The Underappreciated Kingdom

Around 3200 B.C., a lone traveler set out to cross the Alps. He died and was entombed in a glacier. The glacier slowly carried him down the mountain and deposited him, exposed, close to the Austrian-Italian border. A well-preserved 5,000-year-old man is a remarkable find, but most remarkable for mycologists is the fact that the Ice Man (as he came to be called) carried three carefully packed fungal products with him. One was identified as a fungus used as tinder. It makes sense that the Ice Man planned to start a fire. The other two packages contained fungi used in herbal medicine for such ailments as fatigue and wound treatment. The use of fungi for human needs, going back 5,000 years, simply confirms what we all know: fungi are important.

What is less known is that fungi are not plants. Until as late as the mid-1960s, fungi were classified as members of the Plant Kingdom. Many people probably still think of fungi as plants. After all, they look like plants; they grow in the same places; many provide food, such as mushrooms; and they are immobile. In the 19th century scientists realized that certain fungi cause diseases that damage crops, once again confirming a relationship with plants. Perceptions changed with the development of sophisticated methods to study plants and animals. Fungi are now classified within their own kingdom, the Fungi Kingdom.

The kingdom is vast. It consists of tiny, unicellular yeast, which we use in making bread and wine, as well as the largest organism on our planet, a fungus that grows in the Malheur National Forest in Oregon, Armillaria ostoyae. According to the best estimates, it covers 3.7 square miles, weighs about 35,000 tons, and is about 2,400 years old. It is the largest, heaviest, oldest living organism on the planet. If it could walk we would have to call out the military. Fortunately, most of the fungus remains underground. In between the smallest and the largest fungi are a variety of organisms, such as mushrooms, a familiar food source, and molds, the superheroes of our planet’s ecological well-being.

Imagine a world where tons of leaves fall from the trees each autumn and remain on the ground. Imagine trying to walk in such a forest. Fortunately, we don’t have to because molds are on the job, recycling organic matter. How molds accomplish this process is quite unique. Molds cannot photosynthesize and therefore must break down organic matter in their environment to obtain food. To do this the fungi release their own digestive enzymes into their surroundings and then absorb the results. This method is very different from that of plants, which make their own food, and animals, which take in food from their surroundings and absorb it internally.

Decomposition of organic matter is the life force of our ecological system. Besides simply removing debris, decomposition results in the production of carbon dioxide and, eventually, oxygen. As decomposition proceeds, carbon dioxide is released. Plants use the carbon dioxide for photosynthesis. The end product of photosynthesis is the oxygen that we need to live. At the end of the process, the decomposed leaf litter becomes the humus that forms our soil. Without fungi we would have to figure out some other way of recycling organic material.

The slow decay of leaf litter is particularly noticeable in the fall and winter months. Decay happens slowly and, unusual as it may seem, the fungus actually keeps photosynthesis viable as long as possible. Note in the first picture that the leaf has been invaded by mold but the center remains green. The green
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color means that the leaf continues to photosynthesize and therefore continues to manufacture food. The longer the leaf photosynthesizes, the longer the fungus receives nutrients. It seems the fungus is in no hurry to consume the leaf entirely. As time goes on, the green color steadily diminishes. The second picture shows a leaf that no longer is able to photosynthesize but still is not decayed enough to become leaf litter. It has probably been on the forest floor for at least two years.

Did you ever wonder why a fungal infection is so difficult to eradicate? Think of athlete’s foot, for example. Recent genetic studies have come up with an answer.

Way back in the history of our planet, plants, animals and fungi shared a common ancestor. About 1 billion years ago plants diverged from the common ancestor and continued their evolution apart. Animals and fungi continued evolving together until about 800 million years ago when animals and fungi diverged. This “close” relationship is accepted as the reason fungal infections are so hard to cure. 800 million years is a long time in our history, but only the blink of an eye on the evolutionary time scale.

We think of spring as the most dynamic time of year, but fall is equally dynamic. In spring we see the surge of new growth; in fall we see the recyclers at work preparing the products of the growing season for reuse. It will soon be a good time of year to see these changes.

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