

Lec.9

Pheromones of Insects

Definition of pheromones

Pheromones are chemical signals that are released by insects that stimulate a behavioral change to other insects of the same species. They are usually wind borne but may be placed on soil, vegetation, or various items.

This form of chemical communication is used by insects **to direct social behavior** - including **mate attraction**, **gathering**, **egg-laying**, **foraging for food**, **trail following**, and **colony defense**.

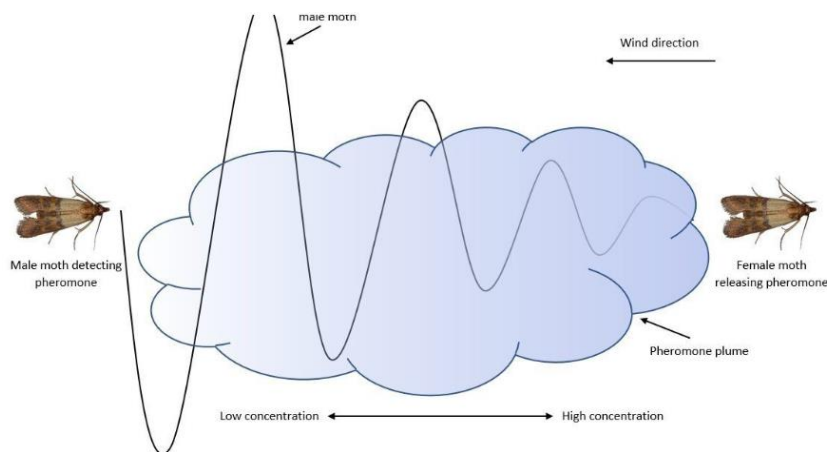


Fig.1 Sex pheromones of Indian meal moth are produced by females to attract males for mating.

What insects use pheromones?

Social insects such as bees, wasps, and ants. These include the familiar trails of ants and the honeybee alarm **pheromones** mentioned earlier.

How do insects detect pheromones?

Insects "smell" with their antennae. **Pheromone-binding proteins (PBP)** pick up **pheromones** at pores in the outside of the antenna and carry them through a watery layer to the nerve endings, where they are released.

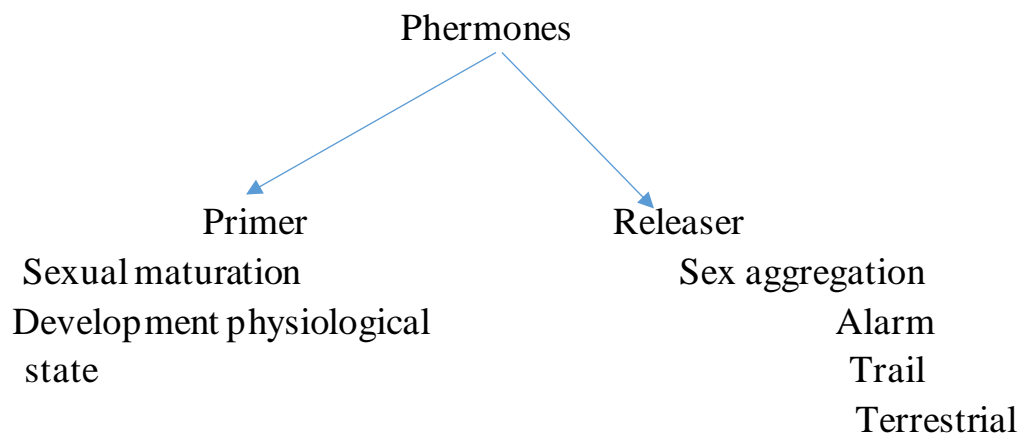
Why are pheromones important to insects?

pheromones to recruit nest mates to a food source (which explains trails of ants at a picnic or in a kitchen). When laying their eggs, some flies, moths, and beetles use certain **pheromones** to repel **insects** of the same and competing species, thereby protecting their progeny from competition for resources.

Types of pheromones

There are two distinct types of pheromones, releasers, and **primers**.

Releaser pheromones initiate immediate behavioral responses in insects upon reception, while **primer pheromones** cause physiological changes in an insect that ultimately result in a behavior response.



1. Releaser effect pheromones operates through the **olfactory sensilla** and regulate the behavior of insects. The pheromones of this category are of the following types in insects: - Sex pheromones, Aggregation pheromones, Alarm pheromones, Trail pheromones.

2. Primer effect pheromones: operate through **gustatory sensilla** and trigger a chain of physiological changes in the body. In insect they regulate cast determination and reproduction in social insect like ant bees and termites. Pheromones have been classified into eight various types: aggregation pheromones, alarm pheromones, oviposition-deterrent pheromones, home recognition pheromones, sex pheromones, trail pheromones, recruitment pheromones, and royal pheromones.

Structure and distribution of pheromone glands

1- In **most insects, pheromones are produced by glandular epidermal cells** concentrated in discrete areas beneath the cuticle.

2- In some species, **gland cells are scattered through the epidermis of different parts of the body**. In male desert locusts (*Schistocerca gregaria*), for example are scattered over the **head, thorax, and abdomen**.

3- In an immature insect, they are small and restricted to the basal part of the epidermis, but as the insect matures, they enlarge and extend distally towards the cuticle.

4- In the higher Diptera, the cuticular hydrocarbons forming the sex pheromone are **produced by epidermal cells, primarily in the abdomen**.

Actual properties of pheromone

- 1- 10-20 large number of carbon atoms.
- 2- High molecular weight 180-300 Dalton
- 3- Difusibility decrease with increase molecular weight.
- 4- Biological activity detected field test male attraction.

Modes of pheromone application

- a- Micro encapsulation method
- b- Hollow fiber method
- c- Pheromone baits traps
- d- Pheromone dispensers



Fig. 2 Mode of pheromone applications

Pheromone Reception

- 1- Exocrine glands
- 2- Medium (Air or water)
- 3- Pheromone Receptors

Receptors should be

- a- Olfactory (smell or gustatory) (Taste).
- b- Antenna often undergo A Marked sexual dimorphism.

Uses of Pheromones in Pest Management

The use of pheromone for controlling pest insects requires three items:

a pheromone chemical, a trap, and a support to hang the trap in the field.

Technically sex pheromones can be used in three principal ways:

1-Detection and Monitoring:

The principal use of insect pheromones is to attract insects to traps for detection and determination of temporal distribution. In most instances, the males are responders to female-produced pheromones. Trap baits, therefore, are designed to closely reproduce the ratio of chemical components and rate of calling females.

2-Mass trapping:

Sex pheromone baited traps can capture male moths continuously, thus preventing mating and multiplication of the pest.

1- Mating disruption:

Sex pheromone can be used for disruption of mating, which is achieved by placing high concentrations of pheromone at regular intervals throughout the field.