# *Tecia solanivora*

## Scientific Name
*Tecia solanivora* (Povolný, 1973)

**Synonyms:**
*Scrobipalpopsis solanivora* Povolný 1973

## Common Name
**Guatemalan potato tuber moth,** Guatemala tuber moth, Central American potato tuberworm, Polilla guatemalteca

**Figure 1.** *Tecia solanivora* adult from Ecuador intercepted by the Servicio Nacional de Sanidad Agraria (SENASA) Peru in a quarantine station at the border (SENASA).

## Type of Pest
Moth

## Taxonomic Position
**Class:** Insecta, **Order:** Lepidoptera, **Family:** Gelechiidae

## Reason for Inclusion
Suggestion from the CAPS community

## Pest Description
Eggs: Newly oviposited eggs are pearl white and measure 0.46 to 0.63 mm in length and 0.43 to 0.39 mm in width (<$^{1}/_{16}$ in). Eggs become matte white before hatching (Povolný, 1973).

Larvae: "Eruciform, 3 pairs of true legs and 5 pairs of pseudolegs (four abdominal and one anal). 1.2–1.4 mm [<$^{1}/_{16}$ in] long (first instar) to 12–15 mm [approx. $^{1}/_{2}$ to $^{9}/_{16}$ in] long (final instar). Transparent white with the head and prothoracic shield dark brown (first instar), becoming cream with darker coffee-coloured spots (second instar), then yellowgreen with more visible spots along the body and head, and prothoracic shield dark brown (third instar) and finally purple on the dorsal face and green ventrally" (EPPO, 2005).

Pupae: "Fresh pupae are greenish later becoming light and, gradually, dark brown. The cocoons are of silk, covered with small pieces of earth and detritus. Length of pupa 7.3–9.0 mm [approx. $^{5}/_{16}$ to $^{3}/_{8}$ in]" (Povolný, 1973).

Adults: "Rather stout with lanceolate forewings and larger hindwings with many fringes. Sexual dimorphism (size and coloration)" (EPPO, 2005).

Females: “Bright brown with three marks and bright brown longitudinal lines on the forewings; approximately 13 mm [approx. $^{1}/_{2}$ in]” (EPPO, 2005).

Males: “Dark brown with two marks on the fore wings and scarcely visible longitudinal lines; approximately 9–10 mm [approx. $^{3}/_{8}$ in]” (EPPO, 2005).

A diagnostic protocol for this species is found in EPPO (2006).

## Biology and Ecology

The life cycle from egg to adult lasts approximately six weeks (Povolný, 1973). Heavy rain may be a limiting factor on pest development. Low temperatures (15°C (59°F)) may favor egg laying, but higher temperatures increase the number of generations per year (2 at 10°C (50°F) vs. 10 at 25°C (77°F)) (EPPO, 2005). Each generation lasts from 42 to 95 days depending on temperature. The minimum temperature for development is 7 to 9°C (45 to 48°F) (Econex, 2011).

Females can lay a few hundred eggs each and usually oviposit on soil near the plant base, on uncovered tubers, and occasionally on the foliage of plants (EPPO, 2005). In storage, eggs can be oviposited on tubers (Povolný, 1973).

After hatching, larvae penetrate and attack the tubers, producing multiple galleries which make the tubers unmarketable (Povolný, 1973). Larvae initially build galleries near the surface of the tuber and later move deeper into the tuber (CABI, 2012). In some cases, larvae will attack the base, stems, and leaves of potato plants (Povolný, 1973). Larvae undergo four instars before pupation (EPPO, 2005). Larvae leave the tubers to pupate, leaving 2 to 3 mm (approx. $^{1}/_{16}$ to $^{1}/_{8}$ in) circular exit holes in the tubers (EPPO, 2005; 2006; CABI, 2012). Under laboratory conditions, the larval stage lasts around 14 days (Povolný, 1973). In storage facilities, infestation can occur through larvae in harvested tubers or incoming, flying adults. Generations can occur at 4 to 5 week intervals in storage facilities (EPPO, 2005).

After exiting the tubers, larvae form cocoons made of silk and other material to pupate in (Econex, 2011). Pupation occurs near the surface of the soil (Povolný, 1973). In storage facilities, pupation can occur on walls, in corners, or on burlap sacks used for moving potatoes (EPPO, 2005). Larvae rarely pupate in or on tubers. The pupal stage lasts 13 to 15 days (Povolný, 1973).

Adults are nocturnal and can fly short distances (EPPO, 2005) usually skimming the ground when they fly (CABI, 2012). Mating and egg laying occur in the evening (Bosa et al., 2005).

This species can adapt to different climatic conditions (subtropical zones at 1,000 m (3,281 ft) to colder zones at 3,500 m (11,483 ft)) (CABI, 2012).

## Damage

*Tecia solanivora* attacks potatoes in both field and storage (EPPO, 2005).

Damage is similar to that caused by other tuber moths. Larvae attack tubers and can completely destroy them. Damage is caused by larval galleries that contain residues of food, frass, and the cast skins of larvae (exuviae). Holes and galleries produced by *T. solanivora* are larger than those produced by other Lepidoptera species that attack potato tubers (EPPO, 2006). The entry holes may remain inconspicuous. No external symptoms are seen until larvae leave the tuber through circular exit holes of 2 to 3 mm (approx. $^{1}/_{16}$ to $^{1}/_{8}$ in) (EPPO, 2005; 2006; CABI, 2012). Damage caused by *T. solanivora* can lead to secondary rotting (EPPO, 2005).

*Tecia solanivora* will occasionally attack the green parts of the potato plant (Povolný, 1973).

## Pest Importance

This species is considered one of the most serious pests of potato tubers in both Central and South America (Torres-Lugizamon et al., 2009). Losses may be as high as 100% in stored tubers within three months. In Central America, field losses can be as high as 40% in one season (Germain and McLeod, 2002; EPPO, 2005). Potato production in Tenerife (Canary Islands) was reduced by half in 2001 due to the combination of *T. solanivora* and a severe drought (EPPO, 2005).

Tuber quality is greatly reduced when infested with *T. solanivora,* and heavy infestations can make tubers unsuitable for either human or animal consumption. Damage in storage facilities increases as temperatures increase. This is due to faster population growth and more generations (EPPO, 2005).

If introduced into the United States, it could have a negative effect on potato production. Potatoes are the leading vegetable crop produced in the United States (AgMRC, 2012). It could also have a negative effect on trade; the U.S. exports tubers of *Solanum tuberosum* to four countries that consider this species a pest: Japan, Korea, Peru, and Taiwan (PExD, 2012).

Due to its damaging nature, methods of control have been studied in detail to help lessen the impact caused by *T. solanivora* including biopesticides, insecticides, cultural practices, and behavior modification through the use of pheromones and repellent or attractant compounds (Bosa et al., 2005; Jiménez and Poveda, 2009; CABI, 2012). The increased use of insecticides can potentially increase the risk of insecticide resistance in this species.

## Known Hosts

This species is only known to attack *Solanum tuberosum* (potato). Both field and stored tubers are attacked (Povolný, 2004; Torres-Luguizamon et al., 2009).

Claims of *T. solanivora* attacking *Daucus carota* (carrots), *Lycopersicon esculentum* (tomato), *Nicotiana tabacum* (tobacco), *Solanum melongena* (eggplant) and *Beta vulgaris* (beet) have not been proven. It has not been detected on any wild growing species of Solanaceae (Povolný, 1973).

## Pathogen or Associated Organisms Vectored

This species is not known to vector any pathogens or other associated organisms. However damage caused by *T. solanivora* can lead to secondary rotting (EPPO, 2006).

## Known Distribution

This species is likely indigenous to Guatemala.

**Central America:** Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; **Europe:** Spain (Canary Islands only); **North America:** Mexico; **South America:** Colombia, Ecuador, and Venezuela (NAPPO, 2001; Vives Moreno, 2003; Povolný and Hula, 2004; Torres-Lugizamon et al., 2009; Roblero et al., 2011).

*Tecia solanivora* is established along the border of Ecuador and Peru (EPPO, 2005).

## Pathway

*Tecia solanivora* was first described from Costa Rica in 1973 and has since extended its range in Central America and further into South America. International spread is through movement of potato tubers, which can carry eggs, larvae, and pupae. Spread may also occur through eggs on potato plants, reused potato bags, and soil infested soil with eggs or pupae (EPPO, 2005).

Imports of potatoes are not allowed from any of the countries that are currently known to have *T. solanivora* (FAVIR, 2012). However there have been three interceptions of *T. solanivora* (as *Scrobipalpopsis solanivora*) at U.S. ports of entry. Two were on *S. tuberosum* (potato) from Guatemala, and the other was on *Cucumis melo* (cantaloupe) from Panama (AQAS, 2012, queried May 2, 2012), none of which are allowed from these countries (FAVIR, 2012).

*Tecia solanivora* was recently found in Mexico and is believed to be established throughout most of the country. Introduction of the pest into Mexico was likely through infested tubers from Guatemala (Roblero et al., 2011). Because of this, smuggling of tubers from central and northern Mexico into the United States could provide a pathway for the immature stages of *T. solanivora*. This species is thought to have been introduced into the Canary Islands illegally through potatoes from Venezuela, Colombia, or Ecuador (Germain and McLeod, 2002; EPPO, 2005).

Natural spread is limited to adult flight into new fields and storage facilities (EPPO, 2005).

## Potential Distribution within the United States

Only areas where *Solanum tuberosum* (potatoes) are grown are at risk for establishment of *T. solanivora*. *T. solanivora* can inhabit fields at elevations from 500 m to 3,000 m (1,640 to 9,843 ft) depending on the altitudinal temperature gradient (EPPO, 2005).

A previous risk assessment by USDA-CPHST projected the following states were at risk for the establishment of *T. solanivora*: Arizona, California, Colorado, Florida, Idaho, Montana, Nebraska, New Mexico, Oregon, Texas, and Utah (Fowler and Lakin, 2001).

A map was recently developed by USDA-CPHST (2012) which used Plant Hardiness Zones where *T. solanivora* is known to survive (7 – 13) in addition to areas in the United States where potatoes are produced. Plant Hardiness Zone 7 (orange) is considered marginal for development of *T. solanivora*. The map shows that *T. solanivora* is most likely to become established in areas of the southeast and parts of the west coast.

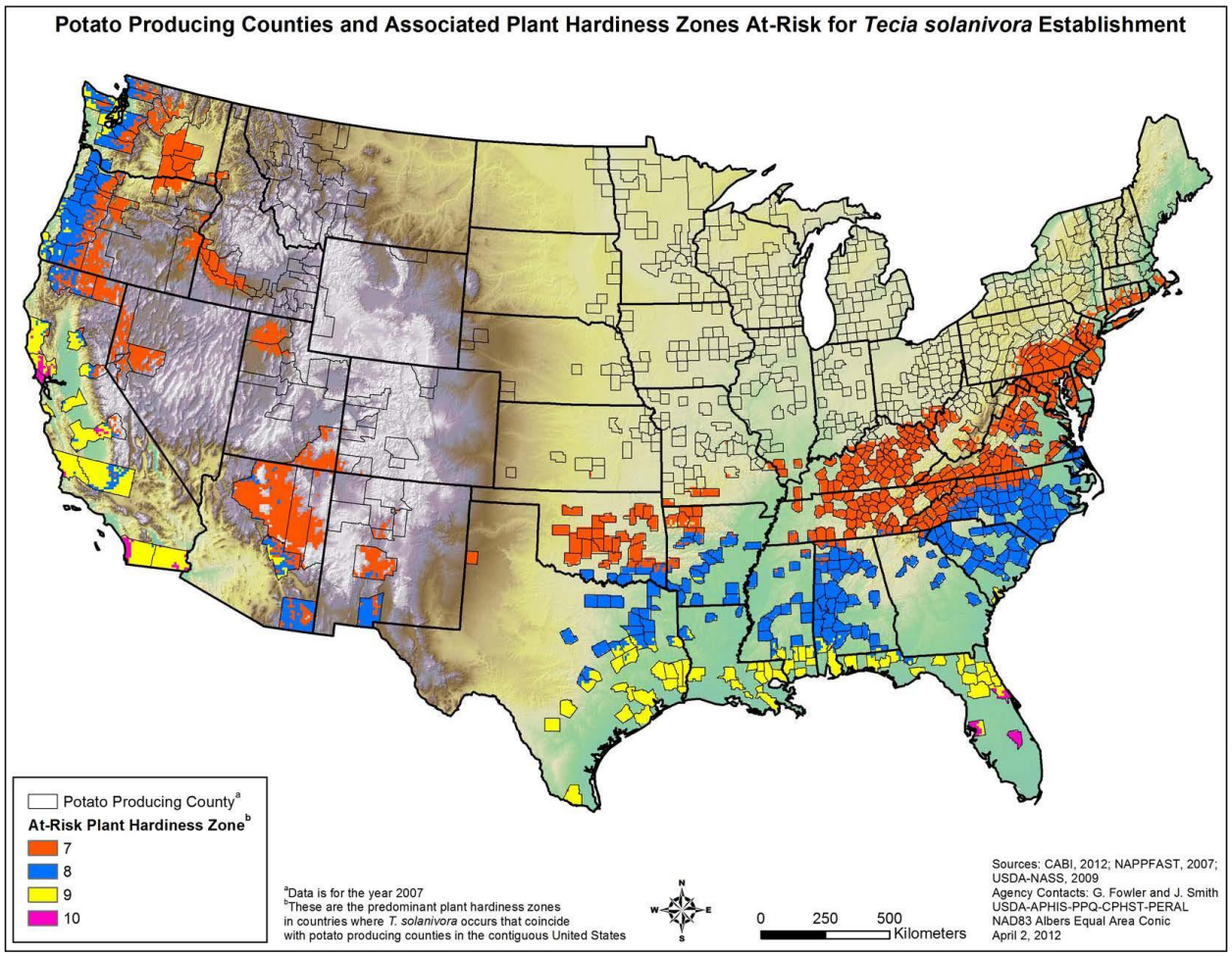


**Figure 2.** Potato producing counties and associated plant hardiness zones at-risk for *T. solanivora* establishment (Developed by USDA-APHIS-PPQ-CPHST-PERAL, 2012).

## Survey

**CAPS-Approved Method*:**

The CAPS-approved method is a trap and lure combination. The trap is the large plastic delta trap. The lure is effective for 30 days.

Any of the following Trap Product Names in the IPHIS Survey Supply Ordering System may be used for this target:

Large Plastic Delta Trap Kits, Green
Large Plastic Delta Trap Kits, Red
Large Plastic Delta Trap Kits, White

The Lure Product Name is *Tecia solanivora* Lure.

Trap color is up to the State and does not affect trap efficacy.

IMPORTANT: Do not place lures for two or more target species in a trap unless otherwise recommended.

Trap spacing: When trapping for more than one species of moth, separate traps for different moth species by at least 20 meters (65 feet).

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at http://caps.ceris.purdue.edu/.

**Literature-Based Methods:**

Trapping:

Econex (2011) states that 1 to 2 traps are needed per hectare for pest detection purposes.

Survey Site Selection:

The only known host of this species is *Solanum tuberosum* (potato). As this species can attack both tubers in the field and in storage facilities, surveys should focus on both.

Trap placement:

Traps are placed at the height of the host plant (around 30 to 60 cm (approx. 1 to 2 ft). More attention should be paid around the edges of the host crop as this is where populations increase the fastest.

Time of year to survey: Surveys for this species should occur during the host plant growing season. Surveying in storage facilities can be done year round.

Visual survey:

Adults are not easy to spot unless they are present together in large numbers. Adults normally rest on the ground on leaves or between cracks. Adults are more common

around the edges of crops and will take refuge in the surrounding weeds and bushes. In storage, adults may be found among potato heaps.

To detect larvae, tubers are inspected for exit holes or cut open to find damage caused by the pest. Larvae may or may not be present (EPPO, 2006; CABI, 2012).

Not recommended:
Adults may be detected by light traps; however, light traps are not species-specific (CABI, 2012). Pheromone traps are more attractive and species specific.

## Key Diagnostics/Identification

**CAPS-Approved Method*:**

Morphological. The descriptions of larvae and adults can be found in Povolný (1973). Larvae are identified by examination of the chaetotaxy (form, number, and shapes of the setae), while adults are identified by examination of male or female genitalia (EPPO, 2006). A description of the male and female genitalia can be found in EPPO (2006).

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## Easily Confused Species

This species has some similarities to *Scrobipalpopsis petasitis* (present in North America and Europe) and *S. tetradymiella* (present in the United States) (Povolný, 1973).

Two similar species that are found in potato include *Phthorimaea operculella* and *Symmetrischema tangolias*. Both larvae and adults of these species are smaller than those of *T. solanivora* (EPPO, 2006). Keys for adults of *Tecia* spp. from southern South America (not including *T. solanivora*) can be found in Povolný (1994).

## References

**AgMRC. 2012.** Agricultural Marketing Resource Center – Potatoes. Last accessed March 9, 2012 from: http://www.agmrc.org/commodities__products/vegetables/potatoes/.

**AQAS. 2012.** AQAS database, all *solanivora* spp. interceptions. Last accessed May 5, 2012 from: https://mokcs14.aphis.usda.gov/aqas/HomePageInit.do.

**Bosa, F., P. Witzgall, A. M. Cotes, T. Fukumoto, and N. Barreto. 2005.** Evaluación de la técnica de al interrupción de la copula de Tecia solanivora Povolný (Lepidoptera: Gelechiidae) [in Spanish]. Revista Colombiana de Entomología 31(2): 145-150.

**CABI. 2012.** Crop Protection Compendium report – *Tecia solanivora* (potato tuber moth). Wallingford, Oxon., UK. Last accessed May 1, 2012 from: http://www.cabi.org/cpc/.

**Econex. 2011.** Econex Sanidad Agricola: Soluciones para insectos. Especialistas en Feromonas y Trampas. *Tecia solanivora* (Polilla guatemalteca de la papa). Last accessed March 8, 2012 from: http://www.e-econex.com/soluciones-para-plagas-ver.php?ids=196&n=Tecia%20solanivora.

**EPPO. 2005.** European and Mediterranean Plant Protection Organization, Data sheets on quarantine pests: *Tecia solanivora*. OEPP/EPPO Bulletin 35: 399-401.

**EPPO. 2006.** European and Mediterranean Plant Protection Organization, Diagnostics: *Tecia solanivora*. OEPP/EPPO Bulletin 36(1): 175-178.

**FAVIR. 2012.** USDA-APHIS Fruits and Vegetables Import Requirements (FAVIR) Database. Last accessed May 2, 2012 from: http://www.aphis.usda.gov/favir/info.shtml.

**Fowler, G. A. and K. R. Lakin. 2001.** Draft Risk Assessment: Central American Tuber Moth, *Tecia solanivora* Povolný (Lepidoptera: Gelechiidae). USDA-APHIS-PPQ-CPHST, Plant Epidemiology and Risk Analysis Laboratory. Raleigh, NC. 15 pp.

**Germain, J. F. and A. McLeod. 2002.** Report of a Pest Risk Assessment, *Tecia solanivora*. European and Mediterranean Plant Protection Organization. 02/9434. WPPR Point 14.1.3. 3 pp.

**Jiménez, M. I. G. and K. Poveda. 2009.** Synergistic effects of repellents and attractants in potato tuber moth control. Basic and Applied Ecology 10: 763-769.

**NAPPO. 2001.** North American Plant Protection Organization, Pest Alert: *Tecia solanivora* (Povolny) 1973. Last accessed February 14, 2012 from: http://www.pestalert.org/viewArchPestAlert_print.cfm?rid=49 (Accessed 02/14/2012).

**PExD. 2012.** Phytosanitary Export Database (PExD): Harmful Organism *Tecia solanivora* (Insect) and Potato Commodity Requirements. Last accessed March 27 and April 4, 2012 from: https://pcit.aphis.usda.gov/PExD/faces/ViewPExD.jsp and https://pcit.aphis.usda.gov/PExD/faces/ReportCommodity.jsp.

**Povolný, D. 1973.** *Scrobipalpopsis solanivora* sp. n. – a new pest of potato (*Solanum tuberosum*) from Central America. Acta Universitatis Agriculturae, Facultas Agronomica 21(1): 133-146.

**Povolný, D. 1994.** Gnorimoschemini of southern South America VI: identification keys, checklist of Neotropical taxa and general considerations (Insecta. Lepidoptera. Gelechiidae). *Sleenstmpia* 20: 1-42.

**Povolný, D. 2004.** The Guatemalan Potato Tuber Moth (*Scrobipalpopsis solanivora* Povolný, 1973) before the gateways of Europe (Lepidoptera, Gelechiidae). Acta Univ. Agric. Brno 52(1): 183-196.

**Povolný, D. and V. Hula. 2004.** A new potato pest invading Southwestern Europe, the Guatemala potato tuber moth *Scrobipalpopsis solanivora* (Lepidoptera: Gelchiidae) [in German]. Entomologia Generalis 27(2): 155-168.

**Roblero, E. N. C., A. C. Vera, and E. A. Malo. 2011.** First report of *Tecia solanivora* (Lepidoptera: Gelechidae) attacking the potato *Solanum tuberosum* in Mexico. Florida Entomologist 94(4): 1055-1056.

**Torres-Luguizamon, M., M. Solignac, D. Vautrin, C. Capdevielle-Dulac, S. Dupas, and J. –F. Silvain. 2009.** Isolation and characterization of polymorphic microsatellites in the potato tuber moth *Tecia solanivora* (Povolný, 1973) (Lepidoptera: Gelechiidae). Molecular Ecology Resources 9(4): 1167-1169.

**Vives Moreno, A. 2003.** Una tribu, ocho géneros y dieciocho especies nuevos para la fauna espanola. *Ypsolopha cajaliella* Vives, sp. n., para la Ciencias en España (Insecta: Lepidoptera). SHILAP Revta. Lipid. 29: 93-110.

This datasheet was developed by USDA-APHIS-PPQ-CPHST staff. Cite this document as:

Molet, T. 2012. CPHST Pest Datasheet for *Tecia solanivora*. USDA-APHIS-PPQ-CPHST.