ENTOMON 42(4): 335-338 (2017)
Short Communication No. ent. 42409

First report of tomato pinworm, *Tuta absoluta* (Meyrick) on egg plant *Solanam melongena* L. from Kerala, India

T. Sivakumar*, A. Josephrajkumar and N. Anitha*****

** ICAR-KVK- Alappuzha, ICAR-CPCRI (RS), Kayamkulam 690 533, Kerala; **Division of Crop Protection, ICAR-CPCRI(RS), Krishnapuram, Kayamkulam 690 533, Kerala; *** Department of Agrl. Entomology, College of Agriculture, Vellayani 695522 Thiruvananthapuram, Kerala*
Email: sivanagri@yahoo.co.in

ABSTRACT: Invasive insect pests are threat to native flora as well as cultivated crops all around the globe. *Tuta absoluta* is a recent invasion to India and caused economic damage to tomato in South-Central India. The pest was noticed on *Solanum* melongena L. in southern most part of the Country and caused heavy defoliation of crops. A promising native ant species, *Diacamma rugosum* was found feeding on pupae from the ventral surface of the leaf. The ant predator could check the pest infestation in one plot. This the first report of the pest on eggplant and its ant predator from this part of the world.

KEY WORDS: *Tuta absoluta*, invasive pest, brinjal, predator, *Diacamma rugosum*

IUCN defines an invasive alien species as a species that is established outside of its natural past or present distribution, whose introduction and/or spread threaten biological diversity. Even though these invasive species include all categories of living organisms, plants and mammals, insects comprise the most common invasive alien species (Reghubanshi *et al.*, 2005). The tomato pin worm or leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is a serious invasive pest of tomato, *Lycopersicum esculentum* Mill. (Pereyra and Sánchez, 2006). Identified first in South America in 1917, *T. absoluta* has spread to Europe, North Africa (Desneux *et al.*, 2010) and Indian sub-continent (Shashank *et al.*, 2015). Active as well as passive means of dispersal, apart from human assisted transfer were reported by Desneux *et al.* (2011).

Apart from tomato, host range of *T. absoluta* include other Solanaceous crops such as brinjal or eggplant *Solanum melongena*; potato, *Solanum tuberosum* (L.), sweet pepper, *Solanum muricatum* L. and tobacco *Nicotiana tabacum* L. (Vargas 1970; Campos 1976), non-cultivated Solanaceae (*S. nigrum* L., *S. eleagnifolium* L., *S. bonariense* L., *S. sisymbriifolium* Lam., *S. saponaceum*, *Lycopersicum puberulum* Ph. etc.) and other plants such as *Datura ferox* L., *D. stramonium* L. and *Nicotiana glauca* Graham (Garcia and Espul 1982; Larraý´n 1986). *T. absoluta* has been reported on bean *Phaseolus vulgaris* in Italy (EPPO 2009). *Chenopodium album* L. (Fa. Convolvulaceae) and *Capsicum annuum* L. were also recorded as a host of *T. absoluta* from Turkey (Portakaldali *et al.*, 2013).

This micro-lepidopteran has caused immense damage to tomato crop in all invaded regions incurring a crop loss up to 80-100 per cent in tomato (Desneux *et al.*, 2010; Shashank *et al.*, 2015). Coupled with indiscriminate use of insecticide and environmental hazard, excess interventions by insecticide usage accounted for huge expenses in

* Author for correspondence

pest management in tomato crop (Desneux *et al.*, 2011).

In India, the pest was reported from Karnataka (Sridhar *et al.*, 2014), Maharashtra (Shashank *et al.*, 2015), Andra Pradesh (Kalleshwaraswamy *et al.*, 2015), Telangana (Kumari *et al.*, 2015) and of late, from Tamil Nadu (Shanmugam *et al.*, 2016). These studies revealed the attack of *T. absoluta* on tomato plants under open conditions. But from across the globe pest infestation was observed both in green house and open conditions. (Desneux *et al.*, 2010).

Field observations in farmers' plot during 2015 and 2016 in Southern Kerala, India revealed the presence of some leaf miners on egg plant, *S. melongena*. Further microscopic observations confirmed it as a lepidopteran pest. The larvae were reared out and morphometric observations were made. The identity of the pest was confirmed as *T. absoluta* with the taxonomic experts and using the keys explained by Roditakis *et al.* (2010).

Apical, tender leaves of egg plants were seen affected by the pest. Symptoms appeared as irregular blisters on dorsal leaf surface (Plate 1). Larvae were found feeding on the internal mesophyll tissues by remaining within the galleries formed. As many as twenty six blisters harbouring larvae of different life stages were noticed on a single leaf of *S. melongena*. Complete destruction of severely affected plants was also noticed. No fruit infestation was observed as reported in tomato (Ballal *et al.*, 2016). Low to severe infestation by *T. absoluta* was observed from different locations in Thiruvananthapuram, Kollam, Pathanamthitta and Alappuzha districts in Southern Kerala. Lack of knowledge and skill in identifying the symptoms of the pest by the growers and field extension staff made the pest infestation went unnoticed. The tomato plants adjacent to the brinjal plants were not affected by the pest.

Pupation of *T. absoluta* was reported in soil, leaf surface or within mines (EPPO, 2009). But we observed pupation on the ventral surface of the leaves, near to main vein of the leaf in brinjal (Plate 2). Under laboratory rearing conditions also the same behavior was observed. The morphometrices of larvae, pupae and adult are presented in table.1. Full grown larvae at prepupal stage had a mean length of 5.52±0.787 mm. The pupae had 4.0±0.432 mm length and 1.34±0.075 mm breadth (Plate 3). Adults were dark straw coloured swift flying tiny moths with wings folded parallel to their body while resting (Plate 4). Adult moths had long sharply bicoloured (with dark and light colouration) filiform antennae and fringed wings with a body length of 3.96±0.233mm from head to wing tip. Pupal period lasted 5 to 7 days.

Infestation by *T. absoluta* resulted in seared appearance of leaves which finally dried and fell off immaturely. Nevertheless eggplant was reported as a host plant, this observation proves the potential of causing regional wise crop specific damage by the pest. The pest has developed resistance against a number of conventional insecticides as well as new generation pesticides (Lietti *et al.*, 2005; Silva *et al.*, 2011) which forms a major impediment in the control strategies. The multivoltine nature, high dispersal rate and r-related species status (Pereyra and Sánchez, 2006) coupled with insecticide resistance make the management strategies against the pest more expensive (Desneux *et al.*, 2011). Several natural enemies had been reported on *T. absoluta* from different regions of the World (Desneux *et al.*, 2010). Spiders (*Argiope* sp), mirid bug *Nesidiocoris tenuis* (Reuter), parasitoids such as *Trichogramma achaeae* Nagaraja and Nagarkatti, *Neochrysocharis formosa* (Westwood), *Habrobracon* sp. and *Goniozus* sp were also reported as natural enemies of *T. absoluta* from India (Sridhar *et al.*, 2014; Kumari *et al.*, 2015; Ballal *et al.*, 2016). In our field observations, the pupal cases were found bitten along with an incision on the leaf blade around the cocoon. Further investigations revealed the presence of an ant predator, *Diacamma rugosum* Le Guillou (Hymenoptera: Formicidae) (Plate 5). The robust black ant was found predating on cocoon of *T. absoluta* by biting open the cocoon with its mouth parts and also found carrying the pupae on their mandibles. The ants attacked the pupae not in groups, but singly. One ant was found consuming as many as three cocoons in 45 minutes. All

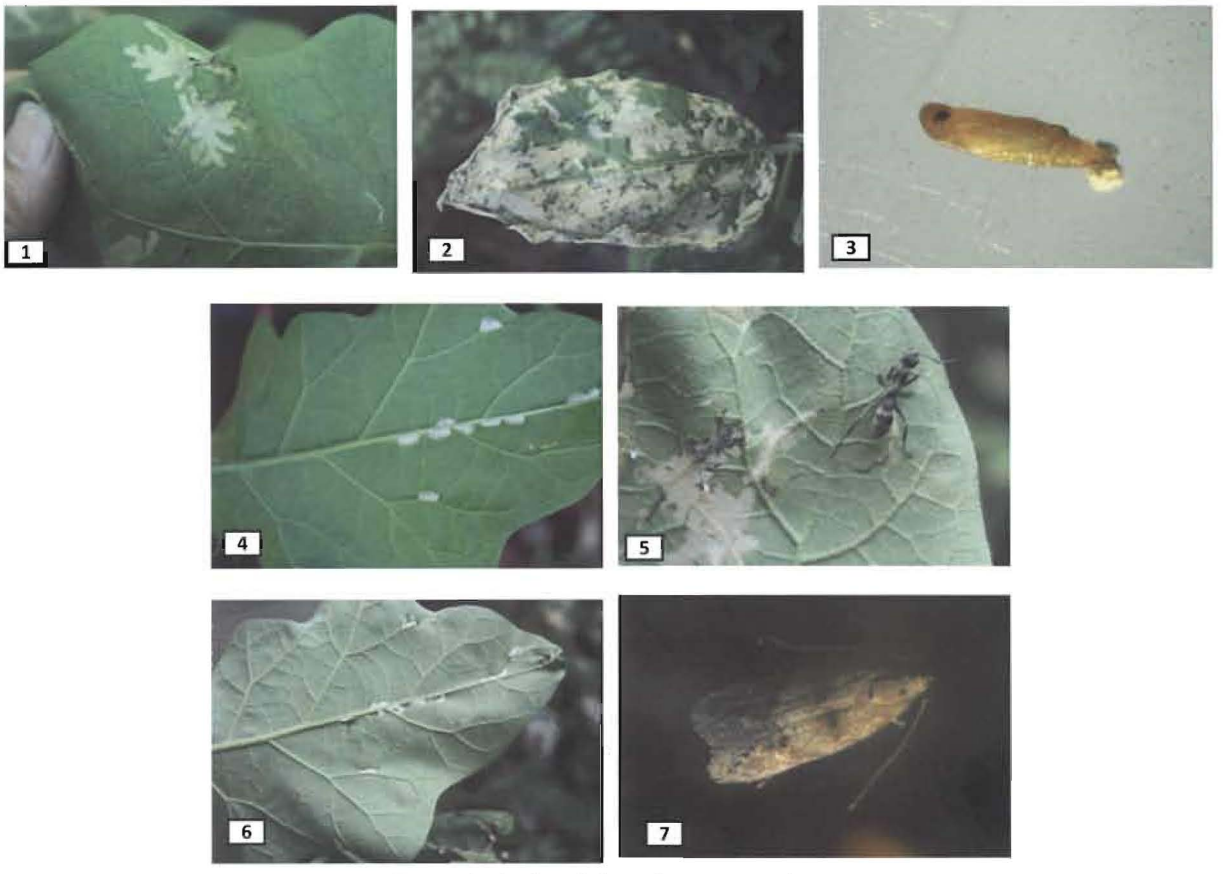

Plate. *T. absoluta* infestation on egg plant
1. Early symptom; 2. Severely damaged leaf; 3. Pupa; 4. Cocoons on ventral surface of leaf
5. Ant predator *D. rugosum*; 6. Predated cocoons; 7. Adult moth

fourteen cocoons found on a single leaf were devoured by the predatory ants in 24 hour. A typical incision was made on the leaf surface while the ants cut the cocoons with their sharp mandibles (Plate 6). Ants were found wandering on the leaf surface in search of cocoons, but attack on larvae was not noticed. The other formicid ant predators, *Pheidole* sp., *Solenopsis saevissima* and *Solenopsis geminata* were reported from Brazil and Ecuador (Desneux *et al.*, 2010).

This is the first report on incidence of *T. absoluta* as a major pest in brinjal from India and first report of this pest from Kerala on any reported host. The predation of *T. absoluta* by formicid, *D. rugosum* was not reported earlier from any part of the World. Large scale transport of tomato and brinjal from Tamil Nadu/Karnataka could be some of the initial source of spread in Kerala. As suggested by Garzia *et al.* (2012), the ecological and biological strategies of the pest might have caused the rapid adaptation to its new environment. A sustainable management strategy comprising of correct blending of biological, chemical, behavioral and cultural methods has to be developed for the control of this noxious pest. Even though the native ant species, *D. rugosum* promises natural control of the pest in this region, other predators and parasites should be explored for their efficacy on *T. absoluta.*

Table 1. Morphometric of different growth stages of *T. absoluta*

T. absoluta		Mean (mm)*	SD
Full grown larva	- Length	5.52	0.787
Pupa	- Length	4.0	0.433
	- Breadth	1.34	0.075
Adult	- Length	3.96	0.233
	- Breadth	1.45	0.131

*Mean of 10 observations; SD=standard deviation

ACKNOWLEDGEMENTS

Authors wish to thank Dr. K. Umamashweran, Professor, College of Agriculture, Vellayani and Department of Agricultural Entomology, Central Plantation Crops Institute (Regional Station) for providing rearing and documentation facilities. The service of Dr. S. Kalesh in identification of the ant species is also acknowledged with thanks.

REFERENCES

Ballal C.R., Gupta A., Mohan M., Lalitha Y. and Verghese A. (2016) The new invasive pest *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in India and its natural enemies along with evaluation of Trichogrammatids for its biological control. Current Science 110(11): 2155-2159. doi: 10.18520/cs/v110/i11/2155-2159.

Campos R.G. (1976) Control quý´mico del "minador de hojas y tallos de la papa" (*Scrobipalpula absoluta* Meyrick) en el valle del Can˜ete. Review of Per. Entomology 19:102–106

Desneux N. Luna M.G., GuillemaudT. and Urbaneja A. (2011) The invasive South American tomato pinworm, *Tuta absoluta*, continues to spread in Afro-Eurasia and beyond: the new threat to tomato world production. Journal of Pest Science 84:403–408

Desneux N., Wajnberg E., Wyckhuys K. A. G., Burgio,G., Arpaia S., Narváez-vasquezc A., González-Cabrera J., Ruescas C.D., Tabone E., Frandon J., Pizzol J., Poncet C., Cabello T. and Urbaneja A. (2010) Biological invasion of European tomato crops by *Tuta absoluta*:ecology, geographic expansion and prospects for biological control. Journal of Pest Science 83:197–215. DOI 10.1007/s10340-010-0321-6

EPPO (2009) EPPO Reporting service. Pest and Diseases. No 8, Paris, 2009-08-01

Garcia M.F. and Espul J.C. (1982) Bioecologý´a de la polilla del tomate (Scrobipalpula absoluta) en Mendoza, Repu´blica Argentina. Rev. Invest Agropecuarias INTA (Argentina) 18:135–146

Kalleshwaraswamy C.M., Murthy M.S., Viraktamath C.A. and Krishna Kumar N. K. (2015) Occurrence of *Tuta absoluta* (Lepidoptera: Gelechiidae) in the Malnad and Hyderabad-Karnataka Regions of Karnataka, India. Florida Entomologist 98(3):970-971. DOI: http://dx.doi.org/10.1653/024.098.0326

Kumari D.A., Anitha G., AnithaV., Lakshmi B.K.M.,Vennila S. and Rao N. H. P. (2015) New record of leafminer, *Tuta absoluta* (Meyrick) in Tomato. Insect Environ 20(4): 136-138.

Larraý´n P.S. (1986) Plagas del tomate. *IPA,* La Platina 39:30–35.

Lietti M. M., Botto E. and Alzogaray R. A. (2005) Insecticide resistance in argentine populations of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Neotropical Entomolgy 34: 113-119.

Pereyra P.C. and Sánchez N.E. (2006) Effect of two solanaceous plants on developmental and population parameters of the tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Neotropical Entomolgy 35(5):671-676.

Portakaldali M., Oztemiz S. and Kutuk H.(2013) A new host plant for *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Turkey. Journal of Entomological Research Society 15(3): 21-24.

Reghubanshi A.S., Rai L.C., Gaur J.P. and Singh J.S. (2005) Invasive alien species and biodiversity in India. Current Science 88(4): 539-540

Roditakis E., Papachristos D. and Roditakis N.E. (2010) Current status of the tomato leaf miner *Tuta absoluta* in Greece. OEPP/EPPO Bulletin 40: 163–166.

Shanmugam P.S., Ramaraju K. and Indhumathi K. (2016). First record of South American tomato moth, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Tamil Nadu, India. Entomon 41 (1): 61-66

Shashank P.R., Chandrashekar K., Meshram N.M. and Sreedevi K. (2015) Occurrence of *Tuta absoluta* (Lepidoptera: Gelechiidae) an invasive pest from India. Indian Journal of Entomology 77(4): 323-329 DOI No. 10.5958/0974-8172.2015.00070.X

Silva G. A., Picanço M. C., Bacci L., Crespo A. L., Rosado J. F. and Guedes R. N. C. (2011) Control failure likelihood and spatial dependence of insecticide resistance in the tomato pinworm, *Tuta absoluta.* Pest Management Science 67: 913-920.

Sridhar V., Chakravarthy A. K., Asokan R., Vinesh L. S., Rebijith K. B. and Vennila S. (2014) New record of the invasive South American tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in India. Pest Management in Horticultural Ecosystem 20(2): 148-154.

Vargas H.C. (1970) Observaciones sobre la biologý´a y enemigos naturales de la polilla del tomate, Gnorimoschema absoluta (Meyrick) (Lepidoptera: Gelechiidae). Idesia 1: 75–110

(Received 06 June 2017; revised ms accepted 11 November 2017; published 06 December 2017)