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Northeast Regional IPM Competitive Grants Program (RIPM)

Project Title: Development and Implementation of Novel Trapping Systems for Monitoring Cranberry Fruitworm and Cranberry Weevil Populations

1st Year Progress Report

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States involved: New Jersey, Michigan, and Massachusetts

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Nontechnical summary. This project is investigating the role of plant volatiles as attractants for the cranberry weevil (CBW) and cranberry fruitworm (CBFW), two major pests in blueberries and cranberries in the northeast US. In the laboratory, Y-tube olfactometer assays were conducted to assess the attractiveness of CBW to damaged and undamaged buds and flowers. In the field, traps baited with cinnamyl alcohol, the major volatile component of blueberry flowers, and pepper weevil pheromone were investigated for CBW attraction. Choice tests indicated that female CBW are attracted to blueberry flowers, while males are attracted to undamaged flower buds and are repelled by damaged flower buds. Yellow sticky traps baited with cinnamyl alcohol were not attractive to cranberry weevils, but pepper weevil lure baited traps attracted significantly more weevils than the control. Pepper weevil is a close relative of the cranberry weevil and it is likely that the two species share pheromone components. Future studies will focus on investigating the role of host plant volatiles in developing monitoring traps, and test the pepper weevil pheromone components to understand the reason for its attractiveness to the weevils. Flight tunnel assays are currently underway to determine the attraction of CBFW to blueberry and cranberry volatiles.

Introduction. Highbush blueberries (Vaccinium corymbosum L.) and cranberries (Vaccinium macrocarpon Aiton) are both native to North America, and have been under commercial cultivation for many years. Blueberries and cranberries are two of the most important crops in the northeast US: cranberries are grown in over 39,000 acres, primarily in Wisconsin, Massachusetts, and New Jersey. Two states involved in this proposal, Massachusetts and New Jersey, account for more than 40% of the total US cranberry acreage and for more than 30% of the total US production, valued at $65.3 million. Blueberries in the US are grown on close to 48,000 acres. Most highbush blueberries are grown in Michigan and New Jersey, two of the states in this proposal. Michigan and New Jersey account for approximately 50% of the total US blueberry acreage and for more than 45% of the total utilized production, valued at $139 million.

The two insect pests in this study, cranberry weevil (CBW), Anthonomus musculus Say, and the cranberry fruitworm (CBFW), Acrobasis vaccinii Riley, can cause major economic losses in the northeast US. Both insects feed on the plant’s reproductive organs (flower buds, flowers, and fruit), which makes them major direct pests in blueberries and cranberries in the growing areas where they occur. In New Jersey blueberries, adults of CBW are monitored using beating trays. In cranberries, adults CBW are monitored using sweeping. These monitoring methods for CBW are labor-intensive. No pheromone has been identified for CBW. In blueberries, monitoring techniques for CBFW involve the use of sex-pheromone baited traps for capturing male moths, combined with berry inspections. In cranberries, IPM programs do not rely on monitoring for determining the timing of the initial sprays and instead, recommend two prophylactic sprays based upon crop phenology; these are followed by collection and visual examination of fruit for presence of visible eggs. Berry inspection is labor-intensive. A cost-effective and reliable method for monitoring CBW and CBFW adults is critical to accurately time insecticide applications.

This study’s ultimate goal was to provide cranberry and blueberry growers with new tools for monitoring CBFW and CBW populations. This project investigated a low-cost, easy-to-use, and reliable monitoring technique based on host-plant attractants. This research is desperately needed to eliminate or precisely time insecticide applications. The present project addressed a top research priority stated by the Fruit IPM Working Group, which is to develop
and implement “Effective monitoring strategies for key pests in which technologies currently do not exist” http://northeastipm.org/work_fruipriority.cfm.

There are several environmental, health, and economic benefits that are anticipated from this study. By monitoring and better timing of applications of insecticides to control CBW and CBFW, we expect a reduction in insecticide use in cranberry and blueberry fields. This reduction of insecticide use coupled with an increase in use of selective reduced-risk practices will have a positive impact on the environment. Furthermore, use of traps will reduce the need for scout visits that are costly and labor-intensive, and thus minimize exposure of scouts to pesticide residues.

**Objectives:**

1. Assess the behavioral responses of adult cranberry weevil and cranberry fruitworm to host-plant volatiles;
2. Identify volatiles important in attraction of the cranberry weevil and cranberry fruitworm to host plants;
3. Evaluate potential compounds and techniques to attract and trap adults in the field;
4. Implement traps into reduced-risk IPM programs;
5. Distribute information on monitoring and control of cranberry fruitworm and cranberry weevil populations to growers.

**Approach.** In the laboratory, Y-tube assays were used to examine the attractiveness of CBW to different plant parts.

In the field, two types of traps were compared: soil traps (placed at ground level) and yellow sticky traps (placed at canopy level). In addition, selected chemicals were tested in the field for their effectiveness to attract CBW to traps. Cinnamyl alcohol, the main blueberry flower volatile, was tested in the field in two different types of lures: “Bubbles” (manufactured by AgBio Inc.) and “SPLAT” (manufactured by ISCA Technologies). Cranberry weevil attraction to the pepper weevil (Anthonomus eugenii Cano) lure (Trécé) was also tested. Yellow sticky traps were placed at four commercial highbush blueberry farms in New Jersey, along the field edge near wooded borders. Traps were monitored weekly for cranberry weevils starting in early April 2008.

**Progress.** In Y-tube bioassays, CBW females were not attracted to leaf or flower buds compared to clean air, but they preferred open flowers over flower buds ($\chi^2=7.7, P<0.01$). Male weevils were attracted to intact flower buds ($\chi^2=4.6, P<0.05$), but were repelled by damaged flower buds ($\chi^2=7.9, P<0.01$). Further investigation will be conducted using host-plant chemicals to identify the volatiles responsible for the observed behavioral responses.

In field experiments, yellow sticky traps caught more CBW adults than soil traps (soil traps caught “0” CBW adults). Yellow sticky traps baited with cinnamyl alcohol were not attractive to cranberry weevils, and no differences were found in CBW attraction between the two different types of lures. Pepper weevil pheromone lure baited traps caught significantly more weevils than other treatments both in the first and second generation (PROC GLIMMIX, $P < 0.05$).