Property Wars

by Larry Gfeller

Since the wildfires we have struggled to nurse our wounded acreage to recovery as healthy native habitat. The entire place, save the small space surrounding our house, was replanted in pine seedlings. We've sown a mixture of native prairie grasses, put in erosion control features, worked on yaupon and other invasives, established a variety of native trees, and built native plant and wildflower beds. Of course there are always challenges, including erosion, drought, weeds, gophers and insects. The weather is sometimes so bad here that people take actual pride in it. Let's face it, Texas is hard on people, plants and livestock. Of all these scourges, our most formidable obstacle has been ants. Yes, that's right . . . ants.

There are said to be over 10,000 species of ants in the world (probably more as yet undiscovered), so it helps to know which kind we're up against: The Texas Leafcutter Ant (*Atta texana).* They have stripped most of our saplings several times, killing four . . . but they captured our singular attention when we noticed destruction of our pine seedlings—our precious pine seedlings! This is a serious matter. Following General George S. Patton's habit of studying his enemy, I set off to learn a bit about these invading creatures. I was not prepared for what I was about to discover. I was stunned by the sophistication, discipline, organization and survival instincts of this underworld society, honed to a fine edge over eons of natural selection. Turns out, Texas Leafcutter ants are a common threat in recently-planted pine forests in East Texas/West-Central Louisiana and in the citrus groves of South Texas. According to the Texas A & M Forest Service, this ant destroys nearly 12,000 acres of pine seedlings and create upwards of $52 million in control and seedling replacement costs in an average year in East Texas. It didn't help to learn that I'm virtually outnumbered by *millions.* That's bigger than the entire Chinese Army!

Worldwide there are some 47 species of ants that chew on plant leaves, divided by two genera: *Atta* (smooth exoskeleton) and *Acromyrmex* (rough exoskeleton)—our Texas Leafcutter belongs to the first group. Leafcutters normally reside in rain forests like the Amazon, where vegetation is rich and plentiful. They've been around since right after the disappearance of the dinosaurs, over 50 million years ago. Today they principally inhabit South American and Caribbean jungles, but also the northern states of Mexico. The Texas Leafcutters are the northernmost migration of the genera, making their home in Texas and Louisiana. Leafcutters are the most complex animal society on the planet, next to humans, according to E. O. Wilson, who is perhaps the most prominent naturalist of our time. *They are the*

dominant herbivore of the new world tropics, consuming some 20% of known vegetation. It's like letting a herd of goats loose on your property to eat whatever they want. Leafcutter ants have evolved to address every small need necessary for their survival over the ages, Dr. Wilson says. Here's what makes them unique: These ants do not *eat* the plants they harvest—they farm them! They do this by maintaining one of the longest running symbiotic relationships in the natural world—with a fungus. Let's take a closer look.

Deep underground in a sprawling system of tunnels and passageways, tucked away in masterfully protected chambers, lies the essence of their existence—a fungus rich in proteins and sugar. The entire colony nourishes itself from this single life source. The living fungus is the focus of all activity; keeping it alive, growing and healthy is all that keeps the ants on the face of the earth. The fungus itself feeds on plant material, a chewed up paste produced by the ants from a seemingly endless production line of cut leaves, transported to the nest by workers. The fungus needs the ants to survive and the ants similarly need the fungus—a classic codependency that seems ageless.

Although different species of leafcutters cultivate different types of fungus, all colonies "farm" fungus by feeding it green plant parts. Only two other types of insects in the world practice fungus-based agriculture: ambrosia beetles and termites. As any farmer knows, it takes a lot of muscle, sweat and struggle to produce a worthwhile crop. Temperatures, moisture, humidity and nutrients all affect the critical microbial reactions that control the growth process. If this is not challenge enough, the successful farmer must also battle the elements and control disease. So too, all these difficulties confront the ant farmers—and the level of agricultural science they bring to their task is astounding.

Many tropical plants contain toxins as a defense mechanism. Most leaves, no matter their toxicity, also contain some fungal components. So how are these ants so successful at preventing disease and pestilence in their living food source? The ants inject their own fungal secretion into the plant parts they chew, which begins the breakdown of natural poisons. More importantly perhaps, the ants are sensitive to the reactions of their garden to fungal materials. If a particular type of plant material causes a bad reaction in their life-sustaining fungus, the ants will recognize this and stop bringing that type of leaf back to the garden. And we're not even getting warmed up yet! There's more, much more.

The principal threat to ant-cultivated fungus is an aggressive type of black mold—as corrosive and lethal as cancer. Lab experiments have shown this mold to destroy leafcutter fungus in short order when the ants are not present. It has long been noted that leafcutter fungi farms are miraculously free of this curse; but it wasn't until 1998 that a young graduate student, Cameron Curry, discovered why. Curry

found that the ants charged with tending to the fungus were covered in a white waxy material that the other leafcutters lacked. Under the microscope, this material was revealed to actually be many thousands of bacteria—the same types of bacteria used in modern medicine to produce half of the antibiotics known to man. *Leafcutters have been using these bacteria to form their own antibiotics, which are then used to protect their food source.* If this isn't incredible enough, remember that leafcutter ants have been doing this successfully for over 50 million years; man only began using antibiotics some 70 years ago!

Like human existence, there's also a waste management function to sustaining leafcutter ant civilization. If waste is not disposed of, it can threaten the health of the fungus garden. Thus, some worker ants are assigned to act as waste transporters or heap workers. These tend to be the older ants (more dispensable), leaving the younger ants to work on the fungus farm. It's their form of social security. Waste is taken to a pile where it is constantly turned by heap-workers, who work it around to aid in quicker decomposition.

The history of man is replete with fits and starts. From early hominids through the Dark Ages to Medieval times and Feudalism, specialization and cooperation did not really come into its own until the Industrial Revolution. The pace of advancement was kicked into high gear then, and today's information revolution promises to take us to places no man has been before. As nearly as researchers can determine, leafcutter ants have been highly organized from day one. With the exception of the queen, they come in four flavors. The smallest ants (workers) either take care of the brood of baby ants (larvae) or they tend to the fungus garden on a full-time basis. Slightly larger workers act as a defense force for the foraging columns, attacking enemies that threaten the foraging lines—much like an armed screening force, i.e., the cavalry. The medium-sized ants are the foragers . . . they cut the leaf stock and carry it back to the nest. The biggest ants are the foot-soldiers—the infantry—primarily defending the nest from invaders, but sometimes being used to clear the foraging trail of large debris or to carry especially heavy loads along the foraging line. Leafcutter ants have been seen carrying loads of more than 10-times their weight. That's equivalent to a 200-lb man carrying a one-ton load over his head!

How, exactly, does this exceptional form of civilization get started? Like all life, it starts with sex. While the selection process is not completely understood, in the spring some larvae develop into winged males and females, with the females having larger heads. These reproductive ants can number into the thousands and they appear much different from the other ants in the colony—larger, winged and colored differently. Throughout April, May and June, on clear, moonless nights, multiple orgies can occur. Great swarms of horny insects indulge their primal urges. More than dance cards get filled during the debauchery. Females take on all comers in their quest to receive the 300 million sperm needed to set up a colony. In

preparation for her future role, a female steals a bit of fungus garden from the nest and stores it inside a small cavity in her mouth. This is the pemmican of life; starter dough—everything she needs to set up house. After mating, the males drop their wings and die, their destiny fulfilled. The females also lose their wings, drop to the ground and attempt to establish small nests underground. A new queen has arrived!

Despite the overwhelming biological success of the *Atta* species, getting started is tough. Only 2% to 5% of young fertilized queens succeed in setting up long-lived colonies. After establishing a basic underground shelter, the young queen begins to culture the bit of fungus she brought with her from her childhood nest into a growing food source for her first brood. The queen is more than an inch long and can produce enormous egg masses that give rise to large numbers of larvae. About ninety percent of these will be eaten by the queen; she is, after all, huge . . . to remain huge requires that she stay vigorous and healthy (some queens can live for up to thirty years).

The first surviving worker ants (all female) will be small due to their limited food intake; however, these first workers bring back bits of plant material to enlarge the fungus garden to provide groceries for later broods. As the colony grows, worker ant size increases and the variability needed to distinguish specialized functions occurs. It is not until then that the nest has any real defenses against invaders. Wielding the power of numbers, the most successful colonies have four or five producing queens and over 8 million individuals—nearly indestructible.

The real estate is complex and sophisticated. Nests are established in open, brushy areas in deep, well-drained sandy or loamy soil—just exactly what the Lost Pines area is known for. Nest areas may cover more than half an acre, marked by many crater-like mounds of loose soil, slanting inward toward a center entry hole. Down as much as 8 feet below the surface, the fungus garden grows in its specialized chambers—the whole underground complex is designed to protect the colony and provide a healthy, stable environment for the fungus garden. There are detritus chambers where waste materials are stored, garden chambers and dormant chambers of unknown function. Eventually, chambers may reach 15 to 25 feet deep.

Vertical tunnels extend to mound openings and lateral foraging tunnels may lead outward 500 feet away. Fresh air is drawn in through peripheral tunnels to maintain proper ventilation. Stale air and heat produced by metabolic processes going on in the gardens is vented through central passageways above the gardens. Chambers within the nest are prevented from flooding by a system of lower passages. In hot, dry periods nest openings are plugged and the workers retreat to recover in moist areas below. Clearly, this thriving underground metroplex makes control with insecticides near impossible, but more on that shortly.

Outdoor activity for leafcutters, like all Texans, depends largely on temperature. During the summer, the ants remain underground during the heat of the day. At dusk, when temperatures drop below 86 degrees, the hordes emerge to forage throughout the night. In winter, they forage during the day. If temperatures remain below 50 degrees, everyone stays hunkered down underground. Early spring and late fall are transitional periods when the colony may be active both during the day and night. Damage to pine seedlings occurs primarily between December through March when grasses and weeds have died back and hardwood leaves cover the ground. Although they will forage on all species of southern pine, their preferred *entrée du jour* is loblolly pine . . . of course. The foragers will completely strip the seedlings of foliage and buds and often clip off the stems at ground level and carry the fragments back to their nest. All seedlings within five acres or more around a central nest area can be plundered within a month's time.

Not only can these ants destroy crops, seedlings and desirable shrubs, but sometimes their underground colonies can become so large as to damage roads and farmland. So, with such a formidable foe, what can be done to control them? There are only two known natural predators for the ants. One is a phorid fly, which lays parasitic eggs directly behind the head of target ants. The ants have even adapted a defense for this; tail-gunners in the form of the smallest worker ants sometimes sitting on the backs of larger foragers to ward off attacks by these flies. The other natural predator is the armadillo. I know what you're thinking, "Would I rather have leafcutter ants or armadillos on my property?" Some other obvious solutions are not practical for most folks, like digging up and destroying the queen(s), their fungus gardens or finding their waste piles and using the material to surround the trees or shrubs that need protection. Yeah, like I'm really going to do that! (I'm close, though. I'm close.) There are no known effective forest management prescriptions either. Many chemical pesticides that did seem to work in the past have been banned by the Environmental Protection Agency for their harmful side effects or known collateral damage to the environment.

Like the late night ads for magic telephone jacks and hair growth secrets, we've succumbed to the lure of easy solutions. Of course, none worked. Don't waste your time. We've tried pouring vinegar down their holes, even Club Soda. I guess the idea is that if you can spoil their fungus garden, they'll start a new one on someone else's property! Didn't happen. Somewhere we heard that spreading cornmeal around the foraging holes would do the trick. The ants are supposed to take the bits of cornmeal down to their central nest where the humidity causes the grain particles to swell many times their original size and . . . I dunno . . . plug the airways and suffocate them? We were desperate. Digging up the surface area of their central nest only transports them to a realm of orgasmic ecstasy, and most commercial ant control treatments only seem to excite them further.

Of all the potential chemical agents, we are left with *Amdro Ant Block* as the only registered option, according to the Texas A&M Forest Service. It comes in 1½ pound containers and can be found in most retail stores, like Lowe's, Home Depot, Ace, Wal-Mart, etc. Originally designed for fire ants, Ant Block adds sugars that are somewhat attractive to leafcutters and compliment the natural sugars of the fungus garden. The bait is applied by mechanical spreader (or by hand—with gloves) to the central nest area. Once the bait is applied, foraging ants search out the pellets and carry them underground. This will usually result in a reduction in foraging and excavation within 5-7 days. These activities will gradually stop and the colony will sometimes become inactive within 2 to 3 weeks. . .not always, however. The worker ant activity of many colonies often recovers to a certain extent after 6-8 weeks, the activity almost never recovers to pretreatment levels though. With luck, the ants prefer to move on to more hospitable habitat. Sometimes, the bait is fed to the queen as part of her fungus intake. In the end, the best defense just may be the arrival of the growing season, when the property fills up with other green life, providing a varied menu of other delights to choose from. Of course, your loblollies may be completely gone by then.

Our struggles with the Texas leafcutters continue. Perhaps the *Ant Block* will work. Perhaps not. Perhaps we should wish for an asteroid strike on our property—that way we all die and we can call it a draw. Somehow I sense the odds, even then, would favor the ants. The loblollies we lost are gone forever, but, as this is written, the leafcutters remain. It's frustrating. The thought that we may be powerless in the face of such an accomplished natural force . . . well, it won't be the first time. Learning about the long and successful evolution of these insects could have been the biggest mistake I ever made. What may at first have been a valiant fight borne of ignorance might have to finally resort to the truth—that rinky-dink little boat in the great sea of persuasion: We humans may not *need* to win as much as the ants do. For them it's a struggle for existence. Our life continues with or without the ants. If we can't seem to find a solution, maybe that's because there isn't a problem. Perhaps in the long march of time, nature sorts it all out. Maybe a few pine seedlings survive despite the odds. Natural selection. Maybe that's how it's supposed to happen.