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## Nicaraguan fungi: a checklist of hyphomycetes

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**Abstract**—A checklist of hyphomycetes (anamorphic fungi) known from Nicaragua is presented. A total of 194 taxa belonging to 70 genera are listed, including 25 determined only to generic level, 156 to specific level and 13 infraspecific taxa. They were compiled from scattered records in the literature, the online databases of the world's major culture collections and fungal herbaria, and sporadic collections of plant debris samples carried out in the departments of Managua and León in 2008. 14 saprobic genera, 19 species and one forma are recorded for the first time from Nicaragua. A host and substrate index is also provided, including 99 host plants belonging to 30 families and 16 host insects belonging to 4 orders. A brief approach to the history of mycology in the country is presented.

**Key words** — biodiversity, Central America, mycota, taxonomy

### Introduction

Nicaragua is a biodiversity rich country in the continental Neotropics but mycologically very poorly studied. Compared with neighboring and relatively well explored countries like Costa Rica and Panama, the knowledge level of Nicaraguan fungal diversity is extremely low (Bermúdez & Sánchez 2000). Information about Nicaraguan fungi is fragmentary and widely scattered throughout the literature, with fungal specimens deposited in foreign institutions and herbaria (Rueda 2007). Only five new species were described for Nicaragua during the period of 1981–90, and only one checklist of plant diseases including fungi is available, without dried or living reference collections and other mycological resources (Hawksworth 1993). Even large, well-preserved and biologically rich areas like Bosawás Biosphere Reserve in the north-central part of the country, which covers around 7% of the nation's total land area, still remain unexplored in terms of its fungal diversity (MARENA/SERNA 2004).

Based on the available literature and online-accessible specimens data, the earliest collections of fungi in Nicaragua date back to the 19th century, when the American botanist Charles Wright briefly stopped in the country in 1856 after leaving the U.S. North Pacific Exploring Expedition, and made collections of plants, insects, small reptiles, fishes, shells as well as fungi (Gray 1886, Howard 1988). These specimens were studied by Revs. M.J.

Berkeley and M.A. Curtis, who identified sixty-six species mostly belonging to *Basidiomycota* (Berkeley & Curtis 1860, Pfister & Sayre 1978). A decade later, Thomas Belt, an English geologist and naturalist who resided in the country from 1868 to 1872, was the first to discover that leaf-cutting ants used leaves fragments for fungus-growing “as a manure, on which grows a minute species of fungus, on which they feed;—that they are, in reality, mushroom growers and eaters” (Belt 1874). In December 1892, a botanical expedition from the State University of Iowa visited Nicaragua, where Bohumil Shimek and Charles L. Smith spent about three months collecting several fungi, lichens and myxomycetes along with mosses, vascular plants and zoological specimens (Ellis & MacBride 1896, MacBride 1893, Shimek 1893, Smith 1893). Later, Smith returned to the country between 1895 and 1896 in a second botanical expedition that included also southern Mexico, and made further collections of fungi and slime molds (Ellis & Everhart 1896, MacBride 1896, MacBride & Smith 1896).

By the turn of the century, Charles F. Baker, an American botanist, entomologist and prolific collector, visited the Pacific region in 1903 and made several collections of botanical specimens, mosses and fungi, mostly rusts and other basidiomycetes (Atwood 1984, Crum 1952). Another American, Arthur G. Kevorkian, sporadically collected plant disease and soil samples from 1943 to 1946 while serving as director of the co-operative Agriculture Experiment Station of the U.S. State Department in Nicaragua, which led to the description of new taxa of *Penicillium* and *Aspergillus* (Anonymous 1946, Raper & Fennell 1948, Raper & Thom 1949). Between 1951 and 1957, Samuel C. Litzenberger, a Canadian-born agronomist and plant pathologist and his associates of the Department of Agronomy of the Servicio Técnico Agrícola (STAN) largely collected plant disease materials. As a result, the first list of Nicaraguan plant diseases including mostly plant pathogenic fungi was published (Litzenberger & Stevenson 1957). More recently, mycologists and plant pathologists have intermittently visited Nicaragua for collecting or providing expertise and later publishing their results, or their specimens have been deposited in recognized institutions and occasionally cited by others, e.g. M.H. Ivory in boletes (Singer et al. 1983, 1991, 1992), J.F. Hennen and J.W. McCain in rust fungi (Hennen & McCain 1993), M. Piepenbring in smut fungi (Piepenbring & Bauer 1997, Piepenbring 2003), K. Boundy-Mills in yeasts (Phaff Yeast Culture Collection 2010), O. Breuss in lichenized fungi (Breuss 2002), A.A. Rees, C.R. Miller, D.E. Shaw, H.C. Evans, M. González-Ávila, R.C. Ploetz and R.W. Barreto in plant pathogenic fungi (Evans 1984, Fernandes & Barreto 2005, González et al. 1985a,b, Miller 1969, Ploetz 2003, Purss 1998, Rees

1998, Rees & Webber 1988), and C. Picone in arbuscular mycorrhizal fungi (Picone 2000) among others.

In the case of anamorphic fungi, and particularly those traditionally known as hyphomycetes, systematic or ecological studies are practically nonexistent. Our knowledge of Nicaraguan hyphomycetes is based mainly on a few contributions related to plant pathogenic or entomogenous species, some specimens deposited in major culture collections and fungal herbaria, and a few scattered records in the literature or in large monographic works (Braun 1995, 1998, Chupp 1954, Ellis 1971). Berkeley & Curtis (1860) were probably the first to describe a Nicaraguan hyphomycete, *Cladosporium pallidum*, on unidentified leaves originally collected by C. Wright in Greytown (or San Juan del Norte). Litzenberger & Stevenson (1957) recorded fifty-six species of plant pathogenic hyphomycetes providing the largest account of the group to date, and many of these specimens are deposited in BPI (U.S. National Fungus Collection). Recently, emphasis has been placed on entomopathogenic species associated with pest control of different crops such as coffee, cabbage, bananas and cotton, with several specimens deposited in ARSEF, and some ecological studies available on natural occurrence and infestation level of *Beauveria bassiana* on *Hypothenemus hampei* and *Leucoptera coffeella* populations, the coffee berry borer and the coffee leaf miner respectively (Monzón et al. 2004, 2008).

During a visit to Nicaragua in 2008, plant debris samples were sporadically collected to study the associated saprobic hyphomycetes. The resulting identifications were added to a compilation of species reported in the literature or currently deposited in major culture collections and fungal herbaria. The purpose of the following checklist is to provide a first comprehensive and updated overview of the poorly known diversity of hyphomycetes in Nicaragua. It is not intended to be an all-inclusive list, and probably some records were overlooked among the several disparate sources of information. It will be followed by additional lists of other groups of Nicaraguan fungi and allies aiming to provide a basic source of information about them, as well as to stimulate the interest in their study and serve as a starting point for further and deeper mycological investigations.

### Materials and methods

Samples of dead palm rachides, petioles and inflorescences, branches, twigs and wood pieces were sporadically collected at different semi-natural areas of the departments of Managua and León in the Pacific region of Nicaragua, during May and June, 2008. They were air-dried, placed in labeled plastic bags and processed later following the protocols outlined in Cannon & Sutton (2004). All specimens were deposited in BPI. A literature and online search was carried out to obtain information about Nicaraguan

hyphomycetes. Relevant literature was thoroughly examined for scattered records. Additional records were obtained by searching online the world's major culture collections and fungal herbaria databases such as: the American Type Culture Collection (ATCC, <http://www.atcc.org/>), the BCCM/MUCL (Agro) Industrial Fungi & Yeasts Collection (MUCL, <http://bccm.belspo.be/about/mucl.php>), the Herb. IMI Database (IMI, <http://www.herbimi.info/herbimi/home.htm>), the CBS Fungal Biodiversity Center (CBS, <http://www.cbs.knaw.nl/>), the NITE Biological Research Center (NBRC, <http://www.nbrc.nite.go.jp/e/index.html>), the USDA-ARS Culture Collection (NRRL, <http://nrri.ncaur.usda.gov/>), the USDA-ARS Collection of Entomopathogenic Fungal Cultures (ARSEF, <http://arsef.fpsnl.cornell.edu>) and the U.S. National Fungus Collections (BPI, <http://nt.ars-grin.gov/fungalatabases/specimens/specimens.cfm>). Clinically important species were not included because their distribution depends mainly on human activity (Piepenbring 2007). The compiled taxa were arranged alphabetically by genus, and then alphabetically by species within each genus. Every accepted name written in bold is followed by the heterotypic or homotypic synonym(s) (in brackets and preceded by "as") originally reported in the source if any, the host name(s) associated with the fungus preceded by "on" and their original synonym(s) if any, and the literature references or the herbarium specimen/culture collection accession numbers. When both the anamorph and teleomorph names were mentioned in the original source, only the former was listed. Specimens collected by the author include collection data such as habitat, locality, date and BPI herbarium number. Nomenclature was standardized and updated when necessary following Index Fungorum ([www.indexfungorum.com](http://www.indexfungorum.com)). Host plant names, synonyms and family names were standardized following Index Kewensis ([www.ipni.org](http://www.ipni.org)). The USDA Plants Database (<http://plants.usda.gov/>) was the source for current or preferred plant names. Culture collections and herbaria acronyms followed Index Herbariorum (<http://sweetgum.nybg.org/ih/>). An asterisk (\*) before the name indicates the taxon is newly reported from Nicaragua. Uncertain or doubtful records and species are included and commented after the checklist, followed by a host and substrate index including host plant families and insect orders. Critical examination of reference material, especially needed for older records, was beyond the scope of this paper and therefore no herbarium specimens or fungal strains cited below were examined except those collected by the author.

## Results

A total of 194 taxa of hyphomycetes belonging to 70 anamorphic genera are recorded for Nicaragua, including 25 determined only to generic level, 156 to specific level and 13 infraspecific taxa. Among them, cercosporoid hyphomycetes and allied genera including *Cercospora*, *Pseudocercospora*, *Passalora*, *Ramularia*, *Fusicladium*, *Ramulariopsis* and *Asperisporium* are the best represented with 42 taxa. Other common and widely distributed genera such as *Penicillium*, *Aspergillus*, *Fusarium*, *Alternaria* and *Bipolaris*

are also relatively well represented. Ecologically, most of the fungi cited below are plant pathogenic, with 174 taxa associated to 99 host plants belonging to 30 families. This is due to the fact that plant pathology literature is currently the main source of information about Nicaraguan hyphomycetes. Host plant families such as *Poaceae*, *Fabaceae*, *Asteraceae*, *Solanaceae*, *Euphorbiaceae* and *Pinaceae* recorded the highest number of hyphomycetes on them. Twenty-nine saprobic taxa are reported inhabiting dead plant debris, with 14 genera, 19 species and one forma newly recorded from Nicaragua. Many of these new records are widespread or cosmopolitan anamorphs, and reflect the lack of basic data about Nicaraguan fungi. Entomopathogenic taxa are represented by only 7 species recorded on 16 hosts belonging to the insect orders *Coleoptera*, *Diptera*, *Hemiptera* and *Lepidoptera*. *Beauveria bassiana* and *Paecilomyces lilacinus* have also been isolated from soil, including 11 other soil-inhabiting species, 5 of them as nematode-trapping fungi. Only single records exist of a hyperparasite, *Acremonium* sp., and a fungicolous species, *Helicofilia madrasensis*.

### Checklist of species

- Acremonium roseogriseum*** (S.B. Saksena) W. Gams, on *Musa* sp. (MUCL 29774).
- Acremonium strictum*** W. Gams (as *Cephalosporium acremonium* Corda), on *Zea mays* (IMI 300371) (McGuire & Crandall 1967, Wellman 1977).
- Acremonium*** sp. (as *Cephalosporium* sp.), on *Glycine max* (Perera 1985), *Pinus oocarpa* (IMI 233841) and hyperparasitic on *Asperisporium caricae* on *Carica papaya* (González et al. 1985b).
- Acrodontium crateriforme*** (J.F.H. Beyma) de Hoog, on *Pinus oocarpa* (IMI 252686).
- Alternaria alternata*** (Fr.) Keissl., on *Glycine max* (Perera 1985).
- Alternaria brassicae*** (Berk.) Sacc., on *Brassica oleracea* var. *capitata*, *B. pekinensis* (BPI 446143) and *B. rapa* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).
- Alternaria citri*** Ellis & N. Pierce, on *Citrus limon* and *C. sinensis* (McGuire & Crandall 1967).
- Alternaria dauci*** (J.G. Kühn) J.W. Groves & Skolko, on *Daucus carota* (Ellis 1971, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).
- Alternaria flagelloidea*** (G.F. Atk.) Luttr. (as *Helminthosporium flagelloideum* G.F. Atk.), on *Panicum maximum* (Wellman 1977).

*Alternaria macrospora* Zimm., on *Gossypium hirsutum* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967) and *Gossypium* sp. (BPI 446412) (Ellis & Holliday 1970).

*Alternaria porri* (Ellis) Cif., on *Allium cepa* (BPI 446491) (Ellis 1971, Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman 1977).

*Alternaria ricini* (Yoshii) Hansf., on *Ricinus communis* (BPI 446522).

*Alternaria solani* Sorauer, on *Lycopersicon esculentum* (Berlin & Eitrem 2005) and *Solanum tuberosum* (BPI 446712, 446830) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

*Alternaria tenuissima* (Kunze) Wiltshire, on *Oryza* sp. (IMI 174383a).

SPECIMENS EXAMINED: León, La Paz Centro, on petiole and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879995G, 879996E).

*Alternaria* sp., on *Glycine max* (Perera 1985), *Pennisetum glaucum* (González et al. 1985b) and *Sesamum indicum* (Litzenberger & Stevenson 1957).

SPECIMEN EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on spathe of dead inflorescence of *Cocos nucifera*, V.30.2008 (BPI 879991F).

*Arthrobotrys musiformis* Drechsler, from soil (Persmark et al. 1995).

*Arthrobotrys sclerohypha* (Drechsler) S. Schenck, W.B. Kendr. & Pramer (as *Dactylaria sclerohypha* Drechsler), from soil (Persmark et al. 1995).

*Arthrobotrys* sp., from soil (Persmark et al. 1995).

*Aspergillus caesiellus* Saito, on *Pinus caribaea* (IMI 261145).

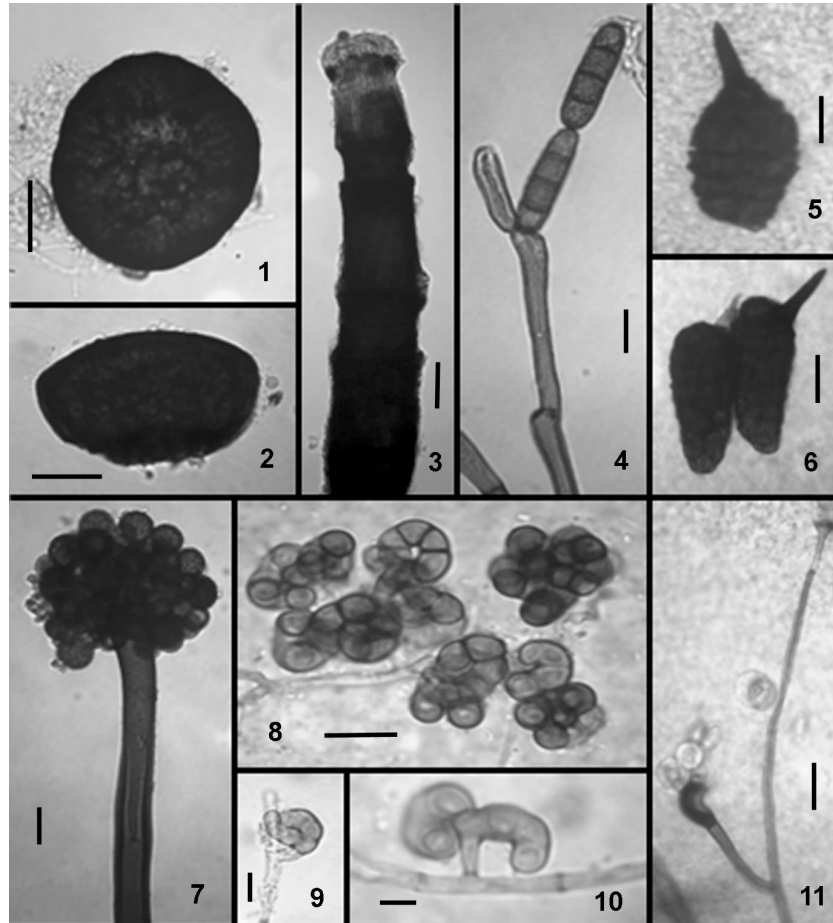
*Aspergillus fischeri* var. *spinus* Raper & Fennell, from soil (ATCC 16898, CBS 483.65, IMI 211390 [Holotype], NRRL A-1148).

*Aspergillus flavus* Link, on *Pinus caribaea* (IMI 192424, 192426, 239313, 239596, 239597).

*Aspergillus fumigatus* Fresen., on *Pinus caribaea* (IMI 250870, 251475).

*Aspergillus niger* Tiegh., on *Allium cepa* (Litzenberger & Stevenson 1957, McGuire & Crandall, 1967).

*Aspergillus ochraceus* G.Wilh., on *Hypothenemus hampei* (Vega et al. 1999).



**Fig. 1–3.** *Tretopileus sphaerophorus* (BPI 879991A). 1, 2. Bulbils. 3. Synnema. 4. *Dendryphiella vinosa* (BPI 879990A). Conidiophore, conidiogenous cells and conidia. 5–6. *Pseudopetrakia kambakkamensis* (BPI 879993). Conidia. 7. *Periconia byssoides* (BPI 879988A). Conidial head. 8–10. *Helicofilia madrasensis* (BPI 879991G). Conidia. 11. *Zygosporium echinosporum* (BPI 879989D). Setiform conidiophore, vesicle and conidia. Scale bars: 1–3 = 25  $\mu\text{m}$ ; 4–8, 11 = 10  $\mu\text{m}$ ; 9–10 = 5  $\mu\text{m}$ .

*Aspergillus sydowii* (Bainier & Sartory) Thom & Church, on *Pinus caribaea* (IMI 250897).

*Aspergillus tamarii* Kita, on *Pinus caribaea* (IMI 250872).

*Aspergillus ustus* (Bainier) Thom & Church, on *Pinus oocarpa* (IMI 252685).

*Aspergillus wentii* Wehmer, on *Pinus caribaea* (IMI 240803).

*Aspergillus* sp., on *Pinus caribaea* (IMI 239599) and *P. pseudostrabus* (IMI 256771).

*Asperisporium caricae* (Speg.) Maubl. (as *Pucciniopsis caricae* Earle), on *Carica papaya* (BPI 454380, 454385) (González et al. 1985b, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

*Beauveria bassiana* (Bals.-Criv.) Vuill., on *Cosmopolites sordidus*, *Hypothenemus hampei* (ARSEF 3440, 3443, 3445, 3448, 3453, IMI 382475), *Leucoptera coffeella* (ARSEF 6801, 6802, 6803, 6804, 6805, 6806, 6807, 6808, 6809), *Plutella xylostella* (IMI 382303), *Phyllophaga* spp. and soil (Monzón 2001, Monzón et al. 2004, 2008, Vega et al. 1999); on Chrysomelid beetle (IMI 336279) (IMI 382474).

\**Beltrania rhombica* Penz.

SPECIMEN EXAMINED: León, La Paz Centro, on petiole and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994I).

\**Bipolaris bicolor* (Mitra) Shoemaker

SPECIMEN EXAMINED: León, La Paz Centro, on petiole and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879995H).

*Bipolaris cynodontis* (Marignoni) Shoemaker (as *Helminthosporium cynodontis* Marignoni), on *Cynodon dactylon* (Lenné 1990, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

\**Bipolaris hawaiiensis* (M.B. Ellis) J.Y. Uchida & Aragaki

SPECIMENS EXAMINED: León, La Paz Centro, on petiole and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879995F, 879996F).

*Bipolaris heveae* (Petch) B.A. Khasanov (as *Helminthosporium heveae* Petch), on *Hevea brasiliensis* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967) and *Hevea* sp. (BPI 429040).

*Bipolaris maydis* (Y. Nisik. & C. Miyake) Shoemaker (as *Helminthosporium maydis* Y. Nisik. & C. Miyake), on *Zea mays* (BPI 429524, 429535, 429540, 429579, 429593) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

*Bipolaris oryzae* (Breda de Haan) Shoemaker (as *Helminthosporium oryzae* Breda de Haan), on *Oryza sativa* (BPI 429831, 429839) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman 1977).



***Bipolaris sacchari*** (E.J. Butler) Shoemaker (as *Cercospora sacchari* Breda de Haan and *Helminthosporium sacchari* E.J. Butler), on *Saccharum officinarum* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Bipolaris sorokiniana*** (Sacc.) Shoemaker (as *Helminthosporium sativum* Pammel, C.M. King & Bakke and *H. sorokinianum* Sacc.), on *Chloris virgata*, *C. gayana* (BPI 430531) and *Triticum aestivum* (BPI 430556, 430565) (Lenné 1990, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Botrytis cinerea*** Pers., on *Capsicum annuum* (as *C. frutescens*) (McGuire & Crandall 1967).

***Cadophora gregata*** (Allington & D.W. Chamb.) T.C. Harr. & McNew (as *Cephalosporium gregatum* Allington & D.W. Chamb.), on *Glycine max* (Perera 1985).

***Cercospora arachidicola*** Hori, on *Arachis hypogaea* (BPI 433001, 433002) (Litzenberger & Stevenson 1957).

***Cercospora arachidis*** Henn., on *Arachis hypogaea* (BPI 433006).

***Cercospora beticola*** Sacc., on *Beta vulgaris* (BPI 433435) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Cercospora canescens*** Ellis & G. Martin, on *Dolichos lablab* (BPI 434037, 434043), *Glycine max* and *Vigna unguiculata* (as *V. sinensis*) (BPI 434044, 434131) (Litzenberger & Stevenson 1957).

***Cercospora capsici*** Heald & F.A. Wolf, on *Capsicum annuum* (as *C. frutescens*) (BPI 434175) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Cercospora citrullina*** Cooke, on *Citrullus lanatus* (BPI 434778).

***Cercospora coffeicola*** Berk. & Cooke, on *Coffea arabica* (BPI 435048, 435055A, 435055B, 435055C) and *Coffea* spp. (CABI/EPPO 1984, Holliday 1980, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Cercospora gossypina*** Cooke, on *Gossypium hirsutum* (González et al. 1985b).

***Cercospora henningsii*** Allesch., on *Manihot esculenta* (as *M. utilissima*) (BPI 437136, 437141, 437143, 437144) (Litzenberger & Stevenson 1957).

***Cercospora kikuchii*** (Tak. Matsumoto & Tomoy.) M.W. Gardner, on *Glycine max* (Litzenberger & Stevenson 1957).

***Cercospora lactucae-sativae*** Sawada (as *C. longissima* Sacc.), on *Lactuca sativa* (González et al. 1985b).

***Cercospora longipes*** E.J. Butler, on *Saccharum officinarum* and *Saccharum* spp. (Hsieh & Goh 1990, Sauntally & Sullivan 2000).

***Cercospora nicotianae*** Ellis & Everh., on *Nicotiana tabacum* (BPI 438847) (Litzenberger & Stevenson 1957, Wellman 1977).

***Cercospora oryzae*** T. Miyake, on *Oryza sativa* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Cercospora personata*** (Berk. & M.A. Curtis) Ellis, on *Arachis hypogaea* (BPI 439496) (Litzenberger & Stevenson 1957).

***Cercospora psoraleae*** W.W. Ray, on *Cyamopsis tetragonoloba* (BPI 440014).

***Cercospora ricinella*** Sacc. & Berl., on *Ricinus communis* (Litzenberger & Stevenson 1957, Wellman 1977).

***Cercospora sapindi*** Obreg.-Bot., on *Melicoccus bijugatus* (BPI 441007).

***Cercospora sesami*** Zimm., on *Sesamum indicum* (BPI 441154) (Litzenberger & Stevenson 1957) and *Sesamum* sp. (BPI 441144).

***Cercospora sorghi*** Ellis & Everh., on *Zea mays* (BPI 441558).

***Cercospora zebrina*** Pass., on *Trifolium resupinatum* and *Trifolium* sp. (BPI 442595) (Litzenberger & Stevenson 1957, Wellman 1977).

***Cercospora zinniae*** Ellis & G. Martin, on *Zinnia* sp. (BPI 442660).

***Cercospora*** sp., on *Catsetum* sp. (BPI 431871), *Glycine max* (Perera 1985), *Melicoccus bijugatus* (BPI 432086, BPI 432087) and *Persea* sp. (BPI 432160); on *Ipomoea batatas*, *Physalis angulata*, *Syngonium angustatum* and *Zinnia elegans* (González et al. 1985a, b); on *Carica papaya*, *Citrus aurantiifolia*, *Mangifera indica* and *Phaseolus vulgaris* (McGuire & Crandall 1967).

**\**Chloridium codinaeoides*** Piroz.

SPECIMEN EXAMINED: León, La Paz Centro, on petioles and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994H).

***Cladosporium herbarum*** (Pers.) Link, on *Gladiolus hortulans* (González et al. 1985b); on *Carthamus tinctorius*, *Paspalum notatum*, *Triticum aestivum* and *Zea mays* (Lenné 1990,

Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman 1977); on *Pinus caribaea* (IMI 250880).

**\**Cladosporium oxysporum* Berk. & M.A. Curtis**

SPECIMENS EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on herbaceous dead stems, V.30.2008 (BPI 879990B); León, León Mun., Rio Dulce, on the road to Poneloya, on dead herbaceous stems (BPI 879988D) and sheath of dead leaf of *Roystonea* sp. (BPI 879989C), VI.1<sup>st</sup>.2008; León, La Paz Centro, on petioles and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994A, 879995A, 879996B).

***Cladosporium tenuissimum* Cooke**, on *Oryza* sp. (IMI 174383b).

***Cladosporium* sp.**, on *Hylocereus undatus* (Anonymous 1994), *Saccharum officinarum* (McGuire & Crandall 1967) and *Sorghum bicolor* (as *S. vulgare*) (González et al. 1985b).

***Corynespora cassiicola* (Berk. & M.A. Curtis) C.T. Wei** (as *Helminthosporium vignicola* (E. Kawam.) Olive), on *Carica papaya* (González et al. 1985b) and *Glycine max* (Litzenberger & Stevenson 1957, Wellman 1977).

SPECIMEN EXAMINED: León, León Mun., Rio Dulce, on the road to Poneloya, on dead herbaceous stems, VI.1<sup>st</sup>.2008 (BPI 879988C).

***Corynespora* sp.**, on *Glycine max* (Perera 1985).

***Curvularia cymbopogonis* (C.W. Dodge) J.W. Groves & Skolko**, on *Hyparrhenia rufa* (BPI 443653).

***Curvularia lunata* (Wakker) Boedijn**, on *Oryza sativa*, *Zea mays* and *Zoysia* spp. (Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman 1977).

SPECIMENS EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on spathe of dead inflorescence of *Cocos nucifera* (BPI 879991E) and decaying piece of wood (BPI 879992A), V.30.2008; León, León Mun., Rio Dulce, on the road to Poneloya, on sheath of dead leaf of *Roystonea* sp., VI.1<sup>st</sup>.2008 (BPI 879989B); León, La Paz Centro, on petioles and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994E, 879995C, 879996D).

***Curvularia verruculosa* Tandon & Bilgrami** (Sivanesan 1990); on *Pinus oocarpa* (IMI 245553).

***Curvularia* sp.**, on *Andropogon gayanus* (González et al. 1985b), *Paspalum notatum* (Litzenberger & Stevenson 1957) and *Paspalum* spp. (Wellman 1977).

SPECIMEN EXAMINED: León, La Paz Centro, on segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008, (BPI 879996J).

***Deightoniella torulosa*** (Syd.) M.B. Ellis (as *Helminthosporium torulosum* (Syd.) S.F. Ashby), on *Musa paradisiaca* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

\****Dendryphiella vinosa*** (Berk. & M.A. Curtis) Reisinger FIG. 4

SPECIMEN EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on herbaceous dead stems, V.30.2008 (BPI 879990A).

***Drechslera gigantea*** (Heald & F.A. Wolf) S. Ito (as *Helminthosporium giganteum* Heald & F.A. Wolf), on *Cynodon dactylon* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Drechslera sesami*** (J. Miyake) M.J. Richardson & E.M. Fraser (as *Helminthosporium sesami* I. Miyake), on *Sesamum indicum* (Litzenberger & Stevenson 1957, Wellman 1977).

***Drechslera tritici-repentis*** (Died.) Shoemaker (as *Helminthosporium tritici-vulgaris* Y. Nisik.), on *Triticum aestivum* (BPI 430732).

***Exserohilum turcicum*** (Pass.) K.J. Leonard & Suggs (as *Helminthosporium turcicum* Pass.), on *Sorghum bicolor* (as *S. vulgare* and *S. vulgare* var. *technicum*) (BPI 430952, 431050), *S. bicolor* subsp. *drummondii* (as *S. vulgare* var. *sudanense*) and *Zea mays* (BPI 431264, 431311, 431317, 431358) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Fusarium decemcellulare*** Brick (as *F. rigidiusculum* W.C. Snyder & H.N. Hansen), on cocoa (ATCC 24810, 24811, 24812, 24813, 24814, 24815, 24816, 24817, 24823, 24824, 24825, 24826, 24827, 24828, 24829, 24830, 24831, 24832, 24833, 24834, 24835, 24836); on *Theobroma cacao* (Hansen 1966, McGuire & Crandall 1967, Ploetz 2006).

***Fusarium graminearum*** Schwabe, on *Triticum aestivum* and *Zea mays* (McGuire & Crandall 1967, Wellman 1977).

***Fusarium incarnatum*** (Desm.) Sacc., on *Theobroma cacao* (IMI 96500).

***Fusarium malli*** Taubenh., on *Allium cepa* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Fusarium oxysporum*** Schltdl., on *Allium cepa*, *Gossypium hirsutum* and *Sesamum indicum* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967); on *Hylocereus undatus* (Anonymous 1994); ***F. oxysporum*** f.sp. ***cepae*** W.C. Snyder & H.N. Hansen, on *A. cepa* (McGuire & Crandall 1967); ***F. oxysporum*** f.sp. ***cubense*** (E.F. Sm.) W.C. Snyder & H.N. Hansen, on *Musa* spp. and *Musa* spp. cv. Bluggoe (Bentley et al. 1995, Holliday 1980, Koenig et al. 1997); ***F. oxysporum*** f.sp. ***elaeidis*** Toovey,

on *Elaeis guineensis* (Wellman 1977); ***F. oxysporum*** f.sp. ***lycopersici*** (Sacc.) W.C. Snyder & H.N. Hansen, on *Lycopersicon esculentum* (Berlin & Eitrem 2005, McGuire & Crandall 1967); ***F. oxysporum*** f.sp. ***nicotianae*** (J. Johnson) W.C. Snyder & H.N. Hansen, on *Nicotiana tabacum* (Miller 1969); ***F. oxysporum*** f.sp. ***niveum*** W.C. Snyder & H.N. Hansen, on *Citrullus lanatus* (as *C. vulgaris*) and *Cucumis melo* (McGuire & Crandall 1967); ***F. oxysporum*** f.sp. ***phaseoli*** J.B. Kendr. & W.C. Snyder, on *Phaseolus vulgaris* (McGuire & Crandall 1967); ***F. oxysporum*** f.sp. ***sesami*** Castell., on *S. indicum* (Wellman 1977); ***F. oxysporum*** f.sp. ***vasinfectum*** W.C. Snyder & H.N. Hansen (as *F. annuum* Leonian and *F. vasinfectum* G.F. Atk.), on *Capsicum annuum* (as *C. frutescens*), *Gossypium hirsutum*, *Gossypium* spp. and *Vigna radiata* (as *Phaseolus aureus*) (Brayford 1992, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Fusarium pusillum*** Wollenw., on *Musa paradisiaca* (as *M. sapientum*) (MUCL 29768).

***Fusarium roseum*** Link, on *Gossypium hirsutum* and *Theobroma cacao* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman 1977).

***Fusarium solani*** (Mart.) Appel & Wollenw., on *Gossypium hirsutum* and *Phaseolus vulgaris* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967); on *Helianthus annuus*, *Hibiscus cannabinus* and *Sesamum indicum* (Wellman 1977); ***F. solani*** f.sp. ***phaseoli*** W.C. Snyder & H.N. Hansen, on *P. vulgaris* (Wellman 1977).

***Fusarium verticillioides*** (Sacc.) Nirenberg (as *F. moniliforme* J. Sheld.), on *Gossypium hirsutum*, *Saccharum officinarum* and *Zea mays* (IMI 300324) (Croft 2000, Litzenberger & Stevenson 1957, McGuire & Crandall 1967); on *Musa* sp. (MUCL 31965) and *Pinus oocarpa* (IMI 233093, 238326).

***Fusarium*** sp., on *Cajanus cajan*, *Carthamus tinctorius*, *Glycine max*, *Gossypium* sp. (BPI 451270), *Helianthus annuus*, *Mangifera indica*, *Musa paradisiaca* (as *M. sapientum*), *Phaseolus vulgaris*, *Solanum tuberosum* and *Urochloa mutica* (as *Panicum purpurascens*) (Lenné 1990, Litzenberger & Stevenson 1957, Marasas et al. 2006, McGuire & Crandall 1967, Perera 1985).

SPECIMENS EXAMINED: León, León Mun., Rio Dulce, on the road to Poneloya, on dead herbaceous stems (BPI 879988E) and on sheath of dead leaf of *Roystonea* sp. (BPI 879989J), VI.1<sup>st</sup>.2008; León, La Paz Centro, on petioles and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994J, 879995L, 879996L).

***Fusicladium heveae*** K. Schub. & U. Braun (as *F. macrosporum* Kuijper), on *Hevea brasiliensis* (Holliday 1980).

***Fusicladium*** sp., on *Pennisetum purpureum* (Lenné 1990, Litzenberger & Stevenson 1957).

***Gliocladium caespitosum*** Petch, on *Musa* sp. (MUCL 30232).

*Graphium putredinis* (Corda) S. Hughes, on *Pinus pseudostrobus* (IMI 262710).

*Harposporium anguillulae* Lohde, from soil (Persmark et al. 1995).

\**Helicofilia madrasensis* Matsush. FIGS. 8–10

SPECIMEN EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, overgrowing synnemata of *Tretopileus sphaerophorus* on spathe of dead inflorescence of *Cocos nucifera*, V.30.2008 (BPI 879991G).

*Helminthosporium sesameum* Sacc., on *Sesamum indicum* (BPI 430237).

*Helminthosporium* sp., on *Ananas comosus* (González et al. 1985b), *Glycine max* (Perera 1985), *Hylocereus undatus* (Anonymous 1994), *Coffea arabica*, *Cynodon dactylon*, *Hyparrhenia rufa*, *Panicum maximum* and *Triticum aestivum* (Lenné 1990, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

*Humicola fuscoatra* Traaen, on *Pinus caribaea* (IMI 234921).

*Hymenostilbe dipterigena* Petch, on flies (Mains 1950).

*Leptoxyphium fumago* (Woron.) R.C. Srivast. (as *Fumago vagans* Pers.), on *Citrus sinensis* and *Gossypium hirsutum* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

*Lecanicillium lecanii* (Zimm.) Zare & W. Gams (as *Verticillium lecanii* (Zimm.) Viégas), on *Aphididae* and allied *Hemiptera* (Monzón, 2001).

*Metarhizium anisopliae* (Metschn.) Sorokīn, on *Aeneolamia varia*, *Leucoptera coffeella* and *Phyllophaga* spp. (Monzón 2001).

*Microdochium oryzae* (Hashioka & Yokogi) Samuels & I.C. Hallett (as *Rhynchosporium oryzae* Hashioka & Yokogi), on *Oryza sativa* (Holliday 1980, McGuire & Crandall 1967).

*Microdochium sorghi* (D.C. Bain & Edgerton ex Deighton) U. Braun (as *Gloeocercospora sorghi* D.C. Bain & Edgerton ex Deighton), on *Sorghum bicolor* (as *S. vulgare*) and *S. bicolor* subsp. *drummondii* (as *S. vulgare* var. *sudanense*) (BPI 453346, 453347, 453366) (Braun 1995, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

*Monacrosporium* sp., from soil (Persmark et al. 1995).

*Moniliophthora roreri* (Cif.) H.C. Evans, Stalpers, Samson & Benny, on *Theobroma cacao* (IMI 383854, 383855) (Aime & Phillips-Mora 2005, Phillips-Mora et al. 2007, Phillips-Mora & Wilkinson 2007, Ploetz 2007).

*Moniliophthora* sp., on *Theobroma cacao* (IMI 383858).

*Monilochaetes* sp., on *Lupinus* sp. (BPI 423575).

*Musicillium theobromae* (Turconi) Zare & W. Gams (as *Verticillium theobromae* (Turconi) E.W. Mason & S. Hughes), on *Musa* sp. (MUCL 29769).

\**Myrothecium* sp.

SPECIMEN EXAMINED: León, León Mun., Río Dulce, on the road to PoneLOYA, on sheath of dead leaf of *Roystonea* sp., VI.1<sup>st</sup>.2008 (BPI 879989I).

*Nakataea sigmoidea* (Cavara) Hara (as *Helminthosporium sigmoideum* Cavara), on *Oryza sativa* (Wellman 1977).

*Nigrospora oryzae* (Berk. & Broome) Petch, on *Oryza sativa* (McGuire & Crandall 1967).

*Nigrospora sphaerica* (Sacc.) E.W. Mason, on *Musa* sp. (MUCL 31966).

SPECIMENS EXAMINED: León, León Mun., Río Dulce, on the road to PoneLOYA, on sheath of dead leaf of *Roystonea* sp., VI.1<sup>st</sup>.2008, (BPI 879989A); León, La Paz Centro, on petioles and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994G, 879995E, 879996C).

*Nigrospora* sp., on *Saccharum officinarum* (González et al. 1985b).

*Nomuraea rileyi* (Farl.) Samson, on *Heliothis zea* (IMI 336639), *Heliothis* sp. (IMI 192420, 192422), *Spodoptera frugiperda* (IMI 336638), *S. sunia* (IMI 337423), *Spodoptera* sp. (IMI 192419, 192421) and other *Lepidoptera* (IMI 336278) (Monzón 2001).

\**Ochroconis humicola* (G.L. Barron & L.V. Busch) de Hoog & Arx

SPECIMEN EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on decaying piece of wood, V.30.2008 (BPI 879992B).

*Oidium monilioides* (Nees) Link, on *Triticum aestivum* (Wellman 1977).

*Oidium* sp., on *Emilia fosbergii*, *Persea americana*, *Teramnus uncinatus* and *Zinnia elegans* (González et al. 1985a, b).

*Oidiopsis taurica* (Lév.) E.S. Salmon (as the conidial stage of *Leveillula taurica* (Lév.) G. Arnaudon), on *Dolichos lablab* (Litzenberger & Stevenson 1957) and *Lycopersicon esculentum* (Berlin & Eitrem 2005).

*Paecilomyces inflatus* (Burnside) J.W. Carmich., on *Pinus oocarpa* (IMI 255617).

***Paecilomyces lilacinus*** (Thom) Samson (as *Penicillium lilacinum* Thom), from soil (Raper & Thom 1949) and on *Galleria mellonella* as bait from soil (ARSEF 8311, 8312).

***Passalora fulva*** (Cooke) U. Braun & Crous (as *Cladosporium fulvum* Cooke), on *Lycopersicon esculentum* (McGuire & Crandall 1967).

***Passalora fusimaculans*** (G.F. Atk.) U. Braun & Crous (as *Cercospora fusimaculans* G.F. Atk.), on *Panicum maximum* (BPI 436572, 436573, 436575, 436578) (Lenné 1990, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Passalora henningsii*** (Allesch.) R.F. Castañeda & U. Braun (as *Cercospora henningsii* Allesch. and *C. cassavae* Ellis & Everh.), on *Manihot esculenta* (McGuire & Crandall 1967).

***Passalora manihotis*** (F. Stevens & Solheim) U. Braun & Crous (as *Cercospora caribaea* Cif. and *Phaeoramularia manihotis* (F. Stevens & Solheim) M.B. Ellis), on *Manihot esculenta* (as *M. utilissima*) (David 2004, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Passalora vaginae*** (W. Krüger) U. Braun & Crous (as *Cercospora vaginae* W. Krüger and *Mycovellosiella vaginae* (W. Krüger) Deighton), on *Saccharum officinarum* (Ricaud 2000, Wellman 1977).

***Penicillium aurantiogriseum*** Dierckx, on *Pinus caribaea* (IMI 239306, 250896); ***P. aurantiogriseum*** var. ***viridicatum*** (Westling) Frisvad & Filt., on *P. pseudostrobus* (IMI 260915).

***Penicillium brevicompactum*** Dierckx, on *Pinus caribaea* (IMI 265988).

***Penicillium citrinum*** Thom, on *Pinus caribaea* (IMI 239305, 250895, 251476).

***Penicillium dierckxii*** Biourge (as *P. fellutanum* Biourge), on *Pinus caribaea* (IMI 251477).

***Penicillium dodgei*** Pitt (as *P. brefeldianum* B.O. Dodge), from soil (Raper & Thom 1949).

***Penicillium expansum*** Link, on *Pinus caribaea* (IMI 251478).

***Penicillium gladioli*** L. McCulloch & Thom (as *P. asperum* (Shear) Raper & Thom), from soil (Raper & Thom 1949).

***Penicillium indonesiae*** Pitt (as *P. javanicum* J.F.H. Beyma), from cocoa (ATCC 48351, NRRL 2085).



***Penicillium papuanum*** Udagawa & Y. Horie (as *P. parvum* Raper & Fennell), from soil (ATCC 10479, CBS 359.48 [Neotype of *P. parvum*], IMI 40587, NRRL 2095 [Holotype of *P. parvum*], NBRC 7732) (Raper & Fennell 1948, Raper & Thom 1949).

***Penicillium rugulosum*** Thom, on *Pinus caribaea* (IMI 239307).

***Penicillium simplicissimum*** (Oudem.) Thom (as *P. janthinellum* Biourge and *P. pulvillorum* Turfitt), from soil (ATCC 10455, CBS 340.48, IMI 40238, MUCL 38788 [Neotype of *P. janthinellum*], NRRL 2016) (Raper & Thom 1949); on *Pinus caribaea* (IMI 250898).

***Penicillium variabile*** Sopp, on *Pinus caribaea* (IMI 251479).

***Penicillium vermiculatum*** P.A. Dang., from soil (Raper & Thom 1949).

***Penicillium verrucosum*** Dierckx, on *Pinus pseudostrobus* (CBS 112577).

***Penicillium*** sp., on *Allium cepa* (McGuire & Crandall 1967).

\****Periconia byssoides*** Pers.

FIG. 7

SPECIMEN EXAMINED: León, León Mun., Rio Dulce, on the road to Poneloya, on dead herbaceous stems, VI.1<sup>st</sup>.2008 (BPI 879988A).

\****Pithomyces chartarum*** (Berk. & M.A. Curtis) M.B. Ellis

SPECIMENS EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on spathe of dead inflorescence of *Cocos nucifera*, V.30.2008 (BPI 879991C); León, León Mun., Rio Dulce, on the road to Poneloya, on dead herbaceous stems, VI.1<sup>st</sup>.2008 (BPI 879988B); León, La Paz Centro, on petioles and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994C, 879995B, 879996A).

\****Pithomyces maydicus*** (Sacc.) M.B. Ellis

SPECIMENS EXAMINED: León, La Paz Centro, on segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879995M, 879996I).

\****Pithomyces sacchari*** (Speg.) M.B. Ellis

SPECIMENS EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on spathe of dead inflorescence of *Cocos nucifera*, V.30.2008 (BPI 879991D); León, La Paz Centro, on petiole and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994D, 879995K).

***Pseudocercospora cruenta*** (Sacc.) Deighton (as *Cercospora cruenta* Sacc.), on *Vigna unguiculata* (as *V. sinensis*) (BPI 435348, 435350) (Litzenberger & Stevenson 1957, Wellman 1977).

***Pseudocercospora fijiensis*** (M. Morelet) Deighton, on *Musa* spp. (CABI/EPPO 2003, Crous et al. 2003, Mourichon & Fullerton 1990).

***Pseudocercospora griseola*** (Sacc.) Crous & U. Braun (as *Isariopsis griseola* Sacc. and *Phaeoisariopsis griseola* (Sacc.) Ferraris), on *Phaseolus vulgaris* (BPI 449431, 449437, 449443, 449450) (Crous et al. 2006, Kirk 1986, Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Pseudocercospora musae*** (Zimm.) Deighton (as *Cercospora musae* Zimm.), on *Musa paradisiaca* (as *M. sapientum*) (BPI 438668, 438670) (Litzenberger & Stevenson 1957) and *Musa* spp. (Crous et al. 2003, Mourichon & Fullerton 1990).

***Pseudocercospora pini-densiflorae*** (Hori & Nambu) Deighton (as *Cercoseptoria pini-densiflorae* (Hori & Nambu) Deighton), on *Pinus oocarpa* (IMI 281636) (Evans 1984) and *Pinus* spp. (CABI/EPPO 1994).

***Pseudocercospora purpurea*** (Cooke) Deighton (as *Cercospora purpurea* Cooke), on *Persea americana* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman 1977).

***Pseudocercospora stizolobii*** (Syd. & P. Syd.) Deighton (as *Cercospora stizolobii* Syd. & P. Syd.), on *Mucuna deeringiana* (Litzenberger & Stevenson 1957) and *Mucuna* sp. (BPI 441660).

**\**Pseudopetrakia kambakkamensis*** (Subram.) M.B. Ellis FIGS. 5–6  
SPECIMEN EXAMINED: on bark of *Eucalyptus* sp., León, La Paz Centro, VI.1<sup>st</sup>.2008 (BPI 879993).

***Pyricularia grisea*** (Cooke) Sacc., on *Digitaria decumbens*, *Pennisetum clandestinum* (BPI 420346, 420347) and *Stenotaphrum secundatum* (BPI 420399) (Lenné 1990, Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman 1977).

***Pyricularia oryzae*** Cavara, on *Oryza sativa* (BPI 420225) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

***Ramularia phaseoli*** (O.A. Drumm.) Deighton (as *Ovularia phaseoli* O.A. Drumm. and *Ramularia phaseolina* Petr.), on *Phaseolus vulgaris* (BPI 413537, 418459, 418523) (Braun 1998, Deighton 1967, Litzenberger & Stevenson 1957, McGuire & Crandall 1967, Wellman, 1977).

***Ramularia pistiae*** R.C. Fern. & R.W. Barreto, on *Pistia stratiotes* [Holotype, VIC] (Fernandes & Barreto 2005).

***Ramularia*** sp., on *Paspalum notatum* (Litzenberger & Stevenson 1957) and *Paspalum* spp. (Wellman 1977).

***Ramulariopsis gossypii*** (Speg.) U. Braun (as *Ramularia areola* G.F. Atk.), on *Gossypium hirsutum* (Litzenberger & Stevenson 1957) and *Gossypium* spp. (BPI 416008, 416009, 416010) (Braun 1998).

***Scopulariopsis brumptii*** Salv.-Duval, on *Pinus pseudostrobus* (IMI 262708).

***Stigmina palmivora*** (Sacc.) S. Hughes (as *Exosporium palmivorum* Sacc.), on *Cocos nucifera* (McGuire & Crandall 1967).

***Spadicoides*** sp., on *Bombacopsis quinata* (IMI 233829).

**\**Taeniolella*** sp.

SPECIMEN EXAMINED: León, La Paz Centro, on segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879996M).

**\**Tetraploa aristata*** Berk. & Broome

SPECIMENS EXAMINED: León, La Paz Centro, on petioles and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879994F, 879995D).

***Thielaviopsis paradoxa*** (De Seynes) Höhn., on *Saccharum officinarum* (Girard & Rott 2000).

**\**Torula herbarum*** (Pers.) Link

SPECIMEN EXAMINED: León, La Paz Centro, on petiole and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879995I).

**\**Torula herbarum* f. *quaternella*** Sacc.

SPECIMENS EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on herbaceous dead stems, V.30.2008 (BPI 879990C); León, La Paz Centro, on petiole and segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879995J).

**\**Tretopileus sphaerophorus*** (Berk. & M.A. Curtis) S. Hughes & Deighton

FIGS. 1–3

SPECIMEN EXAMINED: Managua, Mateare, Chiltepe Peninsula Natural Reserve, around Xiloá Lagoon, on spathe of dead inflorescence of *Cocos nucifera*, V.30.2008 (BPI 879991A).

***Trichoderma*** sp., on *Theobroma cacao* (Wellman 1977).

*Trichothecium roseum* (Pers.) Link, on *Pinus caribaea* (IMI 239304).

*Trichothecium* sp., on *Pinus oocarpa* (IMI 233087).

*Ulocladium atrum* Preuss (IMI 174861) (CABI/EPP0, 2008).

*Ulocladium chartarum* (Preuss) E.G. Simmons, on *Leucaena leucocephala* (IMI 233086).

*Ustilaginoidea virens* (Cooke) Takah., on *Oryza sativa* (BPI 183683, 183685) (Litzenberger & Stevenson 1957, McGuire & Crandall 1967) and *Zea mays* (BPI 183707).

*Veronaea* sp. (IMI 174863).

*Verticillium albo-atrum* Reinke & Berthold, on *Gossypium hirsutum* (Litzenberger & Stevenson 1957, McGuire & Crandall 1967).

*Volutella* sp., on *Coffea arabica* (González et al. 1985b).

**\**Zygosporium echinosporum*** Bunting & E.W. Mason FIG. 11

SPECIMEN EXAMINED: León, León Mun., Rio Dulce, on the road to Poneloya, on sheath of dead leaf of *Roystonea* sp., VI.1<sup>st</sup>.2008 (BPI 879989D).

**\**Zygosporium masonii*** S. Hughes

SPECIMENS EXAMINED: León, León Mun., Rio Dulce, on the road to Poneloya, on sheath of dead leaf of *Roystonea* sp., VI.1<sup>st</sup>.2008 (BPI 879989E); León, La Paz Centro, on segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879996G).

**\**Zygosporium oscheoides*** Mont.

SPECIMENS EXAMINED: León, León Mun., Rio Dulce, on the road to Poneloya, on sheath of dead leaf of *Roystonea* sp., VI.1<sup>st</sup>.2008 (BPI 879989F); León, La Paz Centro, on segments of dead leaf of unidentified palm, VI.1<sup>st</sup>.2008 (BPI 879996H).

### Uncertain or doubtful records and species

***Cercospora caricae*** Chupp. & Cif., on *Manihot esculenta* (McGuire & Crandall 1967). Wrong author citation, may be *C. caricae* Speg. (□ *A. caricae* (Speg.) Maubl.) but is difficult to interpret due to the atypical host.

***Chrysonilia sitophila*** (Mont.) Arx (as *Monilia sitophila* (Mont.) Sacc.), on *Gossypium hirsutum*. Doubtful identification, "something similar, but not fully identified, in El Salvador and Nicaragua" (Wellman 1977).

***Cladosporium pallidum*** Berk. & M.A. Curtis, on leaves (BPI 427372) (Berkeley & Curtis 1860). This species, known only from the type collection, was transferred to *Cercospora* by Cooke (1888) as *C. pallida* (Berk. & M.A. Curtis) Cooke. However, this latter name is an illegitimate later homonym of *C. pallida* Ellis & Everh. (Dugan et al. 2004, Shin & Braun 2000). Critical examination of the type material is needed to clarify its present status.

***Cladosporium zaeae*** Peck, on *Zea mays*. Uncertain record for Nicaragua (Wellman 1977).

***Coniosporium subseriatum*** Ellis & Everh., on bark (Ellis & Everhart 1896). Known only from the original collection, critical study of the type specimen is necessary to determine its current status.

***Isaria*** sp., on *Mangifera indica* (McGuire & Crandall 1967). A confusing record probably belonging to a non-entomogenous *Paecilomyces* species.

***Myrothecium*** sp. and ***Penicillium*** sp., on *Glycine max*. Uncertain records cited as important for quarantine services but unconfirmed on soybean (Perera 1985).

### Host and substrate index

***Aeneolamia varia*** (F.) (Hemiptera): *Metarhizium anisopliae*

***Allium cepa*** L. (Liliaceae): *Alternaria porri*, *Aspergillus niger*, *Fusarium malli*, *F. oxysporum*, *F. oxysporum* f.sp. *cepae*, *Penicillium* sp.

***Ananas comosus*** (L.) Merr. (Bromeliaceae): *Helminthosporium* sp.

***Andropogon gayanus*** Kunth (Poaceae): *Curvularia* sp.

**Aphididae** (Hemiptera): *Lecanicillium lecanii*

***Arachis hypogaea*** L. (Fabaceae): *Cercospora arachidicola*, *C. arachidis*, *C. personata*

**Arecaceae**: *Alternaria tenuissima*, *Beltrania rhombica*, *Bipolaris bicolor*, *Chloridium codinaeoides*, *Cladosporium oxysporum*, *Curvularia lunata*, *Curvularia* sp., *Fusarium* sp., *Nigrospora sphaerica*, *Pithomyces chartarum*, *P. maydicus*, *P. sacchari*, *Taeniolella* sp., *Tetraploa aristata*, *Torula herbarum*, *T. herbarum* f. *quaternella*, *Zygosporium masonii*, *Z. oscheoides*

***Asperisporium caricae*** (hyphomycetes): *Acremonium* sp.

***Beta vulgaris*** L. (Chenopodiaceae): *Cercospora beticola*

***Bombacopsis quinata*** (Jacq.) Dugand (Bombacaceae): *Spadicoides* sp.

**Brassica oleracea** L. var. **capitata** L. (*Brassicaceae*): *Alternaria brassicae*; **B. pekinensis** Skeels: *A. brassicae*; **B. rapa** L.: *A. brassicae*

**Cajanus cajan** (L.) Millsp. (*Fabaceae*): *Fusarium* sp.

**Capsicum annuum** L. (= *C. frutescens* L.) (*Solanaceae*): *Botrytis cinerea*, *Cercospora capsici*, *Fusarium oxysporum* f.sp. *vasinfectum*

**Carica papaya** L. (*Caricaceae*): *Acremonium* sp., *Asperisporium caricae*, *Cercospora* sp., *Corynespora cassiicola*

**Carthamus tinctorius** L. (*Asteraceae*): *Cladosporium herbarum*, *Fusarium* sp.

**Catasetum** sp. (*Orchidaceae*): *Cercospora* sp.

**Chloris gayana** Kunth (*Poaceae*): *Bipolaris sorokiniana*; **Ch. virgata** Sw.: *B. sorokiniana*

**Chrysomelid** (*Coleoptera*): *Beauveria bassiana*

**Citrullus lanatus** (Thunb.) Matsum. & Nakai (= *C. vulgaris* Schrad.) (*Cucurbitaceae*): *Cercospora citrullina*, *Fusarium oxysporum* f.sp. *niveum*

**Citrus aurantiifolia** (Christm.) Swingle (*Rutaceae*): *Cercospora* sp.; **C. limon** (L.) Burm.f.: *Alternaria citri*, *Bipolaris hawaiiensis*; **C. sinensis** Pers.: *A. citri*, *Leptoxyphium fumago*

**Cocoa**: *Fusarium decemcellulare*, *Penicillium indonesiae*

**Cocos nucifera** L. (*Arecaceae*): *Alternaria* sp., *Curvularia lunata*, *Helicofilia madrasensis*, *Pithomyces chartarum*, *P. sacchari*, *Stigmina palmivora*, *Tretopileus sphaerophorus*

**Coffea arabica** L. (*Rubiaceae*): *Cercospora coffeicola*, *Helminthosporium* sp., *Volutella* sp.; **Coffea** spp.: *C. coffeicola*

**Cosmopolites sordidus** (Germar) (*Coleoptera*): *Beauveria bassiana*

**Cucumis melo** L. (*Cucurbitaceae*): *Fusarium oxysporum* f.sp. *niveum*

**Cyamopsis tetragonoloba** (L.) Taubert (*Fabaceae*): *Cercospora psoraleae*

**Cynodon dactylon** (L.) Pers. (*Poaceae*): *Bipolaris cynodontis*, *Drechslera gigantea*, *Helminthosporium* sp.

**Daucus carota** L. (*Apiaceae*): *Alternaria dauci*

**Digitaria decumbens** Stent (*Poaceae*): *Pyricularia grisea*

**Diptera**: *Hymenostilbe dipterigena*

**Dolichos lablab** L. (*Fabaceae*): *Cercospora canescens*, *Oidiopsis taurica*

**Elaeis guineensis** Jacq. (*Arecaceae*): *Fusarium oxysporum* f.sp. *elaeidi*

**Emilia fosbergii** Nicolson (*Asteraceae*): *Oidium* sp.

**Eucalyptus** sp. (*Myrtaceae*): *Pseudopetrakia kambakkamensis*

**Galleria mellonella** (L.) (*Lepidoptera*): *Paecilomyces lilacinus*

**Gladiolus hortulans** L.H. Bailey (*Iridaceae*): *Cladosporium herbarum*

**Glycine max** (L.) Merr. (*Fabaceae*): *Acremonium* sp., *Alternaria alternata*, *Alternaria* sp., *Cadophora gregata*, *Cercospora canescens*, *C. kikuchii*, *Cercospora* sp., *Corynespora cassiicola*, *Corynespora* sp., *Fusarium* sp., *Helminthosporium* sp.

**Gossypium hirsutum** L. (*Malvaceae*): *Alternaria macrospora*, *Cercospora gossypina*, *Fusarium oxysporum* f.sp. *vasinfectum*, *F. oxysporum*, *F. roseum*, *F. solani*, *F. verticillioides*, *Leptoxylum fumago*, *Ramulariopsis gossypii*, *Verticillium albo-atrum*;  
**Gossypium** sp.: *Alternaria macrospora*, *F. oxysporum* f.sp. *vasinfectum*, *Fusarium* sp., *Ramulariopsis gossypii*

**Helianthus annuus** L. (*Asteraceae*): *Fusarium solani*, *Fusarium* sp.

**Heliothis zea** (Boddie) (*Lepidoptera*): *Nomuraea rileyi*; **Heliothis** sp.: *N. rileyi*

**Hevea brasiliensis** (Willd. ex A.Juss.) Müll.Arg. (*Euphorbiaceae*): *Bipolaris heveae*, *Fusicladium heveae*; **Hevea** sp.: *B. heveae*

**Hibiscus cannabinus** L. (*Malvaceae*): *Fusarium solani*

**Hylocereus undatus** (Haw.) Britton & Rose (*Cactaceae*): *Cladosporium* sp., *Fusarium oxysporum*, *Helminthosporium* sp.

**Hyparrhenia rufa** (Nees) Stapf (*Poaceae*): *Curvularia cymbopogonis*,  
*Helminthosporium* sp.

**Hypothenemus hampei** (Ferr.) (*Coleoptera*): *Aspergillus ochraceus*, *Beauveria*  
*bassiana*

**Ipomoea batatas** (L.) Lam. (*Convolvulaceae*): *Cercospora* sp.

**Lactuca sativa** L. (*Asteraceae*): *Cercospora lactucae-sativae*

**Lepidoptera**: *Nomuraea rileyi*

**Leucaena leucocephala** (Lam.) de Wit (*Fabaceae*): *Ulocladium chartarum*

**Leucoptera coffeella** (Guér.) (*Lepidoptera*): *Beauveria bassiana*, *Metarhizium*  
*anisopliae*

**Lupinus** sp. (*Fabaceae*): *Monilochaetes* sp.

**Lycopersicon esculentum** Mill. (*Solanaceae*): *Alternaria solani*, *Fusarium oxysporum*  
f.sp. *lycopersici*, *Oidiopsis taurica*, *Passalora fulva*

**Mangifera indica** L. (*Anacardiaceae*): *Cercospora* sp., *Fusarium* sp.

**Manihot esculenta** Crantz (= *Manihot utilissima* Pohl) (*Euphorbiaceae*):  
*Cercospora henningsii*, *Passalora manihotis*, *P. henningsii*

**Melicoccus bijugatus** Jacq. (*Sapindaceae*): *Cercospora sapindi*, *Cercospora* sp.

**Mucuna deeringiana** (Bort) Merr. (*Fabaceae*): *Pseudocercospora stizolobii*;  
**Mucuna** sp.: *P. stizolobii*

**Musa paradisiaca** L. (= *M. sapientum* L.) (*Musaceae*): *Deightoniella torulosa*,  
*Fusarium pusillum*, *Fusarium* sp., *Pseudocercospora musae*; **Musa** sp.: *Acremonium*  
*roseogriseum*, *Fusarium oxysporum* f.sp. *cubense*, *F. verticillioides*, *Gliocladium*  
*caespitosum*, *Musicillium theobromae*, *Nigrospora sphaerica*, *Pseudocercospora fijiensis*,  
*P. musae*; **Musa** spp. cv. **Bluggoe**: *Fusarium oxysporum* f.sp. *cubense*

**Nicotiana tabacum** L. (*Solanaceae*): *Cercospora nicotianae*, *Fusarium oxysporum* f.sp.  
*nicotianae*

**Oryza sativa** L. (*Poaceae*): *Bipolaris oryzae*, *Cercospora oryzae*, *Curvularia lunata*,  
*Microdochium oryzae*, *Nakataea stgmoidea*, *Nigrospora oryzae*, *Pyricularia oryzae*,  
*Ustilaginoidea virens*; **Oryza** sp.: *Alternaria tenuissima*, *Cladosporium tenuissimum*



**Panicum maximum** Jacq. (*Poaceae*): *Alternaria flagelloidea*, *Helminthosporium* sp., *Passalora fusimaculans*

**Paspalum notatum** Flueggé (*Poaceae*): *Cladosporium herbarum*, *Curvularia* sp., *Ramularia* sp.; **Paspalum** spp.: *Curvularia* sp., *Ramularia* sp.

**Pennisetum clandestinum** Hochst. ex Chiov. (*Poaceae*): *Pyricularia grisea*; **P. glaucum** (L.) R. Br.: *Alternaria* sp.; **P. purpureum** Schumach.: *Fusicladium* sp.

**Persea americana** Mill. (*Lauraceae*): *Pseudocercospora purpurea*, *Oidium* sp.; **Persea** sp.: *Cercospora* sp.

**Phaseolus vulgaris** L. (*Fabaceae*): *Cercospora* sp., *Fusarium oxysporum* f.sp. *phaseoli*, *F. solani*, *F. solani* f.sp. *phaseoli*, *Fusarium* sp., *Pseudocercospora griseola*, *Ramularia phaseoli*

**Phyllophaga** spp. (*Coleoptera*): *Beauveria bassiana*, *Metarhizium anisopliae*

**Physalis angulata** L. (*Solanaceae*): *Cercospora* sp.

**Pinus caribaea** Morelet (*Pinaceae*): *Aspergillus caesiellus*, *A. flavus*, *A. fumigatus*, *A. sydowii*, *A. tamarii*, *A. wentii*, *Aspergillus* sp., *Cladosporium herbarum*, *Humicola fuscoatra*, *Penicillium aurantiogriseum*, *P. brevicompactum*, *P. citrinum*, *P. dierckxii*, *P. expansum*, *P. rugulosum*, *P. simplicissimum*, *P. variabile*, *Trichothecium roseum*; **P. oocarpa** Schiede ex Schldt.: *Acremonium* sp., *Acrodontium crateriforme*, *Aspergillus ustus*, *Curvularia verruculosa*, *Fusarium verticillioides*, *Paecilomyces inflatus*, *Pseudocercospora pini-densiflorae*, *Trichothecium* sp.; **P. pseudostrobis** Lindl.: *Aspergillus* sp., *Graphium putredinis*, *Penicillium aurantiogriseum* var. *viridicatum*, *P. verrucosum*, *Scopulariopsis brumptii*; **Pinus** spp.: *Pseudocercospora pini-densiflorae*

**Pistia stratiotes** L. (*Araceae*): *Ramularia pistiae*

**Plantae**: *Cladosporium oxysporum*, *Corynespora cassicola*, *Curvularia lunata*, *Dendryphiella vinosa*, *Fusarium* sp., *Ochroconis humicola*, *Periconia byssoides*, *Pithomyces chartarum*, *Torula herbarum* f. *quaternella*

**Plutella xylostella** (L.) (*Lepidoptera*): *Beauveria bassiana*

**Ricinus communis** L. (*Euphorbiaceae*): *Alternaria ricini*, *Cercospora ricinella*

**Roystonea** sp. (*Arecaceae*): *Cladosporium oxysporum*, *Curvularia lunata*, *Fusarium* sp., *Myrothecium* sp., *Nigrospora sphaerica*, *Zygosporium echinosporum*, *Z. masonii*, *Z. oscheoides*

**Saccharum officinarum** L. (*Poaceae*): *Bipolaris sacchari*, *Cercospora longipes*, *Cladosporium* sp., *Fusarium verticillioides*, *Nigrospora* sp., *Passalora vaginae*, *Thielaviopsis paradoxa*; **Saccharum** spp.: *C. longipes*

**Sesamum indicum** L. (*Pedaliaceae*): *Alternaria* sp., *Cercospora sesami*, *Drechslera sesami*, *Fusarium oxysporum*, *F. oxysporum* f.sp. *sesami*, *F. solani*, *Helminthosporium sesameum*; **Sesamum** sp.: *C. sesami*

**Soil:** *Arthrobotrys musiformis*, *A. sclerohypha*, *Arthrobotrys* sp., *Aspergillus fischeri* var. *spinosus*, *Beauveria bassiana*, *Harposporium anguillulae*, *Monacrosporium* sp., *Paecilomyces lilacinus*, *Penicillium dodgei*, *P. gladioli*, *P. papuanum*, *P. simplicissimum*, *P. vermiculatum*

**Solanum tuberosum** L. (*Solanaceae*): *Alternaria solani*, *Fusarium* sp.

**Sorghum bicolor** (L.) Moench (= *S. vulgare* Pers., *S. vulgare* Pers. var. *technicum* (Koern.) Jáv.) (*Poaceae*): *Cladosporium* sp., *Exserohilum turcicum*, *Microdochium sorghi*; **S. bicolor** (L.) Moench subsp. **drummondii** (Nees ex Steud.) de Wet ex Davidse (= *S. vulgare* var. *sudanense* Hitchc.): *E. turcicum*, *M. sorghi*.

**Spodoptera frugiperda** (J.E. Smith) (*Lepidoptera*): *Nomuraea rileyi*; **S. sunia** Guenée: *N. rileyi*; **Spodoptera** sp.: *N. rileyi*

**Stenotaphrum secundatum** (Walter) Kuntze (*Poaceae*): *Pyricularia grisea*

**Syngonium angustatum** Schott (*Araceae*): *Cercospora* sp.

**Teramnus uncinatus** Sw. (*Fabaceae*): *Oidium* sp.

**Theobroma cacao** L. (*Sterculiaceae*): *Fusarium decemcellulare*, *F. incarnatum*, *F. roseum*, *Moniliophthora roreri*, *Moniliophthora* sp., *Trichoderma* sp.

**Tretopileus sphaerophorus** (hyphomycetes): *Helicofilia madrasensis*

**Trifolium resupinatum** L. (*Fabaceae*): *Cercospora zebrina*; **Trifolium** sp.: *C. zebrina*

**Triticum aestivum** L. (*Poaceae*): *Bipolaris sorokiniana*, *Cladosporium herbarum*, *Drechslera tritici-repentis*, *Fusarium graminearum*, *Helminthosporium* sp., *Oidium monilioides*

**Unknown:** *Ulocladium atrum*, *Veronaea* sp.

***Urochloa mutica*** (Forssk.) T.Q.Nguyen (= *Panicum purpurascens* Raddi)  
(Poaceae): *Fusarium* sp.

***Vigna radiata*** (L.) R. Wilczek (= *Phaseolus aureus* Roxb.) (Fabaceae): *Fusarium oxysporum* f.sp. *vasinfectum*; ***V. unguiculata*** (L.) Walp. (≡ *V. sinensis* (L.) Savi ex Hassk.): *Cercospora canescens*, *Pseudocercospora cruenta*

***Zea mays*** L. (Poaceae): *Acremonium strictum*, *Bipolaris maydis*, *Cercospora sorghi*, *Cladosporium herbarum*, *Curvularia lunata*, *Exserohilum turcicum*, *Fusarium graminearum*, *F. verticillioides*, *Ustilagoidea virens*

***Zinnia elegans*** Jacq. (Asteraceae): *Cercospora* sp., *Oidium* sp.; ***Zinnia*** sp.: *C. zinniae*

***Zoysia*** spp. (Poaceae): *Curvularia lunata*

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