EPPO Datasheet: *Platynota stultana*

Last updated: 2022-03-29

IDENTITY

Preferred name: *Platynota stultana*
Authority: Walsingham
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Lepidoptera: Tortricidae
Other scientific names: *Platynota chiquitana* Barnes & Busck
Common names: omnivorous leaf roller (US)
view more common names online...
EPPO Categorization: A2 list
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EPPO Code: PLAAST

more photos...

Notes on taxonomy and nomenclature

In the early part of the 20th century, this species was misidentified by at least two authors (e.g., Woglum 1920, Essig 1926) as *Platynota tinctana* Walker or *Sparganothis tinctana*, now recognized as a synonyms of *Platynota flavedana*.

As DNA barcodes of this species have accumulated in BOLD (Barcode of Life Database, Biodiversity Institute of Ontario, University of Guelph, Canada), it has become increasingly clear that *P. stultana* likely represents two closely related species. The sequence data sort into two distinct lineages or Barcode Index Numbers (BINs) with a distance of over 4% between them. One lineage is represented entirely by specimens from California, whereas the other includes specimens from California, Florida, and quarantine interceptions, most likely from Mexico. However, based on morphology, adults of the two clusters are indistinguishable.

HOSTS

As its common name implies, the omnivorous leafroller is a highly polyphagous species, and it has been reported from over 100 plants species in 30 different families. In urban settings it feeds on many garden plants; in greenhouses it can be an important pest of roses and carnations; and in agricultural settings it has been recorded from numerous fruit and vegetable crops. It has been documented from several native Asteraceae and Fabaceae (Frick and Hawkes, 1970; Goeden and Riker, 1976; Brown *et al.*, 2011; Diaz *et al.*, 2015), among other families.

By the 1970s, the omnivorous leafroller was recognized as an important pest of cotton (e.g., Atkins *et al.*, 1957a, b; Godfrey *et al.*, 2013), citrus (e.g., McGregor, 1934; Basinger, 1936), grapes (e.g., Lynn, 1969; AliNiazee *et al.*, 1970), roses (e.g., Nelson, 1936; Zenner-Polania, 1974), carnations (Bohart, 1942) and peppers (e.g., Bentley *et al.*, 2016) in California. Historically, economic damage has been reported primarily in alfalfa, citrus, corn, cotton, grape, peach, pear, and in peppers. In grapes, feeding leads to bunch rot, resulting in crop losses of 25?80%. Larvae are frequently intercepted at U.S. ports of entry on bell pepper (*Capsicum* spp.) from Mexico. Powell (1983) suggested that the species overcame a sort of ‘physiological hurdle’ in regards to larval host acceptability in the 1950s, resulting in its virtual explosion in California on plants in a wide range of families.

Host list: *Actinidia arguta*, *Actinidia deliciosa*, *Albizia sp.*, *Amaranthus sp.*, *Ambrosia psilostachya*, *Annona cherimola*, *Apium graveolens*, *Arachis sp.*, *Asparagus officinalis*, *Aster sp.*, *Atriplex halimus*, *Atriplex prostrata subsp. calotheca*, *Beta sp.*, *Beta vulgaris*, *Bidens laevis*, *Capsicum annuum*, *Capsicum sp.*, *Chenopodium album*, *Chenopodium sp.*, *Chromolaena odorata*, *Chrysanthemum x morifolium*, *Citharexylum spinosum*, *Citrullus lanatus*, *Citrus maxima*, *Citrus sp.*, *Citrus x aurantium var. sinensis*, *Citrus x limon*, *Conium maculatum*, *Convolvulus sp.*, *Conyza bilbaoana*, *Conyza sp.*, *Cotoneaster sp.*, *Cucumis melo*, *Cucumis sativus*, *Cyclamen sp.*, *Dianthus caryophyllus*, *Dianthus sp.*, *Epilobium brachycarpum*, *Eriogonum grande*, *Eriogonum latifolium*, *Eucalyptus*, *Euonymus japonicus*, *Fragaria sp.*, *Fuchsia hybrids*, *Gardenia*, *Ginkgo sp.*, *Glycine max*, *Gossypium herbaceum*, *Grindelia camporum*, *Grindelia hirsutula*, *Jacobaea vulgaris*, *Juglans regia*, *Juglans sp.*, *Juniperus sp.*, *Lactuca sp.*, *Leucaena lanceolata*

, *Lotus scoparius*, *Malus domestica*, *Malva sp.*, *Medicago sativa*, *Melilotus albus*, *Melilotus indicus*, *Mentha sp.*, *Mikania scandens*, *Packera sp.*, *Parkinsonia aculeata*, *Parthenium hysterophorus*, *Pelargonium sp.*, *Persea americana*, *Phaseolus sp.*, *Phaseolus vulgaris*, *Pinus sp.*, *Portulaca grandiflora*, *Portulaca oleracea*, *Portulaca sp.*, *Prunus domestica*, *Prunus persica*, *Punica granatum*, *Pyrus communis*, *Pyrus sp.*, *Ribes sp.*, *Rosa sp.*, *Rubus fruticosus*, *Rubus idaeus*, *Rubus sp.*, *Rumex crispus*, *Salsola kali*, *Sida acuta*, *Solanum lycopersicum*, *Solanum melongena*, *Solidago californica*, *Sorghum bicolor*, *Sorghum sp.*, *Taxus sp.*, *Trifolium sp.*, *Vaccinium macrocarpon*, *Vigna unguiculata*, *Vitis sp.*, *Vitis vinifera*, *Wyethia angustifolia*, *Zea mays*

GEOGRAPHICAL DISTRIBUTION

Platynota stultana (Walsingham, 1884) was described from Sonora, Mexico, in 1884, and its junior synonym, *P. chiquitana* Barnes and Busck, 1920, was described from Arizona in 1920; the two were synonymized by Busck (1933). Whether it slowly expanded its range northward into Arizona and Southern California, or was merely slowly documented more northward, remains somewhat uncertain. Powell (1980, 1983) concluded that *P. stultana* was introduced into Southern California, where it was first collected in 1898. What is certain is that by the 1960s it was widespread and common in California, becoming a pest of several agricultural crops and many native and garden plants throughout the costal lowlands and interior Central Valley (Powell, 1983).

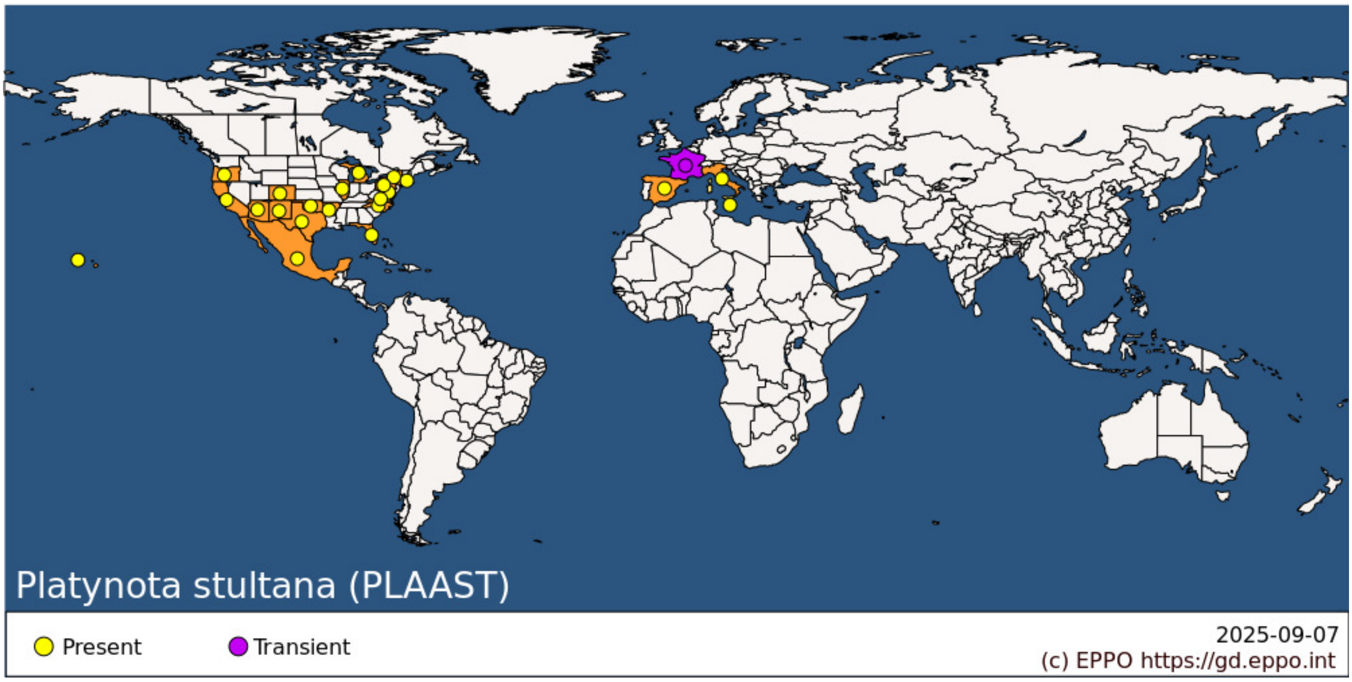
Through the 1930s, the omnivorous leafroller was intercepted frequently at U.S. ports of entry in Arizona, primarily in peppers (*Capsicum* spp.) from Mexico. More recent interceptions have come from Mexico, Guatemala, and Venezuela, on *Capsicum* and *Origanum* sp. (larval identification confirmed by DNA barcoding). In 2011, it was intercepted in the USA on *Capsicum* from Spain.

In 1933 and 1934, the omnivorous leafroller was discovered in Virginia on greenhouse roses (Nelson, 1936) and chrysanthemums, and in Washington, D.C. on roses, but it did not establish, perhaps unable to withstand the cold winter temperatures (e.g., Yokoyama and Miller, 2000; Powell and Brown, 2012). In 1970 it was again recorded from Virginia (Lam *et al*., 2012).

Platynota stultana was first reported in Florida in the 1940s (Kimball, 1965), based mostly on larval collections. Because morphological features of the larvae are not diagnostic, the validity of some of these records is suspect. However, recent records of adults confirm its probable permanent establishment in Florida (Brown, 2009). It also has been recorded on one or more occasions from North Carolina, Oklahoma, Colorado (Powell and Brown, 2012), and Oregon (Brown, 2009).

The species found its way to Hawaii in the 1990s (Miller & Hodges, 1995), and to Europe (Spain) in the 2000s (Groenen and Baixeras, 2009). Although first reported in Spain in 2009, previous field work there in 2005?2008 yielded many examples of this species that were not initially identified as *Platynota stultana*.

Its present range in the Western Hemisphere includes much of Coastal and Central California, Arizona, Southern Texas, and Florida, extending into Mexico, from Baja California and Sinaloa, south to about the state of Veracruz (Brown *et al*., 2011). Based on monitoring using pheromone traps, Aguilera-Pena *et al*. (2005) claim it is absent from Estado de Mexico. Although collected in four regions of Spain (Almeria, Murcia, Alicante, and Granada) (Groenen and Baixeras 2013), it likely has expanded its range there.



EPPO Region: France (mainland), Italy (mainland), Malta, Spain (mainland)
North America: Mexico, United States of America (Arizona, Arkansas, California, Colorado, District of Columbia, Florida, Hawaii, Illinois, Maryland, Massachusetts, Michigan, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, Texas, Virginia)

BIOLOGY

Throughout most of California’s regions of agricultural production, where the biology of this species has been studied in detail, the omnivorous leafroller overwinters (November to February) in the larval stage as third, fourth, of fifth instars in webbed nests of host leaves, leaf litter on the ground, or in vineyards in mummified grape clusters (AliNiazee & Stafford 1972a, b). It appears as though there is no true winter diapause, with larvae continuing to feed, but at a considerably slower rate, probably owing the dry, low-quality condition of the host plant material. In early spring, larvae in the fifth instar pupate, while those in earlier instars continue to feed. The first adults of the year may appear as early as the 10 of March, depending on temperature. Following mating, females lay large, imbricate masses of eggs, which hatch in about seven days, again depending on temperature. On cotton, females are reported to lay one large batch of eggs and several smaller ones (Atkins *et al.*, 1957a, b); females may lay between 100 and 600 eggs during their lifetime. First instars either disperse via a silken thread (‘ballooning’) or begin feeding *in situ* if food plant quality is acceptable. Larvae are found most often on new growth and terminal shoots where they make a silken nest. Later larvae roll or fold leaves of the host, feed between adjacent leaves, or feed between leaves and adjacent fruit, where they cause the greatest economic damage. In greenhouses the larvae go through 5?6 instars over 20?30 days (Zenner-Polania and Helgesen, 1973). Pupation lasts 5?9 days. The entire life cycle takes 32?45 days, and capture records indicate that five or more overlapping generations may occur per year in Southern California and the Central Valley. However, during a comprehensive, 3-year survey of Marine Corps Air Station Miramar in San Diego County (Brown and Bash, 2000), adults of *P. stultana* were collected only in July to September (cumulatively over the 3-year inventory), whereas the ecologically similar and polyphagous *Amorbia cuneana* (Tortricidae) was collected every month of the year. Hence, localized populations of *P. stultana*, especially those in drought-deciduous Mediterranean plant communities may have fewer generations per year. Once established in a vineyard, populations of omnivorous leafroller may achieve economically damaging levels within two to three years.

DETECTION AND IDENTIFICATION

Symptoms

Evidence of the larval infestation includes folded or adjacent leaves tied together with silk, often with conspicuous pellets of frass (faeces) in the silk webbing. Feeding typically results in holes on leaves or damage along their outer margins. However, similar damage is characteristic of several leafrolling larvae including those of other tortricids and the grape leafroller, *Desmia funeralis* (Pyralidae). In grapes, early season damage includes cavities in fruit which scars the berries. Later in the season, larval feeding breaks the skin of the fruit, providing a route for the entry of yeast and fungi, resulting in bunch rot. In apples, larval feeding creates shallow holes or grooves on the fruit surface, frequently near the stem (Wunderlich *et al.*, 2015). In cotton, larvae web leaves or bracts together to form a shelter from which they feed (Godfrey *et al.*, 2013).

Morphology

Egg. Eggs are small, flattened, somewhat disk-shaped, and greenish, laid in masses of about 50-150 eggs, usually on the surface of a leaf.

Larva. The larvae are similar to those of many other species of Tortricinae. Last instars are 12?15 mm long and translucent cream to pale greyish green, with moderately small, pale pinacula bearing moderately long setae (MacKay, 1959; Hoover and Biddinger, 2014). The head is amber to dark brown, often with a dark genal band (lacking in the last instar) and a dark stemmatal patch. The thoracic shield is concolorous with the head with darker lateral and posterior margins. The chaetotaxy (pattern of setae) is also similar to that of most other tortricids, with a trisetose L-group on T1 (the first thoracic segment) and a dorsal "saddle" on A9 (the ninth abdominal segment), representing the fusion of the D2 pinacula. The distance between the V (ventral) setae on A9 is usually 1.5–2.0 times that between the V setae on A8. The anal shield is concolorous with the body or slightly darker brown, and there a distinct anal fork with 5?6 tines at the end of the abdomen beneath the anal shield. Again, the latter feature is typical of many tortricids.

Pupa. Typical of most tortricids, segments 3?7 of the abdomen bear two lateral rows of backward-directed tiny spines, and there is a distinct cremaster at the end of the abdomen bearing two pairs of slightly curved, tiny hooks. The pupa is shiny brown.

Adult. The resting posture of the adult is similar to that of many of tortricid moths, presenting a somewhat bell-shaped appearance with the wings held flat or roof-like over the abdomen (e.g., Bentley *et al*., 2016). Forewing length is 4.5?7.0 mm in the male and 6.5?9.0 mm in the female. Forewing maculation is slightly variable and usually lacks distinct pattern elements (Miller and Hodges, 1995; Powell and Brown, 2012; Groenen and Baixeras, 2013). In the male the forewing is somewhat two-toned, with the basal portion dark brown and the distal portion pale orange brown to tan or pale yellow. In the female, it is more uniform brownish in colour. Like many species in the tortricid tribe Sparganothini, the labial palpi are long and porrect, extending conspicuously forward from the head. *Platynota stultana* is similar to several other species in the genus, but is slightly smaller, and the male lacks a conspicuous costal fold, the latter of which occurs in most species of *Platynota*.

As in many micromoths, an examination of the genitalia is usually necessary for accurate identification. Images of the male and female genitalia of omnivorous leafroller may be found in numerous published sources: Miller and Hodges (1995), Powell and Brown (2012), Groenen and Baixeras (2013).

Detection and inspection methods

Visual inspection of foliage throughout the growing season may reveal the presence of omnivorous leafroller. When nearby alfalfa or sugar beet fields have been harvested, the survey frequency should be increased because omnivorous leafroller may move from these crops to new fields. Foliar damage by omnivorous leafroller larvae is extremely similar to that of many other leafrolling tortricids and some pyralids, such as *Desmia funeralis*. Hence, visual inspection does not result in diagnostic detection; it merely reveals the presence of leafrolling pests.

Shaw *et al.* (1993) developed a sequential sampling strategy for Thompson seedless grapes in the Central Valley of California, based on the inspection of grape clusters. However, they concluded that their sampling plan was applicable only early in the season (i.e., May and early June) because the economic threshold for omnivorous leafroller increases throughout the growing season.

Adults are attracted to light traps (AliNiazee and Stafford 1972b), and males are strongly attracted to pheromone traps (Hill and Roelofs 1975, Webster and Cardé 1982, 1984, Webster 1988), which have been used successfully for detection of this pest in the USA and Spain. Because traps baited with omnivorous leafroller pheromone may attract a number of species in addition to the target, close inspection of trapped specimens is required.

Monitoring protocols developed by the University of California for grapes and peppers include the deployment of a minimum of two pheromone traps per field of less than 20 acres (approx 8 ha) and three traps for fields greater than 20 acres. Traps should be placed within the crop at a height of 5?6 feet (approx. 1.5-1.8 m) starting around mid-February, and should be checked at least once a week until the first moth catch (Bentley *et al*., 2016), and more frequently thereafter. Although a treatment threshold based on trap catch has not yet been established, traps can be used to monitor increases in population density, and therefore help determine the timing of pesticide applications.

PATHWAYS FOR MOVEMENT

Although adults of the omnivorous leafroller are capable fliers, they are not migratory and probably do not disperse long distances. After hatching, first-instar larvae usually crawl around on the host plant, but they also ‘balloon’ (disperse via air currents using a strand of silk), which may enable local dispersal within and/or between fields.

The primary means of long-distance dispersal is through international trade of plants and/or plant products, such plants for planting, cut flowers and branches, and fruit of host plants imported from countries where the pest occurs. The species is intercepted most frequently at international ports of entry on peppers (*Capsicum* spp.).

The rapid, widespread colonization of California may have been facilitated in part by the sale and distribution of nursery stock, including tomatoes, bell peppers, and many ornamentals.

PEST SIGNIFICANCE

Economic impact

Because larvae are primarily external feeders, damage to the surface of citrus, bell peppers, and other fruit, causes scarring, diminishing marketability. In grapes, significant economic loss occurs when larvae feed in the ripening bunches, which breaks the skin of the berries allowing yeast and fungi to initiate rot (AliNiazee *et al*., 1970, 1972a, b). While several high value crops may be attacked, damage to most is minor because pest management practices for other foliage pests keep omnivorous leafroller below economically significant levels. However, grapes, bell peppers, roses, and carnations are exceptions owing to the cosmetic damage caused by *P. stultana*.

Control

In grapes, the primary source of infestation is old mummified clusters hanging on vines or in soil under the vines. Also, because many ornamentals and native plants, including horseweed, lamb’s quarters, little mallow, curly dock, and various legumes (Wunderlich *et al*., 2015), may serve as hosts, control of these weeds may be important for managing omnivorous leafroller. In vineyards, the destruction of leftover and rotting bunches of grapes hanging on vines or on the ground is an integral part of management (AliNiazee and Stafford, 1973). Sanitation practices such as ploughing and the removal of old mummies reduce overwintering populations to a large degree.

Several species of parasitoids have been recorded from omnivorous leafroller, including the larval parasitoids: *Goniozus platynotae*, *Cotesia* (*Apanteles*) sp., *Microgaster phthorimaeae*, *Macrocentrus ancylivorus*, *Cremastus platynotae*, *Diadegma compressus*, *Elachertus proteoteratis*, *Spilochalcis* sp., *Erynnia tortricis*, and *Nemorilla pyste*, and the egg parasitoid *Trichogramma* sp. (Wunderlich *et al.*, 2015; Bolda *et al*., 2015). However, mortality from these natural enemies rarely exceeds about 10% (Bentley *et al*., 2018). In addition, other invertebrate generalist predators such as lacewings, minute pirate bugs, and spiders are also known to attack larvae of omnivorous leafroller, but these are likely to be even less effective than parasitoids. Nearly all of these potential biocontrol agents have limited impact on larvae that have already entered fruit or are concealed in grape bunches.

In addition to sanitation and biological control, the early application of insecticides has been shown to reduce populations. Chemical control is most effective in situations where the omnivorous leafroller feeds externally on leaves. However, it is less useful in grapes and probably peppers because of the protected feeding location of the larvae within webbed or folded leaves and/or tight bunches. Ota (1969) reported that methomyl and *Bacillus thuringiensis* were highly effective against *P. stultana* in greenhouses, and Campbell and Ward (1971) confirmed the efficacy of these two insecticides based on trials on the pest on the ornamental *Euonymus japonica* (Celastraceae), also in a greenhouse situation. Subsequent studies in the 1970s in California vineyards revealed that single treatments of cryolite provided 75?100% control and lead arsenate 50?100% control after two weeks (AliNiazee *et al.*, 1970). Unfortunately, the repeated use of insecticides was subsequently linked to increases in populations of spider mites in many vineyards (AliNiazee and Stafford, 1972a).

Among various chemicals tested against the omnivorous leafroller, AliNiazee and Stafford (1973) found methomyl, trichlorfon, Imidan, carbaryl, and azinphosmethyl to be the most effective (see also Smith *et al*., 1965; Bentley *et al*., 2016, 2018). They also concluded that mid-season (July) treatments were slightly more effective than late-season (August) treatments. In pomegranates, insecticide sprays can be timed based on day-degree accumulations (Bentley *et al.*, 2018). Depending on the crop, *P. stultana* may be controlled by pesticides and other measures already applied against other Lepidoptera pests. However, in greenhouses, management may be more difficult because of specialized integrated control programs.

Mating disruption has also been shown to reduce populations of omnivorous leafroller (e.g., Shorey *et al.*, 1996). Using this strategy, pheromone dispensers should be deployed in February or early March and maintained throughout the growing season. In some orchards, the deployment of pheromone dispensers in mid-May have been effective at controlling moth populations.

For organically certified produce, cultural controls, sprays of *Bacillus thuringiensis* or spinosad (Entrust formulation), and the use of mating disruption are the recommended management tools (Bentley *et al.*, 2016).

For the exportation of table grapes, Yokoyama *et al*. (1999) demonstrated that low temperature storage combined with sulphur dioxide slow-release pads resulted in 100% mortality of *P. stultana* larvae. They further concluded that this combination can be applied in existing packinghouse facilities and has the potential to replace the need for chemical fumigants, such as methyl bromide, in quarantine situations.

Phytosanitary risk

Based on its extremely broad host range, *P. stultana* has the potential to cause economic damage to many cultivated (crops and ornamentals) and native plants in the EPPO region, especially grapes and bell peppers. While the level of damage and economic losses of its potential introduction remain uncertain, its discovery in Spain demonstrates that it has a high potential for establishment in the southern and Mediterranean parts of the EPPO region. Elsewhere, such as in more northern climates, omnivorous leafroller has the potential to become established in greenhouse situations, especially in association with bell peppers, but also in tropical greenhouses such as those in botanical gardens and zoos. Many greenhouse infestations in cold-climate regimes may die-out during winter. However, increased temperatures associated with global climate change are likely to increase the potential range of this pest within the EPPO region over time.

PHYTOSANITARY MEASURES

Visual inspections of plants and plant products for the omnivorous leafroller are not particularly effective because low-level larval infestations, and eggs in particular, can be easily overlooked. Pesticide applications on commodities at their origin can reduce the probability of presence of the pest, but may not guarantee pest-free commodities, especially when infestations are protected within grape bunches or tightly tied leaves. For certain commodities, such as some fruit (e.g., grapes) and vegetables (bell peppers), the combination of low temperature storage and sulphur dioxide slow-release pads during transit may replace the need for chemical fumigants at ports of entry and other quarantine situations (e.g., Yokoyama *et al.*, 1999; Zhou *et al*., 2000). Plants for planting should be dormant without fruit and leaves or in vitro plants, or grown under physical isolation. While the requirement of pest-free production areas in countries of origin would represent more effective safeguards than visual inspections, they likely would impose significant burdens on trade of plants and plant products from areas where omnivorous leafroller is present, primarily the USA (California and Florida) and Mexico. Detailed phytosanitary measures for pathways can be found in Ministerio De Agricultura, Alimentacion y Medio Ambiente (2016).

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