Pheromone Disruption of Oriental Fruit Moth in New York Peaches
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During the past several years, peach growers in Western N.Y. 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, and 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. 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. In this light, the use of pheromone mating disruption was considered to be a potentially useful tactic that needs to be evaluated under Western N.Y. 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 make some chemical applications 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 an affordable and effective component of a multi-tactic management strategy for this suite of pests in N.Y. systems.

During the 2000 season, 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:
1 – Isomate M-100 polyethylene rope dispensers (Pacific Biocontrol/CBC America Corp.)
2 – 3M Sprayable Pheromone, OFM MEC (microencapsulated)
3 – 3M Sprayable Pheromone, OFM "Phase III" (microencapsulated, long-life)
4 – Confuse-OFM, paraffin-base liquid (Gowan Co.)
Methods

All work was conducted in nonreplicated plots set up in orchards at four farms located between Appleton and Youngstown, in western Niagara County; test plots ranged from 2.7–4.5 acres in size, except for one site, Murray, where a trial was conducted to compare the efficacy of Isomate ties deployed starting at different times during the season. At this site, to disrupt OFM starting with the first generation, the ties were hung in a 17-acre planting of young processing peaches on 28 April at a rate of 120/acre (1/tree); on that date, the trees were in the late pink bud stage. On 13 June, ties were hung at the same rate in an older 3-acre planting adjacent to the first one, to correspond with the beginning of the second generation flight. At each of the remaining three sites, four plots of generally equal size were set up to compare the four products previously mentioned:

1 – Isomate M-100 ties, applied 13–15 June at a rate of 120/acre
2 – 3M Sprayable Pheromone, applied by the growers beginning 17 June, at 2-week intervals at a rate of 1.7 oz/acre
3 – 3M Phase III Sprayable Pheromone, applied by the growers beginning 17 June, at 4-week intervals at a rate of 3.5 oz/acre
4 – Confuse-OFM paraffin, applied at the beginning of the 2nd (12-19 June) and 3rd (28 July) summer flights, at a rate of 30 g a.i./acre (3 squirts/tree from a forestry tree-marking paint gun).

Wing-type pheromone traps (Pherocon) baited with commercial lures (Trécé) were hung at chest height in the central interior section of each plot, using 6 traps in the large Murray Isomate plot, and 2 traps in each of the other test plots. Traps were also hung in nondisrupted plantings near the test sites at each farm. All traps were checked 2 times per week from the beginning of the trial until 15–24 August.

To check for mid-season pheromone control efficacy, terminal shoots were inspected on 30 June and again on 11 July for evidence of shoot flagging caused by larval tunnelling in the stem. In each plot, 100 random shoots around the outside and inside of the canopy of each of 4 trees were inspected for infestation, and the percent shoots with flagging damage noted.

Fruit damage at harvest was evaluated on 28–29 August by picking 100 random fruits from each of 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. If available, a similar sample was 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 at petal fall or shuck split for plum curculio, and at one farm, Tower, the grower standard program was oversprayed in all of the pheromone plots, despite our intention that these applications be withheld in the test sites.

Results

The shoot-flagging inspection on 30 June turned up few instances of infestation, so we concluded that it might have been too early for this damage to start showing up, and felt it would be advisable to repeat the procedure after more time had passed. This was corroborated by
similar low readings in a nearby unsprayed block of trees. The 11 July inspection resulted in numbers that seemed to be more representative of shoot-flagging injury, although in most cases it was still relatively modest, generally in the 1–2.5% range, and reaching 4% at only one site (Fig. 1). In general, the treatment showing the most uniformly low incidence of this damage across all plots was the Isomate ties directed against generations 2 and 3.

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. 2). In only one case, Topp, did some breakthrough in moth catches occur during the last month before harvest, when small numbers of OFM moths were caught in the Confuse and Isomate plots. 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 showed fruit damage from OFM feeding and infestation to be quite low in all the treatments, surpassing 1% 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. Because all of the fruits sampled in a given treatment plot were pooled into single 500-fruit lots for evaluation, no statistical analyses were conducted on the treatment means, but simple inspection of the data reveals that few major differences among treatments were seen. The highest incidence of stings was found in the Tower Isomate plot (2.6%), and of internal injury in the Kappus Confuse plot (3.6%). Comparable plots treated using the growers' standard spray program were available at the Kappus and Tower sites, so these were also sampled for purposes of comparison. Unfortunately, at the Tower site, fruit in the 3M Phase III sprayable plot was harvested before we were able to evaluate it for damage. Also, at this location, the grower's standard spray program using Asana, Azinphosmethyl, and Provado was oversprayed in all of the pheromone plots due to a miscommunication regarding experimental protocol.

As a first attempt at controlling this pest using pheromone disruption techniques, this trial demonstrated quite promising results, particularly in comparison with similar efforts that have been directed at other lepidopterous species occurring in N.Y. orchards, with variable levels of success. However, it should be noted that, even in plots receiving a typical program of organophosphate and pyrethroid applications, fruit damage from other insect pests was far more serious than that caused by OFM (Table 1). Plum curculio was especially challenging during the 2000 season because of the long oviposition period and poor spraying conditions during late spring, so perhaps this pest would not normally cause the levels of damage that were evident in some locations (e.g., Murray). In contrast, the greatest threat to clean fruit in this region's stone fruit plantings appears by far to be tarnished plant bug, which caused feeding damage in as much as 20% 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.
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Fig. 1. Oriental fruit moth shoot-flagging damage in plots treated with different pheromone disruption techniques, Niagara Co.
Fig. 2. Oriental fruit moth pheromone trap catches in plots treated with different pheromone disruption techniques, Niagara Co.