



Insects Provide Useful Indicators for Assessing the Status of Biodiversity Over Time

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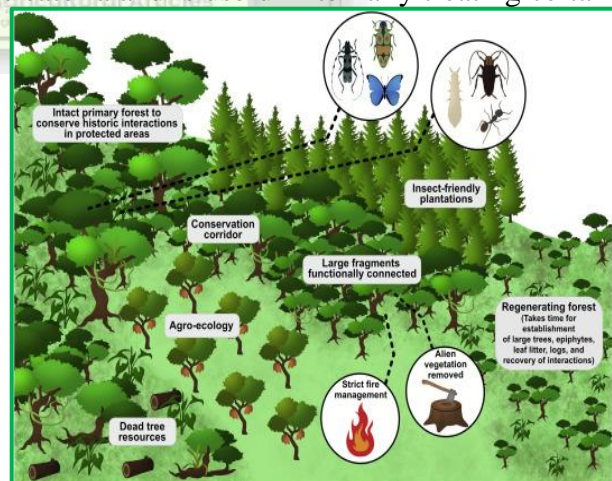
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Insects provide useful indicators for assessing the status of biodiversity over time. Insects possess many of the desirable indicator attributes and respond to environmental changes more rapidly than do vertebrate indicators. Butterflies, for example, may be good indicators for climatic changes, as they are strongly influenced by local weather pattern, microclimate and light levels. In addition, insects can be good indicators of pollution of water bodies. Natural streams, canals, rivers, ponds and lakes are often polluted due to factory wastes and raw sewage discharged into them. The pollution results in death of fish useful to humans in these waters. The degree of pollution is measured by employing the insects. The number and kind of insects that are able to survive in the polluted waters will be an index of pollution; less the number of surviving insects, the more in the pollution of the water body.

Insects are being used for scientific detection of crimes. The presence of bugs, flies and other insects may be useful to solve the crimes from murder and rape to poaching of animals. The term forensic entomology is generally applied to the study of insects and other arthropods found in and on human bodies suspected of criminal action to help in the investigation and initiation of civil proceedings. Based on the species and stage of insects, entomologists are able to predict the time and location of crime. More importantly they indicate whether a suspect is actually involved in the crime or not. In some of the countries like USA and Canada, where mapping of insect populations has been carried out over various seasons, forensic entomologists are routinely called upon to give evidence in cases of crime.

Medicinal Value

Several insects and their products have found their use in medicine. The stings of honey bees are said to have remedial value in the treatment of arthritis and rheumatism. Cantharidin is a substance found in the blister beetle, *Lytta vesicatoria* and is useful internally treating certain urinary diseases and externally as a vesicant and counter-irritant. Cantharidin is also probably the world's best known and most widely abused aphrodisiac. It is also known to be a tonic for hair. However, it has profound physiological effects on human body and its use in medicine is now banned because of its high toxicity. Dr William Boric, a renowned homeopath, mentions two drugs in his *Materia Medica* that are prepared from cockroaches, *Blatta americana* and *Blatta orientalis*, the former for the treatment of tiredness and urinary



ailments, and the latter for asthma. A specific medicine 'Apis' is extracted from the honey bees by digesting the excited bees in alcohol and is used against certain diseases like urinary irritation, diphtheria, etc.

Caterpillar fungus, prepared from caterpillars of *Cordyceps sinensis*, is used as a tonic by the Chinese. Traditionally, this product was considered so precious that only nobles and emperors were able to use it. Now-a-days, it is used by the Chinese athletes for strengthening and rejuvenating the body, to relieve stress, protect lungs and strengthen the immune system. Due to its legendary properties, it has been called the Chinese medicine for eternal youth'. The Aleppo gall of oak is a powerful astringent.

Economic Importance of Insects tonic and antidote for certain poisons, and has been used for about 25 centuries in Europe and West Asian countries. Maggot therapy, i.e. the use of maggots of certain flies to clean wounds and promote healing, has been used for centuries in some societies and probably developed as a result of casual observations that the larvae of some flies had beneficial effects on infected wounds. Allantoin is a substance isolated from the secretions of fly maggots, which seems to have properties of healing deep wounds. With the development of microbial resistance to many antibiotics, there has been a revival in the use of maggot therapy. Myiasis, the infestation of animal tissues (living or dead) by maggots appears to have evolved in some dipteran families that were originally saprophagous, i.e. bred in carrion. Currently, it is mostly observed in three families, viz. Oestridae (all 150 species), Calliphoridae (about 80 species) and Sarcophagidae. However, most of these species are unsuitable for use in maggot therapy because they feed on healthy tissue and are highly host specific. Of about 10 species of the medicinal maggots, the most common are the larvae of the green bottle fly, *Lucilia sericata*. However, in UK, continental Europe and New Zealand, this fly is a major sheep pest, causing 'strike', which may prove fatal in heavy infestations.

Educational and Scientific Value

In view of their simple food and other requirements, short duration time, and high fecundity, many insects can be reared cheaply and easily under laboratory conditions. These attributes of insects make them ideal tools for use in teaching and research. In addition, the remarkable diversity of form and habits of insects, make even an important resource both in and outside the classroom. The fruit fly, *Drosophila melanogaster*, has played a key role as a test insect in advanced genetic research. The genetic experimentation with cumbersome and slow breeding guinea pigs, rats, peas and primroses was shifted to this insect. These tiny flies can be handled with ease, can be reared and maintained on fermenting banana in small vials in the laboratory. The space required and cost of maintenance of these flies are very much less when compared to peas or primroses. The flies have only four pairs of chromosomes in the cells and the large chromosomes of salivary glands reveal clearly the actual chromosomal segments and the flies are able to complete about 30 generations in a year. This enables an investigator to study a number of generations within a limited period. Studies on other insects have provided us with much of the basic knowledge of animal and cell physiology, particularly in the areas of nutrition, toxicology, metabolism, endocrinology, neuromuscular physiology and evolutionary biology. Studies on population dynamic of some pest insects have led to the formulation of some important concepts in population ecology.

Source of Dyes

The dead and dried bodies of certain insects and the galls produced by them are a source of natural dyes. The beautiful carmine red dye cochineal is obtained from the dried and powdered bodies of the cactus scale insects (also called the cochineal insects), *Dactylopius coccus* and *D. tomentosus*, which thrive on *Opuntia* spp. *D. coccus* is specially cultivated on *O. coccinellifera* in Mexico and other countries. In India, *D. tomentosus* occurs on *O. dillenii*. When the insects are fully developed, they are brushed off the host plant and killed by hot

water or sun drying and marketed. Cochineal contains 10 per cent carminic acid and is used for colouring beverages, cakes and sweets, and for dyeing materials like wool, silk and leather where permanent colouring is required. With the advent of synthetic dyes, cochineal is now getting out of use.

Galls are tumourous outgrowths on the surface of plants induced by insect inflicted injuries. They yield valuable materials like tannic acid and dyes. Tannic acid occurs in high percentage (30-70%) in many of these galls which are the richest source of this material. It has been used for centuries for tanning animal skin. Dyes obtained from some galls make the finest and most permanent ink because of which in some countries the law requires that certain records be made only with ink compounded with gallnuts. Our own ancient sages, whose writings on palmleaves have survived to this day, possibly made use of gall inks. African Somali women use gall dyes for tattooing. The Turks obtain a fine scarlet colour from a reddish gall on oak. Turkey red is dyed from "mad apple" in Asia Minor. The ancient Greeks used the Aleppo gall for dyeing wool, hair and skin. More recently, great quantities of it have been used in dyeing leather and seal skin.

Aesthetic Value

Insects have catered to the aesthetic needs of man for a long time. Some of the insects are extremely beautiful and they rival flowers and beautiful birds in this respect. Their shapes, wing colour, and patterns have served as models for artists, florists, textile designers and interior decorators. They have been the subject matter of poems from times immemorial. The inimitable and almost endless variety found among insects and their curious habits have been a source of entertainment and



diversion for humans. Because of their beauty, certain groups, especially butterflies, moths and beetles, are sometimes collected as a hobby. Some are embedded in clear materials from which jewellery, place mats, paper weights, etc. are made, others are simply used as models on which paintings and jewellery are made. Artists and designers have copied extensively from the beautiful colour pattern of butterflies. Ornaments like necklaces are made from whole bodies of some beautiful insects especially beetles. In South Africa and Australia, native people use strings made of beautiful shells of nymphs of certain scale insects. In western countries, several insect based games like Giant Cootie game, Anta in the Pants, Bedbugs, Wacko the Cockroach, Bizzy, Bizzy Bumble Bees, etc. provide enjoyment and fun to children. Insects also figure in several television and video shows like the Tick, Ant, Boy, the Queen Bee, Blue Beetle, Ambush Bug, etc.

Harmful Insects

At a conservative estimate, insects arrived in this world some 300 million years ago and, therefore, when the first ancestor of man came a million years back, insects had already mastered the world and taken full possession of it. The result was that despite his superior intelligence and vast array of tools of destruction at his disposal, insects have defeated man at every stage and in all departments of the war of struggle for survival. If they have wanted our crops, they have taken them. If they have wanted to suck our or our animals' blood, they have pumped it out right under our eyes and if they have wanted to share our abodes, we have just

not been able to oust them. These daring acts they have continued and will continue to do, man's relentless war against them notwithstanding, because both need the same things at the same time. Is it, therefore, not paradoxical that on the one hand the insects are so friendly that they have become indispensable to our existence itself, on the other, they form such formidable foes that we are always kept on tenterhooks to find ways and means to contain them.

Of an estimated 5-10 million species of insects, perhaps about 10,000 constitute pests which, either alone or in conjunction with microorganisms, cause significant damage to humans, agricultural or forest products, and manufactured goods. Insects directly feed on human beings, act as vectors of microorganisms that cause diseases in humans and domesticated animals, compete with us for food and other resources, and transmit diseases in valuable plants. Increasing human population and urbanization presented many opportunities for the dissemination of insect parasites on humans and the diseases transmitted by them. Modern transportation also encourages the spread of pest insects and insect-borne diseases. Likewise, crop intensification has resulted in aggravation of insect pest problems in agriculture.

