Northern NY Agricultural Development Program
2004 Project Report

Development of Alfalfa Snout Beetle Larval Mass Rearing Techniques

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Background:
Alfalfa snout beetle (ASB), *Otiorhychus ligustica*, is the most destructive insect pest of alfalfa in Northern New York (NNY). Alfalfa snout beetle was introduced from Europe (most likely England) at the Port of Oswego between 1850 and its discovery in 1896. When alfalfa was introduced into the region in the late 1920's, ASB was discovered to be a serious agricultural pest. New infestations are often mistaken for winter injury since the majority of plants die after the last harvest and before spring growth.

Recently, a new infestation was identified in the Malone area (Franklin County) and this insect continues to spread throughout New York's productive alfalfa region. This pest causes severe yield and stand losses on alfalfa by larval feeding on alfalfa roots. There are recorded ASB infestations in nine NNY counties and in Canada, across the St. Lawrence River. These are the only recorded North American infestations of this insect. To date, there are no effective methods of controlling this destructive insect pest.

The ability to produce large numbers of alfalfa snout beetle larvae at the identical life stage is critical to research on snout beetle. Laboratory trials to test the effectiveness of potential fungal pathogens or nematode strains against the larvae require quantities of larvae of very similar age. Since ASB has a 2-year life cycle with a mandatory hibernation period of 1 year, laboratory rearing of this insect is difficult. The

development of storage techniques for the adults collected shortly after spring emergence in the mid-90's has lengthened our research window from 1 month to 6-8 months. Mass egg production techniques developed in 2002 opened the door to larval production on alfalfa plants in the greenhouse. Though still very labor intensive, larvae can be produced in the greenhouse on alfalfa plants. Larval development can be predicted within a broad window based on the number of days following the inoculation established alfalfa plants with eggs.

Methods:

Alfalfa plants were established in medium sized plastic waste containers filled with greenhouse potting mix and with holes drilled in the bottom for drainage. Drainage holes were covered with window screen to prevent the escape of small snout beetle larvae from the containers. Alfalfa plants were allowed to grow for 6 weeks in the greenhouse prior to being infested with snout beetle eggs. Each container was infested with 500 eggs in a single dose. Since ASB eggs have only a 55-60% hatch rate, this inoculation resulted in approximately 250 larvae per container.

Inoculated containers were held at a constant 75 °F in a large environmental room with high intensity lighting. This temperature regime was chosen because it simulates the soil temperatures in the field during the summer time and past experience with this insect indicated that 80°F is the maximum temperature this insect tolerates without suffering mortality. After the larvae had developed for 22d, 28d, 35d, 40d, 49d, 54d, 60d or 68d respectively, larvae were separated from the soil from selected containers and the development stage of the larvae was determined. Larval development was correlated to degree-day accumulation using 50°F as a base temperature.

Results:

The results from the study indicate that alfalfa containers inoculated with ASB eggs and held at 75°F would produce a nearly pure culture of 2nd instar larvae in 23 days or approximately 600 DD using a base 50. A predominately 3rd instar culture could be achieved by holding the alfalfa containers for 38-39 days after egg inoculation or 1000 DD. If 4th instar larvae are needed for testing, the containers need to be retained for 54 days or 1400 DD and 1750 DD or 68 days are required for the larvae to mature into the 5th instar larval stage.

Increasing the temperature of the soil does not significantly increase the development speed of the ASB larvae, but the elevated temperature increases larval mortality. The use of artificial media to raise larvae was investigated and was found to be significantly more labor intensive, expensive and yielded fewer larvae of a single age group that the use of potted alfalfa plants.

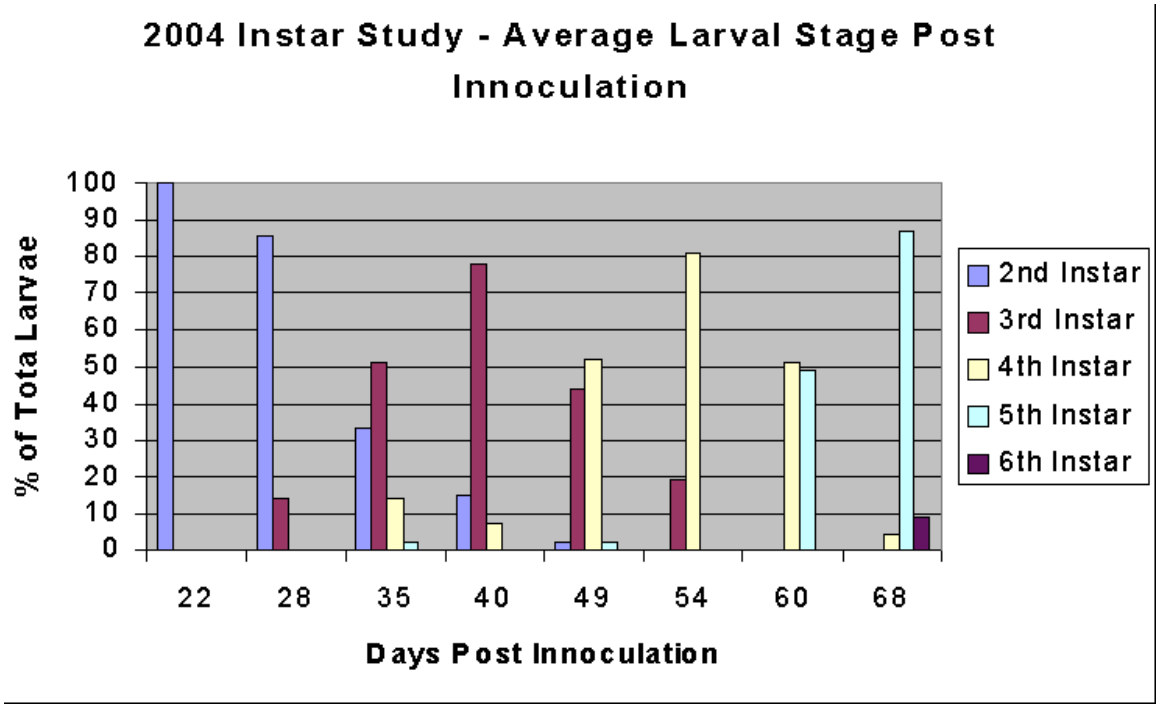

Figure 1. Required days for larval development on established alfalfa plants in containers from egg inoculation. Temperature was maintained at 75° F.

Table 1. Number of degree days (DD) required for development for alfalfa snout beetle larval instars 2-5 using a base temperature of 50° F.

Larval instar	Degree days (base 50)
2nd	600
3rd	1000
4th	1400
5th	1750

Conclusions/Impacts:

The results from this study have already been utilized in ongoing ASB research conducted in my laboratory. This method of larval production was utilized to produce larvae to evaluate the effectiveness of the entomopathogenic nematode species utilized in the current nematode/biological control field study. Should other ASB researchers progress to the point where they are ready to evaluate the effectiveness of fungal pathogens on ASB larvae, this method along with the methodology to produce ASB eggs in large numbers is available to them.

Next steps:

This segment of the research on Alfalfa Snout Beetle is completed. The mass rearing method developed in this study will allow researchers to rear relative large numbers of ASB larvae of similar age for screening trials using entomopathogens, entomopathogenic nematodes and perhaps as a supplemental tool to evaluate the level of resistance in resistant alfalfa plants to mature ASB larvae. Generally speaking, mature insect larvae are able to detoxify levels of toxin fatal to the smaller larvae.

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Northern New York Agricultural Development Program:

The Northern New York Agricultural Development Program provided funding for this integrated pest management – alfalfa snout beetle research project. The Northern New York Agricultural Development Program is a farmer-driven research and education program specific to New York state's six northernmost counties: Jefferson, Lewis, St. Lawrence, Franklin, Clinton and Essex.

Thirty-three farmers serve on the Program board led by Co-Chairs Jon Greenwood of Canton (315-386-3231) and Joe Giroux of Plattsburgh (518) 563-7523. For more information, contact Jon, Joe or R. David Smith at 607-255-7286 or visit www.nnyagdev.org # # #