CAPS Datasheets provide pest-specific information to support planning and completing early detection surveys.

Adoxophyes orana

Scientific Name

Adoxophyes orana
Synonyms:
Tortrix orana
Adoxophyes fasciata

Common Name

Summer Fruit Tortrix Moth

Type of Pest

Moth, foliage and fruit feeder

Taxonomic Position

Class: Insecta,
Order: Lepidoptera
Family: Tortricidae

Pest Recognition

Pest Description

Adult male moths have a wingspan of $^{5}/_{8}$ to $^{3}/_{4}$ inches. The forewings of the male are lighter-brown with distinct dark brown markings. The hind wings are lighter brown or gray (Fig. 1, 2). Adult female moths are slightly larger and have a wingspan of $^{3}/_{4}$ to $^{7}/_{8}$ inches. The forewings are a dullish gray-brown color with markings that are less distinct than in the male moth (Fig. 2). The hindwings are brown-gray (Gilligan and Passoa, 2014). Adults fly at night (Minks and Noordink, 1971). Caterpillars are $^{11}/_{16}$ to $^{7}/_{8}$ in. and are greenish yellow to olive green. The head of the caterpillar is brown

Figure 1. *Adoxophyes orana* adult male. Photo courtesy of Todd M. Gilligan and Marc E. Epstein, CSU, Bugwood.org.

Figure 2. Variation in wing pattern and coloration of *A. orana* adults. Males (top two rows) usually have more well-defined markings than females (bottom row) (Gilligan and Passoa, 2014).

yellow when young and turns to a honey-yellow color when mature. Thoracic legs are light brown (Dickler, 1991; Savopoulou-Soultani et al., 1985). Eggs are flat, oval, and shiny yellow, and are laid on leaves in clusters of 4-150 (Milonas and Savopoulou-Soultani, 2000; Whittle, 1985).

Figure 3. Rolled leaves with larva inside and chewing damage (Photo courtesy of D. Bylemans, PlantwisePlus Knowledge Bank)

Symptoms

Caterpillars damage the tree fruits and other host plants by feeding on the leaves, fruit, and shoots. Larvae occupy silken retreats formed by rolling leaves together (Fig. 3). The first (summer) and second (fall) generation of caterpillars cause the greatest losses in fruit production by leaving point-like holes in the fruit tissue (known as sting-feeding) or leave extensive areas of damage from grazing on the fruit surface (Dickler, 1991). The third generation (late spring) caterpillars feed on opening buds and the damage caused is usually of minor economic interest.

Easily Mistaken Species

Adoxophyes orana very closely resembles two U.S. species, *Adoxophyes furcatana* and *A. negundana*, but there are slight differences in male genitalia. Any identification should be confirmed by an appropriately trained entomologist.

Commonly Encountered Non-targets

The approved survey method is trapping with a brown, green, or orange paper delta trap and *A. orana* lure. Non-targets likely to be encountered in the United States include two native *Adoxophyes*: *A. furcatana* and *A. negundana.* Other non-targets found in *A. orana* traps are *Choristoneura rosaceana* and *Clepsis virescana* (Gilligan and Passoa, 2014).

Biology and Ecology

Adoxophyes orana eggs are yellow and are deposited in masses of 4 to 150, primarily on the upper surface of leaves (Dickler, 1991; Milonas and Savopoulou-Soultani, 2000; Whittle, 1985). Optimal temperature for egg development is 77°F and egg mortality is common below 57°F (Ankersmit et al., 1976; Milonas and Savopoulou-Soultani, 2000).

Larvae hatch after 7 to 40 days depending on temperature (Ankersmit et al., 1976; Cross, 1994; De Jong, 1980). The larvae feed on leaves within a protective silk mesh made by rolling them, or on fruit by finding shelter where two or more fruits touch or by tying a leaf to a fruit (Cross, 1994; Whittle, 1985).

When temperatures drop in the fall, *A. orana* larvae stop feeding, and seek protected locations while entering diapause in response to short day lengths of winter (Barel, 1973; Milonas and Savopoulou-Soultani, 2004; Whittle, 1985). Larvae overwinter as second or third instars in crevices in the bark of host trees, or in silken shelters spun between leaves and twigs (Barel, 1973; Cross, 1994). When temperatures rise in the spring, larvae become active and begin feeding again, while undergoing successive molts. They pupate as they reach the fifth instar and the first adults typically emerge and take flight in May. Eggs are laid soon after and subsequently develop quickly during the warmest parts of the year, resulting in up to two additional generations in the summer (Cross, 1994; Damos et al., 2022).

Flight periods last for approximately four weeks (Barel, 1973). Moths fly at temperatures above 54°F and are typical night fliers with maximum activity around midnight (Minks and Noordink, 1971). Males precede females in flight by a few days and may disperse up to 1,400 feet while female dispersal typically does not extend beyond 220 feet (Barel, 1973). Mating occurs at night or in the early morning hours about a day after emergence (De Jong et al., 1971; Whittle, 1985; van der Kraan and van der Straten, 1988; He et al., 1996). *Adoxophyes orana* mate once 50-60% of the time, but can mate two or more times (Minks and Noordink, 1971). Adult females live from 3 to 22 days (14.6 days on average) (van der Kraan and van der Straten, 1988); adult males live from 7 to 17 days (12 days in average) (Milonas and Savopoulou-Soultani, 2000).

Females produce between 20 and 560 eggs with an average of 280 (Charmillot et al., 1984; De Jong and van Dieren, 1974; Janssen, 1958; van der Kraan and van der Straten, 1988); egg production and laying are temperature dependent (Charmillot et al., 1984). Temperature plays a major role in the growth and development of most insect pests; degree-day models, based on quantification of temperature fluctuations during a 24-hour period, are used to predict a development event, such as a life stage, for these organisms (Damos et al., 2022). There are two or three generations per year depending on temperature (Dickler, 1991; Milonas and Savopoulou-Soultani, 2000).

Known Hosts

Adoxophyes orana feeds preferentially on apples, pears, stone fruit, and other Rosaceous hosts (Barel, 1973; Savopoulou-Soultani et al., 1985; Whittle, 1985). The full host range includes more than 50 plant species from multiple families.

The host list below includes cultivated and wild plants that 1) are infested by the pest under natural conditions, 2) are frequently described as major, primary, or preferred hosts, and 3) have primary evidence for feeding and damage documented in the literature. Plants are highlighted in bold if they are commercially produced and the pest causes economically significant damage.

Preferred hosts

***Malus domestica* (apple)**, *Prunus armeniaca* (apricot), ***Prunus avium* (sweet cherry)**, *Prunus domestica* (plum), ***Prunus persica* (peach, nectarine), *Pyrus communis* (pear)**, and *Rubus* spp.(caneberries) (De Jong et al., 1971; Milonas and Savopoulou-

Soultani, 2006; Pehlevan and Kovanci, 2014; Pehlevan and Kovanci, 2017). All of these hosts are widely distributed in the U.S. (USDA, 2023b).

Pest Importance

The summer fruit tortrix moth is a serious pest of peach and cherry orchards in northern Greece (Milonas and Savopoulou-Soultani, 2006). In central and northern Europe, it is mainly a pest of apple and pear orchards (Cross, 1994; Stamenkovic et al., 1999; Whittle, 1985). Larvae tend to feed on young shoots after overwintering, which make intensively managed orchards that have larger numbers of young shoots particularly susceptible to infestation (Charmillot and Brunner, 1989) between March and May.

The larvae feed on both foliage and fruit. Damage to foliage is insignificant, but damage to fruit can be serious. Extensive injury to the fruit skin results in crop losses or a down-grading of the economic value of the produce (Cross, 1994; Dickler, 1991; Whittle, 1985). Larval feeding creates point-like holes on the fruit surface or a gnawed appearance (Dickler, 1991). *Adoxophyes orana* has caused more than 50% fruit damage in pears (Stamenkovic et al., 1999) and between 10% and 82% crop losses in apples, peaches, and pears in the Netherlands (De Jong et al., 1971; Pehlevan and Kovanci, 2014). Secondary fungal infection is also common where insect damage has occurred, reducing fruit yield and quality (Kocourek and Stara, 2005).

Host plants, both cultivated and wild, are common in the United States and often occur at high densities (Davis et al., 2005). Of the most important hosts, apples, peaches, pears, and sweet cherries were planted on 290,200; 74,400; 41,700; and 84,500 acres, respectively, in the United States in 2021 (USDA, 2023a). The estimated value for that production was $3 billion, $624.4 million, $373.4 million, and $865.8 million, respectively (USDA, 2023a).

Adoxophyes orana is listed as a harmful organism in Brazil, Canada, Chile, Colombia, Costa Rica, Ecuador, Guatemala, India, Israel, Jordan, Mexico, Morocco, Nicaragua, Peru, South Africa, Taiwan, and Thailand (APHIS, 2023a). There may be trade implications with these countries if this moth becomes established in the United States.

Pathogens or Associated Organisms Vectored

This species is not known to be associated with pathogens or other organisms; however, larval superficial feeding on the fruit causes scabs or pitting, predisposing the fruit to secondary pathogens and reduces fruit quality (Dickler, 1991; Kocourek and Stara, 2005).

Known Distribution

This species is native to:
Asia: China (Jilin, Liaoning, Shaanxi), India (Kerala), Japan (Akita, Aomori, Nagano, Niigata), Kazakhstan, North Korea, South Korea, and Taiwan (Chembakassery et al., 2021 Cho et al., 2011; Jashenko and Tanabekova, 2019; Li et al., 2021; Park et al., 2014; Satoh et al., 2017; Sun et al., 2021a; Sun et al., 2021b). **Europe:** Austria, Belgium, Croatia, Czech Republic, Estonia, Finland, France, Germany, Greece,

Hungary, Italy, Lithuania, Netherlands, Norway, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, and the United Kingdom (Baric and Ciglar, 2005; Bylemans et al., 2003; Campbell, 2019; Charmillot and Brunner, 1989; Dickler, 1991; Endel, 2020; FinBIF, 2022; Jakab et al., 2009; Jenser et al., 1999; Kienzle et al., 2020; Kocourek et al., 2007; Kozlov et al., 2017; Lesar and Govedič, 2010; MAGRAMA, 2014; Navrozidis et al., 2005; Pehlevan and Kovanci, 2017; Piskunov et al., 2019; Pluciennik and Olszak, 2010; Sjoberg et al., 2015; Stamenkovic et al., 1999; Trematerra et al., 2009).

There are also miscellaneous records of *A. orana* presence for Armenia, Azerbaijan, Bulgaria, Denmark, and Georgia (EPPO, 2023), but these could not be verified.

Pathway

Adoxophyes orana is liable to be transported on fruit or leaf material of hosts and propagative cuttings or nursery stock of hosts with buds or shoots. Larvae of *A. orana* can survive transport and cold storage by going into diapause (Milonas and Savopoulou-Soultani, 2004). Diapausing *A. orana* larvae on apple from Korea were reported to be tolerant to freezing temperatures (Jo and Kim, 2001). It is not known to be transported on seed or root material (CABI, 2023). Currently, the import of *Malus* spp. plant material is allowed from Belgium, France, Germany, and the Netherlands, all countries known to have *A. orana*. Import of *Prunus* spp. plant material is allowed from the Netherlands and the import of *Rubus* spp. plant material is currently allowed from the United Kingdom (APHIS, 2023b).

Use the PPQ Commodity Import and Export manuals listed below to determine 1) if host plants or material are allowed to enter the United States from countries where the organism is present and 2) what phytosanitary measures (e.g., inspections, phytosanitary certificates, post entry quarantines, mandatory treatments) are in use. These manuals are updated regularly.

Agricultural Commodity Import Requirements(ACIR) manual: ACIR provides a single source to search for and retrieve entry requirements for imported commodities. https://acir.aphis.usda.gov/s/

Plants for Planting Manual: This manual is a resource for regulating imported plants or plant parts for propagation, including buds, bulbs, corms, cuttings, layers, pollen, scions, seeds, tissue, tubers, and like structures. https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/plants_for_planting.pdf

Treatment Manual: This manual provides information about treatments applied to imported and domestic commodities to limit the movement of agricultural pests into or within the United States. https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf

Potential Distribution within the United States

Adoxophyes orana is likely able to establish across most of the United States and territories, except for the northern portion of Alaska, based on the climate suitability map now available for this species (Takeuchi et al., 2018). Host plants are available throughout the endangered area. Climate and host suitability make *A. orana* potentially able to distribute throughout most of the United States.

Survey and Key Diagnostics

Approved Methods for Pest Surveillance*:

For the current approved methods and guidance for survey and identification, see Approved Methods for Pest Surveillance (AMPS) pest page on the CAPS Resource and Collaboration website, at https://caps.ceris.purdue.edu/approved-methods.

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Versions

February 2023 Datasheet update (Version 4)

- Updated and revised **Names and taxonomy, Pest Recognition, Easily Mistaken Species**, **Commonly Encountered Non-targets**, and **Known Hosts** to new template format.
- Added current information to **Biology and Ecology.**
- Updated **Pest Importance** with new information about damage to hosts, statistical data, and countries where *A. orana* is listed as a harmful organism.
- Revised and added references to **Pathogens or Associated Organisms Vectored**.
- Revised the **Known Distribution** section by adding new countries (Croatia, Kazakhstan, Slovakia, Taiwan, and Turkey), adding country-specific distribution for China, India, and Japan, improving citations, and including uncertainty about EPPO reports from Armenia, Azerbaijan, Bulgaria, Denmark, and Georgia.
- Revised the **Potential Distribution within the United States** section and added a reference to the climatic suitability map of *A. orana* in the United States (SAFARIS).
- Made minor adjustments to **Survey and Key Diagnostics** to fit current template.

Reviewer(s)

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