

Hanna R. Royals¹, Todd M. Gilligan¹ and Steven C. Passoa²

1) Identification Technology Program (ITP) / Colorado State University, USDA-APHIS-PPQ-Science & Technology (S&T), 2301 Research Boulevard, Suite 108, Fort Collins, Colorado 80526 U.S.A. (Emails: Hanna.H.Royals@aphis.usda.gov; Todd.M.Gilligan@aphis.usda.gov)
2) USDA-APHIS-PPQ, USDA-FS Northern Forest Research Station and Ohio State University, 1315 Kinnear Road, Columbus, Ohio 43212 U.S.A. (Email: Steven.C.Passoa@aphis.usda.gov)

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The avocado seed moth, *Stenoma catenifer* is one of the most important moth pests in avocado-growing regions of the world. Larvae feed on fruit flesh and burrow into the seed, producing large amounts of frass and causing the fruits to drop from the tree prematurely. Larval damage renders the fruits unfit for commercial sale, leading to significant economic losses. The avocado seed moth has only been recorded as feeding on members of the Lauraceae family, with *Persea americana* (avocado) as the major host and other secondary hosts: *P. schiedeana* (coyo), wild *Persea* spp., and *Beilschmedia* spp. California accounts for the majority of avocado production in the U.S., followed by Florida and Hawaii.

Stenoma catenifer is a small moth with few distinguishing features as an adult. While higher taxonomy has changed over the years, the most recent literature places the avocado seed moth in the Depressariidae, a large and variable family with species worldwide. *Stenoma catenifer* forewings are tan in color with numerous black spots. The defining feature of the forewing pattern is an outline of black dots somewhat resembling a “C” at the distal end of the wing (Figs. 4-6). Hindwings are a uniform lighter tan than the forewings. The large labial palpi of the avocado seed moth have dark-brown/black scaling at the basal end of segment 2 that contrasts with the overall light coloration of the moth (Fig. 7). Adult females are generally several millimeters larger than males, although coloration is consistent between sexes.

This aid is designed to assist in the sorting and screening of *S. catenifer* suspect adults collected from CAPS pheromone traps in the continental United States. It covers basic sorting of traps and first and second level screening, all based on morphological characters. Basic knowledge of Lepidoptera morphology is necessary to screen for *S. catenifer* suspects.



Fig. 1. Dorsal (top) and ventral (bottom) views of 5th instar larva of *S. catenifer*. (photo by Mark Hoddle, University of California Riverside)

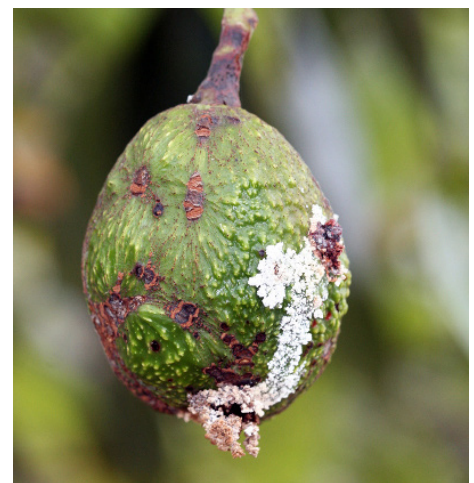


Fig. 2. Larval damage on avocado fruit. (photo by Mark Hoddle, University of California Riverside)

Sorting

Avocado Seed Moth *Stenoma catenifer* Walsingham

Stenoma catenifer 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 have a forewing length of 8.0-15.0 mm (0.3-0.6 inches).
- 2) Moths have an overall shape that is similar to the outline depicted in Fig. 3, but be aware that moths sometimes do not die in a natural position when captured in traps.
- 3) Moth forewings are yellowish-tan in color and may have dark spots (Figs. 4-7,10).

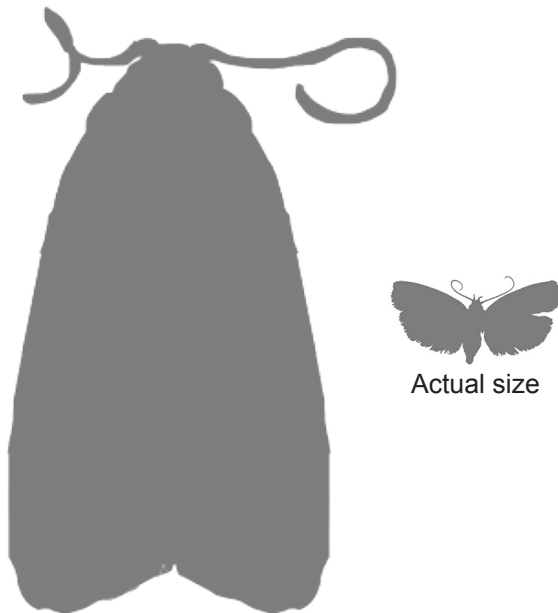


Fig. 3. Resting posture of adult.



Fig. 4. Adult male



Fig. 5. Adult male



Fig. 6. Adult female

(Wing patterns of adult *S. catenifer* are consistent between individuals and sex)

Level 1 Screening

Avocado Seed Moth *Stenoma catenifer* Walsingham

Commonly encountered North American non-targets for *S. catenifer* include other representatives from the family Depressariidae or the superfamily Gelechioidea. Moths that meet the sorting requirements should be screened for suspect gelechioids. Level 1 Screening is difficult for small moths 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 moths in traps should not be manipulated or removed for screening unless expertise is available.

Gelechioid moths, including the Depressariidae 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 are well developed and curve upwards over the head. (Fig. 7). Some families have labial palpi that project forwards - these are not gelechioids.
- 4) Maxillary palpi are small and inconspicuous. Maxillary palpi are large and conspicuous in some commonly captured pyraloid species.
- 5) Proboscis (tongue) is scaled (Fig. 7). Members of the Tortricidae have an unscaled proboscis.

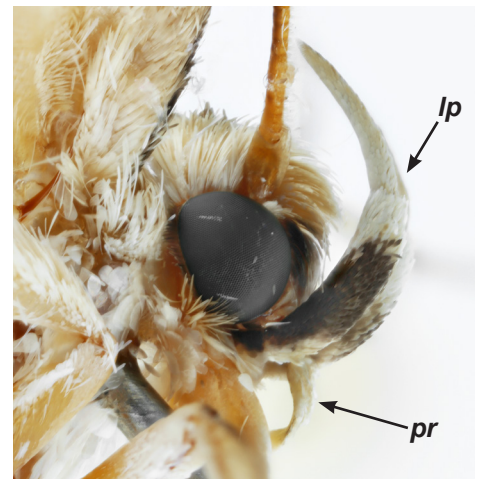


Fig. 7. Upturned labial palpi (lp) and scaled proboscis (pr) are typical of the superfamily Gelechioidea.

Adult 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. 8. 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.

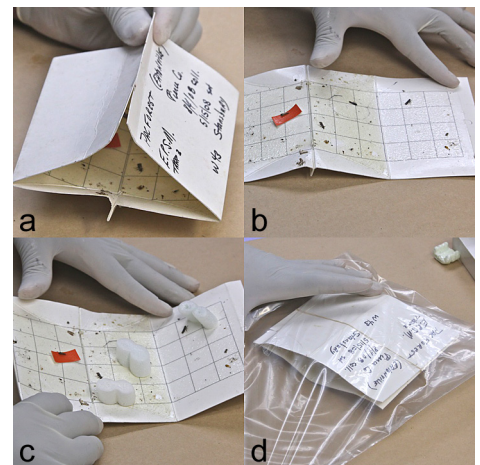


Fig. 8: Recommended packing method for shipment of sticky traps: a & b) open and unfold trap; c) place 2-3 packing peanuts in areas of trap with no moths; d) fold trap, secure with rubber band, and place in plastic bag (Photos by E. LaGasa, WSDA).

Suspect gelechioids should be cleaned to identify suspect *S. catenifer* 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 forewing pattern and mouthparts. While visual comparison should suffice to properly identify *S. catenifer*, inspection of dissected genitalia by a specialist can be used for more accurate species-level identification. Confusion is most likely to occur with other moths in the Depressariidae.

Forewing Pattern

Forewings have a light-yellow or tan coloration with many dark spots throughout. These spots at the distal end of the wing form a rough outline of a “C” shape (Fig. 9). These characters are consistent between individuals and sexes.

Mouthparts

The most obvious character of gelechioids are the large 3-segmented labial palps (lp) that curve upwards over the head. In *S. catenifer* the palpi have dark scaling on the outside of the second segment. Also present are small maxillary palpi (mp) and a scaled proboscis (pr) (Fig. 10).



Fig. 9. Forewing of adult male showing characteristic “C” shape formed by dark spots.

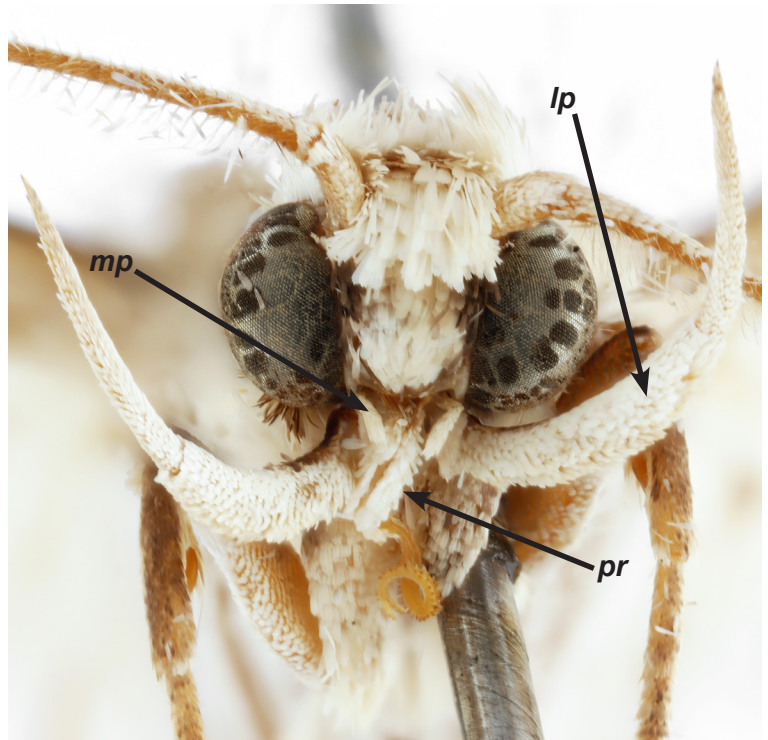


Fig. 10. Anterior view of head showing mouthparts typical of *S. catenifer*.



Fig. 11. *Agonopterix canadensis*



Fig. 12. *Agonopterix canadensis*



Fig. 13. *Agonopterix costimacula*



Fig. 14. *Agonopterix pulvipennella*



Fig. 15. *Agonopterix robiniella*



Fig. 16. *Agonopterix robiniella*



Fig. 17. *Antaeotricha unipunctella*



Fig. 18. *Antaeotricha unipunctella*



Fig. 19. *Antaeotricha osseella*



Fig. 20. *Antaeotricha osseella*



Fig. 21. *Gonioterma mistrella*



Fig. 22. *Gonioterma mistrella*

A sampling of possible North American non-targets. Because of a lack of sampling data for the U.S., the exact non-targets that would be attracted to the *S. catenifer* lure are unknown, and none of the above species have been verified to be found in *S. catenifer* traps. The most common non-targets from *S. catenifer* surveys in other countries are species of *Antaeotricha* (Figs. 17-20). Many of the *Antaeotricha* present in the U.S. can be distinguished from *S. catenifer* by their bright white wings with gray and black markings that resemble bird droppings.

Key to Sort and Screen *Stenoma catenifer* Suspects in the United States

1. Moth forewings measure approximately 8-15 mm long; overall shape typical for a gelechioid (Fig. 3); forewings tan with black spots..... 2
- 1'. Moth forewings larger or smaller than 8-15 mm long; overall shape not typically gelechioid; or forewing color not tan with black spots.....Not *S. catenifer*
2. Abdominal or thoracic tympana absent; antennae simple; labial palpi large and curved up over head; and proboscis scaled as in Fig. 10 3
- 2'. Abdominal or thoracic tympana present; antennae pectinae; labial palpi straight or facing forward; or proboscis unscaledNot *S. catenifer*
3. Dark shading present on second segment of labial palpi; dark spots at the end of forewings create an outline of a “C” shape; color and markings similar to those illustrated in Figs. 4-6, 9..... ***S. catenifer* suspect**
- 3'. No dark shading on labial palpi; dark spots at the end of forewings absent or not as an outline of a “C” shape; or forewing pattern drastically different than those illustrated in Figs. 4-6, 9.....Not *S. catenifer*

Citation

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References for more information on *S. catenifer*

Castillo, A., L. Cruz-Lopez, and J. Gómez. 2012. Moth species captured with the sex pheromone of *Stenoma catenifer* (Lepidoptera: Elasmobranchidae) in avocado plantations of southern Mexico. Florida Entomologist 95: 1111-1116.

Heikkilä, M., Mutanen, M., Kekkonen, M. and Kaila, L. 2014. Morphology reinforces proposed molecular phylogenetic affinities: a revised classification for Gelechioidea (Lepidoptera). Cladistics 30: 563-589.

Hoddle, M. Applied Biological Control Research: The Avocado Seed Moth *Stenoma catenifer*. University of California Riverside. <http://biocontrol.ucr.edu/stenoma/stenoma.html>

Molet, T. and L. D. Jackson. 2016. CPHST Pest Datasheet for *Stenoma catenifer*. USDA-APHIS-PPQ-CPHST.

Acknowledgments

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