



Pheromone: A key tool in integrated pest management

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Intensive uses of organophosphate and pyrethroid insecticides are causing the negative environmental or human health impacts. With increasing public concern about the use of these toxic pesticides to control different insect pests, resource managers are turning toward other techniques of integrated pest management. Some of these techniques are common-sense approaches, such as completing sanitation and other clean-up activities before the crop season when the damaging stages of an insect pest are present. Other tools are more “hi-tech”, such as the use of odour called semio-chemicals and in particular, pheromones, to manipulate the behaviour of insect pests. With these non-toxic and biodegradable chemicals, insects can be lured into traps and then killing of them. Semio-chemicals are chemical signalling system that are produced by a plant or animal and are detected by a second plant or animal and cause a response in the second organism.

What are pheromones?

Pheromones are a class of semio-chemicals that insects and other animals release to communicate with other individuals of the same species and causes specific response in the receiving organism. Pheromones are species-specific chemicals that affect insect behaviour, but are not toxic to insects. They are active (e.g. attractive) in extremely low doses (one millionth of an ounce) and are used to bait traps or confuse a mating population of insects. Pheromones can play an important role in integrated pest management for structural, landscape, agricultural, or forest pest problems. The signals can be effective in attracting faraway mates, and in some cases, can be very persistent, remaining in place and active for days. Long-lasting pheromones allow marking of territorial

boundaries or food sources. Other signals are very short-lived and are intended to provide an immediate message, such as a short-term warning of danger or a brief period of reproductive readiness. Pheromones can be of many different chemical types to serve different functions. As such, pheromones can range from small hydrophobic molecules to water-soluble peptides. Over the last 40 years, scientists have identified pheromones from over 1,500 different species of insects. Pheromones have been found wide application in the fields of agriculture, forestry, and urban pest management and there are companies that specialize in the discovery, manufacturing and sales of pheromone-related products.

Types of pheromones : Sex pheromones are released when an insect is searching for a mate. The sex pheromone secretions of several species of insects can be sensed and recognized miles away.

Aggregation and dispersal pheromones are used to control the density of insects in

certain areas. The release of these pheromones either attracts or deters insects to the area. They can be released to announce an abundant food source which could sustain animals, or if the area has a particularly dangerous environment for the species to deter others from colonizing the area. These pheromones have been adopted by farmers and exterminators as an alternative to insecticides.

Trail pheromones are released by “worker” insects, such as bees and ants, to recruit other workers to food sources and colony sites. If a worker finds a new food source, the insect releases the pheromone to attract other workers to the area.

There are many other types of pheromones, such as alarm pheromones, queen pheromone, epideictic



pheromones. Each pheromone's chemical makeup is unique to each specific species of insect.

Pheromones in insect pest management : There are three main uses of pheromones in the integrated pest management. 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 centres, and to track the nationwide spread of certain major pests such as the gypsy moth.

A second major use of pheromones is to mass trap of insects to remove large numbers of insects from the breeding and feeding population. Massive reductions in the population density of pests ultimately help to protect resources such as food or fibre for human use. Mass trapping has been explored with pine bark beetles and has resulted in millions of insects attracted specifically into traps and away from trees. Mass trapping has been used successfully against the codling moth, a serious pest of apples and pears.

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 crop fields 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. However, only the mating disruption techniques using pheromone requires registration from Central Insecticide Laboratory (CIB).

Advantages and disadvantages of using pheromones: Insect pheromones do not have the nonspecific destructive effects as in conventional pesticides. Applying pheromones to target harmful insects has far fewer damaging effects on humans, animals or beneficial insects. Mating disruption is a major goal of using pheromones as pest control. In some areas, crop growers have substantially decreased conventional

pesticide application by using mating disruption. Crop growers, gardeners and homeowners can use pheromone traps to determine when harmful insects are accumulating. Then they can make well-timed insecticide applications. Pheromone traps also can be used to determine where harmful insects are coming from, as well as the population density and yearly population trends. Additionally, pheromones can attract harmful insects to one specific area where they can be eliminated with insecticides, or with diseases. Pheromone traps have been developed for in-home use as well, according to Encyclopedia Smithsonian. For example, a small box with pheromones to attract Indian meal moths contains a sticky substance to catch the insects for disposal. People can avoid having insecticide in the house that can be dangerous for children or pets.

A disadvantage of using pheromones for pest control is cost, according to the University of Wisconsin, producing these pheromones costs more than producing insecticides; particularly because of usage rates are low. Additionally, a different pheromone is needed for each species. This adds to the overall cost of pest management when farmers and other land owners have problems with more than one type of insect.

Conclusion : Motivation is a main factor for pheromone vs. insecticide use obviously concerns not only the farmers, but also researchers and chemical industries. Pheromone research, funded by the public hand over four decades, has provided the basic knowledge for the development of new pest control techniques. It is important to realize that only goal-oriented research will lead to reliable and more widespread applications. However, for many researchers at academic institutions it may instead be more rewarding to explore new directions and to point out the potential, future use of knowledge yet to be acquired. For future development, we must put stronger emphasis on a multidisciplinary approach combining biological control methods, microbial pesticides and resistant plants for strengthening of the effect of behaviour-modifying chemicals. Clearly, there is a need for intensifying communication and collaboration and for coordinating activities between academic research institutions, chemical industries and extension organizations.

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