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Are Insects Really Important in Nature?

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A B S T R A C T

Insect, belonging to the phylum arthopoda is a tiny six-legged invertebrate animal. They have achieved phenomenal success in both the terms of species richness and abundance. Around 66% of all species now recognised are insects which makes up more than 75% of the world's biodiversity today. As we treat insects as potential pests, their ecological significance is frequently overlooked. But they have various roles in nature including ecosystem cycling, biocontrol agent, pollination, decomposition. In many countries insects are used as human food which contributes significantly to the consumption of animal proteins. Here we will discuss about various functions done by insects in nature.

Introduction

An insect is a tiny six-legged invertebrate animal. They belong to the phylum arthopoda. Arthropods have survived the Permian and Cretaceous major extinctions and have been around for more than 400 million years (Kim, 1993). In terms of species richness and abundance, insects have achieved phenomenal success, and terrestrial arthropods are thought to be the main drivers of species richness (Samways, 1993; Stork *et al.*, 2015). Around 66% of all species now recognised are insects (Zhang, 2011), making up more than 75% of the world's biodiversity today (Kim, 1993). Insect body is divided into three main parts: Head, Thorax and Abdomen. The differentiation of insect body into different parts is known as tagmosis. Most of the insects have wings and antennae. Insects perform various roles in ecosystem. Insects represent a diverse range of trophic niches and ecological activities in their natural environments, including herbivory, carnivory, and detritus eating. They are the most abundant form of animal biomass and life on Earth. Since most people view insects as potential pests, their ecological significance is frequently overlooked. Ecosystem cycle, pollination, predation/parasitism, and decomposition are insects' key ecological roles in ecosystems (Muneer Ahmad and Nadeem Dar, 2020). As a source of food, insects are very important for a wide variety of predators (Carpenter, 1928). Fish eat aquatic insect larvae. Many of stream fishes appear to be constrained by

the availability or abundance of such prey, at least during certain seasons. Many lizards get the majority of their nutrition from insects. Insects make up the majority of an amphibian's animal diet because many of them are carnivorous, especially once they reach adulthood.

Ecosystem cycling

The quality, amount, and timing of plant detrital inputs are altered by insect herbivores, and this might potentially have a significant impact on ecosystem cycle (Mattson and Addy, 1975). It was seen that herbivory by grasshopper had increased plant abundance due to more availability of nitrogen (Belovsky and Slade, 2000).

So, insect herbivores are now significant drivers of ecological processes as they convert living plant material into debris, frass (Hunter, 2001). Insects may be responsible for a sizable portion of above-ground to belowground N and P fluxes throughout entire ecosystems (Metcalfe *et al.,* 2014).

Role of insect as biocontrol agent

Insects serve as important biocontrol agents in agriculture. Odonata (Dragonfly and Damselfly) and Neuroptera (Chrysoperla grub, Mantispidfly, Antlion grub) are important predator orders on insects. Important predator insect families are Coccinelidae, Chrysopidae, Syrphidae, Asilidae etc. They control various harmful insects. Both grubs and adults of ladybird beetles (Coocinelidae) prey on soft bodied insects like aphids, scale, mealybugs, whiteflies, mites which are important pests of crops. Larvae of Syrphid fly (Syrphidae) devour thrips, aphids, scale insecst. One of the most important predators is preying mantids which feed on flies, beetles, aphids etc. Chrysoperla grub is important predator of aphids.

Parasitoids are also important biocontrol agents. Most of the parasitoids belong to the order Hymenoptera. Braconidae, Trichogrammatidae, Chalcididae, Bethylidae, Eulophidae are important parasitoid families.

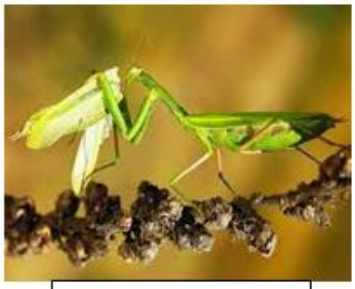
Insect as human food

The practise of eating insects, known as entomophagy, has its origins in the evolution of humans (Fontaneto *et al.,* 2011). In the past, insects have been crucial to human sustenance in South America, Europe, Asia, and Africa. Grasshoppers, beetle, caterpillars, winged termites, grubs, bees, worms, cicadas, ant brood and a variety of aquatic insects are important insect groups which are included in human diet (Bodenheimer, 1951). It's intriguing to learn that more than two billion people regularly consume insects and that consuming insects contribute significantly to the consumption of animal proteins in various regions (Van Huis *et al.,* 2013). There is strong evidence to support the claim that insects constitute a very nutrient-dense and healthful food source, containing many vitamins, lipids, minerals, aminoacids, proteins that are important for both humans and other animals (Van Huis *et al.,* 2013). However, depending on the metamorphic stage, diet, habitat and methods of preparation and processing used before eating, the nutritional contents of those edible insects vary greatly between and within species (Rumpold and Schlüter, 2013). As people of rural communities in Asia, Africa, South America relay on edible insects as a source of proteins, minerals, vitamins etc, so there is a good market demand of these insects (Srivastava and Gupta, 2009). Several families in various African nations, especially in Zimbabwe, South Africa, Nigeria, Zambia and Ivory Coast make a respectable income selling insects (Balinga *et al.,* 2004; Agbidye *et al.,* 2009). Women and children primarily collect these insects from bushes and farmland, process them, and sell in local market.

Fig.1

Ladybird beetle feeding on aphid

Dragonfly with its prey



Preying mantid

Fig.2

Egg parasitoid *Trichogramma sp*. With its host

Larval parasitoid *Bracon brevicornis* with its host

Pupal parasitoid Chalcid wasp with its host

Fig.3

Edible honeypot ant

Edible bugs

Termite fry

Fig.4

Edible meal worm

Edible grub

Edible cricket

Fig.5

Edible grasshopper

Fig.6

Pollination in sunflower

Pollination in grape

Bee pollinating in apple flower

Fig.7

Dung beetle carrying dung ball

Termites in soil

Ant in soil

Role of insect pollinators

Various crops and many wild flowering plants depend on insects for pollination. Among insects the most important pollinator is honey bee. Though 65% of world food production (rice, wheat, maize) do not depend on insect pollination but another 35% of production highly relay on insect pollination (Klein *et al.*, 2007). The most profitable crops in the world including strawberry, peach, mango, cherry, apricot, carrot, potato, onion, grape, sunflower, olive, cucumber, different nuts, a variety of herbs, cotton, lavender and alfalfa depend on the pollination services of insect bees (Tanda, 2019, 2020 a, b). *Apis mellifera*, the European honeybee dominats pollination worldwide but native bee species also play an important role. The biological management, food security, and environmental sustainability are all reliant on the crop pollination system.

Decomposition

An essential ecosystem function is the breakdown of organic waste, such as dung and carrion, which is mostly carried out by soil insects (Moore and Walter, 1988). For the breakdown of litter to nutrients (essential for primary producers), insects play crucial role (Wardle, 2002).

Dung beetles, of which there are over 4000 species known to exist, are crucial to the breakdown of manure. Dung beetles bury dung, which eliminates surface waste and recycles nutrients that plants may consume (Jankielsohn, 2018).They improve the quantity of various factors in the soil like N, P, K, Ca, Mg and total proteins (Macfadyen *et al.*, 2015). Dung beetles reduce GHG emissions upto 7% - 12%, which helps the carbon cycle (Nichols *et al.*, 2008). Apart from dung beetle, other two most important ecosystem builders are ants and termites (Jones *et al.*, 1994; Lavelle, 2002; Hastings *et al.*, 2006). According to Hartley and Jones (2004), the termites are insect kingdom's most outstanding decomposers and important controllers of the dynamics of soil organic matter and litter in many ecosystems (Lavelle, 1997).

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