



## Mating Disruption: A Revolutionary Approach to Insect Pest Control

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In the world of agriculture, insect pests pose a significant threat to crop production and can cause substantial economic losses. Traditional methods of pest control often rely on the use of chemical pesticides, which can have adverse effects on the environment and human health. However, a revolutionary approach known as mating disruption has emerged as a promising alternative in recent years. Mating disruption is a technique that targets the reproductive behavior of insect pests, thereby reducing their population and minimizing crop damage. It works on the principle of interfering with the ability of male and female pests to find and mate with each other. Implementing mating disruption requires careful planning and monitoring. It involves determining the correct timing, dosage, and application method based on the specific pest species and the crop being protected. The pheromone dispensers, which release synthetic sex pheromones, must be strategically placed throughout the field to ensure effective coverage and dispersion. *Pectinophora gossypiella*, the pink bollworm, was one of the first insect species for which this tactic was made commercially available.

### How to Disrupt Mating?

Insect pheromones are significant chemical substances, either single or blended, that are often emitted by one sex of a species to trigger behavioral responses in the other sex in preparation for mating. In the majority of the species, females are the ones who emit pheromones, although there are certain exceptions where males release the pheromone to attract females.

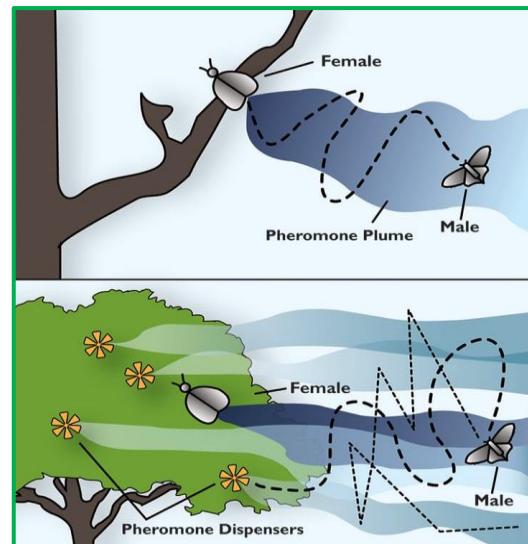
The mating disruption method involves the use of synthetic sex pheromones. These pheromones are typically released into the environment in high concentrations, confusing the male pests and preventing them from locating females for mating. This technique disrupts chemical communication between the sexes, making it difficult for pests to find suitable partners.

### Mechanism of disruption

The mechanism involves impairment of the physiology of either the male or female at the beginning of the sexual activity or the chemical makeup of the female plume by any disruptant.

**1.Competitive Disruption:** The phenomenon when there is no such impairment of senses is known as competitive disruption. Males, females, or the female signal all function normally in the presence of competitive disruption. Males are able to react to females and traps as a result. Competitive disruption is purely a game of numbers, where the dispensers to females and traps ratio has a significant impact and makes the control pest density-dependent.

**2. Non-competitive disruption:** Impairment is categorized as a non-competitive disruption when the disruptant impairs the physiology at the beginning of the sexual activity or the chemical makeup of the female plume. Disruption can be caused by the suppression of female calling behavior and mating, by a violation of the spatial integrity of the signal (masking/camouflage), or by a violation of the reception of the signal caused by a change in signal quality. Male peripheral sensilla become desensitized as a result of adaptation or habituation brought on by prolonged exposure to pheromone plume and exposure at high pheromone levels. This prevents males from responding to any pheromone lure in the environment, preventing attraction and mating.



**Figure 01: Disrupting mating using pheromone dispensers**

### Benefits of new adoption

- ✓ **Reduced pesticide use:** Mating disruption techniques significantly reduce the reliance on chemical pesticides. By disrupting the mating process of pests, it decreases the need for broad-spectrum insecticides that may have negative effects on beneficial insects, non-target species, and the environment. This can lead to a more sustainable and eco-friendly pest management approach.
- ✓ **Targeted pest control:** Mating disruption specifically targets the reproductive behavior of pests, which makes it highly selective. It primarily affects the target species, minimizing the impact on beneficial insects, pollinators, and other non-target organisms. This targeted approach helps to maintain a balanced ecosystem and preserve biodiversity.
- ✓ **Long-term effectiveness:** Mating disruption techniques can provide long-lasting control of pests. By continuously releasing synthetic pheromones that interfere with the mating process, it disrupts the ability of male insects to locate females, reducing the overall mating success and subsequent population growth. This sustained disruption can be effective for an extended period, reducing the need for frequent reapplication.
- ✓ **Integrated Pest Management (IPM):** Mating disruption is compatible with IPM strategies. It can be integrated with other pest control methods, such as biological control, cultural practices, and monitoring techniques, to create a comprehensive and sustainable pest management program. The combination of different tactics in an IPM approach can enhance the overall effectiveness of pest control and reduce reliance on pesticides.
- ✓ **Environmental and human health benefits:** By reducing pesticide use, mating disruption techniques help protect the environment and minimize potential risks to human health. It decreases the exposure of farmworkers, consumers, and nearby communities to chemical residues. Additionally, it helps maintain a healthier ecosystem by preserving natural enemies and pollinators.

### Challenges with new adoption

- ✓ **Cost:** Implementing mating disruption techniques can be costly, particularly when it comes to large-scale applications. The cost of pheromone dispensers, monitoring systems, and the labour required for installation and maintenance can pose financial challenges for farmers and pest control practitioners.
- ✓ **Technical knowledge and expertise:** Effective implementation of mating disruption techniques requires specialized knowledge and expertise. Farmers and pest control professionals need to understand the specific pest's biology, behavior, and the optimal

timing and placement of pheromone dispensers. Lack of knowledge or training in this area can hinder successful adoption.

- ✓ **Scale and landscape limitations:** Mating disruption techniques are often more effective in smaller-scale, isolated areas rather than in large and open landscapes. The dispersal of pheromones can be influenced by factors such as wind, rain, and the presence of barriers like vegetation or topography. These limitations may restrict the applicability of mating disruption techniques in certain environments.
- ✓ **Pest resistance and adaptation:** Pests have the potential to adapt and develop resistance to mating disruption techniques over time. Continuous exposure to the pheromones may lead to reduced response or behavioral changes in the target pests. This resistance can decrease the effectiveness of the technique and necessitate the development of new strategies.

## Conclusion

Mating disruption represents a revolutionary approach to insect pest control in agriculture. Targeting pests' reproductive behaviour offers an environmentally friendly and sustainable alternative to traditional chemical pesticides. As we continue to explore innovative solutions, mating disruption holds great promise in reducing the impact of insect pests on crop production and ensuring a more sustainable future for agriculture.