Hot News on the Natural History of Mosses

Every now and then we read that a great discovery is made in science, that a new study has been published which opens a fresh way of looking at a long-standing mystery or unsolved problem. We typically expect these news releases to be about advances in medicine or in such areas of science as quantum physics, the molecular analysis of genes, or low temperature electronics. How I love to read about advances in natural history!

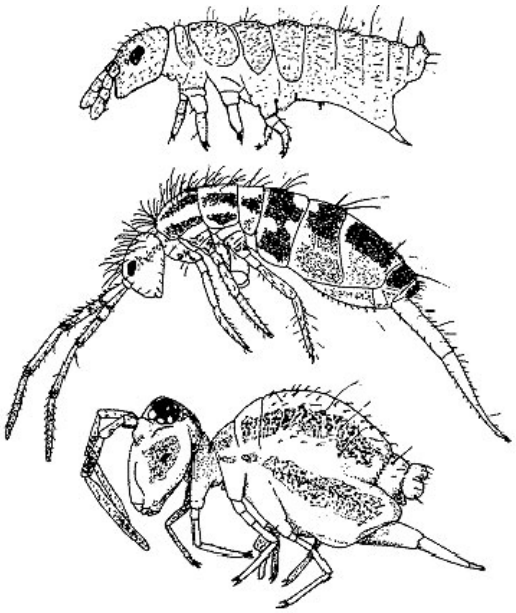
Recently I was delighted to read about a breakthrough in understanding the natural history of mosses. The issue has been a basic one: How are mosses able to sexually reproduce efficiently enough for evolution to occur? The problem is that mosses have the most primitive mode of reproduction among all land organisms. A sperm must swim between male and female plants, through a liquid environment external to the plants. Seed plants have solved the problem by putting their sperm cells into pollen grains and sending them through the air. Flowering plants have taken this one step further by employing insects, birds, and bats to carry pollen from one flower to another. Lacking pollen, mosses must do their best with sending their spermatozoids out into an external, watery world.

A group of Swedish botanists led by Nils Cronberg recently performed an elegant experiment which demonstrates that mosses, too, can use insects to carry sperm from a male plant to a female plant! An "elegant experiment" is a popular phrase among scientists. It means a study done which is original in its conception, creatively designed, simple to execute, unambiguously interpreted, with convincing conclusions of dramatic significance.

Their experiment used a moss widespread in temperate regions of the world, the silvery bryum. It grows like a weed everywhere, even in cracks in the sidewalk in Eugene. Gorgeous, bulging cushions of this moss were pressure blasted off the Washington-Jefferson bridges not too long ago. It is a highly successful moss, yet it grows in unisexual colonies which are either male or female. The big question has been, "How far can sperm swim to fertilize the female plants?" Experiments which attempted to measure this distance in the past have not yielded satisfying results. Moss sperm are coiled and have two long tails that propel them spirally through the water, slowly. Their meager store of energy doesn't let them get far.

What Cronberg and associates did was recognize that mosses live in an ecosystem with a panoply of other organisms around them. Observations going back more than a century noted that small insects had moss sperm stuck to them. Prominent among the co-inhabitants of the moss world are springtails, primitive, tiny, wingless insects. Cronberg's group tested the ability of springtails to carry sperm between moss colonies.

They established small colonies of the silvery bryum in holes in plaster of Paris poured into culture dishes. The plaster held sufficient moisture to keep the colonies healthy, but trapped any sperm which might attempt to swim across its surface. Sets of male and females were placed so they touched or were 2 and 4 centimeters apart. If the mosses grew by themselves, only the female colonies in contact with the male colonies were fertilized and produced spore capsules. The dishes in which male and female colonies were 2 or 4 centimeters apart did not develop spore capsules.



However, when springtails were introduced into the dishes, they roamed about freely feeding on dead organic material in all moss colonies. In the process they carried moss sperm, and within 20 hours all female colonies were well fertilized, producing abundant spore capsules at both the 2 and 4 centimeter distances. EUREKA!

What makes this such a dramatic experiment is its implication in the general natural history of mosses. Springtails are very primitive insects. They have been around as long as mosses--over 300 million years. And springtails are VERY abundant, acting as breakdown organisms in the process of decomposition of dead plant material in almost every habitat.

To see a good press release, visit this site: http://sciencenow.sciencemag.org/cgi/content/full/2006/901/

Be sure to click on the link which shows a video clip that includes the springtails moving around and even moss sperm swimming through water.

This study was published in *Science*, the most prestigious journal in the USA. It demonstrates that such a venerable discipline as natural history still has marvelous discoveries to be made. People who indulge in natural history are doing cutting edge, hard science!

David Wagner, ENHS President

Drawing: 3 representative springtails, Richard Houseman, entomologist, University of Missouri