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Insect Traps and their Role in the Management of Insect-Pests

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INTRODUCTION

Trapping is the most common method used for population estimation, surveillance, monitoring and mass trapping over large areas in Integrated Pest Management programmes. The traps are generally of two types *viz.*, *interception traps* (catch insects randomly), and *attraction traps* which attract the insects and render the crops safe. The interception traps provide the indices of abundance more easily than the other type, as there is no variation due to attraction. Flight traps, aquatic traps, pitfall traps, vacuum traps, malaise traps and windowpane traps are included under interception traps. The traps that attract the insects by some natural stimulus or substitute comprise the shelter traps, light traps, trap host plants, bait traps, sound traps, pheromone traps and allelochemical traps. Examples of conjugation of interception and attraction are sticky traps and water traps. The number of insects caught in a trap depends upon their density, activity, movement range and individual expertise in the selection and placement of the traps. Insects are attracted to different cues *viz.*, visual, chemical or olfactory to communicate with each other or find suitable hosts. This flaw of insects has been explored by using traps. Traps are particularly useful for detecting the initial appearance of a pest and decision making. Seasonal activity of various pests can also be monitored using specific traps. Different types of traps have been used to sample insects. Traps are installed at specific locations and the insects trapped in them are counted at regular intervals. Sometimes, some lures/attractants are placed in the traps so that specific insects get attracted and trapped. However, some limitations with such traps are that it is difficult to define the area of influence and sometimes insect responses may change with time. A variety of devices are used to collect/prevent/kill insects for subsequent use. Some, like hand nets, bag and hopper dozers, suction traps and light traps can be used for collecting insects for subsequently killing them described below briefly.

Those, which can prevent their entry, include attractive lamps for attracting insects away from the area to be prevented, air curtains and slippery bands. Those, which kill them, include electrocuting grids and flame throwers. The different devices/traps for monitoring the insect-pests are mentioned underneath.

i) Electrocuting-grids

Electric units having a UV lamp have been used to control house flies and blowflies. Such units meant for fixing on the wall, are commercially available. The electrocuting device kills insects instantly and retains the cadavers in a removable tray. This arrangement prevents falling of dead ones into food or where their presence is undesirable. The UV lamp is positioned within an electrified grid, and any insect flying through it. Fly and moth problems within dairy barns can be greatly reduced by using electrocutor grid traps with black light fluorescent lamps as insect attractants. It is especially recommended for use in food processing establishments, hospitals and factories.

ii) Light traps

Diverse light traps have been used for attracting nocturnal and stored grain insects. It is the most widely used visual trap employed for sampling agricultural pests, particularly moths, hoppers and beetles, etc. A light trap essentially consists of a light source above a funnel and a container below to collect the catch. It is covered with a protective roof. The light source is generally an oil lamp or electric bulb or fluorescent tube. Insecticides with quick knockdown or fumigant action, such as dichlorvos, are sometimes added to the container.

Many moths and night flying beetles are attracted to short wavelengths of the light spectrum or the black light. So, black light lamps emitting ultraviolet light are widely used in trap design. Shorter wavelengths of the ultraviolet to blue are more attractive to insects in comparison with longer wavelengths of yellow, red and infrared. Though light traps are occasionally used to control insects, they are usually less efficient than other methods of control. Therefore, they are used primarily for detection, surveys and monitoring insect-pest densities to aid decision making. There are many types of light traps. However, besides several species of moths, beetles, flies, and other insects, most of which are not pests, are also attracted to artificial light. So, identification of pests and beneficial insects is of prime importance before any control operation is executed. The simplest light trap consists of a bulb on a cable hanging out in the field for attracting the pests during the night hours. Another is an oil lamp placed on a stone in the centre of an open pan containing water with a film of oil on it. The lamp may instead be hung from a post over the middle of the pan. The insects attracted to the light fall into the pan and get killed. In another light trap, an electric bulb is fixed at the top of a funnel-shaped cone. The lower narrow end of the cone terminates in a bottle containing a fumigant, e.g., calcium cyanide. The insects attracted to light are liable to fall in a bottle through the cone. A device for trapping the stored grain insects using an ultraviolet light source (4 W germicidal lamp) has been commercialized by TNAU, Tamil Nadu. Light traps have been used in the past for mass trapping of insects like the red hairy caterpillar, *Amsacta moorei* L. (Patel et al., 1981; & Saini & Verma, 1991). NIPHM, Hyderabad has developed an affordable natural enemy friendly light trap to enable insect trapping in field conditions thereby reduce the application of chemical pesticides. The trap is provided with a plastic funnel catcher through which the insects fall into a perforated plastic holding jar. Perforations are so made in the holding jar to enable the segregation and escape of the smaller size predators and parasitoids back into the field. A CFL lamp serves to provide the blue colour light to attract the insects in the field. The major problem with light traps is that, sometimes, a large number of non-target species, which may include useful ones, also get trapped which not only make sorting cumbersome but also disturbs the ecological balance.

iii) Suction traps

The suction trap is a machine for controlling the cotton boll weevil and it works on the same principle as a vacuum cleaner. The debris including the infested squares is sucked by the machine from the ground and is dropped back to the ground after pulverizing it. It is designed to pick up approximately 95.0 per cent of the fallen squares. A suction trap consists of a wire-gauze funnel leading to a collecting jar and a motor-driven fan is situated below the funnel to create the suction. Such traps are also utilized for sampling alate aphids and leafhoppers.

iv) Fish-meal trap

For monitoring of shoot flies the fish-meal trap is more efficient in catching the flies. It consists of three jars of different size and one plastic funnel. The bigger coloured jar has entry holes for flies and also the fishmeal dispenser at the bottom. The lid of this jar has four big holes through which shoot flies enter the funnel and from there they enter the transparent collection jar. Some pebbles are placed at the bottom of the jar to make the trap more stable when placed on the soil surface. The flies attracted towards fermenting fishmeal, enter the coloured jar through entry holes. From the dark jar, the flies enter the transparent upper jar through the funnel and get trapped.

Bait traps rely on insect olfaction, or sense of smell, for attraction. A common attractant is food e.g., a mixture of yeast and molasses in a cone trap to sample corn maggot, *Delia platura* (Meigen) adults. The utility of such traps is often short-lived due to infection of the bait by micro-organisms. Therefore, the bait needs to be changed frequently to keep the trap active. For monitoring sorghum shoot fly, *Atherigona soccata* (Rondani), the fish-meal trap is quite effective (Singh & Verma, 1988).

v) Sticky traps

The efficacy of sticky traps is dependent on the response of insects to trap colour and height in relation to crop phenology. Yellow and blue sticky traps are generally used to attract and trap the whiteflies and thrips, respectively. Yellow sticky traps consist of yellow plastic sheets, plates or Petri dishes coated with some sticky substance, either grease or another diluted adhesive kept in position by poles or fixed to the ground by small stakes. Sharaf (1982) stated that yellow colour radiation induces vegetative behaviour of insect that may be a part of the host selection mechanism. These traps are installed on a wooden stake or a bamboo stick at various heights above a plant canopy. The insects get stuck in the adhesive applied to the trap's surfaces. Sticky traps are useful only against actively flying insects and provide useful information on the height of flight as well as on direction. Insects like aphids, hoppers, thrips, flies, hymenopterans and beetles get trapped in such traps.

vi) TNAU insect probe trap

The use of trap is relatively a new method of detecting trapping insects in stored grains. The basic components of a TNAU probe trap consist of three important parts: A main tube, an insect trapping tube and a detachable cone at the bottom. Equispaced perforations of 2 mm diameter are made in the main tube. They are also good mass trapping devices when used at 2-3 numbers / 25 kg bin. The insect trap must be kept in the grain bins vertically with the white plastic cone downside. The top red cap must be with the level of grain. Insects will move towards the air in the main tube and enter through the hole. Once the insect enters the hole, it descends into the detachable white cone at the bottom (Singal, 2006). These should be placed at the top 6 inches of the grain, where the insect activity is seen during the early period of storage. They can remove > 80% of the insects within 10-20 days.

vii) Pitfall trap

Pitfall traps are one of the important monitoring and mass trapping tool for insects active on grain surface and in other layers of grain. The standard model of pitfall trap has 2 parts *viz*., a perforated lid (2 or 3 mm) and a cone shaped bottom portion. TNAU model has a perforated lid, cone-shaped bottom which tapers into a funnel-shaped trapping tube mainly used for early detection of infestation as well as for further avoiding the damage to stored pulses by pulse beetle, *Callosobruchus*

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spp., a stored grain pest. Pitfall trap can be placed in a metal bin, small tin container, utensil and plastic bucket used for storage of any kind of pulses. Beetle once trapped on the greasy or sticky slope of trap cannot escape and succumb to death after some time. These traps are suitable for early detection of infestation as well as for further avoiding the damage to stored pulses by pulse beetle, Commercial model is carved out of plastic, simple and economical (Rs. 25 per trap).

viii) Pheromone traps

A pheromone trap is a type of insect trap that uses pheromones to lure insects. Sex and aggregating pheromones are mostly used to attract and kill the insect-pests. Pheromones are packaged or encapsulated in slow-release dispensers (rubber septa), hollow fibres or rope wicks that are used as a lure in traps of various design. At low densities, these pheromones traps are valuable monitoring tool, providing information on the density and distribution of pest population. At high densities, they can be used for mass trapping sexually active adults in efforts to reduce population density. For commercial application, these are used as pheromone-baited traps for monitoring insect population. Female sex pheromones are formulated in slow-release dispensers and deployed in monitoring traps to attract male members of a species, e.g., Helilure (*Helicoverpa armigera* L.). Pheromone traps can be used to detect both the presence as well as density of pest species. Secondly, use of pheromones combined with insecticides in a lure and kill approach or mass trapping; mass trapping is possible in case of adult insects with a highly developed ability to respond to attractants. The pheromone is deployed in dispensers and has no direct contact with the crop. A modification of the mass trapping technique is the lure and kill method, where instead of being trapped, the responding insects come in contact with a conventional insecticide.

ix) Water trap

It consists of a shallow open pan or tray mounted on a wooden post which is filled with water having some detergent or soap or oil film to aid in wetting or drowning the insects. An omni-directional baffle is usually set in the pan for the interception of insects. The baffle and the interior of pan are sometimes painted (e.g., yellow for aphid) to add physical attraction to the trap. Water traps are useful, in sampling rice pests e.g., brown plant hopper. However, these require protection from weather and catch is to be removed and traps refilled regularly.

x) Malaise trap

A malaise trap essentially consists of a tent made of netting, with one open side, into which insects either fly or crawl. It was invented by Rene Malaise in 1934. Since most insects automatically crawl up the netting once inside, they can be trapped in vials of preservative placed in the upper corners or the peak of the tent. Since these traps depend upon the insect to enter them accidentally, they work well for highly active species such as adults of Diptera and Hymenoptera. The malaise trap is basically a tent made of cotton or nylon mesh with one side open the intercepts flying insects. The roof of the tent slopes upwards to a peak where a container with some preservative is located. Insects tend to move upward and into the container while flying and get collected in the container.

xi) Windowpane trap

Flying Coleoptera can be sampled using windowpane traps, which consist simply of a vertical pane of glass or Plexiglas with a preservative beneath it. Any insect that hits the glass and reacts by falling is caught. These traps are particularly useful for determining the direction of light and can also provide data as to when dispersal flights occur. This is a kind of interception trap consisting of a large sheet of glass that sits in a collecting trough. Insects flying into the glass are knocked down into the trough containing soapy water.

Insect-pests regularly develop resistance against newer chemical insecticides, which is not our desirable achievement and it can be reduced by traps invention and adoption. Trap application performs much better in sustainable agriculture practices, as it doesn't give any residual effects on the field. The part of ideal IPM is not to harm beneficial insects. Hence insect traps fit in the IPM practices almost ideally Extension Department should give awareness to farmers about the trapping system for prosperity and chemical-free healthy environment.