

First records of myxomycetes from Cambodia

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Abstract: Myxomycetes (plasmodial slime molds or myxogastrids) remain an understudied group for much of Southeast Asia, and prior to the study reported herein, there appear to have been no records for the entire country of Cambodia. Samples of dead plant material collected on two visits to Cambodia were used to prepare a series of moist chamber cultures, and these cultures yielded 30 species in 16 genera. *Arcyria cinerea*, *Didymium squamulosum*, and *Perichaena depressa* were the three species represented by the largest numbers of collections, and two of the other species recorded (*Arcyria leiocarpa* and *Didymium cf. inconspicuum*) were new records for Southeast Asia.

Zusammenfassung: Schleimpilze (Plasmodiale Schleimpilze oder Myxogastria) sind eine zu wenig untersuchte Gruppe für weite Gebiete Südostasiens. Vor der vorliegenden Studie gab es für Kambodscha offensichtlich gar keine Aufzeichnungen. Abgestorbenes Pflanzenmaterial wurde bei zwei Aufenthalten in Kambodscha gesammelt und verwendet um eine Serie von Feuchtkammerkulturen anzulegen. Diese Kulturen ergaben 30 Arten in 16 Gattungen. *Arcyria cinerea*, *Didymium squamulosum* und *Perichaena depressa* waren die drei Arten mit der größten Anzahl von Kollektionen. Zwei weitere festgestellte Arten, *Arcyria leiocarpa* und *Didymium cf. inconspicuum*, sind neue Nachweise für Südostasien.

The myxomycetes (plasmodial slime molds or myxogastrids) are a group of fungus-like organisms usually present and sometimes abundant in terrestrial ecosystems (MARTIN & ALEXOPOULOS 1969, STEPHENSON & STEMPEN 1994). However, because of the relatively small size, usually no more than 1–2 mm tall, and ephemeral nature (most examples do not persist for more than a few days) of their fruiting bodies, myxomycetes are easily overlooked in the field unless one knows how and where to look for them.

Myxomycetes remain an understudied group for much of Southeast (SE) Asia. Prior to the study reported herein, there are no records of which we are aware for the entire country of Cambodia. In contrast, 132 species in 30 genera have been reported for neighboring Thailand (KO KO & al. 2010). The totals known for other countries in

the region range from 92 species in 26 genera for Singapore (ROSING 2009, ROSING & al. 2011), 67 species in 26 genera for Myanmar (KO KO & al. 2013), 57 species in 21 genera for Vietnam (TRAN & al. 2014) and 44 species in 17 genera for Laos (KO KO & al. 2012).

Cambodia, officially known as the Kingdom of Cambodia, is a country located in the southern portion of the Indochina Peninsula in Southeast Asia. It is bordered by Thailand to the northwest, Laos to the northeast, Vietnam to the east and the Gulf of Thailand to the southwest. Cambodia has a total land area of 181035 km², and all of the country occurs within the tropics between 10° to 15° N latitude and 102° to 108° E longitude. Cambodia's landscape is characterized by a low-lying central plain that is surrounded by uplands and low mountains. Most of the latter reach elevations of only about 200 m, but the summit of Phnom Aural, the highest mountain in the country reaches 1813 m a.s.l. Like much of Southeast Asia, highly populated areas of Cambodia tend to be thinly forested, but in less populated areas dense tropical forests still exist (RUNDEL 1999). The climate of the country, like that of the rest of Southeast Asia, is dominated by monsoons. There are two distinct seasons of the year. A rainy season, characterized by generally high humidity, extends from May to October. Temperatures can drop to 22 °C during these months. The dry season lasts from November to April, and temperatures during this period can reach 40 °C.

The primary objective of the surveys reported herein was to generate the first body of data on the myxomycetes of Cambodia, with the hope that these data can serve as a starting point for future more comprehensive studies of this group of organisms.

Materials and methods

The specimens of myxomycetes reported in this paper were obtained as a result of two visits to Cambodia. On the first visit, made by the first author, samples of several different types of dead plant material were collected for laboratory isolation of myxomycetes in moist chamber cultures. These samples consisted of forest floor litter, aerial litter (dead but still attached plant parts above the ground) and the dead outer bark of living trees. On the second visit, made by ALISON HARRINGTON, only bark samples for moist chamber cultures were collected. Moist chamber cultures were prepared in the manner described by STEPHENSON & STEMPEN (1994) and consisted of plastic disposable Petri dishes (100 mm diam.) lined with filter paper. The sample material in each dish was moistened with distilled water. After a period of approximately 24 h, the pH of each culture was determined with a portable pH meter, after which excess water in the Petri dish was poured off. Moist chamber cultures were placed on horizontal shelves under diffuse daylight and maintained at room temperature. Water was added to cultures when necessary to maintain moist conditions, and the cultures were checked at least each week for evidence (either plasmodia or fruiting bodies) of myxomycetes for a period of three months. When fruiting bodies were observed, they were recorded, removed from the moist chamber culture, air-dried and placed in small pasteboard boxes for long-term storage. Myxomycetes were identified to species using standard monographs (e.g., MARTIN & ALEXOPOULOS 1969) of the group.

Annotated list of species

The species of myxomycetes recorded from Cambodia are arranged alphabetically, first by genus and then by species. The morphological species concept (ss. STEPHENSON 2003) is the one used herein, and nomenclature essentially follows LADO (2005-2015). The abbreviation 'cf.' in the name of a species indicates that the specimen representing the source of the record could not be identified with certainty. This usually indicates scanty or aberrant material. In order to save space, the number of records

listed herein for a particular species is limited to no more than five. Voucher specimens of all of the species in the list are deposited in the mycological herbarium (UARK) of the University of Arkansas. For the information that follows, mc = collection obtained from a moist chamber culture, AKW = Angkor Wat, Siem Reap Province (13° 21.454 N; 103° 06.366 E, 290 m a.s.l.); PNM = Pich Nil Mountain, Kampong Speu Province (11° 12.241 N; 104° 05.591 E, 125 m a.s.l.); WPN = Wat Phnom, Phnom Penh (11° 34.574 N; 104° 55.389 E, 30 m a.s.l.); SIH = Sihanoukville, Sihanoukville Province (10° 37.572 N; 103° 31.700 E, 30 m a.s.l.); and PHP = Phnom Penh (11° 32.848 N; 104° 53.689 E, 12 m a.s.l.).

Arcyria cinerea (BULL.) PERS. (12 collections)

This cosmopolitan species has also been reported from Laos, Myanmar, the Philippines, Singapore, Thailand and Vietnam in SE Asia.

Collections examined: WR/SLS 31185, PNM, bark (mc); WR/SLS 31188, PNM, bark (mc); WR/SLS 31191, PNM, bark (mc); TWKK 1140, WPN, aerial litter (mc); TWKK 1150, AKW, ground litter (mc)

Arcyria denudata (L.) WETTST. (1 collection)

This species is also known from Brunei, Laos, Malaysia, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collection examined: WR/SLS 31189, PNM, bark (mc).

Arcyria leiocarpa (COOKE) G. W. MARTIN & ALEXOP. (1 collection)

This species has not been reported previously from SE Asia and thus is a new record for this region of the world.

Collection examined: WR/SLS 31190, PNM, bark (mc).

Comatricha elegans (RACIB.) G. LISTER (1 collection)

This species has been reported previously from Singapore and Thailand in SE Asia. The material on which this record is based is limited to a single sporocarp but fits the published description of *Comatricha elegans* better than any other taxon.

Collection examined: WR/SLS 31532, SIH, bark (mc).

Comatricha laxa ROSTAF. (2 collections)

This species has been reported previously from Singapore and Thailand in SE Asia.

Collections examined: WR/SLS 31177, AKW, bark (mc); WR/SLS 31531, PNM, bark (mc).

Cribraria violacea REX (6 collections)

This species has been reported previously from Laos, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collections examined: WR/SLS 31323, SIH, bark (mc); WR/SLS 31336, PHP, bark (mc); TWKK 1143, WPN, ground litter (mc); TWKK 1155, PNM, ground litter (mc); TWKK 1156, PNM, ground litter (mc).

Diachea leucopodia (BULL.) ROSTAF. (1 collection)

This species has been reported previously from Laos, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collection examined: WR/SLS 31179, AKW, bark (mc).

Diderma chondrioderma (DE BARY & ROSTAF.) G. LISTER (3 collections)

This species has been reported previously from Laos, the Philippines and Singapore in SE Asia.

Collections examined: WR/SLS 31321, SIH, bark (mc); WR/SLS 31333, SIH, bark (mc); WR/SLS 31335, SIH, bark (mc).

Diderma effusum (SCHWEIN.) MORGAN (3 collections)

This species has also been reported from Laos, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collections examined: TWKK 1148, AKW, ground litter (mc); TWKK 1149, AKW, ground litter (mc); TWKK 1173, AKW, ground litter (mc).

Diderma hemisphaericum (BULL.) HORNEM. (1 collection)

This species has also been reported from Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam in SE Asia.

Collection examined: TWKK 1160, AKW, ground litter (mc).

Didymium anellus MORGAN (1 collection)

This species has been reported previously from Laos, the Philippines and Thailand in SE Asia.

Collection examined: TWKK 1130, AKW, aerial litter (mc).

Didymium cf. inconspicuum NANN.-BREMEK. & D. W. MITCH. (1 collection)

This is a rare species known from only a few localities worldwide. Our identification is somewhat problematic but this collection appears to fit the published description of *Didymium inconspicuum* better than any other species of *Didymium*, especially with respect to the relatively large (often exceeding 15 µm in diameter) spores.

Collection examined: WR/SLS 31528, SIH, bark (mc).

Didymium iridis (DITMAR) FR. (2 collections)

This species has also been reported from Laos, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collections examined: TWKK 1159, AKW, ground litter (mc); TWKK 1174, PNM, ground litter (mc).

Didymium squamulosum (ALB. & SCHWEIN.) FR. (8 collections)

This species is also known from Indonesia, Laos, Myanmar, the Philippines, Singapore, Thailand and Vietnam in SE Asia.

Collections examined: TWKK 1133, PNM, ground litter (mc); TWKK 1154, AKW, ground litter (mc); TWKK 1170, PNM, ground litter (mc); TWKK 1171, AKW, ground litter (mc); TWKK 1175, WPN, ground litter (mc).

Echinostelium minutum DE BARY (2 collections)

This species has also been reported from Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam in SE Asia.

Collections examined: WR/SLS 31186, PNM, bark (mc); WR/SLS 31324, SIH, bark (mc).

Hemitrichia minor G. LISTER (1 collection)

This species has been reported previously only from the Philippines in SE Asia.

Collection examined: WR/SLS 31320, SIH, bark (mc).

Lamproderma scintillans (BERK. & BROOME) MORGAN (3 collections)

This species is also known from Laos, Myanmar, the Philippines, Singapore, Thailand and Vietnam in SE Asia.

Collections examined: TWKK 1129, AKW, ground litter (mc); TWKK 1132, AKW, aerial litter (mc); TWKK 1139, AKW, ground litter (mc).

Licea biforis MORGAN (1 collection)

This species has been reported previously from Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collection examined: WR/SLS 31325, SIH, bark (mc).

Macbrideola decapillata H. C. GILBERT (2 collections)

This species has been reported previously only from Singapore in SE Asia.

Collection examined: WR/SLS 31329, SIH, bark (mc); WR/SLS 31332, SIH, bark (mc).

Perichaena chrysosperma (CURR.) LISTER (2 collections)

This species has also been reported from Laos, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collections examined: WR/SLS 31331, SIH, bark (mc); WR/SLS 31334, PHP, bark (mc).

Perichaena corticalis (BATSCH) ROSTAF. (2 collections)

This species has also been reported from the Philippines, Thailand and Vietnam in SE Asia.

Collections examined: TWKK 1135, PNM, aerial litter (mc); TWKK 1152, AKW, ground litter (mc).

Perichaena depressa LIB. (11 collections)

This species has also been reported from Brunei, Laos, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collections examined: WR/SLS 31322, PNM, bark (mc); WR/SLS 31330, SIH, bark (mc); TWKK 1131, AKW, aerial litter (mc); TWKK 1136, PNM, aerial litter (mc); TWKK 1151, AKW, ground litter (mc).

Physarum cinereum (BATSCH) PERS. (4 collections)

This species has been reported previously from Brunei, East Timor, Laos, Myanmar, the Philippines, Thailand and Vietnam in SE Asia.

Collections examined: WR/SLS 31326, PHP, bark (mc); TWKK 1142, AKW, ground litter (mc); TWKK 1158, AKW, ground litter (mc); TWKK 1166, AKW, ground litter (mc).

Physarum crateriforme PETCH (2 collections)

This species has been reported previously from Laos, Myanmar, the Philippines, Singapore and Thailand in SE Asia.

Collections examined: WR/SLS 31327, PHP, bark (mc); WR/SLS 31328, PHP, bark (mc).

Physarum decipiens M. A. CURTIS (1 collection)

This species has been reported previously from the Philippines and Thailand in SE Asia.

Collection examined: WR/SLS, PNM, bark (mc).

Physarum echinosporum LISTER (3 collections)

This species has also been reported from Laos, the Philippines and Thailand in SE Asia.

Collections examined: WR/SLS 31182, AKW, bark (mc); TWKK 1138, WPN, ground litter (mc); TWKK 1162, AKW, ground litter (mc).

Stemonaria longa (PECK) NANN.-BREMEK, R. SHARMA & Y. YAMAM (1 collection)

This species has been reported previously from the Philippines, Singapore and Thailand in SE Asia. *Stemonaria longa* is usually represented by specimens that have fruited in the field under natural conditions, but our record is based on a specimen that appeared in a moist chamber culture.

Collection examined: WR/SLS31180, AKW, bark (mc).

Stemonitis fusca* var. *nigrescens (REX) TORREND (7 collections)

This species has also been reported from Brunei, Laos, Malaysia and Thailand in SE Asia.

Collections examined: WR/SLS 31178, AKW, bark (mc); WR/SLS 31181, AKW, bark (mc); WR/SLS 31183, AKW, bark (mc); WR/SLS 31184, PNM, bark (mc); TWKK 1145, AKW, ground litter (mc).

Stemonitis herbatica PECK (1 collection)

This species has been reported previously from Laos, Myanmar, the Philippines, Singapore, Thailand and Vietnam in SE Asia.

Collection examined: WR/SLS 31250, PNM, bark (mc).

Stemonitopsis hyperopta (MEYL.) NANN.-BREMEK (2 collections)

This species has been reported previously only from Myanmar in SE Asia.

Collections examined: WR/SLS 31252, PNM, bark (mc); WR/SLS 31251, AKW, bark (mc).

Discussion

In the survey effort described herein, samples of dead plant material collected on two visits to Cambodia were used to prepare a series of moist chamber cultures, and these cultures yielded 30 species in 16 genera. This total is lower than those known for neighboring countries of SE Asia, but this is due largely to the fact that no field collections were obtained during the first and more extensive visit to Cambodia because of

the uniformly dry conditions. As a general observation, the species represented by the highest numbers of records, namely *Arcyria cinerea*, *Didymium squamulosum*, and *Perichaena depressa*, are myxomycetes noted as common in other surveys carried out in SE Asia. However, two of the 30 species we recorded, i.e. *Arcyria leiocarpa* and *Didymium cf. inconspicuum*, were new records for SE Asia.

The most important aspect of the present survey is that it generated the first body of data on the myxomycetes of Cambodia, and we hope that the latter can serve as a starting point for future more comprehensive studies of this group of organisms in a region of the world where they remain seriously understudied.

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