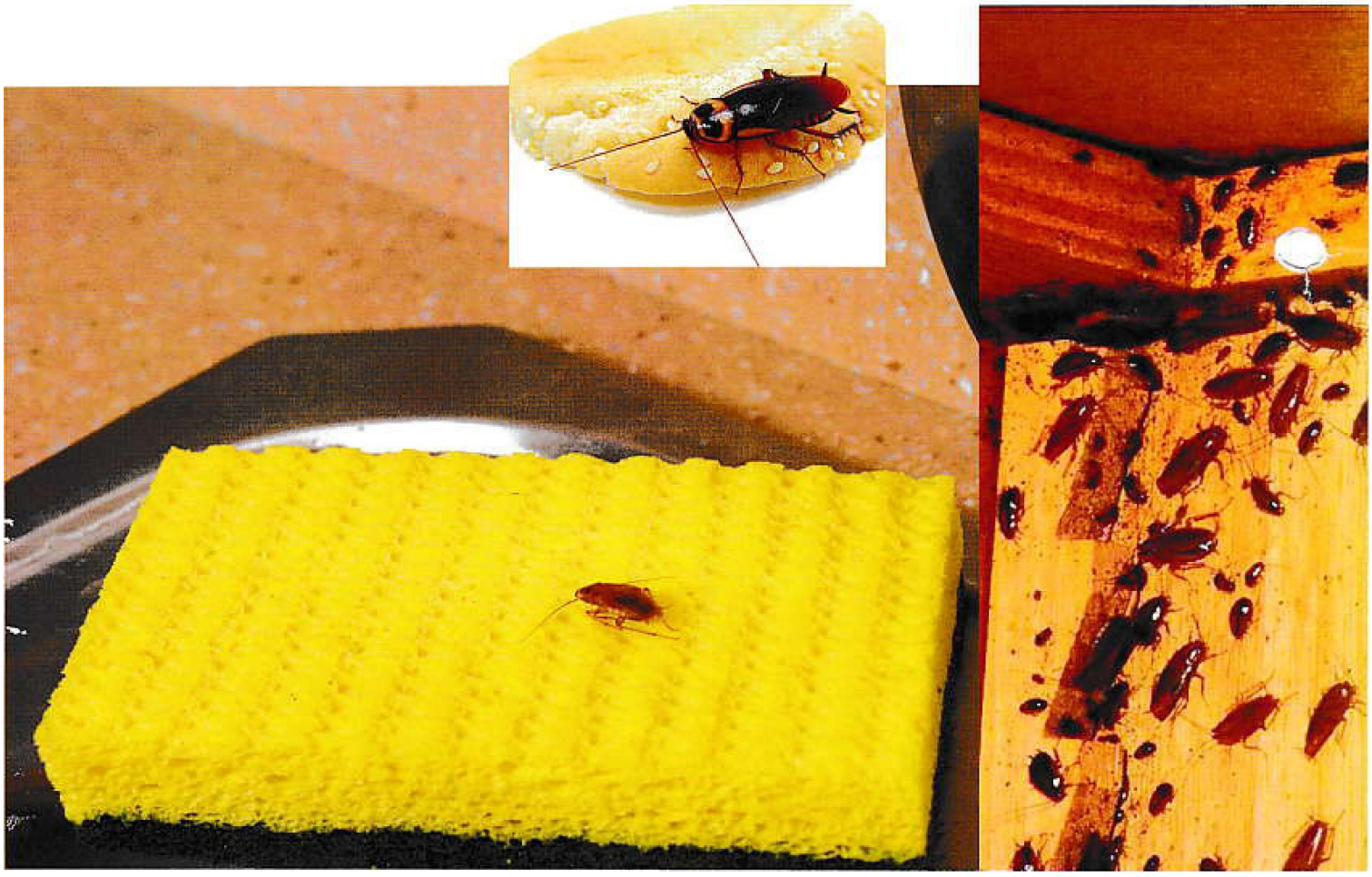
GREEN G
PEST CONTROL SERVICES

Problems

The presence of cockroaches in the home undoubtedly causes more distress than any other insect pest. Many people dislike these "crawlies" in the home. There is a common perception that cockroaches live in homes that are dirty and not well kept, so there is also a negative stigma attached to their presence.

Cockroaches are scavengers and quiet often live in drainages and unsanitary dark areas during the day. At night these insects walk all over our food, utensils and food preparation areas spreading the pathogens carried on their legs and body. More than 200 species of microorganisms can be transmitted by cockroaches. These microorganisms include *Salmonella, Staphylococcus, Streptococcus, Coliform* and other bacterial pathogens that cause dysentery, diarrhea, gastroenteritis, and other diseases of the digestive tract. They may also transmit tuberculosis, cholera, leprosy, poliomyelitis, typhoid, *etc.* Cockroaches also produce odorous secretions, which may affect the flavor of food and when the population is high may leave a musty odour in the area.

Cockroach excrement and cast skins contain a number of allergens, to which many people exhibit allergic responses such as skin rashes, watery eyes, congestion of nasal passages, asthma, sneezing, *etc.* Very often house dust mixed with cockroach fragments and fecal pellets is the trigger for allergic reactions. Cockroaches have also been linked to childhood asthma.

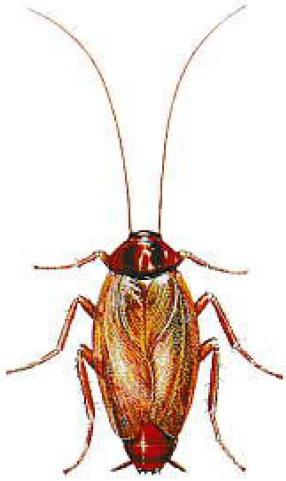


Types of Cockroaches:

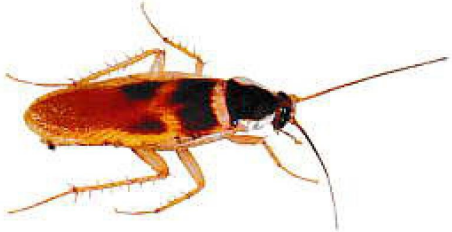
There are nearly 3500 species of cockroaches. Four species of cockroaches are of main concern to hospitality industry and food service facilities in India

- German cockroach (*Blattella germanica*)
- American cockroach (*Periplaneta americana*)
- Brown banded cockroach (*Supella longipalpa*)
- Oriental cockroach (*Blatta orientalis*) Not common

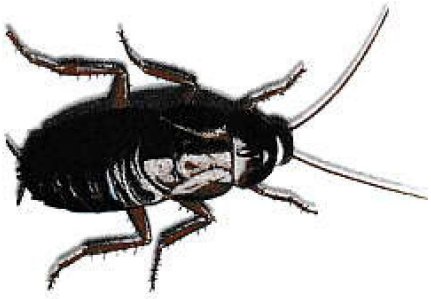
German cockroach
(*Blattella germanica / 10 - 15 mm*)



American cockroach
(*Periplaneta americana / 35 - 40 mm*)

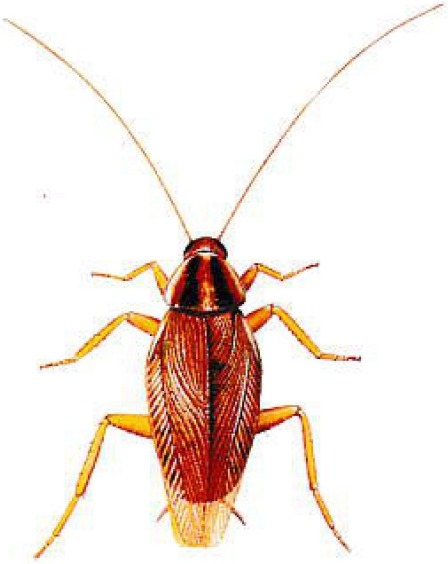


Brown banded cockroach
(*Supella longipalpa / 10 - 15 mm*)



Oriental cockroach
(*Blatta orientalis*)

I. German Cockroach (*Blatella germanica)*

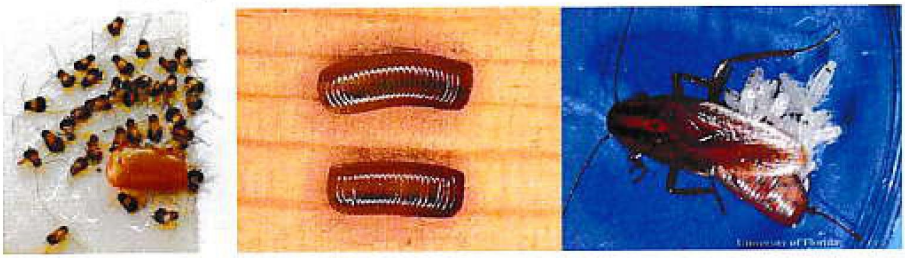


The German cockroach is one of the 'difficult to control' cockroaches and is the most common roach in houses and restaurants. Kitchen platform, kitchen cabinets, trolleys where food is prepared, handled or stored are the common places frequented by German cockroach. Human tendancy to store cartons, boxes, paper articles also provide safe harborage for these insects. Pantry, locker rooms, tea and coffee vending machines, tables, *etc*. places where the staff has snacks are the areas where German cockroaches may abound.

Life Cycle:

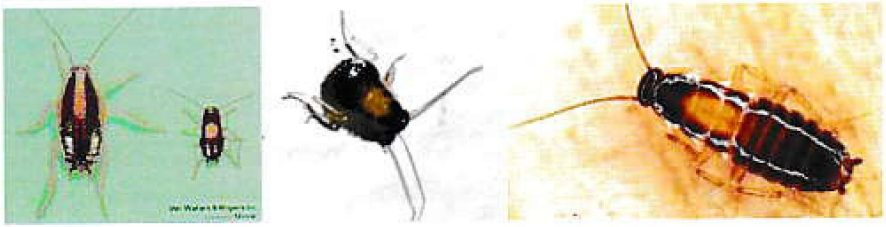
A) Eggs

- The capsule is 8-10 mm long
- Each capsule contains 30 to 45 eggs
- The egg stage lasts for around seven days



B) Nymphs

- The egg capsule splits along the seam and the nymphs emerge
- Young German cockroach nymphs resemble the adults except that they are wingless and darker in color, often being nearly black
- A single light stripe running down the middle of the back is the most prominent marking on the young cockroach
- The nymphs moult six to seven times before reaching adulthood over a period of 60 days



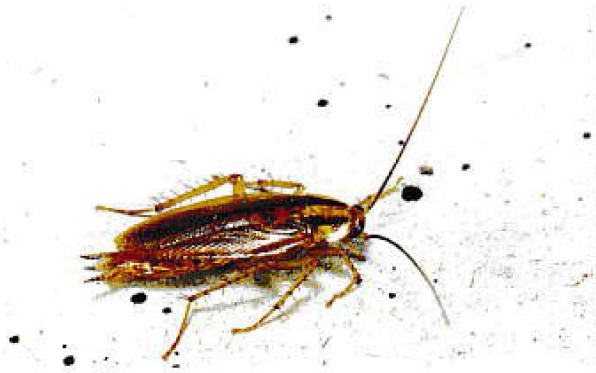
1st Instar 3rd Instar

C) Adults:

- Adults are pale brown and about 15-17mm long
- Both sexes have wings as long as the body, but rarely fly
- They have two dark stripes on the pronotum (which is a shield like plate over the head)
- The male is light brown and somewhat boat shaped
- The female is darker in colour with a broader and rounded posterior

Breeding Habits:

- The adults are ready to breed immediately after the last moult i.e. in 60 days after hatching
- The female carries the egg capsule until the nymphs are about to hatch from the eggs
- The egg case is deposited in an area with conducive conditions for growth ensuring maximum survival of the young hatchlings
- Each female can produce about 8 egg capsules and about 300 eggs in her life time
- Thus it is possible that one female can give rise to 1 lakh young cockroaches in one year



Feeding Habits and Behaviour:

- The German cockroach is a general feeder but seems to prefer fermented foods
- They gather, or aggregate in warm, humid, dark places near food and water
- Because of the high water requirement these insects are most likely to be found infesting kitchens and bathrooms
- If the adults have water, they can live about a month without food, but young nymphs may die of starvation within ten days. Without food or water, the adults may die in less than two weeks
- They like porous surfaces like wood, paper or cardboard better than non-porous surfaces like metal, tiles, glass, *etc*.
- They "mark" porous surfaces with an aggregation pheromone, present in their feces
- These gathering places usually include cracks and crevices of counter tops, wooden cabinets, in and around refrigerators, dishwashers, cooking platforms, *etc*.

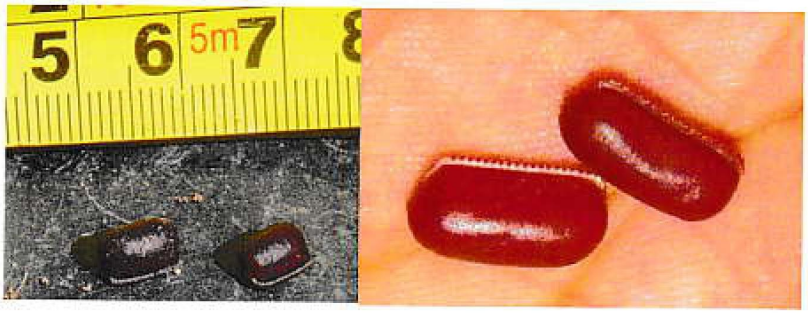
II. American Cockroach (*Periplaneta americana*)

This is larger species among the common cockroaches found in house hold situation, growing to a length of 30-35 mm. American roaches are commonly found frequenting the drains, sewers, manholes, etc. as they prefer moist and dark places with high humidity and decaying organic matter.

Life Cycle:

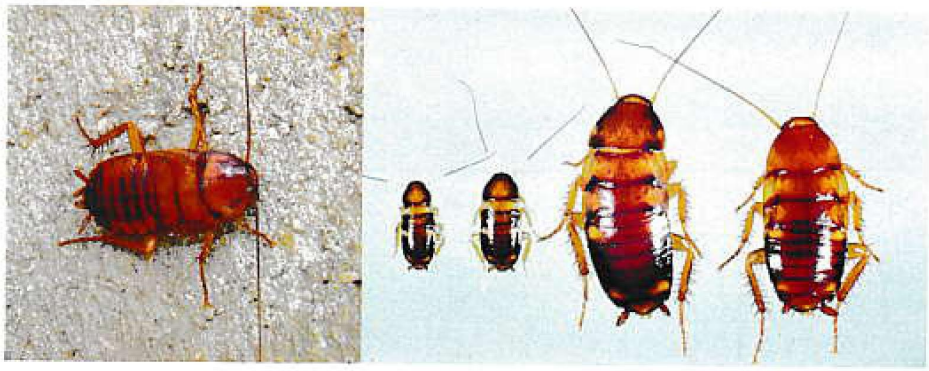
A) Eggs

- The female drops her egg capsule within a day after it is formed
- It may simply be dropped in a suitable location such as near a food source, along the walls or glued to some surface with the help of mouth secretions
- The eggs in a capsule are in two parallel rows
- Each capsule contains from 14 to 16 eggs
- Nymphs generally hatch out in 30 to 45 days



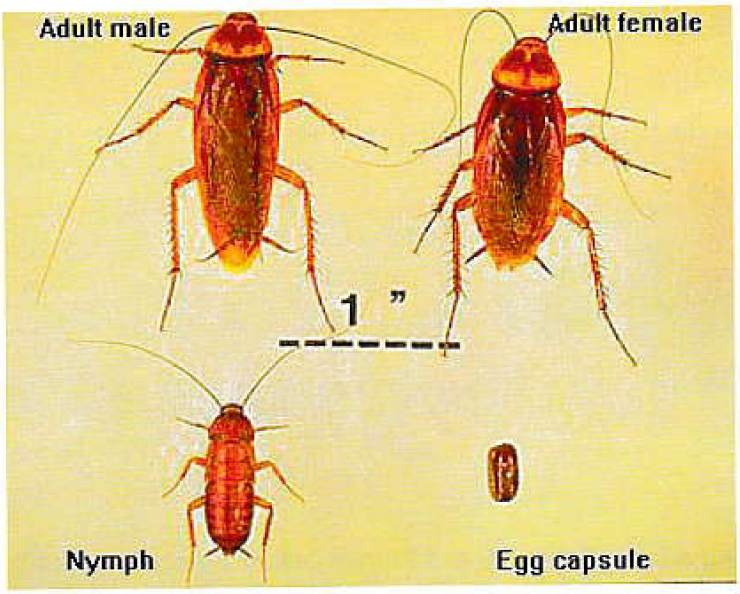
B) Nymphs

- Young nymphs are grayish-brown and each will moult 9 to 13 times before reaching maturity
- After the first few moults, nymphs turn more and more reddish-brown color
- The time required for completion of the nymphal stage varies from 6 to 7 months



C) Adults:

- Adults are reddish-brown, with a yellow border on the back
- Both male and female are fully winged, the wings of the male extending slightly beyond the tip of the abdomen while those of the female are about the same length as the abdomen.
- The adults seldom fly but are capable of gliding long distances
- The male has both stylets and cerci at the end of the abdomen
- The females have a broader abdomen than the males
- The adults live for almost a year
- Each female may produce egg case at weekly intervals



Breeding Habits:

- The female Oriental cockroach produces fewer eggs during her life time
- Each female has the potential to produce only about 250 young ones in a year

Feeding habits and behaviour:

- They feed on all kinds of filth and rubbish and other decaying organic matter. They seem especially fond of garbage
- They can live for a month without food if water is available, but would die within two weeks without water
- Like American cockroaches, they have an affinity for moist humid locations

Internal Premises:

Kitchen and Stores

- All water sources should be checked
- In the kitchen and stores, special attention should be given in the, raw material storage area (dry and wet), food preparation area, serving area, dish washing area, sinks, garbage bins, etc. for signs of cockroach infestation

- Food spillage or food-build up under counters, stoves, refrigerators. Enquire about the procedure and frequency of cleaning service in the kitchen

- Cracks and gaps between the masonry and wood furniture, pipes and el ectrical cables and fittings should be observed
- Check the food processing equipment
  - ❑ Check if there is an accumulation of food residues in and around the working parts of the equipment
  - ❑ Enquire if these units are cleaned, wiped and kept dry at the end of each shift or at least on a daily basis
- Equipment such as Microwave, Mixer, Grinder, Toaster, etc. also are harborages of German and Brown-banded cockroaches.

- Inspect the raw material storage area as it is usually damp it can attract cockroaches.

- Stored material should be ideally kept at appropriate distance, away from the walls and off the floor to allow easy access for regular inspection and cleaning
- Enquire about the procedure of food waste disposal practice. Food waste should not be stored indoors overnight.
- Inspect the rims of floor drains and check the mop and broom storage areas and wheels of mobile carts
- All washing should be completed at night before closing operations for the day

What to look for?

The presence of houseflies and the level of infestation in a particular area can be detected by simple visual observations which include the following:

- Fly adults
- Fly larvae / maggots
- Wet areas as potential breeding sites
- Moist organic matter, garbage, rotting food, waste material of plant or animal origin such as animal excrements, carcasses, etc. attract flies upon which they lay their eggs and multiply
- Fly markings on glass/ smooth surfaces (also called as fly specks)
    - Light colored fly specks are visible signs of feeding
    - Darker fly specks associated with house flies are fecal spots

For effective inspection, involve the facility manager who is familiar with the establishment/ premise and who knows the staff and the way things are done.

Inspection for a fly management service should begin from outside the hotel building since flies are usually found breeding outside.

Where to look for House flies?

- Water is an essential part of a fly's diet as they feed on a liquid diet. Flies do not ordinarily live more than 48 hours without access to water
- Garbage disposal area, dumpsters, garbage bins should be given special attention
- Common sources of food include, sweet foods, milk, syrup, blood, meat, rotting vegetables or fruits and many other materials commonly found in food handling areas such as restaurants and kitchens
- Look for areas where houseflies enter the structure. Windows, doors, receiving area for raw material and various openings and vents in the building/ structure are common entry points for house flies
- House flies prefer warm weather and thus become active after sunrise when temperatures get warmer (approximately 10:00 am) and stop their activity when the day temperature falls (approximately after 3:00 pm).
- They always prefer to sit on edges or thin hanging objects like wires or strings
- During day time, flies can be found actively moving on floors, walls and ceiling indoors whereas they can be located on vegetation, fence wires, garbage cans, *etc*. outdoors.
- During night, house flies prefer to rest mainly on ceilings, electric wires and others such hanging objects indoors whereas outdoors they can be located resting on the building edges, clothes line, grass, weeds, fence wires, electric wires, poles, etc.
- Check areas where the flies are active or resting in the premise.
- Moist rodent baits left unattended can also attract flies.
- Flies can also breed in false ceilings if there is some organic matter and sufficient moisture, so all broken ceiling tiles must be replaced immediately

External Perimeter:

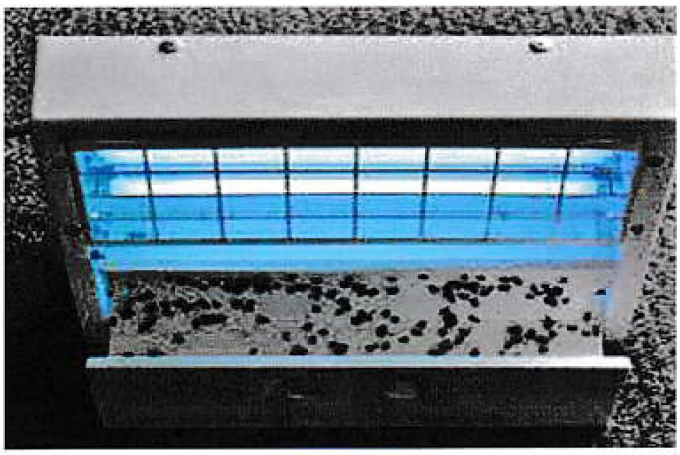
- Check if there are piles of decaying grass clippings, compost heaps and other accumulations of rotting vegetable matter or a dead decaying animal carcasses or even animal excreta. Flies can breed in such spots and utilize even a small quantity of such material for breeding
- Check if there is any poultry, cattle shed, slaughter house, meat processing plant, etc. in the vicinity of the food handling establishment
- Check if there are crop fields/gardens/lawns in the vicinity that are manured with organic compost
- Check if there is sewage treatment plant (STP) nearby

Drainages:

- See if the drain lines, floor drains or septic lines are exposed since flies can easily multiply in sewage sludge
- Check whether the lids of the chambers, nahny traps or drain covers have been closed properly
- The sludge around the edges of man holes or the edges of drain covers when moist can attract and allow flies to breed

Mechanical Control:

- Mechanical fly control includes trapping. Sticky fly paper and traps with glue boards are useful in food handling or food preparation areas, commercial kitchens, etc.
- Insect light traps are often used to supplement fly control in commercial buildings like hotels, restaurants, retail outlets that deal with foods.
- Light traps with electrically charged screens should however be carefully used as the flies would explode on contact with the electric grid and the insect fragments would fall around the trap installation area. This may not be in accordance with the food safety requirements of the food handling/ preparation area.
- To be effective, light traps must be properly placed. This type of trap should be placed where it cannot be seen from outside the building, not more than 7 feet above the floor and away from competing light sources and food preparation areas.
- Insect light traps or sticky traps should be serviced well and proper sanitation should be maintained in the trap
- Use of manual electrically charged grid racquets is now common can be used in non-food areas



2. Application of Space Spray:

- The most commonly employed method is application by mist blower
- Space sprays are useful for achieving quick reductions in fly densities in emergency situations
- Such treatments are used for quick temporary control of flies, e.g. on refuse dumps, manured gardens, etc.

GREEN G
PEST CONTROL SERVICES

Problems

1. Mosquitoes are vectors of some serious diseases like Malaria, Filariasis, Dengue, Chikungunya, Japanese Encephalitis, etc.
2. They are familiar and annoying pests. The female mosquitoes suck blood from the humans or animals and may transmit diseases to them.
3. With each bite, the saliva of mosquitoes is injected into the host body; this contains an antigen which in some people results in a severe instant or delayed reaction.
4. Mosquito bites may cause red, itchy welts, and their rapid wing movement produces a distinctive high-pitched sound which may annoy people.
5. Mosquitoes cause loss of sleep, restlessness and serious nervous irritation.

Types of Mosquitoes:

Various species of mosquitoes have adapted to living in almost all types of water except fast flowing streams and large open bodies of water where there is considerable wave action. The type of water is quiet specific to the species of mosquito that it would breed.

There are over 3200 species of mosquitoes all over the world under 37 different genera. In India there are over 257 species of mosquitoes (*Anopheles* – 58; *Aedes* – 111; *Culex* – 57 and *Mansonia* – 4) belonging to 15 genera.

Some important species of mosquitoes in India are as below -

Anopheles spp.	***Culex spp.***	***Aedes spp.***
An. culicifacies (common in Rural areas)	*Cx. quinquefasciatus*	*A. aegypti,*
An. stephensi (common in Urban areas)	*Cx. tritaenorhynchus group*	*A. albopictus*
An. fluviatilis	*Cx. vishnui*	
An. minimus		
An. Dirus		
An. sundaicus (common in Coastal areas)		

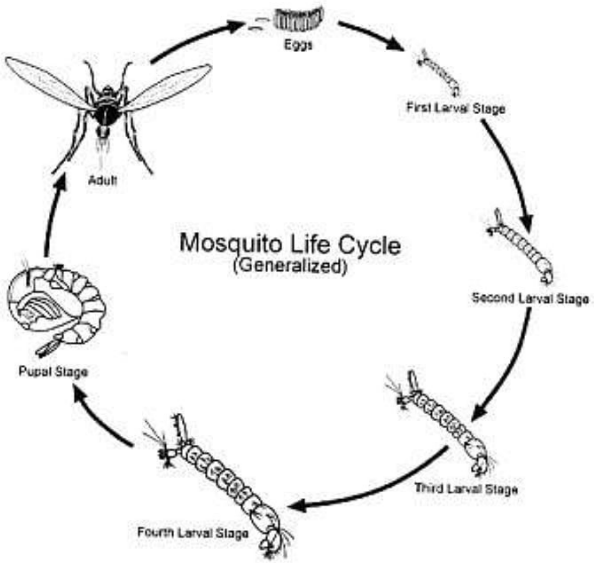
Culex Mosquito

Aedes Mosquito

Anopheles Mosquito

Mosquito Life Cycle

Mosquitoes exhibit complete metamorphosis and have four distinct stages viz. Egg, Larva, Pupa and Adult.



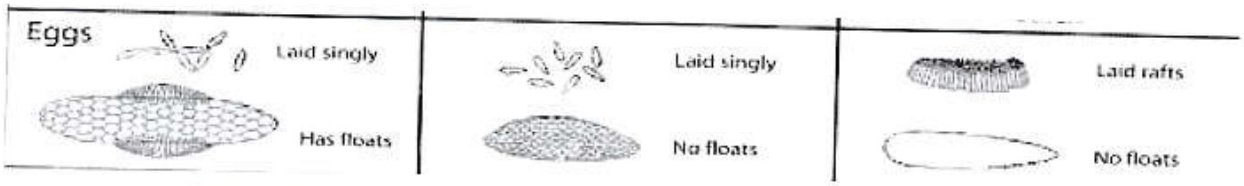
Eggs:

The eggs are laid either singly or in bunch on the surface of the water. *Anopheles* mosquitoes lay 50-200 brown or blackish boat shaped or oval eggs. There is a pair of lateral air filled floats on these eggs.

Culex mosquitoes lay their eggs in the form of a raft which may comprise up to 300 eggs.

Aedes eggs are laid singly and have the capacity to withstand desiccation.

Incubation period of the eggs varies from 2-3 days depending on the normal climatic conditions and type of species



Anopheles Eggs

Culex Eggs

Adults:

Mosquitoes can be distinguished easily from other flies by the fact that they have both a long, piercing proboscis and scales on the hind margin and veins of their wings. Males usually emerge first and wait in swarms near the water surface to mate with the females soon after they emerge. Swarming and mating usually take place at dusk. Female mosquitoes must have a blood meal before they can lay fertile eggs. The adult female is the only stage, which feeds on blood. The mouthparts of the adult male are not suitable for blood sucking. Therefore, their nourishment is normally derived from nectar and plant juices.

The *Anopheles* adults when at rest make an angle with the surface while both the *Aedes* and *Culex* sit horizontal to the surface but the *Aedes* are characterized by black and white markings on the legs.

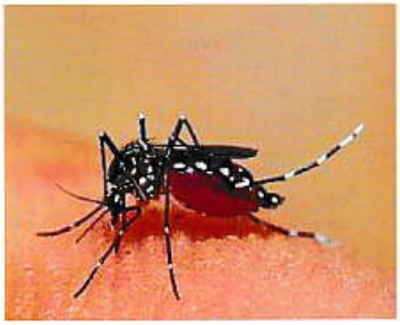
Feeding Behaviour:

Species that prefer to bite humans are called anthrophilic and those that bite mammals, birds and amphibian are called zoophilic.

Body odour, sweat, temperature and carbon dioxide play important role in attraction of the females to the host.

After obtaining a blood meal from the host the female mosquito rest so that the blood is fully digested, the ovaries are fully developed and the eggs are ready for laying. Following the egg laying the adult feeds again on the host for laying another batch of eggs.

Anopheles Adult



Aedes Adult

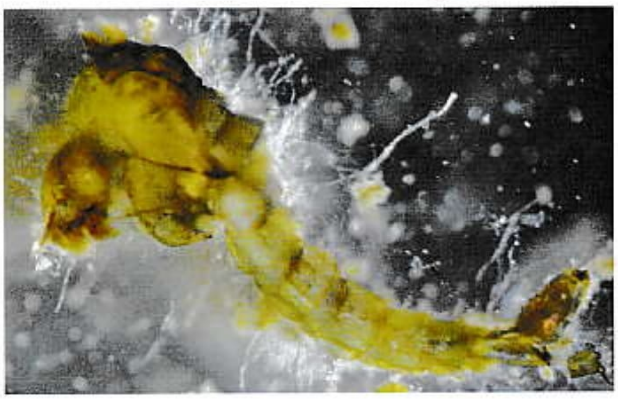
Culex Adult

3. Treatment

- The hotel management and concerned staff should be informed about the procedure of the treatment that will be conducted in the hotel premise for management of the mosquitoes

Larvicide application:

- Locations that have been identified to harbour mosquito larvae should be treated with larvicide. Insect growth regulators are slow in action but are relatively safer to aquatic fauna and provide extended control of the larvae (sometimes even 3 weeks)
- Areas that are outside hotel premises but are potential breeding places of mosquito larvae also need to be considered for larvicide treatment. Treatment of adjoining areas can be also done by residual pesticides
- The larvicides may be in different forms, some of the common formulations include Wettable Powders, Granules, Emulsifiable Concentrates, Tablets, etc.
    1. Stagnant water bodies can be treated with WP or EC formulations
    2. Granules are useful for application in the vegetative areas that may inhibit sprays from reaching the breeding site
    3. Tablets can be applied at localized spots where very small amounts of water are found to breed mosquito larvae



Malformed Larvae

Method of application:

- Hand-operated compression sprayers fitted with a flat fan, cone-jet or adjustable cone-jet nozzle can be used for spraying on water surfaces
- Considering the depth of the water body to be treated, prepare the insecticide spray as per manufacturer's instructions
- Areas such as 'nallahs', open drains, floor drains, septic lines, fountains, ornamental ponds, receptacles of potted plants, scrap or waste accumulated with water and other stagnant water bodies can be treated by uniform spraying on the surfaces
- Lawn, trees, vegetation in the external periphery and other breeding sites which are inaccessible by spraying can be treated with granular formulations
- Granules can be broadcasted by wearing hand gloves on such vegetative areas
- Care must be taken not to apply (unless recommended by manufacturer) to the waters that might be used for humans or domestic animal purpose
- Depending on the type of larvicide, treatment with larvicides can be done at an interval of 1-3 weeks

Adulticide application:

- Adulticide application mainly consists of 2 types, *viz.* Indoor Residual Spraying (IRS) or Space Spraying

  a) IRS:
  - The formulation is usually diluted in water at a recommended dosage and sprayed on the four walls of the room and ceiling surfaces
  - When the mosquitoes enter structure and rest on the walls, they come in contact with the insecticide and get knocked down

Method of application:

- For indoor residual spraying to manage mosquitoes, a flat fan nozzle is useful
- Wear protective clothing (rubber gloves and goggles or other types of eye protection equipments are especially recommended)
- Prepare the insecticide spray according to the manufacturer's instructions
- To ensure the correct swath width, keep the spray tip about 45 cm from the wall
- Do not let spray drip on the floor
- Depending on the type of product, treatment for IRS can be done once in 1-3 months

ii. **Thermal Fogging:**

- In Thermal fogging insecticide is diluted in a carrier liquid, which is usually oil-based
- Hot gas is used to heat the pesticide spray, decreasing the viscosity of the oil carrier, and vaporizing it
- When the mixture leaves the nozzle the vapour hits colder air and condenses to form a dense white cloud of fog

Method of application:

- Plan the fogging operation in the morning or dusk (depending on mosquito activity period)
- Inform all the concerned hotel staff about the operation
- Protect all water containers and foodstuffs
- Remove fish or cover fish tanks
- Close all doors and windows before fogging and keep them closed for 30 minutes after spraying to ensure maximum efficacy.
- Spray operators should work backwards and away from the fog to minimize exposure
- Ensure that the applied area / rooms are ventilated before reoccupation
- Depending on the mosquito infestation fogging treatment can be done once a week during peak season or once in 3 months during low pest activity