

ECONOMIC IMPORTANCE OF INSECTS :

The estimated annual value of the ecological services provided by insects in the United States alone is at least \$57 billion, an amount that justifies greater investment in the conservation of these services. Without the activities of insects, human life on earth would eventually be extinguished. Over one lakh currently living species of insects have been identified, but the true number is surely much larger, about a million.

A. BENEFICIAL INSECTS :

➤ **Pollinators of crops** (Bees, wasps, butterflies, moths, hoverflies, beetles)

Many plants depend on insects to transfer pollen as they forage. Plants attract insects in various ways, by offering pollen or nectar meals and by guiding them to the flower using scent and visual cues. This has resulted in strong relationships between plants and insects. Value of crop production from pollination by native insects is estimated to be about \$3 billion in US alone. When we talk about pollinators the ones that come to mind are honey bees and butterflies, but there are also many other insects that perform this job for flowering plants, as well. There are flies, wasps, beetles and even some other insects that most people know nothing about, such as Hemiptera and thrips. There are many important pollinating insect species in the orders: Hymenoptera (bees, wasps, and ants), Lepidoptera (butterflies and moths), Diptera (flies) and Coleoptera (beetles).

As adults these insects feed on pollen and nectar from flowers. They forage from plant to plant and may initiate pollination by transferring pollen from an anther to a stigma. Female bees and pollen wasps provision their nests with pollen and nectar that they actively collect onto their bodies. Their larvae then feed on the collected pollen and nectar. Yucca moth larvae do not feed on pollen or nectar but on the seeds of yucca plants. The adults pollinate the yucca plant by actively collecting pollen onto their palps and then placing the collected pollen on a receptive stigma to ensure proper seed set for their offspring.

Economic value of insect pollination worldwide is estimated at U.S. \$217 billion (*Science Daily*, Sept. 15, 2008). German scientist found that the worldwide economic value of the pollination service provided by insect pollinators, bees mainly was dollar153 billion in 2005 for the main crops that feed the world. This figure amounted to 9.5% of the total value of the world agricultural food production. The study also determined that pollinator disappearance would translate into a consumer loss of food estimated between dollar 190 to 310 billion.

➤ **Predators of pests** (Dragonflies, beetles, bugs, lacewings, wasps)

The arthropods predator of insects and mites include beetles, true bugs, lacewings, flies, midges, spiders, wasps, and predatory mites. Insect predators can be found throughout plants, including the parts below ground, as well as in nearby shrubs and trees. Some predators are specialized in their choice of prey, others are generalists. Some are extremely useful natural enemies of insect pests. Unfortunately, some prey on other beneficial insects as well as pests.

Major characteristics of arthropod predators:

- Adults and immature stages are often generalists rather than specialists.
- They generally are larger than their prey.
- They kill or consume many preys.
- Males, females, immature stages and adults may be predatory.
- They attack immature and adult prey.

Important insect predators include lady beetles, ground beetles, rove beetles, flower bugs and other predatory true bugs, lacewings and hover flies. Spiders and some families of mites are also predators of insects and mite pests. Natural enemies play an important role in limiting potential pest populations.

➤ **Parasites of pests** (Hymenoptera and Diptera)

Parasitoids are insects with an immature stage that develops on or in an insect host, and ultimately kills the host. Adults are typically free-living, and may be predators. They may also feed on other resources, such as honeydew, plant nectar or pollen. Because parasitoids must be adapted to the life cycle, physiology and defenses of their hosts, many are limited to one or a few closely related host species. Crop losses averted by beneficial insects from predators or parasites of agricultural pests are estimated to be \$4.5 billion. The most valuable insect parasites belong to the following groups:

- Tachinid Flies (Diptera)
- Ichneumonid Wasps (Hymenoptera)

These parasites live in or on one host insect pest which is killed after the parasite completes its development. Parasite (also called parasitoid) adults are free-living; the immature stage lives on or inside a host and kills the host before the host completes its development. Parasites lay one or more eggs on the outside of the host body or they insert the eggs inside their host. The immature parasite feeds on the host and requires only a single individual prey to complete its development. Free-living adults may feed on nectar from flowering plants or

obtain nutrients by piercing the body of host insects and withdrawing fluids (host-feeding). Parasites are often considered more effective natural enemies than predators because many have a narrower host range, require only one host to complete development, have an excellent ability to locate and kill their host and can respond rapidly to increases in host populations.

➤ **Productive insects (Silkworm, Honey bees, Lac insects)**

Sericulture is an agro-based industry. It involves rearing of silkworms for the production of raw silk, which is the yarn obtained out of cocoons spun by certain species of insects. The major activities of sericulture comprises of food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for value added benefits such as processing and weaving. Five varieties of silk worms are reared in India for producing this natural fibre. *Bombyx mori*, the silk worm, feeds on the leaves of mulberry to produce the best quality of fibre among the different varieties of silk produced in the country. Of the total production of 2,969 tonnes of silk in India, as much as 2,445 tonnes is produced by the mulberry silkworms, *Bombyx mori*.

Lac Insect any of the species of *Metatarchardia*, *Laccifer*, *Tachordiella*, *Austrotacharidia*, *Afrotachardina*, and *Tachardina* of the superfamily Coccoidea, order Homoptera that are noted for resinous exudation from the bodies of females. Members of two of the families viz. Lacciferidae and Tachardinidae appear to be more concerned with lac secretion. There are several lac insects, some of which secrete highly pigmented wax. The Indian lac insect *Laccifer lacca* is important commercially. It is found in tropical or subtropical regions on banyan and other plants. The females are globular in form and live on twigs in cells of resin created by exudations of lac. Of the many species of lac insect, *Laccifer lacca*, (= *Tachardia lacca*) is the commercially cultured lac insect. It is mainly cultured in India and Bangladesh on the host plant, *Zizyphus mauritiana* and *Z. jujuba*. The insect starts its life as a larva or nymph which is about 0.6 mm long and 0.25 mm wide across the thorax. The young settles down on a suitable place of the host plant gregariously. On the average some 150 of such larvae may be present per square inch of the twig.

Apiculture or beekeeping is the maintenance of honey bee colonies, commonly in hives by a beekeeper in apiary in order to collect honey and beeswax, and for the purpose of pollinating crops. The genus *Apis* is comprised of a comparatively small number of species including the western honeybee *Apis mellifera*, the eastern honeybee *Apis cerana*, the giant bee *Apis dorsata*, and the small honeybee *Apis florea*. Nectar is a sugar solution produced by flowers containing about 80% water and 20% sugars. Foraging bees store the nectar in the 'honey sac' where the enzyme invertase will change complex sugars into simple sugars called mono-saccharides. Upon return to the hive, the foraging bee will disgorge the partially converted nectar solution and offer it to other bees. Housekeeping bees will complete the enzymatic conversion, further removing water until the honey solution contains between 14 – 20% water.

B. INJURIOUS INSECTS:

Less than 1% of insects are regarded as pests. They can be classified into the following categories.

- **Pests of agriculture and forestry** (Locusts, caterpillars, bugs, hoppers, aphids etc.)

Locusts are among the most destructive of all insect pests. Swarms of desert locusts were among the plagues of the Biblical Egyptians, and they still plague farmers throughout Asia and Africa. Their threat is so great that regional and international organizations monitor desert locust populations and launch control measures when necessary. Locusts are particularly destructive in hot, dry regions when a sudden increase in their numbers, combined with food shortage, forces them to migrate. They migrate in huge swarms, devouring virtually every green plant in their path.

Household pests (carpet beetles, furniture beetles, cloth moth, termites and silverfish)
Common household pests include ants, termites, bed bugs, carpet beetles, furniture beetles, book lice, house flies, fleas, cockroaches, silver fish, clothes moths and spiders - the list seems almost endless. Common household pests enter our homes for shelter and food, and also to nest and breed. Common household pests can cause damage to our homes especially clothes, eatables and furniture. Household pests can also be a threat to health of our families by spreading bacteria, diseases or allergens in our homes. Household pests can be irritating, annoying or irritating and annoying. They can be controlled by spraying insecticides or by fumigants and by maintaining hygiene.

Insects of medical and veterinary importance (Mosquitos, flea, beetles, flies)
Mosquitoes can spread diseases such as malaria, yellow fever, dengue fever. Tsetse flies spread sleeping sickness. Lice suck human blood and can cause sores, which if left untreated can become infected which may lead to blood poisoning. Screw worm flies lay their eggs in the wounds of farm animals and pets. Horseflies and black flies suck blood and have painful bites, which can become infected. Houseflies spread germs and spoil meat by laying eggs in it. Bubonic Plague (or Black Death) was the worst disease epidemic in human history. It took 14 million lives—nearly 1 out of 4 people—in 14th- century Europe. The plague is passed to humans by the bite of the Oriental rat flea (*Xenopsylla cheopis*), which picks up the disease-causing bacteria from rats.

Pests of stored grains The most common insect pests of stored cereal grains are:

Rice Weevil (*Sitophilus oryzae*); Lesser Grain Borer (*Rhyzopertha dominica*);
Rust Red Flour Beetle: (*Tribolium* spp.); Sawtooth Grain Beetle: *Oryzaephilus surinamensis*);
Flat Grain Beetle: (*Cryptolestes* spp.); Indian Meal Moth (*Plodia interpunctella*); Angoumois
Grain Moth (*Sitotroga cerealella*); Khapra beetle (*Trogoderma granarium*); Rice moth
(*Corcyra cephalonica*).

Insect management for stored grain depends upon good sanitation and grain storage practices. Clean storage areas to reduce the potential for insect migration into the new grain. Once the grain is dried to 13 percent moisture or less, cool it as soon as possible by running aeration fans. Reducing the grain temperature to less than 60°F stops insect reproduction, and lowering it to less than 50°F stops insect feeding activity. Infested grains should be fumigated by Aluminum phosphide (Phostoxin, Fumitoxin), which is best in most circumstances. Methyl bromide may also be used.