

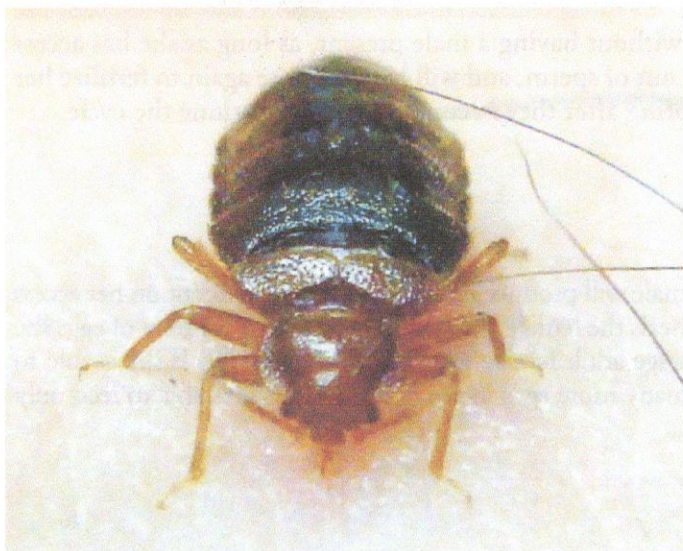
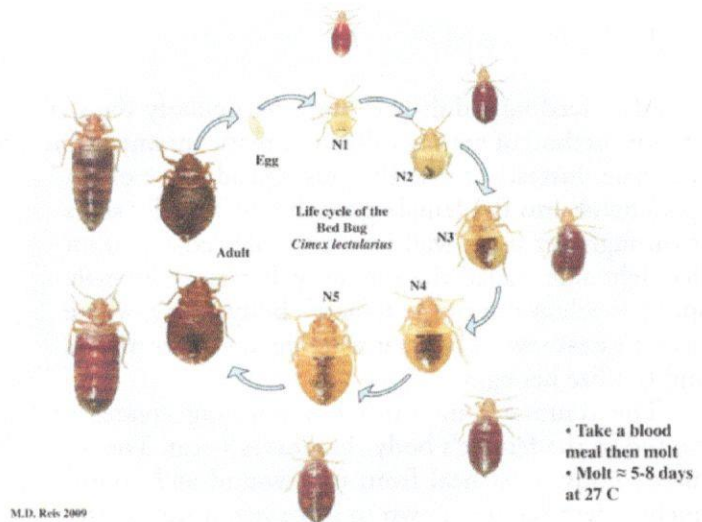
Bed Bug Biology and Behavior

Dini M. Miller, Ph.D., Department of Entomology, Virginia Tech
Andrea Polanco, Department of Entomology, Virginia Tech

Introduction to the Bed bug Lifecycle

The bed bugs that are infesting homes today are the descendents of cave dwelling bugs that originally fed on the blood of bats. When humans began living in the caves, the bugs began feeding on humans. Later, when humans moved out of the caves and started their agricultural civilizations, the bugs moved with them. Since that time, humans have carried bed bugs all over the world.

Bed bugs belong to a family of insects called Cimicidae. All members of this family feed exclusively on blood. The common bed bug (*Cimex lectularius*) has five developmental life stages. Each immature life stage (called nymphs or instars) must take a blood meal in order to develop into the next life stage. Because bed bugs, like all insects, have their skeleton on the outside of their body (exoskeleton) they have to shed their exoskeleton in order to grow larger. This shedding of the exoskeleton is called molting. A bed bug nymph must take a blood meal to molt successfully. After growing through five instar molts, the bed bug becomes an adult. Adult bed bugs, both male and female, must also take regular blood meals to reproduce. The diagram above illustrates the bed bug lifecycle including all instars, before and after feeding. The total development process from an egg to an adult can take place in about 37 days at optimal temperatures (>72° F). Adult bed bugs have a life span of nearly one year depending on regular access to blood meals and favorable temperatures.



Feeding Behavior

Bed bugs have a cryptic lifestyle, meaning they spend the majority of their time hiding together in cracks and crevices where they will not be seen or disturbed. However, they become active at night, between midnight and 5:00 am. It is during this time, when the human host is typically in their deepest sleep, that bed bugs like to feed.

Bed bugs are known to travel many yards to reach their human host. Bed bugs are attracted to CO₂ produced by the host exhalations, and they are also attracted to body heat. However, bed bugs are only able to detect these host cues over short distances (about 3 feet away for CO₂ and even less for heat). It is not well understood how bed bugs hiding in a closet are able to

find a host located in a bed across the room. However, bed bugs are able to move very quickly, and it is thought that they do a lot of wandering around before they are able to locate their food. Ideally, most bed bugs would like to aggregate near the host's bed, on the mattress or in the boxsprings, when they are not feeding. However, this is not always possible in heavy infestations where bed bugs are crowded and many bed bugs have to seek refuge at distances several yards from the host.

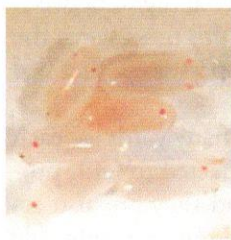
Once a bed bug finds the host, they probe the skin with their mouthparts to find a capillary space that allows the blood to flow rapidly into their bodies. A bed bug may probe the skin several times before it starts to feed. This probing will result in the host receiving several bites from the same bug. Once the bed bug settles on a location, it will feed for 5-10 minutes. After the bed bug is full, it will leave the host and return to a crack or crevice, typically where other bed bugs are aggregating. The bed bug will then begin digesting and excreting their meal. Bed bugs usually feed every 3-7 days, which means that the majority of the population is in the digesting state, and not feeding most of the time.

Mating Behavior

After feeding, adult bed bugs, particularly the males, are very interested in mating. Cimicid bugs have unique method of mating called traumatic insemination. This mating behavior is considered traumatic because the male, instead of inserting his reproductive organ (paramere) into the female genitalia, he literally stabs it through her body wall into a specialized organ on her right side, called the Organ of Berlese. The male sperm is released into the female's body cavity, where over the next several hours it will migrate to her ovaries and fertilize her eggs.

The traumatic insemination stabbing creates a wound in the female's body that leaves a scar. The female's body must heal from this wound and consequently, females are known to leave aggregations after being mated several times to avoid any further abuse. Studies have shown that the process of healing from traumatic insemination has a significant impact on the female's ability to produce eggs. In fact, females that mate only once, and are not subjected to repeated stabbings by the male will produce 25 percent more eggs than females that are mated repeatedly.

In practical terms, this means that a single mated female brought into a home can cause an infestation without having a male present, as long as she has access to regular blood meals. The female will eventually run out of sperm, and will have to mate again to fertilize her eggs. However, she can easily mate with her own offspring after they become adults to continue the cycle.



Egg Production:

The number of egg batches a female will produce in her lifetime is dependent on her access to regular blood meals. The more meals the female can take the greater the number of eggs she will produce. For example, the average adult female will live about one year. If she is able to feed every week, she will produce many more eggs in that year than if she is able to feed only once a month.