Turfgrass and Environmental Research Online

...Using Science to Benefit Golf

University of Kentucky researchers are studying the biology and behavior of mound-building ants, *Lasius neoniger,* in an effort to develop an effective control strategy to limit their mounding activities on golf course tees and putting greens.

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PURPOSE

The purpose of *USGA Turfgrass and Environmental Research Online* is to effectively communicate the results of research projects funded under USGA's Turfgrass and Environmental Research Program to all who can benefit from such knowledge. Since 1983, the USGA has funded more than 290 projects at a cost of $25 million. The private, non-profit research program provides funding opportunities to university faculty interested in working on environmental and turf management problems affecting golf courses. The outstanding playing conditions of today's golf courses are a direct result of ***using science to benefit golf***.

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Nuisance Ants on Golf Courses

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SUMMARY

Mound-building nuisance ants have become one of the most troublesome pests in golf course maintenance. Knowledge of their biology is important in establishing a control strategy for golf course putting greens. University of Kentucky researchers have found:

- Most of the nuisance ant problems on golf courses in the cool-season and transitional zones seem to be caused by *Lasius neoniger*, the so-called turfgrass ant.
- Researchers determined that mound building started in February or March, increased rapidly in April and May, and declined by late summer.
- Ants are the main predators of white grub eggs in the soil, as well as eggs and small larvae of cutworms, sod webworms, and other turf insects.
- *Lasius* ant mounds are concentrated around the edges of sand-based greens. More than 90% of mounds on greens were located within 2 meters (6.5 feet) of perimeter, and only 3% were more than 3 meters (10 feet) into the green.
- Turf ants have a mutualistic relationship with root aphids which they maintain in their nests and "tend" like dairy cattle, feeding on the aphids' sugary excrement. Root aphids are abundant in native soil, but largely absent from high-sand rootzone greens. Maintaining access to root aphids may explain, in part, why ant nests are distributed around the edges of greens. Research will test whether controlling the aphids will discourage ants from nesting.
- Queen ant emergence is synchronized in late summer. Researchers are testing whether treating a narrow buffer zone just outside the collar will intercept new queens, prevent nest establishment, and reduce ant problems the following year.

Mound-building nuisance ants have become one of the most troublesome pests in golf course maintenance. The problem occurs when ants construct nests on putting greens and tees. Ant nests, which are located underground, often have multiple entrances each surrounded by a small volcano-shaped mound of soil. Mounds are formed from soil particles that the worker ants bring to the surface while excavating burrows and enlarging the nest chambers.

Ant mounds can be very abundant in high-sand rootzone putting greens and tees. Besides being unsightly, they dull mower blades, clog machinery, and smother closely mowed grass. On putting greens, ant mounds disrupt smoothness and uniformity and can directly impact the game. This article provides an update on our current USGA-funded research project concerning biology and pro-active management of turf ants on golf courses.

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Basic Ant Biology

Most of the nuisance ant problems on golf courses in the cool-season and transitional zones seem to be caused by *Lasius neoniger*, the so-called turfgrass ant (1). Worker ants, the form most often seen, are light to medium brown and about 2-2.5 mm (1/10th inch) long. *Lasius neoniger* is a cosmopolitan species that typically nests in sunny open areas. The subterranean nest consists of shallow interconnected chambers and is seldom more than 25-38 cm (10-15") deep. Besides workers, the nest contains a single reproductive queen as well as immature stages (eggs, larvae, and pupae) that collectively are called the

Lasius neoniger ant queen on closely mowed bentgrass

brood.

For most of the growing season, the queen lays eggs that develop into infertile female workers that cooperate in the various tasks in the colony including cleaning and enlarging the nest, gathering food, defending the nest from natural enemies, and tending to the queen and her brood. In mid- to late summer she begins laying eggs that develop into reproductive individuals, i.e., males and new queens. These winged reproductive ants emerge from the nest in late summer, mate, and the newly fertilized young queens fly or crawl to new sites to overwinter where they will start a new colony the following year.

Egg-laying begins in early spring. Queens initiating a new nest first lay a small batch of 10 to 20 eggs. This first brood will develop into tiny workers called nanitics. Nanitics, although small and weak, begin foraging for food for the queen, ensuring that she will have enough nutrients to lay additional eggs. The queen then remains in the nest and lays eggs that develop into normal workers. The colony then grows rapidly during late spring and early summer as the ants enlarge their foraging area and increasingly more brood and workers are reared. Winged reproductive forms are produced in late summer to complete the cycle. It is believed that once a nest is established, the resident (old) queen may survive and lay eggs for more than one year.

We determined the seasonal pattern of mound-building by counting active *L. neoniger* mounds on ten sand-based creeping bentgrass tees on each of two Kentucky golf courses monthly from February through November. Mounding started in February or March, increased rapidly in April and May, and declined by late summer.

Many ants obtain carbohydrates by feeding on honeydew that they obtain from aphids (such as the root aphids shown above) or other tiny insects that suck plant sap.

Workers of *L. neoniger* forage on the surface for food including insect eggs, small insects, or insect fragments. A successful foraging trip results in the worker depositing a trail pheromone from its hindgut while returning to the nest. Additional workers use this trail to find the resource discovered by the scout. Subsequent workers reinforce this trail pheromone so long as the food resource is present. Workers also may obtain carbohydrates by feeding at extrafloral nectaries, or by collecting nectar from flowers of nearby plants. For example, we have observed *L. neoniger* feeding at extrafloral nectaries of peonies in flower beds near turf.

Ants, in general, are beneficial to turfgrass. They are important predators contributing to natural control of pest insects (2, 3). Ants are the main predators of white grub eggs in the soil, as well as eggs and small larvae of cutworms, sod webworms, and other turf insects. Ants' burrowing and nesting activities promote air and water infiltration, and help to incorporate organic matter into the soil where the nutrients are available to the grass roots.

Ant-Aphid Mutualism

Many ants obtain carbohydrates by feeding on honeydew that they obtain from aphids or other tiny insects that suck plant sap. The honeydew, essentially sugary aphid excrement, is a complex mixture of nutrients including free amino acids and amides, minerals, and B-vitamins. Often the ants "tend" the aphids like dairy cattle and defend them from predators. When an ant strokes an aphid with its antennae, the aphid relinquishes a sugary droplet from its anus. The ant swallows the droplet and carries it back to the nest where it is shared within the colony.

Lasius neoniger has a specific relationship with root-feeding aphids, *Geoica spp.*, which they maintain in their nests . The ants store and care

University researchers measured the distance from the edge of puttings that ant mounds were found in an effort to understand the behavior of the turfgrass ant.

for the aphid eggs over the winter, mixing them in with their own. The root aphids hatch by early spring and are carried by the ants to nearby grass roots to feed. As the aphids multiply, the ants care for and protect them. Turfgrass that receives supplemental nitrogen and other nutrients often supports large numbers of root aphids that provide ample honeydew for ants. The ants also may eat some aphids to supplement their diet. The aphids themselves don't seem to measurably harm the grass.

Why are ant mounds mainly around edges of sand-based greens?

Superintendents often report that ant mounds are most abundant around edges of sand-based putting greens. We speculated that the abrasiveness of the green's rootzone mix might be unsuitable for the soft-bodied root aphids from which the ants get food, and also for the ant nest itself. If that is true, then the main nest chambers with the queen may be restricted to just outside the collar in native soil. Perhaps ant control efforts should be directed there, rather than spraying the green itself. Mounds encroaching onto greens may represent secondary nest chambers connected by tunnels to the main nest.

We tested that hypothesis by sampling the distribution of ant mounds and root aphids on sand-based greens, collars, and in adjacent roughs, and examining their abundance in relation to soil sand content. Locations of several hundred mounds were mapped on 10 different greens on each of three golf courses by measuring the distance of each mound from the outside edge of the collar. Aphids were sampled by pulling soil cores along transects centered on the collar and extending into the green or rough. The cores were placed in a Tullgren funnel apparatus which slowly dries the samples under heat and light, driving soil invertebrates downward into collection jars. Root aphids were then counted and the sand content of each core was analyzed.

Our samples confirmed that *Lasius* ant mounds are concentrated around the edges of sand-based greens. More than 90% of mounds on

On-site research confirmed that *Lasius* ant mounds are concentrated around the edges of sand-based greens. More than 90% of mounds on greens were located within 2 meters (6.5 feet) of perimeter, and only 3% were more than 3 meters (10 feet) into the green.

greens were located within 2 meters (6.5 feet) of perimeter, and only 3% were more than 3 meters (10 feet) into the green. Root aphids were abundant in native soil, but absent from the high-sand rootzone of collars and greens. It was not practical for us to dig up the greens on cooperating golf courses to look for ant nests, but in 2004 we hope to sample the University of Kentucky research greens to determine if the main ant nests are located in the green, collar, or close rough.

While our results are correlative and do not prove that maintaining access to root aphids is why ants encroach from the perimeter, the ant-aphid mutualism may be a weak link that could be exploited for ant management. We plan an experiment for 2004 to determine if eliminating root aphids with a systemic soil insecticide will discourage ants from nesting in that area.

Pro-active Ant Management

Superintendents often find that spraying putting greens gives only temporary suppression of mound-building nuisance ants. Residues of fast-acting insecticides do kill workers foraging on the turf surface, but often they fail to eliminate the queen in her underground nest chamber. Several pyrethroids including bifenthrin (TalstarOne), cyfluthrin (Tempo), deltamethrin (DeltaGard), lambda-cyhalothrin (Scimitar) are labeled for ant control on golf courses. The best timing is early in the growing season, as soon as mounds appear. At that time, new colonies are just getting started, and established ones are weakened from over-wintering, with depleted food reserves, older workers, and few new brood. Even so, spraying ant-infested turf is not likely to eliminate the ants.

Fipronil, the active ingredient in Chipco Choice and Chipco TopChoice granular insecticides, is labeled for control of mole crickets, fire ants, and nuisance ants on southern golf courses. It is very effective against *Lasius neoniger*, providing season-long suppression of mound activity. Fipronil is only labeled in the 13 southern states where fire ants are established, so it presently is not an option for use on temperate-zone golf courses.

Our earlier USGA-funded research (3) showed that spot-treating with MaxForce Fine Granule Insect Bait (Clorox Co.) often will eliminate ant mounds on putting greens. When the bait, which contains a slow-acting insecticide, is sprinkled around mounds, the ants take it into the nest and feed it to the queen and her brood. The nest dies out in a few days. Ants do not take wet bait, so if trying this approach, apply the bait after dew dries and withhold irrigation for at least 12 hours.

We plan in 2004 to determine if targeting newly-emerged queens in late summer will prevent new ant nests from becoming established in high-profile areas of golf courses. Of the several trap designs we have tested, the most effective for queen monitoring was a sand-filled, 12-ounce plastic drink cup set flush with a golf cup cutter. Crawling queens burrowed into the sand which was periodically checked. Superintendents might

set a few such traps in green surrounds, or simply watch for the first queens crawling on greens or tees.

Recent work (4) indicates that pyrethroids such as deltamethrin or lambda-cyhalothrin provide up to four weeks residual control of cutworms. Queen ant emergence seems to be synchronized, so spraying a narrow buffer zone just outside the collar once in late summer might intercept new queens, prevent nest establishment, and greatly reduce ant problems the following year.

There is much still to be learned about the biology of nuisance mound-building ants on golf courses. Our USGA-funded research project hopefully will point to more efficient ways to manage this pest while reducing overall insecticide use.

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