NPAG DATA: *ACROLEPIOPSIS ASSECTELLA*

LEEK MOTH

POTENTIAL THREAT TO AMERICAN ONION AND *ALLIUM* GROWERS

Draft - August 1, 2000

TAXONOMY:

Phylum: Arthropoda
Class: Insecta
Order: Lepidoptera
Family: Acrolepiidae (*See* Pertinent Points)

Full Name: *Acrolepiopsis assectella* Zeller
Synonyms: *Acrolepia assectella* Zeller; *Roeslerstammia assecrella* Zeller (Zhang, 1994)

Common Name: Leek moth (USDA-ARS, 1960; Zhang, 1994)

DETECTION DATA:

Initial Detection in Canada (Possibly Unconfirmed):

Location: Ottawa region of Ontario
Date: 1997 (Date of publication)
Host: *Allium* spp. (Onion?)
Collector: Not stated
Identifier: Not stated, possibly L. Handfield
Iden. Date: 1997 (Date of publication; the source for this data is Handfield, 1997.)

From Handfield (1997): "Apparently, this species has never been mentioned before; this species is *not* mention in the very recent revision of Gaedike (1984). Therefore, this indicates a recent introduction. This species is found, at least, in Ottawa on the quebecois side of the Outanois, where it infests the domestic *Allium* species, such as onion, garlic, leek, and chive."

Detection(s) in the US:

No report of a detection in the US is known.

QUARANTINES:

The following facts indicate that the leek moth is a pest of quarantine significance:

- The leek moth was the subject of an "INKTO" (Insects Not Known to Occur in the United States) analysis (USDA-ARS, 1960).
- The leek moth appears in *Plant Pests of Quarantine Importance to the Caribbean* (FAO/ RLAC, 1989).
- An EXCERPT search by Julie Clapp (03Jul00) found that four countries (Mexico, People's Republic of Korea, French Polynesia, and New Caledonia) currently regulate for leek.
- Latin and Oman (1983) listed the leek moth as a pest of concern to American agriculture.
- The leek moth appears as a "Minor Pest" in two books by Hill, *Agricultural Pests of Temperate Regions and Their Control* and *Agricultural Pests of the Tropics and Their Control*.

If the leek moth has the ability to live in infested onion bulbs for long periods of time, it has the ability to move long distances in bulbs transported for food or for propagation. According to one source (INRA, 2000), the pupa can overwinter, although the adult moths usually overwinter.

LIFE CYCLE:

The life cycle of the leek moth involves complete metamorphosis:

Egg → Larva (caterpillar) → Pupa → Adult (moth)

In France, the leek moth has 2 generations per year; in Italy, 5 or 6 generations per year (USDA-ARS, 1960). Derived from overwintering adults, the first generation is small in numbers (especially if the winter was hard) and causes little damage. The summer generations are much more harmful (INRA, 2000).

Egg: Females lay about 100 eggs, each alone at the base of the host plant. The eggs hatch in 5 to 8 days. The first generation lays its eggs in April and May; the second generation, in August through October (Carter, 1984).

Other sources say the females deposit the eggs on the leaves or in the center of the inflorescences (INRA, 2000).

Larva: At first, the larvae mine the leaves, leaving the epidermis intact; later, the larvae work their way to the middle of their host plants to feed on the inner leaves. The first generation causes damage in May and June; the second generation, in August through October (Carter, 1984).

Larval development involves 5 instars and takes 15 days at 25°C. The larvae are 10 to 12 mm in length. For each larva, the head, thorax, and legs are yellow; the abdomen is pale green with 8 black spots per segment. Of the eight spots, four are lateral and four are dorsal. Each of the spots bears a seta (INRA, 2000)

Pupa: The larvae pupate in an open-network cocoon on dead vegetation. The first generation pupates in June and July; the second generation, in September and October (Carter, 1984). Pupal duration is 10 days at 25°C (INRA, 2000).

Occasionally, the pupae will overwinter, but this is rare (INRA, 200).

Adult: The adult moths are 16 to 18 mm in wingspan (INRA, 2000) (15 mm in wingspan according to Carter, 1984).

The forewings are pale brown, variably suffused with blackish brown. Each forewing has the terminal quarter sprinkled with white scales and bears a white spot on the dorsum near the middle. The hindwings are pale grey and darker towards the apex (Carter, 1984).

The head and thorax are dark brown; the abdomen, greyish brown. The antennae are simple and filiform (Carter, 1984).

The moths of the second generation hibernate in plant debris (Carter, 1984; INRA, 2000).

Reproduction: Influenced by temperature, the adults resume dusk and night flights in March or April (INRA, 2000).

The females fly at night in an irregular zigzag pattern. Copulation occurs in the early morning and lasts for several hours. Egg laying begins shortly after copulation (USDA-ARS, 1960).

After the discovery of the major component of the sex pheromone, additional components were discovered that make monitoring of the leek moth more effective (Minks *et al*., 1994; Renou *et al*., 1981).

The sex pheromone is available from SiberHegner (2000) or Pherobank which has the following website: http://www.ipo.dlo.nl/Ipowww/dps/phero/sexphero.html

Trece offers traps for the leek moth at the following website:
http://www.trece.com/phercat.html

Ecology: In leek fields, damage, especially second-generation damage, tends to be greater in the borders of fields (Nyrop *et al.*, 1989).

DISTRIBUTION:

Asia:	Extending across Russia to Siberia; Soviet Far East (CIE, 1980; Zhang, 1994) Japan (FAO/RLAC, 1989; not acc. to CIE, 1980) (Possibly *A. sapporensis*)
Europe:	Austria, Belgium, Britian, Czechoslovakia, Denmark, France, Germany, Greece, Hungary, Italy (including Sardinia and Sicily), Netherlands, Norway, Poland, Spain, Sweden, Switerland, Yugoslavia (CIE, 1980) Europe - France to southern Scandinavia, extending across Russia to Siberia (Zhang, 1994)
Africa:	Algeria (Lecomte, 1976)
Pacific Islands:	Hawaii (Acc. to USDA-ARS, 1960 and Zhang, 1994; not acc. to Gaedike, 1997; *see* Pertinent Points)

HOSTS:

Allium cepa Cepa group	Common onion	Carter, 1984; Zhang, 1994
A. cepa Aggregatum group	Shallot	Carter, 1984; Zhang, 1994
A. porrum	Leek	Carter, 1984; Zhang, 1994
A. sativum	Garlic	Carter, 1984; Zhang, 1994
A. schoenoprasum	Chive	Carter, 1984; Zhang, 1994

The host plants are mainly leek and onion, but development is possible on all *Allium* crop species (INRA, 2000).

DAMAGE WHERE ESTABLISHED:

General Statements: In Europe, the leek moth causes heavy damage to leeks, onions, and related crops by mining and feeding within the foliage and bulbs. Damage is followed by extensive rotting. The larvae also feed on the seed stalk preventing formation of seed (USDA-ARS, 1960).

In *Agricultural Pests of Temperate Regions and Their Control*, Hill (1987) lists this pest among the "Minor Pests" of onions (*Allium* spp.). In *Agricultural Pests of the Tropics and Their Control*, Hill (1983) also lists this pest among the "Minor Pests" of onion (*Allium* spp.).

Larvae mine and bore through the folded leaves of leeks, producing a 'shot-hole' effect. They also feed inside the the hollow leaves of onions and sometimes bore down into the bulb. Attacks often lead to extensive rotting of the plants. When flowering shoots are attacked, severe losses of seed may result. This is a serious pest in continental Europe, particularly in France and Belgium. Attacks in the British Isles are sporadic (Carter, 1984).

Leeks: When larvae develop on first-year leeks, the leaves suffer. The lacerated appearance makes the leeks unfit for sale and the lesions facilitate rotting (INRA, 2000).

In The Netherlands, the leek moth is the primary pest of the 2,700 hectares of leeks. Damage by the larvae occurs as mining and perforations in the leaves or as distortion in older leaves due to earlier feeding (Nyrop *et al*., 1989).

In Italy, infestations in leeks increase in intensity during the growing season, reaching 40% or more by late summer (USDA-ARS, 1960).

Onions: In onions, the larvae remain in the leaf cone and cause partial desiccation. The damage in itself is of minor importance; however, under unfavorable conditions, the onions age too quickly and the larvae reach the more turgescent bulbs and form galleries. Harvested crops containing damaged bulbs will be rejected, because hidden damage causes losses in storage. This loss during storage is a serious problem (INRA, 2000).

METHODS OF CONTROL:

Chemical Control: Where leek moth is a regular problem, Greenwood and Halstead (1997) recommend spraying with malathion or pirimiphosmethyl when signs of leaf mining are seen.

Biological Control: Major parasitoid species include *Diadegma fenestralis*, *Phaeogenes impiger*, and *Microgaster hospes*. Parasitism was greatest (74-89%) in the third generation of the pest (Plaskota & Dabrowski - I, 1988). The ichneumonid *Thyraella collaris* (*Diadromus collaris*) parasitises the pupae of the early sumer generations in Algeria; the parasitism rate was about 10% (Lecomte, 1976).

Cultural Control: Because the poulation of the leek moth increases as the season progresses, especially where multiple generations are produced (Nyrop *et al*., 1989), growing of a single planting will reduce damage.

In home gardens, Greenwood and Halstead (1997) recommend searching for the pupae in their net-like cocoons on the leaves and crushing them.

Resistance: Control by resistance is a possibility. When Lecomte and Thibout (1984; abstract) studied various *Allium* species in the laboratory, the species did *not* show the same attractiveness to the leek moth. The degree of attractiveness was thought to depend on sulfur volatiles released by the plant.

Mass Trapping: Because an improved sex attractant exists (Minks et al., 1994), population reduction by mass trapping is possible.

PERTINENT POINTS:

Identification Note: Some references place the leek moth in the Family Yponomeutidae (Holloway, Bradley, & Carter, 1992; Zimmerman, 1978); other in the Family Plutellidae (INRA, 2000), or in the Family Acrolepiidae (Yagulyaev, 1989; Zimmerman, 1978). Illustrations and photographs to aid identification are in the following references: Holloway, Bradley, and Carter, 1992; Yagulyaev, 1989; Zimmerman, 1978.

Presence in Hawaii: Several references report that the leek moth occurs in Hawaii (Mau & Lee, 1995; Zimmerman, 1978; Zhang, 1994). However, these reports are due to a misidentification according to Gaedike (1997). Gaedike (1997) identifies the pest in Hawaii as *A. sapporensis*, not *A. assectella*. In the recent *Hawaiian Terrestrial Arthropod Checklist* edited by Nishida (1997), *A. assectella* does *not* appear.

Presence in North America: A literature search found only a single record of this pest in North America (Handfield, 1997). Confirmation of the identification is needed. If this is a confirmed identification, information on its spread is also needed.

Damage to Native Plants: This pest may be able to adapt to native plants in the Genus *Allium*. As a result, significant damage may occur to native species and to certain crops near infested native plants in the Genus *Allium*.

Among the possible native hosts are the following species:

• *A. amplectens*		WA to southern CA
• *A. bisceptrum*		ID, UT, NV, southern CA
• *A. cernuum*	Nodding onion, wild onion	NY to SC, west to BC and CA
• *A. cuthbertii*	Striped garlic	Coastal plain, NC to FL and AL
• *A. haematochiton*	Red-skinned onion	Dry hillsides, s. CA to Baha Calif.
• *A. rubrum*		NM and AZ to BC and Alberta
• *A. textile*		MN to Alta., s. to CO, NM, and UT
• *A. tricoccum*	Wild leek, ramp	NB to MN, s. to NC and IA

Note: The fact that injury to leeks tends to be greater in the border areas of fields (Nyrop *et al.*, 1989) may indicate additional hosts beyond the leek fields; however, the border effect may be due to (1) loss of overwintering cover for adults in the field after cultural operations and/or (2) scattering of adults and burying of pupae after cultural operations.

Ecological Information: Maps prepared by Walter and his coworkers (1975) divide the world into climatic zones. In Europe the leek moth is established in several climatic zones:

• The Mediterranean Climatic Zone	Zone IV	Greece; Italy; Spain
• An intermediate zone	Zone IV-V	Northern Italy
• An intermediate zone	Zone V-IV	Southern France
• The Warm-Temperate Climatic Zone	Zone V	NW Spain (Probably)
• An intermediate zone	Zone V-VI	Eastern France
• The Typical-Temperate Climatic Zone	Zone VI	Denmark; France; Germany
• An intermediate zone	Zone VI-VII	Southern Russia
• The Arid-Temperate Climatic Zone	Zone VII	Southern Russia
• An intermediate zone	Zone VIII-VI	Southern Sweden

Because the leek moth survives in a number of climatic zones in Europe, it will probably suvive in similar climatic zones in the United States. (See attached maps.)

Potential for Damage in the United States: The climatic zones in the United States likely to be infested contain most of the onion-growing areas. Onions are a major crop in the mucklands of the Great Lakes area of the United States (Janick *et al*., 1981). Information from the National Agricultural Statistics Service (USDA-NASS, 1997) shows that in 1996 onions, as a commercial crop, were harvested from 160,610 acres and had a value of $589.9 million (Table 4-25). In regard to acres harvested (Table 4-26), major onion-growing States were California (37,700 acres), Oregon (19,300 acres), Colorado (17,500 acres), Texas (16,800 acres), New York (12,400 acres), Washington (11,800 acres), and Georgia (10,300 acres).

Trade Implications: Recorded world production is a sizable 18 million metric tons, mostly from China, India, the United States, Spain, and Japan (Janick *et al*., 1981).

In 1996, the United States exported 6,583,000 cwt. of fresh-market onions (USDA-NASS, 1997; Table 4-27).

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http://www.siberhegner.com/rm/rm_agro_phero.htm

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