

## Revision of the corticolous *Mazosia* species, with a key to *Mazosia* species with 3-septate ascospores

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**Abstract:** A revision of corticolous *Mazosia* specimens showed that four species are present, all differing from the foliicolous taxa in the genus. One of them is widely distributed in the tropics and the others are, as far as is known, neotropical. Three species are co-occurring in NE Brazil. They can be distinguished as follows: *M. leptosticta* (Nyl.) Sparrius has longer ascospores ( $22\text{--}35 \times 4\text{--}7 \mu\text{m}$ ) than the other species, *M. endonigra* A. A. Menezes, M. Cáceres & Aptroot sp. nov. has sessile apothecia on a smooth thallus and occasionally also sessile pycnidia, *M. carnea* (Eckfeldt) Aptroot & M. Cáceres comb. nov. has immersed apothecia and a smooth thallus, and *M. viridescens* (Fée) Aptroot & M. Cáceres comb. nov. has distinct verrucae on the thallus. Descriptions are given and an identification key is presented to all *Mazosia* species with 3-septate ascospores, which includes all corticolous species known so far.

**Key words:** Brazil, Ceará, lichens, Piauí, *Roccellaceae*, Sergipe

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### Introduction

The genus *Mazosia* is a small genus with 23 known species (Lücking 2008) in the *Roccellaceae*. Most species are known only from living leaves, but a few occur both on smooth bark and leaves; so far only two species are described that are known only from bark (Sparrius 2004).

During ecological studies by the authors in NE Brazil, mostly on the Chapada do Araripe in Ceará State and in Mata do Crasto, an Atlantic rainforest remnant in the state of Sergipe, three corticolous *Mazosia* species

were found to occur. Their internal structures are almost identical, but the aspect and immersion of the apothecia and the thallus surface differ, from smooth to minutely verrucose to roughly warted. As such thallus structures are among the main species characters in foliicolous *Mazosia* species (Lücking 2008), these species were deemed worthy of recognition. However, only two corticolous *Mazosia* species are currently recognized (Sparrius 2004), which differ in ascospore length and thallus structure. A further, undescribed species from Hong Kong was reported by Sparrius (2004). We examined this material but do not treat it here in the genus *Mazosia* as it has a very pale, non-carbonized hypothecium.

After making descriptions and provisional names for the two additional corticolous species, we encountered increasingly more specimens, and not only from NE Brazil. We decided to investigate the type specimens of the corticolous species already described, particularly of the three species synonymized with *M. ocellata* (Nyl.), R. C. Harris by

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Sparrius (2004), and a further species, the oldest epithet among them, which was cited by Tehler (1993) to be identical with *M. ocellata*. Somewhat to our surprise, they represented two different species.

Here we reinstate one species and make the appropriate combination in the genus *Mazosia* for the oldest epithet available, and provide descriptions and a key to all corticolous species of *Mazosia* including similar foliicolous ones.

### Material and Methods

Identification and descriptive work were 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 the types of the new species and a few other specimens was investigated by thin-layer chromatography (TLC) using solvent A (Orange *et al.* 2001).

### The Species

#### *Mazosia carnea* (Eckfeldt) Aptroot & M. Cáceres comb. nov.

Mycobank No.: 805956

Basionym: *Thelotrema carneum* Eckfeldt, *Bull. Torrey Bot. Club* 21: 394 (1894).—*Ocellularia carnea* (Eckfeldt) Zahlbr., *Cat. Lich. Univ.* 2: 585 (1923).—*Enterographa carnea* (Eckfeldt) R. C. Harris, in Egan, *Bryologist* 90: 163 (1987); type: USA, Louisiana, St Martinsville, 1894, Langlois 1006, 1051, x164 (NY—isotypes, illustrations seen).

*Chiodecton cyclocarpum* Zahlbr., *Sitzungsber. K. Akad. Wiss. Wien. math.-naturw. Kl.* 111(1): 375 (1902).—*Enterographa cyclocarpa* (Zahlbr.) Redinger, *Feddes Repertorium* 43: 69 (1938); type: Brazil, Rio de Janeiro, on tree trunk in Botanical Garden, 1902, Höhnel 171 (W—holotype, illustration).

*Gymnographoidea suborbicularis* Fink, in Hedrick, *Mycologia* 22: 249 (1930); type: USA, Puerto Rico, near Rio Pedras, on branch, 1916, Fink 2194 (NY—holotype, illustrations seen; L—isotype).

(Fig. 1)

*Thallus* crustose, not corticate, dull, greyish green to whitish grey, mostly rather thick, at least minutely fissured or wrinkled, usually

surrounded by a narrow black prothallus line. *Algae* trentepohlioid.

*Ascomata* superficial, round, 0.2–0.4 mm wide; *disc* flat, brownish grey (often rather pale) to dark grey or black, not pruinose, margin pronounced, not raised above the disc, whitish, *c.* 0.1 mm wide. *Excipulum* hyaline, with globose lumina of up to 12.5 µm, with clusters of large hyaline crystals and with algal cells. *Hypothecium* black, 35–55 µm high, often with large hyaline crystals, extending as a thin to thick (up to *c.* 50 µm wide) parathecium between the hamathecium and the excipulum. *Epihymenium* brown, with tiny fuscous crystals. *Hamathecium* not interspersed, yellowish, filaments 1.5–2.0 µm wide. *Asci* clavate, 40–50 × 11–14 µm. *Ascospores* 8 per ascus, hyaline, clavate, 3-septate, 15–18 × 4–6 µm, constricted at the septa, ends somewhat rounded.

*Pycnidia* not observed.

*Chemistry.* Thallus and ascomata UV–, C–, P–, K–. TLC: no substances detected.

*Ecology and distribution.* On smooth bark of trees, pantropical; in NE Brazil in Mata Atlântica and Brejo de Altitude forest.

*Discussion.* This species differs from all other *Mazosia* species by the often rather thick, usually irregularly but finely fissured thallus. This is one of the main reasons that it has always been recognized as a separate species, as it could not be accommodated in any of the known foliicolous taxa.

*Selected additional material examined.* **USA:** Louisiana: Baton Rouge, Burden Research Plantation, S. Tucker 28595 (B).—**Costa Rica:** *Puntarenas:* Parque Nacional Corcovado, Estación Biológica Sirena, disturbed forest along the beach, 0 m, H. Sipman 51138 (B); Cordillera de Tilarán, Monteverde, forest relicts, 1450 m, H. Sipman 12077 (B).—**Puerto Rico:** *Mayagüez District:* Reserva Forestal Maricao, low forest on dry slope, along trail to fish hatchery, *c.* 800 m, H. Sipman 25953, 25985 (B).—**Netherlands Antilles:** *Saba:* Sandy Cruz Trail at The Bottom, secondary forest, 400 m, H. Sipman 54711, 54722 (B).—**Brazil:** *Alagoas:* Pilar, Reserva Particular do Patrimônio Natural Fazenda São Pedro, Mata Atlântica (closed forest), 50 m, M. Cáceres & R. Lücking 01-0157b (F), M. Cáceres 2000 (B), 2013 (F), 2014 (URM), A08-061 (F), A21-187 (F, URM), A38-cortex (F), A45-366a (F), A45-367a (F). *Pernambuco:* Bonito, Parque Municipal de Bonito, Brejo de Altitude

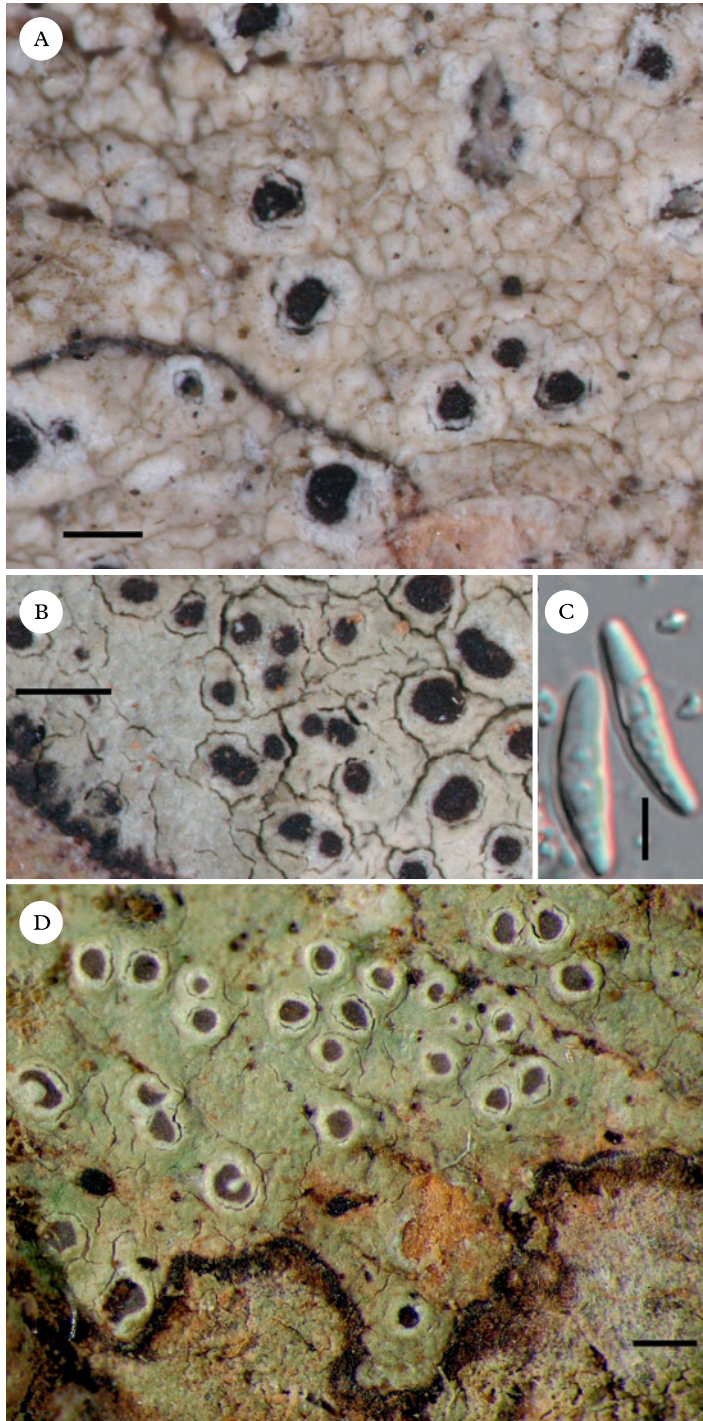


FIG. 1. *Mazosia carnea*. A, holotype, habitus; B, holotype of *Gymnographoidea suborbicularis*, habitus; C, Cáceres & Aptroot 18359, ascospore; D, Cáceres 2040b, habitus. Scales: A, B & D = 0.5 mm; C = 5  $\mu$ m. In colour online.



(high altitude rainforest), 800 m, *M. Cáceres & R. Lücking* 00-0332 (F); Igarassu, Refúgio Ecológico Charles Darwin, Mata Atlântica (closed forest), 20 m, *M. Cáceres & R. Lücking* 00-0400 (B), 00-0413 (F), 00-0389 (URM), 00-0420 (URM). *Rio Grande do Norte*: Baía Formosa, Reserva Particular do Patrimônio Natural Mata Estrela Senador Antônio Farias, Mata Atlântica (closed forest), 0 m, *M. Cáceres* 01-0170 (B). *Sergipe*: Ribeira, Mata Atlântica, *M. Cáceres* 2040b (F); Povoada Pedrinhas, Mata da Fazenda Cafuz, *M. Cáceres & A. Aptroot* 18359 (ABL, ISE, tlc).—**Guyana**: *Upper Takutu District*: southern Rupununi savannah, c. 3 km N of Dadanawa ranch headquarters, on scattered shrubs around pond in savannah, c. 120 m, *H. Sipman* 57524; same area, Kusad mountain, SE-side, sheltered, little disturbed forest in valley at foot of the mountain, 150–250 m, *H. Sipman* 57638 & 57937. *East Demerara District*: along Linden Highway, E of Timehri airport, in savannah bush, c. 10 m, *H. Sipman & A. Aptroot* 19560 (all B).—**Seychelles**: Cousine, 31 iii 2001, *J. Gerlach* (BR).—**Fiji**: Viti Levu, along valley road near Mauka of Belo, O. & I. Degener 31901w (B).

**Mazosia endonigra** A. A. Menezes,  
**M. Cáceres & Aptroot** sp. nov.

Mycobank No.: MB 802579

*Mazosia* on bark with smooth, often greyish green thallus, dark grey to black apothecia, black hypothecium, yellowish hymenium and ascospores 3-septate, 15–18 × 4–6 µm.

Type: Brazil, Ceará, Chapada do Araripe, on bark of tree, c. 900 m, 24 January 2011, *A. A. Menezes* 8294 (ISE—holotype).

(Fig. 2)

*Thallus* crustose, not corticate, dull, greyish green to whitish grey, rather thick, smooth, surrounded by a narrow black prothallus line. *Algae* trentepohlioid.

*Ascomata* superficial, round, 0.2–0.4 mm wide; *disc* flat, dark grey to black, not pruinose, margin pronounced, not raised above the disc, whitish, c. 0.1 mm wide. *Excipulum* hyaline, with globose lumina of up to 12.5 µm, clusters of large hyaline crystals and algal cells. *Hypothecium* black, 35–55 µm high, often with large hyaline crystals, extending as a thin (c. 5 µm) parathecium between the hamathecium and the excipulum. *Epilhymenium* brown, with tiny fuscous crystals. *Hamathecium* not interspersed, yellowish, filaments 1.5–2.0 µm wide. *Asci* clavate, 40–50 × 11–14 µm. *Ascospores* 8 per ascus, hyaline, clavate, 3-septate, 15–18 × 4–6 µm, constricted at the septa, ends somewhat rounded.

*Pycnidia* occasionally present, sessile, semi-globose, black, higher than wide; *conidia* hyaline, ellipsoid, c. 5.5–6.5 × 2.0 µm.

*Chemistry*. Thallus and ascomata UV–, C–, P–, K–. TLC: no substances detected.

*Ecology and distribution*. On smooth bark of trees, in NE Brazil in Caatinga forest. Occurring together with, for example, *Lecanora caesiorubella* Ach.

*Discussion*. This species is somewhat similar to *Mazosia phyllosema* (Nyl.) Zahlbr. (Lücking 2008) and has previously been reported as corticolous material of the latter (Cáceres 2007), but it differs by, for example, the pronounced apothecium margin, the thicker, dull thallus that is not dispersed into rounded patches at the margin but entire and surrounded by a black hypothallus line, trentepohlioid photobiont and by the smaller ascospores.

*Selected additional material examined*. **Brazil**: Ceará: Chapada do Araripe, on bark of tree, c. 800 m, 2012, *A. A. Menezes* 8298, 15899 (ISE); same area, 2013, *M. M. E. Alves* 251, 1026, 1028, 1029, 1031, 1041, 1046 (all ISE), 1117 (apothecia and pycnidia, ABL), 1156, 1186 (all ISE). **Piauí**: Parque Nacional Serra das Confusões, 2012, *M. Cáceres* 9462, 9474 (ISE, both only pycnidia).

**Mazosia leptosticta** (Nyl.) Sparrius

*Biblioth. Lichenol.* **89**: 97 (2004).—*Stigmatidium leptostictum* Nyl., in Triana & Planchon, *Ann. Sci. Nat., Bot.*, sér. 4, **19**: 382 (1863).—*Chiodecton leptostictum* (Nyl.) Zahlbr., *Cat. Lich. Univ.* **2**: 479 (1923); type: Colombia, Barranquilla, Lindig 2646 [“2606” in publication] (H-NYL 4624—lectotype, Sparrius 2004).

(Fig. 3)

*Thallus* crustose, not corticate, dull, greyish green to whitish grey, very thin, smooth, without prothallus line. *Algae* trentepohlioid.

*Ascomata* superficial, round, 0.1–0.6 mm wide; *disc* flat, dark grey to black, not pruinose, margin thin, not raised above the disc, whitish, less than 0.1 mm wide. *Excipulum* black inside, hyaline and with algae outside, without crystals. *Hypothecium* black, 15–25 µm high. *Epilhymenium* hyaline. *Hamathecium* not interspersed, filaments 1.5–2.0 µm wide. *Asci* clavate, 50–65 × 11–15 µm. *Ascospores*

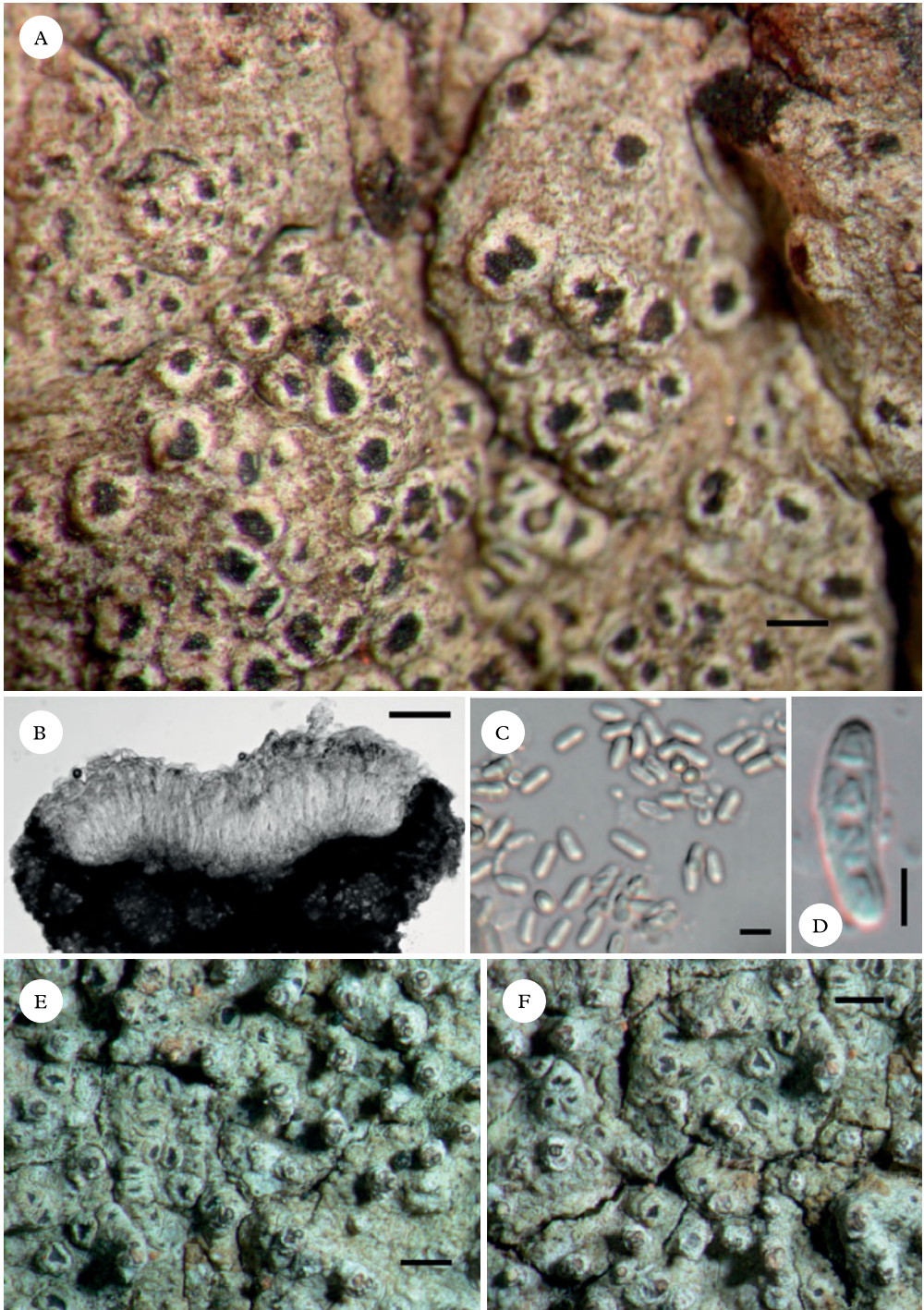


FIG. 2. *Mazosia endonigra*, A, B & D, holotype; C, E & F, *Alves* 1117. A, E & F, habitus; B, section through apothecium; C, conidia; D, ascospore. Scales: A, E & F = 0.5 mm; B = 50  $\mu$ m; C & D = 5  $\mu$ m. In colour online.



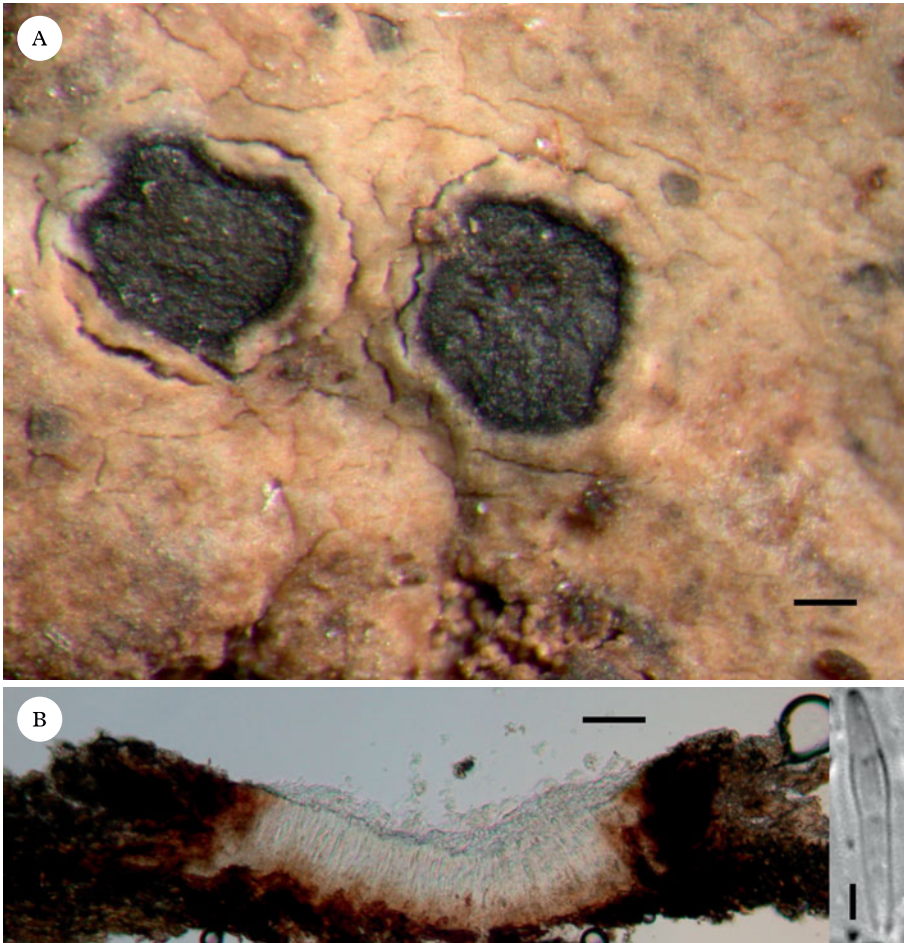


FIG. 3. *Mazosia leptosticta*, Sipman & Aptroot 18638. A, habitus; B, section through apothecium; inset, ascospore. Scales: A = 0.5 mm; B = 50  $\mu$ m, inset = 5  $\mu$ m. In colour online.

8 per ascus, mostly in one bundle, hyaline, clavate, 3-septate, (22–)28–35  $\times$  4–7  $\mu$ m, constricted at the septa, ends somewhat rounded.

*Pycnidia* not observed.

*Chemistry*. Thallus and ascomata UV–, C–, P–, K–.

*Ecology and distribution*. On smooth bark of trees in the Neotropics. Known from Colombia and Guyana.

*Discussion*. This species differs from all other corticolous *Mazosia* species by the longer ascospores.

*Additional specimen seen*. **Guyana**: Upper Mazaruni District: E-bank of Waruma River, 12 km S of confluence with Kako River, on roots in river bank, c. 550 m, 1985, H. Sipman & A. Aptroot 18638 (B).

***Mazosia viridescens* (Fée) Aptroot & M. Cáceres comb. nov.**

MycoBank No.: MB 805954

Basionym: *Urceolaria viridescens* Fée, *Essai Crypt. Écorc.*: 104 (1824); *Urceolaria bonplandiae* Fée, *Essai Crypt. Écorc.*: tab. 25 (1824), nom. nud.—*Gomphospora viridescens* (Fée) A. Massal., *Ricerc. Auton. Lich. Crost.*: 40 (1852).—*Dirina viridescens* (Fée) Müll. Arg., *Flora* **68**: 506 (1885).—*Platygrapha viridescens* (Fée) Müll. Arg., *Soc. Phys. Hist. Nat., Genève* **29**: 14 (1887).—*Schismatomma viridescens* (Fée.) Zahlbr., *Cat. Lich. Univ.* **2**: 566

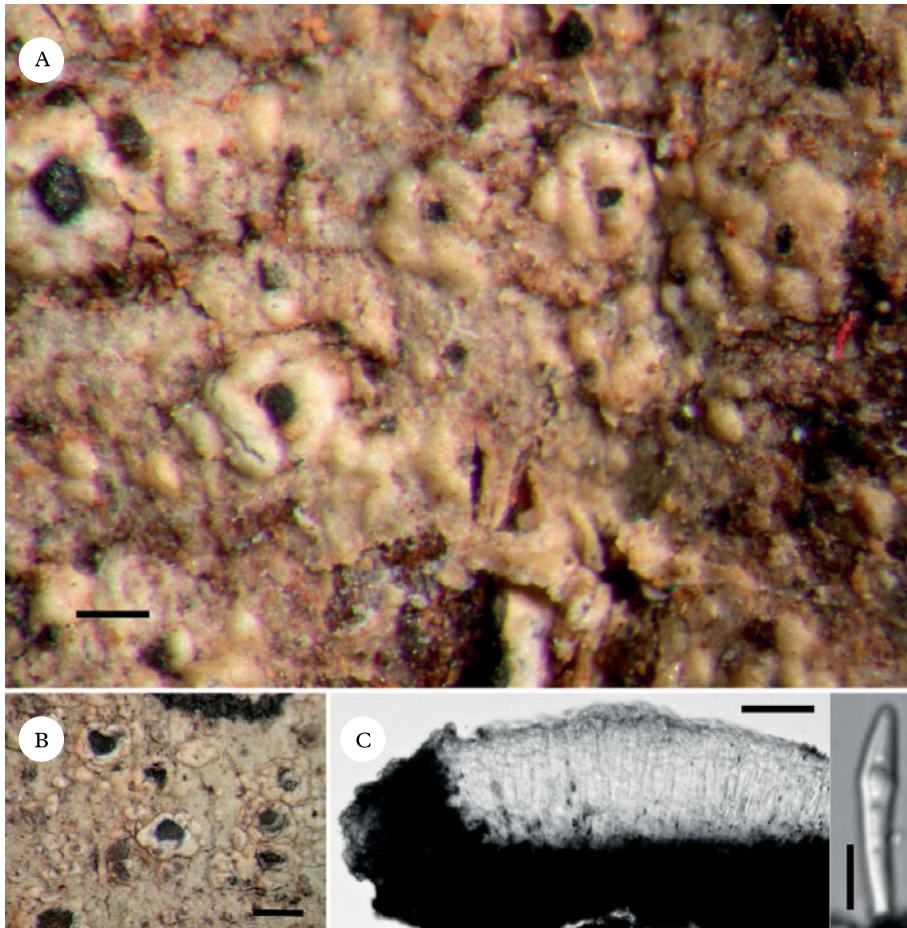


FIG. 4. *Mazosia viridescens*, A, C & D, Santos & Lisboa 12900; B, holotype of *Platygrapha ocellata*. A & B, habitus; C, section through apothecium; inset, ascospore. Scales: A & B = 0.5 mm; C = 50  $\mu$ m, inset = 5  $\mu$ m. In colour online.

(1923); type: South America, on *Bonplandia trifoliata* (G—holotype, not seen).

*Platygrapha ocellata* Nyl., *Acta Soc. Sci. Fennica* 7: 478 (1863).—*Schismatomma ocellatum* (Nyl.) Zahlbr., *Cat. Lich. Univ.* 2: 560 (1923).—*Mazosia ocellata* (Nyl.) R. C. Harris, *Some Florida Lichens*: 43 (1990); type: Colombia, 2000 m, Lindig 2699 (H-NYL 4776—holotype).

(Figs 4 & 5)

*Thallus* crustose, corticate, slightly shiny, grey, rather thick, with irregular and partly confluent warts *c.* 0.1 mm diam. which are filled with hyaline crystals, surrounded by a black prothallus line. *Algae* trentepohlioid.

*Ascomata* immersed in the thallus to slightly emergent, round to usually angular,

0.2–0.4 mm wide; *disc* concave, dark grey to black, not pruinose, margin slightly raised above the disc, grey, often warty and irregular (because of partly confluent thallus warts), *c.* 0.2 mm wide. *Excipulum* hyaline, with tiny hyaline crystals and algal cells. *Hypothecium* black, 45–75  $\mu$ m high, with large hyaline crystals, extending as a rather wide (*c.* 20  $\mu$ m) parathecium between the hamathecium and the excipulum. *Epihymenium* hyaline to pale brown, without conspicuous crystals. *Hamathecium* not interspersed, yellowish, filaments 1.0–1.5  $\mu$ m wide. *Asci* cylindrical, 50–58  $\times$  9–12  $\mu$ m. *Ascospores* 8 per ascus, hyaline, clavate-fusiform, 3-septate,



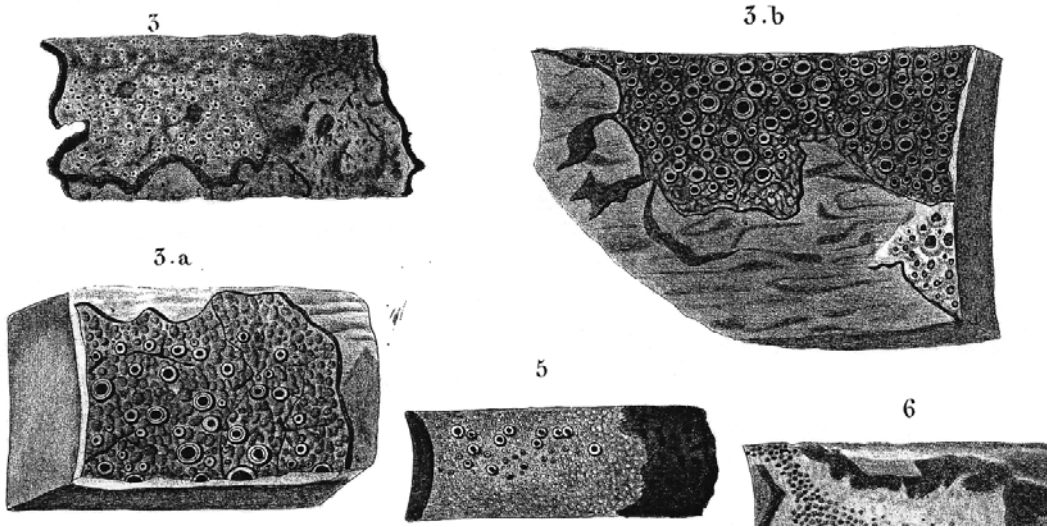


FIG. 5. *Mazosia viridescens*, '3', '3a' & '3b', illustration of holotype, from Fée 1824: tab. 25.

15–18 × 4–5 μm, not constricted at the septa, with pointed ends, second lumen from above bulging out.

*Pycnidia* not observed.

*Chemistry.* Thallus and ascomata UV–, C–, P–, K–. TLC: no substances detected.

*Ecology and distribution.* On smooth bark of trees in the Neotropics, in NE Brazil in transition forest from Mata Atlântica to Caatinga. Occurring together with, for example, *Anisomeridium americanum* (A. Massal.) R. C. Harris.

*Discussion.* This species is somewhat similar to *Mazosia tumidula* (Stirt.) Müll. Arg. (Lücking 2008) but differs by, for example, the more irregular apothecium margin and apothecium outline, the thallus that is not dispersed into rounded patches at the margin but entire, surrounded by a black hypothallus line and having a trentepohlioid photobiont.

*Additional material examined.* **Mexico:** Chiapas: Parque Nacional Lagunas de Montebello, Paso del Soldado, 1500 m, J. Wolf & H. Sipman 2055 (B).—**Guatemala:** Depto. Alta Verapaz: NE of Cobán-Aragón, at the borders of Rio Cahabon, cloud forest, on *Liquidambar styraciflua*, 1700 m, 13 ix 2002, C. Andersohn (B).—**Brazil:** Sergipe: Santa Luzia do Itanhý, Mata do Crasto forest, on bark of tree, 0 m, 2012, V. M. Santos & M. Lisboa

12900 (ISE); Parque Nacional Serra da Itabaiana, c. 400 m, 24 iii 2012, K. A. de Jesus (ISE); Povoada Pedrinhas, Mata da Fazenda Cafuz, M. Cáceres & A. Aprotroot 18366 (ABL, ISE, tlc!).

## Discussion

Most *Mazosia* species are obligately foliicolous, partly common and abundant on living leaves, and rarely occurring on other smooth substrata, such as paint or plastic.

We compared the corticolous species of the genus to similar foliicolous species, and found structural differences between all species. Four corticolous *Mazosia* species can be recognized, and none of them seem to be corticolous specimens of normally foliicolous species.

Only four species so far are known exclusively from bark. It cannot be ruled out *a priori* that they occur also on living leaves. Therefore all similar species are included in the key below, but it is clearly indicated which ones are foliicolous and which are corticolous.

Repeatedly, two different corticolous *Mazosia* were observed side by side in the field, confirming that the observed differences are not phenotypic variation. In the Chapada do Araripe, *M. endonigra* and *M. viridescens*



grow together without intermediates and in the Mata da Fazenda Cafuz, *M. carnea* and *M. viridescens*.

There are relatively few distinguishing morphological characters in the ascospores and other internal apothecium characters. The majority of the species, including all corticolous ones, have fusiform, 3-septate ascospores that are constricted at the septa and of which the cell above the middle is the largest.

These species differ markedly, however, in apothecium morphology and thallus surface. A few species deviate from the general ascoma shape by a more pronounced thalline margin. A key is given here to all 3-septate species of *Mazosia*. For detailed descriptions and nomenclature of the foliicolous species, see Lücking (2008).

Note: all foliicolous species have radiating cells of *Phycopeltis*, while all corticolous species have *Trentepohlia* s. lat. as photobiont.

### World key to *Mazosia* species with 3-septate ascospores

- |        |  |  |
|--------|--|--|
| 1      | Thallus with hairs . . . . .   | 2  |
|        | Thallus without hairs . . . . .  | 3  |
| 2(1)   | Thallus with fine verrucae. Foliicolous . . . . .  | <b>M. tenuissima</b> Lücking & Matzer            |
|        | Thallus smooth. Foliicolous . . . . .  | <b>M. pilosa</b> Kalb & Vězda                    |
| 3(1)   | Thallus with radiating ridges. Foliicolous. . . . .  | <b>M. rotula</b> (Mont.) A. Massal.              |
|        | Thallus without ridges, at most with some ellipsoid warts . . . . .                                    | 4  |
| 4(3)   | Thallus with fine to coarse warts/verrucae . . . . .   | 5  |
|        | Thallus smooth . . . . .   | 9  |
| 5(4)   | Thallus warts fine, regular, c. 0.02–0.05 mm; prothallus usually present. . . . .                      | 6  |
|        | Thallus warts coarser, c. 0.07–0.15 mm, or thallus irregularly verrucose. . . . .                      | 7  |
| 6(5)   | Thallus warts dark brown. Foliicolous . . . . .  | <b>M. bambusae</b> (Vain.) R. Sant.              |
|        | Thallus warts pale. Foliicolous . . . . .  | <b>M. pseudobambusae</b> Kalb & Vězda            |
| 7(5)   | Apothecium margin gently sloping. Foliicolous . . . . .  |  |
|        | . . . . .  | <b>M. melanophthalma</b> (Müll. Arg.) R. Sant.   |
|        | Apothecium margin steeply sloping. . . . .   | 8  |
| 8(7)   | Apothecia round, thallus with a yellowish tone. Foliicolous . . . . .                                  |  |
|        | . . . . .  | <b>M. tumidula</b> (Stirt.) Müll. Arg.           |
|        | Apothecia irregular in outline, thallus without yellowish tone. Corticolous . . . . .                  |  |
|        | . . . . .  | <b>M. viridescens</b> (Fée) Aptroot & M. Cáceres |
| 9(4)   | Ascospores 10–13 µm long. Foliicolous. . . . .   | <b>M. conica</b> Sérus.                          |
|        | Ascospores 15–32 µm long. . . . .  | 10   |
| 10(9)  | Ascospores 22–35 µm long, apothecium margin steeply sloping. Corticolous . . . . .                     |  |
|        | . . . . .  | <b>M. leptosticta</b> (Nyl.) Sparrius            |
|        | Ascospores 15–25 µm long, when spores over 22 µm long, then apothecium margin gently sloping . . . . . | 11   |
| 11(10) | Thallus unevenly cracked to minutely verrucose, apothecia sessile. Corticolous . . . . .               |  |
|        | . . . . .  | <b>M. carnea</b> (Eckf.) R. C. Harris            |
|        | Thallus smooth, apothecia immersed, not much higher than the thallus . . . . .                         | 12   |
| 12(11) | Ascospores 15–18 µm long, apothecium margin steeply sloping. Corticolous . . . . .                     |  |
|        | . . . . .  | <b>M. endonigra</b> A. A. Menezes <i>et al.</i>  |
|        | Ascospores 15–25 µm long, apothecium margin gently sloping. Foliicolous . . . . .                      |  |
|        | . . . . .  | <b>M. phyllosema</b> (Nyl.) Zahlbr.              |

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