

A FIELD GUIDE TO THE ANTS OF NEW ENGLAND

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To everyone who wants to learn more about the ants that share our planet

“I spent long hours with them [the nation of ants], and yet did not get bored. They would come and give us hope that life had not come to a halt.”

—Ahmed Errachidi, from *A Nation of Walnuts*

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<<CT>>Preface

Why ants, why New England, why a field guide? For the last three years, we have repeatedly answered these questions. The short answers are: ants are important, fascinating, and cool; New England is where we live, work, and play; field guides bridge the gap between ant farms and technical keys, and encourage everyone to look more closely at what Professor E. O. Wilson calls the “little things that run the world.” But now that this field guide is in front of you, you deserve some more detailed answers.

Ants are fascinating animals and are familiar to people around the world. Yet most people know little or nothing about their diversity, natural history, ecology, or evolution. What are these ants? How many different kinds are there? What do they eat? Before we wrote this book, most of our parents, nieces, nephews, students, friends, and colleagues had no idea that there are over 130 species of ants in New England alone! Now they know better.

Ants are some of the most important actors in ecological systems (see Chapter 2). In many places, ants make up the largest proportion of animal biomass. If you put all the ants on one side of a scale and any of the other animals (including humans) on the other, ants most likely would be heavier. They eat animals (dead or alive), plants, and fungi, disperse seeds, and turn over more soil than earthworms. They are everywhere: inside and outside, in the soil of forests and meadows, in and on trees, under the sink and in the rafters, and in between the cracks in the pavement. We can see aspects of our own human societies mirrored in the ways ant colonies work – their altruism and division of labor within colonies – and in how colonies interact with each other – fighting for food and space, battling over territories, even parasitizing or enslaving each other. This is not always a mirror into which we want to look, however; their lives and

behaviors have been caricatured in many books and movies, from H. G. Wells' *Empire of the Ants* (1905), through Gordon Douglas' *Them* (1954), to Eric Darnell and Tim Johnson's *Antz* (1998). Because ants are important, fascinating, and cool, we set out to write a book for people interested in learning more about them and their world.

Ants occur on every continent except Antarctica, and in habitats ranging from the Arctic tundra to dry deserts and tropical rain forests. Ants live where people are and where they have been, including rural villages, suburban towns, and densely populated cities, as well as in abandoned mines and overgrown vacant lots. New England is a manageable microcosm of the larger world. We divide the region politically into six states – Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island – but ants, like Boston Red Sox fans, show little respect for state boundaries. Instead, ants are tied to ecoregions: coastal plains with their beaches, dunes, and pine barrens; upland coniferous, deciduous, and mixed forests; the farm fields and old-fields in between; and the wetlands, rivers, lakes, and streams that connect all of these habitats (see Chapter 1). This range of habitats and the diverse climate of New England are similar to much of the eastern United States and Canada and the utility of this guide extends well beyond New England. In the descriptions of individual species (Chapter 5), we include over a dozen species that currently reach the edges of their range on New England's borders in Canada and New York. As the climate changes, some of these may make their way into New England itself.

Ants, like birds, butterflies, and dragonflies, are enchanting to observe in the field, and are downright spectacular when viewed through a hand lens or a dissecting microscope. The ant

fauna of New England displays a stunning variety of sizes, colors, sculpturing, armor, ornamentation, and hairiness. In brief, ants are beautiful. The creations of advertisers, computer graphics artists, cinematographers, and toy makers often are inspired by ants, and it is aesthetically pleasing to study their features at the same time that we identify them. In this guide, we celebrate such beauty. At the same time, we have designed it for use both by beginners first learning how to identify ants and by the experts who make their living studying them.

With only a little background and practice, and a hand lens, amateur naturalists, teachers, and students of all ages can learn to identify the common groups (genera) of ants. In fact, the illustrated key to the genera printed on the inside front cover of this field guide is designed to be used with a 10× hand lens – no microscope required! The modest diversity of New England ants (about 140 species in 31 genera and 6 subfamilies) makes them practical subjects for studies of biodiversity and conservation in the classroom and the field. Although it can be hard to determine in the field the precise identity of an ant, accurate species identification of pinned specimens under a dissecting microscope is not difficult because these identifications are based on distinctive features of visible parts of the ant's body. It is easy to distinguish among many ants once you know what to look for. With this guide, it will be easy for anyone to learn the manageable group of New England ants.

Ant species are identified by using keys (see Chapters 4 and 5). The first comprehensive key to all of the ants of North America was published in 1950, has never been revised, and is now out of print. A complete key to the genera of North American ants was published only in 2007. Before we wrote this book, the identification of ant species from any particular region would require dozens of specialized keys published in obscure journals and that contained only a

few crude line drawings illustrating the most important features or characteristics. Many of these keys could be deciphered and used only after you already knew how to identify the species!

Using identification keys is an exercise in deduction, but need not be an exercise in frustration. Although scientists have developed specialized vocabularies for each group of organisms, and myrmecologists (literally, “students of ants”) have developed their own arsenal of distinctive terms, our keys use relatively simple language and all terms are illustrated (see Chapter 2, and the diagrams printed on the inside back cover). The keys themselves are copiously illustrated: over 500 original drawings (both black-and-white and color) greatly aid their use. Each species is described on its own page, with additional drawings, color photographs taken in the field of the workers, their nests, and their habitats. Simple maps illustrate where in New England each species has been collected.

The world’s climate is changing rapidly, and New England is changing too. Ants will respond to these changes: southern species may move northward into New England and northern species may take refuge on high mountain peaks or emigrate to Canada. This book not only provides an introduction to the tools and techniques of observing and collecting ants (Chapter 3), but it also summarizes the current (as of 2012) patterns of species distributions (maps in Chapter 5; discussion in Chapter 6). Your observations will help test hypotheses about how the distributions of ants will change as the climate changes. All of the data associated with the species’ distribution maps and the analysis of their distribution is publicly available through the Harvard Forest Data Archive (<http://harvardforest.fas.harvard.edu/data/archive.html>), dataset HF-147. Although ants have been collected in many New England parks and towns, many other

locations are entirely unexplored. Go outside, explore the forests and fields, learn about the ants, and add to this growing body of data. Together, we will continue to learn about the world of ants.

<<CN>>Acknowledgments

It is a cliché to say that it takes a village to write a book, but it is really true for a book that brings together so much knowledge of natural history, taxonomy, ecology, and evolutionary biology in one place. First and foremost, we thank Stefan Cover and André Francoeur, myrmecologists extraordinaire, who spent countless hours teaching us the intricacies of New England ant taxonomy and sharing their lifetimes of expertise with us. James Trager brought us up to speed on *Polyergus* taxonomy, and Bernice DeMarco shared her evolving ideas about the subtle differences among *Aphaenogaster* species. The keys have been tested and the text has been critiqued by Stefan, André, and James, along with many other of our students and colleagues: Katie Bennett, David Cappaert, Israel Del Toro, Mark Deyrup, Richard Haradon, Clarisse Hart, Michael Kaspari, Dave McDonald, Mike and Shannon Pelini, and Alex Wild, along with all of the participants in the 2011 Humboldt Field Research Institute Seminar on the Ants of New England: Jennifer Apple, Amy Arnett, Sharon Bewick, Rob Chapman, Rob Clark, Aaron Fairweather, Jonathan Mays, Juan Sanchez, Tony Scalise, Rogério Silva, Conrad Vispo and two anonymous reviewers. They found many mistakes and unclear couplets; we take responsibility for any errors that remain.

The authors shared in the writing and editing of the entire book. All of the illustrations were drawn from New England specimens by co-author Elizabeth Farnsworth. Yale University Press scanned the drawings for the book; the originals are stored in the Harvard Forest Archives in Petersham, Massachusetts. Most of the photographs were taken by co-authors Gary Alpert and Aaron Ellison; additional photographs were contributed by Adam Clark, Elaine and Julius Ellison, Elizabeth Farnsworth, André Francoeur, Benoit Guénard, Rick Hawkins, Sara Lewandowski, Billie Jean Moran, Tom Murray, Claude Pilon, Mike Quinn, Thomas Shahan,

Alex Wild, and the Yale Peabody Museum. Each photograph in the book is imprinted with the initials of the photographer (the aerial photograph of the Thimble Islands on p. XXX is © Peabody Museum of Natural History, Yale University, New Haven, CT, USA); refer to the Internet Resources at the end of the book for a list of web sites where you can enjoy more fine photography by Tom, Claude, Mike, Thomas, and Alex. Ed Kamens showed Aaron Ellison around Yale's Saybrook College to photograph the only known to-date New England habitat of *Paratrechina longicornis*, and Shirley Ellison spent a day with Aaron locating *Nylanderia flavipes* to photograph in the field. Brian Hall (Harvard Forest) helped us with some of the mapping. Ivy Livingston (Harvard Department of the Classics), Donat Agosti (American Museum of Natural History), and Barry Bolton (British Museum of Natural History) taught us more about nouns in apposition than we ever knew we needed to know. Jean Thompson Black, Executive Editor at Yale University Press, has encouraged and supported this project from its inception; her editorial assistant, Sara Hoover, has answered seemingly endless queries and handled the day-to-day processing of the images and the manuscript. Lindsey Voskowsky and Jenya Weinreb in the design and production group at Yale University Press have produced a book that is as much a joy to look at as it is, we hope, to read.

Although all of us have been watching and studying ants for many years, we can trace the genesis of this particular book to a statewide ant collecting blitz we conducted across Massachusetts in 2007 on properties owned by the Massachusetts Audubon Society (MAS) and The Trustees of Reservations (TTOR). Taber Allison (MAS), Robert Buchsbaum (MAS), Paul Goldstein (Field Museum, Chicago), Russ Hopping (TTOR), Julie Richburg (TTOR), and Ernie Steinauer (MAS) provided encouragement and logistical support for that study. The Universities of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont, Cornell

University, Pennsylvania State University, Acadia National Park, the Maine Department of Entomology, the American Museum of Natural History (AMNH), Academy of Natural Sciences (ANS), Harvard's Museum of Comparative Zoology (MCZ), the Yale Peabody Museum (YPM), and the Canadian National Collection of Insects (CNC) opened their collections to us, allowing us to accumulate tens of thousands of historical records of ant occurrences. We are grateful to the faculty and curators at these institutions, not only for helping us access the collections, but also for doing such a great job curating them: Rebecca Cole-Will (Acadia National Park), Andy Bennett, Gary Gibson, and John Huber (CNC), Jane O'Donnell and Dave Wagner (Connecticut), Rick Hoebeke (Cornell), Frank Drummond, Charlene Donohue, and Ellie Groden (Maine), Stefan Cover (MCZ), Don Chandler (New Hampshire), Howie Ginsberg (Rhode Island), the late Kurt Pickett (Vermont), and Ray Pupedis (YPM). From her post as Forest Entomologist with the State of Maine, and as President of the Maine Entomological Society, Charlene Donohue has rounded up specimens from the Maine State collections, those of Dana Michaud and David Bourque, and many more from other members of the society; she, along with Amy Arnett (Unity College, Maine), Beth Choate (University of Maine), Richard Haradon (Essex, Massachusetts), Daniel Jennings (University of Maine), Andrew McKenna-Foster (Maria Mitchell Natural History Museum, Nantucket, Massachusetts), Mark Mello (the Lloyd Center for the Environment, Dartmouth, Massachusetts), Joan Milam (University of Massachusetts), Joe Simonis (Cornell), and Scott Smyers (Oxbow Associates, Massachusetts) sent us ants – sometimes tens of thousands of them – to identify; Chelsea Carr, Israel Del Toro, Terrance Dunn, Clarisse Hart, Samantha Hilerio, Mark Johnston, Kelly McBride, Dave McDonald, Mike Pelini, and Rogério Silva cheerfully sorted and helped to identify them. Eldridge Adams (University of Connecticut) sent us his unpublished distributional records for *Myrmica rubra*.

We especially thank Israel Del Toro, who created a unified database of all of the aforementioned specimens, along with thousands more he collected himself from Virginia to Maine in 2010.

These data are part of his Ph.D. dissertation work at the University of Massachusetts, and we are grateful that he shared the database with us so we could construct accurate distribution maps.

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<<CN>>Chapter 1

<<CT>>Ants and the Environment of New England

New Englanders live in a changeable climate. Locals quip, “if you don’t like the weather, wait ten minutes.” But we don’t always appreciate how diverse our landscape is. We lack the grand mountains of western North America (our tallest, Mount Washington, is just over 2,000 meters high), and it may seem to the casual observer that New England is one large suburb from Portland, Maine to Fairfield, Connecticut. But from an ant’s-eye view, even a change in elevation of only 100 meters or a shift in latitude of only one degree (about 110 kilometers) can determine whether or not a nest can survive. Subtle differences in soil texture, bedrock chemistry, moisture, and temperature all make a huge difference to an ant. To better understand our ants, we start by introducing you to the geological and environmental diversity of New England.

<<txa>>Ancient History Shapes Today’s Environment

New England gardeners grumble that their soils are a messy jumble of rocks, but they rarely consider where those rocks came from. The bedrock of New England is the product of hundreds of millions of years of geological drama involving continental collisions, mountain-building, glacial scouring, and other upheavals. Our oldest rocks date back over 1 billion years, visible in the Grenville gneiss outcrops on Clarksburg Mountain in the southern Green Mountains of western Vermont. Common bedrock types in New England include the familiar hard, acidic granites of New Hampshire and Maine (remnants of the European tectonic plate that pulled away 200 million years ago with the breakup of the supercontinent Pangaea); the volcanic redstones and basalts of west-central Massachusetts and Connecticut (the > 200-million-year-old

Metacomet Range); marbles and limestones from 500-million-year-old beaches and reefs in valleys of western Massachusetts and Vermont; and the much older, highly metamorphosed gneisses and schists of the Berkshire and Taconic Mountains. The composition of the bedrock profoundly influences the chemistry and texture of the soils derived from them as they weather and erode.

The glaciers that have periodically scoured the New England landscape have been the major agents of weathering and erosion. As many as four major glaciation events occurred between 1.6 million and 14,000 years ago – with continent-sized ice sheets spreading south and covering all of New England during periods of extreme cold, then receding north as the climate warmed, leaving behind rocks and fresh soil, ready for ants (and other animals and plants) to recolonize (Figure 1.1).

<<Figure 1.1 near here >>

We think of glaciers as pristine, bluish rivers of ice, but in fact they are huge, dirty conveyor belts, laden with gravel, sand, and silt. Glaciers move like gigantic bulldozers, reworking and depositing rocks and sediments through a combination of movement and meltwater. Glaciers have left many characteristic signatures, including: eskers (sinewy, sandy ridges from the glacier's underbelly visible in central Massachusetts and the Connecticut River valley of New Hampshire and Vermont); drumlins (spoon-shaped hills composed of till overlying knobs of rock, especially common on Cape Ann); kames (terraces of till pushed up against the flanks of hills visible along many valleys in Vermont); kettles (bogs and wet depressions left on the coastal plain by stranded icebergs that melted in place); and sandy outwash plains and deltas

(formed as melting glaciers discharged their loads in places such as the Katama Plains of Martha's Vineyard, the Montague Sandplains of Massachusetts, and the dunes and deltas of the Connecticut River valley). Glacial melting and recession (deglaciation) took place in fits and starts. When the leading edge (or toe) of a glacier pushed forward as fast as it was melting, lots of reworking of sediments occurred, even though the glacier appeared to remain stuck in place. Enormous piles of unsorted rock debris, called moraines, were dumped unceremoniously, concentrated and mounded up at the glacier's toe. Long Island is a terminal moraine formed at the southernmost extent of the glacier; Martha's Vineyard, Nantucket, and Buzzards Bay were all formed as the most recent (Wisconsinian) glacier paused for a few thousand years as it receded north from the last glacial maximum reached 21,000 years ago.

Occasionally, moraines created dams, stopping the flow of melting ice and creating temporary glacial lakes, of which Lake Hitchcock in the Connecticut River valley was one of the largest. This lake stretched nearly 400 miles from what is now New Britain, Connecticut to St. Johnsbury, Vermont. When the dam burst about 12,400 years ago, it left behind layers of sediment that had been deposited at the bottom of the lake for thousands of years. Today, the rich mixture of clays and sands from these former lake-bottoms underlies the floodplain of the Connecticut River and is the basis for the most fertile agricultural soils in New England; sweet asparagus, leaf tobacco, and the Labor Day Ant, *Lasius neoniger*, are hallmarks of this soil in the Pioneer Valley of Massachusetts.

When the glaciers at last loosened their icy grip on New England about 12,000 years ago, a period of rapid climatic change (both warming and cooling) ensued, allowing plants – and ants – to recolonize from the unglaciated south. A period of especially dry, warm weather (the so-called Hypsithermal) prevailed between 9,000 and 5,000 years ago; this warming may have been

enhanced by small changes in the Earth's angle of tilt relative to the sun. During the Hypsithermal, New England supported expansive grasslands reminiscent of today's Midwestern prairies. Remnants of these grasslands still persist in coastal areas of Maine, Massachusetts, Rhode Island, and the islands of Massachusetts, including Martha's Vineyard and Nantucket, that lie to the south of Cape Cod. Ants such as *Formica knighti*, *F. reflexa*, and *F. ulkei*, which are common in Midwestern prairies, can still be found in New England in these isolated grassland fragments.

Never content to remain stable for long, Earth's climate cooled sharply between 1500 and 1850 A.D. This 350-year Little Ice Age gave New England a reprise of cold summers and often deadly winters. Did ants pack up and move south, or did boreal species such as *Myrmica brevispinosa* and *Formica hewitti* expand their range, only to shrink back to their alpine redoubts when the climate warmed again? Although the biogeographic history of species range shifts is difficult to trace, the signatures of these great climatic changes are reflected in the composition of the ant fauna we see today (see Chapter 6).

<<txa>>It's All About the Soil

What do continental collisions and titanic ice ages mean to an ant? Most New England ant species are creatures of the soil, and much of New England's soil has been ground (so to speak) out of bedrock by ice and water. Many ants are quite choosy about the soils they inhabit. Some, like *Solenopsis* cf. *texana*, will nest only in the purest fine sands of windy beaches. Add even a minute amount of clay into the mix, and they are replaced by their less finicky cousin, *Solenopsis molesta*. And no ground-nesting ant prefers soggy soil; even bog ants (*Myrmica lobifrons*) seek out dry microhabitats, nesting and foraging in the relatively high ground atop

hummocks of *Sphagnum* moss.

Stable soils such as till consist of well-defined layers or horizons, topped by a shallow organic surface composed of decaying plant litter. Just below the litter layer is the A horizon, where organic material is constantly being mixed with mineral soil by soil-dwellers like ants and earthworms. Farmers also deepen this layer with their plows; even in soils that have been fallow or reverted to forests long ago, this plow layer (usually about 0.5 meters deep) is still visible today. Iron, clay, aluminum and other minerals leach from the A horizon and accumulate in the underlying mineral soil (B horizon). Beneath these zones, in the C horizon, new soil is created through the erosion of underlying bedrock.

For an ant colony to survive the cold New England winter, most ground-dwelling ants need to dig nests that reach well below the frost-line: at least one meter deep, extending well into the B or C horizons. As we discuss in Chapter 2, ants performing the simple routines of nest house-cleaning also have profound effects on the chemistry, aeration, and recycling of mineral soils brought up from the B horizon. Because ground-dwelling ants must excavate soil to build and maintain their nests, many species are very sensitive to soil texture, which is defined by the relative proportion of sand, silt, and clay. It is less clear whether ants also are sensitive to soil chemistry. For example, do some species prefer basic soils with high pH derived from limestone or more acidic soils with lower pH that were derived from granite? More observations and experimental research are sorely needed in this area.

However, not all ants nest in pure soil. The familiar Eastern Carpenter Ant, *Camponotus pennsylvanicus*, carves its nests in decaying wood (mostly in dead limbs or hollow trunks of living trees, fallen logs, and yes, sometimes wet or rotting wood in houses). Other species, such as *Temnothorax longispinosus*, nest in dead, hollow twigs. Still others, such as *Camponotus*

caryae and *Temnothorax schaumii*, nest under bark high in tree canopies. Many species of *Lasius*, especially the citronella ants in the *claviger* group, seek the shelter of rocks, digging out nests beneath them (and scurrying willy-nilly when you happen to pick up that rock). Still others, including *Temnothorax ambiguus* and the species that enslave it, such as *Protomognathus americanus*, nest in tiny acorns! Finally, some “tramp” species (tiny, mostly tropical, ants that breed rapidly and disperse over long distances), including the Crazy Ant (*Paratrechina longicornis*) and the Pharaoh Ant (*Monomorium pharaonis*), colonize basements, kitchens, and other nooks of human habitation – the only New England habitats reliably warm enough to shelter them year-round.

<<txa>>But Vegetation Matters Too

Both soils and climate heavily influence the composition of vegetation in different regions of New England. New England’s climate varies considerably from the coast (with its maritime influences) to inland (with its continental influences). Cold coastal waters are slow to warm up in the spring and keep air temperatures cooler on Cape Cod than in the interior well into the early summer. Likewise, the mountains of our region experience much cooler temperatures throughout the year than lower elevation sites, shaping the plant communities that occur from north to south and from summit to valley. Because temperature and vegetation go hand-in-hand, ecologists classify New England broadly into five ecoregions – areas that share similar climates, growing seasons, and plant community types (Figure 1.2). If you travel along a transect from northern Maine to southwestern Connecticut, collecting ants along the way, you will find very different suites of species inhabiting these ecoregions.

<<Figure 1.2 near here >>

Northern and western Maine, most of New Hampshire and Vermont, the Berkshire Mountains and Worcester Plateau of Massachusetts, and the Litchfield Hills of Connecticut are in the Northeastern Highlands ecoregion. This ecoregion is cloaked in boreal forests, dominated by hardy spruces, firs, white pines, and northern hardwoods including oaks, American Beech, and Sugar Maple. Bogs reminiscent of Alaskan tundra are the predominant wetlands in this ecoregion. Our highest peaks – Mount Katahdin in Maine, Mount Mansfield and Camel’s Hump in Vermont, Mount Washington and the other high peaks of the Presidential Range in New Hampshire, and Mount Greylock in Massachusetts – have low-lying alpine vegetation that has clung to these summits since the glaciers receded. Boreal and cold-climate ant species such as *Camponotus herculeanus*, *Formica hewitti*, *F. podzolica*, and *Myrmica brevispinosa* extend their range into New England only in the Northeastern Highlands.

Downeast Maine (the low elevation regions of central and northeastern Maine) with its rolling plains, low hills, many lakes and ponds, and a rocky coastline, forms the Acadian Plains and Hills ecoregion. This ecoregion is characterized by a mixture of northern deciduous hardwoods (predominantly Red Oak, Sugar Maple, and American Beech) and evergreen conifers (spruces, firs, Eastern Larch, and Northern White Cedar). Productive farms, pastures, and blueberry barrens punctuate the forest, and are home to prairie ant species such as *Formica ulkei* and *F. knighti*. Downeast Maine’s unique coastal raised bogs perch atop granite bedrock and host bog specialists and cold-climate ant species, including *Dolichoderus mariae*, *Formica neorufibarbis*, *Myrmica alaskensis*, and *M. lobifrons*.

The Northeastern Coastal Zone ecoregion consists of the southern part of coastal Maine,

coastal New Hampshire, all of Rhode Island except Block Island, and the portions of Connecticut and Massachusetts (excluding Cape Cod and its offshore islands) that are lower in elevation than 300 meters above sea level. The temperate and diverse mix of vegetation in this ecoregion consists of deciduous forests, grasslands, and sedge meadows that extend south from New England into the mid-Atlantic coastal plain and piedmont. Southern woodland ant species, such as *Camponotus americanus*, *C. castaneus*, *C. chromaiodes*, and *Formica creightoni*, are characteristic of this ecoregion.

Cape Cod, Martha's Vineyard, Nantucket, and Block Island, together with New York's Long Island, are in the Atlantic Coastal Pine Barrens. This unique ecoregion is dominated by Pitch Pine, Black Oak, Chestnut Oak, and blueberries growing on sandy soils. The once extensive pine barrens have been modified heavily by human activities, and only small remnants of true pine barrens – a globally threatened ecosystem – remain in New England. Many southern species of ants, notably *Pheidole pilifera*, *Monomorium viride*, *Solenopsis* cf. *texana*, and *Temnothorax texanus* are found in this ecoregion.

Finally, the Lake Champlain Valley in the northwestern edge of Vermont is part of the Eastern Great Lakes Lowlands ecoregion. Before European settlement, the forests here were dominated by hardwood trees more characteristic of Mid-Atlantic latitudes, including Beech, White Oak, ashes, and hickories. The rich soils of the Champlain Valley encouraged farming, and now most of this ecoregion is devoted to agriculture and residential development. Nevertheless, some southern species, such as *Camponotus chromaiodes*, find the comparatively warm (for New England) climate around Burlington most hospitable.

Small-scale differences in vegetation within ecoregions profoundly influence microclimate, and ants respond accordingly. Having tiny bodies with large surface-area to

volume ratios, ants are very sensitive to temperature and thus to the plant communities around them. Warmer south-facing slopes of hills will support different ant species (and vegetation) from cooler, north-facing slopes. Deciduous hardwoods and evergreen conifers reflect the sun's rays differently, thereby influencing the temperature on the ground; in winter or summer you have only to walk from a clearing to the deep shade of a conifer forest to appreciate the difference in temperature. On a balmy spring day when the temperature reaches 15 °C (60 °F) – the minimum average yearly temperature at which most ant nests really wake up – you will find an abundance of species in oak glades. Just a few meters away under a dense canopy of hemlock trees, only one or two cold-tolerant species, such as *Aphaenogaster picea*, will be out and about.

Of course, land cover is not static over time, and therefore neither is the ant fauna. What happens if you clear-cut that dense hemlock stand? Suddenly, warm sun floods the forest floor, which is now covered with twigs, branches, and other coarse woody debris. Different species of ants, especially *Formica* species, quickly colonize these newly logged patches in the forest. Three years later, a thick tangle of raspberries and impassable stands of young birches will have taken hold. These may discourage humans from passing through, but other species thrive in these dynamic habitats. Twenty years on, as the free-for-all scramble among the plants has begun to calm down, a more stable mixture of pines and maples will have overtopped the fly-by-night birches; look for *Camponotus novaeboracensis* nesting in fallen birch logs and under bark. Hemlocks and shade-tolerant oaks lurk in the understory, waiting for one of those pines to fall and open up a light gap in which they can grow. In a hundred years or more, a tall forest of mixed conifers and hardwoods will have grown up; look among the acorns for tiny *Temnothorax curvispinosus* nests, in the leaf litter for small nests of the handsome *Stenamma impar*, and in standing dead tree trunks for larger nests of *Camponotus nearcticus*. And a few ant species, such

as *Lasius speculiventris*, nest mostly in the moist soils of the oldest forests, especially those that were never logged.

In many ways, this type of ecological succession mirrors the historical pattern of land-cover change in New England over the past three centuries. Arriving in the 1600s, early European colonists documented vast stands of old-growth coniferous and mixed-deciduous forests, interspersed with clearings and occasional burns made by native American hunters and farmers. Following settlement, nearly 80% of New England's forests, especially in the Connecticut River Valley and the Champlain Basin, was cleared in the 1700s to make way for crops, pastures, and cities (Figure 1.3).

<<Figure 1.3 near here>>

In the wake of the industrial revolution, subsistence farming largely disappeared from New England, and by the early 1900s abandoned farmlands slowly began to revert to forest. Succession proceeded from field to old-field to forest, and today, the majority of the New England landscape is forested once again (Figure 1.4).

<<Figure 1.4 near here>>

New England's agricultural history remains visible in the ubiquitous stone walls built by European colonists and their oxen (Figure 1.5). These stone walls are also good places to look for ants; *Amblyopone pallipes*, for example, often forages between the rocks. Unfortunately, suburban developments and urban sprawl are making inroads into forests, and some elements of

mature forests, including many understory orchids and other herbaceous plants, may never fully recover. Although the seeds of many spring woodland flowers are dispersed by ants, especially *Aphaenogaster picea* and *Myrmica punctiventris*, the seedlings are rapidly eaten by burgeoning populations of deer, which are no longer held in check because their native predators (mountain lions or catamounts, wolves, and lynxes) are now extinct or very rare.

<<stonewalls.tif>>

Glaciers flowed and receded, New England was colonized, cleared, and in places, abandoned, but the forests, pine barrens, grasslands, and wetlands have remained. Their persistence and recovery demonstrates the resilience of New England ecosystems. We will never know all the details of how ants responded to these major historical changes, but we can learn much about these insects, their ecological interactions, and their responses to and influences on ecosystems, by studying them in the multitude of different habitats in our region.

<<CN>>Chapter 2

<<CT>>Ant Basics: Evolution, Ecology, and Behavior

<<txa> The life of ants

Ants are very different from most other animals. They form large colonies of closely related individuals, many of whom have specific tasks required to maintain the colony, and most of whom are unable to reproduce themselves. The ant you see crawling up a tree trunk or along your kitchen counter is almost always a sterile female. She will never reproduce, and she works exclusively for the benefit of the queen and the rest of her colony. An active ant colony consists of one or several queens – the only females that reproduce – and anywhere from a couple of dozen to tens of thousands of female workers. These workers carry out all of the activities of the colony other than reproduction. They gather food, care for the young, defend the colony from predators and invaders, maintain the chambers and passageways, remove waste and debris, and even (in some specialized species such as *Prenolepis imparis*) store food. Queens (and their colonies) can live for decades, but workers rarely live longer than a single year or growing season. Males are produced only when the colony is about to undergo sexual reproduction, but contribute nothing to the care and maintenance of the colony.

How does an ant colony get started? In response to a variety of cues, including day length, temperature, crowding, or stress, the queen lays eggs that develop into special winged females (alates) or winged males. After rains and during daylight hours, especially early morning or late afternoons, the virgin females and males fly out of the nest. These nuptial flights can be spectacular, especially in the boreal forests of New England, where huge clouds of winged ants in the genus *Lasius* rise into the air from many different nests. (Figure 2.1)

<<Figure 2.1 near here>>

Ant swarms often alarm homeowners because they resemble swarming termites, but a closer look reveals clear differences between termites and ants. Our common termites are small, soft, white, and fat (Figure 2.2), and, even though they may be called white ants, they are more closely related to cockroaches than they are to any insect in order Hymenoptera, which includes the ants, bees, and wasps. Three important characters (among many others) distinguish Hymenoptera (including the ants) from termites: the front wings of Hymenoptera (only present on alate queen and male ants) are larger than their rear wings, but they are the same size in termites; most Hymenoptera, including the ants, have a wasp-waist (a narrow constriction in their body; see Chapter 4 for more details), whereas termites do not; and the distal ends of the legs (the tarsi; see Chapter 4) of Hymenoptera have five segments, whereas those of termites have only four.

<<Figure 2.2 near here>>

In some ant species, such as *Aphaenogaster rudis*, the alate females will mate with only a single male. In others, such as the European Fire Ant *Myrmica rubra*, a single female may mate with five or more males. But whether there are single or multiple matings, this is the only point in the life cycle of the colony (Figure 2.3) at which mating occurs. The queen will spend the rest of her life inside her colony, and all her fertilized eggs are produced with sperm that has been stored from this single mating flight.

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After mating, the queen lands, sheds her wings, and searches for a patch of soft soil, a hollow twig, acorn, rotting log, or protected place beneath a small stone roof, where she can found a new colony. But most queens never make it; the vast majority land on inhospitable terrain and end up as food for birds, other insects, or even the occasional carnivorous plant (Figure 2.4).

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The lucky females who land in a good spot dig in and quickly lay a first batch of fertilized eggs, converting some of their wing muscle tissue into spit-like salivary secretions to feed the new brood. The female workers that hatch from these founding eggs will begin gathering food, enlarging the nest, and tending the queen, helping her to produce more sisters for the colony. This first cohort of workers, called natic workers, are much smaller than the workers that are produced later in the life of the colony.

The colony now begins an extended growth phase that can last anywhere from several months to several years, depending on the species and the lifespan of the queen. During this growth phase, the queen continues to produce broods of eggs that will hatch into more female workers. In most species, workers take on different tasks as they age. Young workers attend the queen and take care of eggs and pupae. Older workers feed and care for the maturing larvae. The oldest workers forage for prey, maintain and expand the nest, and defend it from predators, competitors, and slave-raiders.

In many genera, the tasks that any individual worker performs change from day to day, depending on the needs of the colony and interactions among the workers. But in a handful of genera, including *Camponotus* and *Pheidole* here in New England, eggs develop directly into different castes of workers with distinct sizes and appearances that fulfill specialized roles in the life of the colony. The smaller minor workers do most of the colony maintenance and foraging, whereas the largest major workers defend the nest and stores of food. The number and types of workers produced by the queen are under delicate chemical and hormonal control, which is mediated by the quantity and quality of food that is brought back to the nest and by the relative numbers of individuals in different castes.

Whether colonies have flexible workers or fixed castes, without the guiding chemical control of the queen the activity and behavior of the workers can become disorganized or random. If the queen dies or is removed from the nest, the colony usually disintegrates and dies. In a few species, however, workers will begin to produce eggs if the queen dies. Because these eggs are unfertilized, they usually develop into males (see the discussion of haplodiploidy and the evolution of eusociality, below). In rare cases, however, workers can produce new queens either from unfertilized eggs (parthenogenetically) or after mating with a male ant.

An ant colony will continue to grow in size and add workers, but at some point it is mature and will begin sexual reproduction by producing females that can reproduce (virgin queens) and males. Many species produce males and reproductive females just before the nuptial flight. Others produce males and reproductive females that stay in the nest for a long time before the nuptial flight. Our largest carpenter ant, *Camponotus herculeanus*, produces males and virgin queens in late summer. They are groomed and fed by workers throughout the fall and winter before they emerge from the colonies for their mating flights in the spring. Lastly, some species,

including *Monomorium pharaonis* and *Myrmica rubra*, have large colonies with multiple queens that create new colonies asexually by fragmenting the original colony. However, even these polygynous (literally, many queens) and polydomous (literally, many houses, and referring to their many nests) ants eventually go through a phase of sexual reproduction in which males and new queens are produced.

The ant colony thus functions as a highly social, organized “super-organism.” The queens and most workers are safely hidden below ground or protected within the interstices of rotting wood. But for the ant workers that must go out and forage for food for the colony, life above ground is short and dangerous. The single ant that you see running across the forest floor or your kitchen counter is in reality a short-lived specialized genetic extension of the colony itself, just as an individual leaf is a specialized part of a single living tree.

<<txa>>What makes an ant an ant?

Ants are insects, and insects are arthropods: invertebrates (animals without backbones) within the larger group of animals that includes other animals such as lobsters, spiders, and lice (Box 2.1). Like all insects, ants have a segmented body consisting of three major regions (head, thorax, and abdomen), compound eyes and antennae on the head, three pairs of jointed legs on the thorax, and an external (outer) skeleton made of chitin (a stiff starchy compound that feels like plastic or skin) covering the entire body. Ants are all members of one insect order: the Hymenoptera. This order also includes the sawflies, bees, and wasps. With nearly 150,000 described species, the Hymenoptera contains more species than any other order of insects except for the beetles (Coleoptera) and the butterflies and moths (Lepidoptera). All Hymenoptera have membranous wings, an egg-laying organ (called an ovipositor) that is frequently modified as a

stinger, chewing mouthparts (although the proboscis of bees has been modified for drinking nectar), complete developmental metamorphosis with larval and pupal stages (so-called holometabolous development), segmented antennae, compound eyes, and a narrow “waist” (except for the most ancestral group, the sawflies).

Box 2.1 Ants in the animal kingdom

Biologists classify organisms in a hierarchy of groups, beginning with their kingdom. Ants are in their own family – a relatively fine division within the animal kingdom:

Kingdom: Animalia – multicellular organisms that have to eat other organisms to survive

Phylum: Arthropoda – animals without backbones that have an exoskeleton, a segmented body, and jointed appendages (legs, antennae)

Class: Insecta – arthropods with an exoskeleton made of chitin, a body with three major parts (head, thorax, abdomen), three pairs of jointed legs, compound eyes with multiple reflecting lenses, and two antennae

Order: Hymenoptera – the ants, bees, wasps, and sawflies

Family: Formicidae – the ants

Within the Hymenoptera, the ants are in their own family, the Formicidae. Ants are distinguished from the rest of the Hymenoptera by two key evolutionary innovations: (1) a distinctive metapleural gland that secretes antibiotics that keep the ant exoskeleton free from bacteria and fungal spores that could infect the nest; and (2) a morphological modification of the typical hymenopteran narrow waist into a node-like structure called the pedicel. Although the pedicel appears to separate the thorax from the abdomen, don’t be fooled; the pedicel actually

consists of the second segment or the fused second and third segments of the abdomen! This evolutionary re-arrangement has led myrmecologists to develop specific terms to describe ant anatomy. Some of these terms are different from those used to describe the “typical” insect (see Chapter 4).

<<txa>>Evolution of ants

The insect order Hymenoptera originated in the Triassic Period (~ 250 million years ago), and the oldest fossils of ant-like creatures look a lot like wasps. In fact, a short-lived side-branch of the hymenopteran evolutionary tree had characteristics of both ants and wasps. These insects, which went extinct 45 – 65 million years ago, are called sphecomyrmines (from the Greek *sphéx*, meaning wasp + *myrmex*, meaning ant).

The modern ant appears to have evolved between 115 and 135 million years ago; the earliest definitive ant fossil appears in French amber that is about 100 million years old. Ants first evolved in tropical rainforests, but they diversified rapidly and colonized deserts, grasslands, wetlands, and cold northern and high-elevation habitats. Today, they occur on all continents except Antarctica, and in all terrestrial habitats. Even Arctic regions and remote islands that originally had no ant fauna now harbor a few introduced species. In New England, the vestiges of all this evolutionary history are evident in the taxonomic distribution of ant species, genera, and subfamilies (see also Chapter 6). The New England fauna includes species from the big three subfamilies of ants – the Myrmicinae, Dolichoderinae, and Formicinae – along with a handful of species in three other subfamilies, the Amblyoponinae, Proceratiinae, and Ponerinae (Figure 2.5).

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Ants have been in what is now New England for millions of years, leaving when the glaciers covered the land and returning as the glaciers melted. Most of the ant species that we find in New England today recolonized our region after the glaciers receded about 10,000 years ago, but others may have evolved and diversified right here. Exotic tropical species, such as army ants and leaf-cutter ants cannot survive a killing frost or a New England winter. However, some tropical and subtropical tramp species take advantage of global commerce and show up occasionally in New England's hospitals, grocery stores, greenhouses and warm basements.

<<txb>>Eusociality – the pinnacle of social evolution

Scientists distinguish ants from other insects by their unique morphology. But probably the most important event for ants in their nearly 150 million-year history was the evolution of their complex social behavior. Along with humans, naked mole-rats, and reef-forming corals, ants (along with the other social insects) represent one of the peaks of social evolution. Ants are “eusocial” (truly social); there is a reproductive division of labor with one (or only a few) reproductive females, a non-reproducing caste of workers, overlapping generations, and cooperative care of young.

Eusociality has evolved repeatedly within the Hymenoptera. Bees and wasps contain several eusocial lineages, but there are also bees and wasps that are solitary or have only a modest degree of social organization. Across the rest of the animal kingdom, eusociality has evolved only in the termites and the naked mole-rats, although there is evidence for some elements of eusocial structure in a few species of thrips, gall-making insects, and snapping shrimp. Eusociality is an evolutionary paradox, because classical theories of natural selection

(and modern economics) predict that individuals should act in their own selfish reproductive interest. It is hard to understand how evolution would favor the development of sterile castes of workers in which individuals sacrifice their own reproductive potential, caring for the colony and the offspring of the queen instead of reproducing themselves.

The first key to understanding the evolution of eusociality is the observation that all Hymenoptera have a unique genetic system that determines the sex of their offspring. In most animals, males and females are diploid – they each have two sets of chromosomes; one (haploid) set is contributed by each parent in the sperm or the egg. These two haploid sets combine during fertilization so that the offspring (like the parents) is diploid. But the Hymenoptera are different. Like most other organisms, including humans, all female ants (workers and queens) develop from fertilized eggs produced by uniting an egg and a sperm cell – they are diploid. But males develop from *unfertilized* eggs and therefore have only one set of chromosomes – they are haploid. As we described earlier in this chapter, the life cycle of an ant colony consists of repeated production of diploid workers and only occasional production of haploid males. We refer to this as a haplodiploid sex determination, or haplodiploidy, for short.

An important consequence of haplodiploidy is that females share more genes with their sisters than they do with their own daughters. The theory of kin selection predicts that eusociality should evolve in haplodiploid organisms. Workers that give up their own reproduction to help the queen produce more sisters actually are behaving selfishly (in an evolutionary sense) because more copies of their genes will spread through their sisters (kin) than through their own production of daughters. This is the concept of inclusive fitness: if you are not going to produce your own offspring, take care of your siblings (and other more distant relatives) with whom you share genes. In contrast, the haploid males are not more closely related to their sisters than to

their own offspring. The theory of kin selection correctly predicts that males of eusocial species should spend all their time selfishly reproducing (or trying to reproduce) rather than working to contribute to the success of their sisters' colony.

However, haplodiploidy cannot be the ultimate explanation for the evolution of eusociality. Although all ants are eusocial, many groups of bees and wasps are not, even though they all have haplodiploid sex determination. Eusociality also has evolved in some animal species that have typical diploid males, such as naked mole-rats and termites. An alternative hypothesis for the evolution of eusociality is that one female (the queen) can dramatically increase her fitness if she can prevent her offspring from reproducing and instead force them into caring for all the young. Other characteristics of Hymenoptera that may have favored the evolution of eusociality in this order of insects include the habit of group nest-building (which favors cooperative defense), and the repeated occurrence of trophallaxis – the regurgitation of liquid fed to other members of the colony during cooperative care of offspring. But whatever the ultimate forces leading to the evolution of eusociality, it is certainly responsible for much of the evolutionary and ecological success of the ants. The modest ant worker running across the pavement reflects millions of years of successful morphological evolution and social organization that has led to the ecological dominance of ants throughout the world.

<<txa> Ant ecology

Ants are the unseen and unrecognized giants of the terrestrial world. Most ant species are small, usually less than 1 cm long, although the largest living ant, Wilverth's Driver Ant (*Dorylus wilverthi*) is a whopping 52 mm long. The largest ant that ever lived is the extinct Lube's Titanic Ant, *Titanomyrma lubei*, whose ~57 mm-long queens roamed the hills of Wyoming nearly 50

million years ago. But despite their small individual size, ants *en masse* outweigh all other invertebrate groups, and may comprise as much as one-third of the mass of all insects on Planet Earth. In one study in a Brazilian rainforest, the total mass of the ants was approximately four times greater than that of all mammals, reptiles, and amphibians combined!

Although ants are everywhere, they are not especially conspicuous because most ant colonies are underground; we see only the actively foraging workers on the surface or the occasional mating swarm. But it is the ants, not the earthworms, that are the prime movers and turners of soil. The classic brown (podzolic) soils of northern New England are created by ants continually digging up soil from deep beneath the surface, leading to a layer of 25 – 45 centimeters of brown topsoil that accumulated over several thousand years before European colonists began to plow it for agriculture. Indeed, because ants are so abundant and widespread, it is difficult to imagine what the earth's vegetation and soils would look like without them.

Ants are the chief scavengers and garbage collectors of the forest, efficiently consuming and disposing of animal carcasses. Several species of ants that lurk in the dry and decaying leaves littering the forest floor are specialist predators that consume springtails, mites, spiders, and other microfauna. Ants themselves are prey for birds, small mammals, spiders, and other insects.

Ants also compete with one another for limited ecological resources, especially food and nesting sites. Competition among ants occurs directly, when ants engage in coordinated territorial combat and defense of food resources, as well as indirectly, when many species jointly exploit scarce resources. Ants move plants around, too. In New England, the common forest ant *Aphaenogaster rudis* collects the seeds of many different understory herbs, including Wake-robin (*Trillium*), Bloodroot (*Sanguinaria canadensis*), Wild ginger (*Asarum canadense*), Fringed

Polygala (*Polygala paucifolia*), violets (*Viola*), and some species of sedges (*Carex*). Attached to the seeds of these herbs is a fleshy, fat-filled structure called an elaiosome, which is an attractive food for many ants. The ants collect the seeds, eat the elaiosomes, and leave the seeds in or near the nest, where they can germinate in the nutrient-rich soil that the ants have turned over. In many of our forests, *Aphaenogaster rudis* and *A. picea* are the most common and abundant ants to be found, and the more *Aphaenogaster* nests that are present in the forest, the higher the density of understory herbs.

Other ants, including the widespread, silvery-colored *Formica subsericea*, tend aphids and scale insects that themselves are feeding on plant juices. As the aphids and scale insects pump fluids from the plant into their bodies, the ants harvest the sugar-rich liquid they excrete. This honeydew can be either a sweet treat or the primary food supply for the ant colony. Other ants are predators: New England's three *Proceratium* species prey only on spider eggs, and our *Pyramica* species stalk centipedes.

<<txa>>Social Parasitism – Guests, Inquilines, Temporary Parasites, and Slave-Makers

Parasites have evolved to exploit almost every kind of organism. The primary characteristics of a parasite is that it is physically dependent on another species (the host) for at least part of its life cycle; the parasite cannot survive and reproduce successfully without the host. For example, parasitic plants attach to roots of other plants and suck nutrients and carbon from the host. Without this source of essential nutrients and energy, the parasite dies. Parasitic roundworms take up residence inside humans, feeding on blood, tissue, or your last meal. Without the food and shelter provided by your body, these roundworms could not survive. Parasitic protozoa, including the species that cause malaria in humans and birds, have evolved

complex life cycles that require multiple species of hosts to house them, feed them, and move them around.

Many kinds of parasitism have evolved among the ants, too. Myrmecologists recognize four different kinds of social parasites (the prefix “social” refers to the fact that these parasites have evolved in the eusocial insects): **guest ants** (also called xenobiotics); **temporary social parasites**; **slave-makers** (also called permanent social parasites with slavery, and also known as dulosis or pirates); and **inquiline social parasites** (also called permanent social parasites without slavery). Among the ants, less than 2% of species are known to be parasites, but continued exploration and study of ant natural history, especially in the tropics, continues to reveal new parasitic species. And a surprising number of temperate-zone species in the ant subfamilies Myrmicinae and Formicinae are parasitic. In New England alone, we have at least 42 species of social parasites – over 1/3 of our resident species!

Guest ants are fed by, and live in the same nest as, their host. Unlike the other three kinds of social parasites, guest ants rear all of their own workers. In New England, we know of only one such guest ant: *Formicoxenus provancheri* is a guest of *Myrmica incompleta*. *Formicoxenus* forms small nest chambers within the nest of *M. incompleta*, and the host regurgitates food into the mouths of the guest. This behavior co-opts some of the energy from the host colony, but does not compromise its existence.

Temporary social parasites depend on their hosts only to found a new colony. After she has mated, the founding parasitic queen enters a host colony and kills or otherwise removes the host queen. As the parasitic queen lays her own eggs, the host workers care for them, rearing the brood as if they were the hosts’ sisters. As the host workers age and die, they are replaced by the

parasite workers; eventually, the colony is made up entirely of the parasite queen and her offspring. In New England, many species of *Lasius* and *Formica* are temporary social parasites.

Slave-makers, on the other hand, depend on one or more host colonies for their entire lives. As with temporary social parasites, the first step in enslaving a colony is for the founding parasitic queen to find a host colony and kill or expel the host queen. In some species, including our own *Harpagoxenus canadensis*, the parasitic queen also kills or otherwise removes all the host workers, too. In other species, the host workers start to care for the parasitic queen and her offspring. But in both cases, the offspring of the parasitic queen do not care for their brood or forage for their own food. Rather, the parasite workers raid other colonies of the host species and carry off the captured brood. Once these captives are returned to the parasite's nest, they do all the work required to keep the colony clean and well-fed. In New England, species in the *Formica sanguinea* group, our two *Polyergus* species, and *Protomognathus americanus* are our most common slave-making ants.

Finally, inquiline social parasites have dispensed with workers altogether. A founding parasitic queen invades the host's nest, but usually does not kill the host queen. Instead, the host queen continues to produce her own workers, who care for the parasites' offspring, which are only males and new queens. In rare cases, the parasite queen can only invade a nest in which the host queen has died; this appears to be the case in New England for *Anergates atratulus*, which is an inquiline social parasite of the Pavement Ant, *Tetramorium caespitum*. Other New England inquiline social parasites are in the genera *Leptothorax*, *Myrmica*, and *Tapinoma*.

A key feature uniting all these forms of social parasitism is that the parasite queen co-opts the host's work-force, either by displacing the host queen (temporary social parasites and slave-makers) or by exploiting the workers that the host queen continues to produce (guests and

inquilines). How does the parasite queen manage to convince the host colony to care for her (and her offspring)? Ants belonging to a single colony recognize each other by the unique chemical signature of the nest; essentially, they use their antennae to taste and smell each other. If they smell right, they're sisters, but if not, they're foreign, and must be removed or killed. Parasitic species have to mask their own smell and quickly take on the chemical signature of the host colony, and they do this in a variety of ways. For example, on her way into the host's nest, the parasitic queen might grab a host worker, kill it, chew it up, and smear herself with the unique chemicals from the cadaver's exoskeleton. Alternatively, the parasitic queen does the same thing to the host queen once the parasite enters the brood chamber. Slave-makers that capture foreign brood transfer their own chemical scent to the slave-workers as they hatch. There are many variations on these themes, but virtually all of them involve the use of distinctive hydrocarbons – molecules made up only of carbon and hydrogen – that are found on the surface of ants exoskeletons.

<<txa>>Myrmecophily – Life Among the Ants

Socially parasitic ants are not the only species that invade, co-opt, or otherwise take advantage of ants and their nests. Myrmecophiles – literally ant lovers (from the Greek *myrmex*, meaning ant + *philos*, meaning loving) – can be found in all corners of the animal kingdom. Mites, flies, beetles, butterflies, crickets, and many others spend part or all of their lives in the warm, dry, and secure nests that ants build. Like the social parasites, the myrmecophiles use chemical deception to insinuate themselves into their hosts' nests.

Myrmecophiles range from the parasites that feed on their hosts to mutualists that enhance the survivorship or reproduction of the host colony. In New England, the most common

myrmecophiles are scarab beetles in the genus *Cremastocheilus*, clown beetles in the genus *Hetaerius*, rove beetles in the genus *Xenodusa*, and hoverflies in the genus *Microdon*. We also have our share of myrmecophilous crickets, in the aptly-named genus *Myrmecophilus* (Figure 2.6).

<<Figure 2.6 near here>>

Cremastocheilus beetles live in nests of various species of *Formica*, where the adult beetles feed directly on the larvae or brood of the ants. The beetle grubs (larvae) feed on the accumulated detritus of the nest. Adult *Hetaerius* beetles steal liquid food from ants as they exchange food with each other. A few species of *Hetaerius* also have been observed soliciting food from ant workers, and the ant responds by regurgitating bits of food into the mouth of the beetle. The immature stages of *Hetaerius* beetles have yet to be found. If the ants ever attack either of these beetles, the victim will play dead – staying perfectly still and holding its legs tight to its body. The ants may then carry the beetle around and taste or smell it with their antennae, but they eventually release it, whereupon it resumes foraging in another chamber of the nest.

Xenodusa beetles have a very interesting life cycle. The larvae spend the summer in nests of *Formica* species, including *F. exsectoides* and *F. incerta*. The beetle larvae are cared for and fed by the host ants; occasionally the larvae will eat some of the host workers. In mid-summer, the larvae leave the *Formica* nests and move into nests of Carpenter ants, including *Camponotus americanus*, *C. chromaiodes*, *C. novaeboracensis*, and *C. pennsylvanicus*. There, they overwinter, completing their larval development, pupating, and eventually emerging as adults.

Hoverflies in the genus *Microdon* have a similarly bizarre life history. The fly lays its eggs on the surface of the host-ant's nest. As soon as the eggs hatch, the larvae burrow down into the nest, making a bee-line for the brood chamber. The slug-like larvae develop inside the nest, where they feed on detritus or prey on developing ant larvae. Like ant social parasites, many species of *Microdon* produce chemicals on their exoskeletons that mimic the odor of the ant colony they are inhabiting. In the spring, the pupating *Microdon* larvae move up to the top of the ant nest, where they pupate and then emerge as adults, flying off to lay their eggs in new colonies. Most *Microdon* species are thought to be host-specific. In New England, they have been collected from nests of *Camponotus novaeboracensis*, *Formica exsectoides*, *F. incerta*, *F. obscuriventris*, and *F. querquetulana*. To identify them, it is necessary to rear the larvae (or pupae) to adulthood, and also to keep a specimen of the host.

Myrmecophilus crickets also live in ant nests, where they feed on secretions regurgitated by worker ants, or obtain nourishment by licking the hydrocarbons on the ants exoskeleton. Why *Myrmecophilus* is tolerated by ants continues to be studied and debated. The currently accepted explanation is that the cricket fools the host ants into thinking it is an ant itself because some of the body parts of the crickets “feel” like parts of an ant. But eventually, the ants detect the deception, and hustle the cricket out of the nest.

Myrmecophiles are most diverse and abundant in the tropics; hundreds or even thousands of these ant-lovers rely on the ever-moving nests of army ants for food and protection. Much less is known about our temperate-zone myrmecophiles, and new discoveries await your careful observations!

<<txa>>Ant Mimicry - Imitation is the Sincerest Form of Flattery

The evolutionary and ecological success of ants has not gone unnoticed by other organisms, and ant mimics have evolved among spiders, wasps, plant bugs, and beetles, among other arthropods. Collectively, arthropods that look like ants are called myrmecomorphs because they have the form (*morpho* in Greek) of ants (*myrmecos* in Greek). Evolutionary ecologists recognize two broad classes of mimicry – Batesian mimicry and Müllerian mimicry. In both types of mimicry, the species being mimicked (the model) is usually aggressive or distasteful to predators. The difference between the two is that Batesian mimics are harmless and good to eat, whereas Müllerian mimics share the aggressive or unpalatable characteristics of their models. A third type of mimicry, specific to ant mimics, is Wasmannian mimicry. Wasmannian mimics not only resemble the shape and size of their models, but also have evolved behaviors and chemical cues that allow them to masquerade as ants and live within the ant colony itself. Wasmannian mimics are known mostly from the tropics.

Ants are good models for evolutionary mimics. Many ants have stingers or poison glands and are aggressive when disturbed. Others are not especially tasty. The bright coloration of many ant species may be a warning to predators to stay away, and mimics take advantage of this early-warning system. Most myrmecomorphic spiders are palatable Batesian mimics, whereas the “velvet ants” (Figure 2.7), which are actually wasps in the family Mutillidae, are brightly colored Müllerian ant mimics whose stings can be quite painful.

<<Figure 2.7 near here>>

The greatest diversity of ant mimics is in the tropics, where there are also the most ant models. But there are many species of myrmecomorphs in New England. Most are “jumping”

spiders in the family Salticidae; their characteristic jerky movements closely resemble the walking behavior of ants (Figure 2.8). We once collected one of these spiders, *Synemosyna formica*, in a Maine bog. Until we returned it to the laboratory and put the specimen under a dissecting microscope, we were sure it was a bog ant (*Myrmica lobifrons*)!

<<Figure 2.8 near here>>

Perhaps most curious of all our New England ant mimics is the plant bug *Orectoderus obliquus*, in the family Miridae of the order of true bugs (Hemiptera). Like other Hemiptera, *Orectoderus* has hemimetabolous development. That is, unlike ants and other holometabolous insects that go from eggs to larvae to pupae to adults, the hatchlings of true bugs and other hemimetabolous insects look like small (albeit usually wingless) versions of the adults. Each time they molt, they are a little larger and closer to the adult form. *Orectoderus obliquus* has combined hemimetabolous development with Batesian mimicry in a novel way: the different stages (or instars) of *Orectoderus obliquus* mimic different ant species! The small, young instars mimic small ant species in the genera *Leptothorax* and *Tapinoma*. Middle-aged, intermediate instars mimic medium-sized ant species in the genus *Crematogaster* or smaller species of *Formica*. The adult, wingless females mimic large *Formica* species (Figure 2.9).

<<Figure 2.9 near here>>

Not only does their shape change as they mature, but their movement in each instar closely matches the movement, especially the running speed, of their ant models. We caught what we

were sure was a *Formica subsericea* worker running across a north-central Massachusetts grassland, only to discover it was *Orectoderus obliquus* as soon as we looked at it through a hand lens. The piercing-and-sucking mouthparts of *Orectoderus* (and other true bugs) distinguish this behavioral mimic from ants, which have chewing mandibles.

<<CN>>Chapter 3

<<CT>>Observing, Catching, and Collecting Ants

<<txa>>Observing Ants

This field guide focuses mostly on collecting and identifying ants, but you can learn a lot more about their natural history, ecology, and behavior by studying them – alive – in the field. Ant workers often are specialized for foraging, recruitment, and nest defense, and they exhibit a rich array of behaviors that you can easily observe. And, with only a couple of exceptions, there are no ant species in New England that can seriously bite or sting you, so you shouldn't be shy about interacting with them. But first, you have to find them.

<<txb>>Good Ant Habitats

Where should you look? Your first impulse may be to find a “pristine” patch of mature New England forest. But in reality, as we discussed in Chapter 1, there is no such thing because all habitats in our corner of the world have been affected by centuries of human activity. Moreover, intact forest is not necessarily the best habitat for finding different ant species. Ants are thermophiles – they love warm sites, especially if they include protected microhabitats for the establishment of safe nests. Forests, with their dense, leafy canopies, can be quite chilly. For warm temperatures and variable habitats, grasslands and ecotones – the boundaries or margins between different habitat types – are excellent places to start hunting ants. Edges of open fields, campgrounds, picnic areas, parking lots, and even sidewalk cracks and brickwork all are prime habitats for collecting ant species.

Good ant hunting also can begin at home! We hope that you don't have too many ants in your house, but your garden and the grounds around your house are ideal places to find them. Even a tiny yard with a concrete slab probably has at least two or three species. If you have trees, shrubbery, flowers, or vegetables planted, it won't be hard to find six or more species. Despite a long history of myrmecological work in New England, many areas have never been sampled (see Chapter 6). It would not be surprising to find a new regional, state, or county record from your garden samples, and there is even the possibility of finding a new species, one previously undescribed by science. Increasing our understanding of backyard biodiversity is also an important tool for detecting ecological changes associated with long-term climatic change, and for teaching ourselves and our children to appreciate and understand the world around them.

<<txb>>Finding Ants

One way to find ants is to actively look for them. Ants nest and forage for food in vegetation, leaf litter and soil, on tree trunks and leaves, inside grass stems, acorns, hollow twigs, downed branches, and rotting logs, and under stones and man-made objects such as flower pots, garbage cans, and old tires resting on the soil surface. Search these microhabitats actively for ants, and you will find them. If you carry a 10× or 15× hand lens with you, you can see many features that will help you to identify ants to genus in the field (see Chapters 2 and 4).

The activity of ants leaves characteristic signs that you can learn to recognize. Anthills (Figure 3.1) and ant mounds (Figure 3.2), which are the result of ants bringing buried mineral soil and nest debris up to the surface, look like volcanic cinder cones of soil or fine sand. These can range from the very small anthills (< 5 cm diameter) of *Lasius neoniger* or *Pheidole pilifera* to the large mounds (> 1 m diameter) of *Formica exsectoides*.

<<Figure 3.1 near here>>

<< Figure 3.2 near here >>

Many ant colonies use the same trails every day to forage for food or raid other nests. Millions of steps by millions of tiny ant-feet, and active clearing and stomping, compact the soil on these trails, which can be clearly visible where they cross otherwise untrammelled ground. Piles of sawdust at the base of a tree suggest carpenter ants (*Camponotus* species) working away inside of it (Figure 3.3), and small drill holes in acorns (Figure 3.4) are the doorway for workers of tiny colonies of *Temnothorax* species.

<< Figure 3.3 near here >>

<< Figure 3.4 near here >>

Instead of actively searching for ants, you could find a comfortable place and sit still for a while. Look around. Clear the twigs and leaf litter from a small patch on the forest floor, and watch it patiently. You will soon be rewarded with a view of one or more ant workers traversing the open space you have created. If you toss a handful of leaf litter into a white pan, you will usually see ants crawl out in all directions as they try to escape. Other insects are in the litter too, and some may superficially look like ants (see the discussion of mimics in Chapter 2). Do not be deceived. Once you start to appreciate the details, ants look and move differently from most other insects. Between the scape and the funiculus, an ant's antenna has a distinctive flexible "elbow," which is visible from a distance; the scape is also very long relative to any of the

segments of the funiculus. Contrast this with antennae of closely related wasps, which have no bend and have segments more or less equal in size. Ants also walk like ... ants! They have a distinctive scurrying, side-to-side, zigzag gait that is unlike other insects (note that the primitive poneroid ants slither more than they scurry). The more you watch them, the more you will get a feel for the ant gestalt.

Still another strategy for finding ants is to attract foragers to food baits. On a small piece of stiff white paper or cardboard, put a small spoonful of tuna fish, or a pile of crumbled cookies (myrmecologists traditionally use Pecan Sandies[®], which include a generous mixture of fats and sugars, keep well in warm weather, attract ants, and stave off your hunger if you miss lunch). Once a single forager finds the bait, she will recruit additional workers from the nearby nest. If you are lucky, you may even get to observe combat between different species that compete for these patches of food. However, such encounters are relatively infrequent in the cool forests of New England, where the densities of ants (and most other insects) are much lower than they are in the warmer forests further south.

Because the ants from a single colony work in a coordinated fashion to bring food back to their nest, you may be able to find ant nests by following the trail of foragers returning with pieces of bait. Just as different ant species have different shapes, sizes, and morphology, they also have specialized behaviors and distinctive nests. With an inexpensive digital video camera, you can film nest entrances and worker behavior for many different species. Creating a catalog of these films would make an excellent student or class project, and the results would help myrmecologists to better identify species in the field from living material.

A special opportunity for observing ants is to build an ant farm. Take a large glass jar, an old aquarium, or a plastic tub, add soil, a cotton ball soaked in water (to provide moisture), and

then carefully shovel up an entire ant colony (including the queen) and place it gently into the container. Cover the container with a fine mesh (bridal veil or toile fabric works very well) so they get plenty of air but can't escape. If you are careful about feeding and watering this ant farm, you should be able to keep a colony going for many weeks while you observe tunnel construction, feeding behavior, and brood care in great detail. There are many websites and YouTube videos (see Internet Resources) available for details on how to set up your own ant farm.

<<txa>>Collecting ants

Accurately identifying ants requires that you collect and sacrifice individuals. The information you get from specimens that have been collected and properly curated can be of real value to the broader scientific community. Ant collections provide documentation of when and where an individual species was foraging or nesting. These data form the basis of species distribution maps like those in Chapter 5, and are used by scientists to understand how ants may respond to ongoing environmental and climatic change. So collecting ants, or any other insects, is a serious undertaking with broad scientific and societal importance.

<<txb>>The Tools of the Trade

<<Figure 3.5 near here>>

Before you begin collecting ants, you will need a few basic supplies (Figure 3.5). For species identification, ants need to be killed and preserved in 95% ethanol (ethyl alcohol).

Because ethanol is the main ingredient in alcoholic beverages, and is added to gasoline to reduce air pollution, it is tightly regulated, heavily taxed, and sold only by licensed chemical companies. It is also highly flammable, and must be stored in fire-safe containers. If you can't team up with a researcher at a nearby technical school, college, or university who can provide you with a small quantity of ethanol, you can use Everclear grain alcohol (190 proof), which can be purchased at your local purveyor of fine spirits or via the Internet. In a pinch, you can use vodka, gin, tequila, or the rubbing alcohol (isopropyl alcohol) in your medicine cabinet, but specimens killed in any of these alcohols will degrade rapidly and should be promptly transferred to 95% ethanol, or better, dried and pinned (see below). **Do not** use the denatured alcohol that you can buy behind the counter from some pharmacies or medical supply stores. Denatured alcohol contains methanol (methyl alcohol), which is very poisonous.

In addition to your supply of ethanol, sampling vials are indispensable for storing ant specimens. We prefer 2-mL plastic vials with screw-top lids and rubber O-rings that minimize evaporation, but any small leak-proof vial will do. Add about 0.5 ml of ethanol to each of a dozen or more sampling vials so that you don't have to carry a container of ethanol while you collect. Stuff your pockets or your day-pack with these vials so that you have them when you need them.

White paper and a pencil or alcohol-resistant pen (such as a very fine-line [#005] Pigma Micron pen, available for a few dollars at any art-supply store) are used to make simple, but temporary, labels for your vials while you are in the field. We find it easiest to pre-cut the paper into small, vial-sized strips before we go into the field so we don't have to fumble for a scissors every time we collect an ant. A couple of hundred of these precut labels stored in a small sandwich bag will last a long time. You may also want to carry a 5×, 10×, 15× hand lens for

looking at specimens in the field, a small hand trowel for turning over stones and logs, baits and cards to put them on, and a white plastic or metal pan along with a plastic or metal mesh screen (2 mm diameter) for sifting samples of leaf litter (Figure 3.6).

<<Figure 3.6 near here>>

Finally, a portable global positioning system (GPS) unit for recording your exact location, a small digital camera for site photographs (GPS apps and digital cameras are available in many so-called smartphones), and a field notebook to record observations and label information are the remaining tools of the trade.

<<txb>>Catching Ants

Some myrmecologists collect ants with an aspirator, or “pooter,” which consists of rubber, plastic, or metal tubing, a large plastic collecting chamber, and a two-holed rubber stopper (Figure 3.7). This Rube-Goldberg apparatus allows you to suck up ants into the collecting chamber; a tiny screen prevents the ant and debris from entering your mouth. Some pooters deposit the ants directly into an alcohol-filled vial (Figure 3.7). If you use one of these, keep them vertical, lest you find yourself swallowing the alcohol or inhaling the fumes!

<<Figure 3.7 near here>>

However, pooters are yet another thing to carry and they are not easy to use on damp forest floors or soil surfaces. Furthermore, if you are collecting large Formicinae species (especially in

the genera *Camponotus* and *Formica*), you may end up inhaling formic acid, which some species spray as a defense against predators and zealous myrmecologists. Inhaling formic acid in small doses won't hurt, but it isn't pleasant! You can incorporate a fuel filter into your pooter to reduce the amount of formic acid entering your lungs.

We find it much easier to collect ants directly by hand, snatching the workers up between thumb and index finger. Many workers move very quickly and are marvelously adept at avoiding predators, so hand-collecting requires patience and hunting skill (or video-game experience). Wetting your fingers with a drop of saliva may increase your capture success, although it can be a little messy. Alternatively, you can wet the tip of your index finger with a drop of ethanol (from one of your sampling vials) and touch a running worker with your finger tip. This should get the worker a little tipsy and slow it down enough so you can grab it. Finally, you can toss an ant, along with leaf litter into a white plastic tray. When the ant moves out of the litter, gently pick it up and leave the debris behind.

Once you have the specimen in your fingers, hold it securely but gently, so that you don't damage it with too much pressure. Using your free hand (or your teeth), open up one of your sample vials and transfer the ant to the vial. You may have to seal your index finger over the opening and shake up some of the ethanol to catch the ant, which will expire in the ethanol after 5 or 10 seconds. You should immediately add a unique numbered label to your sample jar, and record field notes on the microhabitat, soil, and/or vegetation in your notebook. Use your GPS unit to determine the latitude, longitude, and elevation of the sample, and record those data too.

Hand-collecting is not the only way to catch ants. Myrmecologists often use arrays of bait stations, pitfall traps, or specialized devices for extracting ants and other small arthropods from leaf litter. Pitfall traps usually consist of plastic cups buried flush with the soil surface and filled

with a few milliliters of soapy water, propylene glycol (anti-freeze), or ethanol. Litter sifters are mesh bags or screens used to separate coarse twigs and whole leaves from the fine material in which ants can hide. The sifted litter can be put into Berlese funnels or Winkler sacks (Figure 3.8). As the litter dries from the top down, the ants burrow deeper into the remaining moist litter, eventually falling into the killing jar at the bottom.

<<Figure 3.8 near here>

However, these methods all are more expensive and labor-intensive than hand-collecting, and all have much greater, often unwanted, environmental impacts. Hand-collecting can provide useful quantitative data if you search a fixed area (such as a square or grid of known dimensions) for a standardized amount of time. However, even without such standardized sampling, the ants you collect by hand-collecting still can have a valuable scientific function – if you properly label and store them!

If you come across an entire nest, it is useful to collect at least 3 to 6 workers, because it can sometimes be hard to make a correct identification from a single specimen. You may want to collect the queen of the colony if she is present, but stop and think about it first. Queens are recognizable in the field because they are usually larger than the worker, have distended gasters (because they are constantly laying eggs), and large thoracic segments (especially the mesonotum and metanotum) to support the wing muscles (see Chapter 4 and the inside back cover for further discussion of these body parts). However, if you collect the queen you likely will kill the entire colony, because the workers quickly die off without the queen present. In contrast, collecting only individual workers is more like collecting leaves from a single tree. But

there is no getting around the fact that, in order to identify ants to species, you have to catch and kill some of the workers. For some species, such as the ants in *Formica microgyna* group or workerless social parasites such as *Leptothorax wilsoni*, it may be necessary to collect the queen and even some males to make an accurate identification.

If you are actively collecting by turning over stones, digging in the soil, or opening rotting logs, be sure to put the stones back, fill in the holes, and restore the microhabitat after you have searched, so as not to ruin the entire remaining nest! These structures are part of the ant's habitat, and you should be very careful to minimize your ecological footprint wherever you are collecting. Because the number of ants and ant colonies is vast, there is probably little ecological damage caused by the loss of individual workers or even a few colonies (unless you have destroyed the microhabitat). At the same time, many ant species are locally rare, and others are even listed as Vulnerable to Extinction in state, national, or international lists of threatened and endangered species (see Chapter 5). Colonies and queens of vulnerable or endangered species probably should not be collected. But regardless of whether you are collecting common ants or rare ones, it is important to keep in mind the ethical issues involved in collecting and killing living organisms.

<<txa>>Building an Ant Collection

Once you have gotten your specimens home, you will not want to store them very long in the vials of ethanol. The ethanol is flammable, the vials take up space, and the ethanol continually evaporates and has to be replenished. In addition, colors fade and the specimens become brittle after being in ethanol for a long time. Finally, ants specimens can be identified

accurately only when they are dry; it is impossible to see the various hairs and fine sculpturing on the body of a wet specimen.

<<txb>> Pinning and labeling specimens

For accurate identification and permanent storage, you need to dry out the specimens and pin them (Figure 3.9). Pinning ants (or other insects) means carefully gluing the underside of the ant's mesosoma to a triangular point punched out of stiff paper (heavy-duty, acid-free cardstock available from office supply stores works fine). The point is then stuck through with an insect pin (size #1 or larger), which can then be stored and displayed in an insect box (a cardboard or wooden box lined with Styrofoam for inserting the pins). Pins, punches, and storage boxes can be purchased from entomological supply companies (see Internet Resources).

In addition to the pinned specimen, the insect pin should also include labels. Traditionally, each pin gets three labels: The top label includes the locality where the ant was collected (country, state, county, town, latitude, longitude, and elevation), and the date of collection. The middle label includes information on the habitat. The bottom label includes the scientific name of the ant (genus and species), the name of the person who determined the identity of the specimen, and the date it was identified.

<<Figure 3.9 near here>>

Pinning is an art, and perfection can be achieved only with patience. Different myrmecologists use different tools and techniques. The debates over whether to use hide glue or white glue, or whether to apply glue to the point with a pin or dip the point into the glue can

reach nearly the same intensity as debates over the whether the Boston Red Sox or New York Yankees are the better team. Many excellent websites and YouTube videos illustrate insect-pinning techniques (see Internet Resources).

<<txa>>Illustrating Ants

There is probably no better way to get up close and personal with an ant than to take the time to draw it. The muscle-memory involved in drawing an ant helps you remember its key features. Familiarity breeds fascination, too – you really begin to appreciate the intricacies and beauty of ant anatomy when you have to look closely enough, and long enough, to render it on paper. Drawings also add important information to your field notes. Sketching the location and form of an ant nest, for example, helps you recall its particular features and thus potentially recognize it when you encounter another nest.

For drawing in the field, a mechanical pencil is handy (break a lead? no problem – there's more inside!). Given the unpredictability of New England weather, uncoated (i.e., non-plastic) waterproof paper is also useful, and several suppliers offer a variety of lined and unlined waterproof paper notebooks. Alternatively, a thin marker like a fine sharpie or Pigma Micron pen can be used with just about any paper as long it's not wet, and gives a lovely, nuanced line.

It's fun to sit and watch all the activity around an ant nest while sketching the nest and its surroundings. The ants themselves may scurry around and you may be convinced that it's impossible to draw them when they're in their feeding frenzies. But in reality, this is no harder than drawing any other mobile animal. Watch for a while. The quieter you are, the more fearless the ants become, and any initial agitation they exhibited when you first arrived will quickly subside.

Make a few very quick and simple sketches of a worker during one of her brief coffee-breaks. Sketch in her gaster to start, because it is usually the largest part of the ant and the easiest to see. Once that's down on paper, the sizes of the other parts – her head, the mesosoma, and the petiole (if you can see it) – relative to the gaster start to make sense. The head is usually almost the same size of the mesosoma, which is usually about 2/3 to 3/4 the size of the gaster. The legs are surprisingly long, which explains why ants can move so fast and blithely through the landscape. And the antennae on some species can be longer still, reaching out well in front of the head. Draw what you see and trust your eyes; don't worry about making your drawing look like an ant. If you pay attention to proportions, the drawing will make itself (Figure 3.10).

<<Figure 3.10 near here>>

Once you become adept at catching an ant in your fingers, you can bring her up close and note details and accurate lengths by observing her through your hand lens. Take your time; she may squirm a bit but will be unharmed by your close inspection (plus, you'll get a really good look at her biting mandibles!). Note the length of the antennal scape relative to the length of her head. Is the gaster a different color (or colors) from the head or the mesosoma? Is she hairy or shiny? What color are the hairs and where do they occur? Is there texturing in the form of bumps, dimples, or fine striations on her body or face? Make some notes about her features. You'll be surprised how much you remember when you go to add these details to your drawing, even after you've let her go. (Note: you may occasionally snatch up a winged ant among the crowds that looks truly weird in comparison to the workers you have just sketched. Chances are this is a

male, and these bizarre creatures can challenge the skills and aesthetic sensibility of even the most experienced artist! But these rare finds are special and fun to draw.)

Once home, if you have the luxury to view an ant under a dissecting microscope, you can draw her at leisure and really begin to appreciate her form. It takes practice to draw your specimen when you have to look back and forth between the microscope and the paper. And you need to take care that the lighting does not distort her features or color. With fancy, microscope-mounted cameras, which we describe in the next section, you can take a series of photos from which you can draw your ant. Some cameras connect to a computer so you can see the image projected on a large screen and sketch from that.

Pen-and-ink is a precise way of rendering the outline and details of the ant's anatomy without worrying about color and shading. While making a simple pen-and-ink drawing, you will begin to notice characteristics such as facial features (eye size, hairs on the scape, number of teeth on mandibles, etc.) that are useful identifiers in the keys for this book. Progress to a pencil, and you can show shading and three-dimensionality, giving real life to your ant. Medium-soft leads from 3B to 6B give a sensitive, rich darkness that can then be smoothed using a hard brush or a "stomp," shaped like a pencil, of compressed paper. With a pencil you can also show texturing on various segments of the body. For a very smooth look, you can use graphite scrapings from a soft pencil, applying them with a fine brush and building up layers of this carbon dust to achieve deep tones. It is challenging to depict hairs, which often show up as white or metallic against the dull background of the gaster. Consider using opaque white paint with a fine brush to draw these in once the body is complete. Some artists use scratchboard, a board coated with (usually) dark, etchable ink into which lines are carved with an X-Acto[®] knife or

other fine blade. In this technique, white hairs and other highlights are gradually stippled or cross-hatched in while the naturally dark areas of the ant are left untouched on the board.

For fully illustrating an ant, though, color is essential. Watercolor pencils are easy to control and blend to give a smooth, three-dimensional look. Keep your leads sharp, and you can even draw the ant nearly to life-size (*i.e.*, tiny) while showing diagnostic details, such as the drawings in the matrix keys in this book. Or use a lightly wetted brush on watercolor paper to create a painterly feel.

Illustrations can be very useful for expressing and emphasizing these key features in a way that photographs of a squirming or pinned ant cannot, and for conveying the real beauty of these amazing creatures. You don't have to be an artist to make informative, lovely drawings – all that's needed is practice and patience. Who knows? Start with ants and launch a whole new vocation!

<<txa>>Photographing Ants

There are many excellent amateur photographers who are interested in capturing images of ants and other insects. Searching for ants outdoors, discovering their biology and behavior, and photographing them can be a very enjoyable experience. Many websites (see Internet Resources) bring together communities of myrmecologists and entomologists who can help identify the ants based upon photographs posted to the site.

To take photographs that provide enough resolution so that the species can be identified from the photo alone, you will need a digital camera. To start, you can use cell-phone cameras or digital point-and-shoot cameras, which if used carefully, can yield photographs with sufficient magnification to identify the ant genus, and in many cases, the species. Cell-phone cameras

aimed through hand lenses or that have clip-on macro attachments can capture nice photographs of ants that are at least 3-mm long (such as our common *Camponotus*, *Formica*, or *Myrmica* species). If you use a point-and-shoot camera, the key feature to pay attention to is the minimum focusing distance. In general, this should be three centimeters or less, and if you focus through a high quality magnifying lens, you can get reasonably good photographs of even smaller species.

To take photographs with great image quality, though, you will need to move up to a single-lens reflex (SLR) camera, a macro lens, and a high-speed flash to capture fast-moving individual ants. Wonderful ant images obtained with strobe flashes and a macro lens attached to a digital camera can be the start of an expensive, even addictive, hobby. All the photographs in this field guide were taken with either Canon or Nikon digital SLR cameras, macro lenses that provide images from one to five times life-size, and one or more strobe flashes.

Image quality depends critically upon lighting. Using a flash on shiny ants normally requires a diffuser (a white, translucent piece of plastic) placed over the flash to even out and soften the lighting. The background is also very important; photographing ants on dark soil does not produce as clear an image as an ant resting on clean sand, leaves, or other uniformly light-colored surfaces. To improve your chances of taking good photographs, work early in the morning when the day is still cool and ants are moving slowly. Cloudy days are better than full-sun days. Try to place yourself between the ant and the sun to reduce glare, but avoid casting shadows that can spook the ants. Compare your photographs with similar ones available on the web that others have taken with similar equipment. Most nature photographers will happily share their experiences and expertise, and give you tips to improve your photography.

You will have to remain prone on the ground to capture images of many New England ants. This means rugged field clothes, insect repellent and a brace for your camera. Remember to

tuck long pant legs into socks to keep ants (and ticks!) out. A piece of wood with a camera mount attachment often is all that is needed to protect the camera from dirt and debris.

Do not rely on the automatic settings that are the default for digital cameras. Rather, set all controls to manual, maximize the depth-of-field (use the highest *f*-stop possible) and set the macro lens so that all you have to do to focus is wait until the ant itself comes into view. Then you can point and shoot. Finally, always remember to collect a specimen from the colony you just photographed and keep good field notes: record the locality and other information associated with each photo. If you want to keep your hands on the camera, use a voice-activated digital recorder to take your notes.

Pinned specimens also can be photographed through a microscope, and museum curators often take multiple images of them. Using computer software, these images can be combined into composite images that are in perfect focus and have a 3-D look. Such specialized photomicroscopic imaging systems are very expensive and usually not available to the general public. However, you may be able to volunteer your time and services at a university or museum that has an imaging system in exchange for the opportunity to process your own photographs.

<<CN>>Chapter 4

<<CT>>Identifying Ants

You've found your ant, photographed it, caught it, brought it home, pinned it, and drawn it. Now you want to know what it is. To identify an ant (or any other organism), you key it out. This field guide, and its different keys, are your tools for identification. We present traditional dichotomous keys with illustrations, pictorial matrix keys, verbal summaries of genera and species groups, and detailed species descriptions, each on its own page. This combination provides a suite of identification tools unavailable for ants (or most any other animal) in any other region.

The family of ants (Formicidae) is divided successively into subfamilies and tribes, genera (the plural of genus), occasionally subgenera, and finally individual species, which can be organized into species groups or complexes (Box 4.1).

Box 4.1 Organizing the ants

Taxonomists are scientists who describe and name organisms. Ant taxonomists organize the species within the ant family (Formicidae) in a hierarchy of groups, which is a finer-grained version of the classification of animals presented earlier in this book (see Box 2.1):

Family: Formicidae – the ants

Subfamily: Groups within a family that include a number of tribes or genera. Subfamily divisions are indicated by the suffix **–inae**, and there are six subfamilies of ants in New England: Amblyoponinae, Ponerinae, Proceratiinae, Dolichoderinae, Formicinae, and Myrmicinae.

Tribe: Subfamilies that have many genera are sometimes organized into tribes. Tribal divisions are indicated by the suffix **–ini**. For example, the tribe Camponotini of the subfamily Formicinae includes the genus *Camponotus*.

Genus: The primary taxonomic category that includes related species. It is always a capitalized Latin or Greek name, written in italics. We have recorded 31 genera of ants in New England.

Species: A group of organisms that can successfully reproduce with other members of the same species. The species is the most important taxonomic category, and is always written as a Latinate “binomial:” two italicized words, the first of which is the name of the genus, and the second of which names the species. For example, *Camponotus pennsylvanicus* is the official scientific name of the Eastern Carpenter Ant.

Based on recent evolutionary history or apparent similarity, closely related species can be organized into species groups, and species groups further subdivided into species complexes. Examples of such organization in the New England ant fauna can be found in the genera *Aphaenogaster* and *Formica*.

The differences in the many visible bits and pieces of the ant body, what scientists call morphology (from the Greek *morpho*, meaning form + *lógos*, meaning study or research), are used to distinguish among the different subfamilies, genera, and species. We describe here the body parts that you will need to use to identify ants in New England; all of these parts are illustrated on the inside cover at the back of the book, and the terms are used throughout the keys. However, other morphological characters may be used for identifying ants in other parts of the world.

It is also important to be aware that individual ant specimens will differ in their overall size and color. Their size can depend on when the ant was born (for example, the founding brood of natic workers will be much smaller than the average sizes given in the text), which caste the ant is (minor worker, major worker, queen, or male), or when she last ate (the size of the gaster will depend on the most recent meal). The body color may darken as an individual worker ages and often fades or changes completely in preserved specimens (see Chapter 3 for more information on maintaining an ant collection). Although color and size differences can sometimes help you to separate some species from one another, they can fool or mislead you; morphological characters are much more useful and reliable, and you should invest the time it takes to learn the names of the body parts that are used to identify ants.

Don't be intimidated by what seems to be a long list of named parts. By looking at the illustrations, working through the keys, and looking up the terms as you go along, you'll learn them in no time!

<<txb>>Characters of the head

The **compound eyes** of the worker ant are one of its most distinguishing features. They can be large or small, and consist of several to many lenses or facets, called **ommatidia**, that are used to collect light; the overall size of the eye and the number of ommatidia are important diagnostic characters in several genera. Many species also have three “simple” eyes, called **ocelli**, that look like small, raised dots near the top of the head; each **ocellus** has only one lens. Between the compound eye and the base of the mandible is the **cheek** (sometimes referred to as the gena), which may or may not have **erect hairs** of varying length and density. Erect hairs stick up and out from the head (or other parts of the body). In contrast, **appressed hairs** lie flat.

The segmented (technically, jointed) **antennae** originate from the head. The **condyle** is the rounded “ball-joint” at the base of the antenna (see also Figure 5.1 on page XXX); it sits in a rounded depression, called the **antennal fossa** (plural: fossae) located on either side of the **front** of the head. In some species, the fossae are covered by the **frontal lobes**, whereas in other species (especially in the genus *Myrmica*), the fossae are exposed. The condyle is at the basal end of the *elongated* first segment of the antenna, which is called the **scape**. In some species, the scape nestles into a groove, or **scrobe**, that runs upward (technically, rearward) along the head. A raised edge of chitin (a **carina**) forms the rim of the scrobe. In workers and queens, the scape is much longer than the successive antennal segments (or **antennomeres**). Collectively, these smaller segments are called the **funiculus**, and they join the scape at a pronounced angle, which gives the antennae their characteristic elbowed look. The last 2 – 4 segments of the funiculus may be swollen to form a distinctive **club**. The presence or absence of a scrobe, the total number of antennal segments (counting the scape *plus* all the segments of the funiculus; most worker or queen ants have 11 or 12 antennal segments, but some have as few as six, and males often have 13), the presence or absence of a club, and the number of segments in the club, all are characters

that distinguish many ant genera. In the genus *Myrmica*, the base of the scape often is adorned with a protruding ridge, flange, or scoop (a small **lamina** or a larger **lamella**), and the shape and appearance of these lamellae are key characters used to distinguish among species.

The overall shape of the head is also important. Technically speaking, the ant's head is prognathous – the jaw (*gnathos* in Greek) protrudes forward (Greek: *pro*) from the plane of the head – so what looks like the top of the head is considered by myrmecologists to be *behind* (posterior to) the rest of the head. As indicated in the illustration, the location of each part (top is posterior, lower edge is anterior, front is dorsal, underneath is ventral) is determined by this prognathous orientation.

Start by looking at the head in full-face view: look at the front (that is dorsal view) of the head so that you can draw an imaginary plane in which the *y*-axis (up-and-down) runs from the top (posterior) edge of the head to the bottom of the **clypeus** (or “upper lip”) of the ant, and in which the *x*-axis (left-and-right) runs across the widest part of the head. Note whether the top (posterior) margin of the head in this full-face view is convex, straight, or concave, and what kind of sculpturing may be present. From the top of the head, move down (anteriorly) to the **front**. The width of the front – from scape base to scape base – is used to distinguish some species. The front of the head ends in the aforementioned frontal lobes.

Just below the frontal lobes is the **clypeus**. The shape of the clypeus is important: Does the center of the clypeus bulge out or is it flattened? Is the lower edge, or **anterior clypeal margin**, convex, straight, or concave, or does it have teeth, a shallow concavity in the middle, or a deep, central notch? Do the left and right ends, or **clypeal wings**, extend smoothly to the edge of the face, are they pinched in, or are they raised into a sharp ridge that forms, or connects to, the antennal fossae (like a waxed handlebar moustache)? Beneath the clypeus are the powerful

jaws, or **mandibles**, which usually have conspicuous teeth (the number of teeth, which ranges from zero to eight or more, often distinguishes species or genera). The first, **basal** tooth – the one at the top of the mandible just below the clypeus – may be offset from the line of all the others. Beneath the head are the delicate, segmented **maxillary palps** and labial palps, which the ant uses to further sense the environment. The number of segments of the maxillary palps, along with their relative size, are important characters for distinguishing among species in the genus *Lasius*.

<<txb>>Characters of the mesosoma, the petiole, and the gaster

In ants, the segments of the thorax and the abdomen have been dramatically modified by evolution (see Chapter 2). You can see some of these modifications by looking at the numbered abdominal segments on the drawings on the inside back cover.

In adult ants, the first segment (I) of the abdomen (called the **propodeum**) is fused with the last segment of the thorax (the **metanotum**); this combination of the thorax + propodeum is called the **mesosoma**. The overall shape of the mesosoma, viewed in profile view (from the side) or in dorsal view (from above) is often an important character used to distinguish among genera or species. For example, *Formica* and *Camponotus* are two of the most species-rich genera in New England. They are both in the subfamily Formicinae, but the profile of the mesosoma of *Camponotus* workers is always smooth and evenly-curved (hump-shaped), whereas the profile of *Formica* workers is always lumpy, angular, or “stair-stepped.”

The thorax itself consists of the first three segments of the mesosoma – the **pronotum**, **mesonotum**, and **metanotum**. Sometimes, we refer to the pronotum and the mesonotum together as the **promesonotum**. In queens and males, as in most other Hymenoptera and most

other insects, the mesonotum and metanotum are large and accommodate the wing muscles. These large segments give the thorax a boxy appearance. In contrast, the mesonotum and metanotum in the wingless worker ants are atrophied and comparatively small. Each of these segments supports one pair of legs. Each ant leg has a **coxa**, **trochanter**, **femur**, **tibia**, and a set of **tarsi**, ending in a pair of tiny **tarsal claws**. In some species, we note whether or not the tibia has erect hairs, and whether the one or two **tibial spurs**, which protrude from the base of the tibia, have teeth or not.

The last segment of the mesosoma, the **propodeum**, corresponds to the first segment of the abdomen. Just beneath the propodeum is the **metapleural gland**, which secretes antibiotics that keep the ant exoskeleton infection-free. The propodeum of many species also has one or two pairs of spines that project upwards or towards the rear of the ant.

The second segment (II) of the abdomen (and in some groups the third segment (III) of the abdomen as well), is constricted into a distinctive wasp-waist, or **pedicel**. If the pedicel has only one segment, it is called the **petiole**. If it has two segments, they are distinguished as the (anterior) **petiole** and the (posterior) **post-petiole**. In New England, only ants in the subfamily Myrmicinae have both a petiole and a post-petiole; our other five subfamilies have only a petiole. In some genera of Myrmicinae, notably *Aphaenogaster*, *Stenamma*, and *Temnothorax*, the anterior (front) end of the petiole is substantially thinner than the rest of the petiole and extends forward, and this thin, extended part of the petiole is called the **peduncle**.

The remaining segments of the abdomen together make up the **gaster**. Each of these sections has characteristic sculpturing, texture, and hairiness. The upper (dorsal) surface of each segment of the gaster is called a **tergite**, and the lower (ventral) surface of each segment of the gaster is called a **sternite**.

There are only a few useful diagnostic characters of the gaster. In the three subfamilies Amblyoponinae, Ponerinae, and Proceratiinae (together part of larger group called “poneroids”), there is a pronounced constriction between the first and second segments of the gaster. This constriction, along with their long, tapering gasters, makes poneroid ants appear very wasp-like. The genus *Crematogaster* has a distinctive heart-shaped gaster, and its post-petiole attaches nearer to the top (dorsal) surface of the gaster than in all other genera of ants, in which the petiole or post-petiole clearly attaches to the front (anterior) surface of the gaster. The color and arrangement of hairs on the dorsal surface of the gaster also can be diagnostic for many species. Look carefully at the end of the gaster. Ants in the Myrmicinae and in the three subfamilies of poneroids have a stinger; Formicinae have a tiny, but distinctive **acidopore** (a nozzle often fringed with hairs) at the tip of the gaster; and Dolichoderinae have a simple horizontal slit at their tail end. Males have a pair of flattened appendages (**parameres**) at the end of their abdomen, but workers and queens never have these.

It will often be important to measure different parts of the ant. Measurements that we use throughout this book and that are used frequently by myrmecologists include:

Hair length: the length of an **erect hair**, usually on the head, pronotum, gaster, or tibia.

Head length: from the top (posterior) of the head to the lower (anterior) edge (margin) of the clypeus, when seen in full-face view.

Head width: the greatest width of the head, when seen in full-face view. This measurement should extend to the outer edges of the compound eyes if they protrude from the side of the head.

Mandible length: the length of the mandibles, when closed, when seen in full-face view.

Mesosoma length (also called Weber's length, or Weber's index): the length of the mesosoma, from the front (anterior end) of the pronotum to the rear (posterior end) of the propodeum.

Pedicel length: the length of the petiole, or of the petiole + post-petiole, seen in profile view.

Scape length: the length of a straight line (chord) extending from the base of the scape to where it joins the funiculus.

Total length: the length of an ant, stretched out. On pinned specimens, this would be the length of the mandible + the length of the head + the length of the mesosoma (Weber's length) + the length of the pedicel + the length of the gaster. Because specimens are often curved or contorted, the parts should be measured separately, and then the individual measurements added together to get the total length.

Measurements throughout the book are given in millimeters (mm) for average workers (not nantics), and are best measured on pinned specimens viewed under a dissecting microscope equipped with an ocular micrometer (see below).

<<txa>>The Importance of a Microscope and Light

You may be able to see larger morphological characteristics and identify your specimen to genus using only a 10× or 15× hand lens and the illustrated key on the inside front cover of this field guide. However, you will probably need more magnification to identify which species it is. If the specimen has already been pinned (see Chapter 3), you can stick the pin in a piece of foam or cork, or use a specialized manipulator that can rotate the pin in three dimensions so that you can more easily see all sides of the ant. If the specimen is still in alcohol, remove it from the

vial, and dry it on a paper towel for a few minutes. Then either pin it, or use fine forceps (#4 or #5) to orient it under a dissecting microscope, and light it up with a good light source so that you can see the important morphological characters.

Dissecting microscopes (also called stereo- or binocular microscopes) have eyepieces (oculars) and objective lenses that magnify the specimen. Standard dissecting microscopes have objective lenses that range from 4 – 50× magnification when paired with 10× oculars, and this magnification is enough to identify most ants to species. With higher-powered (and more expensive) oculars (20× or 25×), the magnification would be increased to 8 – 100× (with 20× oculars) or 10 – 125× with 25× oculars. You may need such higher magnification to see, for example, feathery hairs on the gaster of *Lasius plumopilosus* or the teeth on the tibial spurs of *Myrmica* species. Ideally, one of the oculars should have an ocular micrometer in it. Micrometers are lenses etched with a scale so that you can measure specimens accurately (see Chapter 2). The scale of measurement depends on the magnification, so you will need to calibrate your ocular micrometer with a stage micrometer – a measurement scale of known size that you can observe through the microscope. In a pinch, you can put a ruler marked with millimeters under the microscope next to the specimen, but many features are measured in tenths or hundredths of millimeters, so a calibrated ocular micrometer is a better way to go.

Specimens viewed under dissecting microscopes are best illuminated with reflected light from a dedicated light source, such as a simple desk lamp. The under-the-base illuminator provided with many dissecting microscopes is designed to transmit light through a transparent specimen (such as an amoeba in clear water); it will not work for viewing ants. Fiber-optic lights let you point a tube of bright light right where you want it. Ring lights mount underneath the objective and provide more even lighting. Some ring lights attach to your fiber optic light source;

others have light-emitting diodes (LEDs). The different types of lights – desk lamps with incandescent or fluorescent bulbs, fiber optics, and LEDs – have different “temperatures” that correspond to different parts of the visible light spectrum – it’s the same as the white balance setting on your digital camera. Ants look different under the different light sources – if you want to see the ant as it would appear in strong sunlight, use a fiber optic lamp. But the heightened contrast of an LED light source will highlight many subtle morphological characters.

You can also use a digital camera to take pictures of your specimen through the microscope (see Chapter 3). With care, you can take a photograph simply by pointing your camera at the ocular. Some dissecting microscopes let you attach your camera over one of the oculars. Still others come with a third tube (and a third ocular) that let you take pictures while you are looking through the oculars. To get accurate colors in your photographs, be sure to match the camera’s white balance setting to the type of light you are using. It is also best to use the raw or tif setting on the camera, instead of the jpg setting. Although the images are larger, they can be more precisely edited for color and white balance.

Really good dissecting microscopes and light sources can be expensive, but the better the optics and light source, the more you can see. Camera attachments add still more costs. You can hunt for bargains on the web (see Internet Resources) or invest in a new microscope. The investment will pay for itself quickly, and if you care for your microscope, it will last for your entire life.

<<txa>>Using Keys

If you’ve never played Twenty Questions or used dichotomous keys before, you may find their structure initially puzzling and perhaps unduly restrictive. But once you understand how

they work, you will find that they provide a quick and straightforward route to accurate species identification.

Dichotomous means to cut in two (it is derived from the Ancient Greek words *dikha*, meaning apart + *temnō*, meaning I cut [it]), and dichotomous keys literally divide groups into two parts by presenting you with a series of either-or (yes-or-no) choices. As you work your way through the series of questions, you eliminate possible species one by one (or group by group) and hone in on the correct identification. We illustrate how to use a dichotomous key to identify one of our most familiar ants, the Eastern Carpenter Ant, *Camponotus pennsylvanicus*.

A dichotomous key consists of a numbered series of mutually exclusive choices, called couplets. The first couplet of our key to the subfamilies and genera of ants in New England asks whether or not the gaster has a visible constriction between the first and second segments:

1a. Gaster with visible constriction between the first and second segments(Poneroids)	2
1b. Gaster without a visible constriction	4

If the ant has a constriction in its gaster, go to couplet number 2, but if it doesn't, go to couplet number 4. *Camponotus pennsylvanicus* has no constriction, so let's go to couplet number 4.

4a (from 1b). Post-petiole absent (pedicel has only one segment)	5
4b. Post-petiole present (pedicel has two segments)Myrmicinae (16 genera, 61 species)	8

This couplet asks about the number of segments of the pedicel. But before reading this couplet, note the text in parentheses after 4a. This number tells you what couplet in the key led you here: in this example, that was couplet 1, part 1b. If you find yourself lost in a key – neither

fork in the couplet matches the features of your specimen – you can always work your way back by following these numbered signposts. The indentation of the couplets also lines up with where you came from. Note that standard keys for animals do not have indentation, whereas those for plants do. In our experience teaching students who have never used a key before how to identify either animals or plants, we have found that the indentation helps, and so the keys in this book are indented. Back up (and out-dent) one or more steps until you come to a couplet about which you are confident. Then move forward again. If you are unsure which fork to take, try tracing down each of the two paths and see where they lead. Alternatively, if you have a good guess as to the species based on the matrix key or the species pages (see below), try working backwards through the couplets from the endpoint and see if the descriptions match.

We're not lost yet; because the pedicel of *Camponotus* clearly has only a single segment, move to couplet 5.

5a (4a). Acidopore (a small nozzle, often fringed with hair, at the end of the gaster)	
present	Formicinae (8 genera, 62 species) 23
5b. Acidopore absent	Dolichoderinae (2 genera, 7 species) 30

Couplet 5 comes from couplet 4, part 4a. This is a terminal couplet – both part 5a and part 5b end with a definitive identification – either the subfamily Formicinae or the subfamily Dolichoderinae. *Camponotus*, with its prominent acidopore at the end of its gaster, is in the subfamily Formicinae. So now we are directed to jump to couplet 23, which will move us through the eight New England genera in this subfamily.

23a (from 5a: Formicinae) Antennae 9-segmented ; a very small, yellow ant (~1.5 mm long).....	
..... <i>Brachymyrmex</i> (1 species – <i>B. depilis</i>), p. XXX	
23b. Antennae 12-segmented , total body length variable	24
24a (23b). Mesosoma smooth, with a convex profile ; antennal insertions set well back from the top (posterior border) of the clypeus; acidopore without fringing hairs	
..... <i>Camponotus</i> (9 species), p. XXX	
24b. Mesosoma profile not smoothly convex – when viewed from the side, the propodeum is lower than (stepped down from) the level of the promesonotum ;	
antennal insertions are at, or adjacent to, the posterior margin of the clypeus; acidopore with fringing hairs	25

Couplet 23 asks about the number of segments on each antenna. Remember to count the scape! Most Formicinae, including *Camponotus*, have 12-segmented antennae. Couplet 23 also mentions color, but not in bold-face. This is a convention we use throughout the keys – the most important, distinctive character(s) is (are) in **bold-face**. These characters are more distinctive, or less variable, than those described in normal type. It's not that you won't ever find a yellow (or yellow-ish) *Camponotus*, but you will never find a *Camponotus* with a 9-segmented antenna. So move to couplet 24.

Couplet 24 asks about the shape of the mesosoma, viewed in profile. Is it smooth or bumpy? *Camponotus* has a smooth mesosoma (as well as antennae that insert posteriorly on the head and an acidopore without fringing hairs), and part 24a directs you to this genus, on page XXX. There you will find a description and key to the genus, where you will traverse another dichotomous key; this one will lead you to the name of the species. If you have used the key

correctly (and if the species is one that is included in the key!), you will have arrived at the correct species identification. For *C. pennsylvanicus*, you would follow the path in the species-level key from couplet 1 (1b: no notch or median depression in the center of the clypeus), to couplet 4 (4a: microsculpturing visible on the gaster), to couplet 5 (5b: long, golden hairs on the gaster), and finally to couplet 6 (6a: a large, black ant: *C. pennsylvanicus*).

A dichotomous key can be visualized as a branching structure, with the species all occurring at the terminal branch tips. In a similar fashion, the evolutionary history of a lineage can also be depicted as a branching structure, called a phylogenetic tree (see Chapter 2). In a phylogenetic tree, species also occur at the tips of a branching tree. However, the similarity between a key and a phylogenetic tree ends here. In the phylogenetic tree, the branch points represent events such as genetic differentiation and speciation that split lineages; the ancestor (which may be extinct) of the entire group occurs at the base. A dichotomous key does not necessarily use characters that changed during evolution, and the branch points don't necessarily represent evolutionary divergence. Instead, a dichotomous key relies on the simplest and most obvious traits that lead to the quickest discrimination among different species.

We suggest you first learn how to identify the subfamilies and genera of New England ants using either the illustrated key on the inside front cover of this field guide or the dichotomous key to the subfamilies and genera at the beginning of Chapter 5. After only a little practice, you will probably be able to identify the subfamily correctly without even using the key. Next, use the key to determine which genus you have within the particular subfamily. Some genera have only one species (or only one species in New England), so identifying the genus is the same as identifying the species. Other genera have only few, easily distinguished species, whereas others have many similar-looking species. The most challenging genera are *Myrmica*

(21 New England species) and *Formica* (31 New England species); the keys are complex, with many couplets to work through. In all cases, make sure that you have correctly identified the genus before tackling the species-level keys.

Don't despair if some specimens can't be identified at all. You may need to show them to an expert, and even the experts don't always agree! This is because there may be considerable variation in the appearance of a trait within a species and some of the character distinctions are quite subtle. Set aside difficult specimens and return to them later. As you gain experience and confidence, you may find that some of these unknown specimens become easier to identify. Then you will be able to keep your eyes open for "new" species that may not be described in this key. As the climate of New England continues to change over the ensuing decades, the appearance of new southern species in Yankee woodlands is a distinct possibility (see Chapter 6). If your specimen doesn't match anything in the key, there is even a chance that it is a previously undescribed species, and therefore is new to science!

<<txa>>Matrix Keys

Although the dichotomous key has a long tradition in taxonomy, it is not the only method for identifying species. For the genera (or species groups) with four or more species, we also include a matrix key (Figure 4.1), which illustrates the species in a table. Each row of the table is a different species, and each column highlights contrasting characters, which are briefly described or defined for each species. The advantage of a matrix key is that you can scan all the character variations on a single page, which is more difficult with a dichotomous key.

<<Figure 4.1 near here>>

In all our matrix keys, the different species are drawn to the same scale, so that their sizes can be compared relative to one another. More than one character can be shown in each drawing; for example, the first column of this matrix illustrates both the relative size of the ant and its most common color. Remember, though, that size and color can vary among ants from the same colony, and that colors can fade or change in specimens stored in alcohol or pinned in boxes or drawers.

<<txa>>How to Use the Species Pages

The species pages in Chapter 5 are organized by subfamily – the three New England subfamilies of poneroids are described first, followed by the subfamilies Dolichoderinae, Formicinae, and Myrmicinae. Within each subfamily, the pages are grouped alphabetically by genus and then alphabetically by species within genus. Colored tabs on the edges of the page indicate subfamily; different genera are distinguished by different shades of the subfamily colors.

The species pages follow a standard format (Figure 4.2).

<<Figure 4.2 near here – it will occupy a full page>>

Color tabs on the edge of the page indicate subfamily (base color) and genus (shade). The Latin name of the species is given first, followed by the taxonomic authority – the last name of the taxonomist who described it and the date that he described it (surprisingly, none of the New England ant species has been described by a woman...yet!). If the taxonomic authority is in parentheses, it signifies that the name of the genus of that ant has changed since it was first

described. But the original taxonomist's name is preserved – the only true route to immortality in science! If the species name is in **red, bold-face** type, it is listed by the International Union for the Conservation of Nature (IUCN) as Vulnerable to Extinction on the International Red List of Threatened Species (<http://www.iucnredlist.org>), version 2010.4 (ants were last assessed for the Red List as Threatened or Endangered in 1996). If the species name is in **brown, bold-face**, it is a non-native species that has arrived in North America sometime in the last 100-200 years.

Below the Latin name is a common name. For some species, there is an official common name suggested by the Entomological Society of America (<http://www.entsoc.org>); these are indicated by an asterisk (*) in front of the common name. For other species, we have suggested a common name based on the linguistic origin (etymology) of the scientific name.

For most of the species, photographs illustrate the ant in the field – its habitat, nest, or a close-up showing interesting behaviors. These are described in more detail in the text box that summarizes the ant species' habitat, its geographic range, some natural history facts, and look-alike species. Some of the species are rarely collected or very poorly known, and for these, we have photographs of potential habitats or of museum specimens. If you find one of these species in the field, try to get a nice photograph of it and send it to us for use in subsequent editions of this field guide!

The distribution map indicates the New England counties in which we have confirmed records of the species. The black lines are the boundaries of the five ecoregions (see Chapter 1), the dark grey lines are the state boundaries, the counties are bounded in light grey. Any counties with at least one record of the species is filled in light purple. If a species has not yet been collected in New England, we expand the map to include bordering regions of New York or Canada, and indicate the closest specimen record with a single red dot. As we discuss in more

detail in Chapter 6, we have many more samples of ants from some New England counties than from others. The absence of an ant species from a particular county may simply indicate that not much collecting has occurred in that county. Our database of locality records is available on-line (<http://tinyurl.com/antsNE>). Send us your new specimen records; if we can confirm your species identifications, we will add them to the database, enriching everyone's understanding of ants in New England!

The detailed drawings on each species page illustrate important features to look at in order to identify each species. Drawings highlight the key structures used for identification, and we note these features with lettered arrows. The faces and profiles are shown for all species; when especially useful, insets of other important body parts also are provided. Although drawn from actual New England specimens, the illustrations are nonetheless idealized because they deliberately call attention to the characters that are most useful for identifying the species. Legs and other body-parts that don't have diagnostic characters are omitted from these drawings. For those genera with distinctive major and minor workers that have very different appearances, both majors and minors are illustrated. But remember, the drawings are idealized and represent only one or two specimens; they don't capture the variability seen in nature! So don't take them too literally – always check your identification with the keys and other available resources.

Finally, the scale bar in the upper outside corner of the page is the true size of an average full-grown worker of the species. Two scale bars are shown for species with distinctive major and minor workers.

<<txb>>Share and Enjoy!

Once you have gained some skill in ant species identification, share your knowledge by teaching your friends and your students. Books and field guides are not enough; like music, natural history knowledge stays alive only if it is used and shared.

<<CN>>Chapter 5

<<CT>>Descriptions and Keys to the Subfamilies, Genera, and Species of New England Ants

As of November 2011, we know of 32 genera and 142 species of ants nesting in, or on the borders of, New England. These numbers are based on our own field work collecting and studying ants throughout the region, and from thoroughly scouring and inventorying collections – from the well-curated to the unsorted (before we got to them) – in regional and national museums, university departments and broom closets, and in individuals' desk drawers. Indeed, we have seen every one of these species, mostly in the fields and forests of New England, nearby New York, or southeastern Canada; a few of the vagrant tropical and subtropical tramps have turned up only in historical collections.

It has been no small task even to decide what names to use for some of the genera and species. As new species are found and existing genera are revised based on new data – especially gene sequences and other molecular information – the names of ants change. For example, based on new DNA evidence, the genus *Nylanderia* was separated out from *Paratrechina* while we were writing this book. Expert myrmecologists continue to disagree over the correct name for the genus *Pyramica*: is it *Pyramica*, *Smithistruma*, or *Strumigenys*? And fourteen of the species we illustrate have no official names because they have not yet been formally described! So despite the apparent authority of permanent ink on archival paper, this guide to the ants of New England represents only a snapshot: our understanding of the regional ant fauna in 2011. There is still much work to be done, by both amateur and professional myrmecologists, and everyone can contribute!

The following checklist of the ants of New England summarizes our regional fauna; all of these species are discussed and illustrated on the following pages. Of the 131 species that have been recorded from New England, thirteen species are non-natives; these are indicated in the checklist with a single asterisk (*). Eleven other species (including one non-native species), have not yet been found in New England but have been found in a county of New York that borders New England or in habitats in nearby Québec that also are part of the New England landscape. We strongly suspect that these additional species already occur in New England (see the additional discussion in Chapter 6). These “probable” species are indicated in the checklist with two asterisks (**). And finally, three of the 131 New England species were described based on only one or two individuals (or a single colony) and have never been seen since (indicated by a dagger [[†]]).

We use the names of genera and described species that are given in the most current version of Barry Bolton’s *Synopsis of the Formicidae and Catalogue of the Ants of the World*, which is maintained and updated regularly on the web-site of the Global Ant Project (<http://gap.entclub.org>). Because this field guide is not a peer-reviewed taxonomic journal, we do not give names to undescribed species. Rather, we refer to them as unnamed species or as a species “cf.” (from the Latin imperative *confer*, meaning bring together, or compare with, or “near”) another well-known species that the unnamed species resembles. We refer to the two undescribed species in the genus *Leptothorax* and the five undescribed species in the genus *Myrmica* with the codes that Professor André Francoeur of the University of Québec at Chicoutimi uses to reference them. His monographic revision of these genera and description of these species should appear as a journal publication in the next few years.

<<txa>>Checklist of the Ants of New England (and nearby areas)

Dolichoderinae (7 species)

- ☐ *Dolichoderus mariae*
- ☐ *D. plagiatus*
- ☐ *D. pustulatus*
- ☐ *D. taschenbergi*
- ☐ *Tapinoma melanocephalum**
- ☐ *T. sessile*
- ☐ *T. new species* [an inquiline social parasite
of *T. sessile*]

- ☐ *Formica argentea*
- ☐ *F. aserva*
- ☐ *F. creightoni*
- ☐ *F. dakotensis***
- ☐ *F. difficilis*
- ☐ *F. dirksi*†
- ☐ *F. dolosa*
- ☐ *F. exsectoides*
- ☐ *F. cf. fossiceps* [an undescribed species]
- ☐ *F. glacialis*

Formicinae (66 species)

- ☐ *Brachymyrmex depilis*
- ☐ *Camponotus americanus*
- ☐ *C. caryae*
- ☐ *C. castaneus*
- ☐ *C. chromaiodes*
- ☐ *C. herculeanus*
- ☐ *C. nearcticus*
- ☐ *C. novaeboracensis*
- ☐ *C. pennsylvanicus*
- ☐ *C. subbarbatus***

- ☐ *F. hewitti*
- ☐ *F. impexa*
- ☐ *F. incerta*
- ☐ *F. integra*
- ☐ *F. knighti*
- ☐ *F. lasioides*
- ☐ *F. morsei*†
- ☐ *F. neogagates*
- ☐ *F. neorufibarbis*
- ☐ *F. nepticula*
- ☐ *F. obscuriventris*

- *F. pallidefulva*
 - *F. pergandei*
 - *F. podzolica*
 - *F. querquetulana*
 - *F. reflexa*
 - *F. rubicunda*
 - *F. subaenescens*
 - *F. subintegra*
 - *F. subsericea*
 - *F. ulkei*
 - *Lasius alienus*
 - *L. claviger*
 - *L. flavus*
 - *L. interjectus*
 - *L. latipes*
 - *L. minutus*
 - *L. murphyi***
 - *L. nearcticus*
 - *L. neoniger*
 - *L. cf. niger**[this may be an undescribed species]
 - *L. pallitarsis*
 - *L. plumopilosus***
 - *L. speculiventris*
 - *L. subglaber*
 - *L. subumbratus*
 - *L. umbratus*
 - *L. cf. umbratus* [an undescribed species]
 - *Nylanderia flavipes**
 - *N. parvula*
 - *N. new species* [an inquiline social parasite of *N. parvula*]
 - *Paratrechina longicornis**
 - *Polyergus lucidus*
 - *P. montivagus***
 - *P. cf. longicornis* [an undescribed species]
 - *Prenolepis imparis*
- Myrmicinae (62 species)**
- *Anergates atratulus**
 - *Aphaenogaster fulva*
 - *A. mariae*
 - *A. picea* (a species complex)
 - *A. rudis* (a species complex)
 - *A. tennesseensis*
 - *A. treatae*

- ☐ *Cardiocondyla obscurior**
- ☐ *Crematogaster cerasi*
- ☐ *C. lineolata*
- ☐ *Formicoxenus provancheri*
- ☐ *Harpagoxenus canadensis*
- ☐ *Leptothorax retractus***
- ☐ *L. sphagnicola***
- ☐ *L. wilsoni*
- ☐ *L. sp. AF-can* [an undescribed species]
- ☐ *L. sp. AF-erg* [an undescribed species]
- ☐ *Monomorium emarginatum*
- ☐ *M. floricola**
- ☐ *M. pharaonis**
- ☐ *M. viride*
- ☐ *Myrmecina americana*
- ☐ *M. new species* [an inquiline social parasite of *M. americana*]
- ☐ *Myrmica alaskensis*
- ☐ *M. americana*
- ☐ *M. brevispinosa*
- ☐ *M. detritinodis*
- ☐ *M. fracticornis*
- ☐ *M. incompleta*
- ☐ *M. lampra***
- ☐ *M. latifrons*
- ☐ *M. lobifrons*
- ☐ *M. nearctica*
- ☐ *M. pinetorum*
- ☐ *M. punctiventris*
- ☐ *M. quebecensis***
- ☐ *M. rubra**
- ☐ *M. scabrinodis**
- ☐ *M. semiparasitica*
- ☐ *M. sp. AF-eva* [an undescribed species]
- ☐ *M. sp. AF-ine*[†] [an undescribed species]
- ☐ *M. sp. AF-scu* [an undescribed species]
- ☐ *M. sp. AF-smi* [an undescribed species]
- ☐ *M. sp. AF-sub*** [an undescribed species]
- ☐ *Pheidole flavens**
- ☐ *P. pilifera*
- ☐ *Protomognathus americanus*
- ☐ *Pyramica metazytes*
- ☐ *P. pergandei*
- ☐ *P. pulchella*
- ☐ *Solenopsis molesta*
- ☐ *S. cf. texana* [an undescribed species]

□ *Stenamamma brevicorne*

□ *S. diecki*

□ *S. impar*

□ *S. schmitti*

□ *Temnothorax ambiguus*

□ *T. curvispinosus*

□ *T. longispinosus*

□ *T. texanus*

□ *T. schaumii*

□ *Tetramorium caespitum**

Poneroids (7)

□ *Amblyopone pallipes*

□ *Hypoponera punctatissima**

□ *Pachycondyla chinensis** / **

□ *Ponera pennsylvanica*

□ *Proceratium crassicornes*

□ *P. pergandei*

□ *P. silaceum*

<txa>Identifying the Subfamilies and Genera of New England Ants

The first step in identifying an ant is to determine which subfamily and genus it is in.

Most everyone can easily see the difference between a large and a small ant or between a red and a black ant, but it is a significant accomplishment to be able to distinguish among the 32 genera that occur in New England. The illustrated guide to the genera printed on the inside front cover can help you in the field, armed only with a hand lens, to identify the correct genus. In the field, hold the ant gently between the fingers of one hand; with the other hand, bring the hand lens up close to your eye. Now, bring the ant up to the hand lens until it snaps into focus. Work back and forth between the ant and the guide to the genera until you think you have a match. To confirm your genus identification, you will probably have to examine the ant under a dissecting microscope and work through the subfamily and genus keys in this book.

Whether you are looking at the ant through a hand lens or under a microscope, there are some key features to look at first. In the dichotomous keys, these primary characters are indicated by **bold-faced type**. The secondary characters described in normal type will help you get a sense of the overall look and feel of the species, but these secondary characters will not, by themselves, definitively separate species from one another. All the body parts of an ant have their own names – the illustrated glossary printed on the inside back cover includes all the parts we refer to in the text and the keys.

Start by looking at the body of the ant in profile. Do you have a worker ant or a reproductive ant? The latter can be either a queen (also called a gyne) or a male. Our keys and species descriptions are based on workers, but will usually work for queens as well. Queens may or may not have wings (if they have already shed their wings, the base of each wing will still be visible), but both queens and males have prominent bulges on top of their thorax that support the wing muscles.

The males, with only a single set of chromosomes (recall the discussion of haplodiploidy in Chapter 2), almost always have wings and look very different from the queens and workers; for the connoisseur, we provide a key to the genera of males after the key to the genera of workers. It is difficult for even the most accomplished myrmecologist to identify males to species unless workers and queens were collected along with the males at the same time from the same nest. We make no attempt to describe the males of the different species, some of which have never even been seen!

Now back to the workers (or queens). Keeping the ant in profile, look closely at the pedicel – the structure that connects the mesosoma, with its three pairs of legs, to the gaster behind it. Does the pedicel have one or two distinct segments? Does the gaster end in a sting

(which rarely hurts more than being stuck by a tiny needle), a tiny nozzle (the acidopore) that can spray foul-smelling formic acid, or neither? These characters alone separate the New England subfamilies and subfamily groups: two-segmented petiole = Myrmicinae; one-segmented petiole + acidopore = Formicinae; one-segmented petiole + sting = Poneroids; one-segmented petiole with neither acidopore nor sting = Dolichoderinae.

Next, look at the face. Are the compound eyes large or small? How about those jaws (count the teeth on the mandibles)? Check out the antennae – how many segments (be sure to include both the scape and all of the segments of the funiculus in your count)? Is the scape longer than the head or is it shorter? Does the funiculus end in a swollen club or not? As you can see in either key, combinations of these characters separate most of the genera.

For those few genera that remain, go back to the profile of the body. The shape of the petiole (barrel-shaped, triangular, or with a pronounced, elongated peduncle towards the front) is a helpful character in separating out some of the smaller ants in closely-related genera of the Myrmicinae.

Once you've determined the genus, head for the species pages. These are organized by subfamily. Ant species in three subfamilies, the Dolichoderinae, Formicinae, and Myrmicinae, and one subfamily group, the poneroids, occur in New England. The New England poneroids are represented by three closely-related and only recently separated subfamilies, the Amblyoponinae, the Ponerinae, and the Proceratiinae. Many more poneroids can be found in the tropics and subtropics.

Within each subfamily section, the pages are organized alphabetically by genus and then alphabetically by species within genus. For each genus, we first describe its name, history, distribution, diversity, and the characters used to distinguish among the New England species.

Then, we present one or two keys to the species. For genera with fewer than four species, there is an illustrated dichotomous key to the species. For genera with four or more species, we also include a full-color matrix key showing all the species in rows so that specimens can easily be compared with all of the New England species in that genus. We conclude the discussion of the genus with a brief summary of the species that can be confused with those in other genera.

<<txa>>Key to the Subfamilies and Genera, Based on the Workers (and Queens)

<<txb>>Key to the subfamilies

1a. **Gaster with a visible constriction between the first and second segments**.....(Poneroids) 2

<<5-2-ambpal-genbod.tif>>

1b. **Gaster without a visible constriction**..... 4

2a (from 1a). **Teeth present and prominent on the lower (anterior) margin of the**

clypeus; the attachment of the petiole to the gaster is broad

..... Amblyoponinae (1 genus, 1 species – *A. pallipes*), p. XXX

<<6-1-1-ambpal-face-dk.tif>>

2b. **No teeth on the anterior margin of the clypeus**; the attachment of the petiole to the

gaster is narrow, resulting in distinct anterior, posterior, and dorsal surfaces of the petiole

..... 3

3a (2b). **The second segment of the gaster is greatly enlarged and arched** so that it

appears as the hindmost section of the gaster when the ant is viewed in profile; the

remaining segments of the gaster curl underneath the 2nd segment and point towards
the front of the ant.....Proceratiinae (1 genus - *Proceratium*, 3 species), p. XXX

<<5-2-proper-genbod.tif>>

3b. **The second segment of the gaster is not enlarged, and not strongly arched;** the
remaining segments of the gaster point away from the front of the ant
..... Ponerinae (3 genera, 1 species each) 6

<<5-2-hyppun-genbod.tif>>

4a (from 1b). **Post-petiole absent** (pedicel has only one segment) 5

<<5-2-forsub1-genbod.tif>>

4b. **Post-petiole present** (pedicel has two segments) Myrmicinae (17 genera, 62 species) 8

<<5-2-lep-genbod.tif>>

5a (4a). **Acidopore (small nozzle, often fringed with hair) present**
..... Formicinae (8 genera, 62 species) 24

<<5-2-forsub1-acidopore.tif>>

5b. **Acidopore absent** Dolichoderinae (2 genera, 7 species) 31

<<5-2-tapses-gaster.tif>>

<<txb>>Key to the genera (numbering continues from the subfamilies)

6a (from 3b: Ponerinae). **A single tibial spur is visible on the hind tibia**, and the spur is comb-like (pectinate) with many fine teeth 7

<<6-1-3-ponpen-spurs.tif>>

6b. **Two tibial spurs are visible on the hind tibia** – one is large and pectinate, the other is small, thin, and toothless; the appendage below the petiole (also called a sub-petiolar process) is shaped like a parallelogram (a sideways rectangle); a non-native species of temperate forests *Pachycondyla* (1 species – *P. chinensis*), p. XXX

<<6-1-3a-pacchi-spurs.tif>>

7a. **The sub-petiolar process has a circular, usually translucent window near the front**, and two small tooth-like points projecting toward the back; a native species of forests *Ponera* (1 species – *P. pennsylvanica*), p. XXX

<<5-2-ponpen-petiole.tif>>

7b. **The sub-petiole process does not have a translucent window**; the process itself is curved and lacks points; a non-native (tropical) species restricted in New England to the inside of heated buildings *Hypoponera* (1 species – *H. punctatissima*), p. XXX

<<5-2-hyppun-petiole.tif>>

8a (from 4b: Myrmicinae). **The gaster, viewed from above, has a prominent V-shaped depression running almost its entire length**; a workerless, inquiline social parasite of *Tetramorium caespitum*.....*Anergates* (1 species – *A. atratulus*), p. XXX

<<6-4-1-aneatr-inset.tif>>

8b. **Gaster without median longitudinal depression** 9

9a (8b). **Antennae with 6 segments**, the last two forming a distinct club.....
.....*Pyramica* (3 species), p. XXX

<<6-4-12-pyrpul-face.tif>>

9b. **Antennae with more than 6 segments** 10

10a (9b). The **propodeum has neither long spines nor short, tooth-like protuberances**
.....11

<<6-4-7-monema-body.tif>>

10b. **Propodeum armed with long spines or short, tooth-like protuberances**..... 12

<<5-2-lep-genbod.tif>>

11a (10a) **Antennae with 10 segments**, the last two forming a distinct club; a tiny
(body length < 2mm), yellow or yellow-brown ant often found in or near colonies
of larger ants *Solenopsis* (2 species), p. XXX

<<6-4-13-solmol-face.tif>>

11b. **Antennae with 12 segments**, the last three forming a distinct club; small (body
length < 3 mm), shiny, black, or if yellow-red, with a black-tipped gaster
.....*Monomorium* (4 species), p. XXX

<<6-4-7-monema-face.tif>>

12a (10b). **The gaster is heart-shaped; the petiole appears to be attached to the top (dorsal) surface of the gaster***Crematogaster* (2 species), p. XXX

<<6-4-3-crecer-body.tif>>

12b. **Gaster not heart-shaped; petiole appears to be attached to the front (anterior face) of the gaster** 13

13a (12b). **The eyes have short, erect hairs between the facets (ommatidia) of the compound eyes** (visible at 25 – 50× magnification)
.....*Formicoxenus* (1 species – *F. provancheri*), p. XXX

<<6-4-4-forpro-inset.tif>>

13b. **Eyes without short, erect hairs between the ommatidia**..... 14

14a (13b). **Mandible with 4 or fewer teeth**; a long raised edge (a carina) extends from the front posteriorly (towards the top of the head) beyond the eye and forms a groove (scrobe) in which the scape of the antenna can fit 15

<<6-4-11-proame-face.tif>>

14b. **Mandible with 5 or more teeth.** Front of the face without a scrobe...
..... 16

15a (14a). **Mandible with 4 teeth**.....
..... *Protomognathus* (1 species – *P. americanus*), p. XXX

15b. **Mandible with no teeth**.....
..... *Harpagoxenus* (1 species – *H. canadensis*), p. XXX

<<6-4-5-harcan-face.tif>>

16a (14b). **Petiole with a pronounced, anterior peduncle** 17

<<6-4-2-aphrud-peduncle.tif>>

16b. **Petiole without a pronounced, anterior peduncle** 22

<<6-4-9-myrapun-peduncle.tif>>

17a (16a). **Antennal club with 3 segments** 18

<<6-4-10-phefla-club.tif>>

17b. **Antennal club with 4 segments or antennal club indistinct**
..... 21

<<6-4-2-aphrud-antenna.tif>>

18a (17a). **Sting ends in a small, triangular appendage**

(visible at 25 – 50× magnification); top and side (posterior-lateral) portions of clypeus raised into a thin, vertical ridge (carina) that forms a deep socket for the base of the antenna; mandibles with seven teeth; an exotic species commonly found nesting in driveways and on pavement

.....*Tetramorium* (1 species – *T. caespitum*), p. XXX

<<6-4-16-tetcae-inset.tif>>

18b. **Sting simple**; antennal socket not deep 19

19a (18b). **The workers are dimorphic (very large or**

very small); the large workers (majors) have

disproportionately large heads with prominent

posterior, muscle-filled lobes near the top of the

head; in both majors and small workers (minors), the

propodeum is lower than (stepped down from) the level

of the promesonotum; the propodeal spines are short
 and upturned; the sculpturing on the mesosoma is
 generally covered with small punctures (punctate)
 *Pheidole* (2 species), p. XXX

<<6-4-10-phepil-major.tif>>

19b. Workers not dimorphic, heads normal; the
 sculpturing on the mesosoma is generally wrinkly,
 creased (rugose), or with small hexagonal pits
 (foveolate) 20

<<6-4-15-temamb-face.tif>>

20a (19b). Erect hairs present on the mesosoma;
 body sculpturing rugose or linear
 *Temnothorax* (5 species), p. XXX

<<6-4-15-temamb-body.tif>>

20b. Erect hairs absent on the meosoma; body
 sculpturing foveolate.....
 *Cardiocondyla* (1 species), p. XXX

<<6-4-2b-carobs-body.tif>>

21a (17b). **The antennal scapes are short, not reaching the top of the head;** the eyes are small or vestigial; the propodeal spines are short; small ants (2.5 – 4.3mm long) *Stenamma* (4 species), p. XXX

<<6-4-14-stesch-body.tif>>

21b. **Antennal scapes extend beyond the top of the head;** eyes and propodeal spines both prominent; propodeum lower than (stepped down from) the level of the promesonotum; larger ants (4-6 mm long) *Aphaenogaster* (6 species), p. XXX

<<6-4-2-aphrud-body.tif>>

22a (16b). **The petiole is short and cylindrical, appearing barrel-shaped when viewed from the side;** the head has a prominent ridge that runs along the length of the head near the ventral margin; the propodeal spines are short and tooth-like;

two pairs of short propodeal spines may be visible.....
..... *Myrmecina* (2 species), p. XXX

<<5-2-myrame1-thorax.tif>>

<<5-2-myrame1-face-oblique.tif>>

22b. Petiole more triangular/conical than cylindrical when

viewed from the side; head without a prominent ridge running
along the length of the head; propodeal spines clearly
developed; only one pair of propodeal spines 22

23a (22b). Antennae with 12 segments; club may or may not

be visible; tibial spines with fine teeth (view at 50-100×);
pronounced sculpturing, and furrows (rugae) on
promesonotum and entire head; propodeal spines
pronounced and long..... *Myrmica* (21 species), p. XXX

<<5-2-myrmica-tibia.tif>>

23b. Antennae 11-segmented with a 3-segmented antennal

club; tibial spines without fine teeth; an impression or
suture is usually visible on the metanotum. Propodeal

spines short or even stubby; mandibles with six teeth

.....*Leptothorax* (5 species), p. XXX

<<6-4-6-lepcan-body.tif>>

24a (from 5a: Formicinae) **Antennae with nine segments**; a very small, yellow ant (~1.5 mm

long) *Brachymyrmex* (1 species – *B. depilis*), p. XXX

<<6-3-1-bradep-face.tif>>

24b. **Antennae with 12 segments**, total body length variable 25

25a (24b). **Mesosoma smooth, with a convex profile**; antennal insertions set well back from
the top (posterior border) of the clypeus; acidopore without fringing hairs

..... *Camponotus* (9 species), p. XXX

<<5-2-camchr-genbod.tif>>

25b. **Mesosoma profile not smoothly convex – when viewed from the side, the
propodeum is lower than (stepped down from) the level of the promesonotum;**

antennal insertions are at, or adjacent to, the margin of the clypeus; acidopore with

fringing hairs 26

<<5-2-forsub1-genbod.tif>>

26a (25b). **Mandibles long, sickle-shaped, and lacking large teeth** (but with serrated edges) *Polyergus* (3 species), p. XXX

<<6-3-6-polluc-face.tif>>

26b. **Mandibles with teeth**..... 27

27a (26b). **Mandibles with at least 7 teeth** 28

27b. **Mandibles with 5 or 6 teeth**..... 29

28a (27a). **The simple eyes (ocelli) are large and distinct**; the dorsal surface (top) of the propodeum is usually longer than its sloping posterior (rear) surface (the declivity), or the propodeum is evenly rounded without distinguishable surfaces; mostly larger ants (> 4 mm), often seen on the ground foraging; color variable
.....*Formica* (31 species), p. XXX

<<5-2-forsub1-mesosoma.tif>>

28b. **Ocelli small and indistinct, or not visible**; dorsal surface of the propodeum
 apparent and notably shorter than its declivity; small (< 4mm), mostly
 subterranean ants that are brown, orange, or yellow
 *Lasius* (17 species), p. XXX

<<5-2-lasumb-mesosoma.tif>>

29a (27b). **The mesosoma viewed from above is strongly constricted behind
 the pronotum**, giving the mesosoma a distinctive hourglass appearance; the
 erect hairs on the mesonotum are short (0.1 – 0.15 mm long) and bristle-like;
 in full face view, the eyes are situated above the midline of the head
 *Prenolepis* (1 species – *P. imparis*), p. XXX

<<5-2-preimp-inset.tif>>

29b. **Mesosoma viewed from above not sharply constricted behind the
 pronotum**; erect hairs on the mesonotum are long (> 0.2mm long) and coarse,
 not bristly; in full face view, the eyes are situated at or slightly below the
 midline of the head..... 30

<<5-2-nyl-inset.tif>>

30a (29b). **Antennal scapes very long, at least 1.7× (and usually 2×) as**

long as the head; no erect hairs on the scape or propodeum; erect hairs on
the head scattered across the surface; mandibles with 5 teeth.

..... *Paratrechina* (1 species – *P. longicornis*), p. XXX

<<6-3-5a-parlon-newface.tif>>

30b. **Antennal scapes shorter, less than 1.5× as long as the head;** hairs

present or absent on the scape; absent on the propodeum; mandibles with 6
teeth.....*Nylanderia* (3 species), p. XXX

<<6-3-5-nylpar-face.tif>>

31a (5b: Dolichoderinae). **The posterior surface of the propodeum viewed in profile is**

strongly concave, forming a shelf or “beer-bottle opener” that overhangs the petiole; the
petiole fits into this concavity*Dolichoderus* (4 species), p. XXX

<<5-2-dolpus-genbod.tif>>

31b. **The posterior surface of the propodeum is relatively flat and smooth.** The petiole is

flattened (vestigial) and may be hidden by the first segment of the gaster.....

.....*Tapinoma* (3 species), p. XXX

<<5-2-tapses-genbod.tif>>

<<txa>>Key to the Subfamilies and Genera, Based on the Males

<<txb>>Key to the subfamilies

1a. **Gaster with a distinct constriction between the 1st and 2nd segments**.....
..... Poneroids (5 genera) 3

<<ambpal-gaster-male.tif>>

1b. **Gaster lacking a distinct constriction between the 1st and 2nd segments**2

2a (1b). **Post-petiole absent** (pedicel with only one segment)
..... Dolichoderinae (2 genera) + Formicinae (8 genera) 7

<<forsub3-gaster-male.tif>>

2b. **Post-petiole present** (pedicel with two segments).....
.....Myrmicinae (16 genera) 16

<<myrame1-gaster-male.tif>>

<<txb>>Key to the genera (numbering continues from the subfamilies)

3a (1b: Poneroids). **Males wingless, resembling workers (“ergatandrous”)**; antennae 12-segmented*Hypoponera*

<<hyppun-profile-male.tif>>

3b. **Males with wings, distinct from workers**; antennae 13-segmented4

4a (3b). **Y-shaped sutures (“Mayrian furrows”) visible on the top (dorsal) surface of the pronotum**; hind tibia with two spurs – one large, one small5

<<ambpal-dorsum-male.tif>>

<<pacchi-spur-male.tif>>

4b. **Mayrian furrows absent**; hind tibia with only a single small spur.....6

<<ponpen-dorsum-male.tif>>

<<ponpen-spur-male.tif>>

5a (4a). **The mandibles are sickle-like**; the anterior margin of the clypeus has small, bump-like teeth; the petiole is distinctly cube-shaped, and its attachment to the gaster is large and broad; a dark brown to black ant*Amblyopone*

<<ambpal-face-male.tif>>

5b. **Mandibles short and pointed**; anterior margin of the clypeus lacks teeth; petiole distinctly triangular in profile, and its attachment to the gaster is small; a pale yellowish-white ant.....*Pachycondyla*

<<pacchi-face-male.tif>>

6a (4b). **The very last segment of the gaster (the pygidium) has a distinct spine**; the antennal scape is much shorter than the first segment of the funiculus; the pair of appendages on the rear of the gaster (parameres point rearward and are not noticeably enlarged).....*Ponera*

<<ponpen-gaster-male.tif>>

6b. **Pygidium without a distinct spine**; antennal scape much longer than the first segment of the funiculus; parameres enlarged and tucked under the last segment of the gaster *Proceratium*

<<procer-gaster-male.tif>>

7a (2a: Dolichoderinae + Formicinae). **Antennae with 10 segments** *Brachymyrmex*

<<bradep-face-male.tif>>

7b. **Antennae with 13 segments**8

8a (7b). **Mandibles thin, curved, and sickle-shaped** and without any teeth..... *Polyergus*

<<polluc-face-male.tif>>

8b. **Mandibles robust, with at least one apical tooth** and often with many small teeth along their inner margin.....9

9a (8b) **Viewed from above, the base** (that is, the part just behind the petiole) **of the gaster is distinctly concave**10

<<nylfla-dorsal-male.tif>>

9b. **Viewed from above, the base of the gaster is even across its entire width, or it is convex**.....14

<<campen-dorsal-male.tif>>

10a (9a) **Antennal scape very long, at least 1.75× the length of the head; no hairs on the scape**..... *Paratrechina*

<<parlon-face-male.tif>>

10b. **Antennal scape less than 1.5× the length of the head;** scales with or without
hairs.....11

11a (10b). **First segment of the funiculus triangular or pear-shaped** (pyriform).
.....*Lasius*

<<lasfla-antenna-male.tif>>

11b. **First segment of the funiculus not pyriform**12

12a. **Antennal scape shorter than the length of the first 4 funicular**
segments *Prenolepis*

<<preimp-face-male.tif>>

12b. **Antennal scape longer than the length of the first 4 funicular**
segments13

13a. **Tibiae and scapes with dark, erect or nearly erect hairs**
.....*Nylanderia*

<<nylfla-face-male.tif>>

13b. **Tibiae and scapes without dark, erect hairs**; mandibles with many
small teeth along their inner margin*Tapinoma*

<<tapses-face-male.tif>>

14a (9b). **Antennal scapes shorter than the total length of the first 3 funicular
segments**; mandibles with many small teeth along their inner margin
.....*Dolichoderus*

<<dolpus-face-male.tif>>

14b. **Antennal scapes at least as long as the total length of the first 4 funicular
segments**; mandibles with a pronounced apical tooth but few if any other teeth..15

15a. **Genital appendages (parameres) large and pointed downward
(ventrally)**, making almost a right angle with the gaster; antennal scapes
insert at, or just above, the clypeus and are not longer than the total length of
the first 5 funicular segments*Formica*

<<forsub3-gaster-male.tif>>

15b. **Parameres pointed rearward, in line with the gaster;** antennal scapes

insert well above the clypeus, and they are as long as or longer than the total

length of the first 6 funicular segments..... *Camponotus*

<<campen-gaster-male.tif>>

16a (2b: Myrmicinae). **Antennae with 10 segments**.....*Tetramorium*

<<tetcae-face-male.tif>>

16b. **Antennae with more than 10 segments**17

17a (16b). **Antennae with 11 segments;** males wingless and looking like pupae; an inquiline
social parasite of *Tetramorium caespitum* *Anergates*

<<aneatr-face-male.tif>>

17b. **Antennae with 12 or 13 segments**18

18a (17b). **Antennae with 12 segments**.....19

18b. **Antennae with 13 segments**25

19a (18a). **Gaster heart-shaped**; the post-petiole appears to be attached to the top
(dorsum) of the gaster*Crematogaster*

<<crelin-gaster-male.tif>>

19b. **Gaster not heart-shaped**; the post-petiole is attached to front (anterior) of
gaster20

20a (19b). **First segment of funiculus ring-like or nearly spherical (globose)**,
Y-shaped grooves (Mayrian furrows) visible on top (dorsal surface) of the
pronotum; simple eyes (ocelli) protrude noticeably from head *Solenopsis*

<<solmol-face-male.tif>>

20b. **First segment of funiculus cylindrical**. Mayrian furrows absent; ocelli
present but not on protuberance atop head21

21a (20b). **Antennal scape not longer than the total length of the first two
segments of the funiculus**; antennal scrobe absent*Leptothorax*

<<lepcan-face-male.tif>>

21b. **Antennal scape longer than the total length of the first two segments
of the funiculus**; antennal scrobe may be present or absent22

22a (21b). **Eyes with short erect hairs between the facets of the
compound eyes***Formicoxenus*

<<forpro-face-male.tif>>

22b. **Eyes without short erect hairs between the facets of the
compound eyes**23

23a (22b). **Antennal scrobe absent***Temnothorax*

<<temlon-face-male.tif>>

23b. **Antennal scrobe present**24

24a (23b). **Mandibles stubby and squared-off, lacking teeth**
.....*Harpagoxenus*

<<harcan-face-male.tif>>

24b. **Mandibles long and narrow, with small teeth** and ending in
a sharp point.....*Protomognathus*

<<proame-face-male.tif>>

25a (18b). Males wingless and worker-like (ergatandrous) in appearance.....
.....*Cardiocondyla* (wingless males)

25b. Males winged and not worker-like in appearance26

26a (25b). **Mandibles absent or present only as short, toothless stubs**; petiole
cylindrical and barrel-shaped when viewed from the side..... *Myrmecina*

<<myrame1-face-male.tif>>

26b. **Mandibles present**. petiole triangular, with or without a pronounced
peduncle27

27a (26b). **Tibial spurs on middle and hind legs with distinct teeth**;
antennae with a distinct 4- or 5-segmented club.....*Myrmica*

<<myrpun-spur-male.tif>>

<<myrpun-face-male.tif>>

27b. **Tibial spurs lacking distinct teeth**; antennae without a distinct club ...28

28a (27b). **Head viewed in profile distinctly flattened**; eye as tall as the

head *Aphaenogaster*

<<aphrud-face-male.tif>>

28b. **Head viewed in profile not distinctly flattened**; eye not as tall as

the head29

29a (28b). **Ocelli raised from the head on a pronounced platform**;

petiole without a pronounced peduncle *Pheidole*

<<phepil-face-male.tif>>

29b. **Ocelli present but not raised on a platform**; petiole with a

pronounced peduncle30

30a (29b). **Mayrian furrows absent**, head not longer than broad....

.....31

<<monema-dorsal-male.tif>>

30b. **Mayrian furrows present;** but if Mayrian furrows are
indistinct, then the head is distinctly longer than broad.....32

31a (30a). **Antennal scape approximately as long as the total
length of the first two antennal segments***Monomorium*

31b. **Antennal scape at least as long as the total length of
the first five antennal segments**
.....*Cardiocondyla* (winged males)

32a (30b). **Head distinctly longer than broad;** petiole and
post-petiole with thin, membranous appendages, especially
on their lower surfaces; Mayrian furrows may be indistinct
.....*Pyramica*

<<pyrper-face-male.tif>>

<<pyrper-gaster-male.tif>>

32b. **Head not longer than broad;** petiole and post-petiole
lacking thin, membranous appendages. Mayrian furrows
pronounced.....*Stenamma*

<<stedie-face-male.tif>>

<<stedie-dorsum-male.tif>>

<<coltab, color= 95-1>>Poneroids

<<txa>>Poneroids – The Wretched, Laboring Ants (from the Greek *ponerá*, meaning wretched, oppressed, injurious, or evil, and which is derived from *pónos*, meaning work or labor)

<<5-2-ambpal-genbod.tif>>

The seven species of poneroids in New England are cryptic (hard-to-find), mostly litter-dwelling ants. Systematists not only separate the poneroids into multiple genera but also separate them into five subfamilies, three of which – the Amblyoponinae, Ponerinae, and Proceratiinae – are represented in New England. However, we discuss the poneroids together because they share two easy-to-recognize features: (1) a constriction between the first two segments of the gaster that gives these ants a wasp-waist; and (2) a prominent, wasp-like stinger. The resemblance of poneroids to small wasps is not coincidental. The poneroid families group together at the base of the ant family tree (see Figure 2.5 in Chapter 2), which itself is an offshoot of the vespid wasps (a group that includes the familiar bald-face hornets and yellow-jackets). Despite their long evolutionary history, poneroid species make small colonies and, compared with other ant species, are the least eusocial; this “poneroid paradox” is an active area of myrmecological research.

Poneroids are mainly tropical and subtropical ants; of the 34 North American species, only five are native to temperate New England. The Asian “immigr-ant,” *Pachycondyla chinensis*, is rapidly approaching New England from the south. Our one additional species, *Hypoponera punctatissima*, is a subtropical tramp that can live in New England only in heated buildings. It most commonly lurks in hospital basements and commercial kitchens, and usually is observed only when queens emerge from hidden nooks and crannies to establish new colonies.

<<txb>>Identifying the Poneroid Species

It is straightforward to separate the three subfamilies and four genera of poneroids using the genus-level key at the beginning of this chapter. The large, scraggly teeth on the mandibles and another row of teeth on the lower (anterior) edge of the clypeus distinguish *Amblyopone* from the other three genera. The profile of *Proceratium*, with its enlarged and arched gaster, distinguishes it from the more typical-looking *Ponera* and *Hypoponera*. Finally, because *Hypoponera* cannot tolerate New England winters, you can distinguish it from *Ponera* and *Pachycondyla* simply by noting whether or not you collected it out-of-doors. *Pachycondyla* is separated from *Ponera* by the number of tibial spurs: two in *Pachycondyla*, one in *Ponera*.

Because four of the five genera have only one species each in New England, identifying the genus also gets you the species with no extra effort! If it's *Amblyopone*, it's *A. pallipes*. If it's *Hypoponera*, it's *H. punctatissima*. If it's *Pachycondyla*, it's *P. chinensis*. And if it's *Ponera*, it's *P. pennsylvanica*.

Distinguishing the three species of *Proceratium* takes a bit more work, and is best done by examining pinned specimens under a dissecting microscope. All three *Proceratium* species have a distinctive gaster: the second segment of the gaster is greatly enlarged, and the remaining segments are tucked underneath it; as a consequence, the stinger points forward. *Proceratium pergandei* is the easiest of the three *Proceratium* species to distinguish; look carefully at the position of the tucked-under segments of the gaster. In *P. pergandei*, these segments appear to hang off the middle of the second segment of the gaster, whereas in the other two species, these segments are suspended from the back of the second segment of the gaster. Furthermore, the clypeus of *P. pergandei* has a lobe projecting from the middle, whereas in the other two species,

the clypeus has no lobe. The profile of the petiole separates *P. crassicornis* from *P. silaceum*. The petiole of *P. crassicornis* is thick and nearly rectangular in profile – the top of the petiole is nearly as thick as the base. In contrast, the petiole of *P. silaceum* is tapered – the top of the petiole is much thinner than the base. *Proceratium crassicornis* also has short and sparse hairs on its gaster, whereas *P. silaceum* has long and dense hairs on its gaster. These are subtle characters; taxonomists didn't even distinguish these as two separate species until 2003.

<< 6-1-pon-matrix.eps>>

This matrix key illustrates three morphological characters that can be used to quickly separate the seven New England poneroids. Each species is shown in profile; size shown is approximately eight times the size of an average worker. The primary characteristics to look for on the face are large scraggly-toothed mandibles and a toothed clypeus (*Amblyopone pallipes*), finer-toothed mandibles (*Ponera pennsylvanica*, *Hypoponera punctatissima*, *Pachycondyla chinensis*), or coarse-toothed mandibles and small, close-set frontal lobes (*Proceratium* species). The enlarged second segment of the gaster with the remaining segments tucked under the gaster also distinguishes *Proceratium* from the other three genera. The shape of the petiole can be used to reliably separate all seven species. In *A. pallipes*, the petiole is cylindrical, and has no apparent scale. The three Ponerinae (*Ponera pennsylvanica*, *Hypoponera punctatissima*, *Pachycondyla chinensis*) have large petioles, but the hardened lobe of tissue suspended beneath the petiole (a sub-petiolar process) differs in shape among these three genera. In *Ponera*, the sub-petiolar process has a small translucent, circular “window” near its front and a sharp tooth towards the back. Neither the window nor the tooth is present in the other two species. The sub-petiolar

process is rounded in *Hypoponera* and trapezoidal in *Pachycondyla*. Finally, *Proceratium pergandei* has a low, cylindrical petiole, whereas *Proceratium crassicornes* and *Proceratium silaceum* have taller petioles. The petiole of *P. crassicornes* is nearly as thick at the top as it is at the bottom, and appears rectangular in profile. In contrast, the petiole of *P. silaceum* is much narrower at the top than it is at the bottom, and it appears triangular in profile. The species are ordered by size and genus – one species each in *Amblyopone*, *Hypoponera*, and *Ponera*, and three species in *Proceratium*.

<<txb>>Key to the Poneroid Species

1a. **Mandible with both large and small teeth** and the margin of clypeus also with teeth; the petiole is broadly attached to the first segment of the gaster*Amblyopone pallipes*

<<6-1-1-ambpal-face-dk.tif>>

1b. **Mandible with teeth of only one size**; petiole narrowly attached to first segment of gaster...2

<<6-1-3-ponpen-face-dk.tif>>

2a (1b). **The end of the gaster** and the stinger **are directed away from the front of the ant**;
distinct impressions (sutures) are present on the pronotum and (usually) on the
mesonotum; the antennal sockets not exposed3

2b. **End of the gaster** and the stinger **directed upwards or towards the front of the ant**; no sutures on the pronotum and rarely on mesonotum; antennal sockets exposed
..... (genus *Proceratium*) 5

<<6-1-4-proper-gaster.tif>>

3a. (2a). **Sub-petiolar process with a round** (or oval) **translucent “window”** (best viewed with transmitted light) near its front, and a sharp tooth towards the back of the process.....*Ponera pennsylvanica*

<<5-2-ponpen-petiole.tif>>

3b. **Sub-petiolar process lacking a translucent window**, and lacking a tooth4

<<5-2-hyppun-petiole.tif>>

4a (3b). **Hind tibia with two spurs** – one large and comb-like with fine teeth (pectinate), one small and lacking teeth; workers ≥ 4 mm long; an Asian species found in wooded habitats*Pachycondyla chinensis*

<<6-1-3a-pacchi-spurs.tif>>

4b. **Hind tibia with only one spur**, and it is pectinate; workers $\leq 3\text{mm}$ long; a
 subtropical species found only indoors in New England, most commonly seen as
 winged queens (alates) *Hypoponera punctatissima*

<<6-1-3-ponpen-spurs.tif>>

5a (2b). **Second gastral segment enlarged; subsequent segments located below and
 near the front of the second segment**; anterior border of the clypeus slightly convex
 with a projecting median lobe; petiole low and rounded when viewed from above
 *Proceratium pergandei*

<<6-1-4-proper-gaster.tif >>

5b. **Third and later gastral segments located below but near the back of the second
 segment**; anterior border of clypeus without a median lobe; petiole relatively high
 and rectangular when viewed from above6

<<6-1-4-procra-gaster.tif>>

6a (5b). **Petiole thick in profile (the crest is almost as thick as the base)**; frontal
 area $\frac{1}{4}$ as wide as head; frontal carinae diverge towards the top of the head; erect
 hairs on gaster short and sparse. *Proceratium crassicorne*

<<6-1-4-procra-petiole.tif>>

6b. **Petiole slender in profile (crest distinctly thinner than base)**; frontal area $> \frac{1}{4}$

as wide as head; frontal carinae strongly divergent towards the bottom of the

head. Erect hairs on gaster long and dense. *Proceratium silaceum*

<<6-1-4-prosil-petiole.tif>>

<<txb>>Easily Confused Species

The small, litter-dwelling Poneroids are unlikely to be confused with other ant genera in our region.

<<spec>>*Amblyopone pallipes* (Haldeman, 1844)

<<common>>The Snaggle-toothed Ant

<<etym>> From the Greek *ambly*-, meaning dim, dull, diminished + *ponera*; then from the Latin *pallidus* + *pes*, meaning pale-footed

<<coltab, color="95-1">> Genus *Amblyopone*

<<ambpal-queen.tif>>

<<ambpal-nest.tif>>

<<ambpal-map.tif>>

<<hab>>**Habitat:** This entirely subterranean species makes small colonies (< 60 workers) and nests under stones and in soil, litter, and rotten wood. It can often be collected in the iconic stone walls that meander through New England's forests.

<<geog>>**Geographic Range:** Throughout the United States and Canada, except for the Pacific Coast, boreal Canada, and the northern Rocky Mountains.

<<nathist>>**Natural History:** This predatory ant eats mostly centipedes and, in New England, small caterpillars and beetle larvae (wireworms).

<<look>>**Look-alike species:** This is the only New England species in this genus and subfamily. The toothed clypeus and the scraggly teeth along the mandibles make it unlike any other ant in New England.

<<6-1-1-ambpal-face.tif>>

<<6-1-1-ambpal-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Both large and small teeth along the mandibles

<<dist-b>>B. Prominent teeth along the anterior margin of the clypeus

<<dist-c>>C. Large cube-shaped petiole is broadly attached to the gaster

<<scalebar=5.5mm>>

<<spec>>*Hypoponera punctatissima* (Roger, 1859)

<<common>>The Very Punctate Poneroid

<<etym>> From the Greek *Hypo-*, meaning below, or less than normal + *Ponera*; then from the Latin *punctatus*, meaning embossed with punctures + *issimus*, meaning very, and referring to its very punctate head.

<<coltab, color= "114-1">>Genus *Hypoponera*

<<hyppun-habitat-hospital.tif>>

<<hyppun-queen.tif>>

<<hyppun-map.tif>>

<<hab>>**Habitat:** In its native, tropical range, this species nests in soil or in damp litter. In New England, it has been collected only in hospitals, where the ants nest in the floors of large institutional kitchens and laboratories.

<<geog>>**Geographic Range:** This is a wide-ranging, rapidly dispersing (tramp) species that occurs throughout the tropics and subtropics. It was originally described from a colony found in Germany.

<<nathist>>**Natural History:** This tropical species cannot tolerate New England winters, and in our region it is found only in heated buildings. Occasional infestations occur in hospitals and commercial kitchens, where queens may be collected when they emerge *en masse* to disperse from the otherwise well-hidden colonies. The males lack wings, and mate with their sisters inside the nests.

<<look>>**Look-alike species:** Ants in the genus *Hypoponera* are most often confused with ants in the genus *Ponera*, but in fact look more like ants in the genus *Pachycondyla*. Start by looking at the lobe below the petiole. In *Hypoponera*, this lobe viewed in profile is rounded and lacks a translucent “window” towards the front. In *Pachycondyla*, this lobe is trapezoidal and also lacks a translucent “window.” But in New England, *Hypoponera* is never found outside, so if you found the ant out-of-doors, it’s most likely not *Hypoponera*.

<<6-1-2-hyppun-face-worker.tif>>

<<6-1-2-hyppun-face-queen.tif>>

<<6-1-2-hyppun-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sub-petiolar lobe is solid, and lacks a translucent window (contrast with *Ponera pennsylvanica*)

<<dist-b>>B. The sub-petiolar lobe is rounded and lacks a sharp tooth at the back (contrast with *Ponera pennsylvanica*)

<<dist-c>>C. The hind tibia has one spur

<<scalebar=3mm>>

<<spec>>*Pachycondyla chinensis* Emery, 1895

<<common>>*The Asian Needle Ant

<<etym>>From the Greek *pachys*, meaning thick + *kondylos*, meaning articulated joint, and referring to the thickened base of the antennae; *chinensis* for China, its type locality

<<coltab, color= "114-4">>Genus *Pachycondyla*

<<oakslope-HPH-20110524>>

<<pacchi-group.tif>>

<<pacchi-map.tif>>

<<hab>>**Habitat:** This non-native species nests in damp soil, under rocks, rotten logs, railroad ties, bricks, and pavement. Unlike our other non-native species, *P. chinensis* nests in forests as well as in urban environments and human habitations.

<<geog>>**Geographic Range:** Although named for China, *P. chinensis* is found throughout North and South Korea, Japan south of Hokkaido, and Taiwan. It was first recorded in the United States in the 1930s, and since then it has been recorded from Alabama, Florida, Georgia, North and South Carolina, Tennessee, Virginia, and New York. It has not yet been collected in New England, although it was collected in 1980 from Lewisboro, New York, only a few miles from Fairfield, Connecticut.

<<nathist>>**Natural History:** Although *P. chinensis* is not very aggressive, it will sting when disturbed and about 1% of people who are stung by it experience strong allergic reactions, including anaphylactic shock. Since the early 2000s, *P. chinensis* has been found in dense populations in North and South Carolina, where it can outcompete native ant species.

<<look>>**Look-alike species:** Ants in the genus *Pachycondyla* can be confused with *Hypoponera* or *Ponera*. Both *Pachycondyla* and *Hypoponera* lack a translucent “window” on the lobe underneath the petiole, whereas *Ponera* has a little round window. *Pachycondyla* can be distinguished from the other two genera because it has two spurs on its hind tibia, whereas the other two genera have only one. Finally, *Pachycondyla*, whose workers are $\geq 4\text{mm}$ long, is about 25% larger than either *Hypoponera* or *Ponera*, with workers that are $\leq 3\text{mm}$ long.

<<6-1-3a-pacchi-face.tif>>

<<6-1-3-pacchi-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sub-petiolar lobe does not have a translucent window (contrast with *Ponera pennsylvanica*)

<<dist-b>>B. The sub-petiolar lobe is trapezoidal (contrast with *Hypoponera punctatissima*)

<<dist-c>>C. The hind tibia has two spurs

<<scalebar=4mm>>

<<spec>>*Ponera pennsylvanica* Buckley, 1866

<<common>>The Pennsylvania Ponera

<<etym>>The *Ponera* from *Penn*, for the European colonist William Penn + *sylva*, meaning woods or forest, and referring to William Penn's woods (Pennsylvania), its type locality

<<coltab, color= "114-7">>Genus *Ponera*

<<ponpen-rock.tif>>

<<ponpen-nest.tif>>

<<ponpen-map.tif>>

<<hab>>**Habitat:** This species nests anywhere there is enough moisture: under rotting logs, in rotten stumps, in leaf litter, soil, damp places in forests, and open habitats with a lot of moisture, including wet, grassy swales, soggy fields, and the occasional bog or fen.

<<geog>>**Geographic Range:** Throughout deciduous forests of eastern North America, from southern Canada south to the Gulf of Mexico and west to the Mississippi River.

<<nathist>>**Natural History:** This is the most common poneroid in New England. Its colonies are small (< 100 workers) and may have one or more queens. It preys on small soil-dwelling insects and other arthropods.

<<look>>**Look-alike species:** Ants in the genus *Ponera* can be confused with *Hypoconera* or *Pachycondyla*. Technically, one should look at the sub-petiole process (the lobe below the petiole). In *Ponera*, this process viewed in profile has a tooth towards the back and a translucent “window” towards the front. But *Ponera* is the only one of these three genera that is native to New England; *Hypoconera* is only found indoors and *Pachycondyla* has not yet been seen in

New England. So if you collected the ant outside, it's most likely *Ponera*. But keep an eye out for *Pachycondyla*, which has been found just west of the Connecticut border, and which can deliver a painful sting.

<<6-1-3-ponpen-face.tif>>

<<6-1-3-ponpen-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sub-petiolar lobe has a translucent window (contrast with *Hypoponera punctatissima* and *Pachycondyla chinensis*)

<<dist-b>>B. The sub-petiolar lobe is more square and has a sharp tooth at the back (contrast with *Hypoponera punctatissima*)

<<dist-c>>C. The hind tibia has only a single spur (contrast with *Pachycondyla chinensis*)

<<scalebar=3.5mm>>

<<spec>>*Proceratium crassicorne* Emery, 1895

<<common>>The Fat *Proceratium*

<<etym>>From the Greek *pró* + *cerátium*, meaning a forward-pointing little horn; then from the Latin *crassiore*, meaning fat and thick, and referring to the scale on the petiole

<<coltab, color= "90-1">>Genus *Proceratium*

<<procra-site.tif>>

<<procra-worker.tif>>

<<procra-map.tif>>

<<hab>>**Habitat:** A subterranean ant that nests in soil or in well-decayed rotten logs and stumps in open oak or oak-hickory woodlands and forests.

<<geog>>**Geographic Range:** Massachusetts and New York south to Mississippi and west to Missouri.

<<nathist>>**Natural History:** Little is known of this species, which has only recently been clearly distinguished from *Proceratium silaceum*. Like other *Proceratium* species, we assume that it preys on eggs of spiders. It makes small colonies (< 100 workers) and may have several queens.

<<look>>**Look-alike species:** *Proceratium crassicorne* is nearly identical to *Proceratium silaceum*. The two species can be distinguished by the shape of the petiole viewed in profile (thick and rectangular in *P. crassicorne*), the density of hairs on the gaster (relatively sparse in *P. crassicorne*), and the relative width of the space between the antennae (narrow in *P. crassicorne*).

<<6-1-4-procra-face.tif>>

<<6-1-4-procra-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Broad, thick petiole (contrast with *P. silaceum*)

<<dist-b>>B. Short, sparse hairs on the gaster

<<dist-c>>C. Relatively narrow space between the frontal carinae (contrast with *P. silaceum*)

<<scalebar=3mm>>

<<spec>>*Proceratium pergandei* (Emery, 1895)

<<common>>Pergande's *Proceratium*

<<etym>>Named for noted American entomologist Theodore Pergande (1840-1916), who collected the original specimen

<<coltab, color= "90-1">> Genus *Proceratium*

<<proper-hab.tif>>

<<properMCZ001L.tif>>

<<proper-map.tif>>

<<hab>>**Habitat:** This rarely collected forest and woodland species nests in well-decayed, rotten logs and stumps, under rocks, and in the soil in open oak or oak-hickory woodlands.

<<geog>>**Geographic Range:** Massachusetts south to Florida, and west to Iowa, Arkansas, and Louisiana. *Proceratium pergandei* has been collected from New England only twice, both times near Boston.

<<nathist>>**Natural History:** This species is thought to be a specialized predator that feeds on spider eggs.

<<look>>**Look-alike species:** This is the most distinctive of our three New England *Proceratium* species. The petiole is low and cylindrical (bun-shaped), and the tucked-under segments of the gaster are located well forward and beneath the enlarged second segment of the gaster.

<<6-1-4-proper-face.tif>>

<<6-1-4-proper-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Third through last segments of gaster tucked under the 2nd segment of the gaster,
and located far forward

<<dist-b>>B. Bun-shaped petiole

<<dist-c>>C. Anterior border of the clypeus with a projecting lobe in the middle

<<scalebar=4mm>>

<<spec>>*Proceratium silaceum* Roger, 1863

<<common>>The Yellow *Proceratium*

<<etym>>From the Latin *silaceum*, meaning yellow ochre

<<coltab, color= "90-1">> Genus *Proceratium*

<<prosil-hab.tif >>

<<prosil-queen-AW.tif>>

<<prosil-map.tif>>

<<hab>>**Habitat:** This is the most commonly collected *Proceratium* species in New England. It nests underground or in well-decayed rotten logs or stumps in in open oak or oak-hickory woodlands and forests.

<<geog>>**Geographic Range:** Massachusetts west to Illinois, Arkansas, and Oklahoma, and south to Florida. Also recorded from Pelee Island, Ontario (Canada).

<<nathist>>**Natural History:** This ant is thought to prey on eggs of ants, spiders, and other arthropods. It forms small colonies (< 100 workers), with one or more queens.

<<look>>**Look-alike species:** *Proceratium silaceum* is nearly identical to *Proceratium crassicorne*. The two species can be distinguished by the shape of the petiole viewed in profile (tapering in *P. silaceum*), the density of hairs on the gaster (relatively dense in *P. silaceum*), and the relative width of the space between the base of the antennae (relatively wide in *P. silaceum*).

<<6-1-4-prosil-face.tif>>

<<6-1-4-prosil-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Tapering petiole (contrast with *P. crassicorne*)

<<dist-b>>B. Long, dense hairs on the gaster

<<dist-c>>C. Relatively wide space between the frontal carinae (contrast with *P. crassicorne*)

<<scalebar=2.75mm>>

<<coltab, color= “223-2”>>Genus *Dolichoderus*

<<txa>>*Dolichoderus* Lund, 1831– The Long-Necked Ant (from the Greek *dolichós*, meaning long, in the sense of extended + *der(o)*, meaning neck).

<<6-2-1-dolatt-profile.tif>>

Dolichoderus is the largest genus of ants in the subfamily Dolichoderinae; nearly 200 species have been described across Europe, Southeast Asia, Australia, and North, Central, and South America. There are only four North American species of *Dolichoderus*, all of which were formerly placed in the genus *Hypoclinea*, and all of which can be found in New England. None of them have the long neck (actually the rear portion of the head that narrows posteriorly) of the type species *Dolichoderus attelaboides* (Fabricius, 1775) that is shown above. Still, the New England *Dolichoderus* is one of the easiest genus to recognize. The rear (posterior) face (the declivity) of the propodeum in our species is concave, giving ants in this genus a distinctive profile that looks like a bottle opener.

<<txb>>Identifying the Species of *Dolichoderus*

The four New England species of *Dolichoderus* are well defined and easy to identify. Start by looking down at the back of the ant. The top of the bottle-opener-shaped propodeum is nearly square in *D. taschenbergi* and *D. mariae*, but is clearly rectangular in the other two species. *Dolichoderus taschenbergi* is black and hairy, but *D. mariae* is bi-colored (head and mesosoma red, gaster black) and lacks erect hairs on the antennal scapes and the top of the mesosoma. Of the two species with rectangular propodeums, *D. plagiatus* has many (at least 10)

erect hairs on the antennal scapes, whereas *D. pustulatus* has sparse erect hairs on the antennal scapes (usually 4 or fewer) and on the back of the mesosoma. The color of these two species varies from all black to bi-colored with a mix of red and black.

Observations of colony structure in the field can also help distinguish these species.

Dolichoderus pustulatus and *D. plagiatus* make small colonies (normally fewer than 200 workers) in ephemeral nest sites, and usually have only single queens. We commonly find carton nests of *D. pustulatus* in old leaves of the northern pitcher plant, *Sarracenia purpurea*, in bogs and other open wetlands. *Dolichoderus plagiatus* tends to avoid wetlands in favor of drier, but still open, habitats. In contrast, the other two species, *D. mariae* and *D. taschenbergi* make large colonies (often > 10,000 ants); their nests are igloo-shaped dome nests ranging in size from 5 – 50 cm in height that are made out of grasses, *Sphagnum* mosses, pine or spruce needles, and other shredded vegetation. These two species may have multiple queens, are very aggressive, and often forage on well-defined scent trails.

<<6-2-1-dol-matrix.eps>>

This matrix key illustrates three morphological characters that can be used to quickly determine which species of *Dolichoderus* you have. Each species is shown in profile; size shown is approximately five times the size of a worker and colors illustrate both shades and bi-coloration. The species are ordered by size, but note that the differences among species in length average less than 1 mm. The primary characteristic to look for on the mesosoma is the relationship between the length and width of the propodeum (viewed dorsally, looking down on the ant). The length and width of the propodeum are approximately equal in *D. taschenbergi* and

D. mariae, and unequal in the other two species. Head profiles illustrate the prominence of pitting and sculpturing and relative hairiness of the head and antennal scapes. *Dolichoderus mariae* has no hairs and little sculpturing, *D. pustulatus* has few hairs and more sculpturing, and *D. plagiatus* has many hairs and the most sculpturing.

<<txb>>Key to the Species of *Dolichoderus*

1a. **No hairs on the antennal scape or mesosoma and few if any hairs (< 5) on the first segment of the gaster;** a bi-colored ant whose head and mesosoma are red and whose gaster is black *D. mariae*

<<6-2-1-dolmar-gaster.tif>>

1b. **Antennal scape, mesosoma, and gaster with at least 5, usually many more, erect hairs;** body color variable2

2a (1b). **In dorsal view, the propodeum is nearly square** (subquadrate: equal in length and width or only slightly longer than it is wide); the ant is all black.....*D. taschenbergi*

<<6-2-1-doltas-propodeum.tif>>

2b. **In dorsal view, the propodeum is substantially longer than it is wide;** color varies from all black to black with some red or orange3

3a (2b). **The antennal scape has at least 10 erect hairs**; the sculpturing on the head and sides of the propodeum is coarse*D. plagiatus*

<<6-2-1-dolpla-face-dk.tif>>

3b. **Few (< 10) hairs on the antennal scape, but hairs are more common on the dorsal surface of the mesosoma and gaster**; fine sculpturing on head and sides or propodeum, relatively shiny; in New England, this ant is generally black in color, but it can be bi-colored in the southern US..... *D. pustulatus*

<<6-2-1-dolpus-gaster.tif>>

<<txb>>Easily Confused Species

In the field, unless you look closely with a high-powered hand lens (at least 10×), you may confuse *Dolichoderus* for similarly-sized *Myrmica* species. This confusion arises because the concave C-shaped declivity of the propodeum may appear on first glance to be propodeal spines. A more powerful hand lens or a low power dissecting microscope will clearly distinguish these genera.

<<spec>>*Dolichoderus mariae* Forel, 1885

<<common>>Mary's *Dolichoderus*

<<etym>>Named for the entomologist, botanist, and ornithologist, Mary Treat, who “collected this beautiful species in Vineland, New Jersey.”

<<coltab, color= “223-2”>> Genus *Dolichoderus*

<<dolmar-tenders.tif>>

<<dolmar-tenders2.tif>>

<<dolmar-map.tif>>

<<hab>>**Habitat:** This ant nests in bogs and pine barrens.

<<geog>>**Geographic Range:** New Brunswick south to Florida and the Gulf Coast; west into southern Québec, Illinois, Minnesota, and Oklahoma.

<<nathist>>**Natural History:** This species forms enormous colonies with > 10,000 workers and builds nests made of small domes of *Sphagnum* (in bogs) or of plant debris piled up around a clump of grass (in pine barrens and other dry, open sites). Although *D. mariae* may frequently move its colonies to new areas and build new nests, it will continue to use the same scent-marked foraging trails to find and tend a wide variety of aphids that feed on trees, shrubs, and herbs.

<<look>>**Look-alike species:** This species can be confused with bi-colored individuals of *D. pustulatus*, but the relatively large size and almost complete absence of hairs distinguishes *D. mariae* from the other three *Dolichoderus* species.

<<6-2-1-dolmar-face.tif>>

<<6-2-1-dolmar-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. No erect hairs on head, antennal scapes, or the dorsum of the body (contrast with *D. taschenbergi*)

<<dist-b>>B. Bi-colored: head and mesosoma red-orange, gaster dark, with red-orange on the first segment of the gaster

<<dist-c>>C. Smooth and shiny, with little sculpturing

<<scalebar=4.5mm>>

<<spec>>*Dolichoderus plagiatus* (Mayr, 1870)

<<common>>The Mottled *Dolichoderus*

<<etym>>From the Latin *plaga*, meaning striped, streaked, or mottled

<<coltab, color= "223-2">> Genus *Dolichoderus*

<<dolpla-nest.tif>>

<<dolpla-queen.tif>>

<<dolpla-map.tif>>

<<hab>>**Habitat:** This ant favors open fields, higher (drier) portions of bogs, and drier areas of other herb-dominated wetlands.

<<geog>>**Geographic Range:** New Brunswick south to South Carolina and west into the Dakotas, Québec, Ontario, and Manitoba.

<<nathist>>**Natural History:** Colonies of *D. plagiatus* are usually small (< 100 workers) and have a single queen. The nests are hidden in clumps of grass, hollow stems of milkweed (*Asclepias* species) or dogbane (*Apocynum* species), in dried and curled leaves, or in hollowed-out twigs. The workers forage alone, preying on small invertebrates, scavenging debris, and tending aphids and scale insects. There is an intriguing observation by the entomologist Diethe Ortius of a *D. taschenbergi* queen living happily in a *D. plagiatus* nest. If confirmed, it would suggest that *D. plagiatus* is a host for (temporarily) parasitic *D. taschenbergi*.

<<look>>**Look-alike species:** This species is most often confused with *D. pustulatus*. The abundance of erect hairs on its antennal scape is the key characteristic for distinguishing *D. plagiatus* from the other three *Dolichoderus* species.

<<6-2-1-dolpla-face.tif>>

<<.6-2-1-dolpla-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Many erect hairs on the antennal scapes (contrast with *D. pustulatus*)

<<dist-b>>B. Bi-colored, with head and gaster dark and mesosoma orange-brown

<<dist-c>>C. Head and dorsal surface of the mesosoma heavily sculptured

<<scalebar=3.75mm>>

<<spec>>*Dolichoderus pustulatus* Mayr, 1886

<<common>>The Common Bog *Dolichoderus*

<<etym>>From the Latin *pustule*, meaning blister, and referring to the finely punctate sculpturing on the mesonotum.

<<coltab, color= "223-2">> Genus *Dolichoderus*

<<dolpus-hab.tif>>

<<dolpus-nest.tif>>

<<dolpus-map.tif>>

<<hab>>**Habitat:** This ant nests in old-fields and wet meadows, bogs, fens, and other herb-dominated wetlands, often in wetter areas than where *D. plagiatus* nests.

<<geog>>**Geographic Range:** Nova Scotia south into Florida, Mississippi, and Louisiana, and west into southern Québec, Minnesota, Illinois, and Indiana.

<<nathist>>**Natural History:** Like *D. plagiatus*, *D. pustulatus* makes small colonies (< 100 workers) with only a single queen. In bogs, this species often makes carton nests in old pitchers of the carnivorous Northern Pitcher Plant, *Sarracenia purpurea*.

<<look>>**Look-alike species:** This species can be confused with *D. plagiatus* and *D. mariae*.

The few-to-no erect hairs on its antennal scape distinguish *D. pustulatus* from *D. plagiatus*. In New England, *D. pustulatus* is normally all black or dark-brown, unlike the distinctly bi-colored *D. mariae*.

<<6-2-1-dolpus-face.tif>>

<<6-2-1-dolpus-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Few (not more than 4) erect hairs on the antennal scape (contrast with *D. plagiatus*)

<<dist-b>>B. Scattered hairs on the back of the mesosoma and on the gaster

<<dist-c>>C. Punctate sculpturing throughout the body

<<scalebar=3.5mm>>

<<spec>>*Dolichoderus taschenbergi* (Mayr, 1866)

<<common>>Taschenberg's *Dolichoderus*

<<etym>>Named for the German entomologist Ernst Ludwig Taschenberg

<<coltab, color= "223-2">> Genus *Dolichoderus*

<<doltas-tending2.tif>>

<<doltas-tending1.tif>>

<<doltas-map.tif>>

<<hab>>**Habitat:** This ant lives on the edges of woods, old-fields and other open habitats, including bogs. Because of its large nests, it is the most conspicuous *Dolichoderus* in northeastern pine barrens.

<<geog>>**Geographic Range:** Nova Scotia and New Brunswick south into Georgia, Alabama, and Mississippi, and west across the upper Midwest and southern Canada to North Dakota and southern Manitoba.

<<nathist>>**Natural History:** Like *D. mariae*, *D. taschenbergi* makes enormous colonies with > 10,000 workers. The nests are made of piled plant debris such as conifer needles. This species uses well-defined foraging trails and tends aphids. Although removal of aphids (such as *Cinara gracilis*) has little effect on the well-being of the ant colony, when the ants are removed, the aphids lose the protection of ants and are eaten by predators.

<<look>>**Look-alike species:** Both *D. taschenbergi* and *D. mariae* have a nearly square propodeum (viewed from above), but *D. taschenbergi* is black and hairy, whereas *D. mariae* is bi-colored and nearly hairless.

<<6-2-1-doltas-face.tif>>

<<6-2-1-doltas-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The length of the propodeum is nearly equal to its width

<<dist-b>>B. Sparse, short hairs on head, and pronotum (contrast with *D. mariae*)

<<dist-c>>C. Uniformly brown-black in color

<<scalebar=4mm>>

<<coltab, color="232-2">> Genus *Tapinoma*

<<txa>>*Tapinoma* Förster, 1850 – The Fallen Ants (from the Greek *tapeinoma*, meaning fallen or humiliated)

<<5-2-tapses-genbod>>

The genus *Tapinoma* includes ~125 species, at least five of which occur in North America. Only two species of *Tapinoma* can be found outdoors in New England: *T. sessile* and an unnamed, workerless species that is an inquiline social parasite of *T. sessile*. A third species, *T. melanocephalum*, is a tropical tramp species that occasionally turns up in greenhouses when it is imported along with tropical house-plants. The genus *Tapinoma* is recognized by its apparent lack of a node or scale on its petiole; in describing the genus, Arnold Förster named it for the “fallen” scale of the first abdominal segment (the petiole). *Tapinoma* alludes to the astrological term *tapeinoma*, when planets are fallen and not exerting their influence on human or celestial affairs.

<<txb>>Identifying the Species of *Tapinoma*

Of the three New England species in this genus, *Tapinoma sessile* is the most abundant and easily identified. Like *Dolichoderus*, the gaster of *Tapinoma* ends in a distinctive horizontal, slit-like opening; there is neither an acidopore nor a stinger. The small size of *T. sessile*, the lack of a scale on its one-segmented petiole, and its characteristic odor of coconuts or over-ripe bananas make it unmistakable and gave it its official common name. It can be found anywhere in North America, and it is abundant in New England under rocks and fallen logs, in woods, bogs,

and in urban areas. It is also a familiar denizen of our pantries, and it is often referred to as a “sugar ant.” Our undescribed species of *Tapinoma* is an inquiline social parasite of *T. sessile*.

Like other inquiline social parasites, colonies of the unnamed species of *Tapinoma* produce no workers, only queens and males, and depend entirely on their hosts for food and nest space. The unnamed social parasite can be distinguished from the host (*T. sessile*) by size: the parasite queen is about half the length of the host queen and about 80% the length of the host worker. Queens and males of *T. sessile* also are produced and fly in July through early August, whereas the queens and males of the social parasite are produced and fly in mid-August to late-September. As of this writing, the social parasite has been collected only twice: in the early 1900s on Mount Tom, in Holyoke, Massachusetts, and again in 2007 under a flower pot in Stow, Massachusetts. Finally, the aptly-named ghost ant, *T. melanocephalum*, is easily recognized by its dark brown head and mesosoma and milky-white abdomen and legs. This species can be found in tropical regions throughout the world, but so far has been found in New England only inside greenhouses and other warm buildings.

<<txb>>Key to the Species of *Tapinoma*

- 1a. **Workers tiny, < 1.5 mm long;** head and mesosoma brown, gaster and legs milky white; a tropical species that is a rare inhabitant of greenhouses and other heated structures in New England *T. melanocephalum*
- 1b. **Workers larger, 2.5 – 3.5 mm long;** ants uniformly brown2
- 2a (1b). **Queens generally large, at least 5.5 mm;** queens and males produced and fly in mid-summer (late July to early August) *T. sessile*

2b. **Queens much smaller, 2.0 – 2.5 mm long;** queens and males are produced and fly in late summer (mid-August to late September); a rare inquiline social parasite of *T. sessile*.

Note: workers are not produced by this species – if workers are observed in the colony, they are the workers of the host, *T. sessile* An undescribed species of *Tapinoma*

<<6-2-2-tap-comp-queens.tif>>

<<txb>>Easily Confused Species

Tapinoma sessile is occasionally mistaken for the similarly sized, shaped, and colored *Lasius alienus* or the somewhat smaller *Brachymyrmex depilis*. The lack of a scale on its petiole, and the termination of the gaster in a horizontal, slit-like opening, are diagnostic for *Tapinoma*. The gasters of *Lasius* and *Brachymyrmex* both end in acidopores, and the antennae of *Brachymyrmex* are nine segmented, unlike the 12-segmented antennae of *Lasius* and *Tapinoma*.

<<spec>>*Tapinoma melanocephalum* (Fabricius, 1793)

<<common>>*The Ghost Ant

<<etym>>From the Greek *melas* + *kephale*, meaning dark-headed

<<coltab, color="232-2">> Genus *Tapinoma*

<<tapmel-habitat.tif>>

<<tapmel-workers-AW.tif>>

<<tapmel-map.tif>>

<<hab>>**Habitat:** A tropical species that nests anywhere in pre-existing cavities made of plant materials. Indoors, it will nest in walls and in potted plants – the only recorded habitats (so far) in New England.

<<geog>>**Geographic Range:** This species can be found in tropical and subtropical regions throughout the world; its original range is unknown. In North America, it is established in Florida north to Gainesville, in Texas and Hawai'i. We know of only one New England record of *T. melanocephalum*: from a greenhouse in southeast New Hampshire.

<<nathist>>**Natural History:** *Tapinoma melanocephalum* makes colonies with multiple nests and multiple queens. In tropical climates, it makes large nests in larders and pantries. Pinch this ant – the crushed body smells like rotten coconuts.

<<look>>**Look-alike species:** This bi-colored, tiny ant, with its dark head and mesosoma and milky white legs and gaster, looks like no other ant in our region.

<<6-2-2-tapmel-face.tif>>

<<6-2-2-tapmel-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Bi-colored, with a dark head and mesosoma and a white gaster

<<dist-b>>B. Petiole hidden by the first segment of the gaster and lacking a scale

<<scalebar=1.4mm>>

<<spec>>*Tapinoma sessile* (Say, 1836)

<<common>>*The Odorous House Ant

<<etym>>From the Latin *sessilis*, meaning sessile or stalkless, referring to the apparently sessile gaster that conceals the petiole

<<coltab, color="232-2">> Genus *Tapinoma*

<<tapses-nest.tif>>

<<tapses-flight.tif>>

<<tapses-map.tif>>

<<hab>>**Habitat:** This ant makes shallow nests in soil, and under boards, rocks, debris, or litter. It also can be found in damp spaces in houses, such as near pipes, heaters, drains, under and around toilets, and in commercial beehives.

<<geog>>**Geographic Range:** Widespread in the United States and Canada, from coast to coast, north to south.

<<nathist>>**Natural History:** Because of its propensity to forage for sugar left out on kitchen counters, *Tapinoma sessile* is one of the most common ants that you will see in New England. People often call it The Sugar Ant, but its official common name refers to the characteristic odor of rotten coconuts it exudes when squeezed. Most *T. sessile* nests are outside; the workers on the counter are usually foraging along well-marked scent trails that can extend for tens of meters. But this species also will nest indoors, wherever there is enough moisture. *Tapinoma sessile* is not an aggressive ant, and some myrmecologists have hypothesized that the increasing abundance of *T. sessile* in houses and apartments has resulted from the increased use of insecticides to kill

other species of ants that nest outside, but near to houses. In addition, *T. sessile* will nest in bark mulch, which is used in suburban landscaping.

Tapinoma sessile colonies range from small to large, and have one to many queens. These nests are not permanent; *Tapinoma* moves from one covered place to another every few days or so when food becomes locally scarce or when the nest is disturbed or damaged. In urban areas, however, it can form large super-colonies with multiple queens and many nests. This rural-to-urban lifestyle transition has evolved at least four times in different parts of North America.

Tapinoma sessile workers are scavengers, predators, and tenders of aphids and other scale insects. They forage alone, but rapidly recruit nestmates to resources using scent trails.

<<look>>**Look-alike species:** Although *T. sessile* is occasionally mistaken for *Lasius alienus*, the lack of a scale on its petiole, and the termination of the gaster in a horizontal, slit-like opening, are diagnostic. The undescribed species of *Tapinoma* has no workers and relies on *T. sessile* to care for its queens and males. If all you see are muscular males and females in late summer, you probably have a parasitized nest of *T. sessile*. Look for this parasite, which so far is known from only two records.

<<6-2-2-tapses-face.tif>>

<<6-2-2-tapses-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Horizontal slit at the end of the gaster

<<dist-b>>B. Petiole hidden by the first segment of the gaster and lacking a scale

<<scalebar=2.75mm>>

<<spec>>An undescribed species of *Tapinoma*

<<common>>

<<etym>>

<<coltab, color="232-2">>Genus *Tapinoma*

<<tapsA-habitat.tif>>

<<tapsAMCZ001L.tif>>

<<tapsA-map.tif>>

<<hab>>**Habitat:** This is an inquiline social parasite of *T. sessile*.

<<geog>>**Geographic Range:** So far, known only from Mount Tom in western Massachusetts and a flower pot in Stow, in eastern Massachusetts.

<<nathist>>**Natural History:** Much needs to be learned about this newly-discovered species of *Tapinoma*. Colonies of the undescribed species consist of the parasite queens, parasite males, and workers of the host, *Tapinoma sessile*. It is unknown if host queens are present or if they are killed by the parasite. The queens and males of this undescribed species are produced and fly from late August through mid-September, about one month later than those of its host. A similar-looking species was originally described in 1915 as *Bothriomyrmex dimmocki* by William Wheeler from a specimen collected years earlier on Mount Tom, in Holyoke Massachusetts. Re-evaluation of this original record revealed that the workers are small *T. sessile* but the queens may be the undescribed species we illustrate here, or it may be another social parasite. The undescribed species was discovered by Stefan Cover in 2007.

<<look>>**Look-alike species:** The queens and males resemble those of *T. sessile*, but they are about half the size of *T. sessile* queens and about 80% the size of *T. sessile* workers.

<<6-2-2-tapspA-face.tif>>

<<6-2-2-tapspA-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Queens are very small – smaller than *T. sessile* workers

<<dist-b>>B. Queens are produced and fly in early fall

<<scalebar=2.25mm>>

<<coltab, color="191-1 +K=60">>Genus *Brachymyrmex*

<<txa>>*Brachymyrmex* Mayr, 1868 – The Short Ants (from the Greek *brachy*, meaning short + *myrmex*, meaning ant, and referring to their antennae with only 9 segments)

<<6-3-1-bradep-face.tif>>

Brachymyrmex is a Neotropical genus that includes ~60 species. At least six species, and possibly as many as ten, occur in North America, but only the widespread *B. depilis* is recorded from New England. The genus *Brachymyrmex* is in desperate need of taxonomic work. The species are minute and taxonomists have so far failed to settle on morphological characters that might be used to separate workers of different species. Future systematic work most likely will be based on DNA sequencing, and field identification will require the invention of a *Star Trek* tricorder.

<<txb>>Easily confused species

Brachymyrmex is unique among the subfamily Formicinae in having nine-segmented antennae. Nonetheless, its small size and yellow color give it a similar appearance to paler-colored *Tapinoma sessile*, small species of *Lasius* such as *L. flavus*, or ants in the genus *Solenopsis*. Of these three genera, only *Lasius*, like other Formicinae, has an acidopore at the end of its gaster. Like other Dolichoderinae, *T. sessile* has a horizontal slit at the end of its gaster, and the like other Myrmicinae, *Solenopsis* has a two-segmented pedicel (*i.e.*, a petiole + post-petiole). *Brachymyrmex* may also be confused with other small Formicinae, such as *Nylanderia*

or *Paratrechina*, but species of these latter two genera have long, erect dark hairs on their promesonotum, whereas *Brachymyrmex depilis* is essentially bald on top.

<<spec>>*Brachymyrmex depilis* Emery, 1893

<<common>>The Little Hairless Ant

<<etym>>From the Latin *de-*, a prefix meaning without, or deprived of + *pilus*, meaning hair

<<coltab, color="191-1 +K=60">>Genus *Brachymyrmex*

<<bradep-queens.tif>>

<<bradep-tending.tif>>

<<bradep-map.tif>>

<<hab>>**Habitat:** This ant nests in forests on or just below the soil surface, under moss, stones, or rotten logs.

<<geog>>**Geographic Range:** The apparent range of this species is throughout North America, but “*B. depilis*” may in fact be comprised of many species, each with a much narrow geographic range, and which are difficult to separate on morphological features alone.

<<nathist>>**Natural History:** This habitat generalist feeds on honeydew excreted by aphids feeding on plant roots. *Brachymyrmex* colonies have multiple queens and several hundred workers. These ants are seldom seen because they are mostly subterranean and very small in size. The workers are soft-bodied and may appear defenseless, but in fact they can secrete a powerful, repellent poison through their acidopore.

<<look>>**Look-alike species:** This is one of the smallest ant species in New England. It is most likely to be confused with other small Formicinae (*Nylanderia* or *Paratrechina*), but *Brachymyrmex* is unique in having 9-segmented antennae. It is similar in size to the Thief Ants

(*Solenopsis*), but being in the subfamily Formicinae, *Brachymyrmex* has an acidopore, which the Myrmicinae genus *Solenopsis* lacks.

<<6-3-1-bradep-face.tif>>

<<6-3-1-bradep-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The short antennae have only 9 segments

<<dist-b>>B. The head and mesosoma are virtually hairless

<<dist-c>>C. The acidopore points directly rearward from its gaster

<<scalebar=1.3mm>>

<<coltab, color="191-1">>Genus *Camponotus*

<<txa>>*Camponotus* Mayr, 1861 – The Ant with the Bending Back (from the Greek *kampê*, meaning bent + *nōton*, meaning back)

<<5-2-camchr-genbod.tif>>

The genus *Camponotus* is one of the most diverse ant genera in the world. It is also one of the most familiar groups of ants. Many homeowners will recognize the large, black or black-and-red carpenter ants that are members of this genus. Nearly 1,600 valid species and subspecies of *Camponotus* have been described; they account for more than 10% of all the known species and subspecies of ants! There are more than 50 species in North America, eight of which have been recorded from New England; a ninth species included in this guide is *C. subbarbatus*, which been found on Long Island and in Black Rock Forest on the western side of the Hudson River Valley. Although it may now be scarce in the north, it is only a matter of time before *C. subbarbatus* is found in New England.

Camponotus colonies have three different sizes of workers (majors, medias, and minors). The different castes look very different. Minors are small, and their heads are rounded on top (posterior) and usually are much longer than they are wide. Majors are large, and their heads, which are usually at least as wide as they are long, also are usually squared off at the top corners. Medias are in between. Some characters used to distinguish different species are more visible on minors than on majors, and *vice versa*, so accurate identification may be easier if you collect workers of different castes from the same nest.

<<txb>>Identifying the Species of *Camponotus*

The eight New England species of *Camponotus*, along with *C. subbarbatus* lurking on our southern and western borders, are well-defined and easy to identify. There are two main groups divided by size and the presence or absence of a notch, or at least a small concavity, in the middle of the lower (anterior) edge of the clypeus. This is one of the few genera of North American ants that is still separated into more-or-less distinct subgenera by taxonomists. The three species of small-bodied ants (in which the large, major workers are < 7.5 mm long) all have a notched clypeus and are placed in the subgenus *Myrmentoma*. The notch is most clearly visible on small minor and intermediate workers; it is often reduced to a barely noticeable medial depression on the clypeus of the largest major workers. The six species of large-bodied *Camponotus* (major workers > 7.5 mm long) that do not have a notched clypeus are currently placed in the subgenera *Camponotus* (five species) and *Tanaemyrmex* (one species). Although some systematists consider *Tanaemyrmex* to be less of a true subgenus and more of a taxonomic dumping ground for species with unresolved relationships, others consider it to be a geographically and morphologically discrete subgenus (at least among North American representatives), with distinctive nesting habitats.

Subgenus *Myrmentoma* – The three species in the subgenus *Myrmentoma* are *Camponotus caryae*, *C. nearcticus*, and *C. subbarbatus*. *Camponotus caryae* is distinctive because it has erect hairs on its cheeks, is coal-black, and lives in dead branches or under bark high in trees. The gaster of *C. subbarbatus* has purplish stripes, and *C. nearcticus* often has some red coloration on its mesosoma. *Camponotus caryae* and *C. subbarbatus* have erect hairs on their cheeks, but *C. nearcticus* does not.

Subgenus *Tanaemyrmex* – The one New England species in this subgenus, *C. castaneus*, is uniformly colored, ranging from yellow to chestnut brown, and has a shiny gaster. It also has a raised ridge running vertically down the middle of its clypeus. Like other members of this subgenus, *Camponotus castaneus* nests in soil, usually under large stones. Most North American *Tanaemyrmex* occur in the southern and western states, Mexico, the Florida Keys, and the Tortugas Islands. *Camponotus castaneus* is the only species in the subgenus that ranges north into the Mid-Atlantic and New England states.

Subgenus *Camponotus* – The five species in this subgenus do not have a notched or ridged clypeus. Geographically, they predominate in eastern and northern North America, rarely overlapping in distribution with subgenus *Tanaemyrmex*. The New England species in subgenus *Camponotus* are distinguished by the shininess and hairiness of their gasters, as well as by their coloration. The gasters of both *C. americanus* and *C. novaeboracensis* are very shiny. *Camponotus americanus* is bi-colored: its head is always brown or black, but its mesosoma and gaster can range from black to brown or even yellow. *Camponotus novaeboracensis* also is bi-colored. Its head and gaster are black, but its mesosoma and upper legs are red or burgundy-colored. The remaining three species have minute pits all over their gasters; this microsculpturing gives their gasters a dull or matte appearance. *Camponotus pennsylvanicus* is the common Eastern Carpenter Ant; its uniformly black or dark brown body, long golden hairs, and long antennal scapes make it unmistakable. *Camponotus chromaiodes* is bi-colored; its head and gaster are black, but its mesosoma, petiole, and portions of the first segment of the gaster are red. *Camponotus chromaiodes* is a warm-climate species that has been found as far north as

southern New Hampshire; a disjunct (geographically very separate) record from Burlington, Vermont reflects the potential extension into New England of this warm climate species into the Eastern Great Lakes Lowlands ecoregion. In contrast, the Northern or Great Carpenter Ant, *C. herculeanus*, which is mostly black but which has some red on the mesonotum and also has shorter hairs and shorter antennal scapes, is found most commonly at high elevations and in cold climates throughout the northern hemisphere.

<<6-3-2-camponotus-final-matrix.eps>>

This matrix key illustrates three morphological characters and one habitat character that can be used to quickly determine which species of *Camponotus* you have. Each species is shown in profile; size shown is approximately twice the size of a major worker and colors illustrate both shades and bi-coloration. The primary characteristic to look for on the clypeus is the presence of a ridge (*C. castaneus*) or a notch/concavity in the middle (the three small-bodied species in the subgenus *Myrmentoma*). Head profiles illustrate the length of the scape relative to the length of the head of major workers and the presence or absence of cheek hairs on workers of all sizes. The nest location illustrates the most common habitats: soil/ground, dead stumps, twigs, and branches. The species are ordered from largest to smallest by subgenus: one species in subgenus *Tanaemyrmex*, five species in subgenus *Camponotus*, and three species in subgenus *Myrmentoma*.

<<txb>>Key to the Species of *Camponotus*

1a. **Minor and some intermediate workers with a clypeus that has a distinct notch or medial concavity**; in the largest workers, the notch may not be apparent, but if the clypeus is not notched there will be at least a median impression or concavity on the anterior margin of the clypeus; major workers relatively small (3.5 – 7.5 mm in total length)2

<<6-3-2-camnea-face-minor-dk.tif>>

1b. **Both minor and major workers without a notched clypeus**; major workers relatively large (7 – >10 mm total length)4

2a (1a). **There are no erect hairs present on the cheeks** (examine the ant in full-face view); the color of the ant varies from all black to black with some red or burgundy on the mesosoma..... *C. nearcticus*

2b. **Erect hairs present on the cheeks**3

<<6-3-2-camsub-major-face-N-dk.tif>>

3a (2b). **Entire ant uniformly coal-black** *C. caryae*

3b. Body color brownish, with **striping (often purple) on gaster** *C. subbarbatus*

4a. (1b). **Gaster with apparent microsculpturing**, giving the surface a dull (matte) appearance; both erect and appressed hairs golden5

4b. **Gaster surface glossy** (shiny) with little apparent microsculpturing; appressed hairs
sparse or even absent; erect hairs golden7

5a (4a). **The pubescence on the gaster is golden and relatively short**, not hiding the
microsculpturing on the gaster; *on only the largest majors*, the antennal scapes are
short, barely surpassing the corners of the head when observed in full-face view.
There is usually some reddish color on the mesosoma..... *C. herculeanus*

<<6-3-2-camher-gaster.tif>>

5b. **Both erect and appressed long golden hairs on the gaster cover the segments**,
giving the gaster a whitish or yellowish sheen. In full-face view, the antennal scapes
of all workers are long, easily surpassing the corners of the head.....6

<<6-3-2-campen-gaster.tif>>

6a (5b). **A black ant**, sometimes with lighter (dark brown) coxae (the first segments
of the leg) *C. pennsylvanicus*

6b. **A bi-colored ant** whose head is black; mesosoma, petiole, and **at least part of**
the first gastral segment are red-orange or deep red; the remaining gastral
segments are black *C. chromaiodes*

7a (4b). **A single-colored (concolorous), orange to chestnut-brown ant;** in full-face view, a ridge (median carina) may be visible on the clypeus; no erect hairs on the cheeks. *C. castaneus*

<<6-3-2-camcas-major-face-dk.tif>>

7b. **A bi-colored ant;** there is no visible ridge on the clypeus; erect hairs on the cheeks may be present or absent.8

8a. The ant's head and gaster are black; its **mesosoma and legs are red to burgundy**. In full-face view, there are no erect hairs on cheeks. *C. novaeboracensis*

<<6-3-2-camnov-major-face-N-dk.tif>>

8b. **The head is black to dark brown, whereas the mesosoma and gaster are variable in color – black, dark brown, or yellow, (but not red).** In full-face view, erect hairs are present on the cheeks *C. americanus*

<<6-3-2-camame-major-face-N-dk.tif>>

<<txb>>Easily Confused Species

Camponotus colonies have three different sizes of workers (majors, medias, and minors), and the small minors of the larger species can, on first glance, be confused with the large majors of the smaller species or with similarly-sized *Formica* species. The profile of the mesosoma of both majors and minors is unmistakably *Camponotus*-shaped (hump-backed), unlike the clearly lumpy backs of *Formica* species.

<<spec>>*Camponotus americanus* Mayr, 1862

<<common>>The American Carpenter Ant

<<etym>>The Carpenter Ant of America (*americanus*)

<<coltab, color="191-1">>Genus *Camponotus*

<<camame-nest.tif>>

<<camame-group.tif>>

<<camame-map.tif>>

<<hab>>**Habitat:** This widespread species nests in the soil and under stones in both forested and open habitats.

<<geog>>**Geographic Range:** United States east of the Mississippi River (but not in Florida), as well as Texas, Oklahoma, Nebraska, and Kansas, and north into southeastern Canada.

<<nathist>>**Natural History:** This omnivore is most active at night. The rove beetle, *Xenodusa cava* (in the family Staphylinidae), often overwinters in *C. americanus* nests.

<<look>>**Look-alike species:** Although the yellow, yellowish-brown, or chestnut-brown body color of *C. americanus* is similar to that of *C. castaneus*, the head of *C. americanus* is always darker than the rest of its body. Like *C. novaeboracensis*, *C. americanus* is shiny, but unlike *C. novaeboracensis*, *C. americanus* never has any red coloring on its body.

<<6-3-2-camame-major-face-N.tif>>

<<6-3-2-camame-face-minor.tif>>

<<6-3-2-camame-major-body-N.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Bi-colored – head always darker than the mesosoma or gaster

<<dist-b>>B. Hairs present on the cheeks (on both major and minor workers)

<<dist-c>>C. No notch on the clypeus (most easily seen on minor workers)

<<scalebar=10mm>>

<<scalebar=7mm>>

<<spec>>*Camponotus caryae* (Fitch, 1855)

<<common>>The Walnut Carpenter Ant

<<etym>>From the Greek *karuon*, meaning nut or walnut

<<coltab, color="191-1">>Genus *Camponotus*

<<camcar-habitat.tif>>

<<camcar-worker-AW.tif>>

<<camcar-map.tif>>

<<hab>>**Habitat:** This uncommon species nests in dead branches and stems, and under the bark of hickory and walnut trees.

<<geog>>**Geographic Range:** Eastern United States, west into Iowa and Kansas and south to Florida. There are only five New England records of *C. caryae* – from Hillsborough in southern New Hampshire, the Waterboro Pine Barrens and Acadia National Park in Maine, and two of the Boston Harbor Islands.

<<nathist>>**Natural History:** Little is known about this hard-to-find species. It was originally described from a colony found in a piece of hickory wood in Pennsylvania, and it can be found in trees in old cavities made by long-horned beetles (family Cerambycidae). It is one of only a few arboreal ants in New England; it often forages on the trunks and major limbs of mature oaks, walnuts, and hickories. It has not been observed foraging on the ground.

<<look>>**Look-alike species:** New England specimens of *C. caryae* are coal-black. It is most often confused with *C. nearcticus*; note the presence (in *C. caryae*) or absence (in *C. nearcticus*) of erect hairs on the cheeks. The notched clypeus and erect cheek hairs of this small ant also will

distinguish it from similarly-sized minors of *C. pennsylvanicus*.

<<6-3-2-camcar-face-major.tif>>

<<6-3-2-camcar-face-minor.tif>>

<<6-3-2-camcar-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Coal-black body, small, and with a rougher finish than *C. pennsylvanicus*

<<dist-b>>B. Hairs present on the cheeks (of both major and minor workers) (contrast with *C. nearcticus*)

<<dist-c>>C. Notch on the clypeus (most easily seen on minor workers)

<<scalebar=7mm>>

<<scalebar=3.5mm>>

<<spec>>*Camponotus castaneus* (Latreille, 1802)

<<common>>The Chestnut Carpenter Ant

<<etym>>From the Greek *castaneus*, meaning of chestnut color

<<coltab, color="191-1">>Genus *Camponotus*

<<camcas-nest.tif>>

<<camcas-pair.tif>>

<<camcas-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, under rocks, or in decaying wood in the soil.

<<geog>>**Geographic Range:** This species of warm climates ranges from southern New England and southern New York, west into the Midwestern states, and south into central Texas and Florida.

<<nathist>>**Natural History:** This is an ant of forests. The omnivorous workers may forage in buildings, but the colony makes its nests outdoors and does not take up residence in houses. The workers usually forage at night, especially during the hot summer months.

<<look>>**Look-alike species:** This is the only New England species in the subgenus *Tanaemyrmex*, which can be distinguished by the ridge on the clypeus. The body color is similar to *C. americanus*, but unlike that bi-colored species, the head of *C. castaneus* is never black.

<<6-3-2-camcas-face-major.tif>>

<<6-3-2-camcas-face-minor.tif>>

<<6-3-2-camcas-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Chestnut-brown body, large and shiny (contrast with *C. americanus*)

<<dist-b>>B. Ridge on the clypeus (of both major and minor workers)

<<dist-c>>C. Head rounded at the upper corners (on both major and minor workers)

<<scalebar=10mm>>

<<scalebar=7mm>>

<<spec>>*Camponotus chromaiodes* Bolton, 1995

<<common>>*The Red Carpenter Ant

<<etym>>From the Greek *khroma*, meaning color + *ioeides*, meaning violet

<<coltab, color="191-1">>Genus *Camponotus*

<<camchr-nest.tif>>

<<camchr-brood.tif>>

<<camchr-map.tif>>

<<hab>>**Habitat:** This species most often nests in living trees, in stumps and rotted logs. It is rarely found in houses.

<<geog>>**Geographic Range:** This warm-climate species ranges south from southern New England and west to the Mississippi River. Collections of *C. chromaiodes* in New England are almost exclusively south of Ware, in Central Massachusetts, but there are scattered records of this species from southern New Hampshire, and one record of it from Burlington, in the Champlain Valley of Vermont, where the climate is relatively mild (by Vermont standards).

<<nathist>>**Natural History:** The small carrion beetle, *Nemadus triangulum* (in the family Leiodidae), lives in *C. chromaiodes* nests. These beetles are scavengers; they eat waste products of the ant colony.

<<look>>**Look-alike species:** Similar in size and hairiness to *C. pennsylvanicus*, and in color to *C. novaeboracensis*, the bi-colored *C. chromaiodes* can be distinguished by the extension of red coloration onto the first segment of the gaster.

<<6-3-2-camchr-major-face-N.tif>>

<<6-3-2-camchr-face-minor.tif>>

<<6-3-2-camchr-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Red mesosoma, red petiole, and red on first segment of gaster (contrast with *C. novaeboracensis*)

<<dist-b>>B. Long golden hairs, both erect and appressed, on the gaster

<<dist-c>>C. Antennal scapes are very long relative to the length of the head

<<scalebar=13mm>>

<<scalebar=6mm>>

<<spec>>*Camponotus herculeanus* (Linnaeus, 1758)

<<common>>The Great Carpenter Ant

<<etym>>From the Greek *Herakles*, the son of Zeus and Alkmene, and meaning great

<<coltab, color="191-1">>Genus *Camponotus*

<<camher-habitat.tif>>

<<camher-worker.tif>>

<<camher-map.tif>>

<<hab>>**Habitat:** This species nests in living trees, in stumps and logs, and occasionally in rotting beams and timbers inside houses.

<<geog>>**Geographic Range:** This large, cold-climate species is found in high latitudes around the world. In North America, it occurs in all the northern tier states, but it is rare in states with little forest cover, such as North Dakota. It is also found in the Rocky Mountains and the southwestern states at high elevations. In central New England, it is found only in really cold spots. It becomes more common further north and at higher elevations, and it is abundant on New Hampshire's Mount Washington and Mount Monadnock.

<<nathist>>**Natural History:** *Camponotus herculeanus* is one of only a few species of *Camponotus* in which multiple, unrelated queens coexist in a single nest. Queens and males are produced in the late summer, and are fed and groomed throughout the winter by workers before they emerge for mating flights on warm spring days. Bears eat this large ant in summer and fall, and woodpeckers eat it in winter.

<<look>>**Look-alike species:** This species can be confused with *C. novaeboracensis*. Both are

bi-colored, but the top and front of the mesosoma of *C. herculeanus* is black, and the gaster has more of a matte finish than does the more glossy *C. novaeboracensis*.

<<6-3-2-camher-face-major.tif>>

<<6-3-2-camher-face-minor.tif>>

<<6-3-2-camher-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Mesosoma is black to the front and on top, but red underneath and on the legs
(contrast with *C. novaeboracensis*)

<<dist-b>>B. Short pubescence on gaster reveals pits on the gaster, which gives this ant a matte appearance

<<dist-c>>C. Antennal scapes of largest majors are short, rarely reaching corners of the head

<<scalebar=13mm>>

<<scalebar=6mm>>

<<spec>>*Camponotus nearcticus* Emery, 1893

<<common>>The Nearctic Carpenter Ant

<<etym>>*Nearcticus*: of the northern (Arctic) regions of the “New World”

<<coltab, color=”191-1”>>Genus *Camponotus*

<<camnea-hole.tif>>

<<camnea-queen.tif>>

<<camnea-map.tif>>

<<hab>>**Habitat:** This widespread species nests in dead branches and stems in trees. It can also start colonies inside of old insect galls, but the established colonies move out into larger real estate.

<<geog>>**Geographic Range:** *Camponotus nearcticus* occurs in most of the United States and throughout southern Canada. It is less common in the Southwest, and is not known from New Mexico, Arizona, Utah, or Colorado.

<<nathist>>**Natural History:** One of our smallest carpenter ants, *C. nearcticus* colonies are also small (< 500 workers). It nests in and under wooden roofs and can be found in attics.

Unlike the larger carpenter ants, *C. nearcticus* rarely causes structural damage to houses.

<<look>>**Look-alike species:** This species can be confused with minor workers of *C. herculeanus*, *C. novaeboracensis*, or *C. pennsylvanicus*. The notched clypeus is distinctive, but unlike the other two species in subgenus *Myrmentoma*, *C. nearcticus* has no hairs on its cheeks.

<<6-3-2-camnea-major-face-N.tif>>

<<6-3-2-camnea-face-minor.tif>>

<<6-3-2-camnea-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Notched clypeus (most apparent on minor workers)

<<dist-b>>B. No erect hairs on cheeks of both major and minor workers (contrast with *C. caryae*)

<<dist-c>>C. Bi-colored; mesosoma with some red

<<scalebar=7.5mm>>

<<scalebar=4.5mm>>

<<spec>>*Camponotus novaeboracensis* (Fitch, 1855)

<<common>>The New York Carpenter Ant

<<etym>>From the Latin *Novaeboracensis*, taxonomists' name for New York (*Nova Eboraca*)

<<coltab, color="191-1">>Genus *Camponotus*

<<camnov-stump.tif>>

<<camnov-nest.tif>>

<<camnov-map.tif>>

<<hab>>**Habitat:** This widespread ant species nests in living trees, in tree stumps, and in large pieces of downed wood, but also may nest under rocks or cow dung.

<<geog>>**Geographic Range:** In all of the northern United States south into New Mexico and north into southern Canada. It is less common west of the Mississippi River.

<<nathist>>**Natural History:** The pupae of this medium-sized carpenter ant are often parasitized by small *Pseudochalcura gibbosa* wasps; the larvae of these wasps are taken back to the nest by the ants as a food source for the developing brood. But the eaten become the eaters, as some of the wasp larvae develop and then devour the ants.

<<look>>**Look-alike species:** This bi-colored species can be confused with *C. herculeanus* or *C. nearcticus*, but it is glossy and the entire mesosoma is red (unlike the matte *C. herculeanus*, whose anterior mesosoma is black), and its clypeus is not notched.

<<6-3-2-camnov-major-face-N.tif>>

<<6-3-2-camnov-face-minor.tif>>

<<6-3-2-camnov-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Bi-colored. The mesosoma and legs are very red, and the gaster is shiny

(contrast with *C. herculeanus*)

<<dist-b>>B. No erect hairs on the cheeks (both major and minor workers)

<<dist-c>>C. No notch on the clypeus

<<scalebar=13mm>>

<<scalebar=6mm>>

<<spec>>*Camponotus pennsylvanicus* (DeGeer, 1773)

<<common>>*Black or Eastern Carpenter Ant

<<etym>>From *Penn's sylva* (William Penn's woods), its type locality

<<coltab, color="191-1">>Genus *Camponotus*

<<campen-nest.tif>>

<<campen-queen.tif>>

<<campen-map.tif>>

<<hab>>**Habitat:** This widespread ant nests exclusively in rotting wood and is the carpenter ant most commonly encountered in New England's wooden homes. These colonies get into the house through moist areas, and will enter houses alongside pipes and wires. They move in after the wood frame has begun to rot, and so the presence of carpenter ants usually is a good indicator of other structural troubles.

<<geog>>**Geographic Range:** Throughout the Eastern and Midwestern United States and southeastern and central Canada. It is replaced by *C. modoc* west of the Rocky Mountains.

<<nathist>>**Natural History:** Other than The Odorous House Ant (*Tapinoma sessile*), the Eastern Carpenter Ant is probably the most commonly encountered ant in New England. Those black ants emerging from the walls, rafters, or floorboards most likely are *C. pennsylvanicus*. Although the first thought of most homeowners on seeing carpenter ants is to call the exterminator, this will rarely get rid of the ants. That's because the primary nests of *C. pennsylvanicus* are outside, dead wood or decaying tree stumps. The nest in your house is most likely a satellite nest, founded to gain more space, food, or a more hospitable place for the

rearing of brood. The queen will stay outside in the main colony, while the workers will shuttle brood among the satellites. The distance from the central colony to the satellites can be as far as 200 or even 300 meters!

Colonies of *C. pennsylvanicus* can be enormous, with up to 15,000 workers. The workers forage mostly at night, and the colonies can live for decades. During the winter, *C. pennsylvanicus* workers will stop foraging and seal themselves into the nest. The overwintering workers, as well as the queen, store fat in their bodies that they use to keep themselves alive during the winter. They may lose almost half of these fat reserves simply surviving the New England winter. They also fill themselves with glycerol, an anti-freeze-like substance that prevents ice crystals from forming in their bodies. The freezing point of a glycerol-filled carpenter ant can be as low as -22 °C, colder than even the coldest winter night in New England. No wonder these ants are so successful!

<<look>>**Look-alike species:** This large black species, with its long erect and appressed golden hairs, is unique. Small minors of *C. pennsylvanica* can be confused with *C. nearcticus*, but *C. pennsylvanicus* has no notch on its clypeus.

<<6-3-2-campen-face-major.tif>>

<<6-3-2-campen-face-minor.tif>>

<<6-3-2-campen-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A large (often > 6 mm) black ant

<<dist-b>>B. Long erect and appressed golden hairs on the gaster

<<dist-c>>C. No notch on the clypeus

<<scalebar=13mm>>

<<scalebar=6mm>>

<<spec>>*Camponotus subbarbatus* Emery, 1893

<<common>>The Slightly Bearded Carpenter Ant

<<etym>>From the Latin *sub*, meaning weakly or slightly + *barbatus*, meaning bearded, and referring to the sparse hairs below its head.

<<coltab, color="191-1">>Genus *Camponotus*

<<camsub-worker.tif>>

<<camsub-nest-AW.tif>>

<<camsub-map.tif>>

<<hab>>**Habitat:** This small ant nests in small fallen logs, dead branches, and twigs on or just above the ground.

<<geog>>**Geographic Range:** Eastern United States from New York south to Georgia and west into Ohio, Kentucky, and Tennessee. We know of no New England records of this species, but we have collected it in New York from Long Island and at Black Rock Forest along the west side of the Hudson River. It may already be lurking in New England somewhere!

<<nathist>>**Natural History:** This omnivorous scavenger collects honeydew from aphids feeding on maple-leaf viburnum (*Viburnum acerifolium*). It also will collect nectar and pollen from goldenrods (*Solidago*) and Black Cohosh (*Cimicifuga racemosa*).

<<look>>**Look-alike species:** No other carpenter ant in New England has the purple-striped gaster of *C. subbarbatus*.

<<6-3-2-camsub-major-face-N.tif>>

<<6-3-2-camsub-face-minor.tif>>

<<6-3-2-camsub-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Purple striping on the gaster

<<dist-b>>B. Erect hairs present on the cheeks (of both major and minor workers)

<<dist-c>>C. Notched clypeus (most easily seen on minor workers)

<<scalebar=7.5mm>>

<<scalebar=4.5mm>>

<<coltab, color="191-2">>Genus *Formica*

<<txa>>*Formica* Linnaeus, 1758 – The Ant (from the Latin *formica*, meaning an ant)

<<5-2-forsub1-genbod.tif>>

Formica is principally a genus of temperate and boreal regions, and it is the most diverse ant genus in New England. Of the nearly 350 described species of *Formica*, at least 100 can be found in North America, and nearly a third of these have been recorded from New England. Most ants in the genus *Formica* are large (> 4 mm long), and they have a clear separation between their pronotum and mesonotum that gives them a distinctive profile. This “lumpy” back makes it easy to distinguish *Formica* workers from *Camponotus* workers (which have a smooth, convex profile) in the field. A range of parasitic behaviors, including temporary social parasitism,inquilinism, slave-making, and tending of scale insects and aphids, has evolved in different *Formica* species, making them fascinating study subjects for understanding the evolution of behavior in ants. Several species make large and conspicuous mounds in woodlands, forest edges, tree-fall gaps, and open fields. When they occur in large numbers, these mound-builders can function as important ecosystem engineers that move nutrients through the soil and change the structure and composition of the surrounding vegetation.

<<txb>>Identifying the Species of *Formica*

The 31 New England species of *Formica* have been placed by taxonomists into seven groups on the basis of distinctive colors, forms, and behavioral characteristics that can be seen easily in the field. The seven groups are distinguished by the shape of the head (prominently

concave on top or not) and the clypeus (with or without a distinct concavity or notch on its anterior margin); color (whether or not the color of the head and mesosoma are the same as the color of the gaster); and whether or not the ant has a conspicuous silver sheen over most of its body. However, you will usually need a dissecting microscope to differentiate the species within each group.

The *exsecta* group – The two New England species in this group are *F. exsectoides* and *F. ulkei*. The heads of both species have a distinctive concave top (posterior) margin, but *F. exsectoides* is virtually hairless, whereas *F. ulkei* has many hairs on its body. The head and mesosoma of *F. exsectoides* are yellowish-red, light red or medium-red, whereas the head of *F. ulkei* is dark brown or black on top, grading to red below. Both species are temporary social parasites of ants in the *Formica fusca* group: *Formica exsectoides* usually takes over nests of *F. subsericea*, and *F. ulkei* usually takes over nests of *F. glacialis*.

In temporary social parasitism, a founding queen of the parasite enters the host colony, replaces the original queen, and uses the host's workers to rear her own brood. As the host's workers age and die, the colony eventually becomes populated entirely by the parasite queen's worker offspring. These offspring then behave as normal workers, rearing the queen's brood, caring for their sisters, foraging for food, and defending the nest. Although the hosts' nests are often small mounds, once the parasites have moved in, the mounds can be greatly enlarged. *Formica exsectoides* is found sporadically in open shrublands, open woodlands, and meadows throughout most of southern New England. In contrast, *F. ulkei* is a prairie species with only a handful of disjunct occurrences in Downeast Maine.

The *fusca* group – Ants in the *fusca* group are uniquely distinguished by one or two offset teeth at the base of the mandibles (the part of the mandible closest to the head). Six of the seven New England species in the *fusca* group are uniformly black or dark brown ants; the seventh, *F. neorufibarbis*, has a black head and gaster, but a reddish mesosoma. All seven species have a pronounced silvery sheen on top of their base black or brown color that is due to the numerous flattened (appressed) silver hairs on much of their head, body and legs. In the older literature, these species were placed in the subgenus *Serviformica*. The New England species of the *fusca* group are further subdivided into three species complexes: *neorufibarbis*, *fusca*, and *subserica*.

<<6-3-3-forfus-matrix.eps>>

This matrix key illustrates the morphological characters that can be used to separate species in the *fusca* group. Each species is shown in profile; size is shown approximately six times that of an average worker. The species are ordered by size.

The *neorufibarbis* complex is the smallest of the group and includes *F. neorufibarbis* and *F. hewitti*. Both of these ants have coarse pits (punctures) on their cheek that can be seen only at 25 – 50× magnification. *Formica hewitti* is a boreal, hairy, dark-brown to black species, whereas *F. neorufibarbis* is a widespread, bi-colored species with a black head and gaster, and dark red mesosoma.

We have only one member of the *fusca* complex (yes, it has the same name as the group!) in New England – *F. subaenescens*. This species has fewer than 10 erect hairs on the first tergite of the gaster, a dark brown-to-black body, and silver pubescence restricted to the head,

promesonotum, and most prominently on the first gastral tergite of the gaster. The silver hairs may be visible, but are always sparse, on the 2nd and 3rd tergites.

The remaining four species are placed in the *subsericea* complex and are distinguished by the distribution of silver pubescence on their body, the length of the antennal scape relative to the length of the head, and their geographic distribution. *Formica argentea* is a brown ant that has dense silvery pubescence on its head and all four of its gastral tergites, but virtually no silver on its brown legs. The other three species are black ants that make mound nests. *Formica subsericea* has antennal scapes that are longer than the length of its head, and silvery pubescence on its head, mesosoma, all its legs, and on the first three segments of its gaster. *Formica glacialis* is a boreal, cold-climate species that has antennal scapes that are shorter than the length of its head, silvery pubescence on its head, mesosoma, and the first two gastral tergites, and usually no (but sometimes one or two small) erect hairs on its promesonotum. Like *F. glacialis*, *F. podzolica* has short scapes. But in contrast to *F. glacialis*, the silvery pubescence of *F. podzolica* extends onto the third segment of its gaster and it usually has erect hairs on its promesonotum. *Formica podzolica* also ranges further south than *F. glacialis*. In addition to the morphological characters, these species use different materials for their nests: *F. argentea* and *F. podzolica* favor sandy soils, *F. glacialis* and *F. subsericea* favor mineral soil with higher clay content, and the remainder use dead wood along with soil to make their nests.

The *neogagates* group – The two New England species in this group are *F. neogagates* and *F. lasioides*. Both are uniformly brown, shiny, widespread ants that are distinguishable by habitat – *F. neogagates* is a forest-dweller whereas *F. lasioides* nests in open fields – and by the presence (in *F. lasioides*) or absence (in *F. neogagates*) of small, erect, white hairs on the

antennal scape. In the field, they can be distinguished from *fusca*-group ants by their sheen: *neogagates*-group ants lack appressed silver hairs and appear shiny brown, but *fusca*-group ants with their appressed hairs glisten silvery in the sunlight.

The *pallidefulva* group – The three New England species in this group are *F. dolosa*, *F. incerta*, and *F. pallidefulva*. All three are large, yellowish-red to dark brown ants that nest in open or disturbed habitats such as grasslands, heathlands, and old-fields. They forage during the day, and make small-to-moderate sized colonies (up to several thousand workers) with one or a few queens. The top (posterior margin) of the head of ants in the *pallidefulva* group, when viewed in full-face view is noticeably rounded. They also have very long legs. In the older literature, ants in this group were placed in the subgenus *Neoformica*.

<<6-3-3-forpal-matrix.eps>>

This matrix key illustrates the morphological and habitat characters that can be used to quickly distinguish our *pallidefulva*-group species. Each species is shown in profile; size shown is approximately five times the size of a major worker. *Formica dolosa* is the largest and lightest in color of the three; it is distinguished by the dense brush of short hairs on top of its propodeum and the dense, long hairs on its promesonotum and its gaster. *Formica pallidefulva* is the most geographically widespread of the three; its promesonotum is virtually hairless and the hairs on its gaster are short and sparse. In New England, *F. pallidefulva* tends to be light brown in color, whereas it may be lighter in color further south. It is the only one of the three *pallidefulva* group species that commonly ranges into woodlands. Finally, the body of *F. incerta* is generally red in

color, and darker toward the tip of the gaster; it may appear distinctly bi-colored. The hairs on the promesonotum of *F. incerta* are short; it has dense, but short hairs on its gaster; and it has fewer hairs on its propodeum than *F. dolosa*. Like *F. dolosa*, it is generally found in open habitats. A fourth species in this group, *F. biophilica*, is neither pictured in the matrix nor detailed below. It is intermediate in hairiness between *F. dolosa* and *F. incerta*, but the hairs are curved and tapering (as opposed to short and blunt in *F. incerta*). *Formica biophilica* has been recorded only as far north as Long Island, New York. As the climate warms, you may find this species in southern New England.

The *rufa* and *microgyna* groups – Workers of these bi-colored ants have red heads and mesosomas and dark gasters, and like species in the *exsecta* group, they are temporary social parasites on other *Formica* species. In Europe, members of the *rufa* group are often referred to as wood ants; the European wood ant *F. rufa* makes large mound nests and it is considered an invasive species in parts of southern Ontario. But both wood ants and *microgyna*-group ants in New England tend to be sparsely distributed and inconspicuous. The two groups are distinguished by the size of their queens relative to the largest workers in the nest: ants in the *rufa* group have queens that are larger than the largest worker, whereas ants in the *microgyna* group have queens that are smaller than the largest worker. If there are hairs on the promesonotum, these hairs are long and tapering in *rufa*-group ants and tend to be shorter and club- or spoon-shaped in *microgyna*-group ants. Unfortunately, however, not all of the *rufa* and *microgyna* species have hairs, so this character is only useful some of the time. Similarly, in most cases, the heads of *rufa*-group ants are wider than they are long, and the heads of *microgyna*-group ants are longer than they are wide, but there can be substantial variability in this character,

and it is not, by itself, a dependable character with which to separate the two groups. It is currently thought that the *microgyna* group evolved from a *rufa*-group ancestor, but ongoing systematic work will likely rearrange our current placement of these two groups on the *Formica* evolutionary tree.

<<6-3-3-forruf-matrix.eps>>

This matrix key illustrates morphological characters that can be used to distinguish among the New England species of the *rufa* group. Ants are ordered by size, and are drawn approximately five times life-size. The two smallest species have unique hairs: *F. knighti* has a few erect hairs protruding from between the facets of its compound eyes (best seen at 25 – 50× magnification), and short, copper-colored hairs on its mesosoma, tibiae, and gaster, which also has dense gray to silvery pubescence. It often has a splash of yellow on the front of its gaster, just behind the petiole. *Formica reflexa* has hairs on its gaster that bend downward at the tips, forming little loops. The four remaining species in the *rufa* group are distinguished by hairiness, the shape of their clypeus, and their petiole. *Formica obscuriventris* is hairy all over, and has erect hairs all on all sides of its rear tibiae. *Formica dakotensis* is much less hairy than *F. obscuriventris*: it has hairs on its pronotum and gaster, but not on its mesonotum, and has erect hairs only in two rows along the inner surfaces of its middle and rear tibiae. *Formica dakotensis* also has a unique, square-sided petiole (viewed from the back). Finally, *Formica integra* and *F. cf. fossiceps* are shiny, virtually hairless ants that have erect hairs only in two rows along the inner surfaces of their middle and rear tibiae. But *F. integra* has an evenly-curved clypeus, whereas the sides of the clypeus of *F. cf. fossiceps* are pinched in on either side.

Both the workers and the queens of *microgyna*-group *Formica* species can be distinguished by their colors, hairs, and characteristics of their faces and tibiae. Even though workers are collected more frequently than queens, characteristics of queens often are more useful than characteristics of workers. Thus, we present matrix keys for both workers and queens of ants in the *microgyna* group. Note, however, that *F. morsei* is known from only a single collection of three workers and *F. dirksi* is known from only a single queen.

<<6-3-3-formic-worker-matrix.eps>>

This matrix key illustrates differences among *microgyna*-group workers. The ants are illustrated approximately five times life-size and are ordered by size from largest to smallest. Most of these bi-colored ants have red heads, red mesosomas, and black gasters, but the head and mesosoma of *F. nepticula* is a dark burgundy whereas the head and mesosoma of the type-specimen of *F. morsei* has faded over time to more yellow-red than red; we cannot be sure about the true colors of *F. morsei*. The most common *microgyna*-group ant collected in New England is *F. querquetulana*. The body of workers of this ant has a handful of sparse, erect hairs, and it has only two rows of erect hairs on the inner surface of its rear tibiae. Most notably, however, *F. querquetulana* lacks of hairs on the upper corners of its head, and it is not at all shiny. *Formica morsei* is superficially similar to *F. querquetulana*, but it is unique among the New England *microgyna*-group species in that the top of its head is evenly convex and its head is as wide as it is long (all the rest have heads longer than they are wide) and. This species, however, is known from only a single nest, and we know only the name of the town – South Natick, Massachusetts –

in which it was originally collected. *Formica difficilis* can be mistaken for *F. querquetulana*, but *F. difficilis* is distinguished by the erect hairs on the upper corners of its head and its head is a little shinier than its mesosoma. Likewise, *F. nepticula* has hairs on the upper corners of its head, but it also has erect hairs on all surfaces of its rear tibiae, whereas *F. difficilis*, like *F. querquetulana*, has erect hairs only in two rows on the inner surface of its hind tibiae. Finally, *F. impexa*, like *F. nepticula*, has many erect hairs on all surfaces of its hind tibiae. But *F. impexa* is a very hairy ant, with many erect hairs all over its body and around the top of its head.

<<6-3-3-formic-queen-matrix.eps>>

This matrix key illustrates differences among *microgyna*-group queens. These queens are drawn five times life size; they are generally 5 – 25% *smaller* than their corresponding workers. The queens of *F. impexa* and *F. nepticula*, along with *F. dirksi* (which is known from only a single queen collected in 1946 in Daigle, Maine), have many erect hairs on all surfaces of their hind tibiae. In contrast, queens of *F. difficilis* and *F. querquetulana* have only two rows of erect hairs on the inner surfaces of their hind tibiae. Likewise, the hairs on the upper corners of the head help to distinguish among the species. *Formica querquetulana* has none, *F. difficilis*, *F. nepticula*, and *F. dirksi* have sharp, erect hairs on the corners, but the hairs on the corners of the head of *F. impexa* are flattened horizontally. The colors of the queens are often different from those of the workers, however. *Formica difficilis* queens are uniformly yellow, *F. impexa* and *F. querquetulana* queens are bi-colored with yellow heads, yellow mesosomas, and brown gasters, *F. dirksi* queens are bi-colored with red heads and mesosomas and dark brown gasters, and *F. nepticula* queens, while variable in color, is most often uniformly brown.

The *sanguinea* group – The five New England species in this group are *F. aserva*, *F. subintegra*, *F. rubicunda*, *F. creightoni*, and *F. pergandei*. In older literature, ants in this group were placed in the subgenus *Raptiformica*. All of these slave-making ants have a distinct median concavity or notch in the anterior margin of the clypeus. These species are also bi-colored ants; their heads and mesosomas are red or reddish-orange, and their gasters are dark brown or black. They raid nests of ants in other *Formica* groups, taking brood back to their home nests to be raised as slaves.

<<6-3-3-forsan-matrix.eps>>

This matrix key illustrates three morphological characters and one habitat character that can be used to identify species in the *sanguinea* group. Each species is shown in profile; size shown is approximately four times the size of a large worker, and species are ordered by size from largest to smallest. Colors illustrate both shades and bi-coloration. First, look at the shape of the crest of the petiole, viewed from the front. *Formica aserva* has a broad, evenly rounded, fan-shaped scale, whereas the others have more narrow scales, usually with a small notch or concavity at the crest. *Formica aserva* is more commonly found in forests than the other four species, which are collected more frequently in disturbed or open habitats. Next, look at the mesosoma in profile, noting whether or not there are hairs, their shape and size, and the overall body shape. *Formica aserva* is hairless, *F. subintegra* and *F. rubicunda* have short (< 0.14 mm) bristle-like hairs, and *F. creightoni* and *F. pergandei* have long (> 0.1, usually > 0.2 mm) tapered hairs. *Formica subintegra* and *F. rubicunda* can be distinguished by the shape of their mesosoma

and petiole viewed in profile: *F. subintegra* has a blunt-topped scale and a “saddle-backed” mesosoma, whereas *F. rubicunda* has a sharp-topped scale and a more rounded mesosoma in which the propodeum is much lower than the mesonotum. Both *F. subintegra* and *F. rubicunda* enslave ants in the *fusca* group. Finally, *F. creightoni* and *F. pergandei* can be distinguished by their head shape and the relative lengths of their antennal scapes and head: *F. creightoni* has a long, narrow face and scapes that extend well beyond the corners of the head, whereas *F. pergandei* has a short, wide face and scapes that rarely extend beyond the corners of the head. *Formica pergandei* is widespread in New England, but *F. creightoni* is so far known only from two locations in Massachusetts.

<<txb>>Key to the Species of *Formica*

1a. **Top (posterior margin) of head distinctly concave**; nests are large-sized mounds that can exceed 1 m in diameter (*exsecta* group) 2

<< 6-3-3-forexs-concave.tif>>

1b. **Top (posterior margin) of head not distinctly concave**; nests variable in size.....3

2a (1a). **Ant virtually hairless**; head and mesosoma yellow-red, gaster dark..... *F. exsectoides*

2b. **Ant with many erect hairs**; head dark on top, red below, mesosoma red, gaster black
.....*F. ulkei*

3a (1b). **Clypeus notched**; ant bi-colored (head and mesosoma reddish-orange, gaster dark);
slave-makers (*sanguinea* group) 4

<<6-3-3-forper-notch.tif>>

3b. **Clypeus not notched**; ant may be either concolorous or bi-colored; free-living or
temporary social parasites8

4a (3a). **Few (normally < 6) very short (< 0.06mm) hairs or no erect hairs on dorsum
or gaster**; petiole large (broad), fan-shaped, and lacking erect hairs on its crest; a
northern species found at high elevations in Massachusetts as well as throughout
northern New England*F. aserva*

<<6-3-3-forase-inset-dk.tif>>

4b. **At least 6 hairs > 0.06mm long on dorsum and gaster**; petiole with at least a
shallow notch at the crest and with one or more erect hairs on its crest5

5a (4a). **Erect hairs on the dorsum of the mesosoma and gaster short** (0.06 – 0.14
mm), stiff, and bristle-like, usually flattened and blunt-tipped, or abruptly tapered;
enslaves only ants in the *fusca* group.....6

5b. **Erect hairs on the dorsum long** (0.10 – 0.25 mm), evenly tapering to top;
enslaves ants of many *Formica* groups.....7

6a (5a). **Mesosoma saddle-backed in profile; erect hairs absent on the propodeum**; crest of petiole blunt in profile *F. subintegra*

<<6-3-3-forsub2-saddle.tif>>

6b. **Mesosoma more curvaceous in profile; erect hairs present on the propodeum**; crest of petiole sharp *F. rubicunda*

<<6-3-3-forrub-petiole.tif>>

7a (5b). **Head at least as broad as it is long, and usually broader**; scape shorter than length of the head; erect hairs on the gaster > 0.13 mm long and usually longer; hairs on the second gastral tergites dense and closely packed (separated by a distance less than their own length); enslaves *neogagates*, *pallidefulva*, and *fusca* group ants; widespread throughout New England.....
.....*F. pergandei*

<<6-3-3-forper-face-dk.tif>>

7b. **The head distinctly longer than it is broad**; the antennal scape is longer than the length of the head; erect hairs on the gaster < 0.13 mm long; erect hairs on the second gastral tergite separated by at least 0.1 mm (longer than the lengths

of the hairs themselves); enslaves *neogagates* group ants; a Midwestern species rarely collected in New England *F. creightoni*

<<6-3-3-forcre-face-dk.tif>>

8a (3b). **Ants with distinct silvery appressed hairs (pubescence)** on head, mesosoma, and gaster, and sometimes on legs; mandibles with one or two offset teeth at the base of the mandible (the part of the mandible nearest the head); concolorous (brown-to-black) or bi-colored (black head and gaster, red mesosoma; body surface usually shiny (*fusca* group) 9

8b. **Ants lacking silvery pubescence** on body surfaces; mandibles without offset teeth at the base of the mandible; body color variable; body surface shiny or dull15

9a (8a). **The region of the cheek between the eye and the insertion of the mandible is covered with coarse, elongated punctures** that are widely spaced in the posterior half of the cheek..... (*neorufibarbis* complex) 10

<<6-3-3-forneo2-cheek.tif>>

9b. **Region of the cheek between the eye and the insertion of the mandible without coarse, elongate punctures** 11

10a (9a). **A brownish-black or black ant with a hairy body**; hairs are short on the mesosoma, dorsal margin of the petiole, and dorsum of the gaster

.....*F. hewitti*

10b. **A bi-colored ant** in which the posterior half of the head and the anterior gaster are black, while the front half of the head and the mesosoma are dark red (specimens collected in bogs occasionally concolorous brown or black); hairs lacking (or < 5) on the head, promesonotum, and petiole; widespread in

New England.....*F. neorufibarbis*

11a (9b). **Many fewer than 10 erect hairs (average = 4) on the first gastral tergite** (*not including* the hairs on the posterior edge of the first segment);

body brown-black; silvery pubescence apparent on head and mesosoma but absent or faint on gaster and legs

F. subaenescens

<<6-3-3-forsub1-gaster.tif>>

11b. **Usually more than 10 erect hairs on the first gastral tergite** (*not including* the numerous hairs on the posterior edge of the first segment); body black or brown-black, silvery pubescence pronounced on most body parts, noticeably on the gaster

(*subsericea* complex) 12

<<6-3-3-forsub3-gaster.tif>>

12a (11b). A **brown ant**; silvery pubescence dense on head, mesosoma, **and all four gastral segments, but usually absent on legs***F. argentea*

<<6-3-3-forarg-gaster.tif>>

12b. **Black or brown-black ant**; silvery pubescence present on legs **and on first three gastral segments**, but sparse to absent on fourth gastral segment13

13a (12b). **The length of the antennal scape is longer than length of head**; pubescence on head, mesosoma, all legs, and on gastral segments 1 – 3 *F. subsericea*

<<6-3-3-forsub3-face-dk.tif>>

13b. **Scapes equal in length or shorter than length of head**; pubescence variable.....14

14a (13b). **Promesonotum usually lacking hairs**; silvery pubescence on segments 1-2, fading on segment 3; boreal, cold climates
.....*F. glacialis*

<<6-3-3-forgla-gaster.tif>>

- 14b. **Promesonotum usually with erect hairs**; silvery pubescence
 prominent on segments 1-3; extends into warmer climates.....
 *F. podzolica*
- 15a (8b). **Brown-to-black concolorous ants**..... (*neogagates* group) 16
- 15b. **Yellow-to-red** concolorous or bi-colored ants (head and mesosoma red or
 yellowish-red, gaster brown to black).....17
- 16a (15a). **Ants of open fields**; at least three white erect hairs on scape
 (not including hairs at the junction of the scape and the funiculus)
 *F. lasioides*
- <<6-3-3-forlas-face-dk.tif>>
- 16b. **Ants of forests**; no (or rarely 1-2) erect hairs on scape; brown,
 smooth, and shiny *F. neogagates*
- 17a (15b). **Large, yellow-to-red, or reddish-brown, mostly concolorous,**
shiny ants; eyes large (eye nearly as long as cheek); top of the head
 strongly rounded; body long and slender (mesosoma nearly 2× as long
 as high)..... (*pallidefulva* group) 18

17b. **Bi-colored, dull-surfaced ants**; eyes smaller (eye usually 30% smaller than cheek); top of head more squared-off; body more compact (mesosoma < 1.8× as long as high).....
 (*rufa* and *microgyna* groups) 20

18a (17a). **Large, hairy ant with a visible brush of many (> 20) long erect hairs on the propodeum**; gaster densely pubescent; crest of petiole rounded (convex) on top; erect hairs on gaster dense and long*F. dolosa*

<<6-3-3-fordol-propodeum.tif>>

18b. **Only a few (much less than 20) short erect hairs on the propodeum**; hairs may be present or absent on mesosoma; shine of the gaster is visible between the pubescence.....19

19a (18b). **At least five hairs on the mesosoma, long, dense hairs on the gaster, and one to several long hairs on the propodeum**; a shiny red or reddish-brown ant with little sculpturing on the mesosoma and gaster; found in open fields, grasslands, and heathlands *F. incerta*

19b. **No (or certainly fewer than five) hairs on the mesosoma, and short sparse hairs on the gaster**; a shiny yellow-brown to

dark-brown ant that is found in open- and closed-canopy
forests *F. pallidefulva*

20a (17b). **The middle and hind tibiae of workers have two rows of
white erect hairs on their inner surfaces**; the head is distinctly
longer than broad; the top (posterior) of the head rounded and
evenly convex; *F. morsei*

20b. **Middle and hind tibiae of workers (and queens) with two or
more rows of black or copper-colored erect hairs** (rarely white);
head proportions vary from broader than long to longer than broad;
posterior head shape rounded to more square 21

21a (20b). **Middle and hind tibiae of workers and queens with
two rows of erect hairs on their inner surface** 22

21b. **Middle and hind tibiae of workers and queens with hairs
on all surfaces** 27

<<6-3-3-forobs-inset-dk.tif>>

22a (21a). **Erect hairs absent on the dorsum of mesosoma
and also absent on the top edge (posterior margin) of
the head** 23

22b. **Erect hairs present at least on the dorsum of the pronotum, often elsewhere on the mesosoma; erect hairs present or absent on the posterior margin of the head.**²⁴

23a (22a). **Median lobe of the clypeus descending abruptly to the clypeal fossae; the sides of the clypeus make an angle with its upper face, giving the clypeus a pinched look.**..... *F. cf. fossiceps*

<<6-3-3-forfos-clypeus.tif>>

23b. **Median lobe of the clypeus descending gradually to the clypeal fossae, giving the clypeus a smooth look...**
..... *F. integra*

<<6-3-3-forint-clypeus.tif>>

24a (22b). **Hairs on gaster erect at base but reflexed at tip, forming little loops;** crest of petiole extremely thick and rounded in profile. *F. reflexa*

<<6-3-3-forref-inset-dk.tif>>

24b. **Hairs on gaster not reflexed;** petiole shape variable ...

.....25

25a (24b). **Petiole, viewed from behind, appears square,
with a nearly flat top and parallel sides**..*F. dakotensis*

<<6-3-3-fordak-inset.tif>>

25b. **Petiole not square, with a convex top and tapered
or curved sides**.....26

26a (25b). **Erect hairs present on the corners of the
head***F. difficilis*

<<6-3-3-fordif-face-hairs.tif>>

26b. **Erect hairs absent on the corners of the head**
.....*F. querquetulana*

27a (21b). **A few erect hairs on the compound eyes** (visible at
25 – 50×) and scapes; **dense, copper-colored hairs on
mesosoma and gaster**, overlaying dense grey to silvery
pubescence; there is often a splotch of yellow color on the
anterior part of the gaster *F. knighti*

<<6-3-3-forkni-face-dk.tif>>

27b. **No hairs on the compound eyes; hairs on body not copper-colored;** no yellow splotches on the gaster.....28

28a (27b). **The hairs on the pronotum are sharp and tapered (thinner at the top than at the bottom);**
queens at least as large as the largest worker; body very
hairy*F. obscuriventris*

<<6-3-3-forruf-inset-hair.tif>>

28b. **Hairs on pronotum blunt, club-like (clavate), or spoon-like (spatulate), wider at the top than at the bottom;** queens smaller than the largest worker29

<<6-3-3-formic-inset-hair.tif>>

29a (28b). **Gaster with very short and sparse pubescence that does not hide the surface sculpturing;** a shiny ant with a dark-red to burgundy-colored head and mesosoma and a black

gaster; workers have many erect hairs on the
antennal scape but queens have at most 3-5 erect
hairs on the scape*F. neptacula*

<<6-3-3-fornep-gaster.tif>>

**29b. Gaster with long and dense pubescence that
hides the surface sculpturing;** a dull-surfaced ant
with red or yellow head and mesosoma and a brown
or black gaster; both workers and queens have many
blunt-tipped erect hairs on the antennal scape30

<<6-3-3-forimp-gaster.tif>>

30a (29b). Mandibles of queen with eight teeth;
worker with many erect hairs all across the top
of the head; queen with flattened/horizontal
erect hairs on the upper corners of the head;
erect hairs on legs whitish or pale yellow
.....*F. impexa*

<<6-3-3-forimp-hairs.tif>>

30b. **Mandibles of queen with seven teeth;** queen

with upright erect hairs on the upper corners of

the head; worker unknown..... *F. dirksi*

<<6-3-3-fordir-hairs.tif>>

<<txb>>Easily Confused Species

Workers of the large *Formica* species with their lumpy profiles are generally unmistakable, but queens, with their large mesonotal muscles and even larger size, have more convex profiles and can be mistaken for *Camponotus* workers or queens. It is also possible to confuse *F. neogagates* with *Prenolepis imparis*. Both are shiny brown ants, but *P. imparis* has a distinctive hourglass-shape to its promesonotum viewed from above and it also lacks ocelli on its head. The only other comparably-sized ants are *Aphaenogaster treatae*, which is distinguishable by its two-segmented pedicel, and *Polyergus lucidus*, which is distinguishable by its toothless, sickle-shaped mandibles.

<<spec>>*Formica argentea* Wheeler, 1902

<<common>>The Silver Ant

<<etym>>From the Latin *argentum*, meaning silver

<<coltab, color="191-2">>Genus *Formica*

<<forarg-habitat.tif>>

<<forarg-worker(1712).tif>>

<<forarg-map.tif>>

<<hab>>**Habitat:** In New England, this ant nests in sandy soils in open habitats.

<<geog>>**Geographic Range:** This species is most abundant in north-central North America, but its range extends west into California and east into Québec. In New England, it has been recorded from Massachusetts north, with highest frequency in Maine.

<<nathist>>**Natural History:** Of the seven similar species in the *fusca* group, *F. argentea* is generally a species of disturbed areas and open habitats.

<<look>>**Look-alike species:** The hairy, very silvery *F. argentea* is most likely to be confused with *F. subsericea*, whose range overlaps that of *F. argentea*. Key differences include the amount of silvery pubescence on the gaster, and the color of the ant's body. The silvery pubescence of *F. argentea* completely covers the first four segments of the gaster, but extends down the legs only to the top of the femur. In contrast, the silvery pubescence of *F. subsericea* covers only the first three segments of the gaster and extends down the legs well onto the tibiae. Alone among the four species of the *subsericea* complex, the body of *F. argentea* is brown, whereas the others, including *F. subsericea*, are black.

<<6-3-3-forarg-face.tif>>

<<6-3-3-forarg-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Silvery pubescence very apparent on four gastral tergites

<<dist-b>>B. No spots on cheeks under the compound eyes

<<dist-c>>C. Body color is brown

<<scalebar=6.6mm>>

<<spec>>*Formica aserva* Forel, 1901

<<common>>The Slaveless Ant

<<etym>>From the combination *a* (Greek) + *serva* (Latin), meaning without slaves

<<coltab, color="191-2">>Genus *Formica*

<<forase-nestsite.tif>>

<<forase-worker.tif>>

<<forase-map.tif>>

<<hab>>**Habitat:** This slave-maker can be found in deep woods, open woods, and open habitats.

It constructs nests in soil, under rotten logs or under rocks.

<<geog>>**Geographic Range:** *Formica aserva* is primarily a northern species. It occurs throughout Canada and New England, and extends its range further south at high elevations in the Appalachian Mountains in the east, and the Rocky Mountains and Cascade Range in the west.

<<nathist>>**Natural History:** This species, like others in the *sanguinea* group, raids nests of free-living ants of many different *Formica* species, carries off the larvae and pupae, and brings them back to work in its nest. Nonetheless, despite its evolutionary relationship with the other slave-makers in the *sanguinea* group, many *F. aserva* nests have no slaves. Its unusual name is explained in the description of the species: Forel wrote [*p*]ourquoi n'y avait-il pas d'esclaves? [why are there no slaves?].

<<look>>**Look-alike species:** This bi-colored species is unique among the *sanguinea* group in being nearly hairless and in having a broad, fan-shaped petiole. It could be confused with *F. subintegra* or *F. rubicunda*, but these latter two species are quite hairy.

<<6-3-3-forase-face.tif>>

<<6-3-3-forase-body.tif>>

<<6-3-3-forase-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The notched clypeus is diagnostic for the *sanguinea* group

<<dist-b>>B. The broad, fan-shaped petiole that is sharp in profile is unique to *F. aserva*

<<dist-c>>C. There are no erect hairs either below the head or on top of the pronotum

<<scalebar=6.4mm>>

<<spec>>*Formica creightoni* Buren, 1968

<<common>>Creighton's Ant

<<etym>>Named in honor of ant taxonomist William S. Creighton

<<coltab, color="191-2">>Genus *Formica*

<<forcre-habitat.tif>>

<<forcre-MCZ001H.tif>>

<<forcre-map.tif>>

<<hab>>**Habitat:** This slave-making ant is found in open fields and occasionally in forests nesting under logs and in soil.

<<geog>>**Geographic Range:** *Formica creightoni* is a Midwestern species that is uncommon in New England, where it has been recorded so far only from Massachusetts.

<<nathist>>**Natural History:** This species makes slaves of workers in the *neogagates* group.

<<look>>**Look-alike species:** This bi-colored species is most often confused with *F. pergandei*, which also has long, tapering hairs on its promesonotum and gaster. The key differences are the length and density of the hairs on the gaster (shorter and sparser in *F. creightoni*, longer and denser in *F. pergandei*), and the shape of the face, which is longer than wide in *F. creightoni* and wider than long in *F. pergandei*.

<<6-3-3-forcre-face.tif>>

<<6-3-3-forcre-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The notched clypeus is diagnostic for the *sanguinea* group; the notch is relatively shallow in *F. creightoni*

<<dist-b>>B. The head of *F. creightoni* is notably longer than it is wide

<<dist-c>>C. The erect hairs on the promesonotum and gaster are long and tapering, but sparse

<<scalebar=6.6mm>>

<<spec>>*Formica dakotensis* Emery, 1893

<<common>>The Dakota Ant

<<etym>>Named for its type locality, Hill City, South Dakota

<<coltab, color="191-2">>Genus *Formica*

<<fordak-habitat.tif>>

<<fordak-MCZ001L.tif>>

<<fordak-map.tif>>

<<hab>>**Habitat:** This is a grassland species that often nests around the roots of plants and covers the nest with plant thatch or debris.

<<geog>>**Geographic Range:** *Formica dakotensis* is a grassland and Great Plains species whose range extends from Nova Scotia west to British Columbia, in the Midwestern states south to Ohio, Indiana, and Iowa, and in the Rocky Mountains south into New Mexico. Although *F. dakotensis* has been collected in nearby Digby, Nova Scotia and in southern Québec, it has not yet been collected in New England. If it nests here, it will most likely be in Maine.

<<nathist>>**Natural History:** *Formica dakotensis* is thought to be an inquiline social parasite of *Formica fusca* and *pallidefulva* group species, but it has been collected only rarely. Although we follow Creighton in placing *F. dakotensis* in the *rufa* group, it has very small queens and clavate or spatulate hairs on its pronotum. These characters suggest that it would be better placed in the *microgyna* group.

<<look>>**Look-alike species:** This species, with its square-top petiole, is unmistakable.

<<6-3-3-fordak-face.tif>>

<<6-3-3-fordak-body.tif>>

<<6-3-3-fordak-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored ant with a yellowish-red or red head and mesosoma, and a dark gaster

<<dist-b>>B. Petiole is flat-topped and square-sided

<<scalebar=6.5mm>>

<<spec>>*Formica difficilis* Emery, 1893

<<common>>The Troublesome Ant

<<etym>>From the Latin *difficilis*, meaning troublesome or causing difficulty (*i.e.*, in identification)

<<coltab, color="191-2">>Genus *Formica*

<<fordif-MCZ00-1L.tif>>

<<fordif-Q-MCZ-L1_6.tif>>

<<fordif-map.tif>>

<<hab>>**Habitat:** This ant makes cryptic nests lightly thatched with plant debris in soil or under dead wood or trash.

<<geog>>**Geographic Range:** *Formica difficilis* occurs in dry old fields and open woodlands from Massachusetts south to Georgia and west to Iowa.

<<nathist>>**Natural History:** This species collects honeydew from aphids and scale insects, and fat-rich elaiosomes from the seeds of sedges (*Carex* spp.). It is a temporary social parasite of species in the *Formica pallidefulva* group, and also establishes new colonies by fission – splitting one colony into two.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. Its name reflects the challenges of separating the ants in these two groups. It is distinguished from *F. querquetulana* by the presence of erect hairs on the corners of its head (*F. querquetulana* has none). It also has only two rows of erect hairs on the inner surfaces of its middle and hind tibiae (*F. obscuriventris*, *F. impexa*, and *F. nepticula* each have many scattered

hairs on their tibiae). Note also that the queens of *F. difficilis* are small (about the size of a large worker), and uniformly yellow, unlike the bi-colored (red-red-black) workers.

<<6-3-3-fordif-face-worker.tif>>

<<6-3-3-fordif-face-queen.tif>>

<<6-3-3-fordif-body-worker.tif>>

<<6-3-3-fordif-body-queen.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored, ant with few-to-many scattered hairs on its promesonotum

<<dist-b>>B. Clearly visible hairs on the corners of the face

<<dist-b>>C. Queens are yellow, whereas workers are bi-colored

<<scalebar=5.5mm>>

<<scalebar=4.5mm>>

<<spec>>**Formica dirksi** Wing, 1949

<<common>>Dirks' Ant

<<etym>>Named for University of Maine Entomology Professor C. O. Dirks

<<coltab, color="191-2">>Genus *Formica*

<<fordir-habitat.tif>>

<<fordir-map.tif>>

<<hab>>**Habitat:** The only record of this species collected so far was from the edge of a small clearing in a coniferous forest. The nest was under loose bark and in the wood of a decayed and drying tree stump.

<<geog>>**Geographic Range:** *Formica dirksi* was described from a single queen collected in Daigle, between Fort Kent and Presque Isle, Maine in 1946. It has not been collected since then.

<<nathist>>**Natural History:** The type specimen was collected from within a colony of *Formica subaenescens*. It is thought that *F. dirksi* is a temporary social parasite on *F. subaenescens*.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. The queen is distinguished from the morphologically similar *F. impexa* by having only 7 teeth on the mandible. The erect hairs on the corners of the head point upwards, whereas they are flattened horizontally on the head of queens of *F. impexa*. No workers have ever been collected.

<<6-3-3-fordir-face-queen.tif>>

<<6-3-3-fordif-body-queen.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored ant with many hairs all over its body

<<dist-b>>B. Clearly visible erect hairs on the corners of its head

<<scalebar=5.1mm>>

<<spec>>*Formica dolosa* Buren, 1944

<<common>>The Sly Ant

<<etym>>From the Latin *dolusus*, meaning cunning or sly, perhaps referring to the rapidity with which it escapes when disturbed

<<coltab, color="191-2">>Genus *Formica*

<<fordol-nest.tif>>

<<fordol-worker.tif>>

<<fordol-map.tif>>

<<hab>>**Habitat:** This ant can be very abundant in pine barrens, open fields, and open woodlands that are underlain by poor, well-drained, acidic soils.

<<geog>>**Geographic Range:** *Formica dolosa* is a warm-climate species, ranging from southern New England west to Wisconsin and south to Florida and Texas.

<<nathist>>**Natural History:** Little is known of the natural history of this species, which was only recently distinguished from *F. incerta*. It is enslaved by *Polyergus* cf. *longicornis*.

<<look>>**Look-alike species:** This large species is most often confused with *F. incerta*. The key differences are the dense hairs on top of its propodeum, the thick pubescence on its gaster, and its very large size: *F. dolosa* is the largest *Formica* in New England.

<<6-3-3-fordol-face.tif>>

<<6-3-3-fordol-body.tif>>

<<dist>>Distinguishing features:

<<dist-a>>A. The top of the propodeum appears rounded in profile

<<dist-b>>B. There is a pronounced brush of dense erect hairs on the propodeum

<<dist-c>>C. The erect hairs on the promesonotum and gaster are relatively long, tapering, and dense

<<scalebar=7mm>>

<<spec>>*Formica exsectoides* Forel, 1886

<<common>>*The Allegheny Mound Ant

<<etym>>From the Latin *exsecta*, meaning cut out + the Greek suffix *-oides*, meaning resembling. This species was named for its similarity to the European *Formica exsecta*

<<coltab, color="191-2">>Genus *Formica*

<<forexs-mounds.tif>>

<<forexs-tends.tif>>

<<forexs-map.tif>>

<<hab>>**Habitat:** This temporary social parasite of *Formica subsericea* and other *fusca* group species makes very large mound nests – often up to one meter high and two or more meters in diameter – in open areas and at the edges of woods. However, colony reproduction appears to occur primarily by budding; the many mounds in a field usually represent multiple nests of a single colony. Parasitic founding of new colonies by dispersing queens is comparatively rare.

<<geog>>**Geographic Range:** *Formica exsectoides* ranges from Nova Scotia and Ontario south to Georgia and west to Colorado and New Mexico. It is found throughout New England.

<<nathist>>**Natural History:** *Formica exsectoides* is well-known for its polydomous (“many-house”) colonies that can consist of dozens of large-sized mounds. The workers are aggressive predators that also tend a wide variety of aphids, scale insects, and treehoppers for their honeydew, and collect plant sap and nectar. Its large mound nests are home to various beetles, flies, and larvae of Edward’s Hairstreak butterfly (*Satyrrium edwardsii*), which, like some other “blues” (butterflies in the family Lycaenidae), have caterpillars that live in ant nests. The ants

protect the caterpillars from predators, and the caterpillars feed the ants with a sugar-rich fluid that they secrete through a special nectary organ near the end of their back. Larvae of the predaceous syrphid fly, *Microdon abstrusus*, are found in the top of *F. exsectoides* mounds; these fly larvae eat the ant's brood. Adult flies emerge and mate just outside the nest mounds.

<<look>>**Look-alike species:** This aggressive, bi-colored species may be initially confused with any of the *sanguinea* group species, but the top of its head is distinctly concave and its mound nests are unmistakable. Its European congener, *F. exsecta*, is named for its strongly concave head and its heart-shaped, deeply cleft petiole. Our *F. exsectoides* has a less (but still noticeably) concave head and a more shallowly cleft petiole.

<<6-3-3-forexs-face.tif>>

<<6-3-3-forexs-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The concave top of the head is distinctive for the *Formica exsecta* group

<<dist-b>>B. Erect hairs on the body are limited to the back end of the gaster

<<dist-c>>C. The ant is bi-colored, with a red-to-yellow head and mesosoma and a dark gaster

<<scalebar=6.75mm>>

<<spec>>*Formica glacialis* Wheeler, 1908

<<common>>The Icy Ant

<<etym>>From the Latin *glacies*, meaning ice, and referring to its life in boreal regions

<<coltab, color="191-2">>Genus *Formica*

<<forgla-nest.tif>>

<<forgla-workers.tif>>

<<forgla-map.tif>>

<<hab>>**Habitat:** This boreal ant makes small mound nests out of soil. The nests are often covered with living grass or other herbaceous vegetation.

<<geog>>**Geographic Range:** This species can be found in the formerly glaciated regions between 40° and 50° North latitude, from Newfoundland west to Saskatchewan. In New England, it has been collected most commonly in northern New Hampshire and Maine.

<<nathist>>**Natural History:** *Formica glacialis* is a species of open fields and early successional shrublands. The temporary social parasite *F. ulkei* may co-opt its colonies.

<<look>>**Look-alike species:** *Formica glacialis* is often confused with *F. argentea*, *F. podzolica*, *F. subsericea*, and *F. subaenescens*. It is distinguished by its relatively short scapes, silvery pubescence that is densest on the first two segments of its gaster, the lack of hairs on its promesonotum, its boreal habitat, and its small grass-covered mound nests.

<<6-3-3-forgla-face.tif>>

<<6-3-3-forgla-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Silvery pubescence is very apparent on the first two gastral tergites

<<dist-b>>B. Antennal scapes are shorter than the length of the head

<<dist-c>>C. Many erect hairs are present on gaster

<<scalebar=5mm>>

<<spec>>*Formica hewitti* Wheeler, 1917

<<common>>Hewitt's Ant

<<etym>>Named for the Canadian entomologist Charles Gordon Hewitt

<<coltab, color="191-2">>Genus *Formica*

<<moosehead-lake-me.tif>>

<<forhew-MCZ001L.tif>>

<<forhew-map.tif>>

<<hab>>**Habitat:** This boreal species nests in soil and under rocks and logs.

<<geog>>**Geographic Range:** This species ranges across Canada, and south into the western United States at high elevations. In New England, it is currently known from a single individual collected at Moosehead Lake in Maine.

<<nathist>>**Natural History:** *Formica hewitti* is a species of boreal coniferous forests. Like other *fusca*-group species, *F. hewitti* is an omnivorous feeder, preying on small insects, scavenging carcasses, and tending aphids and scale insects.

<<look>>**Look-alike species:** *Formica hewitti* can be confused with *F. neorufibarbis*, as they both have pronounced punctures on their cheeks. Hairiness and color are distinctive: the very hairy *F. hewitti* is dark brown, whereas the much less hairy *F. neorufibarbis* is bi-colored, with a dark head and gaster and a red mesosoma.

<<6-3-3-forhew-face.tif>>

<<6-3-3-forhew-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Distinctive punctures on its hairy cheeks

<<dist-b>>B. Silvery pubescence very apparent only on the first gastral tergites

<<dist-c>>C. Many long erect hairs present on entire body

<<scalebar=5.5mm>>

<<spec>>*Formica impexa* Wheeler, 1905

<<common>>The Unkempt Ant

<<etym>>From the Latin *im* (not) + *pexa*, meaning combed, and referring to its overall hairiness

<<coltab, color="191-2">>Genus *Formica*

<<forimp-larva.tif>>

<<forimp-worker.tif>>

<<forimp-map.tif>>

<<hab>>**Habitat:** This ant nests under stones and logs in open coniferous forests underlain by sandy soils.

<<geog>>**Geographic Range:** *Formica impexa* has been collected in Maine, Massachusetts, New York, Québec, Michigan, and Wisconsin.

<<nathist>>**Natural History:** Little is known of this rarely-collected species.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. Its name reflects its overall hairiness. It is most likely to be confused with *F. nepticula*, but *F. impexa* has long erect hairs and pubescence that obscure any underlying surface sculpture. The queen of *F. impexa* has eight teeth on the mandibles (unlike the seven-toothed mandibles of *F. dirksi*), and the hairs on the corners of the head light flat against the surface of the head (unlike the erect hairs on the corners of the head of *F. dirksi*). Note also the whitish or pale yellow erect hairs on its legs that are unique to *F. impexa*.

<<6-3-3-forimp-face-worker.tif>>

<<6-3-3-forimp-face-queen.tif>>

<<6-3-3-forimp-body-worker.tif>>

<<6-3-3-forimp-body-queen.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored ant that has many hairs all over its body

<<dist-b>>B. Clearly visible, flattened hairs are present on the corners of the face

<<dist-b>>C. Eight teeth on the mandibles of the queen

<<scalebar=4.6mm>>

<<scalebar=4mm>>

<<spec>>*Formica incerta* Buren, 1944

<<common>>The Uncertain Ant

<<etym>>From the Latin *incerta*, referring to its uncertain taxonomic status

<<coltab, color="191-2">>Genus *Formica*

<<forinc-nest.tif>>

<<forinc-worker.tif>>

<<forinc-map.tif>>

<<hab>>**Habitat:** This species can be abundant in moist grasslands, old-fields, lawns, gardens, power line rights-of-way, and other open areas with a wide range of soil types.

<<geog>>**Geographic Range:** *Formica incerta* is a temperate-zone species that ranges from southern New England west to Minnesota and Colorado and further south in the Appalachian Mountains.

<<nathist>>**Natural History:** This species is the only one that is enslaved by *Polyergus lucidus*. In New England, *F. incerta* is also enslaved by *F. pergandei*.

<<look>>**Look-alike species:** This large species can be confused with other *pallidefulva* group species because it is intermediate in hairiness and size between *F. dolosa* and *F. pallidefulva*. But *F. incerta* usually has at least some hairs on its promesonotum, whereas *F. pallidefulva* does not.

<<6-3-3-forinc-face.tif>>

<<6-3-3-forinc-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Sparse hairs on the promesonotum

<<dist-b>>B. Only a few short hairs, if there are any hairs at all, on the propodeum

<<dist-c>>C. Common in open habitats with moist, rich soils

<<scalebar=5.7mm>>

<<spec>>*Formica integra* Nylander, 1856

<<common>>The Complete Ant

<<etym>>From the Latin *integra*, referring to its complete (in this case, unnotched) clypeus

<<coltab, color="191-2">>Genus *Formica*

<<forint-nest.tif>>

<<forint-worker.tif>>

<<forint-map.tif>>

<<hab>>**Habitat:** This ant can be found in forest edges, open woodlands, and old-fields, but it is rare in grasslands. It nests in rotten stumps and logs or under rocks, and often piles sand or other debris on top of its nest.

<<geog>>**Geographic Range:** *Formica integra* is an eastern species that ranges from Nova Scotia and Québec south to Mississippi. It occurs throughout New England, and is one of the more commonly collected species in the *rufa* group.

<<nathist>>**Natural History:** This species collects honeydew and also disperses seeds of violets (*Viola* spp.) after eating the protein- and fat-rich elaiosomes that attract it to the seeds. Although it can make large individual colonies, *F. integra* does not form large polydomous populations like *F. exsectoides* or European wood ants in the *rufa* group.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. It is one of only two that are nearly hairless – the other is *F. cf. fossiceps*. The smooth shape of the clypeus distinguishes *F. integra* from *F. cf. fossiceps*.

<<6-3-3-forint-face.tif>>

<<6-3-3-forint-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored, nearly hairless ant

<<dist-b>>B. The middle of the clypeus drops smoothly and evenly to the sides, unlike the pinched clypeus of *F. obscuriventris* and the unnamed species *F. cf. fossiceps*

<<scalebar=6.9mm>>

<<spec>>*Formica knighti* Buren, 1944

<<common>>Knight's Ant

<<etym>>Named for Iowa State College Professor of Entomology, Harry H. Knight

<<coltab, color="191-2">>Genus *Formica*

<<forkni-worker.tif>>

<<forkni-worker2.tif>>

<<forkni-map.tif>>

<<hab>>**Habitat:** In New England, this species nests in pine barrens. It makes cryptic nests out of plant debris under mats of Bearberry (*Arctostaphylos uva-ursi*).

<<geog>>**Geographic Range:** *Formica knighti* is a prairie species that has been collected from sandy pine barrens in Massachusetts.

<<nathist>>**Natural History:** This uncommon species may be a temporary social parasite of *Formica subsericea*, but little is known of its habits. Although it can make very large colonies (>10,000 workers), they are hard to find under the dense, green bearberry mats.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. When Buren described it in 1944, he hypothesized that it was in the *microgyna* group, but its erect hairs are often pointed at the tip, unlike the blunt hairs characteristic of other *microgyna*-group ants. The hairy compound eyes, copper-colored hairs on its body, and the yellow splash on the anterior surface of its gaster make it nearly impossible to misidentify *F. knighti*.

<<6-3-3-forkni-face.tif>>

<<6-3-3-forkni-body.tif>>

<<6-3-3-forkni-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The few erect hairs projecting out from between the facets of its compound eyes are unique among *Formica* species

<<dist-b>>B. The splash of yellow on the anterior face of its gaster is unique

<<dist-c>>C. The erect hairs on its body are copper-colored

<<scalebar=7.5mm>>

<<spec>>*Formica lasioides* Emery, 1893

<<common>>The Fuzzy *Formica*

<<etym>> From the Greek *lasios*, meaning hairy or fuzzy + the Greek suffix *-oides*, meaning resembling. This species was named for its similarity to the European *Lasius niger*.

<<coltab, color="191-2">>Genus *Formica*

<<forlas-nest(1352).tif>>

<<forlas-runs(1374).tif>>

<<forlas-map.tif>>

<<hab>>**Habitat:** This ant is found in open fields. It makes inconspicuous nests in the soil, or under small rocks and grass clumps.

<<geog>>**Geographic Range:** *Formica lasioides* can be found in most of northern North America and Canada. It is widespread in New England.

<<nathist>>**Natural History:** This is one of our most common grassland ant species. It may be enslaved by *Formica pergandei* and *F. creightoni*.

<<look>>**Look-alike species:** This shiny, dark brown species is most often confused with *Formica neogagates*. *Formica lasioides* is a grassland species that always has at least several small, erect, white hairs on its antennal scapes. In contrast, *F. neogagates* is a species of forests that has at most 2 (and usually 0) white hairs on its antennal scapes. It is also possible to confuse either of these two species with *Prenolepis imparis*, but the latter has no ocelli and has a distinctive, hour-glass shaped promesonotum (viewed from above).

<<6-3-3-forlas-face.tif>>

<<6-3-3-forlas-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The presence of at least three erect hairs on the antennal scapes distinguish this species from *F. neogagates*

<<dist-b>>B. The presence of ocelli distinguishes this species from *Prenolepis imparis*

<<scalebar=4.5mm>>

<<spec>>*Formica morsei* Wheeler, 1906

<<common>>Morse's Ant

<<etym>>Named for A. P. Morse, who collected this species

<<coltab, color="191-2">>Genus *Formica*

<<formor-habitat.tif>>

<<formorMCZ001H.tif>>

<<formor-map.tif>>

<<hab>>**Habitat:** The one record of this species collected so far was from “a flourishing colony in South Natick, Massachusetts.” No details of its nest were provided, and the species has not been collected since.

<<geog>>**Geographic Range:** *Formica morsei* so far is known only from a single colony collected in September, in the early 1900s. Its total geographic range is unknown. Look for it in the woods of Massachusetts!

<<nathist>>**Natural History:** No information is available.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. As only the worker is known (no queens have ever been collected), its placement in the *microgyna* group is based on its having blunt hairs. The worker is distinguished by its relatively long, convex, and rounded head, its single row of white hairs on its tibiae, and the short and sparse white pubescence on its body that is most visible on its gaster.

<<6-3-3-formor-face-worker.tif>>

<<6-3-3-formor-body-worker.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Head notably longer (excluding the mandibles) than broad

<<dist-b>>B. Top of the head clearly convex and rounded

<<dist-c>>C. Sparse, white pubescence most visible on the gaster

<<scalebar=4.5mm>>

<<spec>>*Formica neogagates* Viereck, 1903

<<common>>The New World Black Ant

<<etym>> The New World (*neo*) form of *gagates*. The latter from the Greek *gagates*, meaning jet (as in jet black).

<<coltab, color="191-2">>Genus *Formica*

<<forneo1-nestsites.tif>>

<<forneo1-prey.tif>>

<<forneo1-map.tif>>

<<hab>>**Habitat:** In the eastern United States, this ant is found in rich, moist woods. It nests in the soil or under small rocks.

<<geog>>**Geographic Range:** *Formica neogagates* can be found in most of North America and eastern Canada. It is widespread in New England.

<<nathist>>**Natural History:** This is one of our most common woodland ant species. It makes small colonies, generally with < 500 workers. It tends scale insects and aphids for honeydew and has been reported foraging at the extrafloral nectaries of Bigtooth Aspen. *Formica neogagates* may be enslaved by *F. pergandei* and *F. creightoni*.

<<look>>**Look-alike species:** This clear, dark brown, shiny species is most often confused with *Formica lasioides*, its congener in the *neogagates* group. *Formica neogagates* is a woodland species that lacks erect hairs on its antennal scapes. In contrast, *F. lasioides* is a species of open fields that always has several small, erect, white hairs on its antennal scapes. It is also possible to

confuse either of these two species with *Prenolepis imparis*, but the latter has no ocelli and has a distinctive, hour-glass shaped promesonotum (viewed from above).

<<6-3-3-forneo1-face.tif>>

<<6-3-3-forneo1-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. No erect hairs (rarely one or two erect hairs) on the antennal scapes distinguish this species from *F. lasiodes*

<<dist-b>>B. The presence of ocelli distinguishes this species from *Prenolepis imparis*

<<scalebar=4.2mm>>

<<spec>>*Formica neorufibarbis* Emery, 1893

<<common>>The New World Red-bearded Ant

<<etym>>The New World (*neo*) form of *rufibarbis*. The latter from the Latin *rufus* (red) + *barba* (beard, hair), referring to the reddish cheeks that resemble a short, red beard

<<coltab, color="191-2">>Genus *Formica*

<<forneo2-nest.tif>>

<<forneo2-worker.tif>>

<<forneo2-map.tif>>

<<hab>>**Habitat:** This widespread species usually nests in dead wood and under rocks, but it can also be found nesting in *Sphagnum* moss in bogs and other peatlands.

<<geog>>**Geographic Range:** This species ranges across North America, from Alaska south to Arizona and east to Newfoundland. It is widespread in New England.

<<nathist>>**Natural History:** *Formica neorufibarbis* is a species of coniferous forests and bogs. It is one of the most cold-tolerant ants in North America, and can be found up to the edge of the taiga in northern Canada. *Formica neorufibarbis* occasionally is enslaved by *F. aserva*.

<<look>>**Look-alike species:** This species is one of only two bi-colored *Formica* species that have dark heads and gasters and red mesosomas; the other is *F. ulkei*. These two species can be distinguished by the shape of the top of their head: *F. neorufibarbis* has a flat head and *F. ulkei* has a distinctively concave head. *Formica neorufibarbis* is also a free-living ant, whereas *F. ulkei* is a temporary social parasite. Despite its name, *F. neorufibarbis* is not nearly as hairy as *F. hewitti*, the other species in the *neorufibarbis* complex.

<<6-3-3-forneo2-face.tif>>

<<6-3-3-forneo2-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored ant with a dark, flat head, a dark gaster, and a red mesosoma

<<dist-b>>B. Silvery pubescence faint on all its body

<<dist-c>>C. Distinctive punctures on its somewhat hairy cheeks

<<scalebar=4.8mm>>

<<spec>>*Formica nepticula* Wheeler, 1905

<<common>>The Little Ant

<<etym>>From the Latin *nepticula*, the diminutive form of *neptis*, meaning grand-daughter or niece

<<coltab, color="191-2">>Genus *Formica*

<<fornep-habitat.tif>>

<<fornep-MCZ001L.tif>>

<<fornep-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, under wood, and under stones in pine barrens, open woodlands, old-fields, and in power line rights-of-way.

<<geog>>**Geographic Range:** *Formica nepticula* has been collected in Québec, Maine, Massachusetts, Connecticut, Michigan, Illinois, and Iowa.

<<nathist>>**Natural History:** *Formica nepticula* is a temporary social parasite on species in the *fusca* and *neogagates* groups, but there have been no detailed studies of its natural history.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. Its name reflects its slight and sparse pubescence: it is much less hairy than *F. impexa*, and the sparse pubescence of *F. nepticula* exposes the underlying sculpturing on its shiny gaster. The head and mesosoma are a deep burgundy-red, somewhat darker than found in other *rufa* and *microgyna* species. The queens are smaller than the workers, shiny, and usually entirely brown.

<<6-3-3-fornep-face-worker.tif>>

<<6-3-3-fornep-face-queen.tif>>

<<6-3-3-fornep-body-worker.tif>>

<<6-3-3-fornep-body-queen.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored, ant with many hairs all over its body

<<dist-b>>B. The hairs on the gaster are short, exposing the underlying shiny sculpturing

<<dist-b>>C. Many erect hairs on the antennal scapes

<<scalebar=5mm>>

<<scalebar=4.5mm>>

<<spec>>*Formica obscuriventris* Mayr, 1870

<<common>>The Dark-bellied Ant

<<etym>>From the Latin *obscurus* meaning dark + *ventris*, meaning belly

<<coltab, color="191-2">>Genus *Formica*

<<forobs-nest.tif>>

<<forobs-larvae.tif>>

<<forobs-map.tif>>

<<hab>>**Habitat:** This is an aggressive ant that nests under logs, in stumps, under rocks and trash, and in soil in open woodlands and along the edges of woods. The top of its nest is often thatched with plant litter.

<<geog>>**Geographic Range:** *Formica obscuriventris* can be found from Québec and Maine south to Virginia, west to the prairies of North Dakota and Iowa, and into Colorado and Nevada. It is widespread but seldom common in New England.

<<nathist>>**Natural History:** This species can form large colonies (>10,000 workers) and maintains long columns of workers that forage from the nest. It is an omnivore, preying on small insects, scavenging dead insects, and feeding on honeydew secreted by aphids, scales, and treehoppers.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. Like *F. cf. fossiceps*, it has a deeply pinched clypeus and a square head. Like *F. reflexa*, *F. obscuriventris* is hairy all over, but note especially the many rows of erect hairs on all sides of

its hind tibiae (both *F. cf. fossiceps* and *F. reflexa* have only two rows), and erect, not reflexed, hairs on its gaster.

<<6-3-3-forobs-face.tif >>

<<6-3-3-forobs-body.tif>>

<<6-3-3-forobs-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored, hairy ant with a very square head and a pinched clypeus

<<dist-b>>B. The hairs on the gaster are erect and sharp (contrast with *F. reflexa*)

<<dist-c>>C. There are many rows of erect hairs on all sides of the middle and hind tibiae

<<scalebar=6.3mm>>

<<spec>>*Formica pallidefulva* Latreille, 1802

<<common>>The Pale Ant

<<etym>>From the Latin *pallidus* + *fulvus*, meaning pale reddish-yellow

<<coltab, color="191-2">>Genus *Formica*

<<forpal-nest.tif>>

<<forpal-worker.tif>>

<<forpal-map.tif>>

<<hab>>**Habitat:** This ant can be found in forests as well as in open woodlands, fields, and lawns. It nests in a wide range of substrates, including rotten logs, under bark or tree branches, or under clumps of grasses.

<<geog>>**Geographic Range:** *Formica pallidefulva* has the widest range of all of the *pallidefulva*-group species. It occurs throughout the eastern United States, southern Canada, the Great Plains, and low-elevation sites in the western United States. It is widespread in New England.

<<nathist>>**Natural History:** *Formica pallidefulva* is a frequent slave of *F. pergandei* and *Polyergus montivagus*. It gathers honeydew deposited on leaves by aphids and scale insects, but it does not actively tend them. Adults of the scarab beetle *Cremastocheilus castaneus* sometimes live in the nests of *F. pallidefulva* and feed on the ant's brood.

<<look>>**Look-alike species:** This species is most often confused with *F. incerta*, but the mesosoma of *F. pallidefulva* is virtually hairless and it occurs in wooded areas as well as in open fields and lawns. In New England, *F. pallidefulva* is more often light brown than reddish-yellow.

<<6-3-3-forpal-face.tif>>

<<6-3-3-forpal-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. No hairs on the promesonotum or propodeum

<<dist-b>>B. Hairs on the gaster are shorter than those of *F. dolosa*

<<dist-c>>C. Common in forest habitats with moist, rich soils

<<scalebar=6.2mm>>

<<spec>>*Formica pergandei* Emery, 1893

<<common>>Pergande's Ant

<<etym>>Named in honor of ant systematist Theodore Pergande

<<coltab, color="191-2">>Genus *Formica*

<<forper-attacks.tif>>

<<forper-carries.tif>>

<<forper-map.tif>>

<<hab>>**Habitat:** This slave-making ant nests under rotten logs and in well-drained, sandy soils of relatively open habitats.

<<geog>>**Geographic Range:** *Formica pergandei* ranges throughout the northeastern and north central United States and north into Québec. It has been collected throughout New England.

<<nathist>>**Natural History:** This species makes slaves of workers of many *Formica* species. Most of the slaves are in the *F. pallidefulva* group, but in New England it has also been found enslaving *F. subsericea*, *F. querquetulana*, *F. neogagates*, and *F. difficilis*.

<<look>>**Look-alike species:** This bi-colored species is most often confused with *F. creightoni*, which also has long, tapering hairs on its promesonotum and gaster. The key differences are the length (longer in *F. pergandei*) and density (denser in *F. pergandei*) of the hairs on the gaster, and the shape of the face, which is wider than long in *F. pergandei* and longer than wide in *F. creightoni*.

<<6-3-3-forper-face.tif>>

<<6-3-3-forper-body-tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The notched clypeus is diagnostic for the *sanguinea* group; it is relatively deep in *F. pergandei*

<<dist-b>>B. The head of *F. pergandei* is as wide as, or wider, than it is long

<<dist-c>>C. The erect hairs on the promesonotum and gaster are relatively long, tapering, and dense

<<scalebar=6.2mm>>

<<spec>>*Formica podzolica* Francoeur, 1973

<<common>>The Podzol Ant

<<etym>>From the Russian *podzol*, a type of soil

<<coltab, color="191-2">>Genus *Formica*

<< forpod-nest-AF>>

<<forpod-tends(Q1957).tif >>

<<forpod-map.tif>>

<<hab>>**Habitat:** This ant nests in the acidic, infertile podzolic soils of cold evergreen conifer forests of northern North America.

<<geog>>**Geographic Range:** This species ranges across northern North America, from Nova Scotia to Alaska, and across the northern U.S. south into the mountains of Pennsylvania. In New England, it has been recorded only from northern New Hampshire.

<<nathist>>**Natural History:** *Formica podzolica* is one of the northern species of the *fusca* group. It makes large mound nests.

<<look>>**Look-alike species:** *Formica podzolica* is often confused with *F. argentea*, *F. glacialis*, *F. subsericea*, and *F. subaenescens*. It is distinguished by its relatively short scapes, silvery pubescence on the first three segments of its gaster, many long hairs on its promesonotum, and its habitat.

<<6-3-3-forpod-face.tif>>

<<6-3-3-forpod-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Silvery pubescence very apparent on the first three gastral segment

<<dist-b>>B. Antennal scapes shorter than the length of the head

<<scalebar=5mm>>

<<spec>>*Formica querquetulana* Kennedy and Dennis, 1937

<<common>>The Oak-grove Ant

<<etym>>From the Latin *querquetum*, meaning oak forest and referring to its type habitat

<<coltab, color="191-2">>Genus *Formica*

<<forque-nest.tif>>

<<forque-workers.tif>>

<<forque-map.tif>>

<<hab>>**Habitat:** This ant was described from the sandy oak woodlands of Ohio. In New England, this species most commonly nests under leaves, rocks, or other debris in open pine barrens and shrublands with very sandy, dry soils.

<<geog>>**Geographic Range:** *Formica querquetulana* occurs in deciduous forests from New England to the Midwestern states. In New England, it is one of the most commonly collected species in the *microgyna* group, but overall, ants in this group are encountered infrequently.

<<nathist>>**Natural History:** This species is thought to be a temporary social parasite of ants in the *pallidefulva* group. It forms polygynous colonies of 1,000 – 5,000 workers. Queens and males are produced in late June and early July.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. It is most often confused with *F. difficilis*, but *F. querquetulana* lacks erect hairs at the corners of its head.

<<6-3-3-forque-face-worker.tif>>

<<6-3-3-forque-face-queen.tif>>

<<6-3-3-forque-body-worker.tif>>

<<6-3-3-forque-body-queen.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored, ant with scattered, blunt hairs on its promesonotum

<<dist-b>>B. No hairs on the corners of the face

<<dist-b>>C. The head and mesosoma of the queen are yellow

<<scalebar=5.5mm>>

<<scalebar=5.25mm>>

<<spec>>*Formica reflexa* Buren, 1942

<<common>>The Bent-haired Ant

<<etym>>From the Latin *reflexus*, meaning bent or turned back

<<coltab, color="191-2">>Genus *Formica*

<<forref-habitat.tif>>

<<forref- MCZ001L.tif>>

<<forref-map.tif>>

<<hab>>**Habitat:** This social parasite occupies the mound nests of *F. subsericea*. Like *F. cf. fossiceps* and *F. ulkei*, *F. reflexa* in New England is probably restricted to open areas.

<<geog>>**Geographic Range:** *Formica reflexa* was described from the prairies of Minnesota and Iowa. In New England, it has been collected only once, in 2003, from an open field in Maine's Acadia National Park.

<<nathist>>**Natural History:** *Formica reflexa* is thought to be an inquiline social parasite, but not a slave-maker, of *F. subsericea*. Little is known of its basic natural history.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. It is the only one that has strongly reflexed hairs on its gaster that appear like little loops at 25 – 50× magnification. The overtly similar *F. obscuriventris* does not have reflexed hairs, but does have many more erect hairs on its hind tibiae.

<<6-3-3-forref-face.tif >>

<<6-3-3-forref-body.tif>>

<<6-3-3-forref-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored, hairy ant

<<dist-b>>B. The hairs on the gaster are bent and reflexed, making little loops that are visible at

25 – 50× magnification

<<scalebar=5mm>>

<<spec>>*Formica rubicunda* Emery, 1893

<<common>>The Ruddy Slave-making Ant

<<etym>>From the Latin *rubicundus*, meaning ruddy, reddish, or red

<<coltab, color="191-2">>Genus *Formica*

<<forrub-habitat-HF.tif>>

<<forrub-worker.tif>>

<<forrub-map.tif>>

<<hab>>**Habitat:** This slave-making species nests in soil or under rocks in a wide range of relatively open habitats. It occasionally will make small mound nests topped with gravel or other debris.

<<geog>>**Geographic Range:** *Formica rubicunda* ranges from Québec and Ontario south to the Carolinas, and west to Montana and New Mexico. Most records from New England are from the coastal plain, from Downeast Maine to southern Rhode Island.

<<nathist>>**Natural History:** This species makes slaves of workers in the *fusca* group.

<<look>>**Look-alike species:** This bi-colored species is most often confused with *F. subintegra*, which also has short, bristle-like hairs on its promesonotum. Although *F. rubicunda* tends to be larger and darker than *F. subintegra*, the key feature separating these two species is the shape of the mesosoma. It is curved in *F. rubicunda*, but saddle-backed in *F. subintegra*. The petiole of *F. rubicunda* is also sharp in profile, and may be slightly concave just below the crest. *Formica rubicunda* is the largest of our five species in the *sanguinea* group.

<<6-3-3-forrub-face.tif>>

<<6-3-3-forrub-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The notched clypeus is diagnostic for the *sanguinea* group; it is relatively deep in *F. rubicunda*

<<dist-b>>B. The mesosoma of *F. rubicunda* is curved (contrast with *F. subintegra*)

<<dist-c>>C. The erect hairs on the promesonotum and gaster are relatively short and bristly

<<scalebar=7.6mm>>

<<spec>>*Formica subaenescens* Emery, 1893

<<common>>The Light Bronze Ant

<<etym>>From the Latin *sub* (less than, below) + *aenum*, meaning bronze.

<<coltab, color="191-2">>Genus *Formica*

<<forsub1-habitat.tif>>

<<forsub1-worker.tif>>

<<forsub1-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, under rocks, and in dead wood in eastern North America. It is also commonly found nesting in the drier hummocks of *Sphagnum* in bogs and nutrient-poor fens.

<<geog>>**Geographic Range:** This eastern species ranges from Minnesota east to Labrador, and south into Pennsylvania. It has been collected in all of the New England states.

<<nathist>>**Natural History:** In bogs, *F. subaenescens* is a common prey of the pitcher plant *Sarracenia purpurea*. It can be very aggressive when its cryptic *Sphagnum* nests are disturbed.

<<look>>**Look-alike species:** *Formica subaenescens* is often confused with *F. argentea*, *F. glacialis*, *F. podzolica*, and *F. subsericea*. It is distinguished by the few erect hairs on its first gastral tergite, the silvery pubescence that is most pronounced only on the first gastral tergite, and its dark brown color.

<<6-3-3-forsub1-face.tif>>

<<6-3-3-forsub1-body-tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Silvery pubescence most apparent on the first gastral tergite

<<dist-b>>B. Fewer than 10 (mean = 4) erect hairs on the first gastral tergite

<<dist-c>>C. Color is brown to dark-brown

<<scalebar=5mm>>

<<spec>>*Formica subintegra* Wheeler, 1908

<<common>>The Incomplete Ant

<<etym>>From the Latin *sub* (less than, below) + *integra* (complete), and referring to its less than complete (*i.e.*, notched) clypeus

<<coltab, color="191-2">>Genus *Formica*

<<forsub2-attacks.tif>>

<<forsub2-dance.tif>>

<<forsub2-map.tif>>

<<hab>>**Habitat:** This slave-making ant makes low, spreading nests in soil and under rocks in relatively open habitats.

<<geog>>**Geographic Range:** *Formica subintegra* ranges from Newfoundland and Ontario south to the Carolinas and west to the Dakotas and Alberta. It has been collected throughout New England.

<<nathist>>**Natural History:** This species makes slaves of workers from several species in the *fusca* group.

<<look>>**Look-alike species:** This bi-colored species is most often confused with *F. rubicunda*, which also has short, bristle-like hairs on its promesonotum and a black gaster. The key difference is the shape of the mesosoma, which is strongly saddle-backed in *F. subintegra*. The petiole of *F. subintegra* is also blunt in profile. *Formica subintegra* also can be confused with its namesake, *F. integra*, but the latter most notably lacks a notched clypeus.

<<6-3-3-forsub2-face.tif>>

<<6-3-3-forsub2-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The notched clypeus is diagnostic for the *sanguinea* group; it is not as deep as the clypeus of *F. rubicunda*

<<dist-b>>B. The mesosoma of *F. subintegra* is distinctly saddle-backed (contrast with *F. rubicunda*)

<<dist-c>>C. The erect hairs on the promesonotum and gaster are relatively short and bristly

<<scalebar=6mm>>

<<spec>>*Formica subsericea* Say, 1836

<<common>>The Somewhat Silky Ant

<<etym>>From the Latin *sub* (less than, below) + *sericus*, meaning silk.

<<coltab, color="191-2">>Genus *Formica*

<<for3-worker.tif>>

<<for3-male.tif>>

<<for3-map.tif>>

<<hab>>**Habitat:** This ant nests in open deciduous forests, in old-fields, along roadsides, in lawns and gardens, along power lines, and in the pine barrens of eastern North America.

Although the nests are often flat, sloppy disks of excavated soil with many entrances, it can make very large mound nests that easily exceed a cubic meter in volume.

<<geog>>**Geographic Range:** This species ranges from New Brunswick south to Mississippi and west to Montana. It is the most frequently collected *fusca* group species in southern New England.

<<nathist>>**Natural History:** *F. subsericea* often tends treehoppers and collects their honeydew for food. Its nests are taken over by *F. exsectoides*, and it is enslaved by *F. subintegra*, *F. rubicunda*, and *F. pergandei*. It also is parasitized by the syrphid fly *Microdon megalogaster*.

<<look>>**Look-alike species:** *Formica subsericea* is often confused with *F. argentea*, *F. glacialis*, *F. podzolica*, and *F. subaenescens*. It is distinguished by its relatively long scapes, silvery pubescence on the first three segments of its gaster and its legs, and its habitat.

<<6-3-3-forsub3-face.tif>>

<<6-3-3-forsub3-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Antennal scapes longer than the length of the head

<<dist-b>>B. Silvery pubescence very apparent on the first three gastral segments

<<dist-c>>C. Many erect hairs present on promesonotum

<<scalebar=6.5mm>>

<<spec>>*Formica ulkei* Emery, 1893

<<common>>Ulke's Ant

<<etym>>Named for the mineralogist and insect collector Titus Ulke

<<coltab, color="191-2">>Genus *Formica*

<<forulk-nest.tif>>

<<forulk7901-forager.tif>>

<<forulk-map.tif>>

<<hab>>**Habitat:** This social parasite of *Formica glacialis* makes conical mound nests up to 0.5 meter tall, often with thatches of dried grass on top. The colonies often include multiple nests and individual mounds many contain multiple queens.

<<geog>>**Geographic Range:** *Formica ulkei* is a prairie species of the open lands of Nova Scotia, Québec and Manitoba, and the upper Midwestern United States. It, along with several other prairie species (*F. cf. fossiceps*, *F. reflexa*) has been found in open areas of Downeast Maine.

<<nathist>>**Natural History:** This species tends aphids, scale insects, and treehoppers for their honeydew. Its large mound nests are home to the rove beetle *Megastilicus formicarius* (family Staphylinidae), where it scavenges for food.

<<look>>**Look-alike species:** This bi-colored species with its dark head and gaster and red mesosoma can be initially confused with *F. neorufibarbis*, but it is shinier, the top (posterior) margin of its head is distinctly concave, and its mound nests are unmistakable.

<<6-3-3-forulk-face.tif>>

<<6-3-3-forulk-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The concave top-of-the-head is distinctive for the *exsecta* group

<<dist-b>>B. Many erect hairs on the body distinguish this species from *F. exsectoides*

<<dist-c>>C. The ant is bi-colored, with a dark head and gaster and a red mesosoma

<<scalebar=6.1mm>>

<<spec>>An undescribed species of *Formica* that is closely related to *Formica fossiceps*

<<common>>

<<etym>>

<<coltab, color="191-2">>Genus *Formica*

<<forfos-colony-RH.tif>>

<<forfos-worker.tif>>

<<forfos-map.tif>>

<<hab>>**Habitat:** This undescribed species has been found in blueberry barrens and woodland edges. Its namesake, *F. fossiceps*, makes small mound-shaped nests using leaf litter and other plant parts.

<<geog>>**Geographic Range:** *Formica* cf. *fossiceps* has been collected in Downeast Maine and on Prince Edward Island. Its namesake is a prairie species, and like *F. reflexa* and *F. ulkei*, *F.* cf. *fossiceps* in New England is probably restricted to open areas.

<<nathist>>**Natural History:** Unstudied, but like its namesake, it maintains extensive foraging trails.

<<look>>**Look-alike species:** This is one of many bi-colored species in the *rufa* and *microgyna* groups. It is one of two that are nearly hairless – the other is *F. integra*. The pinched clypeus of *F.* cf. *fossiceps* is distinctive, however, and is the origin of *fossiceps* – from the Latin *fossatus* (dug) + the combination form *-ceps*, referring to its head.

<<6-3-3-forfos-face.tif>>

<<6-3-3-forfos-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A bi-colored, nearly hairless ant

<<dist-b>>B. The middle of the clypeus drops steeply to the clypeal fossae and the sides of the clypeus make a sharp angle (contrast with *F. integra*)

<<scalebar=6mm>>

<<coltab, color="191-4">>Genus *Lasius*

<<txa>>*Lasius* Fabricius, 1804 – The Fuzzy Ant (from the Greek *lasios*, meaning woolly or hairy)

<<5-2-lasumb-genbod.tif>>

Ants in the genus *Lasius* are some of the most frequently encountered ants in New England. These small, yellow-to-brown ants are abundant in fields, forests, wetlands, and uplands throughout the temperate regions of the northern hemisphere. Nearly 150 species of *Lasius* have been described, but for almost 150 years after the genus was first proposed by Johann Christian Fabricius in 1804, there was a great deal of controversy – not only over which species belonged in *Lasius* but also whether the name *Lasius* could even be used for this group of ants. The controversy arose because three years earlier (in 1801), Louis Jurine had anonymously published a paper in the German literary journal *Intelligenzblatt der Literatur-Zeitung*, in which he used *Lasius* to refer to a new genus of bees. Five years later, but after Fabricius named a genus of ants *Lasius*, Jurine admitted to having authored the earlier paper. The so-called “Jurinean controversy” – would *Lasius* be ants or bees – was initially moot, because in 1809, Pierre André Latreille placed all ants in the genus *Lasius* within the larger genus *Formica*. But Gustav Mayr re-opened these ancient wounds in 1861 by resuscitating the genus *Lasius*.

The contemporaneous Civil War in the United States only lasted four years, but the Jurinean controversy raged for a much longer time. In 1916, William Morton Wheeler fired this salvo in a short paper in which he attempted to resolve the Jurinean controversy:

"There seems to be no end to the nomenclatorial cataclysms precipitated by men who delight in resuscitating and reëditing musty entomological documents that have been unfortunately spared by the tooth of time to plague those among us who wish to see taxonomy rapidly stabilized so that we may be able to give all our attention to more interesting and important matters"

It took another 23 years until the International Commission on Zoological Nomenclature ruled in favor of the ants (in its 1939 Opinion number 135). Nearly two decades later, and over 150 years after *Lasius* was first described, E. O. Wilson finally provided, in his doctoral dissertation, the foundation for a modern classification of *Lasius* species. All that remained was the question of whether the "citronella ants" belonged in their own genus (*Acanthomyops*) or in *Lasius*. Examination of DNA sequences by Milan Janda and his colleagues in 2004 led to the inescapable conclusion that the citronella ants are *Lasius*, too.

There are now at least 56 species of *Lasius* in North America, 15 of which have been recorded from New England. Two additional species are included in this guide: *L. plumopilosus*, an attractive and unmistakable species recorded so far only as far north as Long Island; and *L. murphyi*, also known from Long Island, which is superficially similar to *L. latipes*. Both are destined to arrive on New England's southern shores.

<<txb>>Identifying the Species of *Lasius*

The New England species of *Lasius* are easily separated into four groups distinguished by the number of segments of the maxillary palps (three in the citronella ants of the *claviger* group and six in the other three groups) and the size of the eye ("large" in the *niger* group, "medium" in

the *umbratus* group, or "small" in the *flavus* group). In earlier taxonomic works, these groups were considered separate subgenera: *Acanthomyops* (now the *claviger* group), *Lasius* (now the *niger* group), *Chthonolasius* (now the *umbratus* group), and *Cautolasius* (now the *flavus* group). Identifying species within each group requires careful attention to microscopic details, especially – and perhaps not surprisingly – characteristics of body hair.

The *claviger* group – This group, in which all the species have three-segmented maxillary palps, can be quickly recognized in the field because the ants are bright yellow-to-orange, and give off a distinctive lemony or citronella odor when they are disturbed. The *claviger*-group species are all warm-temperate species that are more common in Connecticut, Rhode Island, and coastal Massachusetts, New Hampshire, and Maine than in the central and northern interior regions. All of the species of the *claviger* group are believed to be temporary social parasites of other *Lasius* species, but the actual hosts are not all known. Our six species are *L. claviger*, *L. interjectus*, *L. latipes*, *L. murphyi*, *L. plumopilosus*, and *L. subglaber*; a number of hybrid colonies have been found in nature, but whether or not they produce fertile queens remains unknown.

Lasius plumopilosus has unique, feather-tipped hairs on its gaster. The remaining five species are separated on the basis of the shape of the petiole when viewed from the side, and the distribution and length of hairs on the body. Three species, *L. claviger*, *L. interjectus*, and *L. subglaber*, have petioles that are sharply pointed in profile. Of these three, *L. claviger* has long erect hairs all over its gaster, and long hairs on its cheeks and the underside of its head. *Lasius interjectus* has long erect hairs all over the first segment of its gaster, but only has hairs on the edges of the second and third gastral tergites. It also has very few hairs on its cheeks. *Lasius*

subglaber has short hairs on its cheeks and fine, short, and sparse hairs elsewhere on its body. The last two species in the *claviger* group, *Lasius latipes* and *L. murphyi*, have petioles that are blunt and rounded when viewed in profile. *Lasius latipes* has long hairs all over its body and many long hairs on its cheeks and under its head. In contrast, *L. murphyi* has hairs that are densest on its propodeum and has only a few, short hairs on its cheeks.

<<6-3-4-lascla-matrix.epx>>

This matrix key illustrates four morphological characters that can be used to quickly determine which species of the *claviger* group you have. Each species is shown in profile; size shown is approximately 4× the size of a major worker. The principal characteristics to look for on the head in side view are the length and location of hairs on the cheeks and on the underside of the head. Then, determine whether the petiole is sharp and pointer or rounded and blunt in profile. Finally, check the location, density (and in the case of *L. plumopilosus* the featheriness) of the hairs on the gaster. The species are ordered from top to bottom by size.

The *niger* group – Among the *Lasius* species with six-segmented palps, the four species of the *niger* group have the largest eyes: their length (top-to-bottom) is at least as long as 1/5th the width of the head. *Lasius alienus* has no erect hairs on its antennal scapes or its rear tibiae, and in New England it is found mostly in forests. The other three species in this group, *L. neoniger*, *L. pallitarsis*, and *L. cf. niger* all have some erect hairs on their antennal scapes and their rear tibiae. *Lasius pallitarsis* is distinguished by the small, offset tooth on the top of its mandible (closest to the head). In northern New England, *L. pallitarsis* is most frequently

collected in open fields. *Lasius neoniger* has "normal" teeth on its mandibles and in New England is most common in open habitats, including fields and sand dunes. *Lasius* cf. *niger* is the hairiest of them all, and closely resembles the western North American and European *L. niger*. Our first New England record of this species was collected at the seaward edge of a saltmarsh in Falmouth, Massachusetts, in summer 2011, again demonstrating that new discoveries in the New England ant fauna are being made all the time!

The *flavus* group – The two species of the *flavus* group have the smallest eyes of all of our *Lasius* species: not only is the length of the eye much less than $1/6^{\text{th}}$ the width of the head, but there are always fewer than 35 facets (ommatidia) on each compound eye. Unfortunately, the only character that distinguishes *L. flavus* from *L. nearcticus* is the length of the last segment of the maxillary palp relative to the next-to-last segment of the maxillary palp. In *L. flavus*, the last segment of the palp is shorter than (usually) or equal in length (occasionally) to the penultimate segment. In contrast, the last segment of the palp of *L. nearcticus* is always longer than the next-to-last segment. In general, *L. nearcticus* is found in forests, whereas *L. flavus* is found in open and early-successional habitats like grasslands and farm fields, but we have found the two species co-occurring in early- and mid-successional habitats, including old-fields and young woodlands.

<<6-3-4-lasnig-final-matrix.eps>>

This matrix key illustrates four morphological characters and the most common habitat of the six species in the *niger* and *flavus* groups. The profiles are approximately 4× the size of a

major worker, and are ordered by size. The primary characteristics to look for on the head in side view is the size of the eye (length $> 0.2\times$ the width of the head in the *niger* group and length much less than $0.16\times$ the width of the head in the *flavus* group) and the presence or absence of hairs on the antennal scape. The density of hairs on the gaster and the presence or absence of hairs on the hind tibia further separate the species. In general, *L. flavus* and *L. nearcticus* occur in different habitats, but measure the last two segments of the maxillary palps at $50\times$ magnification to be sure.

The *umbratus* group – The last five *Lasius* species are in this group, and have medium-sized eyes: the eye length is approximately $1/6^{\text{th}}$ the width of head and each compound eye always has more than 35 facets. Like the species in the *claviger* group, the species in the *umbratus* group are all social parasites on other *Lasius* species. And once again, the distribution and size of appressed pubescence (flattened hairs) and erect hairs are used to distinguish the species. The rarely collected *Lasius speculiventris* is unique in the group because the second tergite of the gaster is quite shiny: it completely lacks any appressed pubescence, although this tergite may have 3-5 scattered erect hairs. The remaining four species all have both appressed pubescence and many erect hairs on all segments of their gasters. *Lasius minutus* and *L. subumbratus* both have long, erect hairs on the first segment of the gaster. On *L. minutus*, these erect hairs are as long as or longer than the maximum width of the hind tibia (a useful, relative measurement), but this species has no erect hairs on its tibiae. In contrast, the erect hairs on the first segment of the gaster of *L. subumbratus* are between $0.6\times$ and $0.8\times$ as long as the hind tibia is wide, and there are erect hairs on its hind tibiae. The erect hairs on the gaster of *L. umbratus* are short and stubble-like, $< 0.5\times$ as long as the hind tibia is wide, and this species has no erect

hairs on either its antennal scape or its hind tibiae. An as-yet undescribed species, *Lasius* cf. *umbratus* has similarly short and stubble-like erect hairs on its gaster, but it does have erect hairs on both its antennal scape and its hind tibiae. The species in the *umbratus* group can be found in a wide range of habitats. *Lasius speculiventris* has been collected from bogs, fens, and moist woods, and *L. minutus* is most frequently found in bogs and fens. The remaining three species are generally found in lawns, open fields and early-successional forests.

<<6-3-4-lasumb-final-matrix.eps>>

This matrix key illustrates four morphological characters and the most common habitat of the five species in the *umbratus* group. All of these species have similar medium-sized eyes (length ~ 1/6 the width of the head). The profiles are approximately 4× the size of a major worker, and are ordered by size. The primary characteristics to look for on the head in side view are the presence or absence of erect hairs on the antennal scapes and on/under the cheeks. The density of pubescence and the lengths of the erect hairs on the gaster, and the presence or absence of hairs on the hind tibia further separate the species. *Lasius speculiventris* is a moist woods species that also nests in bogs and fens, whereas *L. minutus* is most frequent in bogs. The other three species are less habitat-specific.

<<txb>>Key to the Species of *Lasius*

1a. **The maxillary palps are short and inconspicuous, and with three segments;** these ants give off a very strong lemony/citronella odor when disturbed; the angle between the dorsal (top) and rear (declivity) faces of the propodeum is rounded..... (*claviger* group) 2

<<6-3-4-lascla-palp.tif>>

1b. **Maxillary palps long and conspicuous, and with six segments;** ants do not give off a lemony/citronella odor when disturbed; the angle between the dorsal face of the propodeum and its declivity is sharp7

<<6-3-4-las-6palp.tif>>

2a (1a). The **hairs on the gaster have feathery (plumose) tips** (best viewed obliquely using a dissecting microscope at 50-100× magnification); currently unknown from New England*L. plumopilosus*

<<6-3-4-lasplu-inset.tif>>

2b. **Hairs on gaster have straight tips** without feathered ends3

3a (2b). **The petiole, viewed in profile, is sharp and pointed;** when viewed from the front, the petiole has a shallow-to-sharp depression in its center; cheeks, viewed from the side, with erect hairs sparse, or if dense, limited to the upper (posterior) 2/3 of the cheeks .

.....4

<<6-3-4-lascla-sharp-petiole.tif>>

3b. Petiole, viewed in profile, is rounded and blunt; cheeks, viewed from the side, with erect hairs distributed over the entire surface6

<<6-3-4-laslat-blunt-petiole.tif>>

4a. (3a) The hairs on the body are thin and wispy; the hairs on the cheeks are short *L. subglaber*

<<6-3-4-lasub1-face-dk.tif>>

4b. Hairs on the body are thick and coarse; the hairs on the cheeks are long5

<<6-3-4-lascla-face-dk.tif>>

5a (4b). Erect hairs are present on all surfaces of all segments of the gaster;
hairs on the ventral surface of the head are long *L. claviger*

5b. Erect hairs are present on the entire surface of the first segment of the gaster but are present only on the posterior edges of the second and third segments; few hairs on the ventral surface of the head *L. interjectus*

<<6-3-4-lasint-gaster>>

6a (3b). **The ant is very hairy all over**; there are many long hairs on the cheeks

.....*L. latipes*

6b. **Hairs on the propodeum denser than elsewhere**; hairs on the cheeks are short ...

.....*L. murphyi*

7a (1b). **The ant has large eyes (eye length > 1/5th the width of the head)**; the color of the

ant is golden-brown to dark-brown (*niger* group) 8

<<6-3-4-lasali-face-dk.tif>>

7b. **Eyes smaller (eye length < 1/6th the width of the head)**; nests can be deep

underground; the color is yellow-to-brown 11

<<6-3-4-las-comp-face-dk.tif>>

8a (7a). **The basal tooth of the mandible (*i.e.*, the tooth closest to head) is offset from,**

and smaller than, the others; there are 7 teeth on the mandible, but because the

basal tooth is offset, it may appear that there are only 6; the anterior margin of the

clypeus is broadly curved; erect hairs are present on the scape and tibia; color dark

brown.....*L. pallitarsis*

<<6-3-4-laspal-inset-cly.tif>>

8b. **Basal tooth of the mandible aligned with the rest of the teeth and normal in size;**
there are 7 teeth on the mandible and all are usually visible; the anterior margin of the
clypeus may be broadly curved or sharply angular in the middle9

<<6-3-4-lasneo-inset-dk.tif>>

9a (8b). **There are usually no erect hairs** (if present, always < 10) **on the antennal
scape or tibia**; color dark brown; forested habitats in New England.....*L. alienus*

9b. **There are many erect hairs on the antennal scape** (usually) **and on the tibia**
(always); color golden-brown; found in open habitats10

10a. **With the mandibles fully open and the head positioned in full-face view,**
the anterior margin of the clypeus is sharply angled; the basal 2 – 3 teeth
on the mandible are irregularly spaced and the second tooth is usually much
smaller than the 1st or 3rd tooth*L. neoniger*

<<6-3-4-lasneo-inset-cly.tif>>

10b. **With the mandibles fully open and the head positioned in full-face view,**
the anterior margin of the clypeus is broadly curved; the basal 2 – 3 teeth
on the mandible are regularly spaced and equal in size.....*L. cf. niger*

<<6-3-4-lasnig-inset-cly.tif>>

11a (7b). **Eyes much shorter than $1/6^{\text{th}}$ the width of the head and with < 35 facets**

..... (*flavus* group) 12

<<6-3-4-lasnea-face-dk.tif>>

11b. **Eyes about $1/6^{\text{th}}$ as long as the head is wide and always with > 35 facets; all**

species are temporary social parasites on other species of *Lasius* (*umbratus* group) 13

<<6-3-4-lasumb-face-dk.tif>>

12a (11a). **The terminal segment of the maxillary palp is usually shorter than, but**

never longer than, **the next-to-last segment**; color yellow to dark yellow-brown;

usually in open habitats*L. flavus*

<<6-3-4-lasfla-inset-dk.tif>>

12b. **Terminal segment of the maxillary palp always longer than next-to-last**

segment; color pale-to-medium yellow; usually in forested habitats

.....*L. nearcticus*

<<6-3-4-lasnea-inset-dk.tif>>

13a (11b). **The second gastral segment is shiny and lacks *appressed* pubescence,**
but may have at most a few scattered erect hairs; color dark-yellow to medium-
brown; occurs in bogs, fens, and moist woods..... *L. speculiventris*

<<6-3-4-lasspe-gaster>>

13b. **Second gastral segment dull, with both appressed pubescence and many**
erect hairs14

14a (13b). **The longest hairs of the first gastral segment are short and stubble-**
like: < ½ the width of the hind tibia at its midpoint15

<<6-3-4-lasumb-gaster.tif>>

14b. **Longest hairs of the first gastral segment are long (> 2/3 the width of the**
hind tibia); found in moist, disturbed, and early successional habitats16

15a (14a). **The petiole viewed from front (or rear) is concave on top; no**
erect hairs are present on the scape or tibia..... *L. umbratus*

15b. **Petiole viewed from front (or rear) is convex on top; erect hairs**
present on the scape and hind tibia..... *L. cf. umbratus*

<<6-3-4-lasumblabsub2-inset.tif>>

- 16a (14b). **The hairs on the gaster are between 2/3rd and 4/5th the maximum width of the hind tibia;** there are some erect hairs present on the tibia; petiole viewed from front or rear evenly convex at top; color is clear yellow*L. subumbratus*
- 16b. **Hairs on the gaster as long or longer than the maximum width of the hind tibia;** no erect hairs present on the tibia; color is brownish-yellow; open habitats, especially bogs, fens, and sedge meadows.....
.....*L. minutus*

<<6-3-4-lasmin-gaster>>

<<txb>>Easily Confused Species

Lasius species can be mistaken for the similarly-sized, -shaped, and -colored *Tapinoma*, *Brachymyrmex*, or *Nylanderia* species. *Lasius* has 12-segmented antennae (*Brachymyrmex* has nine-segmented antennae) and its gaster terminates in an acidopore (*Tapinoma*'s terminates in a horizontal slit). The angular profile of the mesosoma of *Lasius*, along with its generally dense pubescence and fuzzy appearance, distinguish it from *Nylanderia*, which has a lumpy, rounded mesosoma and paired, erect, black hairs.

<<spec>> *Lasius alienus* (Foerster, 1850)

<<common>>*The Cornfield Ant

<<etym>>From the Latin *alienus*, belonging to another place or person

<<coltab, color="191-4">>Genus *Lasius*

<<lasali-nests.tif>>

<<lasali-larva2.tif>>

<<lasali-map.tif>>

<<hab>>**Habitat:** In North America, this commonly collected and widespread ant usually is found in forests and occasionally in bogs and other wetlands. It makes nests in soil, in and under rotten logs and stumps, and sometimes in deep leaf litter. However, in Europe, it is most common in agricultural fields, hence its official common name, The Cornfield Ant. With further study, however, the North American and European “*Lasius alienus*” may turn out to be different species.

<<geog>>**Geographic Range:** This species as currently understood has a Holarctic distribution: it occurs throughout the Northern Hemisphere. In North America, it nests from southern British Columbia west to Nova Scotia, south to northern Florida and in the mountains of the southwestern United States and Mexico. It also occurs throughout Europe and Asia, from the British Isles and Scandinavia south to Morocco and Tunisia, east into Lebanon, northern Iraq, and southern China, and north into Russia, Central Asia, China, and Japan.

<<nathist>>**Natural History:** This omnivorous species collects elaiosomes from seeds, live insects and carcasses of dead ones, and tends a wide variety of aphids, scales, and treehoppers,

and coccids that feed on plant roots. The colonies can be very large and have many queens, but individual queens disperse and found colonies independently.

<<look>>**Look-alike species:** The large-eyed *Lasius alienus* can be confused with either of the other three species in the *niger* group: *L. pallitarsis*, *L. neoniger*, or *L. cf. niger*. The key feature is that *L. alienus* lacks erect hairs on its scape and hind tibiae, and is more common in forested habitats. The other three species all have erect hairs on their scapes and hind tibiae, and are more common in open habitats.

<<6-3-4-lasali-face.tif>>

<<6-3-4-lasali-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The pyramid-shaped propodeum is characteristic of most species of *Lasius*

<<dist-b>>B. The relatively large eye is characteristic of the *niger* group

<<dist-c>>C. The lack of erect hairs on the antennal scape distinguish *L. alienus* from *L. neoniger*, *L. pallitarsis*, and *L. cf. niger*

<<scalebar=3mm>>

<<spec>> *Lasius claviger* (Roger, 1862)

<<common>> *The Smaller Yellow Ant

<<etym>> From the Latin *clavis* (club) + *gero* (bear or carry), hence a club-bearer. This refers to its moderately clubbed antennal scape and antennal funiculus.

<<coltab, color="191-4">> Genus *Lasius*

<<lascla-column.tif>>

<<lascla-carries.tif>>

<<lascla-map.tif>>

<<hab>> **Habitat:** This subterranean ant nests in soil under stones and in well-decayed tree stumps in young to mature forests.

<<geog>> **Geographic Range:** *Lasius claviger* ranges from southern New England west to Minnesota, south to Kansas and into the Florida panhandle.

<<nathist>> **Natural History:** This species is a temporary social parasite of *L. alienus* and *L. neoniger*. The workers are generalist predators and also feed on honeydew secreted by root-feeding mealy-bugs. The colonies can be enormous and spread over wide areas in the forest. Mating flights occur very late in the season, often in late September or early October. The queens mate and then spend the winter under rocks or wood, emerging in the spring to seek nests of their hosts.

<<look>> **Look-alike species:** All species in the *claviger* group smell like citronella when disturbed or crushed. The hairy *L. claviger* and *L. subglaber* are most easily confused, but the

hairs of *L. claviger* are long and dense, whereas the hairs of *L. subglaber* are thin, wispy, sparse, and short on the cheeks.

<<6-3-4-lascla-face.tif>>

<<6-3-4-lascla-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The more rounded propodeum is characteristic of the *claviger* group of *Lasius*

<<dist-b>>B. The long hairs under the head and the modestly clubbed antennae are characteristic of *L. claviger*

<<dist-c>>C. The sharply-pointed petiole distinguishes this species from the similar-looking *L. latipes*

<<scalebar=4.1mm>>

<<spec>> *Lasius flavus* (Fabricius, 1782)

<<common>>The Blond Ant

<<etym>> From the Latin *flavus*, meaning blond or yellow

<<coltab, color="191-4">>Genus *Lasius*

<<lasfla-workers+males.tif>>

<<lasfla-worker+queen.tif>>

<<lasfla-map.tif>>

<<hab>>**Habitat:** This subterranean ant nests under rocks in open habitats and dry woodlands.

<<geog>>**Geographic Range:** This is a Holarctic species with a range in Europe and Asia that is nearly identical to that of *L. alienus*. In North America, it is abundant in the eastern states, but it is rare in the Gulf Coast states. It has been collected occasionally in the northern Rocky Mountains, the Chiricahua Mountains of southeast Arizona, and the Pacific Northwest. It is widespread in New England.

<<nathist>>**Natural History:** *Lasius flavus* is a generalist predator that also tends root aphids and feeds on their honeydew. Mating flights occur in late August and early September.

<<look>>**Look-alike species:** This is one of two New England species of *Lasius* with very tiny eyes; the other is *L. nearcticus*. These two species nest in distinct habitats – *L. flavus* in open, dry habitats and *L. nearcticus* in moist forests – but they can be distinguished reliably only by examining their maxillary palps at 25 – 50× magnification under a dissecting microscope. In *L. flavus*, the last (terminal) segment of the palp is shorter than the next-to-last (penultimate)

segment, whereas in *L. nearcticus*, the terminal segment of the palp is longer than the penultimate segment.

<<6-3-4-lasfla-face-N.tif>>

<<6-3-4-lasfla-inset.tif>>

<<6-3-4-lasfla-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The pyramid-shaped propodeum is characteristic of most species of *Lasius*

<<dist-b>>B. The very small eyes are characteristic of the *flavus* group

<<dist-c>>C. The short terminal segment of the maxillary palp distinguishes *L. flavus* from *L. nearcticus*

<<scalebar=3.5mm>>

<<spec>> *Lasius interjectus* Mayr, 1866

<<common>>*The Larger Yellow Ant

<<etym>> From the Latin *interiectus*, meaning the place between

<<coltab, color="191-4">>Genus *Lasius*

<<lasint-habitat.tif>>

<<lasint-nest-AW.tif>>

<<lasint-map.tif>>

<<hab>>**Habitat:** This subterranean ant nests in a wide variety of habitats, including under rocks in woods and deep in the soil.

<<geog>>**Geographic Range:** *Lasius interjectus* ranges from southern New England west to Idaho, south to Wyoming and New Mexico, and east into Oklahoma, Arkansas and Georgia.

<<nathist>>**Natural History:** Like all species in the *claviger* group, the colonies of *L. interjectus* can be enormous and diffuse. The workers are generalist predators, and also tend root aphids and feed on their honeydew.

<<look>>**Look-alike species:** All species in the *claviger* group smell like citronella when disturbed or crushed. *Lasius interjectus* has a sharply pointed petiole like *L. claviger* and *L. subglabralis*, but *L. interjectus* has many long, erect hairs all over the first segment of its gaster and only on the edges of the other segments of the gaster.

<<6-3-4-lasint-face.tif>>

<<6-3-4-lasint-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The more rounded propodeum is characteristic of the *claviger* group of *Lasius*

<<dist-b>>B. The sharply-pointed petiole distinguishes this species from the similar-looking *L. latipes*

<<dist-c>>C. The long hairs all over the first segment of the gaster but only on the edges of the remaining segments distinguish *L. interjectus* from *L. claviger* and *L. subglaber*

<<scalebar=5mm>>

<<spec>> ***Lasius latipes*** (Walsh, 1863)

<<common>>The Wide-footed Ant

<<etym>> From the Latin *latus*, meaning wide + *pes*, meaning foot, and referring to the greatly enlarged front femurs on the queens

<<coltab, color="191-4">>Genus *Lasius*

<<laslat-habitat.tif>>

<<laslat-queen.tif>>

<<laslat-map.tif>>

<<hab>>**Habitat:** This subterranean ant nests in sandy, well-drained soils under rocks in open forests and woodlands. It is common in pine barrens.

<<geog>>**Geographic Range:** *Lasius latipes* ranges from New England and Québec west to southern British Columbia, south to California, Nevada, and New Mexico, east into Oklahoma and South Carolina.

<<nathist>>**Natural History:** This species is a temporary social parasite on *L. alienus* and *L. neoniger*. The workers are generalist predators that also feed on honeydew secreted by root-feeding aphids. The enlarged front legs are used to rapidly dig a new nest. A particularly nice collection of *L. latipes* in the Maine State Collection was found over Labor Day Weekend in 1971, swarming in a cellar drain in Augusta, Maine.

<<look>>**Look-alike species:** All species in the *claviger* group smell like citronella when disturbed or crushed. The very hairy *L. latipes* and *L. claviger* are most easily confused, but

viewed in profile, *L. latipes* has a blunt and rounded petiole whereas *L. claviger* has a sharply pointed petiole. The queen, with her enlarged front legs, is unmistakable.

<<6-3-4-laslat-face.tif>>

<<6-3-4-laslat-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The more rounded propodeum is characteristic of the *claviger* group of *Lasius*

<<dist-b>>B. There are many erect hairs on the cheeks and on the rest of the body

<<dist-c>>C. The blunt, rounded petiole distinguishes this species from the similar-looking *L. claviger*

<<scalebar=4.4mm>>

<<spec>> *Lasius minutus* Emery, 1839

<<common>>The Tiny-queened Ant

<<etym>> From the Latin *minutus*, meaning small, and referring to the unusually small queens of this species

<<coltab, color="191-4">>Genus *Lasius*

<<lasmin-mound.tif>>

<<lasmin-nest.tif>>

<<lasmin-map.tif>>

<<hab>>**Habitat:** This ant nests in bogs and fens. Its nests can be fairly large mounds approaching half a meter in height.

<<geog>>**Geographic Range:** This is an eastern species that lives throughout eastern North America, south to Virginia, and west to Indiana. It has been collected only a few times throughout New England.

<<nathist>>**Natural History:** *Lasius minutus* is a thought to be a temporary social parasite of *L. alienus* and *L. pallitarsis*. It is also the host of the temporary social hyperparasite (*i.e.*, a parasite of a parasite), *L. speculiventris*. Despite its scientific name, the workers are not unusually small, but the queens are.

<<look>>**Look-alike species:** *Lasius minutus* is most easily confused with the similarly hairy *L. subumbratus*. But the hairs on the gaster of *L. minutus* are very long – longer than the hind tibia is wide – whereas the hairs on the gaster of *L. subumbratus* are much shorter.

<<6-3-4-lasmin-face.tif>>

<<6-3-4-lasmin-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The pyramid-shaped propodeum is characteristic of most species of *Lasius*

<<dist-b>>B. The intermediate-sized eyes are characteristic of the *umbratus* group

<<dist-c>>C. The very long hairs on the gaster distinguish *L. minutus* from *L. subumbratus*

<<scalebar=3.6mm>>

<<spec>> *Lasius murphyi* Forel, 1901

<<common>>Murphy's Ant

<<etym>> Named for Auguste-Henri Forel's friend, one Dr. Murphy, *directeur de l'asile des alienes* ("director of the insane asylum"), for his kind hospitality and friendship.

<<coltab, color="191-4">>Genus *Lasius*

<<lasmur-habitat.tif>>

<<lasmur-MCZ001QL.tif>>

<<lasmur-map.tif>>

<<hab>>**Habitat:** This subterranean ant nests under or next to rocks in open woods or on the edges of woods. It is most common in sandy soils.

<<geog>>**Geographic Range:** This species has been collected most frequently east of the Mississippi River, south to Georgia and the Carolinas. There are scattered records of it from Colorado, Utah, and northern Arizona. It has not yet been collected in New England, but as the climate warms, look for it in pine barrens and sandy areas of southern new England.

<<nathist>>**Natural History:** *Lasius murphyi* is a temporary social parasite of *Lasius neoniger*.

Lasius murphyi hybridizes with *L. latipes* and *L. subglaber* in the field.

<<look>>**Look-alike species:** All species in the *claviger* group smell like citronella when disturbed or crushed. *Lasius murphyi* can be confused with *L. latipes*, which also has a blunt, rounded petiole, but *L. murphyi* has dense hairs on the propodeum and sparse hairs elsewhere on its body. The queens of *L. murphyi* have distinctive, heavily matted body hairs.

<<6-3-4-lasmur-face.tif>>

<<6-3-4-lasmur-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The more rounded propodeum is characteristic of the *claviger* group of *Lasius*

<<dist-b>>B. The blunt, rounded petiole is characteristic of *L. murphyi* and *L. latipes*.

<<dist-c>>C. The dense hairs on the propodeum and sparse hairs elsewhere distinguish *L. murphyi* from *L. latipes*

<<scalebar=3.5mm>>

<<spec>>*Lasius nearcticus* Wheeler, 1906

<<common>>The New World Fuzzy Ant

<<etym>> *Nearcticus*: of the northern (Arctic) regions of the “New World”

<<coltab, color=”191-4”>>Genus *Lasius*

<<lasnea-nest.tif>>

<<lasnea-larvae.tif>>

<<lasnea-map.tif>>

<<hab>>**Habitat:** This subterranean ant nests under rocks in moist forests.

<<geog>>**Geographic Range:** *Lasius nearcticus* ranges from Southeastern Canada to the southern Appalachian Mountains and west to South Dakota and Wyoming. It is widespread in New England.

<<nathist>>**Natural History:** Like its look-alike *L. flavus*, *L. nearcticus* is thought to feed on honeydew secreted by root-feeding aphids. But very little research has been done on this species, which lies and forages almost exclusively underground.

<<look>>**Look-alike species:** This is one of two New England species of *Lasius* with very tiny eyes; the other is *L. flavus*. These two species nest in distinct habitats – *L. nearcticus* in moist forests and *L. flavus* in open, dry habitats – but they can be distinguished reliably only by examining their maxillary palps at 25 – 50× magnification under a dissecting microscope. In *L. nearcticus*, the terminal segment of the palp is longer than the penultimate segment, whereas in *L. flavus*, the terminal segment of the palp is shorter than the penultimate segment.

<<6-3-4-lasnea-face.tif>>

<<6-3-4-lasnea-inset.tif>>

<<6-3-4-lasnea-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The pyramid-shaped propodeum is characteristic of most species of *Lasius*

<<dist-b>>B. The very small eyes are characteristic of the *flavus* group

<<dist-c>>C. The long terminal segment of the maxillary palp distinguishes *L. flavus* from *L. nearcticus*

<<scalebar=3.2mm>>

<<spec>> *Lasius neoniger* Emery, 1893

<<common>>The Labor Day Ant

<<etym>>From the Latin *neo* (new) + *niger* (black), and referring to its similarity to the European *L. niger*

<<coltab, color="191-4">>Genus *Lasius*

<<lasneo-nest.tif>>

<<lasneo-workers.tif>>

<<lasneo-map.tif>>

<<hab>>**Habitat:** In North America, this commonly collected and widespread ant is found in open habitats, including farm fields, old fields and other early-successional habitats, beaches, and sand dunes.

<<geog>>**Geographic Range:** This is an eastern North American species that ranges west into North Dakota, Iowa, and Kansas, with occasional forays into the southern Rocky Mountains. It is abundant and widespread in New England.

<<nathist>>**Natural History:** This species has been nicknamed the Labor Day Ant by Bert Hölldobler and E. O. Wilson because of the propensity for its mating swarms to occur on warm evenings following rains in late August or early September. It is likely to be ecologically very important because it is abundant in nearly every open habitat on the landscape.

<<look>>**Look-alike species:** The large-eyed *Lasius alienus* can be confused with either of the other three species in the *niger* group: *L. pallitarsis*, *L. alienus*, or *L. cf. niger*. The key features are that *L. neoniger* has an angular clypeal margin (best seen in full-face view with the mandibles

open), equally-sized basal teeth, and has erect hairs on its scape and hind tibiae. The other three species have more gently-curved clypeal margins. *Lasius alienus* has no erect hairs on its scape or hind tibiae. *Lasius pallitarsis* and *L. cf. niger* are hairy like *L. neoniger*, but *L. pallitarsis* and *L. cf. niger* have curved clypeal margins. The three basal teeth of *Lasius neoniger* are unequally spaced and the 2nd of these three teeth is smaller than the other two. In contrast, *L. pallitarsis* has a single offset, short, and upturned basal tooth on each mandible, and *L. cf. niger* has equally-spaced and equally-sized basal teeth.

<<6-3-4-lasneo-face.tif>>

<<6-3-4-lasneo-inset-cly.tif>>

<<6-3-4-lasneo-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The angular clypeal margin separates the *L. neoniger* from the other species in the *niger* group

<<dist-b>>B. The erect hairs on the antennal scape distinguish *L. neoniger* from *L. alienus*

<<dist-c>>C. The basal mandibular teeth are unequally sized and unequally spaced (contrast with *L. cf. niger*); and there is no upturned, offset basal tooth on the mandible (compare with *L. pallitarsis*)

<<scalebar=3.2mm>>

<<spec>> *Lasius pallitarsis* (Provancher, 1881)

<<common>>The Pale-legged Ant

<<etym>> From the Latin *pallidus* (pale, wan, indefinite color) + *tarsis* (the leg segment below the tibia)

<<coltab, color="191-4">>Genus *Lasius*

<<laspal-larvae-AW.tif>>

<<laspal-dives(1829).tif>>

<<laspal-map.tif>>

<<hab>>**Habitat:** In North America, this ant abounds in boreal and cold-temperate habitats where it nests in rotten logs and stumps and under stones in forests. In northern Maine and eastern Canada, it is collected commonly in agricultural fields.

<<geog>>**Geographic Range:** This species ranges from eastern Québec across Canada to southeastern Alaska, south to Massachusetts in the east, and south through the mountains of California and the west. A single record exists from the southern Appalachian Mountains of North Carolina.

<<nathist>>**Natural History:** Like *L. alienus*, *L. pallitarsis* is a generalist omnivore: it eats plant debris and other small insects, and tends aphids and other scale insects for their honeydew. It is parasitized by *L. minutus*, *L. umbratus*, and *L. subumbratus*.

<<look>>**Look-alike species:** The large-eyed *Lasius pallitarsis* can be confused with any of the other three species in the *niger* group: *L. neoniger*, *L. alienus*, or *L. cf. niger*. The key distinguishing feature is that *L. pallitarsis* has a clearly defined offset, short, and upturned basal

tooth on its mandible. This offset tooth is best seen in full-face view with the mandibles open, but if you can't open the mandibles, count the teeth you can see. If you only see six (and the offset, seventh one is hidden under the clypeus), it is likely you have *L. pallitarsis*.

<<6-3-4-laspal-face.tif>>

<<6-3-4-laspal-inset.tif>>

<<6-3-4-laspal-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The pyramid-shaped propodeum is characteristic of most species of *Lasius*, and the relatively large eye is characteristic of the *niger* group

<<dist-b>>B. The erect hairs on the antennal scape distinguish *L. pallitarsis* from *L. alienus*

<<dist-c>>C. The upturned, offset basal tooth on the mandible distinguishes *L. pallitarsis* from *L. neoniger* and *L. cf. niger*

<<scalebar=4.3mm>>

<<spec>> *Lasius plumopilosus* Buren, 1941

<<common>>The Feathered Ant

<<etym>> From the Latin *plumosus*, meaning feathered + *pilosus*, meaning hairs, and referring to the distinctive hairs on the gaster

<<coltab, color="191-4">>Genus *Lasius*

<<lasplu-talus-slope.tif>>

<<lasplu-MCZ001L.tif>>

<<lasplu-map.tif>>

<<hab>>**Habitat:** This subterranean ant nests under stones.

<<geog>>**Geographic Range:** *Lasius plumopilosus* is an uncommon, patchily distributed species that has been collected from Iowa, Michigan, Minnesota, North Carolina, and Long Island. It has not yet been collected from New England, but based on its general habitat and distribution, it could occur in Connecticut, Rhode Island, Cape Cod, or the Massachusetts Islands.

<<nathist>>**Natural History:** Very little is known of this rarely-collected species. It is thought to be a social parasite of the social parasite *Lasius claviger*. Although such social hyperparasitism is rare among ants, it does occur among other European and Asian *Lasius* species.

<<look>>**Look-alike species:** All species in the *claviger* group smell like citronella when disturbed or crushed. The feather-tipped hairs on the gaster of *L. plumopilosus* make this ant unmistakable.

<<6-3-4-lasplu-face.tif>>

<<6-3-4-lasplu-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The more rounded propodeum is characteristic of the *claviger* group of *Lasius*

<<dist-b>>B. The feather-tipped hairs on the gaster are unique

<<scalebar=3.5mm>>

<<spec>> *Lasius speculiventris* Emery, 1893

<<common>>The Shiny-bellied Ant

<<etym>> From the Latin *specula*, meaning shiny like a mirror + *ventris*, meaning belly, and referring to its very shiny abdomen

<<coltab, color="191-4">>Genus *Lasius*

<<lasspe-habitat.tif>>

<<lasspe-MCZ001QL.tif>>

<<lasspe-map.tif>>

<<hab>>**Habitat:** This rarely collected ant nests in rotten logs in bogs, fens, and moist woodlands.

<<geog>>**Geographic Range:** This northern species has been collected from the northeastern and Great Lakes states. It is recorded from southern New England.

<<nathist>>**Natural History:** *Lasius speculiventris* has been reported to be a social parasite of the social parasite *L. minutus*; such social hyperparasitism is rare in ants. Very little is known of the natural history of this rarely encountered species.

<<look>>**Look-alike species:** *Lasius speculiventris* is distinguished by the shiny second segment of the gaster that lacks appressed pubescence and has only a few erect hairs. Carlo Emery described it as *Hinterleib stark glanzend, ohne anliegende Behaarung* ["its abdomen is strongly shining without any appressed pubescence"].

<<6-3-4-lasspe-face.tif>>

<<6-3-4-lasspe-body-tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The pyramid-shaped propodeum is characteristic of most species of *Lasius*

<<dist-b>>B. The shining gaster lacking appressed pubescence on the second segment is characteristic of *L. speculiventris*

<<scalebar=4.9mm>>

<<spec>> *Lasius subglaber* Emery, 1893

<<common>>The Somewhat Hairy Ant

<<etym>> From the Latin *sub*, meaning below or less perfect than + *glaber*, meaning smooth and hairless

<<coltab, color="191-4">>Genus *Lasius*

<<hunting-lassub1(1072).tif>>

<<lassub1-nest(1795).tif>>

<<lassub1-map.tif>>

<<hab>>**Habitat:** This subterranean ant nests in soil under stones and in rotten stumps. It may make small soil mounds in forests and in small treefall gaps.

<<geog>>**Geographic Range:** *Lasius subglaber* ranges from North Dakota east to Downeast Maine and southern New York and then south to North Carolina and Georgia.

<<nathist>>**Natural History:** Like many species in the *claviger* group, *L. subglaber* is thought to feed on honeydew secreted by root-feeding aphids. But also like other species in the *claviger* group, it has been rarely studied in the field.

<<look>>**Look-alike species:** All species in the *claviger* group smell like citronella when disturbed or crushed. *Lasius subglaber* can be confused with *L. claviger* and *L. interjectus*, as all three have sharply pointed petioles, but *L. subglaber* uniquely has few erect hairs on its body and virtually none on its cheeks. The erect hairs that are present on its body are short and wispy, unlike the long, robust erect hairs of the other species in the *claviger* group.

<<6-3-4-lassub1-face.tif>>

<<6-3-4-lassub1-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The more rounded propodeum is characteristic of the *claviger* group of *Lasius*

<<dist-b>>B. The short, wispy hairs on its body distinguish *L. subglaber* from *L. claviger* and *L. interjectus*

<<dist-c>>C. *L. subglaber* lacks erect hairs on its cheeks

<<scalebar=4.1mm>>

<<spec>> *Lasius subumbratus* Viereck, 1903

<<common>>The Less Shady Ant

<<etym>> From the Latin *sub*, meaning below, or less than perfect + *umbratus*, meaning shaded, referring to its similarity to *L. umbratus*

<<coltab, color="191-4">>Genus *Lasius*

<<lassub2-fields.tif>>

<<lassub2-worker(1964).tif>>

<<lassub2-map.tif>>

<<hab>>**Habitat:** Wherever *L. pallitarsis* is found (in rotten logs and stumps, and under stones), there also may be *L. subumbratus*.

<<geog>>**Geographic Range:** This northern species ranges from the Canadian Maritimes to western North America. In New England, it is confined to cold-temperate and sub-boreal areas and to date has been collected only from Maine.

<<nathist>>**Natural History:** *Lasius subumbratus* is a temporary social parasite of *L. pallitarsis*.

<<look>>**Look-alike species:** *Lasius subumbratus* is most easily confused with the similarly hairy *L. minutus*. But the hairs on the gaster of *L. subumbratus* are only 60-80% as long as the hind tibia is wide, whereas the hairs on the gaster of *L. minutus* are longer than the hind tibia is wide. It is also possible to confuse *L. subumbratus* with *L. umbratus*, but *L. subumbratus* has a convex-topped petiole (viewed from the front or back) whereas *L. umbratus* has a concave-topped petiole.

<<6-3-4-lassub2-face.tif>>

<<6-3-4-lassub2-inset.tif>>

<<6-3-4-lassub2-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The pyramid-shaped propodeum is characteristic of most species of *Lasius*

<<dist-b>>B. The convex-topped petiole distinguishes *L. subumbratus* from *L. umbratus*

<<dist-c>>C. The length of the hairs on the gaster distinguish *L. subumbratus* from *L. minutus*

<<scalebar=4.3mm>>

<<spec>> *Lasius umbratus* (Nylander, 1846)

<<common>>The Shaded Ant

<<etym>> From the Latin *umbratus*, meaning shaded, referring to its light brown color

<<coltab, color="191-4">>Genus *Lasius*

<<lasumb-nest.tif>>

<<lasumb-prey.tif>>

<<lasumb-map.tif>>

<<hab>>**Habitat:** *Lasius umbratus* nests in moist soil in open woodlands, early successional forests, forest edges, and in farm fields.

<<geog>>**Geographic Range:** This species ranges throughout Europe, Asia, and North America. It has been collected in all of the New England states.

<<nathist>>**Natural History:** *Lasius umbratus* is a social parasite of *L. alienus*, *L. neoniger*, and *L. pallitarsis*.

<<look>>**Look-alike species:** *Lasius umbratus* is most easily confused with the similarly hairy *L. subumbratus*. However, the hairs on the gaster of *L. umbratus* are short and bristly – less than half as long as the hind tibia is wide – whereas the hairs on the gaster of *L. subumbratus* are longer than the hind tibia is wide. In addition, *L. umbratus* has a concave-topped petiole (viewed from the front or back), whereas *L. subumbratus* has a convex-topped petiole. An undescribed species of *Lasius* is similar to *L. umbratus* except that the new species has erect hairs on its antennal scape and hind tibiae, whereas *L. umbratus* does not.

<<6-3-4-lasumb-face.tif>>

<<6-3-4- lasumb-inset.tif>>

<<6-3-4- lasumb-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The concave top of the petiole distinguishes *L. umbratus* from *L. subumbratus*

<<dist-b>>B. The short hairs on the gaster are characteristic of *L. umbratus* and the undescribed species *L. cf. umbratus*

<<dist-c>>C. The absence of hairs on the antennal scape and hind tibiae distinguish *L. umbratus* from the undescribed species *L. cf. umbratus*

<<scalebar=4.4mm>>

<<spec>>An uncertain species of *Lasius* closely resembling *L. niger*

<<common>>

<<etym>>

<<coltab, color="191-4">>Genus *Lasius*

<<lasnig-saltmarsh.tif>>

<<lasnig-MCZ007H.tif>>

<<lasnig-map.tif>>

<<hab>>**Habitat:** This species of *Lasius* was first collected in the summer of 2011 from the edge of the Great Sippewisset salt marsh near Falmouth, Massachusetts.

<<geog>>**Geographic Range:** As of this writing, this species has been collected only in the town of Falmouth, Massachusetts. It closely resembles *Lasius niger*, which ranges throughout Europe, northern and central Asia, China, Japan, and Korea. In North America, *L. niger* is a western species collected from Washington, Oregon, California, Idaho, Montana, Colorado, Utah, and New Mexico.

<<nathist>>**Natural History:** Unknown. Only representatives of a single colony have so far been collected.

<<look>>**Look-alike species:** This undescribed species is similar to *L. neoniger* and *L. pallitarsis*, but is much hairier than either.

<<6-3-4-lasnig-face.tif>>

<<6-3-4-lasnig-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The very long and dense hairs on the antennal scape, head, and body distinguish this species from other New England members of the *niger* group

<<dist-b>>B. The rounded clypeal margin distinguishes this species from *L. neoniger*

<<scalebar=4.5mm>>

<<spec>>An undescribed species of *Lasius* closely resembling *L. umbratus*

<<common>>

<<etym>>

<<coltab, color="191-4">>Genus *Lasius*

<<lasspA-nest.tif>>

<<lasspA-worker.tif>>

<<lasspA-map.tif>>

<<hab>>**Habitat:** This new species of *Lasius* so far is known only from mown lawns and fields in Massachusetts.

<<geog>>**Geographic Range:** As of this writing, this undescribed species has been collected only in the towns of Hamden (in 2005) and Athol, Massachusetts (in 2010).

<<nathist>>**Natural History:** Unknown.

<<look>>**Look-alike species:** This undescribed species is similar to *L. umbratus* except that it has erect hairs on its antenna and hind tibiae, whereas *L. umbratus* does not.

<<6-3-4-lasspA-face.tif>>

<<6-3-4-lasspA-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The short hairs on the gaster are characteristic of *L. umbratus* and the undescribed species *L. cf. umbratus*

<<dist-b>>B. The presence of hairs on the antennal scape and hind tibia distinguish this undescribed species from *L. umbratus*

<<scalebar=4.3mm>>

<<coltab, color="190-6">> Genus *Nylanderia*

<<txa>>*Nylanderia* Emery, 1906 – Nylander's Ants (named for the Finnish entomologist and lichenologist William Nylander (1822-1899))

<<William_Nylander-2.tif>>

The genus *Nylanderia* has an interesting and checkered history. The name *Nylanderia* was first used in 1906 to refer to a subgenus of *Prenolepis*. Thirty years later, it was given full status as its own genus, but it was then lobbed back and forth between full generic status and subgeneric status within *Paratrechina* for another 50 years. In the mid-1980s, *Nylanderia* lost its identity entirely when it was completely subsumed within *Paratrechina*. In 2010, DNA sequence data not only reconfirmed its place as a distinct genus, but also ironically placed most species of *Paratrechina* within *Nylanderia*! With hindsight, it now seems easy to distinguish among these three genera of the so-called *Prenolepis* genus-group. *Nylanderia* is separated from *Paratrechina* on the basis of two key characteristics: the mandibles of *Nylanderia* have six teeth (*Paratrechina* has five-toothed mandibles), and the antennal scapes of *Nylanderia* are $< 1.5\times$ as long as the length of the head (the antennal scapes of *Paratrechina* are $> 1.7\times$ as long as the length of the head). On the other hand, *Nylanderia* is separated from *Prenolepis* with two other characters: the eyes of *Nylanderia* are situated mid-way up the head, with half of their length above and the other half below the midline (the eyes of *Prenolepis* are situated much higher up the head) and the mesosoma of *Nylanderia* is not constricted behind the pronotum (*Prenolepis* has such a constriction, giving it an hourglass appearance when viewed from above).

Nylanderia now includes ~133 species, at least 20 of which (including four exotics) occur in North America. But in New England, only two species of *Nylanderia* can be found out-of-doors: *N. parvula* and an unnamed, workerless species that is a social parasite of *N. parvula*. A third species, *N. flavipes*, is a forest species of Asian origin that is common in wooded median strips in Manhattan (and forests further south) but in New England only occasionally turns up in greenhouses or other heated buildings.

<<txb>>Identifying the Species of *Nylanderia*

Of the three New England species in this genus, *Nylanderia parvula* is the most widespread and easily identified. It is a small (~2.25 mm long), shiny, dark brown or black ant that in profile looks like a tiny *Formica*. It has many erect hairs on its head and body (but no erect hairs on its propodeum), but it has no erect hairs on its antennal scape. The other named species of *Nylanderia*, *N. flavipes*, has at least several erect hairs on its scape, and is red to reddish-brown, sometimes even appearing bi-colored. Finally, the undescribed species of *Nylanderia* is an inquiline social parasite of *N. parvula*. This undescribed species produces no workers, only queens and males, that live in nests of *N. parvula*. The unnamed social parasite can be distinguished from the host (*N. parvula*) by size: the parasite queen is about two-thirds the length of the host queen and about 80% the length of the host worker. In addition, the queens of the parasite always have at least one erect hair on at least one of their antennal scapes (*N. parvula* has hairless scapes). As of this writing, the parasite has been collected in Massachusetts only at Myles Standish State Forest, but it could be as widespread as its host.

<<txb>>Key to the Species of *Nylanderia*

1a. **Antennal scapes without erect hairs**; workers lack ocelli; a native, widespread species

..... *N. parvula*

<<6-3-5-nylpar-face-dk.tif>>

1b. **Antennal scapes with at least one erect hair, workers with many more hairs**; workers, if present, have small ocelli2

2a (1b). **Antennal scapes of workers and queens with many erect hairs**; workers with small ocelli; an introduced species currently recorded in New England only from inside heated buildings and greenhouses *N. flavipes*

<<6-3-5-nylfla-face-dk.tif>>

2b. **Colonies consisting of queens and males relying on host workers of *N. parvula***; queens have at least one erect hair on at least one of the antennal scapes, but host workers lack erect hairs on their antennal scapes; queens < 2 mm long
..... An undescribed species of *Nylanderia*

<<6-3-5-nyl-comp-queen>>

<<txb>>Easily Confused Species

Nylanderia species can be mistaken for its close relatives *Paratrechina* and *Prenolepis* or for the similarly-sized, -shaped, and -colored *Tapinoma*, *Brachymyrmex*, or *Lasius* species. The antennal scapes of *Nylanderia* and *Prenolepis* are $< 1.5\times$ the length of its head, whereas the scapes of *Paratrechina* are $> 2\times$ as long as its head. *Nylanderia* and *Prenolepis* are distinguished by the shape of their mesosoma viewed from above (there is no constriction behind the pronotum of *Nylanderia*), and by the position of their compound eyes (mid-way up the head in *Nylanderia*, above the mid-line of the head of *Prenolepis*). *Nylanderia*, like other genera in the Formicinae, has a gaster that terminates in an acidopore (*Tapinoma*'s terminates in a horizontal slit). The lumpy, rounded profile and paired, erect, black hairs of the mesosoma of *Nylanderia*, distinguish it from *Lasius*, which has an angular, fuzzy mesosoma.

<<spec>>*Nylanderia flavipes* (Smith, 1874)

<<common>>The Yellow-legged *Nylanderia*

<<etym>>From the Latin *flavus*, meaning yellow + *pes*, meaning foot

<<coltab, color="190-6">> Genus *Nylanderia*

<<nylfla-habitat.tif>

<<nylfla-nest.tif>>

<<nylfla-map.tif>>

<<hab>>**Habitat:** This exotic ant nests in urban woodlands, lawns, gardens, and parks.

<<geog>>**Geographic Range:** Originally described from Hyogo, Japan, this species is found in Japan, Korea, and parts of China. It is been introduced, probably repeatedly, into North America, and has established populations along the east coast from Boston to Washington DC. It has also been collected from Ohio and Pittsburgh, Pennsylvania.

<<nathist>>**Natural History:** Along the wooded median strips where it is often found in North America, *N. flavipes* can be the most abundant ant present. Its propensity for forested habitats suggests that, given appropriate climatic conditions, *N. flavipes* could spread rapidly throughout New England. Its colonies consist of 100-500 workers and usually have only one queen. The workers are generalist predators and scavengers, and tend aphids for their honeydew.

<<look>>**Look-alike species:** *Nylanderia flavipes* might be mistaken for *Lasius neoniger*, *Brachymyrmex depilis*, or *N. parvula*. The erect hairs on its antennal scapes distinguish *N. flavipes* from *N. parvula* and *B. depilis*, and the long bristle-like hairs on the promesonotum

distinguish *N. flavipes* from *L. neoniger*. Its reddish color is also distinctive; the other *Nylanderia* species in our region are much browner.

<<6-3-5-nylfla-face.tif>>

<<6-3-5-nylfla-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Erect hairs on the head and body, but not the propodeum distinguish the genus

Nylanderia

<<dist-b>>B. The many erect hairs on the antennal scapes distinguish *N. flavipes* from *N.*

parvula

<<scalebar=2 mm>>

<<spec>>*Nylanderia parvula* (Mayr, 1870)

<<common>>The Little *Nylanderia*

<<etym>>From the Latin *parvulus*, meaning little, insignificant, or dim

<<coltab, color="190-6">> Genus *Nylanderia*

<<nylpar-nest.tif>>

<<nylpar-larvae.tif>>

<<nylpar-map.tif>>

<<hab>>**Habitat:** This native species of *Nylanderia* generally can be found in open habitats, including old-fields and young woodlands. In New England, it is most commonly collected in pine barrens and other habitats with sandy soils.

<<geog>>**Geographic Range:** Throughout eastern North America, from southern Maine south to Florida and west to Michigan, the Dakotas, and eastern Texas.

<<nathist>>**Natural History:** Colonies of *Nylanderia parvula* are small (< 500 ants), usually have only a single queen, and are relatively diffuse. The nests usually consist of scattered chambers, each containing only a few dozen workers and some brood. The workers are generalized predators of small soil animals and scavengers that forage singly. Workers lay down scent trails to bring nestmates quickly to larger food resources.

<<look>>**Look-alike species:** *Nylanderia parvula* might be mistaken for either *N. flavipes* or *Paratrechina longicornis*. Both *N. parvula* and *P. longicornis* are brown ants that lack erect hairs on their antennal scapes, whereas *N. flavipes* is yellow and has many erect hairs on its scape. Note that the scapes of *N. parvula* are much shorter than 1.3× as long as its head and it has six-

toothed mandibles, whereas the scapes of *P. longicornis* are usually more than 2× as long as its head and its mandibles have only five teeth.

<<6-3-5-nylpar-face.tif>>

<<6-3-5-nylpar-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Erect hairs on the head and body, but not the propodeum, distinguish the genus *Nylanderia* from *Prenolepis* and *Paratrechina*

<<dist-b>>B. The lack of erect hairs on the antennal scapes distinguish *N. parvula* from our other *Nylanderia* species

<<dist-c>>C. The scapes of *N. parvula* are < 1.3× as long as the length of its head

<<scalebar=2.2mm>>

<<spec>>An undescribed species of *Nylanderia*

<<common>>

<<etym>>

<<coltab, color="190-6">> Genus *Nylanderia*

<<nylspA-habitat.tif>>

<<nylspA-action.tif>>

<<nylspA-map.tif>>

<<hab>>**Habitat:** This native species of *Nylanderia* is an inquiline social parasite of *N. parvula* that is known from only one location in the pine barrens at Myles Standish State Forest in eastern Massachusetts.

<<geog>>**Geographic Range:** This species' range most likely will overlap that of its host in eastern North America, from Maine south to Florida and west to Michigan, the Dakotas, and eastern Texas. But such parasites usually are rare and hard to find.

<<nathist>>**Natural History:** This inquiline social parasite produces only queens and males that are raised by colonies of the host, *N. parvula*.

<<look>>**Look-alike species:** This new species of *Nylanderia* is likely to be confused only with its host, *Nylanderia parvula*. However, the new species always has at least one erect hair on at least one of its scape, whereas the scapes of *N. parvula* are hairless. The queens are also ~30% smaller than the queens of *N. parvula* and are yellowish-brown; the host queens are slate gray or black.

<<6-3-5-nylspA-face.tif>>

<<6-3-5-nylspA-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. Erect hairs on the head and body, but not the propodeum distinguish the genus

Nylanderia from *Prenolepis* and *Paratrechina*

<<dist-b>>B. The presence of at least one erect hair on the antennal scapes distinguish this new species from its host, *N. parvula*

<<dist-c>>C. The small queens are distinctive to this undescribed species

<<scalebar=1.75mm>>

<<coltab, color="177-6">> Genus *Paratrechina*

<<txa>>*Paratrechina* Motschoulsky, 1863 – The Somewhat Hairy Ant (from the Greek *para*, meaning near, or nearby + *trichinos*, meaning of hair).

<<6-3-5a-parlon-body.tif>>

Like other genera in the *Prenolepis* group, the genus *Paratrechina* has a checkered nomenclatural history. This name *Paratrechina* was first used by Victor Ivanovitsch de Motschoulsky in 1863 to refer to a new genus of ants from Ceylon (modern-day Sri Lanka) that were *très-voisin* [“very similar to”] *Tapinoma*. Curiously, Motschoulsky used the name *Paratrechina* for the genus, but one paragraph later, describes the first species as “*Paratrichina*” *vagabunda* – note the switch from *-trechina* to *-trichina*. He also described *Paratrichina currens*, which is now known as *Paratrechina longicornis*, today the only remaining species in the genus. Although for a time, *Paratrechina*, like *Nylanderia*, was placed within the genus *Prenolepis*, by 1925 it was a genus in its own right. By the mid-1980s, *Paratrechina* included nearly 200 species, but all but one of these were transferred to other genera following analysis of DNA sequences and careful study of morphology.

The monotypic *Paratrechina* now includes only Motschoulsky’s *P. currens*, now appropriately named *P. longicornis*, for its extremely long and distinctive antennae. It is unlikely to be confused with any other species.

<<spec>>*Paratrechina longicornis* (Latreille, 1802)

<<common>>*The Crazy Ant

<<etym>>From the Latin *longus*, meaning long + *cornu*, meaning horn, and referring to its long antennae

<<coltab, color="177-6">> Genus *Paratrechina*

<<parlon-saybrook1.tif>>

<<parlon-saybrook2.tif>>

<<parlon-map.tif>>

<<hab>>**Habitat:** A tropical species of disturbed areas. In New England, it is likely to be found only inside of perennially warm buildings, especially greenhouses and zoos.

<<geog>>**Geographic Range:** This widespread tramp species occurs throughout the world in tropical environments. In New England, it has been collected so far as we know only from one of Yale University's residential colleges in southwestern Connecticut.

<<nathist>>**Natural History:** This fast and erratically running species deserves its common name.

<<look>>**Look-alike species:** No other species in our region has such long antennal scapes. To be sure it's not *Nylanderia*, count the teeth on the mandibles: *Paratrechina* has five, *Nylanderia* has six. The weird-looking, scruffy hairs on its head are also quite distinctive.

<<6-3-5a-parlon-face.tif>>

<<6-3-5a-parlon-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The scapes of *P. longicornis* are at least 1.7× as long as the length of its head, and often longer

<<dist-b>>B. The mandibles have five teeth

<<scalebar=2.5mm>>

<<coltab, color="173-7">> Genus *Polyergus*

<<txa>>*Polyergus* Latreille, 1804 – The Hard-working Ant (from the Greek *poly*, meaning very, much, many, + *ergos*, meaning work).

<<6-3-6-polluc-newface.tif>>

Polyergus species commonly have been called Amazon ants, in reference to the mythical ancient warrior women, but they are found neither in Amazonia nor anywhere else in the tropics. This small genus currently includes three recognized Eurasian and two North American species, but the group is currently being revised by James Trager, who is in the process of describing at least a dozen other North American species!

Within the subfamily Formicinae, *Polyergus* species uniquely possess sickle-shaped mandibles that lack teeth, but the mandibles do have fine serrated edges on their inner border. *Polyergus* species enslave workers of a wide variety of *Formica* species, mostly in the *fusca* and *pallidefulva* groups, and to varying degrees of specificity. Our three New England species, *P. lucidus*, *P. montivagus*, and *P. cf. longicornis* enslave *Formica incerta*, *F. pallidefulva*, and *F. dolosa*, respectively. These “hard-working” ants neither rear their own brood nor feed themselves; rather, they steal brood from the nests of their hosts, which matures in the *Polyergus* nest under the care of *Formica* workers already living there, and who do all the usual work that keeps a colony of ants functioning. The only hard work done by *Polyergus* is when all of the dozens to hundreds of *Polyergus* workers in a single colony leave the nest on a highly concerted brood-pillaging excursion to a nearby host *Formica* nest. The length, pace, and efficiency of these spectacular, summer-afternoon raids truly are a sight to behold.

<<txb>>Identifying the Species of *Polyergus*

We follow Trager in recognizing three species in the New England area. The three *Polyergus* species are distinguished by the number of erect hairs on their heads: *P. montivagus* has < 5 ; *P. lucidus* has $5 - 10$, and *P. cf. longicornis* has ≥ 20 . Note that the erect hairs may be lost during the adult life of the ant or after some time in a collection. However, each hair arises from a conspicuous black or brown-rimmed socket that can be seen at $25\times$ or greater magnification, so the hair counts mentioned below refer to the total number of erect hairs + the number of empty sockets. Each of our three species also enslaves only a single species in the *Formica pallidefulva* group, so it is important to collect and identify the host along with the slave-maker. As of 2011, only *P. lucidus* and *P. cf. longicornis* have been collected in New England. *Polyergus montivagus* is known from Long Island (New York) and further south.

<<txb>>Key to the Species of *Polyergus*

1a. **The workers have 20 or more, coarse, dark, erect hairs on the rear margin of their heads; the host is *Formica dolosa*;** this largest of our *Polyergus* species has workers generally > 6.5 mm long *P. cf. longicornis*

<<6-3-6-pollon-face.tif>>

1b. **Workers with < 10 erect hairs on the rear margin of the head; enslaves other *Formica* species, but never *F. dolosa*.** Workers generally < 6 mm long.....2

2a. **Workers with at least 5, and usually 10 erect hairs on the rear margin of the head;**

enslaves *F. incerta*; body very shiny, head usually shiny *P. lucidus*

<<6-3-6-polluc-newface.tif>>

2b. **Workers usually with no erect hairs, but never more than 5 erect hairs, on the rear**

margin of the head; enslaves *Formica pallidefulva*; body and head with a matte (not shiny) appearance..... *P. montivagus*

<<6-3-6-polmon-face.tif>>

<<txb>>Easily Confused Species

Although the red body coloration and often darker legs of *Polyergus* species are unlike the coloring of any other New England ant, they can be confused on first glance with minor workers of *Camponotus castaneus* or with their hosts in the *Formica pallidefulva* group.

However, the sickle-shaped mandibles of *Polyergus* are the defining characteristic of the genus.

<<spec>>*Polyergus lucidus* Mayr, 1870

<<common>>The Shiny *Polyergus*

<<etym>>From the Latin *lucidus*, meaning bright, shiny, and full of light, and referring to its shiny mesosoma and gaster

<<coltab, color="173-7">> Genus *Polyergus*

<<polluc-habitat.tif>>

<<polluc-nest.tif>>

<<polluc-map.tif>>

<<hab>>**Habitat:** This ant is found in open areas such as fields and grasslands, where it nests with its host, *Formica incerta*.

<<geog>>**Geographic Range:** This species ranges from New England and southern Ontario south to the mountains of North Carolina, and west to the prairies of Wisconsin and Missouri. In New England, it has been collected from southern New Hampshire and Maine south into Massachusetts and Connecticut.

<<nathist>>**Natural History:** *Polyergus lucidus* enslaves *Formica incerta* throughout its range. Colonies of the host greatly outnumber those of the parasite, and it is not commonly collected. It is most often encountered during its late afternoon sorties to acquire *F. incerta* brood (mostly pupae) on warm, dry summer days. At other times, when the slave-makers are not outside, you may first detect nests of this ant when you find a particularly robust nest of the enslaved *F. incerta*.

<<look>>**Look-alike species:** No other species in our region has toothless, sickle-shaped mandibles.

<<6-3-6-polluc-face.tif>>

<<6-3-6-polluc-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sickle-shaped, toothless mandibles immediately identify the genus *Polyergus*

<<dist-b>>B. There are at 5-10 erect hairs on the rear margin of the head of *P. lucidus*

<<dist-c>>C. The body of *P. lucidus* is very shiny

<<scalebar=6mm>>

<<spec>>*Polyergus montivagus* Wheeler, 1915

<<common>>The Rambling *Polyergus*

<<etym>>From the Latin *mons*, meaning hill + *vagus*, meaning wandering or rambling, and referring to its running about in the foothills of its type locality in Colorado

<<coltab, color="173-7">>Genus *Polyergus*

<<polmon-habitat.tif>>

<<polmon-MCZ001H.tif>>

<<polmon-map.tif>>

<<hab>>**Habitat:** This ant is found in semi-open areas such as open oak and pine-oak woodlands, where it nest with its host, *Formica pallidefulva*.

<<geog>>**Geographic Range:** This species ranges from Long Island and Ontario, south to northern Florida, and west to Mississippi. There are disjunct records of this species in the lower elevation montane meadows of Colorado and northern New Mexico. It has not yet been collected from New England.

<<nathist>>**Natural History:** *Polyergus montivagus* enslaves *Formica pallidefulva* throughout its range, and is rarely collected. Colonies of the *F. pallidefulva* greatly outnumber those of the slave-maker. *Polyergus montivagus* is most often encountered during its late afternoon raids to acquire *F. pallidefulva* brood (mostly pupae) on warm, dry summer days. Colony sizes of this species are the smallest of our *Polyergus* species, and you may first find nests of this ant when you find its slaves.

<<look>>**Look-alike species:** No other species in our region has toothless, sickle-shaped mandibles.

<<6-3-6-polmon-face.tif>>

<<6-3-6-polmon-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sickle-shaped, toothless mandibles immediately identify the genus *Polyergus*

<<dist-b>>B. There are usually no erect hairs on the rear margin of the head of *P. montivagus*

<<dist-c>>C. The body of *P. montivagus* has a dull, or matte, appearance (contrast with *P. lucidus*)

<<scalebar=5.5mm>>

<<spec>>An undescribed species of *Polyergus* that is closely related to *Polyergus longicornis*

<<common>>

<<etym>>

<<coltab, color="173-7">> Genus *Polyergus*

<<pollon-habitat.tif>>

<<polsan-MCZ001Ha.tif>>

<<pollon-map.tif>>

<<hab>>**Habitat:** *Formica* cf. *longicornis* is found in open, sandy fields, grasslands, and open woodlands, where it nests with its host, *Formica dolosa*.

<<geog>>**Geographic Range:** This species ranges from New England to New Jersey, west to the sands of northwestern Indiana. The few New England records of this species most likely reflect earlier lumping of this species with the closely related *P. lucidus*.

<<nathist>>**Natural History:** *Polyergus* cf. *longicornis* enslaves *Formica dolosa* throughout its range, and it is rarely collected. Colonies of the *F. dolosa* greatly outnumber those of the slave-maker. *Polyergus* cf. *longicornis* is most often encountered during its late afternoon forays to acquire *F. dolosa* brood (mostly pupae) on warm, dry summer days. When the slave-makers are not out raiding colonies, you may find them in what appear to be particularly large nests of its slaves, *F. dolosa*.

<<look>>**Look-alike species:** No other species in our region has toothless, sickle-shaped mandibles. This species is closely related to *Polyergus longicornis* of the southern United States, which, like *P. cf. longicornis*, has very long antennae compared with other *Polyergus* species.

<<6-3-6-polmon-face.tif>>

<<6-3-6-polmon-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sickle-shaped, toothless mandibles immediately identify the genus *Polyergus*

<<dist-b>>B. There are at least 20 erect hairs on the rear margin of the head of *P. cf. longicornis*

<<scalebar=6.75mm>>

<<coltab, color="173-8 +M=15,K=0">> Genus *Prenolepis*

<<txa>>*Prenolepis* Mayr, 1861 – The Ant with the Drooping Petiole (from the Greek *prenes*, meaning drooping or hanging forward + *lepis*, meaning scale)

<<6-3-7-preimp-body.tif>>

The third and final genus in the *Prenolepis* group, the genus *Prenolepis* originally also included *Nylanderia* and *Paratrechina*. The genus was named for the characteristic forward-pointing petiole: *Stielchen mit einer schief nach oben und vorne gerichteten viereckigen Schuppe* [“pedicel with a square scale skewed upward and forward”]. In North America, *Prenolepis* is separated from the other two genera in the *Prenolepis* group by its constricted promesonotum, which gives it an hourglass shape when viewed from above. Its large, compound eyes are set high on the head, unlike those of *Nylanderia* and *Paratrechina*, in which the eyes are located in the middle of the head. Currently, 35 species and subspecies are recognized within *Prenolepis*, only one of which, *P. imparis*, occurs in all of North America, including New England.

<<spec>>*Prenolepis imparis* (Say, 1836)

<<common>>The Winter Ant

<<etym>>From the Latin *impar*, meaning unequal or odd, and referring to the great difference in color and size between queens and males

<<coltab, color="173-8 +M=15,K=0">> Genus *Prenolepis*

<<preimp-caterpillar.tif>>

<<preimp-repletes.tif>>

<<preimp-map.tif>>

<<hab>>**Habitat:** *Prenolepis* is most common in open woods, in old-fields and on edges of fields, and around buildings. It feeds on nectar and a wide variety of secretions from flowers and fruits, and also eats many other arthropods, and large numbers of these ants have been seen feeding on dead earthworms.

<<geog>>**Geographic Range:** This species occurs from southern Canada to northern Mexico and throughout the United States. In New England, it is frequently collected in Massachusetts, Connecticut, and Rhode Island.

<<nathist>>**Natural History:** This is one of the first ants to become active in the spring and one of the last to disappear in the fall; because of its tolerance of cold temperatures, it is commonly called the Winter Ant. However, its cold tolerance has not led to its extending its range into boreal climates. Some workers can store fats in their distended abdomens, and other members of the colony feed from these repletes during summer dormancy (estivation).

<<look>>**Look-alike species:** No other species in our region has a constricted, hourglass-shaped promesonotum. It can be confused with *Formica neogagates*, but *Prenolepis* lacks ocelli, whereas *F. neogagates* has them.

<<6-3-7-preimp-face.tif>>

<<6-3-7-preimp-body.tif>>

<<6-3-7-preimp-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The hourglass-shaped mesonotum is distinctive for this species

<<dist-b>>B. The lack of ocelli distinguishes *P. imparis* from *Formica neogagates*

<<scalebar=3.6mm>>

<<coltab, color="253-1 +K=75">>Genus *Anergates*

<<txa>>*Anergates* Forel, 1874 – The Workerless Ant (from the Greek *a*, meaning without + *ergates*, meaning workers)

<<6-4-1-aneatr-body.tif>>

Anergates is a monotypic genus – the single described species is *A. atratulus*. It is a workerless, inquiline social parasite of the pavement ant, *Tetramorium caespitum*: colonies of the parasite consist of queens and males that live with and depend on the host workers for food and labor. Like its host, *A. atratulus* is native to Europe, but it has followed its host around the world. It is impossible to misidentify this genus – no other ant genus in the world more closely resembles a squashed rock lobster. The queens have a pronounced longitudinal depression on the top of the gaster and the pupoid males are virtually indistinguishable from pupae, wingless, and barely able to walk.

<<spec>>*Anergates atratulus* (Schenck, 1852)

<<common>>The Small Workerless Ant

<<etym>>From the diminutive suffix (-*ulus*) applied to the Latin *atratus*, meaning dressed in black, and referring to the small size and the dark color of the queens

<<coltab, color="253-1 +K=75">> Genus *Anergates*

<<Anergates atratulus_Pilon.tif>>

<<Tetramorium_Anergates_Pilon.tif>>

<<aneatr-map.tif>>

<<hab>>**Habitat:** *Anergates* can be found in the same habitat as its host, the Pavement Ant *Tetramorium caespitum*: on sidewalks, rocky outcrops, beaches, and other sandy, rocky, or dry places.

<<geog>>**Geographic Range:** This species may occur worldwide with its host. In North America, it is so far known only from sporadic locations along the eastern seaboard, along with geographically widely separated (disjunct) records from Ohio and Montréal, Canada. In New England, it has been collected in New Haven and on the Boston Harbor Islands.

<<nathist>>**Natural History:** Nests of *Tetramorium* that have been parasitized by *Anergates* never have *Tetramorium* queens. It is thought that *A. atratulus* only colonizes orphaned host colonies: those that have lost their queen.

<<look>>**Look-alike species:** No other genus in the world has a large longitudinal depression running down the top of the gaster.

<<6-4-1-aneatr-face.tif>>

<<6-4-1-aneatr-body.tif>>

<<6-4-1-aneatr-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The longitudinal depression on the gaster is distinctive for this genus and its only species

<<scalebar=3mm>>

<<coltab, color="253-1 +K=45">>Genus *Aphaenogaster*

<<txa>>*Aphaenogaster* Mayr, 1853 – The Dull-gastered Ants (from the Greek *aphanes*, meaning unseen, invisible, or obscure + *gaster*, the end of the abdomen)

<<5-2-aph-genbod.tif>>

Aphaenogaster is a diverse genus of ants; the more than 225 species in this genus are distributed around the world. It was named for its dull (not shiny) gaster, but note that our North American *Aphaenogaster* species have shinier gasters than European ones. It was originally described as being similar to ants of the tropical leaf-cutter genus *Atta*. It is easily recognized in our region by its prominently depressed propodeum, and we often refer to it as the “broke-backed ant,” because its distinctive stepped-down profile gives the impression of a broken back. There are ± 40 species in North America, six of which are present in New England. The three New England *Aphaenogaster* species in the *rudis* species group are important seed dispersers of many of our spring ephemerals: woodland herbs such as Bloodroot (*Sanguinaria canadensis*) and Wake-robber (*Trillium* species) that flower in early spring before the canopy trees leaf out.

<<txb>>Identifying the Species of *Aphaenogaster*

Three of the six New England species of *Aphaenogaster* are distinctive and easy to identify, whereas the other three look very similar to one another. First, the easy ones.

Aphaenogaster treatae is a very large ant with a pronounced lobe at the base of its antennal scape. *Aphaenogaster mariae* is nearly as large as *A. treatae*, and it has long, distinct lines or grooves (striae) that radiate out in a sunburst pattern from the post-petiole onto the anterior part

of the first segment of the gaster. This species also has a very long face, long propodeal spines, and coarse sculpturing on its head and mesosoma. Finally, *A. tennesseensis* is virtually hairless and has propodeal spines that are as long or longer than the distance that separates them.

The other three New England species of *Aphaenogaster* often have been lumped into “*Aphaenogaster rudis*,” but careful measurements and a fine eye for detail have begun to separate this group into at least three species. The New England species of “*A. rudis*” – *A. fulva*, *A. picea*, and *A. rudis* itself – are distinguished by the the color of the four terminal segments of the antennae, the shape and size of the top (peak) of the mesonotum, the place of this mesonotal peak relative to the pronotum, and the size of their propodeal spines. The antennal segments are uniformly colored in *A. rudis*, the peak of the mesonotum of these ants is rounded and not higher than the top of the pronotum, and their propodeal spines are short, upwardly pointed, and less than half as long as the length of the sloping face of the propodeum. The last four segments of the antennae of *A. fulva* and *A. picea* species are much lighter than the remaining segments (and the scape). *Aphaenogaster fulva* has the highest and sharpest mesonotal peak of these species in this species group, and the propodeal spines are as long as the length of the sloping face of the propodeum. The propodeal spines of *A. picea* are somewhat longer than those of *A. rudis* – about two-thirds as long as the length of the sloping face of the propodeum – and they point rearwards, not upwards. Befitting its name, *A. picea* is quite dark, whereas *A. rudis* is much redder. Finally, systematic studies by Bernice DeMarco are revealing what we now refer to as *A. rudis* and *A. picea* will each turn out to be complexes of subtly-varying sibling species. DNA sequences will most likel be necessary to disentangle the taxonomy of this genus in North America.

<<6-4-2-aph-final-matrix.eps>>

This matrix key illustrates three morphological characters that can be used to quickly determine which species of *Aphaenogaster* you have. Each species is shown in profile; size shown is approximately 7× the size of a worker and colors illustrate differences ranging from orange red to dark brown. The species are ordered by size, from largest to smallest. The principle characteristics to look for include sculpturing, antennal shape and color, the shape of the mesonotum, its height at the peak relative to the top of the pronotum, and the size and orientation of the spines. The mesonotum peaks well above the pronotum and the long propodeal spines are directed upwards in the reddish-yellow *A. fulva*. The mesonotum barely projects above the pronotum and the intermediate-length propodeal spines point rearwards in the dark brown *A. picea*. The mesonotal peak does not exceed the height of the pronotum in the remaining four species. The small *A. rudis* is reddish-brown, sometimes appearing nearly purple in the field, and has small, upward-pointing spines. The larger, reddish-brown, and uniquely hairless *A. tennesseensis* has very long propodeal spines, the very large, orange-red *A. treatae* has short propodeal spines, and *A. mariae* has coarse sculpturing on its head and mesosoma. *Aphaenogaster treatae* is the only species in our region with a large lobe at the base of the scape. The last four antennal segments are lighter in color in *A. fulva* and *A. picea*, whereas the antennal segments are uniformly colored in *A. rudis*.

<<txb>>Key to the Species of *Aphaenogaster*

- 1a. **The first gastral tergite has long, distinct lines or grooves (striae) that radiate in a sunburst pattern from the postpetiole;** head and mesosoma coarsely sculptured with dense,

anastomosing ridges (rugae); the propodeal spines are very long – at least as long as the distance between their tips*A. mariae*

<<6-4-2-aphmar-inset.tif>>

1b. First gastral tergite lacks striae; sculpturing on head and mesosoma fine; the propodeal spines normally are not longer than the distance between their tips, but if they are, the mesosoma and gaster are hairless2

2a (1b). The cheeks, as well as the dorsum of the mesosoma and gaster are hairless; the propodeal spines are very long – at least as long as the distance between their tips
.....*A. tennesseensis*

<<6-4-2-aphten-spines.tif>>

2b. Cheeks, mesosoma, and gaster with many erect hairs; propodeal spines normally not longer than the distance between their tips3

3a (2b). Base of antennal scape with a wide, thick lobe extending about 1/4 of the length of the scape*A. treatae*

<<6-4-2-aphtre-flange.tif>>

3b. **Base of antennal scape without a lobe**.....4

4a (3b). **The last four segments of the antennae are the same color as the remaining segments**; the propodeal spines are short – not more than $\frac{1}{2}$ the length of the propodeal declivity (rear-sloping face) – and pointed upward; the top (peak) of the mesonotum not higher than the top of the pronotum.....
.....*A. rudis* (species complex)

<<6-4-2-aphrud-meso.tif>>

4b. **The last four segments of the antenna are lighter in color or paler than the remaining segments**; propodeal spines at least $\frac{2}{3}$ the length of the propodeal declivity and pointed either upwards or towards the rear; top (peak) of the mesonotum as high or higher than the top of the pronotum5

<<6-4-2-aphful-meso.tif>>

5a (4b). **Propodeal spines long** – at least as long as the propodeal declivity – and **pointing upwards**; color reddish-brown.....*A. fulva*

5b. **Propodeal spines shorter** – approximately $\frac{2}{3}$ the length of the propodeal declivity – **and pointing towards the rear**; color dark brown or blackish-brown*A. picea* (species complex)

<<txb>>Easily Confused Species

Although the characteristic broken-back profile of the promesonotum of *Aphaenogaster* is a good starting point for recognizing this genus, it is possible to confuse it with the similarly-shaped, but much smaller, *Pheidole*. This is not surprising, since *Aphaenogaster* and *Pheidole* are closely related genera, currently placed in the tribe Pheidolini. However, *Aphaenogaster* workers are generally all the same size, whereas *Pheidole* has large majors and small minors, and they both have disproportionately large heads (most apparent in the major workers). *Pheidole* also has a distinct three-segmented antennal club, whereas *Aphaenogaster* has, at best, only an indistinct antennal club consisting of at least four segments.

<<spec>>*Aphaenogaster fulva* Roger, 1863

<<common>>The Tawny *Aphaenogaster*

<<etym>>From the Latin *fulvus*, meaning tawny or reddish-yellow

<<coltab, color="253-1 +K=45">>Genus *Aphaenogaster*

<<aphful-habitat.tif>>

<<aphful-work.tif>>

<<aphful-map.tif>>

<<hab>>**Habitat:** This species can be found in moist or dry deciduous forests where it nests in rotten logs and in old tree stumps.

<<geog>>**Geographic Range:** From southern Vermont south to Florida, west to the Midwestern prairie states and as far south as Louisiana. Its apparent rarity in New England is likely due to specimens having been lumped in with other *Aphaenogaster rudis*-group species.

<<nathist>>**Natural History:** *Aphaenogaster fulva* is an omnivorous scavenger, but it is an important disperser of violet (*Viola* species) seeds. After eating the nutritious elaiosome, it discards the seeds. Colonies also host larvae of the hoverfly, *Microdon coarctatus* (family Syrphidae), and may also serve as a host of the temporary social parasite *Aphaenogaster tennesseensis*.

<<look>>**Look-alike species:** *Aphaenogaster fulva* is most likely to be mistaken for either *A. rudis* or *A. picea*. Note the very sharp and high peak of the mesonotum in *A. fulva* and its upward-pointing propodeal spines that are as long as the length of the slope of the propodeum.

<<6-4-2-aphful-face.tif>>

<<6-4-2-aphful-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sharply sloping mesonotum is characteristic of *Aphaenogaster*

<<dist-b>>B. The peak of the mesonotum of *A. fulva* is raised above the peak of the pronotum

<<dist-c>>C. The upward-pointing propodeal spines are long in *A. fulva*

<<scalebar=5.2mm>>

<<spec>>*Aphaenogaster mariae* Forel, 1886

<<common>>Mary's *Aphaenogaster*

<<etym>> Named for its collector, entomologist Mary Treat, who also first collected this species

<<coltab, color="253-1 +K=45">>Genus *Aphaenogaster*

<<canann-mt-flank.tif>>

<<aphmar_MCZ001L.tif>>

<<aphmar-map.tif>>

<<hab>>**Habitat:** This species is thought to nest in the canopies of oaks and other hardwood species.

<<geog>>**Geographic Range:** From Connecticut south to Florida, west to Michigan, Iowa, and Kansas.

<<nathist>>**Natural History:** *Aphaenogaster mariae* is thought to be a temporary social parasite of *A. fulva*, but it has been rarely seen or collected because of its propensity for nesting in tree crowns. Our single New England specimen was collected in 1906 by William Wheeler in northwestern Connecticut. You may find it if you put a peanut-butter bait on the trunk of a large oak tree and wait an hour or so for foragers to find the bait.

<<look>>**Look-alike species:** *Aphaenogaster mariae* has long spines like *A. tennesseensis*; Forel described *A. mariae* as being [*t*]rès voisin du *tennesseensis* et exactement de la même couleur ["very similar to *tennesseensis* and exactly the same color"], but the starburst pattern of striae on the first gastral tergite of *A. mariae* is unique.

<<6-4-2-aphmar-face.tif>>

<<6-4-2-aphmar-body.tif>>

<<6-4-2-aphmar-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sharply sloping mesonotum is characteristic of *Aphaenogaster*

<<dist-b>>B. The coarse sculpturing on the head and mesosoma is unlike other New England
Aphaenogaster species

<<dist-c>>C. The radial striae on the first gastral tergite are unique to *A. mariae*

<<scalebar=5.2mm>>

<<spec>>*Aphaenogaster picea* (Wheeler, 1908)

<<common>>The Pitch-black *Aphaenogaster*

<<etym>>From the Latin *piceus*, meaning pitchy or pitch-black, and also referring to spruce

<<coltab, color="253-1 +K=45">>Genus *Aphaenogaster*

<<aphpic-shroom.tif>>

<<aphpic-brood.tif>>

<<aphpic-map.tif>>

<<hab>>**Habitat:** This species nests in moist conifer forests and mixed-deciduous forests. It nests in damp habitats, including rotten logs, in old tree stumps, under bark and fallen tree limbs, and in small cavities.

<<geog>>**Geographic Range:** Throughout southern Canada and New England south to Georgia and west into Ohio. Its apparent rarity in southern New England is likely due to confusion of this species with *A. rudis*.

<<nathist>>**Natural History:** *Aphaenogaster picea* is an omnivorous scavenger, and it is an important disperser of seeds of woodland herbs. It is a host to the temporary social parasite *Aphaenogaster tennesseensis*.

<<look>>**Look-alike species:** *Aphaenogaster picea* is most likely to be mistaken for either *A. fulva* or *A. rudis*. The pale terminal segments of the antennae separate *A. picea* from *A. rudis*, and its rearward pointing propodeal spines that are as approximately two-thirds the length of the slope of the propodeum separate *A. picea* from *A. fulva*. Ongoing genetic work suggests that what we now recognize as *A. picea* is actually a complex of several closely-related species.

<<6-4-2-aphpic-face.tif>>

<<6-4-2-aphpic-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The last four segments of the antennae are lighter in color or paler than the remaining segments (contrast with *A. rudis*)

<<dist-b>>B. The peak of the mesonotum of *A. picea* is only slightly raised above the peak of the pronotum

<<dist-c>>C. The rearward-pointing propodeal spines of *A. picea* are not as long as the spines of *A. fulva*, but they are longer than the spines of *A. rudis*

<<scalebar=4.4mm>>

<<spec>>*Aphaenogaster rudis* Enzmann, 1947

<<common>>The Rough *Aphaenogaster*

<<etym>>From the Latin *rudis*, meaning rough, and referring to its coarsely sculptured body

<<coltab, color="253-1 +K=45">>Genus *Aphaenogaster*

<<aphrud-worker.tif>>

<<aphrud-prey.tif>>

<<aphrud-map.tif>>

<<hab>>**Habitat:** This species can be found in forests and woodlands. It nests in rotten logs, in old tree stumps, and under bark, fallen tree limbs, and rocks.

<<geog>>**Geographic Range:** Throughout southern Canada and New England south to Alabama and west to Missouri.

<<nathist>>**Natural History:** *Aphaenogaster rudis* is an omnivorous scavenger, and it is an important disperser of seeds of many woodland herbs. It is a host to the temporary social parasite *Aphaenogaster tennesseensis*.

<<look>>**Look-alike species:** *Aphaenogaster rudis* is most likely to be mistaken for either *A. fulva* or *A. picea*. The uniformly-colored antennal segments separate *A. rudis* from *A. picea* and *A. fulva*. Its upward-pointing, short propodeal spines, only about one-half as long as the length of the slope of the propodeum, distinguish *A. rudis* from *A. fulva*. Ongoing morphological analysis, paired with genetic work, suggests that what we now recognize as *A. rudis* is actually a complex of several closely-related species.

<<6-4-2-aphrud-face.tif>>

<<6-4-2-aphrud-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. A. The last four segments of the antennae are the same color as the remaining segments (contrast with *A. picea* and *A. fulva*)

<<dist-b>>B. The peak of the mesonotum of *A. rudis* is not raised above the peak of the pronotum (contrast with *A. fulva*)

<<dist-c>>C. The upward-pointing propodeal spines of *A. rudis* are very short

<<scalebar=4.4mm>>

<<spec>>*Aphaenogaster tennesseensis* (Mayr, 1862)

<<common>>The Tennessee *Aphaenogaster*

<<etym>>Named for its type locality, Tennessee

<<coltab, color="253-1 +K=45">>Genus *Aphaenogaster*

<<aphten-worker-queen-AW.tif>>

<<aphten-tends-AW.tif>>

<<aphten-map.tif>>

<<hab>>**Habitat:** This ant lives in forests and woodlands. It nests in rotten logs and in old tree stumps, but it is more common in standing dead trees than in fallen limbs.

<<geog>>**Geographic Range:** From Québec south to Florida and west to Oklahoma. We know of only a dozen specimens collected from all of New England.

<<nathist>>**Natural History:** *Aphaenogaster tennesseensis* is thought to be a temporary social parasite of *A. fulva*, *A. picea*, and *A. rudis*. The colonies are very large (2,000-5,000 ants) and the workers forage on long scent trails along logs and up trees. This species is more carnivorous than other New England *Aphaenogaster* species, and even hunts isopods.

<<look>>**Look-alike species:** *Aphaenogaster tennesseensis* is very distinctive – it is nearly hairless and it has very long propodeal spines. Unusual for ants, the queens are about the same size as the workers.

<<6-4-2-aphten-face.tif>>

<<6-4-2-aphten-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sharply sloping mesonotum is characteristic of *Aphaenogaster*

<<dist-b>>B. The lack of hairs on its mesosoma and gaster distinguishes *A. tennesseensis* from our other *Aphaenogaster* species

<<dist-c>>C. The very long propodeal spines of *A. tennesseensis* are quite distinctive

<<scalebar=5.2mm>>

<<spec>>*Aphaenogaster treatae* Forel, 1886

<<common>>Treat's *Aphaenogaster*

<<etym>>Named for its collector, entomologist Mary Treat, who also first collected

Aphaenogaster mariae

<<coltab, color="253-1 +K=45">>Genus *Aphaenogaster*

<<aphtre-habitat.tif>>

<<aphtre-worker-AW.tif>>

<<aphtre-map.tif>>

<<hab>>**Habitat:** This species nests in sandy soils in warm habitats. It is collected most commonly in grasslands, heathlands, pine barrens, and other open habitats, where it nests in the soil at the base of a wide variety of plants and under rocks.

<<geog>>**Geographic Range:** From Ontario and the Canadian Maritimes south to Florida and west to Michigan and Illinois.

<<nathist>>**Natural History:** *Aphaenogaster treatae* is the most common *Aphaenogaster* collected on Cape Cod and the Massachusetts islands of Martha's Vineyard and Nantucket. It feeds on insects and seeds.

<<look>>**Look-alike species:** *Aphaenogaster treatae* is very distinctive – it is very large and it has a broad lobe at the base of its antennal scape.

<<6-4-2-aphtre-face.tif>>

<<6-4-2-aphtre-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The sharply sloping mesonotum is characteristic of *Aphaenogaster*

<<dist-b>>B. The large lobe at the base of the antennal scape distinguishes *A. treatae* from the other *Aphaenogaster* species in New England

<<scalebar=6mm>>

<<coltab, color="251-2">>Genus *Cardiocondyla*

<<txa>>*Cardiocondyla* Emery, 1869 – The Ants with the Heart-Shaped Post-petiole (from the Greek *cardia* [heart] + *cóndulos* [knuckle], and referring to the vaguely heart-shaped post-petiole).

<< 6-4-2b-carobs-face.tif>>

The genus *Cardiocondyla* includes 68 species of very tiny ants. The Holarctic species, including many tropical tramps, were reviewed and revised in 2003, but much less is known about the tropical species. *Cardiocondyla* is distinguished from other Myrmicinae by its clypeus, which often extends well over the mandibles; a prominent erect hair in the middle of its clypeus; a very wide, heart-shaped (in dorsal view) post-petiole; and the absence of erect hairs on its mesosoma. It can be confused with *Temnothorax*, *Leptothorax*, *Stenamma*, or *Tetramorium*, but ants in all of these genera have erect hairs on their mesosoma, and are generally larger than *Cardiocondyla*. Only one species, the tropical tramp *C. obscurior*, has been recorded from New England.

<<spec>>*Cardiocondyla obscurior* Wheeler, 1929

<<common>>The Dark *Cardiocondyla*

<<etym>>From the Latin *obscurus*, meaning dark, in reference to its gaster

<<coltab, color="251-2">>Genus *Cardiocondyla*

<<carobs-habitat.tif>>

<<carobs-worker.tif>>

<<carobs-map.tif>>

<<hab>>**Habitat:** This tropical tramp nests in soil in warm habitats. In New England, it can only survive inside of heated buildings, such as greenhouses.

<<geog>>**Geographic Range:** Throughout the world, in the tropics and sub-tropics.

<<nathist>>**Natural History:** Like other species in the genus, *Cardiocondyla obscurior* colonies have many queens and also have long-lived males that can occur in two forms – winged and worker-like (ergatandrous). The ergatandrous males will fight and kill each other within the nest so that only a single male can mate with the many queens that may be produced. Because *Cardiocondyla* individuals are very tiny, and the colonies themselves are small and often hidden within soil, packing material, or plants, they can be missed by inspectors and can spread easily into new areas.

<<look>>**Look-alike species:** *Cardiocondyla* is similar in size and shape to *Temnothorax*. But unlike *Temnothorax* (and the other Leptothoracini genera – *Formicoxenus*, *Harpagoxenus*, *Leptothorax*, and *Protomognathus*), *Cardiocondyla* lacks erect hairs on its body.

<<6-4-2b-carobs-face.tif>>

<<6-4-2b-carobs-body.tif>>

<<6-4-2b-carobs-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The genus was named for the heart-shaped post-petiole

<<dist-b>>B. The large clypeus with a long, median hair

<<dist-c>>C. No erect hairs on the mesosoma

<<scalebar=1.25mm>>

<<coltab, color="255-4">>Genus *Crematogaster*

<<txa>>*Crematogaster* Lund, 1831 – The Ants with the Suspended Gaster (from a misspelling of the Greek *kremastos*, meaning hanging + *gaster*, the end of the abdomen)

<<6-4-3-crecer-body.tif>>

Crematogaster is a very large and diverse genus of ants. Nearly 800 valid species have been described, at least 30 of which occur in North America, but only two species are so far known from New England. It is impossible to mistake this genus for any other. As Peter Wilhelm Lund wrote in describing the genus, *Ce genre est caractérisé...mais surtout par l'insertion du pédicule au milieu de la surface supérieure de l'abdomen* [“[t]his genus is characterized...especially by the insertion of the post-petiole in the middle of the upper surface of the gaster”]. We suspect that the gaster suspended from the post-petiole provided Lund with the genus name, but that he dropped an *s*: the Greek word *kremastos* means suspended or hanging. The unique articulation of the petiole and post-petiole to the gaster allows the ant to flex its gaster up and over its back, pointing the stinger forward in a defensive posture. Despite this rather menacing behavior, the spatula-shaped sting is not designed to penetrate potential attackers. Rather, the sting simply secretes a noxious-smelling liquid that repels enemies. The drop of liquid secreted by the stinger drips onto the many hairs on the ant's mesosoma, adding smelly insult to the visual injury.

<<txb>>Identifying the Species of *Crematogaster*

The two New England species of *Crematogaster* are distinguished by the hairiness of their pronotum. *Crematogaster cerasi* has one or two long, erect hairs on each corner (shoulder) of the pronotum, whereas *C. lineolata* has short, erect hairs across the entire pronotum.

<<txb>> Key to the Species of *Crematogaster*

1a. **No erect hairs on mesosoma except for 1-2 pairs of erect hairs on the corners of the pronotum** *C. cerasi*

<<6-4-3-crecer-inset-inverted.tif>>

1b. **Many (8-20) short hairs on the pronotum** and scattered elsewhere on the mesosoma.....
.....*C. lineolata*

<<6-4-3-crelin-inset-inverted.tif>>

<<spec>>*Crematogaster cerasi* (Fitch, 1855)

<<common>>The Cherry Ant

<<etym>>From the Latin *cerasus*, meaning cherry, and referring to the tree on which it was first collected tending aphids

<<coltab, color="255-4">>Genus *Crematogaster*

<<crecer-nest.tif>>

<<crecer-worker.tif>>

<<crecer-map.tif>>

<<hab>>**Habitat:** This ant nests in large rotten logs in open fields, the edges of woods, and in woodlands. It may also nest in the wooden frames of houses.

<<geog>>**Geographic Range:** Eastern North America from Québec to Florida, west to the Rocky Mountains and south to New Mexico. It is widespread in New England.

<<nathist>>**Natural History:** This species makes enormous colonies (10,000 or more ants) and forages on long scent trails. It tends aphids, and was described by Asa Fitch as a tender of “plant-lice” of cherry trees in New York State, hence its scientific name. It also collects seeds and dead insects. Nests of *C. cerasi* are often inhabited by crickets in the aptly-named genus *Myrmecophilus* (“ant-lover”).

<<look>>**Look-alike species:** *Crematogaster cerasi* is easily confused with *C. lineolata*. Look at the pronotum. If there are only one or two erect hairs at the corners of the pronotum, it is *C. cerasi*. If the pronotum is hairy all over, it is *C. lineolata*.

<<6-4-3-crecer-face.tif>>

<<6-4-3-crecer-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The heart-shaped, suspended gaster is characteristic of *Crematogaster*

<<dist-b>>B. The one or two erect hairs at each corner of the pronotum distinguish *C. cerasi*
from *C. lineolata*

<<scalebar=3.6mm>>

<<spec>>*Crematogaster lineolata* (Say, 1836)

<<common>>The Small-lined *Crematogaster*

<<etym>>From the Latin *lineola*, meaning small-lined, and referring to the longitudinal lines (rugae) on top of the mesosoma

<<coltab, color="255-4">>Genus *Crematogaster*

<<cerlin-habitat.tif>>

<<crelin-worker.tif>>

<<crelin-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, under rocks, in and under dead wood, at the base of grass clumps, in open fields, the edges of woods, open shrublands, and in houses. We often find it along power line rights-of-way.

<<geog>>**Geographic Range:** Eastern North America from Québec to Florida, and west to Great Plains. It is widespread in New England.

<<nathist>>**Natural History:** Colonies of *C. lineolata* are large (1,000 – 10,000 workers) and may have many queens. Workers occasionally builds covered chambers, called “cow-sheds,” on the sides of plant stems that are made of plant debris or mud. *Crematogaster* houses aphids and other Homoptera inside these sheds and the ants tend these tiny livestock for their honeydew.

<<look>>**Look-alike species:** *Crematogaster lineolata* is easily confused with *C. cerasi*. Look at the pronotum. If the pronotum is hairy all over, it is *C. lineolata*. If there are only one or two erect hairs at the corners of the pronotum, it is *C. cerasi*.

<<6-4-3-crelin-face.tif>>

<<6-4-3-crelin-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The heart-shaped, suspended gaster is characteristic of *Crematogaster*

<<dist-b>>B. The many hairs on the pronotum distinguish *C. lineolata* from *C. cerasi*

<<dist-c>>C. The fine lines, or striae, on much of the head and body, give this species its name

<<scalebar=3.5mm>>

<<coltab, color="254-6">>Genus *Formicoxenus*

<<txa>>*Formicoxenus* Mayr, 1855 – The Guest Ants (from the Latin *formica* [ant] and the Greek *xenos* [guest, stranger], referring to their habit of living in the nests of other ants

<<6-4-4-forpro-inset.tif>>

The genus *Formicoxenus* is a very small genus of ants with only seven valid species spread all around the northern hemisphere. The genus was thoroughly revised in 1985, as part of a broader analysis of ants in the tribe Leptothoracini (which includes our genera *Formicoxenus*, *Harpagoxenus*, *Leptothorax*, *Protomognathus*, and *Temnothorax*). Ants in this genus are readily identified by the many short, erect hairs poking out from between the facets of their compound eyes. Of the five Nearctic species, only one, *F. provancheri*, is currently known from New England.

<<spec>>*Formicoxenus provancheri* (Emery, 1895)

<<common>>Provancher's *Formicoxenus*

<<etym>>Named for Léon Provancher, who first described this species as *Myrmica tuborum*

<<coltab, color="254-6">>Genus *Formicoxenus*

<<forpro-habitat.tif>>

<<forpro-MCZ001H.tif>>

<<forpro-map.tif>>

<<hab>>**Habitat:** This ant nests in bogs and fens with or near its host, *Myrmica incompleta*.

<<geog>>**Geographic Range:** Northern North America from Québec and Maine west to North Dakota, and at high elevations in Colorado and New Mexico.

<<nathist>>**Natural History:** This species, like others in the genus, is a trophic or xenobiotic social parasite that takes food from the mouths of its hosts. *Formicoxenus* makes small colonies (< 100 workers) in the walls of their host's nests. Although *Formicoxenus* raises its own brood, it depends on its host for food and shelter.

<<look>>**Look-alike species:** *Formicoxenus* is similar in size and shape to ants in the other

Leptothoracini genera – *Harpagoxenus*, *Leptothorax*, *Protomognathus*, and *Temnothorax*.

Similar to *Leptothorax* and *Temnothorax*, the mandibles of *Formicoxenus* have five or six teeth,

whereas *Harpagoxenus* has no teeth and *Protomognathus* only four teeth on its mandibles. But

Formicoxenus has distinctive erect hairs emerging from its compound eyes, which the other four

Leptothoracini genera lack.

<<6-4-4-forpro-face.tif>>

<<6-4-4-forpro-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The erect hairs protruding from the compound eyes are distinctive for this genus

<<dist-b>>B. Mandibles with five or six teeth

<<scalebar=3mm>>

<<coltab, color="254-8">>Genus *Harpagoxenus*

<<txa>>*Harpagoxenus* Forel, 1893 – The Robber Guest Ants (from the Greek *harpaxo* [robber]

+ *xenos* [guest, stranger], referring to their raiding and slave-making habits

<<6-4-5-harcan-face.tif>>

The genus *Harpagoxenus* is a very small genus of ants with only three recognized species that range throughout the northern hemisphere. Only one species, *H. canadensis*, occurs in North America (and New England). Although originally named *Tomognathus* by Gustav Mayr in 1861, that name had been used in 1850 to name another genus – of fossil fish – and so the rules of nomenclature demanded a new name, which Auguste-Henri Forel supplied in 1893. Ants in the genus *Harpagoxenus* are easily recognized by the pronounced grooves (scrobes) on either side of the frontal lobes in which the antennae nestle, and by the lack of teeth on their mandibles. *Harpagoxenus* species raid and enslave ants in the genus *Leptothorax*.

<<spec>>***Harpagoxenus canadensis*** Smith, 1939

<<common>>The Canadian *Harpagoxenus*

<<etym>>Named for its type locality, Québec, Canada

<<coltab, color="254-8">>Genus *Harpagoxenus*

<<harcan-habitat.tif>>

<<harcan-MCZ001H.tif>>

<<harcan-map.tif>>

<<hab>>**Habitat:** This ant nests near its hosts, two undescribed species of *Leptothorax*, in rotten wood and under bark.

<<geog>>**Geographic Range:** Northern North America including the Canadian Maritime provinces, Québec, Maine, Michigan, Minnesota, and a single record from southwest Colorado. In New England, it is known from only two localities in coastal, Downeast Maine.

<<nathist>>**Natural History:** This species raids colonies of its hosts, *Leptothorax* sp. AF-can and *L. sp.* AF-erg, kills the queen, and carries off brood to rear as slaves in its own nest.

<<look>>**Look-alike species:** *Harpagoxenus* is similar in size and shape to ants in the other Leptothoracini genera – *Formicoxenus*, *Leptothorax*, *Protomognathus*, and *Temnothorax*. But *Harpagoxenus* is distinctive because its mandibles lack teeth, it has pronounced antennal scrobes, and its clypeus is deeply notched.

<<6-4-5-harcan-face.tif>>

<<6-4-5-harcan-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have no teeth

<<dist-b>>B. There are pronounced antennal scrobes

<<dist-c>>C. The clypeus is deeply notched

<<scalebar=4.25mm>>

<<coltab, color="265-1 +K=60">>Genus *Leptothorax*

<<txa>>*Leptothorax* Mayr, 1855 – The Thin Ants (from the Greek *leptos*, meaning thin or fine + *thorax*, referring to the mesosoma of the ant)

<<5-2-lep-genbod.tif>>

Once considered a hyper-diverse genus with over 500 species, *Leptothorax* now has been reduced to only 20 or so species; nearly 400 of the others have been transferred to *Temnothorax*, and the remainder placed in at least eight other genera. *Leptothorax* is a cool-climate, almost boreal, genus with representatives throughout the northern hemisphere. In North America, there are at least ten species in two species groups, the *muscorum* group and the *acervorum* group. We have recorded three species from New England, all of which are in the *muscorum* group; two of these species are being assessed and taxonomically revised by Professor André Francoeur, and we refer to the species using his standard abbreviations for them. Another two, one in each species group, have been documented from nearby Québec and are included in this guide.

Leptothorax is named for its slender, tapering mesosoma, but we recognize it by its six-toothed mandibles (except for *L. wilsoni*), its relatively small size (our most common species, *L. sp. AF-* can, is just over 4 mm long, but the other four species are only 2.5 – 3mm long), its broadly triangular-shaped petiole, and a light impression or suture along the mesonotum.

<<txb>>Identifying the Species of *Leptothorax*

Only one of the five species of *Leptothorax* we discuss – the undescribed *L. sp. AF-can* – is especially common in New England. It is the largest of our *Leptothorax* species – workers are at least 4 mm long – and its dark brown to black color is distinctive. In recent literature *L. sp. AF-can* has been referred to variously as “Species B,” “*muscorum*” or “*muscorum*-group,” or even “large brown” or “large black.” A second undescribed species, *Leptothorax sp. AF-erg*, has recently been separated from *L. sp. AF-can* based on the presence of a pronounced tooth-like process on the bottom of its post-petiole. *Leptothorax sp. AF-erg* is also smaller (workers ~2.7 mm) and lighter brown in color. In the scientific literature, *L. sp. AF-erg* has been called “Species A” or “small brown,” to distinguish it from *L. sp. AF-can*. *Leptothorax wilsoni* is an inquiline social parasite of *L. sp. AF-can*; its single-toothed mandibles distinguish it from all our other *Leptothorax* species. The last two species have simple characters that distinguish them from the others: *L. retractus* has a deeply notched clypeus, and *L. sphagnicola* has many erect hairs on its antennae, which is a defining characteristic of the *acervorum* group. *Leptothorax sphagnicola* was originally named *L. sphagnicolus*, but the species name was changed because *sphagnicola* is a noun modifying another noun (*Leptothorax*) – that is, it is a noun in apposition – and hence the ending does not have to agree (in gender) with that of the genus name. Indeed, the rules of naming new species are complex and arcane! Both *L. retractus* and *L. sphagnicola* have been collected in Québec, but are not yet known from New England. If either of these species are here, they will most likely be found in northern Maine or on the high peaks of New Hampshire’s White Mountains or Vermont’s Green Mountains.

<<6-4-6-lep-matrix.eps>>

This matrix key illustrates seven morphological characters that can be used to separate the five New England and eastern Canadian species of *Leptothorax*. Each species is shown in profile; size shown is approximately ten times the size of a worker and colors illustrate differences ranging from dark brown to light brownish-yellow. The species are ordered by size, from largest to smallest. The primary characters to look for on the head are the presence or absence of a notched clypeus, whether or not the antennae have numerous erect hairs, and the number of teeth on the mandible. *Leptothorax retractus* is the only New England species with a notched clypeus, *L. sphagnicola* is the only New England species with many erect hairs on its antennae, and *L. wilsoni*, with its single-toothed mandible, is the only New England species of *Leptothorax* without six teeth on its mandibles. The two remaining species, *L. sp. AF-can* and *L. sp. AF-erg*, are separated by their size, color, length of the erect hairs on their mesosoma, and the presence or absence of a visible process on the lower surface of the post-petiole. *Leptothorax sp. AF-can* is larger (workers > 4mm long), dark brown to black in color, has short (< 0.04mm) erect hairs on its mesosoma, and no process on the bottom of its post-petiole. In contrast, *L. sp. AF-erg* is small (workers < 3mm long), light brown in color, has longer (> 0.07 mm) erect hairs on its mesosoma, and has a distinct, tooth-like process on the bottom of its post-petiole.

<<txb>>Key to the Species of *Leptothorax*

1a. **Ant with numerous erect hairs on the antennal scapes and tibiae**; a species of boreal bogs
*L. sphagnicola*

<<6-4-6-lepsph-antenna.tif>>

1b. **Erect hairs absent on antennal scapes or tibiae**; wooded or open habitats, rarely bogs2

2a (1b). **Clypeus deeply notched**; queens very small; most common in boreal forests, but
extending into boreal-temperate transition zone, especially in stands dominated by Jack
Pine (*Pinus banksiana*) *L. retractus*

<<6-4-6-lepret-face-dk.tif>>

2b. **Clypeus not notched**.....3

3a (2b). **Six teeth clearly visible on mandibles of workers and queens**; lower surface
of the post-petiole with or without a prominent tooth4

3b. **Only one tooth (an apical one) present on mandible of the queens**; lower surface
of the post-petiole with a prominent tooth; any workers (with six teeth) that are
present in the colony are those of this species' host, *L. sp. AF-can* *L. wilsoni*

<<6-4-6-lepwil-mandible.tif>>

4a (3a). **Ant dark-brown to black, hairs on mesosoma short** (< 0.04 mm); no
anterior process visible on lower surface of post-petiole; a widespread species in
northeastern woodlands. *L. sp. AF-can*

<<6-4-6-lepcan-petiole.tif>>

4b. **Ant light-brown to brown. Hairs on mesosoma long** (> 0.07 mm); anterior process visible on lower surface of post-petiole; relatively uncommon species of dry open or disturbed woodlands *L. sp.* AF-erg

<<6-4-6-leperg-petiole.tif>>

<<txb>>Easily Confused Species

Leptothorax is easily confused with *Temnothorax*. Both genera in our region have 11-segmented antennae (except for *T. texanus*, which has 12-segmented antennae). *Leptothorax* generally has six teeth on its mandibles and a petiole without an obviously lengthened peduncle, whereas *Temnothorax* has only five teeth on its mandibles and a petiole with a pronounced elongate peduncle.

<<spec>>*Leptothorax retractus* Francoeur, 1986

<<common>>The Notched *Leptothorax*

<<etym>>From the Latin *retractus*, meaning drawn back, and referring to its deeply notched clypeus

<<coltab, color="265-1 +K=60">>Genus *Leptothorax*

<<lepret-habitat-ME.tif>>

<<lepret-MCZ001H.tif>>

<<lepret-map.tif>>

<<hab>>**Habitat:** *Leptothorax retractus* is an ant of boreal, conifer forests that also lives in mixed stands of larch, birch, and aspen. It nests in dead wood on the soil surface or in wood that has been partially buried.

<<geog>>**Geographic Range:** A mostly boreal species, *L. retractus* has been collected in Canada from the Yukon, and the provinces of Alberta, Ontario, Québec, and New Brunswick. It is also recorded from Utah. There are no known records of this species in New England, but it may occur at high elevations in the White Mountains of New Hampshire or the Green Mountains of Vermont. Because this species often nests in stands of Jack Pine (*Pinus banksiana*), it might also be collected in the coastal bogs of coastal Downeast Maine.

<<nathist>>**Natural History:** This species makes small colonies of ~50 workers and a single queen. When given a choice, the slave-maker *Harpagoxenus canadensis* avoids this species in favor of *L. sp. AF-can*.

<<look>>**Look-alike species:** The deeply notched clypeus of *Leptothorax retractus* distinguishes it from all our other *Leptothorax* species.

<<6-4-6-lepret-face.tif>>

<<6-4-6-lepret-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have six teeth

<<dist-b>>B. The clypeus is deeply notched

<<scalebar=2.4mm>>

<<spec>>*Leptothorax sphagnicola* Francoeur, 1986

<<common>>The *Leptothorax* of the Moss

<<etym>>From the Latin *Sphagnum*, referring to the genus of moss + *-i(n)cola*, meaning one who dwells in, and referring to its habitat

<<coltab, color="265-1 +K=60">>Genus *Leptothorax*

<<lepsph-habitat-ME.tif>

<<lepsph-MCZ001H.tif>>

<<lepsph-map.tif>>

<<hab>>**Habitat:** *Leptothorax sphagnicola* nests in *Sphagnum* and *Polytrichum* mosses in boreal spruce bogs.

<<geog>>**Geographic Range:** A boreal species of cold spruce bogs, *L. sphagnicola* has been collected only from central Québec in the Saguenay–Lac St. Jean region. Its specific habitat requirements suggest that it will be rare in New England. However, as an indicator, if *Dolichoderus* species are present in a bog, it is probably too warm for *L. sphagnicola*. The most likely places to find this species will be in bogs in far northern Maine or on the tops of New England's highest mountains.

<<nathist>>**Natural History:** This species makes small colonies of ~35 workers and may have multiple queens or at least ergatogynes, individuals that share characters of both workers and queens.

<<look>>**Look-alike species:** The many erect hairs on its antennae (and its rear tibiae) distinguish *L. sphagnicola* from our other *Leptothorax* species. This character, along with the

shape of its propodeum and associated spines, its petiole, and its chromosome number, all suggest that *L. sphagnicola* is a member of the *L. acervorum* group of species. The other New England *Leptothorax* species are all placed in the *L. muscorum* group of species.

<<6-4-6-lepsph-face.tif>>

<<6-4-6-lepsph-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have six teeth

<<dist-b>>B. There are many erect hairs on the antennal scapes

<<dist-c>>C. The erect hairs on the mesonotum and gaster are very long (~0.1 mm)

<<scalebar=2.4mm>>

<<spec>>*Leptothorax wilsoni* Heinze, 1989

<<common>>Wilson's *Leptothorax*

<<etym>>Named for Harvard's E. O. Wilson, who said that Mount Monadnock, where this ant was found, is "in the backyard of Harvard University."

<<coltab, color="265-1 +K=60">>Genus *Leptothorax*

<<lepwil-habitat.tif>>

<<lepwil-MCZ001L.tif>>

<<lepwil-map.tif>>

<<hab>>**Habitat:** *Leptothorax wilsoni* is a workerless inquiline social parasite of *L. sp. AF-can* and *L. sp. AF-erg*. It can be found with them in dead stems of open, shrubs and small trees (1-3 m tall) growing in boreal forests and at high-elevations.

<<geog>>**Geographic Range:** A boreal species, *L. wilsoni* has been collected from Alberta, Québec, New Brunswick, Alaska, and its type locality, New Hampshire's Mount Monadnock – Harvard's so-called backyard.

<<nathist>>**Natural History:** *Leptothorax wilsoni* kills the host queens before taking over the host colony, but like other inquiline social parasites, it relies on the host workers to care for its queens and males.

<<look>>**Look-alike species:** The single-toothed mandible and the lack of workers distinguish *L. wilsoni* from all our other *Leptothorax* species.

<<6-4-6-lepwil-face.tif>>

<<6-4-6-lepwil-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have only one weakly-developed apical tooth

<<dist-b>>B. There is a distinctive process beneath the post-petiole

<<dist-c>>C. The propodeal spines are relatively short and stubby

<<scalebar=3.2mm>>

<<spec>>An undescribed species of *Leptothorax*, species code AF-can

<<common>>

<<etym>>

<<coltab, color="265-1 +K=60">>Genus *Leptothorax*

<<lepcan-habitat.tif>>

<<lepcan-worker.tif>>

<<lepcan-map.tif>>

<<hab>>**Habitat:** This ant nests in stumps, rotten wood, under bark, and under rocks.

<<geog>>**Geographic Range:** A temperate and boreal species, *L. sp.* AF-can ranges throughout Canada and Alaska, throughout New England, in the upper Midwestern states, and at high elevations in the Rocky Mountains and southwestern states.

<<nathist>>**Natural History:** Little is known of this species, because for many years it was lumped together with others in the *Leptothorax muscorum* complex of species. In recent literature, it is referred to as *Leptothorax* “species B,” “large brown,” or “large black.” It is one of two hosts for the social parasite *Leptothorax wilsoni*.

<<look>>**Look-alike species:** *L. sp.* AF-can is similar in size and shape to ants in the other Leptothoracini genera – *Formicoxenus*, *Harpagoxenus*, *Protomognathus*, and *Temnothorax*. But *Leptothorax* is distinctive because its mandibles have six teeth, relatively short spines, and no antennal scrobes. *Leptothorax sp.* AF-can can be distinguished from *L. sp.* AF-erg by its larger size, shorter erect hairs, and the absence of a post-petiole process.

<<6-4-6-lepcan-face.tif>>

<<6-4-6-lepcan-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have six teeth

<<dist-b>>B. The erect hairs on the mesosoma are short (< 0.04 mm), compared with those of

Leptothorax sp. AF-erg

<<dist-c>>C. There is no process underneath the post-petiole

<<scalebar=4.5mm>>

<<spec>> Another undescribed species of *Leptothorax*, species code AF-erg

<<common>>

<<etym>>

<<coltab, color="265-1 +K=60">>Genus *Leptothorax*

<<leperg-habitat(1678).tif>>

<<leperg-workers(1680).tif>>

<<leperg-map.tif>>

<<hab>>**Habitat:** This ant nests in stumps, rotten wood, under bark, and under rocks.

<<geog>>**Geographic Range:** A boreal species, *L. sp.* AF-erg ranges throughout Canada. It is known in New England from several localities in Maine. As more collections of *L. "muscorum"* are examined, a better sense of its range will emerge.

<<nathist>>**Natural History:** Little is known of this species, as for many years it was lumped together with others in the *Leptothorax muscorum* complex of species. In recent literature, it is referred to as *Leptothorax* "species A" or "small brown." It is one of two hosts for the social parasite *Leptothorax wilsoni*.

<<look>>**Look-alike species:** *Leptothorax sp.* AF-erg is similar in size and shape to ants in the other Leptothoracini genera – *Formicoxenus*, *Harpagoxenus*, *Protomognathus*, and *Temnothorax*. But *Leptothorax* is distinctive because its mandibles have six teeth, relatively short spines, and no antennal scrobes. *Leptothorax sp.* AF-erg can be distinguished from *L. sp.* AF-can by its smaller size, longer erect hairs, and the presence of a post-petiolar process.

<<6-4-6-leperg-face.tif>>

<<6-4-6-leperg-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have six teeth

<<dist-b>>B. The erect hairs on the mesosoma are long (> 0.07 mm), compared with those of

Leptothorax sp. AF-can

<<dist-c>>C. There is a pronounced process beneath the post-petiole

<<scalebar=2.7mm>>

<<coltab, color="276-1">>Genus *Monomorium*

<<txa>>*Monomorium* Mayr, 1855 – The One-Segmented Ants (from the Greek *monos*, meaning one + *morion*, referring to a member or segment, and referring to the maxillary palp)

<<6-4-7-monflo-face.tif>>

Monomorium is a very diverse genus; nearly 600 species have been described and ~400 species are currently recognized as valid. Fortunately for us, fewer than 20 species of *Monomorium* can be found in North America. Of these, only four are known from New England, two – *M. pharaonis* and *M. floricola* – are tropical tramp species, and only one, *Monomorium emarginatum* is commonly collected in the field.

This is a very easy genus to identify. *Monomorium* is nearly unique among New England Myrmicinae in that it lacks propodeal spines; our only other spineless Myrmicinae genus is *Solenopsis*. But our native *Monomorium* species have 12-segmented antennae with 3-segmented clubs, and are dark green to jet black. In contrast, our *Solenopsis* species have 10-segmented antennae with 2-segmented clubs, and are brownish-yellow or lemon-yellow in color. In describing the genus, Gustav Mayr named it for its one-segmented maxillary palp; he explicitly states that the name is *In Beziehung auf die Kiefertaster* [“in reference to the maxillary palp”]. Although the type species (*M. monomorium*) and our occasional *M. floricola* indeed have one-segmented maxillary palps, our other New England *Monomorium* species have two-segmented maxillary palps. In some Malagasy species, the maxillary palps may have three or even five segments.

<<txb>>Identifying the Species of *Monomorium*

Only one species of *Monomorium* – *M. emarginatum* – is common throughout New England. It is dark black in color, and is distinguished from *M. viride* by the long length of the sloping posterior surface (the declivity) of its propodeum relative to the shorter dorsal surface of its propodeum. In *M. viride*, the dorsal surface is longer than the posterior surface. Furthermore, *M. viride* is a warm-climate species that is restricted to pure sand and has been collected so far only in the pine barrens of Massachusetts and southwestern Rhode Island. In contrast, *M. emarginatum* is much less particular in its nesting sites, although it too prefers sandy soils; it has been collected throughout New England, north to central Maine. The two other species are exotic, tropical species that only survive indoors in New England. The Pharaoh ant, *M. pharaonis*, is easily identified by its overall yellow-to-light brown or red color and black-tipped gaster, whereas *M. floricola* is bi-colored, with a dark head and gaster and a light brown mesosoma.

<<txb>>Key to the Species of *Monomorium*

- 1a. **Ant concolorous**, dark green to black2
- 1b. **Ant bi-colored**, or if concolorous, then yellow-to-light brown with a black-tipped gaster3
- 2a (1a). **Length of the dorsal surface of the propodeum is shorter than the length of the sloping, posterior surface of the propodeum** (the declivity); body black; widespread throughout New England*M. emarginatum*

<<6-4-7-monema-declivity.tif>>

- 2b. **Length of the dorsal surface of the propodeum is longer than the length of the declivity**; body dark green to black; nests only in pure sandy soils*M. viride*

<<6-4-7-monvir-declivity.tif>>

- 3a (1b). **Ant uniformly yellow-red or light brown**, except for the gaster, which is at least dark brown or black at the tip, but may be entirely dark brown or black.*M. pharaonis*
- 3b. **A bi-colored ant** with a dark head and gaster and a light brown mesosoma *M. floricola*

<<spec>>*Monomorium emarginatum* DuBois, 1986

<<common>>The Furrowed *Monomorium*

<<etym>>Named for its furrowed (emarginate) mesonotum

<<coltab, color="276-1">>Genus *Monomorium*

<<monema-nestsite.tif>>

<<monema-queen.tif>>

<<monema-map.tif>>

<<hab>>**Habitat:** This ant nests in open habitats in sandy or sandy-clayey soils.

<<geog>>**Geographic Range:** A temperate species of the northeastern United States, south to Virginia.

<<nathist>>**Natural History:** Little is known of this species, as it was only identified as a unique species 25 years ago. It makes small crater nests in open habitats. The colonies vary in size and are frequently polygynous. The omnivorous workers forage during the day and use scent trails to direct nestmates to good food supplies.

<<look>>**Look-alike species:** *Monomorium emarginatum* is similar in size and shape to *M. viride*. These two species are distinguished by the ratio of the length of the posterior and dorsal surfaces of the propodeum, and in part by their habitat requirements. The ratio is greater than one in *M. emarginatum* and less than one in *M. viride*. *Monomorium emarginatum* nests in a wide variety of soils, but *M. viride* only nests in pure sand.

<<6-4-7-monema-face.tif>>

<<6-4-7-monema-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The propodeum has no spines

<<dist-b>>B. The 12-segmented antennae end in 3-segmented clubs

<<dist-c>>C. The posterior surface of the propodeum is longer than the dorsal surface of the propodeum

<<scalebar=2.1mm>>

<<spec>>*Monomorium floricola* (Jerdon, 1851)

<<common>>The Flower Ant

<<etym>>From the Latin *floris*, referring to flowers + *-i(n)cola*, meaning one who dwells in, and referring to the habitat in which it was originally collected

<<coltab, color="276-1">>Genus *Monomorium*

<<sugarcane.tif>>

<<monflo-worker-AW.tif>>

<<monflo-map.tif>>

<<hab>>**Habitat:** In its native, tropical habitats, this tiny arboreal ant nests in hollow twigs and branches, under bark, and in dead plant stems. In New England, turns up hiding inside the hollow stems of sugar-cane imported from tropical countries and sold in food markets, and it can survive only in heated structures.

<<geog>>**Geographic Range:** *Monomorium floricola* is a tropical species that originated in Asia, but is now found in tropical regions throughout the world.

<<nathist>>**Natural History:** The queens of *M. floricola* are wingless and new colonies are formed by fission and fragmentation of larger colonies. Its ability to make nests in very small spaces has undoubtedly helped it disperse widely.

<<look>>**Look-alike species:** We have no other similarly colored, tiny ant.

<<6-4-7-monflo-face.tif>>

<<6-4-7-monflo-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The propodeum has no spines

<<dist-b>>B. The antennae end in 3-segmented clubs

<<dist-c>>C. The ant is bi-colored, with a dark head and gaster and a light mesosoma

<<scalebar=1.5mm>>

<<spec>>***Monomorium pharaonis*** (Linnaeus, 1758)

<<common>>*The Pharaoh Ant

<<etym>>From Egypt, the land of the Pharaohs, from where Linnaeus received the specimen he described

<<coltab, color="276-1">>Genus *Monomorium*

<<pyramids.tif>>

<<monpha-workers-AW.tif>>

<<monpha-map.tif>>

<<hab>>**Habitat:** This small ant nests in cracks, crevices, and inside of buildings.

<<geog>>**Geographic Range:** A tropical species, originally from Asia, but now found throughout the world. In New England, it only occurs indoors, and is has been reported from greenhouses in New Hampshire and from buildings in New Haven, Connecticut. An infestation was reported many years ago at the Harvard School of Public Health, in Boston, Massachusetts.

<<nathist>>**Natural History:** The queens of *M. pharaonis* are wingless and new colonies are formed by fission and fragmentation of larger colonies. Colonies can have more than 10,000 workers.

<<look>>**Look-alike species:** We have no other similarly-colored, tiny ant with a 3-segmented antennal club. On a quick glance, it could be confused with thief ants (*Solenopsis* species), but thief ants have 10-segmented antennae with two-segmented clubs and are smaller and yellower than the comparatively large, reddish *M. pharaonis*.

<<6-4-7-monpha-face.tif>>

<<6-4-7-monpha-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The propodeum has no spines

<<dist-b>>B. The antennae end in 3-segmented clubs

<<dist-c>>C. The tip of the gaster, and sometimes the entire gaster, is dark brown or black

<<scalebar=2mm>>

<<spec>>*Monomorium viride* Brown, 1943

<<common>>The Green *Monomorium*

<<etym>>From the Latin *viridis*, meaning green, and referring to its dark green color

<<coltab, color="276-1">>Genus *Monomorium*

<<monvir-habitat.tif>>

<<monvir-queen.tif>>

<<monvir-map.tif>>

<<hab>>**Habitat:** This ant nests in open pine barrens habitats, but only in pure sand.

<<geog>>**Geographic Range:** A rarely collected species of the eastern United States, it was described from two geographically separated populations, one in the New Jersey Pine Barrens, and the other in coastal Georgia and Florida. We know of only three New England records: a specimen collected in 1908 in Kingston, Rhode Island, and more recent collections from Myles Standish State Forest and Cape Cod National Seashore, both in Massachusetts.

<<nathist>>**Natural History:** Little is known of this species, as it is geographically restricted in its distribution and it has been confused with other *Monomorium* species. In the pine barrens of New Jersey and on Long Island, *M. viride* forms enormous, polygynous colonies with large crater-like openings. Queens with *and* without wings are produced, but it is not known if there is any adaptive reason for producing these two types of queens.

<<look>>**Look-alike species:** *Monomorium viride* is similar in size and shape to *M. emarginatum*. These two species are distinguished by the ratio of the length of the posterior and basal surfaces of the propodeum. The ratio is less than 1 in *M. viride* and greater than 1 in *M.*

emarginatum. Queens of *M. viride* are more brown than green, and the queen's head and mesosoma are noticeably sculptured.

<<6-4-7-monvir-face.tif>>

<<6-4-7-monvir-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The propodeum has no spines

<<dist-b>>B. The antennae end in 3-segmented clubs

<<dist-c>>C. The posterior surface of the propodeum is shorter than the dorsal surface of the propodeum

<<scalebar=2mm>>

<<coltab, color="284-2">>Genus *Myrmecina*

<<txa>>*Myrmecina* Curtis, 1829 – The Little Ant (from the Greek *myrmex*, meaning ant + *-ina*, a diminutive suffix)

<<6-4-8-myrame-body.tif>>

Myrmecina is a small genus of small ants; 37 species are recognized, only three of which occur in North America. Two of these species occur in New England, and they can be recognized by their barrel-shaped petiole and their propodeum, which is armed with two pairs of spines.

<<txb>>Identifying the Species of *Myrmecina*

The two species of *Myrmecina* can be distinguished by their color, the process underneath the post-petiole, and degree of sculpturing on their body. The common *M. americana* is heavily sculptured, is dark reddish-brown, and has only a tiny tooth-like process underneath the post-petiole. Our other, undescribed, species of *Myrmecina* is golden- to reddish-brown in color, has little sculpturing on the body, and has a large tooth-shaped process underneath the post-petiole. This undescribed species is hypothesized to be a temporary social parasite or facultative slave-maker of *M. americana*, but not enough data are available yet to support or refute this hypothesis.

<<txb>>Key to the Species of *Myrmecina*

- 1a. **Ant reddish-brown or dark brown**, body heavily sculptured, and with a tiny, tooth-like process underneath the post-petiole *M. americana*

<<6-4-8-myrame1-petiole.tif>>

- 1b. **Ant golden- to reddish-brown in color**, lightly sculptured, and with a **pronounced tooth-like process** underneath the post-petiole Unnamed species of *Myrmecina*

<<6-4-8-myrcry-inset.tif>>

<<txb>>Easily Confused Species

The common *M. americana* can be confused on first glance with other small Myrmicinae, such as *Leptothorax*, *Stenamma*, *Temnothorax*, or *Tetramorium*. But the barrel-shaped petiole and the two pair of propodeal spines are unique to this genus.

<<spec>>*Myrmecina americana* Emery, 1895

<<common>>The American *Myrmecina*

<<etym>>Named for its close similarity to the European *Myrmecina graminicola*

<<coltab, color="284-2">>Genus *Myrmecina*

<<myrame1-nest.tif>>

<<myrame1-prey.tif>>

<<myrame1-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, under rocks, in rotten nuts and acorns, in leaf litter, and under logs in most forests.

<<geog>>**Geographic Range:** This species can be found in most of North America and New England, but it has not been collected from the Rocky Mountains, California, or the Pacific Northwest.

<<nathist>>**Natural History:** Colonies of *M. americana* are small (< 100 ants) and usually have only one queen. They are seldom seen because the workers rarely forage on the surface of the soil or the litter. *Myrmecina americana* preys on other soil invertebrates, especially mites and spring-tails (Collembola).

<<look>>**Look-alike species:** *Myrmecina americana* is similar in color and sculpturing to many *Myrmica* species, but its two pair of propodeal spines and barrel-shaped petiole are distinctive.

<<6-4-8-myrame1-face.tif>>

<<5-2-myrame1-face-oblique.tif>>

<<6-4-8-myrame1-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. There is a prominent ridge that runs the length of the head near its lower margin

<<dist-b>>B. There are two pairs of propodeal spines

<<dist-c>>C. The petiole is cylindrical and barrel-shaped

<<scalebar=3.5mm>>

<<spec>>An undescribed species of *Myrmecina*

<<common>>

<<etym>>

<<coltab, color="284-2">>Genus *Myrmecina*

<<myrcry-habitat-Nasami.tif>>

<<myrcry-MCZ001L.tif>>

<<myrcry-map.tif>>

<<hab>>**Habitat:** This ant is a social parasite of *Myrmecina americana*, and is found in mixed colonies with its host.

<<geog>>**Geographic Range:** Neither the global nor New England range of this undescribed species is known. It has been collected from Massachusetts south to northern Florida and west to the Chiricahua Mountains in southeastern Arizona.

<<nathist>>**Natural History:** This species is a social parasite of *Myrmecina americana*. The single queen produces numerous workers that forage for food and work in the colony. These observations are consistent with the hypothesis that *M. cryptica* is a temporary social parasite or a facultative slave-maker, but additional field observations and experimental data are needed to test this hypothesis.

<<look>>**Look-alike species:** This undescribed species of *Myrmecina* differs from its host by being lighter in color, having a pronounced, tooth-shaped process under its post-petiole, and lacking sculpturing on most of its body. Like its host, it has two pairs of propodeal spines and a barrel-shaped petiole.

<<6-4-8-myrcry-face.tif>>

<<6-4-8-myrcry-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. There is a large tooth-shaped process underneath its post-petiole

<<dist-b>>B. There are two pairs of propodeal spines

<<dist-c>>C. The petiole is cylindrical and barrel-shaped

<<scalebar=3mm>>

<<coltab, color="274-5">>Genus *Myrmica*

<<txa>>*Myrmica* Latreille, 1804 – The Ant (from the Greek *myrmex*, meaning ant)

<<6-4-9-myrame2-body.tif>>

Myrmica is a diverse genus of temperate-zone ants, and it is one of the “big four” genera in New England – the other three being *Formica*, *Lasius*, and *Camponotus*. There are nearly 200 recognized species, but the exact number is not yet known; a 2010 analysis of the Palearctic (“Old World”) species in the genus recognizes 142 extant and 5 fossil species of *Myrmica*. The Nearctic species are being assessed and taxonomically revised by Professor André Francoeur, but his revision has not yet been published. However, our presentation of the 21 New England species of *Myrmica* reflects extensive discussions we have had with Professor Francoeur, and we are fortunate to be able to include five as-yet unnamed species in this field guide (we refer to these undescribed species using Professor Francoeur’s standard abbreviations for them).

In North America, the distinguishing characteristic of the genus is the long tibial spur with its fine comb-like teeth, but *Myrmica* can also be recognized by its size, color, generally heavy sculpturing, and, in all but two cases, long propodeal spines. One species in this group of medium-sized, reddish-brown ants, *Myrmica rubra*, is known to the general public as the European Fire Ant and annoys picnickers on the beaches of Maine and Massachusetts. But there are at least 20 other species of *Myrmica* in New England – nearly half of the species currently known from this genus in North America. Three of the four *Myrmica* species that are social parasites on other *Myrmica* species are known from fewer than five records, and their ecological

and behavioral characteristics are only beginning to be discovered. Careful study of this genus undoubtedly will yield new species and new insights into ant ecology.

<<txb>>Identifying the two categories and nine groups of *Myrmica* species

The first step in differentiating among *Myrmica* species is to distinguish among two broad categories defined by the shape of the antennal scape near where it meets the head. The key characteristic – whether the bend at the base of the scape is smoothly rounded (curved) or sharply angled (angular) when viewed in profile – can sometimes be seen with a hand lens, but it is much clearer when viewed on pinned specimens at relatively low power (6-10×) under a dissecting microscope.

This character – the shape of the antennal bend – can be difficult to see because the position of the antenna will not be the same on every specimen, or even on the two antennae of the same specimen (Figure 5.1). The reason that the position of the antenna will vary within and among specimens is because the antenna is connected to the head by a condyle, which is a ball-joint similar to your hip. And like your hips, each antenna rotates independently with respect to the head (Figure 5.1).

<<Figure 5.1 about here>>

It is very difficult to see the antennal bend if the specimen is not pinned, so start by pinning your *Myrmica*. Now, move the specimen around until you can clearly see the profile of the antenna. Sometimes you will see it when the ant is in full-face view, and sometimes you may have to tip the ant backwards and look at its face from below (Figure 5.1). Once you can see the

profile, decide whether the antennal bend is smoothly rounded and curved (Figure 5.2) or sharply angled (Figure 5.3).

<<Figure 5.2 about here>>

<<Figure 5.3 about here>>

In the descriptions of each *Myrmica* species, we note whether the characters of the antenna should be observed in profile view or in dorsal view, where “profile” and “dorsal” views are with respect to the antennal scape as shown in Figures 5.1 – 5.3.

Now that you’ve decided on the shape of the antennal bend, move on to the species groups: we recognize four groups in the “antennal bend curved” and five groups in the “antennal bend angular” categories. In both antennal bend categories, these groups are distinguished by the shape of the clypeus and frontal lobes on the head, the degree and shape of sculpturing on the head and mesosoma, and whether or not there are coarse punctures at the base of the hairs on the gaster. Unlike the genus *Formica*, in which identifying species groups is easy and identifying species within groups is hard, in *Myrmica* it turns out that it is more difficult to distinguish among species groups than to distinguish species within each group. So to learn *Myrmica*, take your time learning the groups.

The four species groups in the antennal bend curved category are the *rubra*, *incompleta*, *punctiventris*, and *lobifrons* groups. The *rubra* group – a Palearctic group represented in New England only by *M. rubra* – has small, thin frontal lobes that point upwards so that the base of the antennae are clearly visible. The edges of the frontal lobes are evenly convex, and the

triangle between the two frontal lobes is smooth, often shiny, and lacks the prominent ridges (rugae) that are visible on the rest of the head and mesosoma.

The three species in the *punctiventris* group have a large, coarse pit or puncture at the base of each erect hair on their gasters. Also, the edges of their frontal lobes are rounded or somewhat convex, and the margin of the clypeus is more or less angular. The propodeum of ants in the *punctiventris* group is noticeably lower than the promesonotum, giving the mesosoma a stepped-down appearance.

The four species in the *incompleta* group have more triangular frontal lobes, a smoothly convex or modestly concave clypeal margin, and only small, generally inconspicuous pits at the base of the hairs on their gasters. The propodeum of ants in the *incompleta* group is at the same level as the pronotum, as it is in all other New England *Myrmica* species.

Finally, the two species in the *lobifrons* group have a shallow- to deeply-notched clypeus.

The antennal bend angular category is broken up into five species groups: *sculptilis*, *latifrons*, *nearctica*, *detritinodis*, and *scabrinodis*. The *scabrinodis* group – another Palearctic group represented in New England only by *M. scabrinodis* – has a prominently flattened scape that gives it a tapered (not round) appearance in cross-section (to use this character, imagine cutting the scape like a salami and looking at the shape of the slice). As of this writing, *M. scabrinodis* has been found only on three islands in Boston Harbor, and in a single backyard in Porter Square in Cambridge, Massachusetts. This last specimen was found only three months before this guide went to press!

The *sculptilis* group, which consists of two as-yet undescribed species, is characterized by thick, rounded, parallel rugae (ridges) on the head, mesosoma, petiole, and post-petiole, and by extended wings on the side of the clypeus that create a ridge that encloses the antennal socket.

The sculpturing at the bend of the antennal scape is relatively inconspicuous on top but more pronounced along the inner descending side. The remaining groups have thinner rugae on their heads, mesosomas, petioles, and post-petioles, and their rugae are wavy and net-like (anastomosing).

The three species in the *nearctica* group each have a clypeus that is concave or shallowly notched, a flat lower surface of their post-petiole, and antennal scapes that are uniformly wide for their entire length. The projection at the bend of the antennal scape looks like a soup spoon.

The one New England species in the *latifrons* group – *M. latifrons* – has characters that are intermediate between the *sculptilis* and *nearctica* groups. It has only a shallow concavity (barely a notch) on the margin of its clypeus and a lobed lower surface of its post-petiole.

Last, the four species in the *detritinodis* group have antennal scapes that are not uniformly wide for their entire length. Rather, their scapes taper and are narrower at the base (closer to the head). The projection at the bend of the antennal scape is less conspicuous on top, but more conspicuous along the inner side of the base, facing the head. One of the species in the *detritinodis* group has no propodeal spines and is thought to be a workerless social parasite. It is known from only a single specimen collected in 2006 in a pitfall trap in a blueberry barren in Maine; it is not yet formally named.

<<txb>>Identifying the species of *Myrmica*

Once you've gotten this far, you've accomplished the hardest part of identifying *Myrmica* species: figuring out to which group it belongs. Three of the groups – *rubra*, *scabrinodis*, and *latifrons* – each have only one species, so identifying the species group is the same as identifying the species. Otherwise, once the species group has been identified, we look to the clypeus,

propodeal spines, and habitat to distinguish among species within groups of the antennal bend curved category, and we use sizes and shapes of the processes, lobes, and flanges decorating the antennal bend itself to distinguish species within groups of the antennal bend angular category. The variation in shape, form, and sculptured processes visible on the scape is best viewed at 25 – 50× under a dissecting microscope.

Once again, we start with the groups in the antennal bend curved category. Many of these species are habitat specialists, which can often help you make a reliable species determination, if you got the species group right.

The *incompleta* group – If you are in a deciduous forest, you most likely have *M. incompleta*, which also has a bulging clypeus with a straight-to-concave anterior margin and net-like rugae on the top of its head. If you are in a boreal forest in Maine or near the tree-line in the mountains of Vermont or New Hampshire, you most likely have *M. alaskensis*, which has a convex margin on its flattened clypeus and very parallel rugae on the top of its head. The other two species in this group are inquiline social parasites of *M. alaskensis* that produce only queens and males, and which are distinguished by the size and shape of the process protruding from the bottom of their petiole. The process below the petiole of *M. quebecensis* is long and rectangular, whereas the process below the petiole of *M. lampra* is conically-shaped. Neither of these parasitic species has much sculpturing, but of the two, *M. lampra* has virtually none at all whereas *M. quebecensis* has light sculpturing. To date, *M. alaskensis* has been collected only in Maine, but neither *M. lampra* nor *M. quebecensis* has yet been collected in New England.

The *lobifrons* group – The two species in the *lobifrons* group are best distinguished by habitat, clypeus, and propodeal spines. *Myrmica lobifrons* is a bog specialist with a deeply notched clypeus and long propodeal spines that curve downward at their tips. *Myrmica brevispinosa* is a boreal species known in New England up until now only from the White Mountains of New Hampshire. It has a shallowly-notched clypeus and short spines that point straight upwards.

The *punctiventris* group – The three species in this group are distinguished by characteristics of their propodeal spines. *Myrmica punctiventris* has long, wavy spines that are reminiscent of the curving horns of a long-horned steer. Each spine is much longer than the distance separating their tips. In contrast, *M. pinetorum* has shorter spines that point straight upward at an angle of $\sim 45^\circ$, and each of these spines are only as long as, but usually shorter than, the distance separating their tips. Finally, *M. semiparasitica* is a temporary social parasite of *M. punctiventris*. It has very short propodeal spines with large, thick bases and small teeth along their lower surfaces. This species also has a pronounced triangular process below its petiole. It has been collected only at two locations in New England: on Nantucket Island and in the Waterboro Pine Barrens in southern Maine.

<<6-4-9-myrmica1-matrix.tif>>

This matrix key illustrates five morphological characters and one habitat character that can be used to separate *Myrmica* species in the antennal bend curved group. Color and size are of little help here; all of our New England *Myrmica* species are varying shades of brown and 3 – 5

mm long. Instead, look first at the clypeus. *Myrmica lobifrons* and *M. brevispinosa* have pronounced clypeal notches. These two species can then be distinguished by the lengths of their propodeal spines (long in *M. lobifrons*, short in the aptly named *M. brevispinosa*) and their habitat (bogs for *M. lobifrons*, boreal woodlands for *M. brevispinosa*). Next, look at the relative levels of the pronotum and the propodeum. The propodeum in ants of the *M. punctiventris* group are noticeably lower than the pronotum, giving the back a stepped-down appearance. Within this group, the propodeal spines of *M. punctiventris* are long – longer than the distance between their tips – and wavy like the horns of a long-horned steer. In contrast, the propodeal spines of *M. pinetorum* are shorter than the distance between their tips and straight. Finally, the spines of *M. semiparasitica* are short, and this species, a temporary social parasite of *M. punctiventris*, has a large triangular process underneath its petiole. Return to the face. If the frontal lobes are thin, small, and pointing straight up, you probably have the European Fire Ant, *M. rubra*. Otherwise, you are in the *M. incompleta* group, which has thick, triangular or rounded frontal lobes that are oriented more horizontally. The four species in this group are easy to tell apart. *Myrmica incompleta* is a temperate species of deciduous forests. Its clypeus bulges out below its triangular frontal lobes. *Myrmica alaskensis* is a cold-climate species of boreal forests. It, too, has triangular frontal lobes, but its clypeus does not bulge out. The other two species are inquiline social parasites of *M. alaskensis* that rely on the host workers for food, shelter, and rearing of the parasites queens and males, and so the parasite will only be collected in association with the host. Both parasitic species have pronounced processes underneath their petioles; the process of *M. lampira* is conical, whereas the process of *M. quebecensis* is rectangular.

Turning to species in the antennal bend angular categories, we look first at the antennal scapes and then at the shape of the lateral wings of the clypeus. Remember to pin your specimen and re-orient it so that you can see the scape in profile (face-on) or in dorsal view (from the top down), depending on the character you need (Figure 5.1, above). Look at the clypeus and its lateral wings in full-face view. Unlike species in the antennal bend curved category, there are few habitat specialists in the species with angular antennal bends. However, there are enough differences among species in their nesting habitats that you can often eliminate some species from consideration based on where you collected the species.

The *detritinodis* group – The four species in the *detritinodis* group have an antennal scape that, in dorsal view, is narrower toward the base (near the bend) than it is at its end. Continue looking at the scape from the top down (in dorsal view), and rotate it slowly towards you (anteriorly). The thin tissue (lamina) at the base of the scape is small and barely visible in *M. fracticornis*, larger and running down the inside of the base of the scape in *M. detritinodis* and *M. sp. AF-ine*, and very large but lacking a secondary lamina down the inside of the scape in *M. sp. AF-sub*. All four of the *detritinodis*-group species are cold-climate specialists. *Myrmica sp. AF-sub* is known from the southern shores of Hudson Bay, and has been collected at the airport at Goose Bay, Labrador, and at Peggy's Cove near Halifax, Nova Scotia. Only the spineless queen of *M. sp. AF-ine* has been collected, and only one specimen at that, from a blueberry barren in Maine. It is much more likely that you will collect *M. detritinodis*, which is common in northern woodlands, or *M. fracticornis*, which is common along forest edges, shrubby shores along rivers, and in other disturbed but wooded areas of New England.

The *nearctica* group – The three species in the *nearctica* group have an antennal scape that, seen in dorsal view, is equally wide along its entire length, and have a pronounced plate-like structure (lamella) atop the bend of the antennal scape. In *M. americana*, this lamella is circular and spoon-like, and projects upwards. Its shape is similar to that of the soup spoons gracing the tables of Chinese restaurants. In *M. sp. AF-eva*, the lamella is smaller, but still circular and spoon-like, and barely projects above the antennal scape; confirm this by rotating the specimen and observing the antenna and its lamella in profile view. In *M. nearctica*, the lamella is large and circular, but in dorsal view, the lamina extends along the inner side of the scape outwards towards the end of the scape and away from the head.

The *sculptilis* group – Finally, the two undescribed species in the *sculptilis* group are distinguished by the lamella on the bend of the scape. Start by looking at this lamella in dorsal view, and then rotate the specimen toward you (anteriorly) so you can see the inside of the antennal bend. In *M. sp. AF-scu*, this lamella is small (dorsal view) and does not extend beyond the base of the scape (rotate the specimen anteriorly from dorsal view); the frontal lobes of *M. sp. AF-scu*, viewed in full-face view, are flattened and cover the base of the antennae. In contrast, the lamella of *M. sp. AF-smi* is large (in dorsal view) and extends beyond the base of the scape (in anteriorly-rotated view). In full-face view, the frontal lobes of *M. sp. AF-smi* point upward, exposing the base of the antennae. The frontal lobes also often have two separate ridges along their edges, whereas there is only one ridge along the edge of each frontal lobe of *M. sp. AF-scu*.

<<6-4-9-myrmica2-matrix.tif>>

This matrix key illustrates six morphological characters and one habitat character that can be used to separate *Myrmica* species in the antennal bend angular group. As with the other group of *Myrmica* species, color and size are of little help here; these are all medium-sized, brownish ants. Rather, the key characters are on the antennal scapes (here drawn in $\frac{3}{4}$ view, a compromise between profile view and dorsal view, and with the base and condyle extended to reveal the inside of the base), the frontal lobes, and the clypeus, as well as the body sculpturing and the propodeal spines. Start with the antenna. The European species *M. scabrinodis* has a horizontal ridge running along the top of its antennal scape, which is also triangular in cross-section. Next, look at the thick ridges (rugae) that run along the sides and top of the body. Ants in the *M. sculptilis* group have thick, parallel rugae that are rounded in cross-section. The two undescribed species in this group are distinguished by the lamina at the bend of the scape – small in *M. sp. AF-scu*, large in *M. sp. AF-smi*, and by whether the frontal lobes cover the antennal insertion (*M. sp. AF-scu*) or not (*M. sp. AF-smi*). The antennal scape tapers towards its base (towards the head) in the *detritinodis* group, but is untapered in the *latifrons* and *neartica* groups. Within the *detritinodis* group, the species are distinguished by the size of the lamina at the antennal bend (small in *M. fracticornis*, large in *M. sp. AF-sub*, and intermediate in *M. detritinodis* and *M. sp. AF-ine*), propodeal spines (absent in *M. sp. AF-ine*), and habitat (*M. detritinodis* in northern forests and open woodlands; *M. fracticornis* in moist forests, wet meadows, streamsides, and riversides; *M. sp. AF-sub* in boreal forest and tundra; and *M. sp. AF-ine*, which has so far been collected only in a blueberry barren). The *latifrons* and *americana* groups are distinguished by the shape of the lower surface of the post-petiole: it is rounded and lobed in the *latifrons* group and flat in the *americana* group. Our only species in the *latifrons* group is the *M. latifrons*. Within the *americana* group, *M. americana* is a common species of open fields, grasslands, and

sandy areas. It has a distinctive spoon-shaped lamina on top of the antennal bend. *Myrmica* sp. AF-eva has a much smaller lamina on top of the antennal bend that only hints of being a spoon. It is a recent arrival in eastern North America, and so far is known only from disturbed areas; in its home range in central North America it is a grassland specialist. The antennal lamina on the heavily-sculptured *M. nearctica* extends anteriorly along the inner margin of the scape.

<<txb>>Key to the Species of *Myrmica*

1a. Antennal scape viewed in full profile is **evenly curved near its base**2

<<6-4-9-myrmica-gp1-scape.tif>>

1b. Antennal scape viewed in full profile is **bent abruptly near its base** at a nearly 90° (right) angle; there is often a thick lamina or other outgrowth on the dorsal surface of the bend11

<<6-4-9-myrmica-gp2-scape.tif>>

2a (1a). **Anterior margin of clypeus distinctly notched**; if notch is shallow, propodeal spines are short..... (*lobifrons* group) 3

<<6-4-9-myrmica-gp3-face-dk.tif>>

2b. **Anterior margin of clypeus usually without a notch**; if a very shallow notch is present,
the clypeus bulges outward in the middle and the propodeal spines are long4

3a (2a). Clypeus deeply and distinctly notched; **propodeal spines long** and pointed
rearward at an ~45° angle and with tips that curve gently downward; **a bog**
specialist *M. lobifrons*

<<6-4-9-myrllob-spines.tif>>

3b. Clypeus shallowly notched; **propodeal spines short and pointing straight**
upward; a boreal species known in New England only from White Mountains of
New Hampshire *M. brevispinosa*

<<6-4-9-myrbre-spines.tif>>

4a (2b). **Coarse, large punctures** (pits) at the base of the erect hairs on the top of the
gaster; level of propodeum noticeably lower than the level of the promesonotum
..... (*punctiventris* group) 5

<<6-4-9-myrpun-gaster.tif>>

4b. No, or at best fine, **inconspicuous punctures** at the base of the erect hairs on the top of the gaster; level of propodeum more or less even with the level of the promesonotum.....7

5a (4a). **Propodeal spines short with thickened base; large triangular process visible below the petiole**; a temporary social parasite of *M. punctiventris*
.....*M. semiparasitica*

<<6-4-9-myrssem-petiole.tif>>

5b. **Propodeal spines long with narrow base; triangular process below the petiole inconspicuous**6

6a (5b). **Propodeal spines longer than the distance separating their tips** and often wavy; frontal lobes extend upward at a shallow angle, exposing the insertion of the antennae; rugae thick, but flattened on top .. *M. punctiventris*

<<6-4-9-myrsun-spines.tif>>

6b. **Propodeal spines shorter than the distance separating their tips** and usually straight; frontal lobes flat to the head, often with a distinct downward deflection at their edges, and covering the insertion of the antennae; rugae thick and rounded on top*M. pinetorum*

<<6-4-9-myrpin-spines.tif>>

7a (4b). Viewed from above, **frontal lobes thin, and pointed upwards**, exposing the insertion of the antennae; clypeal margin with small indentations; an introduced Palearctic species common along coasts and rivers, as well as in urban disturbed areas *M. rubra*

<<6-4-9-myrrib-lobes.tif>>

7b. Viewed from above, **frontal lobes thick and laterally extended**, at least partially covering the insertion of the antennae; clypeal margin entire, without small indentations (*incompleta* group) 8

<<6-4-9-myrinc-lobes.tif>>

8a (7b). **Head, clypeus, mesosoma, and petiole heavily sculptured and striated**; lower surface of petiole with at most a small outgrowth or process; top of post-petiole in side view evenly (straight) sloped9

<<6-4-9-myrinc-petiole.tif>>

8b. **Ant weakly sculptured, if at all; lower surface of petiole with a large, process;** top of post-petiole hump-shaped in profile; inquiline social parasites; if workers are present, they lack the process under the petiole and instead are workers of the host species10

9a (8a). **Ant of deciduous forests;** clypeus bulges in the middle and straight or modestly concave on the margin; rugae on top of the head anastomosing and net-like *M. incompleta*

<<6-4-9-myriinc-clypeus.tif>>

9b. **Ant of boreal forests;** clypeus evenly convex in the middle and distinctly convex on the margin; rugae on top of the head parallel.....
.....*M. alaskensis*

<<6-4-9-myrala-clypeus.tif>>

10a. (8b) **Process below the petiole conical and angular;** ant shiny, with virtually no sculpturing; an inquiline social parasite of *M. alaskensis*
.....*M. lampra*

<<6-4-9-myrlamp-petiole.tif>>

10b. **Process below the petiole large, rectangular, and blunt;** not very shiny, with light sculpturing; an inquiline social parasite of *M.*

alaskensis.....*M. quebecensis*

<<6-4-9-myrque-petiole.tif>>

11a (1b). **Antennal scape tapered on both sides, giving it a ridge on top and a triangular appearance in cross-section;** a Palearctic, non-native species

.....*M. scabrinodis*

<<6-4-9-myrscs-antxsec.tif>>

11b. **Antennal scape not tapered, giving it a rounded shape in cross-section;** Nearctic, native species12

12a (11b). **Mesosoma, petiole, and post-petiole with thick, parallel, rugae** that would appear round in cross-section; in full-face view, lateral wings of clypeus extended and raised anteriorly into a ridge that encloses the antennal socket; in dorsal view, lamella on the antennal bend are most apparent on the interior side, not on top, of the bend.....
.....(*sculptilis* group) 13

12b. **Mesosoma, petiole, and post-petiole with thinner, net-like, anastomosing rugae** that would appear sharply-angled in cross-section; in full-face view, lateral wings of the clypeus usually not raised anteriorly into a ridge that encloses the antennal socket;

but if the clypeal wings are raised and enclose the antennal socket, then the lamella on the top of the antennal bend, in dorsal view, is apparent and well developed14

<<6-4-9-myrgp2-rugae.tif>>

13a (12a). **In full-face view, frontal lobes large and rounded, covering the antennal socket**; in dorsal view, antennal scape with a small outgrowth/lamella that is not wider than the base itself and with a ridge running along the inside of the base (towards the head).....*Myrmica* sp. AF-scu

<<6-4-9-myrsclu-lobes.tif>>

13b. **Frontal lobes smaller and with a convex margin, not covering the antennal socket**; margin of the frontal lobes may have two separate ridges; in dorsal view, the lamella on the base of the scape is wider than the base itself
.....*Myrmica* sp. AF-smi

14a (12b). **In dorsal view, the shaft of the antennal scape is distinctly narrower at the bend than it is at its apex**; the lamina on the dorsal part of the antennal bend may extend downwards towards the head, but never extends along the scape itself (*detritinodis* group) 15

<<6-4-9-myrdet-scape-top.tif>>

14b. **In dorsal view, the shaft of the antennal scape is more or less uniformly wide across its entire length**; the lamina on the dorsal part of the scape does not extend downwards towards the head, but may extend anteriorly along the scape itself.....18

15a (14a). **Propodeum without spines**; rugae create a spider-web pattern on the head, and anastomosing rugae on the sides..... *Myrmica* sp. AF-line

<<6-4-9-myrmec-propodeum.tif>>

15b. **Propodeum with spines**, all castes present16

16a (15b). **In dorsal view, the bend of the antennal scape has a curved or transverse lamina that continues downwards along the inner side of the base** (towards the head). Forested habitats.....
.....*M. detritinodis*

<<6-4-9-myrdet-scape-flange.tif>>

16b. **In dorsal view, the lamina at the bend of the antennal scape is restricted to the top of the scape** and does not run downwards along the base of the antenna; open and forest-edge habitats.....17

17a (16b). **In dorsal view, the lamina at the bend of the scape is small and barely visible**; a widespread ant of open habitats in northern New England*M. fracticornis*

<<6-4-9-myrfra-scape.tif>>

17b. **In dorsal view, the lamina at the bend of the scape is large and conspicuous**; an uncommon, boreal species
.....*Myrmica* sp. AF-sub

<<6-4-9-myrsb-scape.tif>>

18a (14b). **Lower surface of post-petiole is lobed and projecting forward** when viewed in profile.....*M. latifrons*

<<6-4-9-myreme-inset-petiole.tif>>

18b. **Lower surface of post-petiole is flat**; in profile, post-petiole is slightly convex, but not lobed..... (*nearctica* group) 19

<<6-4-9-myrame2-inset-petiole.tif>>

19a (18b). **In full-face view, lateral wings of clypeus are raised into a ridge that encloses the antennal socket**; margin of frontal lobes are evenly rounded over most of their length; in dorsal view, lamella at antennal bend is spoon-shaped, not extending along the inner (posterior) side of the scape towards its apex20

<<6-4-9-myrame2-clypeus.tif>>

19b. **In full-face view, lateral wings of clypeus flattened and not enclosing the antennal socket**; margin of frontal lobes rounded towards the front but straight or convex posteriorly; in dorsal view, lamella at antennal bend large, and the lamina extends along the inner margin of the scape anteriorly towards its apex..... *M. nearctica*

<<6-4-9-myrynea-clypeus.tif>>

20a (19a). **In dorsal view, the bend of the antennal scape has a large, circular, spoon-like lamella** that projects sharply upward
.....*M. americana*

<<6-4-9-myrame2-scape.tif>>

20b. In dorsal view, the bend of antennal scape with a smaller
lamella that is barely deflected inwardly, giving it a shallow

spoon-shape.....*M. yrmica* sp. AF-eva

<<6-4-9-myreva-scape.tif>>

<<txb>>Easily Confused Species

In the field, *Myrmica* may be mistaken for *Aphaenogaster*. *Myrmica* species are relatively slow-moving and make small colonies, whereas *Aphaenogaster* move rapidly and can have very large colonies. The profiles of the mesosomas of these two genera differ dramatically, and can be distinguished with a 5× or 10× hand lens. The mesonotum is close to the same level as the pronotum in *Myrmica* but the mesonotum is much lower than the pronotum in *Aphaenogaster*. The body of *Myrmica* species usually are heavily sculptured with rugae, whereas the body of *Aphaenogaster* species are comparatively lightly sculptured. *Myrmica* and *Myrmecina* may also be confused in the field, but *Myrmica* has one pair of propodeal spines and a triangular petiole, whereas *Myrmecina* has two pairs of propodeal spines and a cylindrical, barrel-shaped petiole.

<<spec>>*Myrmica alaskensis* Wheeler, 1917

<<common>>The Alaskan Ant

<<etym>>Named for its type locality, Seward, Alaska

<<coltab, color="274-5">>Genus *Myrmica*

<<myrala-habitat.tif>>

<<myrala-worker.tif>>

<<myrala-map.tif>>

<<hab>>**Habitat:** This ant inhabits boreal forests, where it nests in the soil.

<<geog>>**Geographic Range:** *Myrmica alaskensis* ranges throughout Canada and Alaska, and in the lower United States in Maine, Michigan, and at high elevations in the Rocky Mountains. It has been collected in New England so far only from Maine.

<<nathist>>**Natural History:** This species digs tunnels around plant roots to find and tend root-feeding aphids and feeds on their honeydew.

<<look>>**Look-alike species:** The boreal *Myrmica alaskensis* is similar in appearance to the more temperate *M. incompleta*; they are most easily separated geographically. Useful morphological characters to distinguish these two species are the clypeus, which is flattened and has a convex margin in *M. alaskensis*, but bulges outward and has a concave margin in *M. incompleta*; and the rugae on the head, which are parallel in *M. alaskensis*, but net-like and anastomosing in *M. incompleta*.

<<6-4-9-myrala-face.tif>>

<<6-4-9-myrala-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head

<<dist-b>>B. In full-face view, the clypeus is flattened with a convex margin

<<dist-c>>C. The rugae on the top of the head are parallel

<<scalebar=3.5mm>>

<<spec>>*Myrmica americana* Weber, 1939

<<common>>The American Ant

<<etym>>Named for its widespread distribution in North America

<<coltab, color="274-5">>Genus *Myrmica*

<<myrame2-nestarea.tif>>

<<myrame2-caterpillar.tif>>

<<myrame2-map.tif>>

<<hab>>**Habitat:** This ant species nests in sandy soils in open fields and grasslands.

<<geog>>**Geographic Range:** *Myrmica americana* occurs throughout eastern North America from the Canadian Maritimes and Québec south to North Carolina and as far west as Manitoba in the north and Arizona in the south. It can be found throughout New England.

<<nathist>>**Natural History:** This omnivorous species feeds on honeydew from scale insects, aphids, and lacewings that it tends, as well as on animal carcasses and plant secretions.

<<look>>**Look-alike species:** *Myrmica americana* has a very distinctive, spoon-shaped lamella at the bend of its antennal scape. It is most similar to *M. nearctica* and *M. sp. AF-eva*, but its evenly rounded frontal lobes distinguish it from *M. nearctica*, and its antennal lamella is much larger than that on *M. sp. AF-eva*.

<<6-4-9-myrame2-face.tif>>

<<6-4-9-myrame2-scape.tif>>

<<6-4-9-myrame2-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In full-face view, the frontal lobes are evenly rounded

<<dist-b>>B. In dorsal view, the antennal lamella is large and spoon-shaped

<<dist-c>>C. In dorsal view, the antennal scape is uniformly wide over its entire length

<<scalebar=5.3mm>>

<<spec>>*Myrmica brevispinosa* Wheeler, 1917

<<common>>The Short-Spined Ant

<<etym>>From the Latin *brevis*, meaning short, + *spina*, meaning thorny, and referring to its propodeal spines

<<coltab, color="274-5">>Genus *Myrmica*

<<myrbre-habitat.tif>>

<<myrbre-MCZ001L.tif>>

<<myrbre-map.tif>>

<<hab>>**Habitat:** This ant nests under rocks and in sandy soils of boreal forests.

<<geog>>**Geographic Range:** *Myrmica brevispinosa* occurs throughout Canada, Alaska, and North Dakota, and at high elevations in the western mountains as far south as New Mexico. It has been collected in New England so far only from the White Mountains of New Hampshire.

<<nathist>>**Natural History:** This species scavenges dead insects for food. Detailed research on this species has shown that the production of queens is enhanced when they are able to obtain sufficient carbohydrates.

<<look>>**Look-alike species:** The boreal *Myrmica brevispinosa*, with its short spines and its notched clypeus, is unmistakable.

<<6-4-9-myrbre-face.tif>>

<<6-4-9-myrbre-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head

<<dist-b>>B. In full-face view, the clypeus is distinctly notched

<<dist-c>>C. The spines are unusually short for a *Myrmica*

<<scalebar=4.25mm>>

<<spec>>*Myrmica detritinodis* Wheeler, 1917

<<common>>The Eroded or Detrital Ant

<<etym>>From the Latin *detritus*, meaning worn away or of the Earth. It may refer either to the absence of sculpturing on the dorsal surface of the petiole or its nesting habitats

<<coltab, color="274-5">>Genus *Myrmica*

<<myrdet-habitat.tif>>

<<myrdet-moss.tif>>

<<myrdet-map.tif>>

<<hab>>**Habitat:** This ant is most common in boreal forests and in cool conifer and mixed deciduous forests in northern temperate regions. It nests in soil, under moss, or under lichens where moisture is relatively high.

<<geog>>**Geographic Range:** This species occurs throughout Canada, Alaska, and the upper Midwestern United States west to North Dakota, and at high elevations in the western mountains as far south as New Mexico. It has been collected throughout northern and central New England.

<<nathist>>**Natural History:** This species is a good indicator of mature forests, but may also occur in recently disturbed areas, such as in clear-cuts and recent fire-scars, if more dominant ant species have been eliminated.

<<look>>**Look-alike species:** The two described species in the *detritinodis* group are similar in overall appearance, and are best distinguished by the lamina at the antennal bend. The lamina in *M. detritinodis* is curved along the top and then runs downwards along the inside of the base of the scape. In *M. fracticornis*, the lamina is smaller and does not run downwards along the base of

the scape. In addition, *M. detritinodis* favors forested habitats, whereas *M. fracticornis* is more common in shrubby woodlands, wet meadows, and along river margins and streamsides.

<<6-4-9-myrdet-face.tif>>

<<6-4-9-myrdet-scape.tif>>

<<6-4-9-myrdet-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The rugae on the body are triangular in cross-section, and they are wavy and anastomosing, not parallel

<<dist-b>>B. In profile view, the antennal scape has a sharp bend before the insertion into the head

<<dist-c>>C. In dorsal view, the antennal scape tapers towards its base, the lamina is curved, and it runs downwards along the base of the scape

<<scalebar=4.9mm>>

<<spec>>*Myrmica fracticornis* Forel, 1901

<<common>>The Broken-Horned Ant

<<etym>>From the Latin *fractus*, meaning broken, + *cornu*, meaning horn, and referring to its right-angled, antennal bend

<<coltab, color="274-5">>Genus *Myrmica*

<<myrfra-habitat.tif>>

<<myrfra-carries.tif>>

<<myrfra-map.tif>>

<<hab>>**Habitat:** This ant nests in moist soils of shrubby woodlands, forest edges, and near stream margins and river banks in north-temperate regions.

<<geog>>**Geographic Range:** *Myrmica fracticornis* ranges throughout eastern Canada and south to Tennessee, with disjunct populations in the Ozark Mountains, and west to the Rocky Mountains. It is widespread in New England.

<<nathist>>**Natural History:** *Myrmica fracticornis* feeds on honeydew from the aphids and lacewings that it tends.

<<look>>**Look-alike species:** The two described species in the *detritinodis* group, *M. fracticornis* and *M. detritinodis*, are similar in overall appearance, and are best distinguished by the lamina at the antennal bend. The lamina of *M. fracticornis* is relatively small and does not run down along the base of the scape. In contrast, the lamina of *M. detritinodis* is curved along the top and then runs down along the inside of the base of the scape. In addition, *M. fracticornis*

is more common in shrubby woodlands, wet meadows, and along river margins and streamsides, whereas *M. detritinodis* favors forested habitats.

<<6-4-9-myrfra-face.tif>>

<<6-4-9-myrfra-scape.tif>>

<<6-4-9-myrfra-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The rugae on the body are triangular in cross-section, and they are wavy and anastomosing, not parallel

<<dist-b>>B. In profile view, the antennal scape bends sharply before the insertion into the head

<<dist-c>>C. In dorsal view, the antennal scape tapers towards its base, and the lamina is curved and small

<<scalebar=4.5mm>>

<<spec>>*Myrmica incompleta* Provancher, 1881

<<common>>The Incomplete Ant

<<etym>>Named for the incomplete ridges on the wings at the base of the propodeum

<<coltab, color="274-5">>Genus *Myrmica*

<<myrinc-habitat-deerfield.tif>>

<<myrinc-worker-AW.tif>>

<<myrinc-map.tif>>

<<hab>>**Habitat:** This ant inhabits deciduous forests, where it nests in moist soil and in mounds of moss.

<<geog>>**Geographic Range:** *Myrmica incompleta* occurs throughout Canada and Alaska, and in the lower United States south to New Jersey and west to Nevada. It has been collected throughout New England.

<<nathist>>**Natural History:** This species feeds on honeydew from root-feeding aphids and scale-insects. It is the host of the trophic parasite, *Formicoxenus provancheri*. Its brood also are preyed on by larvae of the myrmecophilous syrphid fly, *Microdon albicomatus*, which live in the nests of *Myrmica incompleta*.

<<look>>**Look-alike species:** The temperate *M. incompleta* is similar in appearance to the boreal *Myrmica alaskensis*; they are most easily separated geographically. Useful morphological characters to distinguish these two species are the clypeus, which bulges outward and has a concave margin in *M. incompleta* but is flattened and has a convex margin in *M. alaskensis*, and

the rugae on the head, which are reticulate (net-like) in *M. incompleta* but parallel in *M. alaskensis*.

<<6-4-9-myriinc-face.tif>>

<<6-4-9-myriinc-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In full-face view, the clypeus is bulging with a convex margin

<<dist-b>>B. The rugae on the top of the head are parallel

<<dist-c>>C. The ridge at the base of the wing on the posterior sloping side of the propodeum does not reach the bottom of the wing

<<scalebar=4.5mm>>

<<spec>>**Myrmica lampra** Francoeur, 1968

<<common>>The Bright Ant

<<etym>>From the Greek *lampros*, meaning bright

<<coltab, color="274-5">>Genus *Myrmica*

<<myrlam-habitat.tif>>

<<myrlam-map.tif>>

<<hab>>**Habitat:** This ant is a workerless, inquiline social parasite of *Myrmica alaskensis*, and like its host, nests in the soil of boreal forests.

<<geog>>**Geographic Range:** This species is known from only two locations in Québec, but it could be collected wherever *M. alaskensis* occurs, throughout boreal forests in North America. As of this writing, it has not yet been collected in New England.

<<nathist>>**Natural History:** This inquiline social parasite depends on its host to rear and care for its queens and males. It has been collected so rarely that very little is known of its natural history.

<<look>>**Look-alike species:** This species is easily recognized by its bright and shiny appearance and the conical process below the petiole. Unlike most *Myrmica* species that are heavily sculptured, *M. lampra* has only faint microsculpturing.

<<6-4-9-myrlam-face.tif>>

<<6-4-9-myrlam-body.tif>>

<<6-4-9-myrlam-petiole.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head

<<dist-b>>B. The body is bright and shiny, and lacks obvious sculpturing

<<dist-c>>C. There is a large conical process below the petiole

<<scalebar=5.2mm>>

<<spec>>*Myrmica latifrons* Stärke, 1927

<<common>>The Wide-faced Ant

<<etym>> From the Latin *latus*, meaning wide + *frons*, meaning front, and referring to the large value of the ratio of its head width to the distance between its frontal lobes

<<coltab, color="274-5">>Genus *Myrmica*

<<myrlat-habitat-HL.tif>>

<<myrlat-MCZ001H.tif>>

<<myrlat-map.tif>>

<<hab>>**Habitat:** This ant nests in moist, shady soils in shrubby woodlands and open fields.

<<geog>>**Geographic Range:** *Myrmica latifrons* ranges from the Canadian Maritimes west to Manitoba and south to Georgia in the east and Arizona in the west. It has been collected throughout New England. Because there continues to be disagreement over the correct name of this species – it is referred to in the literature both as *M. latifrons* and *M. emeryana* Cole – the geographic range reported here and elsewhere in the literature may be inaccurate.

<<nathist>>**Natural History:** This omnivorous species feeds on fruit, nectar, and dead insects.

<<look>>**Look-alike species:** *Myrmica latifrons* can be confused with species in the *nearctica* group, because all of these have an antennal scape that is uniformly wide over its entire length. But *M. latifrons* has a very distinctive shape to the lower surface of its post-petiole: it is lobed and projects forward when viewed in profile.

<<6-4-9-myrlat-face.tif>>

<<6-4-9-myrlat-scape.tif>>

<<6-4-9-myrlat-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In dorsal view, the antennal scape is uniformly wide over its entire length

<<dist-b>>B. In dorsal view, the antennal lamina is small

<<dist-c>>C. The base of the post-petiole is lobed and projects forward

<<scalebar=4.25mm>>

<<spec>>*Myrmica lobifrons* Pergande, 1900

<<common>>The Lobe-fronted Ant

<<etym>>From the Latin *lobus*, meaning lobe, + *frons*, meaning front, and referring to its pronounced frontal lobes

<<coltab, color="274-5">>Genus *Myrmica*

<<myrlob1-PMNWR-1849.tif>>

<<myrlob2-PMNWR-1857.tif>>

<<myrlob-map.tif>>

<<hab>>**Habitat:** This ant occurs only in bogs and nutrient-poor fens in north temperate and boreal regions.

<<geog>>**Geographic Range:** The exact range of this species is not known, as previous records of it have mistakenly referred to other species. We have collected it from bogs and poor fens in every New England state except Rhode Island.

<<nathist>>**Natural History:** This species is one of the most common ants that can be found in bogs. It is the primary prey of the northern pitcher plant, *Sarracenia purpurea*. In fact, our studies of the interaction between *Myrmica lobifrons* and pitcher plants led us to write this field guide!

<<look>>**Look-alike species:** This is the only bog-inhabiting *Myrmica* with a deeply notched clypeus.

<<6-4-9-myrlob-face.tif>>

<<6-4-9-myrllob-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head

<<dist-b>>B. In full-face view, the clypeus is deeply notched

<<dist-c>>C. The propodeal spines point rearward at an $\sim 45^\circ$ angle and their tips curve gently downward

<<scalebar=5mm>>

<<spec>>*Myrmica nearctica* Weber, 1939

<<common>>The Nearctic Ant

<<etym>>Named for its collection in North America, originally as a subspecies of the Palearctic *M. sabuleti*

<<coltab, color="274-5">>Genus *Myrmica*

<<myrnea-habitat-HL.tif>>

<<myrnea-MCZ001H.tif>>

<<myrnea-map.tif>>

<<hab>>**Habitat:** This ant nests under rocks, logs, and stumps in a mixed deciduous forests.

<<geog>>**Geographic Range:** *Myrmica nearctica* occurs throughout eastern North America from Québec and Manitoba south to North Dakota and Colorado. We have collected it extensively in Massachusetts, and a few specimens were collected from the Waterboro Pine Barrens in southern Maine.

<<nathist>>**Natural History:** This species plays dead when disturbed.

<<look>>**Look-alike species:** *Myrmica nearctica* has a large lamella at the right-angled bend of its antennal scape. Although it can be confused with *M. americana*, the antennal lamella of *M. nearctica* extends horizontally along the inside margin of the antennal scape. It also has frontal lobes that are more rounded towards their base than towards their top.

<<6-4-9-myrnea-face.tif>>

<<6-4-9-myrnea-scape.tif>>

<<6-4-9-myryna-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In full-face view, the frontal lobes are more rounded at the base than at the top

<<dist-b>>B. In dorsal view, the antennal lamella is large and extends horizontally along the posterior side of the scape

<<dist-c>>C. In dorsal view, the antennal scape is uniformly wide over its entire length

<<scalebar=4mm>>

<<spec>>*Myrmica pinetorum* Wheeler, 1905

<<common>>The Ant of the Pines

<<etym>>From the Latin *pinus*, meaning pine and referring to its type locality, the New Jersey Pine Barrens

<<coltab, color="274-5">>Genus *Myrmica*

<<myrpin-habitat-GP.tif>>

<<myrpin-MCZ001D.tif>>

<<myrpin-map.tif>>

<<hab>>**Habitat:** This ant nests in soils of pine forests, mixed deciduous forests, and pine barrens.

<<geog>>**Geographic Range:** This is a warm-climate species that ranges from southern New Hampshire and Québec south to the Carolinas and the Gulf Coast, and west to Oklahoma.

<<nathist>>**Natural History:** This species makes very small colonies in mostly sandy soils.

<<look>>**Look-alike species:** For many years, *M. pinetorum* was considered a subspecies of *Myrmica punctiventris*, and not surprisingly, the two species are easily confused. The two species are best distinguished by their propodeal spines, but characters of the frontal lobes are also helpful. In *M. pinetorum*, the length of each spine is equal to or shorter than the distance between the bases of the two spines, whereas in *M. punctiventris*, the length of each spine is longer than the distance between their bases. The frontal lobes of *M. pinetorum* are flattened, even curved a bit downward at the edges, and cover the bases of the antennae. The frontal lobes of *M. punctiventris* are angled up and do not completely cover the bases of the antennae. *Myrmica*

pinetorum can also be confused with *M. rubra*, but the propodeum of *M. pinetorum* is lower than the level as the promesonotum, but it is at the same level in *M. rubra*.

<<6-4-9-myrcin-face.tif>>

<<6-4-9-myrcin-body.tif>>

<<6-4-9-myrcin-spines.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head, and in full-face view, the antennal insertions are covered by the frontal lobes

<<dist-b>>B. The propodeum is lower than the promesonotum, giving the back a stepped-down appearance

<<dist-c>>C. The length of each propodeal spine is equal to or shorter than the distance between their bases

<<scalebar=4mm>>

<<spec>>*Myrmica punctiventris* Roger, 1863

<<common>>The Punctured Ant

<<etym>>From the Latin *punctus*, meaning pricked or punctured + *ventris*, meaning belly, and referring to the punctures at the base of the hairs on the gaster

<<coltab, color="274-5">>Genus *Myrmica*

<<myrpun-habitat-HighLedges.tif>>

<<myrpun-carries-AW.tif>>

<<myrpun-map.tif>>

<<hab>>**Habitat:** This ant nests under the bark of standing and fallen dead trees, in rotten logs, in leaf litter, in soil under rocks, and in empty shells of nuts in mixed deciduous forests.

<<geog>>**Geographic Range:** This is a warm-climate species that ranges from New England and Québec south to Georgia and west to Arkansas and Nebraska.

<<nathist>>**Natural History:** This is our most common forest-dwelling *Myrmica*, and it is an important disperser of the seeds of spring-flowering forest herbs.

<<look>>**Look-alike species:** This species can be confused with *M. pinetorum* or *M. rubra*.

These species are best distinguished by the frontal lobes, the relationship between the pronotum and the propodeum, and the propodeal spines. The frontal lobes of *M. punctiventris* are angled up and do not completely cover the bases of the antennae, whereas the frontal lobes of *M. pinetorum* are flattened and cover the bases of the antennae and the frontal lobes of *M. rubra* are small, thin, and point straight up, not covering the insertion of the antennae into the head. The propodeum of *M. punctiventris* and *M. pinetorum* is lower than the level as the

promesonotum, but it is at the same level in *M. rubra*. Finally, the propodeal spines of *M. punctiventris* are long and wavy like the horns of a long-horned steer, and the length of each spine is longer than the distance between their bases. In contrast, the length of each spine of *M. pinetorum* is shorter than the distance between the bases of the two spines.

<<6-4-9-myrapun-face.tif>>

<<6-4-9-myrapun-body.tif>>

<<6-4-9-myrapun-spines.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head, and in full-face view, the antennal insertions are not completely covered by the frontal lobes

<<dist-b>>B. The propodeum is lower than the promesonotum, giving the back a stepped-down appearance

<<dist-c>>C. The propodeal spines are wavy, and longer than the distance between their base

<<scalebar=5mm>>

<<spec>>***Myrmica quebecensis*** Francoeur, 1981

<<common>>The Québécois Ant

<<etym>>Named for its type locality in Québec, Canada

<<coltab, color="274-5">>Genus *Myrmica*

<<myrque-habitat-NHUmbugog.tif>>

<<myrque-MCZ001L.tif>>

<<myrque-map.tif>>

<<hab>>**Habitat:** This ant is a workerless inquiline social parasite of *Myrmica alaskensis*, and, like its host, nests in soils of boreal forests.

<<geog>>**Geographic Range:** *Myrmica quebecensis* could be collected from wherever its host *M. alaskensis* occurs, throughout the boreal forests in North America. As of this writing, it has been recorded from many locations in southern Canada. Although its host has been collected in Maine, this parasite has not yet been collected in New England.

<<nathist>>**Natural History:** This species is an inquiline social parasite of *M. alaskensis* and depends on its host workers to rear and care for its queens and males.

<<look>>**Look-alike species:** This species is easily recognized by the large rectangular process below the petiole.

<<6-4-9-myrque-face.tif>>

<<6-4-9-myrque-body.tif>>

<<6-4-9-myrque-petiole.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head

<<dist-b>>B. In full-face view, the clypeus is flattened with a convex margin

<<dist-c>>C. The process below the petiole is large and rectangular

<<scalebar=5mm>>

<<spec>>*Myrmica rubra* (Linnaeus, 1758)

<<common>>*The European Fire Ant

<<etym>>From the Latin *ruber*, meaning red

<<coltab, color="274-5">>Genus *Myrmica*

<<myrrub-habitat.tif>>

<<myrrub-worker.tif>>

<<myrrub-map.tif>>

<<hab>>**Habitat:** This ant nests in soil and under flat stones in wet places, such as streamsides, river margins, and marshes.

<<geog>>**Geographic Range:** This European species ranges throughout Europe and western Siberia. It was introduced into the United States at the Arnold Arboretum in Massachusetts in the early 1900s. In recent years, its range has extended dramatically along coastal New England, and it is now considered an invasive species of management concern. As of this writing, it has been found in all New England states except Connecticut. It is also present in Newfoundland, Nova Scotia, Québec, Ontario, and British Columbia.

<<nathist>>**Natural History:** This species annoys picnickers on beaches throughout New England. In Europe, it is the host for an endangered butterfly, the Dusky Large Blue (*Phengaris nausithous*). *Phenagaris* is in the Lycaenidae, many of which are myrmecophiles (see Chapter 2). The larvae are cared for by the host ant, but after the adults emerge from their cocoons, they have to quickly escape the ant nest before the ants attack and tear apart the butterflies.

<<look>>**Look-alike species:** *Myrmica rubra* can be confused with *M. punctiventris* or *M. pinetorum*, but these three species can be distinguished by their frontal lobes and their profiles. The frontal lobes of *M. rubra* are small, thin, and point straight up, not covering the insertion of the antennae into the head. The frontal lobes of *M. punctiventris* and *M. pinetorum* are thicker, larger, and are either flattened (*M. pinetorum*) or point up at a low angle (*M. punctiventris*). The propodeum of *M. rubra* is at the same level as the pronotum, so it does not have the stepped-down back of *M. punctiventris* or *M. pinetorum*.

<<6-4-9-myrrub-face.tif>>

<<6-4-9-myrrub-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a curved bend before the insertion into the head

<<dist-b>>B. In full-face view, the frontal lobes are small, thin, and point upward

<<dist-c>>C. The propodeum is even with the pronotum

<<scalebar=5mm>>

<<spec>>*Myrmica scabrinodis* Nylander, 1846

<<common>>The Scabrous Ant

<<etym>>From the Latin *scabres*, meaning rough or scabby + *nodus*, meaning lump, and referring to the rough sculpturing of the petiole

<<coltab, color="274-5">>Genus *Myrmica*

<<myrsca-habitat-Grape2008.tif>>

<<myrsca-MCZ001L.tif>>

<<myrsca-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, under bark, and in and under moss in open woodlands.

<<geog>>**Geographic Range:** This is a European species that ranges throughout Europe and into Asia Minor, northern Kazakhstan, and western Siberia. It was found in abundance by Adam Clark on the Boston Harbor Islands in 2007 and 2008, and by Daniella Prince in her Porter Square backyard in 2011.

<<nathist>>**Natural History:** In Europe, this species is known to prey on larvae of *Lasius flavus*. Its ecology in North America has not been studied.

<<look>>**Look-alike species:** This species with its European look – very heavily sculptured with antennal scapes that are triangular in cross-section – this species is quite distinctive.

<<6-4-9-myrsca-face.tif>>

<<6-4-9-myrsca-scape.tif>>

<<6-4-9-myrsca-antxsec.tif>>

<<6-4-9-myrsca-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In profile view, the antennal scape has a sharp bend before the insertion into the head

<<dist-b>>B. The antennal scape is triangular in cross-section

<<dist-c>>C. The sculpturing on the body is heavy and scabrous

<<scalebar=5.5mm>>

<<spec>>*Myrmica semiparasitica* Francoeur, 2007

<<common>>The Partially Parasitic Ant

<<etym>>From the Latin *semi*, meaning in part + *parasitus*, meaning guest or parasite

<<coltab, color="274-5">>Genus *Myrmica*

<<myrsem-habitat.tif>>

<<myrsem-MCZ001L.tif>>

<<myrsca-map.tif>>

<<hab>>**Habitat:** This ant is probably an temporary inquiline social parasite of *Myrmica punctiventris*, with which it co-occurs in mixed deciduous forests.

<<geog>>**Geographic Range:** This species was first described in 2007 by André Francoeur, and so far has been collected only from Long Island, Nantucket, southern Maine, Ohio, and several localities in Canada.

<<nathist>>**Natural History:** Little is known of this newly-described species besides its hypothesized parasitic lifestyle.

<<look>>**Look-alike species:** This species can be distinguished from its host by its relatively small size, its small thick propodeal spines, and the presence of a large triangular process beneath the petiole.

<<6-4-9-myrsem-face.tif>>

<<6-4-9-myrsem-body.tif>>

<<6-4-9-myrsem-petiole.tif>>

<<dist>>Distinguishing features:

<<dist-a>>A. The propodeum is lower than the promesonotum, giving the back a stepped-down appearance

<<dist-b>>B. The propodeal spines are small and thick

<<dist-c>>C. There is a pronounced triangular process below the petiole

<<scalebar=3.5mm>>

<<spec>>An undescribed species of *Myrmica*, species code AF-eva

<<common>>

<<etym>>

<<coltab, color="274-5">>Genus *Myrmica*

<<AR-CT-6840-4-03-Outer Issl. + Horse Isl..tif >>

<<myreva-MCZ001H.tif>>

<<myreva-map.tif>>

<<hab>>**Habitat:** This ant is so far known only from disturbed habitats such as parking lots and old-fields in eastern North America.

<<geog>>**Geographic Range:** No information is available for this undescribed species. In New England, it has been recorded from the Thimble Islands off the coast of Guilford, Connecticut. It has also been collected in Hyde Park, New York.

<<nathist>>**Natural History:** This undescribed species resembles the western and central North American species *Myrmica evanida*, and may be expanding its range. In the Midwestern states, this species (or one that looks just like it) is very abundant in grasslands and prairies, and has long been misidentified, and even considered to be the typical form of *Myrmica americana*.

<<look>>**Look-alike species:** André Francoeur provisionally places this species in the *americana* group, but it is distinguished from *M. americana* by its small, barely spoon-like, antennal lamella.

<<6-4-9-myreva-face.tif>>

<<6-4-9-myreva-scape.tif>>

<<6-4-9-myreva-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. In full-face view, the frontal lobes are evenly rounded

<<dist-b>>B. In dorsal view, the antennal lamella is small and barely spoon-shaped

<<dist-c>>C. In dorsal view, the antennal scape is uniformly wide over its entire length

<<scalebar=4.5mm>>

<<spec>>Another undescribed species of *Myrmica*, species code AF-ine

<<common>>

<<etym>>

<<coltab, color="274-5">>Genus *Myrmica*

<<myrine-habitat-ME.tif>>

<<myrine-map.tif>>

<<hab>>**Habitat:** This ant is so far known from only a single blueberry barren in Downeast Maine.

<<geog>>**Geographic Range:** More information is needed for this undescribed species. The only record of it is of a single queen collected in a pitfall trap in Washington County, Maine.

<<nathist>>**Natural History:** Based on its small size and the absence of spines, this species is thought to be an inquiline social parasite. The shape of the antennal flange suggests that it is in the *detritinodis* or *sculptilis* group, but more specimens are needed to make a definitive decision.

<<look>>**Look-alike species:** André Francoeur provisionally places this species in the *detritinodis* group, but it is distinguished by the lack of propodeal spines.

<<6-4-9-myrine-face.tif>>

<<6-4-9-myrine-scape.tif>>

<<6-4-9-myrine-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. There are no propodeal spines

<<dist-b>>B. In profile view, the antennal scape has a sharp bend before the insertion into the head, the lamina is curved, and it runs down along the base of the scape

<<dist-c>>C. In dorsal view, the antennal scape tapers towards its base

<<scalebar=4mm>>

<<spec>>A third undescribed species of *Myrmica*, species code AF-scu

<<common>>

<<etym>>

<<coltab, color="274-5">>Genus *Myrmica*

<<myrscu-nestsites.tif>>

<<myrscu-worker-0718-AE.tif>>

<<myrscu-map.tif>>

<<hab>>**Habitat:** This ant is widespread in deciduous and mixed forests.

<<geog>>**Geographic Range:** Complete range data are available for this undescribed species. It is widespread in New England, the northern Mid-Atlantic states, and southeastern Canada

<<nathist>>**Natural History:** No information is available for this undescribed species. It is common in forest habitats; study it, and contribute to our knowledge of ants!

<<look>>**Look-alike species:** This species is one of two species in the *sculptilis* group, the two species of which are distinguished from other *Myrmica* species by their heavy, parallel rugae.

Myrmica sp. AF-scu is distinguished from the fourth undescribed species of *Myrmica* (code AF-smi) by its smaller antennal flange.

<<6-4-9-myrscu-face.tif>>

<<6-4-9-myrscu-scape.tif>>

<<6-4-9-myrscu-body.tif>>

<<dist>>Distinguishing features:

<<dist-a>>A. The rugae are thick and parallel

<<dist-b>>B. In profile view, the antennal scape has a sharp bend before the insertion into the head

<<dist-c>>C. In dorsal view, the antennal lamina is relatively small (not wider than the base of the antenna), and there is a small lamina that runs downwards along the base of the scape

<<scalebar=5.5mm>>

<<spec>>A fourth undescribed species of *Myrmica*, species code AF-smi

<<common>>

<<etym>>

<<coltab, color="274-5">>Genus *Myrmica*

<<myrsmi-nest.tif>>

<<myrsmi-worker.tif>>

<<myrsmi-map.tif>>

<<hab>>**Habitat:** This ant is widespread in deciduous and mixed forests.

<<geog>>**Geographic Range:** Complete range data are unavailable for this undescribed species.

It is widespread in southern New England, the Mid-Atlantic states, and southeastern Canada.

<<nathist>>**Natural History:** No information is available for this undescribed species. It is common in warm forest habitats. Find it, watch it, and learn about it!

<<look>>**Look-alike species:** This species is one of two species in the *sculptilis* group, which are distinguished from other *Myrmica* species by their heavy, parallel rugae. It is distinguished from the third undescribed species of *Myrmica* (code AF-scu) by its large antennal lamina.

<<6-4-9-myrsmi-face.tif>>

<<6-4-9-myrsmi-scape.tif>>

<<6-4-9-myrsmi-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The rugae are thick and parallel

<<dist-b>>B. In profile view, the antennal scape has a sharp bend before the insertion into the head

<<dist-c>>C. In dorsal view, the antennal lamina is relatively large, much wider than the base of the antenna, and it runs down along the base of the scape

<<scalebar=5.5mm>>

<<spec>>A fifth undescribed species of *Myrmica*, species code AF-sub

<<common>>

<<etym>>

<<coltab, color="274-5">>Genus *Myrmica*

<<myrsub-habitat.tif>>

<<myrsub-MCZ001H.tif>>

<<myrsub-map.tif>>

<<hab>>**Habitat:** This boreal ant species nests in sandy soils of sparsely-vegetated granitic bedrock.

<<geog>>**Geographic Range:** Up until now, this species has been collected from around the southern shores of Hudson Bay, from the Goose Bay Air Force Base in Central Labrador, and at Peggy's Cove outside of Halifax, Nova Scotia. It has not yet been collected in New England, but it could be present in Downeast Maine.

<<nathist>>**Natural History:** No information is available for this undescribed species. Its presence at airfields and in geographically disparate locations from its supposed home range near Hudson Bay suggests that it can disperse widely.

<<look>>**Look-alike species:** André Francoeur provisionally places this species in the *detritinodis* group because of the shape of the lamina at the antennal bend. It is distinguished from *M. detritinodis* by the very large size of this lamina.

<<6-4-9-myrsub-face.tif>>

<<6-4-9-myrsub-scape.tif>>

<<6-4-9-myrsub-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The rugae on the body are wavy, anastomosing, and triangular in cross-section

<<dist-b>>B. In profile view, the antennal scape has a sharp bend before the insertion into the head

<<dist-c>>C. In dorsal view, the lamina on the antennal bend is very large, curved, and runs downwards along the base of the scape

<<scalebar=5.2mm>>

<<coltab, color="274-7">>Genus *Pheidole*

<<txa>>*Pheidole* Westwood, 1839 – The Thrifty Ant (from the Greek *pheidōs*, meaning thrifty or saving)

<<6-4-10-phepil-face-major.tif>>

Pheidole is a one of the most diverse genus of ants in the world – Professor E. O. Wilson refers to it as a dominant, hyperdiverse genus. More than 1100 species are currently recognized, at least 100 of which occur in North America. However, *Pheidole* is primarily a tropical and warm-temperate genus and only one species, *P. pilifera*, extends its native range into New England. A second species, *P. flavens*, is a widespread tropical species that has been recorded from a greenhouse in New Hampshire. Overall, the genus is easily recognized by its dimorphic workers – the majors have unusually enlarged heads, like the Talosians in *The Cage*, the very first pilot episode of the original *Star Trek* television series (they re-appear in *The Menagerie*, later in the first season). In New England, it is the only genus with the combination of a three-segmented antennal club, a propodeum that is stepped-down relative to the level of the mesonotum, and propodeal spines.

<<txb>>Identifying the Species of *Pheidole*

If you collect a *Pheidole* out-of-doors in New England, it is almost certainly *P. pilifera*. Our native species can be distinguished from the subtropical *P. flavens* by two characters. First, the post-petiole of major workers of *P. pilifera* viewed from above is nearly diamond-shaped and the corners are quite sharp. In contrast, the post-petiole of major workers of *P. flavens* is round.

Second, the sculpturing on the head and mesosoma of *P. pilifera* is linear and more-or-less parallel, whereas the sculpturing on the head and mesosoma of *P. flavens* is granular – almost honey-combed in appearance. This difference is most apparent in minor workers, which conveniently are the ones most frequently collected. A third species that occurs in the mid-Atlantic states and further south (but not included in this guide), is *P. tysoni*. *Pheidole tysoni* resembles *P. flavens*, but neither the major workers nor the minor workers of *P. tysoni* have any sculpturing, granular or otherwise, on their heads.

<<txb>>Key to the Species of *Pheidole*

1a. In dorsal view, the post-petiole of the major workers is more-or-less diamond-shaped

with sharp corners; ant brown; our only native New England species*P. pilifera*

<<6-4-10-phepil-inset-major.tif>>

1b. In dorsal view, post-petiole of the majors is more-or-less round or oval-shaped, lacking

sharp corners; ant yellow; a tropical species encountered in New England only indoors.....

..... *P. flavens*

<<6-4-10-phefla-inset-major.tif>>

<<txb>>Easily Confused Species

Both *Pheidole* and *Aphaenogaster* species have similarly-shaped mesosomas in which the propodeum is much lower than the promesonotum, giving it a stepped-down or broken-back appearance. *Aphaenogaster* on average is much larger than *Pheidole*; in addition, the three-segmented antennal club, along with the unusually large head in the major workers of *Pheidole*, reliably distinguish *Pheidole* from *Aphaenogaster*. It is also possible to confuse *P. pilifera* minors with *Tetramorium caespitum*, but *P. pilifera* does not have the strongly parallel rugae of *T. caespitum*, nor does it have a deep antennal socket.

<<spec>>***Pheidole flavens*** Roger, 1863

<<common>>The Yellow *Pheidole*

<<etym>>From the Latin *flavus*, meaning yellow

<<coltab, color="274-7">>Genus *Pheidole*

<<phefla-greenhouse.tif>>

<<phefla-MCZ001Mi.tif>>

<<phefla-map.tif>>

<<hab>>**Habitat:** This is a tropical ant that nests in soil, under rocks, in small rotten branches, and in flower pots.

<<geog>>**Geographic Range:** *Pheidole flavens* is one of the most widespread New World species of *Pheidole*. It ranges from Florida, throughout the Caribbean Islands, Central America, and throughout tropical and subtropical South America. In New England, it can survive only in heated spaces, such as greenhouses, and as far as we know, it has been recorded only from a greenhouse in New Hampshire.

<<nathist>>**Natural History:** This omnivorous species feeds on smaller arthropods such as mites, as well as nectar and other plant secretions.

<<look>>**Look-alike species:** This species may be mistaken for either the native *Pheidole pilifera* or perhaps *Aphaenogaster tennesseensis*. Major workers of the two *Pheidole* species can be distinguished by the shape of the post-petiole (viewed from above), which is round in *P. flavens* and diamond- or rhomboid-shaped in *P. pilifera*. Minor workers of the two *Pheidole* species can be separated based on their sculpturing, which has a granular, honey-combed

appearance in *P. flavens* and is linear in *P. pilifera*. *Pheidole flavens* can be distinguished from *Aphaenogaster* by its much smaller size and by its three-segmented antennal club. *Pheidole flavens* also looks very similar to *P. tysoni*, which can be collected in the Mid-Atlantic states and further south. But the heads of workers of *P. tysoni* lack the granular sculpturing present on the heads of *P. flavens*.

<<6-4-10-phefla-face-minor.tif>>

<<6-4-10-phefla-face-major.tif>>

<<6-4-10-phefla-body-minor.tif>>

<<6-4-10-phefla-body-major.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The major workers have greatly enlarged heads

<<dist-b>>B. The antennal club has three segments

<<dist-c>>C. The minor workers have granular, honeycomb-like sculpturing

<<scalebar=2.25mm>>

<<scalebar=1.5mm>>

<<spec>>*Pheidole pilifera* (Roger, 1863)

<<common>>The Hairy *Pheidole*

<<etym>>From the Greek *pilos*, meaning hair + *ferre*, meaning to bear

<<coltab, color="274-7">>Genus *Pheidole*

<<phepil-nest.tif>>

<<phepil-majorworker.tif>>

<<phepil-map.tif>>

<<hab>>**Habitat:** This ant makes small crater-like nests in exposed soils of grasslands and other open habitats. It prefers sandy soils with a little bit of clay, and it is less common in pure sand soils such as those found in pine barrens.

<<geog>>**Geographic Range:** *Pheidole pilifera* is the most widespread species of *Pheidole* in the Nearctic region, and the only *Pheidole* species whose range, so far, includes any New England state. It can be found from Massachusetts south to Florida, and west to eastern Colorado.

<<nathist>>**Natural History:** This species collects and harvests seeds that it stores in its nest chambers. Major workers are rarely collected outside of the nest.

<<look>>**Look-alike species:** This species may be mistaken for either the non-native *Pheidole flavens* or species in the *Aphaenogaster rudis* complex. Major workers of the two species of *Pheidole* can be distinguished by the shape of the post-petiole (viewed from above), which is diamond-shaped in *P. pilifera* and round in *P. flavens*. Minor workers can be distinguished by the sculpturing on their heads; *P. pilifera* has linear sculpturing, whereas *P. flavens* has granular,

honey-combed sculpturing. *Pheidole pilifera* can be distinguished from *Aphaenogaster* by its three-segmented antennal club and its smaller size.

<<6-4-10-phepil-face-minor.tif>>

<<6-4-10-phepil-face-major.tif>>

<<6-4-10-phepil-body-minor.tif>>

<<6-4-10-phepil-major-body-N.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The major workers have greatly enlarged heads

<<dist-b>>B. The antennal club has three segments

<<dist-c>>C. The minor workers have linear, rugose sculpturing

<<scalebar=3.5mm>>

<<scalebar=2mm>>

<<coltab, color="274-9">>Genus *Protomognathus*

<<txa>> *Protomognathus* Wheeler, 1905 – the Ancestral Partially-jawed Ant (from the Greek *pro*, meaning before, + *tomos*, meaning part (of a book), + *gnathos*, meaning jaw, and referring to its ancestral phylogenetic position relative to the European *Tomognathus*)

<<6-4-11-proame-face.tif>>

The Nearctic genus *Protomognathus* has only one species. Its European counterpart was named *Tomognathus* for its partial (*i.e.*, untoothed) mandibles, and *Protomognathus* was thought to be the ancestor of *Tomognathus*. However, the name *Tomognathus* (given to ants in 1861) had been used in 1850 to name another genus – of fossil fish with reduced jaws – and so the rules of nomenclature demanded a new name. Forel renamed *Tomognathus* as *Harpagoxenus* in 1893 (see page XXX), so *Protomognathus* ought to have been named *Proharpagoxenus*. However, in 1905, William Wheeler apparently was unaware of the earlier nomenclatural change and named it *Protomognathus*. In 1924, Carlo Emery not only recognized Wheeler's nomenclatural error, but he also transferred *Protomognathus* into the genus *Harpagoxenus*. In 1990, *Protomognathus* was restored to its current status as its own genus by Hölldobler and Wilson in their Pulitzer Prize-winning book, *The Ants*. The genus *Protomognathus*, and its only species, *P. americanus*, is easily recognized by the pronounced grooves (scrobes) on either side of the frontal lobes in which the antennae nestle, and by the four teeth on its mandibles. *Protomognathus* enslaves acorn-nesting ants in the genus *Temnothorax*; for this reason, it is sometimes referred to as the Pirate Ant.

<<spec>>***Protomognathus americanus*** (Emery, 1895)

<<common>>The American *Protomognathus*

<<etym>>Named for America, in contrast to its closely-related European cousins

<<coltab, color="274-9">>Genus *Protomognathus*

<<proame-nest.tif>>

<<proame8026-worker.tif>>

<<proame-map.tif>>

<<hab>>**Habitat:** This slave-making ant nests with its hosts – ants in the genus *Temnothorax* – in acorns and other small cavities, including hollow stems of milkweed (*Asclepias* species) and dogbane (*Apocynum* species).

<<geog>>**Geographic Range:** This species occurs throughout eastern North America, including southeastern Canada. It occurs throughout New England, but it is not commonly collected.

<<nathist>>**Natural History:** This species raids colonies of its hosts, *Temnothorax ambiguus*, *T. curvispinosus*, and *T. longispinosus*, and carries off the brood to its own nest, where *Temnothorax* workers continue to rear the brood.

<<look>>**Look-alike species:** *Protomognathus* is similar in size and shape to ants in the other Leptothoracini genera – *Formicoxenus*, *Harpagoxenus*, *Leptothorax*, and *Temnothorax*. But *Protomognathus* is distinctive because its mandibles have only four teeth and it has pronounced antennal scrobes.

<<6-4-11-proame-face.tif>>

<<6-4-11-proame-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have four teeth

<<dist-b>>B. There are pronounced antennal scrobes

<<scalebar=3.1mm>>

<<coltab, color="308-1 +K=50">>Genus *Pyramica*

<<txa>> *Pyramica* Roger, 1862 – the Angular Ant (from the Greek *pyramis*, meaning an angular structure or a pyramid, and likely referring either to the triangular head and mandibles or to the strongly angular pronotum)

<<6-4-12-pyrpul-body.tif>>

The genus *Pyramica* is a diverse, mainly tropical and subtropical genus of approximately 350 species of ants. *Pyramica* species are inconspicuous and difficult to find because they make very small colonies in leaf litter, topsoil, or rotten wood. But these species are widespread and worth looking for so that you can enjoy their unique appearance. Their triangular and strongly lobed heads, six-segmented antennae, and elaborate spongy “skirts” just behind the post-petiole at the base of the first segment of the gaster, give our three New England species (out of a total of ~40 North American species) a decidedly Lady Gaga-esque appearance.

There is a long-running argument about the correct name of this genus. Julius Roger described it in 1862, but one year later subsumed it within the closely related *Strumigenys*, where it resided until 1948. In that year Bill Brown restored it to full generic status, only to return it to *Strumigenys* 11 years later. In 1999, Barry Bolton revived *Pyramica*, and since then he and Cesare Baroni Urbani have been sparring in the literature over whether it should remain *Pyramica* or return to *Strumigenys*. The basis of the disagreement is whether the genera are united by their inability to cross their mandibles or should be separated based on whether the mandibles hold fast the prey until the ant stings it to death *versus* whether the mandibles directly

kill the prey and need not sting it further. To add to the confusion, in the late 1940s, some of our *Pyramica* (or *Strumigenys*) species were further separated out in the genus *Smithistruma*, where they are still found in Gary Coover's *The Ants of Ohio*. Bolton recognized that the name *Smithistruma* was used later than the name *Pyramica*, so by the abstruse rules of nomenclature, *Pyramica* must prevail. We follow Bolton here. However, the disagreement in the literature persists and will not be resolved without molecular data.

<<txb>>Identifying the Species of *Pyramica*

All three New England species of *Pyramica* can be distinguished easily by facial characters, but because the ants are small, these characters can be seen only at high magnification: 25 – 50×. *Pyramica pergandei* has only a few teeth on the lower (anterior) portion of its mandibles, whereas the other two species of *Pyramica* have teeth along the entire edge of the mandibles. Next, look at the hairs on the margin of the clypeus. In *P. metazytes*, these hairs all curve in towards the mandibles, but in *P. pulchella*, the first pair of hairs on the clypeal margin curve away from the mandibles.

<<txb>>Key to the Species of *Pyramica*

- 1a. In full face view, **mandibles elongate, narrow, and with teeth only on the anterior third to half of the mandibles**; the first (basal) and third mandibular teeth are sharp, but the second mandibular tooth is broad and blunt*P. pergandei*

<<6-4-12-pyrper-mandibles.tif>>

1b. In full face view, **mandibles triangular-to-elongate, with teeth along the entire surface**
except for a small gap between the clypeus and the basal tooth2

2a (1b). **The hairs on the clypeal margins, both lateral and anterior, curve towards the
mandibles; paired erect hairs on dorsum, mesonotum, and first gastral segment are
long, straight, and sharp;** antennal hairs curved; antennal hairs closest to the base of the
scape have broad, rounded (spatulate) ends, those further up the scape are not blunt-
tipped.....*P. metazytes*

<<6-4-12-pyrmet-mandibles.tif>>

2b. **Hairs on the lateral clypeal margins curve towards the mandibles, but those on the
anterior margin curve away from the mandibles; paired erect hairs on dorsum,
mesonotum, and first gastral segment are short and whip-like (flagellate);** antennal
hairs curved and all are spatulate *P. pulchella*

<<6-4-12-pyrpul-mandibles.tif>>

<<spec>>*Pyramica metazytes* Bolton, 2000

<<common>>The Euphonious *Pyramica*

<<etym>>According to Barry Bolton, metazytes is an arbitrary combination of particularly euphonious letters – he just liked the sound of it!

<<coltab, color="308-1 +K=50">>Genus *Pyramica*

<<pyrmet-nest.tif>>

<<pyrmet-close.tif>>

<<pyrmet-map.tif>>

<<hab>>**Habitat:** This ant nests in the litter layer of hardwood forests, and, in the southeastern United States, in the litter of loblolly and shortleaf pines.

<<geog>>**Geographic Range:** *Pyramica metazytes* ranges from Massachusetts south along the eastern coastal plain to Mississippi.

<<nathist>>**Natural History:** This species feeds predominantly on springtails (Collembola). It is a sit-and-wait predator that quickly snaps shut its wide-open jaws on small prey that contact the tiny trigger-hairs between the mandibles. After it catches the prey, it stings it to death.

<<look>>**Look-alike species:** *Pyramica metazytes* is distinguished from *P. pulchella* by its long, straight, and sharp dorsal hairs and by the fact that all the hairs on the clypeal margin curve inward towards the mandibles. In *P. pulchella*, the dorsal hairs are long and whip-like, and the first one or two pairs of hairs on the clypeal margin curve outwards, away from the mandibles.

<<6-4-12-pyrmet-face.tif>>

<<6-4-12-pyrmet-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have teeth along their entire inner margins

<<dist-b>>B. The hairs on the clypeal margins all curve inwards towards the mandibles

<<dist-c>>C. The erect dorsal hairs are long, straight, and sharp

<<scalebar=2mm>>

<<spec>>*Pyramica pergandei* (Emery, 1895)

<<common>>Pergande's *Pyramica*

<<etym>> Named for the noted American entomologist Theodore Pergande (1840-1916), who collected the type specimen

<<coltab, color="308-1 +K=50">>Genus *Pyramica*

<<pyrper-brood.tif>>

<<pyrper-worker.tif>>

<<pyrper-map.tif>>

<<hab>>**Habitat:** This ant nests in rotten logs, in soil, and under rocks in open woodlands.

<<geog>>**Geographic Range:** *Pyramica pergandei* ranges from Massachusetts south to the Carolinas and west to Missouri and Kansas.

<<nathist>>**Natural History:** This is the largest and most frequently collected *Pyramica* in New England. It is a specialist feeder on springtails (Collembola).

<<look>>**Look-alike species:** *Pyramica pergandei* is easily distinguished from our other two *Pyramica* species by the lack of teeth on the basal one-half to two-thirds of its mandibles.

<<6-4-12-pyrper-face.tif>>

<<6-4-12-pyrper-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The antennae have six segments

<<dist-b>>B. The mandibles have teeth only on their lower (anterior) part

<<dist-c>>C. There is pronounced spongy tissue at the base of the petiole and post-petiole

<<scalebar=2.75mm>>

<<spec>>*Pyramica pulchella* (Emery, 1895)

<<common>>The beautiful *Pyramica*

<<etym>>From the Latin *pulcher*, and its diminutive form, *pulchellus*, meaning beautiful

<<coltab, color="308-1 +K=50">>Genus *Pyramica*

<<pyrpul-habitat.tif>>

<<pyrpul-worker.tif>>

<<pyrpul-map.tif>>

<<hab>>**Habitat:** This ant nests in rotten wood and in soil underneath rocks in open woodlands and forests.

<<geog>>**Geographic Range:** *Pyramica pulchella* ranges from Massachusetts and New York south to Florida and west from Wisconsin to Louisiana.

<<nathist>>**Natural History:** This species feeds predominantly on springtails (Collembola).

<<look>>**Look-alike species:** *Pyramica pulchella* is distinguished from *P. metazytes* by its whip-like dorsal hairs and by the fact that the first one or two pairs of hairs on the clypeal margin curve outwards away from the mandibles. In contrast, the dorsal hairs of *P. metazytes* are long, straight, and sharp, and all the hairs on its clypeal margin curve inwards, towards the mandibles.

<<6-4-12-pyrpul-face.tif>>

<<6-4-12-pyrpul-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have teeth along their entire inner margins

<<dist-b>>B. The first one or two pairs of hairs on the clypeal margins curve outwards away from the mandibles

<<dist-c>>C. The erect dorsal hairs are whip-like

<<scalebar=2mm>>

<<coltab, color="305-1">>Genus *Solenopsis*

<<txa>>*Solenopsis* Westwood, 1840 – The Channel-faced Ant (from the Greek *solen*, meaning channel, canal, or tube + *opsis*, meaning of the face, and referring to the longitudinal groove running down the middle of the head).

<<6-4-13-solmol-face.tif>>

Solenopsis is a diverse and often reviled genus; although there are nearly 300 recognized species distributed around the world, the well-known South American Fire Ant, *Solenopsis invicta*, gives all ants in this genus a bad name. The approximately 40 North American species of *Solenopsis* are divided into three groups, but only one, the *Diplorhoptrum* group, is represented in New England, by two species. The other two groups – the *geminata* group of fire ants that includes *S. invicta*, and the *Euophthalma* group – are primarily tropical and sub-tropical. The entire genus is easily distinguished by its lack of propodeal spines, and by its 10-segmented antennae that end in two-segmented clubs.

<<txb>>Identifying the Species of *Solenopsis*

The tiny (< 2mm) members of the *Diplorhoptrum* group, affectionately called “diplos” (and less flatteringly called Thief Ants), all look very similar; the entire group is in desperate need of taxonomic attention and systematic revision. Although we have only two species in New England – *S. molesta* and *S. cf. texana* – they are no easier to distinguish now than they were in 1950, when Creighton wrote that there is so “much confusion in the case of the *molesta-texana* complex..that no adequate solution seems possible.” *Solenopsis molesta* appears to be our most

common *Solenopsis*. It is most readily distinguished from *S. cf. texana* by its habitat: *S. molesta* is never observed nesting in pure sand, whereas *S. cf. texana* nests only in pure sand. If you see them in the field, *S. cf. texana* is a pure lemon-yellow, whereas *S. molesta* tends to be browner, on the reddish end of yellow. These colors fade in specimens that are pinned or stored in alcohol, and morphological differences between the two are subtle at best. In workers, the petiole viewed in profile is narrower in *S. molesta* than it is in *S. cf. texana*. In dorsal view, the post-petiole of *S. molesta* is much wider than the petiole, but the petiole and post-petiole are of similar width in *S. cf. texana*. The differences between the two species are more pronounced in the queens.

<<txb>>Key to the Species of *Solenopsis*

- 1a. **In dorsal view, the post-petiole is noticeably wider than the petiole; in profile view, the summit of the petiole is relatively narrow;** the ant is yellow-brown and nests in a wide variety of soils, but never in pure sand *S. molesta*
- 1b. **In dorsal view, the post-petiole is approximately as wide as the petiole; in profile view, the summit of the petiole is relatively broad;** a lemon-yellow ant that nests only in pure sand *S. cf. texana*

<<6-4-13-sol-inset.tif>>

<<txb>>Easily Confused Species

Both *Solenopsis* and *Monomorium* lack propodeal spines, but these genera can be distinguished by their two- or three-segmented, respectively, antennal clubs.

<<spec>>*Solenopsis molesta* (Say, 1836)

<<common>>*The Thief Ant

<<etym>>From the Latin *molestus*, meaning annoying or troublesome

<<coltab, color="305-1">>Genus *Solenopsis*

<<solmol-nest.tif>>

<<solmol-queens.tif>>

<<solmol-map.tif>>

<<hab>>**Habitat:** This common ant nests with or near other ants in a wide variety of soils and under rocks in open woods and fields. It can also take up residence in houses and other buildings.

<<geog>>**Geographic Range:** *Solenopsis molesta* has been collected from most of North America. It is widespread in New England.

<<nathist>>**Natural History:** Like other thief ants, *S. molesta* often nests with a wide variety of other ant species, from which it steals food and perhaps brood. But *S. molesta* also can be found living independently with no apparent association with other ants. Colonies of *S. molesta* can be large, diffuse, and have multiple queens. Queens and workers of *S. molesta* are both reddish-to brownish yellow in color, but males are black. In its original description, Say wrote that the sting of this omnivorous ant “is like the puncture of a very fine needle.”

<<look>>**Look-alike species:** This is one of two *Solenopsis* species in New England. It is distinguished from *S. cf. texana* by its reddish-to-brownish yellow color, narrow-topped petiole and relatively wide post-petiole, and by its absence from pure-sand soils.

<<6-4-13-solmol-face.tif>>

<<6-4-13-solmol-body.tif>>

<<6-4-13-solmol-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The antennae are 10-segmented and end in two-segmented clubs

<<dist-b>>B. The petiole in profile is narrow

<<dist-c>>C. The post-petiole is noticeably wider than the petiole

<<scalebar=1.6mm>>

<<spec>>An undescribed species of *Solenopsis* that is closely related to *Solenopsis texana*

<<common>>

<<etym>>

<<coltab, color="305-1">>Genus *Solenopsis*

<<soltex-habitat-beach.tif>>

<<soltex-workers.tif>>

<<soltex-map.tif>>

<<hab>>**Habitat:** This undescribed species nests in pure sand in pine barrens.

<<geog>>**Geographic Range:** *Solenopsis* cf. *texana* has been collected on Nantucket and Martha's Vineyard, and in south-central Massachusetts. A fuller assessment of its range awaits a revision of the *Diplorhoptrum* group.

<<nathist>>**Natural History:** Like other thief ants, *S.* cf. *texana* often nests with or near a wide variety of other ant species, from which it steals food and perhaps brood.

<<look>>**Look-alike species:** This is one of two *Solenopsis* species in New England. It is distinguished from *S. molesta* by its yellow color, its broadly-topped petiole, the similar width of its petiole and post-petiole, and its restriction to pure sand in which it builds its nests.

<<6-4-13-soltex-face.tif>>

<<6-4-13-soltex-body.tif>>

<<6-4-13-soltex-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The antennae are 10-segmented and end in two-segmented clubs

<<dist-b>>B. The petiole in profile is broad

<<dist-c>>C. The petiole and post-petiole are similarly wide

<<scalebar=1.5mm>>

<<coltab, color="303-2">>Genus *Stenamma*

<<txa>>*Stenamma* Westwood, 1839 – The Slender Ants (from the Greek *stenos*, meaning close or narrow, and possibly referring to the posterior margin of the clypeus, which extends upward between the two frontal lobes. It could also refer to the narrow, pedunculate petiole, or to the overall slender appearance of the ants in this genus).

<<6-4-14-stesch-face>>

Stenamma is a genus of small litter-dwelling ants that are uncommonly collected. In its current conception, it includes 45 species, roughly evenly split between the Nearctic and Palearctic regions, and Central America. The actual number of species is probably much higher, as the Neotropical species are only now being studied. Of the 17 or so North American species, four species are found in New England. All four species have antennae that end in indistinct, four-segmented clubs, tiny eyes, and short propodeal spines.

<<txb>>Identifying the Species of *Stenamma*

Our four New England species of *Stenamma* – *S. brevicorne*, *S. diecki*, *S. impar*, and *S. schmitti* – are separated by differences in body size, eye size and the number of facets (ommatidia) on the compound eye, and the sculpturing on the mesosoma, petiole, and post-petiole. *Stenamma brevicorne* is the largest of the four, reaching 4 mm in length, and has the largest (yet still quite small) eyes; they have more than 20 ommatidia and 5 – 12 (average = 8) ommatidia across the widest point of the eye. Its dark brown body is heavily sculptured. *Stenamma diecki* and *S. impar* are very similar in body size and eye size, but the ommatidia of *S*

diecki are smaller than those of *S. impar*, and there are fewer (4 – 5) ommatidia across the widest part of the eye of *S. diecki* than there are in *S. impar* (which has 5 – 6 ommatidia across the widest part of the eye). Geographically, *S. diecki* replaces *S. impar* at or just north of the Massachusetts border with Vermont, New Hampshire, and Maine. Finally, *S. schmitti* has the smallest compound eyes; they are barely visible and have only 3 – 6 (average = 4) ommatidia in total.

<<6-4-14-ste-matrix.eps>>

This matrix key illustrates six morphological characters that can be used to separate the four New England species of *Stenamma*. Each species is shown in profile; size shown is approximately ten times that of an average worker, and colors illustrate differences ranging from dark to light brown. The species are ordered by size, from largest to smallest. The primary characteristics are the size of the eye and the number of ommatidia in each compound eye. *Stenamma brevicorne* has large eyes with many facets, *S. schmitti* has tiny eyes with few facets, and the other two are in between. Check your “eye-identification” by looking at the mesosoma. *Stenamma brevicorne* and *S. schmitti* are heavily sculptured on all surfaces. *Stenamma diecki* has a shiny post-petiole but reasonably strong sculpturing on other surfaces of the mesosoma. *Stenamma impar* is only faintly sculptured.

<<txb>>Key to the Species of *Stenamma*

1a. **Compound eye with 5 – 12 facets (ommatidia) in its widest diameter, and > 20 facets**

total; relatively large for a *Stenammas* (total length 2.75 – 4.0mm); *S. brevicorne*

<<6-4-14-stebre-eye.tif>>

1b. **Compound eye with 3 – 6 facets in its widest diameter and < 15 facets total**; a smaller

species (total length 2 – 3.5mm);2

2a (1b). **Compound eyes very small, consisting of 3 – 6 facets**; mesosoma sculptured with

pronounced punctures, giving the ant a matte appearance. *S. schmitti*

<<6-4-14-stesch-eye.tif>>

2b. **Compound eyes larger, consisting of 8 – 15 facets**.3

3a (2b). **Compound eye with 4 – 5 small facets across its widest diameter**; total length

2.7 – 3.5mm; conspicuous sculpturing on the pronotum, but the promesonotum and

the post-petiole are usually smooth and shiny; common north of Massachusetts.

..... *S. diecki*

<<6-4-14-stedie-eye.tif>>

3b. **Compound eye with 5 – 6 coarse facets across its widest diameter**; total length 2.3 – 2.7mm; sculpturing on the mesosoma is faint, and extends to the promesonotum and post-petiole (*i.e.*, not smooth and shiny); more common in Massachusetts and southern New England.....*S. impar*

<<6-4-14-steimp-eye-tif>>

<<txb>>Easily Confused Species

It is possible to confuse *Stenamma* with *Tetramorium caespitum*, but the eyes of *T. caespitum* are much larger and have many more ommatidia than the eyes of even the largest-eyed *Stenamma*, *S. brevicorne*. Unlike any species of *Stenamma*, *Tetramorium caespitum* also has parallel, longitudinal rugae on its head and a pronounced stinger that ends in a triangular process.

<<spec>>*Stenamma brevicorne* (Mayr, 1886)

<<common>>The Short-horned *Stenamma*

<<etym>>From the Latin *brevis*, meaning short, + *cornu*, meaning horn, and referring to its relatively short antennae

<<coltab, color="303-2">>Genus *Stenamma*

<<stebre-habitat.tif>>

<<stebre9367-worker.tif>>

<<stebre-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, usually with some clay in it. Foragers are sometimes found in litter, under rocks, and in rotten wood in moist woods and forest edges.

<<geog>>**Geographic Range:** *Stenamma brevicorne* ranges from the Canadian Maritimes south throughout New England to Virginia, and west across Canada to Ontario and south to Nebraska.

<<nathist>>**Natural History:** As with all *Stenamma* species, *S. brevicorne* is uncommonly collected and rarely studied. Marion Smith referred to it as timid, sluggish, and carnivorous.

<<look>>**Look-alike species:** *Stenamma brevicorne* is similar in size and shape to the pavement ant, *Tetramorium caespitum*. But *S. brevicorne* has much smaller eyes and lacks the triangular stinger of *Tetramorium*. *Stenamma brevicorne* is distinguished from the other three New England species in this genus by its relatively large body and eyes.

<<6-4-14-stebre-face.tif>>

<<6-4-14-stebre-eye-tif>>

<<6-4-14-stebre-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The eye has about 20 ommatidia, 5 – 12 at its widest point

<<dist-b>>B. The body is heavily sculptured

<<dist-c>>C. The propodeal spines are short

<<scalebar=3.4mm>>

<<spec>>*Stenamma diecki* Emery, 1895

<<common>>Dieck's *Stenamma*

<<etym>>Named for the German entomologist and botanist, Georg Dieck, who sent the type specimen to Carlo Emery

<<coltab, color="303-2">>Genus *Stenamma*

<<stedie-habitat.tif>>

<<stedie-closeup.tif>>

<<stedie-map.tif>>

<<hab>>**Habitat:** This ant nests in soil and litter, under rocks, and in rotten wood in moist woods and forest edges and occasionally in wet meadows, bogs, and fens.

<<geog>>**Geographic Range:** *Stenamma diecki* is a cool-climate species that is most common in Canada and across the northern United States. In its southern range – including the Carolinas, Iowa, and California – it is mostly found at high elevations. In New England, it is more common north of Massachusetts than it is in Connecticut or Rhode Island.

<<nathist>>**Natural History:** As with all *Stenamma* species, *S. diecki* is uncommonly collected and rarely studied. It readily preys on springtails (Collembola), and it plays dead when disturbed.

<<look>>**Look-alike species:** *Stenamma diecki* is easily confused with *S. impar*. *Stenamma diecki* can be distinguished by its shiny post-petiole and relatively small ommatidia.

<<6-4-14-stedie-face.tif>>

<<6-4-14-stedie-eye.tif>>

<<6-4-14-stedie-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The eye has about 15 small ommatidia, 4 – 5 at its widest point

<<dist-b>>B. The body is lightly sculptured, and the post-petiole is shiny

<<dist-c>>C. The propodeal spines are short

<<scalebar=3.1mm>>

<<spec>>*Stenamma impar* Forel, 1901

<<common>>The odd *Stenamma*

<<etym>> From the Latin *impar*, meaning odd, and referring to its oddly-shaped metanotum

<<coltab, color="303-2">>Genus *Stenamma*

<<steimp-habitat.tif>>

<<steimp-worker.tif>>

<<steimp-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, both wet and dry, of forests and woodlands. In New England, it is associated strongly with forests dominated by oaks (*Quercus* species), especially along the coast.

<<geog>>**Geographic Range:** *Stenamma impar* ranges from Québec to the Carolinas and west to the Dakotas and Missouri. In New England, it is more common south of Massachusetts, although it has been collected at low elevations in our northern states.

<<nathist>>**Natural History:** As with all *Stenamma* species, *S. impar* is uncommonly collected and rarely studied. It was distinguished as a species by Auguste-Henri Forel based on the fact that the dorsal face and posterior slope (declivity) of the metanotum (the reduced segment of the mesosoma in between the mesonotum and the propodeum) are in the same plane, but he followed up his description by asking *Peut-être est-ce une espèce? Mais il faut attendre de connaître plus de matériel* ["Is it even a species? We must wait for more specimens"]. Even today, we don't know what it eats.

<<look>>**Look-alike species:** *Stenamma impar* is easily confused with *S. diecki*. *Stenamma impar* can be distinguished by its light sculpturing and relatively large ommatidia.

<<6-4-14-steimp-face.tif>>

<<6-4-14-steimp-eye-tif>>

<<6-4-14-steimp-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The eye has about 15 large ommatidia, 5 – 6 in its major diameter

<<dist-b>>B. The body, including the post-petiole, is lightly sculptured

<<dist-c>>C. The propodeal spines are short

<<scalebar=2.5mm>>

<<spec>>*Stenamma schmitti* Wheeler, 1903

<<common>>Schmitt's *Stenamma*

<<etym>> Named for the Reverend P. Jerome Schmitt, who sent the type specimen to William Wheeler from Saint Vincent, Pennsylvania, but The Reverend is perhaps better known for designing the wooden Schmitt box used to store insect specimens

<<coltab, color="303-2">>Genus *Stenamma*

<<stesch-habitat.tif>>

<<stesch-worker-closeup.tif>>

<<stesch-map.tif>>

<<hab>>**Habitat:** This ant nests in litter and moist soil in forests. We have also collected it in shrubby bogs.

<<geog>>**Geographic Range:** *Stenamma schmitti* ranges from Québec to the Carolinas and west to Iowa and Missouri. In New England, it is more common in Massachusetts and further south, but collection records are few and far between. Foragers may be collected in litter samples, but nests are rarely encountered.

<<nathist>>**Natural History:** As with all *Stenamma* species, *S. schmitti* is uncommonly collected and rarely studied. It reportedly eats springtails (Collembola).

<<look>>**Look-alike species:** With its minute compound eye, *Stenamma schmitti* is the most easily recognized of our four *Stenamma* species.

<<6-4-14-stesch-face.tif>>

<<6-4-14-stesch-eye-tif>>

<<6-4-14-stesch-body.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The eye has about 4 large ommatidia

<<dist-b>>B. The body, including the post-petiole, is heavily sculptured

<<dist-c>>C. The propodeal spines are short

<<scalebar=2.75mm>>

<<coltab, color="302-3">>Genus *Temnothorax*

<<txa>>*Temnothorax* Mayr, 1861 – The Divided Ants (from the Greek *temno*, meaning cut or divided + *thorax*, referring to the constriction between the ant's mesonotum and metanotum)

<<6-4-15-temlon-body.tif>>

Once considered part of *Leptothorax*, the diverse genus *Temnothorax* includes nearly 400 species, the majority of the Leptothoracini. *Temnothorax* species live all over the world, in boreal, temperate, and tropical climates. There are approximately 50 species in North America, five of which occur in New England. Although *Temnothorax* was named for a constriction between the second and third segments of its thorax, this constriction is rarely apparent. Instead, *Temnothorax* can be distinguished from the other Leptothoracini (*Formicoxenus*, *Harpagoxenus*, *Leptothorax*, and *Protomognathus*) by its distinctively pedunculate petiole, its five-toothed mandibles, and its lack of any impression or suture on the metanotum.

<<txb>>Identifying the Species of *Temnothorax*

Three species of *Temnothorax* – *T. ambiguus*, *T. curvispinosus*, and *T. longispinosus* – are common in New England. *Temnothorax longispinosus* is the largest and most widespread of our *Temnothorax* species (its workers are nearly 3 mm long). It has very long propodeal spines, and its dark brown to black color is distinctive. The two yellow-orange *Temnothorax* species, *T. ambiguus* and *T. curvispinosus*, are distinctively colored and can be separated by their short and widely-spaced (*T. ambiguus*) or long, curved, and narrowly-spaced (*T. curvispinosus*) propodeal spines. *Temnothorax curvispinosus* also has a dark blotch or strip on its gaster that can be seen in

the field using a low-power (5× or 10×) hand lens. The last two species, *T. texanus* and *T. schaumi*, are warm-climate species restricted to southern New England. *Temnothorax texanus* has an unusually wide post-petiole. *Temnothorax schaumi* has unusually short propodeal spines and nests under the bark of old oak trees.

<<6-4-15-tem-matrix.eps>>

This matrix key illustrates five morphological characters that can be used to separate the five New England *Temnothorax* species. Each species is shown in profile; size shown is approximately ten times the size of a worker and colors illustrate differences ranging from black to orange-yellow. The species are ordered by size, from largest to smallest. The primary character to look at on the head is the number of segments on the antenna (12 in *T. texanus*, 11 in all the other New England *Temnothorax* species). Next, look at spines and the pedicel from above. The black *T. longispinosus* has long propodeal spines, whereas the dark *T. schaumi* has very short propodeal spines. The spines of *T. texanus* are intermediate in length, but unlike the other four species, its post-petiole is much wider (> 1.5× as wide) than the petiole. Finally, the two yellow-orange species have either short, widely-set propodeal spines (*T. ambiguus*) or long, close-set propodeal spines (*T. curvispinosus*).

<<txb>>Key to the Species of *Temnothorax*

1a. **The post-petiole is massive – its width $\geq 1.5\times$ width of the petiole**; antennae with 12 segments; roughly sculptured with rugae on head, mesosoma, petiole, and post-petiole; gaster smooth and glossy; color dark brown/black *T. texanus*

<<6-4-15-temtex-inset.tif>>

1b. **Post-petiole $< 1.25\times$ width of the petiole**; antennae with 11 segments; color black or orange-yellow2

2a (1b). **Head covered with fine lines** (striae); propodeal spines short, length $< \frac{1}{2}$ the distance between their bases; color normally dark brown *T. schaumii*

<<6-4-15-temschespines.tif>>

2b. **Head smooth or with net-like (reticulate) sculpturing, but not finely striated**; propodeal spines longer than $\frac{1}{2}$ the distance between their bases; color yellowish-orange to dark brown or black3

3a (2b). **A dark brown to black ant**; dorsum of head smooth, shining; propodeal spines very long, pointing nearly straight back *T. longispinosus*

<<6-4-15-temlon-spines.tif>>

3b. **A yellowish-brown ant**; top of head sculptured4

4a (3b). **Propodeal spines well-separated at base**; each spine shorter than the
distance separating their bases; gaster uniform in color; post-petiole notably
broader than long *T. ambiguus*

<<6-4-15-temamb-inset.tif>>

4b. **Propodeal spines close together at base**; each spine much longer than the
distance separating their bases; gaster with a dark splotch or stripe; post-petiole
nearly square (subquadrate), *i.e.*, not significantly broader than long
..... *T. curvispinosus*

<<6-4-15-temcur-inset.tif>>

<<txb>>Easily Confused Species

It is easy to confuse *Temnothorax* with *Leptothorax*. Both genera in our region have 11-segmented antennae (except for *T. texanus*, which has 12-segmented antennae), but they can be distinguished by their mandibles and the shape of their petiole. *Temnothorax* has only five teeth on its mandibles and a petiole with a pronounced elongate peduncle, whereas *Leptothorax* generally has six teeth on its mandibles and a petiole without an obviously lengthened peduncle.

<<spec>>*Temnothorax ambiguus* (Emery, 1895)

<<common>>The Doubtful *Temnothorax*

<<etym>>From the Latin *ambiguus*, meaning doubtful or uncertain, and referring to its early separation from *Temnothorax curvispinosus*.

<<coltab, color="302-3">>Genus *Temnothorax*

<<temamb-acorn.tif>>

<<temamb-queen.tif>>

<<temamb-map.tif>>

<<hab>>**Habitat:** This ant nests in soil, dead stems, and in small cavities such as hollow nuts. In New England it is most commonly found in acorns in open oak woodlands, but in the Midwest, it is a prairie species that nests in grasslands and fields.

<<geog>>**Geographic Range:** *Temnothorax ambiguus* is a temperate-zone species that ranges from Québec, throughout New England, south to Virginia, and west to Iowa.

<<nathist>>**Natural History:** This species feeds on honeydew, plant nectar, and tiny insects. It is one of several species enslaved by *Protomognathus americanus*.

<<look>>**Look-alike species:** *Temnothorax ambiguus* is similar in size and shape to *T. curvispinosus* as well as to ants in the other Leptothoracini genera – *Formicoxenus*, *Harpagoxenus*, *Leptothorax*, and *Protomognathus*. But *Temnothorax* is distinctive because its mandibles have five teeth. *Temnothorax ambiguus* can be distinguished from *T. curvispinosus* by its relatively short, widely separated propodeal spines, its rectangular post-petiole, and by its usually uniformly colored gaster.

<<6-4-15-temamb-face.tif>>

<<6-4-15-temamb-body.tif>>

<<6-4-15-temamb-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have five teeth

<<dist-b>>B. The propodeal spines are shorter than the distance between their bases

<<dist-c>>C. There post-petiole is wider than it is long

<<scalebar=2.4mm>>

<<spec>>*Temnothorax curvispinosus* (Mayr, 1866)

<<common>>The Bent-spined *Temnothorax*

<<etym>>From the Latin *curvus*, meaning bent + *spina*, meaning spine or thorn, and referring to its propodeal spines

<<coltab, color="302-3">>Genus *Temnothorax*

<<temcur-acorn.tif>>

<<temcur-workers.tif>>

<<temcur-map.tif>>

<<hab>>**Habitat:** This ant nests in acorns and under bark in dry woodlands.

<<geog>>**Geographic Range:** *Temnothorax curvispinosus* is a temperate-zone species that occurs throughout North America, south and west to Texas. It can be found throughout central and southern New England, and along the coast of Maine; north of southern New Hampshire, it is replaced by *T. ambiguus*.

<<nathist>>**Natural History:** Like *T. ambiguus*, this species feeds on honeydew and plant nectar. It is also one of several species enslaved by *Protomognathus americanus*.

<<look>>**Look-alike species:** *Temnothorax curvispinosus* is similar in size and shape to *T. ambiguus* as well as to ants in the other Leptothoracini genera – *Formicoxenus*, *Harpagoxenus*, *Leptothorax*, and *Protomognathus*. But *Temnothorax* is distinctive because its mandibles have five teeth. *Temnothorax curvispinosus* can be distinguished from *T. ambiguus* by its relatively long and curved spines that are set close together at their base, its nearly square post-petiole, and by the dark markings on the rear part of its yellowish gaster.

<<6-4-15-temcur-face.tif>>

<<6-4-15-temcur-body.tif>>

<<6-4-15-temcur-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The propodeal spines are much longer than the distance between their bases

<<dist-b>>B. The post-petiole is about as wide as it is long

<<dist-c>>C. The gaster has a dark stripe or splotch

<<scalebar=2.5mm>>

<<spec>>*Temnothorax longispinosus* (Roger, 1863)

<<common>>The Long-spined *Temnothorax*

<<etym>>From the Latin *longus*, meaning long + *spina*, meaning spine or thorn, and referring to its propodeal spines

<<coltab, color="302-3">>Genus *Temnothorax*

<<temlon-nestwall.tif>>

<<temlon-workers.tif>>

<<temlon-map.tif>>

<<hab>>**Habitat:** This ant nests under rocks, in acorns, or under bark on living trees.

<<geog>>**Geographic Range:** *Temnothorax longispinosus* is a temperate-zone species that can be found throughout North America east of the Mississippi River. It has been collected throughout New England.

<<nathist>>**Natural History:** This species feeds on honeydew, plant nectar, and tiny insects. It is also one of several species enslaved by *Protomognathus americanus*. Although abundant in hardwood forests, it is the only *Temnothorax* species we find in hemlock forests. Look for it under the rocks of New England's thousands of kilometers of stone walls.

<<look>>**Look-alike species:** The black, long-spined *Temnothorax longispinosus* is unlikely to be confused with any other species in our region.

<<6-4-15-temlon-face.tif>>

<<6-4-15-temlon-body.tif>>

<<6-4-15-temlon-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have five teeth

<<dist-b>>B. The propodeal spines are long and point straight back

<<dist-c>>C. The top of the head is smooth and shiny

<<scalebar=2.8mm>>

<<spec>>*Temnothorax schaumii* (Roger, 1863)

<<common>>Schaum's *Temnothorax*

<<etym>>Named for the German entomologist Hermann Rudolph Schaum, who collected the type specimen in Pennsylvania

<<coltab, color="302-3">>Genus *Temnothorax*

<<temschr-habitat-HL.tif>>

<<temschr-worker-AW.tif>>

<<temschr-map.tif>>

<<hab>>**Habitat:** This ant nests under the bark of large oak trees (*Quercus* species) and Pitch Pine (*Pinus rigida*), and can be found foraging on dead branches of otherwise live trees, standing dead snags, and especially on the trunks of white oaks.

<<geog>>**Geographic Range:** This species ranges from Maine to Florida, west to the upper Midwestern states, and south to Texas. It can be collected throughout New England, most frequently in warmer areas.

<<nathist>>**Natural History:** Very little is known of the behavior or diet of this species, which is one of the few arboreal ant species in New England.

<<look>>**Look-alike species:** The very short spines and fine striations on its head distinguish *T. schaumii* from all other *Temnothorax* species in New England. Its large eyes separate it from the short-spined, but small-eyed *Stenamma* species, and its fine sculpturing is very different from that of *Tetramorium caespitum*.

<<6-4-15-temsche-face.tif>>

<<6-4-15-temsche-body.tif>>

<<6-4-15-temsche-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The mandibles have five teeth

<<dist-b>>B. The propodeal spines are very short and widely separated

<<dist-c>>C. The head is very finely striated

<<scalebar=2.7mm>>

<<spec>>*Temnothorax texanus* (Roger, 1863)

<<common>>The Texas *Temnothorax*

<<etym>>Named for its type locality, Milano, Texas

<<coltab, color="302-3">>Genus *Temnothorax*

<<temtex-habitat-WB.tif>>

<<temtex-worker-WB0218.tif>>

<<temtex-map.tif>>

<<hab>>**Habitat:** This ant nests in sandy soils and sand dunes in pine barrens.

<<geog>>**Geographic Range:** *Temnothorax texanus* is most common in the Mid-Atlantic and Midwestern states, from Michigan south to Texas. In New England, it has been collected so far only from oak-pine woodlands in Massachusetts and northeastern Connecticut.

<<nathist>>**Natural History:** In New England, this is a species of pine barrens and sand dunes. It makes cryptic, tiny, and shallow nests with a single queen in the pure sand soils of open, sparsely vegetated areas. It is most active at dawn and dusk, or on cool, cloudy days.

<<look>>**Look-alike species:** This is our only *Temnothorax* species with 12 antennal segments. That character, along with its unusually wide post-petiole, distinguish it not only from our other *Temnothorax* species, but also from all the other Leptothoracini genera – *Formicoxenus*, *Harpagoxenus*, *Leptothorax*, and *Protomognathus*.

<<6-4-15-temtex-face.tif>>

<<6-4-15-temtex-body.tif>>

<<6-4-15-temtex-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The antennae have twelve segments

<<dist-b>>B. The post-petiole is more than 1.5× as wide as its petiole

<<scalebar=2.6mm>>

<<coltab, color="302-6">>Genus *Tetramorium*

<<txa>> *Tetramorium* Mayr, 1855 – The Four-segmented Ants (from the Greek *tetra*, meaning four + *morion*, referring to a member or segment, and referring to the maxillary palp)

<<6-4-16-tetcae-face.tif>>

The genus *Tetramorium* is a diverse genus of ants that is found throughout the world. Although there are ten North American species, only one, the non-native (European) Pavement Ant, *Tetramorium caespitum*, occurs in New England. *Tetramorium* was named for the number of segments (four) on its maxillary palp, but it is most easily recognized by its antennal sockets, which are deep and round. *Tetramorium caespitum* also is unique among our regional species in having a stinger that ends in a wide triangle (visible at 50× magnification). Ongoing revisionary systematics work by Birgit Schlick-Steiner and others suggests that what we now call *T. caespitum* may turn out to be a complex of as many as seven species (they refer to the North American species as *Tetramorium* species E); only time will tell!

<<spec>>***Tetramorium caespitum*** (Linnaeus, 1758)

<<common>>*The Pavement Ant

<<etym>>From the Latin *caespita*, meaning turf, and named for its native habitat, turf-grass or sod

<<coltab, color="302-6">>Genus *Tetramorium*

<<tetcae-pile.tif>>

<<tetcae-closeup.tif>>

<<tetcae-map.tif>>

<<hab>>**Habitat:** This ant nests in cracks in driveways and roads, under rocks in open woodlands and disturbed areas, and on sandy beaches.

<<geog>>**Geographic Range:** *Tetramorium caespitum* is native to Europe. Although it is now found in much of eastern North America and all of New England, it is not yet well established in the northern Maritime Provinces of Canada, but it is nesting in and around Montreal and southern Ontario.

<<nathist>>**Natural History:** This species is our common pavement ant – it makes crater-shaped nests in asphalt and sidewalks. But it also nests on dirt roads, under rocks, and on beaches. We have collected it extensively nesting at the base of American Beachgrass, *Ammophila breviligulata*, and at the landward edges of salt marshes. The colonies can be large (up to 10,000 workers) and have only a single queen. Nearby, unrelated colonies of *T. caespitum* will fight conspicuous, but non-destructive, territorial battles in the spring and early summer.

Mating flights usually occur in June. *Tetramorium caespitum* is the host species for the rarely-collected inquiline social parasite *Anergates atratulus*, which also is native to Europe.

<<look>>**Look-alike species:** *Tetramorium caespitum* is similar in size and color to *Stenamma brevicorne*, and minors of *Pheidole* species. The large eyes of *Tetramorium* distinguish it from *Stenamma*. The deep pits surrounding the antennal insertions, the parallel rugae on its head, and the triangular-ending stinger are all characters of *T. caespitum* that will separate it from *Pheidole*.

<<6-4-16-tetcae-face.tif>>

<<6-4-16-tetcae-body.tif>>

<<6-4-16-tetcae-inset.tif>>

<<dist>>**Distinguishing features:**

<<dist-a>>A. The antennae insert into a deep crater-like cavity on the head

<<dist-b>>B. There are distinctive parallel rugae on the head

<<dist-c>>C. The stinger ends in a triangular process

<<scalebar=3.6mm>>

<<CN>>Chapter 6

<<CT>> The Biogeography of New England Ants

The distribution map on each species' page provides a snapshot of where each species has been recorded in New England. Where do these maps come from, how accurate are they, and what can they tell us about how New England's ant fauna will respond to changes in regional climate during the next 50 – 100 years? These questions are in the domain of biogeography – the study of the patterns of the diversity of organisms in space and time. It is well beyond the scope of this field guide to present a detailed biogeographic analysis of all the data on the distribution and abundance of ants in New England. However, in this closing chapter, we introduce you to how ecologists think about biogeographic data, illustrate some important patterns in the distribution of New England ants, and show how your own data and collecting can contribute to a better understanding of the diversity of ants in New England.

<<txa>>Where Do Biogeographic Data Come From?

Preserved biological specimens – along with their associated collection information – are stored in natural history collections, museum repositories, and in private collections around the world. For most species, they represent the only quantitative and verifiable data on where and when a particular species was found on the planet. To prepare the species distribution maps for this guide, we scoured collections in museums throughout New England, found additional specimens at Cornell University, Pennsylvania State University, and the Academy of Natural Sciences in Philadelphia. We and our colleagues have also amassed our own collections from a number of ecological field surveys. Collection data that were recovered from the labels included

the journalist's "who, what, when, and where:" the name of the species, where it was collected (at least state and county, and sometimes town, latitude and longitude), from what kind of habitat it was collected, when it was collected, and who collected it. In total, we compiled 24,551 records of 131 species that have been collected somewhere in New England. Not every specimen had every bit of these data; habitat information was most often lacking, and latitude and longitude was rarely recorded for specimens collected in the pre-GPS era. But each of these species is based on an actual specimen or group of individuals collected from the same nest or pitfall trap that had been pinned or was well-preserved in alcohol *and* that included information on at least the state and county in which it was collected. More than 96% of the specimens also included dates of collection. We also checked and re-checked the species identifications and updated labels to reflect current taxonomic revisions and accepted species names. The full database is stored in the Harvard Forest Data Archive (<http://tinyurl.com/antsNE>). If you have properly preserved your ants, neatly pinned them, and included a full label with all the necessary collection details (see Chapter 3), your records can contribute to this unique and growing database.

<<txa>>Ant Collecting in New England

All these museum specimens, and the database we put together, provide a window on the history of myrmecology in New England. The oldest specimen in our database is a Winter Ant, *Prenolepis imparis*, collected in New Haven Connecticut on April 18, 1868 by Addison Emery Verrill. Verrill was a student of Harvard's famous professor, Louis Agassiz, and spent 43 years (1864-1907) teaching and doing research at Yale University, where he was the first Professor of Zoology. Although perhaps better known as the world's authority (at the time) on squids and

other marine invertebrates, Verrill did teach entomology for a few years at the University of Wisconsin. Our most recent specimens are *Temnothorax texanus* that we collected on September 11, 2011 at Wellfleet Bay Wildlife Sanctuary, on Cape Cod, Massachusetts and *Cardiocondyla obscurior* that we collected on November 9, 2011 in a greenhouse at the University of Massachusetts in Boston. In between these times, specimens were collected by dozens of others, including amateur and professional myrmecologists, undergraduate students and their professors, and renters and home-owners with carpenter ants in their walls or *Lasius* in their drains. Ant collecting in New England and our knowledge of the regional ant fauna has clearly accelerated in recent years: more than 70% of the specimen records in the database date from the 1980s or later (Figure 6.1), and the two undescribed species of *Lasius*, *Lasius* cf. *umbratus* and *Lasius* cf. *niger*, were first collected in 1985 and 2011, respectively.

<<Figure 6.1 near here>>

<<txa>>What is Common, and what is Rare?

The first step in describing biogeographic patterns is to rank the 131 New England species from the most common (rank = 1) to the least common (rank = 131). The result can be illustrated with a rank abundance graph (Figure 6.2), with the species rank on the horizontal axis (the *x*-axis) and the number of records on the vertical axis (the *y*-axis). Each bar represents the number of records for a particular species in the database.

<<Figure 6.2 near here >>

This rank abundance graph looks like a smooth, concave curve, with a handful of common species on the left, and a much larger number of uncommon species on the right. The diversity of most other kinds of animals and plants when plotted this way will look very similar – there will be a few common species and a long right-hand “tail” of increasingly rare species. The difference in the relative abundance of the common and rare ant species is striking. At the common end, the five most frequently encountered species in the data set were *Aphaenogaster rudis* (2,083 records), *Tapinoma sessile* (1,816 records), *Lasius alienus* (1,520 records), *Camponotus pennsylvanicus* (1,261 records), and *Myrmica lobifrons* (1,172 records). Together these five species, which represent less than 4% of the 131 ant species so far recorded from New England, account for more than 30% of the collected specimens! In contrast, the 41 least commonly-collected species – those with 10 or fewer records – account for 30% of the species diversity. And in far-right-hand tail of Figure 6.2, the rarest of the rare, there were 14 species each represented by only a single record (singletons): *Aphaenogaster mariae*, *Cardiocondyla obscurior*, *Formica dirksi*, *F. hewitti*, *F. morsei*, *F. reflexa*, *Lasius* cf. *niger*, *Myrmica* sp. AF-eva, *Myrmica* sp. AF-ine, *Paratrechina longicornis*, *Pheidole flavens*, *Proceratium pergandei*, *Pyramica pulchella*, *Tapinoma melanocephalum*.

<<txa>>The Causes of Rarity

Why are so many of these New England’s ant species so uncommon? A number of mechanisms are possible, and often more than one of these explanations will apply to any particular case of rarity.

<<txb>>Taxonomic Rarity

Some species may be rare because they have only been recently described and therefore were not recognized by previous researchers. In our list of 14 singletons, *Lasius* cf. *niger* and *Myrmica* sp. AF-eva fall in this category. These species will probably turn out to be more common once we sort through previously identified material and separate them from closely related species in the same genus. At the same time, it is important to note that taxonomic issues can also affect common species. The most common species on our list, *Aphaenogaster rudis*, is, in reality, a species complex or group of closely related species. Genetic and morphological studies are currently underway to clear up the taxonomy and phylogeny of this important New England ant genus. Like a phone company monopoly, this large complex will eventually be broken up into a set of species, each of which is less common than we now think. However, except for the height of the very first bar in Figure 6.2, this kind of change will not affect the shape of the rank abundance graph very much.

The most challenging cases of taxonomic rarity are those in which a species has been recorded only once, from a single specimen or a single nest. *Formica dirksi*, *F. morsei*, *Myrmica* sp. AF-ine, and the undescribed species of *Tapinoma* fall into this category. The specimen base for these species consists of a single queen of *Formica dirksi* collected in 1946, a group of workers of *F. morsei* collected from a single nest in the early 1900s, a single queen of *Myrmica* sp. AF-ine collected in 2006, and a single nest of the new species of *Tapinoma* collected in 2007 (which may be the same as a species of *Tapinoma* collected in the early 1900s on Mount Tom, Holyoke, Massachusetts). None of these species has been collected again. Without multiple specimens, it is hard to be confident that these specimens actually represent new species rather than variants of existing species, although in all three cases the ant's morphology is so clearly different from any species we know about that identifying them as distinct species seems

reasonable.

<<txb>>Sampling Rarity

Some species may appear to be rare because the traditional sampling methods do not pick them up very well. *Proceratium pergandii* and *Pyramica pulchella* are small-bodied, specialized predators that feed on spider eggs and springtails, respectively, and mostly nest in soil and under rotting logs. The New England species of *Solenopsis* and *Stenamma* are tiny (our *Solenopsis* species are < 2 mm in total body length, and *Stenamma* is not much larger), and timid. All of these species have small colonies (< 100 workers) and do not forage far from their nests and so they tend to not be collected in pitfall traps, bait samples, or hand-collections. Similarly, *Aphaenogaster mariae*, *Camponotus caryae*, and *Temnothorax schaumii* are arboreal species that nest high up in the canopy and rarely forage on the ground. Like *Proceratium* and *Pyramica* in the litter, these canopy-dwellers will rarely, if ever, be collected in pitfall traps; look for them in stacks of cut firewood, and maybe you will get lucky! Some myrmecologists have developed specialized collecting bags (Winkler sacks; see Chapter 3) for separating cryptic ants from leaf litter samples; others climb trees or use insectide fogs to sample ants from the canopy. In tropical rainforests, these methods have uncovered large, specialized groups of ant species in these habitats. Here in New England, we don't have very many species that are canopy or leaf-litter specialists, but undersampling of particular hard-to-see and hard-to-reach habitats is still an important issue in ant surveys.

<<txb>>Geographic Rarity

In theory, the three unique species that have been recorded only from New England

(*Formica dirksi*, *F. morsei*, *Myrmica* sp. AF-ine, the new species of *Tapinoma*) are *endemics*: species whose entire geographic ranges are restricted to one region. But it is more likely that these species have wider distributions, perhaps belong to other described species, or possibly were once abundant have become rare or even gone locally extinct as the New England landscape has changed. In point of fact, the remaining 127 species known from New England all have geographic ranges that extend beyond the boundaries of New England; our ecoregions (see Chapter 1) cross state lines, and thus New England does not form a natural biogeographic unit for ants.

Some species that are rare in New England but are more common elsewhere reach the edge of their geographic ranges here. For example, boreal species such as *Formica hewitti* and *F. podzolica* (with only one and six New England records, respectively) become much more abundant further north in central Québec. Some of the other boreal species that we described in Chapter 5 (*Leptothorax retractus*, *L. sphagnicolus*, *Myrmica lampra*, *M. quebecensis*, and *M.* sp. AF-sub) have not yet been collected in New England; look for them on high mountain tops in New Hampshire and Vermont, and in the boreal forests of northern Maine.

On the other hand, the carpenter ants *Camponotus castaneus* and *C. chromaiodes*, and the small Myrmicinae *Temnothorax texanus* are widespread throughout the southeastern U.S, but in New England, they don't nest north of southern Massachusetts. But there are always exceptions to these rules. For example, our database includes a record of a single *C. chromaiodes* specimen that was collected in Burlington, Vermont, on September 14, 1983, and the specimen is clearly labeled "Burlington, VT," so we know it was not collected in Massachusetts or North Carolina. The large geographic separation between the 151 other records of this species and the single northern Vermont record might reflect poor sampling in intervening areas, which is always a

possibility for New England ants. Or it may represent a true break (or disjunction) in the geographic range of this species. For a southern species like *Camponotus chromaiodes*, the relatively warm microclimate of Burlington along the shores of Lake Champlain is probably the only place in Vermont where we would expect to collect it. And as New England's climate warms, you may start to find other southern species that we described in Chapter 5 (*Camponotus subbarbatus*, *Lasius murphyi*, *L. plumopilosus*, *Nylanderia flavipes*, and *Pachycondyla chinensis*) showing up here in New England.

Taking this to the extreme, we can identify certain species that favor extremely warm or extremely cold temperatures. The most clear-cut examples in New England of such thermal specialists are the tropical tramp species, *Hypoponera punctatissima*, *Tapinoma melanocephalum*, *Cardiocondyla obscurior*, *Monomorium pharaonis*, *Paratrechina longicornis* and *Pheidole flavens*, which can only survive our winters by nesting indoors, in greenhouses and heated buildings. Although thermal tolerances can determine how far a species can range north or south, we should be cautious about reversing this logic and inferring the thermal tolerance of a species from its geographic ranges. For example, The Winter Ant, *Prenolepis imparis*, occurs throughout New England, and its geographic range extends from Canada to Mexico. Its workers can successfully forage at cooler temperatures than those of nearly all other species, and *P. imparis* is usually the first ant to emerge in spring and one of the latest to disappear in autumn. Yet, its range does not extend into boreal regions and it does not nest at high elevations. Clearly its distribution is limited by something more than just its thermal tolerance. Ongoing laboratory studies of the thermal tolerances of New England ant species will eventually help us understand the extent to which thermal specialization contributes to geographic ranges and habitat associations we measure in the field (or the home).

Finally, remember that maps represent only composite snapshots of distributions, based on when and where the specimens were collected. Changes in habitat and land-use are always occurring, in New England and elsewhere, and the abundance and distribution of many species of ants (and other organisms) reflect those changes. For example, as the farm-fields of colonial New England were abandoned and the forests regrew (Chapter 1), prairie species such as *Formica ulkei* and *F. reflexa* became restricted to grassland remnants in Downeast Maine.

<<txb>>Rarity of Habitats and Resources

Some species may be regionally rare, but can be common in certain, often rare, habitats that have particular habitat conditions. A good example of such a species is *Myrmica lobifrons*, which is a true bog specialist. *Myrmica* is a species-rich genus in New England, and most species in this genus are found in forests or other open habitats. But in bogs and nutrient-poor fens, *Myrmica lobifrons* often is the most common *Myrmica* species, and it will not be found in adjacent forests.

But if *Myrmica lobifrons* is such a habitat specialist, why is it number 5 (with 1,172 records) in our database of New England ants? The answer is because we have been focused on collecting ants from bogs throughout New England for the past 15 years. Thus, the records of *Myrmica lobifrons* in our database are artificially inflated by our own collecting efforts in this unique habitat. This shows the potential hazards of non-random sampling and how it can influence the composition and ordering of species lists. If we were to exclude our own samples from the database, there would be only eight records of *Myrmica lobifrons* in the database, and its ranking would change from number 5 to number 93 out of 131. This lower (rarer) rank is probably a more accurate representation of its true occurrence: a randomly chosen pushpin on the

map of New England is unlikely to sample a bog because this habitat constitutes less than 1% of all the available land area in New England.

Of course, we could remove such focused collections or specialized records from our lists, but how would we know where to start and when to stop? Many collectors save only the least common species (do you really want to pin 1,000 Eastern Carpenter Ants?), and most museum records do not include good habitat information for creating separate lists for different habitats. Although latitude, longitude, and elevation can be measured in standard units, we don't have a habitat scale or designation that everyone can agree upon. One collector's "wetlands" might be another collector's "ombrotrophic bog;" sorting out the collections and notes of others can be difficult. Therefore, you should do your best to provide concise, but detailed habitat labels for your ant specimens (see Chapter 3). "Mesic beech-maple forest" is better than "deciduous forest" which is better than "woods." As you collect and study ants, you will want to learn about the associated vegetation and land-use history (Chapter 1) of the landscape in which you find them.

Finally, for most ant species, the underlying causes of habitat specialization are poorly known. We assume that *Myrmica lobifrons* has specialized adaptations that allow it to colonize bog habitats, where the peat mosses and soils are acidic, water-logged, and low in oxygen. Those same adaptations might reduce the performance of *Myrmica lobifrons* in adjacent forests. But that is just an assumption. We would have to conduct experiments in which we move ant nests from one habitat to another, observe the ants' responses, and then determine which aspects of the species' physiology, morphology, or behavior caused the observed responses. Such experiments are challenging to design and replicate, but are well worth the effort.

<<txb>>What About Introduced Species?

Of the 131 species recorded in New England, only 13 are considered to be non-natives: *Hypoponera punctatissima*, *Tapinoma melanocephalum*, *Lasius* cf. *niger*, *Nylanderia flavipes*, *Paratrechina longicornis*, *Anergates atratulus*, *Cardiocondyla obscurior*, *Monomorium floricola*, *Monomorium pharaonis*, *Myrmica rubra*, *Myrmica scabrinodis*, *Pheidole flavens*, and *Tetramorium caespitum*. In total, only 10% of New England ant species are introduced, and this percentage is lower than in many other areas. Florida has highest incidence of non-native species in the United States: 25% of its ant species are non-native, and more arrive every year. The warm climate of Florida is certainly more inviting to tropical ants (of which there are thousands of species) than the frigid winters of New England, and indeed, only five of our non-native species are tropical tramps.

But the other seven of our non-native species arrived in New England from more temperate latitudes on other continents. Ants are superbly adapted for hitchhiking in soil, plants, and wood products, and it is curious that in spite of centuries of trade and human migration between North America and the rest of the world that few species of European ants or ants from the higher latitudes of Asia, South America, Africa, and Australia have colonized New England. For example, there are many species of wood ants (in the *Formica rufa* group) that are very abundant and aggressive, and function as important ecosystem engineers in European forests. *Formica rufa* itself has turned up and established colonies in southern Ontario, and it may only be a matter of time before it shows up here. On the other hand, as with human migration and movements, perhaps some of the so-called “native” New England ant species were introduced so long ago that they were well-established before scientific ant collecting began in earnest in the early 1900s.

Still, most of the non-native species are rare, and probably have little ecological impact. The two exceptions are The Pavement Ant, *Tetramorium caespitum*, and The European Fire Ant, *Myrmica rubra*. *Tetramorium caespitum* is widespread and abundant, but has yet to attract ecological notice. In contrast, *M. rubra* occurs throughout coastal New England and along some inland rivers, and it is considered an invasive species of management concern, especially in Maine. It is aggressive and stings picnickers, although its impacts are nothing like those of the South American fire ant, *Solenopsis invicta*, which has transformed the ecological landscape of the southeastern United States since its accidental introduction in the late 1930s. Watch for new ecological challenges, however, once the Asian Needle Ant, *Pachycondyla chinensis*, reaches New England's forests from further south, where it is already established. *Pachycondyla chinensis* is not as aggressive as the South American fire ant, but it has a powerful sting, and can displace native ant species.

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<<txa>> How Many Species of Ants Are There in New England?

All these data – collection records, distribution maps, experimental determination of the causes of rarity, and the ongoing migration of species – contribute to answering this one fundamental question. Even with our best efforts to comb collections and query experts about the species known from our region, determining the true number of ant species in New England is like shooting at a moving target. Indeed, we found ourselves frantically adding new species descriptions and drawings at the 11th hour: *Lasius* cf. *niger* was first collected in Massachusetts only three months before this book went to press, we discovered the 1901 Connecticut record of *Aphaenogaster mariae* in Harvard's own Museum of Comparative Zoology two months after

that, and we found *Cardiocondyla obscurior* in a greenhouse at the University of Massachusetts's Boston campus while the final manuscript was being reviewed and copy-edited! In a classic example of the challenges of labeling, the collection locality of the MCZ specimen of *A. mariae* was given simply as "Colebrook," without any corresponding country, state, or county. A careful search of the literature turned up this record in a 1906 List of the Formicidae of New England (the only other checklist for New England) written by William Morton Wheeler and published by the now-defunct Boston Society of Natural History. Like priceless art objects, the provenance and validity of specimen records depends largely on how carefully the original collection data were recorded.

<<txb>>Estimating the Number of Species in New England

The data we have already collected can give us some important clues about the number of species that have not yet been detected. To estimate the number of undetected species, we rely on some sophisticated biodiversity statistics that are based on the party game of guessing the number of jelly beans in a large jar. Imagine that our data base of 24,551 ant records of 131 species is transformed into a giant jar of 24,551 individual jelly beans, representing 131 different colors (wow!). Reach into the jar and pull out a single jelly bean, which represents one record of one species. We can plot this simple result on a graph: the x -axis is the number of records (= jelly beans) sampled, and the y -axis is the number of species (= different colors) recorded. Our first jelly bean gives us the first point on the graph, because one jelly bean represents a single, unique color, the point on the graph will be located in the lower left corner, at point (1,1).

But what happens when you pick the second jelly bean? If it is a different color, the graph rises to the point (2,2): two jelly beans (number of records) on the x -axis and two colors (species)

on the y -axis. On the other hand, if you draw the same color jelly bean a second time, the curve will stay flat as the point moves to (2,1): two jelly beans on the x -axis but still only one color (species) on the y -axis. Keep going (that's a lot of jelly beans!), and you will eventually draw all 24,551 jelly beans and record all 131 species, which is the high point of our graph. The curve, which is called a species accumulation curve, will look like a ragged staircase that stays flat when you keep pulling jelly beans of the same color, and then rises by one step whenever you draw a new color jelly bean (corresponding to a species that you have not sampled before). We call this graph a species accumulation curve because species accumulate on the y -axis as individuals (specimen records) accumulate on the x -axis.

Now, put all the jelly beans back in the jar, mix them up, and do it again. Would you get the exact same curve? Probably not, but the new species accumulation curve would look pretty similar. And, if you repeated this sampling experiment hundreds of times and calculated the average of the number of species for each number of individuals, you would end up with a smooth curve that always starts at (1,1) and rises to the endpoint (24551,131).

<<Figure 6.3 near here>>

Such a smooth, averaged species accumulation curve is shown as the solid line in Figure 6.3 (fortunately, a computer did the re-sampling for us!). The averaged species accumulation curve has a characteristic shape: it rises relatively quickly during the early part of the sampling as lots of species (or different colored jelly beans) accumulate. The first species recorded in the curve are usually the common ones. Once the common species are encountered, the curve continues to rise, but much more slowly: it takes more intensive sampling to encounter the

remaining rare species, as we move from left to right in the relative abundance curve (Figure 6.2). Eventually, the species accumulation curve flattens out because it takes more and more searching to find the rarest species. In particular, with jar full of 24,551 jelly beans, you are likely have to pull out an awful lot before you get the one blue jelly bean that represents, for example, *Tapinoma melanocephalum*.

The species accumulation curve lets you estimate how many records you would have to sample to record a particular number of species. For example, in our dataset of 24,551 records, 131 species, and the relative abundance distribution in Figure 6.2, we would need to sample only about 2,700 records to get 100 species. But on average, it will require pulling all 24,551 records to get all 131 species. Because the order in which you sample particular species will vary from time to time (like different tries pulling jelly beans out of a jar), there is uncertainty in the precise shape of the species accumulation curve. The colored funnel in Figure 6.3 shows the range of variability that would be expected for a “typical” draw.

But have we collected all of the species present in New England when we reach 131? Certainly not! We have only recorded only the shape of the species accumulation curve up to the maximum of our current database. Statisticians have developed methods to extend the species accumulation curve out to its hypothetical endpoint, or ceiling. Once the ceiling is reached, we would not expect to find any new species that had not been recorded earlier. The dashed region of the curve in Figure 6.3 shows this forecast, as we extrapolate out beyond the limits of the data. Using this method, we arrive at an estimate of 144 species. In other words, given the data we already have, we predict that there are 14 more species of ants yet to be collected in New England; you might be the first to find one of these species-in-waiting!

For many statistical and biological reasons (including the possibility of climate and

habitat change), it is best to view this forecast as an estimate of the *minimum* number of undetected species. It seems likely that more than 14 will be found with additional collecting. But we have some degree of confidence in this forecast, because it is just a few more species than the number of ant species on our regional species checklist that have been collected just outside of New England, in nearby New York, Québec, and the Canadian Maritime Provinces, but that nest in habitats that can be found somewhere between Connecticut and Maine (Chapter 5).

<txb>>Where Should You Look for Additional Ant Species in New England?

Our prediction of additional species lurking in the fields and forests of New England is encouraging – let’s get out in the field and hunt! But before packing your pooter and loading your daypack, look carefully at the x -axis of Figure 6.3. We have just shy of 25,000 specimens in our database, but the estimated total ant species richness of 144 ant species isn’t reached until the number of specimens exceeds 125,000! In other words, we would need to collect over five times as many specimens as have been collected in the last 150 years to have a reasonable chance of finding these missing 14 species!

Why so much work? The answer is that, for the missing species, we are now looking for the rarest of the rare – so rare, in fact, that they are currently invisible. Nevertheless, it might not be so hard to find these species. The statistical model assumes that we continue to randomly sample ants in the same way that we have over the past 100 years. But with knowledge of which habitats and regions of New England are under-sampled, you may find the missing species without quite so much sampling.

So where should you look? We’ve talked a lot about the number of species and how

common or rare they are, but a lot less about where they are and where collectors have looked for them. Just as it was informative to graph the relative abundance of species and the species accumulation curve, it is also very informative to plot out the places where species richness is high and the places where it is low. Figure 6.4 organizes all of our ant data into a map that illustrates the patterns of species richness and collection records for all 67 New England counties.

<<Figure 6.4 about here>>

The map on the left shows the number of specimen records in each county. In these plots, different shades of red indicate counties from which we have a large number of specimens and different shades of blue indicate counties where we have very few specimens. Using the same color scheme, the map on the right shows the number of species recorded from each county. Although the total number of ant species recorded in New England is 131, the maximum number recorded in a single county is 83 (Plymouth County, Massachusetts, from which we also have 1,700 specimen records), and the minimum is 2 (Orange County, Vermont, from which we have only two specimen records).

Part of the variation in species richness across New England that we observe is clearly a sampling effect – counties with more records tend to have more species. Does this mean that all we need to do is collect more samples from poorly-sampled counties? No. Even if the number of ant species per square kilometer were uniform across New England, we would still expect the species counts to differ among counties for two reasons. First, some counties are larger in surface area than others, and will have more ants because they are bigger (an area effect). Second, some

ant species nest only in very specific habitats or have very narrow climatic requirements.

Different habitats are not evenly or randomly distributed among counties, and climate varies with latitude and elevation. Therefore, different counties will have different numbers of species due to habitat availability and variation in climate.

<<Figure 6.5 near here>>

The two graphs in Figure 6.5 illustrate the sampling effect (A) and the area effect (B) for New England ants. In Figure 6.5A, the x -axis is the number of specimen records and the y -axis is species number. Each point represents a different county, and the six different colors of the symbols indicate the six New England states. Similar to Figure 6.4, “cold” colors represent northern states (blue = Maine, purple = Vermont), and “warm” colors represent southern states (orange = Connecticut, red = Rhode Island). The curve passing through the cloud of data points is the trend in the data, and it can be used for estimation or forecasting.

Figure 6.5B is organized the same way, but now the x -axis is the area of the county (in square kilometers), rather than the number of specimens. In both graphs of Figure 6.5, a strong sampling effect is apparent: species counts drop off sharply for those counties with fewer than 400 records. The largest number of records is from counties in the Boston area, which reflects the historical influence of Harvard’s Museum of Comparative Zoology and the high concentration of myrmecologists in this part of the world. There are also thousands of ant specimen records from York County in Maine, where the Waterboro Pine Barrens were intensively surveyed in 1996 and 1997. On the other hand, the effect of county area is much weaker, as there are several very large counties in Maine that have few species reported. For both

graphs, there is considerable scatter in the data, so the difference among the counties in the number of ant species recorded is due to something more than either county area or sampling effort. These differences may be related to habitat, climate, or other geographic variables.

We can explore the relationship between the number of ant species and a wide range of variables associated with each county. For example, consider latitude, longitude, elevation, and average annual temperature for each county (determined for the geographical center of the county). These variables are good indicators of variability in habitat types and local climate. In Figure 6.6, we illustrate the relationship between each of these variables and the number of ant species. As in Figure 6.5, each point represents a different county, and the six different colors of the symbols indicate the six New England states. The curves illustrate the relationships between each geographic or climatic variable and the observed number of ant species.

<<Figure 6.6 near here>>

Once again, there is a lot of scatter in the data, but some of that can be attributed to variation in the number of sampling records. For example, in the graphs of species richness versus latitude and temperature, there is a cluster of red symbols below the trend line. These red symbols are the counties in Rhode Island, which should have many more species because they are relatively southern and relatively warm compared to the other counties. But Figure 6.4 shows that very few ant specimen records are available from Rhode Island counties, and this reduces the number of species observed.

In spite of all the scatter in Figure 6.6, the curves suggest where you might profitably look for more ant species. There is a strong relationship between species richness and

temperature: there are more species where it is warmer. There is also a strong negative relationship between species richness and latitude: there are more species further south than there are in the north. Average annual temperature as well as habitat diversity (Chapter 1) are both higher in southern New England than in northern Maine. The relationships between the number of ant species and either elevation (low to high) or longitude (west to east) are weaker, but still informative. Ant species richness declines with elevation – high mountain tops are colder and cover less area than the valleys below – but increases towards the coast, which may reflect, in part, the relatively milder maritime climates nearer to the Atlantic Ocean. Thus, the best chances for finding additional species are in the southern coastal counties of Rhode Island and Connecticut. But there are also likely to be cold climate specialists lurking in the high elevations of Vermont and Massachusetts, and the remote, northern counties of Maine. Happy hunting!

<<txa>>Climate Change and the Future of New England Ants

As we were finishing this chapter, Hurricane Irene swept up the east coast of the U.S., first touching land on outer banks of North Carolina on August 27, 2011. By the time it reached New England, it had weakened to a tropical storm, but it nevertheless caused severe damage and flooding, particularly in southern and central Vermont and eastern New York. Historically, such storms are not uncommon in New England; tropical storms and hurricanes regularly track across the region, with notably large or deadly storms in 1635, 1915, 1938, 1944, and 1999.

What is the “ants-eye” view of such storms? Flooding can create the kind of disturbed habitat that favors the invasive species *Myrmica rubra*, but those habitat effects are quite transient. Downed trees open up the canopy and also increase the supply of fallen wood in which

many species nest. Heavy flooding and rain obviously can kill many colonies, but the areas affected are fairly small, and the losses are miniscule compared to the total population size of ants in the area. Overall, a single storm is likely to have only small, barely noticeable effects on regional populations and assemblages of ants.

However, as global warming proceeds, the intensity and frequency of such major storms is expected to increase. More frequent, larger storms not only may displace large numbers of people on the populous eastern seaboard, but also may have larger, accumulating impacts on ants, especially those with geographically-restricted distributions.

Perhaps more important than severe storms, however, are the increasing temperatures that will occur as the concentration of greenhouse gases, especially carbon dioxide and methane, increases in the atmosphere, trapping the earth's radiant heat. New England in 2012 now has a climate much like Pennsylvania had in 1990. Even the most conservative and cautious modeling scenario forecasts that the climate in northern Maine 100 years from now could be comparable to the current climate in Washington, D.C. Warm temperatures will allow southern species to expand their ranges northward into New England, but only if the right habitats are available for them. At the same time, species that currently occur in far northern New England or on our highest mountain peaks are likely to shift their ranges northward and may be lost from the ant fauna of New England.

Ecologists and biogeographers are currently mapping the geographic ranges of species onto measures of contemporary climate and temperature, and then using climate change models to forecast local extinctions and shifts in the geographic ranges. Some of these forecasts are indeed alarming. In the worst-case scenarios (which are not entirely far-fetched), a future edition of this book might have to be renamed *A Field Guide To The Ants of Northern Quebec*. We might

find ourselves using early 21st-Century species lists from Georgia and the Carolinas to identify the ant species of New England a hundred years from now.

But even with increased warming, there are two important reasons why all of these projected range shifts may not come to pass. The first reason is that ant colonies function as highly efficient super-organisms that maintain a great deal of control over their thermal environment. Just as humans are able to live in extreme climates by artificially cooling or heating their homes and cars, ants can maintain fairly constant nest temperatures in the face of fluctuating conditions. Acclimation, habitat modification, and changes in foraging behavior, nest construction, and colony growth may allow some ant species to stay in place even in the face of substantial climate change.

The second reason why some ant species may not shift their ranges is the potential for evolutionary change. The population sizes of many ant species are in the millions, which likely includes a huge reservoir of genetic variation in numerous traits, including thermal tolerance. If temperatures change and some genetic variants are not able to persist, we can expect natural selection to quickly fill the void as genes promoting enhanced heat tolerance will quickly spread through a rapidly evolving population.

The ants of New England will certainly change with the climate, although direct responses to patterns of human movement and changes in land use are likely to be at least as important as responses to increasing temperature. If we humans do not manage to quickly control and reduce the increasing concentrations of atmospheric greenhouse gasses, our own livelihood and survival as a species will be threatened. But even long after we are gone, the ants of New England will certainly still be here.

<<CT>>Bibliography and Further Reading

In order to make the text easy to read, we have avoided in-text citations and footnotes or endnotes. But the keys and detailed natural history information included in this field guide build on more than one hundred years of ecological, evolutionary, and taxonomic research about ants. This bibliography provides an entrée into myrmecological research at a number of levels. Many of the general works will be accessible to budding myrmecologists of all ages. All are delightful to read and chock-full of interesting natural history observations. The systematic and taxonomic works reflect the sources we drew upon for the names of ants and their evolutionary relationships. Although we are now in a period of relative calm and stability with respect to naming the subfamilies and genera of ants, the regular discovery of new species often prompts revisions and re-naming of species and species complexes within genera. Finally, the technical papers on ant biology and ecology harbor detailed information on the relationship between ants and their environment, interactions among different species of ants, and the constant battles between ants and their prey, parasites, and predators. For each of the references in all three sections, we provide a short summary of why we found it to be useful and how it contributed to this field guide.

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An Explanation of Terms used in Entomology. This unfortunately out-of-print book is an indispensable guide to the morass of technical terms used in describing insect anatomy; used book-sellers occasionally turn up a copy.]

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<<txa>>Systematic and Taxonomic Works

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- Covert, Gary A. 2005. *The Ants of Ohio*. Ohio Biological Survey, Inc., Columbus, Ohio. [A useful introduction and good keys to many ants of eastern North America]

- Creighton, William S. 1950. The ants of North America. *Bulletin of the Museum of Comparative Zoology*, number **104**. [Out of print, but available as a free pdf online at: http://www.archive.org/details/ants_06224. Creighton's work is still the only comprehensive key for North American ant species, although rendered partially obsolete by many of the other systematic works listed here.]
- DuBois, Mark B. 1986. A revision of the native New World species of the ant genus *Monomorium* (*minimum* group) (Hymenoptera: Formicidae). *The University of Kansas Science Bulletin* **53**: 65-119. [The current definitive revision of our native *Monomorium* species. Includes the original description of *M. emarginatum*]
- DuBois, Mark B. 1998. A revision of the ant genus *Stenamma* in the Palearctic and Oriental regions. *Sociobiology* **32**: 192-404. [Although focused on the "Old World," this article has excellent historical information on the overall classification of *Stenamma*]
- Francoeur, André. 1973. Révision taxonomique des espèces néarctiques du groupe *Fusca*, genre *Formica* (Formicidae, Hymenoptera). *Memoires de la Société Entomologique du Québec*. **3**: 1-316. [The definitive revision of the *Formica fusca* group]
- Francoeur, André. 1986. Deux nouvelles fourmis Néarctiques: *Leptothorax retractus* et *L. sphagnicolus* (Formicidae, Hymenoptera). *Canadian Entomologist* **118**: 1151-1164. [Description of these two *Leptothorax* species, with other observations on the genus]
- Francoeur, André. 1997. Ants (Hymenoptera: Formicidae) of the Yukon. Pages 901-910 in H. V. Danks and J. A. Downes (editors). *Insects of the Yukon*. Biological Survey of Canada, Ottawa, Canada [Includes a discussion of our current understanding of *Myrmica lobifrons*]
- Francoeur, André. 2007. The *Myrmica punctiventris* and *Myrmica crassirugis* species groups in the Nearctic region. *Memoirs of the American Entomological Institute* **80**: 153-185.

[Description of *Myrmica semiparasitica*, along with other observations on the *punctiventris* species group]

Francoeur, André, Robert Loiselle, and Alfred Buschinger. 1985. Biosystématique de la tribu Leptothoracini (Formicidae, Hymenoptera). 1. Le genre *Formicoxenus* dans la région holarctique. *Le Naturaliste Canadien* **112**: 343-403. [The benchmark for this genus, with natural history, morphometrics, and a key to *Formicoxenus* species]

Heinze, Jürgen. 1989. *Leptothorax wilsoni* n. sp., a new parasitic ant from eastern North America (Hymenoptera: Formicidae). *Psyche* **96**: 49-61. [Description of this species, along with observations on social parasitism in *Leptothorax*]

Johnson, Clifford. 1989. Identification and nesting sites of North American species of *Dolichoderus* Lund (Hymenoptera: Formicidae). *Insecta Mundi* **3**: 1-9. [A useful key to *Dolichoderus* in North America, with a discussion of a potentially new species from Massachusetts]

Kennedy, Clarence H., and Clyde A. Dennis. 1937. New ants from Ohio and Indiana, *Formica prociliata*, *F. querquetulana*, *F. postoculata*, and *F. lecontei*, (Formicidae: Hymenoptera). *Annals of the Entomological Society of America* **30**: 531-544. [Systematics and ecology of various *Formica Microgyna* species]

LaPolla, John S., Seán G. Brady, and Steven O. Shattuck. 2010. Phylogeny and taxonomy of the *Prenolepis* genus-group of ants (Hymenoptera: Formicidae). *Systematic Entomology* **35**: 118-131. [A revision of *Prenolepis*, *Paratrechina*, *Nylanderia*, and related genera based on DNA sequence data and morphological characters]

Mackay, William P. 1993. A review of the New World ants of the genus *Dolichoderus* (Hymenoptera: Formicidae). *Sociobiology* **22**: 1-148. [The definitive taxonomic revision of

- the genus for the western hemisphere. Discounts *Dolichoderus* sp. A of Johnson 1989 as a variant of *D. pustulatus*]
- Mackay, William P. 2000. A review of the New World ants of the subgenus *Myrafant* (genus *Leptothorax*) Hymenoptera: Formicidae. *Sociobiology* **36**: 263-444. [The most recent taxonomic revision of what we now call *Temnothorax*]
- Radchenko, Andrew G., and Graham W. Elmes. 2010. *Myrmica* ants (Hymenoptera: Formicidae) of the Old World. Fauna Mundi, Volume 3. Natura optima dux Foundation, Warsaw, Poland. [A thorough revision of the Palearctic *Myrmica* species; the base reference for any future revisionary work on this genus]
- Schlick-Steiner, Birget C., Florian M. Steiner, Karl Moder, Bernhard Seifert, Matthias Sanetra, Eric Dyreson, Christian Stauffer, and Erhard Christian. 2006. A multidisciplinary approach reveals cryptic diversity in Western Palearctic *Tetramorium* ants (Hymenoptera: Formicidae). *Molecular Phylogenetics and Evolution* **40**: 259-273. [Separates the European *Tetramorium caespitum/impurum* complex into 7 species, and assigns “Species E” to the North American *T. caespitum*]
- Seifert, Bernhard. 2003. The ant genus *Cardiocondyla* (Insecta: Hymenoptera: Formicidae) – a taxonomic revision of the *C. elegans*, *C. bulgarica*, *C. batesii*, *C. nuda*, *C. shuckardi*, *C. stambuloffii*, *C. wroughtonii*, *C. emeryi*, and *C. minutior* species groups. *Annalen des Naturhistorischen Museums in Wien* **104B**: 203-338. [The most recent revision and key to the genus *Cardiocondyla*]
- Shattuck, Steven O. 1992. Generic revision of the ant subfamily Dolichoderinae (Hymenoptera: Formicidae). *Sociobiology* **21**: 1-180. [A reworking of the Dolichoderinae, and reassignment of *Hypoclinea* within *Dolichoderus*]

- Smith, Marion R. 1939. The North American ants of the genus *Harpagoxenus* Forel, with the description of a new species (Hymenoptera: Formicidae). *Proceedings of the Entomological Society of Washington* **41**: 165-172. [Description of *H. canadensis*, along with discussion of the slave-making habitats of *H. americanus*, which was later renamed *Protomognathus americanus*]
- Smith, Marion R. 1947. A study of *Polyergus* in the United States, based on the workers (Hymenoptera: Formicidae). *American Midland Naturalist* **38**: 150-161. [A systematic study of *Polyergus*, now dated, but it would be the starting point for any future, much-needed revision of this genus]
- Smith, Marion R. 1957. Revision of the genus *Stenamma* Westwood in America North of Mexico (Hymenoptera: Formicidae). *American Midland Naturalist* **57**: 133-174. [Still the best key to the Nearctic *Stenamma*, plus a synthesis of available natural history information]
- Snelling, Roy R. 1970. Studies on California ants. 5. Revisionary notes on some species of *Camponotus*, subgenus *Tanaemyrmex* (Hymenoptera: Formicidae). *Proceedings of the Entomological Society of Washington* **72**: 390-397. [A review and taxonomic revision of one group of carpenter ants]
- Snelling, Roy R. 1988. Taxonomic notes on Nearctic species of *Camponotus*, subgenus *Myrmentoma* (Hymenoptera: Formicidae). Pages 55-78 in James C. Trager (editor). *Advances in Myrmecology*. E. J. Brill, New York. [A review and taxonomic revision of one group of carpenter ants]
- Snelling, Roy R., and William F. Buren. 1985. Description of a new species of slave-making ant in the *Formica sanguinea* group (Hymenoptera: Formicidae). *Great Lakes Entomologist* **18**: 69-78. [An excellent key to the slave-making *Formica* species]

- Taylor, Robert W. 1967. A monographic revision of the ant genus *Ponera* Latreille (Hymenoptera: Formicidae). Pacific Insects Monograph 13: 1-112. [In which *Hypoconera* is restored to generic status and where useful natural history and geography of *Ponera* and *Hypoconera* can be found]
- Trager, James C. 1984. A revision of the genus *Paratrechina* (Hymenoptera: Formicidae) of the continental United States. *Sociobiology* **9**: 51-162. [A thorough revision and analysis of *Paratrechina*, including what is now the genus *Nylanderia*]
- Trager, James C. 20xx. Global revision of *Polyergus* (Hymenoptera: Formicidae: Formicinae, Formicini). Unpublished manuscript.
- Trager, James C., Joe A. MacGown, and Matthew D. Trager. 2007. Revision of the Nearctic endemic *Formica pallidefulva* group. *Memoirs of the American Entomological Institute* **80**: 610-636. [Revision of the North American “*Neoformica*” group of *Formica* species]
- Umphrey, Gary J. 1996. Morphometric discrimination among sibling species in the *fulva-rudis-texana* complex of the ant genus *Aphaenogaster* (Hymenoptera: Formicidae). *Canadian Journal of Zoology* **74**: 528-559. [The starting point for systematics of the North American *Aphaenogaster rudis* complex]
- Urbani, Cesare Baroni, and Maria L. de Andrade. 2003. The ant genus *Proceratium* in the extant and fossil record (Hymenoptera: Formicidae). *Museo Regionale di Scienze Naturali, Monografie* **36**. [A thorough taxonomic revision of all of *Proceratium*]
- Urbani, Cesare Baroni and Maria L. de Andrade. 2007. The ant tribe Dacetini: limits and constituent genera, with descriptions of new species (Hymenoptera: Formicidae). *Annali del Museo Civico di Storia Naturale “G. Doria,” Genova* **99**: 1-191. [A recent salvo in the

- debate over whether *Pyramica* is a valid genus, or whether it should be subsumed within *Strumigenys*]
- Ward, Philip S. 2005. A synoptic review of the ants of California (Hymenoptera: Formicidae). *Zootaxa* **936**: 1-68. [In which *Acanthomyops* is returned to subgeneric status within *Lasius*]
- Ward, Philip S. 2007. Phylogeny, classification, and species-level taxonomy of ants (Hymenoptera: Formicidae). *Zootaxa* **1668**: 549-563. [Review of family-level taxonomy of ants, current to 2010]
- Ward, Philip S. 2010. Taxonomy, phylogenetics, and evolution. Pages 3-17 in Lori Lach, Catherine L. Parr, and Kirsti L. Abbott. *Ant Ecology*. Oxford University Press. [A review of our current understanding of subfamily relationships within the ants]
- Wheeler, George C., and Jeanette Wheeler. 1963. *The Ants of North Dakota*. The University of North Dakota Press, Grand Forks, North Dakota. [A regional guide, but with good information on many prairie species that extend into Downeast Maine. It is also notable for its excellent illustrations of the antennal scapes of *Myrmica*]
- Wheeler, William Morton. 1916. Questions of nomenclature connected with the ant genus *Lasius* and its subgenera. *Psyche* **23**: 168-173. [A romp through the Jurinean controversy surrounding the use of the name *Lasius*]
- Wilson, Edward O. 1955. A monographic revision of the ant genus *Lasius*. *Bulletin of the Museum of Comparative Zoology* **113**: 1-205. [The primary source for all *Lasius* outside of *claviger* group]
- Wilson, Edward O. 2003. *Pheidole in the New World: A dominant, hyperdiverse ant genus*. Harvard University Press, Cambridge, Massachusetts. [A magisterial overview and thorough systematic revision of *Pheidole*]

Wing, Merle W. 1968. Taxonomic revision of the Nearctic genus *Acanthomyops* (Hymenoptera: Formicidae). Memoirs of the Cornell University Agricultural Experiment Station, number **405**. [A thorough review of the systematics, ecology, and hybridization of species in the *Lasius claviger* group]

<<txa>>Technical Papers on Ant Biology and Ecology

Archibald, S. Bruce, Kirk R. Johnson, Rolf W. Mathewes, and David R. Greenwood. 2011. Intercontinental dispersal of giant thermophilic ants across the Arctic during early Eocene hyperthermals. *Proceedings of the Royal Society B*. doi: 10.1098/rpsb.2011.0729 [Description of the extinct Lube's Giant Ant, and a discussion of the relationship between ant size and climate]

Bono, Jeremy M., and Joan M. Herbers. 2003. Proximate and ultimate control of sex ratios in *Myrmica brevispinosa* colonies. *Proceedings of the Royal Society of London B*, **270**: 811-817. [Experimental study of food limitation on queen production in *Myrmica brevispinosa*, along with good natural history information on this species]

Brady, Seán G., Ted R. Schultz, Brian L. Fisher, and Philip S. Ward. 2006. Evaluating alternative hypotheses for the early evolution and diversification of ants. *Proceedings of the National Academy of Sciences, USA* **103**: 18172-18177. [An analysis of the relationships among subfamilies of ants based on DNA data]

Buczkowski, Grzegorz. 2010. Extreme life history plasticity and the evolution of invasive characteristics in a native ant. *Biological Invasions* **12**: 3343-3349. [Observations of colony structure in natural and urban populations of *Tapinoma sessile*]

- Buschinger, Alfred. 2009. Social parasitism among ants: a review (Hymenoptera: Formicidae). *Myrmecological News* **12**: 219-235. [A recent review of the distribution and evolution of social parasitism and slave-making in ants, this article also clarifies the names given to different types of social parasitism in ants]
- Creighton, William S. 1927. The slave-raids of *Harpagoxenus americanus*. *Psyche* **34**: 11-29. [Detailed descriptions of behavior of *Protomognathus americanus*, together with a discussion and illustration of the males]
- Cushing, Paula E. 1997. Myrmecomorphy and myrmecophily in spiders: a review. *Florida Entomologist* **80**: 165-193. [The most recent review of ant mimicry by spiders]
- Ellison, Aaron M., Elizabeth J. Farnsworth, and Nicholas J. Gotelli. 2002. Ant diversity in pitcher-plant bogs of Massachusetts. *Northeastern Naturalist* **9**: 267-284. [Biogeography of a regional ant assemblage, based on our work documenting the distribution of *Myrmica lobifrons* in southern New England]
- Ellison, Aaron M., Sydne Record, Alex Arguello, and Nicholas J. Gotelli. 2007. Rapid inventory of the ant assemblage in a temperate hardwood forest: Species composition and assessment of sampling methods. *Environmental Entomology* **36**: 766-775. [How to do quantitative hand-sampling in northeastern forests]
- Espadaler, X., and L. López-Soria. 1991. Rareness of certain Mediterranean ant species: fact or artifact? *Insectes Sociaux* **38**: 365-377. [On the importance of sampling in one's back yard]
- Francoeur, André, and Claude Pilon. 2011. Découverte, au Québec, de la fourmi parasite *Anergates atratulus* (Formicidae, Hymenoptera). *Le Naturaliste Canadien* **135**: 30-34. [Range extension of *Anergates*, along with exquisite photographs]

- Gotelli, Nicholas J., Aaron M. Ellison, Robert R. Dunn, and Nathan J. Sanders. 2011. Counting ants (Hymenoptera: Formicidae): Biodiversity sampling and statistical analysis for myrmecologists. *Myrmecological News* **15**: 13-19. [Statistical methods for analyzing ant data]
- Gotelli, Nicholas J., and Aaron M. Ellison. 2002. Biogeography at a regional scale: determinants of ant species density in New England bogs and forests. *Ecology* **83**: 1604-1609. [Biogeography of ants in bogs and forests of Massachusetts and Vermont]
- Hamilton, William D. 1967. Extraordinary sex ratios. *Science* **156**: 477-488. [The general description of the theory of inclusive fitness, which has been used to explain the evolution of haplodiploidy in ants and other eusocial organisms]
- Heinze, Jürgen, Sylvia Cremer, N. Eckl, and Alexandra Schrempf. 2006. Stealthy invaders: the biology of *Cardiocondyla* tramp ants. *Insectes Sociaux* **53**: 1-7. [A good review of the ecology and evolution not only of *Cardiocondyla* but also of other tropical tramp species]
- Heraty, John M., Joanne M. Heraty, and Javier Torr  s. 2009. A new species of *Pseudochalcura* (Hymenoptera, Eucharitidae), with a review of antennal morphology from a phylogenetic perspective. *ZooKeys* **20**: 215-231. [Includes a discussion of parasitism of *Camponotus* spp. by this wasp]
- Herbers, Joan M. 1985. Seasonal structuring of a north temperate ant community. *Insectes Sociaux* **32**: 224-240. [General ecology of ants in the northeast U.S.]
- Herbers, Joan M. 2001. Nineteen years of field data on ant communities (Hymenoptera: Formicidae): What can we learn? *Myrmecological News* **15**: 43-52. [The beauty of long-term research on ants; includes data from West Virginia, New York, and Vermont]

- Herbers, Joan M., and Susanne Foitzik. 2002. The ecology of slavemaking ants and their hosts in north temperate forests. *Ecology* **83**: 148-163. [A 20-year ecological study of *Protomognathus americanus* and its *Temnothorax* hosts in Vermont and New York]
- Jennings, Daniel T., Mark W. Houseweart, and André Francoeur. 1986. Ants (Hymenoptera: Formicidae) associated with strip-clearcut and dense spruce-fir forests of Maine. *Canadian Entomologist* **118**: 43-50. [Diversity of ants in forests infested by spruce budworm in northern Maine]
- Jurgensen, Martin F., Andrew J. Storer, and Anita C. Risch. 2005. Red wood ants in North America. *Annales Zoologici Fennici* **42**: 235-242. [An interesting comparison of *Formica rufa* group ants in Europe and in North America]
- Kannowski, Paul B. 1959. The flight activities and colony-founding behavior of bog ants in southeastern Michigan. *Insectes Sociaux* **6**: 9-162. [Excellent natural history observations on a variety of bog ants, including *Ponera*, *Myrmica*, *Temnothorax*, *Tapinoma*, *Dolichoderus*, *Camponotus*, *Lasius*, and *Formica* spp.]
- Kronauer, Daniel J. C., and Naomi E. Pierce. 2011. Myrmecophiles. *Current Biology* **21**: R208-R209. [A general overview of ant guests]
- LaFleur, Benoit, William F. J. Parsons, Robert L. Bradley, and André Francoeur. 2006. Ground-nesting ant assemblages and their relationship to habitat factors along a chronosequence of postfire-regenerated lichen-spruce woodland. *Environmental Entomology* **35**: 1515-1524. [Community ecology of various boreal *Formica* and *Myrmica* species]
- Lyford, Walter L. 1963. Importance of ants to brown podzolic soil genesis in New England. Harvard Forest Paper **7**, Harvard Forest, Petersham, Massachusetts (available online at: <http://harvardforest.fas.harvard.edu/publications/pdfs/HFpubs/paper7.pdf>). [A detailed

investigation of how much soil ants can move in the glacially-derived soils of north-central Massachusetts]

- Marlin, John C. 1971. The mating, nesting and ant enemies of *Polyergus lucidus* Mayr (Hymenoptera: Formicidae). *American Midland Naturalist* **86**: 181-189. [A thorough study of the field ecology of this unique slave-making ant; James Trager notes that the species studies was actually *Polyergus montivagus*]
- Menke, Sean B., Warren Booth, Robert R. Dunn, Coby Schal, Edward L. Vargo, and Jules Silverman. 2010. Is it easy to be urban? Convergent success in urban habitats among lineages of a widespread native ant. *PLoS ONE* **5**: e9194. [Genetic analysis of urban and rural *Tapinoma sessile* in different parts of North America]
- McIver, James D., and Gary M. Stonedahal 1987. Biology of the myrmecomorphic plant bug *Orectoderus obliquus* Uhler (Heteroptera: Miridae: Phylinae). *Journal of the New York Entomological Society* **95**: 278-289. [Description and analysis of the temporal mimicry of ants by *O. obliquus*]
- McIver, James D., and Gary Stonedahl. 1993. Myrmecomorphy: morphological and behavioral mimicry of ants. *Annual Review of Entomology* **38**: 351-379. [The most recent review of ant mimicry across the arthropods]
- Ness, Josh H., D. F. Morin and Itamar Giladi. 2009. Uncommon specialization in a mutualism between a temperate herbaceous plant guild and an ant: are *Aphaenogaster* ants keystone mutualists? *Oikos* **118**: 1793-1804. [Detailed study of seed dispersal by *Aphaenogaster* in northeastern forests]
- Nowak, Martin A., Corina E. Tarnita, and Edward O. Wilson. 2010. The evolution of eusociality. *Nature* **466**: 1057-1062. [A new theory for the evolution of eusociality that does not depend on kin-selection and inclusive fitness]

- Ouellette, Gary D., Francis A. Drummond, Beth Choate, and Eleanor Groden. 2010. Ant diversity and distribution in Acadia National Park, Maine. *Environmental Entomology* **39**: 1447-1456. [Summary of the 2003 Ant Blitz at Acadia National Park, and a comparison with Proctor's 1946 biotic survey of Mount Desert Island]
- Ortius, Diethe. 1995. A *Dolichoderus taschenbergi* queen found in a polygynous colony of *D. plagiatus* (Hymenoptera: Formicidae). *Psyche* **102**: 147-150. [Only observation of social parasitism by *D. taschenbergi*. Also describes polygyny in *D. plagiatus*, which is otherwise considered to be uncommon. These observations were made in Maine]
- Pećarević, Marko, James Danoff-Burg, and Robert R. Dunn. 2010. Biodiversity on Broadway – enigmatic diversity of the societies of ants (Formicidae) on the streets of New York City. *PLoS ONE* **5**: e13222. [Diversity of ants in median strips of Manhattan. Includes lots of interesting natural history on exotic species]
- Peck, Stewart B., and Joyce Cook. 2007. Systematics, distributions, and bionomics of the *Neoeocatops* gen. nov. and *Nemadus* of North America (Coleoptera: Leiodidae: Cholevinae: Anemadini). *Canadian Entomologist* **139**: 87-117. [About a group of beetles, some of which live asinquilines and scavengers in *Camponotus* nests]
- Pierce, Naomi E., Michael F. Braby, Alan Heath, David J. Lohman, John Mathew, Douglas B. Rand, and Mark A. Travassos. 2002. The ecology and evolution of ant association in the Lycaenidae (Lepidoptera). *Annual Review of Entomology* **47**: 733-771. [A current survey of the most important group of myrmecophilous butterflies]
- Rolstad, J., and E. Rolstad. 2000. Influence of large snow depths on black woodpecker *Dryocopus martius* foraging behavior. *Ornis Fennica* **77**: 65-70. [Birds that depend on *Camponotus* for winter food]

- Scharf, M. E., C. R. Ratliff, and G. W. Bennett. 2004. Impacts of residual insecticide barriers on perimeter-invading ants, with particular reference to the odorous house ant, *Tapinoma sessile*. *Journal of Economic Entomology* **97**: 601-605. [Presents evidence for the hypothesis that killing off ants with insecticide may provide an opportunity for *T. sessile* to expand into houses]
- Seppä, P., and P. Gertsch. 1996. Genetic relatedness in the ant *Camponotus herculeanus*. A comparison of estimates from allozyme and DNA microsatellite markers. *Insectes Sociaux* **43**: 235-246. [Study of *Camponotus* from throughout its Holarctic range]
- Stuart, Roban J., and Thomas M. Alloway. 1983. The slave-making ant *Harpagoxenus canadensis* M. R. Smith, and its host-species, *Leptothorax muscorum* (Nylander): slave raiding and territoriality. *Behaviour* **85**: 58-90. [A thorough study of slave-making behavior in *H. canadensis*]
- Swenson, Jon E., Anna Jansson, Raili Riig, and Finn Sandegren. 1999. Bears and ants: myrmecophagy by brown bears in central Scandinavia. *Canadian Journal of Zoology* **77**: 551-561. [Bears that depend on *Camponotus* for winter food]
- Traniello, James F. A. 1982. Population structure and social organization in the primitive ant *Amblyopone pallipes* (Hymenoptera: Formicidae). *Psyche* **89**: 65-80. [Detailed observations on *Amblyopone* ecology and behavior]
- Talbot, Mary. 1965. Populations of ants in a low field. *Insectes Sociaux* **12**: 19-48. [Detailed natural history about a wide range of ants living in fields, both wet and dry, in southern Michigan]
- Talbot, Mary. 1963. Local distribution and flight activities of four species of ants of the genus *Acanthomyops* Mayr. *Ecology* **44**: 549-557. [Interesting natural history of the *Lasius claviger* group in Michigan]

- Wetterer, James K. 2010. Worldwide spread of the flower ant, *Monomorium floricola* (Hymenoptera: Formicidae). *Myrmecological News* **13**: 19-27. [A compilation of all known distributional data on this tramp species, along with useful information on its natural history]
- Wheeler, George C., Jeannette N. Wheeler, and Paul B. Kanno. 1994. Checklist of the ants of Michigan (Hymenoptera: Formicidae). *The Great Lakes Entomologist* **26**: 297-310. [More than a checklist, this article is rich in natural history and nest habitats of many species of ants]
- Wheeler, William M.. 1905. An interpretation of the slave-making instincts in ants. *Bulletin of the American Museum of Natural History* **21**: 1-16. [An early classification of different types of social parasitism and slave-making in ants. Wheeler also takes the opportunity, in footnote 1 on page 3 of the article, to identify *Protomognathus* as a distinct genus from *Tomognathus*]
- Wheeler, William M. 1911. Studies on myrmecophiles. I. *Cremastochilus*. *Journal of the New York Entomological Society* **16**: 68-79. [A classic set of natural history observations on these “phlegmatic beetles”]
- Wheeler, William M. 1908. Studies on myrmecophiles. II. *Hetaerius*. *Journal of the New York Entomological Society* **16**: 135-143. [One of the first detailed studies of the natural history of this myrmecophilic genus]
- Wheeler, William M. 1911. Notes on the myrmecophilous beetles of the genus *Xenodusa*, with a description of the larva of *X. cava* Leconte. *Journal of the New York Entomological Society* **19**: 163-169. [A classic set of natural history observations on this myrmecophile]
- Wilson, Edward O., and Bert Hölldobler. 2005. The rise of the ants: a phylogenetic and ecological explanation. *Proceedings of the National Academy of Sciences, USA* **102**: 7411-7414. [A short review of the evolutionary history of the ants, and a nice summary of the

“Ponerine paradox” – why are species in this evolutionary ancient lineage of ants with representatives around the world so lacking in social organization?]

<<txa>>All About Scientific Names

Brown, Ronald Wilbur. 1956. *Composition of Scientific Words*. Smithsonian Institution Press, Washington, D. C. [A dictionary of scientific terms and the starting point for tracking down the etymology of scientific names or for creating new ones]

Buchanan, R. E. 1956. Verbal stems in Latin composition. *International Bulletin of Bacteriological Nomenclature and Taxonomy* **6**: 101-110. [A useful discussion of when the species name should agree in gender with the genus, and when it need not; of particular importance in the *Leptothorax sphagnicolus* vs. *L. sphagnicola* controversy]

International Commission of Zoological Nomenclature. 2000. International Code of Zoological Nomenclature, Fourth Edition. Current version on-line at: <http://www.nhm.ac.uk/hosted-sites/iczn/code/>. [Robert's Rules of Order for naming and re-naming species of animals. There are similar codes for plants and fungi, and bacteria and prokaryotes]

Nicolson, Dan H. 1987. Species epithets ending in *-cola*, a retraction concerning *-colus*, *-colum*. *Taxon* **36**: 742-744. [Another useful discussion of when the species name should agree in gender with the genus, and when it need not]

Trüper, Hans G., and Lanfranco de Clari. 1997. Taxonomic note: correction of specific epithets formed as substantives (nouns) in apposition. *International Journal of Systematic Bacteriology* **47**: 908-909. [Another useful discussion of when the species name should agree in gender with the genus, and when it need not]

<<CT>>Internet Resources

There may be more web sites devoted to ants than there are ants! We list a few of our favorites; any web search engine will uncover many more. Please note that our listing of a commercial web site is for informational purposes only and does not imply any endorsement of a particular product or company by the authors or by Yale University Press.

<<txa>>Where Professional Myrmecologists Hang Out

<http://www.antweb.org/> Databases and images of ants of the world.

<http://www.antbase.org/> Current nomenclature and links to the original taxonomic literature.

<http://fm.cits.fcla.edu/fm.jsp> FORMIS: A master bibliography of the ant literature

<http://www.gap.entclub.org/> Home of The Global Ant Project, it includes biographies of ant taxonomists, interactive keys to the ant genera, current versions of Barry Bolton's *Synopsis of the Formicidae and Catalogue of Ants of the World*, and lots of pointers to additional web-based resources focused on ants.

<http://www.antmacroecology.org/> Home of another Global Ants project, this one bringing together ant ecologists and evolutionary biologists focused on distribution and abundance of ants, and how they may respond to global climatic changes.

<http://research.calacademy.org/ent/courses/ant>

An annual course taught in the southwestern United States or overseas, the Ant Course is an intensive 10-day workshop designed mainly for systematists, ecologists, behaviorists, conservation biologists, and other biologists whose

research responsibilities require a greater understanding of ant taxonomy and field research techniques. Admission is by competitive application.

<<txa>>Other Fun and Useful Web Sites

<http://schoolofants.org/> An international project aimed at helping children and K-12 teachers explore urban backyard biodiversity.

<http://www.antscanada.com/> Ant farms and supplies for building your own formicaria

<http://www.antfarmcentral.com/> A clearinghouse for information about ant farms

<http://antfarm.yuku.com/> A moderated on-line forum for ant farms and myrmecology

<http://www.bugguide.net/> An online community of naturalists who are interested in insects, spiders, and other creatures with lots of legs and an exoskeleton.

<http://www.discoverlife.org/> Discover Life provides free on-line tools to identify species, teach about them, report observations, and create distribution maps.

<http://www.eol.org/> The Encyclopedia of Life is creating electronic species pages for every organism on Earth.

<<txa>>Web Sites Related to this Field Guide

<http://tinyurl.com/antsNE> The Harvard Forest Data Archive file (HF-147) where the all the data used to create the species distribution maps are stored.

<http://www.pbase.com/tmurray74/> Tom Murray's photographs

http://entomofaune.qc.ca/Insectes_du_Québec.html

Featuring photographs by Claude Pilon

<http://www.texasento.net/> Mike Quinn's photographs

<http://www.thomasshahan.com/> Thomas Shahan photography and art

<http://www.alexanderwild.com/> Alex Wild Photography

<<txa>>Purveyors of Entomological Supplies, Hand Lenses, and Dissecting Microscopes

<http://www.bioquip.com/> Bioquip sells collecting equipment, storage supplies, and books on all aspects of entomology.

<http://www.finescience.com> Fine Science Tools sells precision forceps, scissors, and insect pins, among other hand-made research hand-tools.

<http://heliconsoft.com/> Software for capturing and rendering 3-D-like images through a microscope.

<http://www.martinmicroscopes.com/> Martin Microscopes sells a wide range of affordable dissecting microscopes, both new and used.

<http://www.minerox.com/> Miners, Inc. sells high-end hand lenses.

<http://www.riteintherain.com/> Waterproof paper.

<http://www.roseentomology.com/> Rose Entomology sells collecting equipment, storage supplies, and clever manipulators for working with pinned specimens.

<http://www.santetraps.com/> Sante Traps sells specialty traps for collecting insects. They are a good source for Winkler collectors and litter sampling bags.

<http://www.sarstedt.com/> A good source of 2-ml plastic vials with O-ring seals.

<http://www.scientificsonline.com/> Edmund Scientifics sells affordable hand lenses and dissecting microscopes.

<http://www.syncroscopy.com/> Cameras and software for capturing and rendering 3-D-like images through a microscope.

<<CN>>About the Authors

Aaron Ellison is a senior research fellow in ecology at Harvard University's Harvard Forest, and an adjunct research professor of biology and environmental conservation at the University of Massachusetts. He received his Ph.D. from Brown University in 1986 for his research in community ecology of salt marshes. His current research interests include: the evolutionary ecology and biogeography of carnivorous plants; foraging behavior of ants on carnivorous plants; responses of ants, beetles, and plants to global climate change; responses of forests to loss of dominant tree species; and the application of statistical inference to ecology and environmental decision making. He is the author of *A Primer of Ecological Statistics* and the forthcoming *Statistics for Large-scale Experiments in Ecology and Ecosystem Science* (both co-authored with Nick Gotelli, and published by Sinauer Associates). Web site: <http://harvardforest.fas.harvard.edu/personnel/web/aellison>.

Nick Gotelli is a professor of biology at the University of Vermont, where he teaches ecology and evolution. He received his Ph.D. from Florida State University in 1985 for his research in marine ecology. His current research interests include: ant diversity and biogeography; the evolutionary ecology of carnivorous pitcher plants; community responses to global climate change; and the statistical analysis of community structure. He is the author of three books – *Null Models in Ecology* (with Gary Graves, published by Smithsonian Institution Press), *A Primer of Ecology* (published by Sinauer Associates), and *A Primer of Ecological Statistics* (with Aaron Ellison, published by Sinauer Associates) – and the co-author (with Gary Entsminger) of two ecology software packages. Web site: <http://www.uvm.edu/~ngotelli>.

Elizabeth Farnsworth is the senior research ecologist at the New England Wild Flower Society (NEWFS). She received her Ph.D. from Harvard in 1997 for her research on plant

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Gary Alpert is an environmental biologist on the staff of the Environmental Health & Safety Department at Harvard University. He received his Ph.D. from Harvard in 1981 for his research on social insects. Gary has been conducting field studies on the ants of New England since 1990. He has photographed many ant species in the field using Canon digital cameras and the extraordinary 65mm 5:1 macro lens. During the last decade Gary has developed a digital imaging system for close-up three-dimensional images under a microscope, creating high-resolution images of ants. Gary and others have discovered several new state and regional records of ants during this period. Gary is also very interested in the behavioral ecology of other insects that live inside the ant nests, especially *Microdon* and he is the lead researcher on the Navajo Ant Project. He is the author (with Barry Bolton, Piotr Naskrecki, and Phil Ward) of the

revised *Bolton's Catalogue of Ants of the World: 1758-2005* (Harvard/Belknap). Web site:
<http://gap.entclub.org/taxonomists/Alpert/index.html>.