Nature 'Antes Up' For Insect Pest Control

Thieving, marauding ants on a golf course demonstrate one natural way to control Japanese beetles. It appears that healthy ant colonies may help limit those beetle populations

By Timothy J. Gibb

To most everyone who walks on a golf course, the large expanses of turfgrass appear to be a fairly sterile environment, largely devoid of much species diversity. However, upon closer inspection, quite the opposite is true.

Turfgrass provides a complex and diverse habitat for many different forms of plant and animal life. When observed closely, the species richness of a stand of healthy turfgrass is almost overwhelming. Within a shovel full of turfgrass, thatch and accompanying soil, one can find hundreds of different living organisms.

Each has its own set of growth and survival requirements. Each must also compete and interact with all of its surrounding organisms: microbes, bacteria, fungi, micro invertebrates, insects and plants, and even the occasional macro-vertebrate organism.

Ants on a hand, depicting their relatively small size.

Complex chain of behaviors

The African savannas are known for their complex food chain of producers, decomposers, herbivores and predators, but turfgrass ecosystems have an equivalent food chain. . . albeit on a much smaller scale.

The reason that every disease, weed and insect pest does not become damaging every year should be credited to the natural controls that Mother Nature provides.

Just like in Africa, turfgrass has its own versions of producers, herbivores and predators, and each must compete with each other for existence.

In so doing, each impacts the survival of the next and eventually a balance — the balance of nature — occurs, wherein no single population will be allowed to grow unchecked.

Man has taken advantage of the fact that some species outcompete or destroy other species in certain situations. He has extracted and artificially manipulated one popula-

tion to the detriment of another. This is called "biological control."

Using one biological agent to control another is not a new concept or practice. Cats that keep a mouse population under control are a good example of a biological control that has been used for thousands of years. Because of their value as biological control agents, cats have been adored, bred and propagated throughout the world.

What golf course superintendents often do not appreciate is the fact that nature provides her own biological controls for most every established pest on the course. A significant amount of biological control, though unrecognized by even the most observant golf course manager, occurs beneath his very feet. The reason that every disease, weed and insect pest does not become damaging every year should be credited to the natural controls that Mother Nature provides. We simply take many of these for granted.

Eggs of other arthropods, even though laid with great care, are quickly found and taken away or consumed on the spot by thief ants.

Ants and natural control

Take ants for example. Until recently, the value and the role of ants in pest elimination has gone unnoticed by most scientists, as well as golf course superintendents. Ants have only recently been credited as significant control agents of potentially destructive pests which live or lay eggs in turfgrass.

For example, recent studies have shown that up to 75% of webworm eggs can be expected to be consumed by ants. Though their effects have not been quantified, ants also have been cited as primary insect predators on many additional turfgrass pests including chinch bugs, billbugs, army and cutworms.

Most recently, Purdue University research scientists have quantified ants' beneficial effects on white grubs. Studies have found that the majority of natural biological control of white grubs can be attributed to a tiny species of ant that lives below the surface of the soil. Most people do not even know that it exists, although it appears to be common throughout the United States wherever golf courses, lawns, parks or other areas of turfgrass exist.

Due to its color, size and the fact that it lives below ground, never making the visible mounds characteristic of other ant species, this ant is difficult to see.

Its scientific name is Solonopis but it is commonly called a "thief" ant. It derives its common name from its habit of stealing and consuming eggs and larvae from other insects. Thief ant workers are tiny, approximately 1.5 mm to 1.8 mm in length and are light yellow in color. They always nest underground or under objects such as rocks and wood that are totally or partially buried in the soil.

Thief ants are masters at being able to locate any potential food material in the soil. Eggs of other arthropods, even though laid with great care, are quickly found and taken away or consumed on the spot by thief ants. These ants build very narrow tunnels that are presumably too narrow for the defenders or other predators to follow.

One of the most exciting things about recent surveys is that this thievery appears to be very extensive in turfgrass soil systems. Home lawns, parks, golf courses and turfgrass industrial sites were surveyed. These represented different combinations

Ants' random underground foraging pays off when they find a Japanese beetle egg.

Even the Japanese beetle egg is much too large for a single thief ant.

of turfgrass size, management inputs, soil types and moisture levels.

Results indicated that the ants were common in all sites with one exception. Sites that had a history of regular applications of organophosphate or carbamate insecticide use were found to be nearly void of ants.

Given how extensively this ant is distributed, its potential impact on the overall terrestrial turfgrass ecology, as well as its potential as a natural control agent of turfgrass pests, has long been underappreciated.

How thief ants impact pest species

As generalists, thief ants are able to impact pest species that are present, or susceptible, for even a short period time, since other food sources can be used when the pest is not present. This allows the thief ant populations to remain relatively high and negates the usual lag time needed for predator populations to increase before pest control is achieved.

The thievery and marauding activities of the tiny thief ants may be more widespread than even first estimated. In recent studies, thief ants have been shown to be extremely important predators of chinch bug eggs, sod webworms. White grub eggs also are known to be reduced in turfgrass because of this ant.

In Purdue studies, where eggs were placed in subsurface holding containers in the soil, up to 65% of eggs were taken by thief ants within 4 days. Only a few additional eggs were taken by other ants or other insect predators. Reducing the number of viable white grub eggs by 65% is highly significant and in some cases would negate any need for additional pesticides applied to prevent grub damage.

Unfortunately due to applications of some commonly used insecticides, thief ant populations are reduced and Japanese beetle eggs consequently have a much better chance of survival. This finding poses serious questions regarding the routine use of pesticides in lawn care.

The Purdue study then looked at the effect of commonly used insecticides on thief ant populations. Two relatively new insecticides — Merit and Mach 2 — boast long residuals in soils. They were compared with two of the more commonly used insecticides: Diazinon (an organophosphate) and Oftanol (a carbamate).

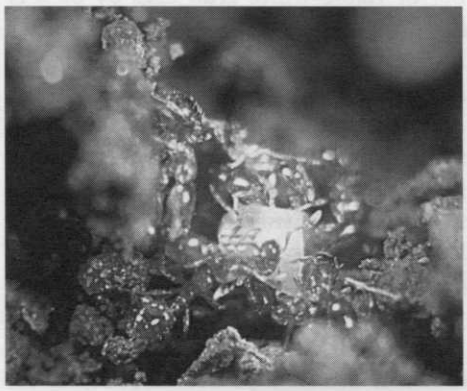
Applications were made at different times throughout the growing season and ant survivorship, as well as grub mortality, were measured. Somewhat surprisingly, the study revealed that both Merit and Mach 2 had almost no effect on the ant populations compared to both the organophosphate and the carbamate, which had an immediate and significantly negative effect on the ants.

In Purdue studies, where eggs were placed in subsurface holding containers in the soil, up to 65% of the eggs were taken by thief ants within 4 days.

Furthermore, the grub populations were reduced to much lower levels in the Merit and the Mach 2 trials than either of the OP or carbamate treatments. This may, in part, be due to a combination of natural ant control with the effects of the chemical treatment.

'Ecosystem' strategy

The concept of an ecosystem where any factor affecting one species must have an influence on all the species present must be the paradigm by which golf course superintendents begin to view turfgrass. To successfully understand any part, we must appreciate the system as a whole.



Many ants work cooperatively to help take this egg back to the nest.

The many factors, both living and nonliving, which make up the golf course environment are all affected by any turf management practice (mowing, fertilization, soil amendments, irrigation or application of herbicide, fungicide or insecticide).

Thief ants have been shown to be important predators of chinch bug eggs, sod webworms and, now, white grub eggs.

Integrated Pest Management, the keystone of sustainable agricultural production systems, is a relatively new concept to many golf course superintendents. Capitalizing on the natural controls of any given pest is at the heart of IPM implementation.

A poor understanding of the identification and ecology of naturally occurring turfgrass predators hampers the ability of researchers to develop biologically intensive management tactics. This has left the natural enemies of turfgrass pests — including arthropods, nematodes and entomophagous pathogens — virtually unused by the turf industry.

Recognizing the overall effects of ant predation in turfgrass and understanding what factors may influence them will allow for improved turfgrass management. Basic understanding and appreciation of the benefits of ants and other naturally occurring controls will allow superintendents to understand how to conserve these important natural enemies.

In so doing, superintendents have the potential to decrease total pesticide used on golf courses while maintaining adequate pest management and reap the benefits of increase public and environmental safety. This is a sure bet, so ante up for ants.

— Timothy Gibb is in the Department of Entomology at Purdue University.

PURDUE UNIVERSITY'S THIEF ANT SURVEY OF TURFGRASS SOIL SYSTEMS CHECKED:

- home lawns
- golf courses
- turfgrass industrial sites
- different combinations of turfgrass size, management, soil types and moisture levels

These underground ants were common except where a site had a history of regular application of organophosphates or carbamate insecticides.