Additions to the genera Asterolibertia and Cirsosia (Asterinaceae, Asterinales), with particular reference to species from the Brazilian Cerrado

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Abstract: Four new Asterolibertia species and a new variety of Cirsosia splendida, all found on native Cerrado plants, belonging to three host families are described, illustrated and named as: A. bahiensis sp. nov. on Erythroxylum sp. (Erythroxylaceae); A. bannhensis sp. nov. on Diospyros burchellii (Ebenaceae); A. campograndensis sp. nov. on Hirtella glandulosa (Chrysobalanaceae); A. parinaricola sp. nov. on Parinari obtusifolia (Chrysobalanaceae); and Cirsosia splendida var. laevigata var. nov., showing both sexual and asexual morphs, on H. glandulosa and H. gracilipes (Chrysobalanaceae). Finally, A. licaniae is reported on a new host, H. gracilipes. Keys to all the known species of Asterolibertia and Cirsosia are included.

Key words: biotrophic ascomycetes foliicolous fungi fungal taxonomy neotropical mycodiversity

INTRODUCTION

Molecular data are generally unavailable for members of Asterinaceae and the taxonomy of most genera in this family to date relies chiefly on morphological data. That is the case of Asterolibertia and Cirsosia. Overcoming this limitation will depend on recollecting the taxa described in the past and where appropriate epitypifying these after extracting and sequencing genomic DNA. There have been a few cases where this was performed successfully from old herbarium specimens (Telle & Thines 2008, O’Gorman et al. 2010, Hawksworth 2013, Guatimosim et al. 2015, Thomas et al. 2015).

The genera of Asterinaceae are presently segregated using well-defined morphological characters, such as the presence or absence of appressoria on the external mycelium, setae on ascomata and/or on the external mycelium, appressorium type (intercalary or lateral), and ascospore septation (Bezerra 2004, Hosagoudar 2012). Within the family, only three genera have intercalary appressorium: Asterolibertia, Cirsosia, and Bheemamycyes (Arnaud 1918, Bezerra 2004, Hosagoudar 2010, 2012). However, in Bheemamycyes the appressoria are both lateral and intercalary (Hosagoudar et al. 2010).

For almost a century, Asterolibertia was considered a well-supported genus, due to the presence of intercalary appressoria as originally established by Arnaud (1918), and this has been always regarded as a strong morphological character. However, Hongsanan et al. (2014), without any molecular basis and morphological justification, recombined species of Asterolibertia into Asterina, a genus with species showing only lateral appressoria. Such recombinations must be regarded as questionable, particularly in the absence of molecular data.

Currently, Asterolibertia includes 35 species (Tables 1–2) found only in the tropics and mainly on the host families Chrysobalanaceae, Malpighiaceae, and Rubiaceae (Hosagoudar 2010, Farr & Rossman 2015). The genus Cirsosia accommodates 15 species and one variety, all from the tropics (Tables 3–4), found mainly on Arecaceae, Chrysobalanaceae, Dipterocarpaceae, and Malpighiaceae (Hosagoudar 2010, Farr & Rossman 2015).

Asterolibertia couepiae, the type species of the genus, was collected in the Brazilian Cerrado by Ule in 1892, while C. manaosensis, the type species of Cirsosia, also from Brazil, was collected also by Ule in the Amazonian forest (Arnaud 1918). Asterolibertia species are characterized by having circular toovoidal ascoma opening by a central star-shape fissure, adhering to the host by superficial hyphae with intercalary appressoria, and showing 2-celled ascospores. Cirsosia species differ from Asterolibertia in the lirelliform or V–Y-shaped ascoma, opening by a longitudinal fissure. However, as in Asterolibertia, Cirsosia species have superficial hyphae with intercalary appressoria and 2-celled ascospores (Bezerra 2004, Hosagoudar 2010, 2012). The specimens studied here were collected from different areas of the Brazilian Cerrado (including a fragment of Cerrado vegetation inserted in an area of the Brazilian Atlantic Forest in the State of Bahia) and yielded what is here recognised as novel taxa and host-associations for Asterolibertia and Cirsosia.

This paper describes four new Asterolibertia species, a new variety of C. splendida, and illustrates A. licaniae in association with a new host.
Table 1. Morphometric characteristics of *Asterolibertia* species (µm), including five new ones described in this study.

| *Asterolibertia* Species | Ascomata | Hyphae | Appressoria | Asci | Ascospores | Source and country |
|--------------------------|----------|--------|-------------|------|------------|-------------------|
| anisopterae (Syd. & P. Syd.) Hansf. | < 800 × 300−450 | 6−7 | 15−20 × 10−15 | 50−70 × 45−55 | 28−38 × 17−22 | Hansford (1949), Philippines |
| bahiensis Firmino, Inácio & DiNane | 175−235 | 4−5 | 14−17.5 × 9−10 | 35−52.5 × 30−42.5 | 32.5−37.5 × 10−14 | Present study, Brazil |
| bakeri (Syd. & P. Syd.) Hansf. | < 350 | 3−5 | 10−15 × 5−8 | 50−70 × 30−40 | 26−36 × 12−14 | Hansford (1949), Philippines |
| barrinensis Firmino & DiNane | 105−167.5 | 4−5 | 9−15 × 7.5−10 | 30−42.5 diam | 20−27.5 × 9−12.5 | Present study, Brazil |
| bredemeyerae (Rehm) Arx | 170−280 | 4−5.5 | − | 55−70 × 18−27 | 18−25 × 8−10 | Müller & Arx (1962), Brazil |
| burchelliae (Doidge) Doidge | 90−120 | 3−4 | 5.5−5.5 wide | 27−37.5 × 16−20 | 13−17.5 × 5−6.5 | Doidge (1942), South Africa |
| campograndensis Firmino & DiNane | 75−160 | 5−7 | 9−14 × 7.5−12 | 30−40 × 20−32.5 | 22.5−30 × 9.5−10.5 | Present study, Brazil |
| couepiae (Henn.) G. Arnaud | 150−200 | 6−8 | − | 30−35 × 26−32 | 16−24 × 8−13 | Amaud (1918), Brazil |
| crozetica (Ellis & Everh.) Hansf. | < 400 | 4.5−5.5 | 4.5−5.5 wide | 100 × 20−25 | 25−28 × 8−14 | Hansford (1955), Dominican Republic |
| cryptoareae (Cooke) Hansf. | < 300 | 4−5 | − | 100 × 35 | 25−32 × 11−13 | Hansford (1954b), Australia |
| gibbsa (Gaillard) Hansf. | < 90 | 5−6 | 10−14 × 7−8 | 27−32 × 18−24 | 17−21 × 8−9 | Hansford (1949), Brazil |
| hiiranensis (W. Yamam.) W. Yamam. | 35−62 | 3−4.5 | 7−11 × 5.5−7 | 23−30 × 16−24 | 14−16 × 6.5−7 | Yamamoto (1957), Taiwan |
| hydnocarpi Hosag. & T.K. Abraham | < 264 | 11−13.5 | 14−16 × 11−13.5 | < 67 diam | 49−51.5 × 26−32.5 | Hosagoudar & Abraham (1997), India |
| inaequalis (Mont.) Toro | 180−280 | 6−9 | 9−14 wide | 100 diam | 32−40 × 18−25 | Toro (1933), French Guiana |
| licaniica (Cooke) Hansf. | < 450 × 300 | 6−9 | 7−13 × 9−13 | − | − | − |
| licaniicola Hansf. | 170 | 4−5 | 9−11 × 6−7 | − | − | − |
| malpighii Bat. & H. Maia | 120−185 | 4−8 | 13.5−21 × 4−8 | 37−43 × 27−32 | 29−35 × 15−16.5 | Batista & Maia (1960a), Brazil |
| mangiferae Hansf. & Thirum. | 250−300 | 7 | 12−15 × 10−11 | < 70 diam | 35−42 × 16−19 | Hansford & Thirumalachar (1948), India |
| megathyria (Doidge) Doidge | 140−200 | 5−6 | 7.5−10 wide | 27−40 × 15−20 | 16−20 × 8−9 | Doidge (1942), South Africa |
| nodulosa (Speg.) Hansf. | < 250 | 5−6 | 10−15 × 10−12 | 100 × 50 | 30−40 × 14−18 | Hansford (1949), Costa Rica |
| nothopegiae Hosag. & T.K. Abraham | < 265 | 5−7 | 10−12 × 9.5−11 | 32−35 × 24−27 | 19−21 × 9−10 | Hosagoudar & Abraham (1997), India |
| parinaricola Firmino, Inácio et al. | 150−207.5 | 4.5−5.5 | 10−15 × 7−9 | 37.5−47.5 × 29−32.5 | 34−40 × 10−14 | Present study, Brazil |
| parinarii (Syd.) Hansf. | 130−160 | 3−4.5 | 6.5−7.5 × 5−6 | 30−38 × 25−35 | 18−22.5 × 5−6 | Hansford (1947), Democratic Republic of the Congo |
| peruviana Hansf. | 200 | 4−6 | 4−6 wide | − | 17 × 8 | Hansford (1954a), Peru |
| pogonophile Bat. & H. Maia. | 125−175 | 4−6 | 10−12 × 6−8 | 43−55 × 33−35 | 33−35 × 10−12 | Batista et al. (1961), Brazil |
| randiae (Doidge) Arx | 75−100 | 2−4 | 20 × 5−8 | − | 15−18 × 5−6.5 | Müller & Arx (1962), Southern Africa |
| santiriae (Syd. & P. Syd.) Hansf. | 400 × 250−300 | 5−7 | 15−20 × 8−10 | 50−75 × 45−60 | 32−36 × 17−22 | Hansford (1954a), Philippines |
| schroeteri (Rehm) Arx | 220−300 | 6−8 | 10−13 wide | 60−70 × 42−46 | 38−42 × 11−13 | Müller & Arx (1962), Brazil |
| sporoboli E. Castell. & Graniti | 60−110 | 6 | 6−16 × 7−10 | − | 16−22 × 7−9 | Castellani & Graniti (1950), Ethiopia |
| thaxteri Hansf. | 250 | 3−5 | 6−7 × 4−7 | − | 50−55 × 21−24 | Hansford (1957), Grenada |
| ulei Hansf. | 200 | 6−7 | 8−12 × 9−11 | − | 24−30 × 12−17 | Hansford (1949), Brazil |
| vateriae Hosag. | 300−400 × 150−250 | 11−13 | 10−15 × 2−14 | < 35 diam | 36−39 × 21−23 | Hosagoudar et al. (2006), India |
MATERIAL AND METHODS

Leaves bearing black colonies were collected and dried in a plant press before being processed and deposited in the Fungarium known as the UB Mycological Collection, a part of Herbarium UB (Universidade de Brasília). Colonies were initially examined using a Zeiss Discovery v.8 stereomicroscope. Entire colonies were removed from the leaves by applying small drops of nail polish. After these had solidified and fungal structures became embedded preventing the collapse of the colonies, these were peeled from the leaf surfaces. These colonies and small samples taken directly from the leaves were mounted on slides containing lacto-glycerol for light microscopic observations. Imaging and measurements were done using a Leica DM 2500 light microscope adapted with a DFC 490 Leica digital camera, operated by a Leica Qwin Plus digital image-processing software. For scanning electron microscopy (SEM), air-dried material was fixed to disks using carbon double-sided tape, and then treated with gold using a 25-mA current, at 1.10–2 mbar for 2 min and 30 s. Photographs were obtained using a JEOL Model JSM-701 F SEM.

RESULTS

A total of 35 species of Asterolibertia have previously been described on 19 different host families (Hosagoudar 2010, Farr & Rossman 2015). These have been described on the families: Chrysobalanaceae (9 species, including two new species described here), Rubiaceae (4); Anacardiaceae, Annonaceae, Dipterocarpaceae, Fabaceae, and Malpighiaceae (2 on each); and Achariaceae, Arecaceae, Bignoniaceae, Bromeliaceae, Burseraceae, Ebenaceae (described here), Erythroxylaceae (described here), Euphorbiaceae, Lauraceae, Melastomataceae, Myrtaceae, Poaceae, Polygalaceae, and Styracaceae (1 on each; Table 2). Asterolibertia bredemeyerae was reported from two different families (Polygalaceae and Fabaceae), as well as A. Schroeteri (Annonaceae and Chrysobalanaceae) and A. peruviana (Bignoniaceae and Chrysobalanaceae). However, A. peruviana apparently belongs to Microthyriaceae due to the well-defined circular ostiole present on the ascomata (Hansford 1955, Wu et al. 2011). As Asterolibertia species are usually host specific, a reevaluation of the three species that occur in two different host families is recommended.

A total of 15 species and one variety of Cirsosia have been described on six different host families (Hosagoudar 2010, Hofmann & Piepenbring 2014, Farr & Rossman 2015): Dipterocarpaceae (5 species); Arecaceae (4); Chrysobalanaceae (3, including the new variety described here); Malpighiaceae (2); and Burseraceae and Lauraceae (1 on each; Table 4). There is no record of the same Cirsosia species being found on two different host families (Hosagoudar 2010, Farr & Rossman 2015).

TAXONOMY

The data in Tables 1–4 that include the characteristics of the new taxa herein proposed were used to formulate the keys provided for the identification of Asterolibertia and Cirsosia species, thus simplifying the text.

Asterolibertia bahiensis Firmino, Inácio & Dianese, sp. nov.
MycoBank MB813315
(Fig. 1)

Etymology: Refers to the state of Bahia where the fungus was collected.

Diagnosis: Asterolibertia bahiensis is quite close to A. nodulifera but differs in having smaller paraphysate ascomata and larger appressoria.

Type: Brazil: Bahia: Una, Bolandeira Farm, on an enclosure of Cerrado vegetation in the Brazilian Atlantic Forest, close to the entrance to Comandatuba Island, 15° 21’ 12.7” S 39° 00’ 7.7” W, on leaves of Erythroxylum sp. (Erythroxylaceae), 26 Aug. 1995, M. Sanchez (UB-Myclol Col. 9882 – holotype).

Description: Colonies amphigenous, circular to irregular, single to confluent, black, 1–12 mm diam. Hyphae straight to flexuous, branching irregularly, pale brown, septate, hyphal cells cylindrical, 4–5 μm diam, smooth. Appressoria numerous, entire, sessile, intercalary, elongated with a lateral protuberance, unicellular, 14–17.5 × 9–10 μm, brown, penetration peg central on the appressorial cell. Ascomata superficial, thyrothecia, scutiform, on top of mycelial mat, circular, single to confluent, fringed at margins, randomly distributed in the colony, 175–235 μm diam, opening by a central star-shaped fissure, dark brown; wall of textura radiata, cells cylindrical. Pseudoparaphyses cylindrical, septate, branched, hyaline, to 1 μm wide. Asci bitunicate in structure, fissitunicate, disposed as an upright palisade layer, globose to ovoid, 8-spored, hyaline, 35–52.5 × 30–42.5 μm. Ascospores cylindrical, ends rounded, straight or slightly arched, 1-septate, constricted at the septum at the supramedian septum, hyaline, becoming brown at maturity, verruculose, 32.5–37.5 × 10–14 μm. Asexual morph not seen.

Other specimens examined: On leaves of Erythroxylum sp. (Erythroxylaceae). Brazil: Minas Gerais: Buritis, Pedra Grande Farm, 8 May 1993, J. C. Dianese 863 (UB-Myclol Col. 3934). Bahia: Una, on an enclosure of Cerrado vegetation in the Brazilian Atlantic Forest at Fazenda Bolandeira, near entrance to Comandatuba Island, J.C. Dianese (UB-Myclol Col. 9871).

Notes: The type material was collected in a rare small enclosure of Cerrado vegetation in the Brazilian Atlantic Forest. However another specimen (UB – Mycol Col. 3934) was found in a typical Cerrado natural landscape in Buritis, Minas Gerais. In addition, this is the first Asterolibertia species found on a member of Erythroxylaceae (Hosagoudar 2010, Farr & Rossman 2015).
Table 2. Summary of the main characteristics of *Asterolibertia* species indicating respective host family, host species, and morphology of colonies, appressoria, paraphyses, asci, and ascospores.

| Species     | Host                     | Families              | Colonies          | Appressoria      | Pseudoparaphyses | Asci                              | Ascospores                                      |
|-------------|--------------------------|-----------------------|-------------------|------------------|------------------|-----------------------------------|-------------------------------------------------|
| anisopterae | Anisoptera thurifera     | Dipterocarpaceae      | epiphyllous       | protuberance     | absent           | globose                           | constricted in the upper third, verruculose      |
|             |                          |                       |                   | towards one side|                  |                                   |                                                 |
| bahiensis sp.nov. | Erythroxylum sp.   | Erythroxylaceae       | amphigenous       | protuberance     | branched         | globose to ovoid                  | constricted in the upper third, verruculose      |
|             |                          |                       |                   | towards one side|                  |                                   |                                                 |
| bakeri      | Calamus sp.              | Arecaceae             | epiphyllous       | barrel-shaped    | absent           | ovoid                             | constricted in the upper third, verruculose      |
|             |                          |                       |                   | to subglobose    |                  |                                   |                                                 |
| barrinhensis sp.nov. | Diospyrus burchellii | Ebenaceae             | epiphyllous       | protuberance     | unbranched       | globose to ovoid                  | constricted in the upper third, verruculose      |
|             |                          |                       |                   | towards one side|                  |                                   |                                                 |
| brede Meyeriae | Bredemeyer lucida    | Polygalaceae          | amphigenous       | subglobose       | unbranched       | ovoid to clavate-cylindrical      | constricted at the central septum, smooth        |
|             | Sweetia nitens          | Fabaceae              |                   |                  |                  |                                   |                                                 |
| burchelliae | Bertiera racemosa       | Rubiaceae             | epiphyllous       | barrel-shaped    | absent           | ellipsoid-ovoid                   | constricted in the upper third, smooth           |
|             | Burchella babalina      |                       |                   | to cylindrical   |                  |                                   |                                                 |
|             | Crema sp. triliril      |                       |                   |                  |                  |                                   |                                                 |
|             | Tarenna pavettoides     |                       |                   |                  |                  |                                   |                                                 |
| campogradensis sp.nov. | Hirtella glandulosa | Chrysobalanaceae      | epiphyllous       | protuberance     | unbranched       | globose to ovoid                  | constricted in the upper third, smooth           |
|             |                          |                       |                   | towards one side|                  |                                   |                                                 |
| couepiae    | Couepia grandiflora     | Chrysobalanaceae      | epiphyllous       | protuberance     | absent           | globose to subglobose             | constricted in the upper third, smooth           |
|             |                          |                       |                   | towards one side|                  |                                   |                                                 |
| crustacea   | Psidium guajava         | Myrtaceae             | epiphyllous       | cylindrical      | absent           | clavate to cylindrical            | constricted in the upper third, smooth           |
| crypto caryae | Cryptocarya grandis    | Lauraceae             | amphigenous       | -                | absent           | ellipsoid                        | constricted in the upper third, smooth           |
| gibbosa     | Basanacantha spinosa     | Rubiaceae             | amphigenous       | barrel-shaped    | absent           | ovoid to globose                  | constricted in the upper third, smooth           |
|             |                         |                       |                   | to cylindrical   |                  |                                   |                                                 |
| hiiranensis | Styrax hayataianus      | Styraceae             | epiphyllous       | -                | absent           | obovoid to subglobose             | constricted at the central septum, smooth        |
|             | Styrax suberilolius     |                       |                   |                  |                  |                                   |                                                 |
| hydencarpri | Hydrococcus macrocarpa  | Achariaceae           | epiphyllous       | globose          | -                | globose                           | constricted in the upper third, smooth           |
|             |                          |                       |                   | to ovoid         |                  |                                   |                                                 |
| inaequalis  | Melastomataceae         | Melastomataceae       | epiphyllous       | barrel-shaped    | absent           | subglobose                        | constricted in the upper third, verruculose      |
|             | member                  |                       |                   | to subglobose    |                  |                                   |                                                 |
| licaniae    | Licania sp.              | Chrysobalanaceae      | epiphyllous       | barrel-shaped    | absent           | globose                           | constricted at the central septum, smooth        |
|             |                         |                       |                   |                  |                  |                                   |                                                 |
| licanicola  | Licania sp.              | Chrysobalanaceae      | epiphyllous       | barrel-shaped    | absent           | -                                | constricted at the central septum, smooth        |
|             |                         |                       |                   |                  |                  |                                   |                                                 |
| malpighii   | Malpighiaeae member      | Malpighiaeae          | epiphyllous       | protuberance     | absent           | ellipsoid to subglobose           | constricted at the central septum, verruculose   |
|             |                          |                       |                   | towards one side|                  |                                   |                                                 |
| mangiferae  | Mangifera indica        | Anacardiaceae         | epiphyllous       | barrel-shaped    | absent           | globose                           | constricted in the upper third, smooth           |
|             |                          |                       |                   |                  |                  |                                   |                                                 |
|              |                          |                       |                   |                  |                  |                                   |                                                 |
### Table 2. (Continued).

| Species | Host | Families | Colonies | Appressoria | Pseudoparaphyses | Asci | Ascospores |
|---------|------|----------|----------|-------------|------------------|------|------------|
| megathyria | Tricalysia capensis | Rubiaceae | amphigenous | barrel-shaped | − | ovoid to clavate-cylindrical | constricted in the upper third, smooth |
|          | T. lanceolata and T. sonderiana | | | | | | |
| myocoproides | Guzmania plumieri | Bromeliaceae | amphigenous | − | branched | ovoid to cylindrical | constricted at the central septum, verruculose |
| nodulifera | Angelesia splendens | Chrysobalanaceae | amphigenous | protuberance towards one side | absent | globose to ovoid | constricted in the upper third, verruculose |
| nodulosa | Guatteria dolichopoda | Annonaceae | epiphyllous | barrel-shaped to subglobose | absent | ovoid to ellipsoid | constricted at the central septum, verruculose |
| nothopegiae | Nothopegia aureofulva | Anacardiaceae | epiphyllous | globose | − | ovoid | constricted at the central septum, smooth |
| parinaricola sp. nov. | Parinaria obtusifolia | Chrysobalanaceae | epiphyllous | protuberance towards one side | branched | globose to ovoid | constricted in the upper third, verruculose |
| parinani | Parinaria subcordata | Chrysobalanaceae | epiphyllous | protuberance towards one side | unbranched | ellipsoid to subglobose | constricted in the upper third, smooth |
| peruviana | Bignoniceae member | Licania macrophylla | Bignoniaceae | epiphyllous | cylindrical | − | − | constricted in the upper third, smooth |
| pogonophorae | Pogonophora schomburgkiana | Euphorbiaceae | epiphyllous | protuberance towards one side | absent | oblong to subglobose | constricted in the upper third, smooth |
| randiae | Randia dumetorum, Keetia gueinzii, Canthium capensis | Rubiaceae | amphigenous | protuberance towards one side | − | ovoid to subclavate | constricted in the upper third, smooth |
| santiriae | Santiria sp., Licania macrophylla | Burseraceae | amphigenous | globose | − | ovoid to ellipsoid | constricted in the upper third, smooth |
| schroeteri | Annona sp., Chrysobalanus icaco | Annonaceae | epiphyllous | protuberance towards one side | absent | ovoid to ellipsoid | constricted in the upper third, smooth |
| spatholobi | Spatholobus ferrugineus | Fabaceae | epiphyllous | barrel-shaped to cylindrical | absent | ovoid to globose | constricted in the upper third, smooth |
| sporoboli | Sporobolus rupiolianus | Poaceae | epiphyllous | globose to ellipsoid | − | − | constricted in the upper third, verruculose |
| thaxteri | unknown plant | − | | hypophyllous | − | − | − | constricted in the upper third |
| ulei | Malpighiaeae member | Malpighiaceae | epiphyllous | subglobose | absent | ovoid to globose | constricted in the upper third, verruculose |
| vateriae | Vateria indica | Dipterocarpaceae | amphigenous | oblong to ovoid | − | ovoid to globose | constricted at the central septum, smooth |
Fig. 1. A–H. Asterolibertia bahiensis (UB-Mycol. Col. 9882 – holotype): A. Colony showing thyriothecial ascomata on superficial mycelium. B. Central star-shape fissure in SEM. C. Intercalary appressoria with lateral protuberance. D. Immature ascus. E. Globose to ovoid mature ascus. F. Immature ascospores. G. Brown, verruculose, cylindrical ascospores. H. Verruculose ascospores in SEM. Bars: A = 100 μm; B = 50 μm, and all others = 10 μm.
**Asterolibertia barrinhensis** Firmino & Dianese, sp. nov.  
MycoBank MB813316  
(Fig. 2)

**Etymology**: Epithet refers to the type locality in Brazil, Barrinha.

**Diagnosis**: *Asterolibertia barrinhensis* is quite close to *A. campograndensis* but differs in having opposite hyphal branching, loose ascomatal fringes and verrucose ascospores.

**Type**: Brazil: Minas Gerais: Divinópolis, Barrinha Farm, right side of Highway from Divinópolis to Formiga, 20° 13' 54.9" S 45° 06' 33.7" W, on leaves of *Diospyros burchellii* (Ebenaceae), 16 Feb. 1994, J. C. Dianese (UB-Mycol Col. 5890 – holotype).

**Description**: Colonies epiphyllous, circular to irregular, single to confluent, black, 1–6 mm diam. *Hyphae* straight to flexuous, mostly showing opposite seldom irregular branches, ferruginous to brown, septate, hyphal cells cylindrical, 5–7 μm diam, smooth. *Appressoria* numerous, entire, intercalary, elongated with a lateral protuberance, unicellular, 9–14 × 7.5–12 μm, ferruginous to brown, penetration peg central on the appressorial cells. *Ascomata* superficial, thyriothecia, scutiform, on top of mycelial mat, circular, single to confluent, fringed at margins, massed in the centre of the colony, 75–160 μm diam, opening by a central star-shaped fissure, dark brown; wall of *textura radiata* to *irregulata*, cells cylindrical to irregular. *Pseudoparaphyses* cylindrical, septate, unbranched, hyaline, to 1 μm wide. *Asci* bitunicate in structure, fissitunicate, disposed as an upright pulvinate layer, globose to ovoid, 8-spored, hyaline, 30–40 × 20–32.5 μm. *Ascospores* oblong-clavate, rounded ends, straight, 1–septate, septum supramedian, constricted at septum, hyaline, becoming brown at maturity, smooth, 22.5–30 × 9.5–10.5 μm. Asexual morph not seen.

Other specimens examined: On leaves of *Diospyros burchellii* (Ebenaceae). Brazil: Minas Gerais: Divinópolis, Barrinha, 16 Feb. 1994, J. C. Dianese (UB-Mycol Col. 5891, and 5901); Goiás: Mineiros, Parque Nacional das Emas, Água Ruim, 18° 8' 12.04" S 52° 58' 44.06" W, 7 Apr. 1997, J. C. Dianese (UB-Mycol Col. 13844).

**Notes**: This new *Asterolibertia* species is the first reported on a member of *Ebenaceae* (Hosagoudar 2010, Farr & Rossman 2015). It shows characteristics in common with several species (Table 1–2), including the one described below, but clear differences persist as shown in the discussion that follows the description of *A. campograndensis*.

**Asterolibertia campograndensis** Firmino & Dianese, sp. nov.  
MycoBank MB813317  
(Fig. 3)

**Etymology**: Epithet refers to the city where the fungus was collected, Campo Grande.

**Diagnosis**: *Asterolibertia campograndensis* differs from *A. parinarii* in having larger hyphae, appressoria and ascospores, and globose to ovoid asci.

**Type**: Brazil: Mato Grosso do Sul: Campo Grande, left lane of BR-163 Highway, 200 m from the roundabout turn to São Paulo, behind Cerealista Juliana, 20° 35' 8.58" S 54° 34' 49.51" W, on leaves of *Hirtella glandulosa* (*Chrysobalanaceae*), 22 Aug. 1996, M. Sanchez (UB-Mycol Col. 12712a – holotype).

**Description**: Colonies epiphyllous, circular to irregular, single to confluent, black, 1–6 mm diam. *Hyphae* straight to flexuous, mostly showing opposite seldom irregular branches, ferruginous to brown, septate, hyphal cells cylindrical, 5–7 μm diam, smooth. *Appressoria* numerous, entire, intercalary, elongated with a lateral protuberance, unicellular, 9–14 × 7.5–12 μm, ferruginous to brown, penetration peg central on the appressorial cells. *Ascomata* superficial, thyriothecia, scutiform, on top of mycelial mat, circular, single to confluent, fringed at margins, massed in the centre of the colony, 75–160 μm diam, opening by a central star-shaped fissure, dark brown; wall of *textura radiata* to *irregulata*, cells cylindrical to irregular. *Pseudoparaphyses* cylindrical, septate, unbranched, hyaline, to 1 μm wide. *Asci* bitunicate in structure, fissitunicate, disposed as an upright pulvinate layer, globose to ovoid, 8-spored, hyaline, 30–40 × 20–32.5 μm. * Ascospores* oblong-clavate, rounded ends, straight, 1–septate, septum supramedian, constricted at septum, hyaline, becoming brown at maturity, smooth, 22.5–30 × 9.5–10.5 μm. Asexual morph not seen.

**Notes**: Seven species of *Asterolibertia* have been reported previously in association with living leaves of *chrysobalanaceous* hosts. Four of these were recorded from Brazil: *A. couepiae* on *Couepia grandiflora*, *A. licaniae* and *A. licanicola* on *Licania* sp., and *A. peruviana* on *Licania macrophylla*. Additionally, *A. nodulifera* was recorded on *Angelesia splendens* from the Philippines, *A. parinarii* on *Parinari subcordata* from the Democratic Republic of the Congo, and *A. Schroeteri* on *Chrysobalanus icaco* from India (Arnaud 1918, Hansford 1947, 1949, 1955, Müller & von Arx 1962, Hosagoudar 2010, Hofmann & Piepenbring 2014, Farr & Rossman 2015).

*Asterolibertia campograndensis* differs from the species previously reported on *Chrysobalanaceae* (Table 1) (Arnaud 1918, Hansford 1947, 1949, 1955, Müller & von Arx 1962, Hosagoudar 2010, Hofmann & Piepenbring 2014, Farr & Rossman 2015). It is closest to *A. parinarii*, which has smaller appressoria and ascospores, narrower hyphae, and ellipsoid to subglobose asci. *Asterolibertia couepiae* is distinct from the new species in having black hyphae, larger thyriothelial ascomata, lacking pseudoparaphyses, 4–6-spored asci, and ovoid ascospores. *Asterolibertia nodulifera* has amphiogenous colonies, no pseudoparaphyses, larger ascomata and larger, echinulate ascospores. *Asterolibertia licaniae* differs from *A. campograndensis* in the dark brown hyphae, barrel-shaped and larger appressoria, ascomatal dehiscence by an irregular fissure, a lack of fringes at the margins of the ascomata, the absence of pseudoparaphyses, and finally larger, ellipsoidal, dark brown ascospores with a central septum. *Asterolibertia*
Fig. 2. A–H. *Asterolibertia barrinhensis* (UB-Mycol. Col. 5890 – holotype): A. Colony showing thyriothecial ascomata on superficial mycelium. B. Ascomata showing central star-shape fissure in SEM. C. Superficial mycelium showing intercalary appressoria. D. Intercalary appressoria with lateral protuberance. E. Globose to ovoid mature ascus. F. Immature ascospores. G. Brown smooth cylindrical to oblong-clavate ascospores. H. Smooth ascospores in SEM. Bars: A = 100 μm; B = 50 μm, and all others = 10 μm.
Fig. 3. A–H. *Asterolibertia campograndensis* (UB-Mycol. Col. 12712a – holotype): A. Colony showing thyriothecial ascomata on superficial mycelium. B. Ascomata showing central star-shape fissure in SEM. C. Superficial mycelium with intercalary appressoria. D. Intercalary appressoria with lateral protuberance. E. Immature ascus. F. Globose to ovoid mature ascus. G. Light brown immature ascospores. H. Brown, smooth, oblong-clavate ascospores, constricted at septum on its upper third. Bars: A = 100 μm; B, C = 50 μm, and all others = 10 μm.
licanicola differs from A. campograndensis in the wider hyphae, barrel-shaped appressoria, larger ascocoma, absence of pseudoparaphyses, and dark brown ascospores with a central septum. Asteroilibertia peruviana has narrower appressoria, larger ascocoma that are not fringed at the margins, and smaller appressoria and ascospores. Asteroilibertia Schroeteri differs in the larger ascocoma with an irregular fissure, the absence of pseudoparaphyses, and larger asci and ascospores (Tables 1–2) (Arnaud 1918, Hansford 1947, 1949, 1955, Müller & von Arx 1962, Hofmann & Piepenbring 2014).

Asteroilibertia campograndensis is morphologically rather similar to A. barrinensis. However, these species differ in important morphological details such as ascospore ornamentation, the shape of the ascocoma fringes (loosely set in A. barrinensis), and hyphal branching patterns (opposite in A. barrinensis, and irregular in A. campograndensis).

Asteroilibertia campograndensis is the fifth species of Asteroilibertia reported on hosts belonging to Chrysobalanaceae in Brazil, and the first on Hirtella.

Asteroilibertia parinaricola Firmino, Inácio & Dianeese, sp. nov.
MycoBank MB813319 (Fig. 4)

Etymology: Refers to the host genus, Parinari.

Diagnosis: Asteroilibertia parinaricola differs from A. licanicola in having conspicuous lateral protuberance of the appressoria, presence of pseudoparaphyses, and much larger, verruculose ascospores constricted at a supramedian septum.

**Type**: Brazil: Distrito Federal: Brasília, PAD-DF, on leaves of Parinari obtusifolia (Chrysobalanaceae), 10 Nov. 1992, C. Furlanetto (UB-Mycol Col. 2567 – holotype).

Description: Colonies epiphyllous, circular or irregular, single or confluent, black, 3–10 mm diam. Hyphae straight, with opposite branches, brown, septate, hyphal cells cylindrical, 4.5–5.5 μm diam, smooth. Appressoria numerous, entire, intercalary, elliptical or with a lateral protuberance, unicellular, 10–15 × 7–9 μm, brown, penetration peg central on the appressorial cells. Ascomata superficial, thryotheca, scutiform, on top of a mycelial mat, circular, single to confluent, fringed at the margins, randomly distributed in the colony, 150–207 μm diam, opening by a central star-shaped fissure, dark brown; wall texture radiata, with isodiametrical cells. Pseudoparaphyses cylindrical, septate, branched, hyaline, 1–1.5 μm wide. Asci bitunicate in structure, fissitunicate, disposed as an upright palisade layer, globose to ovoid, 8-spored, hyaline, 37.5–47.5 × 29–32.5 μm. Ascospores oblong to oblong-clavate, ends rounded, straight to slightly arched, 1-septate, constricted at the supramedian septum, hyaline, becoming pale brown to brown at maturity, verruculose, 34–40 × 10–14 μm. Asexual morph not seen.

Other specimens examined: On leaves of Parinari obtusifolia (Chrysobalanaceae). Brazil: Maranhão: Nogueiras, 60 km North of Balsas, 6° 57' 52.47" S 46° 10' 13.19" W, 11 Apr. 1995, M. A. de Freitas (UB-Mycol Col. 8020). Distrito Federal: Brasília, PAD-DF; 04 Nov. 1993, C. Furlanetto (UB-Mycol Col. 2568 and 2569). Notes: Seven species of Asteroilibertia have been reported previously in association with living leaves of chrysobalanaceous hosts. Asteroilibertia couepiae on Couepia grandiflora from Brazil, A. nodulifera on Angelesia splendens from the Philippines, A. licaniae and A. licanicola on Licania sp. from Brazil, A. parinarii on Parinari subcordata from the Democratic Republic of the Congo, A. peruviana on Licania macrophylla from Brazil, and A. Schroeteri on Chrysobalanus icaco from India (Arnaud 1918, Hansford 1947, 1949, 1955, Müller & von Arx 1962, Hosagoudar 2010, Hofmann & Piepenbring 2014, Farr & Rossman 2015).

Asteroilibertia parinaricola differs from the species previously reported on Chrysobalanaceae (Table 1) (Arnaud 1918, Hansford 1947, 1949, 1955, Müller & von Arx 1962, Hosagoudar 2010, Hofmann & Piepenbring 2014, Farr & Rossman 2015), and is most similar to A. licanicola. However, the latter has barrel-shaped appressoria, no pseudoparaphyses, and much smaller, smooth ascospores constricted at the central septum. Asteroilibertia couepiae differs from the new species in the wider hyphae, lack of pseudoparaphyses, smaller asci and ascospores, and smooth ascospores. Asteroilibertia nodulifera differs in the larger thyrothecia, asci bitunicate in structure, and represents the sixth species of Asteroilibertia reported on this host family in Brazil. This is the second species of Asteroilibertia described on Parinari, and the first species found on P. obtusifolia.
Asterolibertia and Cirsosia from the Cerrado

Fig. 4. A–H. *Asterolibertia parinaricola* (UB-Mycol. Col. 2567 – holotype): A. Colony showing thyriothecal ascomata on superficial mycelium. B. Ascomata showing central star-shape fissure in SEM. C. Superficial mycelium with intercalary appressoria. D. Intercalary elliptic appressoria showing a lateral protuberance. E. Globose to ovoid immature ascus. F. Mature ascus. G. Pale brown to brown, ascospores, constricted at septum on its upper third. H. Verrucolose ascospores on SEM. Bars: A, B = 100 μm; C = 50 μm, and all others = 10 μm.
Fig. 5. A–H. *Asterolibertia licaniae* (UB-Mycol. Col. 9715): A. Colony showing thyriothecial ascomata on superficial mycelium. B. Ascomata showing central to irregular fissure in SEM. C. Superficial mycelium with intercalary appressoria. D. Intercalary, elliptical appressoria. E–F. Globose immature asci. G. Immature ascospores. H. Brown to ferruginous smooth ascospores constricted at middle septum. Bars: A, B = 100 μm; C = 50 μm, and all others = 10 μm.
**Specimen examined:** Brazil: Rondônia: RO-494 Highway, 82 km from Pimenta Bueno towards Parecis, 11° 45’ 16.43” S 61° 18’ 54.45” W, on leaves of *Hirtella gracilipes* (Chrysobalanaceae), 13 Jul. 1995, M. Sanchez (UB-Mycol Col. 9715).

**Description:** Colonies epiphyllous, circular to irregular, single to confluent, dark brown to black, 3–5 mm diam. Hyphae straight or flexuous, branching irregularly, pale brown to brown, septate, hyphal cells cylindrical, 5–8 μm diam, smooth. *Appressoria* numerous, entire, intercalary, elliptical, unicellular, 9–15 × 7.5–10 μm, pale brown, penetration peg central on the appressorial cell. *Ascomata*, superficial, thyriothecial, scutiform, radiate, arising on top of a mycelial mat, circular, single to confluent, fringed at the margins, randomly distributed in the colony, 180–410 μm diam, opening by a central star-shaped fissure, dark brown; wall *textura radiata*, cells cylindrical. *Pseudoparaphyses* cylindrical, septate, branched, hyaline, 1–1.5 μm wide. *Asci* bitunicate in structure, fissitunicate, disposed as an upright palisade layer, globose, 8-spored, hyaline, 57.5–65 μm diam. *Ascospores* oblong, ends rounded, straight, 1-septate, constricted at the median septum, hyaline, becoming brown to ferruginous at maturity, smooth, 30–35 × 19–22.5 μm. Asexual morph not seen.

**Notes:** The specimen described above was collected in the state of Rondônia on living leaves of *Hirtella gracilipes*, a new host for *A. licaniae*. This species was originally described by Hansford (1949) based on material from Brazil collected on leaves of *Licania* sp.

### Key to the known *Asterolibertia* species

See Tables 1–2 for further information on the characters of the species keyed out here.

1. Colonies amphigenous or epiphyllous ................................................................. 2
   Colonies hypiphyllous ......................................................................................... A. thaxteri

2 (1) Ascospores smooth ....................................................................................... 3
   Ascospores verruculose ..................................................................................... 24

3 (2) Ascospores medianly constricted ................................................................... 4
   Ascospores constricted supramedianly ............................................................. 9

4 (3) Ascomata with fringed margin ...................................................................... 5
   Ascomata with uniform margin ........................................................................ A. licaniae

5 (4) Ascomata opening by a stellar fissure ......................................................... 6
   Ascomata opening by an irregular fissure .......................................................... A. vateriae

6 (5) Colonies epiphyllous ...................................................................................... 7
   Colonies amphigenous ..................................................................................... A. bredemeyerae

7 (6) Ascospores more than 16 μm in length ....................................................... 8
   Ascospores 14–16 × 6.5–7 μm ........................................................................ A. hiiranensis

8 (7) Ascospores 19–21 × 9–10 μm ................................................................. A. nothopegiae
   Ascospores 24–28 × 12–15 μm ....................................................................... A. licaniicola

9 (3) Colonies amphigenous ................................................................................... 10
   Colonies epiphyllous ....................................................................................... 14

10 (9) Ascomata with a fringed margin .................................................................. 11
   Ascomata with a uniform margin ................................................................... 12

11 (10) Ascospores 15–18 × 5–6.5 μm ............................................................... A. randiae
   Ascospores 32–36 × 17–22 μm ....................................................................... A. santiriae

12 (10) Ascomata over 90 μm diam ................................................................. A. gibbosa

13 (12) Ascospores 16–20 × 8–9 μm ............................................................... A. megathyria
   Ascospores 25–32 × 11–13 μm ....................................................................... A. cryptocaryae

14 (9) Ascomata opening by stellar or irregular fissure ...................................... A. peruviana
| Step | Description | Outcome |
|------|-------------|---------|
| 15 (14) | Pseudoparaphyses present | 16 A. campograndensis |
| | Pseudoparaphyses absent | 17 A. parinaricii |
| 16 (15) | Ascospores 22.5–30 × 9.5–10.5 µm | 18 A. hydnocarpi |
| | Ascospores 18–22.5 × 5–6 µm | 19 A. crustacea |
| 17 (15) | Ascomata with a fringed margin | 20 A. Schroetleri |
| | Ascomata with a uniform margin | 21 A. coueipiai |
| 18 (17) | No leaf discoloration under the colonies | 22 A. pogonophorae |
| | Conspicuous leaf discoloration under the colonies | 23 A. burchelliae |
| 19 (18) | Ascomata opening by a stellar fissure | 24 A. patholobi |
| | Ascomata opening by an irregular fissure | 25 A. sporoboli |
| 20 (19) | Appressoria showing a lateral protuberance | 26 A. mycoporoides |
| | Appressoria barrel-shaped to cylindrical | 27 A. malpighii |
| 21 (20) | Ascospores 16–24 × 8–13 µm | 28 A. nodulosa |
| | Ascospores 33–35 × 10–12 µm | 29 A. mangiferae |
| 22 (20) | Ascospores less than 30 µm in length | 30 A. burchelliae |
| | Ascospores 35–42 × 16–19 µm | 31 A. patholobi |
| 23 (22) | Ascospores 13–17.5 × 5–6.5 µm | 32 A. sporoboli |
| | Ascospores 18–20 × 7.5–8.5 µm | 33 A. mycoporoides |
| 24 (2) | Ascomata with a fringed margin | 34 A. parinaricii |
| | Ascomata with a uniform margin | 35 A. barrinhensis |
| 25 (24) | Pseudoparaphyses absent | 36 A. anisopterae |
| | Pseudoparaphyses present | 37 A. bahiensis |
| 26 (25) | Ascospores medially constricted | 38 A. nodulifera |
| | Ascospores constricted supramedianly | 39 A. unaeqale |
| 27 (26) | Appressoria with a lateral protuberance | 40 A. bahiensis |
| | Appressoria barrel-shape to subglobose without a lateral protuberance | 41 A. nodulifera |
| 28 (25) | Colonies epiphyllous | 42 A. bahiensis |
| | Colonies amphigenous | 43 A. nodulifera |
| 29 (28) | Pseudoparaphyses present | 44 A. bahiensis |
| | Pseudoparaphyses absent | 45 A. nodulifera |
| 30 (29) | Pseudoparaphyses branched | 46 A. bahiensis |
| | Pseudoparaphyses unbranched | 47 A. bahiensis |
| 31 (29) | Appressoria showing a lateral protuberance | 48 A. bahiensis |
| | Appressoria barrel-shaped to subglobose without a lateral protuberance | 49 A. bahiensis |
| 32 (31) | Hyphae 3–5 µm wide | 50 A. bahiensis |
| | Hyphae more than 5 µm wide | 51 A. bahiensis |
| 33 (32) | Ascospores 24–30 × 12–17 µm | 52 A. bahiensis |
| | Ascospores 32–40 × 18–25 µm | 53 A. bahiensis |
| 34 (28) | Pseudoparaphyses present | 54 A. bahiensis |
| | Pseudoparaphyses absent | 55 A. bahiensis |
Cirsosia splendida var. laevigata Firmino & Dianese, var. nov.
MycoBank MB813320 (Figs 6–7)

Etymology: Refers to the smooth ascospores.

Description: Cirsosia splendida var. laevigata differs from C. splendida var. splendida in having smaller ascomata, pseudoparaphyses, and the smooth ascospores.

Type: Brazil: Mato Grosso do Sul: Campo Grande, BR-163 Highway left lane, 200 m from the roundabout turn to São Paulo, behind Cerealista Juliana, 20° 35' 8.58" S, 54° 34' 49.51" W, on leaves of Hirtella glandulosa (Chrysobalanaceae), 22 Aug. 1996, M. Sanchez (UB-Mycol Col. 12712b – holotype).

Cirsosia splendida var. laevigata

| Species | Origin | Colony | Ascomata | Hyphae | Appressoria | Ascii | Ascospores |
|---------|--------|--------|-----------|--------|-------------|-------|------------|
| australiacum | Australia | amphigenous | circular | straight or flexuous | intercalary | 5–7 | 5–8 | 5–10 μm, smooth |
| laevigata | Brazil | hypophyllous | circular | straight or flexuous | intercalary | 5–7 | 5–8 | 5–10 μm, smooth |

Other specimen examined: Brazil: Rondônia: RO494 Highway, 82 km from Pimenta Bueno towards Parecis, on leaves of Hirtella gracilipes (Chrysobalanaceae), 13 Jul. 1995, M. Sanchez (UB-Mycol Col. 23245).
### Table 4. Summary of the main characteristics of Cirsosia species indicating respective host family and species, and morphology of colonies, appressoria, paraphyses, asci, and ascospores.

| Species       | Host                      | Host Family       | Colonies          | Appressoria          | Pseudoparaphyses | Asci          | Ascospore                               |
|---------------|---------------------------|-------------------|-------------------|----------------------|------------------|--------------|-----------------------------------------|
| arecacearum   | Calamus thwaitesii        | Arecaceae         | epiphyllous       | globose              | –                | ovoid        | constricted at the central septum, smooth |
| dipterocarpi  | Dipterocarpus grandiflorus| Dipterocarpaceae  | epiphyllous       | protuberance towards one side | branched        | globoso to ovoid | constricted at the central septum, verruculose |
| flabellariae  | Flabellaria pedunculata   | Malpighiaceae     | epiphyllous       | barrel-shaped        | unbranched       | subgloboso to ovoid | constricted at the central septum, verruculose |
| globulifera   | Calamus sp.               | Arecaceae         | epiphyllous       | globose              | –                | globoso to ovoid | constricted at the central septum, smooth |
| hoplei       | Hopea ponga               | Dipterocarpaceae  | epiphyllous       | globose to barrel-shaped | –                | globoso      | constricted at the central septum, verruculose |
| hughesi      | Ancistrophyllum sp.       | Arecaceae         | epiphyllous       | globose              | unbranched       | subgloboso to ovoid | constricted at the central septum, smooth |
| irregularis   | Vatica obtusifolia        | Dipterocarpaceae  | hypophyllous      | –                    | absent           | globoso to ovoid | constricted at the central septum, verruculose |
| litsea       | Litsea travancorica       | Lauraceae         | hypophyllous      | barrel-shaped        | –                | globoso to ovoid | constricted at the central septum, smooth |
| manaosensis   | Malpighiaceae member      | Malpighiaceae     | epiphyllous       | globose to barrel-shaped | present         | ovoid        | constricted at the central septum, verruculose |
| moquileae    | Licania tomentosa         | Chrysobalanaceae  | amphigenous       | protuberance towards one side | branched        | subgloboso | constricted in the upper third, smooth |
| mouleinenensis | Dipterocarpus sp.        | Dipterocarpaceae  | epiphyllous       | protuberance towards one side | absent        | globoso to ovoid | constricted in the upper third, smooth |
| santiriae    | Santiria nitida          | Burseraceae       | amphigenous       | globose to barrel-shaped | branched       | subgloboso to ellipsoid | constricted at the central septum, smooth |
| splendidia   | Hirtella americana       | Chrysobalanaceae  | hypophyllous      | globose              | unbranched       | subgloboso | constricted in the upper third, verruculose |
| splendidia var. laevigata | Hirtella glandulosa     | Chrysobalanaceae  | hypophyllous      | protuberance towards one side | branched        | globoso to subclavate | constricted in the upper third, smooth |
| transversalis | Arecaceae member          | Arecaceae         | epiphyllous       | protuberance towards one side | branched       | subgloboso to ellipsoid | constricted at the central septum, verruculose |
| vateriae     | Vateria indica            | Dipterocarpaceae  | amphigenous       | globose              | –                | globoso      | constricted at the central septum, smooth |
Fig. 6. A–H. *Cirsosia splendida* var. *laevigata*, sexual morph (UB-Mycol. Col. 12712b): A. Colony showing opened lirelliform ascomata on superficial mycelium. B–C. Ascomata opened by a longitudinal fissure seen in SEM and light microscopy, respectively. D. Intercalary elliptic appressoria showing a lateral protuberance. E–F. Globose to subclavate asci. G. Immature ascospores. H. Brown to ferruginous, smooth, cylindrical to subclavate ascospores, showing slight constriction at septum. Bars: A = 100 μm; B = 50 μm; C = 20 μm; G, H = 5 μm, and all others = 10 μm.
Fig. 7. A–H. Cirrosia splendida var. laevigata, asexual morph (UB-Mycol. Col. 12712b): A. Colony showing opened pycnothyrial condidiomata on superficial mycelium. B–C. Ostiolate pycnothyrium. D. Surface mycelium with intercalary appressoria. E. Intercalary appressorium showing lateral protuberance. F. Immature conidia. G. Brown to ferruginous, smooth, ellipsoidal germinating conidia. H. Smooth-walled conidium seen in SEM. Bars: A, B = 50 μm; D = 20 μm; E = 5 μm, and all others =10 μm.
Notes: Two species of Cirsosia have been reported previously in association with living leaves of chrysobalanaceous hosts: C. moquileae on Licania tomentosa from Brazil, and C. splendida on Hirtella americana, Chrysobalanus icaco, and H. triandra from Brazil, Panama, and Puerto Rico, respectively (Batista & Maia 1960b, Hofmann & Piepenbring 2014, Farr & Rosman 2015).

Cirsosia splendida var. laevigata, the first Asterinaceae reported on H. glandulosa and H. gracilipes, is almost identical to C. splendida, except for the smaller ascomata, presence of pseudoparaphyses, and smooth ascospores (Batista & Maia 1960b, Hofmann & Piepenbring 2014). Such differences are here considered enough to recognize the specimen studied as a new variety of C. splendida. Furthermore, both occur on the same host genus in Brazil, but on different species.

Finally, Cirsosia moquileae differs from the new variety by dehiscence through a central star-shaped fissure (instead of the longitudinal fissure normally shown in Cirsosia species), and narrower ascospores (Batista & Maia 1960b). Indeed, such a form of dehiscence and the shape of the ascomata in C. moquileae indicate that that species could be better accommodated in Asterolibertia (Batista & Maia 1960b).

Key to the known Cirsosia species

See Tables 3–4 for further information on the characters of the species keyed out here.

1  Ascospores smooth .................................................................................................................. 2
   Ascospores verruculose ............................................................................................................. 10

2  (1) Ascospores medianly constricted ....................................................................................... 3
   Ascospores supramedianly constricted .................................................................................... 7

3  (2) Colonies amphigenous ....................................................................................................... 4
   Colonies hypophyllous or epiphyllous .................................................................................. 5

4  (3) Ascospores 28–32 × 15–18 μm .......................................................................................... C. vateriae
   Ascospores 32.5–35 × 19–21.5 μm ......................................................................................... C. santiriae

5  (3) Colonies epiphyllous ......................................................................................................... 6
   Colonies hypophyllous ............................................................................................................ C. litseae

6  (5) Asci 4-spored ..................................................................................................................... C. arecacearum
   Asci 8-spored ......................................................................................................................... C. globulifera

7  (2) Ascomata opening by a longitudinal fissure ................................................................. 8
   Ascomata opening by a stellar fissure ..................................................................................... C. moquileae

8  (7) Appressoria having a lateral protuberance .................................................................... 9
   Appressoria globose ............................................................................................................... C. hughesi

9  (8) Ascospores 17.5–27.5 × 6–9.5 μm ................................................................................. C. splendida var. laevigata
   Ascospores 26–33.5 × 15–20.5 μm ....................................................................................... C. moulmeinensis

10 (1) Ascospores medianly constricted .................................................................................. 11
    Ascospores supramedianly constricted ................................................................................. C. splendida var. splendida

11 (10) Colonies epiphyllous ..................................................................................................... 12
    Colonies hypophyllous .......................................................................................................... C. irregularis

12 (11) Appressoria with a lateral protuberance .................................................................... 13
    Appressoria barrel-shaped to globose .................................................................................. 14

13 (12) Appressoria 8–10 × 13.5–15 μm .................................................................................. C. dipterocarpi
    Appressoria 11–14 × 7–9 μm ............................................................................................... C. transversalis

14 (12) Hosts in Malpighiaceae ............................................................................................. 15
    Hosts in Dipterocarpaceae ................................................................................................. C. hopeae

15 (14) Asci 27–29.5 × 19–24 μm .......................................................................................... C. flabellariae
    Asci 55–65 × 45–50 μm ......................................................................................................... C. manaosensis
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