Insect Opera

After a 17-year silence, cicadas will creep out of their underground chambers this spring to fill the Appalachian forests with a deafening noise.

BY T. EDWARD NICKENS

I STEPPED TOWARD THE TREES AND QUELLED A FLUTTER IN my gut. I harbor few phobias, and none regarding insects. But a biologist friend had warned me about this. It's like a movie, he'd said. A horror film to most folks. If you go, you'd better really, *really* like bugs. ■ A typical North Carolina Piedmont forest bordered the two-lane blacktop—oaks and pines, mostly,

Despite their beady red eyes and shiny black armor, cicadas do not sting or bite.

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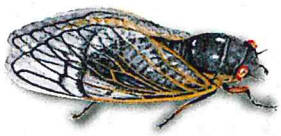


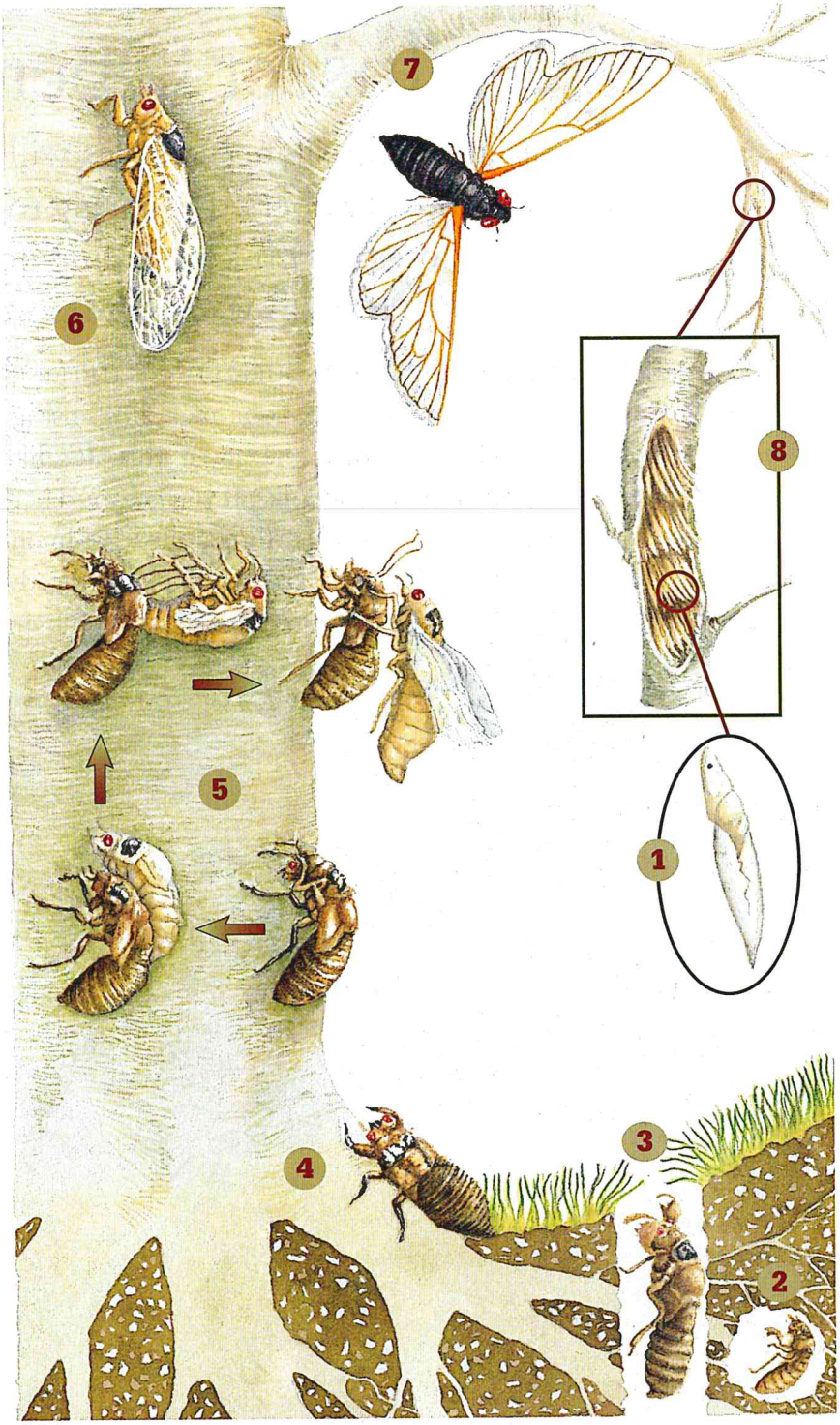
nodding over American holly, sassafras, and greenbrier. And from trunk to topmost twig, every parcel of vertical real estate in sight crawled with cicadas. I moved gingerly from tree to tree, eyeball to compound eyeball. Hundreds of individuals sheathed each tree trunk; hundreds more clasped each branch.

An inch long and plump as my finger, most of them clung unmoving to bark and leaf. Others marched slowly upward, lending to entire trees the illusion of movement. High in the canopy, thousands more careened from bough to leafy bough like legions of tiny bats.

I could not rest my hand on a branch without squashing a few. I could not take a step without crushing a handful more. And I could barely hear myself think. The chorusing of the male cicadas was deafening, a hellish clatter of ticks and buzzes so loud it sounded as if the earth were groaning in pain. I began to yell, an unscientific gauge of the collective din. I heard my own voice only as the strain of screaming made my throat hurt.

Few events in nature are at once as astounding and predictable as the sudden, explosive emergence of these creatures, the periodical cicadas. Often called 13-year and 17-year locusts, periodical cicadas are not locusts at all. *Locust*, in fact, refers to certain species of short-horned grasshoppers that migrate in plaguelike swarms. Cicadas, on the other hand, are plant-sucking members of the order Homoptera.

Listen to cicada *songs—from alarm buzzes to courtship calls—at www.ummz.lsa.umich.edu/magicicada/.*



The Nature of Cicadas With a lifespan of 13 or 17 years, periodical cicadas are America's longest-lived insects. Only about a month of the cicada's life, however, is spent topside. Falling to the ground from a rice-grain-size egg (1), the tiny nymph burrows, sucks on roots (2), and periodically molts. Shortly before its emergence, it tunnels an exit (3). After the nymph's exodus from the underworld (4), it finds a spot to complete the final molt to adulthood (5). New adults appear white (6) but soon darken as their outer skeleton hardens (7). Then males begin their love songs, alternating singing with short flights until they lure a female. She then excavates nests in twigs (8) and lays as many as 600 eggs, which hatch in 6 to 10 weeks.

JANE WATKINS

Found only in North America, periodical cicadas are close kin to the annually appearing, or dog-day, cicadas found in most of the world. The difference between them is in their life cycles. Whereas annual cicadas appear every year, the seven species of periodical cicadas, all from the lovely named genus *Magicicada,* lead an underground, nymphal existence for 13 or 17 years, depending on the species. Sucking sap from tree roots, the insects rarely move more than a few feet during their entire fossorial lives. They molt every few years, as they grow ever larger, and eventually metamorphose into pupae. Then, just before their aboveground debut, all the members of a local population, called a brood, tunnel toward daylight to rest in the detritus of the forest floor.

There are 15 broods in North America, each emerging in varying years. They also vary tremendously in size. Some engulf huge swaths of the eastern continent; one emerges only in a few woodlots in a couple of northern New York counties. Generally, each brood contains three different *Magicicada* species, each singing its own distinct song. The brood emerging this spring, in the southern Appalachian highlands of North and South Carolina, is one of the least-studied.

My last—and only—cicada experience was in the summer of 1996. An emerging brood of cicadas is an event of Biblical proportion. Suddenly one night in late May or early June, the insects emerge in densities wondrous or horrifying, depending on your perspective. Prompted by temperature and, to a lesser extent, day length, and recent warm, soaking rains, 40,000 cicadas might appear beneath a single tree; as many as several million individuals have been found in one acre. The emerging nymphs walk to the nearest large object on the horizon—tree, shrub, telephone pole—climb a few feet, and metamorphose into winged adults. Males congregate to attract females, buzzing a tambourinelike abdominal membrane in a collective clamor as loud as 100 decibels. After breeding and egg-laying, they all die.

Their long incubation makes these seven species among the world's longest-living insects, but more impressive is the transformation of a landscape that follows their raucous arrival. One day a woodlot, a backyard, or a solitary urban cemetery is a quiet retreat. The next it is the haunt of hordes of wailing, copulating, rectal-fluid-expelling banshees. It's just the sort of thing I would drive hours to witness.

As I slipped deeper into the woods, my hair and forearms were covered with a light mist, the excess liquid

expelled by a few hundred thousand sap-sucking insects. Underfoot, the forest floor was spackled with shed skins, desiccating bodies, and dainty wings spat out by gorging birds. A cicada emergence sets the table for a huge array of predators. The cicadas' arrival coincides with the nesting season for many birds, prompting everything from warblers to hawks to binge. Fish take them from the surface of rivers and streams. Turtles, lizards, snakes, dogs, cats, foxes, raccoons, and insects from ants to stinkbugs also join in.

In fact, such high rates of predation help explain *Magicicada*'s awesome numbers. Instead of fleeing or fighting their enemies, periodical cicadas sacrifice themselves in enormous quantities. The strategy, called predator satiation, follows a simple, gruesome logic: If all the lambs lie down with the lions, those not eaten will be at peace. No matter how many individuals succumb to tooth and claw, enough survive to mate, breed, and perpetuate the line.

Predator satiation is employed by a few aphid and gall wasp species, and it may help explain why mayflies emerge in enormous hatches. But only periodical cicadas have a built-in mechanism to prevent predators from evolving a life cycle to match theirs. Predators with a regular cycle—say a population spike every two or five years—could never be in sync with periodicals, for the numbers 13 and 17 are large prime numbers, divisible only by themselves and one.

THESE CYCLICAL EMERGENCES can affect forests in a quarter of the continent, says Thomas E. Moore, a University of Michigan cicada expert, who has traveled across the country to see every brood emerge. After breeding, females use a saw-tipped abdominal appendage, called an ovipositor, to slice open pencil-size twigs of deciduous trees. They lay 600 to 800 tiny eggs in the slits. About nine weeks later the eggs hatch, spilling rice-size nymphs to the ground. Often the egg slits are a wound grievous enough to kill individual twigs. "In effect," explains Moore,

"these cicadas prune forest trees."

And they may fertilize them, too. Periodical cicadas pour valuable nutrients into the soil—a ton and a half of dead cicadas has been tallied on a single acre—nitrogen and proteins that reach deep underground via millions of finger-size emergence holes tilled through the dirt. "Sunlight, air, water, and rotting bugs go right back into the ground," Moore says. "The insects return back to the forests all they've taken for 13 or 17 years." Other scientists aren't so sure. "Cicadas are clearly adding nutrients back to the soil," says Rick Karban, an entomologist at the University of California at Davis. But Karban has examined trees that show a reduction in growth for a few years following these mass emergences. "Millions of tiny nymphs feeding on tree roots could take a toll," he says.

Such careful consideration of these amazing cicadas is rare, even in the field of entomology. Rarer still is the notion of going out of your way to witness a periodical emergence: bug science as ecotourism. A light breeze rippled overhead and sent an audible rain of dying insects tumbling to the ground. I picked one up and pulled a magnifying glass from a small pack. The creature was lustrous black with bold orange abdominal stripes. Each wing, transparent and dainty as cellophane, flashed with vivid orange veins. A pair of bulging, coal-red eyes perched on the end of a head blunt as a cigar stub. The insect was female, and her ovipositor quivered as I held her between thumb and forefinger.

In the hand, this single insect seemed innocuous enough, but few folks ever embrace an emergence. A few years ago, Moore told me, he was in downtown Nashville during an emergence of 13-year cicadas. Near a small, wooded park their clamor was so loud he could barely hear diesel

DOUG WECHSLER

In 1991 trees from Illinois to Cape Cod and Tennessee to Long Island were taken over by the country's second-largest brood.

buses. Shoppers scurried down the sidewalks with their hands over their ears, ducking into stores and offices for a bit of auditory shelter.

"I thought it was beautiful, and that these people didn't know what they were missing," he says. "They were witness to a marvel of biology, something known only to North America and famous throughout the worldwide scientific community. And they were running away from it."

Moore would have recognized the drawn look on the face of my fellow witness to this marvel of evolutionary munificence: She watched me from across the road, where her double-wide trailer with blue shutters squatted over a lawn pocked with a few pear trees. Cicadas crawled drunkenly across the driveway, front steps, a light pole, a car. The woman, still dressed in a nightrobe and slippers, peered through the front screen door. She was unalarmed by a stranger plucking bugs from her roadside orchard and staring into holes in the ground. "They woke me up at three o'clock this morning," she hollered through the screen. "It's a cryin' and whinin' worse than a baby." She glanced with disgust at the fat insects matted thick on her brick cube of a porch. "People say it could be weeks before they all die off."

I told her that I thought she'd seen the worst of it. Already, I pointed out, dead and dying cicadas were thick on the ground. The show was closing. She seemed unimpressed, overly weary of sharing space with these visitors from underfoot.

But I left reluctantly, and when I did, I drove away with the car windows rolled down, the radio off, and my head hanging out the window. I drove slowly, with the droning of the cicadas gradually drowning in the rushing air, out of the cicada woods, toward open fields and the highway, and into the interlude of a 17-year silence.

T. Edward Nickens has written about mass emergences of midges and snow goose flocks in the tens of thousands. Nothing, he says, compares to a billion braying bugs.