EPPO Datasheet: *Tecia solanivora*

Last updated: 2021-02-08

IDENTITY

Preferred name: *Tecia solanivora*
Authority: (Povolny)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Lepidoptera: Gelechiidae
Other scientific names: *Scrobipalpopsis solanivora* Povolny
Common names: Central American potato tuber worm, Guatemalan potato moth
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EPPO Categorization: A2 list
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EU Categorization: A1 Quarantine pest (Annex II A)
EPPO Code: TECASO

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HOSTS

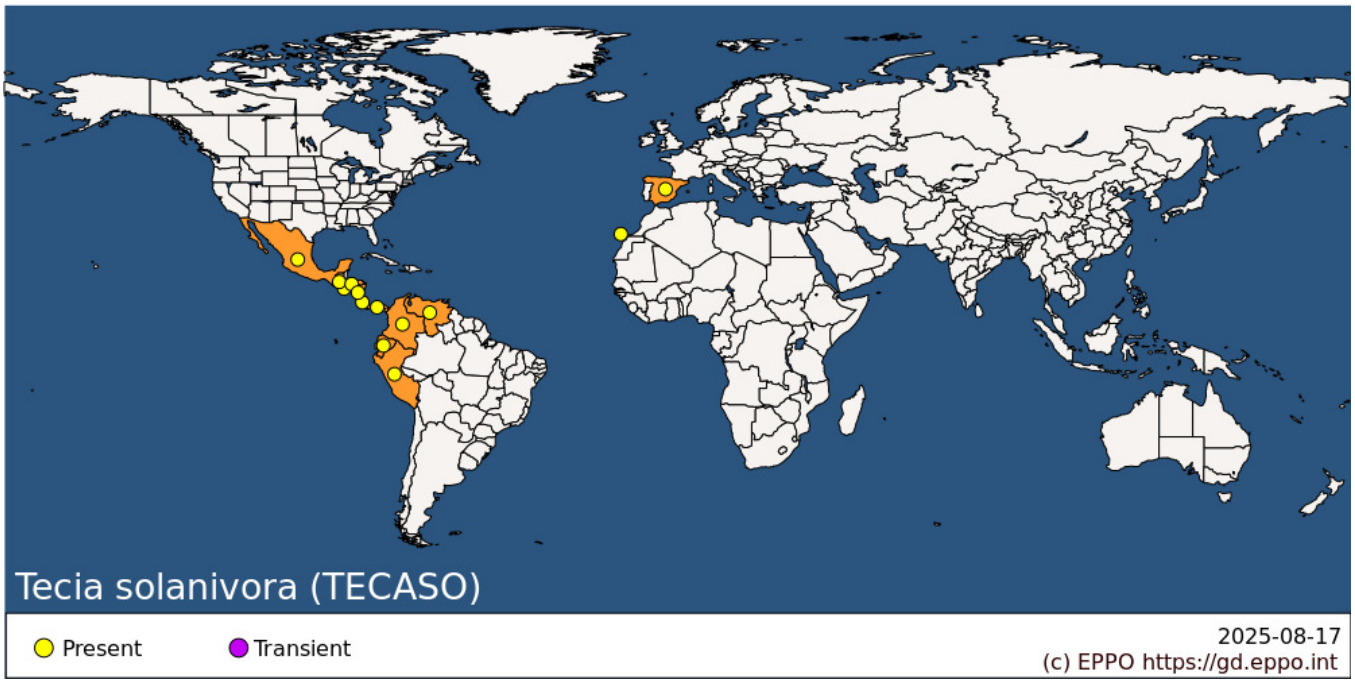
Potato is the only host identified so far.

Host list: *Solanum phureja*, *Solanum tuberosum*

GEOGRAPHICAL DISTRIBUTION

Tecia solanivora was first described in Central America in 1956. The pest is considered most likely to originate from Guatemala where its genetic diversity is reported as being the greatest (Torres-Leguizamon *et al.*, 2011). Since the 1970s the pest spread southwards from Guatemala, through Central America to South America. *T. solanivora* is not yet reported in Peru but is present in the extreme south of Ecuador and is commonly found in stores at Huaquillas, close to the Peruvian border, a town which is reported as a crossroads for active potato trade exchanges with Peru. The pest was first reported in Mexico in 2011.

The pest was first observed in the EPPO region in 1999 in Tenerife (Islas Canarias). In continental Spain, it was first identified in Galicia in 2015. It is thought that it was introduced with potatoes from Islas Canarias, probably by sailors because the first reports were in the surroundings of fishing harbours.



EPPO Region: Spain (mainland, Islas Canárias)
North America: Mexico
Central America and Caribbean: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama
South America: Colombia, Ecuador, Peru, Venezuela

BIOLOGY

T. solanivora attacks potato both in the field and in storage. Adults are nocturnal and fly short distances. In the field, they lay eggs on the ground or on uncovered tubers, and a few eggs are laid on leaves and stems. Emerging larvae enter tubers and feed on them. They build galleries which may completely destroy the tuber. After completing their development (four instars), larvae leave the tubers, by a circular 2–3 mm diameter exit hole, to pupate. In storage, eggs are laid on tubers. The pupal stage may take place on the ground, on the walls of storerooms, in bags or, occasionally, within the tuber.

In Costa Rica, affected potato cultivation areas are located around 1300 m high, with annual temperatures ranging from 19°C to 23°C. In Islas Canarias, the highest damage occurs between 500 and 600 m (Povolny, 2004). In Continental Spain infested areas are located between 0 and 400 m altitude with annual mean temperatures of 13.6°C. Heavy rain may be a limiting factor. A low temperature (15°C) is thought to favour egg laying. However, a higher temperature increases the number of generations per year, i.e. from 2 at 10°C to 10 at 25°C. Under laboratory conditions (15.5°C, RH 65.6%), the life cycle lasted about 93 days. The mean duration of developmental stages was 15 days for eggs, 29 days for larvae, 5 days for pre-pupae and 26 days for pupae. Adult males lived for 16 days, while adult females lived for about 20 days, during this time they laid around 200 eggs (Torres *et al*., 1997). At 20°C, the life cycle lasted 57 days for females and 54 days for males, and at 25°C, optimum temperature for population development, the life cycle lasted 42 days for females and 41 days for males (Torres *et al*., 1997). *T. solanivora* does not survive below 7.9°C or above 30°C (EFSA PHL, 2018).

T. solanivora can develop in storage, either from larvae present in stored tubers at harvest, or from incoming flying adults. Data from a study in Spain with infested potato in storage reported that flying activity started at temperatures higher than 15°C and RH lower than 90%. In these conditions, four generations were produced in 10 months, with 37 to 53 day intervals between each generation (Rivera Martinez *et al*., 2018).

DETECTION AND IDENTIFICATION

Symptoms

Damage is similar to that of other potato tuber moths. Larvae bore superficial galleries containing residues of food, frass and larval exuviae. The entry hole may remain inconspicuous but 2–3 mm circular exit holes are visible after the larvae leave tubers. Secondary rotting may occur (EPPO, 2006; Rivera Martinez *et al*., 2018).

Morphology

Eggs

Eggs are ovoid in form, measuring 0.46–0.6 mm in length and 0.39–0.43 mm in width. Eggs are pearly white when freshly laid, becoming mat white before hatching (EPPO, 2006).

Larvae

Larvae are eruciform, with three pairs of true legs (thoracic) and five pairs of pseudolegs (four abdominal and one anal pair). The insect has 4 larval instars. After hatching, larvae measure 1.2-1.4 mm in length and are transparent white, with the head and prothoracic shield dark brown. Second-instar larvae are cream, with darker, coffee-coloured spots. Third-instar larvae are yellow-green; the spots along the body are more visible and the head and prothoracic shield are dark brown. Last larval instar is 12.4–14.2 mm long. Head, pronotum and tubercles pale chitin are brown. Sutures of head and mandibles are chestnut brown. Thoracic legs are pale. Body coloration is bright red-scarlet with pale to whitish pleurae and body underside (CABI, 2020; EPPO, 2006).

Pupae

The pupa is fusiform, measures on average 8.5 x 2.9 mm (female) or 7.8 x 2.4 mm (male). Freshly formed pupae are greenish, later become light and, gradually, dark brown. The cocoons are made of silk, covered with small pieces of earth and detritus. Pupation may occur on the ground, on the walls of storerooms, in sacking or within the tuber itself (CABI, 2020; EPPO, 2006).

Adult

Adults are rather stout moths with lanceolate front wings and larger rear wings with many fringes. The female is bright brown, the first pair of wings having three marks and bright brown longitudinal lines. The male is dark brown, with two marks on the first pair of wings and scarcely visible longitudinal lines. The female is larger than the male, measuring approximately 13 x 3.4 mm, whereas the male measures approximately 9.7 x 2.9 mm (Barroso, 1974; Torres, 1989; Sotelo, 1996). See also the EPPO diagnostic protocol for this species (EPPO, 2006).

Detection and inspection methods

Unlike *Phthorimaea operculella*, which produces galleries in leaves and sprouts, *T. solanivora* larvae only affect tubers. Pheromone traps can be used to detect flying adults (Rivera Martinez *et al*., 2018). Tubers can be inspected shortly before harvest, during or after harvest on the farm or at officially registered potato storage units (EPPO, 2007). Visual inspection of tubers should be performed, looking for holes and galleries with or without larvae (EPPO, 2006). Visual examination at the beginning of an infestation is very difficult because of the absence of external symptoms on the plants.

To confirm that a plant is infested by *T. solanivora* and not by another potato moth species such as *Phthorimaea operculella* and *Symmetrischema tangolias*, it is essential to identify larvae or adults found using morphological or molecular analyses (EPPO, 2006). Royals *et al*. (2017) published a key to sort and screen suspected *T. solanivora* specimens in the United States.

PATHWAYS FOR MOVEMENT

Although adults are weak fliers, during their lifetime, male moths are able to move more than 200 m from their release point (Perera González, 2020), contributing to local spread and storage unit or field infestations.

International spread is associated with the movement of potato tubers. Long-distance pathways include seed and ware potatoes, re-used potato bags (which may carry eggs and pupae) and infested soil (which may carry eggs or pupae) (EFSA PHL, 2018; EPPO, 2002).

Spread of the pest in Central and South America has been quite rapid (Guatemala in 1956, Costa Rica in 1971, Panama 1973, Venezuela in 1983, Colombia in 1985 and Ecuador in 1997), partly due to the use of infested seed potatoes, ware potatoes or farmer-produced seed potatoes in the field. Introduction into the Islas Canarias in Tenerife is attributed to the illegal import of infested potatoes from Venezuela, Ecuador or Colombia. Introduction in continental Spain is also attributed to illegal import of infested potatoes from Islas Canarias (Rivera Martinez *et al*., 2018).

PEST SIGNIFICANCE

Economic impact

Larvae feed exclusively on potato tubers, in the field and in storage. Tuber quality is greatly reduced and heavily infested tubers can no longer be used for food. Stocks can be totally destroyed in less than 3 months. The temperature at which potatoes are stored influences the development of the pest population and subsequent damage. More damage occurs as the store temperature increases, allowing faster population growth and more generations.

Damage between 50% and 100% in the field and storage is commonly reported in South America (Villanueva & Saldamando, 2013). In Ecuador, a crop may be destroyed in 2–3 months. Damage can reach 40% of the yield of a field in Central America. In 1994, Colombia attributed losses of 276 323 tonnes to *T. solanivora*. In Colombia during 1995, 4.4% of field potatoes were damaged and 11.3% of potatoes in store were damaged (Arias *et al*., 1996). In Costa Rica, *T. solanivora* is so important that 12–24 insecticide applications are performed each year against this pest, raising the likelihood that resistance may appear (Hilje, 1994). Since 2001, potato production was reduced by 50% in some areas of the north of Tenerife because of *T. solanivora.* During 2019 an administrative emergency was declared in Tenerife where an average of 35% losses were reported, reaching 80% losses in some areas (Ríos Mesa *et al*., 2020).

International markets for countries where *T. solanivora* was introduced are affected, as is the case of imports of seed potatoes and tubers from Islas Canarias to the EU which are now prohibited. In addition, export costs for treatment before export reduces international market competitiveness.

In continental Spain (Galicia), potato-growing was forbidden in 32 municipalities in 2017 and this measure was applied to one more municipality in 2018. Financial compensation for growers represented more than 100 000 EUR in 2017 and 89 000 EUR in 2018.

Control

Integrated control measures, both in the field and in storage, are applied where the pest occurs.

In the field, pheromone traps are used to control populations (Villanueva & Saldamando, 2013). Chemical control is in any case not effective or poorly effective once larvae are inside the tuber. Some plant protection products with active substances such as clorantraniliprol, piperonyl butoxide, clorprofam or pyrethrins, are used as protectants in the field or in storage. Cultural practices may be used in the field, such as ensuring that tubers are planted deeply (more than 5 cm) and that the base of the stems of developing potato plants are covered with soil to hamper egg laying and larval access. Crop rotation and destruction of potato crop residues (including volunteer potato plants) would prevent pest survival (Perera González, 2020) Promising results have been obtained in Central and South America with a *Baculovirus* of the Granulovirus genera, which seems to be the main direction of current research (Villanueva & Saldamando, 2013). The use of parasites (*Copidosoma* spp.) as biological control agents is also being investigated. Some field trials using *Copidosoma koehleri* in Islas Canarias have reported satisfactory results (Piedra?Buena Díaz *et al*., 2020).

Storage units should be cleaned and disinfected (e.g. space and surface treatment with an insecticide). Potatoes

should be stored on the day of harvest. Tubers should be selected so that only uninfested potatoes are stored. They may be treated with a *Baculovirus* (Villanueva & Saldamando, 2013). Indirect light and aeration are preferable (rather than storage in the dark), to hamper the development of *T. solanivora*. Pheromone traps can also be used for detection and control during storage. Packing material should not be re-used where the pest occurs. Use of packing material which is less favourable for the survival of the pest is also being studied, for example thin polyethylene bags allowing entry of light between the tubers, thus reducing infestation instead of 'traditional' potato bags.

In Islas Canarias, to avoid any further spread of *T. solanivora*, the prohibition to use ware potato tubers from infested areas as seed potatoes is being enforced. In Continental Spain (Galicia and Asturias) where the pest is only present in non-commercial production areas, measures taken to avoid any further spread includes the prohibition of planting potato in infested areas as well as the removal and destruction of infested plants. In Islas Canarias as well as Continental Spain, information campaigns for growers describing pest and control methods are being carried out and intensive surveys are being performed in potato fields and stores with pheromone traps. Data reported from Spanish regional governments in Asturias and Galicia showed a high reduction in the presence of this pest during more recent years, allowing some areas to recover the pest-free status in 2019 and 2020.

Phytosanitary risk

T. solanivora has been introduced into the EPPO Region; Islas Canarias (Spain), where damage and rising concern has been reported, as well as in continental Spain where spread from its initial introduction point was a great concern to domestic and commercial potato producers. Potato is a very important crop in various parts of the EPPO region. *T. solanivora* presents a high risk of establishment and damage in the southern countries of the EPPO region (EPPO, 2002). These countries have temperatures that would allow multiple generations to develop each year. Cold winters, where minimum temperatures are often below 7.9°C will prevent *T. solanivora* from establishing outdoors in Northern Europe (EFSA PHL, 2018).

PHYTOSANITARY MEASURES

The import of seed potatoes from third countries is prohibited in several EPPO Countries, namely in the EU (EU, 2019), but sometimes authorized under derogation procedures. Following the risks identified in a national Pest Risk Analysis reviewed by EPPO on *T. solanivora* (EPPO, 2002), specific requirements are recommended in the EPPO potato Standard PM 8/1 (EPPO, 2017) for the international trade of seed (except micropropagative material and minitubers) and ware potatoes. This Standard recommends that seed and ware potatoes should be washed or brushed so that they are free from plant debris and have no more than respectively 0.1% and 1% w/w of soil remaining, and where appropriate subject to transitional arrangements (pest-free area for *T. solanivora* and origin from a pest-free potato production and distribution system for the pest, according to EPPO Standard PM 3/61 (2) (EPPO, 2019)). To import potato tubers from countries of Central and South America where *T. solanivora* is not known to occur, pest free status should be demonstrated by detection survey and tuber inspection or testing at import. Tubers should also be packed in containers which are new, or cleaned and disinfected, and the tubers should be free from larvae, pupae or adults of insects by visual inspection.

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Datasheet history

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