First records of myxomycetes from Ascension Island

Steven L. Stephenson

Department of Biological Sciences, University of Arkansas, Fayetteville, Arkansas 72701

Stephenson, S. L. (2009) First records of myxomycetes from Ascension Island. Sydowia 61 (1): 105–115.

Ascension Island (7° 57' S, 14° 22' W) is a small (total area of only 98 km^2), isolated island in the South Atlantic, located approximately 1600 km from the coast of Africa. Although much of the biota is relatively well documented, groups such as the myxomycetes (plasmodial slime molds or myxogastrids) remain understudied or even unknown. During early March of 2007, specimens of myxomycetes that had fruited in the field under natural conditions and samples of dead plant material for laboratory isolation of these organisms in moist chamber cultures were collected at a number of localities on Ascension Island. As a result of this effort, 36 species representing 17 genera were recorded. Presumably, most of these reached the island as a result of long-distance dispersal by wind, but some species may have arrived along with the large-scale introductions of various plants that have occurred over the past two centuries.

Ascension Island (7° 57' S, 14° 22' W) is a small (total area of only 98 km^2), isolated island in the South Atlantic, located approximately 1600 km from the coast of Africa. The island is a dependency of the British overseas territory of Saint Helena, which is situated 1287 km to the southeast. Ascension Island is the tip of a 3200 m high, 60 km wide shield volcano, and the oldest exposed rocks date to only about 1 million years ago. When the island was discovered in 1501, it was almost entirely barren, with a sparse flora consisting of no more than about 20–30 species of vascular plants (Ashmole & Ashmole 2000). Since then, large-scale introductions of many different kinds of plants have occurred, and the island now represents a good example of terraforming as the term might be used in a terrestrial context (Wilkinson 2004).

Although much of the biota of Ascension Island is relatively well documented, this is not the case for groups such as the myxomycetes (plasmodial slime molds or myxogastrids). The myxomycetes are a group of eukaryotic microorganisms usually present and sometimes abundant in terrestrial ecosystems. Myxomycetes have been known from their fruiting bodies since at least the mid-17th century, and

their life history has been understood for more than a century (Martin & Alexopoulos 1969). Approximately 875 species are known (Lado 2001), with about 100 of these having been described in the past 25 years. The primary microhabitats for myxomycetes are decaying coarse woody debris, ground litter (dead plant parts on the ground), aerial litter (dead but still attached plant parts above the ground) and the bark surface of living trees (Stephenson & Stempen 1994). Most species of myxomycetes are thought to be cosmopolitan, although some may be restricted to the tropics and subtropics and others appear to be strictly temperate. The greatest biodiversity of myxomycetes is known from temperate forests of the Northern Hemisphere, but they also inhabit deserts, grasslands, alpine areas at high elevations, coniferous forests and tundra at high latitudes, and tropical forests (Alexopoulos 1963, Stephenson & Stempen 1994). The large number of species known from temperate regions undoubtedly reflects, at least in part, the concentration of collector activity, but results from recent studies of Neotropical forests (e.g., Schnittler & Stephenson 2000, Stephenson *et al.* 2004) suggest that biodiversity of myxomycetes is lower in tropical forests than in temperate forests. As might be expected, based on what is known for other organisms, overall biodiversity of myxomycetes appears to be lowest in high-latitude regions of the world (Stephenson *et al.* 2000).

Myxomycete fruiting bodies can achieve macroscopic dimensions (usually no more than 1–2 mm tall in most species but sometimes as much as several centimeters or more in total extent) and be collected and preserved for study in much the same way as the ascomata or basidiomata of fungi or even specimens of bryophytes, lichens and vascular plants. However, most species of myxomycetes tend to be rather inconspicuous or sporadic in their occurrence and thus not always easy to detect in the field. Moreover, fruiting bodies of most species are relatively ephemeral and do not persist in nature for very long. The moist chamber culture technique as it applies to myxomycetes (Gilbert & Martin 1933, Stephenson & Stempen 1994) provides a convenient and often very productive method of supplementing field collections when studying such microhabitats as aerial litter, ground litter and bark.

The primary objective of the project described herein was to carry out a preliminary survey for myxomycetes on Ascension Island, where there appear to be no previous records for any member of this group of organisms. A secondary objective was to obtain data relating to the distribution and ecology of the species present on the island and to consider the ways in which they may have been introduced. Samples of soil/humus and dead plant material for laboratory isolation of two other groups of eumycetozoans (dictyostelids and protostelids) were collected during the survey for myxomycetes, and

the species recorded from these samples were reported in an earlier paper (Landolt *et al.* 2008).

Materials and Methods

During early March of 2007, specimens of myxomycetes that had fruited in the field under natural conditions and samples of various types of dead plant material (aerial litter, ground litter and the bark from living trees and shrubs) for laboratory isolation of myxomycetes were collected at a number of localities on Ascension Island. All localities were referenced to geographic location through the use of the NAVSTAR Global Positioning System (GPS), with latitude and longitude determined by means of a portable GPS unit.

Samples of dead plant material were examined for myxomycetes using the moist chamber culture technique as it applies to these organisms (Stephenson & Stempen 1994). Moist chambers consisted of disposable plastic Petri dishes (100 mm diam.) lined with filter paper. Samples were moistened with distilled water adjusted to pH 7.0 with KOH. After a period of approximately 24 hours, the pH of each culture was measured using a flat plate electrode and an Orion model 610 pH meter. After pH had been determined, excess water in each dish was removed. Cultures were kept at room temperature (22–25 °C) in diffuse daylight and examined with a stereomicroscope on a regular basis for a period of up to three months. When necessary, a small amount of water was added to each culture to maintain moist conditions. Myxomycete plasmodia and/or fruiting bodies were noted and recorded each time the cultures were checked. All fruiting bodies were air-dried and glued in small pasteboard boxes for permanent storage.

Results

Samples of dead plant material collected in the present study were used to prepare a total of 131 moist chamber cultures, and 116 of these (89.5 %) produced some evidence (either plasmodia or fruiting bodies) of myxomycetes. The average yield per culture was 1.3 species. Altogether, 36 species representing 17 genera were recorded from Ascension Island. Three of these were recorded as field collections, and 34 species were recovered from moist chamber cultures. Members of the genus *Physarum* were the most common, with nine different species being recorded, and almost half (47 %) of the myxomycetes now known to occur on Ascension Island belong to the order Physarales.

Annotated list of species

In the list that follows, myxomycetes recorded from Ascension Island are arranged alphabetically by genus and then species. Information is provided on the source of each record (either a field collection [fc] or a collection obtained from a moist chamber [mc] culture), the pH of the culture in which the specimen appeared, the substrate upon which it was collected or cultured and the locality from which the specimen itself or the sample of dead plant material used to prepare the moist chamber culture was collected. Nomenclature follows Lado (2001) and Hernández-Crespo & Lado (2005), with the conserved names of several genera (Lado *et al.* 2005) approved recently by the Committee for Fungi (Gams 2005) of the IAPT. The abbreviation 'cf.' in the name of a taxon indicates that the specimen representing the source of the record could not be identified with certainty. This usually indicates scanty or aberrant material. Specimens listed herein (a maximum of three for a particular species) are deposited in the herbarium of the University of Arkansas (UARK). Collection numbers are those of the author. Nomenclature used for vascular plants follows Packer (2002).

Arcyria cinerea (Bull.) Pers.

Collections examined: 22288, ground litter (mc, pH 6.4), planted palms near Devil's Ashpit; 22356, twigs on the ground (mc, pH 5.6), overlook to Devil's Ashpit; 22385, aerial litter (mc, pH 6.3), along trail to The Pines (a planted forest of *Araucaria excelsa*).

Arcyria* cf. *denudata (L.) Wettst.

Collection examined: 22382, aerial twig (mc, pH 6.5), along trail to the summit of Green Mountain.

Badhamia melanospora Speg.

Collections examined: 22029, 22031, 22060; dead cactus (*Opuntia vulgaris*?) pad (fc), along road to Two Boats, 12 March 2007.

Comments: This species commonly occurred on the lower surface of dead cactus pads in contact with the ground, and several collections consisted of > 100 sporocarps The fact that *Badhamia melanospora* is often associated with decaying cacti has been noted in a number of studies (e.g., Novozhilov *et al.* 2003) carried out in arid areas of North America where these plants occur.

Calomyxa metallica (Berk.) Nieuwl.

Collections examined: 22343, 22384; *Juniperus bermudiana* bark (mc, pH 6.2 and 6.3), along road to Devil's Ashpit; 22371, *Casuarina equisetifolia* bark (mc, pH 4.5), along road to Devil's Ashpit

Collaria arcyrionema (Rostaf.) Nann.-Bremek.

Collections examined: 22357, twigs on the ground (mc, pH 5.6), overlook to Devil's Ashpit; 22364, decaying inflorescence of *Alpinia speciosa* (mc, pH 5.8),

along trail to summit of Green Mountain; 22408, ground litter (mc, pH 6.2), Elliott Trail on Green Mountain.

Comatricha* cf. *elegans (Racib.) G. Lister

Collection examined: 22400, ground litter (mc, pH 4.3), planted palms near Devil's Ashpit.

Cribraria confusa Nann.-Bremek. & Y. Yamam.

Collection examined: 22388, palm litter (mc, pH 4.7), planted palms along road to Devil's Ashpit.

Cribraria microcarpa (Schrad.) Pers.

Collection examined: 22589, twigs on the ground (mc, pH 6.1), along trail to summit on Green Mountain.

Cribraria violacea Rex

Collections examined: 22391, ground litter (mc, pH 6.4), planted palms near Devil's Ashpit; 22448, aerial litter (mc, pH 6.2), along road below Garden Cottage on Green Mountain; 22486, ground litter (mc, pH 6.6), Elliott Trail on Green Mountain.

Diachea leucopodia (Bull.) Rostaf.

Collections examined: 22291, 22361; ground litter (mc, 5.0 and 5.1), Middleton Ridge on Green Mountain; 22389, ground litter (mc, pH 5.0), along trail to summit of Green Mountain.

Diderma effusum (Schwein.) Morgan

Collections examined: 22387, *Casuarina equisetifolia* bark (mc, pH 5.4), along road to Devil's Ashpit; 22437, ground litter (mc, pH 6.4), The Pines; 22449, fern (*Asplenium ascensionis*) aerial litter (mc, pH 5.5), Old Marine Barracks on Green Mountain.

Diderma hemisphaericum (Bull.) Hornem.

Collections examined: 22416, aerial litter (mc, pH 5.5), along road below Garden Cottage on Green Mountain.

Didymium anellus Morgan

Collections examined: 22312, 22316; aerial litter (mc, pH 6.3), along trail to The Pines.

Didymium* cf. *clavus (Alb. & Schwein.) Rabenh.

Collections examined: 22306, 22314; aerial litter (mc, pH 6.2 and 6.3), along road below Garden Cottage on Green Mountain; 22328, ground litter (mc, pH 7.4), overlook to Devil's Ashpit.

Comments: The collections obtained in the present study consist of only a few sporocarps in which the sporotheca is relatively less discoid than is typical for *Didymium clavus*. As such, it is possible that they represent some other species.

Didymium squamulosum (Alb. & Schwein.) Fr.

Collections examined: 22290, ground litter, Elliot Trail on Green Mountain; 22380, decaying inflorescence of *Agave americana* (mc, pH 6.30), lower portion of Grazing Valley along road to the old NASA site.

Echinostelium minutum de Bary

Collections examined: 22286, 22287; bark of unidentified tree (mc, pH 5.5 and 5.6), The Pines.

Fuligo cinerea (Schwein.) Morgan

Collections examined: 22336, 22365; dead inflorescence of *Agave americana* (mc, pH 6.3 and 6.9), lower portion of Grazing Valley along road to the old NASA site; 22451, aerial litter (pH 6.1), along trail to summit of Green Mountain.

Hemitrichia pardina (Minakata) Ing

Collection examined: 22434, aerial litter (mc, pH 6.2), along trail to summit of Green Mountain.

Lamproderma scintillans (Berk. & Broome) Morgan

Collections examined: 22359, aerial litter (mc, pH 6.5), Dew Pond on Green Mountain; 22373, ground litter (mc, pH 6.1), Elliott Trail on Green Mountain; 22417, aerial litter (mc, pH 5.7), Elliott Trail on Green Mountain.

Licea biforis Morgan

Collections examined: 22302, aerial litter (mc, pH 6.3), Middleton Ridge on Green Mountain; 22407, aerial litter (mc, pH 4.3), overlook to Devil's Ashpit; 22575, ground litter (pH 5.6), Elliott Trail on Green Mountain.

Licea pedicellata (H. C. Gilbert) H. C. Gilbert

Collection examined: 22301, *Casuarina equisetifolia* bark (mc, pH 4.5), along road to Devil's Ashpit.

Perichaena chrysosperma (Curr.) Lister

Collections examined: 22369, fern aerial litter (mc, pH 5.6), Old Marine Barracks on Green Mountain; 22421, aerial litter (mc, pH 5.7), Elliott Trail on Green Mountain; 22616, ground litter (mc, pH 5.6), Elliott Trail on Green Mountain.

Perichaena corticalis (Batch.) Rostaf.

Collections examined: 22304, 22305, 22315; aerial litter (mc, pH 5.6–6.3), along road below Green Cottage on Green Mountain.

Perichaena depressa Lib.

Collections examined: 22358, aerial litter (mc, pH 6.2), along trail to Dampier's Drip; 22381, aerial litter (mc, pH 6.5), along trail to summit on Green Mountain; 22426, *Juniperus bermudiana* bark (mc, pH 5.2), Elliott Trail on Green Mountain.

Perichaena vermicularis (Schwin.) Rostaf.

Collection examined: 22342, aerial litter (mc, pH 6.20), Middleton Ridge on Green Mountain.

Physarum cinereum **(**Batsch.) Pers.

Collections examined: 22372, aerial litter (mc, pH 5.7), along Elliott Trail on Green Mountain; 22453, aerial litter (mc, pH 6.2), Middleton Ridge on Green Mountain.

Physarum compressum Alb. & Schwein.

Collections examined: 22309, ground litter (mc, pH 6.5), along trail to summit on Green Mountain; 22313, aerial litter (mc, pH 6.3), road below Green Cottage on Green Mountain; 22340, decaying inflorescence of *Alpinia speciosa* (mc, pH 5.8), along trail to summit of Green Mountain.

Physarum crateriforme Petch.

Collections examined: 22299, 22331, 22429; *Juniperus bermudiana* bark (mc, pH 6.0–6.8), near old NASA site on road to Devil's Ashpit.

Physarum didermoides (Pers.) Rostaf.

Collections examined: 22370, aerial litter (mc, pH 5.5), along road to Two Boats; 22377, ground litter (mc, pH 5.0), along road to Two Boats; 22410, aerial litter, lower portion of Grazing Valley along road to the old NASA site.

Physarum melleum (Berk. & Broome) Massee

Collections examined: 22376, aerial litter (mc, pH 6.1), Dew Pond on the summit of Green Mountain; 22405, aerial litter (mc, pH 6.1), along trail to the summit of Green Mountain; 22424, aerial litter (mc, pH 5.7), along Elliott Trail on Green Mountain.

Physarum pusillum (Berk. & M. A. Curtis) G. Lister

Collections examined: 22303, 22392; aerial litter (mc, pH 5.6 and 6.3), along road below Garden Cottage on Green Mountain; 22324, decaying inflorescence of *Agave americana* (mc, pH 6.3), lower portion of Grazing Valley along road to the old NASA site.

Physarum serpula Morgan

Collections examined: 22332, 22425; bark of unidentified tree (mc, pH 6.2), planted palms near old NASA site on road to Devil's Ashpit; 22339, twigs on the ground (mc, pH 5.9), overlook to Devil's Ashpit.

Physarum superbum Hagelst.

Collections examined: 22420, ground litter (mc, pH 6.2), Elliott Trail on Green Mountain; 22446, aerial litter (mc, pH 6.2), along road below Garden Cottage on Green Mountain; 22546, decaying inflorescence of *Alpinia speciosa* (mc, pH 6.1), along trail to summit of Green Mountain.

Physarum viride (Bull.) Pers.

Collection examined: 22025, dead bark (fc), The Pines, 11 March 2007; same locality and date, decaying wood (fc), 22028.

Comments: This is an extremely common and widespread species, and the first of the two collections cited above (22025) is typical in every respect. The second collection (22028) is a relatively old fruiting in which the sporocarps had been colonized by a fungus. The features that could be observed appeared to conform most closely to *Physarum viride*, but it is possible that this material represents another species.

Stemonitis fusca Roth

Collections examined: 22024, dead bark (fc), The Pines, 11 March 2007; 22346, decaying inflorescence of *Alpinia speciosa* (mc, pH 6.1), along trail to summit on Green Mountain; 22454, aerial litter (mc, pH 6.1), along trail to Dampier's Drip.

Comments: The two collections (22346 and 22454) obtained from moist chamber cultures would key out to *Stemonitis fusca* var. *nigrescens* (Rex) Torrend on the basis of the size (< 5 mm tall) of the sporocarps. This variety is sometimes considered to represent a distinct species, *S. nigrescens* Rex.

Stemonitopsis hyperopta (Meyl.) Nann.-Bremek.

Collection examined: 22539, *Eucalyptus camaldulensis* bark (mc, pH 5.2), Middleton Ridge on Green Mountain.

Comments: The collection (22539) cited above consists of just a few sporocarps in which the sporotheca is more elongated than is typical for *Stemonitopsis hyperopta*. However, the spores are pale lilac, generally 5.0–5.5 µm in diameter and marked with a close-meshed reticulation. All of these are features associated with this species.

Discussion

It has long been recognized that various small particles, including dust, spores, bacteria and other microbes, can be carried long distances by wind. For example, the British mycologist Berkeley (1857) concluded that the trade winds, for instance, carry spores of fungi mixed with their dust, which may have traveled thousands of miles before they are deposited. A process that could introduce enormous numbers of microorganisms into the atmosphere was identified in the late 1990's, when satellite images revealed the astonishing magnitude by which desert soils are aerosolized into giant clouds of dust (Griffin *et al.* 2001, 2002; Kellogg & Griffin 2006). These clouds of dust frequently move from the deserts of northern Africa across the Atlantic Ocean and reach the Caribbean, Central America, northern South America and the southeastern United States, where the particles they contain (including spores) are deposited. Similar long-range movements of dust have been demonstrated for other parts of the world, including from Asia across the Pacific Ocean to western North America and from Australia to New

Zealand. Clearly, airborne spores would have the potential of being dispersed by wind over considerable distances. Muñoz *et al.* (2004), who evaluated the possible role that wind might play in long-distance dispersal of mosses, liverworts, lichens and pteridophytes among land masses in the Southern Hemisphere, found that floristic similarities were more strongly correlated with global wind patterns than geographic proximity. For the most part, the land masses considered in this study were the small, rather isolated islands in the Southern Ocean, for which the groups of organisms being considered are well documented. Although myxomycetes were not among the groups of organisms for which floristic comparisons were carried out, the overall results reported would seem to lend support for the idea that myxomycetes could have reached these same islands as a result of long-distance dispersal by wind. The data available for one of the islands (Macquarie Island, located south of Tasmania) indicate that it is characterized by a relatively diverse assemblage of myxomycetes (Stephenson *et al.* 2007). In the same way, diverse assemblages of myxomycetes also are known to occur on the isolated Hawaiian Islands (Eliasson 1991, 2004), the Galápagos Islands (Eliasson 1971, Eliasson & Nannenga-Bremekamp 1983) and Cocos Island in the Pacific Ocean (Rojas & Stephenson 2008).

If the spores of myxomycetes are largely wind-dispersed, as is generally considered to be the case (Alexopoulos 1963), then the global wind patterns noted above would give them considerable potential for long-distance dispersal over the expanses of ocean that separate Ascension Island from the continents of Africa and South America (Stephenson *et al.* 2008, Landolt *et al.* 2008). However, it is also possible that myxomycetes may have been introduced to the island along with the large-scale introductions of various plants that have occurred over the past two centuries. As the results obtained from moist chamber cultures in the present study and numerous previous studies (e.g., Stephenson 1989, Schnittler & Stephenson 2000) clearly indicate, the spores and/or microcysts of myxomycetes are consistently present on all types of plant material. As such, it would have been virtually impossible to have imported plants to Ascension Island without also inadvertently introducing myxomycetes. Obviously, there is no way of knowing just how the members of the assemblage of species now known to occur on the island arrived, although many of the microhabitats from which samples were collected in the present study did not exist prior to the terraforming that has characterized large areas of Ascension Island over the past two centuries. This would suggest that the introduction and subsequent establishment of an appreciable number of species of myxomycetes on an isolated island is a process that requires relatively little time in which to occur.

Acknowledgements

This study was supported in part by a grant from the National Science Foundation. Appreciation is extended to Susanna Musick and Stedson Stroud of Ascension Island Conservation for supplying information on collecting sites and various aspects of the biota of Ascension Island and to David Mitchell and Gabriel Moreno for helping confirm the identification of some of the specimens reported in this paper.

References

Alexopoulos, C. J. (1963) The myxomycetes II. *Botanical Review* **29**: 1–78.

Ashmole P., Ashmole M. (2000) *St. Helena and Ascension Island: a natural history.* Anthony Nelson, Oswestry.

Berkeley, M. J. (1857) *Introduction to Cryptogamic Botany.* H. Bailliere, London.

Eliasson U. (1971) A collection of Myxomycetes from the Galápagos Islands. *Svensk Botanisk Tidskrift* **65**: 105–111.

Eliasson U. H. (1991) The myxomycete biota of the Hawaiian Islands. *Mycological Research* **95**: 257–267.

Eliasson U. H. (2004) A critical review of myxomycete records from the Hawaiian Islands. *Systematics and Geography of Plants* **74**: 81–86.

Eliasson U. H., Nannenga-Bremekamp N. E. (1983) Myxomycetes of the Scalesia forest, Galápagos Islands. *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Ser. C*, **86**: 143–153.

Gams W. (2005) Report of the Committee for Fungi: 13. *Taxon* **54**: 828–830.

Gilbert H. C., Martin G. W. (1933) Myxomycetes found on the bark of living trees. *University of Iowa Studies in Natural History* **15**: 3–8.

Griffin D. W., Kellogg C. A., Garrison V. H., Shinn E. A. (2002) The global transport of dust. *American Scientist* **90**: 230–237.

Griffin D. W, Kellogg C. A., Shinn E. A. (2001) Dust in the wind: long range transport of dust in the atmosphere and its implications for global public and ecosystem health. *Global Change and Human Health* **2**: 20–33.

Hernández-Crespo J. C., Lado C. (2005) An on-line nomenclatural information system of Eumycetozoa. http://www.nomen.eumycetozoa.com (24-X-2005).

Kellogg C. A., Griffin D. W. (2006) Aerobiology and the global transport of desert dust. *Trends in Ecology and Evolution* **21**: 638–644.

Lado C. (2001) Nomenmyx. A Nomenclatural Taxabase of Myxomycetes. *Cuadernos de Trabajo Flora Micológica Ibérica* **16**: 1–221.

Lado C., Eliasson U., Stephenson S. L., Estrada-Torres A., Schnittler M. (2005) Proposals (1688–1691) to conserve the names *Amaurochaete* against *Lachnobolus*, *Ceratiomyxa* against *Famintzinia*, *Cribraria* Pers. against *Cribraria* Schrad. ex J. F. Gmel. and *Hemitrichia* against *Hyporhamma* (Myxomycetes). *Taxon* **54**: 543–545.

Landolt J. C., Shadwick J. D., Stephenson S. L. (2008). First records of dictyostelids and protostelids from Ascension Island. *Sydowia* **60**: 235–245.

Martin G. W., Alexopoulos C. J. (1969) *The Myxomycetes*. University of Iowa Press, Iowa City.

Muñoz J., Felicisimo A. M., Cabezas F., Burgaz A. R., Martinez I. (2004) Wind as a long-distance dispersal vehicle in the Southern Hemisphere. *Science* **304**: 1144–1147.

Novozhilov Y. K., Mitchell D. W., Schnittler M. (2003) Myxomycete biodiversity on the Colorado Plateau. *Mycological Progress* **2**: 243–258.

Packer J. E. (2002) *A concise guide to Ascension Island, South Atlantic*. The Ascension Island Heritage Society, Ascension Island.

Rojas C., Stephenson S. L. (2008) Myxomycete ecology along an elevation gradient on Cocos Island, Costa Rica. *Fungal Diversity* **29**: 117–127.

Schnittler M., Stephenson S. L. (2000) Myxomycete biodiversity in four different forest types in Costa Rica. *Mycologia* **92**: 626–637.

Stephenson S. L. (1989) Distribution and ecology of myxomycetes in temperate forests. II. Patterns of occurrence on bark surface of living trees, leaf litter, and dung. *Mycologia* **81**: 608–621.

Stephenson S. L., Laursen G. A., Seppelt R. D. (2007) Myxomycetes of subantarctic Macquarie Island. *Australian Journal of Botany* **55**: 439–449.

Stephenson S. L., Novozhilov Y., Schnittler M. (2000) Distribution and ecology of myxomycetes in high-latitude regions of the northern hemisphere. *Journal of Biogeography* **27**: 741–754.

Stephenson S. L., Schnittler M., Lado C., Estrada-Torres A., Wrigley de Basanta D., Landolt J. C., Novozhilov Y. K., Clark J., Moore D. L., Spiegel F. W. (2004) Studies of Neotropical mycetozoans. *Systematics and Geography of Plants* **74**: 87–108.

Stephenson S. L., Schnittler M., Novozhilov Y. K. (2008) Myxomycete diversity and distribution from the fossil record to the present. *Biodiversity and Conservation* **17**: 285–301.

Stephenson S. L., Stempen H. (1994) *Myxomycetes: a Handbook of Slime Molds*. Timber Press, Portland, Oregon.

Wilkinson D. M. (2004) The parable of Green Mountain: Ascension Island, ecosystem construction and ecological fitting. *Journal of Biogeography* **31**: 1–4.

(Manuscript accepted 20 April 2009; Corresponding Editor: R. Pöder)