



Insects: An Inevitable Part of Ecosystem

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Insects and pests hold the same position in the overall understanding of the general public. However, all pests are harmful, causing one disease or the other to the associated plant or animal. Unlike them, insects can be beneficial, enabling some of the processes and enhancing the state for better performance and higher production of agricultural crops. Insect ecology can be best described as the interaction of insects with the environment in such a way that both of them maintain harmony with each other alongside uplifting their condition of survival and adaptation. In this article, I have tried to describe the relationship between different insects with themselves as well as their residing environment.

Agriculture is the branch of science which holds every element from the nature viz. air, water, soil, gases. It enriches people and

animals with the amount of nutrients required by their body. Agriculture is the most comprehensive word used to denote the many ways in which crop plants and domestic animals sustain the global human population by providing food and other products. The English word agriculture derives from the Latin *ager* (field) and *colo* (cultivate) signifying, when combined, the Latin agricultural: field or land tillage.

One of the pivotal parts of agriculture, insects in turn provide the suitable condition of soil, pollinate blossoms and eliminate the harmful insects and other organisms to enhance the production of crops and animals. Insects find their way via air, water, soil as well as seeds for their survival, nourishment and reproduction.

Carnivorous insects	Feed on other animals, as parasites and predators	Predatory Lady bird beetles, Mantids, <i>Trichogramma spp.</i> , <i>Bracon spp</i>
Herbivorous insects	Feed on living plants	Crop Insect pests
Omnivorous insects	Feed on both plants and animals	Wasps and cockroaches
Polyphagous	Feed on wide range of cultivated and wild plants	Locusts, Grasshoppers, Cutworms (<i>Spodoptera litura</i>), Borers (<i>Helicoverpa armigera</i>)
Oligophagous	Feed on plants belonging to one family	Cabbage butterfly (<i>Pieris brassicae</i>), Diamond backed moth (<i>Plutella xylostella</i>)
Monophagous insects	Feed on a single species of plants	Paddy stem borer (<i>Scirpophaga incertulas</i>), Brinjal epilachna beetle (<i>Epilachna vegintiactopunctata</i>)
Saprophytic insects	Feed on decaying plants	Fruit fly <i>Drosophila</i> , and cecidomyiid flies
Scavengers	Feed on dead organic matter	House flies, Scarabid beetles

Table 1

Inter-specific interaction

Insects from one species interact with other species to build some kind of relationship which can be beneficial for both, harmful for both or beneficial for one and indifferent for the other. This type of interaction is termed as inter-specific associations. The various terms used for these interactions are described below:

- **Symbiosis:** The relationship between insects of different species that live in close proximity, is termed as symbiosis and each member is known as symbiont.
- **Mutualism:** When the association benefits both the symbionts, it is known as mutualism. This is shown by Ants and Aphids, Termites and flagellate protozoans in their guts, Crow on cattle to pick up ticks and mites.
- **Commensalism:** In this type of association, one insect gets benefitted by living on or inside the other while the other doesn't get affected. The benefitting insect is called commensal and the other is called the host. This is shown by gall forming insects. When the host is used as means of transport by commensal, it is termed as phoresy. For instance, Some species of the pseudoscorpions hide themselves under the wing covers of large insects like beetles. This gives them protection from their predators, and also provides them a means of transportation over a larger area. Because of its small size and lack of sting, it does not harm the beetle in any way. *Telenomus beneficiens* (a parasite) attach themselves to the anal tuft hairs of rice stem borer females (*Scirpophaga incertulas*) for their transport, and this parasite parasitizes the freshly laid eggs.
- **Parasitism:** Parasitism is a phenomenon of deriving nutrients from the host by living on them externally or internally. This is a harmful association where a parasite gets benefitted in the expense of the host.
 - **Ectoparasites:** This attacks its host from outside of the body of the host. The mother parasite lays its eggs on the body of the host and after the eggs are hatched, the larvae feed on the host by remaining outside only. Head louse: *Epiricania melanolenca*, *Epiropyrops* spp. on sugarcane fly.
 - **Endoparasites:** This enters the body of the host and feeds from inside. The mother parasite either lays its eggs inside the tissues of the host or on the food materials of the host to gain entry inside. Braconoids and Ichneumonoids, *Apanteles flavipes* on jowar stem borer.

- **Stage of the Host:** Egg parasite Attacks egg stage of the host, *Trichogramma* spp. Early larval parasite Attacks early larval stage, *Apanteles* spp. Mid larval parasite Attacks mid larval stage, Bracon hebetor. Late larval parasite Attacks late larval stage, *Gonozus nephantidis*. Pre-pupal parasite Attacks pre-pupal stage, *Elasmus nephantidis*. Pupal parasite Attacks pupal stage, *Tetrastichus Israeli Trichospilus pupivora Stomatocerus* spp.

The roles of beneficial insects are listed below:

- **Pollination:** Bees, wasps, butterflies, and ants pollinate flowering plants.
- **Food source:** Insects are eaten in some parts of the world as they provide protein, vitamins, and minerals to the human body. In fact, every insect is eaten in one form or the other by one part of the population or the other. The most popular ones are cicadas, locusts, mantises, grubs, caterpillars, crickets, ants, and wasps. From South America to Japan, people eat roasted insects, like grasshoppers or beetles.
- **Controlling insect pests:** Lady bird beetle (*Coccinella septempunctata*) preys on aphids, whiteflies, mites, fleas and potato Colorado beetle. These beetles can consume more than 5,000 aphids during their lifespan. Preying mantis preys on wide range including caterpillars, moths, beetles and crickets which feed on new plant growth. One peculiar characteristic of this mantis is that it can turn its head 180 degrees to view its surrounding. Likewise, spiders prey on bedbugs, aphids, mosquitoes, fruit flies. In addition, Braconid wasps prey on tobacco hornworm, tomato hornworm, caterpillars and aphids. Tachinid flies parasitize pests by laying eggs onto the host or the nearby foliage. Bees, wasps, butterflies, and ants pollinate flowering plants. Finally, all insects fertilize the soil with the nutrients from their droppings.
- **Medicinal:** In the past, fly larvae (maggots) were used to treat wounds to prevent or stop gangrene. Gangrene is inflicted by infection of dead flesh. Maggots only eat dead flesh, so when they are placed on the dead flesh of humans, they actually clean the wound and can prevent infection.

Finally, all insects fertilize the soil with the nutrients from their droppings, provide substantial food source both for animals and plants, enhance the ecosystem, prevent the number of plant and animal pests, cure diseases. Though the general idea about insects is marked as damaging, they are helpful in innumerable aspects.

It's high time, we realize their roles in making our environment more liveable, our lives easier and our ecosystem healthier. With knowledge of beneficial insects and the natural enemies of harmful ones, agricultural production is sure to rise. Insects are not only consumed by people. They are the primary source of food for many birds, reptiles, amphibians and mammals, marking their positions in food chain and food webs extremely valuable. It is certain to happen that food webs could collapse if insect population declines. One might argue that insects are not important to us, they cannot stay away from being the vital component of surroundings. Thus, marking them as an inevitable part of our ecosystem.

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