International Journal of Entomology Research
ISSN: 2455-4758; Impact Factor: RJIF 5.24
Received: 04-11-2019; Accepted: 05-12-2019
www.entomologyjournals.com
Volume 5; Issue 1; January 2020; Page No. 15-17

A report on various beneficial roles of insects

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Abstract
It is estimated that out of approximately one million recorded insect species, less than 1000 species are actually pests which transmit diseases and damage crops. They are important part of food chains of many invertebrates, birds, reptiles, amphibians, fishes and even mammals. They are also important in survival of insect pollinated flowering plants. Insects plays variety of roles in nature like pollinators, predators of pests, parasitoids of pests, weed killers, scavengers, decomposers, soil builders, food provider *etc*. insect are also useful in medicines and have aesthetic as well as scientific values. Currently beneficial insects are widely used in integrative pest management (IPM) and integrative crop management (ICM). Out of million insect species currently we are using only a few insect species for our benefits but I think the scope of insects in welfare of mankind is enormous and we must look in this direction. We must think how we can get more and sustainable benefit from these millions of insect species.

Keywords: insects, pollinators, apiculture, sericulture, entomophagy, bioindicators

Introduction
Most insects are generally considered as pests but it is a wrong notion. Most insects are beneficial and play many beneficial roles. It is estimated that out of approximately one million recorded insect species, less than 1000 species are actually pests which transmit diseases and damage crops. They are important part of food chains of many invertebrates, birds, reptiles, amphibians, fishes and even mammals. They are also important in survival of insect pollinated flowering plants. Insects plays variety of roles in nature like pollinators, predators of pests, parasitoids of pests, weed killers, scavengers, decomposers, soil builders, food provider *etc*. insect are also useful in medicines and have aesthetic and scientific values. Currently beneficial insects are widely used in integrative pest management (IPM) and integrative crop management (ICM) [1].

Results and Discussions
Insects as pollinators
Pollination refers to the transfer of anther to stigma in flowering plants for sexual reproduction. Entomophily refers to pollination of entomophilous plants aided by insects. Pollination is the most beneficial aspects of insects. Even flowering plants and their pollinating insects are co evolved and show mutualism. Insect pollinates all kinds of flowering plants such as trees, shrubs, vegetables, herbs, crops, ornamental plants, legume plants, drug plants *etc*. it is estimated that 80% of insect pollination is performed by honey bees. Single bee may visit and pollinate about 1000 flowers in a day. Insect pollination also helps in uniform seed set, improvement in quality and increase of crop yield. Especially mustard, cotton, sunflower, onion, apple, cardamom *etc* are seen to increase in yield due to bee pollination. Hoverflies aid cross pollination of carrot, cotton, pulses *etc*. Fig is pollinated by fig wasp (*Blastophaga psenes*) only. There is no other mode of pollination for them. There are two types of fig Capri fig and Symrna fig. Fig wasp lays eggs in Capri fig, larvae develops in galls of flowers mates with females inside galls. Mated wasps then emerges out of flower with lot of pollen dusted around its body. The fig wasp enters Symrna fig with lot of pollen and deposits it on its stigma but it cannot oviposit in the ovary of Symrna fig which is deep seated. It again moves to Capri fig for egg laying. So Capri fig must be planted next to Symrna fig to aid in pollination. Oil palm pollination weevil (*Elacidobins kamerunicus*) helps in increasing oil palm bunch weight by 35% and oil content by 20%. Alfalfa is pollinated by leaf cutting bees. Pumpkins and squashes are pollinated by squash bees. Blueberries, tomatoes, peppers *etc* are pollinated by wild bees. Cranberries are pollinated by bumblebees. Cacao is pollinated by midges [2, 3].

Insects as weed killers
Phytophagous insects which help in controlling weeds by feeding on them are called weed killers. For example *Dactylopius opuntiee* feeds on *Opuntia dilleni* (prickly pear). This insect was introduced in India in 1925 and within 5 to 10 years it controlled the weed. *Zygogramma bicolorata* feeds on *Parthenium hysterophorous* (congress grass), *Ophiomyia lantanae* feeds on *Lantana camara* (Lantana), *Pariuchaetes pseudoinsulata* feeds on *Choromoloena odorata* (siam weed), *Cryptobagus singularis* feeds on *Salvania molesta* (water fern), *Papilio aristalochiae* feeds on *Arista lochia*, *Danaus chrysippus* (butterfly) and *Poecilocerus pictus* (grasshopper) feeds on *Calotropis* weed, *Neochetina eichorniae* and *Neochetina bruchi* (weevil) feeds on water hyacinth [2].

Insects as scavengers and decomposers
Organisms which feed on dead and decaying plant animal matter are called scavengers and organism which help in decay of organic matter are called decomposers. Some common insect scavengers are Termites (Isoptera), Ants (Hymenoptera), Rove beetles (Staphylinidae: Coleoptera), Darkling beetles (Tenebrionidae: Coleoptera), Chafer

beetles (Scarabaeidae: Coleoptera), water scavenger beetles (Hydrophilidae: Coleoptera), Muscid flies (Muscidae: Diptera) *etc*. Dung beetles bury dung as food for their larvae. Burying beetles dispose of carrion while wood boring beetles and termites dispose of dead trees and plants. Insects also help in recycling of many nutrients. Soil dwelling insects such as beetles, ants, cutworms, crickets, termites, wasps, larvae of flies *etc* disintegrate the soil and brought subsoil to the surface. They also enrich soil by aeration and their excreta. Termites have a major soil building role and acts as nature's plow. Springtails are soil dwelling insects that largely feed on fungal hyphae. They enhance plant microbe interaction in soil and hence enhance plant production [3, 4].

Insects as food and producers

Entomophagy refers to the use of insects as food. In many areas of the world insects are directly or indirectly consumed as human food. Insects like termites, grasshoppers, palm weevils, grubs of beetles are mostly used as food. Insects have highly digestible protein and have high calorie value. As we know that insects gives us many useful products like honey, silk, dyes, shellac, lac, pollen, propolis, bee wax, bee venom, royal jelly, tannic acid, cantharidin *etc*. honey and silk are most famous and ancient products we derive from insects [1, 5, 9].

Honey bees give us honey, bees wax, pollen, propolis, royal jelly, bee venom through apiculture. Honey is used as sweetener and has many nutritional and medicinal values. Bees wax is used in casting, modeling and is important ingredient of cosmetics, varnishes, polishes, candles *etc*. Propolis is a resin used in medicine and food products. Main honey bee species which produce honey are *Apis mellifera*, *Apis indica*, *Apis florae* and *Apis dorsata*. Silk is derived from Silkworms in Sericulture. Silk is a fiber consisting of fibroin protein secreted from two salivary glands of larvae of silkworm and a gum called sericin cements them together. According to different qualities, varieties of silk is produced by different species of silkworms like Mulberry silk is produced by *Bombyx mori*, Tasar silk is produced by *Antheraea paphia*, Oak silk is produced by *Antheraea pernyi*, Muga silk is produced by *Antheraea assama* and Eri silk is produced by *Attacus ricinii*.

Shellac is derived from the secretion of scale insect that dwells on fig trees in Asia. Some insect species are used to cultivate and extract dyes. Red dye is derived from chochineal insects like *Kermes itices, Kermes vermilio, Kerria lacca, Porphyrophora polonica, Dactylopius coccus etc*. Tannic acid is derived from galls of oak trees. Oak trees (*Quercus infectoria*) produce gall tissue in response to chemical secreted by larvae of tiny wasps (*Cypnips gallae*) that infest trees. Galls dry weight is mostly composed of tannic acid. Lac is a resin produced by scale insect (*Laccifer lacca*). Ber (*Ziziphus mauritiana*), Dhak (*Butea monosperma*), Kusum (*Schleichera olessa*), Peepal (*Ficus religiosa*) *etc* are the common host trees of the lac insect in India [6].

Insects as medicines

Before the discovery of antiseptics and antibiotics, flesh eating fly larvae were used to clean wounds. They selectively eat upon the necrotic tissue and not the healthy tissue. This maggot therapy is even used today in the case of patients who developed antibiotic resistance. Some insects are also used in forensic science to determine the time of death of cadavers. Honey bees are also used as healers. Bee venom acupuncture therapy us used for relief of rheumatoid arthritis and osteoarthritis. Cantharidine derived from blister beetles is used to treat warts. *Mylabris cinchorii* in India and *Lytta cericatoria* in Europe are the best known species for obtaining cantharidine [7]. Honey is used as laxative, antiseptic and sedative. It is also used as preventive measure against cough, cold, ulcer, fever *etc*.

Insects as biocontrol agents

Biological control refers to the use of living organisms to control other harmful species (pests). They do this either by predation or parasitism. Predators are organisms that capture and eat other organisms. Different orders of insects like Praying mantis, Hoverflies, Tachinid flies, Water scorpion, Petatomid bugs, Dragonflies, Ants, Wasps, Ladybird beetles, Ground beetles, Tiger beetles *etc* are effective predators of pests. *Coccinella septempunctata* predate against aphids, *Rodolia cardinalis* predate against cotton cushion scale insect. Parasitoids are insects that parasitize other insects [8]. Examples of some parasitoid insects are *Trichogramma achaeae* which parasite upon cotton bollworm, *Telenomus proditor* which parasite upon caster semilooper, *Trichogramma brasiliensis* which parasite upon *Helicoverpa armigera* and *Pectinophora gossypiella.*

Other beneficial roles

Some insects have aesthetic value. Jewel beetle (Buprestidae: Coleoptera) are used for making necklaces, bracelets *etc*. some insects also have scientific value. As we know that, mosquitoes are cultured and used for study of diseases caused by them. Cockroaches are used in dissection exercises in practical of Entomology and Zoology courses. Drosophila and Chironomids are widely used in cytology and genetics study. Some plants use ants to plants their seeds (Myrmecochory) [9, 10]. In these plants, the seed has an elaiosome containing oils and chemicals that compels some ant species to take it to the nest. Here the elaiosomes is eaten and the undamaged seed is discarded in an abandoned gallery, which is moist, fertile and safe from predators. This is a mutualistic relationship in which the ants are fed and the plants do seed dispersed. Some insects are also acts as bioindicators. Bioindicators are the organism that are sensitive to environmental pollution and gives us an idea of the health of an ecosystem. Butterflies are considered as bioindicators and act as litmus test of our environment. Reduce in their population gives us warning about high pollution and habitat degradation. Dragonflies, damselflies and Chironomids are also used as bioindicators of aquatic ecosystems. Their distribution and abundance is reduced due to heavy metal contamination in water bodies [10].

Conclusions

It is clear that only a few insect species out of million are harmful to human beings. Most insects are beneficial and are important part of our food webs. Insects are beneficial to mankind in different ways. Insect and their products are being used by mankind for food, medicine, research, pollination, pest management and many more. We must encourage the use of beneficial insects in our agriculture and horticulture system. We can attract beneficial insects by providing them shelter (habitat), water and food. Out of million insect species currently we are using only a few

insect species for our benefits but I think the scope of insects in welfare of mankind is enormous and we must look in this direction. We must think how we can get more and sustainable benefit from these millions of insect species.

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