Managing Bed Bugs: A Reemerging Pest in Poultry Production

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Bed bugs (*Cimex sp.*) are a reemerging pest in poultry breeder houses. Although the first record of bed bugs in poultry barns in the U.S. dates back to the early 1930s (Kulash, 1947), lately an ever increasing number of insect complaints from breeders involve bed begs. Growers typically complain of a mite-like creature on birds, equipment, support posts, nest boxes, and egg belts, and brownish red spots on eggs from bed bug excrement. Bed bugs can cause irritating white welts on the skin of chickens and large infestations may lead to excessive feather loss, cloacal irritation, lesions on the breasts and legs, and possibly anemia in severe cases (Mitchell, 2015, & Tomberlin and Drees, 2007).

Growers become unnerved, to say the least, when an entomologist informs them that they have bed bugs. It creates discontent among hired labor. Infested barns act as a source for bed bug movement to workers' homes, hitchhiking on clothing, boxes or bags. The integrator becomes concerned about spreading bed bugs across the entire complex on equipment, as well as the potential as a stress point for flock production.

The bed bugs common name can actually refer to 90 species in 21 genera collectively known as either bed bugs or bat bugs, depending on their primary host (humans, bats, or birds). However, when most people say "bed bugs," they are referring specifically to *Cimex lectualrius*. In poultry, *C. lectularius, C. pilosellus, Oeciacus vicarious*, and *Haemotosiphon inodora* have all been identified from poultry houses in the literature (Tabler et al., 2018). Nonetheless, management practices will likely not change whether we are dealing with *C. lectularius* or *C. pilosellus*. Herein we will be covering the biology, behavior and management of *C. lectularius*, the most common species implicated in breeder house infestations.

Bed bug biology

Bed bugs are nocturnal, hematophagus, ectoparasites of birds and mammals; that is, they feed on blood, mostly at night, and rarely make an appearance out of cracks and crevices during the day. Fortunately, bed bugs are not competent vectors of any known human or bird disease (Basnet and Kamble, 2019). In fact, bed bugs are the only hematophagus insects not known to vector disease, which makes them the focus of genomic studies to determine if there are any clues on how to render other species ineffective at disease transmission (Basnet and Kamble, 2019).

Bed bug eggs are laid either singly or in clusters in crevices protecting them from insect predators. After two weeks, eggs hatch into mite-sized, translucent nymphs that undergo five molts before reaching the adult stage. Each nymphal instar lasts about one week; bed bug nymphs and adults take about 15 minutes to ingest a blood meal before retreating back into hiding for another 3–7 days (Mitchell, 2015). Adult bed bugs are brown, oval, wingless, about the size of an apple seed, and flattened. After feeding, they become engorged, similar to a tick, and blood can be seen through the cuticle making them redder in appearance. The entire life cycle can take only 4–5 weeks at 82–86° F and 75–80 percent humidity (Polanco et al., 2011), which makes a poultry barn like a bed bug incubator. Adult bed bugs can live for three months without a blood meal, but can find alternative hosts (rodents, humans, barn swallows) even when birds are removed. For this reason, a stringent rodent and bird abatement program is necessary to reduce alternative resources for bed bugs. Bedbugs do not travel far from their last blood meal, making nest boxes, roosts, slats, curtains and support posts ideal hiding places while the parasites are resting between feedings.

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Controlling infestations

Scouting for and prevention of bed bug colonization may be the best tool for combating infestations. Workers should be trained in bed bug identification. There should be regular inspections of clothing and other items that move between barns and homes. Any workers who find bed bugs in their home should consider hiring a pest management professional for effective treatment. Clear Zone® Double Impact is an aerosol formulation that can be sprayed directly on mattress and furniture seams, bed frames, baseboards, curtains, shelves and picture frames. This product can also be used inside of depopulated poultry barns for fly control. Ortho® Bed Bug Traps can be placed in nest boxes and in workers homes to scout for bed bugs. Early detection will increase the efficacy of any bed bug management program since smaller populations of insects are easier to mitigate than large populations.

Insecticide resistance in urban bed bug populations has been documented for many neurotoxin classes including chlorinated hydrocarbons (DDT), neonicotinoids, organophosphates, and pyrethroids (Mitchell, 2015, & Basnet and Kamble, 2019). Insecticide resistance in poultry barns will vary between populations and depend on their repeated exposure to a certain insecticide class.

Combining neurotoxins with insect growth regulators (IGRs) to manage bed bugs is a common practice in professional pest control. In animal production, we have access to only four neurotoxin classes (pyrethroids, neonicotinoids, organophosphates, and spinosyns) and two insect growth regulator classes (juvenile hormone analogs and chitin synthesis inhibitors). The neurotoxin classes each work on a different segment of the insect nervous system, whereas the insect growth regulators manipulate hormones specific to insects that keep immature insects form molting into the adult (reproductive) stage.

Thoroughness is the name of the game when it comes to bed bug control. The only time that you can truly be thorough in a poultry barn is when birds are removed. During depopulation, the applicator will have the ability to apply insecticides that cannot be sprayed on or over birds. After any necessary cleaning and disinfection of the barn is allowed to dry, a product from the neurotoxin class should be chosen and tank mixed with one of the insect growth regulators **[see Tables 1 and 3]**. If a pyrethroid is chosen, adding the synergist piperonyl butoxide (PBO) (Exponent® or SynerPro™ PBO) is highly recommended in order to prevent metabolic resistant bed bugs from detoxifying these active ingredients. This surface spray mix should be applied at the highest label rate and 1 gallon of solution should cover 1,000 ft^2. The idea is to cover every possible inch of the barn with a surface spray. In particular, nest boxes (in, around and underneath), roosts, slats, curtains, and support posts are critical areas to treat for successful bed bug management. However, do not neglect ceilings, walls, floors, egg collection rooms, cooler and cool cell "doghouses," and any other surfaces in the barn, making every effort to treat all cracks and crevices. With birds in the barn, you will be limited to a handful of products to choose from **[Table 2]**. Furthermore, it will become exponentially more difficult to be as thorough as necessary for satisfactory results.

Surface sprays should be followed up with a fog or mist of natural pyrethrins **[see Table 4]**. Natural py is highly irritating to insects and causes hyper excitation. The idea is to penetrate cracks and crevices and make the bed bugs move through freshly applied surface sprays. A fog or mist can be generated using cold foggers or backpack mist blowers. Thermal foggers that use a flame are not recommended due to the loss of some active ingredient when the device heats up the oil solvent to produce a visible vapor or smoke. Many natural py products can be applied with birds in the house. Direct the nozzle of the fogger or mist blower upward at a 45° angle and sweep back and forth as you walk backward through the barn. This is so that the fog or mist can distribute throughout the entire space of the barn rather than trying to direct the application sideways or down.

> Early detection of bed bugs will provide you with the greatest possibility of bed bug eradication.

Next, apply Beetle Shield® 6 in 2' x 2' scratch boxes dispersed throughout the scratch area at 1 lb/100 birds. As birds instinctively use these boxes to dust themselves, they will reapply an application of organophosphate.

Application to the exterior surface of the barn will enhance all bed bug and insect management programs by preventing migrating insects from entering the barn. Bed bugs can utilize other bird species nesting under the eaves of the roof and rodents as hosts, which makes the foundation and eaves of the barn an often overlooked entry point for these persistent pests. Exterior applications also allow the use of insecticides not labeled for the interior of poultry barns, giving access to chemical classes that bed bugs may have not previously been subjected. Labels usually allow for insecticides to be applied to the exterior foundation anywhere from 1–3' up and 1–10' out and 18" around any openings into the barn, such as doors, vents, fans, pipes, electrical equipment and the eaves of the roof. Exterior applications should be made at least twice per year. It is recommended that the first application occur in the Spring when insect populations begin to increase and the second application mid-Summer when populations reach their maximum density.

Alternative treatments for bed bugs include extreme heat and cold treatments. Heating individual bed bugs and their eggs to 118°F for 90 minutes will result in 100 percent mortality (Basnet and Kamble, 2019). Steam treatments have also shown to be deadly to all bed bug life stages (Puckett et al., 2012). However, the logistics of heating every crack and crevice to 118°F in a poultry barn is challenging to say the least. Cold treatments are at least equally impractical. While adults and nymphs can be killed if temperatures are as low as 10°F for one week, eggs require a temperature of at most -24°F for 1 week to die.

In summary

Bed bugs have been reported in poultry breeder houses for almost a century. For years they were thought to be at least close to eradication due to the use of DDT. Perhaps due to resistance to multiple insecticide classes and the increase in human population and commerce, bed bugs have made a comeback both in domestic housing and in poultry barns. In order for a management strategy to be effective, a chemical class has to be selected for a population based on exposure history or, rather, the lack of exposure. An insect growth regulator will also prevent bed bug nymphs from becoming reproductive. Remember to be thorough when spraying for bed bugs, and that clean outs are the best time for success. Early detection of bed bugs will provide you with the greatest possibility of bed bug eradication.

References

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Table 1.

SURFACE SPRAY PRODUCTS WITH BIRDS REMOVED

MFR.	PRODUCT	ACTIVE INGREDIENT	INSECTICIDE CLASS	RATE
BASF	Alpine® WSG	Dinotefuran (40.0%)	Neonicotinoid	30 g/gal; 1 gal of solution/1000 ft²
	Durashield® CS	Chlorpyrifos (20.0%)	Organophosphate	5 oz/gal; 1 gal of solution/1000 ft²
	Optashield® CS	Cyfluthrin (6.0%)	Pyrethroid	2 oz/gal; 1 gal of solution/1000 ft²
	Permacap CS™	Permethrin (23.0%)	Pyrethroid	5.3 oz/gal; 1 gal of solution/1000 ft²
BAYER	Annihilator™ PolyZone®	Deltamethrin (4.75%)	Pyrethroid	1.5 oz/gal; 1 gal of solution/1000 ft²
	Credo® SC	Imidacloprid (42.8%)	Neonicotinoid	3 oz/gal; 1 gal of solution/1000 ft²
	Ravap® EC	Tetrachlorvinphos (23.0%) Dichlorvos (5.3%)	Organophosphates	10 oz/gal; 1 gal of solution/1000 ft²
	Tempo® 20 WP	Cyfluthrin (20.0%)	Pyrethroid	20 g/gal; 1 gal of solution/1000 ft²
CONTROL SOLUTIONS	Bifen I/T	Bifenthrin (7.9%)	Pyrethroid	1 oz/gal; 1 gal of solution/1000 ft²
	Cyzmic® CS	Lambda-cyhalothrin (9.7%)	Pyrethroid	0.8 oz/gal; 1 gal of solution/1000 ft²
	Dominion® 4L	Imidacloprid (42.3%)	Neonicotinoid	3 oz/gal; 1 gal of solution/1000 ft²
	Optimate® CS	Gamma-cyhalothrin (5.9%)	Pyrethroid	0.65 oz/gal; 1 gal of solution/1000 ft²
	Permethrin® CS	Permethrin (23.6%)	Pyrethroid	5.3 oz/gal; 1 gal of solution/1000 ft²
	Pyrofos™ 42® CS	Chlorpyrifos (41.85%)	Organophosphate	2.3 oz/gal; 1 gal of solution/1000 ft²
ELANCO	Elector® PSP	Spinosad (44.2%)	Spinosyn	0.8 oz/gal; 1 gal of solution/1000 ft²
MGK	Darlex®	Chlothianidin (23.0%)	Neonicotinoid	4.0 oz/gal; 1 gal of solution/1000 ft²
	Onslaught® FastCap	Esfenvalurate (6.4%) Prallethrin (1.6%) PBO (8.0%)	Pyrethroids Synergist	1.0 oz/gal; 1 gal of solution/1000 ft²
	Tobex™	Lambda-cyhalothrin (4.0%) Prallethrin (0.4%) Pyriproxyfen (1.3%) PBO (6.0%)	Pyrethroids Juvenile Hormone Analog Synergist	4.0 oz/gal; 1 gal of solution/1000 ft²

Prior to using any product mentioned in this article, carefully read and follow all available instructions, warnings and safety information made available by the product's manufacturer.

Table 2.

SURFACE SPRAY PRODUCTS WITH BIRDS PRESENT				
MFR.	BRAND NAME	ACTIVE INGREDIENT	INSECTICIDE CLASS	DIRECTIONS
BAYER	Ravap® EC	Tetrachlorvinphos (23.0%) Dichlorvos (5.3%)	Organophosphates	2.5 oz/gal; 1 gal of solution/1000 ft^2
ELANCO	Elector® PSP	Spinosad (44.2%)	Spinosyn	0.8 oz/gal; 1 gal of solution/1000 ft^2

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Table 3.

INSECT GROWTH REGULATORS TO TANK MIX WITH PRODUCTS FROM TABLE 1 WITH BIRDS REMOVED				
MFR.	BRAND NAME	ACTIVE INGREDIENT	INSECTICIDE CLASS	DIRECTIONS
CONTROL SOLUTIONS	Tekko™ 10	Novaluron (9.3%)	Chitin Synthesis Inhibitor	3.0 oz/gal; 1 gal of solution/1000 ft^2
MGK	NyGuard®	Pyriproxyfen (10.0%)	Juvenile Hormone Analog	8.0 ml/gal; 1 gal of solution/1000 ft^2

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Table 4.

NATURAL PYRETHRIN PRODUCTS FOR FOGGING OR MISTING WITH OR WITHOUT BIRDS PRESENT				
MFR.	BRAND NAME	ACTIVE INGREDIENT	INSECTICIDE CLASS	DIRECTIONS
CONTROL SOLUTIONS	Stryker 100	Pyrethrins (1.0%) PBO (5.0%)	Pyrethroid Synergist	1 oz/1000 ft^3
MGK	ULD® BP-100	Pyrethrins (1.0%) PBO (5.0%)	Pyrethroid Synergist	1 oz/1000 ft^3

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