



Nature's Silent Helpers: The Role of Beneficial Insects in Daily Life

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Many insects found in agricultural fields pose no threat to crop production; on the contrary, they provide numerous benefits to farmers. These include roles as natural enemies of pests, pollinators, productive insects (such as honey bees and silkworms), scavengers, weed suppressors and soil enhancers. However, in the current agricultural scenario, the primary focus of many farmers is on maximizing profit, often at the expense of environmental health and the well-being of beneficial insects. While insecticides remain a valuable tool for protecting crops and enhancing yields, their excessive and indiscriminate use can lead to serious health hazards for farmers and unintended harm to non-target organisms, including beneficial insects.

How insects are considered beneficial?

Beneficial insects are the ones that play vital roles in agricultural ecosystems by naturally regulating pest populations. They act as predators and parasites of harmful insects and plant pests, thereby helping to suppress their numbers. In addition to pest control, beneficial insects contribute to plant pollination, aid in the decomposition of organic matter, and enhance soil nutrient cycling. By attacking pest species such as destructive insects and mites, they can either prevent or significantly reduce the severity of pest outbreaks, minimizing the need for chemical interventions.

Importance of Beneficial insects

1. Use as Commercial Products

Honey and Beeswax

Honey is widely used as a food product and as an ingredient in the manufacture of various goods. Beeswax, produced by honeybees, is commercially valuable and is used in the production of candles, sealing wax, polishes, certain types of ink, molds, dental impressions, cosmetics and other products.

Silk

Silk is produced by the larvae of the silkworm moth (*Bombyx mori*) and is renowned for its fine, lustrous quality. It has traditionally been used as a luxury fabric for garments, including hosiery and a wide range of clothing materials.

Shellac

Shellac is a natural resin secreted by the lac insect, a type of scale insect found on trees such as fig and banyan. It is harvested and processed to create a versatile product used in varnishes, food coatings and polishes.

2. Role in Pollination

Insects such as bees, butterflies and beetles are essential pollinators of flowering plants, playing a key role in fruit and seed production. Insect-driven pollination is a critical component of plant reproduction, supporting a vast majority of flowering plant species,

including many cultivated crops. Globally, about 75% of flowering plants and approximately 35% of food crops depend on animal pollinators, more primarily insects. It is estimated that nearly one-third of the world's agricultural output relies directly or indirectly on insect pollination, underscoring their importance to global food security and ecosystem health.

3. Role as Entomophagous Insects

Entomophagous insects are those that feed on other insects, many of which are agricultural pests that damage crops and stored grains. These beneficial insects play a vital role in maintaining ecological balance by suppressing the populations of phytophagous (plant-feeding) insects, thereby preventing them from becoming dominant and causing widespread damage (Getanjaly et al., 2015).

Entomophagous insects are broadly classified into two groups: **predators** and **parasitoids**.

Predators

Predatory insects are generalized feeders and devour many small individuals for getting a single meal. They help control pest species that pose a threat to agricultural crops. Common examples include:

- **Lady beetles (ladybugs)** – feed on aphids and scale insects.
- **Lacewings** – prey on aphids, thrips, and caterpillars.
- **Spiders** – consume a wide range of insect pests, contributing to natural pest control.

Parasitoids

Parasitoids are organisms that lay their eggs on or inside a host insect. The developing larvae feed on the host, eventually leading to its death. Unlike predators, a single parasitoid usually completes development within a single host. Most parasitoids used in biological pest control belong to the following insect orders:

- **Order Hymenoptera** – families include *Ichneumonidae*, *Braconidae*, *Eulophidae*, and *Trichogrammatidae*.
- **Order Diptera** – includes various parasitic flies.

Together, predators and parasitoids form a cornerstone of biological control strategies, offering a natural, sustainable alternative to chemical pesticides in integrated pest management (IPM) systems.

Role as Weed Killers

Insects can play a significant role in weed management through biological weed control, an eco-friendly method that involves using specific insects to suppress or eliminate invasive or unwanted plant species. These insects target and feed on particular weeds, reducing their growth, reproduction and spread without harming crops or the environment.

Examples of Insects Used in Weed Control:

- **Cactus Moth (*Cactoblastis cactorum*)** – Used to control prickly pear cactus.
- **Lantana Fly and Lace Bug** – Target and reduce the growth of common lantana.
- **Chrysomelid Beetle** – Helps manage Congress grass (*Parthenium hysterophorus*), a highly invasive weed.
- **Water Hyacinth Beetles (*Neochetina spp.*)** – Used to control the spread of water hyacinth, an aquatic weed.
- **Flea Beetles** – Effective against alligator weed.
- **Various Beetles** – Employed in the control of water ferns (*Azolla spp.*).

Biological control using these insects offers a sustainable alternative to herbicides, helping to reduce chemical use while preserving ecological balance.

4. Soil Builders

Certain beneficial insects, such as beetles and ants, contribute to soil health by aerating the soil through their tunneling activities, which enhances water infiltration and root development. Additionally, the decomposition of insect bodies, shed exoskeletons (exuviae), and secretions like saliva enrich the soil with organic matter and nutrients.

5. Role as Scavengers

Many insects serve as natural scavengers by feeding on dead and decaying organic matter, including plant debris and animal carcasses. This process accelerates the decomposition and

recycling of nutrients back into the ecosystem, preventing the accumulation of waste materials that could otherwise become environmental or health hazards.

Two major insect orders act as primary scavengers:

- **Order Coleoptera (beetles)**
- **Order Diptera (flies)**
- **Termites (Order Isoptera)** feed on dead wood, playing a key role in breaking down lignin and cellulose.
- **Ants** consume dead animals and decaying plant material, aiding in decomposition and soil turnover.

Together, these scavenger insects help maintain ecological cleanliness and nutrient balance in both natural and agricultural ecosystems.

6. Insects as Food

Insects have served as a nutritious food source since ancient times. Even today, entomophagy, the practice of eating insects is common in many cultures around the world. Insects are high in protein, low in fat and rich in essential nutrients. For example:

- Dried grasshoppers are sold in markets across Mexico.
- Insects are often ground into flour for making tortillas or fried as snacks.
- Wood-boring beetle larvae are traditionally boiled or roasted over open fires.

Common edible insects include ants, bees, termites, water grubs, caterpillars, flies, crickets, katydids, beetle larvae and dragonfly nymphs. In Thailand, silkworm pupae are widely consumed as a delicacy and nutritional supplement.

7. Educational and Scientific Value

Insects are invaluable in scientific research due to their short life cycles, high reproductive rates and minimal space and food requirements. They can be easily and economically reared under laboratory conditions, making them ideal model organisms.

- The fruit fly (*Drosophila melanogaster*) is one of the most studied organisms in genetics and developmental biology.
- Research on insects has significantly contributed to our understanding of cell physiology, heredity, behaviour and evolutionary biology.

8. Medicinal Value

Certain insects and their products are used in traditional and modern medicine:

- Honey bee venom is known to have therapeutic effects in treating arthritis, rheumatism and other inflammatory conditions.
- In homeopathy, a remedy called “Apis” is derived from honey bees by processing them in alcohol. It is used to treat ailments such as urinary irritation, diphtheria, and inflammatory disorders.
- Insects are also being studied for their antimicrobial and wound-healing properties.

9. Cantharidin

Cantharidin is a potent chemical compound extracted from the blister beetle (*Lytta vesicatoria*). It has medical applications both:

- Internally, in the treatment of certain urinary disorders.
- Externally, as a vesicant (blister-inducing agent) and counter-irritant.

Despite its medicinal uses, cantharidin is also widely known (and misused) as an aphrodisiac, making it one of the most controversial substances derived from insects. Another significant example is the caterpillar fungus (*Cordyceps sinensis*), a parasitic fungus that grows on caterpillars. Widely used in traditional Chinese medicine, it acts as a tonic that enhances stamina, reduces stress, strengthens lungs & immune system.

10. Maggot Therapy

- Maggot therapy involves the use of fly larvae (maggots) to clean infected wounds by consuming dead tissue, a practice that has been used for centuries. This method promotes rapid wound healing and helps prevent infection.

- A key compound secreted by maggots, allantoin, has shown remarkable properties in tissue regeneration and healing of deep wounds. Maggot therapy is now recognized as a valuable tool in modern medicine, especially for treating chronic wounds and ulcers.

11. Insects as a Source of Natural Dyes

Insects also contribute to the production of natural, eco-friendly dyes. For example:

- Cochineal dye, a vibrant carmine red pigment, is obtained from the dried and powdered bodies of cactus scale insects (*Dactylopius coccus* and *D. tomentosus*) that feed on *Opuntia* (prickly pear cactus) species.
- Insect-induced galls on plants also serve as raw material for traditional dye extraction.

These dyes are valued for their vivid colour, historical importance and use in textiles, food coloring and cosmetics.

12. Aesthetic and Cultural Value

Insects have long captivated human imagination with their beauty, color patterns and forms. Species such as butterflies, moths and beetles rival flowers and birds in their aesthetic appeal and have inspired:

- Artists and designers (in textiles, decor, and jewelry).
- Florists and collectors who admire insects for their symmetry and vibrant hues.

Some insects are collected as hobby specimens, while others are preserved in resin or acrylic to create jewellery, paperweights, placemats and decorative items, reflecting their aesthetic and cultural significance.

Conclusion

Thus, beneficial insects play a vital role in sustainable agriculture by supporting natural pest control, boosting crop yields and enhancing environmental health. Embracing their importance helps farmers build a more resilient, eco-friendly farming system that benefits both agriculture and the broader ecosystem.

References

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