



COOPERATIVE EXTENSION

Bringing the University to You



Fact Sheet 98-41

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INTRODUCTION

With increasing public concern about the use of toxic pesticides to control insects and other pestiferous organisms, resource managers are turning toward other techniques of integrated pest management. Some of these techniques are common-sense approaches, such as completing sanitation or clean-up activities before the season when the damaging stages of an insect pest are present. Other tools are more "hi-tech", such as the use of odors called semiochemicals, and in particular, pheromones, to manipulate the behavior of insect pests. With these non-toxic and biodegradable chemicals, insects can be lured into traps or foiled into wasting energy that they normally need for locating food and mates.

Semiochemicals are chemical signals 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. Many species depend on these chemical signals for survival.

WHAT ARE PHEROMONES?

Pheromones are a class of semiochemicals that insects and other animals release to communicate with other individuals of the same species. The key to all of these behavioral chemicals is that they leave the body of the first organism, pass through the air (or water) and reach the second organism, where they are detected by the receiver.

In insects, these pheromones are detected by the antennae on the head. 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 also been isolated from many higher animals such mammals and reptiles. Human pheromones remain elusive. Scientists have found certain chemical effects associated with the human reproductive cycle, but have not identified any powerful attractants for humans so far. With insects, though, pheromones have 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.

HOW ARE PHEROMONES USED IN INSECT PEST MANAGEMENT?

There are three main uses of pheromones in the integrated pest management of insects. 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 such as the gypsy moth, Medfly, and the Japanese beetle.

With major increases in worldwide trade, exotic pests are being brought into ports of entry in cargo containers and packing materials (ship dunnage). Sometimes containers from ships are transferred uninspected to semi-trailers and trucked far inland. When the containers are opened and packaging materials are removed, the exotic insect pests are able to disperse without the usual level of scrutiny provided at ports of entry. Pheromone traps are currently in use to monitor the movement of such exotic insect pests into most major North American ports of entry.

A second major use of pheromones is to mass trap insects to remove large numbers of insects from the breeding and feeding population. Massive reductions in the population density of pest insects ultimately help to protect resources such as food or fiber 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. Relatives of bark beetles called ambrosia beetles have been mass trapped from log sorting and timber processing areas throughout British Columbia. 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. Another common example of mass trapping involves yellowjackets, which can become bothersome at the end of the summer season. However, mass trapping of yellowjackets in colorful yellow-green traps is carried out with a food attractant, rather than a pheromone bait.

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 odor 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.

SUMMARY

In summary, pheromones are species-specific chemicals that affect insect behavior, 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 in Nevada.

FURTHER READING

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