

by importing the infested plants from one country to another, introduces the insects of that crop in a new locality e.g. sugarcane pyrilla was introduced in Indo-Pak from Hawaii

5. Through scientific research

Insects are important for the scientists for research purposes but their mishandling creates problems e.g. Gipsy moth was imported from Europe into America for the scientific research. Its eggs from the research laboratories accidentally reached into the field and it became serious pest of apple in America.

### 2.3 FOUNDATIONS OF INSECT CONTROL.

Followings are the foundations of insect control. Detailed knowledge of these aspects is helpful in controlling the insects.

#### 2.3.1 External morphology

External morphology includes head, thorax, abdomen and their appendages.

##### A. Head:

Head consists of antennae, compound eyes and mouthparts.

- i. **Antennae** are sensory organs having the receptors for sense of smell and touch. The antennae control attraction or repulsion of insects towards a particular source. So, we can control insects with the help of attractant and repellents.
- ii. **Compound eyes** have perception of light and thus enable different insects to be attracted towards light. We can control insects by putting up light traps.
- iii. **Mouthparts** are generally of two types. Knowledge about mouth parts determine the type of insecticide to be used for the control of particular insect pest.
  - a) Chewing: Stomach insecticides are used for insects having chewing type mouthparts.
  - b) Sucking: Systemic insecticides are used for insects having sucking type mouthparts.

##### B. Thorax:

The thorax bears locomotory organs (legs and wings). With the help of these organs, the insects move from one place to another. So, it enables insects to either reach towards an insecticide or move away from insecticides with the help of wings or legs. Thus, knowledge about appendages of thorax helps greatly for the control of insects by different methods.

##### C. Abdomen:

The abdomen contains two types of appendages, the cerci and genitalia. The genitalia or ovipositor (egg laying apparatus) provides the information about the egg laying habit/ability of insects i.e. whether the eggs are laid in the soil, on plant tissue, leaves or veins etc. If we know the place of laying eggs, we can easily remove/ destroy the eggs and thus control the insects.

### **2.3.2 Internal morphology**

The study of internal morphology provides information for effective control of insects. Knowledge about body cavity and tracheal system greatly helps in the control of insects. Many parasites/ parasitoids live in the body cavity of certain insects and thus help in the biological control of various crop pests. The fumigants (volatile insecticides at ordinary temperature) enter in the body of insects through spiracles and kill them. So, the type and application of insecticide greatly depends upon the internal morphology of insects.

### **2.3.3 Metamorphosis**

The metamorphosis tells us about the following:

- i. Different stages of an insects pest (i.e. through how many stages it passes in its life cycle)
- ii. Which stage is harmful
- iii. Which stage can easily be controlled
- iv. Where different stages are found (at which place they are living)

Information about the above mentioned points helps in control of insect pests.

### **2.3.4 Life history**

The study of life history is also very important for the control of insect pests because it gives us the information about the:

- a. Host plants of a particular insect pest.
- b. The duration of various life stages.
- c. Habits and behavior of the insect pests.

If we have the information about the above points, we can easily control the insect pests.

## **2.4 PRINCIPLES OF INSECT CONTROL.**

There are three basic principles of insect control: