***Tuta Absoluta* (Meyrick, 1917), (Lepidoptera: Gelechiidae) Adult Feeding on Tomato Leaves. Notes on the Behaviour and the Morphology of the Parts Related**

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ABSTRACT

The Tomato Leaf Miner, *Tuta absoluta* (Meyrick) (Lepidoptera Gelechiidae), is actually a most dangerous pest of solanaceous crops. While demonstrating the Tomato Leaf Miner adults, both male and female, ability to feed on tomato leaves we report an unexpected behaviour for this microlepidoptera. This paper details also morphological adaptation of the proboscis involved in feeding and evidences of the action on the leaves. Observation were given by digital camera-equipped stereoscope and Cryo-SEM. We discuss the mean of adult feeding in respect to moth mating and egg laying. A possible use of adult feeding in Tomato Leaf Miner IPM is also discussed. The adult Tomato Leaf Miner is capable to feed by wounding tomato leaf by its proboscis.

Keywords: *Lepidoptera* mouthparts, *polilla del tomate*, *tomato borer*.

INTRODUCTION

Tuta absoluta is a highly invasive pest capable of destroying a tomato field or greenhouse in few days, if the infestation is not checked properly (Filho *et al.*, 2000; Gomide *et al.*, 2001). Originating from South America, Tl accidentally invaded Spain (Urbaneja *et al.*, 2007), thus spreading very fast in other countries of the western Palearctic Region (Desneux *et al.* 2010; EPP0 2008, 2009a, 2009b, 2009c, 2009d, 2009e, 2009f, 2010a, 2010b, 2010c, 2010d, 2010e, 2011a, 2011b, 2011c; Ostrauskas *et al.* 2010; Toševski *et al.* 2011).

Generally until now we've considered *Tuta absoluta* caterpillars to be the only plant tissue feeder instars. Contrary to the common opinion this study provides evidences that adults of *Tuta*

absoluta are also able to feed on leaves. This adult feeding is not as massive as to produce any relevant economic damage; nonetheless this behaviour may have an impact on pest management strategies eliciting the inclusion of adult-targeting means of control in the horticultural crop IPM.

MATERIALS AND METHODS

For our study we have used *Tuta absoluta* adults from a laboratory breed at 23°C and 70%RH, under natural photoperiod, originated from Italian wild-collected parental. We also had plenty of adults evaded from field-collected *Tuta*-infested tomato plants. Tomato host plants in laboratory were young (7-15 leaves) potted Oxheart Tomato plants that were caged five each

in three IKEA Fyllen Laundry baskets. A total of 78 adults, from teneral to one day starved, were exposed on fresh tomato leaves to observe feeding. Experiment leaves were obtained from T1-free glasshouse tomatoes and were checked prior to the expositions to ascertain they were undamaged, in order to have experimental evidence of adult feeding.

Behavioural observations were given with a Motic and a Leitz stereomicroscope focusing on fresh tomato leaves stripes about 20 x 5 mm wide, fixed on double sided tape into a 25 x 25 x 25 mm cubic glass box made by gluing together five coverslips. The bottom side of the cube was open to allow adult T1 placement but placed on the microscope table to complete the box. Each behavioural observation was 5 minutes long, avoiding strip desiccation, curling or other relevant changes. We scrutinized and imaged damaged leaves by a Zeiss Universal compound microscope, a Zeiss Tessovar macro system and a Hitachi TM3000 Cryo-SEM.

Light microscopes were equipped with an Olympus PEN E-PL5 digital camera to shoot pictures and record HD movies. We have used this equipment for both ex vivo observations and for macro and microphotography. The camera was connected to a monitor in "Live View" allowing us to observe the subject in real time.

RESULTS AND DISCUSSION

Proboscis morphology:

The proboscis is normally 2.5 times coiled and about 1.4 mm long; uncoiled, it measures approximately 4 times the major diameter of the eye. It can be roughly divided in three major parts: the proximal, the middle and the distal third. Scales line the proximal third, the middle third bears scales on the dorsal surface only, while the distal third is devoid of. This last third appears rough by minute cuticular processes – 2 µm wide and tall. About 40 trichoid sensilla appear on the bare dorso-lateral side of the distal third; the scales hide the same sensilla on the rest of proboscis. The very tip of the proboscis – 30-35 µm – is shaped into two lobes: one for each proboscis-forming galea.

Adult behaviour:

Undisturbed adults stay into the glass box intermingling walking, flapping or attempting to fly. Once in touch with the leaf strip we observed

the proboscis uncoiled for feeding. The uncoiled proboscis taps the leaf surface forcing contact time by time. One can perceive the forced contact through the straightening of the proboscis and the slight adverse reaction of the body to the proboscis itself. The proboscis action may be single or clustered, each action lasting less than one second, but clusters can be clearly seen. The adult can step straight on the leaf strip during clustered proboscis actions.

Moreover, fast up-and-down body movements, antennal flagella shaking and egg laying was recorded. Other observed behaviours demonstrate that glass boxed adults were neither suffering nor disturbed by the caging and that they behave as free-living individuals.

Leaf wounds:

Corresponding to the proboscis actions the strips show small wounds on the superior leaf surface. Each wound, from sub-circular to elongate, is 0.5-3 mm long and 0.4-2 mm wide. The wounds appear slightly concave and bordered by a yellow-green boundary. The wound floor is marbled by an unusual pattern. Several single wounds may be found in a line or in a group of few (3-4) elements.

CONCLUSION

The evidence that we reported clearly demonstrates a kind of interaction among adults and tomato host plants that has never been reported before.

We may infer that adult feeding has a role in triggering several different trophic and non-trophic interactions between the phytophagous and the host-plant. In example host-plant feeding may bias host-plant acceptance, allow massive egg production or elicit egg-laying. Intraspecific semiochemicals (pheromones) may also originate from plant precursors as acquiring plant tissue may help, or inhibit perhaps, pheromone synthesis or modulate fraction of it.

Anyway, interferece with adult feeding may lead to further effective pest control means or *Tuta absoluta* IPM components.

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REFERENCES

1. Desneux N, Wajnberg E, Wyckhuys KAG, Burgio G, Arpaia S, Narváez Vasquez CA, González- Cabrera J, Catalán Ruescas D, Tabone E, Frandon J, Pizzol J, Poncet C, Cabello T, 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.
2. Filho MM, Vilela EF, Jham GN, Attygalle A, Svatos A, Meinwald J (2000). Initial studies of mating disruption of the tomato moth, *Tuta absoluta* (Lepidoptera: Gelechiidae) using synthetic sex pheromone. *Journal of the Brazilian Chemical Society* 11(6):621–628.
3. Gomide EVA, Vilela EF, Picanço M (2001). Comparação de procedimentos de amostragem de *Tuta absoluta* (Meyrick) (Lepidoptera:Gelechiidae) em Tomateiro Estaqueado. *Neotropical Entomology*, Vacaria, 30(4): 697–705.
4. Ostrauskas H, Ivinskis P (2010). Records of the tomato pinworm (*Tuta absoluta* (Meyrick, 1917)) – Lepidoptera: Gelechiidae – in Lithuania. *Acta Zoologica Lituanica* 20(2): 151–155.
5. Toševski I, Jović J, Mitrović M, Cvrković T, Krstić O, Krnjajić S (2011). *Tuta absoluta* (Meyrick, 1917) (Lepidoptera, Gelechiidae): a new pest of tomato in Serbia. *Pestic. Phytomed. (Belgrade)* 26(3):197–204.
6. Urbaneja A, Vercher R, Navarro V, Garcia Mari F, Porcuna JL (2007). La polilla del tomate, *Tuta absoluta*. *Phytoma España* 194:16–23.
7. ***EPPO 2008 - First record of *Tuta absoluta* in Morocco. EPPO Reporting Service 9(174): 2.
8. ***EPPO 2009a - First record of *Tuta absoluta* in France. EPPO Reporting Service 1(003):2–3.
9. ***EPPO 2009b - First record of *Tuta absoluta* in Italy. EPPO Reporting Service, 2(023):6.
10. ***EPPO 2009c - First record of *Tuta absoluta* in Netherlands. EPPO Reporting Service 2 (024):7.
11. ***EPPO 2009d - First record of *Tuta absoluta* in Tunisia. EPPO Reporting Service 3(042): 2.
12. *** EPPO 2009e - First report of *Tuta absoluta* in Albania. EPPO Reporting Service 9(170): 2.
13. ***EPPO 2009f - First report of *Tuta absoluta* in Portugal. EPPO Reporting Service 9(171): 3.
14. ***EPPO 2010a - First report of *Tuta absoluta* in Bulgaria. EPPO Reporting Service 1(002): 2.
15. ***EPPO 2010b - First report of *Tuta absoluta* in Cyprus. EPPO Reporting Service 1(003): 2.
16. ***EPPO 2010c - First report of *Tuta absoluta* in Germany. EPPO Reporting Service 1(004): 3.
17. ***EPPO 2010d - First report of *Tuta absoluta* in Hungary. EPPO Reporting Service 3(052): 2.
18. ***EPPO 2010e - First report of *Tuta absoluta* in Israel. EPPO Reporting Service 2(026):3.
19. ***EPPO 2011a - First report of *Tuta absoluta* in Greece. EPPO Reporting Service 4(071):3.
20. ***EPPO 2011b - First report of *Tuta absoluta* in Lithuania. EPPO Reporting Service 4(071): 3.
21. ***EPPO 2011c - *Tuta absoluta* continues to spread around the Mediterranean Basin. EPPO Reporting Service 4(071):4–5.