

## Records of Coprophilous Fungi from the Lesser Antilles and Puerto Rico

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**ABSTRACT.**—Records of 54 species of coprophilous fungi obtained by incubating, in damp chambers, 21 samples of dung from mammalian herbivores from Puerto Rico, St John (USVI), Guadeloupe (France), Dominica and St Lucia are presented. Many are apparently new records for the region, and the distribution and occurrence of unusual or interesting species is discussed.

**KEYWORDS.**—diversity, herbivore dung, ascomycete, basidiomycete, 'pyrenomycete', zygomycete.

### INTRODUCTION

The coprophilous mycota is a diverse community of morphologically and physiologically specialised fungi, important in the decomposition and recycling of animal feces, especially those of herbivorous mammals. Passage of the spores through the gut of an animal is often necessary to facilitate spore germination of coprophilous fungi. They are adapted to the coprophilous habitat by having asci that forcibly discharge their spores at around midday towards the sun, to increase the chances of being widely dispersed into the airstream. Ascospores often have gelatinous appendages, or a complete or partial sheath, that enables them to stick to vegetation to increase the chances of being consumed by grazing animals, and the exospores are often pigmented, to provide protection against UV exposure.

As part of an ongoing study of the occurrence and distribution of coprophilous fungi (see, e.g., Richardson 2001a), samples of herbivore mammalian dung collected from Puerto Rico and some Lesser Antillean islands were incubated in moist chambers and the coprophilous fungi that developed were identified. Apart from bats, none of these islands have any extant native terrestrial mammals, so the substrata available for exploitation by coprophilous fungi are limited to the dung of introduced,

and mainly domesticated, animals, especially sheep, goats, cattle and horses. Although Caribbean fungi are now well documented, especially through the work of Minter et al. (2001, 2002), Jodhan and Minter (2006) and Cantrell et al. (2006), searches of these and related datasets return very few records of coprophilous fungi from the area, and virtually none for areas other than the Dominican Republic, Puerto Rico and Trinidad and Tobago. Stevenson (1975) lists occasional records of some species for Puerto Rico, but without localities or other details, and most are from the earlier works of Seaver (1924, 1925), Seaver & Chardón (1926) and Seaver et al. (1932). Ferdinandsen and Winge (in Raunkiaer 1908) recorded two species from St Thomas (USVI). Since very few of the fungi recorded from the samples that form the basis of this study are recorded in those lists, the occurrence of some of the more interesting or unusual coprophils in the Caribbean area is discussed in the context of what is known about their distribution world-wide, from existing monographic sources, especially Brummelen (1967), Mirza & Cain (1969), Ahmed & Cain (1972), Lundqvist (1972), and in the Caribbean from Minter et al. (2001, 2002) and Cantrell et al. (2006), and from records the author has made from over 1000 samples collected from various parts of the world.

## METHODS

Dung samples were collected from the field into clean paper envelopes from various localities, and on various occasions. Samples were rehydrated and incubated, on return to the UK, on moist paper towelling in plastic boxes with lightly fitting transparent lids, under ambient light and room temperature (ca 15-18°C). Care was taken to ensure that cultures were not too wet. Samples were generally of similar size, with incubation chambers 10 × 7 cm, which would accommodate approx. 2-4 g D.W. (= 15 goat/sheep pellets), or 13 × 8 cm for the horse/cattle samples (approx. 10-20 g D.W.). Samples were examined frequently at intervals of a few days, with a ×7-45 magnification stereomicroscope. Fruiting bodies were removed and mounted in water for examination and identification at higher magnification. Samples were incubated for up to 15 wk, with observations continuing while new fungi were being observed. Localities (latitude and longitude, WGS 84 datum) were determined with a GPS satellite navigator.

To estimate the diversity and species richness of the Antillean coprophilous mycota a species abundance curve was plotted. The equation for the log relationship between sample number and cumulative number of species allows an estimation of the number of species that might be expected to occur on a standardised number of samples, for comparison with other values.

## RESULTS AND DISCUSSION

Twenty-one dung samples were collected, from Puerto Rico, US Virgin Islands (St John), Guadeloupe, Dominica, and St Lucia (Table 1). On incubation they yielded a total of 199 records of 54 species. The composition of the mycota was very similar to those found elsewhere. The average number of characteristically coprophilous species recorded from a sample was nine, with a range from 3-15. The average is slightly lower than the 10-12 for analogous dung types (e.g. excluding samples from lagomorphs and herbivorous birds) re-

ported from much larger collections worldwide (Richardson 2001a).

Twelve species comprised about 60% of the records. Of these, five were apothecial ascomycetes: *Ascobolus immersus*, *Saccobolus citrinus*, *S. minimus*, *S. truncatus* and *Iodophanus carneus*; four were perithecial ascomycetes:—*Podospora communis*, *P. immersa*, *P. longicaudata* and *Phomatospora minutissima*; one was the pseudothecial ascomycete *Sporormiella minima*; *Coprinus cordisporus* and *C. stercoreus* were the two most frequent basidiomycetes and *Pilobolus crystallinus* the most frequent zygomycete.

Although the number of species per sample was only a little less than usually found when such samples are incubated, the number of different species to be expected from a collection of 50 samples was, at approx. 85, much lower than would be expected from tropical regions, based on the results of other studies, which have shown that there is a latitudinal gradient of species richness, which increases with decreasing latitude (Richardson 2001a (based on 425 samples); Richardson 2006 (based on an additional 603 samples)). It may be that the combination of small island habitats that, in much of the Caribbean, have never been connected to a continental landmass, and a restricted terrestrial mammalian fauna, contribute to a low potential diversity of coprophilous fungi.

## RECORDS

Details of individual records and comments on species of particular interest are given below. A few could not be identified to species, but details are provided for completeness. The records (e.g. 4/97) refer to sample 4 from 1997; the origin of that sample can be found in Table 1. Voucher material of sample numbers suffixed by **E** has been deposited in the herbarium of the Royal Botanic Garden, Edinburgh, **L** in the National Herbarium Nederland, and **K(M)**, British Museum (Mycology). Species names in bold type are apparently new records for the Caribbean region. Many others are new records for a particular state. There appear to be no previously published

TABLE 1. Collection details of dung samples collected from Puerto Rico and some Lesser Antillean islands.

Sample no.*	Locality	Longitude (°W)	Latitude (°N)	Date	Dung
<b>Puerto Rico</b>					
4/97	km 11, route PR186, Caribbean National Forest, Canovanas	65.85	18.28	13.3.97	cattle
3/98	El Verde Field Station, km 19.5, route PR186, Caribbean National Forest, Rio Grande	65.82	18.32	19.2.98	rat
4/98	Guyanabo	66.12	18.32	28.2.98	sheep
5/98	Guyanabo	66.12	18.32	28.2.98	horse
1/01	El Verde Stream House, route PR186, Caribbean National Forest, Rio Grande	65.82	18.34	14.2.01	cattle
<b>St John (U.S. Virgin Islands)</b>					
1/98	Lameshure	64.72	18.32	13.2.98	white-tailed deer
2/98	Cinnamon Bay	64.75	18.35	15.2.98	donkey
<b>Guadeloupe (France)</b>					
1/07	Fond Heliot, Deshaies, Basse Terre	61.80	16.28	8.2.07	goat
2/07	Fond Heliot, Deshaies, Basse Terre	61.80	16.28	8.2.07	donkey
3/07	Roches Caraibes, Bailiff, Basse Terre	61.74	16.03	8.2.07	cattle?
4/07	Plage Bois Jolan, St Anne, Grande Terre	61.35	16.23	11.2.07	goat
5/07	Plage Bois Jolan, St Anne, Grande Terre	61.35	16.23	11.2.07	cattle
<b>Dominica</b>					
1/00	Roseau	61.39	15.29	14.3.00	goat
2/00	Morne Trois Piton NP	61.32	15.34	16.3.00	sheep
3/00	Springfield	61.38	15.34	18.3.00	cattle
1/02	Springfield	61.38	15.34	2.3.02	cattle
<b>St Lucia</b>					
3/04	Laborie	61.00	13.75	27.2.04	sheep
4/04	Anse La Raye	61.04	13.94	28.2.04	goat
5/04	Mamiku Valley, Praslin	60.91	13.87	2.3.04	cattle
6/04	Mamiku Valley, Praslin	60.91	13.86	2.3.04	sheep
7/04	Mamiku Valley, Praslin	60.90	13.86	2.3.04	goat

\*MJR no./year

records of any of the fungi reported here for Guadeloupe, Dominica or St Lucia.

### Ascomycota, Pezizales

#### *Ascobolus amoenus* Oud.

The identity of this collection was confirmed by J. van Brummelen (*in litt.* 7 April 1998). In that letter, however, Brummelen also writes 'From Dr H.A.Dade I received . . . samples of this species from ten localities in Victoria, Australia; collected between 1965 and 1969'. Bell (2005), in discussing this or a similar fungus, says that 'in [a] letter to van Brummelen (August 25<sup>th</sup> 1969), Dade described [a] species which he variously named *Ascobolus amoenus* Oudem . . . . He stated that the Australian material was rather differ-

ent concerning its ascospore ornamentation'. Bell (2005) observes that there were no records in Dade's files of any reply from Brummelen, but that it is clear that Dade considered his Australian fungus to be *A. amoenus*. Bell (2005) has frequently recorded the same species from Australia, and says that 'it does not at all resemble Oudemans' *A. amoenus* as described by van Brummelen (1967)', and that 'with its magnificent warted spores represents an undescribed species', and it is described as *A. dadei* A. Bell & D.P. Mahoney. The spores of this collection from St Thomas are not magnificently warted, as illustrated by Bell for *A. dadei*, and so it would appear that it is *A. amoenus* as understood by Oudemans and Brummelen. The spores were ellipsoid, 32-38.5 ×

17.7-19.5  $\mu\text{m}$ , uniformly minutely punctate, with no cracks in the exospore, and with an all-round gel but thinner at the poles than along the sides.

*St Thomas (USVI)*: 1/98E; **L 984.303 431; K(M)56920.**

*A. immersus* Pers.

An unmistakable, common and cosmopolitan species, it has a tendency to be more frequent in samples from low latitudes (Richardson 2007). It was recorded from each of the five islands, with 12 records in total, thus a high frequency of occurrence, 57%.

*Puerto Rico*: 4/97, 4-5/98, 1/01; *St Thomas (USVI)*: 2/98; *Guadeloupe*: 2-5/07; *Dominica*: 2-3/00; *St Lucia*: 4/04.

*A. scatigenus* (Berk. & M.A. Curtis) Brumm.

The largest species in the genus with mature apothecia reaching 3 cm diam, with the mature disc changing instantaneously from dark purple to buff with the simultaneous discharge of spores. Its distribution is distinctly tropical, and Brummelen (1967) examined many specimens from pantropical locations, including several from Puerto Rico. Records may also be found under the synonym *A. magnificus* Dodge.

*Puerto Rico*: 4/97 (photograph, Richardson 2007); *Dominica*: 1/02E (spores).

*Coprotus cf. albidus* (Boud.) Kimbr.

*St Lucia*: 3/04.

*Coprotus cf. lacteus* (Cooke & W. Phillips) Kimbr., Luck-Allen & Cain

*Puerto Rico*: 4/97, 2, 5/98; *Dominica*: 1/00. *St Lucia*: 5-6E/04.

*Coprotus leucopocillum* Kimbr., Luck-Allen & Cain

*Puerto Rico*: 1/01.

*Coprotus cf. niveus* (Fuckel) Kimbr., Luck-Allen & Cain

*St Lucia*: 5/04.

*Coprotus ochraceus* (H. Crouan & P. Crouan) Kar. Larsen

*Dominica*: 3/00.

*Iodophanus carneus* (Pers.: Fr.) Korf

A common and widely distributed species, with 9 records from four of the five islands.

*Puerto Rico*: 4/97, 4/98, 1/01; *Guadeloupe*: 1, 4/07; *Dominica*: 1-2/00, 1/02; *St Lucia*: 7/04.

*Iodophanus granulipolaris* Kimbr.

Superficially similar to *Iodophanus carneus*, but distinguished by its larger ascospores (15-28  $\times$  14-15  $\mu\text{m}$ ) and by its finely verrucose ornamentation more highly concentrated at the poles (Kimbrough et al. 1969; Cinto & Dokmetzian 2006).

*Puerto Rico*: 1/01.

*Saccobolus citrinus* Boud. & Torrend

*Puerto Rico*: 1/01; *Guadeloupe*: 2-5/07; *Dominica*: 2E/00.

*Saccobolus glaber* (Pers.) Lambotte

A cosmopolitan species, mostly occurring on cattle or sheep dung.

*Puerto Rico*: 1E/01.

*Saccobolus minimus* Velen.

Brummelen (1967) noted that, because of its very small apothecia, the species is rarely recorded, but it probably has a worldwide distribution. He studied material from Europe, Canada, USA, Thailand, Hawai'i, and Ecuador (Galapagos). Doveri (2004) reported 11 collections from Italy and Bell (2005) recorded several collections from Australia.

*Puerto Rico*: 4/98; *St Thomas (USVI)*: 2/98; *Dominica*: 2/00; *St Lucia*: 4, 6-7/04.

*Saccobolus portoricensis* Seaver

At the time of Brummelen's (1967) monograph, this species was known only from the type collection, described by Seaver (1928) from the dung of an unidentified animal from Puerto Rico. As there are no extant native land mammals, other than bats, in Puerto Rico, or most of the other

Caribbean islands, it is possible that the dung would have been from an introduced domestic mammal—horse, cattle, sheep or goat. There are few subsequent records so the species must be considered rare and with a tropical distribution. Ebersohn & Eicker (1997) recorded it from the dung of game animals in the Kruger National Park, South Africa, Bell (2005) illustrated material from Northern Territory, Australia, and there is a record from India (Anonymous 2001-07). There are three collections, all from cattle dung, from Puerto Rico and two Lesser Antillean islands.

*Puerto Rico*: 4E/97; *Dominica*: 3E/00; *St Lucia*: 5/04.

***Saccobolus truncatus* Velen.**

A widespread species, probably underrecorded because of its small size, but Doveri (2004) provides an extensive bibliography of records worldwide.

*Puerto Rico*: 4E-5E/98; *Guadeloupe*: 2-5/07; *Dominica*: 3E/00; *St Lucia*: 5-6/04.

***Saccobolus cf. verrucisporus* Brumm.**

*Guadeloupe*: 4/07E. *St Lucia*: 3/04.

**Ascomycota, Thelebolales**

***Thelebolus microsporus* (Berk. & Broome) Kimbr.**

*Dominica*: 2/00.

**Ascomycota, Sordariales**

***Cercophora cf. coprophila* (Fr.) N. Lundq.**

Included in these determinations is material of *Cercophora* (indicated by \* below) that had a white tomentum around the ostiole, a characteristic of *C. coprophila*, but with the immature, vermiform spores only 35-42 µm long, much shorter than reported for that species (46-64 µm (Lundqvist 1972), 52-65 µm (Doveri 2004)), and usually without an apical globule in the ascus. Lundqvist (1972) observed that '*C. coprophila* is the commonest and most widely dis-

tributed member of the genus . . . yet rather misunderstood . . . authors did not realize the ecological specialization of the species . . . [which is] highly one-sided in its substrate choice. One can safely state that practically all finds on matrices other than cow dung refer to other species. There are very few, if any, common and widespread coprophilous fungi that seem to be uniquely restricted to the dung of one animal species, so I do not consider that an occurrence on dung of white-tailed deer (1/98), donkey (2/98) or goat (1/00, 4/04) necessarily rules out a determination of the material as *C. coprophila*, with short immature spores. *C. coprophila* was recorded from Puerto Rico, as *Pleurage arachnoidea*, by Cantrell et al. (2006).

*St Thomas (USVI)*: 1E\*, 2\*/98; *St Lucia*: 4\*/04; *Dominica*: 1\*/00, 1E/02.

***Cercophora mirabilis* Fuckel**

*Puerto Rico*: 4/97, 1E/01; *Dominica*: 3E/00, 1/02.

***Cercophora cf. sordarioides* (Speg.) N. Lundq.**

*St Lucia*: 5-7/04.

***Podospora communis* (Speg.) Niessl**

A characteristic species, with spores with four distinct appendages at the distal tip. Lundqvist (1972) noted that it prefers dung of domestic animals, and appears to be worldwide in distribution, but that verified records from the tropics are very few. I have found, however, that *P. communis* is one of group of species, including *P. fimiseda*, *P. immersa*, *P. longicaudata* and *P. paucisetata* (which follow), that is more likely to be recorded from samples from a lower latitudinal range of 40°N-40°S, rather than from higher latitudes. Of 84 records of these four species, 73 (87%) are from those lower latitudes. It is reported from Haiti, as *Pleurage vestita*.

*Puerto Rico*: 4/97, 5E/98, 1/01; *St Thomas (USVI)*: 2E/98; *Guadeloupe*: 1-2, 5/07; *Dominica*: 2E/00, 1/02; *St Lucia*: 5-6/04.

***Podospora cf. curvicolla* (Wint.) Niessl**

This material had a mixture of various *Podospora*/*Schizothecium* characters. Perithecia had a few short setae, <22  $\mu\text{m}$  long, and some darker almost papillate cells, cf. sect *Rhyphophila*, and a perithecial wall more schizothecial in structure, but with no scales or inflated cells. The asci had an estimated 5-600 spores, and the spores were elliptical, 12.8-14.5  $\times$  8  $\mu\text{m}$ , with a proportionate pedicel slightly enlarged at the tip, and a simple gelatinous appendage at each end. Apart from their smaller size, the spores agree exactly with the illustrations of Lundqvist (1972) for *P. curvicolla*.

*St Lucia*: 4E/04.

***Podospora fimiseda* (Ces. & De Not.) Niessl**

A distinctive and easily recognised species, mainly north temperate in its distribution and mostly associated with domestic herbivores, but with material from Brazil, Chile and Venezuela, and a collection from Puerto Rico examined by Lundqvist (1972).

*Puerto Rico*: 4/97.

***Podospora immersa* (R. Stratton) Cain**

*Podospora immersa* is recognisable by the unusual nature of the spore appendages. The pedicel is cylindrical, but constricted at its junction with the pigmented cell of the spore, which is completely surrounded by a gel with a radially fimbriate structure. It seems to be particularly frequent in the Caribbean samples, and is a co-dominant perithecial species together with *P. communis* and *P. longicaudata*.

*Puerto Rico*: 4E-5E/98; *St Thomas (USVI)*: 1E-2E/98; *Guadeloupe*: 1, 5/07; *Dominica*: 1E/00; *St Lucia*: 3E/04.

***Podospora longicaudata* (Griffiths) Cain**

*Guadeloupe*: 2-4/07; *St Lucia*: 3, 4E, 5E/04.

***Podospora pauciseta* (Ces.) Traverso**

*Guadeloupe*: 2, 4-5/07.

***Podospora prethopodalis* Cain**

*St Lucia*: 3/04.

***Podospora setosa* (G. Winter) Niessl**

*Dominica*: 2/00; *St Lucia*: 6/04.

***Podospora venezuelensis* Mirza & Cain**

A sect. *Rhyphophila* species with 32-spored asci, cf. *P. pleiospora*, but with smaller spores, 22.5-29  $\times$  13-21  $\mu\text{m}$  and a relatively short pedicel, 22-32  $\times$  3.5-4  $\mu\text{m}$ , broadened to 6  $\mu\text{m}$  at the tip.

*St Thomas (USVI)*: 2E/98

***Schizothecium dakotense* (Griffiths) N. Lundq.**

*Dominica*: 2/00.

***Schizothecium* sp.**

Only one immature perithecium seen, so specific determination not possible.

*Guadeloupe*: 5/07.

***Sordaria fimicola* (Rob.) Ces. & DeNot.**

*St Lucia*: 6/04.

***Zygopleurage zygospora* (Speg.) Boedijn**

An interesting fungus by virtue of its ascospores, which consist of two dark ellipsoidal cells connected by a long cylindrical hyaline cell which, in the ascus before spore discharge, is coiled in the central part, separating the two sets of polar and distal pigmented cells. Lundqvist (1969) reported it as widespread, having examined material from Sweden, France, Canada, U.S.A., Puerto Rico, Egypt and Liberia, with unverified records from Poland, Hungary, Bulgaria, Algeria, Chad, Indonesia and W. Pakistan. It does not, however, appear to be common. Delgado *et al.* (2000) recorded it from Venezuela, and there are five records from Brazil (Richardson 2001b).

*Guadeloupe*: 5/07.

**Ascomycota, Hypocreales*****Selinia pulchra* (Winter) Sacc.**

*Puerto Rico*: 1E/01; *Dominica*: 2E/00.

**Ascomycota, Xylariales*****Phomatospora minutissima* (P. Crouan & H. Crouan) N. Lundq.**

An established, but little recorded species, since the perithecia are very small

(150-250  $\mu\text{m}$  diam.) and immersed in the substratum, apart from the protruding perithecial neck. It also appears late in the incubation period, the date of first observation varying from 29-116 d (mean 52 d) of incubation for 32 observations of *P. minutissima* and the related *P. coprophila* (Richardson 2002). Six of the seven Caribbean records were first observed after 52, 53, 53, 67, 67 and 73 days incubation. The sixth, from Dominica, although first seen after only 11 days incubation, was on dung that had clearly been in the field for longer than 11 days, as it already had abundant growth of *Ascobolus scatigenus* present when collected.

Guadeloupe: 3E; 4-5E/07; Dominica: 1/02; St Lucia: 3E, 5E-6E/04.

### Ascomycota, Pleosporales

*Sporormiella minima* (Auersw.) S. I. Ahmed & Cain

There are fifteen records of this very common *Sporormiella* species, from all five islands from which samples were collected.

Puerto Rico: 4/97, 3-5/98, 1/01; St John (USVI): 2/98; Guadeloupe: 3-4/07; Dominica: 1-3/00, 1/02; St Lucia: 3-6/04.

*Sporormiella* sp.

Two collections, with many similarities, that may well be an undescribed species, as no species in Ahmed and Cain (1972), Doveri (2004), nor Bell (2005) has a combination of such small spores and a biseriate arrangement in the ascus. The St Lucia material has small superficial to semi-immersed pseudothecia, with erumpent ostioles. Asci are long-stalked, cylindrical,  $80 \times 7 \mu\text{m}$ , tapering to the base, the distal part with spores 40-50  $\mu\text{m}$  long. Spores are biseriate, 4-celled,  $13-16 \times 3 \mu\text{m}$ , with slightly tapered end-cells and shorter intercalary cells. Germ-slits are almost parallel to the long axis of spore. The Puerto Rico material had small immersed pseudothecia, with a long neck. Asci are long-stalked, cylindrical,  $100 \times 9 \mu\text{m}$ , tapering to the base, with a large foot, distal part with

spores 55-60  $\mu\text{m}$  long. Spores are biseriate, 4-celled,  $17-22 \times 3 \mu\text{m}$ , with end-cells not markedly tapered, and all cells more or less equal, tending to fragment into component cells. Germ-slits are very slightly oblique to almost parallel to the long axis of spore.

Puerto Rico: 1/01; St Lucia: 7E/04.

### Basidiomycota, Agaricales

*Conocybe neoantipus* (G.F. Atk.) Singer

St John (USVI): 2E/98.

*Coprinus cordisporus* Pat.

Puerto Rico: 5/98, 1/01; St John (USVI): 2/98  
Guadeloupe: 2E/07; Dominica: 1/02; St Lucia: 5-6/04.

*Coprinus heptemerus* M. Lange & A. H. Sm.

St John (USVI): 1/98; Dominica: 1/00; St Lucia: 4, 6E-7/04.

*Coprinus marculentus* Britzelm.

Guadeloupe: 2E/07

*Coprinus niveus* (Pers.: Fr.) Fr.

Guadeloupe: 4E-5/07.

*Coprinus pellucidus* Karst.

St John (USVI): 2/98; Guadeloupe: 2, 3E/07;  
Dominica: 1-2/00, 1/02.

*Coprinus pseudoradiatus* Kühner & Joss. ex Watling

Puerto Rico: 1/01; Guadeloupe: 3E/07; Dominica: 1/00; St Lucia: 7/04.

*Coprinus radiatus* (Bolton) Gray

St Lucia: 4-5E/04.

*Coprinus stellatus* Sacc.

Puerto Rico: 1/01; Dominica: 3/00.

*Coprinus stercoreus* (Bull.) Fr.

One of the commonest and most widespread *Coprinus* spp. worldwide, and present in two-thirds of the 21 samples from the five Caribbean islands.

Puerto Rico: 4/97, 4-5/98, 1/01; *St John (USVI)*: 2/98; *Guadeloupe*: 1/07; *Dominica*: 1-2/00, 1/02; *St Lucia*: 3-7/04.

*Zygomycota, Kickxellales*

*Coemansia reversa* Tiegh. & G. Le Monn.

Associated with (possibly parasitic on?) penicillioid coremia (*Isaria* sp.?)

Puerto Rico: 3E/98.

### Zygomycota, Mucorales

*Cunninghamella echinulata* (Thaxt.) Thaxt. ex Blakeslee

*Guadeloupe*: 5/07.

*Phycomyces blakesleeanus* Burgeff

Puerto Rico: 3/98.

*Pilobolus crystallinus* var. *crystallinus* (F. H. Wigg.) Tode

*Guadeloupe*: 1/07; *Dominica*: 1/00.

*Pilobolus crystallinus* var. *kleinii* (Tiegh.) R. Y. Zheng & G.Q. Chen

Puerto Rico: 4/97, 5/98; *Guadeloupe*: 2, 4/07; *Dominica*: 3/00; *St Lucia*: 3, 6/04.

*Pilobolus lentiger* var. *lentiger* Corda

*St Lucia*: 7/04.

*Pilobolus roridus* var. *umbonatus* (Buller) F.M. Hu & R.Y. Zheng

*Dominica*: 1/00; *St Lucia*: 6/04.

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