

Pheromones: Needs Today in Integrated Pest Management

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Introduction

German chemist, Adolf Butenandt (1959) identified and isolated first insect pheromone from silk worm and the substance was a kind of alcohol that Butenandt christened bombykol, after the moths name, Bombyxmori. German Bio-chemist, Peter karlson and Swiss Entomologist, Martin Luscher (1959), who had been engaged in research on the chemical control of caste development in termites and proposed the term 'Pheromone' (a word with Greek roots meaning 'Carrier of excitation) to describe a chemical that an animal secretes or excretes that release a specific reaction for example, a definite behaviour or development process in a member of the same spicies. A substance generally produced by the female to attract male for mating (sex pheromone).

Insect Pest Management

Sex Pheromones are crucial in the insect life-cycle and are therefore excellent targets to interfere with to obtain pest control. One of the first attempts at controlling insects by pheromones was made against the gypsy moth, *Porthetria dispar*. Attempts were made to control the gypsy moth by using traps baited with virgin female. Later crude extracts of female abdominal tips were used in monitoring traps. The chemical compound was an alcohol named gyptol Subsequently disparlure was isolated and synthesised. Over the last 40 years, scientist have identified the pheromones from over 150 different species of insects. Some of the important and frequently used pheromones are given in Table-1. Pheromones can be used in different techniques in the pest management programme as follows:

Monitoring: The use of sexual pheromones as lure in monitoring traps is now wide spread. Monitoring serves four functions:

- (a) Detection of cut breaks
- (b) Establishment of emergence times of adult insects
- (c) Distribution mapping
- (d) Assessment of changes in abundance.

Pheromones baited traps for monitoring pest populations provide a highly sensitive means of detecting the insect pests with many advantages over conventional methods such as light traps and scouting programmes. Pheromone monitoring systems can thus provide vital intelligence for the timing of insecticidal control measures

Ex: Use of Pheromone traps for cotton ballworm, pink bollworms, rice stem borer, Brinjal shoot and fruit borer, tobacco caterpillar etc.

Table: 1: Pheromones of some important insect pests

Sl.No.	Common Name	Insect Species	Pheromone
1	Gypsy moth	<i>Porthetrica dispar</i>	10-acetoxy-cis-7-hexadecanol (Gyptol)
2	Pink boll worm	<i>Pectinophora gossypiella</i>	(Z, E)-7, 11-Hexadecadien-1-ol acetate and (Z, Z)-7-11- hexadecadien- 1-ol acetate (1:1) (Gossyplure)
3	American bollworm	<i>Helicoverpa armigera</i>	(Z)-11- hexadecenal and (Z)-9-hexadecenal (97:3) (Helilure)
4	Tobacco Caterpillar	<i>Spodoptera litura</i>	(Z, Z)-9, 11-tetradecadienyl acetate and (Z, Z)-9, 12- tetradecadienyl acetate (10:1) (Spodolure)
5	Rice stem borer	<i>Chilosuppressalis</i>	(Z)-9- hexadecenal and (Z)-13-ctadecenal
6	Yellow stem borer	<i>Scipophaga incertulas</i>	(Z)-11-hexadecenal And (Z)-9-hexdecenal (3:1)

7	Brinjal Shoot and fruit borer	<i>Leucinodes orbonalis</i>	(E)-11-Hexadecenyl acetate
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Source: Baba and Rupawat, 2010

Mass Trapping:

Population reduction by mass trapping becomes feasible with attractants that can out compete sexual attractants. Most successful examples are those of the bark beetle trapping programmes. In these insects, communication involves both aggregation and sexual pheromones and so both males and females can be lured into traps. A powerful highly specific attractant should trap a sufficiently large number of target pest individuals to reduce its populations below economic threshold level. A modification of mass trapping is lure and kills technique where instead of being trapped, the responding insects are exposed to a pesticide.

Mating Disruption:

This technique depends on blocking the Communication channel between male and female insects by flooding the medium with sexual pheromone. The exact way in which mating disruption is achieved may include masking of aerial trails by the persistent cloud of odour, the formation of false trails from dispensers that act as female or male mimics, greatly outnumbering the calling insects. The greatest success has been achieved for the Control of pink bollworm, *pectinophora gossypiella* by using controlled release formulations of its female sex pheromones a 1:1 mixture of (Z, E) and (Z, Z)-7, 11- hexadecadienyl acetate known as gossplure.

Advantages: Pheromones can be used in integrated Control measures alongwith many other control measures:

1. Pheromone monitoring traps are cheap to produce and transport which are highly selective.
2. Its compatibility with biological control measure and it is to be hoped that it will herald a new era in which the use of chemical insecticides will decline.
3. Pheromone monitoring traps are involved in detection, density estimation, forewarning of insect pests and timing of insecticide applications.

4. It is not leaving any toxic residue so these are environmentally safe.

Disadvantages:

1. It is effective against a single pest or a closely related group of insects.
2. Pheromones are not providing immediate control of insect.
3. The chemical substances are not stable and photodegradable.
4. It has to be applied on an area of wide basis in order to achieve desired results.
5. Lack of proper delivery system of pheromones in the fold.

Conclusion

Sex pheromones have been successfully used in integrated pest management programme through mass trapping and mating disruption techniques against different insect pests of agricultural and horticultural crops. Pheromones are considered clean and eco-friendly as compared to insecticides.