New England Botanical Club – Minutes of the 939th Meeting

5 June 1998 Prepared by Dr. Paul Somers, Recording Secretary

The 712th meeting of the New England Botanical Club, being the 939th since the original organization, met on Friday, June 5, 1998 at the Biological laboratories of Harvard University with 39 members and guests present.

The names of three new members were announced by Vice President, Dr. Lisa Standley. Following a number of announcements, Lisa introduced the evening speaker, Dr. Aaron M. Ellison, Fisher Associate Professor of Environmental Studies in the Department of Biological Sciences at Mount Holyoke College, who addressed the topic "Direct Interactions Between Northern Pitcher-plants (*Sarracenia purpurea*) and Their Associated Animal Communities". Following ten years of research on mangroves, his Ph.D. research at Brown University and subsequent work at Mt. Holyoke, Ellison is now launching a new line of research on pitcher plants at Hawley Bog in Franklin County, Massachusetts with the assistance of a grant from the National Science Foundation. His talk dealt with research ideas being explored by himself, students and Nicholas J. Gotelli, a collaborator at the University of Vermont.

The Sarraceniaceae or pitcher plant family, occurs only in the western hemisphere. Members of the family in the genera *Sarracenia, Darlingtonia,* and *Heliamphora* are characterized by pitcher-like leaves that trap water and in it a variety of organisms. How are these pitchers formed? What environmental and physiological factors influence the formation of pitchers? These are among the questions for which the researchers are seeking answers. Using a two hectare sphagnum bog mat at Hawley Bog in Franklin County, Massachusetts as an outdoor research area and with more controlled environments provided by greenhouses, the researchers will attempt to quantify energy and nutrient inputs and outputs from purple pitcher plants, *Sarracenia purpurea*, in order to better understand the factors influencing pitcher formation. These results may be applicable to the eastern hemisphere pitcher-plant families Nepenthaceae and Cephalotaceae.

Ellison presented several perspectives on pitcher plant ecology. From an insect's perspective, pitchers are distributed in a patchy fashion and are of various quality for meeting their needs. The insects themselves play an important role in controlling the quality of these patches. A typical zoologist's view of pitcher plants, he said, is to treat them as a vase-like organisms containing an aquatic ecosystem. Their studies thus far have involved examination of the relationships among protozoans, mosquitoes, flies, rotifers, midges, mites, yeast and bacteria. In a given year, pitcher leaves are colonized by three basic insect communities: one dominated by rotifers and mites, one dominated by midge and mosquito larvae, and one consisting only of larvae of a sarcophagid fly. Rotifers such as *Habrotrocha rosa*, via their excretion rates, may be capable of supplying all the pitcher plants needs for nitrates, ammonia and phosphate. The quality of the pitcher plant patches vary, he said, depending in large part on what the inhabitants do. The botanical view focuses mainly on the "living plant" and takes into consideration the role of photosynthesis, growth rates and how these things and nutrients influence pitcher leaf formation and flower production. Is there any relationship between pitcher nutrients and growth? One research question being asked is whether or not adding nutrients to the pitchers will

influence leaf production. In the oligotrophic bog environment, it has been assumed that few nutrients are taken up by the roots even though they may be well developed. Ellison's goal is to get the complete "pitcher", relating both botanical and zoological aspects to how pitcher plants function.

Part of getting the complete "pitcher" has involved monitoring the Hawley Bog population. Monitoring in 1996 and 1997 has shown there is considerable year to year variation in the percent that produce flowers (ca. 10% in '96 vs. ca. 50% in '97) and in the number of pitcher vs. flat leaves (called phyllodia) produced. Interestingly, the phyllodia, which are also referred to as winter leaves, sometimes produce rudimentary pitchers at their apices. What factors determine flower or pitcher production? Why should plants produce pitchers at all, Ellison has asked? Since flat leaves intercept more light, they may more effective at delivering the benefits of photosynthesis. Why be carnivorous? Since bogs are high light but low nutrient environments, a role in providing key nutrients is generally regarded as a reason for carnivory. By carefully monitoring and modeling the nutrient conditions in the bog habitat, in the pitcher plants, and in the pitchers with their inquiline assemblages, Ellison and company hope to better understand the complexity of these interrelationships and what triggers the pathway to carnivory.

Questions at the end of the presentation brought out some interesting facts about pitcher plants. Two species of moths are known to bore into pitchers, drain them, then use them for part of the growing season, and secondarily provide habitat for certain spiders. A species of *Papaipema* moth considered rare in Massachusetts utilizes pitcher plants. At least one species of rotifer is considered to be restricted to pitcher plant pitchers and is capable of encysting if the pitchers dry out. Pitcher plants rarely flower two years in a row. In years when flowering occurs, plants produce smaller and fewer leaves. It is suspected that the year following flowering is typically a year with lots of pitcher production. Horticulturists have learned to nip flower buds to achieve more leaf production. Pollinators are primarily queen bees of the genus *Bombus* but adult flesh flies are known to accomplish the task also. Regarding the morphology of pitcher leaves, a 1940's paper concluded that the inside of pitcher represents the adaxial leaf surface. Pitcher plants are considered inefficient at trapping insects. At Hawley Bog, ants were frequent prey in pitchers while *Collembola* were more frequently the victims of pitfall traps designed by humans. Another interesting tidbit was that a paper has been written on algae occurring in pitcher plants.

Following the lengthy question and answer session, the group adjourned for refreshments.