Leek Moths: An Emerging Problem for *Allium* Crops in New York

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The leek moth (*Acrolepiopsis assectella* Zeller) is a small, white spotted, pale brown or black moth with an affinity for plants in the *Allium* family including, but not limited to, onions, leeks, and garlic. Leek moth (LM) is a native insect of Europe, where it has been known as an endemic pest of *Allium* crops for hundreds of years. In 1993, the first North America LM detection occurred in Ottawa, Canada and LM has since expanded its range westward along the St. Lawrence Seaway. In 2009, LM was found in Plattsburg, NY and represented the first detection within the continental United States. At present, LM has been found in St. Lawrence County, Essex County, and possibly Jefferson County. It has also been found in Vermont. If LM becomes established in major onion production areas of NY, the economic damage could be significant to this $54 million industry

LM moth is a member of the insect order Lepidoptera, family Acrolepiidae. It feeds exclusively on *Allium* spp. and causes a wide range of damage depending on life stage and plant morphology. In onions, larvae burrow through the leaf and feed on interior plant tissue creating a window-pane effect. In leeks, larvae cause leaf mining or external feeding damage. LM completes its entire life cycle on or in plants such as onions or leeks and the feeding behavior of LM limits control options.

The LM overwinters as a pupa on in protected areas such as leaf litter, dead plant matter, or even the soil. In the spring, adults will emerge when temperatures reach 50°F and usually live about 23 days. Within 24 hours of emergence, mating occurs and females will lay eggs on the surface of *Allium* plants 2-6 days later, continuing until their death. Upon hatching larvae immediately start feeding by burrowing directly into plant tissue where the remaining larval stages are completed. Mature larvae crawl out of the plant and spin a distinctive silk cocoon inside of which they pupate. After a period of 11 - 23 days, a mature adult will emerge. Depending on localized conditions, from 1 to 3 generations will occur in a single season.

LM is found throughout Europe, where it has been an endemic pest of *Allium* crops for centuries. Biological control has been widely implemented as part of an overall strategy there. A parasitoid wasp, *Diadromus pulchellus*, has been very successful at suppressing populations in Europe and it has been released on a limited basis in Ontario, Canada to determine if it will be successful. There is also the possibility that natural enemies native to North America will provide some control. In 2010, we collected some *Conura albifrons*, a generalist parasitoid, from LM pupae collected from Northern NY. Hover fly larvae may also have some predatory role based on anecdotal observations made during LM collections from onion plantings. Biological control through the use of parasitoids, predators and pathogens could be a useful tool in the long-term management of LM and we are searching for funding to allow us to investigate these areas.

Insecticidal control of LM, whether conventional or organic, should be considered as part of an overall management system for LM. In 2010 we petitioned NY DEC and were granted the first insecticide registrations for LM in the US: Warrior II, Radiant, Lannate, Entrust and DiPel. However, because of LM behavior, insecticide control will be challenging. Since LM are leaf mining insects from the moment they hatch, how products are applied may be just as important as what insecticide (chemical or biological) is applied. We have conducted a series of tests in the laboratory with these and other insecticides and our results can be summarized as follows.

Pyrethroids (such as Warrior) should only be used if insects haven't penetrated the plant tissue since they has no systemic activity. Our studies indicate that pyrethroids should be applied preventively, not more than 2 days apart on a regular schedule, to target newly hatched larvae before they enter the plant. Use as a 1-time treatment also will not work because pyrethroids will not persist over time on plants. Sprays should be applied during the adult flight. Methomyl (Lannate LV), spinetoram (Radiant SC), and chlorantraniliprole (Coragen), on the contrary, provide very good preventive control of newly hatched larvae, even 8 days post treatment (Note that Coragen is not labeled for LM in NY). Spinosad (Entrust), if combined with a surfactant, provides good control and may be an alternative for organic production. Other organic products, including *Bacillus thuringiensis* strains, neem oil, and *Beauvaria bassiana* did not control LM.

Alternative methods of LM control are very important because conventional options are limited. Exclusion is an excellent means of preventing plant damage from LM and floating row covers work well for small areas. Since adult LM are nocturnal and emerge at dusk, producers can remove row covers during the day and cover plants at night. Kaolin clay applications might provide a physical barrier to oviposition, but this needs to be researched.

Cultural control can be an economical means of LM management. Good field sanitation is one important step that can be implemented. LM pupate on the outside of *Allium* leaves and can be removed by hand. Growers should remove and destroy all culled plants between growing seasons to break the LM life cycle. Time of planting may be another simple yet effective tool to avoid LM infestations. Planting a crop outside the window of a LM flight may prevent an initial infestation and minimize damage from subsequent generations. Onions and leeks are good candidate crops for this method. Finally, fall tillage may be a useful control method. This increases the likelihood that pupae will be destroyed or die of exposure over the winter.

Leek moth is an emerging invasive pest in NYS. Eradication is not realistic so it is important to establish good management practices as soon as LM is detected so the population does not grow and spread to other areas. The potential for economic damage is significant in both small and large scale *Allium* production operations. Best management practices should be implemented now and these include: starting with clean transplant; proper conventional or organic insecticide selection and application; implementation of cultural controls like exclusion methods and removing infested plants, and; an awareness of emerging biological control options in the future. To limit LM damage in already infested areas and prevent its further spread, will require a focused and regional management program.

To learn more about LM and to see pictures of it and the damage it causes, we have developed a website: http://web.entomology.cornell.edu/shelton/leek-moth/index.html