EPPO Datasheet: *Grapholita packardi*

Last updated: 2023-09-04

IDENTITY

Preferred name: *Grapholita packardi*
Authority: Zeller
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Lepidoptera: Tortricidae
Other scientific names: *Cydia packardi* (Zeller), *Enarmonia packardi* (Zeller), *Enarmonia pyricolana* (Murtfeldt), *Laspeyresia packardi* (Zeller), *Laspeyresia pyricolana* (Murtfeldt), *Steganoptycha pyricolana* Murtfeldt
Common names: cherry fruit worm
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EPPO Categorization: A1 list
view more categorizations online...
EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II A)
EPPO Code: LASPPA

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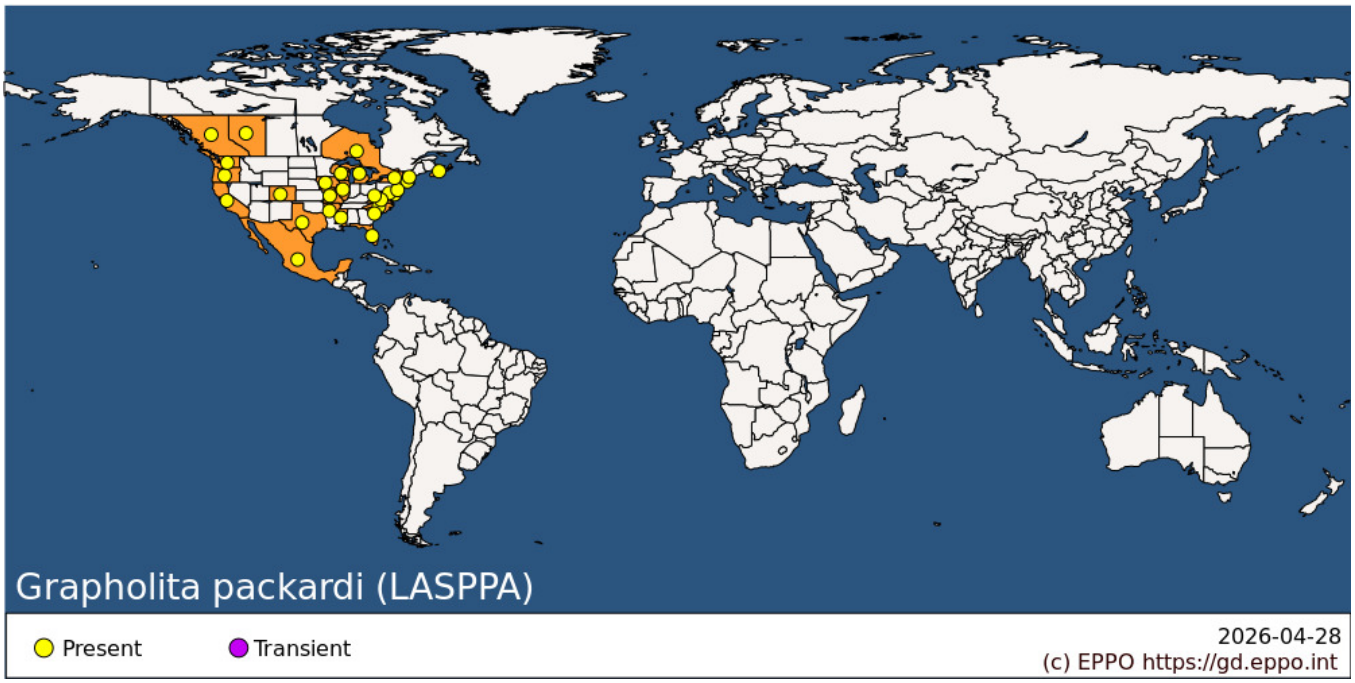
HOSTS

The major cultivated host plants are cherries, apples and *Vaccinium* spp. Other cultivated hosts that have been reported include plums, roses, *Pyracantha* sp. and quinces. Wild hosts that have been reported include *Crataegus* spp. and *Prunus virginiana*. Except for *Vaccinium* (Ericaceae), all hosts are members of the Rosaceae.

Host list: *Crataegus mexicana*, *Crataegus*, *Cydonia oblonga*, *Malus domestica*, *Malus*, *Prunus avium*, *Prunus cerasus*, *Prunus domestica*, *Prunus serotina*, *Prunus virginiana*, *Prunus*, *Pyracantha sp.*, *Pyracantha*, *Rosa sp.*, *Rosa* , *Vaccinium corymbosum*, *Vaccinium macrocarpon*, *Vaccinium*

GEOGRAPHICAL DISTRIBUTION

G. packardi is indigenous to North America including relatively new reports from Mexico (Salinas-Castro *et al.*, 2018).



North America: Canada (Alberta, British Columbia, Nova Scotia, Ontario), Mexico, United States of America (Arkansas, California, Colorado, Delaware, Florida, Illinois, Iowa, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Oregon, South Carolina, Texas, Virginia, Washington, West Virginia, Wisconsin)

BIOLOGY

Grapholita packardi overwinters as a mature larva. Pupation occurs within the larval overwintering quarters during May or early June. For larvae that develop on cherries the pupal stage lasts about 29 days (Hoerner & List, 1952; Oatman & Ehlers, 1962); however, a pupal period of 10-14 days has been reported for larvae that develop on apple shoots (Sanderson, 1901; Garman, 1918). Adults emerge from mid-June to early July. Eggs are laid singly on terminal leaves of apple shoots or on fruits of other hosts, usually on sutures or rough areas, but sometimes on fruit stems. Eggs hatch in 7-10 days, and larvae bore into fruits (cherries, *Vaccinium*, *Crataegus*, rarely apples) or terminal shoots (apples).

In cherries and *Vaccinium*, larvae mature in about 3 weeks and emerge from fruits in mid-July to mid-August and begin to construct overwintering quarters. Larvae may tunnel into broken or pruned branches, lining the cavity with silk and sealing the opening, or may spin cocoons in crevices of bark or in the soil. All accounts indicate one generation annually on these hosts (Hoerner & List, 1952; Vergeer, 1954; Dever, 1957; Oatman & Ehlers, 1962; Neunzig & Falter, 1966). Habits of larvae on *Crataegus* are similar, but two generations occur on this host in New York state (Chapman & Lienk, 1971).

In apples, larvae penetrate the outer terminal leaves of the shoot and bore 25-50 mm into the twig. As the twig dies, larvae penetrate new shoots from lateral buds. Terminal shoots of nursery stock and young orchard trees, and the tender "water sprouts" on trunks of old trees, may be attacked. Larvae mature during late June, and moths emerge during July. A third generation results in emergence of moths in August, and the resulting larvae overwinter in silk-lined tunnels of shoots or in cocoons in crevices of bark (Sanderson, 1901; Chapman & Lienk, 1971).

DETECTION AND IDENTIFICATION

Symptoms

Fruit or shoot tips of hosts may be infested by larvae. Infested cherries have a narrow, brown, irregular tunnel leading from a small entrance hole (visible with a hand lens) to a sunken brownish area over the larval feeding site;

mature infested cherries are black and distorted, as illustrated by Oatman & Ehlers (1962). External evidence of infestation of cherries by young larvae is occasionally not detectable (Hoerner & List, 1952). Infested apples may be detected by the presence of larval mines just below the skin of the fruit; fruit damage is less common than shoot damage, which is indicated by blight of terminals and the formation of new shoots from lateral buds (Garman, 1918). The feeding on shoots resemble shoot injuries caused by feeding by the oriental fruit moth, *Grapholita molesta*. The presence of a larva in an apple shoot is often indicated by a zigzag, knotty shoot that retains a leaf petiole at its tip, as illustrated by Sanderson (1901).

Morphology

Eggs

Oval, about 0.55 x 0.65 mm, initially opaque and pale-cream in colour, with embryo and head capsule of larva becoming visible before hatching (Oatman & Ehlers, 1962; Chapman & Lienk, 1971).

Larva

First instar white with black head; final instar with pale-pink body, head light-brown with darker-brown pattern near stemmata, prothoracic shield pale-brown, anal shield brown, dorsal pinacula on eighth and ninth abdominal segments large, brown, and often confluent (paler and smaller in *G. molesta* and *G. prunivora*), anal fork present, body length 7.5-9 mm, head width 0.85-0.94 mm (Garman, 1918, figure of setation; MacKay, 1959, figure of setation; Chapman & Lienk, 1971, colour figure of head and thorax).

Pupa

Golden-brown, about 6 mm long, abdominal segments two to nine with one or two rows of dorsal spines, segments four to six with double row or very irregular row of spines (single, regular row in *G. molesta* and *G. prunivora*), spiracles round; in tightly woven cocoon (Garman, 1918, figure; Chapman & Lienk, 1971).

Adult

Forewing length 4-5 mm, wing-span 9-11 mm, colour greyish-brown, darker in females, with broad, transverse band across middle, less distinct in females, male underside with brown spot from near base to midwing; male hindwing with large, dark-brown spot on basal half, female hindwing with basal half pale. Adult male illustrated by Garman (1918), Chapman & Lienk (1971) (colour) and Miller (1987); male and female genitalia illustrated by Heinrich (1926) and Miller (1987).

Detection and inspection methods

In orchard/plantation settings flight of the *G. packardi* males can be monitored using pheromone traps baited with *G. packardi* female sex pheromone based on E8-12 Ac (Roelofs *et al*. 1969). The visual searches for larval infestation or eggs are quite difficult as the larvae are present inside the fruit. Eggs are frequently detected on calyx end of fruit, however they are also difficult to observe due to their flattened shape and the fact they are opaque.

Molecular detection methods have been developed to distinguish different fruit borers including *G. packardii* (Barcenas *et al*., 2005; Yokomi *et al*., 2022).

PATHWAYS FOR MOVEMENT

Grapholita packardi could be transported as larvae in raw fruit or as overwintering larvae on host plants, especially nursery stock. The pest has been intercepted by USDA inspectors in fruit imported from Mexico (e.g., USDA, 1960; 1963) but has not been intercepted in fruit imported in the EU (EFSA, 2018). The adults could be dispersed for short distances by wind.

PEST SIGNIFICANCE

Economic impact

G. packardi has not been considered a significant pest of fruit in North America since the early part of the 20th century, except perhaps for *Vaccinium*. *G. packardi* has been reported as a pest of *Vaccinium* in North Carolina, Michigan, New Jersey and Washington (Kaur 2023, Neunzig & Falter, 1966, Mallampalli & Isaacs, 2002, Vergeer, 1954). Fruits of all recorded hosts are known to be attacked, although larvae have been recorded infrequently from fruits of apples, pears and plums. In apples, terminal shoots are usually attacked (Garman, 1918). *Grapholita packardi* was considered a major pest of cherries from 1914 to the 1960s, although it was primarily a problem in poorly sprayed orchards (Hoerner & List, 1952; Oatman & Ehlers, 1962). In Colorado, infestations of 2-3% were reported as common, and a few of 6-8% were noted (Hoerner & List, 1952).

Control

Insecticide treatments for control of *Cydia pomonella* (codling moth), *Rhagoletis pomonella* (apple maggot), *R. cingulata* (cherry fruit fly) and *Drosophila suzukii* (spotted-wing drosophila) also provide incidental control of *G. packardi*. Insecticides may be applied on *Vaccinium* (Kaur, 2023; EFSA, 2018). Cultural control includes removing overwintering environments (e.g. weeds) and other hosts on field borders (Kaur, 2023). Natural enemies reported for *G. packardi* in the USA include parasitic insects such as *Chelonus grapholithae* (Braconidae), *Phanerotoma fasciata* (Braconidae), *Scambus transgressus* (Ichneumonidae), *Glypta rufiscutellaris* (Ichneumonidae), *Psychophagus omnivorus* (Pteromalidae) and *Euderus cushmani* (Eulophidae) (Krombein *et al*., 1979).

Phytosanitary risk

Hosts of *G. packardi* include important fruit crops in the EPPO region. Considering its distribution in North America *G. packardi* is likely to establish in the EPPO region if it was introduced. The magnitude of impact is uncertain, and the control measures currently applied in orchards against other pests such as *Drosophila suzukii* or *Grapholita molesta* may limit its impact. Because *G. packardi* is a quarantine pest in a number of countries, its introduction into the EPPO region could impact the export of host fruits.

PHYTOSANITARY MEASURES

Measures taken against *Rhagoletis pomonella, R. indifferens* and other North American *Rhagoletis* spp. (EPPO/CABI 1996; EPPO, 2023a,b) should be effective to prevent the introduction of *G. packardi* but may not cover the full host range of *G. packardi*. In addition, it may be noted that the cherry fruit fly *Rhagoletis cingulata* has been introduced and has spread into the EPPO region in the 2000s (EPPO, 2023c).

Possible specific measures are as follows. Consignments of host fruit from countries where *G. packardi* occurs should be inspected for symptoms of infestation and those suspected should be cut open in order to look for larvae. Fruits should come from an area where *G. packardi* does not occur, or from a place of production found free from the pest by regular inspection. Fruits may also be treated (e.g. cold treatment). Plants of host species transported with roots from countries where *G. packardi* occurs should be free from soil, or the soil should be treated against puparia, and the plants should not bear fruits.

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Datasheet history

This datasheet was first published in 1997 in the second edition of 'Quarantine Pests for Europe' and revised in 2023. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

CABI/EPPO (1997) *Quarantine Pests for Europe (2nd edition)*. CABI, Wallingford (GB).

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