



## Important Insects of Helpful in Doubling the Income of Farmers

(\* Om Prakash Meena and Meetha Lal Meena)

Raja Balwant Singh College, Bichpuri, Agra-283105 (U.P.)

\*Corresponding Author's email: [omprakashmeena5799@gmail.com](mailto:omprakashmeena5799@gmail.com)

Insects have lived on Earth for about 350 million years, compared with less than 2 million for humans. Of an estimated 5-10 million species of insects, probably not more than a fraction of one per cent interact, directly or indirectly, with humans. The fact that insects do more good than harm would probably come as a surprise to lay persons whose familiarity with insects is generally limited to mosquitoes, house flies, cockroaches, etc. and to farmers who protect their crops and livestock against a variety of pests. Humans have long recognized the importance of insects in their well-being. Production of silk from silkworm pupae has been carried out for almost 5000 years. Similarly, the usefulness of honey bees has been known to man from prehistoric times. The service rendered by insects in pollination of crops, biological control of pests, soil builders and scavengers has been well recognized. Insects and/or their products have been eaten by humans for thousands of years. Locust swarms, which originally may have been an important seasonal food for humans, took on new significance as humans turned to farming rather than a hunting existence.

Several features of recent human evolution like increase in population, a trend towards urbanization, increased geographic movement of people and agricultural products, and intensification of agriculture to feed more people, have led to increase in the severity of harmful insects. The relatively crowded conditions of urban areas enable insects parasitic on humans, both to locate a host and to transfer between host individuals. Thus, urbanization has facilitated the spread of insect-borne human diseases such as typhus, plague, and malaria. An increasing need to produce more and cheaper food led to the practice of monoculture. By simplifying the ecosystem, humans encourage the buildup of populations of the insects that compete with them for food being grown. A massive increase in human geographic movements and a concomitant increase in trade led to the transportation of a number of species, both plant and animal, into areas previously unoccupied by them. Some of these were able to establish themselves and, in the absence of normal regulators of population (especially parasitoids and predators), increased rapidly in numbers and became important pests.

### Beneficial Insects

Insects may be beneficial to humans in various ways, directly or indirectly. The most important beneficial species are those whose products are of immense commercial value. The insects which bring about pollination of crops are also of considerable importance. There are other beneficial insects which are used as food, for biological control of insect pests and plants, soil scavengers, in medicine and research, and for aesthetic value

### Commercially Valuable Product

The best known insects which provide commercially valuable products are the honey bee, silkworm, lac insect and wax scale.

**Honey Bees:** There are four species of the honey bee, viz. *Apis cerana*, *Apis florea*, *Apis dorsata* and *Apis mellifera*; the first three are indigenous, and the last one has been introduced and acclimatized in India for the last about 50 years. The honey bee originally occupied the African continent, most of Europe (except the northern part), and western Asia. Bee management was probably first carried out by the ancient Egyptians. Honey bees were brought to North America by colonists in the early 1600s, and today honey and beeswax production is a billion dollar industry. The honey yield of *A. mellifera* averages 50-100 kg per colony per year as compared to very low yield (3.6-4.5 kg in hills and 1.3-2.2 kg in plains) of *A. cerana*. The world honey production is estimated at about 1.31 million tonnes, China is the world's largest honey producer (0.27 million tonnes), accounting for almost 20 per cent of the total.

In India, the production of honey is estimated at about 60,000 tonnes out of which 15,000 tonnes is exported. There are over 1.4 million honey bee colonies in India, out of which over 1.5 lakh are a *mellifera* colonies. The Punjab state has the distinction of producing 8,500 tonnes of honey (25% of the total honey produced in India), by about 2.5 lakh bee colonies, maintained by more than 25,000 beekeepers. In addition, beeswax is produced at the rate of about 1 kg for every 50-100 kg of honey; its value varies between one and three times that of honey. There is also a significant world trade in pollen which is used not only by beekeepers to supplement the reserves in the hive but also in the health-food industry. Other products that are collected include propolis (bee glue), venom (used to desensitize patients with severe allergies to bee stings), and royal jelly which is added to certain food supplements.

**Silkworm:** There are four species of silkworm in India, which can be exploited for commercial silk production. These are mulberry silkworm, *Bombyx mori*, tassar silkworm, *Antheroes paphia*, muga silkworm, *Antheraea assama*; and eri silkworm, *Philosamia ricini*, among which the first one is the most important. Silk production has been commercially important for about 4700 years. The industry originated in East Asia and spread into Europe (France, Italy and Spain) after eggs were smuggled from China to Italy in the sixth century AD. The production of silk remains a labour intensive industry, making production costs high. In 1988, world silk production was about 67,000 tonnes. By the end of 1998, production had increased slightly to 72,000 tonnes. In 2006, world silk production rose to 1,439,42 tonnes. At present, China is the leading producer of silk with about 70 per cent of the world total, followed by India and Japan. The total production of raw silk from all the four species of silkworms in India is about 20,000 tonnes.

**Lac Insect:** The lac insect, *Kerria lacca*, is a scale endemic to India and Southeast Asia that secretes about itself a coating of lac, which may be more than 1 cm thick. The twigs on which the insects rest are collected and either used to spread the insects to new areas or ground up and heated in order to separate the lac. The lac is a component of shellac, though its importance has declined. The important lac producing countries are India and Thailand. India produced 23,230 tonnes of lac in 2006-07, which declined to 20,640 tonnes in 2007-08.

**Pela Wax Scale:** The pela wax scale, *Ericerus pela*, has been used in China for commercial production of China wax, mainly in Sichuan province, for more than 100 years. It is the second instar males that produce economically valuable wax. Wax production peaked in the early 1900s and in a good year the production reached 6000 tonnes. Most of this wax was used in the manufacture of candles. However, with the coming of electricity and discovery of other waxes (particularly paraffin wax), interest in China wax declined and currently about 500 tonnes is harvested every year. It is used for a variety of horticultural, industrial and pharmaceutical purposes, viz. grafting agent for fruit trees, insulation of electrical cables and equipment, manufacture of molds for precision instruments, production of high-gloss, tracing,

and wax paper, as an ingredient of furniture and automobile polishes, and coating candles and pills

**Insect Pollinators:** Many species of insects and plants have evolved a mutualistic relationship, in which plants produce nectar and pollen for use by insects, while the latter provide a transport stems for effective cross-pollination. In the self-pollinated plants, pollen grains from the anthers automatically fall on to their stigmas. However, even these plants may produce more and better fruits or seeds by cross-pollination than by self-pollination. In the case of cross-pollinated plants, the chief agents which carry the pollen from plant to plant for pollination are the wind and the insects. More than two-thirds of all the flowering plants depend upon insects for pollination.

Cereals and grasses are wind-pollinated crops and flowers of such crops are generally small, inconspicuous with dull coloured and poorly developed petals and brush-like stigmas; their pollen are dry and light, and are produced in large number. Horticultural crops like fruits, vegetables and ornamental plants and field crops like cotton and tobacco are pollinated by insects. These crops have coloured and scented flowers with well-developed showy petals of conspicuous size with nectarines and their stigmas are sticky, and their pollen grains are sticky and are produced in large numbers. Insect pollination results in a uniform crop and in some cases in the improvement in the quality of the fruit. It has been estimated that roughly one-third of the world's agricultural production relies either directly or indirectly on insect pollinators.

Nectar is secreted by insect pollinated flowers to attract the insects. As they visit flowers for nectar, the pollen grains get dusted all over the body and transferred to the stigma of the flower they visit, thus bringing about pollination. The important pollinators are the honey bees, solitary bees like *Xylocopa*, *Andrena* and *Halictus*, and bumble bees, *Bombus* spp. Other insects which are useful as pollinators are the stingless bee (*Trigona* spp.), wasps, many kinds of flies (*Syrphus*, *Bombylius* and *Sacrophaga*), beetles, black ants, thrips, butterflies and moths like *Acherontia* spp. and *Deilephila* spp.

Bumble bees are generally too few in number to serve as effective pollinators in nature. However, they are valuable in the case of crops whose flowers are large enough, as cotton and lady's finger, to facilitate pollen transfer and where the corollas are long and tubular with deep-seated nectaries in which case short tongued bees may not be of any value.

By far, the honey bees remain the most important pollinators of crops. The potentiality of honey bees can be imagined from the fact that members of a colony visit about 100 flowers during a field trip and make about four million field trips. Fruits like apple, pears, plum, blackberry, raspberry, strawberry, citrus, mango, fig, grapes, papaya and cherry; vegetables like asparagus, brinjal, melons, lady's finger, cucumbers, pumpkins, squash, cabbage, cauliflower, onion and tomato; and oilseeds like rape, mustard, toria, and sunflower, seed crops such as clovers, fennel, pepper, and sunflower, and many ornamentals, depend upon honey bees for pollination.

Some plants like many fruits particularly figs, peas, beans, tomatoes, many vegetables, sunflower, seasonal flowers, chrysanthemum and many ornamental plants would produce no fruits unless pollinated by insects. It has been estimated that 50-70 per cent of the grain crops are pollinated by insects, bulk of it by bees alone. Every time the bees collect honey worth Rs 100, they make Rs 2000 worth of seeds and fruits by pollinating the flowers. In India, it has been found that visit by honey bees resulted in magnificent increase in yield of agricultural and horticultural crops.

Realizing the importance of honey bees in pollination of crops, bee colonies are being hired out to orchard growers in many parts of the world. The practice of renting bee colonies for pollination service started in USA by about 1910. In California, about 1.4 million hives are rented annually to augment natural pollination of almonds (about 50% of the hives),



alfalfa, melons, and other fruits and vegetables. Under such conditions the value of bees as pollinators may be up to 140 times their value as honey producers.

However, the mortality among honey bees in transit has to be guarded against. For pollination services, honey bee colonies have to be transported from a distance, have to be packed properly, loaded on a truck, then unloaded at the destination and taken to the site of placement. In USA, providing honey bee colonies for pollination is a professional job with some beekeepers, but in India this degree of sophistication has not been achieved so far.

The movement of honey bee colonies from lower altitudes or the plains to the apple orchards is being practiced at a reasonable scale with very promising results. The number and strength of colonies for pollination work are different than those required for honey production. Although much of the efficiency of pollination depends on the vigor and foraging habits of the colony, and the climatic conditions, but a colony should be sufficiently strong.

A pollination colony may preferably be on two chambers having a strength of 50,000 bees or one chamber having a strength of 25,000 bees. The number of colonies to be kept in an orchard or field crops should be given due consideration. The number of colonies per unit area depends upon the concentration of flowers, their attractiveness, presence and abundance of other pollinating insects, and presence of competing crops in the vicinity. However, it is usually recommended that five colonies are maintained for two hectares of crop and it should be more in case of profusely flowering field crops like alfalfa and red clover. A colony should be kept for pollination as near the orchard as possible to avoid waste of time and energy on the part of bees in making to and fro trips. The colonies should be moved into the field or orchard for pollination, just when sufficient numbers of plants have flowers for the bees to work.

**Entomophagous Insects:** Entomophagous insects are those which feed upon other insect destroying our crops and stored grains. They constitute the greatest single factor to check the phytophagous species from gaining overwhelming predominance over other animals in the world or at least from causing much more damage to cultivated crops. This check by entomophagous species on phytophagous insects is much more effective than all other efforts of man through multifarious means. It is only relatively recently that humans have gained an appreciation of the importance of insects in the regulation of populations of potentially harmful species of insects. Entomophagous insects can be divided into two groups, viz. predators and parasitoids.

**Predators:** A predator is usually larger than its prey kills its prey and requires more than one prey to complete its development. Predators are usually active in habits and have structural adaptations for catching the prey with well-developed sense organs and capacity for swift movements. Many predators remain stationary and suddenly seize the prey when it comes within its reach, whereas others capture the prey while on its wings. Some of them have cryptic colorations and deceptive markings as in praying mantis and robber flies. The insect predators are spread over a wide range of orders including Coleoptera, Neuroptera, Diptera, Hemiptera, and Hymenoptera. Dictyoptera, etc

## Conclusions

The insects provide us many useful products in the form of honey, royal jelly, silk, lac, wax, dyes, etc. The insects and their products are also eaten as delicacies in different parts of the world. In addition, they perform a valuable service of pollination of a number of field, vegetable and fruit crops. They also perform unique functions of soil builders, scavengers, killers of insect pests and weeds. They are of great educational, scientific and aesthetic value. Using these beneficial insects in combination with sustainable farming practices can lead to improved crop health, increased productivity, and reduced environmental impact. Integrating these helpful insects into farming systems can be a cost-

effective and eco-friendly way to double farmers' income by improving overall agricultural efficiency. However, if the verdict is to be given in favour of only one of the options, the rationale is to call the insects as one of the best friends of man. This is because we could reduce the injuries and treat the diseases they cause, but just cannot pollinate the plants and trees to retain their yield at the same level as with insects and also we cannot synthesise the useful products (honey, wax, silk, shellac, etc.).