, and covered by dark brown granules. *Asci* clavate, 8-spored, 100–125 × 17–20 µm, K/I−, except for a distinct K/I+ blue apical ring surrounding a small ocular chamber and the endoascus that is K/I+ pale blue especially in the young asci. *Ascospores* slightly to strongly curved, ± fusiform, slightly attenuated at one end, (4–)5(–6)-septate, microcephalic, not constricted at septa, cells rectangular, (50–)57·5–68(–80) × (3·5–)4–4·5(–5·5) µm, l/b ratio 13–16·5 (n = 50), becoming evenly dark brown when very over-mature; perispore indistinct.

Pycnidia not observed.

Chemistry. Thallus and apothecia K−, C−, KC−, P+ orange to red, UV+ yellowish to pale orange; TLC: protocetraric acid and trace of a fatty acid of Rf 48 in solvent C (probably roccellic acid) (all specimens tested).

Distribution and ecology. Known only from the type locality in Madagascar where it was collected from several trunks in a montane forest dominated by *Myrtaceae* and *Syzygium* species. Ambalamanakana represents a mosaic of secondary forest, swamp forest and open swamps.

Discussion. The new species with its tomentose stromatoid structures with discoid individual ascomata, black hypothecium and production of protocetraric acid in the thallus fits well in the genus *Syncesia*. It is easily recognized by the 5-septate ascospores as

all known species of *Syncesia* have 3-septate ascospores, with the exception of *S. afromontana* described above which differs from *S. madagascariensis* by having notably shorter and (6–)7-septate ascospores and a byssoid thallus. Amongst the *Syncesia* species having consistently 3-septate ascospores (Tehler 1996), the closest species seems to be *S. glyphysoides* (Fée) Tehler that also has long ascospores and an UV+ pale yellow thallus. However, according to the description of Tehler (1996) and the examination of two specimens (*Ertz* 9084 & 9104, see Material & Methods), *S. glyphysoides* differs by its consistently 3-septate ascospores that are distinctly shorter (41–55 µm) than those in *S. madagascariensis*, a water-absorbent, creamy to white and smooth thallus, smaller synascomata (up to 2·5 mm diam.), shorter hymenium and asci (65–100 µm and 60–90 µm respectively), and by the presence of atranorin in addition to protocetraric and roccellic acids (chemistry of *Ertz* 9084 & 9104 not tested).

Additional specimens examined. **Madagascar:** same locality as the holotype, *Ertz* 12961, 12954, *Fischer, Killmann, Razafindrahaja & Sérusiaux* (BR).

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References

Aptroot, A. (2008) A new *Scoliciosporum* from Madagascar. *Lichenologist* **40:** 119–122.

Archer, A. W., Elix, J. A., Fischer, E., Killmann, D. & Sérusiaux, E. (2009) The lichen genus *Pertusaria* (Ascomycota) in Central Africa (Congo/Kivu, Rwanda and Burundi) and Western Kenya. *Nova Hedwigia* **88:** 309–333.

Bjerke, J. W., Fischer, E. & Killmann, D. (2007) New records of the lichen genus *Menegazzia* from Africa. *Cryptogamie Mycologie* **28:** 333–337.

Bock, C., Hauck, M. & Fischer, E. (2007) The lichen flora of Rwanda: an annotated checklist. *Willdenowia* **37:** 563–575.

Cáceres, M. E. d. S. (2007) Corticolous crustose and microfoliose lichens of northeastern Brazil. *Libri Botanici* **22:** 1–168.

Egea, J. M., Tehler, A., Torrente, P. & Sipman, H. (1995) *Tania*, a new genus with byssoid thallus in the order Arthoniales and new data on *Sagenidiopsis*. *Lichenologist* **27:** 351–359.

Elix, J. A., Fischer, E. & Killmann, D. (2005) New saxicolous species of *Hypotrachyna* and *Parmotrema* (Parmeliaceae) from Rwanda. *Lichenologist* **37:** 101–104.

Ertz, D., Christnach, C., Wedin, M. & Diederich, P. (2005) A world monograph of the genus *Plectocarpon* (Roccellaceae, Arthoniales). *Bibliotheca Lichenologica* **91:** 1–155.

Ertz, D., Lawrey, J.D., Sikaroodi, M., Patrick, M.G., Fischer, E., Killmann, D. & Sérusiaux, E. (2008) A new lineage of lichenized basidiomycetes inferred from a two genes phylogeny: the Lepidostromataceae with three species from the tropics. *American Journal of Botany* **95:** 1548–1556.

Ewango, C. E. N. (2002) Flore et végétation de la forêt naturelle de Nyungwe, Rwanda. *Systematics and Geography of Plants* **71:** 1009–1015.

Fischer, E., Dhetchuvi, J.-P. & Ntaganda, C. (2003) A new species of *Impatiens* (Balsaminaceae) from Nyungwe Forest, Rwanda. *Systematics and Geography of Plants* **73:** 91–101.

Fischer, E., Ertz, D., Killmann, D. & Sérusiaux, E. (2007) Two new species of *Multiclavula* (lichenized basidiomycetes) from savanna soils in Rwanda (East Africa). *Botanical Journal of the Linnean Society* **155:** 457–465.

Fischer, E. & Hinkel, H. (1991) Anmerkungen zur Geographie, Flora, Fauna und Demographie. In *Ruanda* (U. Löber & E. Rickal, eds): 13–49. Landau/Pfalz.

Fischer, E. & Hinkel, H. (1992) *Die Natur Ruandas*. Mainz.

Fischer, E. & Killmann, D. (2008) *Illustrated Field Guide to the Plants of Nyungwe National Park, Rwanda*. Koblenz: Geographical Colloquia, Series Biogeographical Monographs 1.

Goodman, S. M. & Benstead, J. P. (2003) *The Natural History of Madagascar*. Chicago: The University of Chicago Press.

Henssen, A., Renner, B. & Vobis, G. (1979) *Sagenidium patagonicum*, a new south American lichen. *Lichenologist* **11:** 263–270.

Killmann, D. & Fischer, E. (2005) New records for the lichen flora of Rwanda, East Africa. *Willdenowia* **35:** 193–204.

Orange, A., James, P. W. & White, F. J. (2001) *Microchemical Methods for the Identification of Lichens*. London: British Lichen Society.

Rogers, R. W. & Hafellner, J. (1987) *Sagenidiopsis*, a new genus of byssoid lichenized fungi. *Lichenologist* **19:** 401–408.

Sérusiaux, E., Fischer, E. & Killmann, D. (2006) *Nyungwea*, a new genus of lichen with goniocyst-producing stipes from Rwanda and Uganda (East Africa). *Lichenologist* **38:** 115–121.

Sérusiaux, E., Brand, A. M., Fischer, E., Killmann, D., van den Boom, P. P. G. & Ertz, D. (2009) A new species of *Melanotopelia* (*Graphidaceae*) from Africa. *Lichenologist* **41:** 243–247.

Tehler, A. (1996) *Syncesia* (Arthoniales, Euascomycetidae). *Flora Neotropica* **74:** 1–48.

Thor, G. (1990) The lichen genus *Chiodecton* and five allied genera. *Opera Botanica* **103:** 1–92.

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