

# Insects As A Bio-Indicator of Different Environmental Pollutants

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## Abstract

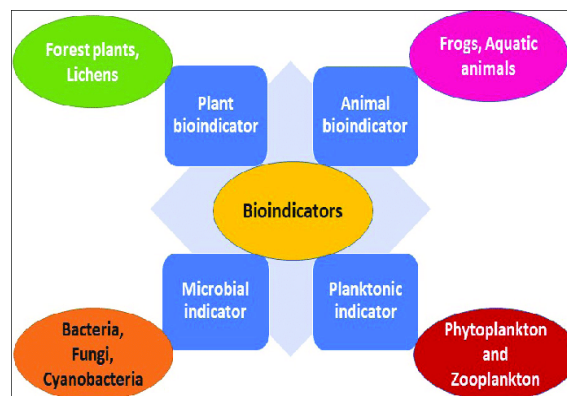
One of the most important issues facing the globe today is environmental pollution. In recent years earth is highly affected because of human activities such as manufacturing, resource depletion, deforestation, extractive industries, poor waste management, transportation or agriculture and various ecological processes which leads to pollutions. Major forms of pollution include light pollution, noise pollution, air pollution, water pollution, soil contamination, industrial pollution. It is necessary to know the level of pollutants present in environment and to which extent cause damage to environment in which insect's play major role. An increase or decrease in the population of insect species may indicate significant changes in the ecosystem.

**Key Words:** Environmental pollutions, Insects, Bio-indicators, anthropogenic activities.

## INTRODUCTION

In recent years industrialization and urbanization have created problem of contamination of water, air and land. The pollutants generated from various human activities affect the biodiversity of the environment (Findorakova et al., 2017). These environmental changes can be detected by certain living organisms known as bio-indicators. Prolonged changes in an environment will bring about changes in the community of organisms which occupies that environment. These changes in the biota, then can be useful indicators of the environmental change that caused them. Generally insects are responsible for many processes in the ecosystem and its loss can have negative effects on entire communities. Thus, a strong understanding of insect responses to human activity is necessary in order to know consequences of human disturbance on ecosystems.

(Chaudhary and Saini, 2022)



## Why insects are bio-indicators

As insects are present in virtually every terrestrial and fresh water habitat, and fill a wide variety of niches. Furthermore, they are often present in large numbers. These two facts mean there are insect species available to serve as indicators in almost every ecological situation. Instead of these two reasons insects also respond quickly to environmental stress, smaller in size, have short generation times and are usually easily sampled and identified (Lenhard and Witter, 1977).

## Classification of bio-indicators

McGeoch (1998) classified bio-indicators into environmental, ecological and biodiversity bio-indicators based on their application.

**(1) Environmental indicators:** An environmental indicator is a species or group of species that responds predictably, in ways that are readily observed and quantified, to environmental disturbance or to a change in environmental state.

**(2) Ecological indicators:**

Indicator taxa are now used far more frequently to demonstrate the effects of environmental change (such as habitat alteration and fragmentation and climate change) on biotic systems.

**(3) Biodiversity indicators:**

A biodiversity indicator is a group of taxa (e.g. genus, tribe, family or order, or a selected group of species from a range of higher taxa), or functional group, the diversity of which reflects some measure of the diversity (e.g. character richness, species richness, level of endemism) of other higher taxa in a habitat or set of habitats

**Advantages of using insects as bio-indicators**

- (a) Biological impacts can be determined.
- (b) to keep an eye on the antagonistic and synergistic effects of several contaminants on a creature.
- (c) Early stage diagnosis as well as harmful effects of toxins to plants, as well as human beings, can be monitored.
- (d) Countable because of their widespread occurrence (Parmar et al., 2016).

**Disadvantages**

- a) The natural fluctuations of populations must be understood in order that such changes not be wrongly interpreted as the result of major long-term environmental change.
- b) Severe conditions such as flooding, drought, or extremes of temperature may cause drastic temporary reductions in an insect population.
- c) Parasites, predators, competitors, hosts, or prey organisms will have an effect on the insect population in question (Lenhard and witter 1977).

**Insects as bio-indicators of water pollution**

Sea skaters have ability to accumulate cadmium in their tissues and high concentrations have been measured in skaters from tropical oceans. Mayflies are susceptible to low oxygen levels in moving water. Stoneflies indicate highly oxygenated water and caddis flies larvae occur in all types of fresh water and are sensitive to water pollution. Odonates have been widely proposed as indicators of environmental quality in aquatic ecosystems for well-known reasons. By way of reproduction, these insects lay their eggs in or near only freshwater and thus, their high abundance in an area is a good indication of the quality of freshwater.

**Insects as bio-indicators of soil pollution:**

Ant species assemblages have been used as good predators against leaf eating caterpillars in citrus orchards. Ant groups have the potential as biological indicators of soil conditions as well as crop management. The response of the ground beetle *Pterostichus oblongopunctatus* to heavy metal pollution by assessing morphological traits. Elytra length (a measure of body size) decreased with increasing pollution levels.

**Insects as bio-indicators of air pollution:**

Existence of honey bees highly depends directly on the quality of environment. *Apis mellifera* showed two signals to indicate the chemical disruption of the environment, i.e., mortality and residues detected in their bodies or bee hive products. The wasps of the genus *Polistes* (paper wasps) have a worldwide distribution and are widespread in human-built areas. The larval faecal masses, in the form of a semi-solid ball, are made up

of the residues of the diet of the larva. Larval faecal masses may accumulate lead (up to 36 times with respect to the adult body).

### **Insects as bio-indicators of industrial pollution**

The pupal weight, length and width of the pine beauty moth (*Panolis flammea* L.) and pine looper moth (*Bupalus piniarius* Denis and Schiffermüller.) was negatively correlated with increasing distance from the source of pollution emission. Peppered moth have two colour forms, light coloured- *typica* and dark coloured-*carbonaria*. With accumulation of soot and pollutants from industries on tree trunks white coloured moths are exposed to bird's predation and dark moths have camouflaged against the darken trees. Therefore black moths have a chance to high survival and reproduction in polluted areas and their presence is the indication of presence of pollutants.

### **Insects as a bio-indicator of light pollution**

Many insects' developmental cycles are disturbed when they are exposed to excessive light. Their daily activity regime or biological clock is negatively affected. Migration of Monarch butterflies highly disturbs due to heavy flashlights at night time.

### **Insects as bio-indicators of sound pollution**

Negative effects of vehicular horns, the noise of moving vehicles and other sources suppress the advertisement calls of males during mating. The abundance of the family Cicadellidae increased as a function of background sound level while the abundances of families Mutillidae and Lycosidae and genus *Pardosa* (Lycosidae) decreased.

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