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DICTYOSTELID CELLULAR SLIME MOLDS FROM SAN SALVADOR ISLAND, BAHAMAS

John C. Landolt
Department of Biology
Shepherd College
Shepherdstown, WV 25443 U. S. A.

Craig W. Stihler
West Virginia Division of Natural Resources
P. O. Box 67
Elkins, WV 26241 U. S. A

ABSTRACT

Fifty soil and litter samples, taken from both cave and above ground sites on the island of San Salvador, Bahamas were examined for the occurrence and distribution of dictyostelid cellular slime molds. These samples were collected during April 1995, January 1996 and January 1997. At least 10 different species of cellular slime molds were recovered: *Dictyostelium aureo-stipes*, *D. mucoroides*, *D. polycephalum*, *D. purpureum*, *D. sphaerocephalum*, *D. vinaceo-fuscum*, *Polysphondylium pallidum*, and *P. violaceum* together with two forms still to be assigned; *Dictyostelium* sp. and *Polysphondylium* sp. In addition, several isolates tentatively assigned to *P. pallidum* show some morphological features consistent with a new type which has yet to be formally characterized. While most of these species are rather wide spread in world distribution, there are several particularly noteworthy collections. The *Polysphondylium* sp. is unique compared to all other species of the genus in that it produces spherical rather than oval spores. This suggests a possible new taxon. *Dictyostelium polycephalum* is occasionally isolated elsewhere, but is relatively common on San Salvador as it seems to be with regard to certain other island groups.

INTRODUCTION

Dictyostelid cellular slime molds are rather ubiquitous components of the soil-litter interface, particularly in tropical, subtropical and temperate zones (Raper, 1984). This relatively small group of organisms consists of approximately 60 recognized species comprising three genera (Hagiwara, 1989). Most of the period of the life cycle is spent in a unicellular, amoeboid state with cells feeding upon bacteria, protists and microfungi. When such food supplies are abundant, slime mold myxamoebae proliferate by way of mitotic cell division. As the local bacterial food supply becomes relatively depleted, hundreds to thousands of myxamoebae, responding to chemotactic signals, aggregate and collectively differentiate as a stalked fruiting body or sorocarp, consisting of cellulosic, vacuolated cells forming a branched or unbranched sorocarp with a cluster of spore cells at each stipe terminus. These stalked fruiting bodies range between 1-2 mm to 1-2 cm in length.

While there are a number of described species that appear to be rather cosmopolitan in distribution, several species of dictyostelids appear to be associated with narrower geographic or edaphic situations. In general, species richness is greatest in the American tropics with 35 species recovered from just a small area near Tikal in Guatemala (Vadell et al., 1995). Species richness declines with increase in either latitude or elevation (Cavender, 1973). There are indications that species richness and composition may be correlated with aspects of ecological disturbance and patterns of community succession arising thereafter (Cavender et al.,1993).

METHODS AND MATERIALS

The soil/litter samples were processed in the laboratory within a few days of collection using procedures similar to those of Cavender and Raper (1965). An initial 1:10 dilution of sample material with sterile, distilled water was then further diluted to a final 1:25 proportion. An aliquot of 0.5 ml of this diluted sample was added to a phosphate buffered, hay-infusion agar (filtered, sterile infusion of well-leached hay, 1.5 g/l KH_2PO_4, 0.62 g/l $Na_2HPO_4.7H_20$, 15.0 g/l granulated agar per liter), in 95 mm diameter plastic culture dishes. In this fashion, 0.02 g of fresh sample material/ dish was introduced into culture. Three to four drops of a heavy suspension of *Escherichia coli* were added to each plate to serve as a food source. These cultures were incubated at room temperature (ca. 20^0 C) and examined microscopically

Figure 1. A taxonomic key to the dictyostelids of San Salvador, Bahamas

1. Sorophore fruiting bodies unbranched or with sparse, irregular branching -*Dictyostelium* 2
1a. Sorophores with whorls of lateral branches bearing terminal sori - *Polysphondylium* 7

2.Spores elliptic with very distinct, bipolar granules 3
2a Spores oval to elliptic without polar granule inclusions 4

3. Pseudoplasmodium very slender, migrating extensively, sorophores coremiform..... *Dictyostelium polycephalum*
3a. Pseudoplasmodium not migratory, sorophores not coremiform ..... *D. aureo-stipes*

4. Sori shaded lavender to dark purple 5
4a. Sori white to ivory or pale yellow 6

5. Sorophores long, over 5mm, sorophore base clavate or slightly expanded ..... *D. purpureum*
5a. Sorophores usually less than 5mm, sorophore base digitate ..... *D. vinaceo-fuscum*

6. Sorophores long and slender, rarely branched, sori relatively small diameter ..... *D. mucoroides*
6a. Sorophores relatively short and thickened, irregular branches common, sori fairly large in diameter ..... *D. sphaerocephalum*

7. Spores oval 8
7a. Spores spherical ..... *Polysphondylium* sp

8. Sori pale lavender to purple, sorophores robust ..... *P. violaceum*
8a. Sori hyaline or milky white, sorophores rather thin and delicate ..... *P. pallidum*

Table 1. Dictyostelid species recovered from San Salvador, Bahamas

Species and collection site	No. of different samples from which the species was recovered
Dictyostelium aureo-stipes (K.)	1
Dictyostelium mucoroides (*D. firmibasis* ?) (B.,D.,E.,L.,)	4
Dictyostelium polycephalum (D., M., ?,?)	4
Dictyostelium purpureum (B.,C.,D.,E.,F.,G.,H.,I.,K.,N.,O.,?,?,?)	17
Dictyostelium sphaerocephalum (A.,E.)	2
Dictyostelium vinaceo-fuscum (B.,E.,K.,M.,O.)	10
Dictyostelium sp. (M.)	1
Polyshpondylium pallidum (*P. colligatum*?) (E.,F.,K.,P.,?,?)	7
Polysphondylium violaceum (F.,G.,J.,Q.)	5
Polysphondylium sp. (with spherical spores) (K.)	1

A. outside Alter Cave
B. outside Crescent Top Cave
C. trail along Reckley Pond
D. house with *Eptesicus* sp. bats
E. outside Berney's Cave
F. inside Alter Cave
G. inside Reckley Maze Cave
H. inside Garden Cave
I. shore of Great Lake
J. inside Crescent Top Cave
K. outside Lighthouse Cave
L. inside Berney's Cave
M. outside Pipe Cave
N. Hard Bargain Trailhead
O. Bahamas Field Station-Almond stand
P. Hard Bargain Trail-beyond 60' Hill
Q. Bahamas Field Station near water tanks

? From an April 1995 unspecified site location

(B &L Stereozoom; 10X-25X) each day for a period 10-14 days. The locations of aggregations and clusters of sorocarps were marked as they appeared and, when necessary, isolated dictyostelids were sub-cultured for more detailed examination and identification. A reference collection of representative dictyostelids isolated in this study is available for examination at the home institution of the first author. The nomenclature used herein follows Raper (1984)

RESULTS AND DISCUSSION

Of the 50 samples collected and examined, 29 (58%) yielded one or more species of cellular slime mold. Eight identifiable forms were recovered along with two types that have not yet been assigned to a taxon (Table 1). Of these identified forms, all are relatively common in subtropical locations of the western hemisphere. By far, the most common isolated species was *Dictyostelium purpureum*, a form rather characteristic of warm temperate, subtropical and tropical environments (Cavender, 1973). Several isolates of a form that would be consistent with Raper's concept of the cosmopolitan *D. mucoroides* were recovered. This species is the most widespread in world distribution of any described form. The isolates so identified in the study also have the expanded sorophore base and robust habit that conforms with a taxon distingished by Hagiwara (1989) as *D. firmibasis*. The species *D. vinaceo-fuscum* was isolated from a number of samples. This form, considered by Cavender (1973) to be subtropical and tropical in affinity, is one of the several species within the group that produces sorocarps with a crampon, digitate base.

The species *Polysphondylium violaceum* is a common and widespread, temperate form and appeared at a fairly high relative density in several cave samples. Of the 8 soil samples collected within the several caves, *P. violaceum* was recovered from 4, representing material from 3 different caves making it the species most often recovered from cave sites. The species *D. polycephalum*, a form with unique coremiform sorocarps and extremely slender, migratory pseudoplasmodia, was isolated from 3 different samples. *D. polycephalum* is, compared to the other isolated species, relatively rare but it has been recovered from a number of other island locations including Guam, Tahiti and Hawaii (unpublished data; Olive, 1975) suggesting a possible affinity or tolerance to sandy and/or saline substrates. Cavender (1973) considered *D. polycephalum* to be a species with tropical and subtropical affinities.

Several of the isolates assigned here to *P. pallidum*, while having spore characters and dimensions consistent with the formal description of this taxon, also show clumped sorophores and a faint brownish stalk pigmentation which Cavender (unpublished) has suggested to represent a different form which he has informally designated as "*P. colligatum*". One of the unassigned forms is perhaps the most noteworthy in that the morphology of the fruiting body is clearly that of a member of the genus *Polysphondylium*; but it is unique in having spherical spores rather than the elliptic or oval spores characteristic of this genus. This isolate and an unassigned *Dictyostelium* sp. continue to be evaluated.

Overall density of cellular slime molds was calculated to be 136 clones per gram of fresh soil-litter material. This is higher than in Hawaii and similar to that found in rain forests of Puerto Rico (unpublished) and in the Philippines (Cavender, 1976). This density is substantially lower than that commonly reported from temperate and even boreal forests (Raper, 1984). In general, species richness and densities were higher in samples collected above ground than in those collected from within caves. Many of the soil samples which were devoid of recoverable cellular slime molds were those with a particularly high proportion of sand and very little recognizable organic matter.

Dictyostelid cellular slime molds occur at a moderately high level of species richness on the island of San Salvador and at modest densities. With 8-11 distinguishable forms, this island compares favorably to the Hawaiian archipeligo and Puerto Rico where 10 species each have been discovered (unpublished) and the Philippines where Cavender (1976) recovered 9 different forms. Species richeness is substantially higher than records from another Philippines collection (Dogma and Blancaver, 1965) with four species, or from Guam or Moorea (3 species each) and even New Zealand where only 5 species have been recovered (unpublished). Cavender (1970) reported finding as many as 14 dictyostelid forms in a survey of Trinidad and Tobago. The fact that San Salvador is located relatively close to other islands of the Bahamas group, together with the group's proximity to the North American mainland makes it possible for spores and other propagules to be dispersed to San Salvador, most likely by birds or bats which are known vectors of dictyostelids (Stephenson and Landolt, 1992; Suthers, 1985). The dictyostelid species make-up of San Salvador is similar to that reported from a Florida Everglades hammock forest (Cavender and Raper, 1968) and in other south Florida and Florida Keys collections (unpublished). It is likely that further examination of soil/litter material would produce

several additional species of cellular slime molds on San Salvador. Additional isolates of the unique, spherical-spored *Polysphondylium* would permit a formal description to be proposed.

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