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Insects : Their importance and role in ecosystem

Muneer Ahmad and Nadeem Dar
Division of Entomology, SKUAST-Kashmir, Srinagar (J&K) India
(Email : jabarimuneer@gmail.com)

Insects or insecta (from Latin *Insectum*) are hexapod invertebrates and the largest group within the arthropod phylum.

Insects are arthropods: Arthropods are characterised by having the following features:

– A hard external skeleton (called a exoskeleton)
– A segmented body
– At least three pairs of jointed legs

The Arthropoda is divided into a number of classes. These include the:

– Crustacea (crabs, crayfish, prawns)
– Arachnida (spiders, mites, scorpions)
– Myriapoda (millipedes and centipedes)
– Insecta (insects)

Insect features:

– The insect body is divided into three main parts, the head, thorax and abdomen.

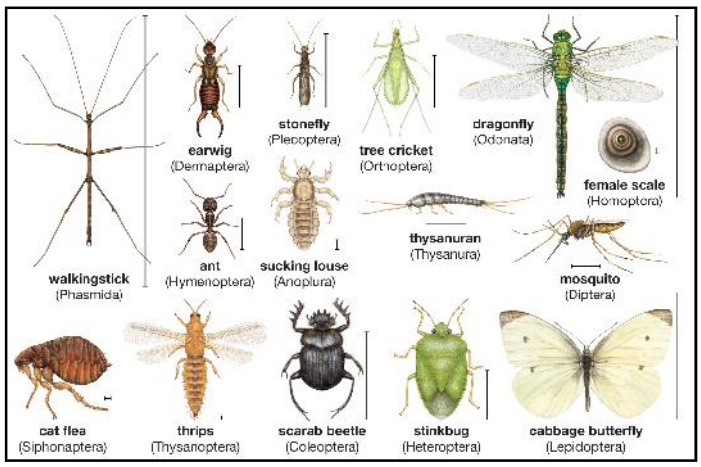
– Insects have no internal skeleton, instead they are covered in an external shell (exoskeleton) that protects their soft internal organs.

– No insect has more than three pairs of legs, except for some immature forms such as caterpillars that have prolegs. These are appendages that serve the purpose of legs.

– The typical insect mouth has a pair of lower jaws (maxillae) and upper jaws (mandibles) which are designed to bite. There are many variations to this structure, as many moths and butterflies have tubular sucking mouthparts, many bugs and other blood-sucking insects have sucking stabbing mouthparts and some adult insects simply don't have functional mouthparts.

– Insects have one pair of antennae located on the head

– Most insects have one or two pairs of wings although some insects such as lice, fleas, bristletails and silverfish are completely wingless.



Role of insects in ecosystems : Biotic communities are vital for providing ecological functions and ecosystem services. As a dominant form of animal biomass and life on earth, insects represent many different trophic niches and a wide range of ecological functions in their natural ecosystems, including herbivory, carnivory and detritus feeding. Insects are abundant in all terrestrial ecosystems and display a wide variation among species in almost any aspect of their biology. Because of the large numbers of insects and great intra-and interspecific variety the functional significance of insects is enormous and the ecosystem services provided by insects vital. Insects are the key components in diverse ecosystems as major role players in functioning of ecosystem processes. Since insects are mostly perceived as pests or potential pests, this ecological importance of insects often goes unnoticed. The main ecological functions of insects in ecosystems are ecosystem cycling, pollination, predation/parasitism, and decomposition.

Ecosystem cycling: Insect herbivores change the quality, quantity and timing of plant detrital inputs and can potentially have large effects on ecosystem cycling. Belovsky and Slade found that grasshopper herbivory increased plant abundance because of greater N availability. Insect herbivores are, therefore, important drivers of ecosystem processes by transforming living plant biomass into frass, greenfall and throughfall and may drive a significant fraction of above-ground to below ground N and P fluxes across entire ecosystems.

Pollination : Over three quarters of wild flowering plant species in temperate regions need insects for pollination and about two thirds of all plant species rely on insects for pollination. The most important pollinators are bees, beetles, butterflies and flies. Insects

therefore contribute to plant diversity and affects animal biodiversity through pollination indirectly.

Predation/Parasitism: Occupying the higher trophic levels as secondary or tertiary consumers, predators and parasites help control the population increase of primary consumers or phytophagous organisms below a threshold. Herbivorous insects with the potential of becoming pests are under natural control by insect predators and parasitoids. In the insect orders Odonata (dragon flies) and Neuroptera (lacewings and ant lions) all the insect species are predators, while a large percentage of species in the orders Hemiptera (bugs), Coleoptera (beetles), Diptera (flies) and Hymenoptera (wasps, bees and ants) are predators, either as larvae or in both larval and adult stages. There are various parisitoids in the order Hymenoptera that parasitizes either adults, larvae or eggs of other insects. For instance, Aphytislingnanensis parasitizes scale insects, Aphelinusasychis, Aphelinusvaripes, Diaeretiellarapae, Aphidiuscolemani, Aphidius, matricariae and Aphidiuservi parasitizes cereal aphids and Trichogramma parasitic wasps attack Lepidopteran eggs.

Decomposition: The decomposition of organic waste, such as dung and carrion is an important ecosystem process which is largely provided by insects. There are about 4000 documented dung beetle species which play an important role in the decomposition of manure. Dung beetles are principally important in the maintenance of pasture health by burying dung, which has the effect of removing surface wastes and recycling nutrients that can be used by plants. Negative environmental effects, such as loss of grass cover, growth of unpalatable grass, leaching of nutrients in surface rainwater runoff and the buildup of large populations of dung-breeding flies, that resulted from a lack of dung beetles contributing the needed ecosystem function were seen in Australia before the introduction of dung beetles adapted to cattle dung (46). Dung beetles contribute to soil health by increasing nitrogen, phosphorus, potassium, calcium and magnesium or total proteins content. Dung beetles also contribute to the carbon cycle reducing GHG emissions by between 7 pe cent and 12 per cent. Beetle larvae, flies, ants and termites clean up dead plant matter and break it down for further decomposition by microbes. Ants and termites, the soil macrofauna in dry and hot regions, play an important role in the increase of mineral nitrogen in the soil. Carrion provides food to a diverse community of insects with major roles for insect detritivores such as flies and beetles (49). Calliphorid flies are the first to exploit cadavers and this is the start of a dynamic succession of arthropod species colonizing the cadaver, which can comprise 100 species from tens of insect families. It is, however, the function contributed by a specific species that determines the efficiency of the decomposition. Farwig *et al*. (2014) found that decomposition rate of carrion is dependent on composition not abundance of the assemblages of insect scavengers.

Insects in agriculture: For as long as humans practiced crop agriculture, pests have occurred on their crops and insects have been predominantly perceived as competitors in the race for survival. The insect-plant relationship is the dominant biotic interaction and approximately 50 per cent of insect species are herbivorous, with most herbivorous species feeding on plants in one or a few related plant families. Herbivorous insects damage 18 per cent of world agricultural production and this is mainly controlled by chemical methods. Despite these damages, less than 0.5 percentage of the total number of the known insect species are considered pests. Aside from anthropocentric perception and societal prejudice, insects are not pests in an ecological or evolutionary context.

References:

Farwig, N., Brandl, R., Siemann, S., Wiener, F. and Muller, J. (2014). Decomposition rate of carrion is dependent on composition not abundance of the assemblages of insect scavengers. *Oecologia,* **175** : 1291–1300.

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