Epifoliaria fungi from Panama

Don R. REYNOLDS¹ & Gregory S. GILBERT²

¹Research and Collections
Natural History Museum, LAC, 900 Exposition Boulevard
Los Angeles, California 90007, USA

²Environmental Studies
1156 High St., 405 ISB, University of California, Santa Cruz, CA 95064, USA
and
Smithsonian Tropical Research Institute
Apartado 2072, Balboa, Panama, Republic of Panama

Abstract – Epifoliaria ascomycete taxa are annotated from leaf surfaces collections in the lowland tropical rain forest at the Smithsonian San Lorenzo canopy crane research site on the Caribbean slope of the Republic of Panama. This paper provides comparative taxonomic descriptions of 23 species of epifoliaria fungi in 17 genera and 8 families as a companion to a study conducted at Cape Tribulation, Queensland, Australia.

Epifoliaria fungi / Panama

INTRODUCTION

Epifoliaria fungi comprise specialized nutritional guilds on living plant surfaces, particularly the leaves. Several polyphyletic Ascomycete groups evolved into this habitat at higher taxonomic or deep clade branch levels. All share morphological adaptations including melanin pigmentation and the manner of ascospore and mitospore production. They comprise several ecological guilds as well, living as saprobes or parasitizing plants or other fungi. Lichenized taxa of epifoliaria fungi have developed similarly morphological adaptations to the epifoliaria habitat, but at more shallow taxonomic levels of genus and species (Lücking, 2002).

Epifoliaria fungi are known from previous mycological work in Central America. Monographic literature on Panamanian fungi extends back over a century; citations are included in works encompassing higher taxonomic levels (Batista 1959b; Müller and Arx 1962; Batista and Ciferrí, 1962, 1963a, 1963b; Santesson, 1952) as well as in the more specific revisions cited below. Any regional assessment of the diversity of epifoliaria fungi is complicated by a number of historical factors that make it difficult to reconcile modern and historical approaches to classification. Many species are now known only from descriptions in the literature. Much historical material from the neotropics was destroyed during wars, especially type specimens such as those collected by 20th century

* Corresponding Author: Email: dreyold@nhm.org
mycologists H. Sydow, P. Sydow and H. Rehm; those collections that survived are now scattered in world-wide herbaria. A major problem is the common practice of inadvertent repetitious description of the same species based on minor morphological variation or similar collections from different host plant species. For example, over 100 species described in the genus Micropeltis by A.C. Batista and his coworkers utilized single, regional collections. Another major issue is the widespread and unfounded assumption of a one-to-one relationship of a saprobe or a parasite with an associated host plant species that results in species proliferation and ambiguity. The best example is of this unfortunate practice is the monograph of the Meliolales by Hansford (1961).

Here we describe 23 species of epiloric fungi from 17 genera and 8 families from the San Lorenzo rain forest in Panama. This represents a companion study to one conducted at Cape Tribulation, Queensland, Australia (Gilbert and Reynolds, 2005). Together with that study, these data provide the basis for an ecological assessment of the observed host range and microclimate preferences of epiloric fungi (Gilbert, Reynolds, and Bethancourt submitted manuscript).

METHODS

Examined fungi were primarily from pressed and dried leaves collected from the tropical lowland rain forest at the Smithsonian Tropical Research Institute crane facility at San Lorenzo (formerly called Fort Sherman) (9°17'N, 79°58'W; Altitude: 130 m above sea level), on the Caribbean coast of the Republic of Panamá (Colón province). The site averages 3152 mm rain annually. Specimens were collected from ground level to the top of the forest canopy; vertical access was facilitated by the canopy access crane (Wright et al., 2003). Other specimens were obtained for comparison from other herbaria (Holmgren et al., 1990; www.nybg.org/bsci/ih/ih.html). Each of our Panama collections is identified with a unique number prefixed with PA.

Observations and measurements of fungal structures were made from dried specimens mounted in lactophenol, using Zeiss dissecting and compound light microscopes and a Cambridge Scanning Electron Microscope. Photomicrographs were taken with a Nikon Coolpix 4500 digital camera. The 175 specimens collected at the crane site utilized in this study, and cited in Appendix 1, are curated at the University Herbarium (UC) at the University of California, Berkeley, CA, USA and Herbarium PMA at the Universidad de Panamá, Republic of Panamá.

FUNGAL DESCRIPTIONS


Thallus comprised of flattened cells arranged radially and circularly or in bands or in irregularly diverging rows; Ascomata dispersed, subthallial, round or
Fig. 1. Brefeldiella brasiliensis. PA84. The asccarp, seen here, and the pycnidium when present, form a similar fruiting structure under a hyphal band. Bar = 35 μ.

elongate in outline, pore formed as an apical fissure of covering thallus cells; asci clavata, obvate or spherical, paraphysate; ascospores hyaline or brown, 1-2 septate.

Brefeldiella Spegazzini, 1889:58.
Brefeldiella brasiliensis Spegazzini, 1889:558.
=Asterina subcuticulosa Cooke, 1889:81.
=Asterella subcuticulosa (Cooke) Saccardo, 1891:937.
=Brefeldiella subcuticulosa (Cooke) Theissen, 1912:16.

Description: Ascoma pelliculate, applanate, irregular to confluent, without mycelium, becoming darkly pigmented; paraphyses disintegrating at maturity, 95-180 μ; ascus, pyriform, 25 μ in length; ascospores hyaline, elliptical-clavate, 3-6 septate, 15-44 × 3-10 μ. Fig. 1

Notes: The ascospores of our collections are larger than those found in Australian collections (Reynolds and Gilbert 2005). Also, we did not find any associated asexual reproduction.
Specimens examined: PA083, PA084, PA085, PA109, PA115, PA136, PA166, PA171, PA198, PA248, PA291, PA304, PA329, PA330, PA331, PA336, PA351, PA399, PA417, PA418, PA442, PA444, PA445, PA446.
Capnodiaceae (Saccardo) Höhn ex Theissen, 1916:363.

We found 2 ascomycete and two mitosporic genera in this family. The inclusion of monomorphic mitosporic and ascosporic fungi as well as pleomorphic genera and species in this family elaborates a concept of polyholomorphism in systematic mycology that was explored by Hughes (1971) and Reynolds and Taylor (1993). “Sooty mold” mitosporic taxa share morphological attributes of their phylogenetically associated sexual ascomycetes in the Capnodiaceae. The conidiomata is an upright structure developed from a superficial mycelium on living plant surfaces. Walls of mycelium and reproductive structures have dark brown to black pigments. The asexual sooty mold taxa have a common spore dispersal strategy. The mitospores form in a centrum that is predictably positioned in several stalk locations (Olejněk et al. 1999). The mitospores range from small, unicellular, hyaline mitospores to multisepitate, hyaline or darkly pigmented spores; ascospores vary similarly. Spores disperse via the canopy flow-through water and germinate quickly once dispersed.

Conidiocarpus Woronichin. in Jaczewski, 1917:743.

Conidiocarpus penzigii Woronochin, 1926:250.

Description: Conidiomata elongate, narrow, darkly pigmented, 200 - 1000 μm long, the midstalk conidiogenous swelling up to 50-80 μm wide and otherwise 10-15 μm. The mitospores are hyaline, ellipsoid, 5 μm × 1.5 μm.

Notes: We identify our collections as Conidiocarpus. Batista and Ciferri (1963b) maintain that Woronochin’s (1926) description of Conidiocarpus was characterized by two different conidiomata: an elongate one and an oval and short one. Both morphs were present in our collections. They appear to represent different stages of fruit body development, while both produce mitospores. Hughes (1976) acknowledged both morphs in his redescription of the genus. One of us (Reynolds) examined Woronochin material from the V. L. Komarov Botanical Institute in St. Petersburg, Russia (Herbarium LE) and found no specimen of C. penzigii. We also found no specimens of Conidiocarpus in the Woronochin collections at the Georgian Academy of Sciences in Tbilisi, Republic of Georgia (Herbarium TB1).

Hughes (1971) interpreted single-spore isolation data from Yamamoto (1954) to link Conidiocarpus to Scorias, thus establishing a pleomorphic link of this mitotic fungus with Scorias as well as with Phragmocapnia. We examined Yomomoto specimens at the National Taiwan University (Herbarium NTUF) and reviewed his available original research material and determined that there was no apparent success in establishing a pleomorphic connection between Conidiocarpus and Scorias from single spore isolate cultures as might be inferred from Yamamoto’s (1954) report. The coincidence of the co-occurrence in Nature on the same mycelium of Conidiocarpus and Phragmocapnia reproductive structures was recognized by Hughes (1996) and was found in our collections from Australia (Reynolds and Gilbert 2005) as well as those at hand from Panama. Specimens examined: PA082, PA146, PA201, PA201, PA291, PA418.

Fumiglobus gen. nov.
Non Asbolisia Spedazzini, 1918:293.
*Type specimen*: URM2743, Coll: 16 May 1956 by M. da Silva. Loc: Brasilia, F.D., Brazil.

*Etyology*: *Fumiglobus*: *fumeus-*a smoky wisp to refer to the *Capnodium*-like pigmentation; *globus* -rounded to indicate the characteristic shape of the conidomata.

*Description*: Mycelium superficiale, membranosum laxum, ex hyphis fuscus-brunneis, constrictis, compositum. Pycnostoma globosa ad subglobosa, glabrata. Mitosporae continuae, hyalinae, bacillae, ellipsoidae vel cylindriceae.

Mycelium superficial, sometimes becoming aerial, membranose or loosely formed, composed of dark-brown, blackish, constricted hyphae. Pycnothecium formed from several hyphae or from intercallary hyphal cells, globose to subglobose, glabrous; mitosores hyaline, continuous, and bacillate to ellipsoidal or cylindrical.


*Description*: Conidomata globose-depressed, glabrous, darkly pigmented, ostiolate, 855-100 mm; mitosores hyaline, continuous, 3-4 μm x 1-3 μm.

This species is based on a P.C. Stanley collection in 1924 from the Canal Zone in Panama.

*Notes*: The nomenclatural status of the generic name *Asbolisia sensu* Batista, Nascimento and Ciferri (Batista & Ciferri, 1963) and the related family name *Asbolisiaceae* is clearly in need of resolution (Hansford, 1946; Hughes, 1971). In an attempt to resolve the nomenclature of *Asbolisia*, Batista and Ciferri (1963b) reinterpreted Spegazzini's type specimen and description of the taxon. Still, Sutton (1977) and Petrak (1929) considered the name *Asbolisia* as 'dubious', and Kirk *et al.* (2001) declared the taxon a nomen dubium.

In further rectification, and even though we found a single example of the taxon, we propose the new name, *Fumiglobus*, for the genus *Asbolisia novum confusum*. We have examined the specimens cited in Batista and Ciferri (1963b) and the Spegazzini material. We recognize the concept for the genus as defined by Batista and Ciferri (1963b). The family *Asbolisiaceae sensu* Batista and Ciferri (1963b) is not addressed here.

Batista & Ciferri (1963b) clearly define a distinct sooty mold genus that is found throughout the tropics. The typical sooty mold mycelium of melinoid pigmentation, a pellicle forms that ranges in habit from flattened on the leaf surface and to having aerial hyphae. The fruit bodies are formed as intercallary or terminal structures from single or several hyphal cells. They become globose, glabrous, ostiolate structures producing an abundance of uncellular, hyaline, ellipsoidal or cylindrical mitosores.

Batista & Ciferri (1963b) utilized *Asbolisia* as a definitive mitotic taxon in the sense implied by the common designation of 'sooty mold' and members of the *Capnodiaceae*. Kirk *et al.* (2001) noted, "They created the family *Asbolisiaceae* for these mitosporic species of the *Capnodiaceae* with darkly pigmented mycelium and reproductive structures that characteristically occur on living plant surfaces." They excluded Spegazzini's type, *A. ampullata*, from the genus because of its putative synonymy with *Cicinnobella ampula* and
inadmissibly designated a Brazilian species, *A. cirina* Batista, Nascimento and Ciferri, as a ‘Lectotypus,’ Hughes (1976) concurred that *Asbolisia* was dubious, noting that Hansford (1946) regarded *Cicinnobella* species as the mitosporic component of hyperparasites of *Dimeriaeeae* genera in the Pleosporales.

*Specimen examined:* PA356, URM4836 ex BPI (type), URM2470 (type).

**Additional Fumiglobus species**

*Fumiglobus ampullula* (Spezzazzini) Reynolds & Gilbert nov. comb.
= *Asbolisia ampullula* (Spezzazzini) Spezzazzini 1918:293.

*Fumiglobus cirina* (Batista & Ciferri) Reynolds & Gilbert, nov. comb.

*Fumiglobus didymopanacis* (Batista, Nascimento & Ciferri) Reynolds & Gilbert nov. comb.

*Fumiglobus foeda* (Saccardo) Reynolds & Gilbert, nov. comb.
= *Capnodium foeda* Saccardo, 1882:77
= *Apiosporium foeda* Saccardo, 1882:77
= *Chaetophoma foeda* Saccardo, 1884:200.

*Fumiglobus glabrides* (F.L. Stevens) Reynolds & Gilbert, nov. comb.
= *Asbolisia glabrides* (F.L. Stevens) Spezzazzini 1918:293.

*Fumiglobus indica* (Agarwal & Sharma) Reynolds & Gillbert, nov. comb.

*Fumiglobus juniperina* (Baccarini) (1917) Reynolds & Gilbert, nov. comb.
= *Capnodium juniperinum* Baccarini, *in* Saccardo, 1921:383.

It was assumed to be a pleomorphic component of *Phragmocapnia juniperi*

*Fumiglobus portoricensis* (Spezzazzini) Reynolds & Gilbert, nov. comb.
= *Asbolisia portoricensis* Spezzazzini, 1924:362.

**Excluded species**


This species (URM5690) is a *Polychaeton*.

An anamorphic status was indicated (sensu ICBN, 1999, Article 59) by Batista & Ciferri for *A. juniperi* in putative association with *Phragmocapnia juniperi* (Cooke) Theissen & Sydow 1917:480. [sic “(Phillips & Plowright) Clements & Shear”] *r*de Batista and Ciferri, 1962:43. The Index of Fungi (Kirk et al. 2005) cites a teleomorphic connection to *Aithaloderma* for *A. cirina*, *A. didymopacis*, *A. foeda*, *A. glabrides*, *A. indica*, *A. inocarpi*, *A. juniperina* and *A. portoricensis* although there is no documentation of these pleomorphic associations (P. Kirk, personal communication).


= *Antennularia tenuis* Earl, 1904:302
= *Tephrosticta ficina* Sydow, 1913:271.
= *Pheosaccardinula ficina* (Sydow) Hansford, 1946:156.
=Phaeosaccardinula malloti (Rehm) Theissen, in Theissen & Sydow, 1917:481.
=Limacinula zanteschiae Batista & Ciferri, 1963:139.
=Phaeopeltis sapota Batita, 1951:159.
=Naetrocymbe mauritiae Batista, 1951:155.
=Limacinula samoensis von Höhnel, 1909:1200.
=Limacinula samoensis von Höhnel, 1907:101. Not validly published; generic name not yet published. This species was incorrectly revised as L. samoensis von Höhnel (Reynolds, 1971).

Description: Ascocarp reddish brown, 200-500 μm diam.; ascospores hyaline, 6-7 transseptate, 35 μm × 6-9 μm, muriform.

Notes: The ascocarps of this taxon are typically collabent (Fig. 6). A superficial similarity with the ascomata typical of the Chaetothyriaceae derives from a circumcursive continuation of hyphal strands from the apical region of the fruit body. The chaetothyriaceous ascomata is appendaged with a covering shield comprised of a distinctive tissue, that continues onto the substratum. Bitancourt (1936) described the structure as adherent to the outer wall of the upper part of the ascomata. Batista & Ciferri (1957, 1962) refer to the structure as a “mycelial network or pellicle.”

Specimens examined: PA336, NY(type); URM138, NY (Rehm Ascomycetes 1075); URM9232; URM279; URM6478; URM5531; URM7993; URM585.


Phragmocapnia bete (Sydow & Butler) Theissen Sydow emend. Reynolds, 1979:425

Description: Ascocoma minimally stalked, ostiolate, 75-165 μm × 70-120 μm, with setae measuring 55-115 μm in length; ascus fissitunicate, 35-50 μm; ascospores hyaline, 3 (-5) septate, cylindrical to elliptical, 16-29 μm × 3-5 μm.

Notes: This species is similar to Trichomerium (Reynolds, 1982) and differs with a stalked, setose ascomata and more transsepta in the ascospores (Reynolds, 1979). The association with Conidiocarpus is a constant one.

Specimens examined: PA082, PA291, PA418, K (Isotype).

Chaetothyriaceae Hansford ex Barr, 1979;

Ciferriusia orientalis Batista & Costa. in Batista & Ciferri, 1962:17

Description: Ascomata globose-depressed, with a mycelial shield, 90-180 μm diameter, ostiolate; ascis clavate, fissitunicate, paraphysate, 40-60 μm; ascospores clavate, 3-transversely septate, hyaline, 15-20 μm × 4-5 μm.

Notes: Batista and Ciferri (1962) distinguished this genus within their Chaetothyriaceae with nonsetose ascomata and hyalophragmiaceous ascospores. Arx and Müller (1975) placed Ciferriusia as a synonym of Yatesula Sydow (1917), which has muriform ascospores, and with Ceramothyrium Batista & Maia (Ciferri, 1956) pro parte. Sydow (1917) described Yatesula calami in a monotypic genus as a member of the "Microthryriacearum" from the Philippines and as having muriform ascospores. Batista & Ciferri (1962) defined Ciferriusia species as paraphysate and included both paraphysate and nonparaphysate species in
Ceramothyrium, which may have been the character on which Arx and Müller (1975) selected certain species to transfer to Yatesula. They also included the name Ceramothyrium Batista & Maia (non-pro parte) as a synonym of the Metacapnodaceae genus Limacina Neger (Johow, 1896).
Specimens examined: PA284, PA285, PA303, URM11203 (=BO16599).

Meliola Fries, 1825:111.  

Meliola protii Stevens, 1928:19.  
Description: Capitate hypopodia alternate; mycelial setae scattered, straight to 250 μm with dentate tips; ascomata 225 μm diameter; ascospore 4-septate, 40-45 μm × 25 μm.

Notes: This name is the closest fit to the morphology of the Meliola species found in our collections. The Hansford (1961) generic concept is likely unreflective of speciation in this lineage. The premise he utilized organized Meliola species by the host plant family. As a result, a very large number of species have been described by virtue of the same fungus being recognized on hosts in different families. There are no data in support of an obligate fungus - host relationship. Hansford made exceptions to this contrary rule with the recognition of some Meliola species in more than one family and the description of species for which the identity of the host is unknown.

Using Hansford's concept, 30 species have been described from Panama collections and an additional 26 species were reported as new records for the country. M. protii is also reported from Puerto Rico and British Guiana. The type specimen host is Protium panamense in the Burseraceae. Our collections were found on the Araceae, Annonaceae, and Moraceae. The mycelial setae are shorter than described in M. protii and the ascospores are slightly larger.
Specimens examined: PA202, PA239, PA386, PA459.

Microscleraceae Clements & Shear, 1931:100.  

This family is characterized by a specialized, flattened, and inverted ascoma called a thyrrothecium or scutellum. The basal plate of the thyrrothecium, equivalent to a lower, outer wall plus ascogenous cells, is hyaline. Superficial mycelium may be present or not at maturity of the ascomata. The construction of the upper plate ranges from reticulate to plectenchymatous and pararchymatic; if the component tissue is radiate or parallel it is at the periphery only. This contrasts with the Microthyriaceae where the construction of this layer is of parallel hyphae. Dehiscence is via a rounded pore or one that appears stellate or irregularly fractionated from further modification of the pore or a centralized nonporate spore dispersal area. The color of the ascomata has been described as black, black-green, brown, blue-black, blue-green, cinnamon, maroon-black, and olive. The multicellular ascospores are hyaline.

Hansfordioelopsis Farr, 1986:274.  

Description: Conidiomata blue-green, ostiolate, 150-380 μm; conidiophores flabellate; mitospores hyaline, bacillate, continuous, 5-6 μm × 1 μm. Fig. 2

Notes: The genus is distinguished from Hansfordioelptis (Batista and Costa, 1956) by a lack of mycelium and the absence of conidiophores. The
mycelium is sparse in our specimens. The ascomata and the mitosporae are larger than described by Farr (1986). This taxon and other mitosporic species with an conidiomata constraction similar to the Micropeltidaceae would be placed in the family Plenotrichaceae fide Batista and Ciferri (1959).

Specimens examined: PA192, PA193, PA206, PA295, PA298, PA330, PA360, PA375, PA412, PA422, PA426.


=Scolecopeltis Spegazzini. 1889:574.
=Micropolitilla Sydow, 1913:404.
=Parapeltella Spegazzini, 1919:505.
=Micropolitidium Spegazzini, 1923:505.
=Scolecopeltella Spegazzini, 1923:354.
=Scolecopeltidium Stevens & Manter, 1925:282.

Since the description of the type species Micropolites applanata Montagne (1842), 228 specific names have been proposed in the family. In a major review of the taxon, Batista (1959) recognized 89 species and 2 subspecies. Following Clements and Shear (1931), In organizing the Micropolitidaceae,
Batista (1959) placed the 33 genera that are "destituidos de micélio livre" (lacking free mycelium) into the subfamilies Dictyopectoideae (those with blue-green ascocarps) and the Haplopectoideae (brown ascocarps). The 12 genera with ascocarps that mature within a "micélio livre" were placed in the subfamily Stomopeptoideae. Distinction of genera in the family was based on a combination of characters, including presence or absence of an ostiole, setae, and periphyses.

*Micropeltis* was recognized by Batista (1959) as having a blue-green to brown thyriothecium with plectenchymatous construction, paraphysate asci, and multisepitate, hyaline ascospores. Distinction of species was based on variation of color of the thyriothecium, size of the ascothecium and ascospore length and width. We find the Gómez-Ascosta (1995) revision of the genus and several species from the Greater Antilles, including specimens from select type localities, to be a good, conservative approach to speciation in this taxon. Using historical and recently collected material, the genus was revised as: the thyriothecium forming without free mycelium, orbicular, dimidiate, blue-green with a central pore, with plectenchymatic, retulate or meanderform cellular construction. Paraphyses were described as hyaline, and few or abundant, sometimes forming a column in the central cavity of the ascocarps. The ascus was determined to be "bitunicate", generally saciform to elliptical, sissile or subsessile. The ascospores are hyaline, of variable form, and with multiple-transseptation. The revisionary emphasis was on ascospore shape as filiform or clavate, the number of septa, and corresponding size.

The synonymy for the revision of this taxon by Gómez-Ascosta (1995) included 8 genera and by implication their 302 named species. Of this number, 210 were described as new by Batista and his coworkers and 45 taxa were transferred from older authors.

This group of species recognized by Batista and coworkers is in need of revision. Ninety-two percent of the species were described from a single collection and most of them have not been reported in the literature since the initial report. The 210 Batista collections were made in the vicinity of Recife, Brazil, the location of his home institution, thus representing a sporadic sampling of a limited area.

The 24 collections of *Micropeltis* in our study were made from 8 hosts in 7 vascular plant families that were found within a 0.9-ha sample plot. We determined that there is little evidence for host specificity for these fungi from analysis of collections from sites in tropical Australia and Panama (Gilbert, Reynolds, and Bethancourt, *submitted manuscript*). The characters utilized by Batista to define the species were found to have a range of values in this sample rather than discrete, host-related recognition. The color and size of the ascocarp, the shape of the ostiole, and the abundance of paraphyses were similarly variable.

The determination of a species epithet for our Panama material is somewhat arbitrary in that no attempt was made to review all available historical specimens. We relied on descriptions in the literature as well as herbarium material to interpret the data from our specimens. We mainly used the Saccardian ascospore characters to determine a useful name. We annotate similarities with other descriptions, thus suggesting a synonymy rather than formally proposing one. Where the species was recognized by Batista (1959) in a genus other than *Micropeltis*, a nov. comb. was made.

*Description*: Ascomata blue-green with brown overlay, 375-425 μm, ostiole becoming stellate; ascus 40 μm; ascospores 3-4 septate, 30.3-35 μm × 3-4 μm, hyaline.

*Notes*: Our material differs from the original species description in having 3-4 septa rather than 2-3, and an ascospore width less than 5.5-11 μm. The closest species seems to be *M. hirtellaeana* Batista & Lima (Batista 1959:111) with fewer transsepta.

*Specimens examined*: PA315, PA334.

**Micropelitis bambusina** von Höhn, 1909:322.

*Description*: Ascomata blueish, 175-350 μm, ostiolate becoming stellate; ascus 30-35 μm; ascospores hyaline, 3-4 septate, 15-28 μm × 5-6 μm.

*Notes*: This species is similar to *M. clava* Toro, *Micropelitis consimilis* Rhem (=*Micropolystella consimilis* (Rehm) Theissen), *M. hexaspora* Batista & H. Lima, *M. marginalis* Montagne, *M. pseudo-ostiolata* Batista, (=*Micropolystella marginata* (Montagne) Batista) *M. subapplanata* Spegazzini (=*Parapolystella subapplanata* (Spegazzini) Batista), and *Micropolystella cassinola* Batista.

*Specimens examined*: PA137, PA248, PA294, PA311, PA314, PA317, PA333, PA354.


*Description*: Ascomata blueish, ostiolate, 125-35 μm; ascus 35 μm; ascospores hyaline, 3-4 septate, 10-40 μm × 5-6 μm.

*Specimens examined*: PA184, PA294.

**Micropelitis bogorensis** von Höhn, 1912:346.

=*Micropolystella bogorensis* (von Höhn) Sydow

*Description*: Ascomata blue-green, ostiolate, 450-1000 μm; asc. 128 μm in length; ascospores hyaline, 2-13 septate, 23-63 μm × 6-13 μm. Fig. 3

*Specimens examined*: PA115, PA123, PA142.

**Micropelitis caesalpiniae** F. Tassi, 1899:28.

*Description*: Ascomata blue-green, ostiolate becoming stellate, 100-200 μm; ascus 60 μm; ascospore hyaline, 1-2 septate, 10-12 μm × 5-6 μm.

*Notes*: This is one description that stands apart within the described *Micropelitis* species. The ascospores in our material are 2-3 septate vs. 4 septa in the original description and are a little wider. The species was described from the botanical garden in Senesi, Italy. The host plant, *Caesalpinia gilliesii*, is a native of southern South America.

*Specimens examined*: PA318, PA359.

**Micropelitis clavispora** (Sydow) comb. nov

=*Micropolystella clavispora* Sydow, 1913:404.

*Description*: Ascomata 640 μm, maroon; ascus 100 μm; ascospores hyaline, 4-5 septate, 25-35 μm × 4 μm.
Fig. 3. Micropeltis bogorensis. PA142. The ascomata is rounded in this top view on a leaf surface; the ostiole is formed in an elevated central region. Note the absence of mycelium. Bar = 200 μ.

Notes: Our material differs from the original description with larger ascomata, and narrower ascospores. It is similar to M. rhopaloides Sydow, which also has wider ascospores.

Specimen examined: PA123, PA142, PA336

Micropeltis megasperma (Sydow) nov. comb.
=Dictyothyriella megasperma (Sydow) Stevens & Manter, 1925:273.

Description: Ascomata blue-green, ostiolate; ascus 170 μm; ascospores hyaline, 2 septate, 70 μm × 10 μm.

Notes: This species is similar to Micropeltis hansfordii Batista & Vital and M. psychoiæ Batista.

Specimen examined: PA374.

Micropeltis semecarpa Sydow 1913:488.
=Dictyothyriella semecarpi (Sydow) Stevens & Manter 1925:273.

Description: Ascomata olivaceous-maroon, ostiolate; 425 μm; ascus 55 μm; ascospore hyaline, 1 sepat, 15 μm × 3-5 μm.

Specimen examined: PA104, PA163, PA174, PA193, PA312, PA412.


Description: Ascomata brown with dark ringed ostiole, setae 65 μm in length, 160 μm in diameter, with fringed edge; ascus 45 μm in length, paraphysate; ascospores hyaline, 1 septate, 13-15 μm × 5 μm.

Specimen examined: PA206.

Stomiopeletella Theissen, 1914:86.

Stomiopeletella caricis Siemaszko, 1925:271

Description: Mycelium persistent; ascomata maroon, 100-150 μm, ostiolate; ascus 45 μm; ascospore hyaline, 1 septate, 8 × 3 μm.

Specimen examined: PA130.

Microthyriaceae Saccardo, 1883:658.


Description: Pycnocarium upper plate brown hyphae radiate with component hyphae continuing individually as a fringe, ostiolate, 125-250 μm; phialides flask shaped, forming palisade on lower tissue layer of upper plate; mitospore hyaline, elongate, 6.8 × 2.5 μm.

Notes: The pycnothelial fringe formed by individual hyphae continue in a parallel pattern is more promiment in our material compared to the description by Batista and Cavalcanti (1963) and Farr (1986) for E. rubescens, both from Brazil. An ostiole forms in the densely pigmented center; the distinguishable individual hyphae continue in a parallel pattern to form an outer fringe. The conidiophores are prominent, flash-shaped. This mitosporic genus and others with a conidiomata construction similar to those in the Microthyriaceae were placed in the family Pelasteraceae.

Specimen examined: PA121, PA130, PA137, PA280, PA356, PA396, PA431.

Saccardiaceae von Höhnel, 1909:95.


Description: Ascomata 250-750 μm; ascus 45 μm in length, paraphysate; ascospores hyaline, 2-4 septate, 7-25 μm × 3-6 μm. Fig. 4

Notes: Cyanodiscus glabrescens was described from Cuba (Gómez, 1977). There are two outstanding differences between this species and the original C. occidentalis (Müller & Farr 1971). The ascoearps range up to twice the diameter. In one collection (PA304) the characteristic blue-green pigmentation was absent, but the ascoearps were broadly sessile rather than stalked as in Epibolium E. Müller. In C. glabrescens the ascospores are larger and the crossepta range in number from 2–11, whereas C. occidentalis was described with
3 - 5 crossepta. However, the entire range of ascospore septation can be found collectively in several ascomata rather than in a single example.

Specimens examined: PA127, PA136, PA164, PA195, PA272, PA304, PA335, PA351, PA356, PA361, PA389.

**Schizothyriaceae** Höhnel ex Trotter, in Saccardo, 1928:1254

**Metathyriella** Sydow, 1927:96.

**Metathyriella roupalae** Sydow, 1927:96.

*Description*: Mycelium absent. Ascomata dimidiate, somewhat subcircular, scutate, ovate, 125 - 175 µm; asci, 25 µm in length, paraphysate; ascospores hyaline, 3-septate, 12 × 5 µm.

*Notes*: The ascostromata in the original description measure up to 350 µm in diameter; the ascospores are described as 16 µm in length.

Specimens examined: PA128, PA129, PA186, PA193, PA194, PA229, PA304, PA444.

**Plochmopeltis** Theissen, 1914:87.

**Plochmopeltis ellisi** Arx, 1959:3.
Description: Ascoma, flat, shield shaped, rounded, dark brown, 450-800 μm; ascus 20-82 μm in length, developing from a colorless basal shield, formed on the cuticular surface, ellipsoid to globose, surrounded by longer upright paraphyses with branched, darkly pigmented tips; ascospores hyaline, 2-celled, 10-12 μm × 3-5 μm.

Notes: The ascospores of our species are slightly smaller in length than described for P. elliottii.

Specimens examined: PA101, PA129, PA351.

Vizellaceae Swartz, 1971:455.

The Vizellaceae was described by Swart (1971) with 2 genera. Vizella and its 15 recognized species, including two of Eocene age, was distinguished from the monotypic Blastozaa Saccardo & Sydow (1902) by an ascospore character. Arx & E. Müller (1975) included Entopelis Höhnel in the family. Vizella species are subcuticular.

Vizella Saccardo, 1883:662. Sylloge Fungorum 2:662

The hyphae are characteristically dark banded at the septa. The brown ascospores have a conspicuous, traversely median hyaline band. Many species have a characteristic small, hyaline basal unicellular appendage.

=Stigmatozella royenae Doidge, 1927 Bothalia 2:232
=Hypocelis costariensis Petrak, 1929:27

Description: Ascomata subcuticular, dimidiate, 150-265 μm diameter, ostiolate at maturity; Asc 35-50 μm in length; ascospores brown, with horizontal band, 13-23 × 9-15 μm; the small basal appendage present in some species is not apparent here. Fig. 5.

Notes: This species is similar to Vizella amazonica Farr (1987). The ascospore's basal appendage is slightly larger in our material than that of Farr's species. We did not observe the association with the mitotic species, Marginella oblongispora Farr (1986), that Farr emphasized.

Specimens examined: PAN109, PAN144, PAN351, PAN359, PAN360, PAN433.

Mitotic Ascomyces


Description: Colonies linear, darkly pigmented on leaf surface; mitospores originate from short, brown, nonseptate, attenuated cells; conidia one-celled, dark brown, lenticular, circular in outline, smooth, 11-22 μm × 6-10 μm; peripheral rim is pale colored, appearing as a distinctive line in a side view. Mitospores are produced singly and acrogenously.

Notes: This is one of the most common species in our collections. As we found in the Australia collections, (Reynolds & Gilbert, 2005) the mitospores in our material are consistent with those of C. coniosporoides, but somewhat smaller.
Fig. 5. *Vizella royena*. PA144. Hyphal strands with thickened septa that appear as dark bands. Bar = 10 μ.

Fig. 6. *Limacina tenuis*. PA336. The flattened ascomycar has a circumcious continuation of hyphal strands from the apical edge that merge into the mycelium on the substratum.
than those described for C. vinosa. The conidiophores are formed only from hyphal cells with hyaline, multicellular, lanceolate structures observed in the outer areas.


**Acknowledgements:** We thank the Andrew W. Mellon Foundation for funding, and S.J. Wright, S. Aguilar, R. Perez, and the Smithsonian Tropical Research Institute for facilitating the work. We thank the Republic of Panama for preserving their forests and making them available for study.

**REFERENCES**


HENNING P., 1904 — Einige neue Pilze aus Costarica und Paraguay. Hedwigia 43:147-149.


JOHOW E., 1896 — Estudios de las Islas de Juan Fernandez Imprenta Cervantes, Santiago, Chile.


Rehm H., 1913 — Ascomycetes Philippinenses. III. Philippine Journal of Science C. Botany 8:391-405


SaccARDo P.A. & Trotter A., 1913 — Syllage Fungorum. JW Edwards, Ann Arbor, Michigan USA.

SaccARDo P.A., 1882 — Syllage Fungorum. JW Edwards, Ann Arbor, Michigan USA.


Sagra R. de la., 1845 — Historia física, politica y natural de la isla de Cuba IX. Criptogámicas y plantas celulares por Camilo Montagne. A. Bertrand, Paris.


Spegazzini C., 1882 — Syllage Fungorum. JW Edwards, Ann Arbor, Michigan USA.


SUTTON B.C., 1977 — Coelomycetes VI. Nomenclature of generic names proposed for Coelomycetes. Mycological Papers 141.
TASSI F., 1899 — Description of Micropelites caesalpiniae. Bulletinino del laboratorio ed orto botanico della r. universita di Siena. Siena: 28, Tab. 26, Fig. 24.

From herbaria: