VENOMOUS ARTHROPODS

Although most often a domestic rather than a public-health problem, venomous arthropod encounters occasionally require the response of public agencies. For example, several mosquito-control districts assign personnel specifically for control of honey bee and wasp problems. As the Africanized honey bee spreads in the U.S., the demand for these services will increase. This chapter deals with the major groups of venomous arthropods: the **hymenopterans**, spiders, centipedes and scorpions, and urticating caterpillars.

I. HYMENOPTERA

Yellowjackets, Hornets and Wasps

More than 2,500 species of wasps occur in North America. About 50 of these are troublesome to humans. They are divided into hornets and yellowjackets, *Vespa* spp. and *Vespula* spp.; paper wasps, *Polistes* spp.; mud daubers, *Sceliphron* spp. and *Chalybion* spp.; and velvet ants (members of the parasitic wasp family Mutillidae).

Developmental stages. Yellowjackets (Figure 7.1), hornets and wasps have similar life cycles. Adult forms include fertile females (queens), workers (females, usually sterile) and fertile males. In late summer, colonies produce new queens and males. After mating, these new queens go into hibernation in such places as cracks in rocks, under loosened bark of trees, in buildings and holes in the ground. Some paper wasps hibernate in attics and basements. Males and workers do not survive the winter.

Figure 7.1
Yellowjacket

The following spring the queen emerges from hibernation and searches for a suitable nesting site. She then collects wood or other vegetable fiber from nearby plants and chews it into a paperlike substance for constructing a comb of a few shallow cells (later enlarged into a nest). In each cell she lays an egg and then protects the resulting **larvae**, feeding them daily with freshly killed insects. After 12 to 18 days, the larvae spin cocoon caps over their cells and transform into **pupae**. When adults emerge about 12 days later, they serve as the first brood of workers, and the queen resumes egg laying.

Mud daubers, unlike the other wasp species discussed here, have no workers. The female builds a nest of several clay cells. In each she places an egg and several small paralyzed spiders. She then caps the cells and abandons the nest. After hatching, the larvae feed on the spiders for several days, then pupate. In about two weeks the **adults** emerge to start new nests. Mud daubers also differ from other wasps in that they overwinter as larvae.

Among the mutillid wasps (velvet ants), females deposit single eggs in suitable habitats, mostly on the larvae of other ground-dwelling wasps they parasitize.

Bionomics. A single hornet or yellowjacket nest may have up to 15,000 workers and several hundred queens and males. Paper wasp nests are single-layered, open-faced and umbrella-shaped. The size of the nest depends upon the number of resident wasps and is incrementally enlarged to accommodate the growing population. Their nests consist of multilayered combs surrounded by a paper shell. In late summer, nests may contain up to 5,000 workers. A mud dauber nest consists of several clay cells. Old nests are not reused.

These stinging insects are found throughout the country and can harm humans. Three yellowjacket **species** cause concern: the eastern yellowjacket, *Vespula maculifrons*; the southern yellowjacket, *Vespula squamosa*; and the German yellowjacket, *Vespula germanica*. Yellowjackets are named after their yellow and black striped body markings. Worker yellowjackets are about ½ inch long. The eastern yellowjacket and southern yellowjacket usually build nests in underground holes and only occasionally in above-ground cavities. The German yellowjacket almost always nests above ground. A large nest usually is about the size of a basketball. Yellowjackets and hornets will aggressively defend their nests, and this aggressiveness increases in late summer and fall. Because yellowjackets forage for meats, sweets, ripe fruit and garbage, they pose a threat to humans even when away from the nest. They are a particular problem in picnic areas, orchards and around garbage containers.

The baldfaced hornet, *Dolichovespula maculata*, about ⅔ inch long and black with whitish markings, is technically a yellowjacket but builds a very distinctive pear-shaped, basketball-sized nest covered with grayish paperlike material. It usually constructs its nest in a tree or shrub, or under the eave of a building. The European hornet, *Vespa crabro*, is dark brown with yellow and reddish markings and is about 1¼ inches long. It usually nests in a hollow tree or log, or inside buildings. The nest is covered with a brown envelope of coarse wood fibers. These hornets are beneficial because they capture other insects. Often their nests are situated away from humans and, as a result, are not harmful.

Mud daubers (Figure 7.2) are solitary wasps of the family Sphecidae. They vary in length from ½ to 1¼ inches and are very slender with threadlike waists. They build mud nests in sheltered areas. These nests are tubelike cells, often positioned side by side. Two common species are the black and yellow *Sceliphron caementarium* and the metallic blue *Chalybion californicum* (it steals the nests of *S. caementarium*, replacing nest contents with its own). Mud daubers sting only if pinned against the skin.

Figure 7.2. Mud dauber

Velvet ants, easily recognizable by bright red-orange or yellow pubescence on the abdomen, are actually solitary wasps rather than ants. This large group is mostly found in the southern and western parts of the U.S. Females are wingless and usually smaller (measuring ⅓ to 1 inch) than males. They have a characteristic red, orange or yellow pubescence covering the posterior half of the abdomen and are most commonly seen scurrying along on the ground. They inflict a painful sting when accidental encounters occur with humans.

The several species of paper wasps (Figure 7.3), all about ⅔ to 1 inch long, are slender and variously colored with brown, red and yellow. They build their single-comb, unprotected nest from the eaves of porches and buildings and other sheltered locations. As with most other wasps, only the queen survives the winter to start new colonies in the spring. Paper wasps are not as aggressive as yellowjackets or hornets in defense of their nest.

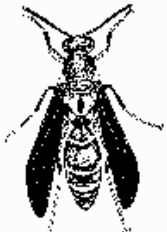

Figure 7.3. Paper wasp

The cicada killer wasp, *Sphecius speciosus*, is 1½ to 2 inches long and brownish-black with yellow markings on the abdomen and face. The female digs a burrow in the soil. It captures cicadas, paralyzing them by stinging, and places them in the burrow. An egg is deposited on each cicada, and that cell is closed off. Cicada killer wasps produce one generation per year, with larvae spending the winter in the nest cell in soil. The only damage these wasps cause is the creation of dirt piles, dug out to create nests, that usually disappear with the first rain. While their size is intimidating, cicada killers are not aggressive and will sting humans only if pinned against the skin.

Control. Individual foragers can often be discouraged or easily dispersed. For example, a single wasp in an automobile can be gently pushed out an open window using an object such as a folded newspaper. A yellowjacket on the lip of a soft drink container should be gently coaxed away. To swat a wasp, particularly while it is on skin, invites a sting. In fact, smashed or injured yellowjackets release an alarm pheromone that greatly increases the aggressiveness of other members of the colony. Good sanitation practices in picnic and recreational areas are essential. Food garbage and empty beverage cans should be placed in containers with tight-fitting lids.

Traps offer some control of foraging yellowjackets. One such trap employs a dead fish suspended from a tripod above a tub filled with water containing a wetting agent such as soap. Foragers are drawn to the odor and will often cut away a piece of fish that is too heavy to carry and then fall into the water, where the wetting agent prevents their escape. Another trap consists of a 6- to 8-inch-high flower pot with holes in the bottom. A screen wire cone with a ½-inch diameter hole at the tip is inverted over the holes in the bottom of the pot and a bait tray with meat is suspended from a tight-fitting screen cover for the top of the pot. Foragers enter through the holes in the bottom and pass through the hole in the screen to get to the meat but then are unable to find their way out. The trap is tied to a post or suspended from a tree branch about 4 feet above the ground, so that the top and bottom of the pot are unobstructed. To kill the wasps in the trap, remove the trap and place it in a freezer overnight.

Yellowjacket and hornet control efforts involve treatment of nests and surrounding areas with a variety of formulations recommended for the specific situations. **Insecticides** may be used as dusts, wettable powders, solutions or emulsions. Rapid garbage disposal will reduce the numbers of some species that congregate around garbage. The spraying of garbage containers once a week, particularly around the tops, will help control these wasps. Residual sprays are effective for control of wasps in buildings when applied to screens, window frames, doorframes and other places where wasps generally crawl. Use oil-based solutions with care when spraying outdoors to avoid damage around vegetation.

Follow these guidelines when attempting yellowjacket or hornet control:

- Most wasps are least active at night, when in the nest. Locate the nest during daylight, then treat it after dark by directing the insecticide into the nest opening.
- Use a red-lens flashlight during the treatment to minimize wasp awareness.
- Dusts are easy to apply to some hornet and yellowjacket nests whether above or below the ground. However, it may be preferable in some circumstances to use a formulation that tends to “freeze” the insects on contact.
- There may be more than one entrance to underground nests.
- If the ground is relatively smooth and soft around the entrances, placing a metal or hard plastic container upside down over the entrance holes after treating will help ensure control. Place weights on the containers to hold them snugly against the ground.
- The extension tube on a hand duster can be inserted into the nest opening. Two or three strong puffs of dust filter through the nest and usually kill the colony within 24 hours.
- Solutions and emulsions should be sprayed into and onto the nests. The more nearly saturated the nest, the quicker the kill.

- Wear a protective bee suit when attempting to control yellowjackets.
- Some people have tried to remove a hornet nest by suddenly covering it with a plastic trash bag, tying the bag tightly to the branch, and then sawing the branch off. Don't do it. Bald faced hornets can escape from trash bags with ease.

Mud daubers are not usually subjected to control measures because they are beneficial, but when necessary, undesirable nests can be knocked down and the residual soil washed off with water and a brush.

Paper wasps are not as aggressive as yellowjackets or hornets in defense of their nest. These nests should be eliminated only if they are located near human activity. To do so, use a pressurized stream. Return a few hours later and remove the nest to discourage others from nesting there.

Control efforts are not recommended for cicada killers, but, if control is necessary, spray the soil where digging activity is observed.

Bees

Bees play an important pollination role in agriculture. For decades entomologists have been including a strong statement about the protection of bees in their insect control guides and pest management programs. However, when bees become a threat to public health or the welfare of domestic animals, they must be dealt with differently. Honey bees are more likely to require such action than are bumble bees and the solitary bees.

Developmental stages. Bees undergo complete **metamorphosis**, passing through the egg, larval and pupal stages to the adult. Eggs, **larvae** and **pupae** are nurtured in cells within the hive by worker bees. The social order can be quite complex, being dependent on physiological influences of both worker and queen bees. Queens control whether the eggs are fertilized and develop into females (workers) or unfertilized and develop into males (drones). Virgin queens take flight and mate. After about three days, they begin to lay eggs.

Figure 7.4. Honey bee

Honey bees. Honey bees (Figure 7.4), *Apis mellifera*, are about ½ inch long with a fuzzy light brown to black appearance, with striped brown and black abdomens. They are typified by their moderate size, hairy eyes, the ability of the workers to sting only once, pollen baskets on hind legs of workers and the strict caste system in which the queen performs no duties other than egg laying. They are considered to be the one of the most beneficial insect species because they pollinate plants and produce honey and beeswax. Because they sting in defense of the hive or nest, however, honey bees become pests when colonies are in the wrong location.

The life cycle of honey bees differs from that of hornets and wasps. After the mating flight of new queens, the old queen leaves with a number of workers (a swarm) to start a new hive. Only one of the fertile new queens is able to return to the old hive where she begins laying eggs. Developmental time and longevity in honey bees varies with each caste and among races (European, Italian, African, etc.). After emergence as adults, honey bees continue to develop reproductive organs (queens, drones) and to mature into queens, drones and workers. A single queen may lay 1.5 million eggs in her three- to five-year life, and may have as many as 100,000 offspring living at one time, although in a typical colony there will be one laying queen, 20,000 to 60,000 workers, and 100 to 300 drones.

Wild colonies of honey bees nest in existing cavities such as hollow trees, whereas domestic bees are housed in manufactured hives. Unlike other bees and wasps, the honey bee may occupy the same nest from year to year. The queen and many workers survive the winter in the nest. At various times new queens are produced, resulting in the old queen and a number of workers leaving the hive to "swarm" in search of a new home. Swarming is the natural means of honey bee dispersion. A new honey bee colony is established after a swarm leaves an established colony to seek a new location. The swarm flies from a few to several hundred yards and lands on a low-hanging tree limb or other structure. From there, scout bees seek out a suitable area to establish a new colony. Swarms may stay in their temporary location from a few hours to a few days. During this time swarms may be hived by beekeepers.

Absconding is a behavioral trait of all honey bees. Absconding occurs when all of the adult bees, including the queen, workers and drones, leave the old nest and relocate to a new site. Absconding is usually the result of a severe disturbance such as predator activity, flooding, starvation or other major stress. Absconding bees may travel 30 to 50 miles before finding a suitable nest site. Long flights may have to be interrupted several times to forage for food.

Stinging is a defensive behavior. Virtually all defensive behavior occurs in the immediate vicinity of the hive. Away from the hive, bees literally have to be forced to sting. Swarming bees are rarely defensive and do not sting unless provoked. However, "hunger swarms" or absconding bees are usually very defensive and are frequently the cause of stinging incidents. A bee's stinger is barbed. When a bee stings a human or other large mammal, the stinger, poison sac, surrounding muscles and nerves are torn from its body. Thus, the honey bee can sting only once, and then soon dies. The stinger will continue to pump venom until it dries up. An alarm **pheromone** (odor) is also released. This pheromone will attract other bees to the area and prompt an aggressive response, thus increasing the chances of additional stinging. Stimuli that have a tendency to increase the defensive behavior of bees include sudden and rapid movements, jarring or bumping hives or frames, vibrations and noise such as lawn mowers or tractors, odors (both good and bad), and dark colors. Bees are more defensive in cooler, cloudy weather.

The Africanized honey bee (AHB) is simply a hybrid honey bee resulting from the natural cross of the European honey bee (EHB), *Apis mellifera mellifera*, with an African honey bee, *Apis mellifera scutellata*. This different genetic background causes the habits of the Africanized bee to differ from the habits of the EHB. But identifying these different races of honey bees and their hybrids is difficult. The characteristics (morphological measurements, specific proteins, DNA or cuticular hydrocarbon analysis) used for identification differ only slightly and overlap considerably among individuals.

Since the intentional introduction into South America in the late 1950s of the African honey bee, AHBs have received a great deal of attention concerning their impact on human welfare. They are extremely sensitive to the slightest nearby disturbance and are likely to respond with massive and persistent stinging attacks. Compared to the EHB, the AHB is much easier to provoke, responds quicker and in larger numbers when the colony is threatened, and remains agitated for a longer period of time. Disturbing an AHB colony may result in six to 10 times as many stings as an EHB colony. This phenomenon is attributed not only to the AHB's more acute sensitivity but also to its response to the alarm pheromone, the chemical odor that is released after stinging is initiated. The AHB may swarm four to eight times a year, but in relatively small numbers compared with an EHB colony, which typically swarms once every year or two. Also, whereas absconding is rare in EHB colonies, it's rather common with the AHB. Unlike other honey bees, the AHB will nest in almost any place that is protected from the weather. Because the AHB is tropical in nature, it may not be able to regulate its body temperature as efficiently as the EHB and studies indicate that the AHB does not form as efficient a cluster during cold weather as the EHB. Swarms of AHBs are reported to often take over EHB colonies, particularly colonies

that do not have functional queens. However, EHB swarms will do the same. AHBs are difficult to manage commercially and have a strong tendency to abscond and settle elsewhere, which makes them a persistent threat. Experience has taught that the AHB warrants concern but not hysteria, which may lead to unwise management decisions.

The AHB spread throughout Brazil by swarming and absconding and continued to spread northward through Central America and Mexico at about 200 to 300 miles a year, reaching Panama in 1980, Mexico in 1985 and the U.S. in 1990. In advance of this natural spread, numerous introductions were detected in the U.S. as early as 1979 and as far north as Baltimore, Md., and Strong Point, N.Y. Upon detection, these swarms were eliminated, thus preventing the establishment of the AHB in the U.S. at that time. They now are present in the southwestern U.S.

Solitary bees. Sweat bees, mining bees, leaf-cutting bees and others make up a rather large group of small-bodied solitary bees (up to ½ inch long). Most of these bees nest in the soil, and often a large number of them will nest close together, usually in areas with sparse vegetation. Occasionally, some may nest in natural cavities such as in wood. Sweat bees get their name from an attraction to people who are perspiring. They rarely sting except when pinned against the skin. Some species of mining bees may be attracted in large numbers to swimming pools. All of these types of bees are beneficial because they pollinate plants. Controlling them is undesirable even if one could do so.

Bumble bees. Bumble bees of the genus *Bombus* are robust and densely covered with black and yellow hairs (setae), the pattern of colors varying with species. They range from about ½ to 1 inch long. Bumble bees are social insects, nesting in existing cavities, usually on or in the ground. They often use abandoned mouse and bird nests or anything containing cotton or other soft materials. Only fertilized queens survive the winter. In the spring, the new queen finds a nesting site, partially fills it with dry grass or moss, adds bee bread (a mixture of pollen and nectar) and then adds eggs. She cares for this first brood until the new workers take over all of her duties other than egg laying. Bumble bees seldom enter structures and do not behave very aggressively except in defense of their nest. They normally are a nuisance only if they have built a nest close to human activity.

Control of bees. When bees colonize an area frequented by humans or domestic animals, they become a pest or health risk. At such times they must be removed or eliminated. Bees that need to be removed fall into two categories: swarms and established colonies.

Bee swarms. A swarm of honey bees is a temporary inconvenience that may last a few hours and then move away as soon as the bees find a new home. Only in unusual situations will a swarm remain to build a comb and not move from a cluster site. Honey bees in a swarm are usually gentle because they have stomachs full of honey. If left undisturbed, a swarm will locate new quarters and often disappear as quickly as it appeared. In the past, local beekeepers collected swarms to put into unused hives, sometimes charging a nominal fee. Capturing swarms is relatively easy because bees are not defensive when swarming, and this was a common method of obtaining bees by hobbyists and commercial beekeepers. Capturing wild swarms is not recommended for those who aren't familiar with the habits of bees and don’t have the proper protective equipment.

Swarms seldom stay for long before scout bees find a suitable site to colonize. However, it may be desirable to eliminate swarms in an effort to prevent AHB colonization of certain sites, such as in or near dwellings. Swarms may be eliminated with approved insecticides or by spraying with soapy water using a high volume spray to achieve the best effect. Liquid dishwashing soap at a 5 percent solution is recommended (1 cup of soap/gallon). Avoid fine mists.

Feral colonies. Although feral colonies seldom cause problems unless provoked, they should be eliminated if they are established in an area where interaction with humans or domestic animals may occur. Numerous insecticides are approved for bee control. Soapy water doesn't work effectively because honeycomb prevents adequate coverage. Colonies may be removed physically by hand or by vacuuming with special types of vacuums. Once collected, the bees can be placed in a hive, released at a different location or killed with insecticide.

Colonies nesting in structures such as attics, between the wall studs of houses or garages, within porch roofs, or in similar areas are a great problem because there is no easy, convenient method of removing the bees. Every effort should be made to determine the extent of the nest and to give priority to removing and relocating the bees, brood and honey stores. Simply killing the bees will only make for more complex problems in the future. An unattended nest of beeswax, honey, brood and pollen will attract other insects and animals. Wax moths will enter to consume the wax, and cockroaches and ants will find the brood and honey. Decaying brood and fermenting honey will cause undesirable odors. Melting wax and honey can soak into walls, making them impossible to paint or wallpaper. Walls will also remain moist to the touch for a considerable period of time. If removing the bees and their nest is not practical, then other methods of dealing with them can be considered. The following steps are appropriate guidelines.

Locating bees. The first step in eliminating the pest problem is locating the nest and getting rid of adult bees. The comb may be some distance from the entrance/exit used by the bees, making it difficult to locate. If bees are inside a wall with sheet rock on one side, feel the sheet rock for warmth; tap the sheet rock and listen for a solid sound vs. a hollow sound. Listen also for buzzing when tapping. If bees are in a wood, brick or sheet rock wall, when you think you have located the nest, drill a hole (1/16 inch) large enough for a coat hanger wire. Straighten out a coat hanger and stick it in the hole. You should have honey or wax on the hanger when you withdraw it. Work close to the top of the wall with holes and coat hanger because bees always hang the honeycomb down from an overhead support.

In some instances, it will be quite expensive to attempt removal of the nest. The owner may be willing to put up with the smell and the damage from honey-soaked walls. Aerosol sprays may be very effective if sprayed through the holes drilled for the coat hanger probe. It may be necessary to drill a number of holes to inject an aerosol spray or dust. Insecticide should be applied at the entry/exit area of the nest and, if feasible, directly onto the nest (through holes drilled for this purpose). Several repeat applications are usually necessary to kill the bees.

Handling bee problems. It is better to prevent bee stings than treat them. Prevention can be enhanced in several ways. "Safening" is a term used for action taken to modify a habitat, a structure, or other factor that will result in a safe environment for people or domestic animals. With respect to bees, this is usually action taken to reduce or eliminate a population. It could also be action taken to prevent or discourage bees from colonizing an area. Structures may be made safer by locating and removing bee colonies; reducing access to desirable nesting sites by discarding barrels, old appliances, abandoned cars and piles of debris; removing other materials, hollow trees and logs; filling cavities in landscape trees with foam insulation; repairing loose insulation beneath mobile homes and open vents beneath homes or attics; screening vents, knot holes and cracks with wire mesh small enough to prevent bee entry; and closing or filling openings for utilities and plumbing to prevent entry of bees.

Insofar as is practical, inside and outside facilities of parks and recreational areas should be thoroughly inspected, bee colonies eliminated and modifications made to prevent future colonization. High-use areas, such as camp sites, boat launches and picnic areas should be re-inspected periodically to

remove any new colonies of bees. In large wooded areas used for recreational purposes or training sites, signs may be posted informing people that bee swarms may be encountered, requesting that such swarms not be disturbed and directing that swarms be reported to appropriate authorities.

Bees do not like the noise, vibrations or air movement created by lawn mowers and other power equipment. A quick inspection of an area to be mowed or shredded can detect bee or wasp colonies that would be disturbed by such actions. Removal of bee colonies prior to mowing dramatically reduces the likelihood of multiple stings. Similarly, some large equipment will incite an attack — especially with the AHB — from the engine noise and exhaust, or simply by hitting the colony. The most likely victims are operators of vehicles with open cabs, such as jeeps, Humvees, bulldozers, backhoes and tractors. Avoidance can be maximized if the cab can be quickly closed in the event an attack begins.

Domestic animals are subject to bee stings. Wherever the AHB becomes established, the number of animal deaths due to bee stings is predicted to increase four to five times. Animals not confined seldom receive many stings because they usually flee the area defended by the bees. Animals in pens or tied cannot run away and may receive a lethal dose of venom. Animals should not be confined or tied before the area is checked to make sure that no bee colonies are established nearby.

Bumble bees and solitary bees seldom require insecticidal control. However, when large numbers of mining bees invade swimming pools, they can be controlled by treating the soil where they are nesting if it can be located. In the same manner as yellowjacket and hornet treatments, bumble bee nests can be treated safely after dark with the aid of a red lens or a lens covered with red cellophane, as bees and wasps cannot see red. It is important to wear a protective bee suit and tape trouser cuffs to shoes when attempting to control bees.

Ants

Many types of ants produce winged queens and males that swarm at certain times of the year and thereby initiate new colonies. The developmental characteristics and colony structure of many ant species are similar to other social **hymenopterans**, with adult workers tending the immatures in the egg, larval and pupal stages. The main public-health threat, however, comes from harvester ants and two imported species of fire ant (Figure 7.5). Other ants, although considered pests from the standpoint of sharing habitation with humans, are not serious health pests.

Figure 7.5
Fire ant

Fire ants and harvester ants. The black imported fire ant, *Solenopsis richteri*, arrived in the southern U.S. in 1918, and the red imported fire ant, *S. invicta*, sometime during the 1930s. Both probably were in ballast that was unloaded at port from ships arriving from South America. These ants dispersed naturally and as hitchhikers in commerce by infesting interstate nursery stocks and other agricultural commodities. They can survive average low temperatures of 10EF and arid areas with as little as 10 inches of rain annually. With few natural enemies to restrain their dispersal and a highly aggressive disposition, fire ants have successfully occupied a variety of habitats that ensure regular encounters with humans. They now infest the entire southeastern U.S. from North Carolina and Tennessee to Texas and Oklahoma, and have recently invaded California. Indigenous harvester ants, *Pogonomyrmex* spp., have somewhat similar bionomics.


Figure 7.6. Imported fire ant

Fire ants are small (⅛ to ¼ inch long) reddish-brown to black ants that build nests housing colonies that comprise as many as 500,000 individuals. The nest of a mature colony is a dome-shaped mound up to 3 feet in diameter and 1.5 feet high. Harvester ants differ in that they are two to three times larger than fire ants, their nest is flat or only slightly elevated and the surrounding ground is defoliated. These dimensions vary with soil type.

Below ground the nests can be several feet deep, providing cool shelter in hot weather and warm shelter in cold weather. At favorable temperatures the foraging ants occupy the area just beneath the top layers. The ants are omnivorous and collect solid foods of various origins, pass the particles to 4th **instar** larvae that liquefy it and regurgitate the liquid as food for the colony. Worker ants tend the brood (immatures) and the queen, which can produce as many as 2,000 eggs daily for six to seven years. Worker ant lifespan ranges from one to seven months, whereas winged males live only about a month, having fulfilled their usefulness with the completion of the mating flight. Single queen colonies (monogyne) do not tolerate intrusion of fire ants from other colonies. But many colonies (polygyne) have 20 to 60 queens as a result of expansion by the process of budding; these colonies do not fight off workers from other colonies.

The ants prefer open sunny areas such as lawns and pastures, but fire ants also inhabit rotting logs and tree stumps and are found under pavement, in electrical junction boxes and indoors. Recently disturbed soil is attractive to colonization.

Most encounters with fire ants are due to their very rapid response to nest intrusion. Worker ants boil out of the nest and rapidly crawl over an intruder, resulting in multiple stings within a few moments (the winged forms do not sting). Often this occurs when the nest is not built up above ground level and thus is hidden from view. The stings cause painful, burning and itching pustules that might last for 10 days and are subject to secondary infection. Individual worker ants can inflict multiple stings. A major threat to humans who are particularly sensitive to the proteinaceous materials in the venom is an allergic reaction that may include a rash, swelling, possible paralysis, **anaphylactic** shock and death. Foraging ants have been reported to inflict hundreds of stings on hospitalized invalids and others who are incapacitated to the extent that they cannot escape.

Control. Control is compromised in some situations because of the ability of the pest to reinfest. Female mating flights may result in colonization as far as 12 miles away, but more often within a mile. Colonies with multiple queens are more difficult to eliminate than single queen colonies. Mating flights and budding occur during the active season and are not limited to springtime.

Regardless of these considerations, the products registered for control are very effective. Slow-acting toxicant baits formulated on corn cob grits are designed to ensure that bait collected by worker ants can be fed to the entire colony, providing control within a few days. Insect growth regulator (IGR) materials are available that stop all egg production by the queen or selectively inhibit production of worker eggs, providing control within five to 10 weeks. To be effective these formulations should be applied fresh, dry and when the ants are actively foraging. Strategies with these materials include bait broadcasts, individual mound treatments and spot treatments. Aerosol, dust and liquid fumigant mound treatments are effective. Drenches and hot water applications have some effect when applied properly but may not be as effective or predictable as the other treatment types. Insecticides can be used for barrier treatment, but with lower levels of effectiveness.

Be aware that there are several species of native fire ants that are not nearly as aggressive as the imported fire ants. If these native species can be tolerated (that is, if they are not a threat to children or in an area frequented by adults) then they should be left alone. Destroying the native fire ant colonies will create a niche vacuum that will likely be reinfested by the imported fire ant species. As repeated elsewhere in this manual, the proper identification of species is the first step necessary to achieving proper control or avoiding control problems in the first place.

II. SPIDERS

The 3,000 kinds of spiders in the U.S. are categorized in the order Araneae. Like their relatives the mites, spiders live in all parts of the world. Spiders are valuable for their role as predators and natural regulators of insect populations. But some spiders, when found in or around structures, are considered pests, especially those that are poisonous. Fear of spiders prompts many people to insist on their control even if the spiders present no significant threat or problem.

The two-part spider shape is well-known. Its head and thorax are combined in the **cephalothorax**. Four legs are attached to each side of the cephalothorax. Spider eyes, some very large, are in front. Like all arachnids, spiders have no antennae. The abdomen, immediately behind the cephalothorax, is saclike and usually globular. The anal opening is located near the end of the abdomen, and close by are some short appendages called the **spinnerets**. Silk webbing threads out from these spinnerets. All spiders produce silk. Some make silk retreats such as tubes and funnels. Others make irregular cobwebs or the evenly spaced, spiraled, great orb webs. Most spiders feed out a continuous thread of silk wherever they walk and thus never fall off edges without catching themselves. Spiders are wingless, but they can drift by releasing the thread of silk until it is long enough for the wind to catch it and carry them off. The process is known as **ballooning**. Newly hatched spiderlings use this as a method of dispersal.

Though all spiders are venomous to some extent, few bite humans. Nevertheless, several spiders are considered dangerous to humans in the U.S. Spider mouthparts, located in front below the eyes, include two short, leglike appendages (palps or **pedipalps**) and a pair of needle-sharp fangs (**chelicerae**). The fangs, connected internally to poison sacs, are used inject poison into the prey (mostly other arthropods) to immobilize it. Two short, leglike mouthparts help hold the paralyzed prey while the chelicerae work back and forth, tearing the exoskeleton. Spiders expel enzymes into the prey to liquefy and partially digest soft tissue as well as ingest the liquid. They work their prey in this way until all tissues have been consumed and the remainder is a dry, crumbled lump.

Black widow spider. Black widow spiders (Figure 7.7) are distributed throughout the nation. The southern black widow spider, *Latrodectus mactans*, is found in the eastern and southern U.S. Females have a large, round, shiny black abdomen usually decorated with an hourglass and a red spot just above the spinnerets. The western black widow, *L. hesperus*, is similar to *L. mactans* but occurs in the western U.S. and western Canada. In the northern widow, *L. variolus*, the hourglass is often broken in the middle and there are red spots down the back. This species is found in the northern U.S. and Canada. An introduced spider, the brown widow, *L. geometricus*, occurs throughout most of peninsular Florida and southern Texas, and is the most prevalent widow in houses. It is various shades of brown with banded legs, an orange hourglass and an egg sac that has tufts of

Figure 7.7.
Black widow spider

silk all over it. The red widow, *L. bishopi*, has a reddish abdomen with reddish to orange spots outlined by white. This species only occurs in selected, isolated habitats of central and southern Florida. Male widows are streaked black and white with a small red or yellow hourglass; they are not dangerous. Black widows hang upside down in the web, and the hourglass is obvious. This ½-inch or larger, shiny, black spider is unmistakable and eye-catching.

Black widow females are not aggressive but will give full attention to anything that disturbs the web. They weave tangled webs of coarse silk in dark, quiet locations. Mature females are so large they can hardly crawl. Though public-health pesticide applicators are not commonly called on for black widow control, they may well run into these spiders when inspecting crawl spaces, porches, garages and sheds for other pests. Black widow spiders can be found in stacked pots or baskets, firewood piles, rodent burrows, water meters, stacked boards, under bricks and stones, etc. Usually the spiders are outside, but they may be brought inside, or the young may move inside on ground floors. Northern widows are common around pine stumps. Move cautiously when treating any potential spider **harborage**.

Black widow bites are immediately painful. Two small red marks from the fangs are noticeable on the skin. The pain at the site of the bite increases during the first half-hour following a bite. Then other symptoms set in, such as headache, dizziness, shortness of breath, and abdominal and back pain. Black widow bites are seldom fatal to healthy adults. Children and elderly people are the most vulnerable. Victims should receive hospital treatment as soon as possible.

Brown recluse spider. The brown recluse spider (Figure 7.8), *Loxosceles reclusa*, is a dusky tan or brown spider with the widest range of any recluse spider in the U.S. — from central Texas north to Oklahoma, Kansas and Iowa, and south through Illinois, North and South Carolina, northwestern Georgia and Alabama, with a few sightings in adjacent states and where they have been transported in luggage and household furnishings. Other species of recluse spiders live in the Southwest, particularly in desert areas. This spider lives outdoors in the southern part of its range and primarily indoors throughout the rest of its distribution. It is commonly found in older homes in the Midwest. The brown recluse is smaller than the black widow. It has an oval abdomen rather than a round one. The abdomen is uniformly tan to brown without marking. A dark, fiddle-shaped mark is obvious on the cephalothorax: The broad base of the fiddle begins at the eyes and the narrow fiddle neck ends just above the attachment of the abdomen. Legs are long, with the second pair longer than the first. The brown recluse makes a fine, irregular web. It commonly wanders in the evening in indoor infestations. Another medically important spider, the hobo spider, is restricted to the Northwest.

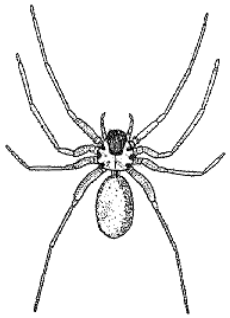

Figure 7.8.
Brown recluse spider

Recluse spiders avoid parts of rooms where human activity is prevalent, remaining where there is no activity and in closed or unused rooms. Even though indoor infestations can be large, household inhabitants are seldom bitten. Bites can be expected when guestrooms are suddenly put into use or when stored clothing is brought out for use. Brown recluse bites are sharp but not initially painful like those of the black widow. A blister is quickly raised, broken and surrounded by a red welt. The depressed center of this raised red circle (the size of a dime to a quarter) turns dark within a day. The dead tissue sloughs away, and the bite area scars over in one to eight weeks. Death seldom occurs, but the bite is debilitating and psychologically traumatic.

The spider is delicate. After biting, it frequently can be found lying where it was slapped by the victim. It should be killed and taken to the physician for positive identification. Other biting arthropods can produce lesions resembling the bite of the brown recluse spider.

Yellow house spider. The yellow house spider, *Chirocanthium mildei*, was introduced into the U.S. in the late 1940s and is now common. Native species are common outdoors. These spiders are about ¼ inch long, with legs and cephalothorax darker than the abdomen. It has been reported as being yellow, white or greenish. In late summer and early fall, yellow house spiders migrate into structures and automobiles. At this time, they have not reached the adult stage, and they weave protective, white, silken, cocoonlike webs in which to overwinter and molt to the adult stage in spring.

This spider will bite if pressed or accidentally confined (for example, during the victim's sleep). The venom has been described as causing pain and reddening at the site of the bite. In some instances a deadening of the tissue will occur, but it is much less severe than that caused by the brown recluse spider. Children that show symptoms of spider bites (the two fang marks) may have been bitten by the yellow house spider. This spider, however, cannot pierce the skin of everyone. There is a very large margin of safety.

Control and management of spiders. Spiders in structures can be controlled by sanitation, habitat alteration and judicious use of pesticides. By careful elimination and inspection of preferred indoor harborage sites, human exposure can be substantially reduced. Black widow indoor habitat is more predictable that the brown recluse because it is somewhat more limited and the spider stays at the web. Pesticides can be effective against black widows when applied as crack and crevice residual applications that are in place before the spiders become established in the summer and settle into their webs. The brown recluse is subject to greater pesticide exposure because it is a hunter, but both are partially protected because they tread lightly on the hairs at the tip of the leg, which limits control. Indoor infestations of these spiders and the yellow house spider can be reduced by exclusion strategies that limit access to living areas.

III. CENTIPEDES AND SCORPIONS

Scorpions. Scorpions make up a small order (Scorpiones) of arthropods related to spiders. Scorpions (Figure 7.9) have eight legs, a combined head and thorax (**cephalothorax**) and a segmented abdomen. They have a pair of large pincerlike **pedipalps** at the front of their bodies, which they use for catching prey. Their abdomens are segmented with an elongated tail ending in a stinger, usually elevated over the body.

Scorpions feed on spiders and soft-bodied insects. Small prey may be eaten immediately, while larger prey are stung and then eaten after movement stops. Scorpions hide during the day and are active at night. They tend to live under boards, stones or other objects, or beneath loose bark on trees and logs. Indoors, they are most often found in crawlspaces and attics. Although scorpions tend to be found on dry land, they require moisture and may be attracted to water sources. They generally do not like extremely high temperatures and may be driven to enter the living areas of homes seeking relief from heat and dryness.

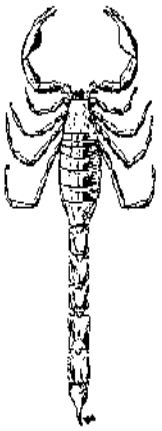

Figure 7.9
Scorpion

Several species of scorpions are found in the U.S., with most inhabiting areas in the South and Southwest. The most dangerous species in the U.S., *Centruroides exilicauda*, is limited to the Southwest. A widely distributed species is the striped scorpion, *C. vittatus*. Adult striped scorpions are yellowish-tan with two broad, darkened longitudinal bands on the top of the abdomen. They are up to 2½ inches long. The female produces living young, which she carries on her back for five to 15 days until they leave and become independent. Adult life span ranges from two to five years.

Poison glands are located in the bulbous last segment of the abdomen, which ends in the stinger. Scorpions rarely sting humans except when pinned against the skin. The sting of the striped scorpion usually causes a localized painful swelling and discoloration at the sting site. The effect lasts only for a few hours and has been described as being similar to a bee or wasp sting. However, fatal stings have been reported in the Southwest.

Centipedes. Centipedes (Figure 7.10), in the class Chilopoda, are most numerous in the southern half of the U.S. but are widely distributed. They are generally **nocturnal**, hiding during the day under rocks or similar shelter and in crevices, closets, basements and other humid, protected locations. Prey consists of insects and other small arthropods encountered during foraging. Two powerful claws, located immediately behind the head, inject venom into such victims and humans that inadvertently step on them or pick them up. In the U.S., most centipedes are small and not a threat to humans.

Figure 7.10
Centipede

Control. Sanitation is important to minimize scorpion encounters. Boards, stones, wood piles and similar harborage sites should be removed from around the house. Firewood and lumber should be stored off the ground. During dry weather, scorpions may be collected after being aggregated by attraction to wet burlap bags spread on the ground around the house. They then can be killed by crushing with a heavy object. Eliminating and excluding insect populations by caulking or other means of closing cracks under and around doors and windows helps because it removes the scorpions' food source. Ducks and chickens maintained in the yard around a house will eliminate most scorpions.

Applying a barrier strip of residual pesticide around the house helps to reduce infestations. Spray the ground from the foundation out about 10 feet and the foundation from the ground up about 2 feet. Particular attention should be paid to treating weep holes in brick veneer and around basement window wells. Attics, wall voids and crawlspaces are best treated with dust formulations; residual crack and crevice sprays also help.

Complaints about the large centipede, *Scolopendra subspinipes*, usually occur after heavy rains when flooding forces them to seek shelter in homes. Caulking of spaces between walls and concrete floor slabs of poorly constructed homes reduces the likelihood of entry into homes. Removing rocks, wood piles and other trash eliminates harborage sites. Chemical control with dusts or wettable powder formulations gives better residual control than emulsions for centipedes, but generally centipedes are not sufficiently numerous to warrant chemical control.

IV. URTICATING CATERPILLARS

The immature stages of several species of moths in states east of the Rocky Mountains are venomous to humans because of their external poisonous spines and hairs. Some species are infrequently encountered, but three species are more nationally common.

The Io moth caterpillar (Figure 7.11), *Automeris io*, when fully grown is about 2 to 3 inches long with a row of **tubercles** armed with green and black spines, many of which are connected to poison glands. This insect undergoes one or two generations per year and overwinters in the pupal stage. The caterpillars are encountered as they feed on favored vegetation.

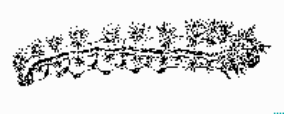

Figure 7.11.
Io moth caterpillar

Figure 7.12.
Puss caterpillar

The white to dark gray puss caterpillar (Figure 7.12), *Megalopyge opercularis*, is about 1 inch long when fully grown and completely covered with venomous hairs that resemble tufts of cotton. The moth undergoes two generations a year in the Southeast, during which the caterpillars feed on shrubs and bushes where they pose a threat to humans.

The saddleback caterpillar (Figure 7.13), *Sibine stimulea*, feeds on shrubs, bushes, trees and other plants. Easily recognizable by the brown or purplish saddlelike coloration on its back, it has multiple stout, venomous spines along the sides of the body and the four tubercles.

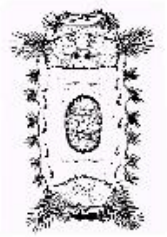

Figure 7.13.
Saddleback
caterpillar

Specific control activities are usually not warranted for these pests. Public education and an awareness of the hazards are usually sufficient to prevent repeat exposures. However, if necessary, insecticides registered for use on plants can be used to control these pests.

V. THE MEDICAL ASPECTS OF STINGS

The various sting mechanisms in these parasites and predators are usually modified ovipositors. The venom produces lethal or narcotic effects in prey, and the stings of many are very well-suited for defensive use. While unprovoked stinging of large animals is considered rare, very little provocation is needed to incite some stings in nest areas. Whatever their reasons for stinging, **hymenopterans** kill more people in the U.S. each year than do snakes and spiders combined.

Although serious reactions from stings occur in only a very small percentage of the population, everyone should be aware of the possibility of medical complications that might result from stings to themselves, children and others. The lethal dose of bee venom, for example, for humans is about 10 stings per pound of body weight, assuming all of the bee's venom is injected by the sting. So deaths due to the toxic effects of EHB venom received in multiple stings are extremely rare. The venoms of the AHB and the EHB are almost identical, but the increased stinging activity of the AHB makes it more dangerous.

But, for the 1 percent to 4 percent of the population hypersensitive to honey bee and other venoms, one sting can be fatal. Reactions to stings range from slight pain and swelling to much more serious symptoms, including **anaphylaxis**. Early symptoms of an allergic reaction include a tingling sensation on the palms, bottoms of the feet, tongue and lips; tightening of the throat; dizziness; and nausea. Allergy tests are available but can be expensive. If their normal routine does not bring them in contact with venomous arthropods, people should not have to take the test. But for beekeepers or others who work where hymenopterans are present, such testing is usually recommended. Firefighters or police officers who may respond to emergency calls for insect stings should be tested. Allergy testing will determine how sensitive a person is, and a person's immunity can be built up with small, regularly scheduled injections of venom. Kits are available as a prescription item for people who are allergic to stings. Such kits are equipped with syringes and epinephrine for emergency treatment. Doctors, emergency medical services, and other health care personnel are well-educated in the diagnosis and treatment of stings and anaphylaxis.

In the U.S., deaths from all hymenopterous insects (bees, wasps, yellowjackets, ants) average between 40 and 50 per year. The arrival of the AHB in the U.S. has created a public awareness of the associated health risks. This awareness provides an opportunity to educate the public on medical aspects of the AHB and other stinging insects.

First aid for sting victims. If the victim is showing no signs of dizziness or difficulty in breathing, or has been stung only once, practical first aid measures are:

- Remove the sting with a sideways scraping movement of a fingernail, credit card or dull knife to prevent more venom from being pumped in by the venom sac.
- Apply a paste of baking soda and cold cream or of wet salt within five minutes of sting, when possible, and apply an ice pack to relieve pain and calamine lotion to relieve itching.
- Watch for any unusual reaction, such as the appearance of red blotches anywhere on the body within two to 20 minutes, or breathing difficulties. Breathing difficulty indicates a serious response, requiring medical attention within 15 to 20 minutes.
- Seek medical attention immediately if a person with health problems is stung by an insect.
- Stay with the victim until medical care is obtained.

At-risk groups. Certain groups in the population may be considered at-risk for incidents involving venomous arthropods. Children are exposed to habitats that increase the chance of interaction with stinging insects; plus, they have a greater tendency to disturb those insects. Because of low body weight, children may be particularly susceptible. The physical condition, health and immunological status of the elderly place them in the at-risk group; they should be prepared. Sportsmen, the handicapped, outdoor workers, military personnel, etc., should be considered at risk when their work involves exposure in habitats likely to be occupied by stinging arthropods. The risk is greater when operating mowers, weed eaters, heavy equipment, chain saws, or other equipment that can provoke defensive behavior from arthropods. Workers unable to flee, such as those on poles or scaffolding, are at higher risk.

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