Tuta absoluta

Scientific Name
Tuta absoluta (Meyrick 1917)

Original combination:
Phthorimaea absoluta Meyrick, 1917

Synonyms:
Gnorimoschema absoluta (Meyrick)
Scrobipalpula absoluta (Meyrick)
Scrobipalpuloides absoluta (Meyrick)

Figure 1. Adult *Tuta absoluta* on a sticky trap, viewed from the side and showing the narrow brown speckled wings folded close around the body. Adult trapped in England and associated with tomatoes from Spain (Image courtesy of The Food and Environment Research Agency [FERA], Crown Copyright).

Common Names
Tomato leaf miner, tomato leaf worm, South American tomato pinworm

Type of Pest
Moth

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

Pest Description
Eggs: The eggs are small (0.36 mm long and 0.22 mm large), cylindrical, and creamy white to yellow in color (EPPO, 2005).

Larvae: Creamy with a dark head; body becoming greenish to light pink in the second to fourth instars (EPPO, 2005). First instar is 0.9 mm long and fourth is 7.5 mm long (EPPO, 2005). The last instar has a black line behind the head (van Deventer, 2009).

Pupae: Newly formed pupae are greenish and turn dark brown as they mature (USDA-APHIS, 2011). On average, male pupae are 4.3 mm (between $^{1}/_{8}$ and $^{3}/_{16}$ inch) in length and 1.2 mm (less than $^{1}/_{16}$ inch) in width; female pupae on average are 4.7 mm (approx. $^{3}/_{16}$ inch) in length and 1.4 mm (less than $^{1}/_{16}$ inch) in width (USDA-APHIS, 2011).

Adults: Adults are small, with a body length of around 7 mm (approx. $^{1}/_{4}$ inch) Their wings are narrow (4.2 to 5.0 mm long), brown or gray in color, mottled with dark grey and yellowish orange spots. The antennae are long and ringed with

black and brown. The legs and labial palps are also ringed with black and brown, and the palps are long and upcurved (Figure 1) (Korycinska and Moran, 2009).

Biology and Ecology

Tuta absoluta has a high reproductive potential; a single female can lay approximately 260 eggs in her lifetime (EPPO, 2005). Females mate once a day for several days (Uchoa-Fernandes et al., 2005) using pheromones to attract males. A calling behavior sequence has been observed by virgin females under laboratory conditions; females usually remain within the canopy while males fly towards them in groups (Uchoa-Fernandes et al., 2005). The number of generations per year can range from 5 to 12 (EPPO, 2005). In Mediterranean climates, *T. absoluta* adults have been detected year round (Tropea Garzia et al., 2012).

Larvae prefer leaves, stems, buds, or the calyx over tomato fruit (FERA, 2009). Diapause in larvae does not occur unless food is unavailable (EPPO, 2005). "Development stops between 6 and 9°C (42.8 and 48.2°F) (Barrientos et al. 1998; Bentacourt et al., 1996), depending on the life stage" (Potting et al., 2009).

Eggs are laid on the aerial parts of host plants (EPPO, 2005). *Tuta absoluta* goes through four larval instars (Vargas, 1970). Pupation places are dependent on environmental conditions and can occur in the soil, on leaf surfaces, or in mines (EPPO, 2005). Larvae may be covered by a cocoon when pupating on or in host plants (van Deventer, 2009). Depending on environmental conditions, the life cycle may take 29 to 38 days (EPPO, 2005). In laboratory experiments, "the development of *T. absoluta* averaged 76.3 days at 14°C (57°F), 39.8 days at 19.7°C (67.5°F), and 23.8 days at 27.1°C (81°F)" (Barrientos et al., 1998). "In a greenhouse with a year-round tomato crop, *T. absoluta* could have approximately 9 generations" (Potting et al., 2009).

Adults are nocturnal and may be found hiding between leaves during the day (EPPO, 2005; FERA, 2009). The moth is active to temperatures of 9°C (48.2°F). Moths can move several kilometers by flying or drifting with the wind (van Deventer, 2009).

This species may survive colder climates in greenhouses, possibly spreading to field crops during warmer months (Potting et al., 2009).

Damage

All parts of the tomato plant can be attacked by *T. absoluta* (Potting et al., 2009). Larvae can feed and develop on tomato fruit, leaves, or stems, creating feeding mines which can affect the plant's photosynthetic capabilities (Potting et al., 2009). Even a small amount of damage can make fruit unmarketable if intended for the fresh market (Potting et al., 2009).

Because larvae prefer leaves, stems, buds, or the calyx over tomato fruit, examining these areas of the fruit first is suggested (FERA, 2009).

Fruit rot can occur when secondary pathogens invade the galleries bored by *T. absoluta* (EPPO, 2005). Fruits can be attacked at any stage (EPPO, 2005), although they are not usually attacked unless infestations are heavy (Korycinska and Moran, 2009). When attacking fruit, larvae may tunnel into the fruit, leaving a hole visible on the surface. Larvae may also mine below the surface, turning the mine of the pest yellow (Figure 2). Besides tomato, there are no records of other species of fruit being attacked (Korycinska and Moran, 2009).

Figure 2. Tomato fruit showing entrance holes created by *Tuta absoluta* larvae. Image taken in a fruit packing house in England on fruit imported from an unknown European country (Image courtesy of The Food and Environment Research Agency [FERA], Crown Copyright).

Larvae feed on mesophyll tissue and leave the epidermis intact. Mines are irregular and sometimes become necrotic (EPPO, 2005). Several mines can be found on a single leaf (Korycinska and Moran, 2009). The development of plants can be affected by stem galleries produced by *T. absoluta* larvae. *Tuta absoluta* prefers apical buds, flowers, and new fruits and can be found in these areas along with black frass. Tomatoes can be attacked at any stage of development (EPPO, 2005); however, larvae only attack the above ground portions of the tomato plant (van Deventer, 2009). *Tuta absoluta* only attacks aerial parts of potato and cannot develop on tubers (EPPO, 2005).

“Unacceptable levels of cosmetic fruit damage may occur in fresh market tomato production due to the mining habit of the organism. Without any control measure the potential damage may be 100%, especially at high population densities at the end of the growing season” (Potting et al., 2009).

Pest Importance

Tuta absoluta is considered a key pest in many areas where it is present, including Latin America (EPPO, 2005; Anonymous, 2010). A key pest is one that occurs regularly and will cause economic losses if left uncontrolled.

In Latin America, *T. absoluta* can lead to reduction in yield and fruit quality through direct feeding and introduction of secondary pathogens. Some consider *T. absoluta* to be the major limiting factor in tomato production in South America (Ferrara et al., 2001). It is known as the most devastating tomato pest in Brazil, at times causing 100% loss of production (Filho et al., 2000).

Tomatoes may lose their commercial value when severely attacked. Losses of 50-100% have been reported for tomato, mainly during low rainfall. *Tuta absoluta* can potentially become a pest of tomatoes in both field and greenhouses (EPPO, 2005). In introduced areas like Spain, high crop losses have occurred (EPPO, 2008).

Larvae are difficult to control because they develop within the plant, making this species hard to control with pesticides. Intensive use of pesticides to control *T. absoluta* has led to pesticide resistance in this species (van Deventer, 2009).

Known Hosts

Tuta absoluta is mainly a pest of solanaceous plants.

Major hosts

Solanum lycopersicum (tomato) (Korycinska and Moran, 2009)

Other hosts

Capsicum spp. (pepper), *Datura ferox* (fireweed), *Datura stramonium* (Jimsonweed), *Lycium chilense* (Chilean wolfberry), *Lycopersicon hirsutum* (hairy tomato), *Lycopersicum puberulum*, *Nicotiana glauca* (tree tobacco), *Phaseolus vulgaris* (bean), *Physalis peruviana* (cape gooseberry), *Solanum elaeagnifolium* (silverleaf nightshade), *S. lyratum*, *S. melongena* (aubergine), *S. muricatum* (pepino), *S. nigrum* (black nightshade), *S. puberulum* (green nightshade), *S. tuberosum* (potato) (Vargas, 1970; NAPPO-PAS, 2008; Korycinska and Moran, 2009, Potting et al., 2009).

Pathogens Vectored

This pest is not currently known to vector any pathogens or other associated organisms. However, damage by *T. absoluta* may lead to invasion by secondary pests.

Known Distribution

Africa: Algeria, Egypt, Kenya, Libya, Morocco, Senegal, Sudan, and Tunisia; **Asia:** Iran, Iraq, Israel, Jordan, Palestinian Authority (West Bank), Qatar, Saudi Arabia, Russia, Turkey, and Yemen; **Europe:** Albania, Austria, Bulgaria, Croatia, Cyprus, France, Germany, Greece, Italy, Kosovo, Malta, Montenegro, Netherlands, Portugal, Serbia, Spain, Switzerland, and the United Kingdom (including Guernsey[1]); **Central America:** Costa Rica and Panama; **South America:** Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela (EPPO, 2007; EPPO, 2009; Garzia, 2009; Korycinska and Moran, 2009; Russell IPM Ltd., 2009; EPPO, 2010a; b; c; d; e; Kiliç, 2010; Roditakis et al., 2010; EPPO, 2011a; b; MIDA, 2011; USDA, 2011; Baniameri and Cheraghian, 2012; EPPO, 2012a; b; c; Hrnčić and Radonjić, 2012; Mohamed et al., 2012; Smith, 2012; Anonymous, 2013; Lobos et al., 2013; IPPC, 2014).

[1] This population is listed as under eradication (EPPO, 2012b).

Potential Distribution within the United States

According to both climate and host availability data, *T. absoluta* is most likely to establish in areas around the Gulf Coast as well as parts of California and Arizona (USDA-CPHST, 2011). The main host of *T. absoluta*, *Solanum lycopersicum* (tomato), is grown in the highest proportion in Florida and California (USDA-CPHST, 2009).

Note: This species could also establish in areas with unfavorable climates by establishing in greenhouses. There have been many recent introductions of this species into new countries through greenhouses.

Pathways

Spread of this pest can occur through trade. *Tuta absoluta* is not likely to enter on potatoes as this pest does not attack the tubers (EPPO, 2005). However, it can be moved with shipments of plants for planting as well as tomato fruits; this potential pathway is likely how *T. absoluta* spread throughout parts of Europe (Potting et al., 2009).

Packing material may also serve as a pathway for this pest (FERA, 2009; Potting et al., 2009). *Tuta absoluta* can survive in greenhouse conditions in areas where it may not otherwise survive during winter (Potting et al., 2009).

Areas that may have an increased likelihood of introduction include nurseries dealing with host plant material, tomato farms, vegetable markets, processing plants, and vegetable repacking and distribution centers (Al-Zaidi, 2009a).

A Federal Order is currently in place to prevent the entry of *T. absoluta* into the United States from foreign countries where the pest is known to occur (DA-2014-33, July 23, 2014). Countries that are approved to export tomatoes to the United States where *T. absoluta* occurs have to meet certain requirements before shipments will be accepted into the United States.

Survey

CAPS-Approved Method*: Trap with lure. The trap type for *T. absoluta* is the large plastic delta trap. Lures should be replaced every four weeks.

IMPORTANT UPDATE: Effective September 2012.

A new type of sticky trap insert (liner), which uses a hard type of adhesive, has been approved for use in *Tuta absoluta* CAPS surveys. This product has been tested by CPHST and has been found to be as effective as the traditional trap liners at capturing *Tuta absoluta.* In addition, PPQ identifiers are able to pre-screen a higher number of specimens from the hard glue liners, and the

specimens tend to be of higher quality. The product name in the IPHIS survey Supply Catalog is “Large Plastic Delta Trap - Liners - Hard Glue.”

Traditional glue liners are still considered effective at capturing *Tuta absoluta*. Data from surveys that used the traditional trap liners will still be valid and acceptable for negative data reporting. However, hard glue liners are preferred because of the improvement in specimen processing and identification.

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

The Trap Insert Product Name is “Large Plastic Delta Trap - Liners - Hard Glue.”

The Lure Product Name is “*Tuta absoluta* Lure.”

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

Survey site selection:
The spread of *Tuta absoluta* to new areas has been more due to human activity than natural spread of the insect; therefore, surveys should be conducted in high risk sites (Al-Zaidi, 2009a). High risk survey sites can include each step along the production chain, starting from nurseries that sell tomato seedlings to tomato processing plants and food waste facilities (Al-Zaidi, 2009a).

Time of year to survey:
Tuta absoluta can be present in greenhouses year-round (Al-Zaidi, 2009b). In locations with mild winters, there can be up to 10 to 12 generations per year, each about 30 to 40 days long, so the pest may be present year-round (Roble, 2009).

Trap placement:
Tuta absoluta does not fly very high; therefore, place traps 0.3 to 0.6 meters (1 to 2 feet) over the host plant (Al-Zaidi, 2009a).

IMPORTANT: Do not include lures for other target species in the trap when trapping for this target.

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

Literature-Based Methods: Ferrara et al. (2001) found that traps baited with pheromones were only attractive to males during the early morning when females exhibit their calling behavior. The most efficient traps were CICA-R

traps, most likely due to their formatting which are black and completely open (Ferrara et al., 2001). A concentration of 100µg of the main sex pheromone component received the highest response from *T. absoluta* males. Ferrara et al. (2001) also found that traps placed at 20 cm (7 $^{7}/_{8}$ in) above ground in industrial tomato crops caught the most *T. absoluta* males, although there was no significant difference between the different heights tested.

Filho et al. (2000) found that adding the minor pheromone component (E3Z8-14Ac) to the major component (E3Z8Z11-14Ac) did not significantly increase catches of male *T. absoluta* in the field. This may be because of uncontrollable variables in the field and reduction or partial loss of antennal receptor selectivity due to the high doses of pheromone used (Filho et al., 2000).

Both South America and Spain use pheromone water traps for mass trapping of *T. absoluta*. These consist of large bucket containers filled with water (van Deventer, 2009), while de Oliveira et al. (2008) found that black light bulbs (BLB) and ultraviolet lamps were effective at trapping *T. absoluta*.

Identification

CAPS-Approved Method*: Morphological. *Tuta absoluta* is very similar to many species in the same family, Gelechiidae, including other tomato pests (Brambila et al., 2010). For final identification, it is necessary to carefully examine adult genitalic structures as color is not distinctive for this species (Brambila et al., 2010).

For field screening use:
Brambila, J., S. Lee, and S. Passoa. 2010. *Tuta absoluta*, the Tomato Leafminer, Field Screening and Diagnostic Aid.

For identification use:
Brambila, J., S. Lee, and S. Passoa. 2010. *Tuta absoluta*, the Tomato Leafminer, Identification Aid.

*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/.

Easily Confused Species

This species is very similar to many species in the same family, Gelechiidae, including *Keiferia lycopersicella* (tomato pinworm) and *Phthorimaea operculella* (potato tuber moth); both species are present in the United States and may be found as pests in tomato fields (Brambila et al., 2010). Both species may be found in pheromone traps of *T. absoluta* whether they are attracted to the lure or not (Brambila et al., 2010). Symptoms of pest damage on tomato plants caused by *P. operculella* and *T. absoluta* cannot be distinguished macroscopically (Roditakis et al., 2010). Mines on tomato leaves may also be confused with the

larvae of leaf-mining flies in the genus *Liriomyza*. The mines of *Liriomyza* are more linear than those of *T. absoluta*. However, visual observation of mines cannot rule out the presence of *T. absoluta*; pheromone traps are the most efficient survey method.

Commonly Encountered Non-targets

Phthorimaea operculella, a morphologically similar species, has previously been caught in *T. absoluta* pheromone traps in Greece; as such, moth specimens should be thoroughly examined even when specimens are from *T. absoluta* pheromone traps (Roditakis et al., 2010).

In Florida, the most commonly encountered non-targets caught in *T. absoluta* traps are the gelechiid moths *Sinoe capsana* (Lee and Brambila, 2012), and *Keiferia lycopersicella,* the tomato pinworm (J. Brambila, personal communication, 2013).

Additional Resources

Hayden, J.E., S. Lee, S.C. Passoa, J. Young, J.-F. Landry, V. Nazari, R. Mally, L.A. Somma, and K.M. Ahlmark. 2013. Digital Identification of Microlepidoptera on Solanaceae. USDA-APHIS-PPQ Identification Technology Program (ITP). Fort Collins, CO.
http://idtools.org/id/leps/micro/factsheet.php?name=%3Cem%3ETuta+absoluta%3C%2Fem%3E

References

Al-Zaidi, S. 2009a. Recommendations for the detection and monitoring of *Tuta absoluta*. Russell IPM.

Al-Zaidi, S. 2009b. Survey recommendations for *Tuta absoluta*. Personal communication to L.D. Jackson on July 22, 2009 from S. Al-Zaidi. (Russell IPM Ltd).

Anonymous. 2010. The tomato leafminer, *Tuta absoluta*, recommendations for sustainable and effective resistance management [Poster]. Insecticide Resistance Action Committee Lepidoptera Working Group.

Anonymous. 2013. U.S. Government Helps to Combat Tomato Pest. Embassy of the United States Sana'a, Yemen. Accessed June 14, 2013 from: http://yemen.usembassy.gov/hctp.html.

Baniameri, V. and A. Cheraghian. 2012. The first report and control strategies of *Tuta absoluta* in Iran. EPPO Bulletin 42(2): 322-324.

Barrientos, R., J. Apablaza, A. Norero, and P. Estay. 1998. Temperatura base y constante termica de desarrollo de la polilla del tomate, *Tuta absoluta* (Lepidoptera: Gelechiidae) [abstract]. Ciencia e Investigación Agraria 25(3): 133-137.

Brambila, J., S. Lee, and S. Passoa. 2010. *Tuta absoluta*, the Tomato Leafminer, Field Screening and Diagnostic Aid. Cooperative Agricultural Pest Survey Program. 4 pp.
http://caps.ceris.purdue.edu/screening/tuta_absoluta

Brambila, J. 2013. Identification and non-targets encountered with *Tuta absoluta*. Personal communication to L. D. Jackson on December 10, 2013 from J. Brambila (USDA-APHIS-PPQ).

de Oliveira, A. C. R., V. da R. S. Veloso, R. G. Barros, P. M. Fernandes, E. R. B. de Souza. 2008. Capture of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) with light trap in tomato crop [abstract]. Pesquisa Agropecuária Tropical 38 (3): 153-157.

EPPO. 2005. Data sheets on quarantine pests: *Tuta absoluta*. EPPO Bulletin 35: 434-435. Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2007. EPPO Plant Quarantine Information Retrieval System (PQR), version 4.6. European and Mediterranean Plant Protection Organization.

EPPO. 2008. First report of *Tuta absoluta* in Spain (2008/001). EPPO Reporting Services. Paris: European and Mediterranean Plant Protection Organization.
.
EPPO. 2009. Index of the EPPO Reporting Service (2009/226). EPPO Reporting Services (226). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2010a. First report of *Tuta absoluta* in Bulgaria (2010/002). EPPO Reporting Services 1(002). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2010b. First report of *Tuta absoluta* in Cyprus (2010/003). EPPO Reporting Services 1(003). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2010c. First report of *Tuta absoluta* in Germany (2010/004). EPPO Reporting Services 1(004). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2010d. First record of *Tuta absoluta* in Israel (2010/026). EPPO Reporting Services 2(026). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2010e. First report of *Tuta absoluta* in Kosovo (YU) (2010/114). EPPO Reporting Service, 6(114). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2011a. First report of *Tuta absoluta* in Croatia. (2011/236). EPPO Reporting Service 11(236). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2011b. First report of *Tuta absoluta* in Austria (2011/237). EPPO Reporting Service 11(237). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2012a. First report of *Tuta absoluta* in Russia (2012/009). EPPO Reporting Service 1(009). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2012b. First report of *Tuta absoluta* in a tomato crop in Guernsey. EPPO Reporting Service 11(232). Paris: European and Mediterranean Plant Protection Organization.

EPPO. 2012c. First report of *Tuta absoluta* in Qatar. EPPO Reporting Service 5(091). Paris: European and Mediterranean Plant Protection Organization.

FERA. 2009. Managing *Tuta absoluta* infestations at packing sites in the UK: Best practice guidelines to mitigate the risk of spread of this pest in the UK. The Food and Environment Research Agency. 2 pp.

Ferrara, F. A. A., E. F. Vilela, G. N. Jham, Á. E. Eiras, M. C. Picanço, A. B. Attygalle, A. Svatos, R. T. S. Frighetto and J. Meinwald. 2001. Evaluation of the synthetic major component

of the sex pheromone of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Journal of Chemical Ecology 27 (5): 907-917.

Filho, M. M., E. F. Vilela, A. B. Attygalle, J. Meinwald, A. Svatoš and G. N. Jham. 2000. Field trapping of tomato moth, *Tuta absoluta* with pheromone traps. Journal of Chemical Ecology 26 (5): 875-881.

Garzia, G. T. 2009. *Physalis peruviana* L. (Solanaceae), a host plant of *Tuta absoluta* in Italy [abstract]. In: Integrated Control and Protected Crops, Mediterranean Climate. IOBC/WPRS Working Group Meeting. Greece, September 7-10, 2009.

Hrnčić, S. and S. Radonjić. 2012. Tomato leafminer – *Tuta absoluta* Meyrick (Lepidoptera, Gelechiidae) – current status in Montenegro. EPPO Bulletin 42(2): 341-343.

IPPC. 2014. New pest in Kenya: Preliminary surveillance report on Tuta absoluta- preliminary report by Kenya. Accessed August 18, 2014 from: https://www.ippc.int/countries/kenya/basic-reporting/new-pest-kenya-preliminary-surveillance-report-tuta-absoluta.

Jackson, L. D. 2010. *Tuta absoluta* (Tomato Leaf Miner) Survey Information. United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Center for Plant Health Science and Technology.

Korycinska, A. and H. Moran. 2009. Plant Pest Notice: South American tomato moth, *Tuta absoluta* (No. 56). pp. 1-4. Department for Environment, Food and Rural Affairs, Food and Environment Research Agency.

Lee, S. and J. Brambila. 2012. A new species of the genus *Sinoe* (Lepidoptera: Gelechiidae:Litini) from Florida. Florida Entomologist, 95(4):873-876.

Lobos, E., M. Occhionero, D. Werenitzky, J. Fernandez, L. M. Gonzalez, C. Rodriguez, et al. 2013. Optimization of a trap for Tuta absoluta Meyrick (Lepidoptera: Gelechiidae) and trials to determine the effectiveness of mass trapping. Neotropical Entomology 42(5):448-457.

MIDA. 2011. Notification. Ministry of Agricultural Development, National Bureau of Plant.

Mohamed, E. S. I., M. E. Mohamed, and S. A. Gamiel. 2012. First record of the tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Sudan. EPPO Bulletin 42(2): 325-327.

NAPPO, PAS. 2008. First detection of tomato leafminer (*Tuta absoluta*) in Spain. North American Plant Protection Organization, Phytosanitary Alert System. Retrieved April 18, 2008, From http://www.pestalert.org/viewNewsAlert.cfm?naid=57. Accessed on 10/12/10.

Potting, R., D. Jan van der Gaag, A. Loomans, M. van der Straten, H. Anderson, A. MacLeod, J. M. G. Castrillón, and G. V. Cambra. 2009. *Tuta absoluta*, Tomato leaf miner moth or South American tomato moth. Ministry of Agriculture, Nature and Food Quality (LVN) Plant Protection Service of the Netherlands. Accessed on 10/21/10 from: http://www.minlnv.nl/cdlpub/servlet/CDLServlet?p_file_id=42402.

Roble, B. 2009. Survey recommendations for *Tuta absoluta*. Personal communication to L.D. Jackson on July 22, 2009 from B. Roble (Marketing Coordinator, ISCA Technologies, Inc.).

Roditakis, E., D. Papachristos and N. E. Roditakis. 2010. Current status of the tomato leafminer *Tuta absoluta* in Greece. EPPO Bulletin 40: 163-166.

Russell IPM Ltd. 2009. *Tuta absoluta* information network - News. Russell IPM Ltd. From: http://www.tutaabsoluta.com/agrinewsfull.php?news=89&lang=en. Accessed on 10/12/10.

Smith, M. 2012. Virginia Tech research program confirms presence of invasive insect in Senegal. Accessed June 14, 2013 from: http://www.vtnews.vt.edu/articles/2012/09/092812-oired-tuta.html.

Tropea Garzia, G., G. Siscaro, A. Biondi and L. Zappala. 2012. Tuta absoluta, a South American pest of tomato now in the EPPO region: biology, distribution and damage. Bulletin OEPP/EPPO Bulletin 42(2), 205–210.

USDA. 2011. Federal Import Quarantine Order for Host Materials of Tomato Leafminer, *Tuta absoluta* (Meyrick). SPRO#: DA-2011-12. United States Department of Agriculture, Plant Protection and Quarantine.

Uchoa-Fernandes, M. A., T. M. C. Della Lucia, and E. F. Vilela. 1995. Mating, oviposition and pupation of *Scrobipalpuloides absoluta* (Meyr.) (Lepidoptera: Gelechiidae). Anais da Sociedade Entomologica do Brasil 24:159-164.

USDA–APHIS. 2011. New Pest Response Guidelines: Tomato Leafminer (Tuta absoluta). USDA–APHIS–PPQ–EDP Emergency Management, Riverdale, Maryland.

van Deventer, P. 2009. Leafminer threatens tomato growing in Europe. Pages 10-12 *in* Agri- & HortiWorld, Fruit & Veg Tech.

Vargas, H. C. 1970. Observaciones sobre la biología y enemigos naturales de la polilla del tomate, *Gnorimoschema absoluta* (Meyrick) (Lep. Gelechiidae). Idesia, 1: 75-110.

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

Molet, T. and L. D. Jackson. 2011. CPHST Pest Datasheet for *Tuta absoluta*. USDA-APHIS-PPQ-CPHST. Revised March 2014.

Revisions

March 2014

1) Revised the **Distribution** section.
2) Revised the **Easily Confused Pests** section. Added information on *Liriomyza* mines.
3) Revised the **Commonly Encountered Non-targets** section. Information on non-targets caught in *T. absoluta* traps in Florida was added.
4) Added the **Additional Resources** section.

August 2014

1) Revised the **Distribution** section.
2) Revised the **Pathways** section. Included information on Federal Order DA-2014-33.