



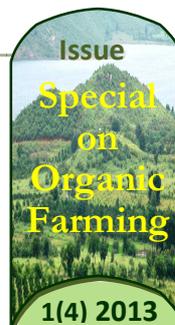
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## Insect Pheromones: An Eco-Friendly Weapon for Pest Management

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Semiochemicals are organic compounds that transmit chemical messages. They are used by insects for intra- and inter species communication. Pheromones intra-specific are chemicals capable of acting outside the body of the secreting individual to impact the behavior of the receiving individual. There are different kinds of pheromones available, among them sex pheromones are gaining paramount importance in ecofriendly pest management. These have been used widely for monitoring, mass trapping and mating disruption of destructive insect pests.

### Introduction

“The toxins have entered into the food chain and into our breakfast, lunch and dinner.....” This is one of the statements we hear from people at least once in a day. The glory of green revolution also left some major consequences. The introduction of high yielding varieties along with excess fertilizer use aggravated the insect pest problem in India. Increased insect pest problem forced the scientists to recommend and farmers to use synthetic insecticides. Now after five decades of continuous harm to environment we are in a frame of mind to correct our mistakes. Many strategies were brought in by scientists in an umbrella as Integrated Pest Management (IPM) to manage insect pests, which include biological control, habitat manipulation, modification of cultural practices, use of resistant varieties, insect growth regulators and pesticides as last resort. In IPM, one of the important components which have been proved effective is insect pheromones.

### What Are Pheromones?

Chemicals which involved in signalling between organisms and affecting behavioural modification are called semiochemicals. These chemical signals are intraspecific (within the same

species) and interspecific (between different species). Chemicals which mediate intraspecific interactions are termed as pheromones. Chemicals which mediate interspecific interactions are called as Allelochemicals. Former one has been most commonly and commercially used for the pest management, whereas latter one is less commonly used.

Pheromones, derived from the Greek words meaning “to carry” and “to excite or stimulate”, chemical/s emitted by one member of species that triggers a response only from individuals of same species. There are many types of pheromones viz., aggregation pheromone, alarm pheromone, trail pheromone and sex pheromone. The most well known in IPM are the sex pheromone. A sex pheromone is usually secreted by insects of one sex, it causes attraction and excitation in sexually mature individuals of the opposite sex, thus leading to copulation between female and male of the same species. This mechanism attraction of opposite sex has been exploited and many synthetic or para pheromones have been developed against array of insect pests for their management.

#### Uses of Sex Pheromones in Pest Management

Many insect sex pheromones have been used in IPM for three purposes,

- 1. Monitoring:** Most successful use of sex pheromone was in monitoring of insect pests. Traps baited with synthetic pheromone lures helps in detection of pest accurately. It can be used to understand insect lifecycle, adult emergence pattern and prediction of early infestation in cropping season. This information can be used effectively to take decision for insecticide spray at right time. The information collected from the trap catches can be used to develop pest forewarning system. Careful monitoring and effective interpretation of data are important for successful implementation of pest management. Till now, more than 2000 insect sex pheromones were identified worldwide. Only few hundreds were used in agriculture and horticulture pest management (Nandagopal et al., 2008). In India, less than 20 insect sex pheromones were used for monitoring. Gram pod borer (*Helicoverpa armigera*), rice stem borer (*Scirpophaga incertulas*), tobacco cut worm (*Spodoptera litura*), brinjal shoot and fruit borer (*Leucinodes orbonalis*) are few among several successful examples where sex pheromones used in monitoring.
- 2. Mass-trapping:** Mass trapping with pheromones, or simply catching as many insects as possible to reduce overall numbers. Here a large number of traps were installed to catch insects in order to bring down the population below damaging level. This method is direct method of managing insect pests. If the population is of moderate level, mass trapping followed by

application of bio-pesticides will be sufficient to manage the insect pest. There are many factors decide the successful mass-trapping of insect pest viz., type of trap, trap height, trap density and environmental conditions. In India, mass trapping technology was used in managing more than 10 insect species. Among them some reports says that brinjal shoot and fruit borer, cotton pink bollworm, tobacco cut worm and gram pod borer can be solely managed by mass trapping. However, the success of mass trapping still has to be proven in larger area. But, the potential of this technology should not be ignored (Cork and Hall, 1998).

- 3. Mating disruption:** This has been most effectively used in management of agriculturally important moth pests. In this scenario, synthetic pheromone is dispersed into crops and the false odour plumes attract males away from females that are waiting to mate. This causes a reduction of mating, and thus reduces the population density of the pests. In some cases, the effect has been so great that the pests have been locally eradicated. In India, mating disruption is shown to be effective in numerous cropping systems. Examples include sugarcane stem borer (*Chilo auricilius*), tobacco cutworm (*S. litura*) in groundnut, rice yellow stem borer. Cost is a consideration, so tends to be used where, effective and low-cost insecticides lacking, insecticide resistance is an issue, and use of insecticides would disrupt biological control and environmentally sensitive area.

#### **Points to be Remembered While Using Insect Sex Pheromone Traps**

1. Different types of traps available viz., funnel trap, wing trap, water trap etc. The selection of trap is depending on which insect you want to manage.
2. Pheromone lures are available only for specific pest and select exact lure for targeted insect pest.
3. Traps should be placed 40-100 m apart.
4. Check traps twice a week, recording trap count and removing insects from the trap. .
5. Always inspect crop in conjunction with the traps in order to make an assessment of insect activity and damage.
6. Replace pheromone lures throughout the season, referring to manufacturer's instructions on how long pheromones last.
7. Replace when they become wet or dirty.

The monitoring and mass-trapping technology of pheromone can be better appreciated in management of brinjal shoot and fruit borer in India. Following example (Table 1) illustrate the use of pheromone trap in brinjal and other guidelines for using pheromones.

Table 1. Guidelines for using pheromones with an example

Pest	Brinjal shoot and fruit borer (For Monitoring)	Brinjal Shoot and fruit borer (for mating disruption)
Type of trap	Pheromone lure + Water trap/Funnel trap/Wing trap	Pheromone lure + Water trap/Funnel trap/Wing trap
No. of traps/ha	8	100
Place in field	Before the flowering of brinjal	Before the flowering of brinjal
Arrangement in field	Place the traps either at canopy level or at slightly above the canopy level for effective attraction	Place the traps either at canopy level or at slightly above the canopy level for effective attraction.
Interpreting catches	Depending on the insecticide selected, insecticides may be applied at upswing in pheromone trap counts or 6-10 days thereafter. A repeat application may be needed if emergence is extended or fresh injury continues to be detected.	If mating disruption is working properly, very low numbers or no shoot and fruit borer moth should be captured in these traps. If moths are captured in traps, this indicates a possible failure of mating disruption, and supplemental insecticide sprays may be required at borders and/or the entire block.

### Conclusion

Pheromones can provide a means of monitoring and controlling insects which is non-toxic to animals and plants and specific for the target pest. The exploitation of pheromone technology is a need of hour. Even though, the lack of awareness among farmers, slow pace of research on identification of pheromones of insects pests of India and insufficient investment in popularizing pheromone technology are some major constraints. However, the efficient technologies will always be in forefront.

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