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Microfungi from Nicaragua in a historical collection kept at the Herbarium of the Charles University in Prague

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Abstract – A set of historical specimens collected by the American mycologist Charles Leonard Smith in southeastern Nicaragua during 1896 and currently deposited at the Herbarium of the Charles University in Prague (PRC) was examined for the presence of microfungi. Despite the age of the specimens, twenty-two taxa were identified, seventeen of them to species level and other five to generic level. All of them are recorded for the first time from Nicaragua. *Cryptophiale* cf. *kakombensis* and *Sporoschisma juvenile* were found associated with their putative teleomorphic states. Historical facts surrounding the expedition source of these samples and bibliographical data about Smith are also given.

Central America / hyphomycetes / morphology / Neotropics / taxonomy

INTRODUCTION

One of the first botanical expeditions to collect fungi in Nicaragua was conducted by the American botanist and professor Bohumil Shimek and his assistant Charles Leonard Smith from the Department of Botany of the State University of Iowa in the late 19th century (Shimek, 1893a; Anonymous, 1895a). The expedition lasted for about three months and was very fruitful considering the large amount of vascular plants, ferns, mosses, fungi and myxomycetes they collected including zoological specimens. They arrived in Greytown, San Juan de Nicaragua today, via Bluefields in the country's Atlantic Coast (Fig. 1A). They traveled west along the Rio San Juan to Ometepe Island in Lake Nicaragua following a popular route at the time for travelers in their way to California, making different stops along the path to collect. According to Shimek's detailed account of the expedition they collected around 230 species of fungi represented by numerous specimens belonging to basidiomycetes and ascomycetes but also around 30 species of myxomycetes (Shimek, 1893a). Shortly after in 1894, Smith returned alone to Central America in a second expedition that lasted for about two years. In that occasion he visited southern Mexico first, where he collected in the states of Veracruz and Oaxaca, traveling later to Nicaragua until his return to the United States in 1896 (Stevenson,

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1971). An online search in the Mycology Collections Data Portal (MyCoPortal) shows that fungal specimens collected by Smith in Nicaragua during both expeditions are deposited nowadays mostly in BPI and NY but also to a lesser extent in six other North American herbaria (CfUP, F, FH, LSUM, NCU, SYRF). They comprise 451 records and 189 taxa mostly belonging to Xylariaceae (Ascomycota) and Polyporaceae (Basidiomycota) (MyCoPortal, 2015).

Recently, a large number of previously unnoticed historical specimens from Nicaragua and United States were found in the Herbarium of the Department of Botany of the Charles University in Prague. They were apparently brought by Shimek himself while serving as an exchange lecturer of Botany at the university between 1913 and 1914 (Martin, 1937; Koukol, 2012). In order to expand the current checklist of hyphomycetes from Nicaragua (Delgado, 2011), a small set of historical specimens collected during the second expedition and showing colonies of microfungi was selected for study. Surprisingly, several interesting and inconspicuous hyphomycetous anamorphs or in a couple of cases together with their putative teleomorphic states were recovered from the materials. All of them were previously unknown from Nicaragua and are reported here for the first time along with a detailed revision of the specimens where they were found. Descriptions and notes on their morphology, taxonomy and their known distribution in Central America or the Neotropics are also included.

MATERIALS AND METHODS

All specimens were collected by Charles Leonard Smith in March, 1896 in southeastern Nicaragua. Collection sites were along the Indian River or near Greytown (Fig. 1A). Most of them were in good condition and are placed in small packets with original handwriting in pen or pencil, often with a collector number. Substrate data were not provided in any packets but were inferred directly from the specimens after comparison with the literature or with similar specimens collected by Smith and deposited in herbaria with available online records. They consist mostly of bark fragments, decaying wood and dead bamboo stems. Fungal structures were first briefly rehydrated in water after removal from substrate and later mounted in lacto-cotton blue for microscopic observation. A maximum of 100 measurements were made depending of the availability of the material that in most cases was quite scant. Identifications were based on morphological features and DNA extractions from herbarium specimens were not attempted. Images were taken using an Olympus BX-45 microscope and edited using Adobe Photoshop Elements 7.0. All specimens studied were annotated using acid-free determinavit slips including substrate data, specimen condition and fungi identifications. They were numbered and deposited in the Herbarium of the Department of Botany of the Charles University in Prague (PRC) along with semi-permanent slides. Collateral to the examination of Smith's specimens in PRC a checklist entitled "Taxa collected by Charles Leonard Smith in Nicaragua" was created in MyCoPortal based on voucher specimens deposited in North American herbaria. It is available at http://mycoportal.org/portal/checklists/checklist.php?cl=102&pid=13 under "Fungi Across the World: Historic" tab. References to correspondence in the Discussion are based on about forty letters between the American mycologist Job Bicknell Ellis and Smith or Thomas Houston MacBride spanning the years 1892-1899 and currently deposited at the Archives of

Fig. 1 **A.** Map of Nicaragua showing localities visited by Smith during the first and second expeditions **1.** Bluefields **2.** Greytown **3.** Rio San Juan **4.** El Castillo **5.** San Carlos. **6.** Ometepe Island **7.** Puerto Momotombo **8.** El Hoyo Volcano **9.** Momotombo Volcano **10.** Indian River **11.** Black Water River (based on INETER http://www.ineter.gob.ni/) **B.** Charles Leonard Smith (taken from University of Iowa Hawkeye Yearbook, 1895). Scale bar A = 50 km.

The LuEsther T. Mertz Library, The New York Botanical Garden (NYBG). Herbaria acronyms mentioned throughout the text followed Index Herbariorum (http://sweetgum.nybg.org/ih/).

RESULTS

Taxonomy

Twenty-two taxa of hyphomycetous anamorphs were identified, seventeen of them to species level and five to generic level. They are arranged alphabetically below including descriptions, location and substrate data, specimens' details and comments on taxonomy or distribution in Central America or the Neotropics whenever relevant.

Brachydesmiella sp. **Fig. 4E**

Conidia narrowly pyriform, 1-septate, 20-27 µm long, apical cell ellipsoidal, brown, 16-19 × 9-11 µm, basal cell cylindrical, truncate at base, with a slightly darkened scar, 6-7 × 4 µm.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River near Greytown, on dead bamboo stems, March 1893, C.L. Smith (PRC 674); idem, Indian River, March 1896 (PRC 745).

Notes: The specimens PRC 674 and PRC 745 consist of several strips of dead bamboo stems of different sizes darkened by black, hairy colonies of *Corynesporopsis isabelicae* Hol.-Jech. and with visible black ascomata of an undetermined ascomycete. Along with PRC 682 they have in common a collector number "86" hand-written with pencil in the upper left corner of the packets. The collection date written in PRC 674 (Fig. 4A) differs from the other specimens in the year 1893 and is the only one from the whole set with that collection year. Considering they are likely duplicates of the same sample, this is probably a careless annotation and PRC 674 was collected also during Smith's second expedition of 1896. Moreover Shimek, in his account of the first expedition, never mentioned that they visited Indian River but instead Deseado River to the west of Greytown (Shimek, 1893a).

In both specimens, scattered conidia morphologically similar to *Brachydesmiella anthostomelloidea* Goh & K.D. Hyde (Goh & Hyde, 1996a) but smaller were found mixed with the colonies of *C. isabelicae*. The protologue illustration and a subsequent specimen described from Brazil (Barbosa & Gusmão, 2011) show that conidial morphology is quite variable in this species, even

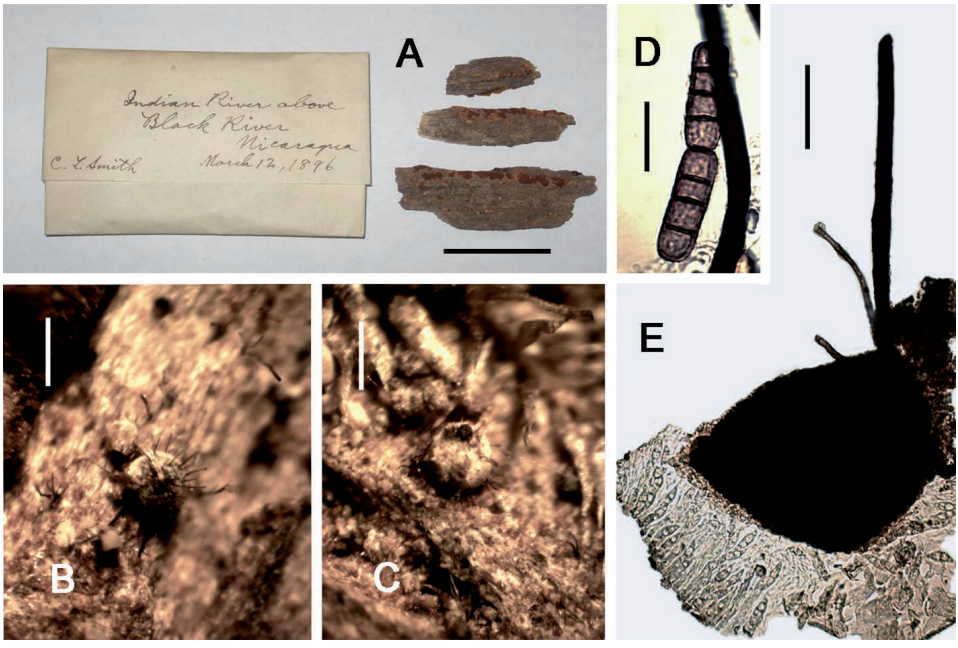

Fig. 2. **A.** PRC 673. Packet and specimen. *Sporoschisma juvenile* **B, C.** Ascomata surrounded by conidiophores. **D.** Conidia. **E.** Squash of ascoma showing ascospores, conidiophore and capitate setae arising from ascomatal wall. Scale bars: A = 25 mm, B,C = 300 µm, D = 20 µm, E = 50 µm.

the Brazilian specimen has also smaller conidial and conidiophores dimensions. The Nicaraguan material is probably conspecific with *B. anthostomelloidea* and differences in conidial size are maybe within the species range of variation. However, further characterization was not possible due to the scarcity of the material and the absence of conidiophores.

Brachysporiella gayana Bat., Bol. Secr. Agric. Pernambuco 19 (1-2): 109, 1952 **Fig. 3G**

Colonies effuse, dark brown, hairy. *Conidiophores* straight or gently curved, simple, cylindrical but gradually tapering toward the apex, 6-12-septate, brown to dark brown, up to 400 µm long, 6-9 µm wide, 10-15 µm wide at base, 4.5-6 µm wide at the apex, with 0-7 successive percurrent extensions and 0-2 enteroblastic regenerative extensions. *Conidiogenous cells* monoblastic, integrated, terminal, percurrent, cylindrical, doliiform or ampulliform, usually non septate but occasionally 1-septate, 5-11 × 4-6 µm. *Conidia* obovoid to clavate with the distal cell larger, pale brown to brown, smooth, usually 3-septate, rarely 2, 16-38 × 11-19 µm, basal cell conico-truncate, 3-5 µm wide.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark, March 1896, C.L. Smith (PRC 681).

Notes: The specimen PRC 681 consists of two pieces of bark with black stromata of a xylariaceous ascomycete forming small clusters. Some of them are empty or broken and several fragments of the black stromata were found loosen inside the packet. The packet has location, collector and date hand-written with pen and a "74' see other 74" hand-written with pencil on the upper left corner. An online search on MyCoPortal shows two specimens of *Hypoxylon nicaraguense* Ellis & Everh. (Xylariaceae) collected by Smith and currently deposited in NY 830452 and BPI 738733 with the same number 74. However, according to the specimens' notes their location and date are different. They were collected during the winter of 1893 in Castillo, a town along the San Juan River formerly known as Castillo Viejo and El Castillo today that was visited by Smith and Shimek during the first expedition (Shimek, 1893a). MyCoPortal also shows a total of 23 specimens of Xylariaceae collected by Smith on March 1896 along the Indian River and also deposited in BPI and NY (MyCoPortal, 2015) of which PRC 681 could probably be a duplicate. *Brachysporiella gayana* was found around or occasionally overgrowing the stromata of the xylariaceous ascomycete. Mercado *et al*. (1997a) previously recorded this fungus from neighboring Costa Rica on a dead petiole of an undetermined palm tree and on dead branches of *Smilax* sp. and now is reported for the first time from Nicaragua.

Candelabrum microsporum R.F. Castañeda & W.B. Kendr., Univ. Waterloo Biol. Ser. 35: 16, 1991 **Fig. 3 I-J**

Conidiophores semimacronematous, septate, subhyaline, up to 44 µm long, 4 µm wide. *Propagules* spherical or subspherical, subhyaline to light cream, 39-66 × 31-48 µm.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark, March 1896, C.L. Smith (PRC 678).

Notes: The specimen PRC 678 includes six small bark fragments in poor condition with some visible, black ascomata on the surface and a few orange apothecia. Only a few scattered propagules were recovered and identified as *C. microsporum* based on propagules size (Castañeda & Kendrick, 1991). However, they could be also smaller, young propagules of *C. brocchiatum* Tubaki, a

morphologically similar species with larger propagules 70-120 µm in diameter of which *C. microsporum* is currently accepted as a distinct species (Voglmayr, 1998). This is the first record of this fungus from Central America previously known on rachis of dead leaf of *Scheelea liebmannii* Becc. (Arecaceae) in southeastern Mexico (Becerra *et al*., 2007).

Cordana abramovii Seman & Davydkina, Nov. sist. Niz. Rast. 20: 115, 1983 **Fig. 3E**

Colonies effuse, inconspicuous, hairy. *Conidiophores* erect, straight or flexuous, simple, cylindrical, smooth, brown to dark brown, paler toward the apex, 6-12-septate, up to 460 µm, 7-9 µm wide, 13 µm wide at base, with up to 3 enteroblastic regenerative extensions. *Conidiogenous cells* polyblastic, integrated, terminal and intercalary, cylindrical but swollen at the zone bearing conidiogenous loci, sympodial; conidiogenous loci clustered proximally or distally on the conidiogenous cell, flattened or slightly denticulate. *Conidia* broadly ellipsoidal to obovoid, brown, 1-septate, with a central pore at the septum, verruculose, 16-23 × 13-17 µm, thick-walled, 3-3.5 µm wide; basal scar truncate, 4-5 µm wide, with a pore in the scar wall.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark, March 1896, C.L. Smith (PRC 680, 683, 686); idem, Indian River near Greytown (PRC 744).

Notes: These four specimens, consisting of several bark fragments of different sizes, are apparently duplicates of the same bark sample, even they share some fungal species in common e.g. *C. abramovii*, *Fusichalara novae-zelandiae* S. Hughes & Nag Raj and *Monotosporella setosa* (Berk. & M.A. Curtis) S. Hughes. The packets basically contain the same information (location, collector and date) but specimens PRC 683 (Fig. 3D), 686 and 744 have a collector number "84" handwritten with pencil on the upper left corner and the latter with the location as "Indian River Near Greytown". Zelski *et al*. (2014) recently noted morphological differences such as the presence of verruculose conidia between Peruvian collections of *C. abramovii* and specimens from the Old World tropics and the type material from northern Ossetia. The Nicaraguan collections have also finely rough conidia smaller in size supporting their hypothesis that geographically distant specimens of this fungus might represent a species complex or even distinct species. *Cordana abramovii* is known already from Central America on dead branches in neighboring Costa Rica (Mercado *et al*., 1997a) and now for the first time from Nicaragua.

Corynesporopsis isabelicae Hol.-Jech., Česká Mykol. 41(2): 109, 1987 **Fig. 4B**

Colonies effuse, hairy, black. *Conidiophores* simple, erect, straight or flexuous, cylindrical, brown to dark brown, 8-13-septate, smooth or slightly rough, thick-walled, occasionally with 1-regenerative percurrent extension, up to 440 µm long, 4.5-8 µm wide; basal cell radially-lobed, dark brown to black, 7-10 µm wide. *Conidiogenous cells* monotretic, determinate, terminal, cylindrical, often paler brown. *Conidia* fusiform to elongated fusiform or elongated naviculiform, solitary or in short chains of up to 4 conidia, smooth or verruculose, 1-septate, with a dark band 1-3 µm wide, brown, concolorous or not, often with the apical cell light brown, 21-41 × 4.5-7 µm, basal scar 2-4.5 µm wide.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River near Greytown, on dead bamboo stems, March 1893, C.L. Smith (PRC 674); idem, March 1896 (PRC 746); idem, Indian River, March 1896 (PRC 675, 682, 684, 745).

Notes: This group of specimens consists of different numbers of dead bamboo strips mostly darkened with effuse colonies of *C. isabelicae* but also showing scattered black ascomata of an undetermined ascomycete. They are

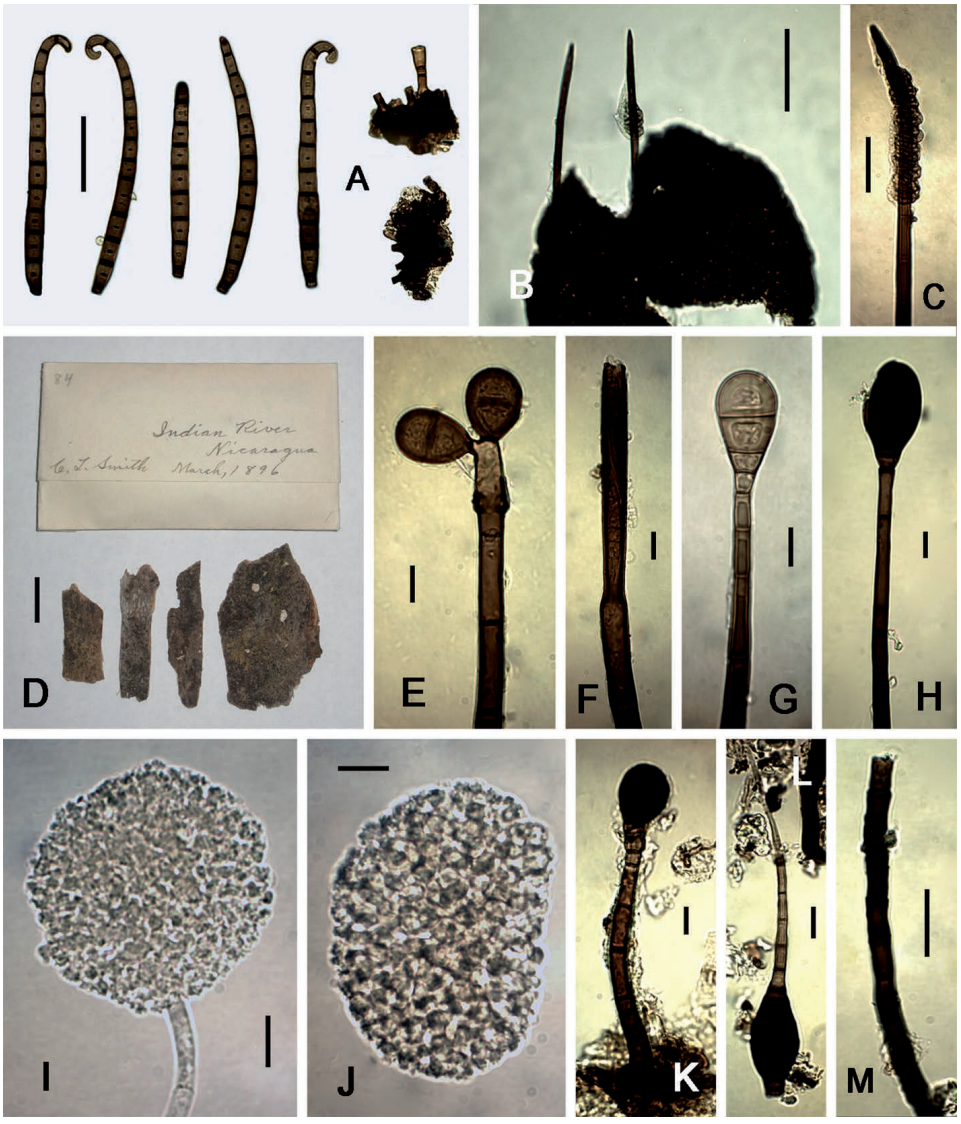

Fig. 3. *Stanjehughesia curviapicis* (PRC 673) **A.** Conidia and conidiogenous cells. *Cryptophiale* cf. *kakombensis* (PRC 743) **B.** Squash of ascoma showing seta and setiform conidiophore. **C.** Detail of conidiophore and conidiogenous zone. **D.** PRC 683. Packet and specimen. *Cordana abramovii* **E.** Conidiophore and conidia. *Fusichalara novae-zelandiae* **F.** Phialide with conidia. *Brachysporiella gayana* (PRC 681) **G.** Conidiophore and conidium. *Monotosporella setosa* (PRC 681) **H.** Conidiophore and conidium. *Candelabrum microsporum* (PRC 678) **I, J.** Conidia. *Rhexoacrodictys erecta* (PRC 679). **K.** Conidiophore and conidium. *Repetophragma cubense* (PRC 680) **L.** Conidium. **M.** Conidiophore. Scale bars: A = 30 µm, B = 50 µm, C, M = 20 µm, D = 10 mm, E, F, G, H, I, J, K, L = 10 µm.

apparently duplicates of two samples, one of them including specimens PRC 674, 682 and 745 as previously stated and the other sample consisting of PRC 675, 684 and 746, which similarly have also written a collector number on the upper left corner of the packets, in this case "76", even PRC 684 says "76 see other 76". *Corynesporopsis isabelicae* has been previously collected in neighboring Costa Rica on rachides of an undetermined palm tree mixed with meliolaceous and microthyriaceous fungi (Mercado *et al*., 1997a). The Nicaraguan collections were abundant in all the specimens examined and agree well with the type material from Cuba (Holubová-Jechová, 1987) except that conidiophores are larger and along with conidia are consistently verruculose or smooth.

Chaetosphaeria pulchriseta S. Hughes, W.B. Kendr. & Shoemaker, N.Z. Jl Bot. 6: 356, 1968

Colonies effuse, hairy. *Setae* erect, straight or slightly flexuous, smooth, brown, thick-walled, 4-8-septate, tapering toward the pointed apex, up to 170 µm, 5-7 µm in the widest part; penultimate cell blackish brown, 28-41 µm long. *Conidiophores* erect, straight or slightly flexuous, cylindrical, septate, pale brown, 26-52 × 3-4.5 µm, with 1-3 funnel-shaped or inconspicuous, terminal and lateral collarettes.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark and decaying wood, March 1896, C.L. Smith (PRC 743).

Notes: The specimen PRC 743 consists of nineteen pieces of bark and decaying wood including tiny wood fragments, with some of the larger pieces showing visible black fructifications of an undetermined hysteriaceous ascomycete. The description above corresponds to the dictyochaeta-like anamorph of the holomorphic *C. pulchriseta* (Hughes & Kendrick, 1968) and it was found in the largest piece forming effuse colonies around or even overgrowing the hysterothecia. The material was relatively abundant but in poor condition even conidia were not found but the characteristic sterile setae with an acute apex and a darkly pigmented penultimate cell allowed proper identification (Kuthubutheen & Nawawi, 1991; Whitton *et al*., 2000). *Chaetosphaeria pulchriseta* has been collected several times in the Neotropics on submerged twig and bark and dead plant material from Brazil (Santa Izabel *et al*., 2011; Barbosa *et al*., 2013, 2014) and on rotten fruit of *Cocos nucifera* L. and unidentified dead branches from Cuba (Castañeda, 1986; Mercado *et al*., 1997b; Delgado & Mena, 2004). This is the first time this fungus is recorded from Nicaragua and Central America.

Chalara sp. **Fig. 4 I-K**

Colonies inconspicuous. *Conidiophores* cylindrical, septate, brown to dark brown, up to 232 µm long, 9-11 µm wide, 14 µm wide at base. *Conidiogenous cells* monophialidic, integrated, terminal, occasionally extending percurrently one time; venter subcylindrical, brown, smooth or slightly rough, 12-16 µm wide, transition to collarete gradual or none; collarette cylindrical, brown, 9-11 µm wide. *Conidia* cylindrical, guttulate, catenate, hyaline at first, light brown or brown when older, smooth or finely rough, with rounded or truncate ends, often both ends with minute marginal frills, 1-septate, 18-28 × 7-9 µm.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on dead bamboo stems, March 1896, C.L. Smith (PRC 682).

Notes: This *Chalara* specimen is morphologically similar to *C. cladii* M.B. Ellis in phialide, conidial morphology and pigmentation as described and illustrated by Ellis (1961) and Nag Raj & Kendrick (1975). The present fungus,

however, differs in having phialides with rough, wider venters and cylindrical, larger, 1-septate only and equal-celled conidia. Kirk & Spooner (1984) considered *Chaetochalara cladii* B. Sutton & Piroz. (Sutton & Pirozynski, 1965) conspecific with *C. cladii*, the holotype of the latter having widely scattered, less numerous dark brown setae and an associated teleomorph *Phaeoscypha cladii* (Nag Raj & W.B. Kendr.) Spooner (Hyaloscyphaceae, Helotiales). The Nicaraguan specimen

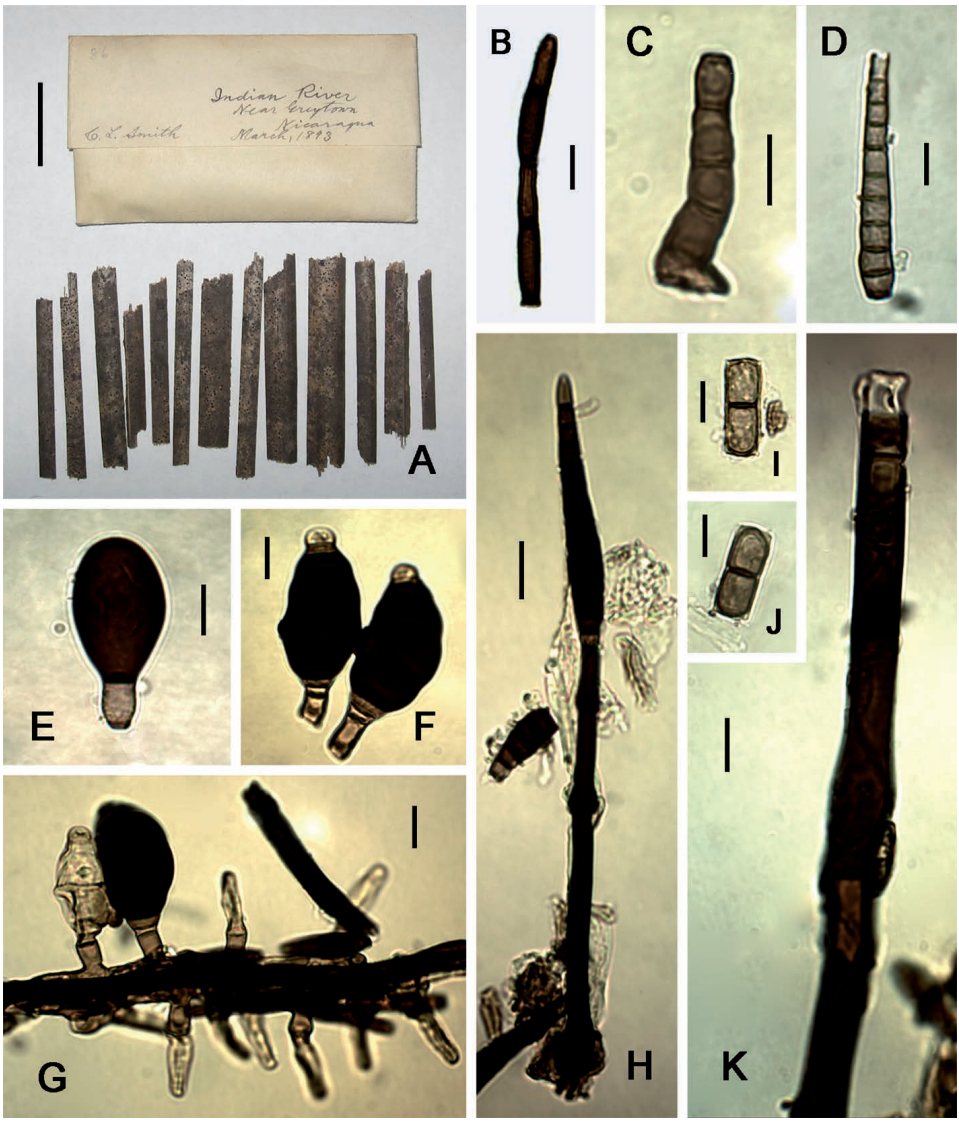

Fig. 4 **A.** PRC 674. Packet and specimen. *Corynesporopsis isabelicae* **B.** Conidia. *Sporidesmium pachyanthicola* **C.** Conidiophore. **D.** Conidium. *Brachydesmiella* sp. **E.** Conidium. *Septosporiopsis elaeidis* **F.** Conidia. **G.** Overgrowing conidiophores of *C. isabelicae*. *Sporidesmium nodipes* (PRC 674) **H.** Conidiophore and conidium. *Chalara* sp. (PRC 682). **I, J.** Conidia. **K.** Phialide with conidia. Scale bars: A = 20 mm, B, C, D, E, F, G, H, I, J, K = 10 µm.

was found mixed with colonies of *C. isabelicae* and other microfungi, and if considered conspecific with *Ch. cladii* sensu Kirk & Spooner, setae or apothecia were not seen. Identification to species level was left inconclusive considering the several morphological disparities with the holotype of *C. cladii* and the paucity of the available material.

Cryptophiale cf. ***kakombensis*** Piroz., Can. J. Bot. 46: 1124, 1968 **Fig. 3 B-C**

Colonies inconspicuous, composed of mixed ascomata and conidiophores. *Ascomata* superficial, subglobose, dark brown to blackish brown, ostiolate, 105-140 × 93-123 µm, ostiole 9-10 × 20-32 µm, setae 2-9-septate, up to 200 µm long, 4-6 µm wide. *Conidiophores* setiform, straight or flexuous, brown, subulate, 4-9-septate, up to 220 µm long, 4-6 µm wide, 12-16 µm wide at base, occasionally with one enteroblastic percurrent extension. *Conidiogenous zone* cylindrical, light brown, 11-61 × 3-14 µm. *Conidia* seen as a stiff, hyaline blob to one side of the conidiogenous zone.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark and decaying wood, March 1896, C.L. Smith (PRC 743).

Notes: A few blackish, setose perithecia associated with setiform conidiophores closely resembling *C. kakombensis* Piroz. (Pirozynski, 1968) were found in one small fragment of decaying wood belonging to specimen PRC 743. Hyde *et al.* (1999) previously observed a connection between *C. kakombensis* and a chaetosphaeriaceous teleomorph, *Chaetosphaeria saltuensis* K.D. Hyde, Goh, Joanne E. Taylor & J. Fröhl. on natural substrate. The Nicaraguan material showed a few setose conidiophores growing around or developing directly on some ascomata confirming the anamorph-teleomorph connection. However, the age and scarcity of the material and the lack of relevant morphological features prevent a reliable identification of both morphs and further collections as well as molecular or cultural data will be necessary to corroborate this link.

Ellisembia adscendens (Berk.) Subram., Proc. Indian natn Sci. Acad., Part B. Biol. Sci. 58(4): 183, 1992

Conidiophores cylindrical, erect, brown, 1-2-septate, 17-29 × 6-7 µm, without percurrent extensions. *Conidia* obclavate, straight, reddish-brown, 11-14-distoseptate, constricted at some septa, apex more or less rounded, basal cell conico-truncate, 81-102 × 14-17 µm.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on decaying wood, March 1896, C.L. Smith (PRC 679).

Notes: PRC 679 consists of six small fragments of decaying wood in different sizes with visible synnemata of a *Phaeoisaria* species. The packet has a collector number "83" on the upper left corner handwritten with pencil. An online search in MyCoPortal shows a specimen of *Kretzschmaria coenopus* (Fr.) Sacc. (Xylariaceae, BPI 594472) with identical number but collected by Smith between February and March 1893 in Castillo Viejo, as previously noted a different locality along the San Juan River that was visited during the first expedition (Shimek, 1893a). The present collection of *E. adscendens* was very scarce and mixed with other microfungi but the presence of short conidiophores and long, distoseptate conidia wider than 14 µm matched well reference morphological descriptions (Ellis, 1971; Wu & Zhuang, 2005). The fungus has been previously recorded in Central America from neighboring Costa Rica on unidentified dead branches (Mercado *et al*., 1997a) and from Panama on dead rachides of *Elaeis melanococca* Gaertn. (Arecaceae) (Esquivel, 2011a) and now for the first time from Nicaragua.

Fusichalara novae-zelandiae S. Hughes & Nag Raj, N.Z. Jl Bot. 11: 670, 1973
Fig. 3F

Colonies effuse, black, hairy. *Conidiophores* simple, erect, straight or flexuous, cylindrical, 4-8-septate, up to 350 µm long, 10-11 µm wide, 14-15 µm wide at base, ending in a phialide, with up to 4 enteroblastic regenerative extensions. *Conidiogenous cells* monophialidic, integrated, terminal or intercalary, subcylindrical, composed of a brown, slightly swollen venter with a distal thickening, 10-13 µm wide, and a brown to dark brown, cylindrical collarette, 10-12 µm wide, occasionally extending percurrently up to two times. *Conidia* fusiform, straight or slightly sigmoid, end cells hyaline, medium cells pale brown, 3-7-septate, mostly 7, 26-60 (-72) × 5-7 µm.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark, March 1896, C.L. Smith (PRC 683, 686); idem, Indian River near Greytown (PRC 744).

Notes: The phialidic genus *Fusichalara* S. Hughes & Nag Raj is characterized by a distinct thickening of the inner wall of the phialide at the point of transition from venter to collarette and two types of conidia (Hughes & Nag Raj, 1973; Nag Raj & Kendrick, 1975). The first-formed, long-cylindrical, rounded at the apex, 9-12-septate type of conidia was not seen in any of these collections and description above is based only on the fusiform, predominantly 7-septate other type. However, sometimes a phialide was found to extend percurrently through the collarette and form a second phialide up to two times. Percurrent extending phialides were not described in the type specimen or in subsequent collections of the fungus. This is the first time *F. novae-zelandiae* is recorded from Central America with only a previous Neotropical record from Peru on a decaying petiole of an indeterminate palm tree (Matsushima, 1995).

Helicosporium sp.

Colonies effuse, felty, brown with whitish patches of conidia. Mycelium mostly superficial composed of light brown, septate, branched hyphae, 4-6 µm wide; sclerotia-like vesicles globose, light brown, 18-38 × 20-40 µm. Conidiophores arising laterally from hyphae, erect, simple or branched, light brown, up to 68 µm long, 5-8 µm wide. Conidiogenous cells monoblastic or polyblastic, integrated, terminal, denticulate; denticles cylindrical, 1.5-2 × 2-3 µm. *Conidia* hyaline, smooth, septate, coiling 2¼-3¾ times, 40-68 µm diam.; conidial filament 3-5 µm wide.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark, March 1896, C.L. Smith (PRC 678).

Notes: The material belonging to this helicosporic fungus was relatively abundant in one of the bark fragments that forms the specimen PRC 678 but once mounted was found to be fragmented and in poor condition so identification to species level was difficult to accomplish. The mycelium was mixed or coated with debris but apparently formed a network and hyphae were seen sometimes anastomosing. Interestingly, more or less globose structures similar to the stalked sclerotia or "sclérotes pedicelées" described for *Helicosporium pannosum* (Berk. & M.A. Curtis) R.T. Moore (≡ *Drepanospora* pannosa Berk. & M.A. Curtis) or *Helicomyces roseus* Link (Pirozynski, 1972; Zhao *et al*., 2007) were observed among the conidiophores, mostly without any distinctive stalk and suggesting instead immature or ascomata initials. Mercado *et al*. (1997a) recorded these and other *Helicosporium* species from neighboring Costa Rica any of which could be conspecific with the present collection.

Melanographium citri (Gonz. Frag. & Cif.) M.B. Ellis, Mycol. Pap. 93: 21, 1963

Colonies tufted or velvety, dark blackish brown. *Stroma* present, dark brown. *Conidiophores* fasciculate, brown to dark brown, septate, 3-5 µm wide, forming moderately dense, dark brown fascicles, often paler and spreading in the upper part, up to 1600 µm, 63-162 µm wide. *Conidiogenous cells* integrated, terminal or intercalary, sympodial, slightly geniculate, with flat, inconspicuous conidiogenous loci. *Conidia* curved, reniform or ellipsoidal, non-septate, brown to dark brown, smooth or verruculose, occasionally with a longitudinal germ slit, 12-18 × 9-12 µm.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River above Black Water River, on dead bamboo stem, 12 March 1896, C.L. Smith (PRC 747).

Notes: *Melanographium citri* was found forming densely tufted colonies covering almost completely the two strips of dead bamboo stem that comprise specimen PRC 747. This is a pantropical species commonly found on dead wood and bark of various trees and palms (Holubová-Jechová & Mercado, 1986) that has been linked to a xylariaceous teleomorph named *Lasiobertia africana* Sivan. on natural substrate (Sivanesan, 1978). However, this connection has been recorded only once and molecular and cultural data are still needed to confirm it. The fungus has been previously collected in Central America on rachis of palm tree in Panama (ILLS 36442) and now for the first time from Nicaragua.

Monodictys sp.

Colonies effuse, inconspicuous. *Conidia* muriform, globose or subglobose, smooth, dark brown to black, single or aggregated, 16-34 × 14-31 µm.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on decaying wood, March 1896, C.L. Smith (PRC 685).

Notes: The specimen PRC 685 consists of three pieces of decaying wood showing synnemata of a *Phaeoisaria* species mixed with empty, broken ascomata of an undetermined ascomycete. The *Monodictys* colonies were inconspicuous and scarce but the presence of black, more or less globose, muriform conidia often loosely aggregated or single allowed identification to generic level only (Ellis, 1971; Rao & de Hoog, 1986). This is the first time this genus is recorded from Nicaragua.

Monotosporella setosa (Berk. & M.A. Curtis) S. Hughes, Can. J. Bot. 36: 787, 1958 **Fig. 3H**

Colonies effuse, brown-black, hairy. *Conidiophores* macronematous, mononematous, erect, straight or slightly flexuous, simple, smooth, cylindrical but gradually tapering toward the apex, 5-11-septate, dark brown, paler toward the apex, up to 560 µm long, 8-12 µm wide, up to 18 µm wide at base, 6-7 wide at the apex, sometimes with 1-2 widely spaced annellidic percurrent extensions and up to 4 enteroblastic regenerative extensions. *Conidiogenous cells* monoblastic, integrated, terminal, cylindrical, truncate at the apex, percurrent. *Conidia* pyriform, 2-septate, distal cell larger and dark brown, proximal cell pale brown to brown, smooth, 31-49×21-28 µm.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark, March 1896, C.L. Smith (PRC 680, 683, 686); idem, Indian River near Greytown (PRC 744).

Notes: The specimens examined of *M. setosa* possess simple, unbranched conidiophores similarly to previous collections of this fungus placed in *Monotosporella* S. Hughes (Hughes, 1979; Sadowski *et al*., 2012). Hughes (1979) recognized two

varieties in this fungus, variety *setosa* and variety *macrospora*, the latter with shorter conidiophores (up to 170 μm long) and wider conidia (27-36 μm). The Nicaraguan collections overall resemble variety *setosa* in conidiophore and conidial size and shape. This is the first time this fungus is recorded from Central America previously found in the Neotropics on litter and on unidentified twigs and bark from Brazil (Marques *et al*., 2008; Almeida *et al*., 2011; Barbosa *et al*., 2014).

Phaeoisaria sp.

Colonies effuse, hairy. *Synnemata* erect, cylindrical or subulate, indeterminate, dark brown to blackish brown, paler toward the apex, up to 900 μm long, 10-22 μm wide, 13-48 μm wide at base, composed of brown to dark brown, septate, parallel and tightly packed conidiophores 1.5-3 μm wide. *Conidiogenous cells* polyblastic, integrated, terminal, sympodial, subhyaline, denticulate, arising apically or laterally along the synnemata.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on decaying wood, March 1896, C.L. Smith (PRC 679, 685).

Notes: Typical but sterile synnemata of a *Phaeoisaria* species, probably belonging to *P. clematidis* (Fuckel) S. Hughes (Ellis, 1971), were found in the specimens cited above. A reliable identification to species level was not possible due to the lack of conidia in both collections.

Repetophragma cubense (Mercado) J. Mena, in Mena, Delgado & Heredia, Bol. Soc. Micol. Madrid 25: 268, 2000 **Fig. 3 L-M**

Colonies effuse, hairy, black. *Conidiophores* cylindrical, straight or flexuous, smooth, reddish brown to dark brown, 7-18-septate, up to 330 μm long, 5-8 μm wide, 10-11 μm wide at base, with up to 9 annellidic percurrent extensions and up to 4 enteroblastic regenerative extensions. *Conidiogenous cells* integrated, terminal, cylindrical, brown, indeterminate, percurrent. *Conidia* obclavate, rostrate, smooth or finely rough, dark brown, 5-13-septate, with black bands at the septa, 36-144 × 14-17 μm, rostrum pale brown to subhyaline, 1-7-septate, up to 103 μm long, basal cell conico-truncate, pale brown to brown, 6-7 μm wide.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on bark, March 1896, C.L. Smith (PRC 680).

Notes: Among species of *Repetophragma* Subram. (Subramanian, 1992), *R. cubense* is distinct in having conidiophores with up to 17 cylindrical, successive annellidic percurrent extensions and obclavate, 50-200 × 13-18 μm, 6-13-septate conidia with obscure bands at the septa and a long rostrum up to 130 μm long (Mercado, 1984; Mena *et al*., 2000; Castañeda *et al*., 2011). The Nicaraguan material agrees well with the original description but annellations were in less number and not that conspicuous or regularly spaced as seen in the protologue illustration. Conidiophores often also possess nodose, blackish brown enteroblastic regenerative extensions not related with conidiation that sometimes alternate with the annellidic extensions. This is the first time this fungus is recorded outside its type locality in western Cuba (Mercado, 1984).

Rhexoacrodictys erecta (Ellis & Everh.) W.A. Baker & Morgan-Jones, in Baker, Partridge & Morgan-Jones, Mycotaxon 82: 99, 2002 **Fig. 3K**

Colonies inconspicuous. *Mycelium* mostly superficial consisting of branched, septate, light brown to brown, 2-3 μm wide hyphae. *Stromata* none or rudimentary, brown. *Conidiophores* single or in loose groups of few, straight or flexuous, smooth, 2-7-septate, brown, paler and slightly tapering toward the apex,

34-97 × 4-7 µm, 6-10 µm wide at base, with 0-2 enteroblastic regenerative extensions. *Conidiogenous cells* integrated, terminal, with a narrow, subhyaline, apical dehiscence zone. *Conidial secession* rhexolytic. *Conidia* ellipsoidal, obovoid or subsphaerical, 24-37 × 15-23 µm; basal cell cylindrical, truncate, 4-6 µm wide.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on decaying wood, March 1896, C.L. Smith (PRC 679).

Notes: The specimen PRC 679 includes sparse but well preserved conidiophores and conidia of *R. erecta* mixed with other microfungi. This is a cosmopolitan species with a widespread distribution (Baker *et al*., 2002) that has been previously collected in Central America on dead palm from Belize (Morris, 1978) and dead stems of *Zea mays* L. from Panama (Esquivel, 2011b) and now for the first time from Nicaragua.

Septosporiopsis elaeidis (J.M. Yen & Sulmont) W.A. Baker & Morgan-Jones, Mycotaxon 110: 102, 2009 **Fig. 4 F-G**

Colonies inconspicuous. *Mycelium* superficial composed of pale brown, septate hyphae, 4-5 µm wide. Conidiophores semi-macronematous, simple, erect, arising laterally from the hyphae, cylindrical, 1-5 septate, light brown, up to 48 µm, 6-7 µm wide, with 1-2 percurrent extensions. *Conidiogenous cells* monoblastic, integrated, terminal, indeterminate, percurrent. Conidial secession rhexolytic. *Conidia* ellipsoidal, smooth, brown, apical and basal cells paler, with 6-7 transverse and 1-2 longitudinal septa, 35-48 × 18-22 µm, sometimes with 1-2 lateral protrusions; basal cell 5-6 µm wide, with an irregular basal frill and often carrying 1-2 cells from the upper portion of the conidiophore after detachment.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River, on dead bamboo stems, 1896, C.L. Smith (PRC 675).

Notes: The genus *Septosporiopsis* W.A. Baker & Morgan-Jones was introduced to segregate *A. elaeidis* J.M. Yen & Sulmont (Yen & Sulmont, 1970; Pirozynski, 1972) from *Acrodictys* M.B. Ellis based on the presence of reduced, semi-macronematous condiophores extending percurrently and dictyoconidia that secede rhexolytically and possess a few equatorial conical appendages or lateral protrusions (Gams *et al*., 2009; Seifert *et al*., 2011). The Nicaraguan material was also found associated with colonies of *C. isabelicae* even occasionally overgrowing their conidiophores. *Septosporiopsis elaeidis* is apparently pantropical in distribution (Holubová-Jechová, 1983) but this is the first report of its presence in Central America, previously known from rachis of dead leaf of *Acrocomia mexicana* Karw. ex Mart. (Arecaceae) in eastern Mexico (Heredia *et al*., 1997).

Sporidesmium nodipes (Penz. & Sacc.) S. Hughes, Can. J. Bot. 36: 809, 1958 **Fig. 4H**

Colonies effuse, black, hairy. Hyphae superficial, light brown, 1-2 µm wide, occasionally ascending and bearing short conidiophores on longer conidiophores. *Conidiophores* cylindrical, smooth, dark brown, up to 152 µm long, 4-5 µm wide, 7-8 µm wide at base. *Conidiogenous cells* terminal, cylindrical, lageniform or ampulliform, nodose, 1-2-septate, brown to dark brown, 5-30 µm long, 4-6 µm wide, 5-9 µm wide at the nodes, with up to 6 successive percurrent extensions. *Conidia* obclavate, tapering to an acute apex, straight or slightly flexuous, smooth, brown to dark brown, paler toward the apex, 9-16-septate, most septa with dark bands, 38-77 × 6-8 µm; basal cell cylindrical or conico-truncate, pale brown to brown, 3-5 µm wide.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River near Greytown, on dead bamboo stems, March 1893, C.L. Smith (PRC 674); Indian River, March 1896 (PRC 682, 745).

Notes: Subramanian (1992) erected the genus *Penzigomyces* Subram., based on *Sporidesmium nodipes* as the type species, to accommodate *Sporidesmium*-like anamorphs with euseptate conidia and conidiophores typically showing doliiform, lageniform or nodose percurrent extensions. Wu & Zhuang (2005), however, favored keeping *Penzigomyces* species in *Sporidesmium* due to the frequent difficult in delimiting both genera using morphological features, a criterion followed here considering that Subramanian's arrangement is schematic and not phylogenetically informative (Reblová, 1999). The Nicaraguan collections were also mixed with *C. isabelicae* even sometimes growing on its long conidiophores. Ascending hyphae bearing shorter, branch-like conidiophores were occasionally seen on longer conidiophores as described by Ellis (1963). This fungus has been previously collected in Central America on decaying palm rachides and petioles in Panama (Goos, 1997; NY 163943, 163944, 985605, 985606, 985608) and now for the first time from Nicaragua.

Sporidesmium pachyanthicola R.F. Castañeda & W.B. Kendr., Univ. Waterloo Biol. Ser. 33: 45, 1990 **Fig. 4 C-D**

Colonies inconspicuous. *Conidiophores* macronematous, mononematous, simple, cylindrical, smooth, 2-6-septate, brown, 14-32 × 5 µm, 4 µm wide at the apex, 6-7 µm wide at base. *Conidia* narrowly obclavate or long subcylindrical, subhyaline to pale brown, 5-12-septate, sometimes slightly constricted at one septum, apex rounded, basal cell conico-truncate or subcylindrical, often slightly darker, 24-57 × 3.5-5 µm.

Specimens examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River near Greytown, on dead bamboo stems, March 1893, C.L. Smith (PRC 674); idem, Indian River, March 1896 (PRC 682, 745).

Notes: Conidiophores and conidia of *S. pachyanthicola* were also found mixed with colonies of *C. isabelicae* on the same substrate. This fungus is characterized by short conidiophores and long, narrow and mutiseptate conidia (Wu & Zhuang, 2005). The Nicaraguan collections have shorter conidia with less septa than those of the type specimen from Cuba: 50-140 µm long and 10-30-septate (Castañeda & Kendrick, 1990) but the available material was scarce in all specimens. This is the second time this rare anamorph is collected in the Neotropics outside from its type locality.

Sporoschisma juvenile Boud., Icon. Mycol. 1: 12, 1904 **Fig. 2 B-E**

Colonies effuse, composed of mixed ascomata and conidiophores. *Ascomata* solitary, scattered, superficial, broadly obpyriform, about 300 µm diam., with several capitate setae all over the surface and covered with a yellow tomentum, apex papillate, conical, black; ascomatal wall pseudoparenchymatous, composed of small, angular, dark brown cells. *Ascospores* fusiform, 3-septate, rarely 5 and then with 1-2 longitudinal or oblique septa, central cells light brown, apical cells subhyaline to light brown, 20-30 × 7-9 µm. *Conidiophores* solitary or in small groups, arising from blackish brown stromata up to 55 µm wide, straight or flexuous, subcylindrical, blackish brown, septate, up to 280 µm long, 9-10 (-12) µm wide, 12-18 µm wide at base. *Setae* capitate, erect, straight or flexuous, 3-5-septate, brown, paler toward the apex, with 0-2 percurrent extensions, 119-210 × 4-6 µm, 6-12 µm wide at base, apex 5-8 µm wide, with apical or intercalary mucilaginous caps usually around extensions, 7-11 µm diam. *Conidiogenous cells* monophialidic,

integrated, terminal, up to 205 µm long; venter subcylindrical, brown, 14-16 µm wide; collarette cylindrical, blackish brown, 11-13 µm wide. *Conidia* catenate, cylindrical, with rounded or subtruncate ends, mostly 3-septate, occasionally 4 or 5-septate, pale brown, verruculose, 26-40 × 8-10 µm.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River above Black River, on decaying wood, 12 March 1896, C.L. Smith (PRC 673).

Notes: The specimen PRC 673 (Fig. 2A) consists of three pieces of decaying wood and includes conidiophores of *S. juvenile* growing on or around a few perithecia of a species of *Melanochaeta* E. Müll., Harr & Sulmont, apparently the teleomorphic state, mixed with ferruginous-colored colonies of a basidiomycetous fungus. Connections between *Sporoschisma* anamorphs with *Melanochaeta* species (Chaetosphaeriales) are well established (Goh *et al*., 1997; Sivichai *et al*., 2000) but hitherto unknown for *S. juvenile*. Hughes (1949) examined several British collections of this fungus deposited in IMI and commented on the lack of associated perithecia. In this case, however, the remarkable morphological continuity between the sexual and asexual states e. g. the presence in both of capitate setae, confirms their relationship and makes a cultural proof almost unnecessary (Müller & Samuels, 1982). The material examined is consistent with previous morphological descriptions of the anamorph on natural substrate but some conidia were occasionally 4 or very rarely 5-septate. Hughes (1949) remarked the absence of 4-septate conidia in the collections of S. juvenile he examined but attributed the presence of 1, 2 or 4 septa in S. mirabile Berk. & Broome, a morphologically similar species with also 3-septate conidia, to abnormalities during septum formation. Further collections are still needed for a more detailed description of the teleomorph due to the limited availability in the Nicaraguan material. *Sporoschisma juvenile* has been mostly collected in temperate countries (Holubová-Jechová, 1973; Nag Raj & Kendrick, 1975) with only two previous Neotropical records from Brazil on submerged twigs (Barbosa & Gusmão, 2011) and recently on submerged woody debris from Peru (Zelski *et al*., 2014).

Stanjehughesia curviapicis (Goh & K.D.Hyde) D.A.C.Almeida & Gusmão, Nova Hedwigia 98 (3-4): 438, 2014 **Fig. 3A**

Colonies inconspicuous, sparse, hairy. *Conidiophores* absent. *Conidiogenous cells* monoblastic, ampulliform or lageniform, dark brown to blackish brown, sometimes solitary but usually clustered, 9-14 (-16) × 4-5 µm, 6-8 µm wide at the bulbous base, 4 µm at the apex. *Conidia* straight or slightly bent, cylindrical-obclavate, rostrate, with the apex curved or hamate, smooth, brown, 6-13-euseptate and 5-10-distoseptate, 56-116 × 5.5-7 µm; basal cell cylindrical or rarely conico-truncate, sometimes darker than the remaining cells, 3-5 × 3-5 µm.

Specimen examined: Nicaragua, Rio San Juan, San Juan de Nicaragua, Indian River above Black River, on decaying wood, 12 March 1896, C.L. Smith (PRC 673).

Notes: Almeida *et al.* (2014) recently transferred *Janetia curviapicis* Goh & K.D. Hyde (Goh & Hyde, 1996b) to *Stanjehughesia* Subram. based on the presence of monoblastic instead of polyblastic, non-denticulate conidiogenous cells including also the morphologically similar species *S. hamatiella* W.P. Wu (Wu & Zhuang, 2005) as a synonym. The Nicaraguan material also showed monoblastic conidiogenous cells and absence of conidiophores in conformity with *Stanjehughesia* current generic concept (Subramanian, 1992). This is the first record of this fungus in Central America previously known in the Neotropics only from Brazil on decaying bark and twig (Almeida *et al*., 2014).

DISCUSSION

The revision of these historical specimens proved to be a great source of novelties for the poorly studied Nicaraguan mycobiota and in general for the Neotropical region despite their age and condition. With a few exceptions, most of the microfungi found and described above were not obviously the target of the sample once collected and their colonies were inconspicuous or overgrowing the main fungus occurring in the sample. Identification to species level was not possible only in a few cases where the material, as not the target of the sample, was scant or incomplete. Curiously, although they were collected by Smith in 1896, the majority of these fungi were first described decades later in other countries. It is very likely that a deeper study of the remaining collections recently discovered in PRC or even other collections made by Smith or Shimek in Nicaragua and kept nowadays in North American herbaria will provide further new records of microfungi to the country. With the addition of these fungi, the list of documented Nicaraguan hyphomycetes is expanded to 216 taxa.

In contrast with the first Nicaraguan expedition carried out by Smith and Shimek between 1892 and 1893, the second trip of Smith to Nicaragua and the source of the samples studied here was poorly documented, although lasted for about two years and included also southern Mexico. The entire botanical collections of the first expedition consisted of about 1500 sets of specimens containing over 1000 species and 8000 to 10000 specimens, and in Shimek's own words was "the largest and most valuable addition thus far made to the herbarium at any one time" (Shimek, 1893b). He wrote a detailed and lively account of the expedition (Shimek, 1893a) including dates, visited locations, number of collections per site, personal observations on the country landscape, weather and so on, even later he published a large and impressive study about Nicaraguan ferns collected by him (Shimek, 1897). Fungi and myxomycetes were also largely studied and mostly identified by Ellis and MacBride (Shimek, 1893b, Stevenson, 1971). They were included in several papers (Ellis & MacBride, 1896; MacBride, 1893a, 1896; Smith, 1893) and in large monographic works (MacBride, 1899).

After the success of the first expedition MacBride, at the time professor of Botany and later head of the Department and future president of the State University of Iowa, requested to the Board of Regents to send a second expedition by December 1st, 1893 upon approval and conditioned by the success of the Nicaragua Canal Company (MacBride, 1893b). This second expedition was carried out by Smith alone whose life and deeds are not well known may be due to his few active years as a botanical collector. Charles Leonard Smith (1866-1923) (Fig. 1B) received a Bachelor of Arts degree in Botany, History of Botany and German from the State University of Iowa in 1891 (Anonymous, 1901) and by 1897 he was a non-resident candidate for a Master's degree in Central American Plants and History of Botany (Anonymous, 1897). He also appeared in a list of faculty as instructor of the Department of Botany between 1894 and 1896 while Shimek and MacBride were serving as professors and curiously by the same years he was traveling to Mexico and Nicaragua (Pickard, 1899). Under Shimek guidance and companionship during their time together in Nicaragua he probably developed his outstanding collector skills as seen in his varied and numerous collections of fungi and vascular plants. After returning from the first expedition he engaged in an active correspondence and specimens exchange with Ellis, who already maintained correspondence with MacBride (Kaye, 1986), for help in the identification of the pyrenomycetous fungi

that led to the first paper about the group in Nicaragua (Smith, 1893). He was by then experienced enough in traveling to tropical regions to be entrusted a second expedition.

Smith never wrote a full account of his travels across Mexico and Nicaragua but three successive notes about them entitled "South Mexican expedition" and a fourth as "South American expedition" appeared in the Catalogues of the State University of Iowa between the years 1894 and 1897 (Anonymous 1894, 1895b, 1896, 1897). These brief notes showed that Smith arrived in Mexico by October, 1893 acting as a botanist for the University, and he was expected to work there during 1894 to reach Nicaragua and thence the US by June, 1895. According to the third note, he finally arrived in Nicaragua by August, 1894 where he stayed until May, 1896 according to the forth note, returning home in June that same year. Online records of his vascular plant collections available in MO, however, slightly differ in timing and provide further details on locations and dates despite some contradictions and careless annotations among them. Smith was first in Jalapa, state of Veracruz, Mexico, by January, 1894 until May or June of the same year when he traveled to neighboring Oaxaca state visiting different localities e.g. Sierra de San Felipe and Mount Alban near Oaxaca City, to return to Jalapa by the end of December, 1894. He then traveled to Coatzacoalcos in southern Veracruz in January, 1895 and moved around the Isthmus of Tehuantepec until April that year. The correspondence between MacBride and Ellis spanning the years 1893 and 1895 often contain references to Smith travels throughout Central America, even the department letterheads in 1894 include Smith name followed by "Collector (Jalapa, Mexico)" that later changed to "Collector, Oaxaca, Mexico" in 1895.

Around May, 1895 he arrived in Nicaragua (Fig. 1A), staying first in Puerto Momotombo in the northwestern shore of Lake Managua, department of León, for about three months until July. During this stay he apparently visited and botanized on both the closer Momotombo and Del Hoyo volcanoes. He later traveled to Greytown in the Atlantic Coast, probably following the same route of his first trip with Shimek but this time from west to east. Collection records resume by November, 1895 showing he collected in the vicinity of the town and also in Indian River and its affluent Black Water River or Caño Negro in Spanish until March, 1896, when the specimens studied here were collected. Only an expedition report entitled "A collecting trip through Mexico and Nicaragua" was presented by Smith in 1896 at The Baconian Club of Iowa City, a scientific organization whose members where actively engaged in teaching or research in natural or physical sciences that included renowned botanists such as MacBride and Shimek (Anonymous, 1911). Unfortunately no written record of this presentation was made but an exsiccate entitled "Central American Fungi", consisting of three fascicles, 150 numbers and 22 extra specimens, currently deposited in FH and BPI, was prepared by Smith including collections from both Nicaragua and Mexico (Stevenson, 1971; Pfister, 1985). Ellis & Everhart (1896) also described some new fungal species collected by Smith in Mexico without date and in Nicaragua by 1893 or 1896 including a few described by Ellis together with MacBride. MacBride & Smith (1896) is the only publication fully devoted to materials collected during the second expedition in both countries and comprises a succinct list of myxomycetes from Jalapa and Cerro (Sierra) de San Felipe in Mexico and Momotombo, Indian River and Greytown in Nicaragua.

Interestingly, the packets containing the specimens surveyed in this study bear Shimek's handwriting although they originated from the second expedition carried out by Smith alone and not from their joint expedition. Once back in Iowa City, Smith probably worked together with Shimek, his mentor and curator of the

university's herbarium since 1895 (Hudson *et al.*, 2008), in processing and identifying his collections for deposit, giving the myxomycete specimens to MacBride and sending again duplicates of other fungal groups to Ellis in New Jersey. A while after his return from Central America, however, Smith apparently switched his career path, appearing in 1901 as a freshman in a list of students from the College of Medicine and also in a list of Faculty and Instructors as a Fellow and later Scholar in Histology (Anonymous, 1901; 1902). By the time Shimek traveled to Prague in 1913 carrying these specimens it was years since Smith was no longer with the Department of Botany. Speculatively, Shimek prepared the duplicates by himself and took this large amount of specimens to Prague with the approval of MacBride, at the time head of the Department (Hudson *et al.*, 2008), may be as a gift to his host institution. Apart from the microfungi, around one hundred specimens of basidiomycetes and pyrenomycetes from Smith's expedition are currently housed in PRC. Despite its brevity, the pioneer contribution of C.L. Smith to Mycology and Botany in the region was nevertheless invaluable to the point that even a hundred years later his collections are still a source of interesting fungal discoveries.

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