**Introduction:** The Great Smoky Mountains National Park (GSMNP), which comprises more than 200,000 hectares, serves as a refuge for one of the richest and most diverse biotas in the temperate regions of the world. It also has the largest remaining tracts of old growth forest in Eastern United States, estimated at 40,000 hectares. A new research initiative called the All Taxa Biodiversity Inventory (ATBI) under the rubric of a non-profit organization, Discover Life In America (DLIA), represents a research effort to inventory and identify all of the life forms in the park. Cryptogam sampling for fungi, lichens, mosses, liverworts and ferns in the park has been confined to ground sites. Life in treetops must adapt to different environmental conditions and corticolous Myxomycetes found there are often distinct from the surrounding biotic communities (Keller and Braun, 1999).

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**Discovery of a New Obligate Tree Canopy Myxomycete in the Great Smoky Mountains National Park**

*by Harold W. Keller and Melissa Skrabal*

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**Important Dates**

- **April 15: Deadline: Inoculum 53(3)**
- **June 22-26: MSA 2002, Corvallis OR**

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**MSA Homepage:**

http://msafungi.org
**METHODOLOGY:** The All Taxa Biodiversity Inventory management plan established 20 one-hectare study plots scattered through the park. Site selection was based on major forest/vegetation types, elevation and relative accessibility. Our tree canopy biodiversity study emphasized champion-sized trees of certain species. Some of these trees were up to 55 meters in total height. Safety was emphasized in all of our activities.

Student climbers completed a training school taught by a professional arborist. The double rope climbing technique was used because the climbers could advance to higher levels in the tree canopy. A Big Shot slingshot was used to shoot a slick line (attached to a weighted throw bag) over crotches and branches usually at heights of 18 to 24 meters. A climbing rope was attached to the slick line and pulled over the limb. This rope was tied to a climbing saddle and a friction knot used to vertically ascend the rope. Each tree was climbed was entered in a database used to vertically ascend the rope. Each rope was attached to the slick line and pulled over the limb. This rope was tied to a climbing saddle and a friction knot used to vertically ascend the rope. Each tree climbed was entered in a database that included a tag number for each tree, numbered samples at three meter intervals that included a tag number for each tree, tree climbed was entered in a database used to vertically ascend the rope. Each to a climbing saddle and a friction knot pulled over the limb. This rope was tied to a climbing saddle and a friction knot used to vertically ascend the rope. Each tree climbed was entered in a database that included a tag number for each tree, numbered samples at three meter intervals up to 40 meters measured with elevation lines, diameter at breast height, total height of tree, climber’s name, observations of in situ specimens on the tree trunk, place location description and global positioning system reading, altitude, and weather conditions. All student climbers were given tutorials that included lecture slide shows, demonstration specimens, practice keying, and field experience with experts from the multidisciplinary research team that enabled them to recognize and collect the targeted groups of organisms. A total of 240 trees representing 35 different tree species were climbed during two three-week periods in June, July and August of calendar years 2000 and 2001.

**LABORATORY MOST CHAMBER CULTURES:** Bark samples were scanned by student climbers in the field for plasmodial tracks and myxomycete fruiting bodies. Corticolous myxomycetes that grow on the bark surface or epiphytes on living trees are usually less than 1 mm in diameter. Sometimes the sheer number or bright colors of fruiting bodies makes it easier to see them on the bark but it takes a sharp eye and knowing what to look for to find them. Most field researchers have collected bark samples at about two meters or less so our knowledge of corticolous myxomycetes is based on samples taken near ground level. The moist chamber culture technique was used to process field-collected samples of bark and epiphytes from living trees and vines by placing the bark sample in a sterile petri dish with sterile filter paper lining the bottom of the dish that serves as a wick. The contents were moistened with the addition of 10 ml of sterile glass distilled water. Any excess water was poured off in 24 hours and the cultures incubated at 25°C for up to four weeks. Cultures were examined daily to observe plasmodial and fruiting body development, record data on time of maturation, and harvest fruitings in a fresh fully mature state for preservation and identification (Keller and Braun, 1999).

**TREE CANOPY MYXOMYCETES:** Are there any myxomycete species confined to the upper tree canopy? My (HWK) collecting and climbing experience dating back to the 1960s mostly with Juniperus virginiana (Red Cedar) trees in the midwest and southeastern United States, suggested that myxomycete taxa found on the trunks extended up into the tree canopy. These trees were climbed either with pole climbing spurs and a safety belt or free-handed.

Melissa Skrabal was the Central Missouri State University undergraduate student who discovered the first obligate tree canopy myxomycete, a new species in the genus Diachea. Melissa kept a field diary of her discovery and excerpts are reproduced here.

The drive was only about 10 minutes from the Cades Cove House to the Turkey Pen Ridge Trailhead. We slung our 70-pound gear bags containing a climbing harness, 120-foot rope, slick line, gloves, and more, onto our backs and began the hike up the trail. After hiking slightly more than a mile we came to a fork in the trail. We were impatiently itching to climb the White Oak trees in the area but the trees were about 30 meters tall. I figured we would be up and down the trees in no time and with little accomplished due to their small size. We gave our “Big Shot” slingshot a test run on a White Oak tree. The throw line was shot up so accurately over the first high branch it took only a few minutes to rig the climbing rope. Coordinating all my body parts in a rhythmic upward motion with synchronized pull-ups and pelvic thrusts I was able to reach a height of 6 meters where I secured number 88 to the tree. After filling a small white bag halfway I folded the top edge over and let it cruise to the ground. The ground crew member labeled the sample bag with the appropriate data. An elevation line attached to each climbers harness monitored collection height. These lines were handmade by our ground crew team out of paper dog tags attached every foot to a lightweight line and labeled with a permanent marker. I continued to climb and paused at about 9 meters to take...
would have to be completed. Without any collections and moist chamber culture work more. And Myxomycetes are glorious!Liverworts, Myxomycetes, bugs, and insects exist in microscopic proportions. This project taught me that trees are made of a mosaic of mosses, lichens, liverworts, Myxomycetes, bugs, and more. And Myxomycetes are glorious! project taught me that trees are made of a mosaic of mosses, lichens, liverworts, Myxomycetes, bugs, and more. And Myxomycetes are glorious!project taught me that trees are made of a mosaic of mosses, lichens, liverworts, Myxomycetes, bugs, and more. And Myxomycetes are glorious!project taught me that trees are made of a mosaic of mosses, lichens, liverworts, Myxomycetes, bugs, and more. And Myxomycetes are glorious!

RESULTS: There are three trees, *Quercus alba* (White Oak), *Juniperus virginiana* (Red Cedar) and *Fraxinus americana* (White Ash), in the GMSNP where this taxon was found. All of the sporangia collected in the field were above 3 meters. Approximately 20 moist chamber cultures of bark collected under 3 meters have not yielded the new *Diachea*. These trees have been climbed at least twice and each time the sporangia were found above 9 meters on the White Oak and 4.6 meters on the Red Cedar. The plasmodial tracks on the White Oak tree extended a distance from 9 to 24 meters. This bright yellow phaneroplasmidium migrates all over the upper and lower surfaces of bark, mosses, and the filter paper in the bottom of Petri dishes. Sporangia fruit on the upper and lower bark surface, on the moss phyllidia, on the filter paper and on the side of the plastic Petri dish. All of the *Diachea* species have gorgeous iridescent peridia but this one is striking because of its glittering golden colors and the contrasting pink to reddish orange stalk. The capillitium is attached to the apex of the cubulmella and the spore ornamentation as seen with scanning electron microscopy is unique in the Myxomycetes. What a great experience for an undergraduate student!


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instruction and certification for climbers. More images are displayed on our webpage at [http://www.cmsu.edu/biology/Faculty/keller.html](http://www.cmsu.edu/biology/Faculty/keller.html) and Discover Life in America “Tree Canopy Biodiversity in the Great Smoky Mountains National Park” [http://www.discoverlife.org/nh/tx/Fungi/](http://www.discoverlife.org/nh/tx/Fungi/). Mike Ferro spent many hours preparing our web page. James Murray served as our research project photographer. Keith Langdon from the GSMNP and Jeanie Hilten from Discover Life in America provided assistance with equipment, housing and logistics. The multidisciplinary research team included: Drs. Alex Ciegler, lichenologist, Paul Davison, bryologist (mosses and liverworts), Professor Uno Eliasson, Göteborg University, Sweden, Myxomycetes and vascular plants, Professor Thomas Gaither, Myxomycetes and macrofungi, Ken Nelson, volunteer ecologist, Drs. Jay Raveill, expert on the flora of the GSMNP, David Smith, bryologist, Ted Stampfer, volunteer moist chamber culture specialist. This research project is funded by the National Science Foundation, Division of Environmental Biology, Biotic Surveys and Inventories Program, Award # DEB-0079058 and Discover Life in America Award #2001-26.