SBIR Phase II Final Report

Commercial Implementation of Biointensive IPM in Pepper Production Systems

SBIR Project No.: FLAK-9703371

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November 30, 2000

Summary

Florida's most destructive pepper pests are probably the pepper weevil *(Anthonomus eugenii* Cano) and various species of flower-feeding thrips. The only control treatments are toxic chemicals in the carbamate and pyrethroid groups. The carbamates and pyrethroids are in question because of FQPA, and their ability to exacerbate thrips problems. This means that when carbamates and especially pyrethroids are used on a frequent basis, beneficial insect populations are greatly reduced, which leads to resurgence of plant-feeding, damaging thrips. The overall objective of this project was to develop a proprietary biologically based insect management program for pepper weevils and thrips so that insecticide usage can be minimized. The project had two major foci: 1) evaluating various companion cover crops and weedy field margin habitats for their ability to carry natural enemies of phytophagous thrips; and 2) developing a biointensive management program for the pepper weevil based on an improved monitoring system for the weevil and a better understanding of the weevil's off-season survival.

Concerns about the performance and cost of the standard pepper weevil pheromone-based monitoring system have prompted recent developments in new pheromone formulations with increased longevity and attraction. We tested two new pepper weevil pheromone formulations at commercial pepper farms in the 1998 spring crop in southern Florida. Various trap designs were also evaluated in a preliminary trial. One dual lure system (TRE8420 + 8462) showed superior longevity and sensitivity compared to the standard lure and unbaited control. The new lure system retains activity up to five weeks in the field and provides an economical means for monitoring and controlling pepper weevils.

We used yellow sticky panel traps with Trece's newly formulated pepper weevil pheromone to monitor pepper weevils at different pepper farms across south Florida during the crop season and subsequent fallow. Traps detected weevils at least seven days before pepper fruit infestation was found in the field during routine scouting operations. Weevil trap catch was related not only to pepper fruit infestation but also, and in one site exclusively, to black nightshade growing on field borders and ditch banks. Black nightshade can act as an alternative host to pepper weevil. During the crop season, trap catch increased with increasing distance from the nearest weevil source. Traps attracted weevils from farther away in the absence of pepper than when pepper was present. Trap catch peaked during crop destruction activities. During the fallow, trap catch dropped but still exceeded that of the prior crop season. Trap catch was determined by the trap's relative attractiveness compared to nearby pepper and nightshade and correlated with disturbance events in the crop environment (i.e., field tillage and leveling, plastic laying, etc). Our study demonstrates that the new pepper weevil lure formulation has good field longevity and will therefore be more economical in monitoring pepper weevils than the previously marketed weevil lure. We now need to develop more efficient trap designs and determine the best placement strategies for the traps for cost efficacy and to avoid losses from pepper weevils. We also need to establish treatment thresholds based on the relationship of trap captures with weevil populations and fruit damage.

We examined the use of a biointensive control (PROKIL Cryolite 96) to assess its efficacy in controlling pepper weevil infestation on bell peppers. Treatments consisted of one-acre plots where half of a plot was treated and the other half left as a control. The use of PROKIL gave 2.5-4 times better control of pepper weevil than using no chemical control. However, its use still resulted in 9-30% fruit infestation. This level of control is often what is obtained by using much more toxic chemicals such as Vydate, which greatly reduce or eliminate beneficial insects. In this

study we also found a greater abundance of coccinelids (ladybeetles) at one site (Shiloh) than at other sites, which was directly related to the use of a biointensive pesticide program on that farm.

Berries from black nightshade were collected from various habitats across south Florida from March–September 1999, to determine the importance of this host plant in the weevil's lifecycle. Nightshade plants were found at pepper farms in disturbed habitats along field borders and cypress hammocks, and to a lesser extent, within sugarcane windbreaks. Infested berries were found during the spring crop, the summer fallow season, and into the subsequent fall crop. In one intensively sampled site in Palm Beach County, infestation averaged 2.21% during June and July but dropped to 0.42% in August, as plant vigor and abundance declined. Nightshade was also prevalent in tomato farms during the spring crop, and weevil infested berries were collected from these sites as well. More parasitic wasps were recovered from weevil infested nightshade fruit than from weevil infested pepper fruit. However, very low (<2.5%) or no parasitoids were recovered from nightshade or pepper fruit, respectively.

Flower-infesting thrips are a major concern in Florida pepper production due to fruit damage and virus disease dissemination. Natural enemies, such as *Orius insidiosus* (Say), can keep thrips populations below the economic threshold. Attracting and augmenting beneficial insect populations in and around pepper fields may maintain yields and reduce pesticide costs. We evaluated the potential of selected cover crops and weedy hosts to serve as refugia for beneficial insects. *Bidens alba* (Beggar ticks) supported a low-to-moderate, stable population of the thrips predator *Orius insidiosus* and a plethora of other beneficials as it bloomed year-round. Sunflower planted as a windbreak attracted high numbers of *Orius*, but only a single planting was evaluated. *Wedelia trilobata*, blooming from March to December, proved important in carrying *Orius* during the summer months and into the fall season. White Dutch Clover planted in drive middles and White Sweet Clover on field margins supported moderate-to-high *Orius* populations, but only toward the end of the spring season, and therefore cannot contribute to early-season thrips control. It should be noted that all of these companion plantings also supported populations of thrips, (mostly *Frankliniella bispinosa)* that are not considered important pests in pepper. These thrips are necessary to support *Orius* populations.

Glades Crop Care, Inc. has taken the results of this study and applied them to their consulting and scouting program. Based on these results and our years of experience in vegetable consulting we are strongly advocating to our growers the benefits of using the more efficacious pheromone traps to detect pepper weevil populations before they move into the field. Our research has shown that *Orius* can reduce damaging thrips populations that had previously been controlled poorly with several highly toxic pesticide applications, which destroyed most of the natural enemies in these systems. This has resulted in most of our scouted acres having fewer thrips problems and less use of highly toxic insecticides for their control. The other major pest of peppers, the pepper weevil, is now managed with a combination of insecticides that integrate the use of the much less toxic and predator-friendly PROKIL insecticide. These newly developed tactics have also been incorporated into Glades Crop Care's proprietary THRIPS software package.

We see several additional opportunities resulting from our study that will continue to augment the biointensive pest management system we have developed. One such opportunity is to examine how the weevil traps, nightshade, and biointensive insecticide programs can be integrated across a large pepper production area. More work also is needed in elucidating the movement of *Orius* in the field to understand its temporal and spatial dynamics in controlling thrips and other pests. Understanding the answers to these questions will move us that much closer to a complete, commercially viable, biointensive pest management program.