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TORTRICIDAE - *Grapholita*

Taxonomy

Tortricoidea: Tortricidae: Olethreutinae: Grapholitini: *Grapholita*

Synonyms: *Aspila*, *Endopisa*, *Grapholitha*, several others

Larval diagnosis (Summary)

- D1 and SD1 on the same pinaculum on A9
- L group on T1 not extending beneath the spiracle
- Anal comb present
- Crochets numerous (>25), uniordinal or biordinal
- SV group variable, usually 3:3:2:2:2 or 3:3:2:2:1
- On Rosaceae or Ericaceae

Host/origin information

Grapholita larvae are most commonly intercepted on *Cydonia* and *Prunus* from Europe and Mexico. The most frequent origin/host combinations are listed here:

Origin	Host(s)
Albania	*Cydonia oblonga*
Mexico	*Cydonia oblonga*, *Prunus persica*
Romania	*Cydonia oblonga*

Recorded distribution

Grapholita is a cosmopolitan genus. Its members are found on every continent except Antarctica.

Identification authority (Summary)

Most *Grapholita* are found on Rosaceae or Ericaceae and have a combination of the following characters: D1 and SD1 on the same pinaculum on A9; L group on T1 not extending beneath the spiracle; anal comb present; crochets numerous (>25), uniordinal or biordinal; SV group variable, usually 3:3:2:2:2 or 3:3:2:2:1. It is difficult or impossible to reliably identify species of *Grapholita* using only morphology. In many cases molecular diagnostics are necessary to confirm species-level identifications.

Pest characterization

(Based on Cavey 2001, Brown 2011)

- Taxonomy: **High.** Identification to genus is usually possible.
- Distribution: **High / Low.** Some *Grapholita* are present in the U.S.; however, some important pest species are not.
- Potential Impact: **High.** Many *Grapholita* are important pests.

This ranking characterizes *Grapholita* as quarantine significant for the U.S. in some instances and not quarantine significant in other instances. The actual ranking for an intercept will depend on the species involved.

Larval diagnosis (Detailed)

The worldwide genus *Grapholita* contains approximately 125 described species. This genus contains many well known tortricid pests, such as the oriental fruit moth (*G. molesta*), cherry fruit worm (*G. packardi*), lesser apple worm (*G. prunivora*), and plum fruit moth (*G. funebrana*). Larvae are internal feeders in fruit and can cause significant economic damage to stone and pome fruit (almonds, apricots, cherries, nectarines, peaches, pears, plums, etc.). The white to reddish larvae resemble those of other internal-feeding olethreutines, such as *Cydia*.

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Fig. 1: *Grapholita molesta*, lateral view


Fig. 2: *Grapholita funebrana*, lateral view


Fig. 3: A9 dorsal


Fig. 4: A9 lateral


Fig. 5: Anal comb

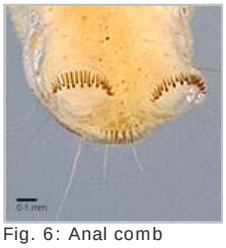


Fig. 6: Anal comb


Fig. 7: Crochets

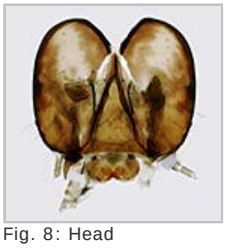


Fig. 8: Head


Fig. 11: Hypo. complex

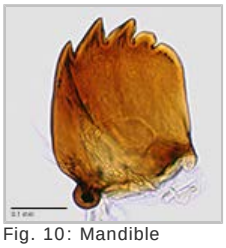


Fig. 10: Mandible

Brown (2011) divided intercepted tortricid larvae into four "types." *Grapholita* are grouped under the "Olethreutinae type" with D1 and SD1 on the same pinaculum on A9, the L group on T1 not extending beneath the spiracle, and an anal comb present. He used the following characters to identify larvae of *Grapholita*: 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.

MacKay (1959) grouped most Nearctic *Grapholita* pest species in "*Laspeyresia* Group 3," a group that also contained several *Cydia*. Her diagnosis for the group included the following: head with ocellar area always rounded; adfrontals never strongly tapered anteriorly, often being of about the same width throughout; ocelli [stemmata] all of approximately the same size and not spaced far apart; spinneret rounded at distal end (broken in our illustrated specimen, see Cepeda et al. 2011: Fig. 11 for an intact example) but varying in length; SD1 on segment 8 always anterior or anteroventral to the spiracle; spiracle on segment 8, in some species, tending to be slightly posterior to a mid-dorsovental line; L1 and L2 on segments 1-7 occasionally slightly posterior to a vertical line through spiracle but never anterior to it; SV group on segment 9 almost invariably a single seta; the anal shield rounded or often somewhat truncated posteriorly, and L1s and SD1s of the anal setae about as long as the anal segment; crochets uniordinal, often unevenly so; pinacula of V1s on thorax fused to coxae or almost so; anal fork absent, or small if present.

Note that MacKay described the anal comb (= fork) as both present and absent in this group. An anal comb is absent in most *Cydia* and present in *Grapholita*, although there are a few *Grapholita*, such as *G. interstinctana*, in which it is absent. Fortunately, all of the major pest species of *Grapholita* have a small anal comb, and this character can be used to separate them from common *Cydia*, such as *C. pomonella*.

Unfortunately, MacKay's descriptions are little help in separating larvae of *Grapholita* from other genera or from each other. This is partially due to the variability of many of the characters within the genus; as an example, here is her description of the SV counts in *G. molesta*: "SV group on segments 1,2,7,8, and 9 usually 2:3,2:2:2:2 but unstable and occasionally 2:3,2:2:2:1 or 3,2:3:2:2:1 and even 2:3,2:2:2:2 on one specimen." She attempted to separate the economically important species of *Grapholita* using head size, spinneret size, and coloring. However, larval pattern and pigmentation can vary in the *Grapholita* genus group (Komai 1999: 27).

Brown (1987) also attempted to separate *G. molesta*, *G. prunivora*, and *G. packardi* using head capsule size and body color in preserved specimens. He used the following characters for the genus *Grapholita*: SV group on A9 usually unisetose; SD2 on T2 usually anterodorsal to SD1; anal comb present SV group on A2; and L group on A9 trisetose. Komai (1999: 105) added that the *Grapholita* subgenus *Aspilia* (that includes *G. molesta*) has SD1 and SD2 on the same pinaculum on A1-7; a feature they share with the tortricine tribe Archipini. Cepeda et al. (2011) described, and later made a key (Cepeda and Cubillos 2012), to the Tortricidae of economic importance attacking fruit trees in Chile. They separated *C. pomonella* and *G. molesta* from other Olethreutinae by having the MSD1 and MSD2 pinacula fused on the mesothorax and by having uniordinal crochets on A3-6.

While some of the characters listed by MacKay (1959) and Brown (1987) may be useful in diagnosing *Grapholita* larvae to species in parts of North America, they are likely only reliable in late-instar individuals. When tested against other pest species, like *G. funebrana* (e.g. Baker 1963, reproduced in Whittle 1984), the characters are subtle and may not be practical for identifiers without a large larval collection for comparison. We do not recommend attempting to identify *Grapholita* larvae below the genus level with morphology unless there is a compelling need to do so. Molecular diagnostics are usually required to obtain a reliable species-level identification for interceptions that are quarantine significant. Several diagnostic methods are available: Chen and Dorn (2009) developed a PCR-RFLP assay to separate *G. funebrana* from *G. molesta* and several other species; and Barcenas et al. (2005) used a type of DNA barcoding to separate early instars of *C. pomonella*, *G. molesta*, *G. prunivora*, and *G. packardi*.

Identification authority (Detailed)

Host can be useful in identifying larvae of *Grapholita*, although origin is usually not. Most *Grapholita* are found on Rosaceae or Ericaceae and have a combination of the following characters (Brown 2011): D1 and SD1 on the same pinaculum on A9; L group on T1 not extending beneath the spiracle; anal comb present; crochets numerous (>25), uniordinal or biordinal; SV group variable, usually 3:3:2:2:2 or 3:3:2:2:1.

It is difficult or impossible to reliably identify species of *Grapholita* using only morphology. In many cases molecular diagnostics are necessary to confirm species-level identifications.

The presence of an anal comb separates most *Grapholita* larvae from *Cydia*. The anal comb may be difficult to see in very small larvae without careful examination. Identifiers should be especially careful with small *Cydia*-type larvae where the anal comb appears to be absent, but there is a large number of crochets on the abdominal prolegs (25 or more).

Key to larval Tortricidae intercepted, or potentially encountered, at U.S. ports of entry

Origin records

Grapholita have been intercepted from the following locations:

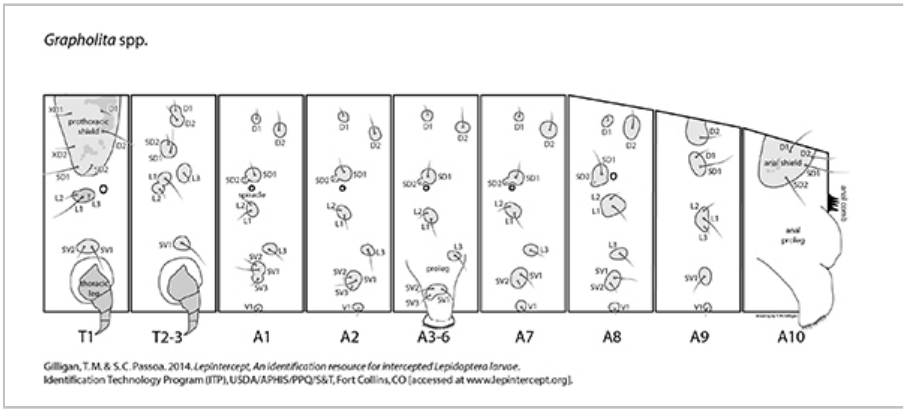
Albania, Argentina, Armenia, Australia, Austria, Azerbaijan, Bosnia and Herzegovina, Brazil, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, France, Germany, Greece, Guatemala, Hungary, India, Iran, Iraq, Ireland, Italy, Japan, Jordan, Kenya, Lebanon, Lithuania, Luxembourg, Macedonia, Mexico, Moldova, Montenegro, Morocco, Netherlands, Nigeria, Poland, Romania, Russia, Saudi Arabia, Serbia, Serbia and Montenegro, Slovenia, South Korea, Spain, Switzerland, Togo, Turkey, Ukraine, United Kingdom of Great Britain and N. Ireland, Yugoslavia

Host records

Grapholita have been intercepted on the following hosts:

Amaranthaceae, *Capsicum frutescens*, *Casimiroa edulis*, *Crataegus* sp., *Crotalaria* sp., *Cycas revoluta*, *Cydonia oblonga*, *Cydonia* sp., *Dialium guianense*, *Dianthus* sp., *Diospyros kaki*, *Diospyros* sp., *Ficus* sp., *Helianthus annuus*, *Limonium* sp., *Malus domestica*, *Malus* sp., *Malus sylvestris*, *Melicoccus* sp., *Mespilus germanica*, *Ocimum basilicum*, *Persea americana*, *Pithecellobium dulce*, *Prunus armeniaca*, *Prunus domestica*, *Prunus dulcis*, *Prunus persica*, *Prunus* sp., *Psidium guajava*, *Punica granatum*, *Pyrus bretschneideri*, *Pyrus communis*, *Pyrus pyrifolia*, *Pyrus* sp., *Rosa* sp., Rosaceae, *Solanum melongena*, *Vaccinium* sp., *Zea mays*

Setal map



Grapholita molesta setal map

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