DIVISION OF AGRICULTURE
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Pest Management News

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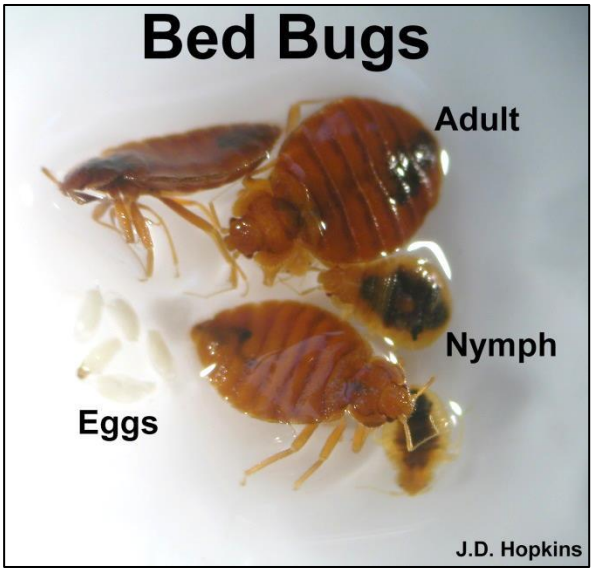
Bed Bug Movement and Control??? with "Green" Products

John D. Hopkins

Recent "mark-release-recapture" studies conducted in affordable housing communities in three New Jersey cities revealed that there was extensive movement of bed bugs within and between apartments indicating that bed bugs can travel much further through apartment buildings than was previously thought. The study was published online: Cooper R, Wang C, and Singh N (2015) Mark-Release-Recapture Reveals Extensive Movement of Bed Bugs (*Cimex lectularius* L.) within and between Apartments. PLoS ONE 10(9): e0136462. doi:10.1371/journal.pone.0136462 and may be accessed by clicking on the following link:

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0136462



Selecting an appropriate bed bug control strategy is essential to containing and ultimately eliminating an infestation. Many are interested in using "green" products that are advertised as being effective in controlling bedbugs. If you are going to rely on a "green" product, make sure the product has been University tested and has proven efficacy against bed bugs. A recent study by Narinderpal Singh, Changlu Wang, and Richard Cooper, published in the Journal of Economic Entomology investigated the potential of essential oil-based pesticides and detergents for bed bug control. See link below:

http://entomology.rutgers.edu/personnel/changlu-wang/pdfs/Singh2014Essentialoilsbedbugcontrol.pdf

In this study, nine essential oil-based products and two detergents were compared to two conventional insecticides Temprid SC (imidacloprid plus beta-cyfluthrin) and Demand CS (lambda-cyhalothrin). All but two of the "green" materials tested killed a very low percentage of the bed bugs. Two of nine materials tested (EcoRaider/1% geraniol, 1% cedar extract, and 2% sodium lauryl sulfate and Bed Bug Patrol/0.003% clove oil, 1% peppermint oil, and 1.3% sodium lauryl sulfate) controlled over 90% by contact. However, the efficacy of EcoRaider and Bed Bug Patrol was significantly lower than that of the two conventional insecticides in choice exposure residual bioassay. One thing to keep

in mind when assessing product efficacy in this research project is that bed bugs had forced exposure to the products under laboratory conditions. There was nothing that would block bedbug contact, such as clutter, that would be encountered in the real world. Also in a real world situation, bed bugs harbor in cracks and crevices and other hard to reach places where they may be protected from contact with sprayed products. Also, the two “green” materials that exhibited direct contact efficacy against bed bugs did not exhibit detectable repellency against bed bugs in the presence of a carbon dioxide source. It is the presence of exhaled CO_2 that bed bugs key in on when locating a human on which to feed.

When it is all said and done, there is no “magic solution” to controlling bed bugs. The best way to achieve acceptable results is through an integrated bed bug control program. This type of program involves bed bug monitoring, sealing crawlways and harborages, mechanical controls, sanitation and cultural controls, in addition to the use of effective insecticides, which may include research proven “green” materials.

Preventing Unwanted Pests from Invading Your Home

John D. Hopkins

When the weather begins to change in the fall and things get cooler, arthropod pests like the multi-colored Asian lady beetle, the boxelder bug, crickets, various stinkbugs, or spiders are just some of the pest problems that homeowners may have to deal with. The first thing most people think of when trying to prevent a pest problem is WHAT INSECTICIDE DO I SPRAY? However, there are other measures that should be taken that will help prevent these pests from entering your home and may even eliminate the need for an insecticide application. Pest proofing your home is the **BEST** way to prevent unwanted invaders at this time **or any other time of year**. Your goal is to prevent pest entry and eliminate conditions that are conducive to pest infestation. Here are the ABC’s of pest proofing your home:

A. Ensure that screens on doors and windows are properly installed and maintained. If you don't have screen doors on your home, install them. Any damaged screens should be repaired or replaced. Fine mesh screening will prevent all but the tiniest insects from entering your home.

B. Doors should seal properly. If air can pass through or light can be seen through cracks around doors then insects or spiders can get in. Install tight-fitting thresholds and door sweeps to the bottoms of exterior doors and use door seals to fill the gap around the sides and top of each door.

C. Cracks in the foundation, exterior walls, and fascia boards should be repaired. Arthropod invaders use these cracks in to gain entrance to your home. Carefully inspect the exterior of your home and use your favorite caulk or silicone sealant to fill any cracks that are found.

D. Gaps around utility lines entering the home and gaps around appliance vents should be eliminated. Just like cracks in the foundation, any gaps around dryer vents, gas lines, telephone lines, etc. should be filled. If gaps are too large for caulk, spray foam products may be helpful. Also, if holes are required for ventilation (weep holes in brick veneer) copper gauze may be used to block pest entry while still allowing for air flow. Steel wool is not recommended if conditions for rust exist.

E. Varmint-proof wire or metal mesh should be installed on attic vents and crawl space vents. Rats, mice, bats, skunks, raccoons, squirrels, birds and a myriad of other creatures may make themselves at home in attics or crawl spaces if you don't install barriers to keep them out. These animals may carry fleas, mites, or create conditions favorable for other pests that may then infest your home.

F. Moisture sources should be eliminated by fixing any leaks. Most insect pests require a certain amount of humidity to survive and any source of moisture can be attractive to them. Promptly repair all plumbing leaks and remember, even condensation on pipes can drip and create conducive conditions for infestation. Make use of dehumidifiers if necessary. Basements or crawl spaces that flood during heavy rains should be equipped with a proper ventilation and drainage system.

G. Sanitation is extremely important so keep the kitchen clean. Where food and water is readily available, certain types of pests will make themselves at home. Make every effort to keep your kitchen clean. Wipe, sweep, and vacuum surfaces as required, and clean up spills immediately. Don't leave dirty dishes in the sink overnight. Toasters and microwave ovens should be cleaned out regularly and be sure to scrub down your stovetop daily. Properly dispose of food scraps and packaging.

H. Sealable containers should be used for food storage. Sealed storage containers not only prevent pest entry, but also prevent cross contamination of other food stuffs if the original product happened to be already infested. Items like cereals, grains, dry beans, rice, and other pantry items should be disposed of immediately upon first sign of infestation. Non-perishable items should be stored in air tight containers while perishables should be stored under refrigeration or frozen.

I. Eliminate clutter. Cluttered home environments provide easily accessible sites for pests to hide and harbor. Dirty laundry should be kept in clothes hampers and laundered promptly. Floors should be kept clear of belongings and items should be properly put away when no longer in use (preferably in sealable plastic storage containers. Recyclable items should be rinsed and recycled promptly. Beverage cans and bottles, milk jugs, pet food cans, etc. will all attract insects if they are not rinsed out thoroughly.

J. Clean up after your pets. Some pests like dry pet food so store your pet's food in an air tight container. Do not leave extra pet food exposed and accessible except at feeding time and clean your pet's food dishes regularly. Other pests like flies are attracted to pet waste so clean your cat's litter box daily. Also, wash pet bedding on a regular basis.

K. Frequent removal of household garbage is a necessity. Even before you can smell it, it is attractive to pests so remove household garbage often. Line waste bins with plastic garbage bags and secure the bags tightly before taking them to outdoor garbage containers. Outdoor containers should not be located near entryways and regular scheduled pick up and removal should be arranged.

L. Clean trash bins as needed. Sometimes plastic liners or garbage bags tear and spills occur inside garbage cans. At least several times a year, clean the inside of garbage containers with soap and water or a mild bleach solution to eliminate smells and sticky substances that may attract pests. As before, outdoor garbage containers should not be kept close to the house.

M. Do not allow trees and shrubs to contact the house. Trees and shrubs in contact with the roof or outside walls of your home can serve as a bridge to allow pests to gain access to your home. Keep shrubs and tree branches pruned away from the home.

If the above listed maintenance and sanitation guidelines are carried out, pests will be discouraged or prevented from invading in the first place.

However, if nuisance pests do get inside:

In large numbers,

1. They can be vacuumed up and the vacuum bag can be discarded outside.
2. Line vacuum hose with a stocking and insects will be conveniently bagged.
3. NO INSECTICIDE RECOMMENDED! If an insecticide is used, many insects will die in inaccessible places making clean up impossible and these dead insects will serve as a food source for other pest insects like dermestid beetles.

In low numbers or individually

1. Pests can be swept up and removed, or
2. Treated with an over the counter aerosol insecticide and removed.
3. Over the counter residual insecticides labeled for crack & crevice and/or surface treatment may also provide relief (Low numbers only)

The use of residual insecticides labeled for perimeter application can also help provide a barrier to prevent insect pest/spider entry.

Finally, pest proofing or preventing nuisance pests from gaining entry in the first place is the **BEST** strategy for stopping problem pests from invading your home whether it is in the fall or any other time of year.

EPA Launches New Pesticides Website

John D. Hopkins

EPA's Pesticides website has a new look, feel, and address. Many of EPA's stakeholders have noticed the agency's gradual move to new versions of its content as part of the larger EPA effort to build a more user-friendly website. EPA reports that with the new pesticides website, information should now be easier than ever to access, regardless of the type of electronic device they use, including tablets and smartphones.

With the transition to the new site completed, web page addresses will be different. This may cause links and bookmarks to break and EPA is working to fix any broken links on their website. The majority of the old pesticide pages will redirect to the new web areas, but EPA encourages users to update their bookmarks. EPA's new "Page Not Found" notification will help users find what they are looking for by providing suggested search terms, links to the A-Z index, and other helpful links.

If users have trouble locating information, try using the search feature available on every EPA web page and in the archive (archive.epa.gov).

Connect to the EPA's new pesticides website by clicking on the following link:

http://www2.epa.gov/pesticides

Fall Treatment for Horse Bot Flies

Kelly M. Loftin

Over the last few weeks we have noticed an increase in bot eggs on our horses. This serves as a good reminder that time for treatment of this serious pest is approaching. Although the adults are free living and do no direct harm to horses, their immature stages (larvae) can cause damage to the stomach lining as well as colic.

Figure 1. Adult horse bot fly, *Gasterophilus intestinalis* (DeGeer). *(Kelly M. Loftin)*

Horse Bot Flies (Family Gasterophilidae). Horse bot flies are in the family Gasterophilidae. The larval forms are important internal parasites of equines. The three species considered important in the U.S. are: *Gasterophilus intestinalis* (DeGeer), the horse bot fly; *Gasterophilus nasalis* (L.), the throat bot; and *Gasterophilus haemorrhoidalis* (L.), the nose bot. Adults resemble bees in that they are about the same size and hairy-bodied (Figure 1). Adult bot flies are short-lived, possess non-functional mouthparts thus do not feed. Adult activity begins in warm weather and ceases at the first frost.

Adult female bot flies attach eggs to the hairs of the host's body similar to lice (Figure 2). The site of egg attachment is specific to the bot fly species. Horse bot flies attach eggs on the forelegs between the knee and hock; throat bot flies attach eggs under the jaw; and the nose bot flies attach eggs to the upper lip. Horse and throat bot fly eggs are stalkless; and nose bot fly eggs are stalked. For the horse bot fly, egg hatching is stimulated by moisture and friction from the animal's licking. Larvae gain access to the host's mouth by this licking, and burrow into the tongue or gums. They remain there for about a month then pass to the stomach attaching to its mucous membrane where they remain for about 9 months (Figure 3). In the spring larvae (Figure 4) detach from the stomach and are passed with feces and pupate (Figure 5) outside their host. Adults emerge from pupae in about a month to 6 weeks. Horse bot flies may cause significant damage to the stomach lining and possibly stomach rupture or colic if the passageway between the stomach and small intestine becomes blocked. The life cycle of the throat and nose bot flies are similar to the horse bot fly, except mature nose bot fly larvae attach to the rectum near the anus; and the mature throat bot fly larvae attach in the duodenum (first section of small intestine) near the pylorus.

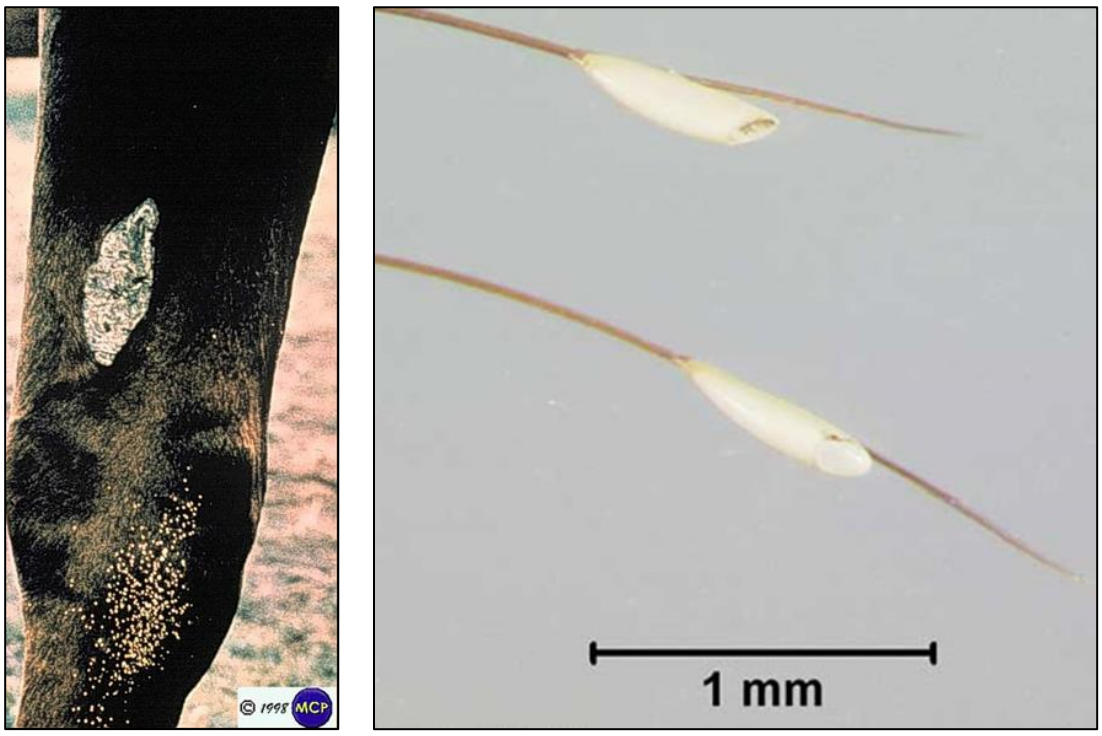


Figure 2 a. & b. Eggs of the bot fly, *Gasterophilus intestinalis* (DeGeer), deposited on the hairs of a horse's foreleg. (*a. Marcelo de Campos Pereira, http://www.icb.usp.br/~marcelcp/* b. University of Florida)

Chemical control of bot flies is aimed at the parasitic stage within the horse. Avermectin formulations containing products such as ivermectin or moxidectin are available for bot fly control in equines. These products are relatively easy to use, effective and fall treatments should be administered after fly activity ceases (generally after the second killing frost). The "Insecticide Recommendations for Arkansas - 2015"(MP 144 http://www.uaex.edu/Other_Areas/publications/PDF/MP144/MP-144.asp) provides a listing of products available for controlling bots in equines. "Arthropods Pests of Equines" (MP 484 http://www.uaex.edu/Other_Areas/publications/PDF/MP484.pdf) provides biology and control information on major arthropod pests of equines including horse bots. "Livestock Health Series: Internal Parasites of the Horse" (FSA 3096 http://www.uaex.edu/Other_Areas/publications/PDF/FSA-3096.pdf) is available for more information on other internal parasites of equines including bots.

Non-chemical bot fly control is aimed at the eggs. Equine owners can frequently sponge the horse with warm water or to stimulate hatching of bot fly eggs. New hatched bot fly larvae quickly die especially if done on a cool day. For the horse bot fly, concentrate efforts on the animal's legs between the hock and knee. Also, applying insecticidal washes to egg laying sites can reduce the number of larvae ingested by the animal. Bot combs or pumice bot stones can also be used to scrape away the eggs. These remedies should reduce the number of bot fly larvae ingested by the animal, but will not control any larvae that were unaffected and ingested. Because of the seriousness of bot fly infestations, treatment with a boticide to control the parasitic stages is recommended.

Figure 3. Bot fly larvae, *Gasterophilus nasalis* (L.), attached to the pyloric region of horse stomachs. *(Marcelo de Campos Pereira, http://www.icb.usp.br/~marcelcp/)*

Figure 4. Bot fly larva, *Gasterophilus intestinalis* (DeGeer). *(Marcelo de Campos Pereira, http://www.icb.usp.br/~marcelcp/)*

Figure 5. Pupa of bot fly, *Gasterophilus nasalis* (L.) *(Marcelo de Campos Pereira, http://www.icb.usp.br/~marcelcp/)*

Very rarely, horse bots fly can cause ocular myiasis in humans. Ocular myiasis is an invasion of the eye by first stage larvae. These cases are rare and can occur in individuals handling horses that have bot fly eggs on their hair. On these rare occasions, bot fly larvae will enter the eye possibly as a result of rubbing their eyes. In other rare instances, hatched larvae enter the human skin causing cutaneous myiasis which can result in visible, inflamed tracks, irritation and itching from the larva's burrowing. People working with horses during bot fly season should not rub eyes after combing or washing animals and thoroughly wash their hands.

Mysterious Holes in the Lawn

Becky McPeake

As many Master Gardeners know, the penalty for maintaining a well-watered and fertilized lawn is battling wildlife. Recent drought conditions may be linked to higher-than-normal outbreaks of mysterious holes appearing in lawns. Limited water and food resources could cause an animal to abandon its normal home range and invade a neighboring animal's territory. Lawns with ample water, soft soils for digging, and an abundance of roots, tubers, and soil invertebrates are an attractive oasis for many of these desperate critters.

Vole photo by Joe Kosack, Pennsylvania Game Commission.

The first step when responding to such problems is identifying the culprit, which can be many and varied. Some of the more common invaders digging holes are underground insects, voles, moles, gophers, chipmunks, tree squirrels, armadillos, skunks, and raccoons.

Chipmunk photo by Jacob Dingel, Pennsylvania Game Commission.

Oftentimes the first clue is the size of the hole, which corresponds to the size of the culprit. Another clue is whether the entry has scattered dirt or is clear of dirt. Whether holes are dug day or night may help narrow the focus. Following are descriptions of holes and possible invaders.

- Small dime-size holes could be made by insects such as burrowing wasps, yellow jackets, or cicadas which emerge when the weather becomes hot. During peak cicada years, these holes can be quite numerous.
- Multiple holes of 1 inch to 1 3/8 inch without surrounding dirt indicate a mouse-sized critter. If surface trails of 1 to 2 inches are visible in the grass, the culprit is probably a vole, also called field mouse.
- Holes of 1 ½ to 2 inches in diameter with no scattered dirt at the opening could indicate chipmunks. They eat

seeds and nuts so typically plant damage isn't a problem. (Occasionally they are reported to consume bulbs.) Their extensive tunneling can be of concern near foundations and decks. Chipmunks are active and visible during daylight hours.

- Subsurface tunneling with mounding activity can be pocket gophers or moles. A fresh gopher mound typically is a crescent-shaped and a mole hills is volcano-shaped. Surface holes are 1 to 1 3/8 inch in diameter and plugged with dirt. Both gophers and moles create subsurface tunnels which can kill grass when roots become separated from soil. Pocket gophers consume roots and plant material while moles seek primarily grubs and earthworms for their meals.

- Other daytime rodents are gray and fox squirrels. Squirrels dig numerous quarter-sized test holes for burying their winter store of nuts. They also leave holes when they move or consume their cache of nuts.

If digging activities are occurring at night, it could be armadillos, skunks, or raccoons. These mammals are searching for soil invertebrates such as grubs or earthworms.

- Armadillos dig small holes in lawns from 1 to 3 inches deep and 3 to 5 inches wide. They live in burrows of 7 to 8 inches in diameter in brushy areas with substantial throw dirt, though the throw dirt may become less evident with use. Tracks and trails should be visible.

- Skunks dig small cone-shaped holes typically 1 to 3 inches deep. They reuse burrows abandoned by woodchucks, armadillos, or foxes found under outbuildings, wood piles, home foundations, or porches.

- Raccoons may dig holes in lawns and roll up new sod during periods of dry weather when other food sources are less available. Sod may be neatly pulled back or rolled up to expose soil underneath. Holes may also appear as if plowed.

- Soil rooted up by feral hogs also appears as if plowed, though typically damage is more extensive and holes deeper than when dug by raccoons. Raccoons are more likely to inhabit yards in residential areas, though feral hogs are known to tear up yards in rural locations.

Determining what causes holes in your yard is like solving a mystery. Consider placing a trail/game camera at the site where damage is occurring. Make a muddy patch or scatter flour on bare ground to detect tracks. Look online for free animal track guides if you should find some tracks to identify. Once the animal is identified, visit "Dealing with Wildlife" (http://www.uaex.edu/environment-nature/wildlife/dealing-with-wildlife/) for ways to address these problems.

Name That Weed

Bob Scott

This month's weed is a serious problem in wheat and overgrazed pastures. In pastures it can cause blisters on the noses of grazing cattle and give milk a sour taste. In Arkansas wheat, a biotype of this member of the sunflower family is resistant to ALS chemistry like Finesse making control a problem. This population is most severe in Monroe County around the Brinkley area but is growing.

Be the first to send me, Bob Scott, one of its two most commonly used common names at bscott@uaex.edu and win a prize.

To The Readers

Please offer any suggestions for Urban or Livestock Integrated Pest Management topics (insect pests, plant diseases, weed problems, wildlife control problems) that you would like to see – *OR* – feel free to submit an article that you have prepared. Kelly and I will be glad to include it (subject to editing). Send feedback to jhopkins@uaex.edu or kloftin@uaex.edu

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