The Illinois

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Mushrooms and Spring Fever

The sunny days of spring herald the appearance of the spring mushrooms and, of course, bring out the mushroom hunters. Spring is when the delicious morel is found.

The morel is easily identifiable and is recognized by a hollow stem capped with a hollow spore-producing tissue that has ridges and deep, rounded or angular pits which give the cap the appearance of a sponge. This morel, or sponge mushroom, is not a mushroom in the sense that it belongs to the class Ascomycota. In comparison, the commercial mushroom has gills on the underside of a cap and belongs to the class Basidiomycota.

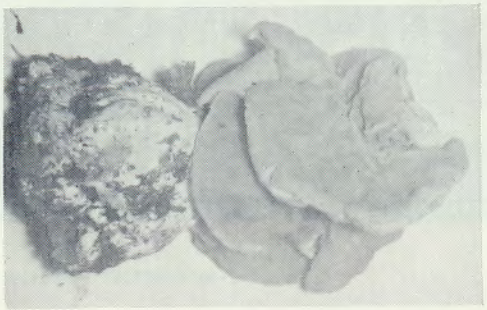
A day of searching woodlands, hillsides, and ravines in the cool spring air, followed by a meal of this delicacy simmered slowly in butter, will surely cause most mushroom hunters to feel the contented lassitude called spring fever. However, the fatigue may be persistent for several days, and the abdomen may become swollen and the stomach painful if the false morel is eaten, according to Jean D. Schoknecht, medical mycologist, Department of Life Sciences, Indiana State University, who is also an affiliate in Botany and Plant Pathology at the Survey.

Caution should be exercised so that the similar *Gyromitra esculenta* is not eaten as well. This false morel is often collected along with the edible morel, a species of the genus *Morchella,* in spring in Illinois. Its globular cap is not like a sponge as is its close relative the morel, but is irregularly lobed and can be 5 to 8 and even 10 cm in diameter and 6 to 32 cm tall. Its cap does not have regular ribs and deep pits as the true morel, but is irregularly folded or convoluted like a brain or crumpled blanket. It is variable in color, from tan, yellowish-brown, red-brown, or even darker. The stem is hollow, often furrowed and white to tan in color.

The false morel should be regarded as dangerous. Yes, many Illinoisans collect this false morel and will attest that it is edible and very tasty. Luck, however, runs out for some, as 2 to 4 percent of all mushroom fatalities result from eating these false morels.

Gyromitra esculenta is known to contain monomethylhydrazine (N-methyl-N-formalhydrazine) which has been called helvellic acid or gyromitrin. Gyromitrin is a very strong hemolytic compound which rapidly causes rupture of red blood cells, causing hemoglobinuria and also hemolytic jaundice from effects on the liver. Poisonings with *G. esculenta* begin to show 2 to 12 hours after eating the mushroom. The symptoms are abdominal pains, nausea, vomiting, and bloody diarrhea, cramps, swelling of the abdomen, weakness, lassitude, and headache. The symptoms may be mild; however, if the condition is severe these develop into swelling of the liver, jaundice, convulsion, coma, and even death. The liver and kidney are most damaged.

Recipes abound for making the "mushroom" safe. For example, boiling first and throwing the liquid away does remove some gyromitrin from the mushroom, but gyromitrin can be carried in the steam, absorbed through the nose, and cause illness. Therefore, it is dangerous to the cook to boil these. Moreover, enough gyromitrin can be left in the fungus to cause illness.



Top: The poisonous mushroom, *Gyromitra esculenta*, or the false morel.

Right: The true morel, *Morchella* sp., which mushroom hunters seek in the spring (photos by Jean Schoknecht).

As this is reportedly a tasty mushroom, many devoted mycophagists have sought to explain why it is sometimes more poisonous than at other times. Many cases of death from eating the false morel occurred to individuals who had eaten them before. Some of the poisonings described are interesting because not all of the persons who ate the mushroom dish were taken ill. In a family, some members may suffer no effects, some become ill, and some die from the same dish. This may be explained by differing quantities ingested or perhaps individual susceptibility to the poison.

There is obviously much individual difference in the amount of gyromitrin contained by an individual mushroom and it may vary according to region, weather, or other conditions, and is thus dependent on still insufficiently investigated factors. There is currently *no* evidence that any visible physical factor such as age, cap size or color, nor that any growth factor is related to production of gyromitrin. In other words, there is no way to recognize a very poisonous specimen. Although some mushroom texts recommend that *Gyromitra* should never be eaten raw, there is no treatment that renders them safe.

Pine Squirrels in Deciduous Forests

The pine or red squirrel is common throughout the coniferous forests of North America and is known for its strong territorial behavior. Adult red squirrels defend their home ranges by calling at and chasing after intruders. This behavior has evolved to protect the food supply of the individual squirrel and controls population size by limiting the number of squirrels that can live in a particular area.

Red squirrels occurred in Illinois around the turn of the century but have been absent from the state for about 60 years before their reappearance in the mid-1970's. In an effort to determine the status of the red squirrel in Illinois, Survey scientist B. W. Brown has undertaken a study of the red squirrel in deciduous habitats in Illinois. Apparently red squirrels have not been reintroduced into pine forests in Illinois. The range of the red squirrel in Illinois seems to be concentrated along the Kankakee and Iroquois rivers in eastern Illinois. Populations are also known from the Beaver Creek area, the Iroquois County Conservation Area near Indiana, and Thorncreek Woods in Will County. It appears that red squirrels are expanding their range in Illinois. The origins of these populations appear to be a combination of red squirrels from Indiana expanding their range down the Kankakee River system into Illinois and the introduction of red squirrels from Minnesota in the 1960's.

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The pine or red squirrel as found in localities having black walnuts in Illinois (photo credit: Museum of Zoology, University of California, Berkeley).

from red squirrels living in deciduous habitats indicated that, in contrast to squirrels in coniferous habitats, red squirrels in Illinois are not territorial. This difference in behavior is probably because food supplies in deciduous forests are difficult to defend. Furthermore, red squirrels have little effect on fox squirrels living in the same areas in deciduous habitats in Illinois. Although gray squirrels are common in many areas of Illinois, they are not found in the same regions as red squirrels. Both gray and fox squirrels have been reported from areas where red squirrels were common, but reports of interactions were rare. Thus, it is not known if red squirrels compete with fox and gray squirrels in coniferous habitats.

Observations of food habits and vegetational analysis of red squirrel habitats indicated that black walnuts were important to red squirrels in deciduous forests in Illinois. At present red squirrels occur only in habitats with black walnuts in Illinois, but it is not known if black walnuts are an essential component of the habitat. Neither forest quality nor tree density seemed strongly related to red squirrel populations.

Conservation Tillage and Pesticides

Over the last decade, farmers have adopted wholeheartedly conservation tillage practices to control soil erosion. There are many kinds of conservation tillage systems, but all leave crop residue on the soil surface to decrease erosion of soil by strong winds and torrential rain storms.

Coincident with the adoption of conservation tillage practices, farmers have been using more pesticides. The soil environment is substantially different in no-till than in conventional tillage. The properties most affected by lack of tillage, e.g., moisture, temperature, organic matter content, microbial communities, are those that influence the fate, behavior, and efficacy of soil-applied pesticides. Crop and environmental protection specialists are concerned about the performance and behavior of pesticides under no-till conditions. These concerns can be expressed as three questions:

1. Will pesticide use and application rates need to be increased under conservation tillage?
2. Will degradation rates and metabolic pathways be different enough to affect bioactivity of the pesticides?
3. Will leaching and runoff of pesticides be changed by leaving more crop residue on the soil surface?

To answer these questions, entomologists Allan Felsot, Kevin Steffey, and Eli Levine have been investigating the fate of soil insecticides and interactions with pests in cornfields managed with conventional and conservation tillage systems. Studies were conducted during the 1983-1985 growing seasons at the University of Illinois Cruz farm in Champaign and at the Northwestern Illinois Agricultural Research and Demonstration Center near Monmouth. At planting time soil insecticides were applied to cornfields that were prepared by molboard plowing (conventional tillage), disking or chiseling (reduced tillage), or left untilled (no tillage).

At various time intervals following planting, soil cores were collected to determine the degradation rate of the insecticide in the top 4 inches of soil. This segment of the soil profile around the corn roots is where most corn rootworm feeding would occur. Soil columns of 8 inches in length were also taken from the experimental field plots and sliced into 2-inch sections to measure the distribution of pesticide around the root zone and to determine if any chemical was moving deeper

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into the soil profile. Corn rootworm and black cutworm feeding damage and crop yields were measured. To estimate the size of rootworm populations and therefore the amount of stress from root pruning, adult beetles emerging from the soil were trapped and counted during July and August. Rootworm eggs laid in the soil were sampled in the number of eggs per acre estimated.

Felsot, Steffey, and Levine have concluded that insecticides can effectively control corn rootworms with current rates of application. Initial emergence of adult beetles was delayed about 1 week under no-till conditions, but peak emergence did not differ from conventional tillage. Black cutworm damage tended to be greatest in no-tillage plots. Corn yields tended to be lower in no-tillage systems without insecticides. However, yields were not significantly different when insecticides were applied.

The insecticide residues were confined mainly to the top 2 inches of the soil profile regardless of tillage system. This limited distribution of the insecticides might result in inadequate root protection, especially if rootworms are feeding at a depth of 3 to 4 inches and populations are very large. This hypothesis may help explain why soil insecticides sometimes do not provide sufficient protection of the roots.

Felsot has been investigating also the influence of tillage systems on pesticide runoff in cooperative studies with Professor J. Kent Mitchell from the Agricultural Engineering Department at the University of Illinois. Preliminary results showed that no-till is effective in reducing pesticide runoff from sloping ground. Orienting the crop rows on the contour can significantly reduce washoff of the more water-soluble herbicides and insecticides in the moving water. This research will help farmers with crop land in watershed regions to decide which field management practices they can adopt to control movement of pesticides into nearby streams, ponds, and lakes.

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