Multi-Species Pheromone Disruption in Orchards Under a Selective Pesticide Program

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This multi-site and multi-year research project is examining pest control programs that use only selective and reduced-risk pest control tactics. Among the approaches that are being used in these plots are selective (soft) insecticides, mating disruption, conservation of natural enemies, and cultural practices. This work will help evaluate recently registered selective insecticides to demonstrate their efficacy and, more importantly, their weak points when used in a seasonal program over a range of growing conditions.

Recent regulatory changes threaten to restrict or eliminate certain pesticides that are currently instrumental in New York apple pest management systems, such as organophosphates (e.g., Guthion, Imidan) and carbamates (e.g., Sevin, Lannate, Vydate). Such restrictions could possibly lead to situations that may eliminate or greatly reduce apple production in some regions. Newer pesticides could eventually replace the older products, but little work has been done on these recently registered insecticides to demonstrate their efficacy and, more importantly, their weak points when used in a seasonal program over a range of growing conditions.

New York is a participant in a multistate USDA-RAMP (Risk Avoidance and Mitigation Program) project that is examining pest control programs that use only selective reduced-risk pest control tactics on multiple farms throughout the state over a four-year period, to determine the best use of these tactics and any changes in the biological systems that may result from their use. Among the approaches that are being used in these programs, which are designed for fresh market apple production, are selective (soft) insecticides, mating disruption, conservation of natural enemies, and cultural practices. These tactics are being integrated into specific pest management programs designed to be most appropriate for each major production region within the state. This article reports the results of the mating disruption component of the project during the first season of the study (2002).

The RAMP Project in NY

Research sites were set up in all the major apple growing areas of New York: Western NY (Appleton, Oak Orchard, Lyndonville, Waterport; Sodus, Phelps); Central NY region (Lafayette); Hudson Valley (Milton, Stone Ridge, Gardiner); Capital District (Burnt Hills, Granville); and Champlain Valley (Chazy, Valcour). Each research site was a "split-plot design" in which the entire 10-acre block received a program of soft insecticides, and a five-acre portion of the block was additionally treated with pheromones for mating disruption of the later summer generations of codling moth (CM), oriental fruit moth (OFM), and lesser appleworm (LAW). A comparison block, which had the same varieties and planting style, was also monitored at each site. These blocks all contained at least one fresh fruit variety such as 'Empire' that might be selected for marketing in Europe or some other market outlet that could eventually require IPM protocols for market access.

Private crop consultants played a leading role in the interactions with growers within a region, being responsible for general communication with cooperating growers, and in ensuring that recommended insecticide sprays were applied to the plots. In growing areas where there were insufficient numbers of private crop consultants, the leading role for grower selection and appropriate seasonal interactions was taken by the Cornell researchers or field extension personnel. Materials used in the blocks receiving the soft pesticide program included: Apollo or dormant oil plus Pyramite (as needed in summer) for mites, Avaunt for early season pests (including spotted tentiform leafminer, plum curculio and tarnished plant bug) and apple maggot plus internal Lepidoptera, and Confirm and SpinTor for leafrollers. All sprays were applied by the grower.

From April 16–30, Trécé Pherocon IIB pheromone traps were hung in all the plots at each commercial orchard site as follows: a CM , OFM, and an LAW trap group was placed at head height and arranged around the canopy of each of three trees in a middle row (one at each end, and one in the center) of the Soft Pesticides, Pheromone+Soft Pesticides, and Comparison blocks at each site. Also, additional CM and OFM trap groups were placed in two trees situated halfway between each end tree and the center tree in the Pheromone+Soft Pesticides block, to make a total of five trapping stations for this treatment. All traps were checked and cleaned weekly until mid-August, and lures were changed during the first two weeks of July. From June 21–July 9, polyethylene pheromone tie dispensers were hung in the Pheromone+Soft Pesticides blocks at each site, using two products to disrupt two separate moth species: Isomate C+ at 400 ties/A for codling moth, and Isomate M-100 at 100 ties/A for oriental fruit moth. Ties were hung in the upper

Figure 1. Attaching pheromone tie to hoop applicator.

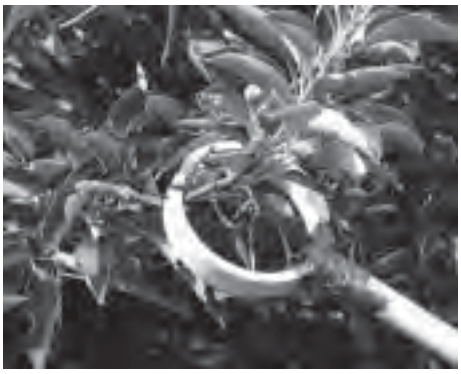

Figure 2. Placing hoop with tie over foliar shoot.

Figure 3. Tie affixed to shoot after twisting pole.

Figure 4. Application of pheromone ties to larger trees using pole+hoop method.

third of the tree canopy by hand for dwarf trees, and using a pole+hoop applicator (Figs. 1-4) for trees taller than 7 ft. Time requirements for deploying the pheromone ties (500 per acre total) were as follows:

Hand-applied: 1.6 hr/A/person (or 0.6 A/hr/person); 306 ties/hr/person

Pole+hoop: 3.9 hr/A/person (or 0.3 A/hr/person); 128 ties/hr/person

From July 22–26, fruit was examined for internal larval feeding damage in each block by inspecting 20 random fruits on each of 30 trees along the edges and near hedgerows where pressure from immigrating moths was expected to be most severe. Shortly before the respective harvest date in each orchard, 20 fruits were picked from each of 35 trees in each plot: 6 trees grouped in the center of the block, 12 trees from the mid-interior region (a few rows in from each of the four edges), and 12 trees from the outside edges + 5 extra along one edge designated as being at high risk for apple maggot injury. All fruits were inspected for damage caused by diseases and insects, including the three internal Lepidoptera species.

Results for 2002

Pheromone trap catches from around the state revealed unanticipated population patterns for the different species. Catches from some representative orchards are shown in Figs. 5 and 6. As seen in the numbers from all four orchards presented here, codling moth levels were fairly moderate throughout the season in all the blocks, with catches rarely exceeding 10 moths per trap per week, and, in many cases, considerably fewer than five per trap. Abundance of the remaining two species, however, was highly variable, and dependent on geographical location. In most western sites (e.g., Fig. 5), lesser appleworm levels tended to be modest, but oriental fruit moth pressure was sometimes severe, with numbers exceeding 100 per trap per week in one instance. In the eastern orchards (e.g., Fig. 6), the opposite trend was seen, with OFM scarcely present, particularly during the latter half of the season, and LAW at reasonably high levels in most of these blocks, particularly toward the end of the season and beyond harvest. In all cases, however, the application of pheromone ties appeared to suppress trap catches of not only the two target species (CM and OFM), but also LAW, at levels at or near zero for the remainder of the season. The suppression of LAW is presumed to have occurred because of the similarity of its pheromone blend (98:2 of Z:E-8 12-OAc) to that of OFM (92:8 of Z:E-8 12-OAc).

Fruit damage at harvest caused by internal Lepidoptera was uniformly low across all blocks and treatments (Table 1), with no statistically significant differences between the soft pesticide blocks, with or without pheromones, and the grower standards. Some distinct differences did occur among the stratified samples taken within respective blocks, so that for instance, localized damage of up to 8–13 percent was noted along a specific orchard edge in two cases. Subsequent analyses will be conducted on these data to establish any correlations between location of damage incidence and the treatment regimens.

The orchards used in this trial were assumed to be relatively clean at the initiation of this multi-year project. If the selective pesticide program tested here does exhibit any shortcomings in the control of CM, OFM, or LAW, we would expect to see evidence of this over time as local populations are given the chance to increase beyond levels that are economically acceptable.

Acknowledgments

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TABLE 1

RAMP plots 2002, summary of internal Lepidoptera fruit damage

	Mean % fruit damage by internal-feeding Lepidoptera	
Treatment	July 22-26	Harvest
Pheromones+Soft Pesticides	0.17 a	0.40 a
Soft Pesticides	0.40 a	0.25 a
Grower Standard	0.16 a	0.33 a

Means followed by the same letter not significantly different (P = 0.05, Fisher's Protected LSD test). Values transformed by arcsine-square root before analysis.

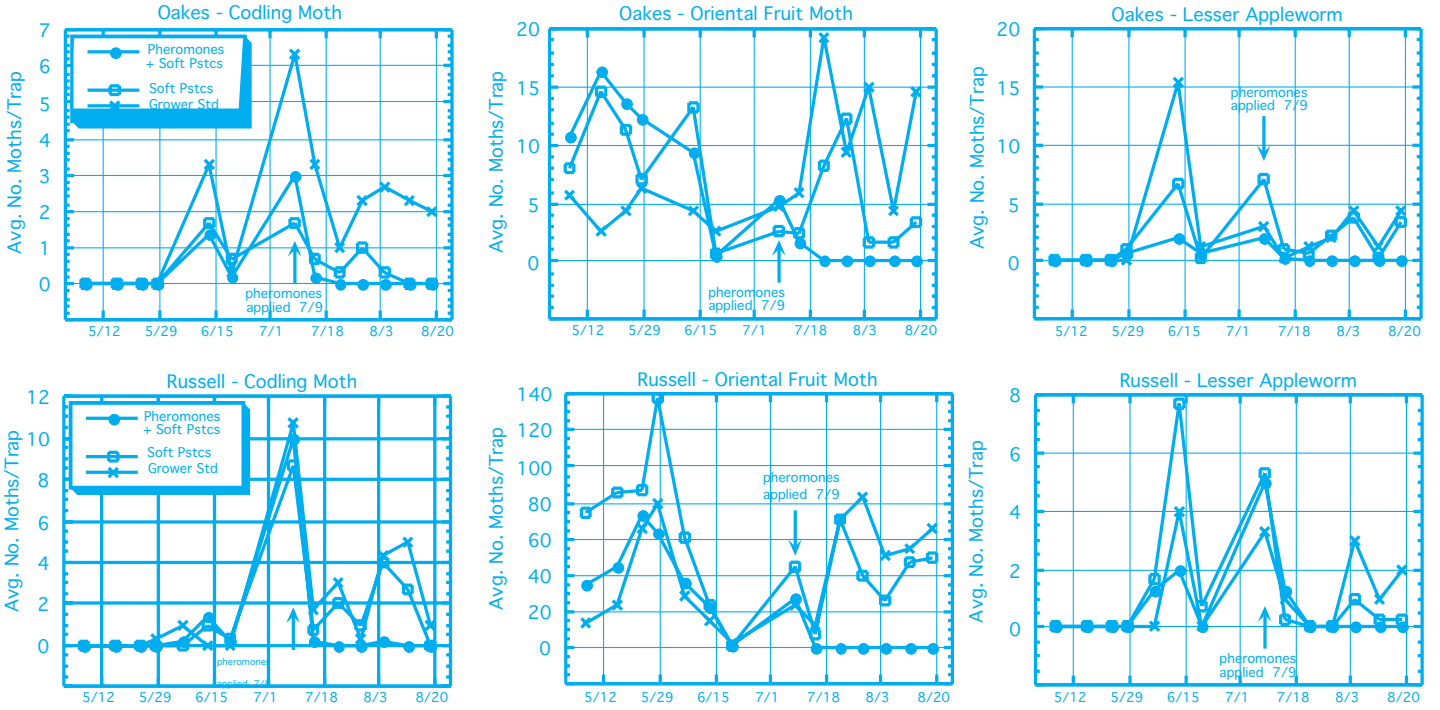

Figure 5. Pheromone trap catches of internal lepidoptera moth pests in Western N.Y. apple orchards receiving a program of pheromones plus soft pesticides, soft pesticides only, or under the grower's standard management program. 2002

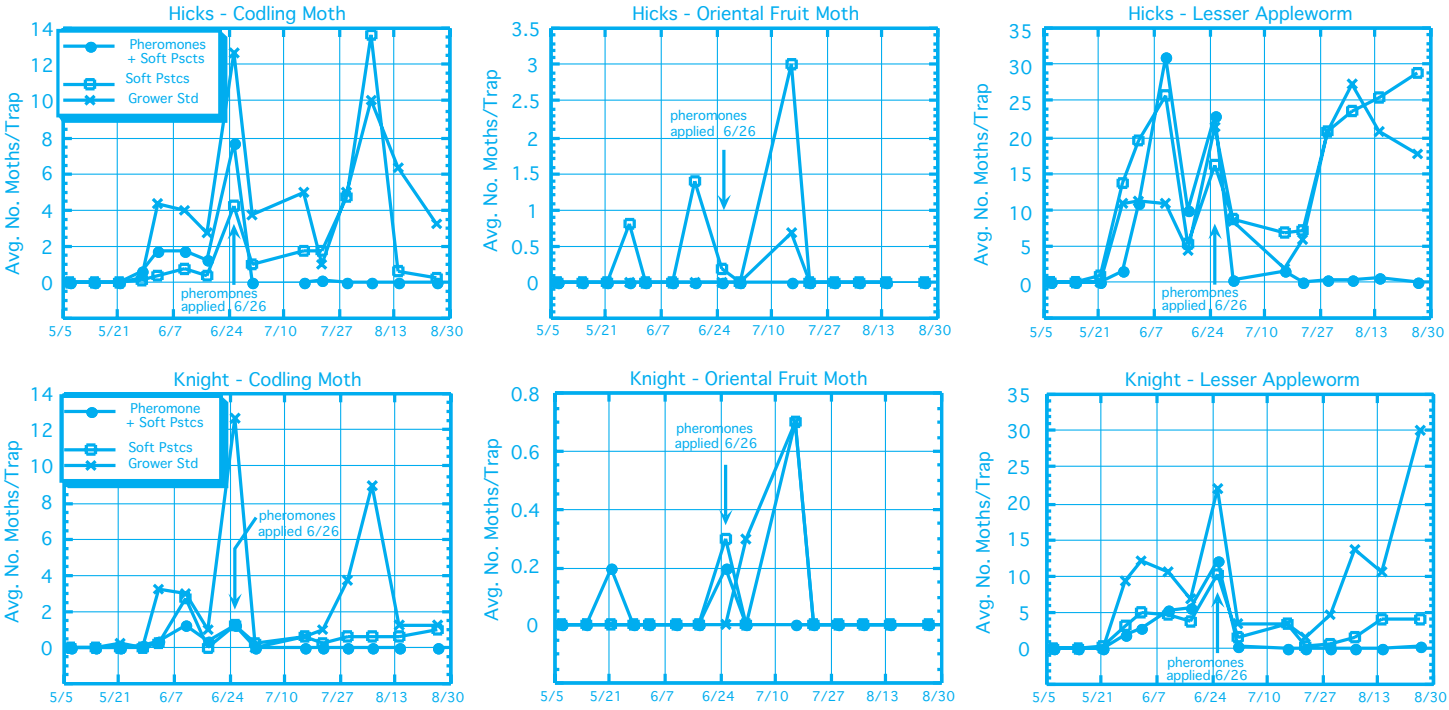

Figure 6. Pheromone trap catches of internal lepidoptera moth pests in Eastern N.Y. apple orchards receiving a program of pheromones plus soft pesticides, soft pesticides only, or under the grower's standard management program. 2002

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