

Semester II

Course: Fundamentals of Entomology

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INSECT ECOLOGY (Part II)

INTRODUCTION

The word ecology is the modified form of 'Oekologie' derived from the Greek 'Oikos', meaning 'Home' and 'Logos' meaning 'Discourse' introduced by Reiter in 1869 and later anglicized to 'Ecology'. Odum (1953) defined ecology as 'the study of the structure and functions of nature (or Environmental biology)'

Ecology is divided mainly into

1. Autecology
2. Synecology.

Autecology is the study of individual organisms or an individual species in relation to the environment.

Synecology is the study of the group or groups of organisms associated in a community in the same environment *i.e.*, in relation to various other species living in the same environment.

Ecological studies assist pest control programmes by explaining pest problems and suggesting alternate ways of combating insects. The outbreaks of the pests can also be predicted. The ecological studies investigate the causes for the changes in population number and the mechanism of natural control. The key mortality factors in a natural population help to integrate the various methods of control, without disturbing the balance of nature. The pest surveillance programmes form a part of ecology. Forecasting of the possible attack by different pests can be done and accordingly the control measures can be initiated in time. Suitable chemicals can be selected depending on the presence or absence of natural enemies.

In nature the living organism and the non-living substances of environment interact to form ecosystem. The environmental complex constitute

(1) Biotic factors known as 'Density dependent factors' include

a) Food and b) Other organism and

(2) Abiotic factors known as 'Density independent factors' comprise

a) Temperature b) Humidity c) Rainfall d) Light e) Air f) Water g) Soil *etc.*

(1) BIOTIC FACTORS:

A) Food: Each insect species has certain nutritional requirements for completion of its lifecycle. According to nutritional requirements, insects are categorized into:

1. **Omnivorous:** Which feed on both plants and animal. Eg. Wasps, cockroaches

2. **Carnivorous:** which feed on other animal as parasites and predators.
Eg: Predators (Lady bird beetles and Mantids)

3. **Herbivorous:** which feed on living plants (crop pests) and these can again be categorized into

(a) **Polyphagous:** which feed on wide range of cultivated and wild plants.
Eg. Locusts, grasshoppers

(b) **Monophagous:** which feed on single species of plants. Eg: Rice stem borer

(c) **Oligophagous:** which feed on plants of one botanical family.
Eg: Diamondback moth, Cabbage butterfly.

4. **Saprophagous (Scavengers):** which feed on decaying plants and dead organic matter. Eg: Drosophila flies, House flies, scarabaeid beetles.

B) Other organisms: Include beneficial and harmful insects.

Beneficial associations:

i) Symbiosis: Inter relationship between organisms of different species which live in close union without harmful effects are known as **symbiosis**, each member being known as **symbiont**.

ii) Commensalism: One insect is benefited by living on or inside another insect without injuring the other and is known as **commensal** and it lives on the surplus food or the waste food of its host. Eg: Gall forming insects. When the commensal uses its host as a means of transport the phenomenon is termed as **phoresy**.

Eg: *Telonomus beneficiens* parasitoid attaches themselves to the anal tufts of female moths of rice stem borer *Scirpohaga incertulas* (Walker) for their transport. The parasitoid parasitizes freshly laid eggs.

iii) Mutualism: When both the symbionts are benefited by the association it is known as **mutualism** Eg: Ants and aphids. Termites and flagellates.

Harmful associations:

Those that live with the expense of other living organisms are

(1) **Parasites**

(2) **Predators.**

ABIOTIC FACTORS –

1. **TEMPERATURE,**

2. **MOISTURE,**

3. **RAINFALL,**

4. **LIGHT & OTHERS**

Effect of Abiotic Factors on Insect Population

1) Temperature: This is the most important physical factor which determines the duration of the various stages in the insect life cycle and consequently the number of generations during any period of time. It acts on insects in two fold manner

1. By acting directly on the survival and development which determine the abundance of a pest

2. Indirectly through food and other environmental factors such as moisture, rainfall, wind etc.

Depending on the maintenance of body temperature, animal kingdom is divided into

1) **Warm Blooded Animals (Homeothermic):** These animals maintain a constant body temperature within certain narrow limits irrespective of the temperature variations in the external environment are also called as 'Endothermic animals'. Eg. Mammals

2) **Cold Blooded Animals (Poikilothermic) :** These animals are not capable of maintaining constant body temperature are also called as 'Ectothermic animals'. Eg. Insects.

Under unfavourable seasonal temperature the insects suspend their activities. These are of two types

1) Hibernation: A period of suspended activity in individuals occurring during

seasonal low temperature

2) Aestivation: A period of suspended activity of individual occurring during seasonal high temperature or in a dry weather.

2) Humidity:

Unlike in temperature, there are no definite ranges of favourable humidity to all insects. Different species and their different immature stages have their own range. Humidity effects the speed of development, fecundity, colour etc.

3) Rainfall:

Relative humidity is dependent on rainfall. The total amount of rainfall distribution in time influences the abundance of insects in an area. More than 12.5 cm rain during May-June results in increase in soil moisture which is not favorable to the cutworms and hence forced to come out of the soil and fall a ready prey to their parasites and predators. On the other hand if the rainfall is less than 10 to 12.5 cm during summer, cutworms remain protected in soil and there is outbreak of the pest in next season. Hence, the outbreak of pest can be forecasted, if the number of wet days (0.8 cm) during May-July is noted. If there are less than 10 wet days there will be an increase of cutworms in the following year. If there are more than 10 wet days there will be a decrease. Desert locust does not lay eggs and even if laid does not hatch unless soil has sufficient moisture. Rainfall also plays an important role in movement of swarms of desert locust.

4) Light: Light is a non lethal factor. It helps in orientation or rhythmic behaviour of insects, bioluminescence, period of occurrence and inactivity.

Visible and ultra violet light influences the following:

Growth, moulting and fecundity

Based on daily activity cycle, insects or animals are categorized as

Diurnal: Insects which are active during daylight hours

Nocturnal: Insects which are active at night

Crepuscular: Insects which are active at dusk

5) Other factors:

i) Atmospheric pressure

ii) Wind and Air currents

6) Edaphic (Soil) factors: Loamy soils allow digging and burrowing operation and are usually favourable for insects. *Agrotis sylviae* in soil of fairly light texture in which they move around freely in response to daily or seasonal temperature and moisture changes.