

***The* Poultry Engineering, Economics & Management NEWSLETTER**

***Critical Information for Improved Bird Performance Through Better House
and Ventilation System Design, Operation and Management***

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Understanding And Controlling Litter Beetles

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Litter beetles are common pests in poultry houses and are well known for eating feed, disturbing chickens, harboring diseases, and causing damage to housing. The darkling beetle is also often referred to as litter beetle or black beetle and in the scientific community as *Alphitobius diaperinus* (panzer). The origin of the litter beetle is suspected to be from bird and bat colonies in sub-Saharan Africa. From there this pest has spread to colonize most of the temperate and tropical areas of the world. In the United States it is considered an exotic species that was introduced from Europe during the colonial period. Since coming to the United States they can be found throughout the environment; however, they are typically found in large numbers in poultry houses. Unfortunately a modern poultry house is a nearly perfect environment for these pests.

Understanding the Litter Beetle Life-Cycle: Key to Controlling Beetles

To gain adequate control of litter beetle infestations, it is important to understand a little bit more about litter beetle biology. Litter beetles are nocturnal, cosmopolitan, have no natural enemies in the environment, and because of their long association with birds, are attracted to ammonia. Yes, birds and small mammals do eat them, but there are no predators in the US that actively hunt them. They have a well defined life cycle, reaching maturity in 40 to 80 days under typical conditions. The 40 to 80 day life cycle of litter beetles can be further broken down to individual stages. Typically a mature female lays 200-400 eggs with the eggs hatching in 4-7 days. The emerging larva will go through several growth stages known as larval instars; this will last anywhere from 35 to 65 days. Towards the end of this stage the larva will start to search for an ideal area to pupate. This area is typically dark and out of the way, like along the side wall, in insulation, and in lumber or other soft materials. The pupa stage lasts 4 to 7 days, after which a litter beetle will emerge. Six to seven days after emerging from the pupa stage the beetle will become sexually mature. Females will

Modern poultry houses offer an almost ideal habitat for darkling beetles. A typical house may have over 2 million beetles. They cause significant financial losses – eating feed, disturbing birds and infecting them with diseases, and damaging houses. Good control of beetles requires proper litter management and biosecurity practices, along with wise use of insecticides. It is very important to use insecticides in rotation. Continued reliance on just one chemical control measure will lead to insect resistance – and loss of control.



start laying eggs every 1-5 days. The typical adult beetle can live about a year. Doing some simple arithmetic and assuming the lowest number of eggs (200) and the longest time between lay (5 days), a female can easily lay 1200 or more eggs per month.

It is easy to see why litter beetles are common in a modern broiler house. Survival and reproduction of the beetles depends primarily on temperature, with the ideal temperature being in the range of 70°F to 95°F. Litter beetles prefer an environment with about 12% moisture; however they do still thrive in moisture levels higher than this. In a modern broiler house the environment is kept fairly dark, there is an abundance of feed and water, plenty of ammonia produced from the bird's droppings, and the temperature range maintained in the house is ideal for beetle's reproduction. In a typical poultry house, it is not unusual to have 1,000 beetles per square yard.

Beetles Consume Feed, Disturb Birds and Carry Diseases

One thousand beetles per square yard equates to over 2 million beetles in one 40x500 foot house. That many beetles can consume a significant amount of feed. Assuming that each beetle weighs 100mg and they consume as much feed by weight as a chicken, a typical infestation of beetles can easily consume at least 1 point of feed conversion. That alone is a significant hit on the bottom line; however beetles do more than eat feed.

Litter beetles also directly affect the birds by pestering them, causing unnecessary movement, which will reduce feed efficiency. Additionally, moisture starved beetles have been observed to crawl onto the birds and chew at the base of the feathers. The resulting lesions have sometimes been mistaken for skin leukosis at the processing plant. These skin bites may also predispose the birds to contracting Gangrenous Dermatitis and Cellulitis. If the infestation in the house is heavy enough, beetles are known to kill weakened chicks in their search for moisture and food. Chickens will readily consume beetles instead of feed, sometimes hundreds per day. The consumption of this many beetles will have a negative impact on feed efficiency, since beetles are filling, but not as nutritious as the provided feed. In addition to reduced feed efficiency, consumption of beetles may lead to other intestinal problems, such as impaction of the gut and enteric diseases.

Litter beetles have been associated with transmitting many diseases, including IBDV, Marek's, LT, RSS, E. coli, Salmonella, Dermatitis, Necrotic Enteritis, Aspergillosis, and Coccidiosis, just to name just a few. Essentially any disease that the beetles come into contact with can be transmitted throughout the house. The disease-causing agent is carried either on the exterior of the beetle or inside the beetle's gut. Beetles pick up the disease-causing agents by either crawling through an infected environment or by consuming an infected meal, like a dead bird. Typically the disease causing organism can be carried for 2 to 3 weeks and for some agents even longer.

Beetles Cause Significant Damage to Houses

In addition to directly affecting the birds, beetles can cause significant damage to houses. While they are searching for food and a place to pupate it is common for them to damage wood and insulation. The amount of damage is dependent upon the level of infestation and the construction material used; however, even a fairly mild infestation can cause hundreds of dollars worth of repair costs to a poultry house annually. This is the visible cost and does not take into consideration the hidden cost of reduced house efficiency because of air leakage and a reduction in the insulation's R value.



Darkling beetles burrow into wood and foam insulation in search of food and for dark places to pupate. The damage to houses they cause can easily run to several hundred dollars per house per year. Photo shows damage to blueboard insulation. Damage like this – happening throughout the house, as it often does when beetles are not controlled – will seriously impair house heating and cooling efficiency. This means poor flock performance resulting from less than optimum in-house conditions.

Litter Beetle Insecticide Comparison Chart (40 X 500 ft House Basis)

Insecticide	Packaging	Chemical Class	Label Directions	Common Usage
Durashield (Pesticide License Required)	4 x 120 oz jug	Organophosphate	2 to 5 oz / 1000 sq. ft.	60-120 oz / house
Rabon 50 WP	6 x 4 # bag	Organophosphate	0.5 % solution	2 bags / house
Beetle Shield (Rabon 3% dust)	4 x 10 # bag /pail	Organophosphate	4 to 8 oz / 100 sq. ft. 50 to 100 lb/20,000sq. ft.	50-75-100 lb / house
Ravap	4 x 1 gallon	Organophosphate	5 to 10 oz / 1000 sq. ft.	2 gallon / house
Standguard	18 x 8 oz. Bottles	Pyrethroid	0.75 ozs./1,000 sq. ft.	16 ozs. / house
Optishield CS	4 x 120 oz jug	Pyrethroid	2 oz / 1000 sq. ft.	40 oz / house
Tempo 20 WP	6 x 420 gram jar	Pyrethroid	20 to 40 gram / 1000 sq.ft. 1-2 jars / 20,000 sq. ft.	2 jars / house
Tempo 1 % Dust	4 x 10 # bag / pail	Pyrethroid	0.5 to 1 lb / 1000 sq. ft.	20-30 lb / house
Elector PSP	18 x 8 oz. Bottles	Spinosad	8 oz / 20,000 sq. ft. (add 2 ounces of clear household Ammonia per gallon of tank mix)	8 oz / house
Pyrishield EC (Insect Growth Regulator)	6 x 1 pint	Nylar	1 oz / 1000 sq. ft.	20 oz / house
Boric Acid	50 # bag	Boric Acid	1 - 2 lb / 100 sq. ft.	100 lb / house (under feed lines)

Keys to Successful Beetle Control Using Insecticides

- Rotate between the different classes of chemicals at least every two flocks. If one product is used for an extended period of time, resistance to it will build in the beetle population and that chemical will no longer be effective.
- Don't be too hasty in judging any particular chemical to be ineffective. The number of beetles killed in the first 24 hours is not the best indication of effectiveness. Some insecticides will kill the beetles in just a few hours and others may take a few days to begin killing the beetles, but then continue killing the beetles for the entire growout. When the birds are 4-5 weeks old look under several feed pans and see how many beetle adults and larvae you find. If you only find a few beetles and larvae you have good control.
- Apply the label recommended amount of each insecticide. Using less than the recommended amount will lead to increased resistance to the insecticide.
- If you are seeing large populations of beetles, apply your insecticide before placement of each flock. This will keep the beetle populations under control in every flock.
- Apply insecticide using as little water as possible. It is best not to exceed 12 gallons of water in a 500-ft house. Change your nozzle tips to a flat fan, 04-08 nozzle tip to get a fine mist, instead of a coarse spray application.
- Apply insecticide in a 3 ft wide band under the feed lines and a 3 ft wide band along the walls, including the footing and 2 ft up onto the wood above the footing, instead of the entire house. Focusing the insecticide applications to the areas where the beetles are living will offer much better control.
- Add 1 packet of Citric Acid or PWT to each Organophosphate or Pyrethroid insecticide tank mix before applying the material. These insecticides kill more beetles when they have an acid added to the tank mix.
- Add 2 ounces of clear household ammonia/gallon of tank mix when using Elector.
- Apply insecticide on top of the litter after caking out, or on top of fresh shavings after clean out. The beetles crawl on top of the litter as they are making their way to the feed line areas after bird placement. You will not get as good results if you apply the insecticide on the bare floor.
- After caking out or clean out apply insecticide to any litter stored in the stacking shed. This will prevent the beetles from migrating right back into your houses.

Keys to Beetle Control: Biosecurity Practices, Litter Management, and Insecticides

Good beetle control can be achieved through a combination of management approaches and the use of insecticides. Although management practices will not eliminate the beetles, they will help to discourage them. Some of these suggestions are really about practicing good biosecurity. This includes restricting food available to beetles by picking up mortalities on a daily basis and cleaning up any spilled feed, even if it does not look like a large amount. Packing litter after decaking and top dressing before chicks are placed will discourage beetles from entering the litter and will make the house environment just a little more hostile to the beetles and their larva. More frequent cleanouts help prevent beetle populations from growing overly large, and may be justified if infestations are severe. Litter beetles do not like temperatures below 40°F, so leaving a poultry house open between flocks in winter will help in driving beetles off.

Various commercially available insecticides, if used properly, will do a good job of controlling beetle populations (see table on page 3). One key to success in using these products is rotating between the different classes of chemical at least every two flocks; and not being discouraged by the lack of quick kill with some of the chemicals listed. If one product is used for an extended period of time, resistance to it will build in the beetle population. Once the population is resistant to that class of chemical, it will no longer provide control and must be removed from the rotation for several years. It is important that the chemicals are used wisely to ensure their effectiveness for years to come.

A combination of management and chemical treatment is using in-house windrow composting in conjunction with a chemical (see Newsletter #47). Initially form a windrow pile in the house. After it is formed, apply a chemical insecticide in a band about 1 foot wide down either side of the windrow pile. Then spray the chemical insecticide over the top of the pile so that any insects trying to escape from the pile are exposed and killed.

The Bottom Line

In summary, beetles are a major pest of poultry, causing serious financial losses from damage to houses, reduced bird efficiency and disease. Their control is important in saving money, your poultry houses, and possibly your flock. While the variability of conditions from house to house and complex to complex makes it impossible to put an exact dollar value on the problem, it has definitely been shown that achieving good beetle control does result in improved flock performance.



U.S. Poultry & Egg
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