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Potential Use of Semio Chemicals in Integrated Pest Management

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Abstract

Insect pheromones, especially sex pheromones, have successfully contributed to pest management programs around the world since the 1970s. By far the greatest use of insect pheromones has been for monitoring existing populations and detecting the presence of invasive species. Monitoring with pheromone traps allows for other, curative measures such as insecticide applications or cultural/biological controls to be implemented intelligently. Research has now shown that pheromone does not need to completely shut off mating, but merely impede it to the point of delaying first and second mattings in females to reduce their fecundity by 50%. Mass trapping by deploying large numbers of pheromone traps regularly spaced in the cropping area has re-emerged as a viable and effective technique for using pheromones directly for population suppression.

Introduction

The injudicious use of pesticides has created problems like resurgence, insect resistance to insecticides, secondary pest outbreak, killing of non target organism and environmental pollution. Now-a-days more attention is given to non chemical insect control measures in IPM programme. Among various methods of non chemical insect control, pheromone is one of the effective tools and it fits well in IPM strategies. According to Yadav *et al*. (2004) pheromones are used in the whole world in an area of about 1,313,000 ha and there are 1250 pheromones related to moths, 45 to beetles, 17 to flies and 1 each to scale insects, aphids, and mites. Under the category of types of pheromones which are in use includes 1280 of sex pheromones, 32 of aggregation pheromones, 1 of alarm pheromone and 30 of attract and kill pheromones. Under the type of use of the pheromones 421 for

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monitoring, 306 for mass trapping and 556 for male confusing techniques (Yadav *et al.*, 2004; Nandagopal *et al.*, 2008).

Types of pheromone:

1). Primer effect pheromone

2). Releaser effect pheromone: Territorial, aggregartion, alarm, trail, apidiactic,sex

- Territorial pheromone: Secreted by males of some species to attract female e.g. Males of bumble bees and carpenter bees demarcate the territory for foraging activity.
- Aggregation pheromone**:** Produced by one or both sexes that brings both sexes together for feeding and reproduction. e.g. Aggregation pheromones in the management of cotton boll weevil (*Anthonomus grandis)*, stored product weevils (*Sitophilus zeamais*), (*Sitophilus oryzae)*, and pea and bean weevil (*Sitona lineatus*) has been demonstrated.
- Alarm pheromone: It is produced by insects to repeal and disperse other insects in the area. e.g. Cornicles in aphid, Poison gland in ant, At the time of sting to another animal in bees
- Trail pheromone: Marks a trail laid by pioneering individuals towards a source of food or refuge. Other individuals follow it to reach the source. e.g. Ant
- Epidiactic pheromone: Females who lay their eggs in these fruits deposit these mysterious substances in the vicinity of their clutch to signal to other females of the same species they should clutch elsewhere. e.g. Fruit flies
- Sex pheromone: A substance generally produced by male or female to attract for the purpose of mating. e.g. dispalure (gypsy moth), gossy lure (pink bollworm), grand lure (cotton grey weevil), loop lure(*Trichoplusia ni*), heli lure (heliothis), lit lure (spodoptera).

Types of pheromone trap

A pheromone trap is a type of insect trap that uses pheromones to lure insects. Sex pheromones and aggregating pheromones are the most common types used. A pheromone-impregnated lure is encased in a conventional trap such as a Delta trap, water-pan trap, or funnel trap. Insect traps are used to monitor or directly reduce populations of insects or other arthropods. They typically use food, visual lures, chemical attractants and pheromones as bait

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and are installed so that they do not injure other animals or humans or result in residues in foods or feeds. Visual lures use light, bright colors and shapes to attract pests. Chemical attractants or pheromones may attract only a specific sex. Insect traps are sometimes used in pest management programs instead of pesticides but are more often used to look at seasonal and distributional patterns of pest occurrence.

Pheromones in IPM

Integrated pest management (IPM), also known as Integrated Pest Control (IPC) is a broad-based approach that integrates practices for economic control of pests. Unlike crop fields, use of the pheromones for monitoring and mass trapping of insect pests in stored product ecosystem is more efficient, as there is always slow permeation of the pheromone chemicals in the controlled conditions and not much wastage of pheromone chemicals. Therefore, in storage ecosystems use of pheromones for the management of insects is a viable technology being the confined environment and the pest has no or least choice to run away (Nandagopal *et al.*, 2008). There are three main uses of pheromones in the integrated pest management of insects.

1. Monitoring

The most important application is in monitoring a population of insects to determine if they are present or absent in an area or to determine if enough insects are present to warrant a costly treatment. This monitoring function is the keystone of integrated pest management. Monitoring is used extensively in urban pest control of cockroaches, in the management of stored grain pests in warehouses or distribution centers, and to track the nationwide spread of certain major pests. With major increases in worldwide trade, exotic pests are being brought into ports of entry in cargo containers and packing materials (ship dunnage). Pheromone traps are currently in use to monitor the movement of such exotic insect pests into most major ports of entry. Under field conditions, pest monitoring is applicable when the relationship between moth catches in pheromone trap and corresponding larval population in field are consistent and good (Srivastava *et al.*, 2010) thus the farmers could be warned of pest outbreak during season.

2. Mass trapping

A second major use of pheromones is to mass trap insects to remove large numbers of insects from the breeding and feeding population. Mass trapping has been explored with pine

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bark beetles and has resulted in millions of insects attracted specifically into traps and away from trees. These trapping operations have reduced damage to the wood in raw logs and newly cut boards. Mass trapping has also been used successfully against the codling moth, a serious pest of apples and pears, pests of cotton, etc. Installation of large number of pheromone baited traps reduces the male moth population and thereby least chances of matting with females moth. As such, the eggs laid by the female moths are generally unfertilized. This technology i.e. mass trapping of moths can be well fits as one of the IPM tools (Sachan and Lal, 1997).

3. Mating disruption

A third major application of pheromones is in the disruption of mating in populations of insects. This has been most effectively used with agriculturally important moth pests. In this scenario, synthetic pheromone is dispersed into crops and the false odour plumes attract males away from females that are waiting to mate. This causes a reduction of mating, and thus reduces the population density of the pests. In some cases, the effect has been so great that the pests have been locally eradicated (Brunner *et al*., 2001)

Conclusion

There is a good deal to be optimistic about the prospects for successful implementation of pheromones in population management programs involving trapping for monitoring and detection, and possibly even for mass trapping. Careful studies of behavioral responses, dispersion and dispenser performance/ longevity will help inform the decision-making needed for choosing optimal trap deployment locations and trap density. Despite all, it is exciting to look ahead and envision the many ways in which pheromones may possibly be used to manipulate behaviour and have an impact on insect populations control for the benefit of society.

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