THE GROWING ROLE OF PHEROMONES: FROM INDICATOR TO CONTROL METHOD

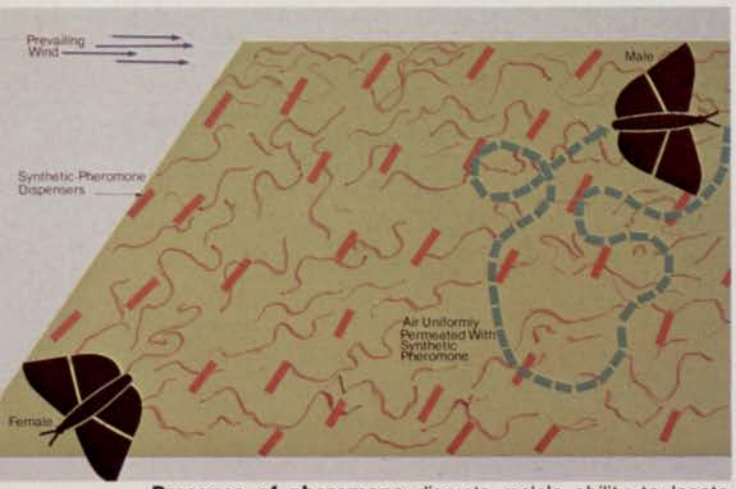
By Ian Weatherston, Technical Director, Albany International, Needham Heights, Massachusetts. Address delivered to the National Arborist Association Annual Meeting in February 1981.

Increased ecological awareness by the public has encouraged the commercial development of alternatives to some chemical toxins as a means of controlling insect pest species. Among the alternatives which show promise are sex pheromones.

The attractiveness of female moths to males of the same species has been known since the 18th century but it was not until 1959 that the word pheromone was coined and defined as, "A chemical message carrier between members of the same species, and beneficial to that species."

Organisms other than insects possess pheromones, but insect pheromones are our primary interest. Subsequently, pheromones were categorized according to their function, leading to "trail pheromones", "aggregation pheromones", "alarm pheromones", "territoriality pheromones" and "sex pheromones". The promise offered by sex pheromones as an alternative to insecticides is that they could be used in insect control without detrimental side effects on nontarget organisms and the ecosystem, and this has been the major driving force behind much pheromone research.

The first sex pheromone was identified in 1959, and today pheromones or attractants are known for more than 350 species of Lepidoptera belonging to 29 families (there are of course many more pheromones known—belonging to the Coleoptera, Hymenoptera and Diptera). The pheromones of the Lepidoptera are generally blends of relatively simple chemicals whose subtlety is a factor in maintaining species integrity. Within this blend components may be identified as causing long range orientation while others are classified as close range pheromones.



Presence of pheromone disrupts male's ability to locate female.

Although improved instrumentation has lessened the difficulty in isolating and identifying pheromones, and although there is frenetic activity in the field testing of pheromones, the commercialization has only recently begun to pick up momentum.

As you well know, there are two steps involved in pest insect population management. There is monitoring or surveying and there is the control or regulation of the numbers to an acceptable economic level. In both steps pheromones can play an important part. The Albany International system is used for control through mating disruption. Normally the female releases her pheromone, and the plume is carried downwind. A male can orient to the plume and find the female. However, when the air is permeated with the synthetic pheromone, the male is unable to find the female. For this strategy to succeed, the synthetic pheromone must be disseminated over a period of time minimally equal to the duration of the adult stage of the target pest. Our system used to obtain this controlled release is based on hollow fiber technology; that is, the pheromone in the fiber diffuses out of the open end at a steady rate. The rate of release is dependent on the internal diameter of the fiber, and of course, on the environmental temperature.

In 1980 we treated 66,500 acres of cotton in the United States and South America by this disruption technique for control of the pink bollworm. The material was aerially applied, with an average of three applications. The rate of application averaged 20 grams per acre of formulation which is equivalent to 1.52 grams of synthetic pheromone per acre. Other insects against which products have been commercially used with success are the western pine shoot borer in the Pacific Northwest and the tomato pinworm in Mexico. Development of application methods is also an integral part of creating diversity for the system; besides aerial application, hand and ground application equipment are available.

For monitoring, the pheromone system is composed of a trap and a lure. Information obtained is (a) presence of specific pests, (b) population density (although this is a very complex question), and (c) the determination of peak emergence on which to base a subsequent treatment. Traps come in a variety of shapes and types. Sticky traps include the delta trap, the ice-cream carton trap, and the wing trap. Advantages of

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these types of traps are that they are commercially available, easily handled, cheap, and disposable. The negative side is the trap's efficiency to catch a moth decreases as the number of moths caught increases.

Another type of trap is the wire cone trap. In this design the males are trapped in the upper portion and are unable to find their way out. The non-overloading trap is one in which the moth is attracted into the top portion of the trap, knocked down, by say vapona, and is collected in the lower portion.

The number of captures rises to a point where trap effectiveness drops.

The lure or pheromone dispenser used with the trap must release the pheromone at the desired rate. Generally when the concentration of the bait is increased, the number of captured insects also rises to an optimum point, beyond which the number of captures decreases. Materials which have been used as bait include rubber septa, polyethylene vial caps, beem capsules, dental wicks, cigarette filters, polymer matrices, and a lure composed of a parallel array of hollow fibers. The rate of release of hollow fiber arrays is dependent on the diameter of the fiber and also on their number.

Three insects of interest are the gypsy moth, the Japanese beetle, and clearwing borer. Although Albany International, at this time, does not manufacture products for the consumer market, we believe that this year several gypsy moth products will be introduced for sale to the home owner. It is highly probable that they will be part of a system which will also contain a killing agent. We do sell, however, a monitoring system for this insect. Pheromones are classified as biorational pesticides and as such, when used for insect control, must be registered by the Environmental Protection Agency. For strictly monitoring purposes registration is not required. However, trap and lure combinations purporting to be a control system require a registration.

A product which is commercially successful is aimed at controlling the Japanese beetle. It is known as Bag-A-Bug. This is not an Albany International product but it does use as the attractive source a combination of the sex pheromone and the floral scent.

The 1980 national insect pest priority list of the National Arborist Association identifies several borers, including dogwood borer, rhododendron borer, ash borer, peach tree borer, and lilac borer, in the top forty pests. The pheromone systems for 52 species of clearwing borers are known. **WTT**