

DARKLING BEETLES

Dr. Lindsay Kehler

Alphitobius diaperinus, or the darkling beetle is arguably the most significant arthropod pest in broiler production world-wide. Although darkling beetles are present in the majority of broiler houses throughout the world, the effects that these infestations have on poultry production are difficult to quantify. However, economic loss due to darkling beetle infestations are certain considering that the adult darkling beetle and its larval stage (the lesser meal worm) contribute to disease transmission, structural damage to houses, as well as reduced weight gains and feed conversion within a flock.

Darkling beetles are omnivores that feed on bird droppings, spilled feed and dead birds. Poultry houses provide almost perfect environments for the pest including plenty of food, and ideal climatic conditions. Larvae generally concentrate around feed lines and feed trays. Newly hatched larvae are approximately 1mm long but can reach a size of up to 18mm before pupating. Adult beetles are about 6 to 10mm long, and are brown or black in colour. The full life cycle is completed in approximately 42 days. Adults can live anywhere from three months to one year and females are capable of producing up to 2000 eggs in a lifetime (14).

Darkling beetles can act as reservoirs and vectors of disease for a number of important poultry disease agents including leucosis, Marek's disease, infectious bursal disease, fowl pox, reovirus, coronavirus, avian influenza, aspergillus, and Newcastle disease virus. They can act as the intermediate host for tapeworms, coccidia and caecal nematodes. Darkling beetles can also transmit a number of food-borne pathogens that are important public health concerns, particularly, *Escherichia coli*, *Salmonella* and *Campylobacter* (4, 6, 7, 8, 9, 10,). They have been implicated as one of the main vectors in the re-introduction of *Salmonella* to the chicken house after cleaning and disinfecting (6). It is clear that these pests pose a biosecurity threat that can have substantial impact on both bird welfare and food safety.

The larval stage of the darkling beetle is capable of causing significant damage to poultry houses. Larvae will migrate up walls and into insulation in search of pupation sites. They are capable of forming tunnels in drywall, wood posts/beams and paneling. The result is increased moisture entering the walls and insulation, creating condensation and ultimately accelerating the deterioration of the building. Some estimates suggest that severe infestations can result in losses of up to 25% of the insulation in a poultry house per year. Furthermore, energy costs have been estimated to be up to 60% higher in buildings with beetle damage (1).

Darkling beetles can consume large amounts of poultry feed resulting in direct economic loss to the producer. Additionally, they are an attractive food source to young birds, who, when exposed to beetles may choose to eat them in lieu of starter feed. The consumption of beetles and larvae during brooding may result in the birds being exposed to detrimental doses of parasite and disease agents. Weight gain and feed utilization may be negatively impacted by birds feeding on beetles and lesser meal worms (5).

Control of darkling beetle populations relies on fundamental management principles and integrated pest management. Prompt removal of feed spillage and mortalities from the barn floor inhibits beetles from gaining access to a feed source and can prevent potential disease transmission. The darkling beetle has established the ability to display resistance to most insecticides so shuttling is an important concept. In most cases, it is ideal to switch insecticides after use on two consecutive flocks (2). Beetles can be collected annually or biannually for resistance testing to ensure that products selected for rotation will be efficacious. It is important to always apply the labeled amount of insecticide, as low doses can promote resistance. To successfully keep beetle populations at a low level, insecticides must have a residual activity of at least three weeks (2). Ideally, they should be applied within 24 hours of removing the birds from the house. Beetle populations are often the highest along the side walls and under feed lines; therefore, it may be advantageous to apply the majority of the insecticide to these high density areas to reduce the overall population. One study found that low volume application of insecticide (4-25 gallons of water) is more effective than higher volume application (200 to 300 gallons of water). Therefore, it may be beneficial to invest in a good sprayer that is designed to apply insecticides in low volumes. Additionally, windrowing litter between flocks offers a good opportunity to apply insecticides after the pile is formed to treat a large number of beetles that migrate to the surface of the windrow (13). Alternative methods to beetle control such as pheromone trapping are currently being investigated and may have some commercial use in the future (3).

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