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A Preliminary Checklist of Marine Fungi from Zapata Swamp Biosphere Reserve, South of Cuba

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Abstract: A total of 73 higher marine fungi (47ascomycetes, 3 basidiomycetes and 23 mitosporic fungi) were documented from sandy beaches and mangrove forests in Zapata Swamp Biosphere Reserve, South of Cuba. Of these, 40 species were identified as new records for Cuba in the current survey. This present work presents a preliminary checklist of higher marine fungi in Zapata coast, Cuba.

Key words: Marine fungi · Biodiversity · Mangrove forests · Cuban archipelago · Zapata Swamp

INTRODUCTION

The diversity of fungi from Cuba remains unknown in large part. In this country there are probably 70 000 species of fungi, but only approximately 3 914 have been recorded [1, 2]. With reference to higher marine fungi, worldwide, over 549 species have been described [3]. In comparison, the diversity of Cuban higher marine fungi is little known, with only 44 species recorded, all of this from sandy beaches [1, 2, 4, 5].

Zapata Swamp is the largest Cuban wetland and one of the most important in the Insular Caribbean, which is located south of Matanzas province, Western Cuban District. It is identified as an important site for worldwide conservation (Biosphere Reserve by UNESCO in 1998 and RAMSAR site by the Convention on Wetlands in 2001). Its basin has one of the largest and most complex karst drainage systems of the country and its coastline has many beaches and mangroves located in estuaries and bordering brackish lagoons [6].

However, the biodiversity of marine fungi in its coastal ecosystems has been little studied. Enríquez *et al*. [5] initiated the study of marine fungi from Zapata Swamp, reporting the occurrence of 15 species from 4 sandy beaches. These reports demonstrated the need to carry out similar studies in other ecosystems, like mangrove forests, thus encouraging the development of the present study.

Consequently the objective of this study was to document the biodiversity of marine fungi in mangroves and sandy beaches of Zapata Swamp Biosphere Reserve, South of Cuba. This paper presents a preliminary checklist based on the present study and published literature.

MATERIALS AND METHODS

Decaying intertidal wood, drift wood, sand buried wood, mangrove wood, foam samples and other debris was collected during low tides from three mangrove forests and seven sandy beaches locations along the coast of Zapata Swamp, from July 2010 to December 2011. The surveyed sites include beaches (Los Pinos, Reserva, Caleton, Máquina, Playa Larga, Punta Perdiz and Rio) and mangroves (Rio, Buenaventura and Salinas). Vegetation is predominantly composed of *Rizophora mangle* at each sampling site in mangroves. Covered with moist sand from the surveyed sites, samples were incubated in sterile polythene bags at room temperature (18-32°C), for 2-8 months. Fungi were examined on natural substrates and then made into permanent slides, according to the double cover glass method [7].

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Table 1: List of Marine fungi from Zapata Swamp Biosphere Reserve

Isolated fungi	Surveyed site	Substrate	Reference
Ascomycetes			
**Acrocordiopsis patilii* Borse *et* Hyde	MF	MW	PS
**Aniptodera intermedia* Hyde *et* Alias	MF	MW	PS
**Aniptodera chesapeakensis* Shearer *et* Mill.	MF	MW	PS
**Aniptodera haispora* Vrijmoed, Hyde *et* Jones	MF	MW	PS
**Aniptodera longispora* Hyde	MF	MW	PS
**Aniptodera nypae* Hyde	MF	MW	PS
**Aniptodera salsuginosa Nakagiri et Ito*	MF	MW	PS
Antennospora quadricornuta (Cribb *et* Cribb) Johnson	MF, BCH	MW,DW,IW	PS, 5
Arenariomyces majusculus Kohlm. *et* Volkm.-Kohlm.	MF	MW	PS
Arenariomyces parvulus Koch	MF, BCH	MW, IW, S	PS, 5
Arenariomyces trifurcatus Höhnk	MF, BCH	MW,IW, S	PS, 5
Arenarriomyces triseptatus Kohlm.	BCH	IW, S	PS
**Bicrouania maritima* (Crouan *et* Crouan) Kohlm. *et* Volkm.-Kohlm.	MF	MW	PS
**Caryosporella rhizophorae* Kohlm.	MF	MW	PS
Corollospora armoricana Kohlm.*et* Volkm.-Kohlm.	BCH	?	5
**Corollospora besarispora* Sundari	MF	SBW, S	PS
Corollospora cinnamomea Jørg. Koch,	BCH	IW, S	PS
Corollospora colossa Nakagiri	MF	SBW, S	PS
Corollospora gracilis Nakagiri *et* Tokura,	MF, BCH	MW, S	PS, 5
Corollospora intermedia Schmidt	BCH	?	5
Corollospora maritima Werderm.	MF, BCH	MW, S	PS, 5
Corollospora pseudopulchella Nakagiri *et* Tokura	MF,BCH	MW, S	PS
Corollospora pulchella Kohlm. Schmidt *et* Nair	MF,BCH	MW, S	PS
**Dactylospora haliotrepha* (Kohlm. *et* Kohlm.) Hafellner	MF	MW	PS
Dryosphaera tropicalis Kohlm. *et* Volkm-Kohlm.	BCH	IW, S	PS
**Etheirophora blepharospora* (Kohlm. *et* Kohlm.)Kohlm. *et* Volkm -Kohlm.	MF	MW	PS
Haiyanga salina Pang *et* Jones	MF,BCH	MW,DW	PS, 5
**Halokirschsteinionthelia maritima* (Linder) Boonmee *et* Hyde	MF	MW	PS
**Halonectria milfordensis* Jones	MF	MW	PS
**Iwilsoniella rotunda* Jones	MF	MW, DW	PS
**Leptosphaeria australiensis* (Cribb *et* Cribb) Hughes	MF	MW	PS
Lignincola laevis Höhnk	MF	MW	PS
Lignincola tropica Kohlm.	MF	MW	PS
Lindra thalassiae Orpurt, Meyers, Boral *et* Simms	MF, BCH	*T. testudinum*	PS, 5
Lulworthia grandispora Meyers	MF,BCH	MW, IW	PS, 5
**Mycosphaerella pneumatophorae* Kohlm.	MF	MW	PS
**Nais inortata* Kohlm.	MF	MW, DW	PS
Neptunella longirostris (Cribb *et* Cribb) Pang *et* Jones	MF	MW	PS
**Ocostaspora apilongissima* Jones, Johnson *et* Moss	MF	MW	PS
**Payosphaeria minuta* Leong	MF	MW	PS
**Rimora mangrovei* (Kohlm. *et* Vittal) Kohlm., Volkm.-Kohlm.,Suetrong, Sakayaroj *et* Jones	MF	MW	PS
Savoryella lignicola Jones *et* Eaton	MF	MW	PS
**Savoryella paucispora* (Cribb *et* Cribb) Jørg. Koch.	MF	MW	PS
**Thalassogena sphaerica* Kohlm. *et* Volkm.-Kohlm.	MF	MW	PS
Torpedospora radiata Meyers	BCH	IW	PS, 5
**Trematosphaeria mangrovei* Kohlm.	MF	MW	PS
**Verruculina enalia* (Kohlm.) Kohlm. *et* Volkm.- Kohlm.	MF	MW	PS
Basidiomycetes			
**Calathella mangrovei* Jones *et* Agerer	MF	MW	PS
**Halocyphina villosa* Kohlm. *et* Kohlm.	MF	MW	PS
**Physalacria maipoensis* Inderb. *et* Desjardin	MF	MW	PS
Mitosporic fungi			
**Asteromyces cruciatus* Moreau *et* Moreau ex. Hennebert	MF	MW	PS
**Botryophialophora marina* Linder	MF	MW	PS
**Cirrenalia macrocephala* (Kohlm.) Meyers *et* Moore	MF	MW	PS

Table 1: Continued

Isolated fungi	Surveyed site	Substrate	Reference
Cumulospora marina Schmidt	MF	MW	PS
Halenospora varia(Anastasiou) Jones	MF	MW	PS
**Helicorhoidion nypicola* Hyde *et* Goh	MF	MW	PS
**Hydea pygmea* (Kohlm.) Pang *et* Jones	MF	MW	PS
Matsusporium tropicale (Kohlm.) Jones *et* Pang	MF	MW	PS
Moheitospora adarca (Kohlm., Volkm.-Kohlm. *et* Erikss.)Abdel-Wahab, Abdel-Aziz *et* Nagahama	MF	MW	PS
**Nypaella frondicola* Hyde *et* Sutton	MF	MW	PS
**Periconia prolifica* Anastasiou	MF	MW	PS
**Phialophorophoma litoralis* Linder	MF	MW	PS
**Phoma sp.* Kohlm., Volkm.-Kohlm. *et* Erikss.	MF	MW	PS
**Pleurophomopsis nypae* Hyde *et* Sutton	MF	MW	PS
Trichocladium achrasporum (Meyers *et* Moore) Dixon	MF, BCH	MW	PS, 5
Trichocladium alopallonellum (Meyers *et* Moore) Kohlm.*et* Volkm.-Kohlm.	MF	MW, IW	PS
Trichocladium constrictum Schmidt	MF, BCH	MW, DW	PS, 5
**Trichocladium lignicola* Schmidt	MF	MW	PS
Trichocladium medullare Kohlm. *et* Volkm.-Kohlm.	MF	MW, IW	PS
Trichocladium nypae Hyde *et* Goh	MF, BCH	MW	PS, 5
Varicosporina ramulosa Meyers *et* Kohlm.	BCH		5
**Xylomyces rhyzophorae* Kohlm. *et* Volkm.-Kohlm.	MF	MW	PS
Zalerion maritimum (Linder) Anastasiou	MF	MW	PS

*New records for Cuba

MF= Mangrove Forest; BCH= Beach; MW=Mangrove Wood; IW= Intertidal Wood; DW= Drift Wood; SBW= Sand Buried Wood; S = Sand; ?= Not mentioned; PS = Present Survey; [5] Enriquez *et al*., 2009.

Identification of marine fungi were done using taxonomic keys by Kohlmeyer and Volkmann Kohlmeyer [8], Hyde and Sarma [9], Jones *et al* [10] and considering the taxonomic changes listed by Jones [3]. Specimens are deposited as slides and/or dried material in the fungal collection at the Collection of Marine Microorganisms of the Institute of Oceanology, in Havana, Cuba.

RESULTS AND DISCUSSION

Presented data in Table 1 shows the total of species documented from the present study and published literature, which are listed alphabetically according to their major groups, with information on collecting sites, substrates and reference.

A total of 70 higher marine fungi were recorded from three mangrove forests and seven sandy beaches in the present study. This includes 45 ascomycetes, 3 basidiomycetes and 22 mitosporic fungi and of these, there are 40 species identified as 25 ascomycetes, 3 basidiomycetes and 12 mitosporic fungi as a new records for Cuba. This brings the total number of known higher marine fungi for Cuba to 84. The species obtained in the present survey were added to the records from the literature for Zapata Swamp, resulting in a total of 73 taxa as 47ascomycetes, 3 basidiomycetes and 23 mitosporic fungi (Table 1). Of the 70 species registered in this study, only 12 species were previously reported by Enriquez *et al*. [5] for Zapata swamp.

In the Cuban archipelago marine fungi have been poorly investigated, in comparison with other tropical countries such as India [11-17], Malaysia [18-23], Seychelles [24, 25] and Brunei [26-31]. However, it appears that the biodiversity of marine fungi in Zapata Swamp is high, based on the number of collections made and the number of species obtained in this work.

It is observed that the majority of marine fungi found during the current study belonged to Ascomycota (64%). The reports of several previous papers [1, 2, 5, 11-18] support this observation. Five species registered in the present investigation were established recently as new genera based on molecular data. They included the ascomycetes *Halokirschsteinionthelia maritima* [≡*Kirschsteinionthelia maritima*]; *Rimora mangrovei* [≡*Astrosphaeriella mangrovei*]; the mitosporic fungi *Hydea pygmea* [≡*Cirrenlaia pygmea*], *Matsusporium tropicale* [≡*Cirrenalia tropicalis*] and *Moheitospora adarca* [≡*Cirrenalia adarca*]. These taxonomic changes were also listed by Jones [3].

In general, the biodiversity of marine fungi in the Cuban archipelago is unknown for the most part. This study in Zapata Swamp mangroves marks the beginning of research on mangrove marine fungi in Cuba. Therefore, it is necessary to continue the investigations of these unique fungi, to contribute the knowledge and conservation of Cuban marine fungal diversity, as well as to constitute the basis for exploring other areas like their

physiology, biochemistry and ability to produce bioactive compounds and enzymes and their use for commercial application as well.

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