Myxomycetes associated with two types of grasslands in northwest Arkansas

HAYDEN E. FISCHER
STEVEN L. STEPHENSON
Department of Biological Sciences
University of Arkansas
Fayetteville, Arkansas 72701, USA
Email: slsteph@uark.edu

Accepted 12. August 2014

Key words: slime molds, ecology, microhabitats, moist chamber cultures. – Myxomycetes of USA.

Abstract: The moist chamber culture technique was used to investigate the myxomycetes associated with two types of grassland (managed grassland and semi-natural grassland) in Pea Ridge National Military Park in northwest Arkansas. Seventeen species of myxomycetes representing 10 genera were recorded from the 95 fruitings appearing in a total of 100 moist chamber cultures (50 for each type of grassland). *Arcyria cinerea* (19 records) was the single most abundant species, and seven other species were represented by >5 records. The managed grassland was more productive than the semi-natural grassland, and differences in abundance for the two types of grasslands were clearly apparent for several species of myxomycetes.

Zusammenfassung: Die Feuchte-Kammer-Kulturtechnik wurde verwendet, um die Myxomyceten zu untersuchen, die mit zwei unterschiedlichen Typen von Grünland (bewirtschaftet und naturnah) im Pea Ridge National Military Park im Nordwesten von Arkansas assoziiert sind. Es konnten 17 Schleimpilzarten aus 10 Gattungen von den 95 Fruktifikationen, die in den 100 feuchten Kammern (50 für jeden Grünlandtyp) auftraten, aufgezeichnet werden. *Arcyria cinerea* (19 Einträge) war die einzige sehr häufige Art; sieben weitere Arten waren mit > 5 Einträgen vertreten. Das bewirtschaftete Grünland war produktiver als das naturnahe. Unterschiede in der Abundanz für die beiden Grünlandtypen waren bei mehreren Schleimpilzarten klar ersichtlich.

The myxomycetes (also referred to as myxogastrids or plasmodial slime molds) are a group of fungus-like organisms that have been known from their fruiting bodies since at least the mid-17th century (MARTIN & ALEXOPOULOS 1969, STEPHENSON 2011). Approximately 900 species are known (LADO 2005–2014), and some of these apparently occur anywhere on earth where there are plants and thus plant detritus. However, most species are inconspicuous or sporadic in their occurrence and thus often difficult to detect in the field. As such, the moist chamber culture technique as it applies to myxomycetes (GILBERT & MARTIN 1933) provides a convenient and often very productive method of supplementing field collections, especially in habitats such as grasslands in which field collections are uncommon (STEPHENSON 1989, ROLLINS & STEPHENSON 2013).

Myxomycetes are most abundant in forests, where their fruiting bodies are found associated with such microhabitats as decaying coarse woody debris and forest floor leaf litter. However, both the diversity and abundance of these organisms appear to be

relatively low in grasslands. In the most extensive study carried out to date, ROLLINS & STEPHENSON (2013) reported 59 species in 18 genera for nine study sites in the grasslands of the western central United States. These numbers are appreciably lower than what would be expected for a comparable number of study sites in forest ecosystems (STEPHENSON 1988, 1989). However, some of the species they reported seemed to be largely restricted to grasslands and only rarely encountered in forests.

Pea Ridge National Military Park (36º 27’ 16” N, 94 º 02’ 03” W) is a unit of the United States National Park Service located in extreme northwest Arkansas near the Missouri border. The park protects the site of the Civil War Battle of Pea Ridge, which was fought on 7–8. March 1862 (NATIONAL PARK SERVICE 2014). Pea Ridge National Military Park has a total area of 1727 ha, with approximately 230 ha consisting of regularly mowed (managed) grassland dominated by tall fescue [*Schedonorus arundinaceus* (SCHREB.) DUMORT.]. As a result of recent efforts to reestablish tall grass prairie species that historical records indicate once existed within the boundaries of the present park at the time of the battle, some areas of semi-natural grassland also occur in the park (Fig. 1). The latter are dominated by big bluestem (*Andropogon gerardii* VITMAN) and little bluestem [*Schizachyrium scoparium* (MICHX.) NASH]. In both types of grasslands, various species of exotic and native grasses and broadleaf plants are intermixed with the dominant grasses (DIAMOND & al. 2013).

The overall purpose of the present study was to characterize the assemblages of myxomycetes associated with two types of grassland in northwest Arkansas. Specific objectives were (1) to determine if these relatively small areas of grasslands support the same assemblage of myxomycetes reported for the much more extensive areas of grassland in the western central United States and (2) to assess any differences in the assemblages of species associated with the two types of grassland being considered.

Materials and methods

Five bulk samples of dead grass were collected from each of the two types of grassland in Jan 2014. The samples were returned to the laboratory at the University of Arkansas and allowed to air-dry for five days. Once dried, ten moist chamber cultures were prepared with material from each sample, yielding a total of 50 cultures for the managed grassland and another 50 cultures for the semi-natural grassland. The culture chambers used consisted of 15 cm plastic disposable Petri dishes, each lined with a piece of filter paper. Enough sample material was placed in the dish to cover the bottom as completely as possible yet still allowing a lid to be placed securely on the dish. Distilled water was then added to each Petri dish and the latter left undisturbed for a period of approximately 24 hours, when the pH of what had become a moist chamber culture was determined with a portable pH meter and a flat surface electrode. After the value of pH had been recorded, most of the water in each Petri dish was poured off, and the moist chamber cultures were stacked and placed in an area of the laboratory receiving only diffuse light. Each culture was examined once a week for several months, and water was added when necessary to maintain moist conditions. When fruiting bodies of myxomycetes appeared in a culture, the piece (or pieces) of substrate material upon which they occurred was removed, glued to a small paper tray, and the latter mounted in a pasteboard box for permanent storage. All occurrences of the same species in a single moist chamber culture were considered to represent one record. Identifications were made with the use of standard monographs. Nomenclature used herein for myxomycetes essentially follows LADO (2005–2014) except for *Stemonitis nigrescens*, where the treatment used is that of MARTIN & ALEXOPOULOS (1969). Voucher specimens of all species are deposited in the herbarium of the University of Arkansas (UARK). GENTRY & al. (2013) is the source of the nomenclature used for vascular plants.

Fig. 1. Managed grassland (left) and semi-natural grassland (right) study sites in Pea Ridge National Military Park.

Table 1. Occurrence of myxomycetes in moist chamber cultures prepared with samples from the two types of grassland.

Species	Managed	Semi-natural	Total
Arcyria cinerea	7	12	19
Trichia subfusca	14		14
Lamproderma scintillans	2	9	11
Perichaena chrysosperma	5	5	10
Comatricha pulchella		7	7
Perichaena vermicularis	7		7
Physarum cinereum	7		7
Physarum pusillum	5	1	6
Physarum melleum	1	2	3
Comatricha cf. *nigra*		2	2
Hemitrichia pardina		2	2
Physarum cf. *citrinum*	2		2
Diderma effusum		1	1
Didymium difforme	1		1
Licea operculata		1	1
Physarum bivalve	1		1
Physarum oblatum	1		1
Total	53	42	95

Results

Eighty-four of the 100 moist chamber cultures (84%) yielded some evidence (fruiting bodies or plasmodia) of myxomycetes, and 17 species representing 10 genera were recorded (Table 1). Many fruitings were rather limited in extent, sometimes consisting of only a few sporocarps, which made identification of some species difficult. *Arcyria cinerea* was the single most common species and was recorded from 19 different moist chamber cultures. The other more common species were *Trichia subfusca* (14 records), *Lamproderma scintillans* (11 records) and *Perichaena chrysosperma* (10 records). Only four other species were represented by >5 records, and five species were represented by a single record. Moist chamber cultures prepared with samples from the managed grassland yielded 12 species, whereas those prepared with samples from the semi-natural grassland yielded 10 species.

The total number of positive moist chambers was slightly higher (44) for the managed grassland than the semi-natural grassland (40), and numbers of fruitings followed the same pattern, with 53 for the managed grassland and 42 for the semi-natural grassland. The mean value of pH (5.7, range = 5.4 to 6.9) recorded for cultures prepared with samples from the managed grassland was only slightly lower than the corresponding value (pH = 5.8, range = 5.7 to 6.7) for cultures prepared with samples from the semi-natural grassland.

Discussion

There have been few studies of the myxomycetes associated with grassland ecosystems, with the study by ROLLINS & STEPHENSON (2013) representing the most noteworthy exception. The grasslands considered in the latter study were examples of the three major types of naturally occurring grasslands (tall grass, mixed grass and short grass) found in the western central United States. Although considerably reduced in extent as a result of human activities, especially agriculture, fairly extensive examples of each of the three grassland types still occupy portions of a number of national parks and other protected areas, and these served as study sites in the earlier investigation. In contrast, the two grassland sites used in the present study were relatively limited in extent and were characterized by assemblages of species different from those of the grasslands included in the study by ROLLINS & STEPHENSON (2013), although the semi-natural grassland undoubtedly contained some species shared in common with the tall grass examples they studied. As such, it is not surprising that 12 of the 17 species recorded in the present study were among those reported in this earlier study. Moreover, three of the four most common species we recorded were among the more common species noted by ROLLINS & STEPHENSON (2013). The only exception was *Trichia subfusca*, the second ranking species in the present study but not recorded in the earlier study. Interestingly, this species was not recorded from the semi-natural grassland in the present study but was the single most abundant species in the managed grassland.

Differences in abundance for the two types of grassland also were apparent for several other species. For example, all seven records for both *Perichaena vermicularis* and *Physarum cinereum* were from samples collected in the managed grassland, whereas *Comatricha pulchella* (7 records) was restricted to the semi-natural grassland.

Nine of 11 records of *Lamproderma scintillans* were from the latter grassland, and five of six records of *Physarum pusillum* were from the managed grassland. Indeed, for species represented by enough records for a pattern to be evident, *Perichaena chrysosperma* was the only one equally distributed (with 5 records from each type) in the two types of grasslands, although *Arcyria cinerea* was only slightly more abundant in the semi-natural grassland (12 records) as compared with the natural grassland (7 records).

Just why these differences in distribution and abundance of myxomycetes exist for the two types of grasslands considered in the present study is unknown. As a general observation, the samples from the semi-natural grassland may have contained a greater admixture of broadleaf plants, but all samples from both types of grasslands consisted mostly of grasses. The two study sites are located no more than about two kilometers apart and thus factors related to climate can be discounted. The pH of the substrates upon which myxomycetes occur can affect the distribution of particular species, but the values recorded for two sets of samples did not differ appreciably. As such, the data obtained in the present study would suggest that the taxonomic composition of the assemblage of grasses at a particular site, which also would be reflected in differences in the structure of the grassland community itself (e.g., the semi-natural grassland was observed to be noticeably more dense than the managed grassland), is enough to result in differences in the assemblages of myxomycetes present.

Appreciation is extended to the personnel of Pea Ridge National Military Park for their assistance in making it possible to carry out the study reported herein.

References

DIAMOND, D. D., ELLIOTT, L. F., DEBACKe, M. D., JAMES, K. M., PERSELL, D. L., STRUCKHOFF, A., 2013: Vegetation classification and mapping of Pea Ridge National Military Park. – Natural Resources Report NPS/PERI/NRR 2013/649.

GENTRY, J. L., JOHNSON, G. P., BAKER, B. T., WITSELL, C. T., OGLE, J. D., 2013: Atlas of the Vascular Plants of Arkansas. – University of Arkansas, Department of Printing Services.

GILBERT, H. C., MARTIN, G. W., 1933: Myxomycetes found on the bark of living trees. – Univ. Iowa Stud. Nat. Hist. **15**: 3–8.

LADO, C., 2005–2014: An online nomenclatural information system of *Eumycetozoa*. http://www.nomen.eumycetozoa.com (accessed on 2. August 2014).

MARTIN, G. W., ALEXOPOULOS, C. J., 1969: The myxomycetes. – Iowa City: University of Iowa Press.

NATIONAL PARK SERVICE—PEA RIDGE, 2014: www.nps.gov/peri (accessed 24. June 2014).

ROLLINS, A. W., STEPHENSON, S. L., 2013: Myxomycetes associated with grasslands of the western central United States. – Fungal Divers. **59**: 147–158.

STEPHENSON, S. L., 1988: Distribution and ecology of myxomycetes in temperate forests. I. Patterns of occurrence in the upland forests of southwestern Virginia. – Canad. J. Bot. **66**: 2187–2207.

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., 2011: From morphological to molecular: studies of myxomycetes since the publication of the MARTIN and ALEXOPOULOS monograph. – Fungal Divers. **50**: 21–34.