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Insects Saprophygy

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Abstract

Insects provide important ecosystem services like Nutrient cycling, decomposition of animal and plant matter and decomposers of corpse. Many insects and other arthropods are important decomposers especially Coleoptera, Diptera, Blattodea (Termites), and few Hymenoptera. These insects are largely responsible to create a layer of humus on the soil that provides an ideal environment for various fungi, microorganisms and bacteria. These organisms produce much of the nitrogen, carbon, and minerals that plants need for growth. Carrion feeders include several beetles, ants, mites, wasps, fly larvae (maggots), and others. These insects occupy the dead body for a short period of time but rapidly consume and/or bury the carcass. Typically, some species of fly are the first to eat the body, but the order of insects that follows is predictable and known as the faunal procession. Insects help humans in eradicating the dead and the decaying matter from human habitations.

Introduction

Saprophygy refers to the eating of non living organic material (decomposing dead plant or animal biomass) to obtain their essential nutrients (Price *et al.*, 2011). The activity of animals feeding only on dead wood is called sapro-xylophagy. Within the ranks of saprophagous insects, entomologists recognize several major groups:

- Those that feed on dead or dying plant tissues,
- Those that feed on dead animals (carrion), and
- Those that feed on the excrement (feces) of other animals.

As dead plants are eaten away, more surface area is exposed, allowing the plants to decay faster due to an increase in microorganisms eating the plant (Meurant, 2017).

Decomposers of Dead or Dying Plant Tissues

Degradation of cellulose requires the presence of the enzyme cellulase, which most arthropods lack. Many insects have solved this problem by means of mutualistic relations with micro-organisms, having bacteria or symbiotic protozoa in the intestinal tract.

Among the well-known insect decomposers are termites (Isoptera) and cockroaches (Blattodea). The termites possess symbiotic bacteria and protozoa, and in their absence wood cannot be assimilated by these insects.

Not all arthropods assimilate cellulose by means of symbiotic bacteria, but they make use of woody materials that are pre-digested by extra-intestinal microorganisms. Included in this group are some species of springtails such as *Tomocerus* (Collembola), ambrosia beetles (Coleoptera: "Curculionidae" Scolytinae), ants of the genus *Atta* (Hymenoptera: Formicidae)

and termites (Isoptera) that cultivate fungi. In the aquatic ecosystem water scavenger beetles (Hydrophilidae) scavenge on decaying plant material and detritus in fresh bodies of water.



Figure 1: Water Scavenger Beetle

Most passalids live in rotting wood; a few live in other habitats, such as leaf-cutter ant detritus chambers, termite nests or under the roots of epiphytic bromeliads – all sites of decaying organic matter.

All plant remains do not always present the same difficulty of digestion for arthropods. Fruits are extensively exploited

by arthropods due to the presence of yeast that enhance decomposition allowing some arthropods such as fruits flies, *Drosophila* and wasps.

Decomposers of Corpse

During summer and autumn in temperate regions, and in the rainy period in tropical areas, corpses are rapidly colonized by arthropods. As a result, rapid decay is observed, with the vast majority of carrion being consumed by various arthropod species, principally fly larvae. For example, more than 100 species of arthropods belonging to 16 orders and 48 families have been found in just one rabbit corpse (Table 1).



Figure 2: Housefly

Table 1: List of Insects decomposers of Corpse

Waves	Insects colonizing the corpse
First waves	Blow flies (Diptera: Calliphoridae) and house flies (Diptera: Muscidae)
Second wave	Diptera: Sarcophagidae
Third wave (viscera decompose and the fat of the corpse turns rancid)	Phorids (Diptera: Phoridae), drosophilids (Diptera: Drosophilidae) and hover flies of the subfamily Eristalinae (Diptera: Syrphidae)
Fourth wave	Diptera: Piophilidae
Fifth wave (keratin and feeding on the remaining hair and feathers)	Dermestids (Coleoptera: Dermestidae), trogids (Coleoptera: Scarabaeoidea: Trogidae) and clerids (Coleoptera: Cleridae) and tineid caterpillars (Lepidoptera: Tineidae)
Fifth wave (keratin and feeding on the remaining hair and feathers)	Dermestids (Coleoptera: Dermestidae), trogids (Coleoptera: Scarabaeoidea: Trogidae) and clerids (Coleoptera: Cleridae) and tineid caterpillars (Lepidoptera: Tineidae)

The larvae of these flies are, in turn, consumed by larvae and adults of predatory beetles living in corpses. Staphylinids (Coleoptera: Staphylinidae), histerids (Coleoptera: Histeridae) and silphids (Coleoptera: Silphidae), all are predators of flies, though they also feed on carrion. Among Coleoptera, a principal group in many temperate ecosystems is Silphidae (*e.g.*, *Nicrophorus*, *Silpha*). Diptera are among the most important decomposers, especially some of the Calliphoridae (*e.g.*, *Lucilia*, *Calliphora*, *Chrysomyia*, *etc.*), followed by some

Muscidae (*e.g.*, *Fannia*), and Sarcophagidae (*e.g.*, *Sarcophaga*).

Decomposers of Excrement

Many dung beetles and manure flies are attracted to the smell of animal feces. The adults often lay eggs on fresh excrement and the larvae will feed on the organic matter. Many species of dung-feeders have evolved so they will only feed on feces from a specific species. There is even a type of dung-beetle that will roll feces into a ball, push

it into a pre-dug hole, laying an egg in that dung and then cover it with fresh dirt to provide a perfect nursery for their larvae.

The best-known species of Scatophagidae is probably *Scatophaga stercoraria*, a species frequently found visiting dung anywhere in the Northern Hemisphere, and also in northern and southern Africa. Scarabaeinae has coprophagy as a characteristic of most of its species. In this case, most of the nutrients eaten by the adults are derived from eating microbes or colloids suspended in dung.

The larvae feed on the dung supplied by their parents in a nest chamber. Coleoptera of the families Hydrophilidae, Staphylinidae, and Histeridae are associated with carrion as



Figure 3: Dung Roller

predators of larvae of flies and dung-beetles. However, the two former families also include coprophagous species. In the temperate region, the hydrophilids *Cercyon* and *Sphaeridium* (Coleoptera: Hydrophilidae) are coprophagous, arriving within the early hours after deposition of dung (Capinera, 2008).

Conclusion

Insects adapted to this lifestyle are an essential part of the biosphere because they help recycle dead organic matter. Insects in the orders Isoptera, Diptera, Coleoptera feed on dead and decaying animal matter, and thus accelerate the return of elements to the food chain. Since these insects help to remove the waste elements from the earth's surface without which the world is just a pile of garbage. Thus these scavengers play a major role in biodegradation and balancing the earth's equilibrium.

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