Yponomeuta malinellus

Scientific Name
Yponomeuta malinellus (Zeller)

Synonyms:
Hyponomeuta malinella Zeller
Hyponomeuta malinellus Zeller
Yponomeuta malinella
Yponomeuta padella (L.)
Yponomeuta padellus malinellus

Common Names
Apple ermine moth, small ermine moth

Figure 1. *Y. malinellus* adult (Image courtesy of Eric LaGasa, Washington State Department of Agriculture, Bugwood.org).

Type of Pest
Caterpillar

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

Reason for Inclusion
2012 CAPS Additional Pests of Concern

Pest Description
Eggs: "The individual egg has the appearance of a flattened, yellow, soft disc with the centre area slightly raised, and marked with longitudinal ribbings. Ten to eighty eggs are deposited in overlapping rows to form a flattened, slightly convex, oval egg mass. At the time of deposition, the egg mass is covered with a glutinous substance, which on exposure to air forms a resistant, protective coating. This coating not only acts as an egg-shield but provides an ideal overwintering site for the diapausing first-instar larvae. The egg mass is yellow at first but then darkens until eventually it is grey-brown and resembles the bark of apple twigs. Egg masses average 3-10 mm [0.12-0.39 in] in length and 4 mm [0.16 in] in width but vary considerably in size and shape" (CFIA, 2006).

Larvae: "Grey, yellowish-grey, greenish-brown, and greyish-green larvae have been reported. The mature larva is approximately 15-20 mm [0.59-0.79 in] in length; the anterior and posterior extremities are much narrower than the remainder of the body. There are 2 conspicuous laterodorsal black dots on each segment from the mesothorax to the 8th abdominal segment. Head, thoracic shield and anal plate are black" (CFIA, 2006).

Pupae: “Length 6-8 mm [0.24-0.31 in], width 2 mm [0.08]. Head, thorax and abdominal segments 8-10 or 9-10 are dark brown. Remainder of pupa orange-yellow, yellow-brown. In white cocoon, 10-12 mm [0.39-0.47 in] long and 3 mm [0.12 in] wide; densely woven and opaque” (CFIA, 2006).

Figure 2. Larva of *Y. malinellus* (Image courtesy of Ian F. Smith, Bugwood.org).

Adults: “Small moths (16-20 mm [0.63-0.79]) with snowy-white forewings and grey or leaden hind wings. The wings have long fringes on the lateral and posterior margins. The upper sides of the forewing usually have 15 to 30 small, black dots arranged or distributed in 3 or 4 rows. Head, palpi and antennae white. Thorax white with a few black dots” (CFIA, 2006).

Biology and Ecology:

The female deposits her egg mass on tree bark from July to September laying between 10 to 80 eggs (Antonelli et al., 1989). Eggs are covered with a yellowish, gum-like secretion that hardens (Carter, 1984), and are laid in batches near buds on branches of host plants (Ovsyannikova and Grichanov, n.d.). In its introduced range in the United States, *Y. malinellus* lays about 50 eggs per mass on branches from one to three years in age in mid to late summer (Unruh et al., 2003). Eggs take 8-15 days to hatch (Ovsyannikova and Grichanov, n.d.). *Y. malinellus* overwinters as first instar larvae (Philip and Edwards, 1991) under the remains of the egg mass (Cossentine and Kuhlmann, 2002).


Figure 3. *Y. malinellus* larvae and prepupa (Image courtesy of Eric LaGasa, Washington Department of Agriculture).

In British Columbia, larvae can be found from late April to mid June while adults can be found from July to August (Philip and Edwards, 1991). In Washington, larvae will emerge in mid-April and will move into developing, nearby leaves (Antonelli et al., 1989). They initially mine leaves but will begin feeding within a communal web towards the end of bloom (Antonelli et al., 1989). Second and third instar larvae feed on the upper epidermis and parenchyma of apple leaves while fourth and fifth instar larvae will eat entire leaves, minus larger veins and petioles (CFIA, 2006). After larvae have defoliated a particular part of a host plant, individual colonies may migrate to other parts of the tree (CFIA, 2006).

Webs can be as large as tennis balls and can be extended to include more leaves; several tennis ball-sized tents are constructed during development (Antonelli et al., 1989). Larvae continue to feed until early or mid-June (Antonelli et al., 1989).

When pupating, larvae line up in a tightly packed cluster (Antonelli et al., 1989) either within or adjacent to the webs (CFIA, 2006). Adults then emerge beginning in late June (Antonelli et al., 1989). Females mate one to two weeks following emergence, attracting mates with a pheromone (CFIA, 2006). Adults live for 20-30 days (Ovsyannikova and Grichanov, n.d.). They begin flying right before twilight and continue through the night. During the day, the moths spend a majority of their time sitting motionlessly in the shade underneath leaves (Ovsyannikova and Grichanov, n.d.).

One generation occurs per year (Philip and Edwards, 1991).

Damage

Y. malinellus have characteristic communal webs that can have spotted larvae or white cocoons close together, depending on the time of year (CFIA, 2006). Webs can be as large as tennis balls and there can be several found on each infested tree (Antonelli et al., 1989). Webs typically begin with a few leaves at the end of a twig and can eventually expand to include more leaves as needed (CFIA, 2006). Defoliation begins at the tips of branches with leaves taking on a reddish color (HYPPZ, n.d.) or brown tip (Ovsyannikova and Grichanov, n.d.). Young fruit within webs may have bite marks from the larvae (HYPPZ, n.d.). When infestations are high, trees can drop all leaves leading to abscission of seed buds with remaining fruits decreasing in size (Ovsyannikova and Grichanov, n.d.). Severe defoliation can cause fruit to stop growing and drop prematurely (HYPPZ, n.d.).

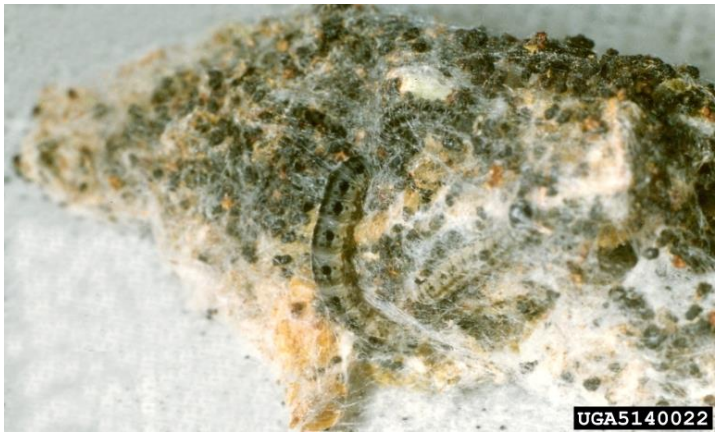

Figure 4. *Y. malinellus* webbing with larvae and frass (Image courtesy of Ian F. Smith, Bugwood.org).

Figure 5. *Y. malinellus* pupal clusters in Olympia, WA (Image courtesy of Eric LaGasa, Washington Department of Agriculture).

Figure 6. *Y. malinellus* defoliation in Olympia, WA (Image courtesy of Eric LaGasa, Washington Department of Agriculture).

Figure 7. *Y. malinellus* larval tents (Image courtesy of Eric LaGasa, Washington Department of Agriculture).

Pest Importance

In Europe, this pest usually occurs at low, sub-economic levels. This is punctuated by outbreaks that can cause significant damage to host plants (Unruh et al., 2003). Damage by this pest has been reported in France, Germany, England, Sweden, Iran, and Russia in the past (Hatmaker, 1985). Extensive damage (up to 95% in some years and areas) was reported from 1967 to 1982 in different parts of Lithuania (Rilishkene and Zayanchkauskas, 1984). Although serious infestations of this pest have been eliminated in Western Europe due to their usage of chemical treatments, it is still an important pest in Eastern Europe (Herrebout and Menken, 1990).

When infestations are high, leaf drop and a decrease in fruit size can occur (Ovsyannikova and Grichanov, n.d.). Ovsyannikova and Grichanov (n.d.) state that complete loss of fruits has been reported in some cases. High infestations can decrease tree defenses to environmental conditions like frost and drought, and fruit production the following year may suffer (Ovsyannikova and Grichanov, n.d.).

Larvae of this pest can cause serious defoliation (Antonelli et al., 1989). By the time this pest was found in Washington in 1985, it was causing a significant amount of defoliation to host plants (Unruh et al., 2003). In some cases, almost complete defoliation was observed between May and June (Antonelli et al., 1989). Since its introduction in the United States, several parasitoids have been introduced to help control populations of this pest (Unruh et al., 2003). The parasitoid *Ageniaspis fuscicollis*, originally taken from France, China, Korea, and Russia, may help suppress outbreaks of *Y. malinellus* in the future (Unruh et al., 2003). Today, *Y. malinellus* is considered a “fairly innocuous background

species" in its introduced range in the United States (LaGasa, personal communication).

Known Hosts

The major hosts of *Y. malinellus* are *Malus* species. Some sources state that this pest exclusively feeds on *Malus* species (apple) (Carter, 1984; Philip and Edwards, 1991; CFIA, 2006), while others include a broader host range (Menken et al., 1992; HYPPZ, n.d.). According to LaGasa (1991) this pest shows a strong preference for *Malus* species. *Y. malinellus* does not appear to feed on *Pyrus* species in Washington State (Orr, 1991).

Malus domestica (apple), *Malus* spp. (apple), *Malus sylvestris* (European crabapple), *Pyrus communis* (pear) (Philip and Edwards, 1991; Menken et al., 1992).

Pathogen or Associated Organisms Vectored

This pest is not currently known to vector any pathogens or other associated organisms.

Known Distribution

This species is found throughout most of Europe and parts of Asia.

Specific countries where this pest is found include but are not limited to: **Asia:** China, Japan, Kazakhstan, and Korea; **Europe:** Czech Republic, Finland, France, Georgia, Germany, Italy, Lithuania, the Netherlands, Sweden, Turkey, Ukraine, and United Kingdom; **Middle East:** Armenia, Azerbaijan, Iran, Pakistan, and Uzbekistan; **North America:** Canada (Ovsyannikova and Grichanov, n.d.; Gershenzon, 1970; Pustovarov, 1980; Mamedov and Makhmudova-Kurbanova, 1982; Arduino et al., 1983; Kuhlmann et al., 1998; Orr, 1999; Jonaitis, 2001; Gençer, 2003; Hrudová, 2003; Unruh et al., 2003; Lee and Pemberton, 2005; CFIA, 2006; Kimber, 2011).

This species is currently found in Oregon and Washington (Unruh et al., 1993; Antonelli et al., 1989).

Pathway

Egg masses can spread to new areas through nursery stock (Orr, 1991; Hatmaker, 1985). Natural spread may also occur as this pest is already established in parts of the Pacific Northwest. Both males and females fly and could travel considerable distances in favorable conditions (Orr, 1991). Natural spread per year has been estimated at 50 to 100 miles (Orr, 1991).

Potential Distribution within the United States

This pest is already found in parts of the United States, including Oregon (found in 1991) and Washington (found in 1985) (Unruh et al., 1993; Antonelli et al.,

1989). This species was previously found in New York in 1909, but this infestation was eradicated (CFIA, 2006).

This pest is most likely to establish in areas of the United States that have higher concentrations of *Malus* species.

Survey

CAPS-Approved Method*:

The CAPS-approved method is a trap and lure combination. The trap type is a wing trap. The lure is effective for 84 days (12 weeks).

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

Wing Trap Kit, Paper
Wing Trap Kit, Plastic

The Lure Product Name is "*Yponomeuta malinellus* Lure."

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).

*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:

A pheromone is available to monitor male moths (Philip and Edwards, 1991). There are two main components used to trap *Y. malinellus*, Z11-14:OH and Z9-12:Ac (McDonough et al., 1990). This blend has been found to trap more males than traps baited with live females (McDonough et al., 1990).

Although each species in the *Y. padellus* complex (including *Y. malinellus*) produce different sex pheromones, interspecific cross-attraction may occur (Sperling et al., 1995).

Survey site and selection:

When surveying for this species, focus on areas with high host densities like orchards, nurseries, and ornamental plantings.

Time of year to survey:

Pupation occurs in early summer with emergence of adults occurring in one to two weeks (Junnikkala, 1960; Unruh et al., 2003). In northwestern

Washington, flight will continue from early July to early September (Uhruh et al., 2003).

Visual:
When inspecting for this pest, leaves should be checked for larvae and/or feeding damage. White cocoons may be present near defoliated or webbed areas (Philip and Edwards, 1991). When surveying in nursery stock, surveyors should look for small, oval egg masses on bark near buds; if host plants are not in a dormant stage, webbing or cocoons should be looked for (CFIA, 2006). Mature trees should have their crowns checked (CFIA, 2006).

Identification

CAPS-Approved Method*:
Morphological.

Literature-Based Methods:
Work has been done to differentiate three sibling species of the *Yponomeuta padellus* complex found in North America, including *Y. malinellus*, *Y. padellus*, and *Y. cagnagellus* (Sperling et al., 1995). All three are morphologically similar, although they have different host preferences (Sperling et al., 1995). Sperling et al. (1995) found that the mtDNA of *Y. malinellus* had 0.8-0.9% divergence from the other two species, *Y. padellus* and *Y. cagnagellus*.

To identify adults accurately, knowledge of the larval host associations is needed (Sperling et al., 1995). Although morphological identification based on genitalia measurements can be used, this method is not 100% accurate and is dependent on specimen sex, characters available, and the species distinguished (Sperling et al., 1995; Povel, 1984).

*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/.

Easily Confused Pests

Y. malinellus is a part of the "*padellus* complex" which is made up of five species, including *Y. padellus*, *Y. cagnagellus*, *Y. mahalebellus*, *Y. malinellus*, and *Y. rorellus* (McDonough et al., 1990). These species can be difficult to distinguish morphologically; other features including larval feeding preference and sex pheromones can be used to help distinguish between the different species (Van der Pers and Den Otter, 1978; McDonough et al., 1990).

Y. padellus is now present in the Pacific Northwest (Unruh et al., 2003). Larvae of *Y. malinellus* are identical to larvae of *Y. padellus* (Philip and Edwards, 1991).

Nests made by both of these species can be confused with nests of fall webworm and tent caterpillars (Philip and Edwards, 1991). Nests of fall webworms occur later in the summer and are much larger with denser webbing while nests of tent caterpillars have silken pads on trunks and major limbs. Nests of ermine moths include loosely gathered leaves which extend the length of the branches (Philip and Edwards, 1991).

Y. multipunctella is the only species in this genus that is native to North America and similar to the *Y. padellus* complex (Sperling et al., 1995). It can be distinguished from the *Y. padellus* complex by the wing coloration (Sperling et al., 1995; Hoebeke, 1987).

Y. malinellus can interbreed with other similar species, including *Y. padellus* (Arduino et al., 1983), but this is uncommon.

References

Antonelli, A. L., E. LaGasa, and E. C. Bay. 1989. Apple Ermine Moth. EB1526. Washington State University Cooperative Extension.

Arduino, P., R. Cianchi, and L. Bullini. 1983. Taxonomic status, natural hybridization and electrophoretic identification of *Yponomeuta padellus* and *Yponomeuta malinellus* (Lepidoptera: Yponomeutidae) [abstract]. Atti XIII Congresso Nazionale Italiano de Entomologia. Turin: Istituto di Entomologica Agraria e Apicoltura, Università di Torino. pp. 485-489.

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

CFIA. 2006. *Yponomeuta malinellus* (Zeller)- apple ermine moth. Canadian Food Inspection Agency. Accessed on February 9, 2011 from: http://www.inspection.gc.ca/english/plaveg/pestrava/ypomal/tech/ypomale.shtml.

Cossentine, J. and U. Kuhlmann. 2002. *Yponomeuta malinellus* Zeller, apple ermine moth (Lepidoptera: Yponomeutidae). In: Biological Control Programmes in Canada, 1981-2000. P. G. Masonand J. T. Huber. (eds.). pp. 275-278.

Gershenzon, Z. S. 1970. A description of the morphological characters of species of the ermine moth group (Lepidoptera, Yponomeutidae) [abstract]. Entomologicheskoe Obozrenie 49(3): 665-671.

Gençer, L. 2003. The parasitoids of *Yponomeuta malinellus* Zeller (Lepidoptera: Yponomeutidae) in Sivas. Turkish Journal of Zoology 27: 43-46.

Hatmaker, E. D. 1985. Data Sheet on *Yponomeuta malinellus*. USDA-APHIS-PPQ-CPHST-PERAL, New Pest Advisory Group.

Herrebout, W. M. and S. B. J. Menken. 1990. Preliminary data on the origin of small ermine moths introduced into North America (Lepidoptera: Yponomeutidae). Proceedings of the Section Experimental and Applied Entomology of the Netherlands Entomological Society (N.E.V.) 1: 146-151.

Hoebeke, E. R. 1987. *Yponomeuta cagnagella* (Lepidoptera: Yponomeutidae): a palaearctic ermine moth in the United States, with notes on its recognition, seasonal history, and habits. Annals of the Entomological Society of America 80: 462-467.

Hrudová, E. 2003. The presence of nontarget lepidopteran species in pheromone traps for fruit tortricid moths. Plant Protection Science 39(4): 126-131.

HYPPZ. No date. Apple small ermine moth. Accessed February 8, 2001 from: http://www.inra.fr/internet/Produits/HYPPZ/RAVAGEUR/6ypomal.htm.

Jonaitis, V. 2001. Some peculiarities of the long-term dynamics of the day's absolute maximum and minimum temperatures and the emergence rate of adult apple ermine moths (*Yponomeuta malinellus* Zell.) in Lithuania [abstract]. Acta Zoologica Lituanica 11(3): 319-325.

Junnikkala, E. 1960. Life history and insect enemies of *Hyponomeuta malinellus* Zell. (Lepidoptera: Hyponomeutidae) in Finland [abstract]. Ann. Zool. Soc. ''Vanamo'' 21, 1–44.

Kimber, I. 2011. 426 Apple Ermine *Yponomeuta malinellus*. UK Moths. Accessed on February 9, 2011 from: http://ukmoths.org.uk/show.php?id=3591.

Kuhlmann, U., K. P. Carl, and N. J. Mills. 1998. Quantifying the impact of insect predators and parasitoids on populations of apple ermine moth, *Yponomeuta malinellus* (Lepidoptera: Yponomeutidae), in Europe [abstract]. Bulletin of Entomological Research 88: 165-175.

Lee, J-H. and R. W. Pemberton. 2005. Larval parasitoids of the apple ermine moth, *Yponomeuta malinellus* in Korea, Japan, and China. BioControl 50: 247-258.

Mamedov, Z. M. and D. D. Makhmudova-Kurbanova. 1982. The morphology, biology and natural enemies of ermine moths in the Azerbaijan SSR [abstract]. Izvestiya Akademii Nauk Azerbadzhansko SSR, Biologicheskikh Nauk 3: 83-88.

McDonough, L. M., H. G. Davis, C. L. Smithhisler, S. Voerman, and P. S. Chapman.1990. Apple ermine moth, *Yponomeuta malinellus* Zeller. Two components of female sex pheromone gland highly effective in field trapping tests. Journal of Chemical Ecology 16: 477-86.

Menken, S. B. J., W. M. Herrebout, and J. T. Wiebes. 1992. Small ermine moths (Yponomeuta): their host relations and evolution. Annual Review of Entomology 37: 41-66.

Orr, R. 1991. Pest Risk Assessment on Apple Ermine Moth (AEM). USDA-APHIS-PPD-PRAS. 16 pp.

Ovsyannikova, E. I. and I. Y. Grichanov. No date. *Yponomeuta malinellus*. In A. N. Afonin, S. L. Greene, N. I. Dzyubenko, A. N. Frolov (eds.). 2008. Interactive Agricultural Ecological Atlas of Russia and Neighboring Countries. Economic Plants and their Diseases, Pests and Weeds [Online]. Available at : http://www.agroatlas.ru/en/content/related/Lonicera_edulis/

Philip, H. G. and L. Edwards. 1991. Apple/Cherry Ermine Moth: *Yponomeuta malinella* (Zeller)/*Yponomeuta padellus* (L.) In: Harmful and Beneficial Insects and Mites of Tree Fruits. British Columbia Fruit Growers' Association.

Povel, G. D. E. 1984. The identification of the European small ermine moths, with special reference to the *Yponomeuta padella-complex* (Lepidoptera, Yponomeutidae). Proc. K. Ned. Akad. Wet. Ser. C Biol. Med. Sci. 87: 149-180.

Pustovarov, V. V. 1980. On the fauna of Microlepidoptera of the forests in the south-eastern regions of Armenia [abstract]. Biologicheskii Zhumal Armenii 33(3): 271-278.

Rilishkene, M. A. and P. A. Zayanchkauskas. 1984. Abundance and harmfulness of the apple ermine moth in orchards of the Lithuanian SSR in 1967-1982 [abstract]. Acta Entomologica Lithuanica 2: 24-34.

Sperling, F. A., J-F. Landry, and D. A. Hickey. 1995. DNA-based identification of introduced ermine moth species in North America (Lepidoptera: Yponomeutidae). Annals of the Entomological Society of America 88(2): 155-162.

Unruh, T., R. Short, F. Herard, K. Chen, K. Hopper, R. Pemberton, J. H. Lee, L. Ertle, K. Swan, R. Fuester, and E. LaGasa. 2003. Introduction and establishment of parasitoids for the biological control of the apple ermine moth, *Yponomeuta malinellus* (Lepidoptera: Yponomeutidae), in the Pacific Northwest. Biological Control 28: 332-345.

Unruh, T.R., B. Congdon, and E. LaGasa, 1993. *Yponomeuta malinellus* Zeller (Lepidoptera: Yponomeutidae), a new immigrant pest of apples in the Pacific Northwest: phenology and distribution expansion, with notes on efficacy of natural enemies [abstract]. Pan. Pacific Entomol. 69, 57–70.

Van der Pers, J. N. C. and C. J. Den Otter. 1978. Single cell responses from olfactory receptors of small ermine moths to sex-attractants. Journal of Insect Physiology 24:337-343.