Light Brown Apple Moth (LBAM)

Epiphyas postvittana (Walker)

Screening and Identification Aid

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The light brown apple moth (LBAM) is a member of the Tortricidae, a large family of moths (Lepidoptera) that includes many pest species. In North America there are approximately 1200 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. Although wing pattern can be used to identify some tortricids, the forewings of LBAM are extremely variable and wing pattern should not be used for identification.

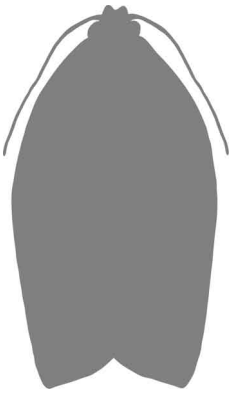

Figure 1: Outline of a light brown apple moth in resting position.

This aid is designed to assist in the screening and identification of LBAM adults collected from sticky traps in the United States. It covers basic sorting of traps, first and second level screening, and identification based on morphological characters. Due to the extreme variability of LBAM adults, prior knowledge of dissection techniques and Lepidopteran morphology may be necessary to identify suspect LBAM specimens.

Figure 2: Examples of LBAM adults caught in a sticky trap.

Sorting

Traps should be initially sorted based on 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:

1) moths are approximately 7-12 mm long (forewing length) (Fig. 2 & 3)

2) moths caught in sticky traps have yellowish-brown to dark brown appearance (Fig. 2)

3) moths caught in sticky traps will generally have standard appearance similar to the outline shown in Fig. 1

Figure 3: Actual size (7-12 mm forewing length) of an LBAM adult.

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Level 1 Screening

Moths that meet the sorting requirements should be screened for suspect tortricids. Level 1 screening of individuals can be performed without a genitalic dissection and covers couplets 1-4 of the screening key (page 4). Tortricid moths can be identified by the following combination of characters:

1) Antennae simple, thread-like, and never pectinate (feathery).
2) Tympanum absent. Members of the Pyraloidea may appear similar but have a tympanum at the base of the abdomen.
3) Labial palpi pointed and project forward. Some families have labial palpi that curve upwards.
4) Maxillary palpi are very reduced and not visible in tortricids. Maxillary palpi may be visible under magnification in some commonly intercepted pyralid species.
4) Proboscis (tongue) unscaled. Members of the Gelechioidea and Pyraloidea have a scaled proboscis.
5) Chaetosema (patch of bristle-like setae) present above the compound eye. (Chaetosema may be difficult to see without a high-quality microscope.)

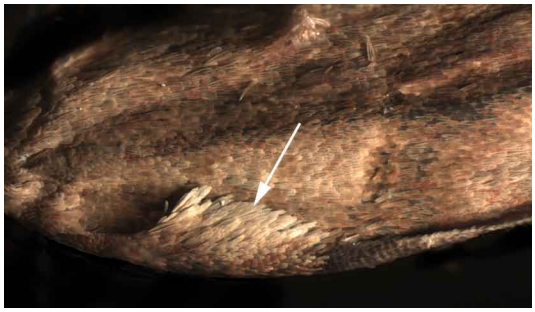

Figure 4: Costal fold on a male LBAM.

Figure 5: Suspect tortricid on a 2 x 2 cm card cut from a sticky trap and protected for storage or transport.

Moths meeting the above criteria should be further examined to determine if they are male or female. Males have a single frenulum bristle on the hindwing and a slit where the valves meet on the end of the abdomen. Females have multiple frenulum bristles on the hindwing and hairy ovipositor lobes on the end of the abdomen. If the specimen is determined to be a female tortricid it should be moved to level 2 screening. If the specimen is determined to be a male, the forewing should have a fold at the base of the costal margin (Figs. 4). Males lacking this costal fold can be discarded as not LBAM; males with a costal fold should be moved to level 2 screening. Both male and female LBAM have mottled hindwings (Fig. 6). This faint spider web-like reticulation should be visible in a majority of LBAM specimens; any specimens with mottled hindwings should be moved to level 2 screening.

Figures 6: Spread LBAM adult showing characteristic mottled hindwing.

Suspect tortricids may be sent to level 2 screening on individual 2 x 2 cm cards cut from the sticky trap. Cards can be safely transported in small jars or vials (Fig. 5) either singly or back-to-back to avoid damaging the specimens. If jars or vials are not available, pin the card to a foam bottom mailing box with several insect pins. Screeners that have more than two suspect LBAM adult specimens in a single trap should send the whole trap rather than cut out individual specimens if using a Centralized Identification Laboratory. Samples must be properly labeled with trap number, location, collection date, and any other information required by the LBAM National Survey Guidelines.

Level 2 Screening

Suspect tortricids should be cleaned and dissected to identify suspect LBAM specimens. Details on cleaning specimens caught in sticky traps can be found in the following article:

Miller, R. S., S. Passoa, R. D. Waltz & V. Mastro. 1993. Insect removal from sticky traps using a citrus oil solvent. Ent. News 104(4): 209-213.

Cleaned specimens should be pinned and the abdomen removed for dissection. The pinned specimen, and all appropriate data, should be retained as a voucher along with a label that associates the pinned specimen with the separated abdomen. Standard dissection procedures for Lepidoptera are outlined in Clarke (1951) and Robinson (1976). Dissected tortricids can be screened based on the following characters. Level 2 screening covers couplets 4-6 of the screening key (page 4).

Males

Male LBAM genitalia (Fig. 7) can be distinguished based on a combination of two characters:

1) Uncus spatulate (spoon-shaped) (Fig. 8). This character should not be used alone since several common non-target tortricids (*Choristoneura rosaceana* and many *Clepsis* species) have a similarly shaped uncus.

2) Valva with a membranous lobe on the apex (Fig. 9). This is the best diagnostic character for male LBAM, although the lobe may vary in size and may be difficult to see in some specimens. Questionable specimens should be sent forward for identification.

Females

Female LBAM are difficult to screen. LBAM has a long straight ductus bursae and a corpus bursae with a signum, but this combination is not unique. A common non-target in California, *Clepsis peritana* (garden tortrix), has a spiral ductus bursae; this character can often be seen by brushing scales off the abdomen while the specimen is in alcohol or a cleaning agent. Females with characters similar to those in Figs. 10-11 should be sent forward for identification.

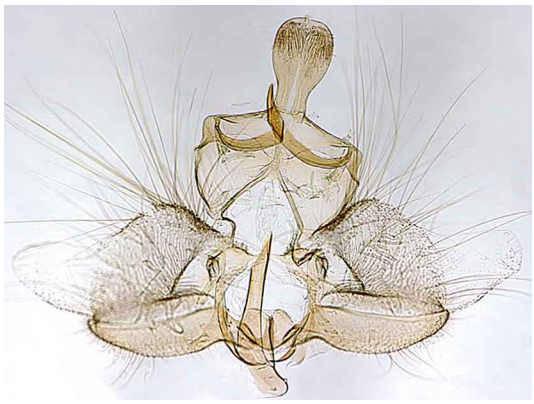

Figure 7: Complete male LBAM genitalia.

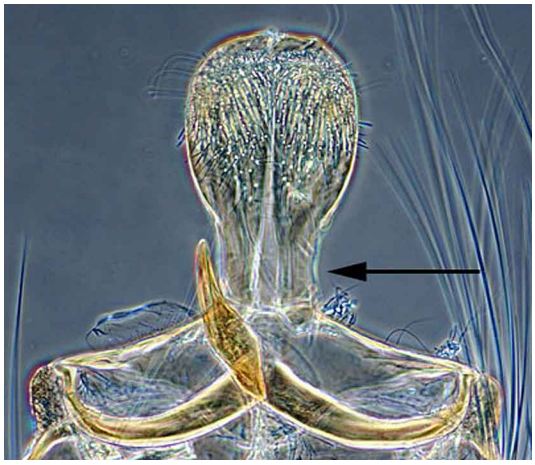

Figure 8: Male LBAM spatulate (spoon-shaped) uncus (phase contrast image).

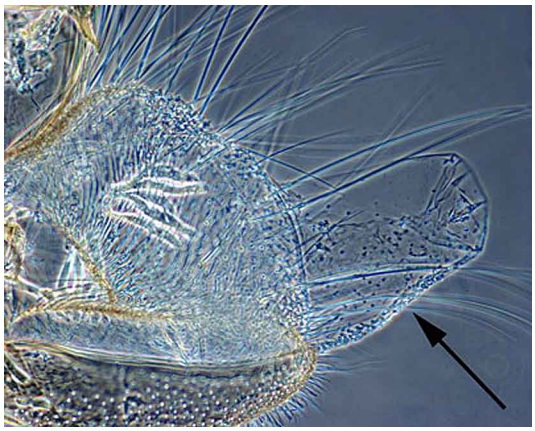

Figure 9: Membranous lobe on the apex of the male LBAM valva (phase contrast image)

Key to Screen LBAM Suspects in the United States

The following key covers both level 1 and 2 LBAM screening for suspect tortricids. Sticky traps normally capture only males moths, although California LBAM traps capture female tortricids more often than expected. Both sexes of moths are included along with notes to help the identifier with each couplet.

1. Abdominal or thoracic tympanum present; antenna pectinate; labial palpi upturned; proboscis scaled or absent; moths not about 7-12 mm long ..... **Not LBAM**

1'. Abdominal and thoracic tympanum absent; antenna simple; labial palpi pointed and projecting forward; proboscis not scaled; moths about 7-12 mm long **2**

2. Chaetosema absent..... **Not LBAM**

2'. Chaetosema present or condition unknown **3**

3. Males.....**4**

3'. Females **6**

4. Costal fold absent; uncus tubular ..... **Not LBAM**

4'. Costal fold present; uncus spatulate.....**5**

5. Membranous lobe from apex of valve absent ..... **Not LBAM**

5'. Membranous lobe from apex of valve present..... **LBAM Suspect**

6. Ductus bursae in a spiral; signum absent ..... **Not LBAM**

6'. Ductus bursae straight, never in a spiral; signum present **7**

7. Ductus bursae no more than 2-3 times as long as the corpus bursae and entire bursae 1/2 the length of the abdomen or less..... **Not LBAM**

7'. Ductus bursae 4-5 times as long as the corpus bursae and entire bursae (ductus + corpus bursae) at least 2/3 length of abdomen..... **LBAM Suspect**

Figure 10: Female LBAM papillae anales and sterigma.

Figure 11: Female LBAM hook-shaped signum in corpus bursae.

Notes: 1) In California, crambid moths in the genus *Achyra* are often captured. Based on previous surveys in the Eastern United States in the 1990's, LBAM traps have commonly captured a species of *Pyrausta*. Therefore it is particularly important to understand how to separate Crambidae from Tortricidae in any LBAM survey. **2)** If the chaetosema are clearly absent, this can be used to rule out LBAM. If chaetosema are present, or the user is unsure of this difficult character, it is best to proceed with LBAM as a possibility. **3)** Knowledge of separating males from females is required to effectively use the key. **4)** The costal fold is a sexual character in tortricids, found only in the males of some species, including LBAM. The uncus is spatulate (spoon-shaped) in the LBAM but also a few common non-target tortricids. **5)** It is best to send forward any male specimens with a membranous lobe on the valve. **6)** Female LBAM have a long straight ductus bursae and a corpus bursae with a signum, but this combination is not unique. A common non-target in California, *Clepsis peritana* (garden tortrix), has a spiral ductus bursae; this character can often be seen through the abdomen if the scales are brushed off while the specimen is in alcohol or a cleaning agent.

Identification

Male LBAM can be distinguished by the large membranous lobe extending laterally from the apex of the valve (Dugdale et al. 2005) (Fig. 9). In addition, the base of the uncus is only slightly narrowed (Fig. 8). Powell (1964) reports *Clepsis virescana* as having a weak membranous lobe on the apex of the valve; however, this lobe is much smaller than the lobe found in LBAM and *virescana* males do not have a costal fold. Dugdale et al. (2005) mentions the shape of the costal fold as a potential character, but similarity to other species (like *C. rosaceana*) limits its usefulness by non-specialists. Identification of LBAM based on female genitalia is difficult and best left to specialists. Instructions for submitting suspect LBAM specimens for identification are outlined in the LBAM National Survey Guidelines.

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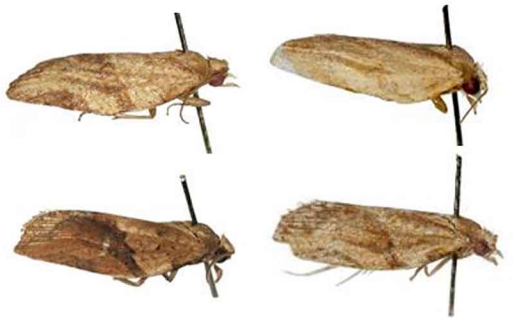
Figure 12: Dorsal view of wing pattern variation in LBAM adults.



M. O'Donnell & M. Epstein, CDFA

Figure 13: Lateral view of wing pattern variation in LBAM adults.

Figure 14: LBAM adult on sticky trap. Note partially visible mottled hindwing.

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