

Ex. No. 3

Date:

**PEST SURVEILLANCE THROUGH LIGHT TRAPS,
PHEROMONE TRAPS AND FORECASTING OF PEST
INCIDENCE**

Objective:

To understand the concept of insect pest surveillance through light and pheromone traps

Light traps:

Light acts as a source of attraction for some insects has been deployed to catch insects in suitable traps. Most of the insect species are nocturnal and are positively photophobic. The photophobic behaviour is altered and modified by temperature, humidity, moisture etc. this phenomenon has been utilized by the entomologists to capture adult insects in a device called light trap.

In agriculture, light traps are important tools in insect ecological research and pest management. They are used for the following purposes.

1. Determining the presence or absence of insect species in an area.
2. Obtaining quantitative estimates of population density, species composition, age and sex.
3. Providing early warnings of crop infestation and oviposition.
4. Determining economic threshold levels to assist insecticide application.
5. Suppressing population to help managing the pest.
6. Detecting migration.
7. Collecting specimens for taxonomic purposes or for establishing laboratory cultures.

An ideal light trap should be cheap, durable and robust. It should be serviced easily by personnel of little training, should be highly efficient and attract a large number of insects of different species.

Trap design: Light traps vary in design but generally consist of three components *viz.*, 1) a light source 2) arrangement of baffles around the source 3) a catch container with a killing agent.

Light Source: Various types of light sources have been tested and used. Numerous studies have shown that the shorter visible and near ultraviolet wavelengths between 320-600 nm are most attractive to a wide variety of insects. The most efficient sources are the mercury vapour lamp and fluorescent tubes.

Baffles: Most light traps are fitted with baffles, which surround the bulb. They are often four, arranged perpendicular to each other to help retain these insects and thus greatly increase the catch of a trap. They may be made from an opaque material such as galvanized iron, or from a transparent material such as acrylic.

Container: In most traps, insect attracted to light fall into a funnel fixed below which opens into a killing and holding container. Dichlorvos is commonly used as a killing agent. Kerosene and water mixed with some detergent also serve as killing agent in many local light traps.

Some of the commonly used light traps are

1. The Chinsura light trap
2. Robinson trap
3. Bamboo light trap
4. Mercury vapour lamp
5. Modified Robinson light trap
6. Rothamsted trap
7. The Pennsylvania and Texas trap
8. The new Jersey trap
9. The aquatic light trap
10. Incandescent lamp

Advantages :

1. Both male and females are attracted and there is possibility of using them as a control measure.
2. It is an eco-friendly measure of control since it is non-insecticidal.
3. It is compatible with any other methods of control in IPM.
4. It is simple, cheap and can be handled even by a less trained person.
5. Technical know-how requirement is less except that identification of desired target species is essential.

Disadvantages :

1. Beneficial non target insect species may also be trapped.
2. Light trap data vary with the weather conditions as well as moon light phases.
3. Expensive and bulky.
4. Availability of power source restrict trap installation.
5. It is not specific to a particular species of insect and therefore cumbersome to work with mixtures.
6. It should be operated in a large area and useful for strong flying insects.

Pheromone traps :

Pheromones are semiochemicals that are secreted into the external environment by insect which elicit a specific response in receiving individuals of the same species. These chemicals are also called as ectohormones. Pheromones are identified by extracting them from the insects and later synthesized artificially. The synthesized product is then impregnated in rubberized septa and used in integrated pest management.

Pheromones are used in integrated pest management (IPM) programmes for,

- a) Population density surveys
- b) Forewarn regarding outbreaks of important insect pests
- c) Male confusion – Mating disruption

Pheromones have greater direct behavioural control usefulness in surveys to determine the presence/abundance of insect species so that other control measures can be exercised. Several models of pheromone applications and traps are available.

Modes of Pheromone Application:

Rubber septa – sulphur free

Hollow fibres: Small thermo-plastic tubing sealed at one end & filled with pheromone. Pheromone release depends on evaporation through open end. Effectiveness is controlled by adjusting the length.

Twist tie ropes: 15 cm long plastic tube containing pheromone sealed at both ends is attached to crop manually. High concentration of pheromone provides relatively long persistence of release.

Laminated flakes : Two layers of vinyl sandwiching central porous layer with pheromone. Flakes are applied with sticker and thickening agent through special equipment or by hand. Emission rate from flakes controlled by layer thickness & chemical concentration

Micro capsules : Micro encapsulation of small droplets of pheromone done by using polymer can be easily manufactured on large scale. Readily applied over a large area with conventional sprayers.

Modes of Pheromone Application



Laminated flake lure



Rubber septa & poly-vials



Short fibre lure



Twist tie ropes

Types of Pheromone Traps:

1. **Delta trap** : It is a rigid and durable plastic trap using a replaceable sticky insert. The insert on its top consists of a non-drying adhesive. It can be removed by opening one end of the trap. Pheromone lures are placed in the centre of the sticky insert. Catch inspection is possible without the need for dismantling the trap. The dispensers and sticky inserts should be replaced every six weeks. Traps should be inspected once in every two to three weeks.
2. **Funnel trap** : Robust trap made of moulded plastic with a large base and removable cap, for housing a pheromone dispenser. Kits may be supplied with an optional killing agent (insecticidal strip) or an insecticidal spray may be used inside the trap for control purpose. Flying insect pests are lured into the trap by the pheromone attractant. Insects once enter the trap, unable to escape and are exposed to the insecticidal strip.
3. **Probe trap** : This is used in grain storage silos. It is an acrylic cylindrical tube with small angled holes drilled on the upper 2/3rd of its length. Lower part of the tube contains a removable collection tube. At the top of the trap, there are two holes to pass a card to fix a marker, which lies on the top of the grain. The trap is vertically buried in the grain 0.5 to 1 m below the grain surface. The trap should be kept at 10-35 m distance. The crawling insects enter the trap through holes and fall into the specimen tube through funnel. The collection tube is coated with a substance, which prevents insects from crawling out.
4. **Omni directional pheromone trap** : It is exclusively used for monitoring *Earias*. It consists of an aluminium vessel of 30 cm diameter. Holes are provided on the sides of vessels. The trap contains a septum on the inner side and hung in the field.
5. **Bait trap** : The olfactory stimuli from the food source attract insects and are manipulated in the pest management.
6. **Poison bait trap**: This is used to trap and collect the larvae of *Spodoptera litura*. Poison bait consists of 500 g of molasses, 5 kg of rice bran and 500 g of carbaryl 50 wp/acre. The pelleted baits are kept along the irrigation channels during evening hours to attract the caterpillars. Upon ingestion of the bait containing carbaryl 50% wp, larvae will be killed.

Advantages of pheromones in pest control :

1. Pheromones are safe to environment.
2. They are species specific.
3. They are safe to natural enemies.
4. Pheromones need small doses.

5. Compatible with other pest management programmes.

6. They are economical than other control techniques.

Disadvantages :

1. Basic behaviour of most of important insect pests like pheromone reception, migration *etc.* was not fully understood.
2. The pheromones of a few insects were only identified, a large number of them are to be identified.
3. If the crop is affected by more than one pest and when pheromone trap is placed for major pest, there are chances of secondary pest outbreak.

Fore Casting of Pest Incidence

Fore casting is the systematic monitoring of pest population, dispersion and dynamics in different crop growth phases to fore warn the farmers to take up timely crop protection measures needed. An advance knowledge of probable pest infestations (out breaks) in a crop would be very useful not only to plan the cropping pattern in such a way as to minimize the damage but also to get the best advantage of the pest control measures.

Insect forecasting service is useful in the following ways:

1. To predict the forth coming infestation level of the pest, which knowledge is essential in justifying use of control measures mainly insecticidal applications.
2. To find out the critical stage at which the applications of insecticides would afford maximum protection.
3. To assess the level of population and damage by pest during different growth stage of crop
4. To study the influence of weather and seasonal parameters on pest
5. To fix up hot spot, endemic and epidemic areas of the pest
6. To fore warn the farmers to make decisions in timing of control measures.

To forecast of any pest or pest infestation must be related to the economic threshold of the pest. The fore casting will be made by conducting the following studies.

1. Population studies

These studies should be carried out several years using appropriate sampling methods to find out the seasonal range, the population variability and geographic distribution. The seasonal counts should be related to the climatic and topographical data.

2. Studies on the pests life history

The possible number of generations and the behavior of the different larval instars under controlled conditions in the insectary, fecundity and the length of life cycle both in the field and in the laboratory can be related to range of environmental factors such as temperature, humidity etc.

3. Field studies on the effects of climate on the pest and its environment

Climatic factors usually influence pest numbers and also its parasites and predators either directly or indirectly. The spread of pest from area to area is largely determined by wind currents. A nationwide pest observatory work over entire country is essential to note the systematic occurrence of insect pests in many places and this would contribute to an effective pest forecasting service.

Types of pest forecasting

a. Short term forecasting

It may cover a particular season or one or two successive seasons only and is usually made employing insect trapping methods or some other sampling procedures for the pest within the crop. Such predictions can also be based on the rate of emergence of the pest observed by rearing in the laboratory.

b. Long-term forecasting

Long term forecasts cover large areas and are based mainly on the possible effects of weather on the insect abundance or by extrapolating from the present population density into the future.

Various methods of pest forecasting

Forecasting based on environmental factors

Environmental factors such as temperature and rainfall are the two most important factors on which forecasting can be made.

Forecasting based on climatic areas

The areas where critical infestations are likely to occur can also be forecasted for some pests. The principal factors may be biotic, topographic or climatic. Combinations of temperature and rainfall, temperature and atmospheric humidity or in the soil insects, soil temperature and soil moisture content are the most important.

Predictions from empirical observations

Attempts have been made to forecast the population of the insect pests in the forthcoming season by counting the pest numbers in the previous season. This can however be usually successful in case of static pests only.

Record Work:

- 1) Draw neat labeled diagrams of different light and pheromone traps, and different pheromone application method given in the photographs.
- 2) Record populations of known insects trapped in the light/pheromone trap present in the department