

## CLINICAL RESEARCH

# Biology, Medically Importance of Cockroaches and their Control

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### **ABSTRACT**

Cockroaches belong to the order of Blattaria. Approximately a total of 4500 cockroach species were identified. The occupied wide variety of breeding places. The main important cockroaches are: German Cockroach (*Blattella germanica*), American Cockroach (*Periplaneta americana*), Brown-Banded Cockroach (*Supella longipalpa*), Oriental Cockroach (*Blatta orientalis*), Australian cockroach (*Periplaneta australasiae*), Smokybrown cockroach (*Periplaneta fuliginosa*). These species are living in human houses. Cockroaches have been found to carry agents that cause tuberculosis, cholera, leprosy, dysentery, typhoid, salmonella, viruses and helminthes. The main important control measures are: Sanitation, environmental managements, using sticky trap (glue boards), pheromone traps, using WHO recommended insecticides from different groups of insecticides, biological control using Ensign Wasp and Emerald cockroach wasp.

### **KEYWORDS**

Cockroaches; Medical importance; Control

### **INTRODUCTION**

The word cockroach comes from the Spanish word "cucaracha" which means "crazy bug". To date approximately 4500 cockroach species have been named and there are probably at least twice these numbers still to be discovered worldwide. Of which 30 species (<1% of the total) are associated with human habitations and about four species are well known as pests. Cockroaches exhibit a remarkable diversity of size, form, coloration and behavior, occupy a very wide range of habitats from caves to mountains, from rainforests to deserts. Order Blattaria have several families including: Blattellidae: (*Parcoblatta pennsylvanica*, *Supella longipalpa*, *Blattella germanica*), Blattidae: (*Periplaneta americana*, *Blatta orientalis*), Blaberidae: (*Archimandrita tessellata*, *Blaberus giganteus*, *Panchlora*

*nivea*), Cryptocercidae: (*Cryptocercus punctulatus*). Cockroaches typically are nocturnal insects; they only appear during the day when disturbed or when there is an excessively large infestation. Cockroaches will eat almost anything: left-over human food, paper, wood, leather, cigarette butts, tooth paste, coffee grinds, glue, soap, toothpaste, any feces, fabric, shoes, paint, the glue on the back of wallpaper, human hair, fingernails etc. cockroaches are often accidentally brought into buildings with groceries (especially (paper) bagged bread, potatoes and onions), beverage cartons and cases, used furniture and appliances. Cockroaches usually live in groups. They are mostly active at night; in the daytime they hide in cracks and crevices in walls, door frames and furniture, and in secure places in bathrooms, cupboards, steam tunnels, animal houses, basements, televisions, radios and other electric devices, drains and sewer systems. If the lights are turned on in an infested kitchen at night the cockroaches will run from dishes, utensils, working surfaces and the floor towards shelter.

### **Medically Importance**

Cockroaches have been found to carry agents that cause: Tuberculosis, cholera, leprosy, dysentery, typhoid, salmonella, Viruses and Helminthes. Cockroaches are one of the most commonly noted household pest insects. They feed on human and pet food and can leave an offensive odor. They can also passively transport microbes on their body surfaces including those that are potentially dangerous to humans, particularly in environments such as hospitals. Cockroaches infestations have been shown to be linked with allergic reactions in humans. One of the proteins that trigger allergic reactions has been identified as tropomyosin. These allergens have also been found to be linked with asthma.

### **Main Important Cockroaches**

#### **German cockroach**

The German Cockroach (*Blattella germanica*) is the roach that exterminators are most often called upon to control in the world. Adult German cockroaches average about five-eighths of an inch long. They have long antennae which they use to detect chemicals, moisture, air currents, and probably sound waves and vibrations in their environment. German cockroaches prefer warm, moist areas, and are frequently found in kitchens and bathrooms. Thousands of German cockroaches can occupy a single kitchen. A female German cockroach carries an egg capsule containing around 40 eggs. She drops the capsule prior to hatching, though live births do rarely occur. Development from eggs to adults takes 3 months - 4 months. Cockroaches live up to a year. The female may produce up to eight egg cases in a lifetime; in favorable conditions, it can produce 300-400 offspring (1.2) (Figure 1).



**Figure 1:** The German cockroach (*Blattella germanica*).

**American cockroach**

*Periplaneta americana* is large roaches, ranging in length up to an inch and a half. These are the roaches that people usually are talking about when they say "You could have put a saddle on it. They prefer dark, moist, warm areas. They are commonly found in basements, steam tunnels, boiler rooms, rubble foundations, and similar places. Often, they aren't even noticed until a light is turned on, and they scurry away rapidly. Both sexes have working wings and at least some flight capability, but oddly enough, they seldom fly [3] (Figure 2).



**Figure 2:** American cockroach (*Periplaneta americana*).

**Brown-banded cockroach**

*Supella longipalpa* is about half an inch in length as adults. Adults of both sexes have wings, although only the males fly. It has two light-coloured bands running across the base of their wings, hence the name "brown-banded cockroach." Compared to other common roaches (such as the German cockroach, as which they often are misidentified. They tend to prefer drier conditions. They're commonly found in bedrooms (especially in the cabinets and night tables), in closets, behind peeling wallpaper, and inside electrical and electronic equipment [4] (Figure 3).



**Figure 3:** Brown banded cockroach (*Supella longipalpa*).



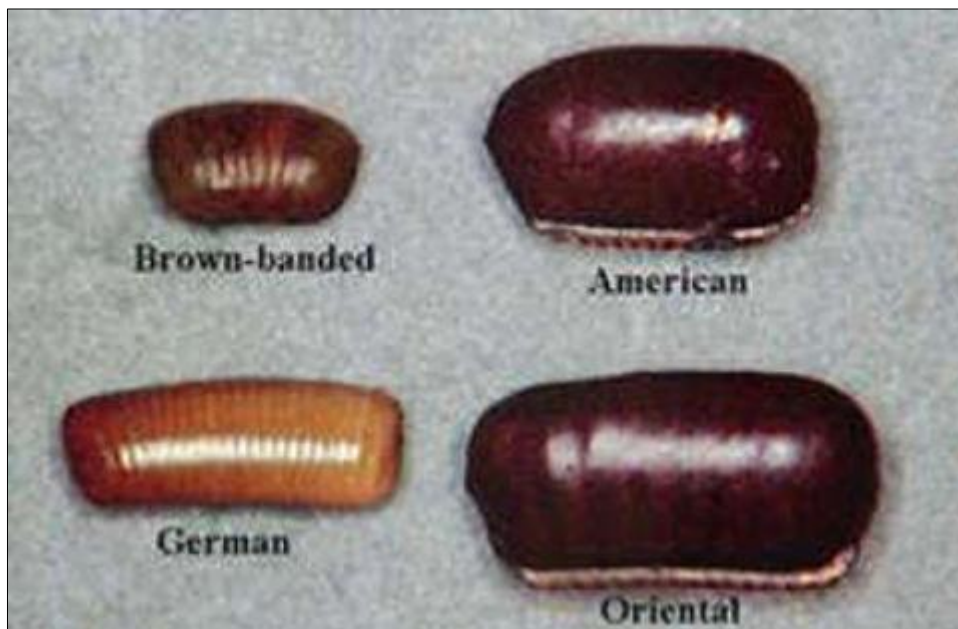
***Oriental cockroach***

*Blatta orientalis* is black or very dark brown in color and roughly an inch in length. Adult males' wings reach about three-quarters down their abdomens, but they cannot fly. Adult females have only small wing pads. They tend to live outdoors when the weather is warm, but they readily move inside during extremes of heat, cold, or drought. They can commonly be found in garbage storage areas, basements, and under porches and decks. They are often found along sill plates in unfinished basements and crawl spaces [5] (Figure 4).



**Figure 4:** Oriental cockroach (*Blatta orientalis*).

Figure 5 shows different egg sac or ootheca of different cockroaches.



**Figure 5:** Different egg sac or ootheca of different cockroaches.

**Australian cockroach (*Periplaneta australasiae*)**

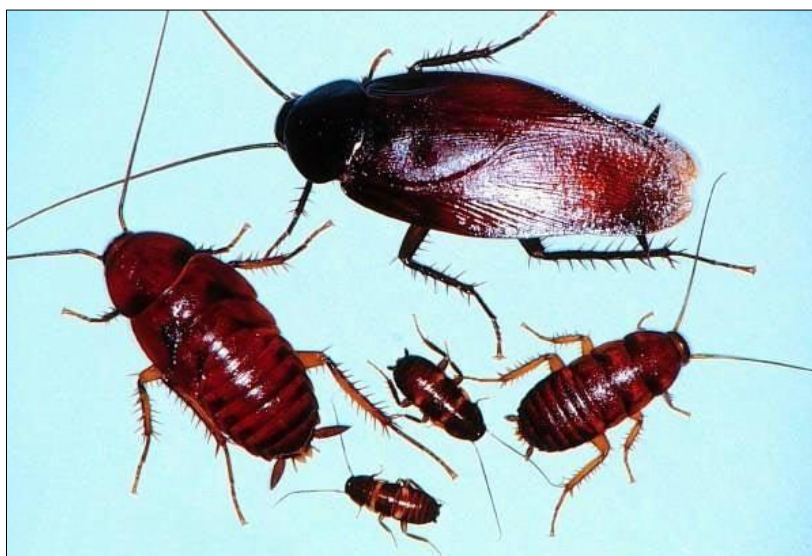
This insect which occurs mainly in tropical and subtropical areas. It is similar to the American cockroach, but It has a pale yellow stripe on each forewing extending for about one-third its length. The egg case contains about 22–24 eggs (6) (Fig.6).



**Figure 6:** Australian cockroach (*Periplaneta australasiae*).

**Smokybrown cockroach (*Periplaneta fuliginosa*)**

Smokybrown cockroaches are about 30 millimetres long, a shiny dark brown-black color and fully winged. Egg cases contain up to 26 eggs and are dropped or glued to surfaces. When hatched, nymphs take 6 months - 12 months to develop to adulthood. Adults live for 6 months - 12 months, during which time females produce up to 17 egg cases. Smokybrown cockroaches are susceptible to losing moisture through their cuticle, and so are usually found in damp, dark, poorly ventilated environments. They rarely infest the dwelling parts of buildings, and are instead found in sheds, wall and roof voids, subfloors, mulched areas, in and around grease traps and in drains. They prefer food of plant origin, and are therefore often a pest in greenhouses, nurseries and gardens. They can fly short distances in warm weather, and are often attracted to lights at night [7] (Figure 7).



**Figure 7:** Smokybrown cockroach (*Periplaneta fuliginosa*).

### ***Medically importance of cockroaches***

Cockroaches can spread diseases through droppings, vomit and mechanical transfer from their feet and other body parts. They transmit, campylobacteriosis, listeriosis, *Escherichia coli* infections (Figure 8), cholera, leprosy (Figure 9), dysentery (Figure 10), typhoid fever (Figure 11), salmonellosis (Figure 12), plague, asthma, giardia. They can not only contaminate food by leaving droppings and bacteria that can cause food poisoning [8] but they can also transmit bacteria, fungi, and other pathogenic microorganisms in infested areas [9,10]. Cockroaches feed on garbage and sewage and so have copious opportunities to disseminate human pathogens [11,12]. In addition, their nocturnal and filthy habits made them ideal carriers of various pathogenic microorganisms [13]. Cockroaches frequently feed on human faeces, garbage, and sewage. Therefore, they have copious opportunities to disseminate pathogenic agents on food resources. They are nocturnal and have filthy habits which coupled with their feeding mechanisms make them efficient vectors of pathogens like bacteria (*Klebsiella pneumoniae*, *Enterobacter cloacae*, *Enterobacter aerogenes*, *Salmonella* spp., *Shigella sonnei*, *Vibrio cholerae*, *Citrobacter freundii* [14], viruses (*Poliomyelitis*) [15], protozoa (oocysts of *Isospora belli*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*, cysts of *Entamoeba histolytica*, *Balantidium coli*, and *Giardia lamblia*) [16-18], fungi (*Candida* sp., *Rhizopus* sp., *Aspergillus* sp., *Mucor* sp.) [19], and eggs of some pathogenic intestinal worms (*Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm, *Enterobius vermicularis*, *Hymenolepis nana*, *Toxocara canis*, and *Strongyloides stercoralis* larvae) [20-23]. Cockroaches not only contaminate food with their droppings or by pathogens, but they also cause food poisoning [24]. Recently microbiological investigation of Cockroaches by early researchers showed an array of 29 different bacterial isolates, 17 different parasites, 7 different fungi spp. and a number of exotic viruses including Hepatitis virus. Some people are allergic to antigens and faeces of cockroaches which may result in asthmatic-related health problems. Studies have been carried out in several countries of the world in order to evaluate the risks of parasitic infestation associated with the presence of cockroaches in households.



**Figure 8:** *Escherichia coli* infection by cockroaches.





**Figure 9:** Leprosy transmitted by cockroaches.



**Figure 10:** Dysentery transmitted by cockroaches.



**Figure 11:** Typhoid transmitted by cockroaches.



**Figure 12:** *Salmonellosis* transmitted by cockroaches.

### ***Cockroach control***

The first step in addressing any cockroach problem is sanitation. This means doing a thorough clean up to remove sources of food, water, and harborage. Be especially careful about things like paper bags, cardboard boxes, and other refuse that can provide roaches with a protected place to live. Ensure foods are stored in containers with close fitting lids, and promptly clean and remove spillage, crumbs, and waste. This will increase cockroach activity and movement making them more likely to encounter insecticides. Cockroaches like warm, moist environments. Keep food rooms well ventilated. Ventilation accelerates dehydration of the insects and interferes with the operation of their antenna.



***Sticky trap (glue boards)***

Figure 13 shows sticky trap.



**Figure 13:** Sticky trap (glue boards).

***Pheromone trap***

(Figure 14)



**Figure 14:** Pheromone trap.

***Chemical Treatment***

After sanitation and population reduction, chemical treatment should be used to kill off the remaining roaches.

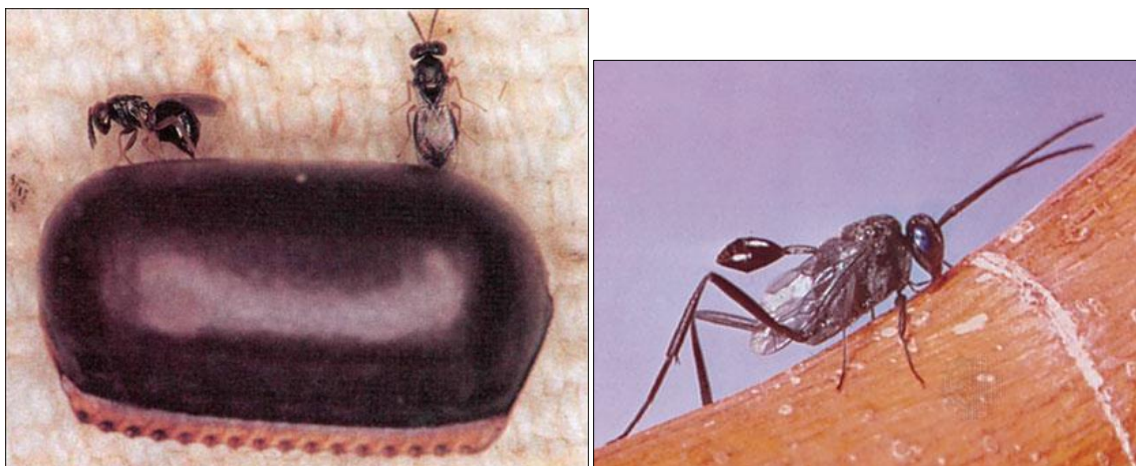
***WHO recommended insecticides***

Bendiocarb, Hydramethylnon, Boric acid, Fenoxycarb, Flufenoxuron, Pyriproxyfen, Hydroprene, Dinotefuran, Imidacloprid, Chlorpyrifos, Chlorpyrifos-methyl, Diazinon, Fenitrothion, Malathion, Pirimiphos-methyl, á-

Cypermethrin Pyrethroid,  $\beta$ -Cyfluthrin, Bifenthrin, Cyfluthrin, Cyphenothrin, D, D-trans-Cyphenothrin, Cypermethrin, Deltamethrin, Esfenvalerate, Etofenprox,  $\lambda$ -Cyhalothrin, Permethrin, Fipronil, Sulfluramid.

**Biological control using Ensign Wasp (*Evaniidae* family)**

This wasp is considered as parasitoid of ootheca (Figure 15).



**Figure 15:** Ensign Wasp (*Evaniidae* family).

***Emerald cockroach wasp***

The emerald cockroach wasp or jewel wasp (*Ampulex compressa*) is a solitary wasp of the family *Ampulicidae*. It is known for its unusual reproductive behavior, which involves stinging a cockroach and using it as a host for its larvae. It thus belongs to the entomophagous parasites (Figure 16).



**Figure 16:** Emerald cockroach wasp.

**CONCLUSION**

Cockroaches constitute an important reservoir for pathogens. Therefore, close contact with cockroaches especially in human dwellings should be discouraged. Due to the low standard of sanitation in the world, there is a need to properly educate the population on the dangers associated with cockroaches and how to control them. Environmental hygiene is very necessary and should be encouraged in every locality, to reduce the population and bad effects of cockroaches in human surroundings [25-30].

**DECLARATION**

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