Mating Disruption/SIR

Development and Testing of the Pheromone Microsprayer for Orchard Pest Management

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Insect pest control can be achieved by using sex pheromones to disrupt the intra-specific communication between males and females. Commercial application of synthetic pheromones is made using various technologies, including hand-applied plastic ropes, microencapsulated sprays, and mechanical release devices. These delivery methods vary in the degree of control of release rate and protection of the active compounds.

A team of entomologists and engineers at Michigan State University has designed an automated, electronically controlled Microsprayer. The Microsprayer was engineered to provide reliable, precise, season-long release of insect pheromones without the need for maintenance, refilling, or component replacement. The operational performance of this device was determined both under laboratory conditions and throughout summer 1998 in Michigan apple orchards.

The pheromone Microsprayer was developed based on the following design principles: 1) the pheromone must be protected from oxygen and ultraviolet light; 2) the device must release pheromone at the desired rate throughout a 6-month growing season, without maintenance; 3) the cost averaged over 10 years must be competitive with other mating disruption technologies.

The Microsprayer consists of a pheromone canister, the opening of which is sealed with a Ford fuel injector that acts as a solenoid valve, connected to a reservoir of propellant. An electronic circuit powered by a 9V battery controls the frequency and duration of the solenoid opening the release valve. The circuit is designed to be extremely efficient and to draw minimal current at each firing of the solenoid, thus enabling season-long operation.

Microsprayers were deployed in 2-acre apple orchards at the Trevor Nichols Research Complex, Fennville, Michigan, in May 1998. Each was filled with 550 ml of an ethanolic solution of major pheromone components for disruption of mating by the codling moth *(Cydia pomonella),* obliquebanded leafroller *(Choristoneura rosaceana),* and redbanded leafroller *(Argyrotaenia velutinana)*. The units were placed in apple trees at the top of the canopy foliage and set to release pheromone every 170 s. Eight apple blocks were treated with Microsprayers, 4 of which were treated with a pyrethroid on the border rows each week to investigate the effectiveness at reducing pest immigration. Two untreated blocks were also included for comparison. Male moth capture in pheromone traps and percent fruit injury were used to evaluated these three treatments.

The number of male codling moths captured in pheromone traps was not significantly different in untreated or pheromone treated blocks. However, male captures for the two leafroller species were significantly different with fewer moths captured in the pheromone-treated blocks.

Evaluation of fruit for insect damage at the time of harvest shows that border sprays used in conjunction with the pheromone Microsprayer reduce the amount of injury sustained from

leafrollers compared to blocks treated with pheromone only or the untreated check. Leafroller injury in the pheromone block without border sprays was also lower than the untreated check. Injury sustained from codling moth was not reduced by border sprays or use of the pheromone Microsprayer. This finding is consistent with results showing the failure of the pheromone to inhibit captures in pheromone traps.

Laboratory and field testing of the Microsprayer has shown that this device provides a reliable method for dispensing defined quantities of pheromone under field conditions. Pheromone release rates are predictable and can be set in advance to provide the optimal combination of release frequency and duration. This novel technology provided season-long mating disruption of insect pests without the need for maintenance or refilling. The ability to use multiple component formulations will allow control of more than one species. Used in conjunction with Microsprayers, chemically treated borders help to further reduce the level of fruit injury caused by leafrollers, while providing an alternative to the use of organophosphate insecticides.