Final Project Report to the NYS IPM Program, Agricultural IPM 2003-2004

TITLE: IMPLEMENTATION OF AN INSECTICIDE RESISTANCE MANAGEMENT STRATEGY FOR ONION THRIPS ON ONIONS

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TYPE OF GRANT: Monitoring

PROJECT LOCATIONS: Research was conducted in most of the major onion growing regions in NY. The survey information is applicable only to NY onion growers, but the technique is applicable worldwide.

ABSTRACT:

Funds from the NYS IPM program were used to supplement funds from the NYS Onion Research and Development Program for a pest management program for thrips on onions. The primary goals of the overall project were to monitor thrips susceptibility to Warrior, Lannate and Penncap-M in commercial onion fields in upstate NY using TIBS (Thrips Insecticide Bioassay System) and work with extension educators and one private sector company to educate their personnel to use TIBS.

TIBS has proven to be an essential tool to monitor for resistance to Warrior, the most widely used insecticide against thrips (Shelton et al. 2003). Using TIBS, growers can have knowledge about the susceptibility of their thrips populations to Warrior prior to treatment, and thus only use this insecticide when appropriate. However, we needed to develop similar information about the other two major insecticide classes used against thrips in onions-organophosphates and carbamates. We used methyl parathion and methomyl as representatives of each respective class in eight commercial fields. Using the TIBS assay at the field concentration of each insecticide (3200 ppm for methomyl and 2000 ppm for methyl parathion), we had >90% mortality for both insecticides in seven of the eight populations examined (in the last field, mortality using methomyl was 73%). Based on our previous work with TIBS using Warrior, we can infer that field control would still be acceptable with both insecticides.

However, our data also indicate potential problems in the future. At 100 ppm of methomyl, half of the 8 populations tested had < 50% mortality while the other half had mortality > 85%. At 100 ppm of methyl parathion, one-quarter of the populations had < 60% mortality while half the population had >90% mortality. These larger differences between populations indicate the potential for resistance to develop if an insecticide resistance management program is not utilized.

We believe that the information on susceptibility to each of these classes of insecticides in individual fields can be provided in a timely fashion, and thereby allow growers to make more informed decisions on thrips management. From our outreach efforts (goal #2), we realize that TIBS is probably not going to be done by extension educators because they do not have the time or capacity to conduct these assays themselves. A good functioning private consultant group could implement TIBS but a different model is needed since they too may not have the capacity to do the actual tests. However, TIBS has proven to be an essential tool for thrips management so an alternative implementation strategy is needed. One model we are exploring is to have the private sector charge growers for the service and then bring infested onion plants to our lab so that we can run TIBS. The private sector would charge the grower for the service and then provide some payment to us for running the tests.

BACKGROUND AND JUSTIFICATION:

The onion thrips , *Thrips tabaci* Lindeman, is a pest of onions and related *Allium* species, as well as dozens of other plant families (Lewis 1997) , and was listed by NY growers in a 2002 survey as being their highest priority for research. Reports indicate that thrips can significantly reduce onion yield and bulb size when they are not controlled. The severity of thrips infestations is usually highest in hot, dry years because more generations are produced in the hot weather and populations do not suffer high rates of mortality due to the lack of rainfall. The major control strategy for onion thrips is the frequent use of insecticides and growers may apply treatments weekly, especially in hot, dry years. There is concern that such intensive treatments may result in the development of resistance.

In 2001 and 2002 (Shelton et al. 2003) we evaluated the susceptibility of onion thrips to λ-cyhalothrin (Warrior) in several commercial fields of onions using the Thrips Insecticide Bioassay System (TIBS) developed by Rueda and Shelton (2003). This system allows thrips to be collected directly from onion plants into a 0.5 mL microcentrifuge tube previously treated with an insecticide. Thrips mortality is assessed at 24h with the help of a dissecting stereoscope.

During the 2001 growing season, onion thrips populations were collected from 16 different sites encompassing the major growing areas of New York. Of the 16 populations examined in 2001, seven had LC_{50} values greater than the field concentration of 100 ppm, indicating a potential for poor field performance. There was considerable variation within each region; some fields had populations of thrips with LC_{50} values much higher or lower than 100 ppm. This suggests that individual grower practices probably dictate the development of resistance and that thrips populations are somewhat localized. The grower records we were able to obtain seemed to confirm this hypothesis.

In 2002, populations were collected from 10 different sites in the middle of the season and again late in the season; two collections were made to determine whether there were changes in susceptibility to lambda-cyhalothrin over time. For the first collection (mid-season) there was considerable variation in the percent control with half the populations having ≥ 50% mortality at 100 ppm. For the late-season collection, there was again considerable variation in the percent

control with half the populations having > 50% mortality at 100 ppm. However, only one population that had >50% mortality at 100 ppm in the early part of the season had >50% mortality in the later part of the season. We suspect that insecticide use during the season caused these changes. These results suggest that resistance to lambda-cyhalothrin may be unstable and amenable to resistance management strategies (we are also investigating other ecological factors such as immigration of onion thrips from other crops).

OBJECTIVES:

1. Monitor thrips susceptibility to Lannate and Penncap-M in commercial fields in upstate NY using TIBS and evaluate its usefulness in predicting control.
2. Work with one private sector company and extension educators in 2002 to educate their personnel to use TIBS.

PROCEDURES:

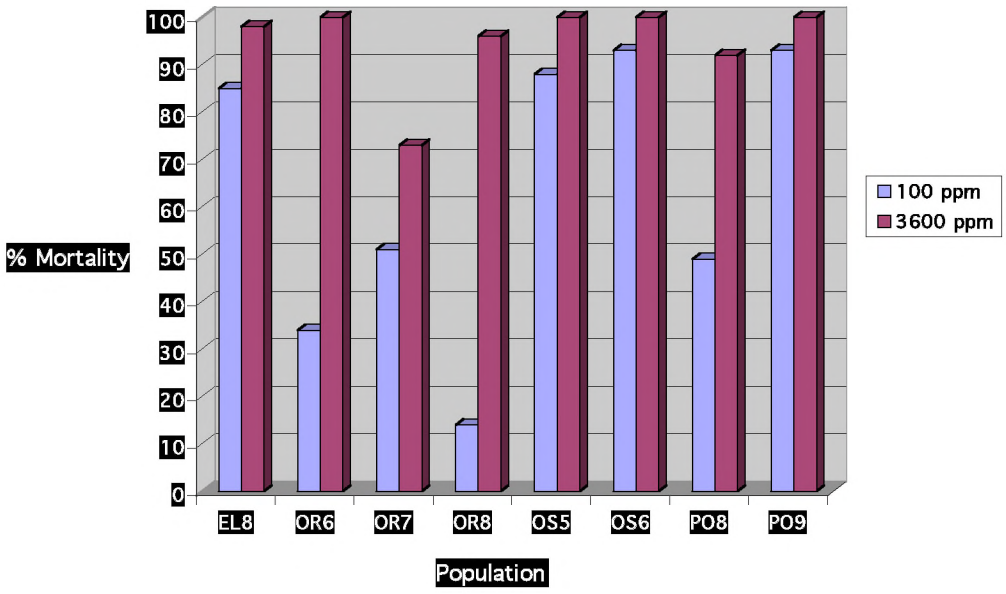
1. Using a discriminating dose (i.e., the field rate) of each insecticide, we will monitor the susceptibility of thrips in 8 fields in western NY twice during the season. Fields will be chosen based on recommendations of the Extension Educators and Agricultural Consulting Services (ACS). The results of each sample will be reported to the grower, agent and ACS.
2. We will work with ACS to show them how to construct the TIBS, collect thrips for the assay and read and interpret the assay. In the review process of the grant, it was suggested that we also include the county agents in the demonstration of the project, and this was done.

RESULTS AND DISCUSSION

In 2003 we examined thrips populations, at mid-season and late-season, in 8 commercial fields for their susceptibility to methomyl (Lannate) and methyl parathion (Penncap M), the other two insecticides of choice besides Warrior. In **Figure 1** we show only the example from Lannate during the late-season, but the results are similar for methyl parathion. Using the TIBS assay at the field concentration of each insecticide (3200 ppm for methomyl and 2000 ppm for methyl parathion), we had >90% mortality for both insecticides in seven of the eight populations examined (in the last field, mortality using methomyl was 73%). Based on our previous work with TIBS using lambda-cyhalothrin, we can infer that field control would still be acceptable with both materials. Therefore, we believe that the information on susceptibility to each of these classes of insecticides in individual fields can be provided in a timely fashion, and thereby allow growers to make more informed decisions on thrips management.

It should also be mentioned that in 2003 when we examined populations of onion thrips against the field rates of methomyl and methyl parathion, we also tested each population at 100 ppm. This was done to provide an indication whether there were more subtle differences in genotypes of the populations. At 100 ppm of methomyl, half of the 8 populations tested had < 50% mortality while the other half had mortality > 85% **(Figure 1)**. At 100 ppm of methyl parathion, one-quarter of the populations had < 60% mortality while half the population had >90% mortality. These larger differences between populations indicate the potential for resistance to develop if an insecticide resistance management program is not utilized.

Figure 1. Percent mortality of onion thrips larvae to methomyl (Lannate) in New York,



During the season we worked with ACS and the extension educators in the regions where thrips were collected. Our procedure was to ask the extension educators to help locate the growers we could work with, visit the fields when we were collecting samples, and help us provide the information to the growers. This worked well. Since ACS does not presently have many onion customers, our focus was to help educate them about TIBS and the potential service it could provide growers. ACS also visited our lab for a training session on TIBS.

TIBS has proven to be a very effective tool for onion thrips management and, as one grower (L. Sachelli) said, it has saved him thousands of dollars and made his thrips control much better. However, from our outreach efforts in 2003 we realize that TIBS is probably not going to be done by extension educators because they do not have the time or capacity to conduct these assays themselves. A good functioning private consultant group could implement TIBS but a different model is needed since they too may not have the capacity to do the actual tests. However, TIBS has proven to be an essential tool for thrips management so an alternative strategy is needed. One model we are exploring is to have the private sector charge growers for the service and then bring infested onion plants to our lab so that we can run TIBS. The private sector would charge the grower for the service and then provide some payment to us for running the tests.

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