



Poultry Extension Collaborative Newsletter

A collaboration between Purdue University, University of Maryland,
University of Georgia, and Virginia Tech

POULTRY PARASITES: BED BUGS

IN THIS ISSUE

- Bed bug biology and life cycle
- Bed bugs in poultry facilities
- Signs of infestations
- How bed bugs affect people and poultry
- Pest management options



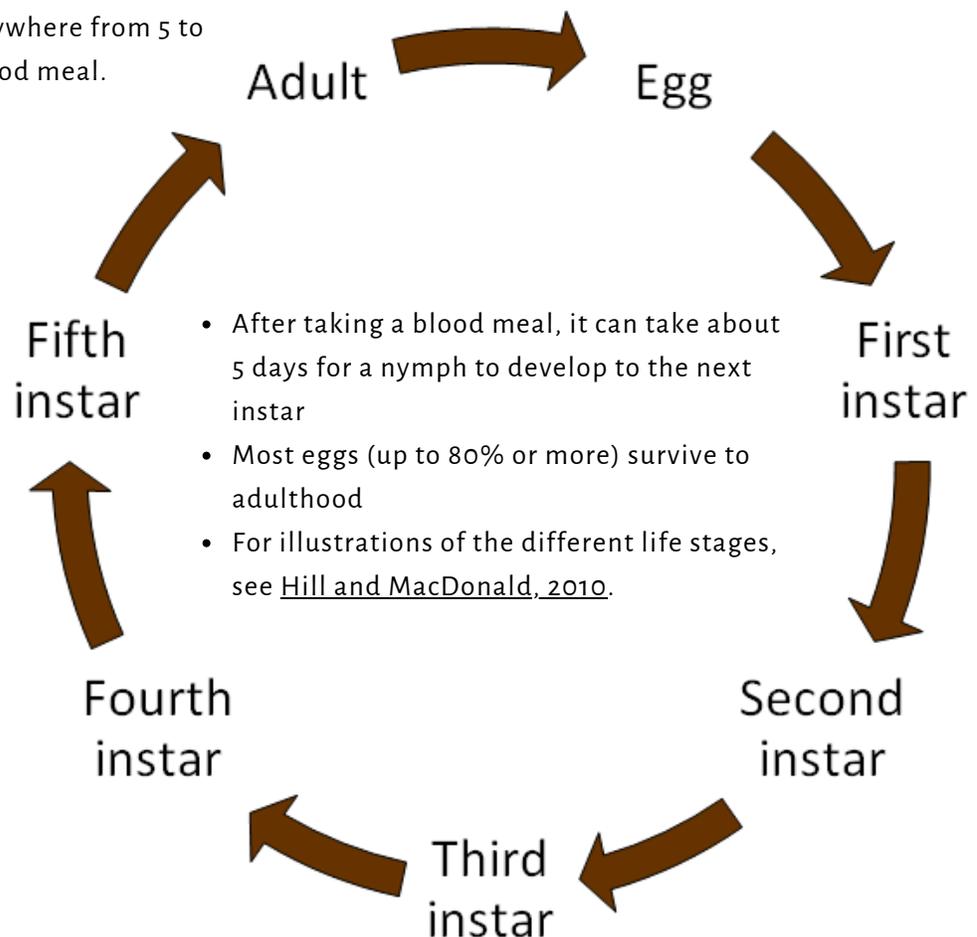
Photo credit: John Obermeyer,
Purdue University Department of Entomology

The common bed bug (Latin name *Cimex lectularius*) is part of a group of blood-feeding parasites called Cimicids. The common bed bug was mostly eradicated in North America in the 1960s. Then, in the 1990s, large cities such as New York, Chicago, Cincinnati, Toronto, Montreal and Winnipeg saw a rise in bed bug infestations that spread throughout the U.S. and Canada, and worldwide. Bed bugs continue to be problematic, not only in human dwellings, but within poultry houses as well, where they are sometimes referred to as poultry bugs. Bed bug problems in poultry facilities were reported as early as the 1900s.

BED BUG BIOLOGY AND LIFE CYCLE

After hatching from eggs, immature bed bugs develop through a total of five life stages, called instars, to reach adults which are able to reproduce. Bed bugs that are not yet mature are called nymphs. Under optimal conditions, it can take as few as 37 days for a bed bug to develop from an egg into an adult. Bed bug nymphs, adult males and females consume blood meals, and therefore feed on people and animals. Adult bed bugs are oval-shaped and flat with a reddish-brown color and are about ¼ inch (6.3 mm) long. Nymphs are smaller and lighter in color.

Adult bed bugs can ingest up to 7.4 µl of blood in one meal. Female bed bugs can produce anywhere from 5 to 20 eggs from one blood meal.



BED BUG BIOLOGY AND LIFE CYCLE

- Bed bugs are temporary parasites, meaning that they only spend part of their life cycle on the host, which includes mammals and birds, including humans, bats, chickens, and many others



Images are from Pixabay

- Bed bugs are obligate hematophagous (blood feeding) ectoparasites: their only source of food is blood, they live outside of their host (ectoparasite) and they repeatedly feed on the same host
- Bed bugs are nocturnal, and come out at night to feed when their host is mostly inactive
- Thankfully, bed bugs are flightless!
- It takes an adult bed bug between 5 and 20 minutes to complete a meal; bed bugs typically return to their resting spot within 30 minutes after feeding
- If adult bed bugs have access to abundant food, they will feed about once or twice a week
- Mature female bed bugs start laying eggs within 2 to 5 days after a meal and can lay between 200 and 500 eggs in a lifetime
- Bed bugs communicate through pheromones: they secrete alarm pheromone when distressed, which can cause other bed bugs to disperse from that area; and aggregation pheromone which attracts other bed bugs to an area
- Bed bugs can find their hosts from a distance of 1.5 m (4.9 ft) by detecting carbon dioxide (CO₂) from breath, body heat, and possibly odors, but the science about odors is still inconclusive
- Normally, adult bed bugs can live for up to 2–4 months, but this depends on their environment

BED BUGS IN POULTRY FACILITIES

Bed bugs (poultry bugs) are not only problematic for humans, but they can infest poultry houses as well, where they cause problems for the poultry and the farm workers. The bugs can spread between the farm workers' residences and the poultry facilities. The exact prevalence of bed bug infestations in poultry houses is unknown, but there are reports that bed bugs are problematic, especially in cage-free poultry facilities (see a recent article [here](#)).

Within poultry barns, bed bugs are found in many different places, such as poultry nests, on belts such as manure belts and egg belts, and within cracks and crevices throughout the facility. The common bed bug is not the only blood-feeding parasite to attack poultry. Other Cimicids that can be found in poultry facilities include the Mexican chicken bug, the Brazilian chicken bug, the Tropical bed bug and other related species of bugs. These bugs can be found in wild bird nests as well. For some images of some of these bugs, see [Cranshaw et al. \(2013\)](#).



Photo credit: Marisa Erasmus

Why are bed bugs so difficult to control and eradicate?

- Bed bugs are nocturnal and spend most of their time in their “harborages”, places where they hide close to their host, making them difficult to detect
- Bed bugs are resistant to many types of insecticides, which is especially problematic in places where animals are used to produce food for human consumption, such as in poultry houses
- Bed bugs can survive for a long time without food; adults can survive for several months and nymphs can survive for up to 70 days
- For poultry facilities, this means that the bugs can stay in their harborages where they are very difficult to find and eradicate during periods when there are no poultry in the facility
- The more complex the housing environment, the more difficult it is to detect and find bed bugs
- If conditions are optimal and females lay lots of eggs, the bed bug population can double in size every 13–16 days depending on environmental conditions and availability of blood (food) source

EFFECTS OF BED BUG BITES ON PEOPLE

Because bed bugs can travel from people's homes to other facilities, such as poultry houses, and vice versa, it is important to be able to identify signs of bed bug infestations and to recognize the effects that bed bugs can have on people and poultry.

Signs of bed bug bites and their effects on humans

- Rashes or signs of bites may not always be an indicator of a bed bug infestation, because it can be difficult to distinguish between bed bug bites and bites from other insects
- Often, body parts that are not covered by clothes, such as the arms and face, are locations of bed bug bites
- Bites can occur in a linear pattern and cause wheals (red, swollen areas)
- Not all people develop reactions to, or symptoms of, bed bug bites
- For most people who develop symptoms, this occurs within one to two days after being bitten, but it can take as long as 9 to 10 days for symptoms to develop
- People who react to bed bug bites may develop the following
 - Skin reactions, such as rashes, raised areas and hives, blisters, and allergic reactions
 - Loss of blood, which can lead to anemia, fatigue and lethargy
 - Itching, discomfort, and loss of sleep
 - In some people, excessive itching of bite areas or wheals/welts can lead to secondary infections, which can further affect their health
- For people that are bitten, finding bed bugs is the surest evidence of an infestation and cause of bites and rashes

Other ways in which bed bugs influence people

- It can take over a week for the bitten area to heal, or longer if there is a more severe reaction to the bite
- Mental health impacts, including stress, anxiety and depression associated with having an infestation and physical reactions to being bitten
- Relationship conflict and social isolation
- The costs associated with exterminating bed bugs, which can include the extermination costs, loss of furniture and equipment within the affected area, and the inability to use the area while extermination is taking place, among other costs

EFFECTS OF BED BUGS ON POULTRY

How do bed bugs affect poultry?

There is no question that bed bugs can have impacts on the health and welfare of poultry, but there is still much that is not known about bed bugs' effects on poultry. More research is needed to understand how bed bugs affect different types of poultry (meat vs. egg production) and in which types of housing facilities bed bugs are most likely to be found. Based on the limited work that has been done to date, effects of bed bugs on poultry include:

- Skin reactions and lesions (sores), but these can be difficult to see
- Anemia (blood loss)
- In breeder and egg facilities, bed bugs can cause a decrease in egg production
- If the infestation is severe enough, it can result in death of the birds
- Economic losses due to lost productivity and extermination costs

SIGNS OF BED BUG INFESTATIONS

- Because bed bugs are nocturnal, small and flat, they squeeze into small cracks and crevices during the day, making them hard to see
- Bed bugs sometimes leave dark brown fecal spots and smudges in areas where they feed
- If the infestation level is high, you may even see groups of bugs varying in size and life stages, along with their empty shells that they shed when they molt between or within life stages, and fecal spots, as seen in the image to the right
- Look for bed bugs in cracks, crevices, floor joints, where other structures join together, where the floor and wall meet and in electrical receptacles. In human dwellings, bed bugs can be found in mattress seams, bed frames, sofas, chairs, and wooden furniture, in addition to the places mentioned previously.



Bed bug infestation: numerous bugs are present, varying in size

Photo credit: Purdue University Department of Entomology

PEST MANAGEMENT OPTIONS

The integrated pest management (IPM) approach that incorporates personnel training, monitoring for bed bugs and both chemical and non-chemical interventions is best for managing bed bug infestations. For more detailed information, see [Bennett et al. 2016](#).



Photo credit: John Obermeyer
Purdue University Department of Entomology

Pest management options include:

1. Training and education
2. Early identification of infestations
3. Control interventions
4. Continued monitoring

These strategies are discussed in detail in the following sections.

1. Training and education: poultry farm workers and managers need to be trained in how to identify and recognize different life stages of bed bugs and report possible infestations
2. Early identification is key to prevent bed bug populations from growing; it is also easier and cheaper to try to control a low level of infestation (~5–10 bed bugs) than when the infestation becomes established and when the bed bug population numbers are high

To determine whether there are bed bugs, different approaches can be used, such as

- a. Having trained people visually inspect the facility to look for evidence of bed bug infestations
- b. Using traps that catch bed bugs, such as Climbug® interceptors or traps that are baited with heat, carbon dioxide and pheromones
- c. Some companies have trained dogs that can detect bed bug infestations using odor (smell) cues



Did you know?

Bed bugs reproduce through a process called traumatic insemination, whereby the male uses a hard, needle-like organ to pierce the female's abdomen and inject sperm. This causes damage to the female's skin. Repeated traumatic insemination by males can actually affect the female's longevity and her ability to reproduce. However, a single female that has mated can cause an infestation on her own even if there are no males around. This is because sperm from a single mating event is enough to produce fertile eggs throughout her life time.

PEST MANAGEMENT OPTIONS CONTINUED

3. Control interventions: controlling and reducing bed bug populations through non-chemical and chemical methods

Non-Chemical methods

Non-chemical methods are methods such as physically removing the bugs or using heat or cold to kill the bugs. If bed bugs can be seen and reached, several methods can be used to trap and kill them, such as

- Vacuuming them up
- Sealing up and removing parts of the facility, such as pieces of furniture
- Using Climbup® interceptors to trap bed bugs, but these traps may not be useful inside barns
- Using high temperatures (close to 50°C; 122°F) for 4 hours, or lower temperatures (45-48°C; 113-118°F) but for a longer period of 6-8 hours. It is recommended to rely on licensed and insured pest management companies to implement bed bug heat treatments.
 - High efficiency or commercial grade heaters
 - Portable hot steam applicators
- Bed bugs can also be killed by exposing them to cold temperatures (-20°C; -4°F for 2 days or -15 to -18°C; 5 to -0.4°F for 3.5 days), but this may be difficult to do
- A Cryonite® machine, which creates dry ice (-110°F) from carbon dioxide can be used to instantly freeze bed bugs. While this is a useful control method for low level or recent bed bug introductions, it is not feasible to use Cryonite for large bed bug infestations.

Chemical methods

- A problem with using chemical methods is that bed bugs are resistant to some chemicals, and in particular, pyrethroids (synthetic insecticides)
- Depending on the facility that the bed bugs are in, some chemicals may not be permitted and/or may be toxic to humans and other animals
- In general, chemical methods that can be applied include
 - Classes of chemicals called pyrethroids that are available in dust or spray formulations
 - Certain chemicals from the organophosphate insecticide class (only for use in poultry)
 - Silicates (diatomaceous earth)
 - Essential oils and detergents
 - The following are not registered for use with poultry:
 - Chemicals called neonicotinoids (e.g. dinotefuran)
 - Mixtures of pyrethroids and neonicotinoids
 - Pyrroles (chlorfenapyr)

Before using any chemical method, you should consult with a pest management company or expert

PEST MANAGEMENT OPTIONS CONTINUED

4. Continued monitoring. It is important to continue to monitor the facility for bed bugs, even after an infestation has been eliminated, to make sure that new infestations are detected early

- For poultry facilities, pest management options differ depending on whether poultry are present or the facility is empty.
- If the facility is empty, all bed bugs can be killed if the inside of the facility can be heated such that bed bug harborages reach a temperature of $>50^{\circ}\text{C}$ ($>122^{\circ}\text{F}$); however, the effects of heat on different components of the poultry facility and possible resulting damage need to be considered.
- Using diatomaceous earth may be helpful, but the amount used and possible effects on poultry present in the facility need to be considered, and diatomaceous earth cannot reach all of the areas where bed bugs harbor.
- Certain pesticides can be used when the birds are housed in the barns, whereas some others can be used only when the facility is empty. To prevent pesticide misuse, product label directions should be followed meticulously. Because of the common occurrence of pesticide resistance in bed bugs, the use of pesticides should always be combined with other non-chemical control measures (i.e. integrated pest management plan should be adopted).
- Industrial grade bleach and Virkon, which are used in poultry houses as disinfectants can kill bed bugs within a few minutes of direct contact, but dried residues of these products are not effective. As such, the use of bleach and Virkon will not completely eliminate bed bugs.
- Any chemical application should be done when ventilation is good, because chemicals can be irritating or toxic to any animals or humans within the facility.

Before using any chemical method, you should consult with a pest management company or expert

Sources used and further reading

1. Anonymous, n.d. Bed bugs. Purdue University Medical Entomology. Available online: <https://extension.entm.purdue.edu/publichealth/insects/bedbug.html>
2. Bennett, G.W., A.D. Gondhalekar, C. Wang, G. Buczkowski, and T.J. Gibb. 2015. Using research and education to implement practical bed bug control programs in multifamily housing. *Pest. Manag. Sci.* 72: 8-14. Available online: https://www.extension.entm.purdue.edu/bedbugs/pdf/Bennett_et_al-2016-Pest_Management_Science.pdf
3. Cranshaw, W.S., m. Camper, and F.B. Peairs. 2013. Bat bugs, bed bugs and relatives. Colorado State University Extension. Available online: <https://extension.colostate.edu/topic-areas/insects/bat-bugs-bed-bugs-and-relatives-5-574/>
4. Dill, J.F., and C.A. Kirby. Bed bugs. Pest management fact sheet #5004. University of Maine Cooperative Extension. Available online: <https://extension.umaine.edu/ipm/ipddl/publications/5004e/>
5. Evison, S.E.F., W.T. Hentley, R. Wilson and M.T. Siva-Jothy. 2018. Bed bug biology. In: *Advances in the biology and management of modern bed bugs*. Doggett, S.L., D.M. Miller, and C. Lee (eds.). John Wiley & Sons, Inc. Hoboken, N.J. pp 109-114.
6. Hahn, J. and S. Kells. 2021. Bed bugs. University of Minnesota Extension. Available online: <https://extension.umn.edu/biting-insects/bed-bugs>
7. Hill, C.A., and J.F. MacDonald. 2010. Bed bugs: biology and public health risk. Purdue University Extension. Available online: <https://extension.entm.purdue.edu/publications/E-249.pdf>
8. Hwang, S.J.E., S.L. Doggett, and P. Fernandez-Penas. 2018. Dermatology and immunology. In: *Advances in the biology and management of modern bed bugs*. Doggett, S.L., D.M. Miller, and C. Lee (eds.). John Wiley & Sons, Inc. Hoboken, N.J. pp 109-114.
9. Jacobs, S. 2015. Bed bugs. PennState Extension. Available online: <https://extension.psu.edu/bed-bugs>
10. Miller, D.M. 2018. The bed bug resurgence in North America. In: *Advances in the biology and management of modern bed bugs*. Doggett, S.L., D.M. Miller, and C. Lee (eds.). John Wiley & Sons, Inc. Hoboken, N.J. pp 45-48.
11. Miller, D.M. and A. Polanco. N.d. Bed bug biology and behavior. Virginia Tech University Extension. Available online: <https://www.vdacs.virginia.gov/pdf/bb-biology1.pdf>
12. Mullens, B. and A. Murillo. 2018. The future of poultry pest management. In: *Advances in poultry welfare*. Mench, J.A. (ed.). Woodhead Publishing, Cambridge, MA.
13. Polanco, A.M., C.C. Brewster, and D.M. Miller. 2011. Population Growth Potential of the Bed Bug, *Cimex lectularius* L.: A Life Table Analysis. *Insects*. 2: 173-185. <https://doi.org/10.3390/insects2020173>
14. Potter, M.F. 2020. Bed bugs. University of Kentucky Entomology. Available online: <https://entomology.ca.uky.edu/ef636>
15. S.L. Doggett. 2018. Miscellaneous health impacts. In: *Advances in the biology and management of modern bed bugs*. Doggett, S.L., D.M. Miller, and C. Lee (eds.). John Wiley & Sons, Inc. Hoboken, N.J. pp 133-136.
16. Tabler, T., K.M. Loftin, and J. Wells. 2018. Combatting bed bugs in broiler breeder houses. Mississippi State University Extension. Available online: <http://extension.msstate.edu/sites/default/files/publications/publications/p3293.pdf>
17. Waldvogel, M., P. Alder, and C. Apperson. 2018. Bedbugs – biology and control. NC State Extension. Available online: <https://content.ces.ncsu.edu/bedbugs-biology-and-control>