

Fairy Ring: Fantasy or Nightmare?

“At night, fairies come out of their hiding places, join hands, and dance in a circle. By morning, mushrooms have sprouted in the circular path where the fairies danced.”

BY JAMES J. FARRAR



may be pleasant to fantasize about fairies dancing in a circle, fairy ring actually is a serious problem of golf greens and fairways.

SYMPTOMS

Fairy ring fungi produce three kinds of symptoms: mushrooms, dark green rings, and rings of dying turf. One or any combination of symptoms may appear at any particular time. On golf courses, fairy rings generally occur in two- to five-year-old greens. The classic fairy ring symptom is a ring or partial ring of mushrooms. Rings vary in

One or a combination of fairy ring symptoms may appear at any one time. Dark green rings are primarily an aesthetic problem.

That pre-golf-era tale was the original explanation for roughly circular patterns of mushrooms growing in forests, grasslands and, later, golf courses and lawns. Fairy ring of turfgrass is actually caused by mushroom-forming fungi growing and reproducing in the soil. Although at least 60 species of fungi have been reported to form fairy rings, fairy ring in any one particular location is caused by only one species of fungus. The most common are species in the genera *Marasmius* and *Lepiota*.

Fairy ring is an odd turf disease since the fungus does not directly attack the grass plant. The fungus grows on the dead organic matter in the soil and only indirectly causes symptoms. While it



diameter from a few inches to 30 feet or more. Larger rings are often arcs or partial rings, and there may be large gaps in the ring. Fairy ring symptoms can occur without the mushroom stage, and on golf courses the appearance of mushrooms is the least common of the three symptoms.

There are two non-mushroom symptoms. One is a ring of darker green grass and the second is a ring of water-stressed or dying grass. Although the dark green rings are usually considered an aesthetic problem, the mushrooms and rings of dead grass interfere with play of the game.

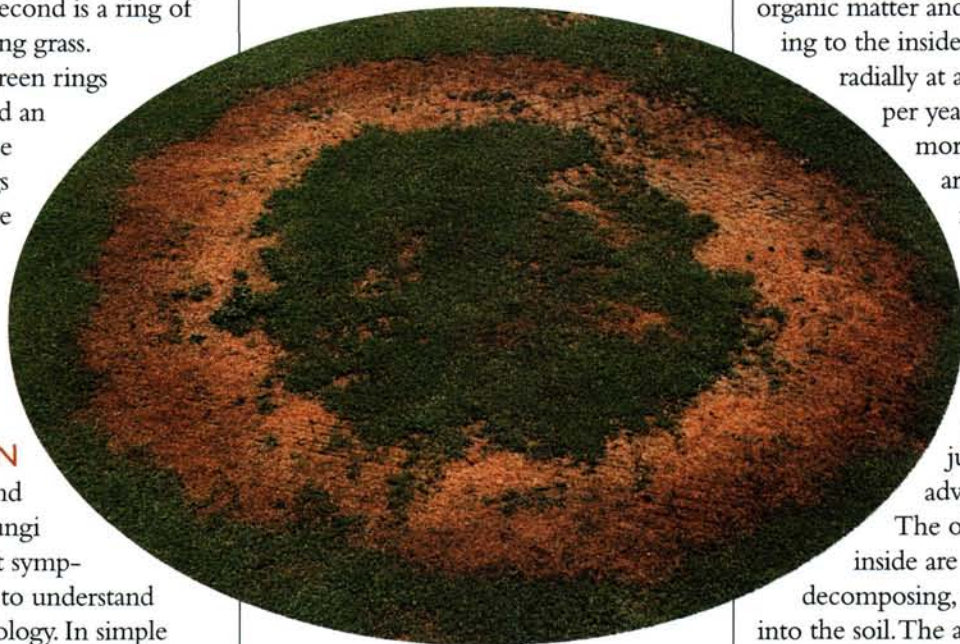
FUNGI GROWTH AND REPRODUCTION

In order to understand how the fairy ring fungi produce the different symptoms, it is important to understand some basic fungal biology. In simple terms, the fungus life cycle consists of three parts — mushrooms, spores, and vegetative filaments called hyphae. Mushrooms are the sexual reproduction stage, and they produce millions of microscopic, airborne spores. The spores are passively transported by air currents and then settle to the ground. If the spores land in a suitable environment, they germinate to produce hyphae.

Hyphae are very fine, threadlike structures. Hyphae produced from spores of opposite mating types must fuse together in order to continue the life cycle. Hyphae grow by elongating at the tip and branch, so that starting from one point the vegetative body expands radially. This means the fungus expands as an enlarging circle. The expansion rate is generally a few inches per year.

Hyphae in the leading or outside edge of the circle grow and digest the organic matter in the top few inches of

soil. Hyphae toward the inside of the circle die from lack of food since all the available organic matter has been consumed. Then the mass of hyphae changes from a solid circle to a ring shape. When the fungus has gathered enough energy from digesting organic matter in the soil, it forms a mushroom and reproduces by making spores.



Fairy ring exhibits itself as dying, water-stressed grass, and eventually dead turf. The rings of dead grass interfere with play of the game.

DEVELOPMENT OF FAIRY RINGS IN GOLF COURSES

With that understanding of fungal biology and reproduction, it is easier to understand the symptoms. Fairy ring fungi thrive on organic matter that contains high amounts of lignin, such as thatch, peat moss, sawdust, wood chips, and bark. If thatch is not properly managed by regular core aeration, vertical mowing, and sand topdressing, then a high-lignin habitat for fairy ring is created. The airborne spores of the fungus will settle on the thatchy turf and begin growing. Regular thatch maintenance helps prevent fairy ring by not allowing a favorable habitat to develop. Recently constructed greens also are a good habitat for fairy ring

since they are typically constructed of a combination of sand and peat moss. Symptoms may occur two to five years after construction of a new green, since that is enough time for the spores to land, grow, and cause symptoms.

The ring pattern for all three symptoms (mushrooms, dark green grass, and water-stressed to dead grass) is due to the hyphae growing outward into new organic matter and the old hyphae dying to the inside. Rings expand

radially at a rate of a few inches per year. Figure eights and more complex patterns are the result of neighboring rings expanding and contacting each other.

The dark green ring of grass is produced in the area just behind the advancing new hyphae.

The old hyphae to the inside are dying and decomposing, releasing nitrogen into the soil. The additional nitrogen causes the grass, especially grass that is slightly nitrogen deficient, to become a darker green.

The water-stressed and dying rings of turf are somewhat more difficult to understand and much more difficult to control. If the hyphae are growing closely packed together because of an abundance of organic matter, they form a tight mat-like layer in the upper one to two inches of soil. Hyphae are water-repellent (hydrophobic), and when they are packed tightly together, they form an impervious layer that irrigation water does not penetrate. The soil dries out below the water-repellent layer of hyphae. Therefore, grass roots will not have water to absorb and send to the grass blades. The grass wilts and, in severe cases, dies from a very localized lack of water. The mat of white hyphae and the localized area of dry soil below are easily visible if one cuts into the ring with a soil probe or shovel. The

soil just a few inches away from the localized dry spot has plenty of moisture.

MANAGEMENT OF FAIRY RING

Using the knowledge of the biology and causes of fairy ring makes it easier to understand the remedies to the problem. Mushrooms interfere with play, but they can be easily dealt with by mowing off the tops, vertical mowing to remove the mushroom stumps, and sand topdressing. These treatments just remove the existing mushrooms and more may spring up the next day or next week. Hyphae are still growing in the soil and will continue to produce mushrooms for up to several years.

Applying additional fertilizer to the surrounding turf to make all the grass the same color can mask the dark green ring symptoms. Foliar applications of iron are especially good for masking

symptoms. Fertilizer applications are cosmetic fixes and do not affect the fairy ring hyphae in the soil.

The most difficult symptom to control is the ring of water-stressed and dying grass. Several different controls can be applied alone or in combination. These include vertical mowing, core aerifying, and sand topdressing to break up the hydrophobic layer of fungal filaments, surfactants (soap-like chemicals) to break down the hydrophobic properties of the fungal filaments, and specific fungicides to kill the fungus. All of these control treatments help promote healthy turf, but none of them provides perfect control. Core aerifying and surfactant treatments break up the hydrophobic layer and allow water to penetrate the soil but do not kill the fungus. Fungicide treatments kill or debilitate much of the hyphae. The older fungicides were not always effective at controlling fairy ring, but the new strobularin

fungicides (e.g., ProStar and Heritage) work well. Despite the best control efforts, fairy ring may reappear as a slightly larger ring in the same location year after year.

CONCLUSIONS

Fairy rings are caused by certain species of mushroom-forming fungi growing on the organic matter in the soil. Rings expand as the fungus continues to grow outward. Management of fairy ring consists primarily of prevention and judicious use of strobularin fungicides when symptoms appear. Although the name fairy ring evokes fantastic images of fairies dancing on the turf, the disease is much more like a nightmare for golf course superintendents.

JAMES FARRAR, PH.D., is assistant professor in plant pathology at California State University in Fresno.



The classic fairy ring symptom is a ring or partial ring of mushrooms. The mushroom mycelia feed on organic matter found in the turfgrass root zone.