Eupoecilia ambiguella

Scientific Name
Eupoecilia ambiguella Hübner, 1796

Synonyms:
Tinea omphaciella Faure-Bignet de Simonest, 1801
Tortrix roserana Frölich, 1828
Clysia turbinaris Meyrick, 1935

Common Name(s)
European grape berry moth, grape berry moth, grape bud moth, vine moth, grape moth, grapevine moth

Figure 1. *Eupoecilia ambiguella* adult (V. V. Neimorovets).

Type of Pest
Moth

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

Reason for Inclusion
Suggestion from CAPS Community

Pest Description
Eggs: "0.8 x 0.6 mm; grayish brown when laid, later becoming speckled with orange" (Alford, 2007).

Larvae: "Late instar larvae are approximately 10-12 mm in length. The head, prothoracic shield, and legs are dark brown to black. Body color varies from brown to yellow and green. Pinacula are large, conspicuous, and brown. The anal shield is pale brown" (Gilligan and Epstein, 2012).

Figure 2. *Eupoecilia ambiguella* egg (Rémi Coutin, OPIE).

Pupae: "5-8 mm [approx. $^{3}/_{16}$ to $^{5}/_{16}$ in] long; reddish brown; cremaster with a ring of 16 hook-tipped bristles and a pair of short horns dorsally" (Alford, 2007).

Adults: The wingspan is 12-15 mm [approx. $^{1}/_{2}$ to $^{9}/_{16}$ in] (Alford, 2007).

"The forewing is yellow or yellowish orange with a well-defined dark-brown to black median fascia. Males and females exhibit no sexual dimorphism in wing pattern although females may be slightly larger than males. Males lack a forewing costal fold. Male genitalia are distinguished by a reduced uncus, short socii, prominent transtilla, distally triangular valva, and large aedeagus. Female genitalia are distinguished by a broad, short ductus burase and a corpus bursae with numerous sclerotizations and spines" (Gilligan and Epstein, 2012).

Figure 3. *Eupoecilia ambiguella* pupa (Rémi Coutin, OPIE).

Biology and Ecology

Both *Lobesia botrana* and *Eupoecilia ambiguella* share similar native ranges. In some years, both pests are present, while in others, one is more dominant (EPPO, 2002). *Eupoecilia ambiguella* is found in more Northern, humid climates because of its preference for cooler weather (Arn et al., 1986). As such, it is more of a pest in northern countries (EPPO, 2002). *Eupoecilia ambiguella* usually has two generations per year, but a third generation can sometimes be observed in central Asia (Schmidt et al., 2003; AgroAtlas, n.d.). Flight of the overwintering generation occurs soon after bud-break (EPPO, 2002).

When females are ready to mate, they stay in a "calling position" where pheromone is released (Schmieder-Wenzel and Schruft, 1990). The male uses this to orient himself towards the female over long range (Schmieder-Wenzel and Schruft, 1990). Once the male finds the female, visual cues are used to successfully complete the mating process (Schmieder-Wenzel and Schruft, 1990). Findings by Schmidt-Büsser et al. (2009) suggest that host plant chemostimuli along with the sex pheromone help males find females on host plants.

Overwintered females usually begin egg laying during grape inflorescence and can lay up to 100 eggs (AgroAtlas, n.d.). Egg development at 15°C (59°F) takes 13 days, while development at 19 to 25°C (66.2 to 77°F) takes 6 to 7 days (AgroAtlas, n.d.). After hatching, the first generation larvae penetrate single flower buds. Later, the larvae tie several flower buds together with a silken web where they continue to feed; at this point tolerance is high and depends on grape variety (Ibrahim, 2004). Lab and field experiments have shown that larvae feed in the evening and early morning with mating occurring after midnight to early morning. Eggs are laid during the afternoon and evening (Ibrahim, 2004). In the spring, eggs are laid singly on grape clusters; eggs are laid on berries during the summer (later generations) (Ibrahim, 2004). First generation larvae development lasts 15 to 25 days (AgroAtlas, n.d.). Schmidt et al. (2003) found through modeling that the population density and longevity of larvae is due to temperature and relative humidity. Development is most favorable at 70 to 90% relative

humidity and temperatures of 18 to 25°C (64.4 to 77°F); the lower threshold of development is approximately 7°C (44.6°F) (AgroAtlas, n.d.). Second generation flight occurs 2 to 2.5 months after the first generation (HYPP Zoology, n.d.). Pupation occurs on the edges of leaves or trunks; this is the overwintering stage (Ibrahim, 2004).

Damage

The main host of this pest is grapes. Larvae damage flowers, immature berries, and parts of the seed through direct feeding damage and secondary infections (reviewed in USDA, 1986; Gilligan and Epstein, 2012).

Figure 4. *Eupoecilia ambiguella* larva and damage (Rémi Coutin, OPIE).

Grape: Larvae chew round holes in the berries and consume the pulp and unripe seeds (AgroAtlas, n.d.). On average, one larva can damage 9 to 12 berries (AgroAtlas, n.d.). As larvae grow, they begin to spin webs around surrounding flower buds or berries (depending on the generation) where they stay and continue to feed until pupation.

Larval damage is similar to damage caused by *Lobesia botrana*. Flower buds, open flowers, and young fruitlets can be destroyed, as well as developing or mature grapes later on in the season (Alford, 2007). Tunnels and partly eaten seeds can be seen through the pulp of berries (USDA, 1986). Both the silken larval habitations and sticky exudations serve as contaminants in grape clusters (Alford, 2007). Damage differs depending on the generation; the first generation will cause minor damage by feeding on the flower buds, while the second generation will feed on the grape berries (Gilligan and Epstein, 2012).

Larval damage can lead to infection by *Botrytis cinerea* causing a destructive grey mold rot on ripening berries; this can lead to additional problems and crop losses (EPPO, 2002).

This species seems to prefer cultivars that have green, yellow green, or yellow skins as they are more heavily attacked than cultivars that are wine red or dark blue (reviewed in USDA, 1986).

Pest Importance

This pest causes severe problems in Northern European wine production areas (Schmidt et al., 2003) and Southern Germany (Kast, 2001). Both *E. ambiguella* and *Lobesia botrana* are considered the most important insect pests of European vineyards (Carde and Minks, 1995).

The presence of larvae, webs, and rotten fruit downgrades grape crops (HYPP zoology, n.d.). Inflorescences can be destroyed by three or more webs made by larvae (AgroAtlas, n.d.). Although this pest can cause extensive damage, attacks earlier in the season are not usually as damaging as later season outbreaks (Alford, 2007).

Although damage is caused by destruction of fruit, a majority of damage is caused by the fungus *Botrytis cinera* which develops on plant injuries caused by the larvae of *E. ambiguella* (Meijerman and Ulenberg, 2000). This fungus can destroy entire grape clusters, making action thresholds low (Carde and Minks, 1995). Wine making becomes difficult when molds are present (HYPPZ, n.d.).

Eupoecilia ambiguella is also viewed as a threat to the grape industry in the United States if it were to become established. One study estimates the total 2004 value of wine, grapes, and grape products to the U.S. economy to be $90 billion (MKF, 2006).

Eupoecilia ambiguella is listed as a harmful organism in the following eight countries: Canada, Chile, Colombia, Ecuador, Egypt, Israel, Japan, and South Africa. There may be trade implications with these countries if this moth becomes established in the United States.

Known Hosts

The main host of this pest is the *Vitis* genus specifically *Vitis vinifera* (cultivated grapes), but larvae are considered polyphagous (AgroAtlas, n.d.).

Major hosts

Prunus domestica (plum), *Ribes nigrum* (black currant), *Vitis* spp. (grapes), *Vitis vinifera* (grapes) (CABI, 2007).

Minor hosts

Prunus salicina (Japanese plum) (CABI, 2007).

Reported as hosts

Acer spp. (maple), *Acer campestre* (hedge, field maple), *Ampelopsis* spp., *Berberis aquifolium* (hollyleaved barberry), *Cissus quadrangularis* (veldt-grape), *Citrus limon* (lemon), *Clematis vitalba (*old man's beard), *Cornus* spp. (dogwood), *Cornus alba* (redosier dogwood),*Cornus mas* (Cornelian cherry), *Cornus sanguinea* (bloodtwig dogwood), *Cuscuta* spp. (dodder), *Cuscuta reflexa* (giant dodder), *Daphne gnidium* (flax-leaved daphne), *Eleutherococcus* spp. (ginseng), *Euonymus europaea* (European spindle tree), *Frangula* spp. (buckthorn), *Frangula alnus* (alder buckthorn), *Fraxinus* spp.(ash), *Galium* spp. (yellow bedstraw), *Galium mollugo* (false baby's breath), *Hedera* spp. (ivy), *Hedera helix* (English ivy), *Ligustrum* spp. (privet), *Lonicera* spp. (honeysuckle), *Lonicera ramosissima*, *Medicago sativa* (alfalfa), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus* spp. (stone fruit), *Prunus spinosa* (blackthorn), *Pyracantha coccinea*, *Rhamnus* spp. (buckthorn), *Rhamnus cathartica* (European buckthorn), *Rhus glabra* (sumac), *Ribes* spp. (currant), *Rubus fruticosus* (blackberry), *Rubus ideaus* (red raspberry), *Sambucus racemosa* (red elderberry), *Silene uniflora*

subsp. *prostrata* (sculpit)*, Sorbus aucuparia* (European mountain-ash), *Symphoricarpos* spp. (schisandra), *Symphoricarpos albus* (snowberry), *Symphoricarpos rivularis, Syringa persica* (Persian lilac)*, Syringa* spp. (lilac), *Syringa vulgaris* (lilac), *Trifolium pratense* (red clover)*, Viburnum lantana* (wayfaring tree)*,* and *Viburnum* spp. (UK moths, n.d.; USDA, 1986; Meijerman and Ulenberg, 2000; Ibrahim, 2004; Alford, 2007; Robinson et al., 2011; reviewed in Gilligan and Epstein, 2012).

Pathogens or Associated Organisms Vectored

The entry holes made by *E. ambiguella* in grapes help facilitate the establishment of the fungus, *Botryotinia fuckeliana* (anamorph, *Botrytis cinerea*) which is the causal agent of grey mold (Bournier, 1976; EPPO, 2002). This pathogen favors rainy conditions and occurs from flowering time onward (EPPO, 2002).

Known Distribution

This pest is widely distributed in central and southern Europe. It has a less southerly distribution than *Lobesia botrana* (European grapevine moth).

Asia: Armenia, Azerbaijan, China, Republic of Georgia, Japan, Kazakhstan, Korea (South), Kyrgyzstan, Pakistan, Taiwan, and Uzbekistan. **Europe:** Albania, Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France (including Corsica), Germany, Greece[1], Hungary, Italy (including Sardinia and Sicily), Latvia, Lithuania, Luxembourg, Macedonia, Moldova, the Netherlands, Norway, Poland, Portugal[1], Romania, Russia, Serbia[2], Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom.

This species has previously been reported from Brazil, but this record could not be verified (CABI, 1986). There is also an unconfirmed record from Australia (CABI, 2007). This species is not considered established outside of Asia and Europe (Gilligan and Epstein, 2012).

[1]Aarvik (2011) states that *E. ambiguella* is absent from these countries
[2]Listed as Serbia and Montenegro (CABI, 1986)

Pathway

This species has not previously been intercepted at U.S. ports of entry. However, this species could potentially be introduced into the United States on infested host material from areas where the species is found. This pathway was likely how two other tortricid moths were introduced into the United States, *Epiphyas postvittana* (light brown apple moth) and *Lobesia botrana* (European grapevine moth).

Currently, the import of *Prunus* spp. plant material is allowed from Belgium, France, Germany, and the Netherlands, all countries known to have *E. ambiguella*. Since 2004, there have been shipments of *Prunus* spp. plant material from France (31), Germany (1), and the Netherlands (13). The largest of these shipments contained over 46,000 plant units. Since 2004, there have also been 140 interceptions of *Prunus* spp. plant

material intended for propagation from 24 different countries known to have *E. ambiguella* (AQAS, 2014).

The import of *Ribes* spp. plant material is allowed from countries in Asia, several of which are known to have *E. ambiguella*. Since 2004, there have been shipments of *Ribes* spp. plant material from Japan (3), and Kyrgyzstan (1). One of these shipments from Japan contained over 2,900 plant units. Since 2004, there have also been 56 interceptions of *Ribes* spp. plant material intended for propagation from 12 different countries known to have *E. ambiguella* (AQAS, 2014).

The import of *Vitis* spp. propagules except seeds is prohibited from all known *E. ambiguella* host countries (USDA, 2013). However, there have been 105 interceptions of *Vitis* spp. plant material intended for propagation from 23 different countries known to have *E. ambiguella* (AQAS, 2014).

Potential Distribution within the United States

A host map for grape is included below. Because *E. ambiguella* is considered polyphagous (AgroAtlas, n.d.), establishment is not dependent on grape distribution.

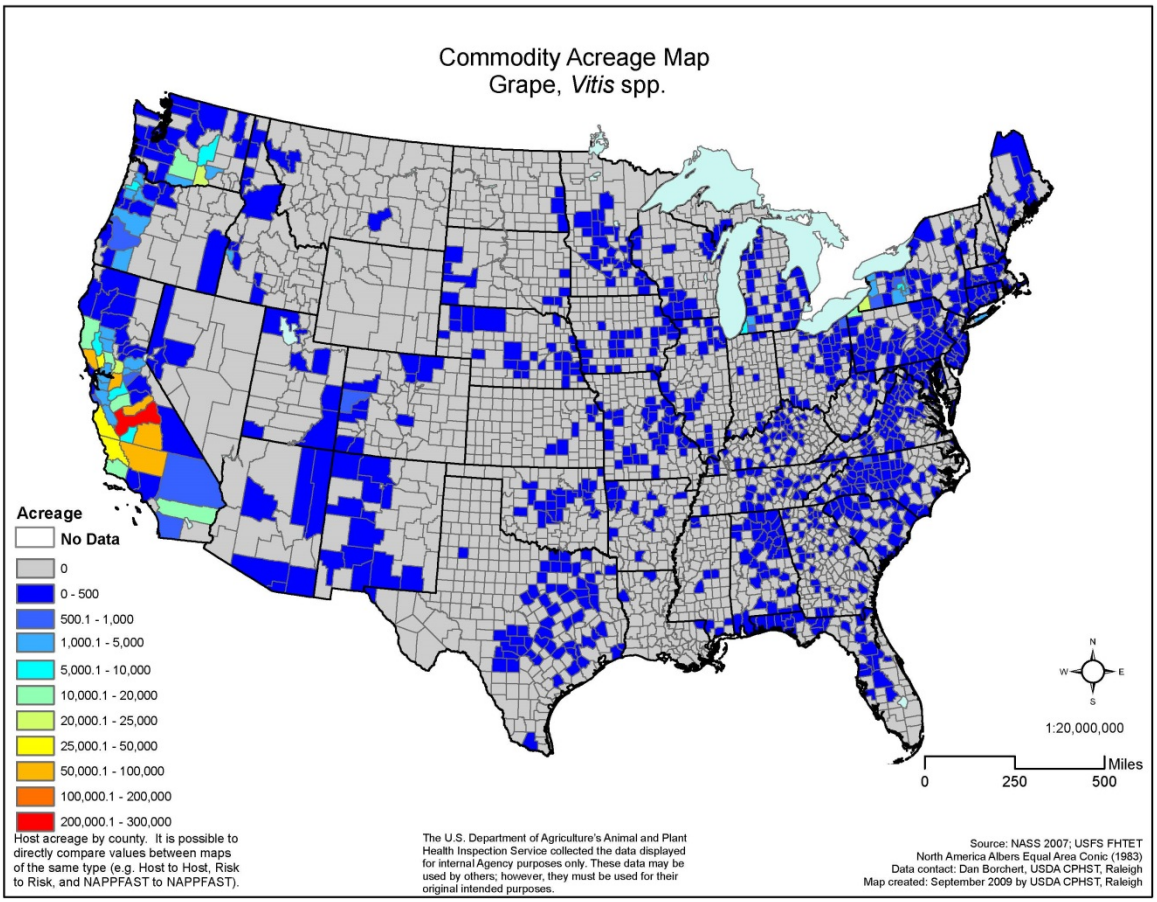

Figure 5. A host map for grape in the United States.

Survey

CAPS-Approved Method*:

The CAPS-approved method is a trap and lure combination. Any of the following Trap Product Names in the IPHIS Survey Supply Ordering System may be used for this target:

1) Wing Trap Kit, Paper
2) Wing Trap Kit, Plastic

The Lure Product Name is "*Eupoecilia ambiguella* Lure." This lure is effective for 42 days (6 weeks).

IMPORTANT**:** Do not include lures for other target species in the trap when trapping for this target.

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 https://caps.ceris.purdue.edu/node/223.

Time of year to survey:

Throughout most of its range, adults are present from May to June for the first generation and from August to September for the second generation (Gilligan and Epstein, 2012).

Literature-Based Methods:

Trapping: In Europe, pheromone traps are used to monitor the flight period although correlation between trapped insects and real populations is not strong (EPPO, 2002). Arn et al. (1986) found that the best attractant was a blend of Z-9-dodecenyl acetate, dodecyl acetate and octadecyl actetate with the last two serving as synergists to the main compound.

Survey Site Selection: *Vitis* spp. (grape) is the main host of *E. ambiguella*.

Visual survey: This species may be detected in the following ways: 1) Conduct surveys in damp places or during wet summers when the adult population increases. 2) Inspect for eggs on the blossoms (not on unopened buds, bracts, or pedicels of vines) or on the grapes. 3) Cut flower buds open and look for larvae, especially webbed flower clusters. Cut the fruit to expose the larva tunneling in the pulp and seeds. 4) Inspect for cocoons under loose bark on the stems of the vines, attached to the stems, in cracks in the poles, or among debris on the ground (USDA, 1986). However, for CAPS surveys, pheromone trapping is more effective and efficient than visual surveys.

Key Diagnostics/Identification

CAPS-Approved Method*:

Confirmation of *E. ambiguella* is by morphological identification. Identification requires dissection of the adult male genitalia.

Specimens can be sorted and screened based on the level of available expertise. Level 1 screening is difficult for small moths and may need to be performed by a trained Lepidopterist. When in doubt distinguishing first level screening characters, forward traps that have passed the sorting requirements to a trained taxonomist. Use Gilligan et al. (2014) for both sorting and screening.

Gilligan, T. M., M. E. Epstein, and S. C. Passoa. 2014. Screening aid: European grape berry moth, *Eupoecilia ambiguella* (Hübner). Identification Technology Program (ITP), USDA-APHIS-PPQ-S&T, Fort Collins, CO. 5 pp.
https://caps.ceris.purdue.edu/dmm/2535

A new identification tool, *Tort AI – Tortricids of Agricultural Importance*, is available at http://idtools.org/id/leps/tortai/ from CPHST's Identification Technology Program. This tool contains larval and adult keys, fact sheets, an image gallery, molecular search capacity, and more. *Eupoecilia ambiguella* is included in this tool.

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at https://caps.ceris.purdue.edu/node/223.

Easily Confused Species

This pest can be confused with *Lobesia botrana* (European grapevine moth) (Vasquez, 2009). Both have a similar biology, damage, and synchronous flight periods (Bournier, 1976). *Eupoecilia ambiguella* can also be confused with *Endopiza viteana* (present in the United States).

Commonly Encountered Non-targets

Non-target moths captured in *Eupoecilia ambiguella* will vary by region. For images of similar species, see:

Gilligan, T. M., M. E. Epstein, and S. C. Passoa. 2014. Screening aid: European grape berry moth, *Eupoecilia ambiguella* (Hübner). Identification Technology Program (ITP), USDA-APHIS-PPQ-S&T, Fort Collins, CO. 5 pp.
https://caps.ceris.purdue.edu/dmm/2535

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Revisions

October 2014

1) Revised the **Pathway** section.
2) Revised the **Pest Importance** section.
3) Revised the **Survey** section; added visual survey information.
4) Added the host map for grape.
5) Revised **Key Diagnostics/Identification** section. Added Gilligan et al. (2014).
6) Revised **Commonly Encountered Non-targets** section. Added Gilligan et al. (2014).

November 2014

1) Revised the **Synonyms** section.
2) Revised the **Pest Description** section.