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Turfgrass ants: Biology dictates strategies for control

Understanding ant biology can help superintendents manage these nuisance pests.

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Mound-building nuisance ants can be one of the most troublesome pests in golf course maintenance (Figure 1). Ant mounds can be very abundant in greens and tees with high-sand root zones. Besides being unsightly, ant mounds dull mower blades, clog machinery and smother closely mowed grass. On greens, ant mounds disrupt smoothness and uniformity and can negatively affect the game.

Superintendents often report difficulty in eliminating ants with insecticides, and ant problems seem to be on the rise. Possible reasons for these trends include the decline of residues of chlordane and other persistent soil insecticides used in the past and the replacement of broad-spectrum insecticides (for example, diazinon) with more-selective soil insecticides, which has allowed ant populations to resurge.

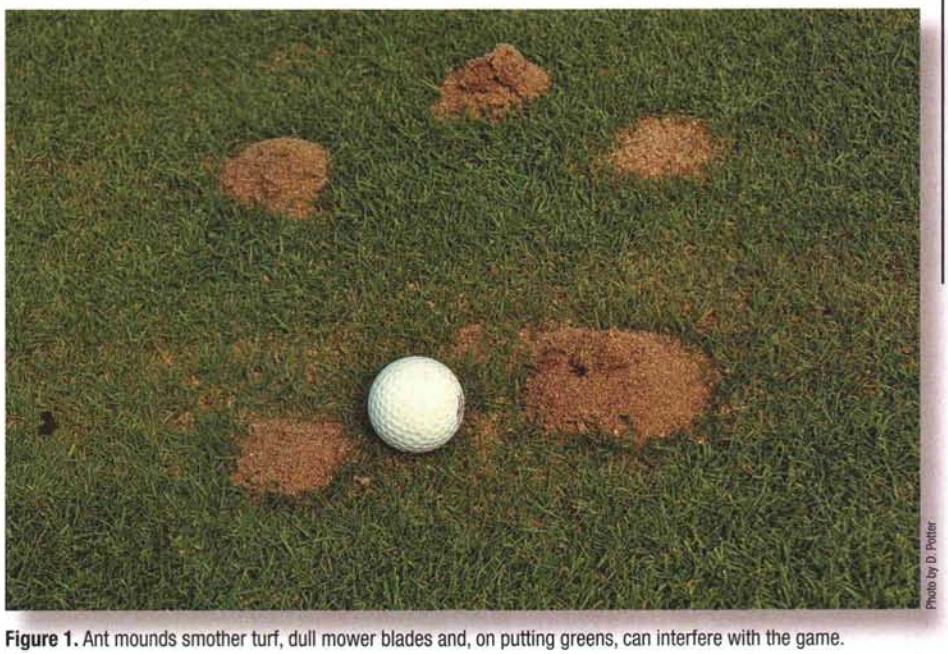

Figure 1. Ant mounds smother turf, dull mower blades and, on putting greens, can interfere with the game.

Habits of the turfgrass ant

Nearly all nuisance ant problems on golf courses in the cool-season and transitional zones are caused by *Lasius neoniger*, the so-called turfgrass ant. This cosmopolitan species typically nests in open, sunny areas. It is not the same as the red imported fire ant, *Solenopsis invicta*, a pest in the southern United States that inflicts painful stings when its mounds are disturbed. Turfgrass ants do not bite or sting humans.

Like all ants, *L. neoniger* is a social insect. Workers, the form seen at nest entrances, are light to medium brown and about 0.10 inch (2-2.5 millimeters) long (Figure 2). The subterranean nest consists of interconnected burrows and chambers and is seldom more than 10-15 inches (25-38 centimeters) deep. Mounds are formed from particles that the worker ants bring to the surface while excavating and enlarging the nest. Each mound marks a different nest entrance. The number of mounds varies from a few to dozens per nest and increases from early spring to midsummer as the colony grows. Besides workers, the nest contains a single reproductive queen as well as immature stages (eggs, larvae and pupae) that are collectively called the brood.

In general, ants are beneficial to turfgrass. They are the main predators on eggs and small larvae of grubs, cutworms and sod webworms, helping to keep those pests under control (1). The burrowing and nesting activities of ants promote air and water infiltration and help to incorporate organic matter into the soil where the nutrients are available to the grass roots.

The ant life cycle

For most of the growing season, the queen lays eggs that develop into infertile female workers that cooperate in cleaning and enlarging the nest, gathering food, defending the nest and tending to the queen and her brood. In early summer, she begins laying eggs that develop into winged reproductive forms. These males and young queens emerge in late summer. After mating, the males die, and the newly fertilized queens fly or crawl to new sites where they will start new colonies.

We monitored queen emergence by placing pitfall traps around putting greens in 2003 and 2004. In both years, there were several pulses of emergence from mid-August to mid-September, usually following periods of rain (4). The queen has a fatter abdomen, is much larger than the workers and may be seen crawling on greens and other closely mowed grass (Figure 3). Young queens chew

Photo by Alex Wild

Figure 2. Worker of *Lasius neoniger,* the so-called turfgrass ant.

Photos by D. Potter

Figure 3. *Lasius neoniger* ant queen on closely mowed creeping bentgrass.

Figure 5. *Lasius neoniger* obtains carbohydrates by feeding on honeydew of root aphids (shown here) and other tiny insects that suck plant sap.

off their wings before burrowing into the soil to overwinter.

Egg-laying begins in late winter. Queens initiating a new nest first lay a batch of 10-20 eggs. This first brood will develop into tiny workers called nanitics, which begin foraging for food for the queen, ensuring she will have enough nutrients to lay additional eggs. The queen stays in the nest and lays more eggs that develop into normal workers. The colony grows rapidly in late spring and early summer as the ants enlarge their nest and foraging area and increasingly more workers are reared. Production of males and new queens in late summer completes the cycle. Once a nest has been established, the resident queen may survive and lay eggs for several years.

Recommendations for controlling turfgrass ants usually emphasize early treatment, soon after the mounds appear. We determined the seasonal pattern of mound-building by counting active mounds on 10 sand-based bentgrass tees monthly on each of two Kentucky golf courses (4). Mounds first appeared in February or March, peaked in May and June and declined by late summer (Figure 4).

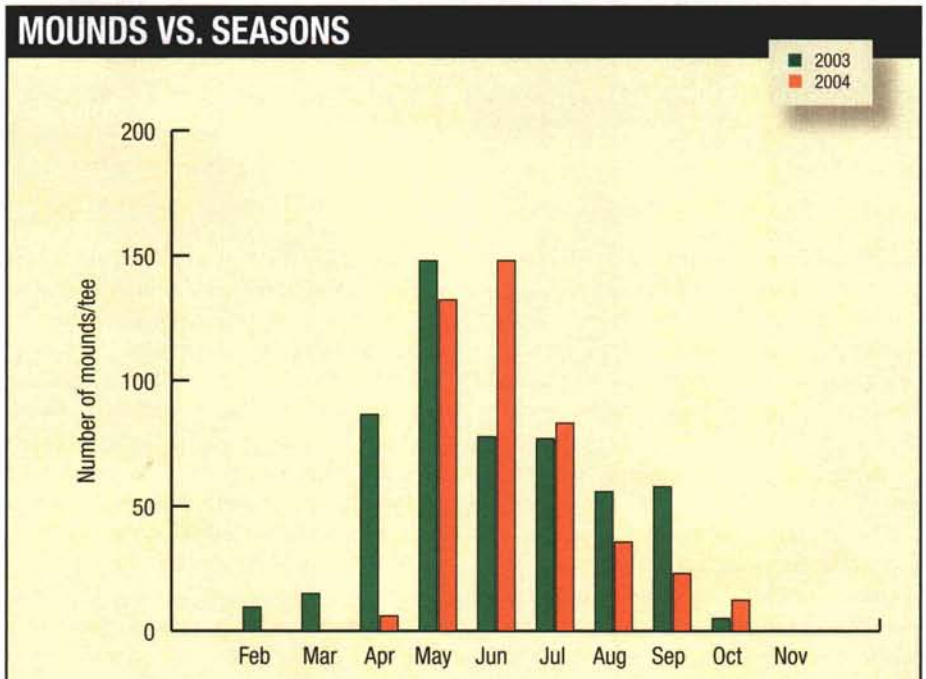

Figure 4. Seasonal abundance of ant mounds on 10 tees on each of two central Kentucky golf courses.

Feeding habits

Workers of *Lasius neoniger* forage for insect eggs, small insects, insect fragments or seeds. Once food is found, the worker deposits a pheromone trail as it returns to the nest. Other workers follow this trail — and reinforce it — to find the resource discovered by the scout. Workers also obtain carbohydrates (sugars) by feeding on nectar from nearby plants.

Many ants also obtain carbohydrates by feeding on honeydew from aphids or other sap-feeding insects. The honeydew, essentially aphid diarrhea, contains sugars, amino acids, minerals, vitamins and other nutrients. Often the ants tend the aphids like dairy cattle, defending 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 special relationship with root-feeding aphids (*Geoica* species), which the ants maintain in or near their nests, even in winter (Figure 5). 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 do not seem to harm the grass.

Ant mound location

We have observed — as have superintendents — that ant mounds tend to be concentrated around the edges of sand-based putting greens. Why? We suspected that the structure, depth and abrasiveness of the high-sand root-zone mix are unsuitable for

permanent ant nests and the soft-bodied root aphids from which the ants get a portion of their food. If so, mounds encroaching onto greens might represent secondary nest chambers connected to main nests (with queen and brood) located outside the collar in natural soil. If the main nests are just outside the green, control efforts should focus there, rather than on the entire putting surface.

Testing the hypothesis

We tested our hypothesis by mapping several hundred mounds on 10 sand-based greens on each of three golf courses (3). Root aphids were sampled by pulling soil cores along transects centered on the collar and extending into the green or rough. More than 90% of the ant mounds were located within 6.5 feet (2 meters) of the perimeter, and only 3% were more than 10 feet (3 meters) into the green. Root aphids were associated with ant nests in natural soil, but nearly absent from the high-sand root-zone mix of greens. Obviously we could not dig up greens at our cooperating golf courses to excavate ant nests, but our sampling of USGA sand-based greens at the University of Kentucky Turf Research facility confirmed that the main nests, with queen and brood, were located in natural soil outside the collar. Nearly all of the nest chambers in the greens themselves contained only worker ants (3).

We cannot say for certain why the main ant nests are largely absent from sand-based greens. Perhaps the high moisture levels are not conducive to brood rearing, or the absence of root aphids plays a role. Alternatively, the high-sand root-zone mix may be structurally unsuitable for permanent nests.

Attracted to greens

Why does *L. neoniger* expand its secondary nest chambers and mounds into greens? As a result of mowing, the edges of greens have abundant dead insects, eggs or insect fragments that are scavenged by worker ants. Indeed, when we placed diced black cutworms around the edge of a sand-based green, workers quickly congregated on the food items, in some cases excavating nest entrances with mounds where none were present before. Opening new nest entrances allows workers to take food items underground quickly, alleviating losses to competitors. The high-sand root-zone mix seems suited to tunneling, if not for permanent nests. Indeed, in other experiments, we showed that the ants respond to both low-cut turf and sandy soil by increased mound-building. Short-cut grass may also favor more efficient foraging from the standpoint of trail pheromones. Although ant nests are abundant in roughs, lawns and other high-mowed turf, we tend to see few volcano-shaped mounds in such areas. In high grass, it may be easier for the ants to strew excavated soil than to pile it around nest entrances.

To summarize, our work indicates that most ant mounds on sand-based greens are associated with subnests constructed by workers to expand the area over which the colony collects food resources (3). Such subnests are connected via underground tunnels to main nests located just outside the collar in natural soil. Encroachment of mounds into greens occurs as colonies grow seasonally and expand their foraging territories, which accounts for the concentration of mounds being around the perimeter (Figure 6). *Lasius neoniger* hunts and forages on sand-based greens but does not permanently nest there. Clusters of mounds on such greens represent garrisons of worker ants on hunting forays.

Implications for managing ants

Superintendents often find that spraying greens only temporarily suppresses ant mounding. Fast-acting insecticides kill workers foraging on the turf surface, but usually fail to eliminate the queen in her underground nest chamber. Several pyrethroids, including TalstarOne (bifenthrin), Tempo (cyfluthrin), DeltaGard (deltamethrin) and Scimitar (lambda-cyhalothrin), are labeled for ant control on golf courses. The best time for applying pyrethroids is early in the growing season, soon after the mounds appear. At that time, new colonies are just getting started, and established ones are weakened from overwintering, with depleted food reserves, older workers and few new brood. Such treatments often provide 50%–70% suppression of mounding for four to six weeks, although they are unlikely to totally eliminate the ants or mounds.

Chipco Choice and TopChoice granular insecticides, which contain the active ingredient fipronil, are labeled against mole crickets, fire ants and nuisance ants on Southern

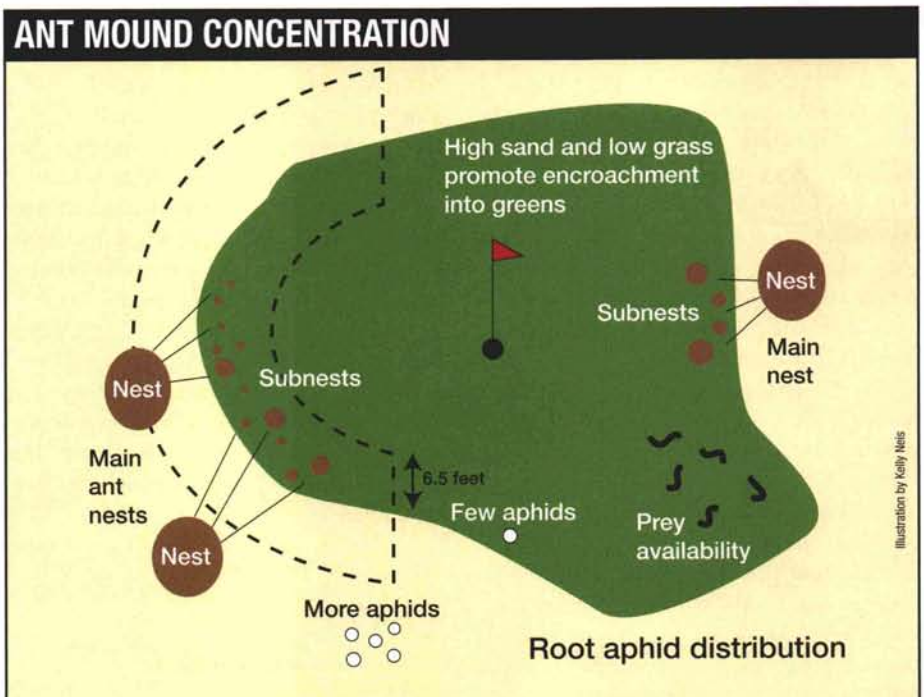

Figure 6. Several factors contribute to the concentration of ant mounds around the perimeter of sand-based greens. Main nests are outside the collar in natural soil; subnests, representing garrisons of food-gathering worker ants, encroach inward as colonies expand their foraging territories. Root aphids, a source of carbohydrates, are abundant in natural soil associated with main nests, but are largely absent from greens. Abundant protein food (dead and living insects), closely mowed grass and sandy soil all promote incursion into greens, with excavation of subnest chambers and mounding. Dashed lines show the zone where superintendents should focus their control efforts.

golf courses. Fipronil is very effective against *L. neoniger* and can provide season-long suppression of mounding (2). One reason it is so effective is that its relatively slow knockdown activity allows exposed workers time to return to the nest, where the insecticide is spread among nest-mates by mutual grooming. At present, fipronil is labeled only in the 13 Southern states where fire ants are established and therefore is not an option for use on temperate-zone golf courses.

Spot-treating with MaxForce Fine Granule Insect Bait (hydramethylnon) often eliminates small clusters of ant mounds on greens (2). When the bait, which contains a slow-acting insecticide, is sprinkled around mounds, the workers take it into the nest and feed it to the queen and her brood. Treated subnests usually become inactive within a few days, although it is uncertain how long it takes for the main nest to die out. Because ants do not take wet bait, apply the bait after dew dries and withhold irrigation for at least 12 hours.

Controlling root aphids and queens

Some entomologists have suggested that controlling root aphids with a soil insecticide will indirectly suppress turfgrass ants. We tested that approach by applying Merit 75 WP (imidacloprid) at the highest label rate to creeping bentgrass tees with abundant ant mounds. The treatment did not eliminate the root aphids or reduce ant mounding within six weeks after treatment. Turfgrass ants obtain nutrients from diverse sources, and we doubt that they are so dependent on root aphid honeydew that controlling the aphids would eliminate the ants.

We also tried intercepting newly emerged queens with an insecticide in late summer before they could establish new nests. We sprayed Kentucky bluegrass with DeltaGard at weekly intervals, then collected newly emerged queens and placed them in the treated plots. One-day-old and one-week-old residues killed 94% and 75% of the queens, respectively (4), but residual control declined thereafter. Because queens emerge over about a one-month span, several applications would be needed to intercept most of them. Still, if a superintendent treats for cutworms in late summer, timing the application to coincide with ant queen emergence and treating a band just outside the collar will kill queens and prevent some future nests. Such action may have value as part of an overall ant management plan.

THE RESEARCH says . . .

- **The turfgrass ant,** *Lasius neoniger,* does not sting or bite humans, but builds mounds that are a nuisance on golf courses.
- **Controlling root aphids** does not seem to reduce or eliminate ants.
- **Insecticides to suppress** mounding are best applied early in the spring when the first mounds appear.
- **Timing insecticide applications** to coincide with queen emergence and treating a band just outside the collar of the green will kill some queens and prevent some future nests.
- **Control measures should** focus on the perimeter of the green, about 6 feet (2 meters) on either side of — and including — the collar, whether baits or conventional insecticides are used.

Recommendations

Much remains to be learned about the biology and management of mound-building ants on golf courses. For example, although greens constructed according to recommendations with a root-zone mix high in sand seem unsuited for permanent nests, we do not know if push-up greens are suitable nesting sites. If they are, ant mounds would be expected to be more uniformly distributed throughout such greens.

In summary, our research indicates that multiple factors contribute to ant mounds being concentrated around the edges of sand-based putting greens. Control measures should focus on the perimeter, about 6 feet (2 meters) on either side of — and including — the collar, whether baits or conventional insecticides are used. This approach should help superintendents manage ants with reduced chemical inputs. No one treatment is likely to eliminate a severe ant problem, but infestations often can be suppressed to tolerable levels using the approaches described here.

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