Morels, false morels, and other cup fungi

Fig. 1 Cup shaped apothecium.

Fig. 2 Saddle shaped apothecium.

A pleasant madness affects many people in April and May. They take to the woods with bags or baskets, searching for the tasty morels, also commonly known as sponge mushrooms. Morels have a distinctive appearance and most people collect and eat them with confidence. There are several other interesting fungi that appear during the morel season. Some are beautiful and add to the enjoyment of a sunny spring day. Some contain toxins that can be quite harmful to people who eat them. This publication includes information on how to identify these fungi: morels, false morels, saddle fungi, and other large cup fungi found in the woods in the spring and early summer.

The chief characteristics of the fungi described in this publication are:

- They form an open fruiting body called an **apothecium.**

- The apothecium may be shaped like a cup (figure 1), a curved "saddle" (figure 2), or a wrinkled or pitted cup (figure 3).

Fig. 3 Pitted cup shaped apothecium.

• The main body of the fungus, the **mycelium,** remains in the litter or soil. It continues to grow as long as food is available and the environment remains favorable, producing apothecia in succeeding years. Thus, a morel is actually a specialized fruiting body producing hundreds of thousands of spores, each capable of developing into a new fungus.

• The apothecium has a surface layer, a **hymenium,** consisting of thousands of finger-like cells called **asci** (figure 4) interspersed with elongate, several celled filaments called **paraphyses** (figure 5). Under this layer is the outer wall of the apothecium. It is composed of interwoven, sometimes modified, multicellular filaments.

• Each mature ascus will normally contain eight ascospores that will be discharged from the tip of the ascus through a pore or by the opening of a lid. The ascospores are airborne to a suitable substrate where they germinate, and produce mycelium that eventually, perhaps after several years' growth, may develop fruiting bodies.

Fig. 4 Asci.

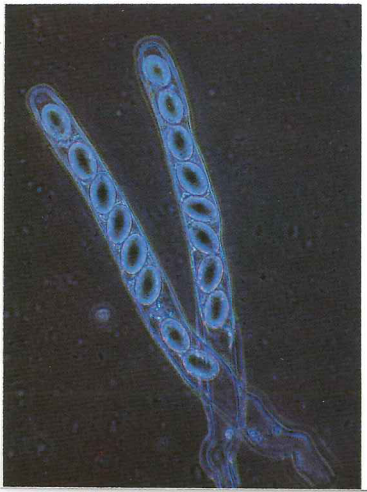


Fig. 5 Paraphyses and asci.

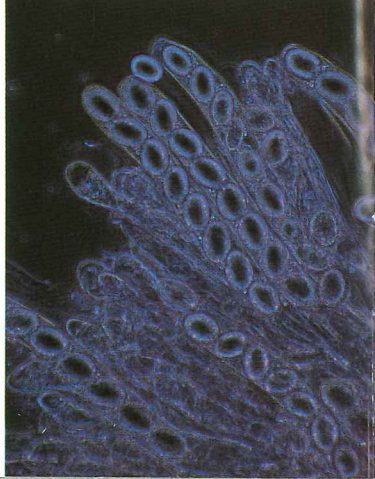


Fig. 6 A true morel; genus *Morchella*.

The genus *Morchella*— true morels or sponge mushrooms

The true morels are separated from other similar fungi by the pitted, spongelike cap that is fused, at least in its upper portion, to the hollow stalk (figure 6). These species of *Morchella* are all considered extremely delicious by many people. None is known to be toxic.

Morchella esculenta (figure 7), the common yellow or tan morel, usually develops on the ground in woods and occasionally other habitats in mid-April to mid-May. The cap, the apothecium, may range from subglobose to elongate to cone shape and has irregular to elongate pits surrounded by ridges that are lighter in color. The apothecium is fused along the entire length to the hollow stalk (figure 6). When mature, the cap is tan to yellow-brown, 2 to 3½ inches long by ¾ to 1¾ inches in diameter. The pit areas are lined with asci and paraphyses. Each mature ascus contains eight broadly elliptical one-celled ascospores arranged in a single row. The mature ascospores are 20 to

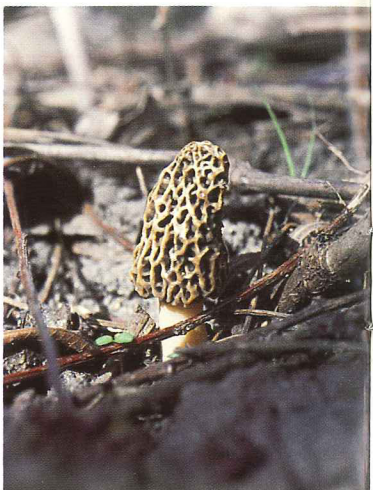
24 by 12 to 14 μm, (1 μm = .001 mm) and appear to be colorless when examined through a microscope. However, a spore print, made by placing a morel on a piece of paper and allowing the discharged ascospores to accumulate on the paper, is light yellow. The hollow white to cream colored stalk usually is slightly enlarged at the base, slightly shorter and narrower than the cap.

Morchella deliciosa (figure 8), the gray morel, is another common species. It is smaller than *M. esculenta* with a cap 1 inch wide by 2 inches long. The elongated pits in the cap sometimes are interconnected. The pit areas are gray to blackish and surrounded by ridges that are lighter. The asci and ascospores are very similar to those of *M. esculenta*. The stalk is slightly shorter and narrower than the cap, often with a slightly enlarged basal portion.

Although both species may develop in the same area during the spring, *M. deliciosa* typically is found 7 to 10 days before *M. esculenta*. Some

Fig. 7 *Morchella esculenta*.

Fig. 8 *Morchella deliciosa*.



observers have noted that some morels identified as *M. deliciosa* have immature asci. As these fruiting bodies matured, they could not be easily distinguished from those of *M. esculenta.* Such evidence indicates that *M. deliciosa* and *M. esculenta* might be considered to be one species. On the other hand, field observations by other observers indicate that the mature fruiting bodies of the two species maintain the distinguishing characters that have been used to separate them.

Morchella crassipes (figure 9), a third species, has often been considered to be a giant form of *M. esculenta.* It is delicious and is the largest morel, with a cap length of 3 to 5 inches and an overall length of 8 to 13 inches. The cap is elongated when mature with wide and irregular pits. Asci and ascospores are very similar to those of *M. esculenta. M. crassipes* is usually found in late spring, at the end of the morel season.

Morchella angusticeps (figure 10), commonly called the black morel, has a narrow, cone-shaped cap

Fig. 9 *Morchella crassipes.*

with long narrow pits outlined by black ridges. The total fruiting body is 2 to 6 inches in height and 1½ to 2½ inches wide at the base of the cap. The stalk is tan to grayish with a flaky or mealy surface, often somewhat furrowed at the base. Although black morels have been documented in only one area of Iowa, they have been reported in other locations.

Morchella semilibera (figure 11), another distinctive species, has a short cap that is 1 by ¾ inch, bell to subconic in shape and attached to the stalk for about one-half to one-quarter of its length. It also has very long, yellowish to brownish pit areas that are shallower than those of the other morels and sometimes extend almost the length of the cap. The hollow, tapered stalk is much longer in proportion to the cap than in other species of morels, often 3 to 4 inches long with a diameter of 1 inch to slightly larger at the base. The stalk is white to yellowish with a "scurfy" to mealy surface. Ascospores, 22 to 26 by 12 to 16 μm, are slightly larger than those of other species of *Morchella* that have been discussed. *Morchella semilibera* occurs on the ground in the woods at about the same time as *M. esculenta.*

Fig. 10 *Morchella angusticeps.*

Fig. 11 *Morchella semilibera.*

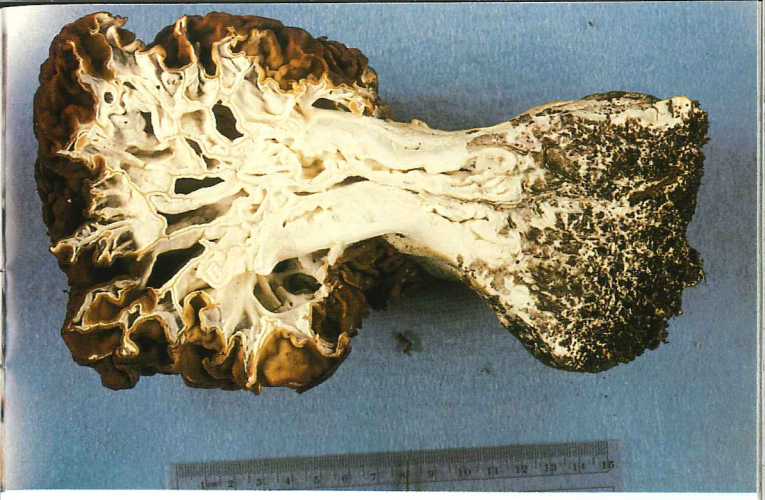


Fig. 12 A false morel; genus *Gyromitra*.

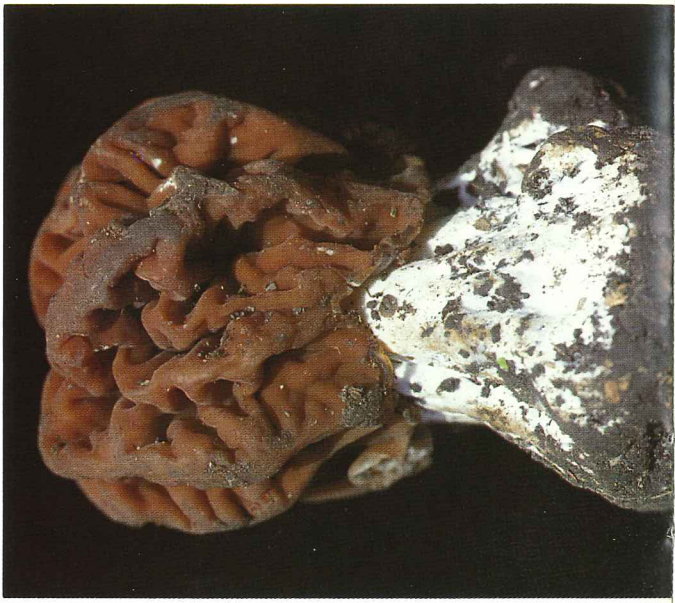
The genus *Gyromitra*—false morels

Species of *Gyromitra* are known as false morels. The fruiting body is quite different from that of a morel. Generally the caps are saddle or irregularly lobed in shape, with rounded anastomosing ridges, partly attached to the stout, often strongly fluted stalks (figure 12). The caps are typically reddish-brown to yellow-brown; the stalks range in color from white to cream to light gray.

Unfortunately, information on the toxin content of species of *Gyromitra* is incomplete. When you read other publications about edible fleshy fungi, you may find confusing and sometimes contradictory recommendations regarding edibility and toxicity. We recommend that no species of *Gyromitra* be eaten until more complete information is available.

Fig. 13 *Gyromitra brunnea*.

Fig. 14 *Gyromitra caroliniana*.



Gyromitra brunnea (figure 13), the most common species, occurs on the ground in woods throughout the spring morel season, often in the same sites as morels. It has been reported to contain the toxin gyromitrin and should not be eaten. (See the section on "Safe use of fungi as food.") It develops a massive fruiting body. The saddle-shaped, convoluted cap is irregularly lobed and ridged and is attached to the stalk at various points. The reddish-brown to yellow-brown cap may reach a diameter of 2 to 5 inches. The stalk is 2½ to 5 inches long and 1½ to 3 inches wide, white to yellowish to grayish in color, and often chambered. The asci contain eight elliptical one-celled, 28 to 30 by 12 to 15 μm, colorless ascospores. Each ascospore usually contains at least one large oil drop and with age becomes sculptured with small warts or ridges and projections at each end.

Gyromitra caroliniana (figure 14) also occurs throughout the spring morel season but is much less common. It also may contain gyromitrin and should not be eaten. It produces a massive fruiting body that is typically larger and has a more rounded cap than *G. brunnea*. The dark red-brown to brown convoluted cap is 2 to 5 inches long by 2 to 4 inches wide and is attached to a furrowed stalk that is white to creamy in color. The stalk is 3 to 4 inches long, often measuring up to 3½ inches in diameter at the base. The ascospores are like those of *G. brunnea*, but the walls develop reticulate thickenings when mature.

Fig. 15 (left) hollow stalk, *Morchella;* (right) stuffed stalk, *Verpa.*

The genus *Verpa*— another stalked cup fungus

Species of *Verpa* have bell-shaped to conic caps attached only at the top of the long stalk, thus hanging free. When the stalk is split lengthwise, the interior is loosely stuffed with cottony aggregates of white mycelium along its entire length (figure 15). There may be toxins in species of *Verpa,* and there are reports of loss of muscular coordination after eating *V. bohemica.*

There are two species of *Verpa* in Iowa. *Verpa conica* (figure 16), the most common species, has a cap that ranges from smooth to irregularly wrinkled. It is olive to darker brown in color and measures about 1 inch long and 1 inch wide. The loosely stuffed stalk is slightly scurfy and is 2½ to 4 inches long and ½ inch wide. The asci are similar to those of *Morchella* species with eight elliptical, colorless, 20 to 26 by 12 to 16 μm, one-

celled ascospores in a row in each ascus. *Verpa conica* occurs on the ground in wooded areas in the spring, at about the same time as *M. esculenta.*

Verpa bohemica (figure 17) is quite rare in Iowa. It occurs on the ground in the woods early, before the *Morchella* species appear. As mentioned above, it probably should be avoided. *Verpa bohemica* caps have long ridges that may extend along all or a part of the length of the free, bell-shaped cap. The cap is ½ to 1½ inches by ⅝ to 1¼ inches. It is yellowish when young but becomes more brown with maturity. The loosely stuffed, almost cylindrical stalk is 2 to 5 inches in length. The asci contain only two ascospores per ascus. Each ascospore is colorless to slightly yellow, one-celled, ellipsoid, 50 to 80 by 15 to 18 μm. Fruiting bodies of *V. bohemica* easily may be confused with those of *M. semilibera.* The two-spored ascus of *V. bohemica* is the distinguishing characteristic.

Fig. 16 *Verpa conica.*

Fig. 17 *Verpa bohemica.*

Fig. 18 *Helvella crispa*.

The genus *Helvella*— the saddle fungi

Another pair of distinctive stalked cup fungi are two species of *Helvella*, both commonly called "saddle fungi" because of the shape of their apothecia. Saddle fungi usually occur from late spring through fall on the ground in the woods. Although they are as fleshy as the morels, they are smaller and less conspicuous and usually are not considered by persons searching for edible species. They have not been investigated for toxin content and we suggest that they not be eaten.

Helvella crispa (figure 18) is probably the most common species of saddle fungus. The cream-colored stalk may be up to 2½ inches long, with the saddle reaching a diameter of ½ to 2 inches. The cylindrical, longitudinally fluted stalk is hollow and measures about 1 inch in diameter. The ascospores, eight in an ascus, are broadly ellip-

tical, one-celled, colorless, 18 to 22 by 12 to 14 μm, each with a single large oil drop.

Helvella elastica (figure 19) also has a saddle-shaped apothecium, with a smooth, slender, hollow stalk, ⅛ to ⅜ inch in diameter. The fruiting body is about the same size as *H. crispa*, and the ascospores are similar.

A third species of *Helvella*, *H. acetabulum* (figure 20), is less conspicuous than the longer-stalked cup fungi and may be easily overlooked. In some years it is common on the ground in woods from mid-spring into early summer. It is short; the stalk is approximately ½ inch long. The conspicuous forked ribs on the outside of the deep, cup-shaped apothecium extend down along the stalk. The cream-colored to brown cup is ¾ to 1¼ inch high and 1 to 2½ inches in diameter.

Fig. 19 *Helvella elastica*.

Fig. 20 *Helvella acetabulum*.

Fig. 21 *Urnula craterium.*

Cup fungi—various genera

Because of their small size and comparative rarity, the cup fungi discussed here have not been considered edible.

Two nonstalked cup fungi are common on the ground in woods from late March into May. They appear to lie directly on the ground, but if one digs carefully around them, it is easy to discover that they are attached to small tree branches buried in the litter.

One of these, *Urnula craterium* (figure 21), usually grows from oak branches. The apothecia are brown to black both inside and out, 1 to 1½ inches in diameter and ½ to 2½ inches deep, with a tough and leathery texture. They are closed when young, but later they tear open at the top, leaving a rough margin. The asci lining the inside of the deep urn-shaped apothecium each contain eight broad-ellipsoid, smooth, colorless, and 25

to 35 by 12 to 14 μm ascospores. Even though this cup is quite large, it is easily missed in the spring woods because the color blends so well with the overwintered leaves that usually surround it.

The other early spring cup, *Sarcoscypha coccinea* (figure 22), is conspicuous, enough that it has the common name of crimson cup. The red color of the hymenium is due to pigments in the paraphyses that occur among the asci. It develops from the partly buried small branches of various deciduous trees from March to May, and is particularly common on basswood branches. The deep cup, ¾ to 1½ inches in diameter, is brilliant scarlet inside and white on the outside. Several of these large showy apothecia often develop from a single buried branch. The ascospores, usually eight in each ascus, are colorless, one-celled, elliptic, 26 to 40 by 10 to 12 μm, often with two large oil drops in each ascospore. Crimson cup apothecia may also be found in the woods in October or early November in some years, and are usually smaller than the spring crop.

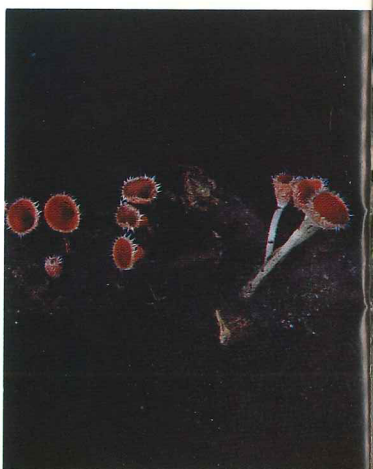
Fig. 22 *Sarcoscypha coccinea*.

If sufficient moisture is available, two other species of *Sarcoscypha* are common from late spring throughout the summer. However, their apothecia are smaller and a duller red than those of *S. coccinea*. They develop singly or in groups from buried branches in litter on the ground in the woods. *Sarcoscypha occidentalis* apothecia (figure 23) are shallow cups ½ to 1 inch in diameter. Like *S. coccinea*, the cup is red inside and a dull white on the outside. *Sarcoscypha floccosa* apothecia (figure 24) are smaller, ⅜ inch deep and ¼ inch in diameter, and deeply goblet-shaped, with matted white hairs on the outside and around the rim of the cup.

A third nonstalked cup fungus found in the woods in spring is *Peziza repanda* (figure 25). The large tan to pale brown apothecia, occasionally up to 5 inches in diameter, are on rotten logs or on the ground where large amounts of wood chips or rotting wood are present. These large shallow cups occur singly or in groups of quite different sizes. The ascospores, usually eight in each ascus, are elliptical, colorless, smooth, and 14 to 16 by 8 to 10 μm.

Fig. 23 *Sarcoscypha occidentalis.*

Fig. 24 *Sarcoscypha floccosa.*



Species of *Discina* (figure 26) have large (up to 2 inches in diameter) apothecia that develop on the ground or on very rotten wood in the spring. Some of the apothecia may have a short stalk, but they are more commonly flat on the ground and partly covered by overwintered leaves. They are often turned under at the edges with age, and the yellow-brown or reddish-brown to dark brown upper surface may be irregularly wrinkled. The ascospores are ellipsoid to tapered at each end, with a projection (an apiculus). The apothecia of *D. perlata* (figure 27) are reddish-brown and irregularly wrinkled with short, stout, furrowed stalks, somewhat suggestive of an abnormal *Gyromitra* fruiting body. This species is usually found in coniferous woods.

Fig. 25 *Peziza repanda.*

Fig. 26 *Discina*.

Fig. 27 *Discina perlata*.

Safe use of fungi as food

Anyone gathering and eating any natural food must exercise care. Morel hunters need to be particularly careful. Most people recognize that some species of *Amanita* and a few of the true mushrooms can be deadly poisonous. But the possibility of toxic compounds also exists in a wide range of other fungi.

Several of the fungi discussed here may contain insidious toxins. In Europe, fatalities have occurred from poisoning caused by species of *Gyromitra*. The toxin itself is called gyromitrin, and its principal component, mono-methyl-hydrazine, is an insidious toxin for two reasons. First, it may be cumulative, so that a person can eat fleshy fungi containing it until a certain level of toxin is present in the body. When this level is reached it may cause serious illness or even death. The other problem is that mono-methyl-hydrazine is carcinogenic, and persons who eat fungi that contain this compound may not receive warning of the toxicity until very serious problems arise.

There are two other reasons for care and moderation in eating mushrooms. First, because the human immunological system reacts to foreign proteins, it is possible to develop allergies to any high protein food such as mushrooms, whether they are labeled poisonous or not.

Second, mushrooms can also "spoil" in the same way that any fresh high protein food will, especially if left unrefrigerated in plastic bags. Mushrooms should not be gathered in plastic sacks. It is best to wrap each specimen in paper

toweling or wax paper until it can be cleaned. Mushrooms should be refrigerated if they are to be kept overnight.

There are always two major rules for safe eating of fleshy fungi:

1. Be absolutely sure of the identity of each specimen in your basket.

2. Don't eat excessive amounts even though you are sure of the identity.

References

For more complete discussions of the cup fungi the following references are recommended:

Dennis, R. W. G. *British Ascomycetes.* J. Cramer, Germany. Revised ed., 1981.

Jensen, R. D. "Some Stipitate Discomycetes of Iowa." *Iowa State Journal of Research* 52: 37-52. 1977.

Seaver, F. J. *The North American Cup-fungi (Operculates).* Privately published, 1942.

Prepared by Lois H. Tiffany, George Knaphus, professors of botany, and Robert F. Nyvall, former extension plant pathologist, Iowa State University. Photos by George Knaphus.

For more general information on mushrooms the following publications are recommended:

Groves, J. W.; "Edible and Poisonous Mushrooms of Canada." Publication 1112, Canada Department of Agriculture, Minister of Supply and Service, Ottawa, Canada, 1979 (Paperback; color and excellent black-and-white photographs).

Huffman, D. M., L. H. Tiffany, and G. Knaphus. *Mushrooms and Other Fungi of the Midcontinental United States.* Iowa State University Press, Ames, Iowa, 1989 (Paperback, excellent color photographs, keys).

Miller, O. K. *Mushrooms of North America.* E. P. Dutton and Co., Inc., New York, N.Y. 1972 (Excellent color photographs; also available in paperback, 1977).

Smith, A. H. and N. S. Weber. *The Mushroom Hunter's Field Guide.* University of Michigan Press, Ann Arbor, Mich., 1980 (Enlarged edition, all photographs color).

Smith, H. V. and A. H. Smith. *How to Know the Non-gilled Fleshy Fungi.* W. Brown Company, Dubuque, Iowa, 1973 (Drawings).

Smith, A. H., H. V. Smith, and Nancy I. Weber. *How to Know the Gilled Mushrooms.* W. Brown Company, Dubuque, Iowa, 1979 (Drawings).

Tiffany, L. H., G. Knaphus, and R. Nyvall. "Mushrooms and Related Fungi." North Central Region Extension Bulletin. No. 129. Cooperative Extension Service, Iowa State University, 1980 (Reprint, 1982).

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