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The summer fruit tortrix, *Adoxophyes orana* (Fischer von Röslerstamm), is a serious pest of fruit crops in Europe and Asia. Larvae are polyphagous and feed on the leaves and fruits of trees in many different families, although the majority of recorded hosts are in the Fagaceae and Rosaceae. Most economic loss is caused by damage to apple (*Malus*) and pear (*Pyrus*). A European native, *A. orana* is widely distributed throughout Europe and several countries in Asia (China, Japan, North Korea, and South Korea). This species is included in a complex of *Adoxophyes* that feed on tea in Asia and is sometimes referred to as the “smaller tea tortrix” in that region.

*Adoxophyes orana* is a member of the Tortricidae, a large family of moths (Lepidoptera) that includes many pest species. In North America, there are approximately 1,200 species of tortricids, which are often referred to as “leafrollers” because the larvae of some species feed inside a rolled leaf. Most tortricid moths are small and brown with a wingspan of approximately 10-30 mm. The wing pattern of *A. orana* is quite variable (Figs. 1-2, 4-5, 8-10), and adults appear similar to many species of tortricids in other genera, including *Archips*, *Choristoneura*, *Argyrotaenia*, *Clepsis*, and *Pandemis*. Identification is difficult, and a genitalic dissection is necessary to confirm the identity of *A. orana* and to separate it from the native North American *Adoxophyes*, *A. furcatana* and *A. negundana*.

This aid is designed to assist in the sorting and screening *A. orana* suspect adults collected from CAPS sticky traps in the continental United States. It covers basic sorting of traps, first level and second level screening, all based on morphological characters. Basic knowledge of Lepidoptera morphology is necessary to screen for *A. orana* suspects. See the following for more information on this and other pest tortricids:

Gilligan, T. M. and M. E. Epstein. 2012. TortAI, Tortricids of Agricultural Importance to the United States (Lepidoptera: Tortricidae). Identification Technology Program (ITP), USDA-APHIS-PPQ-S&T, Fort Collins, CO. (<http://idtools.org/id/leps/tortai>).



Fig. 1: *Adoxophyes orana* male.



Fig. 2: *Adoxophyes orana* male.

# Sorting

## Summer Fruit Tortrix

*Adoxophyes orana* (Fischer von Röslerstamm)

*Adoxophyes orana* pheromone traps should be sorted initially for the presence of moths of the appropriate size, color, and shape. Traps that contain moths meeting all of the following requirements should be moved to Level 1 Screening (Page 3):

- 1) Moths are approximately 7-14 mm (0.25-0.6 inches) long (Fig. 3).
- 2) Moths have an overall shape that is similar to the outline depicted in Fig. 3. Note that moths caught on their side or back may have a different outline.
- 3) Moth forewings are a shade of brown (light brown, dark brown, tan, orangish brown, yellowish brown, etc. - see the comparison of forewing colors in Fig. 4).

Note that the appearance of moths caught in sticky traps can vary substantially depending on the amount of sticky glue on the moth (most individuals usually appear darker when covered in glue). For this reason, any small, tortricidlike moth meeting the above criteria should be sent forward to Level 1 Screening.

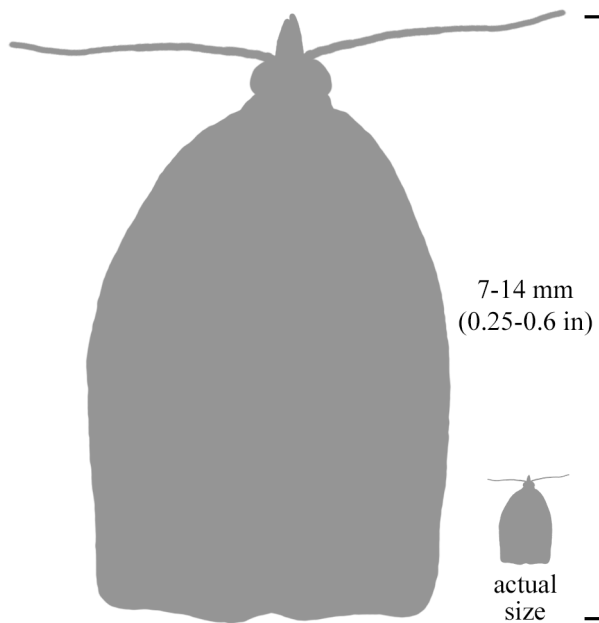


Fig. 3: Outline and size of a resting *A. orana* male. Many tortricids that are easily confused with *A. orana* have a similar appearance: rectangular forewings that form the outline of a “bell” when folded in the resting position.



Fig. 4: Variation in wing pattern and coloration of *A. orana* adults. Wing pattern varies from well-expressed in some individuals to nearly absent in other individuals. Males (top two rows) usually have more well-defined markings than females (bottom row).

# Level 1 Screening

## Summer Fruit Tortrix *Adoxophyes orana* (Fischer von Röslerstamm)

Moths that meet the sorting requirements should be screened for suspect tortricids. Level 1 Screening is difficult for small moths (like tortricids) and may need to be performed by a trained Lepidopterist. When in doubt distinguishing or evaluating first-level screening characters, forward traps that have passed the sorting requirements to a trained taxonomist. Suspect tortricids in traps should not be manipulated or removed for screening unless expertise is available.

Tortricid moths can be identified by the following combination of characters (note that some characters may be difficult to see on specimens coated in sticky trap glue):

- 1) Antennae simple, threadlike, and never pectinate (feathery).
- 2) Tympanum absent. Pyraloidea and Geometridae have a tympanum at the base of the abdomen. Noctuoidea have a tympanum on the thorax near the junction with the abdomen. Tympanal organs may be difficult to see without manipulating the specimen.
- 3) Labial palpi pointed and projecting forwards (Fig. 6). Some families (especially in the Gelechioidea) have long labial palpi that curve upwards over the head - these are not tortricids.
- 4) Maxillary palpi are very reduced and not visible in tortricids. Maxillary palpi are conspicuous in some commonly captured pyraloid species.
- 5) Proboscis (tongue) unscaled. Members of the Gelechioidea and Pyraloidea have a scaled proboscis.
- 6) Chaetosema (patch of bristle-like setae) present above the compound eye behind the ocellus (Fig. 6). Note that chaetosemata may be difficult to see without a high-quality microscope.

Moths meeting the above criteria should be moved to Level 2 Screening (Page 4). Traps to be forwarded to another facility for Level 2 Screening should be carefully packed following the steps outlined in Fig. 7. Traps should be folded, with glue on the inside, making sure the two halves are not touching, secured loosely with a rubber band or a few small pieces of tape. Plastic bags can be used unless the traps have been in the field a long time or contain large numbers of possibly rotten insects. Insert 2-3 styrofoam packing peanuts on trap surfaces without moths to cushion and prevent the two sticky surfaces from sticking during shipment to taxonomists. DO NOT simply fold traps flat or cover traps with transparent plastic wrap (or other material), as this will guarantee specimens will be seriously damaged or pulled apart – making identification difficult or impossible.



Fig. 5: Live adult in resting position (Photo by Jae-Cheon Sohn, Bugwood.org - 5143071).



Fig. 6: Tortricid head; ch = chaetosema; oc = ocellus; lp = labial palpi. Note that the chaetosema is above the compound eye behind the ocellus (Photo from Gilligan et al. 2008).

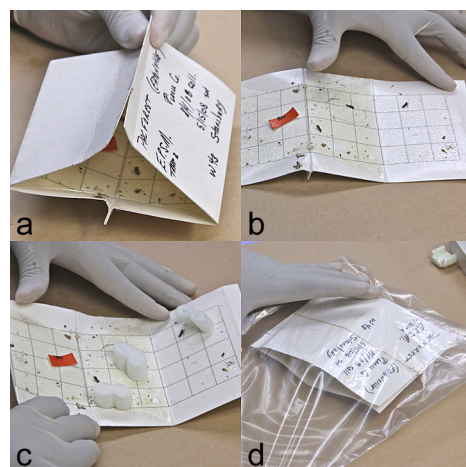


Fig. 7: Recommended packing method for shipment of sticky traps: a & b) open and unfold trap; c) place 2-3 packing peanuts in areas of trap with no moths; d) fold trap, secure with rubber band, and place in plastic bag (Photos by E. LaGasa, WSDA).

Suspect tortricids should be cleaned to identify suspect *A. orana* individuals. Instructions on cleaning specimens caught in sticky traps can be found here: <http://idtools.org/id/leps/tortai/dissections.html>.

Cleaned specimens should be pinned and labeled. Level 2 Screening is based on the presence of a forewing costal fold and wing pattern. Because the wing pattern of *A. orana* is variable and very similar to that of many other tortricids, a genitalic dissection by a specialist is necessary for species-level identification.

## Forewing Costal Fold

A costal fold is present in all male *A. orana* individuals. The costal fold is a “flap” of scales that arises from the base of the costal margin (near the head) of the forewing and extends 1/3 to nearly 1/2 the length of the wing in *A. orana* (outlined in blue in Figs. 8-10). Many other tortricids that are similar to *A. orana* also have a costal fold, but males lacking a costal fold cannot be *A. orana*. Note that the costal fold can be difficult to see in some specimens and examination under a quality microscope is often necessary. Specimens without a forewing costal fold should be eliminated as suspects before beginning careful examination of forewing pattern.

## Forewing Pattern

Forewing pattern varies considerably in *A. orana* and is not always useful in screening suspects. “Typical” males have a forewing pattern with two major elements (outlined in red in Figs. 8-9): a median dark bar that extends from the end of the costal fold towards the base of the wing, branching into the shape of an “h” and two outer dark bars that extend from the costal margin of the wing to form a “V.” However, these markings are often reduced or not strongly contrasting with the rest of the wing; Fig. 10 is an example of the “h” being reduced to a short bar extending from the end of the costal fold, and the “V” being reduced to a dark spot on the costal margin of the wing.

Non-targets likely to be encountered in *A. orana* traps are illustrated on Page 5. These include two native *Adoxophyes*: *A. furcatana* (Figs. 11-13) and *A. negundana* (Figs. 14-16). Wing patterns are similar to *A. orana*; however, the native *Adoxophyes* tend to have a darker reticulate (“spider-web”) forewing pattern. Another non-target often found in *A. orana* traps is *Choristoneura rosaceana*. This is a very common tortricid that is distributed across most of the continental U.S. Forewing pattern ranges from three dark bars across the forewing to a single bar in the middle of the wing and a dark mark on the costa (Fig. 18). All of the non-targets illustrated on Page 5 have a forewing costal fold in the male.

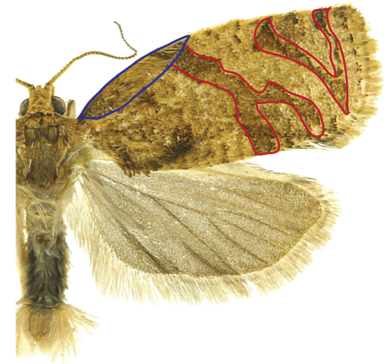


Fig. 8: *Adoxophyes orana* male; forewing costal fold is outlined in blue; wing markings are outlined in red.



Fig. 9: *Adoxophyes orana* male; forewing costal fold is outlined in blue; wing markings are outlined in red.



Fig. 10: *Adoxophyes orana* male; forewing costal fold is outlined in blue; wing markings are outlined in red.



Fig. 11: *Adoxophyes furcatana*.



Fig. 12: *Adoxophyes furcatana*.



Fig. 13: *Adoxophyes furcatana*.



Fig. 14: *Adoxophyes negundana*.



Fig. 15: *Adoxophyes negundana*.



Fig. 16: *Adoxophyes negundana*.



Fig. 17: *Choristoneura rosaceana*.



Fig. 18: *Choristoneura rosaceana*.



Fig. 19: *Clepsis virescens*.



Fig. 20: *Clepsis virescens*.

Suspect *A. orana* specimens (tortricids with a forewing costal fold and wing pattern or coloration similar to the specimens in Figs. 1-2, 4-5, and 8-10) should be sent forward for identification. Specimens must be labeled and carefully packed to avoid damage during shipping.

Final species-level identification must be performed by a specialist using genitalic characters. Ensure that all specimens forwarded for identification have intact abdomens; if the abdomen has been separated from the specimen, store it in a gelatin capsule on the same pin as the specimen.

## Key to Sort and Screen *Adoxophyes orana* Suspects in the United States

1. Moths approximately 7-14 mm long; overall bell-shape is typical for a tortricid (Fig. 3); and forewings are a shade of brown as in Fig. 4 ..... 2
- 1'. Moths larger or smaller than 7-14 mm long; overall shape not typically tortricid; or forewing color not a shade of brown ..... Not *A. orana*
2. Abdominal or thoracic tympana absent; antennae simple; labial palpi projecting forward; proboscis not scaled; and chaetosemata present ..... 3
- 2'. Abdominal or thoracic tympana present; antennae pectinae; labial palpi upcurved; proboscis scaled; or chaetosemata absent..... Not *A. orana*
3. Forewing costal fold present; and forewing pattern with “h V” markings or similar to those in Figs. 1-2, 4-5, 8-10 ..... ***A. orana suspect***
- 3'. Forewing costal fold absent; or forewing pattern drastically different than those illustrated in Figs. 1-2, 4-5, 9-10..... Not *A. orana*

## Citation

Gilligan, T. M. and S. C. Passoa. 2014. Screening aid: Summer fruit tortrix, *Adoxophyes orana* (Fischer von Röslerstamm). Identification Technology Program (ITP), USDA-APHIS-PPQ-S&T, Fort Collins, CO. 6 pp.

## References for more information on *A. orana* and non-targets

Gilligan, T. M., D. J. Wright and L. D. Gibson. 2008. Olethreutine moths of the midwestern United States, an identification guide. Ohio Biological Survey, Columbus, Ohio. 334 pp.

Gilligan, T. M. and M. E. Epstein. 2012. TortAI, Tortricids of Agricultural Importance to the United States (Lepidoptera: Tortricidae). Identification Technology Program (ITP), USDA-APHIS-PPQ-S&T, Fort Collins, CO. (<http://idtools.org/id/leps/tortai>).

Moth Photographers Group. Mississippi State U. (<http://mothphotographersgroup.msstate.edu/Plates.shtml>)

Powell, J. A. and P. A. Opler. 2009. Moths of western North America. University of California Press, Berkeley. 369 pp.

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