New records and host plants of fly-speck fungi from Panama

Article in Fungal diversity - June 2006

2 authors:

Tina Antje Hofmann
Autonomous University of Chiriqui (UNACHI), Panama
28 PUBLICATIONS 262 CITATIONS

Meike Piepenbring
Goethe-Universität Frankfurt am Main
212 PUBLICATIONS 2,430 CITATIONS

Some of the authors of this publication are also working on these related projects:

First International Symposium on Tropical African Mycology (FISTAM), University of Parakou, September 2019 View project

tropical fungi View project
Fungal Diversity

New records and host plants of fly-speck fungi from Panama

Tina A. Hofmann* and Meike Piepenbring

Institut für Ökologie, Evolution und Diversität (Botanik), J.W.-Goethe Universität, Siesmayerstrasse 70-72, 60323 Frankfurt am Main, Germany


Fly-speck fungi are bitunicate Ascomycota forming small thyriothecia on the surface of plant organs. New records of this group of fungi for Panama and new host plants are described and illustrated, Asterina sphaerelloides on Phoradendron novae-helvetiae and Morenoina epilobii on unknown host (Asterinaceae); Micropeltis lecythisii on Chrysophyllum cainito (Micropeltidaceae); Schizothyrium rufulum on Encyclia sp. and Myriangiella roupalae on Salacia sp. (Schizothyriaceae) and Chaetothyrium vermisporum and its anamorph Merismella concinna on a Rubiaceae (Chaetothyriaceae).

Key words: Asterinaceae, Chaetothyriaceae, Micropeltidaceae, Schizothyriaceae, thyriothecia

Introduction

Fly-speck fungi are inconspicuous Ascomycota mainly found in the tropics and subtropics. They form small scutellate fruiting bodies, called thyriothecia, on the surface of host organs. They are plant parasites on living leaves and stems (Theissen, 1913; Stevens and Ryan, 1939), saprobes on dead leaves and stems (Ellis, 1976) or commensals (fungal epiphylls) on living leaves (Gilbert et al., 2006). Saprobes are found in temperate zones as well as in the tropics or subtropics. True plant parasites and commensals, which are thought to be species-rich, are delimited to tropical or subtropical regions of the world.

Most fly-speck fungi belong to one of two subclasses of bitunicate Ascomycota: Chaetothyriomycetidae or Dothideomycetidae (Kirk et al., 2001). The systematic relationships between families, genera and species are not solved yet, as complete phylogenetic studies are lacking for this group, except for some members of Chaetothyriomycetidae (Berbee, 1996; Liu and Hall, 2004) and Dothideomycetidae (e.g. Tam et al., 2003).

In the past, many authors described tropical fly-speck fungi (e.g. Theissen, 1913; Sydow, 1927; Hansford, 1946). During the last decades

*Corresponding author: T.A. Hofmann; e-mail: Tina.Hofmann@em.uni-frankfurt.de
members of fly-speck fungi have been described from many tropical and subtropical regions: Africa (Mibey and Hawksworth, 1997), Asia (e.g. Hosagoudar and Abraham, 1998; Song et al., 2004), Australia (Reynolds and Gilbert, 2005) and North America (e.g. Ahn and Crane, 2004). However, only Batista (1959), Batista et al. (1963) and Farr (1986, 1987) published morphologic and taxonomic studies on this group in the neotropics, and only from Brazil. As the diversity of fly-speck fungi is very high in tropical latitudes (Batista, 1959), our knowledge is still very incomplete. During recent field work in Panama, many tropical fly-speck fungi were observed. Only the fly-speck fungi *Chaetothyrina panamensis* (F. Stevens & Dorman) Arx (Dennis, 1970), *Chaetothyriopsis panamensis* F. Stevens & Dorman (Stevens, 1927), *Micropeltis bakeri* Syd. & P. Syd. (Cash and Watson, 1955), *Yamamoota carludovicae* (Bat.) Arx & E. Müll. (Sivanesan, 1984), *Scolecopeltidium bakeri* (Syd. & P. Syd.) F. Stevens & Manter (Batista, 1959) and *Scolecopeltidium mayteni* Bat. & I.H. Lima (Gilbert et al., 1997) are known so far from Panama.

In the present study six species new for Panama on several new host plants are described and illustrated. We are convinced that many more species will be found in Panama during future field work.

**Materials and methods**

Specimens of fungi forming black dots on leaves were collected in Panama in 2004. Dried herbarium specimens are deposited in the Herbarium of the University of Panama (PMA) and in the Botanische Statssammlung München (M). For comparison, additional specimens were obtained from BPI (U.S. National Fungus Collections). Microscopic preparations were made in water or embedding medium (Heinze, 1952, modified after M. Göker) and observed with a Leitz Dialux 20 microscope. Cross-sections through sporomata were made with a Leica CM 1510 Freezing-Cryotome. Preparations for measurements and drawings of asci and ascospores were mounted in water or cotton blue in lactic acid. For each specimen 30 ascomata, asci and ascospores were measured. Measurements are given as mean values ± standard deviation (SD) with extreme values in brackets. The drawings were made freehand at a fixed scale or with a drawing mirror.

**Results**

**Subclass: Dothideomycetidae**

**Asterinaceae**
**Fungal Diversity**

*Asterina sphaerelloides* Spagazzini, F. Guar. non nulli 123; Rev. Argentina Hist. Nat. I, Buenos Aires (1891). (Figs. 1-6, 27)

Synonyms: see Stevens and Ryan (1939).

**Colonies** black, discrete or laterally adnate, epi- and hypophyllous. **Surface mycelium** brown, hyphae of surface mycelium 4-6 µm broad, septate, branched, smooth, curved, with irregularly undulating walls. **Appressoria** 8-12 × 5-7(-9) µm, elliptical, not lobed, apices slightly hooked, penetration-porous sometimes visible. **Setae** absent. **Thyrothecia** (62-)71-94(-109) µm diam., 35-50 µm high, dimidiate, round, brown, superficial, unilocular, developing directly underneath the surface mycelium. **Scutellum** pseudoparenchymatic, radiate, brown, scutellum cells 3-7 × 3-4.5 µm, isodiametric, thick-walled. **Ostiole** absent, scutellum opening by star-shaped fissures. **Asci** 25-34(-36) µm diam., globose, slightly stalked, bitunicate with fissitunicate dehiscence, 8-spored, few mature asc in one thyrothecium. **Pseudoparaphyses** septate, with clavate, slightly pigmented apices. **Ascospores** 21-24 × 11-12(-13) µm, brown at maturity, elliptic, smooth, two-celled, strongly constricted at septum, cells almost spherical. **Mucous sheaths or cilia** absent.

**Anamorph:** *Asterostomella* sp.

**Pycnothyria** (65-)74-92(-99) µm diam., up to 50 µm high, brown, superficial, scattered between ascomata originating on the same mycelium. **Scutellum** like that of the teleomorph. **Conidiogenous cells** hyaline, inserted below the scutellum. **Conidia** (11-)19-24 × (7-)11-13 µm, brown at maturity, with a hyaline band in the middle, elliptic to slightly clavate, with basal scar not thickened or pigmented.

**Hosts:** *Ilex* sp. (*Aquifoliaceae*), *Clematis* sp. (*Ranunculaceae*), unknown *Loranthaceae* (Stevens and Ryan, 1939). *Phoradendron novae-helveticae* Trel. (*Loranthaceae*) is presented here as a new host plant.

**Known distribution:** Brazil (Theissen, 1913), new record for Panama.

**Material examined:** PANAMA, Chiriqui, Bajo Mono, ca. 1.500 m, on *Phoradendron novae-helveticae* Trel. (*Loranthaceae*), 5 November 2004, M. Piepenbring et al. 3414 (PMA, M).

**Additional specimens examined:** Asterina phoradendri Henn. on *Phoradendron racemosus* L., DOMINICAN REPUBLIC, Moca, E.N.A., 27 February 1930, Ekman s.n. (BPI 690251, type); Asterina phoradendricola Stev. & Poll. on *Phoradendron flavescens* (Pursh) Nutt. ex A. Gray, USA, Florida, near Gainesville, 11 November 1943, A.S. Rhoads s.n. (BPI 690232, type).

**Notes:** Until now two species of *Asterina* have been described on *Phoradendron* spp., *A. phoradendri* and *A. phoradendricola*. *Asterina phoradendri* forms hypostromata in the host tissue and bears short flask-shaped setae. Therefore, *A. phoradendri* probably does not belong to the genus *Asterina*. The ascomata of *A. phoradendricola* are characterized by a spherical, not dimidiate shape and the scutellum cells become hyaline and slimy at

maturity. These characteristics correspond to the Englerulaster-type (Stevenson, 1946), which is known for several species of *Asterina*. The sizes of the thyriothecia, asci and ascospores of the Panamanian species of *Asterina on Phoradendron novae-helveticae* correspond to those of *A. sphaerelloides* described by Theissen (1913) on an unknown *Loranthaceae*. The morphology of the surface mycelium is similar and the appressoria have the same shape and size. Up to now, no species of *Asterina* is known from *P. novae-helveticae*.

In this case, we follow the species concept proposed by Stevens and Ryan (1939), in which species of different host plant families can serve as hosts of the same *Asterina* species.

*Morenoina epilobii* (Libert) Müller & Arx, Beiträge zur Kryptogf lora der Schweiz 11(2): 129-130 (1962). (Figs. 7-10, 28)

Synonyms: see Müller and von Arx (1962).

*Surface mycelium* subhyaline, epi- and hypophyllous, hyphae 2-3 µm broad, septate, branched. *Appressoria* or *setae* not observed. *Thyriothecia* (120-)135-355(-680) × (40-)42-58(-60) µm, 15-30 µm high, elongated, rarely Y- to X-shaped, dark brown, lighter coloured at the margins, superficial. *Scutellum* pseudo-parenchymatous, radiate, several cell-layers thick, scutellum-cells 2-6 × 1.5-4 µm, isodiametric, thick-walled, brown. *Ostiole* absent, scutellum opens with a longitudinal fissure. *Asci* (12-)15-18 × (8-)9-10(-11) µm, ovoid to broadly clavate, not stalked, bitunicate with fissitunicate dehiscence, 6-spored, in two parallel rows underneath the scutellum. *Pseudoparaphyses* not observed. *Ascospores* 6.5-7.5(-8) × 2.5-3.5 µm, pale brown at maturity, elliptic to slightly clavate, straight to slightly curved, with one septum in the middle, slightly constricted at the septum. *Mucous sheaths* or *cilia* absent.

*Hosts*: *Epilobium* sp. (*Onagraceae*) (von Arx and Müller, 1975); unknown host plant.
**Micropeltis lecythisii** Batista & Lima, Instituto de Micologia, Universidade do Recife 56: 402 (1959).

(Figs. 11-13, 29)
Fungal Diversity

Surface mycelium hyaline, densely reticulate, forming one cell-layer, epiphyllous. Appressoria or setae absent. Thyriotheca (240)-280-407(-500) µm diam., up to 50 µm high, gray-black, roundish, dimidiate, discrete, superficial, unilocular. Scutellum epidermoid, dark, pelluculous, hyaline at the margins, formed by many layers of cells, not radiate, scutellum-cells 5-15 × 1.5-2 µm, irregularly branched and lobed. Ostiole (27-)33-43(-50) µm diam., central, round, bright, closed in young thyriothecia. Asci (57-)78-104(-120) × (14-)17-21(-24) µm, hyaline, elliptic to clavate, elongated, erect or curved, bitunicate with fissitunicate dehiscence, (2-)4-8-spored. Pseudoparaphyses 1-1.5 µm broad, never longer than asci, filiform, hyaline, rarely septate, at maturity often disappearing. Ascospores (33-)34-40(-44) µm long, small basal cell (4-)5-6(-7) µm broad, large upper cell 7-9(-12) µm broad, hyaline, elliptic to clavate, straight or curved, thick-walled, (2-)3(-4)-celled. Upper cell of ascospore lemon-shaped, basal cell shorter, elliptic to clavate. Mucous sheath 1-2 µm thick. Cilia absent.

Hosts: Lecythis sp. (Lecythidaceae) (Batista, 1959). Chrysophyllum cainito L. (Sapotaceae) is reported here as a new host plant.

Known distribution: Brazil (Batista, 1959), new record for Panama.

Material examined: PANAMA, Bocas del Toro, El Valle, Finca Celestine, ca. 600 m, on Chrysophyllum cainito (Sapotaceae), det. T. Hofmann), 27 February 2004, T. Hofmann 102 (PMA, M); BRAZIL, Pernambuco, Bento Velho, Vitória, on Lecythis sp. (Lecythidaceae), 5 March 1955, S.J. da Silva s.n. (BPI 645385, BPI 645386, type).

Notes: The type-material from Lecythis sp. differs from the Panamanian material only by a brownish colour of the scutellum. Until now, no species of Micropeltis is known from Chrysophyllum spp. As no detailed analysis of substrate- or host-specificity of Micropeltis spp. exists, we do not describe a new species. First of all, studies on the ecology and way of nutrition of Micropeltis spp. are necessary.

Schizothyriaceae

Schizothyrium rufulum (Berkley & Curtis) Arx, Beiträge zur Kyptogamenflora der Schweiz 11(2): 201 (1962). (Figs. 14-16, 30)

Synonyms: see Müller and von Arx (1962).

Surface mycelium hyaline, epi- and hypophyllous, forming one cell-layer, hyphae 2-3 µm broad, densely reticulate. Appressoria or setae absent. Thyriotheca (440-)587-869(-940) diam., 25-35 µm high, brown, paler at margins, round, dimidiate, superficial, unilocular. Scutellum not radiate, pseudoparenchymatic, formed by one cell layer, scutellum cells 3-8 × 2-3 µm, isodiametric, reticulate, thick-walled, brown. Ostiole absent, scutellum opens with irregular fissures, resulting in clod-shaped parts of the scutellum. Asci

(48-)52-64(-70) × (33-)39-51(-53) µm, globose, not stalked, bitunicate with fissitunicate dehiscence, 8-spored, mature endotunica thin. *Pseudoparaphyses* 1.5-2 µm broad, densely packed and distinct. *Ascospores* (29-)31-35(-37) × 9-11(-12) µm, hyaline, smooth, straight to curved, with one septum, slightly constricted at the septum, upper cell mostly larger, basal cell more acuminate, apices rounded. *Mucous sheaths* or *cilia* absent.

*Hosts*: Broad host spectrum (Müller and von Arx, 1962); *Fabaceae, Sapindaceae, Malpighiaceae* (Farr, 1987); *Rubiaceae, Encyclia* sp. and *Epidendrum* sp. (*Orchidaceae*).

*Known distribution*: Tropics (Müller and von Arx, 1962), Brazil (Farr, 1987), new record for Panama.

*Material examined*: PANAMA, Chiriquí, Caldera, on unknown *Rubiaceae* together with *Chaetothyrium vermisporum* (see below), 3 March 2004, T. Hofmann 142 (PMA, M); PANAMA, Chiriquí, Los Algarrobos, ca. 150 m, on *Encyclia* sp. (*Orchidaceae*, det. R. Mangelsdorff), 28 December 2004, R. Mangelsdorff 2247 (PMA, M); PANAMA, Chiriquí, Los Algarrobos, ca. 150 m, on *Epidendrum* sp. (*Orchidaceae*, det. R. Mangelsdorff), 28 December 2004, R. Mangelsdorff 2248 (PMA, M).
Notes: The sizes of ascomata and ascospores of *Schizothyrium rufulum* vary strongly (Müller and von Arx, 1962). *Schizothyrium rufulum* grows completely superficial on the cuticula of living leaves or on dead plant material in leaf spots. When the ascomata develop at the lower surface of leaves of *Encyclia* sp., the scutelli are perforated just above the stomata of the host (Fig. 31). The penetration of hyphae through the stomata was not observed. The fungus probably feeds on plant waxes, which are secreted by the cuticula. This was proved for related fungi causing fly-speck disease and sooty blotch on apples (Belding et al., 2000).

*Myriangiella roupalae* (Sydow) Arx & Müller, Studies in Mycology 9: 28 (1975). (Figs. 17-19, Fig. 31)

Synonyms: see von Arx and Müller (1975).

**Surface mycelium** hyaline, densely reticulate, one cell-layer thick, at maturity often missing, epipyllous. **Apessoria or setae** absent. **Thyriothecia** (209-)300-475(-550) µm diam., up to 50 µm high, pale brown, round, dimidiate, superficial, unilocular. **Scutellum** irregularly pseudoparenchymatic, not radiate, one cell-layer thick, pale brown to brown, brighter at margins, translucent, scutellum cells cylindrical, elongated, 1-2 µm broad. **Ostiole** absent, scutellum opens with irregular fissures. **Asci** (55-)62-73(-76) × (32-)37-47(-50) µm, globose to slightly clavate, bitunicate with fissitunicate dehiscence, slightly stalked, (2-)4-8-spored. **Pseudoparaphyses** hyaline, 1-2 µm broad, numerous. **Ascospores** (33-)39-49(-52) × 8-10(-11) µm, broader in the middle, hyaline, fusiform, straight to curved, with (9-)11-14(-15) transverse septa, constricted at the septa, end-cells rounded. **Mucous sheaths or cilia** absent.

**Hosts:** *Roupala veraguensis* Klotzsch es. Meissn (*Proteaceae*) (Sydow, 1927). *Salacia* sp. (*Hippocrateaceae*) is a new host plant.

**Known distribution:** Costa Rica (Batista, 1959), new record for Panama.

**Material examined:** PANAMA, Chiriquí, Caldera, on *Salacia* sp. (*Hippocrateaceae*, det. T. Hofmann) together with several other, unidentified fly-speck fungi, 3 March 2004, T. Hofmann 128 (PMA, M).

**Notes:** Batista et al. (1963) described *Sydowiellina rionegrensis*, which has ascospores septated as in *M. roupalae*. The ascospores of *S. rionegrensis*, however, are shorter (22-32 µm) and broader (10-14 µm) than those of *M. roupalae*. The genus *Sydowiellina* is now treated as a synonym of *Myriangiella* (Index Fungorum), although most of the included species of *Sydowiellina*, such as *S. rionegrensis*, are not recombined.

The sizes of the different structures of the Panamanian fly-speck fungus on *Salacia* sp. (*Hippocrateaceae*) are slightly different from those of *M. roupalae* in Batista’s description (1959) and the host belongs to a different

family. Because no information on host and substrate specificity of Myriangiella spp. exists, no new species of Myriangiella is described here.

In the field it is not possible to distinguish fly-speck fungi with thyriothecia from Ascomycota forming perithecia with broad black shields. Therefore, we also collected and investigated the following member of Chaetothyriomycetidae.

Subclass: Chaetothyriomycetidae

Chaetothyriaceae
Figs. 20-22. *Chaetothyrium vermisporum* (teleomorph) on an unknown *Rubiaceae* (Hofmann 117). **20.** Longitudinal section of a perithegium covered by the pellicle and associated with setae forming a ring around the perithecium. 150 µm of the length of the setae have not been drawn. Bar = 50 µm. **21.** Young and mature asci on ascogenous hyphae. Bar = 10 µm. **22.** Fusiform ascospores with inclusions. Bar = 10 µm.

*Chaetothyrium vermisporum* Hansford, Mycological Papers 15: 151 (1946). (Figs. 20-22)

Colonies epiphyllous. *Surface mycelium* hyaline, densely reticulate, one cell-layer thick. *Appressoria* not observed. *Mycelial setae* (153-)190-313(-392) µm long, at apex 2-3 µm broad, at base 5-8(-9) µm broad, dark brown, scattered, discrete, unbranched, formed on dense, dark hyphae, (18-)22-32(-36) µm broad. Setae in rings around perithecia (they never form a ring around pycnothyria). Perithecial setae not observed. *Perithecia* 100-200 µm diam., up to 80 µm high, round, flat, superficial, unilocular, covered by a layer of brown cells corresponding to a pellicle. *Pellicle* (284-)300-371(-396) µm diam., brown, merging at margins with hyaline surface mycelium, cells of the pellicle 5-15 × 2-3 µm, thick-walled, epidermoid, irregularly lobed and branched.
Ostiole not observed, perithecia opening by central star-shaped fissures. Asci 41-58(-66) × (15-)17-22(-24) µm, clavate to ellipsoid, bitunicate with fissitunicate dehiscence, (4-)6-spored. Young asci with endotunica thickened up to 3 µm, mature asci thin-walled, not numerous in one perithecium. Paraphyses or periphyses not observed. Ascospores (42-)45-61(-66) × 6-7(-8) µm, hyaline, fusiform, elongated, with (7-)8-16(-17) transverse septa (rarely 1-3 longitudinal septa present), end-cells rounded. Mucous sheaths or cilia absent.

Anamorph: Merismella concinna Syd. (see below).

Hosts: Canthium sp. (Rubiaceae), Hugonia platysepalae (Linaceae), Ventilago africana (Rhamnaceae) (Hansford, 1946). An unknown Rubiaceae and Clusia sp. (Clusiaceae) are recorded here as new host plants.

Known distribution: Africa, Uganda (Hansford, 1946), new record for Panama.


Notes: Chaetothyrium spp. have perithecia and are therefore no "true" fly-speck fungi, which have flattened ascomata called thyrothecia. They look like fly-speck fungi because of special pellicle structures, which press the perithecia close to the surface of the leaves.

Chaetothyrium vermisporum differs from other species of this genus by ascospores with numerous septae. The teleomorph C. vermisporum is easily distinguished from the anamorph Merismella concinna by the presence of a ring of setae around the thyrothecia.


Conidiomata (279-)285-416(-630) µm diam., up to 35-55 µm high, round, dimidiate, superficial. Conidia (81-)87-103(-107) × 2-3 µm, hyaline, directly arising from basal hyphae of the conidioma, with 4-5(-6) elongated-filiform branches, with (4-)5-7(-9) septa per conidial branch, constricted at septa, fragmentation at constricted parts not observed, mass of conidia liberated in dense bundles.

Teleomorph: Chaetothyrium vermisporum Hansf. (see above).

Hosts: Casearia sylvestris (Flacourtiaceae) (Sydow, 1927). An unknown Rubiaceae and Clusia sp. (Clusiaceae) are recorded here as new host plants.

Known distribution: Greece (Sydow, 1927), other species of Merismella from San José, La Caja; Costa Rica, Piedades de San Ramon; Brazil (Sydow, 1927). This is a new record of this species for Panama.


Additional specimen examined: Merismella amazonensis Farr on unknown Sapindaceae, BRAZIL, Território de Roraima, along Boa Vista-Dormida Rd, 4 December 1977, K.P. Dumont et al. s.n. (BPI 389173, type).

Notes: When Sydow (1927) proposed four species of Merismella he described the conidia as “fructiferous hyphae” ("kurzgliedrige Fruchthyphen") sitting on “short conidiophorous structures” and dissociating at maturity into “rodlet-shaped conidia”. Like Farr (1986) we were unable to observe the described fragmentation of the filiform branches. They have a regular ramification beginning directly on top of the basal cell. We consider them primary propagules that might dissociate at the septa to form secondary propagules at an advanced stage of maturity.

Because of strong morphological similarities among species of Merismella, Sydow (1927) assumes a close affinity of the species. Farr (1986) confirmed that theory, nevertheless described a new species, Merismella amazonensis Farr. Merismella amazonensis differs from other species of the genus Merismella by shorter ramifications and smaller conidiomata. We think, however, that the different species of Merismella correspond to variable specimens of a single species. The different sizes of conidioma and conidia
Fungal Diversity

might be due to different quantities of nutrients available on different substrates.

Acknowledgements

We thank R. Kirschner for critically reading the manuscript, R. Mangelsdorff for providing specimens and identification of Orchidaceae and the curator of BPI for loans of specimens. We are grateful to the DAAD for financial support of the expedition to Panama. This investigation is realized in the context of the university partnership between the UNACHI and the University of Frankfurt with financial support by the DAAD.

References


(Received 17 January 2006; accepted 15 March 2006)