e-ISSN: 2582-7278
https://doi.org/10.59265/mycoasia.2024-04

Short Communication

Notes on the ecological distribution of the myxomycete *Arcyria globosa*

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Abstract

Prior to the virtual elimination of American chestnut (*Castanea dentata*) from the forests of eastern North America by the chestnut blight fungus, *Arcyria globosa* was commonly found on old chestnut burs that had fallen to the ground. The association of this myxomycete with chestnut burs was not absolute, but occurrences on other substrates appear to have been rare. During field collecting carried out in a forest in northern Thailand, it was noticed that old fallen cupules (burs) of *Castanopsis indica* often had scattered fruiting bodies of *A. globosa* present. *Castanea* and *Castanopsis* belong to the same family (Fagaceae) and produce spiky cupules that are rather similar morphologically. As such, *A. globosa* appears to display a particular affinity for the cupules of *Castanopsis* in the same manner as it does for *Castanea*. The basis for this seemingly remarkable ecological distribution is not known.

Keywords: burs, *Castanopsis*, *Castanea*, ecology, slime molds

Stephenson SL, Rollins AW, Ko Ko TW, Darrah RG (2024) Notes on the ecological distribution of the myxomycete *Arcyria globosa*. **MycoAsia 2024/04**.

Received: 01.08.2024 | **Accepted**: 26.10.2024 | **Published**: 28.10.2024 | **Handling Editor**: Dr. Belle Damodara Shenoy | **Reviewers**: Dr. Preeti Phate, Dr. Thomas Edison E. dela Cruz

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In their classic monograph, Martin and Alexopoulos (1969) described the usual habitat of the myxomycete *Arcyria globosa* Weinm. as "old chestnut burs" and indicated that "with the nearly complete destruction of the American chestnut (*Castanea dentata* [Marshall) Borkh.], this species, formerly common, has become very rare in the eastern United States." Hagelstein (1944) also referred to the fact that "this species was very common formerly, often associated with *Craterium concinnum* Rex on fallen chestnut burs." However, the association of *A. globosa* with chestnut burs was not absolute, since Hagelstein went on to indicate that he had found it on two occasions on the dead leaves of chestnut oak (*Quercus montana* Willd.). Nevertheless, there seems to be little question that *A. globosa* displayed a clear preference for the substrate represented by chestnut burs that had fallen to the ground, where the individual sporocarps could be found on the projecting spines that characterize the distinctive type of cupule ("bur") produced by American chestnut (Figure 1).

Figure 1. Distinctive type of spiky cupule ("bur") produced by American chestnut (*Castanea dentata*). Scale bar = 2 cm.

American chestnut was once one of the most abundant trees in the forests of eastern North America, where it probably made up 40% of the canopy in many areas (Stephenson et al. 1993). The introduction into North America from Asia of the chestnut blight fungus (*Cryphonectria parasitica* [Murrill] Barr) at the very

e-ISSN: 2582-7278
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beginning of the twentieth century was an ecologically significant event for American chestnut. The fungus proved to be a highly virulent pathogen, and this tree species was virtually eliminated from the forest canopy by the late 1940s. Although some individuals of American chestnut still survive as root sprouts in the forests in which the species was once dominant, only rarely do these reach the size and age to produce burs (Stephenson et al. 1991). In more than 50 years of collecting, one of us (Stephenson) has observed sporocarps of *A. globosa* occurring naturally on chestnut burs only once, although the species has been recorded from moist chamber cultures prepared with portions of the burs of Chinese chestnut (*C. mollissima* Blume).

There are relatively few records of *Arcyria globosa* from the tropics. In her monograph on Neotropical myxomycetes, Farr (1976) listed the species for Brazil, Columbia, and Puerto Rico. Schnittler et al. (2002) added Ecuador, and Camino et al. (2008) added Cuba. All of these records were mentioned by Lado and Wrigley de Basanta (2008) in their review of Neotropical myxomycetes.

During the period of 2010 to 2012 surveys for myxomycetes were carried out throughout northern Thailand (Ko Ko et al. 2010, Stephenson, unpub. data). These surveys involved both specimens of myxomycetes collected in the field as well as those obtained with the use of moist chamber cultures (*sensu* Stephenson and Stempen 1994) and were based at the Mushroom Research Center (MRC) north of the city of Chiang Mai (Rojas and Stephenson 2024). Forests in this region of Thailand are often dominated by genera that belong to the families Dipterocarpaceae and Fagaceae. Members of the genus *Castanopsis* in the Fagaceae are not uncommon in these forests. Some members of *Castanopsis* produce a bur that is strikingly similar to that produced by *Castanea dentata* (Figure 2).

Figure 2. Spiky cupule produced by *Castanopsis indica*, which is similar to the cupule produced by American chestnut. Scale bar = 2 cm.

During collecting carried out in a forest in northern Thailand during the 2011 field season, old fallen burs of *Castanopsis indica* (Roxb. ex Lindl.) A.DC. were sometimes found to have scattered sporocarps of what was tentatively identified in the field as *A. globosa* present (Figure 3). These specimens of *A. globosa* were returned to the Eumycetozoan Laboratory at the University of Arkansas for additional study and then deposited in the herbarium (UARK) of the university.

The exact locality where the specimens of *Arcyria globosa* were collected was a Dipterocarpus-Castanopsis forest (19°06.623N, 98°44.388 E, elevation ca 1075 m) on a ridgetop NE of the Pathammikaram Temple, approximately 60 km north of the city of Chiang Mai. The specimens (designated as MFLU0828, MFLU0829, MFLU0830, MFLU0836 and MFLU0837) were collected on 30 June 2011.

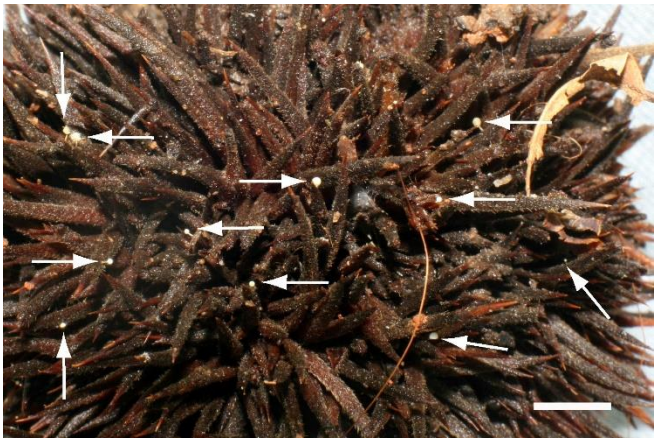

Figure 3. Sporocarps of *Arcyria globosa* on the spines of the cupule of *Castanopsis indica*. Scale bar = 5 cm.

Later, several specimens were sent to Oleg Shchepin at the University of Greifswald in Germany for sequencing. Based on data for 18S rRNA gene, the specimens from Thailand group together with a specimen of *A. globosa* from Cuba (Camino et al. 2008). However, their sequences differ from sequences of this species in GenBank. There are too few sequences available for *A. globosa* to reach any definitive conclusions, but it seems likely that what is currently recognized as the *A. globosa* morphospecies consists of several biological species.

As already noted, the genus *Castanopsis* belongs to the same family (the Fagaceae) as *Castanea*. *Castanea* occurs throughout temperate regions of eastern North America, western Europe, and eastern Asia. In contrast, members of the genus *Castanopsis* are restricted to

e-ISSN: 2582-7278
https://doi.org/10.59265/mycoasia.2024-04

tropical and subtropical regions of eastern and southeast Asia. As already noted, both *Castanea* and *Castanopsis* produce spiky cupules (burs) that are rather similar morphologically.

Although there are records of *A. globosa* from forest floor litter at two known localities in the Neotropics (Schnittler et al. 2002, Camino et al. 2008) and three localities in the Philippines (Macabago et al. 2012, Dagamac et al. 2017, Bernardo et al. 2018), our observations in Thailand suggest that this species appears to display a particular affinity for the burs of *Castanopsis* in the same manner as it does for *Castanea dentata* in temperate regions of the Northern Hemisphere. The burs produced by the two trees are remarkably similar. Both have sharply pointed spines and range in diameter from about 2.5 to 7.5 cm, with the burs of *Castanopsis* sometimes reaching a slightly larger size than those of *Castanea dentata* (Figures 1 and 2). The basis for this seemingly remarkable ecological distribution is completely unknown. Many species of myxomycetes are generalists, occurring on a wide range of different habitats. However, other species are known to have a more limited distribution with respect to the habitats on which they are found. For example, succulenticolous myxomycetes are rarely collected from substates other than succulent plants such as cacti. Because of the relative rarity of *Arcyria globosa*, the substrate specificity displayed by this species cannot be fully assessed, but there is no question that the first place to look for it is on spiky cupules (burs) produced by trees in the family Fagaceae.

Acknowledgements
Appreciation is extended to Oleg Shchepin at the University of Greifswald in Germany for sequencing the specimens of *Arcyria globosa*. The research described herein was funded in part by grant OISE-1042602 from the National Science Foundation of the United States.

Declaration of Competing Interest
The authors declare that there are no competing interests with the people and places mentioned in this manuscript.

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