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News From Hudsonia

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Disease, Death, and Decay

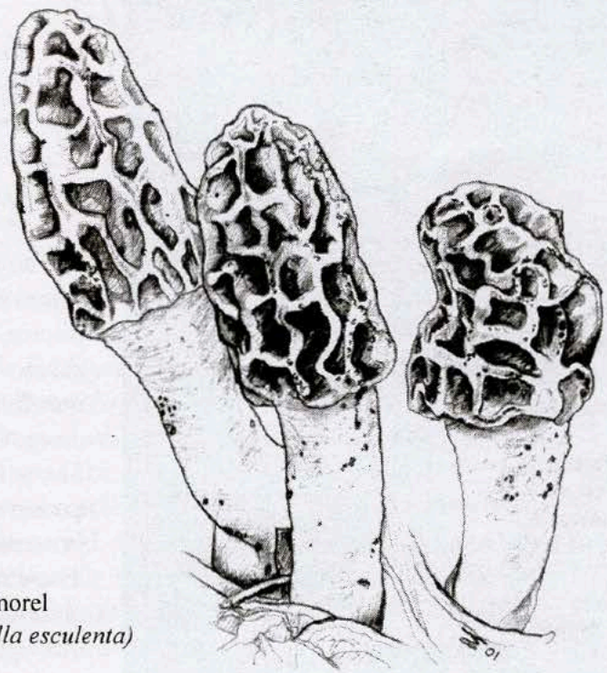
By Dwane Decker*

The air felt cool in the deep ravine where a trickle of water fell over rock and moss. A stand of giant hemlocks blocked out the sun allowing the ground to retain its moisture. On the otherwise clayey soil, a few inches of organic matter had developed from fallen leaves of the neighboring black oak, sugar maple, and shagbark hickory. The air was infused with a familiar aroma, a rich and heavy redolence alluded to by a member of our nature walk, "Smells like fungus."

We walked for hours admiring the bright colors of spring: purple trillium, trout lily, Solomon's seal, wild geranium, violets, periwinkle, kidney-leaved buttercup, as well as shadbush and black cherry blossoms. After a game of "scratch and sniff" botany--spicebush, skunk cabbage, and wild ginger--an eastern phoebe called out reminding me to attend to my other senses. With some practice, I'll learn to pay attention to the details without ignoring the whole.

Throughout the walk I envisioned fungi. When a member of the group remarked, "Look at that beautiful elm!" I thought of *Ophiostoma (Ceratocystis) novo-ulmi*, the fungus associated with Dutch elm disease. I imagined a small bark beetle or a gust of wind carrying spores to its next victim. *Ophiostoma novo-ulmi* can kill a tree within a few months or over a period of years. The fungus blocks the vascular system of the tree preventing water and minerals from reaching the branches and leaves. The leaves wilt and eventually the tree dies.[1]

I kept my eyes peeled for the mushroom I choose to fill my quiche, one of spring's greatest treats, the yellow morel (*Morchella esculenta*). It shows its elongated blond or yellow-brown honeycombed cap when the spring is cool and moist. This choice edible can be found in late April in old apple orchards and burned areas, around tuliptree, ashes, oaks, elms, and American beech. A dead elm is your visual cue to look down and open your basket. Beware of toxic look-alikes, however, particularly the false morel (*Gyromitra esculenta*)!



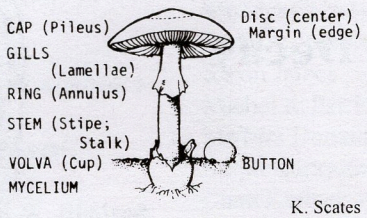
Yellow morel
(Morchella esculenta)

A Kingdom of Their Own

What are fungi anyway? They are neither plant nor animal, but are classified in their own Kingdom, Fungi. Their cell walls are made of chitin, whereas plant cell walls are made of cellulose; animal cells lack cell walls entirely. Like animals, fungi require organic substances for energy and are unable to convert solar into chemical energy as many plants do. Fungi, like animals, store energy as glycogen, whereas plants store energy as starch.

*Program Associate

Fungi that produce mushrooms are composed of long, cellular, threadlike structures called hyphae, which form a web of tissue in the substrate upon which the fungus feeds. This web of hyphae, called mycelium, is responsible for absorption of nutrients and for metabolism. When the environmental conditions are favorable for spore growth and germination, the fungus produces the above-ground fruiting body, or mushroom, containing the reproductive spores.



K. Scates

Fungi live in three ways: as saprophytes, as parasites, or as mycorrhizae.[1] **Saprophytic fungi** live on non-living organic matter, including dung, dead wood, and leaf litter. These fungi are considered non-invasive and contribute to the natural processes of decay and recycling. Their role in the integration and regulation of energy and nutrient fluxes through ecosystems is immense. As decomposers, fungi and bacteria drive the global carbon cycle, and reduce organic substrates to nutrients that other organisms can use. They also improve soil structure and remove materials that would otherwise accumulate and diminish ecosystem productivity.[10]

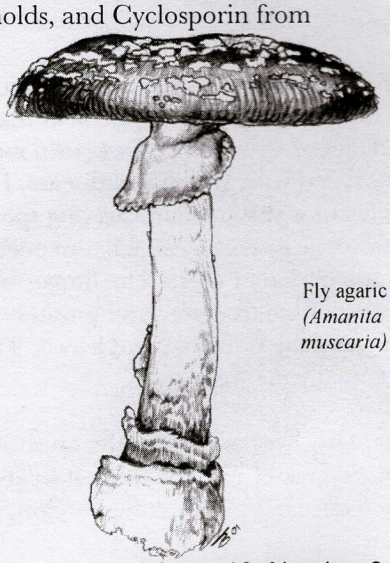
Parasitic fungi attack living plants and animals and are often considered "invasive." Parasites are defined as organisms that live at the expense of others without providing any useful services in return. Many parasites are microfungi, such as rusts, spots, and molds, and may help to regulate the population dynamics of their hosts.[2]

Mycorrhizal fungi have mutualistic relationships with plants.[2] The mycelium wraps around a plant's roots, sometimes entering the root cells, bringing water and minerals to the plant, and protecting the plant from heat, drought, and pathogens. Many plants rely on mycorrhizae for these services and do not thrive in their absence. In return, the fungus receives sugars, carbohydrates, and vitamins. This mutually beneficial association can be visually apparent when certain species of mushrooms are found occuring only with certain species of trees.

These are some of the ways in which fungi are fundamental to the processes that sustain the living world. A better understanding of fungi, their ecological functions, and their sensitivities to environmental degradation is thus essential to our efforts to preserve biodiversity and the integrity of ecosystems.

Other Services

Fungi are not only essential components of functional ecosystems, but they provide numerous and invaluable services directly to humans. We can thank fungi, for example, for leavened bread, cheese, wine, and beer. From prehistoric times, human societies have used fungi for medicine, tinder, and food. Penicillin antibiotics, originally derived from *Penicillium* molds, and Cyclosporin from



Fly agaric *(Amanita muscaria)*

Cylindrocarpon lucidum and *Trichoderma polysporum,* revolutionized medicine in the 20th century.[5] Fungi hold great promise as sources of other yet-to-be discovered substances of pharmaceutical value. Many religions and philosophies have been created or transformed by the use of hallucinogenic fungi.

Fungi also serve as valuable tools for biologists. Mycorrhizal inoculants are used extensively in habitat restoration projects to help native plants become established on disturbed land.[3] Parasitic fungi may be used for the biological control of invasive exotic species of plants and animals. *Entomophaga maimaiga*, for example, is a widespread gypsy moth pathogen in Asia. *Metarhizium anisopliae*, a native forest soil fungus, attacks arthropods, and has potential to control the deer tick *(Ixodes scapularis*), vector of Lyme disease, ehrlichiosis, and babesiosis.

Fungal mycelia have proven effective in "mycofiltration" systems to remediate pollution.[10] The same enzymes that break down molecules of lignin and cellulose also break down hydrocarbons found in certain pesticides, PCBs, petroleum, and many other pollutants. As we learn more about their ecological requirements, we will also learn to use fungi more effectively as indicators of ecosystem integrity.

Summer and Fall Fungi

The slimes and jellies are the Dr. Jekyll and Mr. Hyde of the fungus world. When young, *Hemitrichia calyculata,* for example, resembles a bright red fish egg atop a tiny stalk. Once mature, it becomes a snow cone of yellow pollen-like spores on a stick. For me, the transformation is as mysterious and beautiful as the metamorphosis of a caterpillar to a butterfly.

The oyster mushroom *(Pleurotus ostreatus)* is a choice edible of the summer and fall. These broad, oyster-shaped, lignicolous (wood dwelling) mushrooms have overlapping fan-shaped bodies that seem to originate from a central or common base. Oysters can be found on most deciduous tree species, especially maples, willows, and poplars. You may notice a delicate anise fragrance. Clean this mushroom carefully, as it often has grubs and small beetles living in its gills. A recipe recommended by a local expert includes browning with butter and onions, and adding cream and a splash of Pernod.

The wood blewit *(Clitocybe [Lepista] nuda),* one of autumn's many delectable fungi, has a large violet cap and stalk. Its habitat varies, but the blewit can be found on compost, under blackberry stems, along paths, and in woods

Oyster
(Pleurotus ostreatus)

borders. This is a choice and fragrant edible, but it has a few toxic look-alikes, so use caution.

Mushrooms are found in great abundance in the fall, when lower air temperatures are accompanied by fall rains. After the colorful conks (shelf fungi) fade, *Amanita* buttons dot the earth. The fly agaric, *A. muscaria* var., looks magical against the florest floor. As the mushroom grows, the protective tissue (universal veil) surrounding it breaks into fragments that remain on the bright red, orange, or yellow cap as small wart-like polkadots. The fly agaric is common around the world, and can be found in the Northeast almost exclusively in stands of pines or birches. While some Amanitas are edible, many are extremely poisonous and contain hallucinogens. Amanitas are documented in thousands of years of folklore from Siberia to South Africa, and India to the United States.[7]

The king bolete (*Boletus edulis)* is large, with a wide, convex, reddish-brown cap, white to yellow pores, and a whitish-brown stalk that thickens at the base. Boletes have thick flesh and a sponge-like tube layer instead of gills. This edible is most abundant in September but can be found through October. Look under pines, hemlocks, or birches. For safety, the best procedure is to avoid any bolete with orange to red pores, especially any that bruises blue.

Mushroom Poisoning

There are a few other rules of thumb for collecting wild mushrooms for consumption. Always be suspicious of a mushroom collected without the aid of an expert mycologist, as many edible fungi have toxic look-alikes. Avoid drinking alcohol when eating mushrooms (alcohol metabolism is inhibited by various compounds found in fungi).[1] Focusing on a few species you know well and enjoy can

narrow the chances of fatal mistakes or allergic reactions. Do not be overconfident. Keep aware of the look-alikes even for mushrooms you think you know well. Each person's body reacts to chemicals in its own way, so an edible for one person may be toxic to another.

Fungal Threats

Despite all the culinary, medicinal, and environmental benefits, most of us still associate fungi with disease, death, and decay. Fungal diseases plague our agricultural crops, livestock, and the plants and animals of natural communities.[5,6] Fungi infect human tissues causing athlete's foot, ringworm, yeast infections, thrush, and subcutaneous ulcers or sporotrichosis. Fungi infect human lungs causing cryptococcosis, histoplasmosis, and aspergillosis. Recently, *Stachybotrys* has flooded the news with tales of respiratory bleeding and memory loss. Fungi are also responsible for coccidioidomycosis, the most threatening systemic fungal disease.

The Fate of Fungi

Although fungi are ubiquitous and powerful ecological agents, they are not immune to environmental stress. Fungi may be undergoing mass declines due to air pollution,[11] chemical fertilizers, agricultural pesticides, soil erosion, general habitat destruction, and a host of other environmental assaults. These losses will not only harm the natural communities that depend on fungi, but will also undermine future efforts at environmental restoration.[8]

Mycology (the study of fungi) is a stimulating area of study for scientists and a field wide open for graduate research. While 69,000 species of fungi have been described to date, an estimated 1.5 million still await identification.[9] Many aspects of fungal life history are obscure, taking place in the soil or inside plant or animal tissue. Relatively few fungi are observable and identifiable without the use of a microscope.

With all of the work yet to be done, there is a tremendous need for funding of mycological studies. Biodiversity inventories, technical identification procedures, and good natural history research are all vital to understanding fungi.

While fungi can be technically challenging to scientists and amateur mycologists alike, all of us can nonetheless enjoy the brilliant fungal displays of the spring and fall, and learn more about the ecological roles of fungi. Whether you choose to study them in your kitchen, library, laboratory, or forest, you will find, as I have, that fungi are endlessly fascinating.

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Recommended Fungi Texts

Field Guides:

National Audubon Society Field Guide to North American Mushrooms. G.H. Lincoff. 1981. Alfred A. Knopf, New York. 926p. This is the most comprehensive field guide to mushrooms of North America. Over 700 full-color identification photographs show mushrooms as they appear in their natural habitats. All mushrooms are grouped by color and shape to facilitate identification in the field. Season, habitat, range, look-alikes, and other notes supplement each species description. An introduction to fungi, spore print color chart, mushroom poisoning information, and culinary tips make this guide the best available.

Mushrooms of Northeastern North America. A.E. Bessette and A. Bessette. 1997. Syracuse Univ. Press, Syracuse, NY. This guide is organized as a dichotomous key making technical identification easier. Although supplemented by photographs, this text lacks detailed illustrations that would be helpful to the beginner. Highly recommended for advanced students.

Other:

The Fungal Community: **Its Organization and Role in the Ecosystem.** G.C. Carroll and D.T. Wicklow. 1992. Marcel Dekker, New York. 976 p. This is one of the most significant compilations of scientific writing in the history of mycology. This text contains nearly 1000 pages of published scientific research on fungal ecology, environmental factors, population dynamics, fungal community interactions and development, fungal biomass and productivity in ecosystems, nutrient cycling, experimental approaches, and much more. This heavy tome is not an easy read, but it is a bible of fungal research, with thousands of references. Highly recommended.

"Far from the madding crowd's ignoble strife"

-Thomas Gray

By Erik Kiviat*

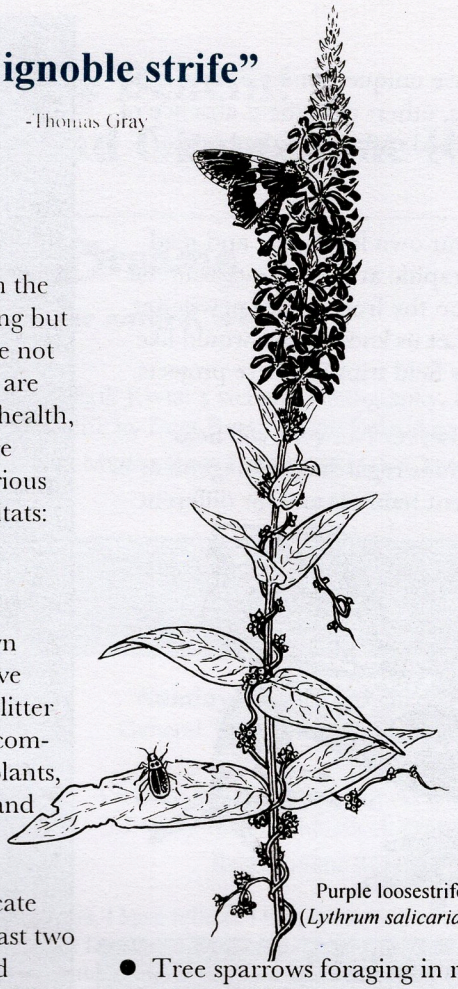
In recent years, Hudsonia has conducted research on the frontier of science, studying two of the most interesting but least understood species in North America. These are not feathered dinosaurs holding secrets of evolution, nor are they emergent disease organisms threatening public health, nor tropical trees that promise to cure cancer. We are studying two plants that many ecologists consider serious pests due to invasion of marsh and wet meadow habitats: purple loosestrife and common reed.

Stands of loosestrife or reed, whether in city parks or country landscapes, support complex and little-known biological communities. Looking closely at the massive storage organs just above or below the soil, the deep litter of dead leaves and stems, the hollow stems, and the complex structures of the fruiting tops, I find coexisting plants, mammal teethmarks, mosses, snails, insects, spiders and birds' nests.

While hundreds of costly projects to reduce or eradicate reed and loosestrife have been undertaken over the last two decades, Hudsonia has taken the position, considered heresy in some quarters, that we don't yet know enough about these unpopular plants to take such drastic action against them. Loosestrife and reed may be ecologically beneficial at some locations, and detrimental at others.

Our studies focus on the interactions of reed and loosestrife with other flora and fauna. These two plants have undergone population explosions, and the rest of the biota is trying to catch up with them. To better study these complex systems, Hudsonia has enlisted help from volunteers, especially in New York City and Westchester County, where our "Volunteer Observer Network" projects have been supported by grants from the New York City Environmental Fund and the Westchester Community Foundation.

Increasingly, scientists use naturalists and other outdoors-people to learn about regional biota. Witness breeding bird atlas projects, the Metropolitan Flora Project of the Brooklyn Botanic Garden, and Joan Ehrenfeld's study of the distribution of an invasive plant (Japanese barberry) in New Jersey. We reasoned that naturalists, intrigued by species invasions, could make observations on the biota associated with reed and loosestrife. These observations and the perceptions of land managers, combined with other data from Hudsonia studies and the literature, would help us understand the impacts of invasive plants on native biota and formulate new approaches to managing reed and loosestrife.



Purple loosestrife
(*Lythrum salicaria*)

To these ends, during the past year-and-a-half we conducted a series of field trips and workshops in Westchester and New York City. We distributed information and forms for reporting observations, on paper and via Hudsonia's website. Our efforts resulted in numerous interesting reports, including:

- Tree sparrows foraging in reed tassels, where the observer found small insects called thrips as well as the tiny seeds. (Jean Bourque, Brooklyn) (In winter, tree sparrows are much more likely to be feeding on seeds than insects.)

- A horse eating reed. (Catherine Marsh, Westchester) (Livestock grazing reed is well documented in Europe, little in the U.S.)

- Many species of butterflies visiting loosestrife flowers for nectar. (Jeff Glassberg) (This is a widespread phenomenon.)

- Downy woodpecker foraging on reed stem. (Catherine Barron, Staten Island) (Confirms observations in Mid-Hudson Valley.)

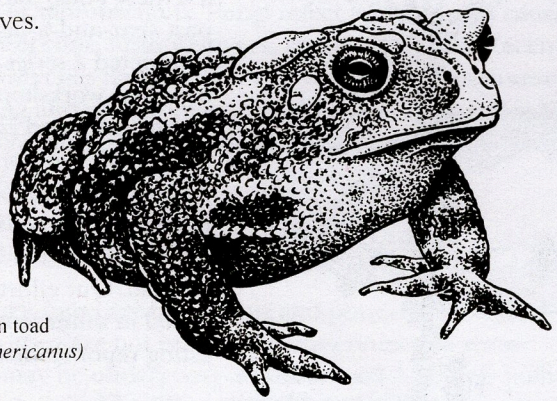
Other observers have reported a rare orchid growing beneath a reed stand, many kinds of insects on reed and loosestrife, common grackle nesting in reed, muskrat carrying reed material, and a house sparrow collecting nesting material from reed. Growing under loosestrife in Dutchess County, I found the liverwort *Aneura maxima* which in New York was known from a single other locality (identified by Norton Miller, New York State Museum).

*Executive Director

Some of these observations are unique, some confirm data from distant places and times, others document absence of a species from loosestrife or reed. All add to the body of information on these plants.

I encourage you to report your own loosestrife and reed observations (from any geographic area) to kiviat@bard.edu or the telephone or address on the front of this newsletter (or see www.hudsonia.org). Let us know if you would like to be notified of late-summer field trips for these projects.

Data from the Volunteer Observer Network will help Hudsonia make recomendations regarding management of loosestrife and reed in different habitats and for different objectives.



American toad
(*Bufo americanus*)

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Biodiversity Education Project Update

The summer of 2001 has been an exciting season for the launch of our Biodiversity Education Project, which coincides with the publication of the *Biodiversity Assessment Manual for the Hudson River Estuary Corridor*. The purpose of the project is to introduce the *Manual* to local land use planners and decision-makers at a crucial time for protecting natural resources in the Hudson Valley. With increasing suburban sprawl and other poorly planned development in the region, the loss of important habitats and species has been accelerating. This education project is intended to support local communities in identifying, understanding, and protecting significant biodiversity resources. The project is carried out in partnership with the Hudson River Estuary Program of the New York State Department of Environmental Conservation.

The Biodiversity Education Project is designed especially for the local agencies and organizations -- such as Conservation Advisory Councils, Planning Boards, and land trusts -- that are most involved in land use planning, land use decision-making, and conservation in the Hudson Valley.

The cornerstone of the project is a training program in map analysis and field techniques for identifying ecologically significant habitats. The Training is offered, on a competitive basis, to five communities or organizations. Each agency selected for the Training is also awarded a $1000 grant to help cover the start-up costs for a large-scale biodiversity assessment.

The Town of Pleasant Valley, Dutchess County, is the first community to be awarded the biodiversity assessment training and grant. The Pleasant Valley Conservation Advisory Council will use the information and skills obtained through the program to contribute to general land use planning throughout the town, to help with environmental reviews of proposed development projects, and to advise the Town Board on incorporating biodiversity protection into the Town Code.

If your agency or organization is interested in receiving more information about the training, contact Carina Bandle, Biodiversity Educator, at 845-758-1522, or bandle@bard.edu.

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Premiere Performance and Champagne Reception!!

Marsh Dreams

Dance that opens your senses to the natural world...

Featuring the interplay of Elaine Colandrea's choreography, Erik Kiviat's wetland photography, Elizabeth Cunningham's and Cait Johnson's poetry, and a world music score...brought to life by Deni Bank, Elaine Colandrea, Cait Johnson, Mindy Nowik, Magdalene San Millan, Marguerite San Millan, Abby Saxon, Martha Ross Tobias and Helen Townsend.

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For nearly 25 years, I have followed Erik Kiviat (my husband) into swamp, bog, fen and marsh throughout Dutchess County and in many parts of the country and world. His understanding of the complex relationships between all life forms has influenced me deeply and led to the creation of *Marsh Dreams*. In *Marsh Dreams*, I explore the aspects of bird, mammal, reptile and plant that live within us, weaving together image, word, movement, and sound inspired by the experience of being in wetlands.

-Elaine Colandrea

Dear Friends,

2001 marks Hudsonia's 20th year. Twenty years of pure and applied research on the special habitats and species of the Hudson Valley and elsewhere in the Northeast has contributed to our just-published *Biodiversity Assessment Manual for the Hudson River Estuary Corridor*. We hope the *Manual* will help equip readers to better understand and protect the natural systems that sustain us all. Your support through the years has made this work possible. Your continued support will enable us to provide the scientific underpinnings for thoughtful land use planning and decision-making in the future.

Michael Trimble, Board Chair

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