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The cherry bark tortrix (CBT), *Enarmonia formosana* (Scopoli), is a minor pest in Europe that has become established in the Pacific Northwest of North America. It first appeared in British Columbia in 1990, rapidly spreading to neighboring Washington by 1991, and also now to Oregon. The larva feed on a wide variety of fruit trees. While CBT prefers those in *Prunus*, especially cherry, any woody shrub or tree in the Rosaceae family is at risk of infestation. Damage from larvae depends on the intensity of the infestation and can take years to kill a host plant, but feeding and other damage by larvae can provide the opportunity for secondary bacterial and fungal pathogen entry. The widespread presence of appropriate host plants in the northwestern U.S. could aid in the rapid spread of this moth. While there are two observed peaks of flying adults in the late summer, there is apparently only one annual generation. Various larval instars overwinter giving an appearance of subsequent multiple generations.



Fig. 1. *Enarmonia formosana* adult in resting position (Photo by Csaba Szaboxy, Bugwood.org: 5429104).

Enarmonia formosana is a member of the Tortricidae, the leaf-roller moths, one of the largest families of microlepidoptera with over 10,000 described species. The CBT resembles other species of the subfamily Olethreutinae but can be distinguished by careful inspection of the wing pattern and by the unique structures of the male and female genitalia. There is little sexual dimorphism in general habitus between male and female CBT. Forewing length is between 7.0-9.0 mm and forewing pattern consists of a black ground-color and silver and yellow markings with three conspicuous parallel black bars that form the “eye spot” near the end of the wings (Fig. 10). Hindwings are mostly dusky-gray to black. While many olethreutine species lack a defined eye spot, that of *E. formosana* is more well-defined and larger than in several common non-target species such as *Episimus argutus* (Fig. 10c).



Fig. 2. Curled bark and frass tubes left by feeding larvae (Photo by Todd Morray, WSU:Skamania County Extension).

This aid is designed to assist in the sorting and screening *CBT* 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 adult morphology is necessary to screen for *CBT* suspects.

Sorting

Cherry Bark Tortrix *Enarmonia formosana* (Scopoli)

Enarmonia formosana 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 7.0 - 9.0 mm (0.25-0.35 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 black with intricate silver-grey and yellow markings (Figs. 4-7,10).

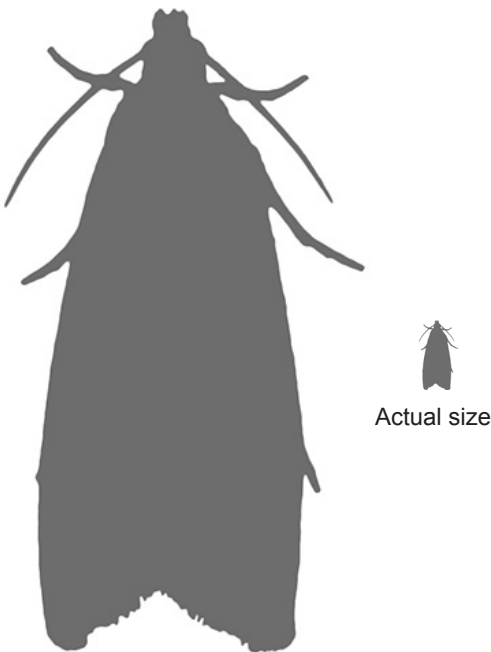


Fig. 3. General shape of resting adult. Dorsal view.



Fig. 4. Adult male



Fig. 5. Adult male



Fig. 6. Adult female



Fig. 7. Adult female

Figs. 4-7. Wing patterns of adult *E. formosana* are consistent between individuals and sex.

Level 1 Screening

Cherry Bark Tortrix *Enarmonia formosana* (Scopoli)

Commonly encountered North American non-targets for *CBT* include representatives from a number of families in addition to Tortricidae including: Gelechiidae, Geometridae, Lymantriidae, Oecophoridae, and Yponomeutidae. 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 (comb-like).
- 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. 9. 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 decaying 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 seriously damage or fragment specimens – making identification difficult or impossible.



Fig. 8: 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).

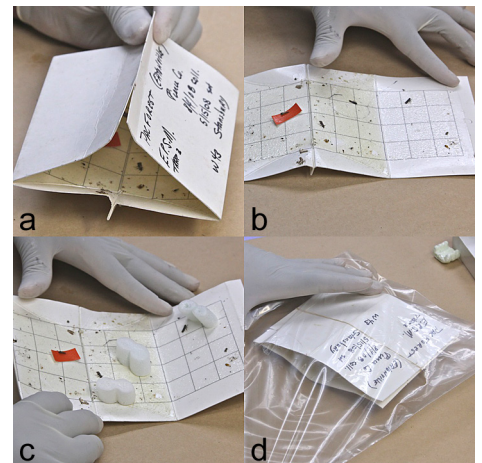


Fig. 9: Recommended packing method for shipment of sticky traps: a & b) open and unfold trap; c) place 2-3 packing peanuts in areas of trap with no moths; d) fold trap, secure with rubber band, and place in plastic bag (Photos by E. LaGasa, WSDA).

Suspect tortricids should be cleaned to identify suspect *E. formosana* 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 almost exclusively on wing pattern. While visual comparison should suffice to properly identify *E. formosana*, inspection of dissected genitalia by a specialist can be used for more accurate species-level identification. Confusion is most likely to occur with *Episimus argutanus*, one of the more common non-targets with a wing pattern similar to that of *E. formosana*, having a well-defined forewing eye spot.

Forewing Pattern

Forewings have a dark brown to black ground color and are intricately marked with yellow-orange and silver-grey patterning. A distinguishing feature of CBT is the conspicuous eye-spot, or ocellus, anterior to the tornus, about 1/2 as wide as the termen, with an outer ring that is golden-brown, a silver inner ring, and a center containing alternating brown or black and yellow-orange longitudinal dashes (Figs. 10a,b). Costal strigulae are well-defined and consist of shiny white comma-shaped streaks separated by black marks. The eye spot in *E. argutanus* is not as well-defined, with smaller black dashes (Fig. 10c).

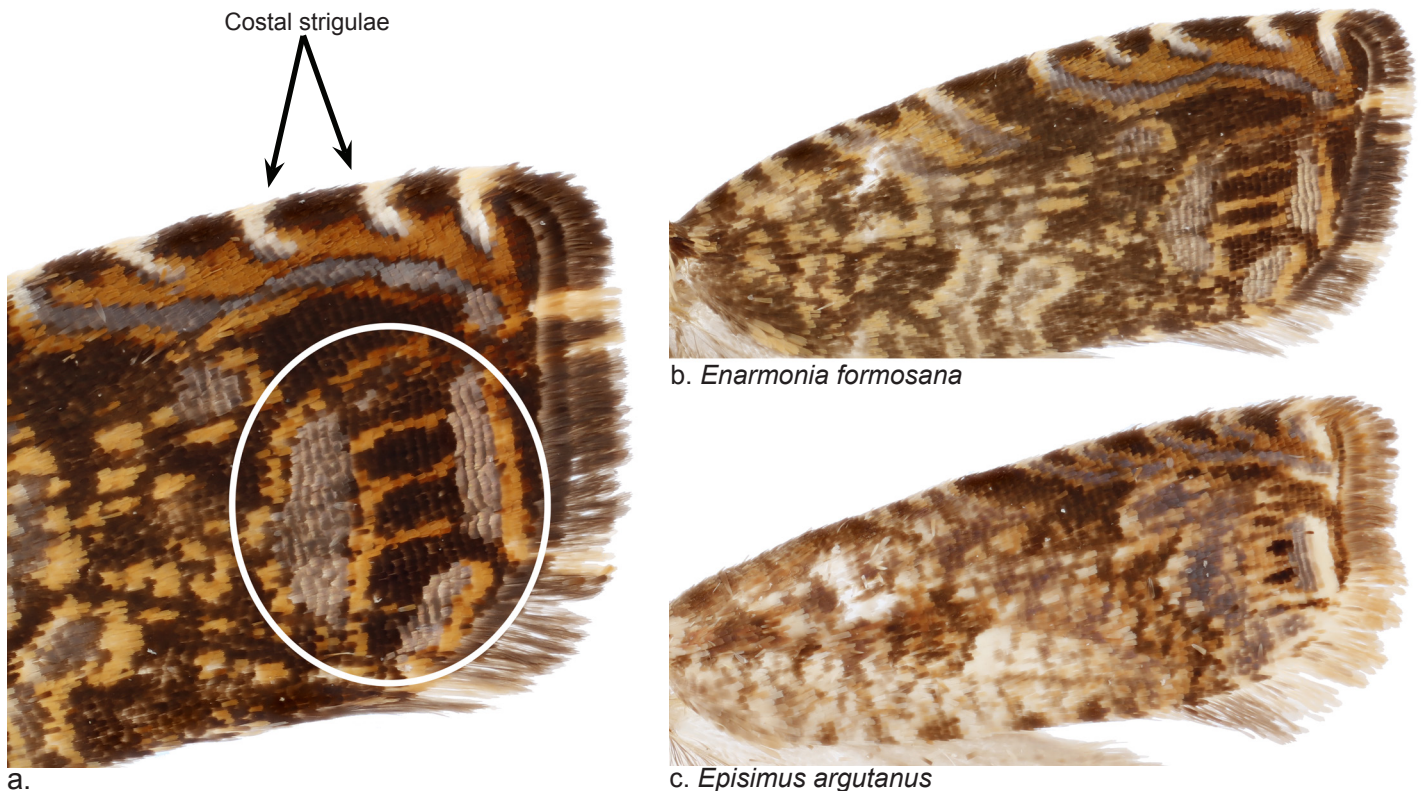


Fig. 10. a) Costal strigulae and ocellus on forewing of adult *E. formosana*. b) Forewing patterns of *E. formosana* and c) *E. argutanus*.



Fig. 11. *Episimus argutanus**



Fig. 12. *Ancyliis ocellana**



Fig. 13. *Archips fuscopreanus**



Fig. 14. *Acleris holmiana**



Fig. 15. *Olethreutes auricapitana*



Fig. 16. *Olethreutes astrologana*



Fig. 17. *Notocelia rosaecolana**



Fig. 18. *Grapholita prunivora**



Fig. 19. *Eucosmomorpha nearctica*



Fig. 20. *Retinia picicolana**



Fig. 21. *Endothenia hebesana**



Fig. 22. *Choristoneura rosaceana**



Fig. 23. *Argyrotaenia franciscana**



Fig. 24. *Acleris variegana**



Fig. 25. *Grapholita lunatana**



Fig. 26. *Cacoecimorpha pronubana**

A sampling of North American tortricid non-targets (Figs. 11-26). Names with an * denote species that were collected in CBT sticky traps in previous surveys. The most common tortricid non-target is *Episimus argutanus* (Fig. 11). CBT traps also capture other families of moths; see page 3 for instructions on screening tortricid suspects. Non-target data was obtained from Washington State Department of Agriculture CBT trap records (1991-2011) for the Pacific Northwest and Passoa (1991) for the Northeast.

Key to Sort and Screen *Enarmonia formosana* Suspects in the United States

1. Moth forewings measure approximately 7-9 mm long; overall shape typical tortricid-like (Fig. 3); and forewings mottled brown-black and yellow..... 2
- 1'. Moth forewings are larger or smaller than 7-9 mm long; overall shape not typically tortricid; or forewing color not mottled brown-black and yellow Not *E. formosana*
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 *E. formosana*
3. Forewing costal strigulae and ocular spot well-defined and markings and similar to those in Figs. 4-7, 10a, b ***E. formosana suspect***
- 3'. Forewing costal strigulae and ocular spot absent or poorly-defined; or forewing pattern drastically different than illustrated in Figs. 4-7, 10a, b..... Not *E. formosana*

Citation

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References for more information on *E. formosana* and non-targets

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