

First report of South American Tomato moth, *Tuta absoluta* (Meyrick) on French bean from India

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Abstract

In India, South American tomato moth, *Tuta absoluta* has been recorded infesting plants of solanaceae family in 2014. Larvae of *T. absoluta* were observed feeding on French beans, *Phaseolus vulgaris* during October 2016 in Bengaluru, India. Olfactometer bioassays revealed *T. absoluta* preferred *P. vulgaris* leaves when tomato leaves are significantly damaged by the pest. In choice test, with healthy tomato leaf versus healthy bean leaf, all larvae significantly preferred tomato leaf ($P < 0.0001$). However when *T. absoluta* larvae and adults were offered with damaged tomato leaf and healthy bean leaf, the female adult and larvae significantly preferred bean leaf ($P < 0.02$ and 0.04 , respectively). This study revealed that *T. absoluta* is expanding its host range in India. With the expansion of *T. absoluta* damage to other than solanaceae, there is a need for constant monitoring of the pest in other crops also, particularly from Fabaceae family.

Key words: Bioassay, *Phaseolus vulgaris*, host range, *Tuta absoluta*

Introduction

The South American tomato moth, *Tuta absoluta* (Meyrick) is one of the serious pests of solanaceous crops in several countries (Barrientos *et al.*, 1998; Miranda *et al.*, 1998). This pest was reported for the first time in India from Bengaluru (12.9716° N, 77.5946° E) in Karnataka (Sridhar *et al.*, 2014) followed by Maharashtra (Shashank *et al.*, 2015) on tomato and currently has spread to other parts of India. Tomato, *Solanum lycopersicum* is the major host plant of *T. absoluta* and it can feed and survive on other solanaceous plants like potato, egg plant and sweet pepper (Sridhar *et al.*, 2015; Harizanova *et al.*, 2009; Campos, 1976). The larvae feed on the chlorophyll content of leaves by mining and produces large blotch like symptoms. It has a potential to cause yield loss up to 100% under natural conditions (Apablaza, 1992).

Recently, European and Mediterranean Plant Protection Organization reported *T. absoluta* feeding on plants outside Solanaceae. It was found feeding on beans, *Phaseolus vulgaris* (Fabaceae) in Sicily, Italy (EPPO, 2009). Concurrent findings were reported by Abdul-Ridha *et al.* (2012) in Iraq, where the pest was found infesting broad bean, *Vicia faba* L., cowpea, *Vigna unguiculata* L. Walp. (Fabaceae) and wild radish, *Raphanus raphanistrum* (Brassicaceae). Hence, it was felt essential to monitor the incidence of this pest in alternate hosts.

Materials and methods

Survey and biology of the pest: In October 2016, under field conditions at Indian Institute of Horticultural Research, Bengaluru several common bean plants, *P. vulgaris* growing adjacent to tomato crop were found damaged by *T. absoluta*. To ensure the identity of this insect a number of infested leaves of common bean plant were brought to laboratory and maintained

in 0.3 m³, wooden cages (6 nos) with wire mesh and reared till the emergence of adults. The pest's identity was confirmed as *T. absoluta* based on male genitalia (Brambila *et al.*, 2010). To confirm further about the completion of life cycle of *T. absoluta* on French bean, *P. vulgaris* plants were grown under polyhouse conditions along with tomato plants. The plants were enclosed under netted cage (cotton) with 10 plants per each cage and the biology of the pest was worked out.

Olfactory bio-assay: The bioassays were carried out in a vertical Y-shaped Pyrex tube. Two-day old adults and larvae of *T. absoluta* were used to assess olfactory preference between the odours of healthy leaves of tomato versus healthy leaves of bean and 70 per cent infested tomato leaves versus healthy bean leaves. Each individual was observed until it had walked at least one of the side arms or until 30 min for the subsequent data analysis. For each test, an adult was evaluated only once to prevent any behaviour conditioning by experience. After repeating the trial with adults for five times, the odour sources were switched between the left-hand and right-hand side arms to minimize any spatial effect on choices. The olfactory bioassays were conducted at 25 ± 2 °C, 65 ± 10 % RH, and 150 ± 10 lux.

Statistical Analyses: For the data on olfactometer bioassays, the responses of *T. absoluta* adults and nymphs were analysed by a chi-square test. The null hypothesis was that insect pest had a 1:1 distribution across the two odour sources. All analyses were performed using the software SPSS version 21.0 (SPSS, IBM).

Results and discussion

The tomato moth, *T. absoluta* was recorded on French bean, *P. vulgaris*, with gallery like structures in the leaves, completely devouring the chlorophyll by the larvae (Fig.1) indicating French



Fig. 1. French bean, *Phaseolus vulgaris* plant infested with *Tuta absoluta* bean as a host. In other parts of the world, *P. vulgaris* is reported as a host for *T. absoluta* (EPPO, 2009; Harizanova *et al.*, 2009; Abdul-Ridha *et al.*, 2012 and Portakaldli *et al.*, 2013). The pest completed the life cycle in 32.7 ± 6.2 days ($n=10$ plants) under field conditions on bean plants.

Y-tube olfactometer test: In choice tests, 37 out of 50 females showed a significant preference to healthy tomato leaves than healthy bean leaves ($P = 0.0002$). However, when offered with infested tomato leaves and healthy bean leaves, females significantly preferred bean leaves over tomato leaves ($P = 0.0288$). Similarly males showed significant preference towards tomato leaves than healthy bean leaves ($P = 0.0006$) and no significant preference was noticed when infested tomato and bean leaves were offered ($P = 0.6476$). However when larva was subjected to two-choice test with healthy tomato leaves and healthy bean leaves, it showed significant attraction towards tomato ($P = 0.0001$) (Fig. 2) and also showed significant attraction to bean leaves, when choice was given between infested tomato leaves and healthy bean leaves ($P = 0.0477$). These observations showed that in the absence of tomato host or severe infestations to primary host *i.e.*, tomato, the pest shifted its preference towards *P. vulgaris*. (Fig. 3).

This study confirmed that *T. absoluta* is expanding its host range in India from the main hosts belonging to the family Solanaceae to hosts from families like Fabaceae. The French bean could be one

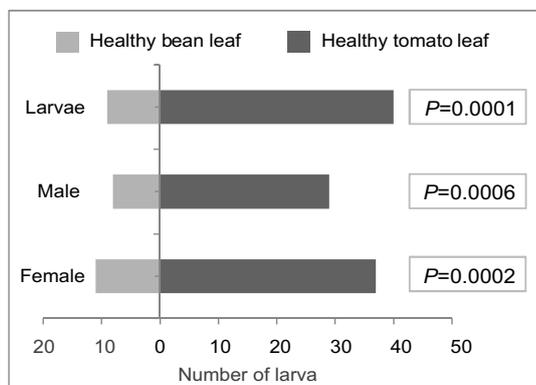


Fig. 2. Response of *T. absoluta* in a Y- olfactometer to the odours of healthy tomato leaf and bean leaf. *Chi-square* statistics ($P < 0.05$; DF:1) tested the hypothesis that the distribution of side-arm choices deviated from a null model where odour sources were chosen with equal frequency ($n=50$).

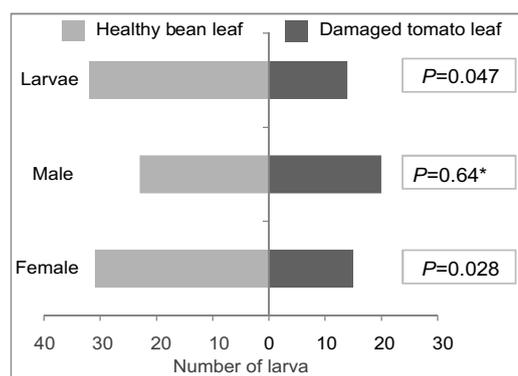


Fig. 3. Response of *T. absoluta* in a Y- olfactometer to the odours of damaged tomato leaf and healthy bean leaf. *Chi-square* statistics ($P < 0.05$; DF:1) tested the hypothesis that the distribution of side-arm choices deviated from a null model where odour sources were chosen with equal frequency. *- non-significant.

of the alternate hosts in the absence of Solanaceous hosts, hence close monitoring of the pest on Fabaceae family is recommended.

Acknowledgement

The authors are grateful to the Director, ICAR-Indian Institute of Horticultural Research, Bengaluru for providing facilities, DST-INSPIRE fellowship for funding and technical assistance of Rajendra Prasad, Kumar, K.P. Raghava. T and Dr. T. Nagaraja.

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Received: August, 2017; Revised: September, 2017; Accepted: September, 2017