Integrated Strategies for Controlling Flower Thrips in Southern Highbush Blueberries1

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Introduction

There are a number of thrips species that damage blueberries in North America. On lowbush blueberry in Maine and Atlantic Canada, *Frankliniella vaccinii* Morgan and *Catinathrips kainos* O'Neill are minor pests causing leaf distortion and discoloration in small isolated patches in fields (Langille and Forsythe 1972). In the past few years, thrips have caused considerable damage to highbush blueberry plantings in New Jersey. Two species in particular, *F. tritici* (Fitch) [eastern flower thrips] and *Scirtothrips ruthveni* Shull were causing extensive damage to leaves and flowers with potential to damage fruit (Polavarapu 2001). Typically, leaf curling and malformation were observed, with damage to styles and surrounding green tissue in the flowers. In the Southeast, *F. tritici, F. bispinosa* (Morgan) [Florida flower thrips] and *F. occidentalis* (Pergrande) [western flower thrips] have been identified as pests of both rabbiteye and southern highbush blueberries (Liburd et al. 2002). These three species are known to have a wide host range and cause extensive damage to many different crop plants. Flower thrips are among the most important insect pests that attack early-season blueberries.

Description

Flower thrips are small insects (approximately 1 to 1.3 mm long) with yellowish-orange coloration. When viewed under a microscope, adults have long thin wings with fine hairs and distinctive antennae. Females are generally larger than males; and have more distinctive characteristics. Adults and nymphs have rasping mouthparts, which are used to extract cell sap from plant tissues

Life Cycle

In general, flower thrips are usually present in 'hot-spots' where the populations are very concentrated. They have a very short life cycle (approximately 18 to 22 days under ideal conditions); and complete multiple generations per year (Lewis 1997). Females lay their eggs within plant tissue, making them very difficult to see with the naked eye. Thrips development progresses through four larval instars, each resembling the adults. The first two instars are very active while the second two are inactive. They hide in the ground or in the flowers and do not feed.

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Damage

Flower thrips may feed on pollen, which may lead to fruit abortion. They also feed on styles, ovaries, petals and fruits during the blueberry production season, reducing the quality and quantity of fruits produced (Figure 1). These types of feeding injuries can initiate major yield losses.

Figure 1. Second instar larva of flower-thrips feeding on a mature blueberry fruit. Credits: H. A. Arevalo, University of Florida

Sampling Methods

Based on previous studies two sampling techniques were selected to monitor thrips population in the field. These techniques were white sticky board traps and flower collection.

White Sticky Board Traps

A sticky board trap was hung within the canopy of each blueberry bush. Approximately, 10 traps were placed on each farm. These traps were collected and randomly rotated every week for five weeks. The number of thrips caught on the sticky board traps were then counted and recorded at the University of Florida's Small Fruit and Vegetable Laboratory.

Flower Collection

Fifty flowers (5 clusters of 10 flowers) were randomly collected from each plant on the same day that the white sticky board trap was collected. The flowers were placed into 70% ethanol. The thrips were extracted from inside the flowers by a repetitive manual shaking and rinsing process.

The results of our studies show that the flower collection method is more accurate in determining thrips population infesting blueberry bushes compared with the use of sticky boards. However, growers are unlikely to use the flower collection method because of the difficulties and the time needed to use this process. For this reason, we developed a correlation measure between these two methods (Figure 2), which allows us to calculate an approximation of the average number of thrips inside the flowers based on the number of thrips captured on white sticky board traps per week (Figure 2).

Thrips Population Dynamics

A grid of trapping stations was placed within and around two blueberry plantings in Gainesville to study the population dynamics of thrips during a typical blueberry season. Traps were placed 30 m apart covering an area of 180 m x 180 m (3.2 ha). Samples were collected every 48 hours from floral initiation until petal fall.

Our results indicate that thrips population is strongly correlated with the percentage of opened flowers in the field (Figure 3). Also, the maximum number of thrips is captured when 90% of the flowers are opened (right before the start of petal fall). The "hotspots" with high populations of thrips develop seven days after the flowers begin to open. Ten days later, thrips populations reach their maximum growth. After ~ 15 days the population of thrips will begin to decrease as a result of petal fall.

Evaluation of Reduced-Risk and Conventional Insecticides for Control of Flower Thrips.

The insecticide trial for control of flower-thrips was conducted in Sebring, FL. Six insecticides were compared with malathion (Malathion 5EC at 1 pint/acre) as the standard (Control) [used by most of the blueberry growers]. The insecticides selected were acetamiprid (Assail 70W at 2.3 oz/acre), novaluron (Diamond 0.83 EC at 20 oz/acre), spinosad (SpinTor 2SC at 6 oz/acre), thiamethoxam

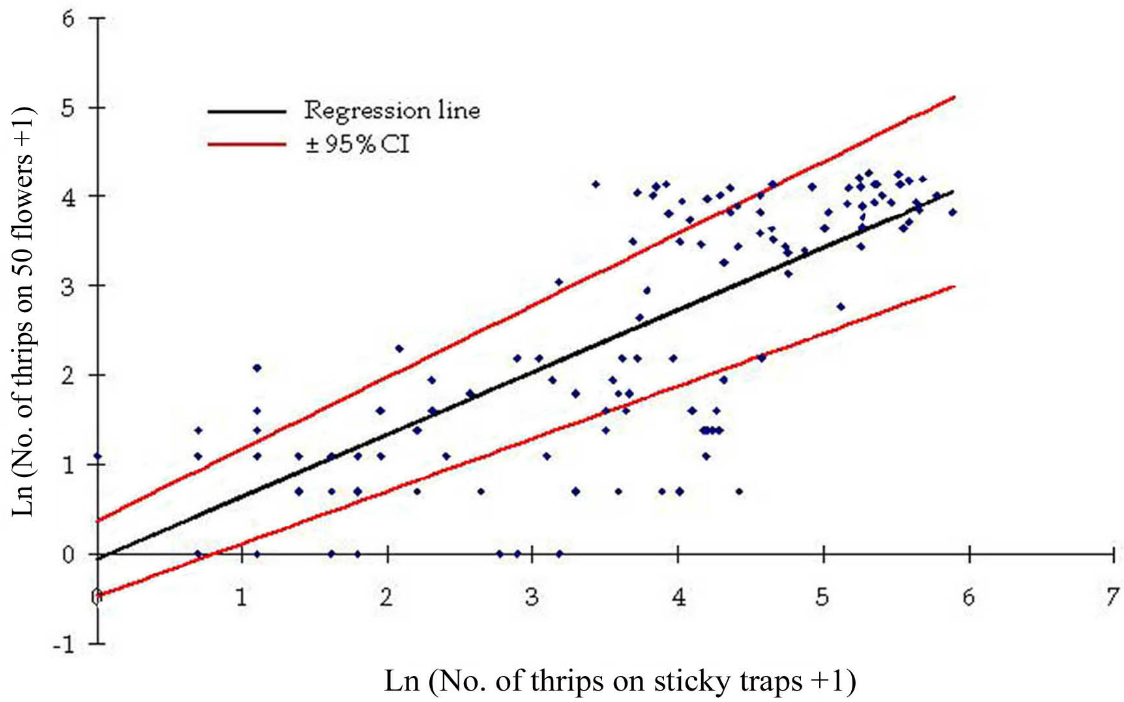

Figure 2. Correlation between the number of thrips captured on sticky traps and inside 50 blueberry flowers.

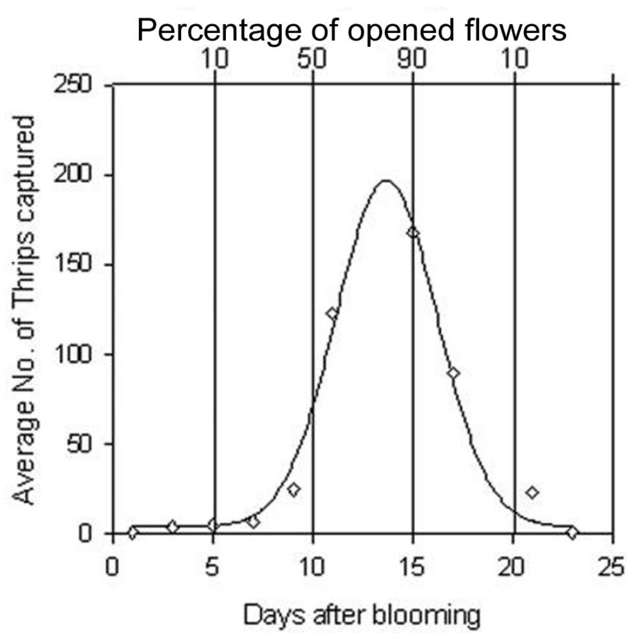

Figure 3. Average number of thrips captured on white sticky boards inside 'hot spots' formed by thrips infestation in the field.

(Actara 25WG at 4.5 oz/acre), acetamiprid (TD 2480 at 5.4 oz/acre).

The treatments were arranged in a completely randomize block design with four replicates. Each plot covered 0.13 acres of blueberry for a total of 0.5 acres per treatment. Two applications of each treatment were applied 14 days apart as recommended (February 10 and 24), using an airblast sprayer. In order to monitor the thrips population two techniques were used: 1) white sticky boards and 2) flower collection. These techniques were described previously under the sampling methods.

White Sticky Boards

Data were separated as, before and after application, and the variation in population size after/before was analyzed using Least Square Difference LSD test (alpha = 0.05). Our results show that acetamiprid (Assail 70W), novaluron (Diamond 0.83 EC), and thiamethoxam (Actara 25WG) significantly slowed down the growth in the population of thrips when compared with Malathion (Figure 4).

Flower Collection

Due to the reduced population of flower-thrips during this season we did not have noteworthy data collected from the flowers, making it impossible to

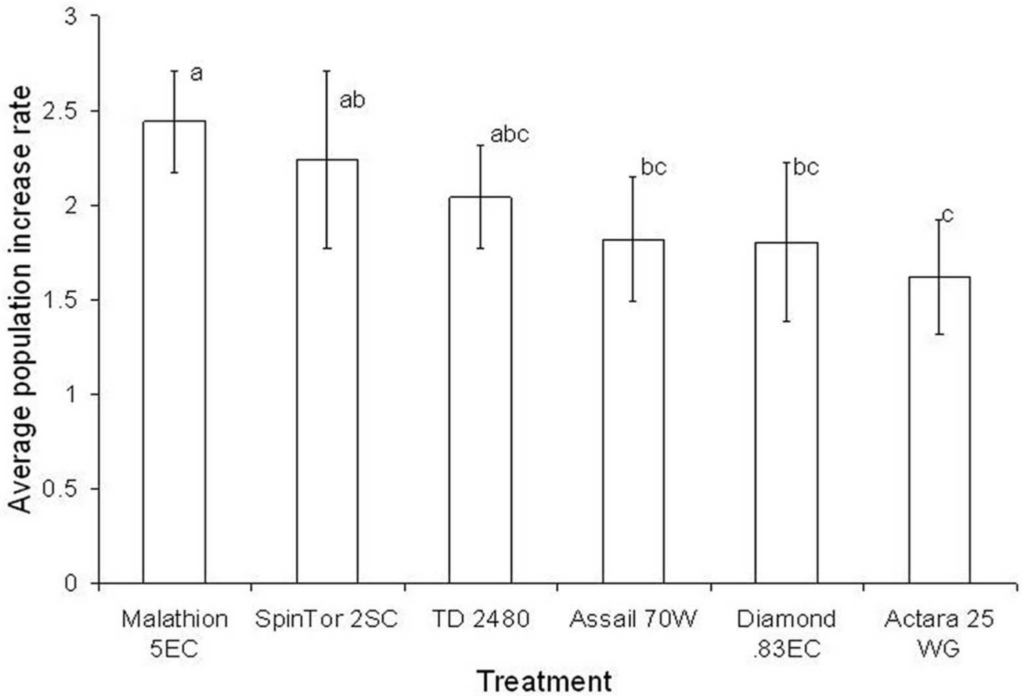

Figure 4. Average variation in population size after/before the application of selected insecticides to control flower thrips in blueberries. Columns with the same letters are not significantly different when compared using LSD test (alpha = 0.05).

analyze the populations of flower-thrips inside the flowers.

Overall, flower-thrips population for the 2005 blueberry season was low compared with the previous years. The 2005 results complement those obtained during previous seasons when acetamiprid (Assail 70W) significantly suppressed thrips population compared with malathion. The other two insecticides that showed significant differences (Diamond 0.83 EC and Actara 25 WG) were tested for the first time during the 2005 season.

Effect of Reduced-Risk and Conventional Insecticides on *Orius insidiosus* (Say)

The insecticides chosen for this study were selected based on their potential to control thrips from previous efficacy tests. We used (Malathion 5EC at 1 pint/acre) as the standard conventional insecticide since this is the insecticide that is most widely used by blueberry growers. The reduced-risk insecticides chosen were acetamiprid (Assail 70W at 2.3 oz/acre), spinosad (SpinTor 2SC at 6 oz/acre), and thiamethoxam (Actara 25WG at 4.5 oz/acre). We also introduced a control by applying water to green beans for direct comparisons. All of the insecticides and the water-treated control were sprayed onto green beans and allowed to air-dry for 2 h. Then 10 *O. insidiosus* adults were released into plastic containers with the treated green beans. The plastic containers were covered with no-thrips mesh to permit gas exchange. The number of dead insects was counted at 1, 2, 12, 13, 15, 20, and 24 h after the insects were released.

The results showed that acetamiprid and thiamethoxam were the most toxic insecticides to *O. insidiosus* followed by malathion. These insecticides had an immediate effect on *O. insidiosus*, significantly reducing the population after two hours. Spinosad was the least toxic to *O. insidiosus*, which only killed an average of 30% of the insects after 24 h of exposure (Figure 5).

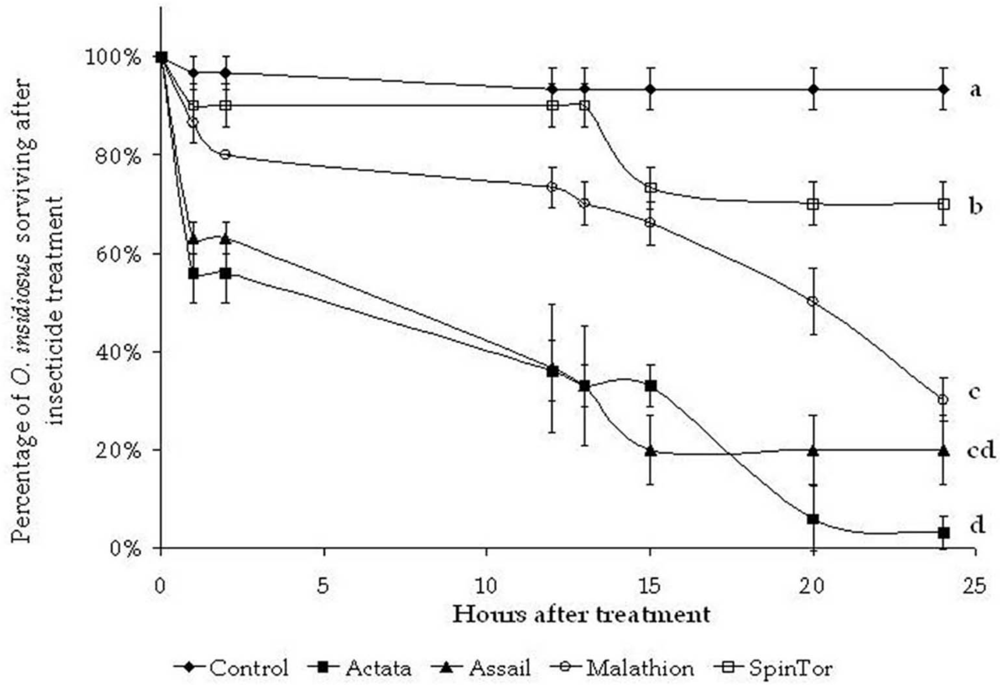

Figure 5. Effect of various insecticides on *Orius insidiosus* a key natural enemy of flower thrips. Treatments followed by different letter are significantly different at 24 h after release using LSD test (alpha = 0.05).

Conclusion

All of the experiments were conducted with the assistance of blueberry growers and producers collaborating with the project. We setup demonstration plots where other growers were able to visit and observe first hand the various monitoring and control techniques being evaluated. Our findings were significant for blueberry growers in the southeastern United States. Once again, our studies show that white sticky board traps provide a valuable, effective and practical method for blueberry growers to monitor thrips population on their farms. More demonstrations of this type will be important for growers located in remote areas of the state. A new finding resulting from our work is that monitoring data collected from floral buds provide more reliable information on thrips population in blueberry fields. Also, information gathered from floral bud collection can be correlated with trap catches from sticky boards allowing a more practical method (sticky boards) for growers to monitor their fields. We also found that peak thrips flight is correlated with 90% of the flowers being opened and that the use of reduced-risk insecticides such as SpinTor will conserve a key natural enemy of thrips, *O. insidiosus*, while moderately suppressing thrips population.

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