ants & Public Health

Given the incidence and serious nature of anaphylaxis, PCOs play a critical role in protecting public health for they are often called upon to solve problems with these potentially dangerous insects.

By John H. Klotz, Herb C. Field, Stephen A. Klotz and Jacob L. Pinnas

"*A 25-year-old woman was stung by a small black ant. Although the bite produced pain, no pustules formed. Immediately, the woman developed generalized itching, puffy eyes and erythema. She had initial tachycardia due to fright and respiratory difficulty, but she showed no signs of collapse. Five minutes after the onset of these generalized symptoms, she took two antihistamine capsules orally. Twenty minutes later, she arrived at an emergency room with respiratory distress, generalized urticaria and decreased blood pressure. She was treated with epinephrine and corticosteroids.*"

The above paragraph describes an actual allergic reaction

A twig ant, *Pseudomyrmex ejectus* (Photo: AntWeb [www.antweb.org])

Editor's note: This article is part one of a two-part series about pest management and public health. Look for part two, about kissing bugs, in the April issue of PCT.

to a sting by an ant belonging to the genus *Tetramorium* (Majeski et al. 1974). The incident took place in South Carolina; however, since the species was not identified we can only speculate that it may have been a pavement ant, *T. caespitum*, a common urban and structural ant pest, whose range includes most of the United States. It illustrates the sudden onset, sometimes with irrevocable finality, of a condition known in medical terminology as "anaphylaxis." It means "without protection" and many of its victims have no prior history of an allergic reaction.

It is estimated that up to 5 percent of the population in the United States is allergic to stings of Hymenoptera. In fact, in some areas infested with imported fire ants as much as 50 percent of the population has been stung (deShazo et al. 1990) and as many as 17 percent are sensitized to their venom (Caplan et al. 2003). For the hypersensitive individual, one sting is sufficient to precipitate an anaphylactic reaction.

Given the incidence and serious nature of anaphylaxis, PCOs play a critical role in protecting public health for they are often called upon to solve problems with these potentially dangerous insects.

WHAT IS ANAPHYLAXIS? For most people, a sting is limited to a welt causing pain for an hour or two (Greene 2005). Toxic envenomations occur with multiple stings, sometimes hundreds and may resemble anaphylaxis. However, anaphylaxis is an immunologic response to venom protein and not a reaction to venom toxicity. Histamine is one of the chemicals released from cells during this immunologic reaction and it has profound effects on the human body. In more severe allergic reactions the blood pressure plummets and air passageways constrict, making it difficult to breathe, with some victims describing a feeling of "impending doom." Anaphylactic reactions vary along a continuum from minor to severe to life-threatening. The most common are skin reactions where the victim breaks out in hives. At the other end of the spectrum are rare fatal reactions where the victim dies within 30 minutes after the sting due to cardiopulmonary collapse.

There are many other agents, in addition to venom, that cause anaphylactic reactions including various foods, medications, latex, vaccines, hormones and exercise. However, immunotherapy for anaphylaxis is commercially available only for stinging insects (Golden 2005). The procedure consists of repeated injections of small amounts of venom from the offending bee or wasp, or whole body extract (in the case of imported fire ants). Due to the specificity of the allergic reaction to a particular allergen in the venom, an identification confirmation by an entomologist of the stinging insect is helpful to the allergist. It is also important for emergency room and primary care physicians to have a record of the specific insect that caused a reaction in a patient.

Treatment of Hymenoptera sensitivity should also include prevention of stings and immediate treatment of reactions when they occur. Emergency treatment includes administration of H1 antihistamines like Benadryl, H2 antihistamines like Tagamet or Zantac and epinephrine and steroids if needed for serious reactions (Pinnas 2001).

REACTIONS TO STINGING ANTS. The most common causes of sting allergies in the United States are due to yellow jackets and honey bees (Schmidt 1992). However, in certain regions of the country, stinging ants are also a major problem; for instance, imported fire ants are prevalent in the South. Far fewer allergies are caused by native fire ants, but even the incidence of their stings in certain areas is not trivial. For example, in Arizona, excluding Maricopa County (the greater Phoenix area), there were 237 ant stings reported during a two-year period from March 2002 to March 2004. It is probable that many more cases go unreported. The vast majority of these stings are caused by native fire ants and harvester ants. For comparison, there were 623 bee and wasp stings, 4,655 scorpion stings and 346 snakebites for the region over the same time period (Klotz et al. 2005).

CASE HISTORIES. A review follows of several case histories regarding stinging ants.

Fire ants. Most adverse reactions to ant stings in the United States are caused by imported fire ants, with more than 80 deaths attributed to them (Kemp et al. 2000). In contrast, there have been only two reported fatalities caused by native fire ants, both due to stings by the southern fire ant, *Solenopsis xyloni*. In both cases the victims were infants: an 8-month-old baby in Keownville, Miss., (Coarsey 1952) and a 3-month-old baby in Phoenix, Ariz. The baby in Phoenix died as a result of an anaphylactic reaction (Klotz et al. 2004) to stings by southern fire ants that had invaded the home and were found covering the child in her crib.

Two other species of native fire ants have also caused adverse reactions (Hoffman 1997). The desert fire ant, *S. aurea*, is found in the Colorado Desert in California and north along the eastern Mojave into southern Nevada. The tropical fire ant, *S. geminata*, largely has been displaced in the Southeast by imported fire ants but has spread to other parts of the world, including many Pacific islands. Two U.S. servicemen stationed on Guam and Okinawa experienced near fatal reactions to stings by the tropical fire ant. Prior to their deployment in the Pacific both men were sensitized to imported fire ant venom, which is highly cross-reactive with native fire ant venoms. This means that an individual who is sensitized to one species of *Solenopsis* would be expected to react to a sting from another species. Recently, a group of researchers reported allergic cross-reactivity in people sensitive to venoms of imported fire ants and common striped scorpions, two species that overlap in their geographic distribution (Nugent et al. 2004).

Figure 1. Pseudopustules caused by native fire ant stings. (Photo: Jacob Pinnas)

Native fire ants are less aggressive than imported fire ants but their sting can be just as pernicious *(see Figure 1 above)*. Stings from either cause pseudopustules to form on the skin (called "pseudo" because they do not contain pus laden with bacteria as in an infection, but rather sterile serum). The venom contains piperidines, alkaloid compounds that create the burning sensation. However, it is the small protein fraction in the venom that can be allergenic.

Harvester ants *(see Figure 3 on next page)*. There

Figure 2. *Pogonomyrmex rugosus* workers. (Photo: Jacob Pinnas)

are a couple of dozen species of harvester ants that are native to the United States. Their large, circular nest sites with bare, cleared ground are common in the deserts of the western U.S., where these ants play a critical role as one of the principal granivores in these ecosystems (Davidson et al. 1980). Some species, such as the rough harvester ant, *Pogonomyrmex rugosus (see Figure 2 above)* and Maricopa harvester ant, *P. maricopa (see Figure 4 on next page)*, also thrive in urban environments along roadsides and in yards (Klotz et al. 2005, Snelling and George 1979). One of the authors (SAK) treated a patient for anaphylaxis after being stung by a rough harvester ant in Tucson, Ariz. (Klotz et al. 2005). The victim was sitting on a street curb next to a nest when he was stung by an ant that had crawled up his pant leg. Another author (JLP) treated eight patients over a one-year period in Tucson for stings by these two species (Pinnas et al. 1977). Four of these patients were treated for anaphylaxis and one suffered numerous reactions due to an infestation of harvester ants in his yard that had not been exterminated.

The stings of harvester ants are considered to be the most painful of all North American ants and the most toxic of all insect venoms (Schmidt 2003). Drop for drop their venom is more toxic than many poisonous snakes. Their sting has been described as "ripping muscles or tendons" and like "turning a screw in the flesh" (Schmidt 1986). The venom causes localized sweating and gooseflesh at the sting site and is often accompanied by pain and tenderness in nearby lymph nodes. Immunologic tests have demonstrated cross-sensitivity of patients to the venom of various species of *Pogonomyrmex* (Schmidt et al. 1984).

There have been at least two deaths attributed to stings by the red harvester ant, *P. barbatus*. Both cases occurred in Oklahoma (Brett 1950; Young and Howell 1964). The Florida harvester ant, *P. badius*, is the only eastern species and although docile, when disturbed, it can deliver a painful sting (Creighton 1950).

Twig ants. Dr. Daniel Suiter at the University of Georgia Experiment Station in Griffin received an ant from a county agent in southern Georgia that had caused an anaphylactic reaction in a farmer (Klotz et al. 2005). It was identified as *Pseudomyrmex ejectus*, a small wasp-like ant with large compound eyes *(see photo on first page)*. During a 10-year period this farmer had suffered four anaphylactic reactions to stings by this ant. In the first episode he was stung on the back of the neck by ants that swarmed out of a gatepost. He immediately had difficulty breathing, "turned blue" and became dizzy. In addition, his tongue became swollen and he experienced a feeling of "doom." He drove immediately to a nearby emergency room where he was successfully treated with epinephrine and steroids. Another case was brought to our attention by an allergist in Lakeland, Fla., of a woman who also had experienced several anaphylactic reactions to stings by this same species of ant. In two incidents she was stung by ants that fell from a tree that she was sitting under. Their colonies are small, about 100 individuals and their nests are located in twigs, typically in oak trees.

Hypoponera punctatissima. Dr. Austin Frishman of AMF Pest Management Consulting was consulted several times by health-care facilities that had been infested with *Hypoponera punctatissima* (Klotz et al. 2005), an exotic species that may have originated in Europe but is now widely distributed in Florida and in buildings in New England (Alpert 2002, Vail 1994). They are considered occasional pests because the female winged reproductives may sting during their mating flights. For example, in a nursing home in Connecticut, the ants stung a nurse who went into respiratory arrest. The ants were probably brought in on potted plants that they subsequently migrated out of and into the soil beneath the foundation slab. At a hospital on Roosevelt Island, New York City, employees in the laundry facility were getting stung by ants that again were emerging from beneath the slab foundation.

HEALTH-CARE FACILITIES. Ant control is challenging work, particularly for sensitive accounts, such as a nursing home or hospital, where the elderly or infirm are vulnerable to ant attack because of their limited mobility. These accounts require thorough inspections and treatments and sometimes new and creative techniques by the pest management professional. For example, in the case of *Hypoponera* in the nursing home, various strategies were attempted before control was achieved. The winged ants were attracted and caught in insect light traps, but this did little to stop them from stinging residents. Dusting wall voids, attempting to seal cracks in the slab and a soil termiticide applied as foam also failed. The infestation was finally eliminated by breaking up the floor in the kitchen and inserting chopped up mealworms coated with Avert dust. The treated mealworms were placed in a rodent bait station and a board placed over the top to close the floor but allowed for re-inspection.

Extreme measures like this are unusual but illustrate the persistence and innovation required to solve an ant problem in these accounts. Failure is not an option with a population of high-risk patients and could result in a costly lawsuit. Ant attacks on patients in nursing homes are becoming an increasing problem especially in areas infested with imported fire ants (deShazo et al. 2004).

Figure 3. *Pogonomyrmex desertorum* workers. *(Photo: Jacob Pinnas)*

Figure 4. Sting of *Pogonomyrmex maricopa*. (Photo: Jacob Pinnas)

The ants often move into buildings due to environmental factors such as rain or drought, or in search of food (Goddard et al. 2002). Once inside they become a significant liability because of the susceptible nature of the residents, particularly those that are bedridden or wheelchair bound.

In one case a patient was stung in bed more than 500 times (deShazo et al. 1999). Incidents like this have been reported at least 10 times and almost all of them have resulted in lawsuits (Goddard et al. 2002). As a consequence, pest control companies need to have a service contract and maintenance log that spells out exactly what is going to be done and what has been done in these accounts, so that in case of a liability suit they can prove that their services were up to industry standards. Dr. Jerome Goddard et al. 2002 published "Recommendations for prevention and management of fire ant infestation of health care facilities" in a 2002 issue of Southern Medical Journal (95: 627-633). (Reprints of this article, which contains some helpful guidelines on providing pest control services and contracts for health-care facilities, can be obtained from Goddard via e-mail at jgoddard@giemedia.com.)

CHEMICAL CONTROL. The most effective control measures for ants take advantage of their unique behaviors. All ants are social and are characterized by central place foraging. Scouts leave a nest to search for food and return with it to share with the other members of the colony and recruit other ants to the resource. Toxic baits are ideal for exploiting this kind of foraging behavior and some of the most effective ant baits on the market are highly attractive to both fire ants and harvester ants (Wagner 1983). These are the corngrit/soy bean oil ant baits formulated with various active ingredients.

In the highly effective "Two-Step Method" developed by Texas A&M University and Extension Service, a slow-acting toxic bait is broadcasted first and then followed several days later by a fast-acting residual insecticide applied to the nest.

CONCLUSION. There is a delicate balance between satisfying a customer and the liability issues that go along with providing pest control services for accounts with stinging ants. For every 100 accounts that are straightforward and solved to the customer's satisfaction there is always that one case that is especially challenging. Every pest management professional must decide whether they are willing to "go the distance" on this account. It might require multiple approaches, for example baiting around a fence line to prevent re-infestation of the property, in addition to an application of a non-repellent insecticide around the foundation to protect the structure. These procedures might even be just the beginning of a complex and multifaceted control program that also include granular/bait applications to heavy foliage where sprays cannot penetrate and possibly some non-chemical methods such as habitat modification. The latter may include caulking, converting to drip irrigation, installing door sweeps, and removing or cutting back foliage from the structure.

Sometimes, even with the best of intentions and plans, pest management professionals still find themselves in the position of defending their business in a legal proceeding. Every attorney will tell you that even though you cannot avoid a frivolous lawsuit you can be prepared for it by documenting your control procedures and providing the customer with information that outlines what you will do and what you expect them to do in order to solve their problem. Pest management professionals must include any disclaimers, and explain these to the customers before they start the job. For recommendations on wording disclaimers pest management professionals should consult with a good general liability attorney.

In addition, pest management professionals can contact their insurance carriers for help with this, often without charge. Finally, the pest management professional should obtain signatures on all pertinent forms before making the first application. Even though taking on a stinging ant account can turn around and bite you with a lawsuit, most pest management professionals would probably agree that providing these valuable services to our customers can make good business sense given that the pest management professional is adequately prepared and takes the problem seriously.

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