

Effects of Pest Control and Pesticides

Dr. Varsha Pratibha

Associate Professor,

Masters In Business Administration, Presidency University, Bangalore, India,

Email Id: varsha.ps@presidencyuniversity.in

Pests have tormented humanity from the dawn of time, according to ancient Chinese, Egyptian, and Hebrew literature. For example, in Exodus 10:14-15, there is a graphic portrayal of a major insect invasion: and the locusts spread across Egypt and settled on the whole nation. They darkened the face of the whole area by covering it with their bodies, and they ate in all plants and trees fruit. In Egypt, not a single green item remained, neither tree nor field plant. Pest-borne diseases such as plague and malaria have altered the trajectory of human history [1], [2]. Pest management efforts are also as ancient as history. Chalk, plant extracts, mercury, arsenic, lead, and other substances were utilised as early control techniques. People have also sought to control pests via sacrifices, prayers, rituals, dances, and other methods across time. Many of the offending insects were dragged into court, pronounced guilty, excommunicated by the archbishop, and expelled from the kingdom during an epidemic of beetles in Switzerland in 1476.

Chemicals have come to dominate human pest control attempts during the past century or so. The ideal insecticide, like pharmaceuticals, is both safe and effective safe for both human and ecological health and functional at controlling the target species. Previously, although numerous substances were suggested for pest management, nearly none were experimentally investigated, and the majority were shown to be worthless Keifer, Wesseling, and McConnell, 2005. Paris green copper aceto arsenate was one of the first agricultural chemicals to be widely employed. It was discovered to have insecticidal effects in the 1860s and was used to suppress the Colorado potato beetle, *Partial view disseminate*. Paris green was also a powerful fungicide. Lead arsenate became a popular insecticide and was frequently employed in agriculture later in the nineteenth century. In 1939, chemical pest control took a drastic turn.

Chemicals have come to dominate human pest control efforts during the previous century or two. The ideal insecticide, like pharmaceuticals, is both safe and effective safe for human and environmental health while also managing the target species. Previously, despite the fact that numerous substances were suggested for pest management, nearly none were experimentally evaluated, and the majority were shown to be worthless Keifer, Wesseling, and McConnell, 2005. Paris green copper aceto arsenate was one of the first agricultural chemicals to see widespread application. It was first employed to suppress the California potato beetle, *Leptinotarsa disseminate*, in the 1860s. Paris green worked well as a fungicide as well. Later in the nineteenth century, lead arsenate was frequently utilised in agriculture as a pesticide. In 1939, chemical pest control evolved substantially [3]–[5]. After the war, DDT and other chlorinated insecticides found their way into the agricultural market. The use of these substances in agriculture altered pest control and food production over the globe. Yet, public health and ecological research has uncovered a growing number of pesticide-related issues, ranging from human toxicity to animal toxicity to ecosystem disturbance. Rachel Carsons 1962 book *Silent Spring* was a forceful wake-up call, exposing the public and politicians to the dangers of extensive pesticide usage. As a result, modern pest management has attempted to move beyond dependence on pesticides entirely, using a mix of chemical and nonchemical approaches.

Insect Pests

Insects are classified as Insecta or Hexapoda and have three body parts head, thorax, and abdomen, six legs attached to the thorax, and thoracic wings in most adults Triplehorn and Johnson, 2005. Insect mouthparts might be eating or sucking. Grasshoppers, termites, and fleas, for example, rip and crush plant material, insects, or other things. Aphids, butterflies, and mosquitoes use sucking mouthparts to puncture their meal and remove fluids in order to eat. All insects undergo one of two forms of development, or metamorphosis: progressive egg, nymph, and adults or complete egg, nymph, and adult egg, larva, pupa, and adult. Juveniles in insects that undergo imperfect metamorphosis seem just like adults; as they develop, they grow in size via a series of moults. They acquire external wing pads with each moult; with their last moult to the adult form, completely functioning wings and reproductive systems emerge. Juveniles and adults of insects that undergo full metamorphosis seem quite different. They go through a series of moults as larvae, ending in a resting stage known as the pupa. At this stage, the insects' bodily tissues reorganise themselves to form the adult. As the last moult occurs, the insect emerges from the pupal skin as a fully functioning adult.

Bedbugs

Bedbugs are worldwide pests that are human ectoparasites that is, they dwell on exterior surfaces. They are members of the order Hemiptera and cannot fly as adults Triplehorn and Johnson, 2005. They go through a partial metamorphosis and must feed on blood to live. The bedbug is also known as the mahogany flat, chinch, and red coat Truman, Bennet, and Butts, 1982. *Cimex lectularius*, the adult common bedbug, is approximately 0.2-inch length, 0.1 inch broad, and oval in shape.

Insect Repellants

Insect repellants are not intended to kill insects, but rather to keep them from landing on your skin or clothing. These are successful ones for both avoiding the pain of mosquito and other insect bites and preventing disease transmission. The reduction of bug bites has a significant public health advantage. Mosquitoes, for example, alone spread illness to about 700 million people each year. Malaria remains a common disease in low- and middle-income countries see Box 20.5, and mosquitoes in the United States transmit eastern equine encephalitis, western equine encephalitis, St. Louis encephalitis, and La Crosse encephalitis, as well as West Nile virus since 1999, demonstrating that no part of the world is immune to mosquito-borne diseases.

Commercially accessible insect repellants include those derived from plants and others composed of synthetic compounds. The efficiency of a repellent is determined by a variety of parameters, including the type of biting organism; the users age, sex, level of activity, and biochemical attraction to biting arthropods; and the ambient temperature, humidity, or wind speed Fradin and Day, 2002. As a consequence, no repellent is equally effective for all users. N,N-diethyl-mtoluamide, now known as N,N-diethyl-3-methylbenzamide, or DEET, is a primary component of practically all consumer insect repellants Bell, Veltri, and Page, 2002. DEET, which was discovered by scientists at the United States Department of Agriculture and patented by the United States Army in 1946, has been utilised in commercial repellents since the late 1950s DEET Is Hard to Beat, 2003. It is a broad-spectrum repellent that works against a variety of mosquitoes, biting flies, chiggers, fleas, and ticks Fradin and Day, 2002. As compared to alternatives such as IR3535 and natural repellants such as citronella, soybean oil, peppermint oil, eucalyptus oil, and prickly pear cactus, DEET has been demonstrated to be considerably better in repelling insects.

When administered to the skin, it is absorbed in amounts ranging from 5% to 15% in various tests Sudakin and Trevathan, 2003. It is digested and eliminated in the urine in 12 to 24 hours. Acute toxicity is exceedingly uncommon. Since 1960, fewer than fifty instances of substantial toxic effects have been described in the medical literature; the majority of them were caused by extraordinarily large exposures and resolved without long-term consequences Fradin and Day, 2002. Nonetheless, animal studies have

revealed that DEET may have neurological consequences Abdel-Rahman and others, 2004. As a result, it is advised to use DEET sparingly. The following are some use guidelines:

1. Do not use concentrations more than 50% since effectiveness plateaus at that level Buescher, Rutledge, Wirtz, and Nelson, 1983. Concentrations of 20 to 30% are usually adequate.
2. Apply DEET on or near all exposed skin areas; it is ineffective beyond approximately two inches from the application site. DEET may be applied to garments to reduce skin absorption, however it is a plasticizer that can dissolve certain synthetic textiles.
3. Since DEET is only effective for a few hours about five hours in one rigorous research; Fradin and Day, 2002, it may be required to reapply it on a regular basis.
4. DEETs potency reduces with increasing temperature.
5. Since DEET is easily washed away by sweat, rain, or other water sources, it must be reapplied after becoming wet.

Cockroaches

Cockroaches are members of the Blattodea order Triplehorn and Johnson, 2005. The majority of cockroaches are tropical, and they are abundant in the southern United States. Those most typically observed in northern locations are those that dwell inside, in homes, restaurants, and other structures. Cockroaches are not known to spread dangerous illnesses. They do, however, contaminate food, have a disagreeable stench, and may be a considerable annoyance, and exposure to cockroach antigen is a significant risk factor for getting asthma. German, brown banded, Oriental, and American roach are the four most frequent pest species in the United States. Cockroaches go through a slow metamorphosis with egg, nymph, and adult phases Truman, Bennet, and Butts, 1982. Mature females lay egg casings known as ootheca. They protect the eggs from desiccation and may be carried about by the female until hatching or deposited in protected places, depending on the species. Adult cockroach wings may be long and completely functioning or small and virtually nonexistent. Only males in certain animals have functioning wings and may or may not fly. The majority of cockroaches are nocturnal; however they may be spotted during the day when populations are great.

The most prevalent cockroach in American households is the German cockroach, *Blatella germanica*. Adults are around 1.3 cm long, light brown, and have two black stripes on their pronotum, or back. Females are the only frequent house infesting cockroaches that hold their ootheca until the eggs are ready to hatch. German cockroaches are generalist feeders that like fermenting food, and adults may survive for roughly a month provided water is available.

The biggest of the house-dwelling cockroaches 4 cm or more is the American cockroach, *Periplaneta americana*, or water bug, Bombay canary, or flying water bug. It is reddish-brown in colour, and both men and females are fully winged but seldom fly. Females deposit or secure ootheca near food sources, such as baseboards or outside in wet, decomposing wood southern United States. They enjoy dark, wet environments and are often found in basements. Book bindings, manuscripts, and other starchy material, as well as syrup and other sorts of sweets, are common food sources for American cockroaches.

The Oriental cockroach, *Blatella orientalis*, often known as the water bug, black beetle, or shad roach, is a global nuisance. These roaches are around 3 cm long and black in colour. Male wings cover around three-quarters of the abdomen, whereas female wings are rudimentary. Females either deposit their eggs or attach them to a safe place near a food source. Oriental cockroaches eat on dirt and junk, and they are particularly fond of rubbish. They also like high-moisture environments and need water to live. *Supella longipalpa* is a little less than 1.5 cm cockroach with two lighter transverse stripes at the base of the wings and abdomen. Females carry ootheca for one or two days before attaching them to a safe place. This species may be found high on ceilings, hiding behind picture frames, and near heat-generating motors and electrical gadgets. They need less water than other cockroaches and are uncommon in kitchens and toilets. Brown-banded cockroaches like starchy foods, although they will eat almost anything [6]–[8].

Fleas

Fleas are little ectoparasites 2 to 4 mm length of the Siphonaptera order Triplehorn and Johnson, 2005. Fleas have chewing mouthparts as juveniles and piercing-sucking mouthparts as adults, both of which are utilised to feed on blood Truman, Bennet, and Butts, 1982. Eggs are placed on the host animal, but they fall off onto carpets, furniture, and pet bedding. Legless, wormlike larvae develop from the eggs. Larvae feed on trash and other organic material, including adult flea excrement and dried blood. Larvae go through three stages instars before spinning cocoons and entering the pupal stage. Adults are ready to eat and breed when they emerge in seven to fourteen days. Fleas are very important because they carry illnesses such as plague and murine typhus. There are several species of fleas, including those that feed on humans and pets. *Ctenocephalides felis*, the cat flea, and *Ctenocephalides canis*, the dog flea, are ubiquitous across the United States and prefer to feed on dogs, cats, people, and sometimes rodents.

They love regions with a lot of organic material and may be found in homes, beneath structures, and in yards. Both species are intermediate hosts for the canine tapeworm *Dipylidium caninum*, which can be passed on to youngsters who eat afflicted fleas while playing with dogs. The human flea, *Pulex irritans*, is abundant across the United States, particularly along the Pacific coast. It mostly feeds on people, although it will also eat pigs and dogs on occasion. In laboratory circumstances, it may spread plague, however it is not generally a carrier of this illness. *Xenopsylla cheopis*, the oriental rat flea, is widely seen on Norway and roof rats and has spread across the United States. It is the primary vector of bubonic plague in rats. It prefers rats as hosts, although it may sometimes feed on people. The northern rat flea, *Nosopsyllus fasciatus*, may also be found in the United States, where it feeds on rats and mice. Despite the fact that it is a confirmed carrier of the plague bacteria, it seldom bites people. In the southern and southwestern United States, the sticktight flea, *Echidnophaga gallinacea*, is largely a pest of poultry; but it may bite other species, including humans. While this flea may be infected with cholera and murine typhus, its value as a vector is diminished since females prefer to feed on just one host. The mouse flea, *Leptopsylla segnis*, is abundant on rats in the Gulf states and California, and to a lesser degree on house mice, but it does not transmit illness.

Lice

Lice are flightless, ectoparasitic insects classified as Anoplura sucking lice or Mallophaga chewing lice Triplehorn and Johnson, 2005. These are little 2 to 3 mm long insects that undergo slow transformation. Sucking lice feed on blood by inserting their mouthparts into their hosts Truman, Bennet, and Butts, 1982. Chewing lice feed on the skin scales and fluids of the host. The connection between the head and the thorax distinguishes sucking lice from chewing lice; sucking lice have heads those are conical and narrower than their thoraxes, while chewing lice have shield-shaped heads that are broader than the thorax. Both groups devote their whole lives to their hosts. There are over 500 different types of sucking lice that feed on animals. Just two species of *Pediculus humanus* attack humans: the body louse *P. humanus humanus* and the head louse *P. humanus capitus*, as well as the crab or pubic louse *Phthirus pubis*. Eggs are placed on the host and are attached to body hair. They hatch into nymphs and begin eating on the host right away. Body lice have been linked to the transmission of typhus and recurrent fever. Head lice and pubic lice do not spread illness, but they may be a major annoyance in places like schools and day care facilities. There are around 2,600 different types of chewing lice. All of them are parasitic on birds or animals but do not bite humans.

Mosquitoes

Mosquitoes and other biting insects are members of the Diptera order Triplehorn and Johnson, 2005. Mosquitoes are a large 169 species in North America, well-known, and important group of biting insects that live in water as larvae and above the water's surface as adults. Mosquitoes transmit a variety of human illnesses, including malaria, dengue fever, yellow fever, and various encephalitis viruses. Mosquitoes go through a full transformation Hamilton and Racz, 1998. Female mosquitos deposit their eggs in rafts on the water's surface or individually in or near water. In the latter case, the eggs stay dormant until they are stimulated to develop by the presence of water. Larvae, or wrigglers, feed on algae and

other organic waste after hatching. All mosquitos need air to breathe and must cease feeding on a regular basis to do so. The species determines how this happens. Except for *Anopheles* spp., larval culicine mosquitos breathe by inserting an air tube or syphon on the tip of the abdomen through the water's surface like a snorkel.

Anopheline mosquitos lack an air tube and must breathe by lying horizontal to the water's surface. Some mosquito species may breathe by inserting their breathing equipment into the roots of water plants. Larvae pupate in seven days under ideal circumstances. The little, comma-shaped pupae cling to the surface tension of the water, keeping their breathing tubes in touch with air. As the larvae emerge, both females and males live by feeding on plant liquids like as nectar. Many mosquito species are responsible for spreading the deadliest illnesses. Malaria, for example, is spread by *Anopheles* species. Yellow fever and dengue fever are both transmitted by *Aedes aegypti* Triplehorn. *Culex* species transmit filariasis, which is caused by a filarial worm.

West Nile virus is transmitted by a range of animals that feed on birds, especially those of the genus *Culex*. *Culiseta melanura* is known to spread Eastern equine encephalitis in birds, while *Aedes sollicitans*, *Aedes focal segmental*, and *Coquillettidia perturbans* are considered to be primary vectors of the illness in people Hamilton and Racz, 1998. The common house mosquito, *Culex pipiens*, spreads St. Louis encephalitis. St. Louis encephalitis is common in urban areas because *C. pipiens* is an urban mosquito.

Termites

Termites are insects of the order Isoptera that cause millions of dollars in damage to wood and wooden buildings across the globe Triplehorn and Johnson, 2005. There are around 1,900 termite species worldwide. Termites are classified into four families: Kalotermitidae seventeen species in the United States, Termopsidae three species in the United States, Rhinotermitidae nine species in the United States, and Termitidae nine species in the United States fifteen U.S. species. Termites differentiate themselves from ants by having moniliform beadlike or filiform filament-like antennae, a large link between the thorax and abdomen, and front and hind wings that are equal in shape and size. Unlike termites, ants have elbowed antennae, a tiny link between the thorax and abdomen called a petiole, and front wings that are bigger than hind wings.

Termites have three separate classes in their societies: reproductive females and males, labourers, and soldiers. Termites that reproduce have four wings. Termites go through a basic metamorphosis and feed on cast skins, termite excrement, deceased people, and plant resources like wood and wood products. The cellulose in the wood and wood products that termites consume is processed by a slew of flagellate protists in the termite's digestive tract. Termites would starve to death if these creatures did not exist. Termites do not inherit these organisms rather, they acquire them through eating on the anal secretions of other termites. Humans value termites for a variety of reasons. For starters, due of their fondness for wood, they are very damaging to wooden parts of buildings, furniture, books, utility poles, fence posts, and other structures. They also emit a lot of methane into the atmosphere.

Subterranean termites, drywood termites, and dampwood termites are the three principal types of destructive termites in the United States. Subterranean termites live in wood that is buried in the soil or in touch with it. They may even infiltrate wood that is not in touch with soil but must retain contact with soil in some manner. These termites are a major problem in the eastern United States. *Coptotermes formosanus*, a newly introduced member of this group, is one of its members. This termite is endemic to China and Taiwan and is one of the world's most destructive termites. It has been adopted in a number of nations, including Japan, Guam, and the United States. It originally appeared in Texas in 1965 and has since expanded to Alabama, Louisiana, Mississippi, Georgia, Florida, Tennessee, and North and South Carolina. It targets both live and dead trees, as well as wooden buildings. Drywood termites live aboveground in wooden posts, tree stumps, trees, and wooden structures and do not need soil contact. Dampwood termites inhabit wet, decaying wood, tree roots, and other structures. They are found in Florida as well as the United States southern, northern, and Pacific coasts.

Ticks

Ticks are related to insects and belong to the order Acarina. Ticks have piercing-sucking mouthparts and go through a growth cycle similar to insects, with slow transformation. Mating takes place when the females and males are on the host. Females then descend to the ground to deposit eggs Truman, Bennet, and Butts, 1982. As they hatch, the larvae, or seed ticks, have six legs. They then search for a host to feed on. They moult to the nymph stage after having a blood meal. Some tick larvae that feed on just one host will moult on the host. Nymphs has eight legs and resemble adults, but they lack a genital pore. To live, nymphs, like larvae, must locate a host in order to acquire a blood meal. When they do, they moult to the adult stage. Mature male and female ticks may eat for many days before reproducing. Most ticks are capable of feeding on a broad range of animals, includes birds, reptiles, and mammals. In certain cases, *Ixodes scapularis*, the black-legged or deer tick, juvenile ticks, and adult ticks all feed on various hosts. Ticks are classified as either hard ticks such as the brown dog tick, American dog tick, and blacklegged tick or soft ticks such as the common fowl tick and relapsing fever tick. In the United States, ticks are responsible for at least nine human illnesses, including Lupus, Rocky Mountain spotted fever, relapsing fever babesiosis, and, more recently, ehrlichiosis American Lyme Disease Foundation.

Rhipicephalus sanguineus, the brown dog tick, feeds on a variety of hosts Truman, Bennet, and Butts, 1982. Dogs are the most prevalent host. Brown dog ticks are often found in dog-keeping buildings such as kennels, veterinarians' institutions, and houses. *R. sanguineus* is a vector of canine ehrlichiosis *Ehrlichia canis* and canine babesiosis *Babesia canis* in the United States Lord, 2001. Just a few incidences of them causing sickness in people are known. In dogs, symptoms of canine ehrlichiosis include lameness and fever; babesiosis causes fever, anorexia, and anemia. *R. sanguineus* is a vector of *Rickettsia conorii*, often known as Mediterranean spotted fever, boutonneuse fever, or tick typhus across regions of Europe, Asia, and Africa. It has not been shown that *R. sanguineus* transmits the germs that cause Lyme disease. Adult *Dermacentor variabilis* ticks prefer to feed on dogs but will also feed on bigger animals Truman, Bennet, and Butts, 1982. Larvae and nymphs eat tiny wild animals like mice. They are the most common tick in the United States and may be found both inside and outdoors [2], [9], [10].

Rocky Mountain spotted fever and tick paralysis are transmitted by American dog ticks. The lone star tick, *Amblyomma americanum*, attacks people as well as cattle, sheep, horses, pigs, dogs, deer, and birds at all stages North Carolina Agricultural Extension Service, 2005. The lone star tick is also a vector for Rocky Mountain spotted fever and tick paralysis, as well as a secondary Lyme disease vector. The black-legged tick is a recognised Lyme disease vector ALDF, 2005. The larvae of black-legged ticks' prey on tiny animals found in leaf litter. Nymphs feed on small animals and birds and are generally infected with Lyme disease at this stage if they are not already. Adults eat bigger creatures like deer. Nymphs and adults feed on people as well and, if infected, may spread Lyme disease to humans. Babesiosis may also be transmitted by black-legged ticks. The western deer tick, *Ixodes pacificus*, is a vector of Lyme disease and babesiosis and is abundant in the Midwest and Western United States.

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