New Trypetheliaceae from the Amazon basin in Rondônia (Brazil), the centre of diversity of the genus Astrothelium

André APTROOT and Marcela Eugenia da Silva CÁCERES

Abstract: The following 24 new species of Trypetheliaceae are described after three weeks of fieldwork in an area with a radius of 50 km around Porto Velho in Rondônia: Astrothelium bivelum with astrothelioid ascocarps, 5-septate ascosporae with polar gelatinous caps, and a thallus without lichexanthone; A. curvisporum with bent, 5-septate ascospores of 115–135 × 29–36 μm with a 17–22 μm thick gelatinous layer; A. decemseptatum with pseudostroma that are essentially black and look like breaking through the bark, with anthraquinones mostly on the pseudostromata but also on some parts of the thallus, best seen under UV light as the colour of the pruina is not very strong, and ascospores 7–11-septate, fusiform, 50–65 × 11–17 μm; A. disjunctum with black pseudostroma and ascospores 3–septate, (27–)39–33 × (8–)12–14 μm; A. duplicatum which is similar to A. mesoduplex, but pseudostroma are only yellowish inside and ascospores 45–55 × 11–15 μm; A. eustomitatum which is similar to A. eustomum, but with 9–11-septate ascospores of 65–70 × 15–17 μm; A. eustomum which is also similar to A. eustomum, but with submuriform ascospores of 37–45 × 15–19 μm; A. flavoduplex which is similar to A. mesoduplex, but with ascospores 110–350 × 20–27 μm and the thallus containing lichexanthone; A. flavomurisporum with deeply immersed ascomata with muriform ascospores of 165–200 × 28–35 μm, with a distinctly thickened central septum and yellow oil; A. flavostromatum which is close to A. aeneoides and mainly differs by the bullate thallus and the cream pseudostroma; A. flavum which is similar to A. aeneum, but differs in the contrast between the linear to reticulate yellow stromata and the unpigmented thallus, and the ascospores of 16–18 × 6–7 μm; A. mesoduplex which is similar to A. flavoduplex, but with ascospores 90–100 × 20–23 μm and a thallus without lichexanthone; A. nigrum with mostly conical black pseudostroma that contrast sharply with the thallus, superficially resembling Pyrenula infraleucotrypa; A. novemseptatum which is similar to A. eumultisepatum, but without lichexanthone anywhere in the thallus or pseudostroma; A. ochroleucoeis which is similar to A. corallinum, but with lichexanthone on the thallus and pseudostroma; A. octoseptatum which is similar to A. eumultisepatum, but with the whole pseudostroma, not just the ostioles, containing lichexanthone, and ascospores somewhat asymmetrical, which is highlighted by the unusual dominant even number of septa (eight) and the asymmetrically placed central septum in the case of uneven septum numbers; A. quatuorseptatum which is similar to A. octoseptatum Aptroot & M. Cáceres, but without lichexanthone, ascospores somewhat asymmetrical, which is highlighted by the unusual dominant even number of septa (four) and the asymmetrically placed central septum in the case of uneven septum numbers; A. robustosporum with solitary ascomata with an eccentric ostiole, and ascospores 11–15–septate, 90–125 × 20–27 μm; A. solitarium which is similar to A. ceratinum (Fée) Aptroot & Lücking, but with ascospores 33–36 × 10–11 μm; A. stromatofluorescens which is close to A. phlyctaena, but with lichexanthone only on the pseudostroma, not on the thallus; A. supraclandestinum is close to A. subclandestinum, but the hamathecium is not inspersed; A. testudineum with solitary ascomata with an eccentric ostiole, an inspersed hamathecium, and ascospores 8 per ascus, muriform, 50–65 × 23–27 μm; A. xanthosuperbum which is similar to A. disjunctum, but with muriform ascospores, 130–160 × 28–35 μm; and Pseudopyrenula flavocrenagens which is similar to P. subgregaria, but with lichexanthone in the thallus. Only a few species were also found elsewhere, such as other areas of Brazil, or in Venezuela, Colombia, Guyana, Panama, Australia and/or Papua New Guinea. Currently, 55 species of Trypetheliaceae are known from this spot, including 46 species of Astrothelium. The Amazon basin is the centre of diversity for the family, at least for Astrothelium, the largest genus in the family.

Key words: Australia, Colombia, Guyana, lichens, Panama, Papua New Guinea, Pseudopyrenula, Venezuela

Accepted for publication 29 November 2015

A. Aptrout: ABL Herbarium, G.v.d.Veenstra 107, NL-3762 XK Soest, The Netherlands. Email: andreaproot@gmail.com

M. E. da S. Cáceres: Departamento de Biociências, Universidade Federal de Sergipe, CEP: 49500-000, Itabaiana, Sergipe, Brazil.

https://doi.org/10.1017/S0024282915000584 Published online by Cambridge University Press
Introduction

The family *Trypetheliaceae* is most abundant and also generally thought to be species-rich in open forests such as Caatinga vegetation. However, recent collections from expeditions in Venezuela, Guyana, Bolivia and Brazil (especially Rondônia) suggest that it may be most speciose in rainforest, where it grows both on tree trunks and branches. Recently, numerous undescribed species of this family have been found in these countries.

The rainforest in Rondônia is special in that it has a relatively open structure, but contains many large trees. In response, lichens cover most of the bark from the top of the trees to the forest floor, compared with other rainforests where lichens are largely replaced by bryophytes at ground level. The reason is most probably that the soil is extremely nutrient-poor. Until the start of the current research project in 2012, only about twelve lichens had been reported, mostly foliicolous species (Lücking 2008). However, the first results of this survey for lichens in this largely primary forest shows that the region has among the highest epiphytic lichen diversity in the world. There are many so far undescribed species and genera in groups such as *Graphidaceae* (Cáceres et al. 2014b), *Arthoniales* (Cáceres et al. 2014c) and the pyrenocarps (Aptroot & Cáceres 2013). Surprisingly, there are undescribed species, or some described recently, that are locally abundant e.g. *Pyrenula* spp. (Aptroot et al. 2013b).

The high lichen biodiversity is somewhat surprising in the light of the palynological record, which shows that the rainforest in Rondônia at the southern edge of the Amazonian basin is of a geologically recent age and was replaced by savannah in drier or colder periods in the Tertiary and Quaternary, including the ice ages (Hooghiemstra & van der Hammen 1998; Colinvaux et al. 2000). The explanation may be that lichens are better dispersers than most other organisms, on which the rapid changes in vegetation may have had a greater effect.

We sampled extensively for *Trypetheliaceae* in Rondônia and made a distinction between primary and secondary forest, and between species growing on trunks and branches in the primary forest. The primary forest is the most speciose. Quite unexpectedly, the species on the branches are exclusive to that habitat and do not occur on trunks in the same forest or in nearby secondary localities. Below we describe 25 new species of *Trypetheliaceae* found during three weeks of fieldwork in a radius of 50 km from Porto Velho in Rondônia. From the same fieldwork area, 27 previously described species of *Trypetheliaceae* were reported by Aptroot et al. (2013a) and Cáceres et al. (2014a), to which three species should be added that were at that time not yet taken from synonymy with others, but were already recognized in the material.

The generic concept applied here follows the phylogenetic studies by Nelsen et al. (2014). All species are keyed out in Aptroot & Lücking (2016).

Material and Methods

Identification and descriptive work was carried out in Itabaiana, Universidade Federal de Sergipe, using a Leica EZ4 stereomicroscope and a Leica DM500 compound microscope, and also in Soest using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with interference contrast, connected to a Nikon Coolpix digital camera. Sections were mounted in tap water, in which all measurements were also taken. The chemistry of all specimens was investigated under UV light, and usually spot tests with 10% KOH were carried out. The chemistry of the type specimens was investigated by thin-layer chromatography (TLC) using solvent A (Orange et al. 2001).

The New Species

**Astrothelium bivelum** Aptroot & M. Cáceres sp. nov.

Mycobank No.: MB 815159

*Astrothelium* with astrothelioid ascomata, 5-septate ascospores with polar gelatinous caps, and thallus without lichexanthone.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, alt. c. 100 m, on tree bark in primary rainforest, 19 November 2012, M. E. S. Cáceres & A. Aptroot 15608 (ISE—holotype; ABL—isotype).

(Figs 1A & 5A)

*Thallus* corticate, smooth, somewhat shiny, continuous, covering areas ≤3 cm diam.,
c. 0.1 mm thick, ochraceous green, surrounded by an irregular and rough c. 0.4 mm wide black prothallus that seems to contain pycnidia, not inducing gall formation of the host bark.

Ascomata pyriform, 0.5–0.7 mm diam., mostly 2–6 aggregated, immersed in pseudostromata with a surface only slightly different from the thallus, but not corticate, and which are distinctly raised above the thallus, irregular in outline, sides sloping, ≤c. 3 mm diam. and 1 mm high, ochraceous, not containing bark tissue. Wall carbonized all around, ≤c. 70 μm thick. Ostioles eccentric, fused,
flat, black, surrounded by a black rim. *Hamathecium* not inspersed with oil globules. *Asci* with 8 ascospores. *Ascospores* hyaline, 5-septate, fusiform, 55–65 × 18–21 μm, pointed, lumina diamond-shaped, with two polar gelatinous caps ≤ 6 μm thick.

*Pycnidia* not observed, but prothallus lines seemingly containing old pycnidia.

Chemistry. Thallus surface UV−, thallus medulla K−; pigmented parts of pseudostroma UV+ pink, K−. TLC: besides an unidentified pigment, no secondary substances detected.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. This is one of the few astrothelioid species with 5-septate ascospores but without lichexanthone. The species is characterized by the polar gelatinous caps, a spectacular character known from few lichens. However, it is a character that may disappear in older material, especially when preservation conditions are suboptimal. Material without polar caps is closest to *A. supraclandestinum* (see below), which differs by the absence of the pinkish pigment.

**Astrothelium curvisporum** Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815160

*Astrothelium* with curved, 5-septate ascospores of 115–135 × 29–36 μm with a 17–22 μm thick gelatinous layer.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41'10″S, 63°52'05″W, alt. c. 100 m, on twig in primary rainforest, 17 November 2012, M. E. S. Cáceres & A. Aptroot holotype; ABL—asotype.

(Figs 1B & 5B)

**Thallus** corticate, smooth, somewhat shiny, continuous, covering areas ≤ 5 cm diam., c. 0.2 mm thick, olive-green to olive-brown, medulla whitish, not surrounded by a prothallus, not inducing gall formation of the host bark.

**Ascomata** globose, 0.8–1.2 mm diam., immersed in groups of 3–15 in pseudostromata with a surface different from the thallus, and distinctly raised above the thallus, irregular in outline, sides sloping, ≤ c. 4 mm diam. and 1 mm high, brown with whitish pruina, inside containing bark tissue. *Wall* dark brown all around, ≤ c. 70 μm thick. *Ostioles* apical, not fused, flat, black, often surrounded by a round, flat black disc of c. 0.2 mm diam. *Hamathecium* heavily inspersed with hyaline oil globules. *Asci* with 8 ascospores. *Ascospores* hyaline, 5-septate, fusiform, distinctly curved, 115–135 × 29–36 μm, ends rounded, lumina diamond-shaped, surrounded by a gelatinous layer 17–22 μm thick.

*Pycnidia* not observed.

Chemistry. Thallus surface UV−, thallus medulla K−; pseudostroma surface UV−. TLC: no secondary substances detected.

Ecology and distribution. On twig in primary forest. Known only from Brazil.

Discussion. This species is characterized by the large, curved, 5-septate ascospores and especially by the very thick gelatinous layer, which is the thickest observed in the whole family. However, it is a character that might disappear in older material, especially when preservation conditions are suboptimal. Material without the gelatinous layer is closest to *A. sipmanii* Aptroot, which has straight ascospores.

**Astrothelium decemseptatum** Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815161

*Astrothelium* with pseudostroma that are essentially black and look like they are breaking through the bark, with anthraquinones, mostly on the pseudostromata but also on some parts of the thallus, best seen under UV light as the colour of the pruina is not very strong; ascospores (7–)9–11-septate, fusiform, 50–65 × 11–17 μm.

Type: Brazil, Rondônia, Sítio Ecológico Buriti on Lago Cujubim NE of Porto Velho, 8°35'17″S, 63°40'40″W, alt. c. 100 m, on tree bark in disturbed rainforest, 18 November 2012, M. E. S. Cáceres & A. Aptroot 15384 (ISE—holotype; ABL—asotype).

(Figs 1C & 5C)

**Thallus** corticate, smooth, somewhat shiny, continuous, covering areas ≤ 7 cm diam., under 0.1 mm thick, pale yellowish grey, not surrounded by a prothallus, not inducing gall formation of the host bark.
Ascomata pyriform, c. 0.6–1.2 mm diam., mostly 2–5 aggregated, mostly immersed in the bark tissue, surfacing in a blackish, partly orange pruinose pseudostroma that seems to break through the corticated bark. Wall carbonized, ≤ c. 80 μm thick. Ostioles eccentric, fused, flat, tiny black dots surrounded by a whitish zone c. 0.1 mm wide. Hamathecium inspersed with hyaline oil globules. Asci with 8 ascospores. Ascospores hyaline, (7–)9–11-septate, fusiform, 50–65 × 11–17 μm, ends rounded, lumina diamond-shaped, surrounded by a 2–4 μm thick gelatinous layer.

Pycnidia not observed.

Chemistry. Thallus surface partly UV+ pink to orange, partly negative, thallus medulla K−; pseudostroma surface UV+ red, pigmented parts of pseudostroma K+ red. TLC: anthraquinones.

Ecology and distribution. On smooth bark of trees in disturbed forest. Known only from Brazil.

Discussion. This species contains anthraquinones, mostly on the pseudostromata but also on some parts of the thallus. It is best seen under UV light (the colour of the pruina is not very strong). The pseudostroma are essentially black and look like they are breaking through the bark. It is most similar to A. cinereorosellum (Krempelh.) Aptroot & Lücking, but this has shorter ascospores and a black pseudostroma. Rather similar to A. bicolor (Taylor) Aptroot & Lücking, but with larger ascospores and a black pseudostroma that somewhat resembles a true fungal stroma.

Additional specimen seen. Brazil: same as the type, 15488 (ABL, ISE).

Astrothelium disjunctum Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815162

Astrothelium with black pseudostroma; ascospores 3–septate, (27–)29–33 × (8–)12–14 μm.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, alt. c. 100 m, on tree bark in park near rainforest, 16 November 2012, M. E. S. Cáceres & A. Aptroot 15161 (ISE—holotype; ABL—isotype).

(Fig. 1D)

Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤5 cm diam., c. 0.2 mm thick, pale yellowish grey, surrounded by a black prothallus line c. 0.3 mm wide, not inducing gall formation of the host bark.

Ascomata globose, 0.4–0.6 mm diam., immersed in groups of 5–25 in pseudostromata (resembling true stromata) with a black surface different from the thallus, and which are distinctly raised above the thallus and mostly linear in outline and often forming a network. Wall dark brown all around, ≤ c. 100 μm thick. Ostioles apical, not fused, flat, tiny black dots surrounded by a whitish zone c. 0.1 mm wide. Hamathecium not inspersed with oil globules. Asci with 8 ascospores. Ascospores hyaline, 3–septate, fusiform, (27–)29–33 × (8–)12–14 μm, ends rounded, lumina diamond-shaped, not surrounded by a gelatinous layer.

Pycnidia not observed.

Chemistry. Thallus surface UV−, thallus medulla K−; pseudostroma UV−, K−. TLC: no secondary substances detected.

Ecology and distribution. On smooth bark of trees in park near rainforest. Known only from Brazil.

Discussion. Rather similar to A. bicolor (Taylor) Aptroot & Lücking, but with larger ascospores and a black pseudostroma that somewhat resembles a true fungal stroma.

Additional specimens seen. Brazil: same as the type, 15203, 15221 (ABL, ISE).

Astrothelium duplicatum Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815163

Astrothelium similar to A. mesoduplex, but pseudostroma only yellowish inside and ascospores 45–55 × 11–15 μm.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, alt. c. 100 m, on tree bark in park near rainforest, 16 November 2012, M. E. S. Cáceres & A. Aptroot 15165 (ISE—holotype; ABL—isotype).

(Fig. 1E)

Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤5 cm diam.,
Ascospores 8 ascospores.

Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤7 cm diam., under 0·1 mm thick, pale yellowish grey, surrounded by a black prothallus line c. 0·3 mm wide, not inducing gall formation of the host bark.

Ascomata pyriform, c. 0·6–1·2 mm diam., mostly 2–5 aggregated, mostly immersed in the bark tissue below pseudostromata with a whitish surface different from the thallus, and which are distinctly raised above the thallus and mostly linear in outline and often forming a network. Wall carbonized, ≤c. 80 μm thick. Ostioles eccentric, fused, flat, pale brown, white pruinose, surrounded by a whitish zone. Hamathecium not inspersed with oil globules. Ascii with 8 ascospores. Ascospores hyaline, muriform, fusiform, 45–55 × 11–15 μm, ends rounded, lumina angular with many oblique septa, not surrounded by a gelatinous layer.

Chemistry. Thallus surface UV−, thallus medulla K−; pseudostroma surface UV+ red, medulla K+ blood red. TLC: an anthraquinone, probably parietin.

Ecology and distribution. On twigs of trees in primary forest and on bark in park near rainforest. Known only from Brazil.

Discussion. This is one of a group of probably related new species that mainly occur on branches in rainforest. The habitus is similar in shape, but not in colour, to several other Astrothelium species. Astrothelium flavoduplex and A. ochroleucoides differ, for example, by the presence of lichexanthone, A. mesoduplex and A. flavoduplex both by the yellow to orange pseudostromata, and all these three species by the longer ascospores.

Astrothelium eustomum
Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815165

Astrothelium similar to Astrothelium eustomum (Mont.) Müll. Arg., but with submuriform ascospores 37–45 × 15–19 μm.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, 30 km N of Porto Velho, 8°24′33″S, 63°58′56″W, alt. c. 100 m, on tree bark in primary forest, 15 March 2012, M. E. S. Cáceres & A. Aptroot 11828 (ISE—holotype; ABL—isotype).

(Figs 1F & 5D)

Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤7 cm diam., under 0·1 mm thick, pale yellowish grey, surrounded by a black prothallus line c. 0·3 mm wide, not inducing gall formation of the host bark.

Ascomata pyriform, c. 0·6–1·2 mm diam., mostly 2–5 aggregated, mostly immersed in the bark tissue below pseudostromata with a whitish surface different from the thallus, and which are distinctly raised above the thallus and mostly linear in outline and often forming a network. Wall carbonized, ≤c. 80 μm thick. Ostioles eccentric, fused, flat, pale brown, white pruinose, surrounded by a whitish zone. Hamathecium not inspersed with oil globules. Ascii with 8 ascospores. Ascospores hyaline, 9–11-septate, fusiform, 65–70 × 15–17 μm, ends pointed, lumina diamond-shaped, not surrounded by a gelatinous layer.

Chemistry. Thallus surface UV−, thallus medulla K−; ostiolar region UV+ yellow. TLC: lichexanthone.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. This species is similar to Astrothelium eustomum (Mont.) Müll. Arg., but differs by the 9–11-septate rather than 3–5-septate, and much larger, ascospores. The also newly described A. macrostomum Aptroot is intermediate, with 5–7-septate ascospores; the following species has submuriform ascospores.
alt. c. 100 m, on tree bark in primary rainforest, 9–12 March 2012, M. E. S. Cáceres & A. Aptroot 11547 (ISE—holotype; ABL—isotype).

(Figs 2A & 5E)

**Thallus** corticate, smooth, somewhat shiny, continuous, covering areas ≤ 12 cm diam., under 0.1 mm thick, pale yellowish grey, not surrounded by prothallus, not inducing gall formation of the host bark.

**Ascomata** pyriform, c. 0.6–1.2 mm diam., mostly 2–5 aggregated, mostly immersed in the bark tissue below pseudostromata with a whitish surface different from the thallus, and which are distinctly raised above the thallus and mostly irregular in outline, not forming a network. **Wall** carbonized, ≤ c. 80 μm thick. **Ostioles** eccentric, fused, flat, pale brownish, white pruinose, surrounded by a whitish zone. **Hamathecium** not inspersed with oil globules. **Asci** with 5 ascospores. **Ascospores** hyaline, submuriiform, fusiform, 37–45 × 15–19 μm, ends pointed, lumina diamond-shaped, often surrounded by a gelatinous layer ≤ 10 μm thick.

**Pycnidia** abundant, black, only on the pseudostromata.

**Chemistry.** Thallus surface UV−, thallus medulla K−; ostiolar region UV+ yellow. TLC: lichexanthone.

**Ecology and distribution.** On smooth bark of trees in primary forest. Known only from Brazil; locally common.

**Discussion.** This species is similar to **Astrothelium eustomum**, but differs in the submuriiform rather than 3–5-septate ascospores. The also newly described **A. macrostomum** Aptroot with 5–7-septate ascospores, and the preceding species with 9–11-septate ascospores, are intermediate. This new species is locally common.

*Additional specimens seen* (all ABL, ISE). **Brazil:** same as the type, 11360, 11361, 11362, 11364, 11402; same locality as the type, 2012, 15615; Fazenda São Francisco off BR319, 30 km N of Porto Velho, alt. c. 100 m, on tree bark in primary rainforest, 2012, Cáceres & Aptroot 11857, 11940; UNIR Federal University campus SW of city, alt. c. 100 m, on tree bark in primary rainforest, 2012, Cáceres & Aptroot 11054, 11135.

**Astrothelium flavoduplex** Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815167

**Astrothelium** similar to **A. mesoduplex**, but with ascospores 110–350 × 20–27 μm and lichexanthone present in the thallus.

**Type:** Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, alt. c. 100 m, on twig in primary rainforest, 19 November 2012, M. E. S. Cáceres & A. Aptroot 15553 (ISE—holotype; ABL—isotype).

(Figs 2B & 5P)

**Thallus** corticate, smooth, somewhat shiny, continuous, covering areas ≤ 8 cm diam., c. 0.1 mm thick, olive-green, surrounded by a black prothallus line c. 0.3 mm wide, not inducing gall formation of the host bark.

**Ascomata** globose, 0.4–0.6 mm diam., immersed in groups of c. 7–50 in pseudostromata. **Pseudostromata** with a surface different from the thallus, c. 1 mm raised above the thallus, oval to irregular or reticulate in outline, ≤ c. 3 mm wide, yellow to orange or brownish, pale yellow inside. **Wall** dark brown all around, ≤ c. 40 μm thick. **Ostioles** apical, not fused, flat to convex, brown. **Hamathecium** not inspersed with oil globules. **Asci** with 4–8 ascospores. **Ascospores** hyaline, muriiform with c. 22–30 transverse septa, fusiform to clavate, 110–350 × 20–27 μm, upper end rounded, lower end pointed, lumina angular with only a few transverse, mostly oblique septa, median septum much thickened at the sides, not surrounded by a gelatinous layer.

**Pycnidia** not observed.

**Chemistry.** Thallus surface UV+ yellow, thallus medulla K−; pseudostroma surface and medulla UV+ red, K+ blood red. TLC: an anthraquinone, probably parietin.

**Ecology and distribution.** On smooth bark of trees in primary forest. Known only from Brazil.

**Discussion.** Similar to **A. mesoduplex** but with longer ascospores and lichexanthone. The length of the ascospores is very variable; in general they are longer when the asci are

https://doi.org/10.1017/S0024282915000584 Published online by Cambridge University Press
4-spored, compared with those from 8-spored asci. This new species is widespread and locally common.

Additional material seen. **Brazil: Rondônia:** same as the type, M. E. S. Cáceres & A. Aptroot 15570, 15591a; *ibid.*, 2012, M. E. S. Cáceres & A. Aptroot 11251; same locality but in park near rainforest, 2012, M. E. S. Cáceres & A. Aptroot 15184; Estação Ecológica de Cuniã, km 760 on road BR 319 NNE of Porto Velho, 8°02′44″S, 63°29′11″W, alt. c. 100 m, on tree bark in primary rainforest, 2012, M. E. S. Cáceres & A. Aptroot 15622, 15704; Fazenda São Francisco off BR319, 30 km N of Porto Velho, 8°24′33″S, 63°58′56″W, alt. c. 100 m, on tree bark in primary rainforest, 2012, M. E. S. Cáceres & A. Aptroot 11836 (all ABL, ISE).—**Guyana: Upper Takutu Distr.:**

---

**Astrothelium flavomurisporum**

_Aptroot & M. Cáceres sp. nov._

MycoBank No.: MB 815168

_Astrothelium_ with deeply immersed ascomata with muriform ascospores 165–200 × 28–35 μm, with a distinctly thickened central septum and yellow oil.

_Type_: Brazil, Rondônia, Estação Ecológica de Cuniã, km 760 on road BR 319 NNE of Porto Velho, 8°02'44''S, 63°52'05''W, alt. c. 100 m, on tree bark in primary rainforest, 20 November 2012, _M. E. S. Cáceres & A. Aptroot_ 15697 (ISE—holotype; ABL—isotype).

(Figs 2C & 5F)

_Thallus_ corticate, minutely bullate, somewhat shiny, continuous, covering areas ≤7 cm diam., c. 0.2 mm thick, olive-green, not surrounded by a prothallus, not inducing gall formation of the host bark.

_Ascomata_ pyriform, 0.5–0.7 mm diam., 2–5 aggregated, deeply immersed in the bark, visible only from above by the ostioles, without pseudostroma. _Wall_ carbonized, ≤c. 70 μm thick. _Ostioles_ eccentric, brown, flat to concave. _Hamathecium_ not inspersed. _Ascospores_ 8 per ascus, hyaline, muriform, long, ellipsoid, 165–200 × 28–35 μm, not surrounded by a gelatinous layer, lumina with yellow oil, central septum much thickened.

_Pycnidia_ not observed.

_Chemistry_. Thallus and medulla UV−, K−. TLC: no secondary substances detected.

_Ecology and distribution_. On smooth bark of trees in primary forest. Known only from Brazil.

_Discussion_. This species is characterized by the deeply immersed ascomata with muriform ascospores with a distinctly thickened central septum and yellow oil. The species is most similar to _A. cecidiogenum_ (Aptroot & Lücking) Aptroot & Lücking, which has hyaline and generally shorter ascospores. Ascospores with yellow oil are otherwise known only from _Pseudopyrenula diluta_.

**Astrothelium flavostromatum**

_Aptroot & M. Cáceres sp. nov._

MycoBank No.: MB 815169

_Astrothelium_ close to _A. aeneoides_ Aptroot, mainly differing by the bullate thallus and the cream pseudostromata.

_Type_: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41'10''S, 63°52'05''W, alt. c. 100 m, on tree bark in park near rainforest, 16 November 2012, _M. E. S. Cáceres & A. Aptroot_ 15104 (ISE—holotype; ABL—isotype).

(Figs 2D & 5G)

_Thallus_ corticate, bullate, somewhat shiny, continuous, covering areas ≤5 cm diam., c. 0.2 mm thick, olive-green to olive-grey, not surrounded by a prothallus, inducing gall formation of the host bark.

_Ascomata_ globose, 0.6–1.0 mm diam., immersed in groups of 5–25 in pseudostromata with a surface different from the thallus, which are not distinctly raised above the thallus and often even lower, linear to irregular in outline and often forming a network, cream with yellow pruina. _Wall_ black all around, ≤c. 70 μm thick. _Ostioles_ apical, not fused, mostly concave, brown, often with a thin blackish rim. _Hamathecium_ not inspersed with oil globules. _Asc_ with 8 ascospores. _Ascospores_ hyaline, 3–septate, fusiform, 23–25 × 9–10 μm, ends rounded, lumina diamond-shaped, surrounded by a gelatinous layer ≤5 μm thick.

_Pycnidia_ not observed.

_Chemistry_. Thallus surface UV−, thallus medulla K−; pseudostroma surface UV+ pink to orange, pigmented parts of pseudostroma K+ blood red. TLC: an anthraquinone, probably parietin.

_Ecology and distribution_. On smooth bark of trees in park near rainforest. Known only from Brazil.

_Discussion_. This species is closest in key characters to _A. aeneoides_, and mainly differs by the bullate thallus and the cream pseudostromata.

**Astrothelium flavum**

_Aptroot & M. Cáceres sp. nov._

MycoBank No.: MB 815170

_Astrothelium_ similar to _A. aeneum_ (Eschw.) Aptroot & Lücking, but differing in the contrast between the linear
to reticulate yellow stromata and the unpigmented thallus, and ascospores 16–18 × 6–7 μm.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, alt. c. 100 m, on tree bark in primary rainforest, 9–12 March 2012, M. E. S. Cáceres & A. Aptroot 11410 (ISE—holotype; ABL—isotype).

(Figs 2E & 5H)

Thallus corticate, smooth, somewhat shiny, continuous, covering areas of ≤5 cm diam., c. 0.2 mm thick, olive-green to olive-grey, surrounded by a violet-brown prothallus line c. 0.3 mm wide, not inducing gall formation of the host bark.

Ascomata globose, 0.4–0.6 mm diam., immersed in groups of 5–25 in pseudostromata with a surface different from the thallus, and which are slightly raised above the thallus, irregular to linear or reticulate in outline, ≤c. 3 mm wide, bright yellow, inside with bark tissue. Wall dark brown all around, ≤c. 40 μm thick. Ostioles apical, not fused, flat to concave, black. Hamathecium not inspersed with oil globules. Asci with 8 ascospores. Ascospores hyaline, 3-septate, fusiform, 16–18 × 6–7 μm, ends rounded, lumina diamond-shaped, not surrounded by a gelatinous layer.

Pycnidia not observed.

Chemistry. Thallus surface UV−, thallus medulla K−; pseudostroma surface UV+ red, K+ blood red. TLC: an anthraquinone, probably paretin.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. This species is similar to A. aeneum, but differs in the contrast between the linear to reticulate yellow stromata and the non-pigmented thalli, and the relatively small ascospores.

Astrothelium mesoduplex Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815171

Astrothelium similar to A. flavoduplex, but ascospores 90–100 × 20–23 μm and the thallus is without lichexanthone.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, alt. c. 100 m, on twig in primary rainforest, 19 November 2012, M. E. S. Cáceres & A. Aptroot 15559 (ISE—holotype; ABL—isotype).

(Fig. 2F)

Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤8 cm diam., c. 0.1 mm thick, olive-green, surrounded by a black prothallus line c. 0.2 mm wide, not inducing gall formation of the host bark.

Ascomata globose, 0.4–0.6 mm diam., immersed in groups of c. 3–50 in pseudostromata. Pseudostroma with a surface different from the thallus, c. 1 mm raised above the thallus, oval to irregular in outline, ≤c. 3 mm wide, yellow to orange, pale yellow inside. Wall dark brown all around, ≤c. 40 μm thick. Ostioles apical, not fused, flat to convex, brown. Hamathecium not inspersed with oil globules. Asci with 8 ascospores. Ascospores hyaline, muriform with c. 22–30 transverse septa, fusiform to clavate, 90–100 × 20–23 μm, ends rounded, lumina angular with mostly oblique septa, not surrounded by a gelatinous layer.

Pycnidia not observed.

Chemistry. Thallus surface UV−, thallus medulla K−; pseudostroma surface UV+ red, K+ blood red. TLC: an anthraquinone, probably paretin.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. Similar to A. flavoduplex which has longer ascospores and contains lichexanthone. The new species is locally common. The new species is locally common.

Additional material seen (all ABL, ISE). Brazil: same as the type, 15555, 15591o; ibid., 2012, M. E. S. Cáceres & A. Aptroot 11253, 11254; Rondônia, Fazenda São Francisco off BR319, 30 km N of Porto Velho, 8°24′33″S, 63°58′56″W, alt. c. 100 m, on tree bark in primary rainforest, 2012, M. E. S. Cáceres & A. Aptroot 11958.

Astrothelium nigrum Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815174

Astrothelium characterized by the mostly conical black pseudostromata that contrast sharply with the thallus, superficially resembling Pyrenula infralabiata Aptroot & M. Cáceres.

Type: Brazil, Rondônia, Estação Ecológica de Cuniã, km 760 on road BR 319 NNE of Porto Velho, 8°02′44″S, 63°29′11″W, alt. c. 100 m, on tree bark in primary...
rainforest, 20 November 2012, M. E. S. Cáceres & A. Aptroot 15703 (ISE—holotype; ABL—isotype).

(Fig. 3A & B)

**Thallus** corticate, smooth, somewhat shiny, continuous, covering areas ≤10 cm diam., c. 0.1 mm thick, ochraceous green, surrounded by a black prothallus line c. 0.4 mm wide, inducing gall formation of the host bark in the form of making the bark pieces become slightly concave and thickened along the cracks so that they are almost flaking off.

**Ascomata** pyriform, 0.2–0.4 mm wide, 0.5–0.7 mm high, mostly 4–16 aggregated, immersed in conical to hemispherical pseudostroma with a black surface which is not corticated; **pseudostroma** distinctly raised above the thallus, regular in outline, sides sloping, ≤c. 2 mm diam. and 0.7 mm high, consisting of carbonized bark tissue. **Wall** carbonized all around, ≤c. 100 μm thick. **Ostioles** eccentric, fused, flat to convex, black, surrounded by a dull grey pruinose rim. **Hamathecium** not inspersed with oil globules. **Asci** with 8 ascospores. **Ascospores** hyaline, 3-septate, fusiform, 19–21×7–8 μm, ends rounded, lumina diamond-shaped, not surrounded by a gelatinous layer.

**Pycnidia** not observed.

**Chemistry.** Thallus surface UV−, thallus medulla K−; pseudostroma UV−, K−. **TLC:** no secondary substances detected.

**Ecology and distribution.** On smooth bark of trees in primary forest. Known only from Brazil.

**Discussion.** Unique in the mostly conical black pseudostroma that contrast sharply with the thallus, superficially giving it the impression of a **Pyrenula** species such as **P. infralaleucotrypa.** No other **Trypetheliaceae** is close in appearance.

**Astrothelium novemseptatum** Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815175

**Astrothelium** similar to **A. eumultiseptatum** Aptroot & M. Cáceres, but without lichexanthone anywhere in the thallus or pseudostroma.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41′10″S, 63°52′05″W, alt. c. 100 m, on tree bark in primary rainforest, 9–12 March 2012, M. E. S. Cáceres & A. Aptroot 11538 (ISE—holotype; ABL—isotype).

(Figs 3C & 5I)

**Thallus** corticate, smooth, somewhat shiny, continuous, covering areas ≤7 cm diam., c. 0.2 mm thick, pale greenish grey, with or without a black prothallus line c. 0.3 mm wide, inducing infrequent semi-globose galls of the host bark (lower bark locally swollen and erupting through bark).

**Ascomata** pyriform, c. 0.4–0.7 mm diam., mostly aggregated with 4–10, mostly immersed in the bark tissue below pseudostroma with a whitish surface different from the thallus, and which are distinctly raised above the thallus and mostly oval in outline, and ≤3 mm wide and ≤6 mm long. **Wall** carbonized, ≤c. 40 μm thick. **Ostioles** eccentric, fused, flat, pale brown, surrounded by a whitish zone. **Hamathecium** not inspersed with oil globules. **Asci** with 8 ascospores. **Ascospores** hyaline, 9-septate, fusiform, 49–55×12–17 μm, ends pointed, lumina diamond-shaped, when fresh surrounded by a gelatinous layer ≤8 μm thick.

**Pycnidia** not observed.

**Chemistry.** Thallus surface UV−, thallus medulla K−; pseudostroma UV−, K−. **TLC:** no secondary substances detected.

**Ecology and distribution.** On smooth bark of trees in primary forest. Known from Brazil, Guyana and Colombia.

**Discussion.** This species is most similar to **A. eumultiseptatum** (see above), which however has lichexanthone on the ostioles.

**Additional specimens seen.** **Guyana:** Essequibo River, Gunn’s, 1989, Jansen-Jacobs et al. 1868 (ABL L); Potaro-Siparuni Region, Kaieteur Falls National Park, around airstrip, Sipman 40456, 1996 (B).—**Colombia:** Amazonas: Araracuara, opposite airstrip, alt. 350 m, 1988, Sipman & Duivenvoorden 27867 (B).

**Astrothelium ochroleucoides** Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815176

**Astrothelium** similar to **A. corallinum** Aptroot, but with lichexanthone on the thallus and pseudostroma.

Type: Brazil, Rondônia, Estação Ecológica de Cuniã, km 760 on road BR 319 NNE of Porto Velho, 8°02′44″S,
63°29'11"W, alt. c. 100 m, on tree bark in primary rainforest, 20 November 2012, M. E. S. Cáceres & A. Aptroot 15705 (ISE—holotype; ABL—isotype).

(Fig. 3D)

Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤8 cm diam., c. 0.1 mm thick, olive-green, surrounded by a black prothallus line c. 0.3 mm wide, not inducing gall formation of the host bark.

Ascomata globose, 0.4–0.6 mm diam., immersed in groups of c. 2–40 in pseudostromata. Pseudostroma with a surface different from the thallus, c. 0.5–1.0 mm raised

Fig. 3. Habitus (except 3A) of new species of Trypetheliaceae, (isotypes). A, Astrothelium nigrum, section showing full carbonization; B, A. nigrum; C, A. novemseptatum; D, A. ochroleucoides; E, A. octoseptatum; F, A. quatuorseptatum. Scales: A = 40 μm; B–F = 1 mm. In colour online.
above the thallus, oval to irregular or reticulate in outline, ≤ c. 3 mm wide, brownish black, usually partly with whitish cover, partly brownish, partly whitish inside. Wall dark brown all around, ≤ c. 40 μm thick. Ostioles apical, not fused, flat to convex, brown. Hamathecium not inspersed with oil globules. Asci with 4 ascospores. Ascospores hyaline, muriform, fusiform, 80–115 × 15–24 μm, upper end rounded, lower end pointed, lumina angular with only a few transverse, mostly oblique septa, not surrounded by a gelatinous layer.

Pycnidia not observed.

Chemistry. Thallus surface UV+ yellow, thallus medulla K−; whitish parts of pseudostroma surface UV+ yellow, K−, pseudostroma medulla K−. Thallus, distinctly gular in outline and sometimes forming a network. Wall brown, ≤ c. 30 μm thick. Ostioles eccentric, fused, flat, brown, surrounded by a whitish zone. Hamathecium not inspersed with oil globules. Asc with 8 ascospores. Ascospores hyaline, (7–)8–(9)-septate, fusiform, 40–57 × 15–19 μm, middle septum (if present) asymmetrically divided; dividing the ascospore into two unequal parts), ends rounded, lumina diamond-shaped, surrounded by a gelatinous layer ≤ 7 μm thick.

Pycnidia abundant, black, only on the pseudostromata.

Chemistry. Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤ 7 cm diam., c. 0.1 mm thick, pale greenish grey, not surrounded by a prothallus, not inducing gall formation of the host bark.

Ascomata pyriform, c. 0.6–0.9 mm diam., mostly 2–5 aggregated, mostly immersed in the bark tissue below pseudostromata. Pseudostroma well delimited, not corticate, brown with a whitish (partly brown when abraded) surface clearly different from the thallus, distinctly c. 0.5 mm raised above the thallus, ≤ 3 mm wide and ≤ 7 mm long, irregular in outline and sometimes forming a network. Wall brown, ≤ c. 30 μm thick. Ostioles eccentric, fused, flat, brown, surrounded by a whitish zone. Hamathecium not inspersed with oil globules. Asci with 8 ascospores. Ascospores hyaline, (7–)8–(9)-septate, fusiform, 40–57 × 15–19 μm, middle septum (if present) asymmetrical (dividing the ascospore into two unequal parts), ends rounded, lumina diamond-shaped, surrounded by a gelatinous layer ≤ 7 μm thick.

Pycnidia abundant, black, only on the pseudostromata.

Chemistry. Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤ 7 cm diam., c. 0.1 mm thick, pale greenish grey, not surrounded by a prothallus, not inducing gall formation of the host bark.

Ascomata pyriform, c. 0.6–0.9 mm diam., mostly 2–5 aggregated, mostly immersed in the bark tissue below pseudostromata. Pseudostroma well delimited, not corticate, brown with a whitish (partly brown when abraded) surface clearly different from the thallus, distinctly c. 0.5 mm raised above the thallus, ≤ 3 mm wide and ≤ 7 mm long, irregular in outline and sometimes forming a network. Wall brown, ≤ c. 30 μm thick. Ostioles eccentric, fused, flat, brown, surrounded by a whitish zone. Hamathecium not inspersed with oil globules. Asci with 8 ascospores. Ascospores hyaline, (7–)8–(9)-septate, fusiform, 40–57 × 15–19 μm, middle septum (if present) asymmetrical (dividing the ascospore into two unequal parts), ends rounded, lumina diamond-shaped, surrounded by a gelatinous layer ≤ 7 μm thick.

Pycnidia abundant, black, only on the pseudostromata.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. Somewhat similar to A. eumultiseptatum (see above), in which only the
ostioles contain lichexanthone. The ascospores of this species are somewhat asymmetrical, which is highlighted by the unusual dominant even number of septa (eight) and the asymmetrical placed central septum in the case of uneven septum numbers.

Additional specimen seen. Brazil: Rondônia: Estação Ecológica de Cuniã, km 760 on road BR 319 NNE of Porto Velho, 8°02′44″S, 63°29′11″W, alt. c. 100 m, on tree bark in primary rainforest, 2012, Cáceres & Aptroot 15831 (ISE, ABL).

Astrothelium quatorseptatum Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815179

Astrothelium similar to A. octoseptatum Aptroot & M. Cáceres, but without lichexanthone; ascospores somewhat asymmetrical, which is highlighted by the unusual dominant even number of septa (four) and the asymmetrical placed central septum in the case of uneven septum numbers.

Type: Brazil, Rondônia, Estação Ecológica de Cuniã, km 760 on road BR 319 NNE of Porto Velho, 8°02′44″S, 63°29′11″W, alt. c. 100 m, on tree bark in primary rainforest, 20 November 2012, M. E. S. Cáceres & A. Aptroot 15717 (ISE—holotype; ABL—isotype).

(Figs 3F & 5K)

Thallus corticate, smooth, somewhat shiny, continuous, covering areas ≤7 cm diam., c. 0.1 mm thick, pale greenish grey, surrounded by a prothallus line c. 0.1 mm wide, inducing gall formation of the host bark in the form of making the bark pieces become slightly concave and thickened along the cracks so that they are almost flaking off.

Ascomata pyriform, c. 0.6–0.8 mm diam., mostly 2–5 aggregated, mostly immersed in the bark tissue below pseudostromata.

Pseudostroma well delimited, not corticate, brown, occasionally with a whitish (usually abraded) surface clearly different from the thallus, distinctly c. 0.3 mm raised above the thallus, ≤2 mm diam., rounded to somewhat irregular in outline. Wall brown, ≤c. 30 μm thick. Ostioles eccentric, fused, flat to convex, brown, surrounded by a whitish grey zone. Hamathecium not inspersed with oil globules. Ascii with 8 ascospores. Ascospores hyaline, (3–)4–(5)–septate, fusiform, 45–55 × 15–18 μm, middle septum (if present) asymmetrical (dividing the ascospore into two unequal parts), ends rounded, lumina diamond-shaped, not surrounded by a gelatinous layer.

Pycnidia not observed.

Chemistry. Thallus surface UV−, thallus medulla K−; pseudostroma UV−, K−. TLC: no secondary substances detected.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. Similar to A. octosporum (see above) in the asymmetrical ascospores, but with only half the number of septa and without lichexanthone.

Astrothelium robustosporum Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815180


Type: Brazil, Rondônia, Estação Ecológica de Cuniã, km 760 on road BR 319 NNE of Porto Velho, 8°02′44″S, 63°29′11″W, alt. c. 100 m, on tree bark in primary rainforest, 13 March 2012, M. E. S. Cáceres & A. Aptroot 11696 (ISE—holotype; ABL—isotype).

(Figs 4A & 5L)

Thallus corticate, smooth, dull, continuous but locally abraded, covering areas ≤10 cm diam., c. 0.1 mm thick, pale ochraceous green, not surrounded by a prothallus, not inducing gall formation of the host bark.

Ascomata pyriform (somewhat triangular in horizontal section), 0.6–0.9 mm wide, 0.7–1.1 mm long, solitary, completely immersed in the bark, without visible pseudostromata or swellings. Wall carbonized all around, ≤c. 60 μm thick. Ostioles eccentric, simple, flat to convex, black, presenting the only part of the ascoma that is visible from above. Hamathecium not inspersed with oil globules. Asci with 8 ascospores. Ascospores hyaline, 11–15–septate, fusiform, 90–125 × 20–27 μm, pointed, lumina diamond-shaped, surrounded by a gelatinous layer ≤10 μm thick, central septum much thickened at the sides.

Pycnidia not observed with certainty, although some of the black dots around the ostioles may represent young pycnidia.

https://doi.org/10.1017/S0024282915000584 Published online by Cambridge University Press
Chemistry. Thallus and medulla UV−, K−. TLC: no secondary substances detected.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. This species resembles some Astrothelium species that were formerly in Campylothelium (such as A. puiggarii (Müll. Arg.) Aptroot & Lücking) in gross morphology due to the solitary ascomata with eccentric ostiole, but it has large ascospores that are only

Fig. 4. Habitus of new species of Trypetheliaceae, (isotypes). A, Astrothelium robustosporum; B, A. solitarium; C, A. stromatofluorescens; D, A. supraclandestinum; E, A. testudineum; F, A. xanthosuperbum. Scales = 1 mm. In colour online.
transversely septate rather than muriform as in all former *Campylothelium* species. The new species is most similar to *A. basilicum* (Krempelh.) Aptroot & Lücking, which has longer ascospores.

Astrothelium solitarium Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815181

*Astrothelium* similar to *A. ceratinum* (Fée) Aptroot & Lücking, but with ascospores 33–36 × 10–11 μm.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41'10"S, 63°52'05"W, alt. c. 100 m, on tree bark in primary rainforest, 19 November 2012, M. E. S. Cáceres & A. Aptroot 15501 (ISE—holotype; ABL—isotype).

(Figs 4B & 5M)

*Thallus* corticate, smooth, somewhat shiny, continuous, covering areas ≤7 cm diam., c. 0.1 mm thick, pale ochraceous green, surrounded by a black prothallus line c. 0.2 mm wide, not inducing gall formation of the host bark.

*Ascomata* globose, 0.2–0.5 mm diam., immersed in groups of 7–50 in pseudostromata, not all reaching the surface at one time. *Pseudostromata* well delimited, not corticate, slate grey with a whitish (partly slate grey when abraded) surface clearly different from the thallus, distinctly c. 1 mm raised above the thallus, ≤7 mm diam., irregular in outline and sometimes forming a network, inside with carbonized bark tissue. *Wall* black, ≤c. 30 μm thick. *Ostioles* apical, not fused, flat to concave, ferrugineous brown, surrounded by a whitish zone. *Hamathecium* not inspersed with oil globules. *Asci* with 8 ascospores. *Ascospores* hyaline, 3-septate, fusiform, 20–23 × 7–9 μm, ends rounded, lumina diamond-shaped, surrounded by a gelatinous layer ≤6 μm thick.

*Pycnidia* not observed.

*Chemistry.* Thallus and medulla UV−, thallus medulla K−; pseudostroma surface UV+ yellow. TLC: lichexanthone.

*Ecology and distribution.* On bark of trees in park near rainforest. Known only from Brazil.

*Discussion.* This species is close to *A. phlyctaeum*, which has lichexanthone not only on the pseudostroma, but also on the thallus.

Astrothelium supraclandestinum

Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815185

*Astrothelium* close to *A. subclandestinum* Leight., but hamathecium not inspersed.

Type: Brazil, Rondônia, Porto Velho, Parque Natural Municipal de Porto Velho, 8°41'10"S, 63°52'05"W, alt. c. 100 m, on tree bark in primary rainforest, 16 November 2012, M. E. S. Cáceres & A. Aptroot 15224 (ISE—holotype; ABL—isotype).

(Figs 4C & 5N)

*Thallus* corticate, smooth, somewhat shiny, continuous, covering areas ≤7 cm diam., c. 0.1 mm thick, pale ochraceous green, surrounded by a black prothallus line c. 0.2 mm wide, not inducing gall formation of the host bark.

*Ascomata* globose, 0.2–0.5 mm diam., immersed in groups of 7–50 in pseudostromata, not all reaching the surface at one time. *Pseudostromata* well delimited, not corticate, slate grey with a whitish (partly slate grey when abraded) surface clearly different from the thallus, distinctly c. 1 mm raised above the thallus, ≤7 mm diam., irregular in outline and sometimes forming a network, inside with carbonized bark tissue. *Wall* black, ≤c. 30 μm thick. *Ostioles* apical, not fused, flat to concave, ferrugineous brown, surrounded by a whitish zone. *Hamathecium* not inspersed with oil globules. *Asci* with 8 ascospores. *Ascospores* hyaline, 3-septate, fusiform, 20–23 × 7–9 μm, ends rounded, lumina diamond-shaped, surrounded by a gelatinous layer ≤6 μm thick.

*Pycnidia* not observed.

*Chemistry.* Thallus and medulla UV−, thallus medulla K−; pseudostroma surface UV+ yellow. TLC: lichexanthone.

*Ecology and distribution.* On bark of trees in park near rainforest. Known only from Brazil.

*Discussion.* This species is close to *A. phlyctaeum*, which has lichexanthone not only on the pseudostroma, but also on the thallus.

Astrothelium testudineum Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815186

Astrothelium with solitary ascomata with an eccentric ostiole, inspersed hamathecium, ascospores 8 per ascus, muriform, 50–65 × 23–27 μm.

Type: Brazil, Rondônia, Porto Velho, Parque Circuito, 8°43′54″S, 63°54′04″W, alt. c. 100 m, on Hevea brasiliensis bark in plantation, 8 March 2012, M. E. S. Cáceres & A. Aptroot 11448a (ISE—holotype; ABL—isotype).

(Fig. 4E)

Thallus thickly corticate, smooth, somewhat shiny, continuous, covering areas ≤5 cm diam., c. 0.2 mm thick, ochraceous, surrounded by a black prothallus line c. 0.1 mm wide, not inducing gall formation of the host bark.

Ascomata pyriform, 0.5–0.9 mm diam., mostly 2–6 aggregated, immersed in the thallus, without pseudostroma, but occasionally with paler, lesser corticate areas around the ostioles. Wall carbonized all around, ≤c. 70 μm thick. Ostioles eccentric, fused, flat to convex, brown to black. Hamathecium densely inspersed with hyaline oil globules. Ascii with 8 ascospores. Ascospores hyaline, densely muriform with many locules in straight rows and partly skewed septa, broadly ellipsoidal, 50–65 × 23–27 μm, rounded, lumina angular, wall 2 μm thick.

Pycnidia pale brown, immature but abundant, near the ostioles.

Chemistry. Thallus surface UV−, thallus medulla K−; pseudostroma UV−, K−. TLC: no secondary substances detected.


Discussion. This species is similar to some Astrothelium species that were described in Campylothelium, in the solitary ascomata with eccentric ostioles, but it differs from all other described species by the combination of ascospore size, number of ascospores in the ascus and hamathecium inspersion. It is most similar to A. leioplagum (Müll. Arg.) Aptroot & Lücking, which has no hamathecium inspersion and shorter ascospores.


9–12 March 2012, M. E. S. Cáceres & A. Aptroot 11344 (ISE—holotype; ABL—isotype).
Astrothelium xanthosuperbum
Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815187

Astrothelium similar to A. disjunctum Aptroot & M. Cáceres, but ascospores muriform, 130–160 × 28–35 μm.

Type: Brazil, Rondônia, Sítio Ecológico Buriti on Lago Cujubim NE of Porto Velho, 8°35’17”S, 63°40’40”W, alt. c. 100 m, on tree bark in disturbed rainforest, 18 November 2012, M. E.S. Cáceres & A. Aptroot 15443 (ISE—holotype; ABL—isotype).

Thallus not corticate, dull, continuous, covering areas ≤2 cm diam., whitish grey, surrounded by a black hypothallus line c. 0.2 mm wide, not inducing gall formation of the host bark.

Ascomata globose, 0.25–0.35 mm diam., single, emergent from the thallus. Wall carbonized, ≤c. 40 μm thick. Ostioles apical, not fused, flat, black. Hamathecium inspersed with yellow oil globules. Asci with 8 ascospores. Ascospores hyaline, 3-septate, fusiform, 21–28 × 6–9 μm, ends pointed, lumina diamond-shaped, partly yellow, not surrounded by a gelatinous layer.

Pycnidia not observed.

Chemistry. Thallus UV+ yellow, KOH–. TLC: lichexanthone.

Ecology and distribution. On smooth bark of trees in primary forest, but also in disturbed rainforest. Known from Brazil and Panama.

Discussion. This species differs from P. subgregaria by the presence of lichexanthone in the thallus. This new species is widespread.


Pseudopyrenula flavoreagens Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 815189

Pseudopyrenula similar to P. subgregaria Müll. Arg., but with lichexanthone in the thallus.

Type: Brazil, Rondônia, Sítio Ecológico Buriti on Lago Cujubim NE of Porto Velho, 8°35’17”S, 63°40’40”W, alt. c. 100 m, on tree bark in disturbed rainforest, 18 November 2012, M. E.S. Cáceres & A. Aptroot 15441 (ISE—holotype; ABL—isotype).

Discussion. Currently, 55 species of Trypetheliaceae are known from this small area in Rondônia, including 46 species of Astrothelium (out of less than 200 known worldwide). The presence of so many species in such a limited area, in addition to the high numbers of species found in lowland areas of the Guianas, Bolivia, Colombia and Venezuela, suggests that the Amazon basin is the centre of diversity for the family, at least for Astrothelium, which in its revised circumscription is the largest genus of the family.
The CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) is thanked for a research grant to MESC (Processo 311706/2012-6). The costs of the collecting expeditions to MESC were financed by CNPq (CNPq-Protax Processo 562330/2010-0 and INCT-Herbário Virtual Processo 563342/2010-2). Elton Bill Souza and Allyne Christina Gomes Silva are thanked for logistical support and for organizing the collecting trips. Leo Spier is thanked for performing thin-layer chromatography.

References


https://doi.org/10.1017/S0024282915000584 Published online by Cambridge University Press