



## Role of Semiochemicals in Integrated Pest Management

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Semiochemicals are substances or mixtures of substances released from one organism that evokes either a behavioral or physiological response between members of same or different species. They are considered as valuable ecologically -friendly strategies for both monitoring and direct control of different insect pests due to its efficacy on behavior of insect pests mainly in insect - insect or plant - insect interactions.

Chemical communication which occurs between different organisms is divided into two main categories:

1. Intraspecific and 2. Interspecific

➤ Intraspecific communication passes between individuals of same species

Ex:-Pheromones

➤ Interspecific communication involves interaction between members of different species

Ex:-Allelochemicals

### Intraspecific communication

Chemical signals enables communication between life forms of single/same species is called as pheromone. Pheromones are several types:-

**1. Aggregation Pheromone:-** These pheromones attract individuals of both the sexes at food sites and reproductive habitats. They are attractive to both sexes and tend to operate over long time range and have the potential of attracting thousands of Individuals. The hemiterpene 3-methyl butenol-ol has been shown to the aggregation Pheromone for two beetle pests viz., *Polygraphus rufipennis* and *Lasciotus intricatus*.

**2. Alarm Pheromone:** These pheromones raise an alert for the menace among the members of same species. These are common in social insects such as ants, bees and aphids which are usually found to occur in aggregation. Several compounds viz; Sesquiterpene (E)-B-farnesene(FBT), Germacrene-A, Alpha-pinene which were shown to be the main components of alarm Pheromone of several species of Aphids

**3. Trail marking Pheromone:** These pheromones were useful to guide the social insects to indicate sources of requisites to other members of the colony. Trail pheromones are characteristically less volatile and have both recruitment and orientation effects. Foraging ants, termites and larva of some lepidopteron insects produces trail pheromones. Recently 6-n-pentyl 2 pyrone was shown to be the main trail pheromone for the myrmicine ant, *Pristomyrmex pungens*. (Formicide, Hymenopteran).

**4. Recruitment Pheromone:** These pheromones induce nestmates to leave the nest and migrate to work site/vice versa. They are very common in social insects, which are used to maintain order, recruit member and co-ordinates the activities of the group members, Recruitment Pheromones are discharged from exocrine glands, which are anatomical structures often specialized for synthesis and secretion. Terrestrial ants have wide glandular

sources of recruitment pheromones (Dufours gland ,the Pygidial glands, Poison glands, Sternal glands, Hindgut and Rectal glands),the recruitment mechanism includes several sub categories.

- Initial trail laying by the scout ant.
- Attraction of additional workers to the Scout ant
- Induction of the workers to follow the trail
- Trail orientation.

**5. Retinue pheromone:** These chemicals were reported to be released by honey bee Queen, invoke the retinue attraction which encourages workers to feed, groom the queen and acquire and distribute her pheromone messages to other workers through the colony. Nine different compounds have been identified in Queen Retinue Pheromone.

**6. Royal Pheromones:** Recently identified from subterranean royal termites as a wax like hydrocarbon composed of only C and H atoms called Heneicosane. This pheromone enables workers to recognize patronage (king and queen) and to maintain the strain reproductive division.

**7. Oviposition- Deterrant pheromone:** This pheromone discourages females from laying eggs in the same resource of another female. Several fruit flies *Rhagoletis pomonella* (Diptera,Tephritidae) mark the surface of fruit after ovi-position to parent egg laying by other female flies.

**8. Sex pheromones:** These are released by one sex only and trigger behavior patterns in the other sex and are mainly produced by females to attract males, the first characterization of a sex pheromones was reported in the silk moth *Bombyx mori* (Bombycidae: Lepidoptera). Gossyplure hf (Albay International)was the first registered pheromone product granted by the EPA.

**9. Home recognition pheromones:** These pheromones are common in social insect colonies, bee queens produce a scent mark to enable workers to recognize her colony. Queen pheromones are exocrine gland products released by queen that usually attract workers to her eliciting care and protection.

### Interspecific communication

Substances which transmit chemical messages between different species known as Interspecific communication. These are substances which are primarily emitted by individuals of one species and are understood by individuals of a different species. They have divided into five categories. Allomones, Kairomones, Synomones, Antimones, Apneumones.

**Allomones:** These are released from one organism that stimulates a response in an individual or another species. The response is beneficial to the emitter.

Ex:-poisonous allochemicals these are two types

1. Antixenotics
2. Antibiotics

**1. Antixenotics:-**consists of **repellents** which orients insects away from plants, **Locomotory excitants** will start/speed up moments **suppressants** were inhibit biting/piercing **Deterrents** will prevent maintenance of feeding oviposition.

**2. Antibiotics:-**These will distrubt the normal growth and development of larvae, reduce longevity and fecundity of adults.

**Kairomones:** These compounds were produced from one organism that stimulates a response in an individual of another species and the response is beneficial to the recipient. There are several Kairomones *viz.*, **Attractants** which orients towards host plant. Arrestants will slow down/step moment. **Feeding/ oviposition excitants** will elicit biting, piercing or oviposition

**Synomones:** These compounds will release beneficial effects to both the releaser and receiver scents used by flowers to attract pollinating insects. Moreover, herbivore induces

plant volatiles are considered to be active. Synomones which recruit natural enemies of insect pests towards the affected plant.

**Antimones:**-These compounds will give disadvantage effects for both the releaser and receiver.

**Apneumones:**-A substance emitted by a non living material which evokes a behavioural/physiological reaction that is adaptively favorable to a receiving organism but detrimental to an organism of another species that may found on the non living material.

### Semiochemicals in Pest suppression

Recently semiochemicals based tactics have become an important category of Integrated Pest management. Pheromones and other semiochemicals are widely applied not only for controlling insect pests, but also for conservation of rare and threatened insects.

Various control strategies of insects used in IPM programs are based on semiochemicals and include:-

1. Monitoring
2. Mass trapping
3. Mating disruption
4. Lure and kill
5. Push pull Strategy (stimulo detract)(contact and kill)

**Monitoring:** Semiochemical baited traps using pheromones/Kairomones are simple, cheap and widely used tool for monitoring different insect pests, these traps are effective for detecting the existence of insect pests, estimating their population density and fluctuation in order to determine the first peak flight activity. The monitoring system is helpful in making the decision for control measure to keep the pest population below the economic threshold level. Currently sex pheromone, Aggregation Pheromones, different colored sticky traps and Kairomones employed to monitor insect activity.

Monitoring can be useful in following ways:-

- Detection of pest
- Measurement of pest density
- Assessment of density of natural enemies
- Assessment of phenology
- Assessment of effectiveness of mating disruption
- Monitoring insecticide resistance
- Decision support.

**Mass trapping:** Controlling of insect pest can be achieved by attracting the target pest to a semiochemical based lure and subsequent removal of the attracted pest from the wild population. It aims at catching significant proportion of a pest population before mating, oviposition/ feeding and this will stops the damage of the crop.

**Mating disruption:** It is a strategy which uses Species- Specific sex pheromones that affect mating behaviour by releasing huge amount of synthetic pheromones into the atmosphere. Mating distribution technique in which release of large amount of synthetic pheromones into pest habitat in a sufficient amount to reduce the ability of a male to locate the female and thereby affecting the organisms chance of reproduction, hence reduces the incidence of the insect in the next generation.

**Lure and kill:** It is a modification of mass trapping where instead of being trapped, the responding insects come in contact with a toxicant and killed .

**Lure and infect:** This advanced and capable approach combines an attractive lure with an entomo-pathogen. This technique is called "Autodissemination". In this case the insect that arrive at the source are not killed, but are inoculated with pathogen, to magnify the treatment by spreading the disease to other individuals.

**Push - pull strategy:** It is a combination of deterrent / repellent from the crops (push strategy) and attractive stimuli by lures (pull strategy) , that controls the insects pest by trapping/ killing tactics.

### References

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