

# **A Preliminary Report of the Microfungi of Ding Darling Wildlife Refuge (Sanibel Island, Florida), December 2010**

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## Introduction:

The J. N. "Ding" Darling National Wildlife Refuge, administered by the US Fish and Wildlife Service, is located on the subtropical barrier island of Sanibel in the Gulf of Mexico, just west of Ft. Myers in Lee County, Florida. The refuge is part of the largest undeveloped mangrove ecosystem in the United States and is world famous for its spectacular migratory bird populations

Long recognized as unique, numerous reports, surveys and checklists of the natural area have been generated. An excellent summary of the mangrove uplands and interior wetlands of Sanibel Island including Ding Darling can be found in John Clark's *The Sanibel Report* (Clark, 1976), now out of print but available through the internet. Since that time the area has developed into a tourist haven with the resulting impact of several thousand visitors per year. As recently as 2008 the US Fish and Wildlife Service initiated a comprehensive conservation plan and environmental assessment for Ding Darling announced in the Federal Register April 2, 2008 (Vol. 73, Number 64, pp. 17991-77912). While there is a great deal of interest in the area, a survey of the microfungi (Ascomycetes and their anamorphs) of the Ding Darling Wildlife Refuge has never been conducted. The current report is a preliminary attempt to address that gap.

The information contained in the following report is useful not just from a biodiversity perspective, but can be used to address key initiatives in a conservation plan.

## Scope of Project:

The focus was to collect microfungi (Ascomycetes and their anamorphs) by selecting substrates where fungi are expected to develop. Such substrates include fallen wood and other plant material in various states of decay as well as fungi growing on other fungi and dung. Both terrestrial and marine habitats were investigated. No living plants were sacrificed during the study. All material was gathered during the months of November, January, February and April from 2005-2010. This just happened to coincide with my own "snow-bird" migratory pattern.

Substrates were examined microscopically and the fungi identified to genus and/or species.

Collection sites encompassed visitor accessible areas including Wildlife Drive, Indigo Trail, Cross Dike Trail, Wulfert Key, Shell Mound and Bailey Tract as well as restricted regions around the Refuge Centre and Maintenance shed. The areas consist mainly of mangrove stands

and are predominantly marine except for Shell Mound and Bailey Tract which are more inland. The latter locale has a rather unique stand of *Spartina bakeri* Merr. and *Typha* spp., suggesting a more freshwater environment. A detailed discussion of the vascular plant flora is presented by Herwitz and Wunderlin (1990) and at the Ding Darling Wildlife Refuge website <http://www.fws.gov/dingdarling>.

Since this is the first inventory of microfungi for the area an attempt was made to determine whether there are possible new records for each of the following: Lee County, the state of Florida and mainland United States. All species are considered new records for the Refuge.

### Results:

Over 100 specimens were collected and most identified to genus and/or species. All specimens are housed in the herbarium at the New Brunswick Museum of Natural Sciences, 277 Douglas Avenue, St. John, New Brunswick, E2K 1E5, Canada ([www.nbm-mnb.ca](http://www.nbm-mnb.ca)).

The following are possible new records for fungi found in this study. Although an attempt was made to check published articles (Delgado, 2008; Vogel et al, 2008) for reports of these fungi the possibility remains that some references may have been missed or specimens deposited in herbaria but not reported in the literature. Hence it is prudent to qualify the record with the term "possible".

- a. New Records for Lee County: *Byssosphaeria schiedermayeriana* (Fuckel) Barr, *Jahnula rostrata* Raja & Shearer, *Quintaria lignatilis* (Kohlm.) Kohlm. & Volkm.-Kohlm., *Tracylla spartinae* (Peck) Tassi
- b. New Records for Florida: *Barrmaelia oxycanthae* (Mont.) F.Rappaz, *Niesslia exosporioides* (Desm.) Winter, *Ommatomyces pardalina* (Ellis & Everhart) Wang, Wong & Hyde, *Pseudopetrakia kambakkamensis* (Subram.) M.B. Ellis.
- c. New Records for US (mainland): *Anthostomella palmicola* (Aw.) Rabenhorst, *Ciliochorella mangiferae* Sydow, *Lophiostoma mangrovei* Kohl. et Vittal, *Haplotrichum sphaerosporum* (Linder) Hol.-Jech., *Lophiotrema grandispora* (Sacc.) Shoemaker & Babcock, *Mycoenterolobium platysporum* Goos var *magnum* Mercado & Mena, *Xylomelasma sordida* Reblova.
- d. Possible new species: *Acanthostigma* sp., *Melanospora* sp., *Trematophoma* sp., *Xenolophium* sp.

**SPECIES OF INTEREST** (eg rarely collected, unusual distribution, new hosts or possible new species). A "cf" designation before the genus or species indicates that the identification is not conclusive.

*Acanthostigma* sp.: Ascomata very spiny and shiny, collabent when dry; asci bitunicate, biseriate, 60-70x10µm; paraphyses abundant; spores hyaline, usually 1-septate in the middle but some submedian, curved, a bit broader at the apex, 29-38x6-8µm. Using various references the most appropriate genus for this collection is *Acanthostigma*, however, no described species has uniseptate spores. There are two with 3-septate ascospores (*A. brevispina* and *A. parvula*) but the measurements are much smaller than the Florida material. This could represent a new species.

*Anthostomella* cf *limitata* Sacc.: All characters match the description in Francis (1975). The author includes this species in the key to *Anthostomella* occurring on palms based on a single collection she studied on leaves of *Chamaerops humilis*. It is usually associated with herbaceous material, therefore I have used the name *A. limitata* with some reservation.: Reference - Francis, Sheila. 1975. *Anthostomella* Sacc. (Part 1). Mycol. Papers 139: 1-97.

*Barrmaelia oxycanthae* (Mont.) F.Rappaz: This species has not been reported from Florida but is found on many different plant species mainly in Europe and one collection in New York State (Rappaz, 1995). I have found several collections of this species in the province of Prince Edward Island (PEI), Canada. Reference - Rappaz, F. 1995. *Anthostomella* and related Xylariaceous fungi on hard wood from Europe and North America. *Mycologia Helvetica* 7:99-168.

*Byssosphaeria schiedermayeriana* (Fuckel) Barr: Ascomata superficial, hairy/spinose (spines brown, blunt apex, smooth and septate), possibly with cephalothecoid peridium, dark brown with a very broad orange-red ring around the ostiole, ostiole also quite large, ascomata appear to develop very close to Hypoxylon stromata; asci appear bitunicate, irregularly biseriate; pseudoparaphyses branched and abundant, septate; ascospores usually two-celled (but one was seen with 3 septa), slightly indented at the mid septum, light brown, 32-42-x7-10µm, a gel sheath was observed around one very young spore (no evidence of sheath around mature spores). Reference: Barr, M.E. 1990. *Melanommatales* (Loculoascomycetes). *North American Flora II Part 13*:1-129. Barr examined a collection from Collier Co. Florida but reported no others from Florida. Possibly a new record for Lee County.



*Biscogniauxia* cf *capnodes* (Berk.) Y-M. Ju & J.D. Rogers: Stroma appanate, erumpent through the bark, black, uniperithecial (one layer of ascomata), effused, spreading, carbonaceous, ostioles flush with surface to slightly protruding, no ring around ostiole; spores unicellular, black, ellipsoid with rounded ends, 7-11x5-6µm, 1 germ slit running the full length of the spore. Reference: Ju et al. 1998. The genus *Biscogniauxia*. *Mycotaxon* 66: 1-98. The Florida material matches this species but the ring around the ostiole, typical of the species, was not observed.

***Biscogniauxia* cf *mediterranea*** (de Not.) Kuntze: Stroma appanate, black, uniperithecial (one layer of ascomata), effused, spreading, carbonaceous, ostioles protruding (papillate), no ring around ostiole; spores unicellular, black, ellipsoid with rounded ends, 14-17x7-9µm, 1 germ slit running the full length of the spore. Reference: Ju et al. 1998. The genus

*Biscogniauxia*. Mycotaxon 66: 1-98. In this paper specimens were examined from Hawaii, California and Louisiana and many countries in sub-tropical climates. It appears to match *B. mediterranea varmicrosspora* however this variety has only been recorded on the west coast of N.Am. and mainly on *Alnus*

***Chaetomium* cf *caprinum*** Bainier: Dung collected on Jan 27/09 and ascomata developed after 3wks in a moist chamber. Ascomata elongate (difficult to measure without crushing but seems to be about 350x220µm (a bit small for *C.caprinum*, abundant terminal ascomatal hairs (coiled), definite linear cells in neck region, small ascospores 6-7x5-6µm in face view. Culture attempted on V-8 (Mar 16/10), produces a definite green pigment in culture after 4 wks. Reference: Carter, A. 1982. A Taxonomic Study of the Ascomycete Genus *Chaetomium* Kunze. Ph.D. Thesis, Univ of Toronto. The collection could also be a variety of *Chaetomium bostrychodes* Zopf.

***DiatryPELLA* cf *opaca/herbacea***: Stroma black on the surface and white interior, pulvinate and erumpent, contains 3-7 ascomata; asci polysporous, with long stipe; spores light brown, allantoid, 4-7(9)x1.5µm. Reference: Berllese, A.N.1900. Icones fungorum Vol III, 120pp. The US host index (Fungi on Plants and Plant Products in the United States, Editors Farr D. et al, 1995) cites both species in Florida. *DiatryPELLA opaca* is usually on *Ilex* and *D. herbacea* on *Solidago* or *Ambrosia*.

***Didymosphaeria* sp.**: Ascomata superficial, somewhat conical; asci 160x12µm, spores uniseriate, bitunicate; trabeculate paraphyses, branched at the apex; spores dark brown, 2-celled, pointed apices, 22-26x8-9µm. Reference: Aptroot, A. 1995. Redisposition of some species excluded from *Didymosphaeria* (Ascomycotina). Nova Hedwigia 60: 325-379. Using the key in this paper one comes to *Didymosphaeria*. However, no *Didymosphaeria* species has spores longer than 17µ (Barr, M.E. 1990. Melanommatales (Loculoascomycetes)). North American Flora II Part 13:1-129.

***Haplotrichum croceum*** (Mont.) Partridge & Morgan-Jones: Reference: Partridge, E. Christopher et al. 2002. Notes on Hyphomycetes. LXXXVI. Some additional *Haplotrichum* species with supplementary comments on, and a key to, the genus. Mycotaxon 82: 41-94. As *Haplotrichum croceum*, known also as *Allescheriella crocea*. It is the anamorph of *Botryobasidium croceum* Lentz. Partridge cites a collection from pine plank on tidal banks in Delaware however, he suggests that it is mainly subtropical or tropical.

***Haplotrichum* cf *sphaerosporum*** (Linder) Hol.-Jech.: Cottony, cobwebby, golden brown (buff?) colony spreading widely over wood and fungi beneath conidia spherical, very slightly roughened, 11-13µm dia., pale yellow; denticles frequent and evident. Reference: Partridge, E. Christopher et al. 2002. Notes on Hyphomycetes. LXXXVI. Some additional *Haplotrichum* species with supplementary comments on, and a key to, the genus. Mycotaxon 82: 41-94. Partridge cites only one specimen from Mexico and therefore the current material could represent a new record for mainland US.

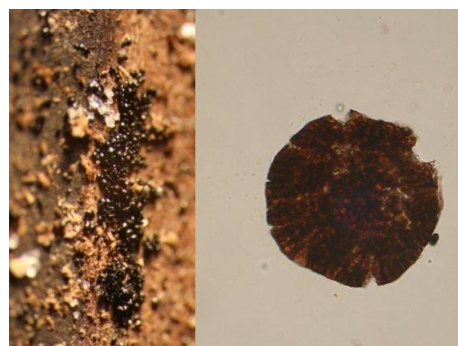
***Hysterobrevis smilacis*** (Schwein.) E.W.A. Boehm & C.L. Schoch: Hysterothecia erumpent, many times surrounded at the base by ruptured epidermis; asci 80-100x15-20µm, short stipitate, bitunicate; Ascospores asymmetric, hyaline to pale yellow dictyospores, with acuminate ends when young and more rounded when mature, and a gelatinous sheath, 19-21x8-10µm. Although found on numerous hosts it has not been reported from *Typha* sp.

***Jahnula* cf *rostrata*** Raja & Shearer: Ascomata mostly without a neck but one seen with a neck, erumpent to superficial, large >15µm dia. cells in peridium, wide hyphal strands from ascomata adhering to substrate; asci clavate to obclavate, 160-180x30-40µm; spores brown, 2-celled, roughened in a somewhat striate fashion, 28-36x13-14µm, no sheath or appendages observed. The spores are a bit small for *J. rostrata*(32-45x12-15µm) but otherwise a good match. See also FAC 129. There are a lot of *Phoma*-like conidiomata (branched phialides) in this collection, only a few *Jahnula* ascomata. Reference - Hyde, K.D. & S.W. Wong. 1999. Tropical Australian Freshwater Fungi XV. The Ascomycete genus *Jahnula*, with five new species and a new combination. Nova Hedwigia 68:489-509. Raja, H.A. & C.A. Shearer. 2006. *Jahnula* species from North and Central America, including three new species. *Jahnula granulosa* is described from South Africa. Mycologia 98: 319-332. The latter article describes *J. rostrata* from Florida.

***Lophiotrema* cf *grandispora***: Ascomata immersed to erumpent, neck is compressed and often appears distinctly slit-like; asci clavate, 105x20µm, short stipitate; abundant paraphyses; hyaline ascospores (possibly some brown spores on the substrate surface), 8(9)-septate, 4(5)th cell from the apex swollen, slightly constricted at the septa, often curved, broad sheath (3µ wide) evident even in dried material, 33-44x6.5-7.5µm, my notes on freshly collected specimens indicate that some spores were distinctly darkened and roughened on the surface but the contents remain hyaline (possibly the sheath dried on the spore surface and therefore the spores appeared roughened). On *Spartina bakeri*. Reference: Shoemaker and Babcock, *Phaeosphaeria* CJB 67: 1500-1599, 1989. Tanaka, Kazuaki & Yukio Harada. 2004. Pleosporales of Japan (4). The genus *Massariosphaeria*. Mycoscience 45: 96-105. As *M. grandispora*. Barr, M.E. 1992. Notes on the Lophiostomataceae (Pleosporales). Mycotaxon 45: 191-221. Barr describes two similar species *Lophiostoma hyalosporum* and *L. spireae* in N.Am but on different hosts.

***Melanospora* sp.:** Ascomata black, immersed with long black neck protruding from substrate, cruciate ostiole?; asci irregularly uniseriate, 8-spored; spores light brown, with 1 possibly 2 germ pores, 8-10x3-5µm. The Florida material does not appear to be *Melanospora lagenaria* which is commonly found on old polypores since *M. lagenaria* has spores 12-22x7-14µm (Cannon & Hawksworth, 1982). It may represent a new species. Reference: A re-evaluation of *Melanospora* Corda and similar Pyrenomycetes, with a revision of the British species. Bot J. of the Linnean Soc. 84: 115-160.

***Mycoenterolobium platysporum*** Goos var ***magnum*** Mena &: Conidia black and shiny (like coal dust as Goos described) superficial in scattered colonies. When mounted in water it is very difficult to see the cells. When cleared with NaHCl however, the radiating cells are evident. The conidia measure up to 225x190µm, much larger than



recorded by Goos (130x80µm) but all other characters match well. Mercado and Mena (1986) describe a variety *M. platysporum* var. *magnum* from Cuba which could be this specimen but I have not seen the description to be certain. Reference: Goos, R.D. 1970. A new genus of Hyphomycetes from Hawaii. Mycologia 42: 171-175. MERCADO-SIERRA, A. & MENA-PORTALES, J. 1986. Hifomicetes de Topes de Collantes, Cuba I. Especies holoblasticas. Acta Botanica Hungarica 32:189-205.

***Niesslia exosporioides*** (Desm.) Winter: Ascomata superficial on bleached spot (black margin) on decaying leaf frond, ascomata collabent on drying with short black spines (pointed apices); asci 40-50x6µm, irregularly biseriate, 8-spored, unitunicate; no paraphyses evident; spores hyaline, two-celled, fusiform, 10-12x2-3µm. A *Monocillium* anamorph is also present. Reference - Barr, M.E. 1993. Redisposition of some taxa described by J.B. Ellis. Mycotaxon 46: 45-76. Barr states that *Venturia sabalicola* Ell. & Ev. is a synonym of *N. exosporioides*.

***Ommatomyces pardalina*** (Ellis & Everhart) Wang, Wong & Hyde: Ascomata immersed, 2-celled curved spores, brown with a germ slit in each cell, septum straight seems to stop just a bit before the septum, 21-24x8-10µm, broad sheath appears to be present; asci uniseriate, unitunicate with broad apical apparatus, definitely blue in iodine (apical apparatus appears to be two layers); paraphyses abundant. The holotype material was collected in 1886 by A.B. Langlois at Point a la Hache, Louisiana on culms of *Spartina cynosuroides*. M.E. Barr (1989) examined type material and placed the species in *Amphisphaeria*. Wang et al (2004) re-examined the type material and redispersed the species to *Ommatomyces*, a predominantly marine genus. Descriptions of the species in both publications match the Florida specimen very well. No new collections of the species have been reported since Langlois's original collection from Louisiana and it is likely that the current material represents the first Florida record for the species. Reference: Barr, M.E. 1989. Some unitunicate taxa excluded from *Didymosphaeria*. Studies in Mycology 31: 22-28. Wang et al, 2004. Revision of the genus *Amphisphaeria*. Fungal Diversity Press, 168pp.

***Ophiodothella fici*** E.A. Bessey: On living leaves. Amphigenous jet black tar spot (most pronounced on undersurface), up to 1cm dia, often with dried white latex on surface, margin with orange-yellow halo; ascomata immersed in black stroma (most often on the undersurface), asci fusiform, over 100µm long, unitunicate (Phyllachoraceae), 8-spored; ascospores filiform (sometimes slightly curved toward the base, aseptate but with large oil globules, 60-72x4-6µm, wider and rounded at the apex, narrowed and more pointed at the base, brownish yellow in mature spores. The anamorph is commonly found on the upper surface. Anamorph: Conidiomata immersed in the stroma with curved filiform, hyaline, aseptate conidia, 14-20x1-2µm. Reference: Hanlin, R.T.; Goh, T.-k.; Skarshaug, A.J. A key to and descriptions of species assigned to *Ophiodothella*, based on the literature. Mycotaxon 44: 103-126. 1992. Plant Pathology Circular No. 170 Fla. Dept. Agr. & Consumer Services September 1976 Division of Plant Industry.

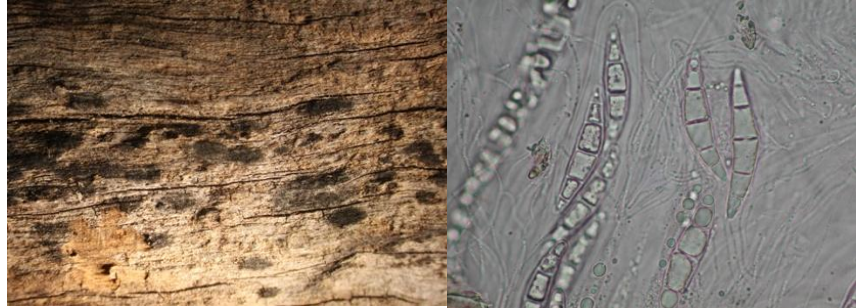
***Psilogonium cf simulans*** (W.R. Gerard) Boehm, Schoch & Spatafora: Ascomata on blackened area of substrate; spores 2-celled, rounded apex and pointed base, hyaline, 16-18x5-6µm. Check also *P. lineare* found in PEI. Reference - [Website of Dr. Eric W.A. Boehm](#)

***Quintaria lignatilis***

(Kohlm.) Kohlm. & Volkm.-Kohlm.: Ascomata deeply (completely)

immersed, only the ostiole showing, in blackened part of wood (?stroma); asci bitunicate, trabeculate

paraphyses seem to be in a gel; ascospores 5-septate, two mid cells wider and longer than other cells, hyaline but seems to turn light yellow at maturity, filled with oil globules, fusiform usually with acute apices, 48-63x12-17µm; a sheath was observed when fresh but not in dried material. *Kallichroma tethys* and *Barrmaelia* sp. also present.



***Rosellinia* cf *mammoidea*** (Cooke) Sacc.: Ascomata immersed in white/cream subiculum, superficial on the substrate, with a slight annulus (appears somewhat flattened) around a protruding ostiole; asci 8-spored uniseriate with discoid apical apparatus (I+); spores, brown, unicellular with no appendages, rounded ends, with a straight germ slit, often with 1-2 oil globules, 9-12x5-6µm, ellipsoidal. Reference - Petrini, Liliane.2003. *Rosellinia* and related genera in New Zealand. N.Z. Journal of Botany 41: 71-138.

***Rosellinia* sp.:** Ascomata embedded in thick, wiry, black subiculum (persistent at base in mature specimens); ascus apex thick; spores flattened on one side, brown, germ slit running the length of spore, no sheath or apical caps noticed, 19-23x7-9µm NO ANAMORPH SEEN (NB SIMILAR TO *R.HUGHESII* L. PETRINI BUT SHOULD HAVE A SYNNEMATOUS ANAMORPH ON SUBICULUM-DEMATOPHORA). Larviform structures, golden yellow-brown, 50-100x12-15µm, faintly septate were observed in the subiculum. Reference: Petrini, Liliane. 2003. *Rosellinia* and related genera in New Zealand. N.Z. Journal of Botany 41: 71-138.

***Trematophoma* sp:** Conidiomata erumpent to superficial, black and short rostrate (papillate); conidiophores hyaline, septate at the base and appear percurrent (annellidic), 20x6µm; conidia hyaline, aseptate, no evident sheath, 9-12x5-6µm, with irregularly shaped oil globule. Several collections of *Trematophoma* spp. have been made in PEI and appear somewhat similar to the Florida collection. Sutton (2004) lists only *T. lignicola* and the spores are too large for that species. This could represent a new species. Reference - Sutton, B.C. The Coelomycetes, CABI Publ., 2004.

***Trematosphaeria lineolatispora*** Hyde: Ascomata immersed and somewhat compressed; asci bitunicate; ascospores 28-32(38)x8-9µm, usually 5-septate, brown with end cells somewhat paler, appears striate particularly mid cells. This is very similar to *T. hydrophila* collected in PEI. SEE ALSO FAC-86, 124, 134. A *Phoma*-like fungus is present on the same piece of wood, conidia 2x1µ, hyaline; phialides long and seem to arise from several central columns (I have seen this fungus on numerous occasions on other woody marine



material (anamorph??). Ascomata immersed and somewhat dorsally flattened with ostiole erumpent, gregarious in gray black area on substrate; asci bitunicate, 8-spored; spores are striate (best seen in fresh material but evident in some spores of old material), (3)5(7) septate, brown with somewhat paler end cells and measure 33-44x7-8µm, often slightly curved with pointed apices. This species is quite similar to *T. hydrophila* (spores 30-37x6-9µm, 5-septate, pale end cells and lacking only the striations of the Florida specimens ) collected in PEI Canada.

Reference - Tanaka, K., Y. Harada and M.E. Barr. 2005. *Trematosphaeria*: taxonomic concepts, new species from Japan and key to species. *Fungal Diversity* 19: 145-156.

***Tubeufia* cf *pezizula*** (Berk. & Curt.) Barr: Ascomata collabent in black hyphal mass, most overmature; spores hyaline, 5-7 septate, 33-42x7-9µm; only one helicosporous conidium seen (*Helicoma* anamorph?). Reference - Barr M.E. 1980. On the family Tubeufiaceae (Pleosporales). *Mycotaxon* XII: 137-167.

***Xenolophium* cf *pachythele/samuelsii***: Ascomata erumpent to superficial, ostiole a prominent slit (no neck); asci 140-150x10-12µm with long stipe; spores brown to dark brown, 22-26x5-6µm, 3-septate with end cells longer than mid cells, constricted and often separating at the mid septum, darker bands at the secondary septa compared to mid septum, no sheath observed. Reference: Huhndorf, Sabine. 1993. Neotropical Ascomycetes 3: Reinstatement of the Genus *Xenolophium* and two new species from French Guiana. *Mycologia* 85:490-502. This could represent a new species since the characters are not quite right for either *X. pachythele* or *samuelsii*.



***Xylaria arbuscula*** Sacc.: Ascomata immersed in conical head, Stroma unbranched, stromatal head (1-1.5cm tall) appears somewhat striate and has a sterile acute apex; stipe 1-1.5cm, pubescent (black hairs); total length 2-3 cm; spores flattened on one side, germ slit often terminates before the end of spore (3/4 length of spore), 13-15x5-7µm. Reference - San Martín G., F.; Rogers, J.D. 1989. A preliminary account of *Xylaria* of Mexico. *Mycotaxon* 34: 283-373. According to this article *Xylaria arbuscula* is a species complex with many variable characters including branched and unbranched stroma.



***Xylocladium* sp.:** Conidiophores arising from a dense black tomentose subiculum, conidiophores single, up to 360x10µm, brown, septate and roughened from middle to the apex; apex is vesicle-like, elliptic (40x24µm); conidia seem to develop from short bottle-shaped "phialides" (6-8x2-



3µm) attached directly to the vesicle (no metulae), "phialides" abruptly tapered at the apex; conidia seem to develop singly and appear as gray to white balls under dissecting scope, they appear dry but appeared to be in a gelatinous ball when fresh, conidia 8-12x2-3µm, hyaline, aseptate with a scar at the base and rounded at the apex. THIS IS PROBABLY A SPECIES OF XYLOCLADIUM THE ANAMORPH OF CAMILLEA PUNCTULATA OR C. TINCTOR. BOTH HAVE BEEN REPORTED FROM SOUTHEASTERN N.AM. Reference Laessle et al, 1989. *Camillea*, *Jongiella* and light-spored species of *Hypoxylon*. Mycological Research 93: 121-155.

***Xylomelasma sordida*** Reblova: Ascomata immersed with long neck protruding up to 1000µm above substrate, cruciate ostiole, black; asci cylindrical, short stipitate, 60-70x8-10µm, with distinct apical apparatus; paraphyses longer than asci and septate; spores light brown, ellipsoidal, 10-13x5-6µm, usually uniseriate in the ascus, germinating spores observed in squash mount, seem to germinate at the apex through a germ pore, probably an apical pore at each end (as mentioned by Reblova) It has been found in several countries in Europe (France, Czech, Denmark, Hungary) and in Argentina. Although not reported from the US, there is the possibility that it is buried in herbaria under the genus *Endoxyla* (Reblova refers to some confusion historically in this regard). This could represent a new record for the US. Reference: Reblova, M. 2006. Molecular systematics of *Ceratostemella* sensu lato and morphologically similar fungi.

**A NOTE ON PLANT PATHOLOGY:** Potential Plant Pathogens - There is always a concern about exotics (plant invaders, non-indigenous species) becoming a problem in the refuge. As a result I felt it important to indicate that to the best of my knowledge none of the possible new records are considered serious plant pathogens and do not threaten the endemic vascular plants in the Refuge. Indeed the fungi probably represent examples of stable populations that have been established for years but remained undiscovered until someone went looking for them.

**GALLS ON RED MANGROVE:** There is a gall on the trunks and prop roots of red mangrove. It is particularly prevalent along the Indigo Trail and I have been asked once or twice as to what might cause the disfiguration. While I did not attempt any isolation or identification of fungi on the galls, I did find a reference (Barnard & Freeman, 1982) describing symptoms similar to those seen at Ding. They identified the fungus *Cylindrocarpon didymium* (Hartig) Wollenw. as the causal agent but suggested that mortality resulting from infections is considered minimal with the primary impact being predisposition of diseased trees to wind breakage. It should be noted, however, that symptoms such as these could be caused by a variety of organisms other than fungi.

**CYTOSPORA RHIZOPHORAE** Kohlm. & Kohlm.: This species is commonly found in red mangrove populations throughout the tropics and subtropics including the Caribbean and Florida. The collections from Ding Darling Refuge most certainly represent a resident population that is probably in equilibrium with the red mangroves. It should be noted, however, that the fungus can cause stem dieback and canker symptoms in red mangroves as shown by work done in Puerto Rico (Weir, Tattar and Klekowski, 2000).

**SOOTY MOULD ON HONEYDEW OF CROTON SCALE:** A black sooty mould fungus was reported in 2009 growing on the honeydew exudates of a scale insect previously unrecorded from Sanibel. I did not find it in the Refuge but it will no doubt find its way there. The scale

feeds on a variety of hosts including *Croton* spp, *Ficus* spp and numerous others. Sooty mould fungi are generally not considered pathogens as they do not invade plant tissue but grow superficially on insect exudates on plant parts. It would be useful to clearly identify the sooty mould as it might also prove to be a new record for Florida. For more information on the insect see the Florida Department of Agriculture and Consumer Services [Pest Alert](#)

#### Discussion:

Since this is very much a preliminary survey it is unwise to draw too many conclusions but that doesn't stop one from speculating. The Refuge is an area where marine, freshwater and terrestrial habitats are in close contact. One might expect facultative halophiles such as *Nais inornata* etc. as well an intermingling of terrestrial and aquatic species. Birds migrate here in great numbers and one might also expect them to bring in fungi from various temperate (northern areas) and perhaps more tropical habitats (southern areas). Ding is in a subtropical area and harbours both temperate (*Barrmaelia* spp) and truly tropical species (*Pseudopetrakia*, *Xenosporium*, *Endocalyx*).

Future studies could include a detailed investigation of one habitat (eg marine or terrestrial or coprophilous) as well as sampling at different times of the year. Several species of mangrove plants occur in quite close proximity (eg red, white and black, as well as the putative mangrove now included as buttonwood) yet are often restricted to their own specific habitat. Perhaps there is a difference in the fungi that occur on each host. The potential for mycological investigation is endless when dealing with an area never before sampled.

Ding Darling is impacted by forces both man-made and natural. As in many Florida localities Ding Darling Wildlife Refuge is subject to devastating hurricanes causing significant destruction. Hurricane Charley made landfall as a Category 3 directly over the Ft Myers area in 2004 causing significant damage. The effects of such natural forces radically change habitats. The Ding Darling Wildlife Refuge is also impacted by man-made intrusion. Over the past 40 years, the population on Sanibel Island has increased from less than 100 to over 6000 and probably significantly more if one considers seasonal residents. These two forces cannot but change the area from year to year. To properly assess the need for environmental management it is vital to have a clear understanding of what is present before considering what must be regulated. The current study provides important baseline data to help in that process.

The year 2010 has been declared the International Year for Biodiversity and it seems timely to present this report on the biodiversity of fungi in the Ding Darling Wildlife Refuge at this time.

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### **Habitats of Ding Darling and Fungi Collected (fungal name – host/substrate)**

BAILEY TRACT (brackish to freshwater): *Acanthostigma* sp. – on well rotted fallen log of *Coccoloba uvifera*; Anamorph of *Phyllachora* sp.- *Spartina bakeri*; *Biscogniauxia* sp (cf *mediterranea*) (de Not.) Kuntze – *Conocarpus erectus*; *Chaetomium* cf *caprinum* Bainier - Marsh rabbit dung; *Daldinia* cf *eschscholzii* (Ehrenb.:Fr.) Rehm – unknown decorticated wood; *Diatrypella* cf *opaca/herbacea* – dead stems of Asteraceae; *Haplotrichum* cf *sphaerosporum* (Linder) Hol.-Jech. - on well rotted wood of *Coccoloba uvifera*; *Hysterobrevium smilacis* (Schwein.) E.W.A. Boehm & C.L. Schoch - on senescent leaves of *Typha* sp.; *Jahnula* cf *rostrata* Raja & Shearer – on submerged wood; *Lecanidion atratum* - on fallen wood of Asteraceae; *Leptosphaeria oraemaris* Linder in Barghorn et Linder – on submerged wood in brackish



water; *Lophiosotoma* cf *semiliberum/macrostomum* - on recently dead stems of *Eupatorium* sp.; *Lophiostoma* cf *mangrovei* Kohlm. & Vittal - on fallen branch of *Laguncularia racemosa*; *Lophiotrema* cf *grandispora* (Sacc.) Shoemaker & Babcock - on dead stems of *Typha* sp. and *Spartina bakeri*; *Mycoenterolobium platysporum* Goos - lining insect tunnels on well rotted wood of *Coccoloba uvifera*; *Nais inornata* Kohlmeyer - on submerged wood; *Ommatomyces pardalina* (Ellis & Everhart) Wang, Wong & Hyde - on dead stems of *Spartina bakeri*; *Pestalotia* cf *versicolor* Speg. - on senescent leaves of *Typha* sp.; *Phomatospora* sp. - on senescent fallen leaves of *Typha* sp.; *Podospora anserina* (Ces. In Rabenh.) Niessl - Marsh rabbit dung; *Tetraploa aristata* Berk. & Br. - on dead leaves of *Typha* sp.; *Tracylla spartinae* (Peck) Tassi - on dead leaves of *Spartina bakeri*; *Trematophoma lignicola* Petrak - on submerged wood; *Trematosphaeria lineolatispora* Hyde - on submerged wood of Sabal palmetto and unknown mangrove (freshwater or possibly slightly brakish); *Verruculina enalia* (Kohlm.) Kohlm. & Volk.-Kohlm. - on fallen branch under red mangroves and submerged wood.

#### INDIGO TRAIL AND REFUGE CENTRE (SEE HABITAT PHOTOS BELOW):

*Anthostomella* cf *limitata* Sacc. - on dead rachis of Sabal palmetto; *Anthostomella palmicola* (Aw.) Rabenhorst - - on dead rachis of Sabal palmetto; *Byssosphaeria schiedermayeriana*

(Fuckel) Barr - on decorticated wood of unknown host; *Daldinia cf concentrica/eschschoitzii* - on decorticated wood of unknown host; *Ciliochorella mangiferae* Sydow - on fallen senescent leaves of *Coccoloba uvifera*; *Endocalyx melanoxanthus* (Berk. & Br.) Petch - on dead rachis of Sabal palmetto (behind maintenance shed); *Gloniopsis praelonga* (Schwein.) Underw. & Earle - on dead rachis of Sabal palmetto; *Gyrothrix circinata* (Berkeley & Curtis) Hughes - on dead fallen leaves of *Coccoloba uvifera*; *Hysterostomella sparsa* (Peck & Clinton) Barr - on dead rachis of Sabal palmetto; *Lophiostoma cf mangrovei* Kohlm. & Vittal - on fallen branch of *Laguncularia racemosa*; *Niesslia exosporioides* (Desm.) Winter - on fallen leaves Sabal palmetto; *Melanospora* sp. – on upper surface of unknown polypore; *Nitschkia acanthostroma* - on bark of live tree (possibly *Rapanea* sp. or *Rhizophora mangle*); *Ophiodothella fici* E.A. Bessey - on living leaves of *Ficus aurea*; *Phaeoisaria cf clematidis* (Fuckel) Hughes - on bark and decorticated wood of fallen log of *Bursera simaruba*; *Pseudopetrakia kambakkamensis* - on bark and decorticated wood of fallen log of *Coccoloba uvifera*; *Ravenelia floridana* Cummins & J.W. Baxter - on living leaves of *Pithecellobium unguis-cati*; *Rhytidhysterion rufulum* (Sprengl.) Speg. - on recently fallen branches of *Pithecellobium unguis-cati*; *Rosellinia mammoidea* (Cooke) Sacc. - on fallen wood of *Coccoloba uvifera*; *Sphaerellopsis filum* (Biv.-Bern. Ex Fr.) Sutton – on rusts on *Pithecellobium unguis-cati* and *Coccoloba uvifera*; *Trematosphaeria lineolatispora* Hyde – on well rotted wood on mudflats of pond behind Refuge Centre; *Tubeufia cf pezizula* (Berk. & Curt.) Barr - on bark and decorticated wood of fallen log of *Coccoloba uvifera* and Sabal palmetto; *Xenolophium cf pachythele/samuelsii* - on well rotted wood (*Coccoloba* sp or Sabal sp.); *Xenosporium berkeleyi* (M.A. Curtis) Pirozynski - on rachis of Sabal palmetto; *Xylaria cf arbuscula* Sacc. – on well rotted wood of palm, *Conocarpus erectus* and *Ficus* sp.

HABITAT PHOTOS OF INDIGO TRAIL AND REFUGE CENTRE AREA





WILDLIFE DRIVE, CROSS DIKE, WULFERT KEY AND SHELL MOUND TRAIL (SEE HABITAT PHOTOS BELOW): *Barrmaelia oxycantha* (Mont.) F.Rappaz - on dead wood (unknown host but possibly a mangrove species); *Biscogniauxia capnodes* (Berk.) Y-M. Ju & J.D. Rogers - on fallen branch, erumpent through bark, unknown host; *Ciliochorella mangiferae* Sydow - on living leaves (starting to senesce), possibly *Rapanea* or *Rhizophora* mangle; *Coniochaeta* cf. *subcorticalis* (Fuckel) Cooke - on decorticated wood of *Rhizophora* mangle; *Eutypella* cf. *scoparia* (Schwein. :Fr.) - on fallen log of *Bursera simaruba*; *Halorosellinia oceanica* (S. Schatz) Whalley, E.B.G. Jones, K.D. Hyde & Laessøe - on fallen wood underneath *Rhizophora* mangle by shore; cf *Hypoxylon stygium* (Lev.) Sacc. - on bark of *Coccoloba uvifera*; *Lophiostoma* cf. *mangrovei* Kohlm. & Vittal - on fallen branch of *Rhizophora* mangle; *Pestalotia* cf. *versicolor* Speg. - on *Coccoloba uvifera*, senescent (dead, brown) leaves on ground; *Quintaria* cf. *lignatilis* (Kohlm.) Kohlm. & Volkm.-Kohlm. - on decorticated wood of *Rhizophora* mangle; *Rhytidhysterium rufulum* (Sprengl.) Speg. - on fallen wood of *Rhizophora* mangle; *Xylomelasma sordida* Reblova - on fallen branch of *Coccoloba uvifera*.

HABITAT PHOTOS OF WILDLIFE DRIVE, CROSS DIKE, WULFERT KEY AND SHELL MOUND TRAIL









TARPON BAY: cf *Barrmaelia* sp. - on fallen log, unknown host; *Cytospora rhizophorae* Kohlm. & Kohlm. - on elongate "seed pod-like" propagules of *Rhizophora* mangle on shore; *Halocyphina villosa* Kohlm. & Kohlm. - on fallen branches under *Rhizophora* mangle, on corticated wood (erumpent through bark) and also on decorticated portions; *Haploctrichum croceum* (Mont.) Partridge & Morgan-Jones - on surface of well rotted wood of *Rhizophora* mangle; *Hydronectria*



*(Kallichroma) tethys* - on submerged wood of Rhizophora mangle in saline water; *Lineolata rhizophorae* (Kohlm.) Kohlm. & Volkm.-Kohlm. - on fallen branch of Rhizophora mangle very near water; *Psilogonium* cf *simulans* (W.R. Gerard) Boehm, Schoch & Spatafora - on wood of Laguncularia racemosa on sand very near water; *Quintaria* cf *lignatilis* (Kohlm.) Kohlm. & Volkm.-Kohlm. - on decorticated wood of Rhizophora mangle; *Rosellinia mammoidea* (Cooke) Sacc. - on fallen wood underneath Rhizophora mangle by shore; *Verruculina enalia* (Kohlm.) Kohlm. & Volkm.-Kohlm. - on submerged wood (freshwater or possibly slightly brackish).