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SPHAEROBOLUS SPP.--THE ARTILLERY FUNGUS

The presence of persistent brown to black spots on cars, house siding, plants, and other surfaces may be an indication of the presence of the fungus *Sphaerobolus* spp. These brown spots are spore masses called peridioles or glebal masses, which are approximately 1-2 mm (1/12 inch) in diameter. They are the dispersal structures of *Sphaerobolus.* This fungus is a Basidiomycete and a member of the class Gasteromycetes, family Sphaerobolaceae. (However, molecular data now suggest that this species might be better placed in the family Geastraceae)

Sphaerobolus is a cosmopolitan saprophyte (decay organism) found on wood and bark chips, dead and decaying wood, and dung and is not considered a pathogen of plants, animals, or humans. The increased prevalence of this fungus during the past ten years appears to be partly associated with the increased popularity and use of bark and wood chip mulches in the landscape.

Sphaerobolus is commonly called the "artillery fungus" or "sphere thrower" since it forcibly ejects its spore masses (called peridioles or gleba) for considerable distances. Peridioles can be projected vertically for more than 2 m (6 ft) and horizontally for over 6 m (20 ft). Some researchers have also reported that the discharge is accompanied by an audible sound. As with most fungi, growth of *Sphaerobolus* is influenced by temperature, light, and moisture. It grows better under wet conditions and is most commonly a problem during the cool, wet conditions of spring and fall. It is much less problematic during the hot, dry periods of midsummer. For much of its life, this fungus consists of a mass of white, thread-like filaments called hyphae, which aren't readily visible to the naked eye (Figure 1).

Figure 1. Magnified view of white, thread-like filaments (hyphae) (arrows) of *Sphaerobolus* growing on wood chips.

However, the presence of this growth can sometimes be recognized as matted or gray, somewhat bleached areas in a mulch bed. This bleaching is attributed to the digestion of the lignin, cellulose, and hemicellulose in the wood, as it is colonized by the fungus.

Fruiting structures (called basidiocarps) usually form on substrates (wood chips, bark, dung, or decaying plant material) in autumn and spring. They are small, spheres approximately 1-2.5 mm (1/10 inch) in diameter and buff to yellow in color (Figure 2). Because of their size, they are very difficult to find in the mulch.

Figure 2. Early stages of developing basidiocarps (arrow).

As the fruiting structures mature, outer walls of the basidiocarps rupture, giving the structures a star or nest-like appearance. As they open, the peridioles or gleba are visible as dark masses at the bottom of the opening structures (Figure 3). Increases in osmotic pressure, possibly due to the conversion of glycogen to sugars, cause the membranes under the peridioles to swell and turn inside out. This process provides the force (estimated to be 1/10,000 horsepower) to propel or eject the peridioles into the air. After the peridioles are discharged, the swollen, inner membranes remain visible as glossy protrusions in the basidiocarps (Figure 4). These fruiting structures usually remain active or "shoot" for approximately 2-3 weeks .

Figure 3. Basidiocarps splitting to form star-like "nests." Note the peridioles (dark objects at bottom of each "nest") before they are shot.

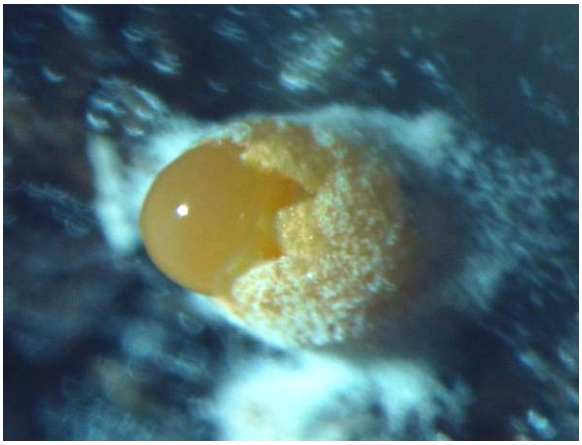

Figure 4. The glossy protrusion visible after the peridioles are discharged.

Adequate light and moisture are also necessary for ejection or discharge of peridioles. The ejection process is phototropic, which means that the peridioles are projected towards light and light-colored objects (e.g., white cars, beige houses). Peridioles are typically quite sticky and, since they are forcibly ejected, they readily

adhere to objects upon which they are impacted (Figures 5 and 6).

Figure 5. *Sphaerobolus* spp. growing on wood chips in a petri dish. Note the brown peridioles shot onto the lid.

Figure 6. Close-up of peridioles stuck to the lid of plastic petri dish after being shot from fruiting bodies. Note the flattened appearance due to impact and the sticky halo of material adhering the peridiole to the surface.

When the peridioles dry, they become *very* difficult to remove (Figure 7). Unfortunately, *Sphaerobolus* can be long-lived and peridioles have been found to still be viable for up to 12 years. In addition to growing on wood and bark mulches, *Sphaerobolus* hyphae and peridioles can also be dispersed by wind or over long distances in plant debris, mulch, animal fur, and animal dung.

Questions about sources of *Sphaerobolus* are common and very difficult to answer. Since the fungus commonly occurs on many substrates in forests, woodlots, and home landscapes, it is impossible to pinpoint or definitively "prove" or identify the source.

Figure 7. Peridioles stuck on an aluminum vent located on the side of a house.

MANGEMENT STRATEGIES:

Prevention and avoidance are the major strategies for managing this fungus, since chemicals have not been found to be effective. Management strategies focus on the substrate (e.g., mulch) that supports the growth of *Sphaerobolus*. This involves removing or disturbing the wood chips or bark mulch with a rake to disperse the fungus and to dislodge the fruiting bodies. This also helps to dry out the mulch by increasing air circulation and creating

conditions that are less favorable for the growth and sporulation of the fungus. Periodically overlaying existing mulch with fresh mulch reduces the light necessary for peridiole discharge and has been successful in some situations. However, when overlaying, it is important to avoid making the mulch layer too thick, since this can be detrimental to the health of any plants in the mulched beds.

The type of mulch used is also an important strategy for managing this problem. It is important to select mulches that contain ***at least 85% bark***. *Sphaerobolus* will not grow as well on bark as on wood, since bark is a less favorable source of carbon than wood. This has become an issue of concern since today, a substantial amount of the mulches used are made from recycled wood or from chipped tree prunings (e.g., branches, trunks), that are comprised mainly of wood. As a consequence, these mulches provide better sources of carbon than the previously used mulches that contained mainly bark. Today's mulches are also more finely-shredded than previously, so these mulches probably hold more moisture than the older, coarsely ground mulches—conditions that favor growth of *Sphaerobolus*, since moisture is necessary for its survival.

All types of mulch can potentially support the growth of this fungus. However, research has determined that large pine bark nuggets tend to remain hard and dry so they are less favorable for growth of the fungus than other types of mulch. Additionally, cypress mulches appear less favorable for growth.

Another tactic to minimize *Sphaerobolus* problems in the landscape is to use an alternative (inorganic) form of mulch. These include black plastic, stone, pea gravel, or marble chips. These types of mulch are best used in areas directly adjacent to homes, cars, or other surfaces where the risk of damage is the greatest.

Sphaerobolus can occasionally be a problem in container-grown plants when bark or wood products are components of the potting media. It has been suggested that composting the bark or wood products prior to use may help to reduce the ability of the artillery fungus to colonize the wood or bark by promoting the growth of beneficial organisms that are antagonistic to it.

Peridioles should be removed from affected surfaces with a stiff water spray from a hose or by scrubbing with a wet cloth or stiff brush **before they dry**. Unfortunately, in most cases, this is not practical and removal is usually attempted **after the peridioles have dried**. When this is the case, they are ***very difficult to remove*** and must be physically scrubbed and scraped from the affected surfaces.

When the glebal masses are on glass surfaces, they can be easily removed by scraping with a razor blade. However, care must be exercised when removing the hardened masses from other surfaces, since the removal process itself can often damage the substrate.

When removing the brown dots or peridioles, one must take into account the fact that they can remain viable for more than 10 years and can serve as a means for spreading the fungus. As a consequence, peridioles should be carefully scraped off affected surfaces. The peridioles will not grow on house siding or inert substrates such as concrete or paved walkways. However, if they fall into mulch or another suitable organic substrate, they can germinate and re-infest these substrates. A

tarp or similar item should be placed under the area that is being scraped to catch the fungal structures as they drop in order to keep them from re-infesting the substrate.

Extensive staining can also remain after the fungal masses are removed. These stains usually fade with time but can be unsightly. Pitting of the substrate has also occasionally been observed, especially on cars. Power washing (and double power washing with a rigorous scrubbing in between) has yielded mixed results and its success appears to be dependent upon the particular type and age of the siding. More effective results have been obtained with new vinyl siding whereas limited success has been reported for old vinyl, aluminum, and older painted wood siding.

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