Status of Problems from Internal Worms in Apples in Eastern Canada and the United State and the Potential Threat for Quebec Growers

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The first reports of problems in controlling internal Lepidoptera feeding in apple orchards in the United States occurred in western fruit growing regions in the late 1980's and early 1990's. Research showed that populations of codling moth infesting apples and pears in commercial orchards in 4 western states were resistant to azinphosmethyl, which had been the most widely used insecticide in this region since the early 1960's. Codling moth resistance to insecticides in western fruit production regions has continued to proliferate, and subsequent studies have shown that this pest is now resistant to multiple classes of insecticides; organophosphates, carbamates, and synthetic pyrethroids. Recent studies have shown that some field populations of codling moth larvae collected from commercial orchards in Washington were also less susceptible to the benzoylhydrazine insecticides, tebufenozide (Confirm) and methoxyfenozide (Intrepid), which have yet to be widely used in commercial orchards in this region.

The OFM has been a major pest of stone and pome fruits in the northeastern United States and eastern Canada for many years. This pest was effectively controlled with organophosphate insecticides until the late 1990's, when studies indicated that populations in peach orchards in Ontario, Canada, had become resistant to organophosphate, carbamate, and pyrethroid insecticides. During the last 30-40 years, internal lepidoptera feeding in apples in NY have been controlled by broad spectrum insecticides (primarily organophosphates) applied against other insect pests feeding directly upon fruit, the plum curculio and apple maggot. These organophosphate-based management programs have been the cornerstone of apple insect management programs because they have provided excellent control of internal fruit feeders and despite their relatively broad-spectrum activity, are now relatively benign to many important natural enemies, particularly mite predators. NY apple growers have experienced difficulty in controlling internal lepidoptera, primarily oriental fruit moth (OFM) since the 2001 growing season. In 2003, most apple growers in western NY who had experienced unacceptable damage in the past began to intensify chemical control programs for control of internal Lepidoptera and consequently, fewer loads were rejected (13), from only about 11 growers. Even though western NY apple growers achieved temporary success in reducing internal lepidoptera damage in 2003, many applied frequent sprays and used materials such as synthetic pyrethroids that are incompatible with IPM programs. Although such intensive control programs may be necessary to achieve acceptable control in orchards with high levels of internal Lepidoptera infestation, more cost-effective, IPM-compatible management programs for this pest complex need to be developed in the future. Studies were begun to investigate the status of the problem of unacceptable lepidoptera infestations and to develop more IPM-compatible management programs in western NY orchards two years ago in 2003.

Initial studies during the 2003 growing season showed that currently available technology for timing insecticide applications against the summer generations of oriental fruit moths, developmental models based on heat unit accumulations and trap catch threshold levels were not

adequate for use in NY apple orchards. Warrior, a synthetic pyrethroid insecticide, which is toxic to beneficials, was the most effective insecticide in protecting fruit, but Avaunt (Indoxacarb) provided similar levels of control. Laboratory bioassays were conducted to compare the susceptibility of field populations of oriental fruit moth in orchards in western NY to a standard organophosphate insecticide, Guthion (Azinphsomethyl) that has been widely used in the past. These studies indicated this pest has developed low levels (about 2-fold) to organophosphates. However, Imidan, another widely used standard organophosphate insecticide, provided adequate control of fruit damage from internal lepidoptera in 9 out of 10 plots in different orchards when it was applied at high rates. Mating disruption alone using sprayable formulations of oriental fruit moth pheromones did not provide adequate control of summer damage in orchards that were subjected to high pressure from this pest. However, an integrated program utilizing sprayable pheromones and two initial applications of Avaunt provided slightly better control. Periodic sampling of fruit throughout the summer in various management programs showed that damage was very low from late July through August. Generally, higher levels of damage were observed in all plots when fruit was evaluated in mid-late October, although fruit infestation levels were generally below 2% at harvest in most of the treatments. The overall results of this study suggest that mating disruption, and standard organophosphate insecticides as well as newer selective insecticides can provide adequate control of internal lepidoptera in problem orchards in western NY

Studies were conducted in 2004 to evaluate multi-tactic management programs integrating mating disruption and improved timing of IPM-compatible insecticides in large-scale plots in grower orchards. Three different OFM control programs were tested in 10 grower orchards in western NY: Seasonal mating disruption, Optimum chemical control, and a Monitoring program based on fruit sampling and pheromone trap catches. All three programs provided excellent control of fruit damage except in one “high risk” orchard. No late season damage was observed in any of the test plots from OFM during the 2004 growing season. OFM development was later than normal in NY apple orchards during the 2004 growing season, and the Pennsylvania DD model did not predict OFM activity accurately. Mating disruption may eliminate a need for special chemical control sprays against OFM except in very “high risk” orchards. Pheromone monitoring traps can be useful in determining the need and timing for control sprays but additional work is needed to test this concept. Monitoring fruit on trees during the season can accurately detect low levels of fruit damage in time to apply appropriate control sprays. However, this technology may not be practical for growers or consultants because it requires about 30 minutes to sample 1000 apples (20/tree sampled from 50 trees) in a single orchard block for internal lepidoptera damage. Perhaps, in the future, this technique can be refined to require less time to monitor fruit during the season, by optimizing timing so that only one session is required and reducing numbers of sampling apples so that only higher unacceptable infestation levels will be detected. Monitoring fruit on trees during the season can accurately detect low levels of damage in time to apply appropriate control sprays, but the technique may be too laborious for consultants or growers to use.