

## ***Cimex lectularius*, common bedbug**

cellular organisms - Eukaryota - Fungi/Metazoa group - Metazoa - Eumetazoa - Bilateria - Coelomata - Protostomia - Panarthropoda - Arthropoda - Mandibulata - Pancrustacea - Hexapoda - Insecta - Dicondylia - Pterygota - Neoptera - Paraneoptera - Hemiptera - Euhemiptera - Neohemiptera - Prosorrhyncha - Heteroptera - Euheteroptera - Neoheteroptera - Panheteroptera - Cimicomorpha - Cimicoidea - Cimicidae - Cimex - *Cimex lectularius*

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### **Brief facts**

- The cimicids or, bedbugs, are highly specialized blood-sucking (hematophagous) insects, which parasitize primarily humans, birds, and bats. Best known human parasites of the taxon are the common bedbug, *Cimex lectularius*, which is distributed worldwide, and *Cimex hemipterus*, which lives in tropical areas and rarely found outside of Florida in the United States. They are 5-7 mm in size, wingless, flat, elongated, brown-colored bugs with broad head equipped with prominent antennae, two dark eyes, and a stylet with a food canal.

- All *Cimex* species have mouthparts designed for piercing and sucking. They inject anticoagulant as well as other pharmacologically active substances, and withdraw blood painlessly.
- Bedbug's association with humans has been documented for more than 4 millennia. Recent well documented increase in bedbug population and some aspects of their biology re-kindled the academic interest in the bedbugs in recent years.
- All cimicids harbor microbial symbionts, which reside in a pair of **mycetomes**. The symbionts play important role in the biosynthesis of key micronutrients from the nutrient-limited blood diet.
- Spiders are considered as primary natural predators of bedbugs. Several arthropod species such as cockroaches, ants, mites, etc. can attack and kill them. Rodents also can snack on the bedbugs. Apart from the predators, bedbugs are vulnerable to such pathogens as fungus *Aspergillus flavus* and bacteria *Serratia spp.* that are effective at eradicating laboratory colonies of bedbugs.
- Extermination of bedbugs is challenging and costly due to insecticide resistance, lack of effective products and health control about spraying places where we sleep with chemicals. Pest control usually involves usage of residual insecticides (usually pyrethroids) and silica gel dust. You can learn about insecticides that are registered for use on bedbugs by contacting **[National Pesticide Information Center](#)**.
- The observation about bedbugs' ability to survive up to one year without a bloodmeal is often given as a reason of possible extermination failure. However, numerous research studies show that bedbugs (male and females) lose their fertility and egg-laying ability in about 2-3 weeks without a bloodmeal (properties that are essential for maintenance

of a given population). However, under starvation, bedbugs can sustain their existence on birds, bats, rabbits, and rodents if they are available.

- Bedbugs most frequently attack exposed areas of the skin: face, neck, hands, and arms.
- In individuals without strong allergic reaction to bedbug's saliva **clinical manifestations** are often presented as groups of three pruritic papular lesions situated linearly and referred as "breakfast, lunch, and dinner". Severe systemic hypersensitivity reactions may rarely occur. Presently, bedbugs are not considered to pose a significant health risk. Potentially, bedbugs can serve as vectors for some viral (Hepatitis C virus, Hepatitis B virus, HIV) as well as bacterial and protozoan parasitic diseases, such as leishmaniasis, American trypanosomiasis, tularemia, typhus, and others, but to date, no reports of transmissions were reliably documented.
- In the wild, bedbugs that parasitize birds (swallow bug *O. vicarius*), were shown to decrease chicks' fitness (body weight, overall survivability) considerably.
- Bedbug infestations result in multimillion dollar damage annually in hospitality industry, bird farms, and regular households combined because of extermination costs, subsequent property repair cost, and reduced egg production and bird fitness in farms.

## Sexual and feeding behavior

- Bedbugs disperse actively by walking (up to 3 m) and passively (in clothing, luggage, furniture, etc.). Current resurgence of world bedbug population is partially attributed to increase in traveling worldwide and, therefore, enhanced transmission.

- *Cimex lectularius* feeds approximately once weekly.
- After a bloodmeal, the bugs can weigh up to 150-200% of their initial weight and increase in length by 30-50%.
- The bugs are attracted to body heat, carbon dioxide gas emission, and kairomones (dried human sweat, sebaceous glands' secretions, etc.). In spite of apparent bedbug advanced sensory mechanisms, human hosts may remain undetected for weeks in spacious accommodations.
- Bedbug feed at night, preferably at pre-dawn hours when human hosts are in a state of utmost inactivity. Bites in progress are painless.
- *C. lectularius* fully engorges in 10 to 20 minutes, after which he returns to its **refugium**, where bugs are aggregating.
- Bedbugs of different developmental and feeding stages aggregate in dark sheltered places - under loose wallpaper, under mattresses on the bed's frame, etc. Because they cannot fly, climb, or even crawl very efficiently they choose to hide not far away from the host (approximately within 1-2 meters). Population size can reach as large as 5,000 bugs per bed; however, 50-200 per a house is more common.
- The bedbugs stink: they produce a very pungent odor well known to professional exterminators. Detector dogs were shown to be useful in locating bedbugs' aggregation areas and their eggs.
- In the course of evolution bedbugs developed quite bizarre mating idiosyncrasy: all members of the family *Cumicidae* exhibit so-called **traumatic insemination**, which involves introducing sperm into female's body through body wall rather than into the female's genital

tract, thus damaging the epidermis. Engorged females with limited maneuverability are preferred for mating and receive as many as 5 traumatic inseminations after each feeding. In order to inject his sperm male pierces the female's abdominal wall with its **intromittent organ** in certain location of his mate's body and deposit the sperm in the special bedbug female organ **mesospermalege**. No apparent courtship behavior was documented. Some "rough" inseminations can result in death of the female. "Homosexual" penetrations (taking place under conditions of prolonged sexual isolation) also may result in rapid death of the receiver.

- It was shown that tissue damage incurred by invasive copulations reduces females' life span by about 50%. However, compensatory mechanisms that somewhat decrease the detrimental effect are believed to exist. Some hypotheses suggest possible nutritive gain when excesses of sperm are phagocytosed by female's body.
- Locations where bedbugs aggregate are not hygienic. Several species of bacteria and fungi were identified from the male intromittent organ and in bedbugs' shelters. These are considered as candidate organisms for sexual transmission. Some experiments suggest that apart from its primary role as a sperm receiver female bedbug spermalege also serves as protection from sexually transmitted infections.

## Developmental stages

### Life Cycle Stages

All life stages of bedbugs require vertebrate blood as sole source of nutrients.

- egg

each female can produce approximately 200 eggs in a lifetime in batches of 3-5 eggs per day, which she cements to rough surfaces in dark sheltered spots

- nymph

*Cimex* is a "true bug"; it develops through four nymph stages and five molts over the course of 6 weeks; each nymph stage requires a bloodmeal to complete; nymphs die within few days of starvation

- adult

bedbugs are long-lived insects and have average life span of 6 to 12 months (*C. lectularius*); senescence, as determined by decline in fertility and egg production in females, starts between 30 and 200 days of age depending on species; females can die after traumatic mating because of gut rupture or infection

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