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TOOLS FOR IDENTIFYING THE LARVAE OF LEAFROLLERS

(LEPIDOPTERA: TORTRICIDAE)

FREQUENTLY INTERCEPTED AT U.S. PORTS OF ENTRY

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INTRODUCTION

Leafrollers (the family Tortricidae) are among the most commonly intercepted microlepidoptera larvae at U.S. ports-of-entry. They frequently infest fruit, nuts, seeds, flowers, leaves, and other parts of vascular plants, and they are encountered in personal baggage as well as in imported commodities. Unfortunately, the most widely available and useful key for APHIS/PPQ port inspectors/identifiers is the portion of Weisman's (1986) Lepidoptera key dedicated to this family. That key includes only 10 species, and the nomenclature is somewhat outdated.

Comprehensive treatments of tortricid larvae were developed by Swatschek (1958) for the European fauna and by MacKay (1959, 1962) for the Nearctic fauna. More recently, Brown (1983) summarized our knowledge of the North American tortricid larvae, providing keys to pest species arranged by host plant groupings (i.e., larvae on conifers, larvae on rosaceous plants, larvae on legumes). Horak and Brown (1991) provided general, brief descriptions of tortricid larvae, focusing on differences at the tribal level. While all of these contributions provide excellent information on the family and are important references, none is particularly useful for identifying the tortricid "fauna" that is encountered by inspectors at our ports.

The purpose of this paper is to provide three dichotomous keys: (1) a much expanded and updated version of the tortricid portion of the Weisman's key; (2) a key to Olethreutinae intercepted most frequently on *Castanea*; and (3) a refined translation of Swatschek's (1958) key to the genera of the tribe Archipini in Europe. The latter group represents the most frequently intercepted Tortricinae at U.S. ports. In addition, a table of the most common plant-tortricid

associations encountered at ports is provided.

Before attempting to use the keys and the table, it is important to make sure that you've correctly identified the larva to family. Tortricids share with many microlepidoptera the following: trisetose L group on the prothorax; L1 and L2 on a shared pinaculum on A2-A7; and crochets in a circle. Larvae of tortricids can be distinguished from other microlepidoptera by a combination of the following characters: (1) A8 with SD1 almost always anterad (sometimes slightly dorso- or ventroanterad) of the spiracle; (2) A9 with D2s almost always on a common dorsal pinaculum on A9; (3) A9 with D1 and SD1 present and in two distinct configurations: on the same or different pinacula; and (4) A10 frequently with an anal fork (lost secondarily in many Olethreutinae).

Deviations from the above can be found in the following. (1) Although SD1 is almost always anterad of spiracle on A8, it is anterodorsad in a few genera and almost precisely dorsad in several North American species of *Eucosma* on *Pinus*. (2) The D2s are almost always on a common dorsal pinaculum on A9; however, they are on separate pinacula in several species of *Cydia* in which the larva is extremely pale and the pinacula nearly without pigmentation. (3) In most Olethreutinae D1 and SD1 are on the same pinaculum, and in most Tortricinae they are on separate pinacula. (4) Microlepidoptera larvae with an anal fork are almost always Tortricidae (although the structure is lost in many Olethreutinae). One genus of Gelechiidae (i.e., *Anarsia*) has an anal fork that can be confused with that of a tortricid. This genus has significant gaps in the crochets on the prolegs (including the anal proleg) so that they do not form in a complete circle.

Because larvae are highly variable, many specimens will not key convincingly to a final

couplet. In these situations, either follow the “best fit” or return to the previous “convincing” couplet. Some larvae are asymmetrical from side-to-side, particularly in the number of setae. In these situations, the “higher number” is almost always the correct value. That is, on a larva that has a bisetose L-group on the right side of A9 and a trisetose L-group on the left side, consider the trisetose condition as “correct.”

Key to Tortricid Larvae

Frequently Intercepted at U.S. Ports-of-entry

1. D1 and SD1 on the same pinaculum on A9 (Fig. 1); anal fork present (Fig. 3) or absent 2

1.' D1 and SD1 on separate pinacula on A9 (Fig. 2); anal fork almost always present.....

.....Group 1 (“Tortricinae” Type)

2. L pinaculum on T1 enlarged, extending beneath and beyond (posterad of) spiracle (Fig. 4).....

.....Group 2 (“*Cryptophlebia*” Type)

2.' L pinaculum on T1 simple or variously modified, but not extending beneath spiracle (Fig. 5).3

3. Anal fork absent.....Group 3 (“*Cydia*” type)

3'. Anal fork present..... Group 4 (“Olethreutinae” type)

Group 1. Tortricinae Type

1.’ SV group on A1,2,7,8,9 usually 3:3:2:2:2 or 2:3:2:2:2 ..... Tortricini (*Acleris* or *Tortrix*)

1. SV group on A1,2,7,8,9 usually 3:3:3:2:2 2

2. Usually <25 crochets; tiny SD2 pinaculum frequently separate from the larger SD1 pinaculum

.....

..... Cnephasiini (mostly *Cnephasia* spp.)

2. Usually >25 crochets; tiny SD2 pinaculum fused with the larger SD1 pinaculum on A1-7

(often difficult to see) ..... 3 (mostly Archipini and Sparganothini)

3. Distance between V setae on A9 usually greater than 1.25 the distance between V setae on A8.

.....4

3.’ Distance between V setae on A9 usually less than 1.25 the distance between V setae on A8 or

A7 (usually about the same distance) 7

4. Europe; L1 setae of anal shield moderate in length.....5

4.’ New World; L1 setae of anal shield extremely long 6

5. Prothoracic shield “two-toned,” pale orange-brown; on lilac (*Syringa*) .....

.....*Adoxophyes orana* (Fischer von Röslerstamm)

5.’ Prothoracic shield yellow or pale yellow, with a large, dark, irregular blotch at posterior

angle, and head with short dark bar on cheek (larva pale; pinacula moderately large; S3 closer to

S2 than to S1; Vs on A9 about 1.5 as far a part as those on A8 only on last instar; crochets 53-58

on abdominal prolegs); on cut flowers and fruit (including *Capsicum*) (Europe).....

.....*Cacoecimorpha pronubana* (Hübner)

6. Prothoracic shield usually uniform dark in color; L and SV pinacula on T1 dark brown or

black, strongly sclerotized; dorsal pinacula on A1-8 usually somewhat elongate-oval; Vs on A9 usually about 2 times as far apart as those on A8; on various hosts (Neotropics) .... *Platynota* spp.

6.’ Prothoracic shield pale with distinct narrow band along ventral edge, continuing anterad on head (genal band) towards stemmatal region; L and SV pinacula on T1 brownish, somewhat sclerotized; dorsal pinacula on A1-8 usually somewhat rounded; Vs on A9 1.25-1.80 times as far apart as those on A8; frequently on *Rubus*, *Crataegus*, *Limonium*, cut flowers (mostly Central America) ....*Amorbia* spp.

7. Spiracles on A1-7 about the same size as the base (point of insertion) of setae SD1 8

7.’ Spiracles on A1-7 larger than the base (point of insertion) of setae SD1 9

8. Head pale yellow with variable brown or light brown pattern; prothoracic shield pale yellow with several darker marks; on lilac (*Syringa*) (Europe).....*Adoxoyphes orana*

8.’ Head mostly dark brown with limited mottling; prothoracic shield variable; on *Capsicum* and cut flowers (Netherlands)..... *Clepsis spectrana* (Treitschke)

8.” Prothoracic shield uniform pale yellow, with small dark spot at genal angle of head; crochets triordinal, 57-60 on abdominal prolegs; Vs on A9 0.9-1.0 times as far apart as those on A8; on *Citrus*, *Fragaria*, *Malus*, cut flowers, and others (Australia, New Zealand) .... *Epiphyas postvittana* (Walker)

9. Prothoracic shield yellow with brown lateral margins; spiracle slightly larger than base of setae; crochets triordinal, 44-48 on abdominal prolegs; Vs on A9 ca. same distance apart as those on A8 (S2 closer to S3 than to S1); on *Ornithogalum* (South Africa)*Epichorista acerbella* (Walker)

9.’ Prothoracic shield usually uniform dark brown, various hosts (crochets on abdomoinal

prolegs, triordinal, 45-50; larva tan, integument granular) (Europe, mostly Netherlands) .....

.....Archipini (poss. *Clepsis* sp.)

Group 2. *Cryptophlebia* Type

1. Anal fork present 2

1.' Anal fork absent 4

2. L-group on A9 bisetose (both setae on same pinaculum); pinacula usually moderate to large; Vs on A9 much further apart than those on A8 (mostly New World).....3

2.' L-group on A9 usually trisetose (all setae usually on same pinaulum); pinacula moderate; Vs on A9 slightly further apart than those on A8 (mostly Africa).....

.....*Thaumatotibia leucotreta* (Meyrick) complex

3. SV-group usually 2:2:2:2:1; pinacula large; on *Capsicum* (Mexico, Central America) .....

.....*Lorita scarificata* (Meyrick)

3.' SV group 3:3:2:2:2(1); pinacula moderate to large; on *Opuntia*, *Pithecellobium*, Asteraceae ....

.....many Cochylini

4. At least one (usually more) dorsal pinacula with small incision, notch, or clear spot; Vs on A9 usually 1.5-2.0 times as far apart as Vs on A8 6

4.' Dorsal pinacula usually without small incision, notch, or clear spot; Vs on A9 variable from 1.0-2.0 as far apart as Vs on A8.....5

5. SV-group on A1,2,7,8,9 usually 3:3:3:2:2; L-group on A9 trisetose, all setae usually on same pinaculum; abdominal prolegs with 45-48 crochets; on litchi, longan, macadamia, and others (Asia, Hawaii)..... *Cryptophlebia ombrodelta* (Lower)

5.' SV-group on A1,2,7,8,9 usually 3:3:2:2(1):1; L-group on A9 uni-, bi- or trisetose; abdominal prolegs with 20-30 crochets, on legumes (South and Central America) . *Cydia fabivora* (Meyrick)

6. SV-group usually 3:3:3(2):2:1; L-group on A9 usually trisetose; abdominal prolegs with 50-60 crochets (South and Central America, Caribbean) ..... *Gymnandrosoma aurantianum* (Lima)

6.' SV-group usually 3:3:3:1:1; L-group on A9 usually bisetose (Asia) .... *Cryptophlebia illepida* (Butler)

Group 3. *Cydia* Type

1. D1s, D2s, and SD1s on A9 all on same enlarged (ill-defined) pinaculum (integument conspicuously spiny; crochets on abdominal prolegs 16-19); on *Annona* and *Mammae* (Mexico, Central America, Caribbean) ..... *Talponia batesi* Heinrich

1.' D2s on pinacula separate from D1 and SD2 (D2 shared pinaculum sometimes very weakly developed).....2

2. On *Castanea* .....go to key of *Castanea*-feeding Olethreutinae

2.' On various other hosts 3

3. On *Aracauria* from South America (Brazil, Argentina, and Chile) (body pinkish with medium large, pale brown pinacula; prothoracic shield light brown, anal shield dark brown; L pinaculum of T1 rather large, **sometimes notched distally**; Ls on A9 sometimes all on the same pinacula; SV-group 3:3:2(3):1(2):1; crochets 34-37)..... *Cydia araucariae* Pastrana

3.' On various hosts (including *Carya, Prunus, Malus*).....4

4. On *Saccharum officinarum* (from Asia) ..... *Tetramoera schistaceana* (Snellen)

4' On other hosts (mostly Rosaceae from Europe, South America, Asia) 5

5. D2s on A9 always on same pinaculum; SV group usually 3:3:2:2:1; usually (but not always) with distinct pattern on anal and prothoracic shields; **A9 with ventralmost L seta on a separate pinaculum**; 30-35 crochets (cosmopolitan) .....*Cydia pomonella* (Linnaeus)

5.’ D2s on A9 on separate or same pinacula; SV group variable; prothoracic shield with “*pomonella*” pattern usually faint or lacking (variably developed); fewer than 25 crochets 6

6. On spruce cones (*Picea*), from Europe ..... *Cydia strobilella* (Linnaeus)

6.’ On *Malus*, from Europe (prothoracic shield moderately uniformly dark; pinacula small and dark) ..... *Cydia* sp.

6.” On Malus, from Europe (prothoracic and anal shields with typical *Cydia* pattern) ....*Cydia pomonella* (Linnaeus)

6.”’ On *Castanea*, from Europe ..... go to key of *Castanea*-feeding Olethreutinae

Group 4. Olethreutinae Type

1. SV group on A1,2,7,8,9 usually 3:3:3:2:2 ..... (mostly Tortricinae) 2

1.’ SV group on A1,2,7,8,9 usually less than 3:3:3:2:2 ..... (mostly Olethreutinae) 7

2. From Europe, Asia, and Africa 3

2.’ From New Zealand or South America.....4

2.” From Mexico (pale color - internal feeder)..... prob. Olethreutinae

3. L-group on A9 bisetose .....Cnephasiini (probably *Cnephasia* spp.)

3'. L-group on A9 trisetose 4

4. On *Vitis* (Europe, Asia, and Africa); integument not particularly spiny (SV group 3:3:3:2:2(1); L-group fairly horizontal on T1; distance between Vs on A9 ca. 2 times distance between Vs on

A8; crochets biordinal) .....*Lobesia botrana* (Denis & Schiffermüller)

4.’ On *Quercus* (from Europe); integument spiny ..... *Tortrix viridana* (Linnaeus)

5. From New Zealand; on *Malus*, *Fragaria*, *Prunus* 6

5.’ From Chile and Argentina; on *Vitis*, *Citrus*, *Prunus*, kiwi, and other fruits (spiracle on A8 relatively large; spiracles on A1-7 larger than base of SD1 seta).....*Proeulia* spp.

6. Prothoracic shield pale, without fuscous margins .....*Planotortrix excessana* (Walker)

6.’ Prothoracic shield pale, with fuscous lateral and posterior margins ....*Ctenopseustis obliquana* (Walker)

7. L group bisetose on A9.....a few Cochylini (some Cnephasiini, see couplet 10)

7.' L group trisetose on A9.....8

8. Pinacula large and brown; prothoracic and anal shields distinctly patterned; on *Castanea* (Europe) ..... *Pammene fasciana* (Linnaeus)

8.’ Pinacula small or moderate, pale or tan; prothoracic and anal shields with or without distinct pattern; various hosts 9

9. Head with black band extending from postgenal suture to seta 02 (SV-group 3:3:2:2:2(1); crochets biordinal, 31-36; whitish with moderately small, pale tan pinacula; integument with conspicuous short spines); primarily on Fabaceae (Central and South America, Caribbean)..... .....*Crocidosema aporema* (Walsingham)

9.’ Head usually without genal band extending to 02 (prothorax usually with SD2 directly caudad of SD1, L setae usually in a more triangular group) 10

10. Crochets few (16-20), uniordinal; SV-group 2:3:2:1:1 (L group in horizontal line on T1; distance between Vs on A9 ca. 2-3 times distance between Vs on A7-8); on various hosts (Europe) ....*Cnephasia longana* (Haworth)

10.’ Crochets numerous (>25), uniordinal or biordinal; SV group variable, usually 3:3:2:2:2 or 3:3:2:2:1; on Rosaceae and Ericaceae (worldwide).....probably *Grapholita* sp.

Key to Larvae of *Castanea*-Feeding Olethreutinae

1. From Europe (primarily Portugal, Spain, Italy, Greece) 2

1.’ From Asia (primarily Korea, Japan, China) 4

2. Anal fork present (Fig. 2), pinacula extremely large, dark.....*Pammene fasciana* (Linnaeus)

2.’ Anal fork absent, pinacula usually moderately small.....3

3. Body pinkish or whitish, pinacula mostly concolorous with body; distance between Vs on A9 slightly to conspicuously greater than that between Vs on A8 (Fig. 3b); number of crochets on most prolegs 19 or fewer (variable form proleg to proleg).....*Cydia splendana* (Hübner)

3.’ Body reddish white, pinacula red; distance between Vs on A9 usually about the same as that between Vs on A8 (Fig. 3a); number of crochets on most prolegs 18-24 (variable from proleg to proleg)..... *Cydia fagiglandana* (Zeller)

4. SV-group on A9 bisetose (Fig. 4a); head dark brown, often with darker maculations; crochets biordinal.....*Eucoenogenes aestuosa* (Meyrick)

4.’ SV-group on A9 unisetose (Fig. 4b), head yellowish brown, without maculations; crochets mostly uniordinal 5

5. Body red, pinacula inconspicuous, concolorous with body; 15-28 crochets on abdominal prolegs.....*Cydia glandicolana* (Danilevsky)

5.’ Body whitish, pinacula conspicuous, darker than body; 25-35 crochets on abdominal prolegs.. .....*Cydia kurokoi* (Amsel)

Key to Archipini Genera of Europe (modified from Swatschek 1958)

1. Crochets at least partially (usually completely) biordinal; SV group bisetose or trisetose on A7 2

1'. Crochets uniordinal; SV group unisetose on A7 ..... *Pseudoargyrotoza*

2. SV group bisetose on A1, A2, and A7 ..... *Ptycholoma*

2'. SV group trisetose on A1, A2, and A7 3

3. Head with S2 about equidistant from S1 and S3; spiracle conspicuously larger than socket of SD1 on A2; V setae located slightly away from base on coxa on T2 [all characters present] 4

3'. Head with S2 closer to S3 than to S1; or spiracle approximately same size as base of SD1 on A2-7; or V setae located at the margin of the coxa on T2 [all characters rarely present together] .9

4. SD1 on A8 located dorsoanterad of spiracle; the terminal claw of thoracic legs elongate and slightly curved at end ..... *Pycholomoides*

4.' SD1 on A8 located anterad or ventrolaterad of spiracle; terminal claw of thoracic legs variable 5

5. Spiracle on A8 distinctly larger than that of prothorax; prothoracic shield with a black spot between D2 and SD1 ..... *Syndemis*

5.' Spiracle on A8 not as large as that of prothorax; prothoracic shield lacking black spot between D2 and SD1 6

6. Spiracle on T1 and A8 elliptical; prolegs with ca. 45 crochets ..... *Parasyndemis*

6.' Spiracles on T1 and A8 round; if elliptical, than prolegs with greater than 60 crochets 7

7. Head without dark pattern (except for stemmatal and genal areas); fronto-lateral sutures not

emarginate toward Frl-l seta ..... *Archips*

7.’ Head with dark pattern; or fronto-lateral sutures distinctly indented toward Frl-l seta 8

8. Distance between V setae on A8 about the same as that on A9 equidistant; prothoracic shield without large dark blotch at lower posterior corner..... *Choristoneura*

8.’ Distance between V setae on A8 conspicuously less than that between V setae on A9; prothoracic shield with large dark blotch at lower posterior corner..... *Cacoecimorpha*

9. Crochets biordinal only along posterior margin 10

9.’ Crochets completely biordinal, or uniordinal only at lateral margin 12

10. Spiracles of A2-A7 larger than the point of insertion of SD1 (situated immediately dorsad); head with S2 closer to S3 than to S1 ..... *Adoxophyes*

10.’ Spiracles of A2-A7 about the same size as the point of insertion of SD1 (situated immediately dorsad); head with S2 equidistant from S3 and S1.....11

11. Setae D1 and SD1 on separate pinacula on A9 ..... *Ditula*

11.’ Pinacula of D1 and SD1 at least partly fused..... *Capua*

12. Head with S2 equidistant from S3 and S1; spiracle on A2 not larger than socket of SD1; V seta on T2 very close to margin of coxa 13

12.’ Without the aforementioned combination of characters [may have one or two, but not all three] 15

13. V setae on T2 situated very close to, but not on coxa ..... *Philedone*

13.’ V setae on T2 situated on coxa.....14

14. Integument only weakly granulate; SV group on A8 perpendicular to longitudinal axis of larva; head yellow..... *Paramesia*

14’ Integument strongly granulate, with distinct brown spinules; SV group on A8 parallel to longitudinal axis of larva; head blackish brown .....*Periclepsis*

15. L group on A9 forming a right angle on a shared pinaculum; S2 equidistant from S1 and S3... .....*Hastula*

15.’ L group on A9 not forming a right angle; or S2 closer to S3 than to S1.....16

16. V setae on A9 further apart than V setae on A8; V setae on T2 located away from coxa 17

16.’ V setae on A9 not further apart than V setae on A8; V setae on T2 located very near coxa..... 18

17. Spiracle on A2 not larger than insertion point of SD1 (situated immediately dorsad); prothoracic shield uniform brown..... *Lozotaenioides*

17.’ Spiracle on A2 larger than insertion point of SD1 (situated immediately dorsad); prothoracic shield with dark spots .....*Lozotaenia*

18. Spiracle on A2 larger than insertion point of SD1 (situated immediately dorsad); SV group on A9 bisetose; D1s not closer than D2s on A8 19

18.’ Spiracle on A2 smaller than socket of SD1 (situated immediately dorsad); if larger, than D1s closer than D2s on A8; or SV group on A9 unisetose 20

19. V setae on T2 situated on the margin of the coxa; or head with S1, S2, S5 so weakly pigmented that they appear white in contrast to other stemmata.....*Pandemis*

19.’ V setae on T2 distinctly set off from coxa; stemmata all uniformly well developed....*Aphelia*

20. Head with S3, S4 and S6 strongly pigmented (appear black), S1, S2 and S5 weakly pigmented (appear white); V setae on T2 distinctly set off from coxa..... *Argyrotaenia*

20.’ Head with all stemmata uniformly pigmented; V setae on T2 situated very close to coxa .....

Common Interceptions by Host Plant

Annona cherimola
Talponia batesi - Central America and Caribbean
Aracauria sp.
Cydia aracauria - South America (Brazil)
Byrsonima crassifolia
Gymnandrosoma aurantianum - Central and South America
Cajanus cajan
Cryptophlebia sp. - Africa
Capsicum spp.
Cacoecimorpha pronubana - Netherlands
Clepsis spectrana - Netherlands
Cochylini sp. - Mexico
Clepsis sp. - Netherlands
Platynota stultana - Mexico
Platynota sp. - Mexico, Caribbean
Thaumatotibia leucotreta - Africa
Castanea sp.
Cydia splendana - Europe
Cydia fagiglandana - Europe
Cydia glandicolana - Asia
Pammene fasciata - Europe
Eucoenogenes aestuosa - Asia
Citrus sp.
Isotenes miserana - Australia, New Zealand
Epiphyas postvittana - Australia, New Zealand
Epiphyas sp. - Australia, New Zealand
Adoxophyes sp. - Australia, New Zealand
Gymnandrosoma aurantiuanum - South America
Proeulia sp. - Chile
Crataegus sp.
Amorbia sp. - Central America
Grapholita sp. - Europe, Central America, South America
cut flowers (general)
Amorbia sp. - central America, South America
Clepsis spectrana - Netherland
Clepsis sp. - Netherlands
Cacoecimorpha pronubana - Netherlands
Cydonia oblonga
Grapholita sp. - Europe
Cydia pomonella - Europe

Diospyros sp.
    Cydia sp. - Europe
    Grapholita sp. - Europe
Limonium sp.
    Amorbia sp. - Mexico
Litchi chinesis
    Cryptophlebia sp. - Asia
    Cryptophlebia sp. - Hawaii
    Gymnandrosoma aurantianum - Costa Rica
Macadamia sp.
    Cryptophlebia sp. - Asia, Hawaii
    Gymnandrosoma aurantianum - Costa Rica
Malus sp.
    Amorbia sp. - Central America
    Cydia pomonella - Europe, Central America
    Grapholita sp. - Europe, Central America
    Platynota sp. - Central and South America
Malvaceae
    Crocidosema sp. - Cosmopolitan
Ocimum sp.
    Platynota sp. - Central and South America
    Amorbia sp. - Central and South America
Ornithogalum sp.
    Epichorista acerbella - South Africa
Persea spp.
    Amorbia sp. - Central America
Phaseolus spp.
    Cydia fabivora - Central and South America
    Crocidosema aporema - Central and South America
Pithecellobium dulce
    Cochylini - Mexico, Central America
    Cryptophlebia sp. - Asia
Prosopis spp.
    Grapholita sp. - Central America
Prunus spp.
    Grapholita sp. - Europe, South America, Central America
    Cydia sp. - Europe, South America, Central America
Psidium guajava
    Gymnandrosoma sp. - Central America, Caribbean
Rosa sp.
    Amorbia sp. - Central America
    Platynota sp. - Central America
Rubus spp.
    Amorbia sp. - Central America
    Platynota sp. - Central America

Seticosta rubicola - Central America (Guatemala, Costa Rica)

Ruscus sp.

Cacoecimorpha pronubana - Europe

Saccharum officinarum

Tetramoera schistaceana - Asia

Sebastiania sp.

Cydia deshaisiana - Mexico

Vitis sp.

Lobesia botrana - Europe

Eupoecilia ambiguella - Europe

Proeulia sp. - Chile