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SPLAT: Specialized Pheromone and Lure Application Technology

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Insect pests cause substantial global crop losses each year and the widespread reliance on chemical insecticides has resulted in resistance development, environmental contamination and negative impacts on non-target organisms. These challenges have accelerated the search for sustainable pest management alternatives. Specialized Pheromone and Lure Application Technology (SPLAT) represents an innovative semiochemical-based approach that exploits insect behaviour rather than relying on direct toxicity. SPLAT is a controlled-release, wax-based formulation that delivers pheromones and other semiochemicals for mating disruption, attract-and-kill and push-pull strategies. By targeting species-specific communication systems, SPLAT reduces pesticide dependence, minimizes environmental risk and preserves beneficial insects. Although it cannot fully replace conventional insecticides in all situations, SPLAT is highly compatible with Integrated Pest Management (IPM) systems and offers a practical pathway toward more sustainable agriculture.

Keywords: SPLAT; Pheromones; Pest control; IPM; Sustainable agriculture

Introduction

Every year, insect pests destroy a significant portion of the world's crops, reducing global agricultural productivity by an estimated 20–40% (Alam *et al*., 2023). For decades, chemical insecticides have been the primary tool for controlling these pests. While effective, their excessive and repeated use has resulted in pesticide resistance, contamination of soil and water, and harmful effects on beneficial insects and other non-target organisms (Pretty & Bharucha, 2015; Alam *et al*., 2023). To address these challenges, researchers have developed more sustainable pest management technologies. One of the most promising innovations is Specialized Pheromone and Lure Application Technology (SPLAT). Instead of killing insects with toxic chemicals, SPLAT exploits their natural behaviour, making pest management more selective, environmentally friendly and compatible with sustainable agriculture (Kumar *et al*., 2023; Panigrahi *et al*., 2025).

How Does SPLAT Work?

Many insect pests depend on sex pheromones to locate their mates. SPLAT is a wax-like formulation that slowly releases synthetic pheromones or other semiochemicals over several weeks or even months, ensuring long-lasting protection in the field (Klassen *et al*., 2023). Rather than poisoning insects, SPLAT interferes with their normal behaviour. It confuses male insects so they cannot locate females, attracts pests to specific locations where they can be controlled, or repels them away from valuable crops. As a result, pest populations decline naturally with minimal disturbance to the surrounding ecosystem. SPLAT can be used in several practical ways, depending on the pest problem and the crop being protected.

Mating disruption: Synthetic pheromones are released into the field to confuse male insects so they cannot find females. Without successful mating, the next generation of pests is greatly reduced.

Attract-and-kill: Pests are drawn to small, specific treatment spots instead of spraying the entire field. This allows control with much less insecticide.

Push-pull systems: Pests are pushed away from the crop using repellent signals and pulled toward traps or treated areas where they can be managed (Rizvi *et al*., 2021).

Another important benefit of SPLAT is its flexibility. It can be applied by hand, with mechanical equipment, or even using drones or aircraft. This makes it suitable for both small farms and large commercial operations (Muthomi *et al*., 2025).

SPLAT vs. Conventional Insecticides

The biggest difference between SPLAT and conventional insecticides lies in how they control insect pests. Chemical insecticides kill insects through direct toxicity. They often provide rapid control, but they can also affect pollinators, predators, parasitoids and other beneficial organisms. Repeated applications may leave chemical residues in soil and water, while continuous exposure encourages pests to develop resistance, forcing farmers to use higher doses or newer insecticides over time (Furlan *et al*., 2018). SPLAT follows a completely different strategy. Instead of poisoning insects, it modifies their behaviour by releasing species-specific pheromones. It targets only the intended pest species, leaving most beneficial insects unharmed. Because it does not rely on toxic action, the risk of resistance development is considerably lower than with conventional insecticides (Panigrahi *et al*., 2025). These characteristics make SPLAT highly compatible with Integrated Pest Management (IPM), where biological control, cultural practices, pest monitoring and selective pesticide use are combined to achieve long-term pest suppression (Pretty and Bharucha, 2015).

Benefits of SPLAT

SPLAT offers several clear advantages compared to conventional pest control methods. Because it targets specific insect species through pheromones, it provides highly selective pest control without harming most beneficial organisms. It also helps reduce dependence on chemical insecticides, lowering the risk of pesticide residues in food, soil and water. Since it does not rely on broad-spectrum toxicity, SPLAT is generally safer for pollinators, predators and natural enemies that support crop health. Another important benefit is its long-lasting effect. The slow-release formulation can remain active for weeks or even months, meaning fewer applications are needed. SPLAT is also fully compatible with Integrated Pest Management (IPM) programs, where multiple sustainable strategies are combined for long-term pest control. In addition, SPLAT is flexible in how it can be applied. It can be placed manually, distributed mechanically, or applied using aerial systems such as drones, making it suitable for both small farms and large commercial plantations. Field studies support its effectiveness. In cotton, SPLAT-PBW significantly reduced pink bollworm damage while maintaining higher yields than conventional farmer practices (Sreenivasa *et al*., 2021). Similarly, SPLAT-Tuta has shown promising results in managing tomato leaf miner while reducing pesticide use and lowering crop protection costs (Sreenivas *et al*., 2023).

Challenges and Future Prospects

Although SPLAT is an important advance in sustainable pest management, it is not a complete replacement for insecticides. Its performance depends on factors such as the target pest, crop, formulation, weather conditions and proper application. Initial labour and implementation costs may also be higher than conventional spraying in some farming systems. Researchers are now working on next-generation improvements, including drone-based application, automated pheromone dispensers, intelligent pest-monitoring systems and plant-based pheromone production that could make the technology more affordable and widely available.

Conclusion

SPLAT represents a new generation of environmentally responsible pest management. By exploiting insect behaviour rather than relying on blanket chemical toxicity, it offers an effective way to reduce pesticide use while conserving beneficial insects and protecting the

environment. Although it cannot completely replace conventional insecticides, it serves as an excellent component of Integrated Pest Management (IPM) programmes and is expected to play an increasingly important role in sustainable agriculture.

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