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Kissing Bugs & Public Health

Similar to stinging ant control in health-care facilities, a thorough inspection and treatment are critical elements in a control program for kissing bugs.

In Part I of this article in March PCT, we focused on allergic reactions to stinging ants and the problems associated with their management in sensitive accounts. Imported fire ants are by far the most important stinging ant pest in the Southeastern United States, but we also described cases of other exotic and native species that are a threat to public health in other parts of the country. For example, native fire ants and harvester ants thrive in urban areas of the desert Southwest and stings by these species are reported on a regular basis, sometimes with fatal

Editor's note: This article is part two of a two-part series about pest management professionals and public health. Part one appeared in the March 2006 issue of PCT.

Figure 1 (above). *Triatoma rubida* (the smaller kissing bug on left) and *Triatoma recurva*, a larger species found in southern Arizona. (Photo: Jacob Pinnas)

Figure 2 (left). An extended proboscis on *Triatoma protracta*, also known as the western bloodsucking conenose bug, the most important species in California. (Photo: Gregory Ballmer)

consequences. In comparison to stinging Hymenoptera, biting insects cause far fewer anaphylactic reactions; however, in certain regions of the country the incidence may be relatively high. In this article, we focus on kissing bugs, the most common cause of anaphylactic reactions to biting insects.

Other than kissing bugs, anaphylactic reactions to biting insects are rare. There are a few reports of anaphylactic reactions to bites of horse and deer flies (Freye and Litwin 1996; Hemmer et al. 1998), black flies (Hoffman 1987), mosquitoes (McCormack et al. 1995), and tsetse flies (Stevens et al. 1996). Other flies have been implicated such as punkies (Hoffman 1987), snipe flies (Turner 1979), and the larval stage of a stiletto fly (Smith 1979), but these reports lack definitive blood tests showing an immunologic response. There is one report 50 years ago of an anaphylactic-like reaction to a bed bug bite (Parsons 1955).

In contrast, anaphylactic reactions to kissing bugs are frequently reported. More than 100 years ago their signature bites around the lips were reported in a rash of news stories around the country giving rise to their name and creating panic among many readers (Ryckman 1979). More precisely, their bite is a pierce or stab since they lack opposable jaws and instead have modified piercing-sucking mouthparts consisting of a short, three-segmented, straight beak or proboscis that is folded back beneath the head; and, contrary to the common name, kissing bugs do not have a predilection for lips but will bite any exposed area. Other common names include Mexican or Texas bed bugs, conenose bugs because of their elongated, conical-shaped heads, and Wallapai tigers (referring to a Colorado River Yuman Tribe meaning "pine tree folk," and tiger due to the colorful striping on some species).

Their bite is painless unlike many other members of the Reduviidae family, which are commonly known as assassin or ambush bugs. Most members of this large family of hemipterans with 160 species in North America are predators on other insects (Triplehorn 2005), but kissing bugs in the genus *Triatoma* are bloodsuckers on a wide variety of mammals and birds. In Latin America, various species of triatomine bugs are vectors of American trypanosomiasis or Chagas' disease, which affects more than 16 million people (Guerenstein et al. 1995). In the United States this disease is rare with only a few reported cases in the Southeast and Southwest (Moffitt et al. 2003).

There are 16 species of *Triatoma* in the United States distributed across the southern two-thirds of the country (Vetter 2001). However, most allergic reactions are to bites of *T. rubida (see Figure 1 on previous page)* in Arizona and *T. protracta (see Figure 2 on previous page)* in California, the two species we will focus on in this article.

Although the geographic ranges of these two species overlap, *T. rubida* is more common in central and southern Arizona (Smith 1982). It is particularly a problem in the foothills of Tucson, where most of the allergic reactions are reported for this species (Pinnas 1997). For example, of the 110 *Triatoma* exposures reported to the National Data Collection System in 1990, 73 were reported from Tucson, and 21 from California. The western bloodsucking conenose, *T. protracta* is found throughout California in the foothill areas that are inhabited by their primary hosts. In one community in southern California 6.7 percent of the population were found to be sensitized to *T. protracta* (Marshall et al. 1986).

BIOLOGY. The primary hosts are various species of *Neotoma*, commonly called wood rats or pack rats (Ebeling 1978). The adults and nymphs of *T. protracta* and *T. rubida* live in the nests of these rodents and feed on them at night. The nymphs are similar to adults in appearance, but are smaller and lack wings. The last nymphal stage has wing pads, which become functional wings in the adult.

The life cycle (Olson 1996) from egg to adult takes one to two years. Eggs are usually laid in summer and hatch three to five weeks later, giving rise to the first of five nymphal instars (growth stages). Each nymphal instar requires a blood meal before it can molt to the next growth stage. Kissing bugs sometimes spend the winter as developing nymphs and molt into adults in the spring.

Due to low host specificity, kissing bugs will readily feed on other mammals besides rodents. For instance humans often become accidental hosts when the bugs enter homes typically in spring and early summer when the adult bugs disperse from rodent nests on mating flights *(see Figure 3 above)*. They are strictly nocturnal and are drawn toward lights in and around homes, but in daylight they seek dark, shaded places often entering homes through any crack or gap in the structure. Once inside they hide in structural cracks and crevices, in bedding, mattresses and box springs, in and under furniture, in closets, and in other dark locations. Often the bugs reside in the home for months, not needing to go outdoors. At night they emerge to feed, orienting to olfactory (CO_2 and other host odors) and thermal cues emanating from their potential victims (Guerenstein and Guerin 2001), which may be a sleeping person or pet. They seek out flowing blood beneath the surface of the skin, entering a blood vessel with their proboscis and secreting a vasodilator (nitric oxide) and anticoagulant.

For most people the bite is harmless, but for those that are sensitized it can cause a life-threatening reaction such as described in the following case that occurred in southern Arizona: "A 45-year old lady has had four severe reactions to an insect bite. She has found the insect in bed each time

KISSING BUG REACTIONS REPORTED IN ARIZONA

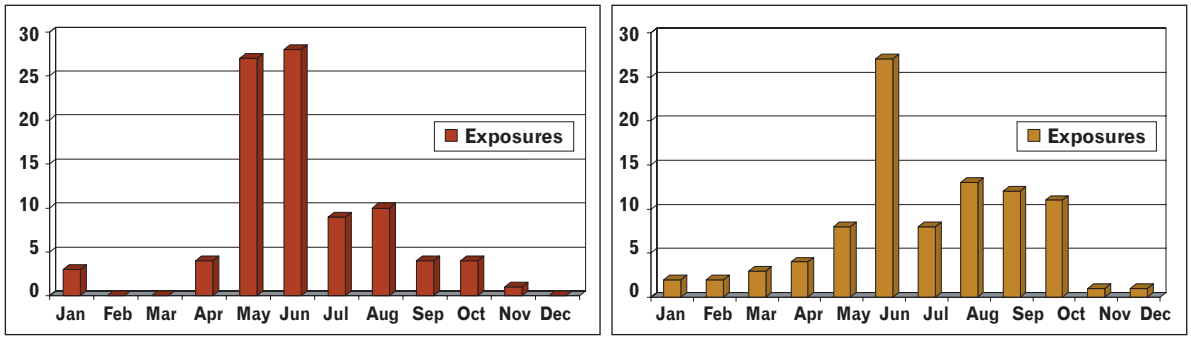

Figure 3. Monthly incidence of people bitten by kissing bugs in Arizona (excluding Maricopa County) for the years of 2002-03. *Source: Arizona Poison & Drug Information Center*

Figure 4. A pack rat nest in an oleander bush. (Photo: Ed Evans)

and from the description it fits the picture of Wallapai tiger or kissing bug. She never feels the bite, but she notices her heart rate increasing, then she feels hot. In two instances she lost consciousness and she had one episode where she had a seizure."

As described, victims are typically bitten while sleeping and often find the engorged bug in their beds. Usually there are multiple bites that are clustered on areas of the body not covered such as the arms, shoulders, neck, and face. There are two types of allergic reactions: one that is localized at the site of the bite with a substantial welt that itches intensely; and the other systemic with anaphylaxis (Pinnas et al. 1986). Severe reactions require immediate treatment with epinephrine and antihistamines, so persons at risk should keep a kit containing these medications close at hand in their bedroom (Lynch and Pinnas 1978).

MANAGEMENT. Because of the serious health risks associated with kissing bug bites, their control in and around the home should be treated as a sensitive account by pest management professionals. Similar to stinging ant control in health-care facilities, a thorough inspection and treatment are critical elements in a control program for kissing bugs; however, in the case of kissing bugs control must also include their host.

PACK RAT CONTROL. The building of custom homes in natural habitats is a popular trend in the Southwest. This encroachment into wildlife areas, however, is not without its consequences for the human as well as animal residents. The bites and stings of venomous animals are probably the most notorious and feared, but for shear destructive mischief pack rats are hard to beat. One of their favorite targets is electrical wire and stories abound of their damage to homes, vehicles, hot tubs, and pool pumps. One of the authors (JP) has two friends whose cars were damaged by packrats gnawing electrical wiring costing more than $3,000 to repair. One insurance company paid while the other called it "an act of God" and did not. They will also burrow under patios, and gnaw through garage door seals.

Pack rats build their nests out of almost any available material and sometimes in the most surprising places. For example, one of the authors (EE) found a nest that was built entirely of 1-inch landscape rock, and another that was located in a barbecue grill. In older neighborhoods they often build their nests in the leaf litter of under-managed vegetation such as oleander, whose thick foliage makes it a popular bush to plant along property lines in order to provide privacy for homeowners *(see Figure 4 at left)*.

Being opportunistic, pack rats are able to find abundant food and water around homes. They will eat leftovers in pet food bowls, climb trees for fruit, and chew through plastic irrigation lines to obtain water.

THE PCO. An experienced pest management professional can usually find a dozen conditions that a homeowner should address in order to help solve their pack rat problem. However, one rarely finds homeowners that are willing to adjust their habits or make the needed environmental modifications to correct the problems. Instead, "How much to get rid of these rats?" is usually about as much cooperation as the pest management professional gets.

Despite this attitude, the pest management professional should give the homeowner a fact sheet that provides basic information on pack rat biology and how to eliminate them from their property. It also should address the problems that can arise with pack rat ectoparasites such as ticks, fleas, and kissing bugs, and the importance of controlling these potential public health pests.

An integrated pest management approach to pack rat control includes baiting, trapping, and habitat modification. The pros and cons of each of these techniques follow.

Baiting. A rodenticide should only be used when it is enclosed in a tamper-resistant bait station that has been secured in place. One way to secure the station is to glue it to a concrete block using an industrial adhesive such as liquid nails *(see Figure 5 at right)*. This places the station off the ground keeping it dry and preventing non-target animals such as coyotes from dragging it away.

Pros:

- Rodent baits and tamper-resistant stations are readily available to the pest management professional.
- Baiting typically takes less effort than other techniques, however, proper placement of the station to gain bait acceptance while limiting access to non-target animals should be given serious consideration.

Cons:

- Potential for secondary poisoning of non-target animals because poisoned rats can be fed upon by predators and scavengers. Consequently, every effort should be made to recover and properly dispose of all rodent carcasses.
- Poisoning of non-target animals entering and feeding on the baits is possible.
- The most expensive technique from a material cost standpoint.

Trapping. Both live traps and snap traps can be used to manage pack rat populations. One of the most effective is the professional (expanded trigger) snap trap,

Figure 5. A rodent bait station secured on a concrete block. (Photo: Ed Evans)

but these should never be placed outside where non-target species can encounter them. One of the authors (EE) designed a low-cost reusable protective device containing two snap traps side-by-side. It consists of a large irrigation valve box (available at Home Depot or most hardware stores) that is secured to a plywood base *(see Figure 6a on next page)*. The large holes in the valve box are sealed and two smaller holes are cut in opposite sides of the box using a 1- to 2-inch hole saw (depending on the size of the target species). The traps are mounted on the plywood base with screws *(see Figure 6b on next page)*.

Pros:

- Inexpensive and reusable.
- Poisoning of non-target animals is not an issue.
- Baiting is optional (expanded trigger).
- Humane (kills quickly).

Cons:

- Poses a threat to non-target animals (unless properly housed when used outside).
- Requires daily monitoring to remove and dispose rats and to reset the traps.
- Live traps have the additional responsibility of releasing the rat at a distant location.

> The effort involved in kissing bug management may seem unduly extreme but for the individual at risk for an allergic reaction it is certainly well worth it.

Habitat Modification. Removal of conditions conducive to pack rat infestation such as readily available food and water as well as unoccupied nests will prevent additional rats from moving in. If the homeowner agrees, it is advisable that only the nearest pack rat nests and pack rats should be removed in the hope that the kissing bugs will move to more peripheral nests rather than into the home.

Kissing Bug Control. After the pack rats have been removed, a broad spectrum insecticidal dust or spray should be applied at the old nesting sites to eliminate any remaining ectoparasites. This is a critical step because in the absence of their natural host kissing bugs will search for another source of blood, which generally ends up being the homeowner (Olson 1996).

All cracks and openings into the home should be sealed as completely as possible (Lynch and Pinnas 1978), using weather stripping, caulk or silicone seal. All windows and vent openings should be properly screened, dog and cat entrances insect proofed, and unused fireplace flues kept shut (Greenberg and Klotz 2002). Lights should be moved away from door or windows where they may attract insects.

An outside perimeter treatment using a broad spectrum insecticide should be applied, paying close attention to thoroughly treat entryways such as doors and windows. In addition, an interior crack and crevice application of insecticide should be made in bedrooms and bathrooms. Spraying the home will kill bugs but does not prevent others from suddenly or eventually appearing: 1) via openings in the home such as doors or eaves; 2) possibly attracted to or on pets; 3) when new eggs hatch; 4) another season arrives; and 5) levels of pesticides fall.

During the active season of kissing bugs, homeowners should inspect their homes thoroughly for bugs both outside and inside. During the day the bugs hide in dark, sheltered places such as beneath flower pots, and emerge at night often resting on the house by the windows (Olson 1996). Inside, homeowners should thoroughly vacuum the bedroom, and before going to bed inspect it and shake out the bedding. Sticky trap monitors placed under and around beds will often catch wandering bugs. Other protective measures on beds include double-sided sticky tape placed on the legs, and mosquito netting that is tucked in all around the mattress (Greenberg and Klotz 2002).

The effort involved in kissing bug management may seem unduly extreme but for the individual at risk for an allergic reaction it is certainly well worth it.

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Figure 6. Outside view of pack rat trapping device constructed from irrigation valve box (a); inside view of device showing two expanded trigger traps (b). (Photos: Ed Evans)

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