

## Insect Pheromones: An Ecofriendly Tool for IPM

Suman<sup>1\*</sup>, Khushboo Sharma<sup>2</sup> and Pooja<sup>3</sup>

<sup>1,2</sup>Faculty of Horticulture, SKUAST-K, Srinagar, Jammu & Kashmir-190025

<sup>3</sup>Division of Fruit Science, IARI, New Delhi-110012

ARTICLE ID: 22

### Abstract

Agriculture is our groundwork of Indian economy and contributes 15% GDP. It majorly fulfill the food demand of increasing population with diminishing cultivable land resource. The global population is projected to reach 8.5 billion by 2030, 9.7 billion by 2050 and exceed 11 billion in 2100. In order to accomplish the food demand of growing population there is need to develop an advanced agriculture production system with sustainable approach. Choosing, integrating, and putting into practise strategies and procedures to control insect populations while taking into account their ecological, economic, and societal ramifications is known as integrated pest management (IPM). It makes the most of natural forces like the weather, pathogens, parasites, predators, etc. Chemical communication systems have become increasingly more sophisticated as our understanding of them has developed, and terminology has also evolved. Even though pheromonal compounds have been used successfully in a number of IPM systems, most end users and even applied researchers are unaware of the extensive work that goes into identifying and refining pheromonal blends so that they are highly species-specific and appealing to a variety of target species. However, there is still much work to be done to promote acceptance of these new Insects are the major concern of agricultural production loss. To get rid of these insects, farmers tend to use many pesticides. Pesticides are toxic not only to pests, but also to humans and animals, nearly 3 lacs deaths are caused worldwide every year by poisoning from pesticides. Considering these and other associated drawbacks (3R) with the usages of pesticides, scientists around the world tried to get to the bottom of this issue with sustainable approach for pest management.

**Keywords:** Pheromone, IPM, semiochemicals, pesticides, sustainable

## Introduction

Sex pheromones are chemical signals sent by an organism that cause a member of the opposite sex of the same species to become sexually responsive. More than 600 kinds of lepidopteran pheromones have been found since the structural characterization of the first sex pheromone of the silkworm moth *Bombyx mori* in 1959. In order to attract potential mates and to indicate their reproductive status, sex pheromones are mostly produced by females. The term "sex pheromones" refers to both courtship pheromones, which cause a variety of close-range responses in the insect partner, and sex attractant pheromones, which cause upwind oriented motions to the conspecific individual. They were quickly thought of as promising tools for controlling insect pests, estimating pest populations, detecting the entry and progress of invasive pests, and protecting endangered species due to their main characteristics, such as species-specificity, non-toxicity to mammals and other beneficial organisms, their activity in minute amounts, and rapid degradation in the environment. In fact, sex pheromones' most effective recent practical uses in integrated pest management (IPM).

## General Characteristics of Pheromones

- All are produced by exocrine glands derived from epidermal cells.
- The amounts of pheromones that insects release is extremely low and varies from a few nanograms to micrograms per unit of time, depending on the species.
- Pheromones are mostly volatile but sometimes they are liquid contact chemicals.
- Dispersion: Air, water, direct contact between individuals, or by contact with a surface.
- Detection: Olfactory receptors and gustatory receptors.

## Types of Pheromones

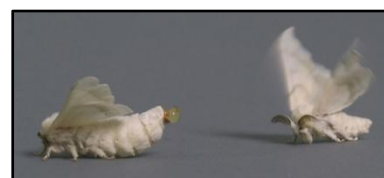


**Primer pheromones**- Trigger off a long-lasting-physiological changes in recipient without any immediate change in behaviour. Acts through gustatory sensilla.

Example: Caste determination in social insects.



**Releaser pheromones** -It stimulates the receiving individual to perform immediate behavioral responses. They are highly volatile substances that operate through the olfactory sensilla, acts on nervous system.



### Use of Pheromones in IPM

Despite the fact that pheromones are well-established in IPM systems, most end-users and even applied researchers are unaware of the effort that goes into selecting and perfecting pheromone blends so that they are highly species-specific and optimally attractive to the target species, allowing for their effective use.

#### 1. Monitoring established populations

The most widespread use of pheromones has been for monitoring endemic pest species' adult populations. Pheromone monitoring traps have established themselves in IPM programmes as vital components to the success of these programmes on other crops in the USA as well as around the world. Their utilisation is acknowledged as a fundamental and common component of IPM.



#### 2. Detection and survey programs for invasive species

The detection of adult pest species influxes from one region to another, as well as from non-crop regions into crop areas, has been greatly assisted by the use of pheromone traps.

The yearly arrival of migrating adult populations of insects like the black cutworm is widely reported and tracked through survey programmes utilising grids of pheromone traps.

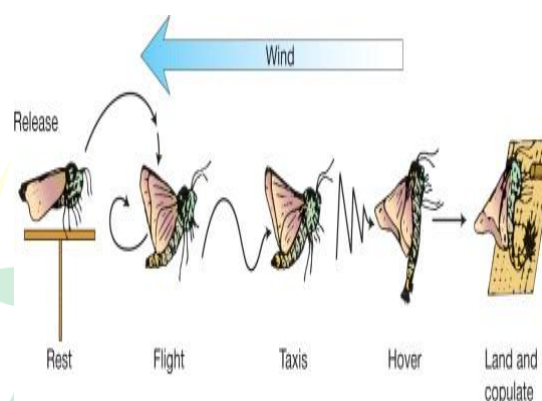
### 3. Mass trapping

Mass trapping with male- or female-produced pheromones, a technique that was once disregarded, has become a highly effective, environmentally friendly, and reasonably priced way to control populations of some pest species whose pheromone communication systems and bionomic characteristics make them amenable to this method.



### 4. Mating disruption

In order to disrupt mating, vast levels of sex pheromone are spread across crop hectares, and males' abilities to find females for mating are suppressed. Previously, it was believed that most, if not all, females would need to stay unmated for mating disruption to be effective. However, recent research has shown that females just need to have their first and second mating postponed rather than prevented.



### Conclusion

Compared to biological control and pesticide technologies, insect pheromone-related technologies for monitoring endemic pest populations, spotting invasive species, mass trapping for population suppression, and mating disruption have a comparatively recent history of development in IPM. In many ways, the use of pheromones in IPM is advancing, including the understanding that mass trapping can be a very efficient and profitable application of these behaviour-modifying substances. New lure-and-trap technologies are constantly being created for pest species that are emerging in different parts of the world. The understanding of how to empirically ascertain the mechanisms of action of mating disruption formulations is also expanding, and growers' and government organisations' acceptance of the mating disruption approach has been rising recently. In the field, where pheromones have been an essential component of insect IPM programmes for roughly 35 years, it is still to be

seen whether other behaviour-modifying compounds, such as host plant volatiles, can be as widely used as pheromones for insect IPM.

### References

- Jhala, J., Baloda, A.S. and Rajput, V.S., 2020. Role of bio-pesticides in recent trends of insect pest management: a review. *Journal of Pharmacognosy and Phytochemistry*, 9(1), 2237-2240.
- Nandagopal, V., Prakash, A. and Rao, J., 2008. Know the pheromones: Basics and its application. *J. Biopestic*, 1,210-215.
- Qadir, I., Qamar, A. and Mir, A.H., 2019. The Success and Challenges in the Employment of Insect Pheromones in Integrated Pest Management Strategies. *Think India Journal*, 22(37), 275-284.
- Ranga Rao, G.V. and Rao, V.R., 2010. Status of IPM in Indian agriculture: a need for better adoption. *Indian Journal of Plant Protection*, 38(2),115-121.
- Rizvi, S.A.H., George, J., Reddy, G.V., Zeng, X. and Guerrero, A., 2021. Latest developments in insect sex pheromone research and its application in agricultural pest management. *Insects*, 12(6), 484-487.