Acrolepiopsis assectella

Scientific Name
Acrolepiopsis assectella (Zeller, 1893)

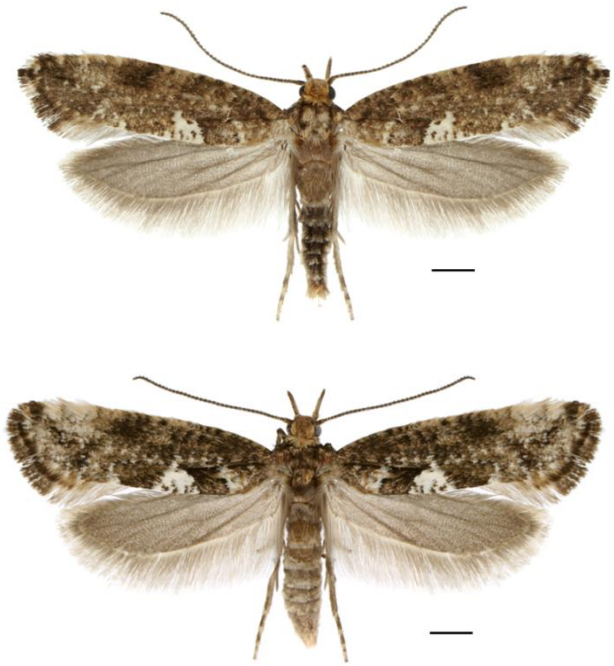
Synonym:
Lita vigeliella Duponchel, 1842

Common Name
Leek moth, onion leafminer

Type of Pest
Moth

Taxonomic Position
Class: Insecta, **Order:** Lepidoptera,
Family: Acrolepiidae

Reason for Inclusion
CAPS Community Suggestion



Figures 1 & 2. Adult male (top) and female (bottom) of *A. assectella*. Scale bar is 1 mm (© Jean-François Landry, Agriculture & Agri-Food Canada, 2007).

Pest Description
Eggs: "Roughly oval in shape with raised reticulated sculpturing; iridescent white" (Carter, 1984). Eggs are 0.5 by 0.2 mm (<$^1/_{16}$ in) (USDA, 1960).

Larvae: "Head yellowish brown, sometimes with reddish brown maculation; body yellowish green; spiracles surrounded by sclerotised rings, on abdominal segments coalescent with SD pinacula, these grayish brown; prothoracic and anal plates yellow with brown maculation; thoracic legs yellowish brown' crochets of abdominal prologs arranged in uniserial circles, each enclosing a short, longitudinal row of 3–5 crochets" (Carter, 1984). Larvae are about 13 to 14 mm (approx. $^1/_2$ in) long (McKinlay, 1992).

Pupae: "Reddish brown; abdominal spiracles on raised tubercles; cremaster abruptly terminated, dorsal lobe with a rugose plate bearing eight hooked setae, two rounded ventral lobes each bearing four hooked setae" (Carter, 1984). The cocoon is 7 mm (approx. $^1/_4$ in) long (USDA, 1960). "The cocoon is white in colour and is composed of a loose net-like structure" (CFIA, 2012).

Figure 3. *A. assectella* larvae on stem of elephant garlic (eastern Ontario, June 2000) (© Jean-François Landry, Agriculture & Agri-Food Canada, 2007).

Adults: “15 mm [approx. $^{9}/_{16}$ in wingspan]. Forewing pale brown, variably suffused with blackish brown; terminal quarter sprinkled with white scales; a distinct triangular white spot on the dorsum near the middle. Hindwing pale grey, darker towards apex. Head and thorax dark brown; abdomen grayish brown; antennae simple, filiform” (Carter, 1984).

Biology and Ecology

Females lay eggs 10 to 14 days after first flight or 2 to 6 days after mating (reviewed in Plaskota and Dabrowski, 1986). In the British Isles, eggs are laid from April to May for the first generation and July for the second. Females lay approximately 100 eggs singly at the base of host plants. Larvae hatch in 5 to 8 days (Carter, 1984) and enter the host plant within 24 hours (Mason et al., 2010).

Larvae are found from May to June and August to October. Larvae initially mine host plant leaves, but will eventually work their way into the center of the plant to feed on inner leaves (Carter, 1984). A 2 to 5 mm (approx. $^{1}/_{16}$ to $^{3}/_{16}$ in) gallery is made in the perforated epidermis (USDA, 1960). Larvae can become gregarious if mines coalesce (Agassiz, 1996; Garland, 2002). Once in the heart of the plant, the larvae will bore in all directions (USDA, 1960). Larvae prefer to feed on younger leaves of leek (0 to 7 days old) but can eat older leaves (2+ months) as well (reviewed in Garland, 2002). Larvae will continue to develop for 15 to 20 days, going through five larval instars, and then leave the plant to pupate (USDA, 1960; reviewed in Garland, 2002).

Pupae can be found from June to July and September to October. Pupation occurs in an open network cocoon on dead vegetation (Carter, 1984) and lasts for about 2 weeks (USDA, 1960) or one week if the temperature is optimal (around 20°C (68°F)) (Plaskota and Dabrowski, 1986).

Adults of the first generation can be found in July while the second generation is found from October to May, overwintering during part of this time (Carter, 1984). Moths overwinter in sheltered locations, like overgrown plant material, either near or in host fields (Plaskota and Dabrowski, 1986). Moths fly at night in an irregular zigzag pattern. Mating occurs in the morning, lasting several hours (USDA, 1960). Adults can live one week to over two months. Overwintering adults can live eight months (reviewed in Garland, 2002).

This species can have 2 generations in northern parts of Europe (McKinlay, 1992) and up to six generations a year in the southern parts of Europe. In eastern Ontario, Canada this species has three generations per year. Approximately 445 Degree Days above a 7°C (45°F) developmental threshold are needed for development from egg to adult. Depending on temperatures, the life cycle takes 3 to 6 weeks to complete in Canada (Mason et al., 2010).

Damage

Due to larval feeding, affected plants yellow at their extremities while the central leaves have irregular bands of perforated and transparent streaks (USDA, 1960). Leaves develop papery and necrotic patches as the young larvae mine the leaves. This is considered of minor importance. Older larvae will make "shot holes" in folded host leaves (McKinlay, 1992). In onion, larvae feeding inside the hollow leaves may bore into the bulb (Agassiz, 1996). Both old and new damage can commonly be found on the same plant (CFIA, 2012).

Figure 4. Hole and feeding damage by *A. assectella* on garlic stem. A cocoon of *A. assectella* is partially visable in the lower left (eastern Ontario, June 2003) (© Jean-François Landry, Agriculture & Agri-Food Canada, 2007).

Figure 5. Damage due to early larval mining of *A. assectella* on elephant garlic leaves (eastern Ontario, June 2000) (© Jean-François Landry, Agriculture & Agri-Food Canada, 2007).

Larval feeding can reduce plant growth; and the affected plant can weaken or wither if enough larvae are present. Infested bulb material can rot if placed in storage (LaGasa et al., 2003). Leaves may rot when severely attacked; if extensive, the affected plants may wilt and die (McKinlay, 1992).

The leafmines and feeding holes are most apparent on young plants (reviewed in Garland, 2002). Damage typically tends to be more prevalent at field edges (Nyrop et al., 1989) and is usually more severe with later generations (McKinlay, 1992). Larvae do not typically attack reproductive parts of the plant as these contain saponins which inhibit growth (Allen et al., 2008).

Pest Importance

A. assectella can cause damage to several species in the *Allium* family, including leeks and onions by mining and feeding in the foliage and bulbs of the host plants. *A. assectella* can also prevent seed formation by feeding on the seed stalk (USDA, 1960).

The establishment of this pest in Canada has resulted in economic losses to garlic, leek, and onion growers, especially organic growers in eastern Ontario and southern Quebec (Mason et al., 2011). Mason et al. (2011) states that "in 2009, garlic growers in

the Ottawa area experienced the most severe damage recorded to-date, in some cases losing entire crops to *A. assectella*." Crop damage increases for each successive generation (Mason et al., 2010; 2011).

It can sometimes be a serious pest in continental Europe (Agassiz, 1996). Areas with several generations per year can have up to 40% infestation in host crops while areas with one to two generations per year can have minor economic damage caused by sporadic populations (Allen et al., 2008).

Known Hosts

Major hosts

Allium cepa Cepa group (onion) and *Allium porrum* (leek) (Ellis, 2006).

Minor hosts

Allium cepa Aggregatum group (Welsh onion), *Allium cepa* var. *aggregatum* (shallot), *Allium fistulosum* (Welsh onion), *Allium sativum* (garlic), *Allium schoenoprasum* (chives), and *Allium senescens* (reviewed in Garland, 2002; Ellis, 2006).

Potential wild U.S. hosts (continental)

Allium amplectens (narrowleaf onion), *Allium biceptrum* (Palmer's onion), *Allium cernuum* (nodding onion), *Allium cuthbertii* (striped garlic), *Allium haematochiton* (redskin onion), *Allium rubrum* (bulbil onion), *Allium textile* (wild onion) (Ellis, 2006).

Pathogen or Associated Organisms Vectored

This species is not known to vector any pathogens or associated organisms. However, plants attacked by *A. assectella* become more susceptible to plant pathogens (Allen et al., 2008).

Known Distribution

This species is found throughout Europe (USDA, 1960). It was mistakenly reported from Hawaii.

Africa: Algeria, **Asia:** Japan, Kazakhstan, Kyrgyzstan, Mongolia, and Russia (EPPO, 2012), **Europe:** Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Croatia, Czech Republic, Denmark, Estonia, Finland, France (including Corsica), Germany, Greece, Hungary, Italy (including Sardinia and Sicily), Latvia, Lithuania, Luxembourg, Macedonia, the Netherlands, Norway, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, and former Yugoslavia (reviewed in Garland, 2002; EPPO, 2012), **North America:** Canada (Ontario, Prince Edward Island, and Quebec; first found in 1993), United States (New York) (Mason et al., 2011).

Pathway

This species has gradually spread in Canada and moved to New York through natural movement (Mason et al., 2011). Allen et al. (2008) state that this species can fly 100 to

200 m (approx. 328 to 656 ft) from overwintering sites, but wind dispersal may lead to long distance movement of the species. Mason et al. (2011) state that this species is likely to continue its range expansion in North America.

This species has been intercepted at least 51 times at U.S. ports of entry*. All interceptions occurred on *Allium* sp. (13 on *A. ampeloprasum*, 6 on *A. cepa*, 3 on *A. fistulosum*, 11 on *A. porrum*, and 17 on *Allium* sp.) except for one interception on *Pimenta* sp. (AQAS, 2012; queried February 10, 2012).

*This does not include 16 interceptions from material that originated from Hawaii since the species thought to be *Acrolepiopsis assectella* was actually a misidentification of *A. sapporensis* (NAPPO, 2001).

Potential Distribution within the United States

A model produced with CLIMEX simulation software predicted that *A. assectella* would readily survive in the eastern United States while some areas in the coastal regions of the Pacific Northwest would be potentially suitable for this pest (Mason et al., 2011).

According to USDA-NASS (2007), onions are grown and harvested for sale in all 50 states, with the most being harvested in California, Oregon, and Washington.

Survey

CAPS-Approved Method*:

The CAPS-approved method is a trap and lure combination. The trap is the large plastic delta trap. The lure is effective for 14 days (2 weeks).

Any of the following Trap Product Names in the IPHIS Survey Supply Ordering System may be used for this target:

Large Plastic Delta Trap Kits, Green
Large Plastic Delta Trap Kits, Red
Large Plastic Delta Trap Kits, White

The Lure Product Name is *Acrolepiopsis assectella* Lure.

Trap color is up to the State and does not affect trap efficacy.

IMPORTANT: Do not place lures for two or more target species in a trap unless otherwise recommended.

Trap spacing: When trapping for more than one species of moth, separate traps for different moth species by at least 20 meters (65 feet).

Time of year to survey:

Expected adult moth flight time in Washington is late June to early July (LaGasa et al., 2003). The flight period of the overwintered population in Canada begins mid to late April and ends in mid-May. The first generation flies from mid-June to mid-July. If the first generation starts in early July, then the last generation will fly around late July to mid-August. Adult activity peaks around July (Mason et al., 2011).

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at http://caps.ceris.purdue.edu/.

Literature-Based Methods:

Trapping: Females produce a sex pheromone to attract potential mates (Garland, 2002). The synthetic pheromone ((Z)-11-hexadecenal) is used in France and Spain to trap males as part of their supervised control program (McKinlay, 1992).

Trap placement:

Traps are placed on stakes 1 m (approx. 3 1/4 ft) from the ground and 1 m (approx. 3 1/4 ft) from the edge of the field with one for each side of the field (Mason et al., 2010).

Key Diagnostics/Identification

CAPS-Approved Method*:

Morphological. Adults may be screened from traps using the guidance below. Final identification is by a designated Domestic Identifier.

An identification key to adults of North American *Acrolepiopsis* can be found in Landry (2007). A description of the larva and pupa can be found in Landry (2007) and Passoa (2007). A key to selected adults for European Acrolepiinae (including *A. assectella*) can be found in Agassiz (1996).

The following guidelines may be used to screen adult samples from *A. assectella* traps.

Level 1: moth with white spot on forewing; labial palpi upturned but without scale tufts.

Glyphipterix (Glyphipterigidae) and some Olethreutinae (*Grapholita, Epiblema, Epinotia*) also have white spots on the lower forewing margin. Unlike the leek moth, the wings of *Glyphipterix* are very narrow and the white spot is clearly curved and pointed. Genitalia of Olethreutinae are unlike that of the leek moth (Passoa, 2009).

The most similar non target is *Acrolepiopsis incertella* (common in traps). Identification is easily done by genitalia (Landry, 2007; Passoa, 2009).

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Easily Confused Pests

In the eastern United States, the leek moth is most likely to be confused with *Acrolepiopsis incertella* (carrion-flower moth)*, A. heppneri*, and *Plutella xylostella.* In the central and western United States, the leek moth is most likely to be confused with three species of *Acrolepiopsis*: *A. californica, A. reticulosa*, and *A. leucosia*. (Ellis, 2006).

In Hawaii, the record for the species thought to be *Acrolepiopsis assectella* was actually a misidentification of *A. sapporensis* (NAPPO, 2001).

Commonly Encountered Non-targets

The following are non-target insects that have been found in *A. assectella* traps in Washington State (E. LaGasa, personal communication):

Family	Genus	Species
Argyresthiidae	*Argyresthia*	*goedartella*
Autostichidae	*Oegoconia*	*quadripuncta* (*novimundi*)
Elachistidae	*Martyrhilda*	*ciniflonella*
Gelechiidae	*Chionodes*	*mediofuscella*
Gelechiidae	*Recurvaria*	*nanella*
Geometridae	*Chloroclystis*	*rectangulata*
Gracillariidae	*Caloptilia*	*stigmatella*
Gracillariidae	*Caloptilia*	*syringella*
Oecophoridae	*Agonopterix*	*alstroemeriana*
Oecophoridae	*Batia*	*lunaris*
Oecophoridae	*Carcina*	*quercana*
Pyralidae	*Dicymolomia*	*metalliferalis*
Tortricidae	*Acleris*	*variegana*
Tortricidae	*Apotomis*	*spurinfida*
Tortricidae	*Archips*	*fuscocupreanus*
Tortricidae	*Archips*	*rosanus*
Tortricidae	*Argyrotaenia*	*franciscana*
Tortricidae	*Choristoneura*	*rosaceana*
Tortricidae	*Clepsis*	*consimilana*
Tortricidae	*Clepsis*	*virescana*
Tortricidae	*Ditula*	*angustiorana*
Tortricidae	*Enarmonia*	*formosana*
Tortricidae	*Epinotia*	*albangulana*
Tortricidae	*Epinotia*	*subviridis*
Tortricidae	*Grapholita*	*packardi*
Tortricidae	*Grapholita*	*prunivora*
Tortricidae	*Rhopobota*	*naevana*
Tortricidae	*Spilonota*	*ocellana*

References

Allen, J., H. Fraser, and M. Appleby. 2008. Leek moth — a pest of *Allium* crops. Factsheet Agdex #625/252. Accessed March 5, 2012, from: http://www.omafra.gov.on.ca/english/crops/facts/08-009.htm.

Agassiz, D. J. L. 1996. Yponomeutidae. Pages 39-114, in: A.M. Emmet (Ed.). The Moths and Butterflies of Great Britain and Ireland. Vol. 3. Yponomeutidae-Elachistidae. Harley Books, Martins, Great Horkesley, Colchester, Essex, England. 452 pp.

AQAS. 2012. All interception data for *Acrolepiopsis assectella*. Queried February 10, 2012 from: https://mokcs14.aphis.usda.gov/aqas/HomePageInit.do#defaultAnchor.

Carter, D. J. 1984. Pest Lepidoptera of Europe with Special Reference to the British Isles. Dr. W. Junk Publishers. 431 pp.

CFIA. 2012. *Acrolepiopsis assectella* (Leek Moth) – Fact Sheet. Canadian Food Inspection Agency. 2 pp.

Ellis, S. E. 2006. New Pest Response Guidelines: Leek Moth. USDA-APHIS-PPQ-PDMP. Accessed February 9, 2012 from: http://www.aphis.usda.gov/import_export/plants/manuals/online_manuals.shtml.

EPPO. 2012. EPPO Plant Quarantine Information Retrieval System (PQR), version 5.0.5540. European and Mediterranean Plant Protection Organization.

Garland, J. 2002. Pest facts sheet–leek moth *Acrolepiopsis assectella* (Zeller, 1839). Bulletin of the Entomological Society of Canada 34(3): 129-153.

LaGasa, E., J. Agnesani, S. Tipton, and D. Bowden. 2003. 2002 Pheromone-trap Detection Survey for Leek Moth, *Acrolepiopsis assectella* (Zeller, 1893) (Lepidoptera: Acrolepiidae), an Exotic Pest of Allium spp. 2002 Entomology Project Report- WSDA PUB 082 (N/04/03), Plant Protection Division, Pest Program, Washington State Department of Agriculture. 2 pp.

Landry, J. –F. 2007. Taxonomic review of the leek moth genus *Acrolepiopsis* (Lepidoptera: Acrolepiidae) in North America. Canadian Entomologist 139: 319-353.

Mason, P. G., M. Appleby, S. Juneja, J. Allen, and J. –F. Landry. 2010. Biology and development of *Acrolepiopsis assectella* (Lepidoptera: Acrolepiidae) in eastern Ontario. Canadian Entomologist 142: 393-404.

Mason, P. G., R. M. Weiss, O. Olfert, M. Appleby, and J. –F. Landry. 2011. Actual and potential distribution of *Acrolepiopsis assectella* (Lepidoptera: Acrolepiidae), an invasive alien pest of *Allium* spp. in Canada. Canadian Entomologist 143: 185-196.

McKinlay, R. G. (Ed.). 1992. Vegetable Crop Pests. CRC Press, Boca Raton, Florida. 406 pp.

NAPPO. 2001. *Acrolepiopsis assectella* Zeller. Phytosanitary Alert System, Pest Alert. North American Plant Protection Organization.

Nyrop, J. P., A. M. Shelton, and J. Theunissen. 1989. Value of a control decision rule for leek moth infestations in leek. Entomologia Experimentalis et Applicata. 53:167-176.

Passoa, S. 2009. CAPS moth target pest identification: Castniidae, Acrolepiidae, Lyonetiidae, Yponomeutidae, Sesiidae, Limacodidae, Cossidae, Lasiocampidae, Gracillariidae, Geometridae. Cooperative Agricultural Pest Survey Adult Lepidoptera workshop. March 17-19, 2009. University of Maryland, College Park, Maryland. Power Point presentation.

Passoa, S. 2007. Quarantine significant Lepidoptera of concern to the southern United States. Southern Plant Diagnostic Network Invasive Arthropod Workshop. May 7- 9 2007. Clemson University. Clemson, South Carolina http://idtools.org/id/leps/lepintercept/Passoa_SouthernUS_concerns2.pdf

Plaskota, E. and Z. T. Dabrowski. 1986. Biological principles of leek moth (*Acrolepia assectella* Zeller, Lepidoptera: Plutellidae) control. II. Biology. Annals of Warsaw Agricultural University, Horticulture No. 13: 35-46.

USDA-NASS. 2010. 2007 Census of Agriculture. United States Summary and State Data. Volume 1, Geographic Area Series, Part 51. AC-07-A-51. United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). 739 pp.

USDA. 1960. Insects Not Known to Occur in the United States. Leek moth (*Acrolepia assectella* (Zell.)). United States Department of Agriculture. 2 pp.

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