Pheromone Disruption of Oriental Fruit Moth in New York Peaches

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Pheromone disruption appears to have the potential for acceptable control of Oriental Fruit Moth within plots, but border sprays may need to be incorporated to prevent moths immigrating from non-disrupted areas.

During the past several years, peach growers in Western New York have experienced increased difficulties in controlling oriental fruit moth (OFM) [*Grapholita molesta* (Busck)] in their stone fruit plantings, particularly those in the most western regions along Lake Ontario, in Niagara and Orleans counties. After unacceptable fruit damage began to show up during the 1997 season, increased efforts were made in population monitoring and spray application timing. However, these still did not produce adequate results in 1998. By this time, the problems had begun to show up in nearby apple plantings as well. Although this insect previously has been controlled easily by common broad-spectrum insecticides such as organophosphates and carbamates, some initial screening of adult males from this region showed at least a tolerance, if not actual resistance, to these materials in approximately one-third of the specimens tested from two locations.

This pest attacks the growing shoots in its first generation, and feeds primarily within the fruit thereafter (Fig. 1). The larva enters the fruit, usually at the stem end, and proceeds to feed in the area around the pit. External evidence of this infestation may go unnoticed unless the fruit is cut. This concealed aspect of its feeding activity naturally makes chemical control of the insect very difficult unless it can be contacted with a pesticide spray before it enters a fruit or shoot. If pesticide resistance is indeed starting to develop in local populations, as it has already done in nearby growing areas of Ontario's Niagara Peninsula, alternative methods of control will need to be considered. Even if resistance is not developing, the imminent regulatory changes in the use of these compounds stemming from the Food Quality Protection Act will require at least a shift to different chemistries, assuming they will be available and economical.

Figure 1. Fruit damage to peach caused by oriental fruit moth infestation.

In this light, the use of pheromone mating disruption was considered to be a potentially useful tactic that needs to be evaluated under Western New York growing conditions. In contrast to other tortricid fruit pests commonly encountered in eastern orchard crops, the OFM has shown itself to be potentially amenable to acceptable control by using commercial mating pheromone dispensers that are already registered and available. Although peach growers would still need to apply some chemicals to prevent fruit damage from direct fruit pests such as plum curculio and tarnished plant bug, some of the newer pheromone dispensing technologies being developed could be affordable and effective components of a multi-tactic management strategy for this suite of pests in New York systems.

During the 2000 and 2001 seasons, we collaborated with a number of peach growers in Niagara County, who allowed us to evaluate the efficacy of several products that are either currently available or under development for commercial use in the control of OFM in orchard crops.

Methods

All work was conducted in non-replicated plots set up in orchards at five farms located between Appleton and Youngstown, in western Niagara County. Test plots ranged from 2.7–6.0 acres. Peach varieties included Babygold 5, Babygold 7, Red Haven, New Haven, Bellaire, Jay Daylee, Loring, and Crest Haven. At each of the sites, four plots of generally equal size were set up to compare the different products:

1. Isomate M-100 polyethylene rope dispensers, Pacific Biocontrol/CBC America Corp.; applied the second week of June at a rate of 120 (2000) or 150 (2001)/acre (Fig. 2).
2. Confuse-OFM paraffin-base liquid, Gowan Co.; applied at the beginning of the second (mid-June) and third

Figure 2. Application of twist-tie pheromone dispensers in young peach planting.

(end of July) summer flights, at a rate of 30 g a.i./acre (1-3 squirts/tree from a forestry tree-marking paint gun or plastic spray bottle), (Fig. 3).

3. 3M Sprayable Pheromone, OFM MEC (microencapsulated); applied by the growers beginning in mid-June at two-week intervals at a rate of 1.7 oz/acre. In 2001, NuFilm 17 was added at a rate of 1 pint/acre.
4. (2000 season only) 3M Sprayable Pheromone, OFM "Phase III" (microencapsulated, long-life); applied by the growers beginning in mid-June at four-week intervals at a rate of 3.5 oz/acre.

Wing-type pheromone traps baited with commercial lures were hung in the central interior section of each plot to assess the extent to which chemical communication between moths was being disrupted. Traps were also hung in non-disrupted plantings near the test sites at each farm, to serve as a check. All traps were checked two times per week from the beginning of the trials until the end of August.

Fruit damage was evaluated each season just before the respective harvest dates of the different peach varieties, by picking 100 random fruits from each of 4-5 trees per plot and inspecting them first for surface damage caused by OFM or any other insect pest, and then cutting each fruit to check for internal infestation. Similar samples were taken from trees managed using the growers' standard pesticide program, which generally consisted of a combination of Asana and azinphosmethyl sprays. All plots received applications of one of these materials during the petal fall to shuck split period for management of plum curculio.

Results

Pheromone trap catches of OFM adult males in the disrupted plots were impressively low throughout the entire season, essentially remaining at or near zero despite considerable population pressure, as reflected in the Check plots (Fig. 4). Two exceptions follow:

2000 In one case, Topp, some breakthrough in moth catches occurred during the last month before harvest, when small numbers of OFM moths were caught in the Confuse and Isomate plots.

2001 At the Kappus site, there was breakthrough in the Confuse plot traps, which occurred at two times, in each case approximately three weeks after the treatment's application date. Following re-application, moth numbers returned to zero in both instances. This level of breakthrough was not seen any of the other plots. It is assumed that the problem was caused by the fact that the Confuse plot at Kappus was directly adjacent to an apple planting, which likely had its own population of OFM that was being attracted into the traps of the pheromone plot.

In general, the growers did a good job of applying the 3M sprayable formulations at the appropriate schedule timings, which is a particularly important aspect of using these products at their highest level of effectiveness.

Results of the pre-harvest fruit inspection in 2000 showed fruit damage from OFM feeding and infestation to be quite low in all the treatments, surpassing 1 percent in very few of the plots (Table 1). OFM injury was placed into one of two categories, with "stings" representing incidence of skin puncturing or nominal pitting progressing less than a few millimeters into the fruit, and the "internal" injury category reserved for actual tunnelling in the fruit flesh, with either the larva or its trail or frass evident when the fruit was cut. Inspection of the data reveals that few major differences among treatments

Figure 3. Foliar residue of paraffin-base pheromone formulation applied using paint marking guns.

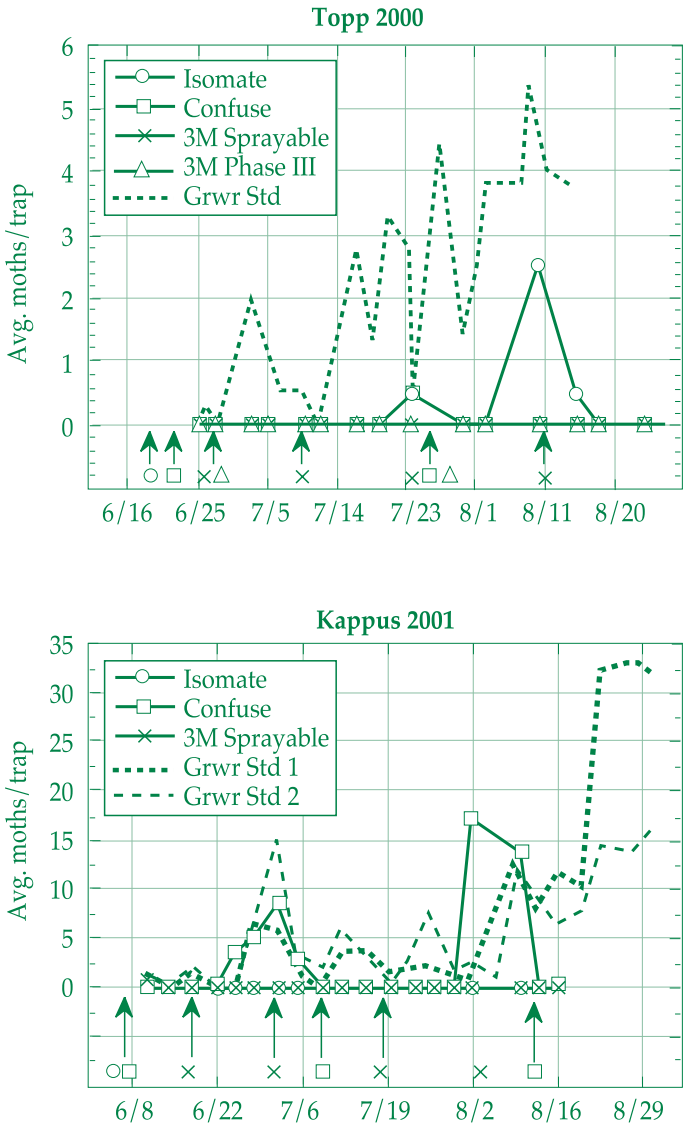

Figure 4. Oriental fruit moth pheromone trap catches in representative plots treated with different pheromone disruption techniques, showing the two instances of moth catch breakthrough.

were seen. The highest incidence of stings was found in the Tower Isomate plot (2.6 percent), and of internal injury in the Kappus Confuse plot (3.6 percent). However, the greatest threat to clean fruit in this region during the 2000 season was tarnished plant bug, which caused feeding damage in as much as 20 percent of the fruit evaluated in our plots. It is apparent that chemical spray programs can go only so far in solving this problem, and that other factors such as orchard floor weed management may likely hold the key to more effectively addressing this perennial stone fruit pest.

In 2001, pre-harvest fruit damage results were similar, but a further complication was noted. The occurrence of "stings" was generally in the range of 1.5-3.5 percent in all plots. Few major differences among treatments were seen in internal larval infestation except for the Kappus site, where it surpassed 10 percent in the Confuse plot. This corresponded with the pheromone trap results, and corroborates the assumption of mated female immigration from the apples, as the injury level was 3.3 percent in the Isomate plot (next in line after the Confuse plot) and only 1 percent in the 3M Sprayable (the plot farthest from the apples). Also, the three plots at this site had different harvest dates because of variety differences, and later dates of harvest corresponded with higher fruit damage levels (3M Sprayable, 6 Aug; Isomate M, 16 Aug; Confuse, 27 Aug). Fruits harvested later in the month would have had a longer period of exposure to potential infestation by any immigrating moths.

TABLE 1

Oriental fruit moth mating disruption trials, fruit damage at harvest, Niagara Co.

Block	Treatment	Application Dates	% Fruit Injury OFM Sting	OFM Int.	TPB	PC
		2000				
Murray	Isomate M-100	6/13	0.0	0.6	13.6	-
Topp	Isomate M-100	6/15	0.0	0.2	11.8	-
Topp	Confuse-OFM	6/19, 7/28	0.0	0.4	17.0	-
Topp	3M MEC Sprayable	6/23, 7/8, 7/28, 8/14	1.0	0.6	12.2	-
Topp	3M MEC Phase III	6/23, 7/28	1.0	0.8	13.2	-
Kappus	Isomate M-100	6/13	0.2	1.2	10.2	0.4
Kappus	Confuse-OFM	6/12, 7/28	0.0	3.6	16.8	0.4
Kappus	3M MEC Sprayable	6/17, 7/3, 7/18, 8/4	1.0	0.4	1.0	-
Kappus	3M MEC Phase III	6/17, 7/18, 8/4	0.0	1.2	15.8	0.6
Kappus	Grower Std Program	Asana: 6/17,7/3,7/18,7/25	1.2	0.2	11.4	2.4
Tower	Isomate M-100*	6/12	2.6	0.2	20.8	-
Tower	Confuse-OFM*	6/12, 7/28	0.2	0.0	11.4	0.4
Tower	3M MEC Sprayable*	7/14, 7/29, 8/10, 8/21	0.2	0.4	10.6	0.2
Tower	Grower Std Program	Asana: 5/11,5/15,7/6,7/29,8/9	5.6	0.0	11.8	-
		2001				
Murray	Isomate M-100	6/8	3.8	0.5	0.3	0.0
Murray	Confuse-OFM	6/8, 8/2	3.5	0.0	0.8	0.0
Murray	3M MEC Sprayable	6/18, 7/3, 7/18	2.3	0.3	0.3	0.0
Topp	Isomate M-100	6/6	2.8	0.3	1.5	0.0
Topp	Confuse-OFM	6/6, 8/2	1.5	1.3	1.0	0.0
Topp	3M MEC Sprayable	6/18, 7/3, 7/18	1.3	0.0	2.3	0.0
Kappus	Isomate M-100	6/6	3.3	3.3	0.0	0.0
Kappus	Confuse-OFM	6/6, 7/9, 8/13	3.0	10.3	0.8	0.0
Kappus	3M MEC Sprayable	6/17, 7/2, 7/18, 8/3	1.8	1.0	0.8	0.0
Niagara	Isomate M-100	6/11	2.5	0.0	2.0	0.0
Niagara	Confuse-OFM	6/11	2.8	0.0	2.3	2.0
Niagara	3M MEC Sprayable	6/18, 6/29, 7/17, 8/2	1.5	0.0	2.3	0.0
Storage	Grower Std Program	Azinphosmethyl: 6/6, 7/20, 8/1	6.3	0.0	1.8	0.0
Transit	(both rec'd all sprays)	Asana: 6/14, 6/21, 6/29, 7/12	0.8	0.0	0.5	0.0

OFM, oriental fruit moth; TPB, tarnished plant bug; PC, plum curculio; Int., internal damage
*Also received Grower Std Prog sprays: Azinphosmethyl: 5/30,6/24,7/14,7/2; Provado: 6/1

Summary

All treatments appear to have the potential for acceptable control within plot interiors, but border sprays may need to be incorporated to forestall infestations by moths immigrating from non-disrupted areas when these products are used in typical commercial production areas in Western New York.

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