Information for pest management professionals and pesticide applicators

UC IPM

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Bed Bug Monitors Enable Early Detection

After decades of relative obscurity, bed bugs (Figure 1) are exhibiting a global resurgence and quickly becoming ubiquitous major household nuisance pests. California has recently experienced a multitude of bed bug reports, with San Francisco now considered one of the Top 10 most infested cities in the country. Suggested factors contributing to this renewed pest status include increased global traffic and commerce, insecticide resistance, and decreases in indoor residual pesticide applications, making it more likely pest management professionals (PMPs) will be called upon to manage infestations.

Bed bug detection can be very difficult and almost always requires special training. One main reason for this difficulty is due to behavior and ecology; when not feeding on blood, bed bugs prefer to hide in dark, inaccessible areas (harborages) near their hosts. Time spent in these harborages may account for 90% of a bed bug's life, and the only times they are easily detectable are the short periods when they are on their host or moving between host and harborage.

Because many people have no visible skin reaction to bed bug feeding, infestations can go unnoticed and continue to grow in density, exacerbating management attempts. Also, bed bug infestation can't be reliably confirmed, even by a trained physician, when based solely on skin reactions such as rashes or wheals, if present. An experienced PMP can examine all possible harborages in a home, searching for the bugs themselves and signs of infestation such as the characteristic black fecal spotting and cast nymphal skins, although low-density infestations may escape detection.

Types of Monitors

Thankfully, several monitors are available that attract or intercept bed bugs during movement between harborage and host, providing PMPs with a positive identification, an indication of initial population density, and an evaluation of management tactics. Bed bug monitors are quite diverse in size, appearance, and price but generally fall within one of two categories: active monitors or passive monitors.

Active monitors employ attractants—heat, carbon dioxide, host odors (kairomones), pheromones, or a combination of these—to lure bed bugs out of their harborage areas and into a pitfall or sticky trap within the monitor. These devices have the potential, especially in the absence of a host, to detect bed bugs that would normally remain hidden. Passive monitors either exploit a bed bug's affinity for dark crevices or rely on chance encounters with pitfalls or sticky traps. Interceptor monitors are a hybrid between active and passive (pitfall) monitors in they rely on the presence of a host (a sleeping human) to attract hungry bugs and trap them on route to their meal.

Research Results

A team of UC researchers led by UC Berkeley entomologist **Vernard Lewis** recently evaluated a series of bed bug monitors, considering active and passive devices at several bed bug density levels. Known quantities of hungry adult bed bugs were released into an inescapable arena containing a monitor and several pieces of bedroom furniture, allowed to forage for 24 hours, then recorded as to position within the arena. Effective monitors should be at least as attractive as the typical harborage locations (cracks and crevices, mainly) within bedroom furniture. The five monitors evaluated (Figure 2) included two passive devices, BB Alert Passive and Bedbug Detection System; two active devices, BB Catch and NightWatch; and one interceptor device, Climbup Insect Interceptor. Since no hosts were available within these arenas, the Climbup device, a pitfall trap for use under legs of beds and other furniture, was regarded as a passive device for this study. Three bed bug density levels (10, 50, or 100) were considered within the 5.8 square meter arenas

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D.-H. Choe, UCR

Figure 1. Bed bug adults (bottom and right, darker red) and nymphs. All life stages and both sexes of bed bugs preferentially feed on human blood.

S. Moore, UCB

Figure 2. Five bed bug monitors were evaluated in recent UC research trials: two active, NightWatch and BB Catch (top row, left to right); two passive, Bedbug Detection System (bottom left) and BB Alert (bottom right); and one interceptor style, Climbup Insect Interceptor (bottom center).

WHAT'S INSIDE ...

Managing Ants with Reduced Use of Pyrethroids

During the last 20 years pyrethroid insecticides have been a standard component of ant control programs. However, pyrethroids have come under increasing regulatory scrutiny because of water quality problems that occur when residues run off into creeks or other bodies of water, where they can be highly toxic to aquatic wildlife. More recently, fipronil products have been used to manage ant infestations but are now also a concern, because they too are appearing in urban waterways.

Regulatory Changes

New regulations issued by the California Department of Pesticide Regulation (DPR) in 2012—and expected to be adopted nationwide with new label updates by the U.S. Environmental Protection Agency (EPA)—significantly limit the way pest management professionals (PMPs) can apply pyrethroids in outdoor nonagricultural settings.

Applications to impervious surfaces such as driveways, sidewalks, walls, foundations, fencing, doors, and windows have been restricted. Both horizontal and vertical impervious surfaces can now be treated using only spot treatments of less than 2 square feet, pin stream applications 1 inch or less wide (Figures 1 and 2), or crack-and-crevice applications. Perimeter band treatments to horizontal impervious surfaces, such as walkways or patios, and to windows and doors are now prohibited. (See the November 2012 issue of *Green Bulletin* at http://www.ipm.ucdavis.edu/greenbulletin/ for more details about these regulations.)

Alternatives to Pyrethroids

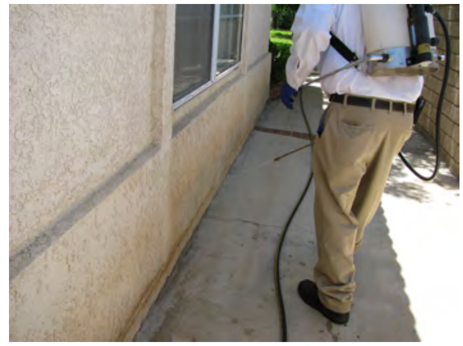
How can PMPs change their management programs to meet the new regulations yet still provide good control of ants for their customers? During the last several years, staff with the UC Riverside Urban Entomology lab have been working with PMPs to find ways to reduce pyrethroid use. Research studies conducted in 2007 through 2010 showed that fipronil sprays are very effective for ant control and can therefore be used in small amounts to reduce the use of pyrethroids. (See the July 2010 issue of *Green Bulletin* at http://www.ipm.ucdavis.edu/greenbulletin/ or Greenberg et al. 2010 in References.)

These studies also showed that applications of .06% fipronil could be reduced from 3 gallons to $^1/_2$ to $^3/_4$ gallon per perimeter by replacing the standard fan spray with a pin stream spray applied as a narrow 1-inch-wide band. Many companies now use fipronil at these rates in place of pyrethroids for their first ant treatment, thereby significantly reducing the amount of pyrethroid used.

In 2012 UC laboratory staff worked with two commercial PMP companies to evaluate ant control programs that limit the use of pyrethoid sprays. The program ran from July through October, with lab personnel providing five houses from their list of volunteer homeowners to each company and asking each company to use a low-impact or IPM approach to manage ants at these houses. Lab personnel then measured the efficacy of the treatments and collected water runoff samples for insecticide analysis. Both companies used an initial pin stream application of .06% fipronil in July (.5-.75 gal).

The first company used a monthly schedule through October for their five houses. For the first treatment they supplemented the fipronil with spot treatments of a pyrethroid where ants were seen in large numbers. For the next three monthly visits this company used only botanical treatments where ants were seen. There were two complaints about ants indoors—one in August and the other in October. The company provided liquid baits to the homeowner for indoor use. There were no other callbacks to the company during the four-month evaluation period.

The second company put their houses on a bimonthly schedule. Their initial fipronil treatment was supplemented with an application of pyrethroid granules. UC's previous study had shown that runoff was minimal from the granules when the product was carefully applied under bushes and trees and away from hard surfaces. There was one callback due to ant resurgence in August. At that time the company used spot treatments and crack-and-crevice applications of a pyrethroid to provide control. For the second visit to all houses in September, granular, spot treatment, and crack-and-crevice pyrethroid applications were all used. These pyrethroid treatments were low in volume and bimonthly in most cases, representing a substantial reduction as compared to standard methods that have used much higher application rates.



L. Greenberg, UCR

Figure 1. Pin stream spray application of fipronil.

L. Greenberg, UCR

Figure 2. Liquid residue after a pin stream spray application.

Preliminary analysis indicates that homeowners were satisfied with the level of ant control from both of these alternative regimes. Results also suggest that it may be possible to limit the use of fipronil to once a year during the peak ant season due to its greater residual effect when compared to pyrethroids. UC researchers expect further reductions in the use of pyrethroids and fipronil to occur as new technologies and products become available to PMPs. More effective botanicals may be developed, and there may be a potential for greater use of bait station dispensers, especially if more effective liquid ant baits such as thiamethoxam become available. These could help control ants near the driveway and sidewalks where spray insecticides can't be used due to runoff issues.

References

Greenberg, L., Rust, M. K., Klotz, J. H., Haver, D., Kabashima, J. N, Bondarenko, S., and Gan, J. 2010. Impact of ant control technologies on insecticide runoff and efficacy. *Pest Mngmnt. Sci.*, 66:980–987.

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Brown Widows Get Foothold in SoCal

During the last 10 years, a new widow spider has moved into parts of Southern California. The brown widow spider, *Latrodectus geometricus*, is closely related to the well-known black widow spider, *L. hesperus*, (Figure 1) that occurs throughout much of California.

A recent survey of widow spiders in Southern California led by retired UC Riverside entomologist **Richard Vetter** revealed new information about the distribution of brown widows. Currently brown widow spiders are known to be common in Los Angeles, Orange, San Diego, Riverside and San Bernardino counties. They have also been reported in Ventura and Santa Barbara counties, and experts believe they may eventually move up the coast of California and also into the Central Valley.

Vetter's group also found that, like the black widow, brown widows are outdoor spiders rarely found inside homes. They also found brown widows tend to inhabit more exposed outdoor habitats such as under eaves or window ledges, garden furniture with solid—not mesh—tops, or recessed handles of plastic trash bins. Black widows, in contrast, prefer more protected habitats such as in garages or sheds, under debris or woodpiles, or in a protected hole in an outer wall. Unlike black widows, brown widows weren't found in natural dry habitats or agricultural areas; they prefer urban environments and structures.

Researchers report anecdotal evidence brown widows may be displacing the black widow spider in some urban habitats. This is probably good news for residents, because, despite the growing numbers of brown widow spiders, their bites are infrequently reported compared to black widow bites and rarely cause severe symptoms in humans; there is only one verified case of a brown widow bite in Southern California, and reported symptoms were mild.

J. K. Clark, UC

Figure 1. Mature adult female black widow spider showing hourglass. The brown widow adult female has a fainter hourglass as well.

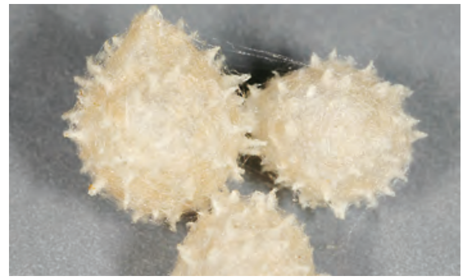
R. S. Vetter, UCR

Figure 2. A mature adult female brown widow spider showing mottling.

J. K. Clark, UC

Figure 3. Immature female black widow spider.

Brown widow spiders are mottled brown in all stages (Figure 2) and resemble immature black widows (Figure 3), so some skill is required to distinguish the two species. The easiest way to identify an infestation of brown widows is to find the egg sacs, which have pointy protuberances (Figure 4) in contrast to the more round black widow egg sac (Figure 5).



R. S. Vetter, UCR

Figure 4. The distinctive egg sacs of brown widow spiders with pointy protuberances.

J. K. Clark, UC

Figure 5. Black widow egg sacs are smooth. Newly hatched spiderlings surround this sac.

For more about identifying brown widows, visit the UC Riverside Center for Invasive Species Research (CISR) Web site, http://cisr.ucr.edu/identifying_brown_widow_spiders.html. For more about widow spiders and managing them, visit the CISR Web site or see *Pest Notes: Black Widow and Other Widow Spider* at http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74149.html. Details of the survey are reported in *J. Med. Entomol.* 49(4):947–951.

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Bed Bug Monitors

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to determine whether monitor performance may change with differing population levels.

The primary finding was none of the tested monitors harbored more bed bugs after 24 hours of foraging than did the furniture, verifying the value of monitors as detection devices, since they are much easier to inspect than cracks and crevices in furniture. Also, at all densities these monitors recovered at least 5% of the released bed bugs. A trend in the data suggests active monitors may be somewhat more reflective of bed bug density, because they recovered a stable proportion of the released bugs regardless of the total number released, while passive monitors recovered a smaller proportion of the total as the total number released increased; however, passive monitors still always captured bed bugs. Active monitors may contain components needing regular replacement and usually cost more than passive monitors. Overall these data suggest passive monitors may be just as effective at detection as active monitors, and all monitors tested may be able to detect bed bugs at low densities. The five tested monitors represent only a fraction of those available, and new devices, especially active monitors utilizing new technology, have come onto the market since this study. For the full report, visit the Structural Pest Control Board Web site, http://www.pestboard.ca.gov/howdoi/research/monitors_bedbug.pdf.

—Andrew Sutherland, UC Statewide IPM Program, San Francisco Bay Area, asutherl@ucanr.edu

Designing Pest-proof Structures

One of the best ways to reduce pest problems in and around buildings is to construct or retrofit structures that keep pests out in the first place. This concept has been a pillar of integrated pest management for many years. Pest-resistant buildings reduce not only pest problems but also the need for pesticide applications. Unfortunately, architects and builders had few guidelines about how to design and construct such structures. However, a new online publication, *Pest Prevention by Design*, released by the San Francisco Department of the Environment and the International Code Council, provides the first comprehensive resource on pest-preventive building design tactics.

Specific guidelines are arranged by building part (e.g., foundation, slab, exterior siding or lighting, roof, landscape, interior walls, floors, doors, windows, bedrooms, bathrooms, kitchens, utilities, HVAC, chutes, refuse, and recycling). For instance, when specifying outdoor lighting, the guidelines provide details about eight factors to consider:

1. Bird-resistant light fixtures
2. Bird deterrents on light fixtures
3. Bird exclusion devices
4. Motion detectors on exterior lights
5. Timers on exterior lights
6. Reflected light rather than direct light
7. Direct exterior lighting only for essential areas
8. Yellow (sodium) exterior lights

All pest preventive design elements are based on minimizing entry of pests into buildings, making pest inspections easier, and eliminating or minimizing the food, water, and harborage vertebrate and invertebrate pests require for survival. These basic principles, which should be followed throughout all areas of building construction, include:

1. Understanding local pest pressure
2. Analyzing the physical context for each building situation
3. Designing for the necessary pest tolerance level
4. Using durable, pest-resistant materials
5. Designing for easy inspection
6. Minimizing moisture
7. Sealing off openings
8. Eliminating potential harborage sites
9. Engineering slabs and foundations to minimize pest entry
10. Designing buildings to be unattractive to pests

The guidelines were assembled as a database that can be updated over time but currently are distributed as a stand-alone document. The San Francisco Department of the Environment led the project, funded through a grant from the U.S. Centers for Disease Control and Prevention. The department assembled an advisory committee of experts from across the United States with expertise in pest control, architecture, engineering, green building, IPM, and public policy who searched literature, professional manuals and publications, and Web sites for information. All content went through a peer review process. The department plans to pilot test the guidelines in San Francisco housing developments and incorporate the guides into green building checklists such as Leadership in Energy and Environmental Design (LEED).

To download a free copy, visit the Department of the Environment's Web site, http://www.sfenvironment.org/download/pest-prevention-by-design-guidelines.

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New Resources

UC IPM has released two new titles in its Pest Notes series of publications about home, garden, and landscape pests: *Goldspotted Oak Borer*, http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74163.html, and *Poison Hemlock*, http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74162.html. To access more than 150 other titles, visit http://www.ipm.ucdavis.edu/PDF/PESTNOTES/index.html.

Ask the Expert!

Q **I've noticed fipronil takes a little longer to kill ants than bifenthrin. Why is that and doesn't that mean it is less effective?**

A Pyrethroids such as bifenthrin kill ants quickly on contact; however, only ants that come in direct contact with the sprayed area are killed. On the other hand, fipronil is slow acting, which allows ants to pick up the insecticide and spread it from one ant to another by physical contact before dying. In this way, fipronil spreads through the colony and can kill more ants over a longer period of time. As a result, lower rates and fewer fipronil applications are necessary to keep ants under control.

Q **How do bed bug monitors compare to canine detection services?**

A Trained and certified canine teams can be more effective than monitors at detecting bed bugs, especially in low density infestations and when dealing with large-scale inspection jobs. Canine detection accuracy, however, has been shown to be highly variable, so third party certification and ongoing training of any canine team should be maintained and ensured, and any alert should be confirmed with a detailed manual and visual inspection. Additional considerations when choosing between monitors and canines include cost, immediacy, and physical access.

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