What's Bugging You—Slime Molds

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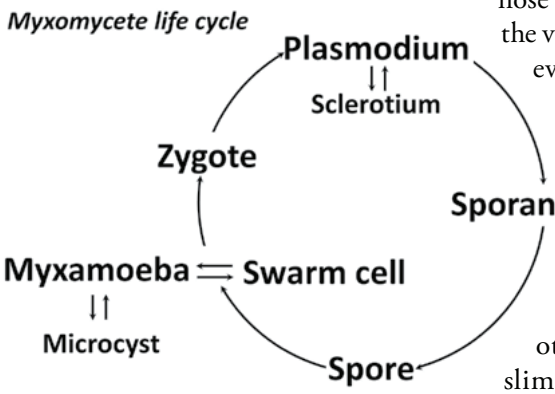
Summer rains in the northeastern US bring out fist-sized masses of grainy yellow goo, frequently on wood chip mulch or decaying wood (Fig. 1). The first concerned "what is that" phone call usually is followed the next day by a more alarmed "*what* is *that*", when the blob has moved a foot or two across the mulch. All too often, alarm moves to disgust when I put the common name of "dog vomit fungus" (*Fuligo septica* is the scientific name) on the mass. This is actually a great opportunity to learn about and enjoy a richly varied and beautiful part of our natural biodiversity.

Figure 1: Fuligo

Fuligo is a Myxomycete, literally "slime mold." The *Fuligo* stage we usually see is the plasmodium, essentially a single huge cell containing many nuclei. Slime molds are not fungi but they share their habitat with fungi and mycologists traditionally study them. Arborists are likely to encounter slime molds and a little understanding can enhance our relationship with the landscape. Slime molds are not harmful, they do not cause plant or animal disease. Unlike mycelial fungi which often extend their hyphae deeply into leaf litter or decomposing wood, slime molds live on surfaces especially shaded, well-watered mulch and lawns. As a matter of cosmetics, a blast from a garden hose or a sweep of a rake can break up the visible portion of a slime mold. However, they are much more interesting to observe than to remove!

Figure 2: Life cycle



Slime molds show great variation in structure and appearance and experts are still determining their relationships to each other and to other organisms. The plasmodial slime molds are distinct from fungi and all other life by the ability to move across surfaces, producing a relatively large plasmodium with many nuclei and no cell walls, and the digestion of food within their own bodies.

A few decades ago, myxomycetes were classified in a separate kingdom, the Protista, along with the protozoa. Biologists now recognize that protists or protozoa are not natural groups of organisms and most specialists tend to avoid those catch-all terms for unrelated organisms.

Although details vary among the approximately 700 known species of slime molds, they tend to follow a common life cycle (Fig. 2). As with fungi, myxomyce-

tes produce microscopic spores. Unlike fungi, the myxomycete spore germinates to release one of two kinds of cells. The first is an amoeboid-type cell known as a myxamoeba. In a favorable environment, a myxamoeba can reproduce by cell division to form new and independent myxamoebae (the plural for myxamoeba). Under adverse conditions, a myxamoeba may rapidly form a thin-walled microcyst as a dormancy strategy and then revive as conditions occur. When free water is available, a germinating spore produces the second type known as a swarm cell, usually with one long whiplash and one very short flagellum. The myxamoeba and swarm cell, although different structurally, are interconvertible, depending on environmental conditions.

When concentrations of myxamoebae or swarm cells reach some threshold concentration, two cells fuse to form a zygote. However, the slime mold cells are self-sterile and need to be from different genetic individuals for fusion. The movement of myxamoebae and swarm cells facilitates the meeting of complementary cells. The zygote divides many times to form the large, multinucleate plasmodium. This plasmodium is what we first see as *Fuligo* moves across the lawn or wood chip mulch. As with myxamoebae and microcysts, adverse environmental pressure can induce small portions of plasmodium to form thick-walled sclerotia.

Free-living myxamoebae and swarm cells as well as the plasmodium gain their nutrition by phagocytosis, the surrounding and engulfing of bacteria, small protozoa, or fragments of organic matter. The spiral motion of the whiplash flagellum of swarm cells may even force bacteria and other food particles towards an ingestion site on the swarm cell surface. This is critically different from fungi which digest their food sources outside and bring the dissolved nutrients inside the fungal cells. Slime molds can also


Figure 3: Hemitrichia

take up soluble nutrients from their environment. Undigested material is forcibly ejected from the myxamoeba.

The ability to move allows the plasmodium to find food and a suitable environment for growth and development. Following the attainment of some threshold size and with some environmental cues, the plasmodium moves from a wet to a drier environment to form a sporangium or fruiting body. Shifts in metabolism convert the multinucleate mass of the plasmodium into uninucleate spores and a variety of of spore-containing sporangia, the size and shape of which are the usual basis for field identification and classification.

Another slime mold with a conspicuous plasmodium is *Physarum polycephalum*. The *Physarum* plasmodium often occurs on the gills or pores of mushrooms (Fig. 3). Some experts suggest that spores and associated bacteria may provide a good food source for the slime mold.

For most slime molds, the plasmodial stage is not readily noticed in nature, but the developing and mature fruitbodies can be quite dramatic. The bright orange *Hemitrichia* visibly stands out from the supporting wood surface (Fig. 4). Developing fruitbodies are very soft and smear easily. As *Hemitrichia* fruit bodies mature, they become firm and mustard yellow in color. Mature *Stemonitis* look like clumps of brown whiskers, 1-2 cm tall (Fig. 5). Immature fruit bodies are brick-red to carmine cylinders supported by very thin, dark stalks. I have seen these develop on wooden frame construction exposed to prolonged dampness. I find the fragile bristles of *Ceratiomyxa* most often on dead logs in dark, shaded woodland plantings (Fig 6).


Figure 4: Physarum

The plasmodium and the fruit bodies of slime molds can be quite dramatic in appearance, yet most of the biological activity of slime molds in unseen. The life cycle is well-established, but we don't know the duration or proportion of biomass at each stage. We know that slime molds graze on living soil microorganisms, but their contribution to the soil food web and plant nutrition is largely unknown. When I first noticed slime molds, they seemed rare and exotic. Now I see them quite often and perhaps you will too! As a group, the slime molds make a rich contribution to our landscape.

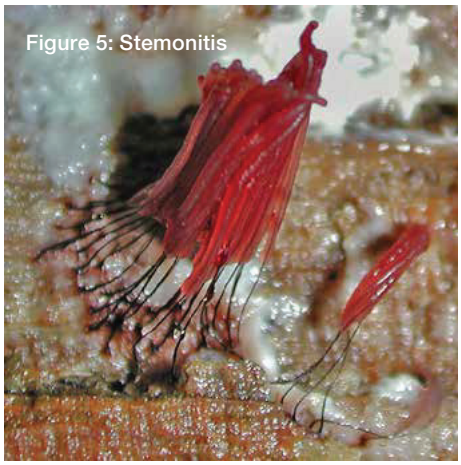


Figure 5: Stemonitis


Figure 6: Ceratiomyxa