International Journal of Agriculture Innovations and Research
Volume 8, Issue 4, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy):
Received: 05/02/2020 | Accepted on: 19/02/2020 | Published: 02/03/2020

Study of South American Tomato Leaf Miner (*Tuta absoluta* M.) in Georgia at Different Temperatures

Tatia Khositashvili * **and Nino Lomidze**
LEPL Technical university of Georgia, Tbilisi, Georgia.
*Corresponding author email id: tatakhosita@yahoo.com

Abstract **– South American tomato leaf miner *Tuta absoluta* (Meyrick, 1917) is a micro lepidoptera insect, which mainly damages tomatoes. Nowadays, it is spread almost worldwide. In Georgia it was discovered in March 2011 and now it is met in all greenhouse farms. In the article are considered the previously unknown details about the South American tomato leaf miner in the conditions of Georgia, as this pest has not been studied for years. The level of pest spread was determined - intense, medium and weak location. In Georgia, for the first time, was studied the duration of phases of the development of the South American tomato leaf miner *(Tuta absoluta)* under different temperature conditions and the number of females and males at different temperatures was established. In the conditions of Georgia, for the first time, studies were carried out on the peculiarities of ontogenesis, the spread of female pests on plant organs in percent. The experiments were carried out at constant temperatures of 10°C, 15°C, 20°C, 25°C and 30^{0}C *Tutaabsoluta* completed its development at all these temperatures, humidity 70 ± 10%. *Tuta absoluta* completed its development at all these temperatures. According to the European and Mediterranean Plant Protection Organization (EPPO) and the North American Plant Protection Organization (NAPPO), *Tuta absoluta* is spread with the seeds, tomato fruits and plastic containers used during harvesting. In the imago and worm phase, it is characterized by the very fast migration ability.**

Keywords **– Biological Control, Life Cycle, Lepidoptera, Tomato Leaf Miner.**

I. Material and Methods

The study was conducted in 2018-2020 in the modern and traditional tomato greenhouses in the regions of Mtshketa-Mtianeti and Kvemo Kartli in the East Georgia. Areas of intense, medium, and weak distribution of pest were identified. Intensive distribution zone - Kvemo Kartli, Shida Kartli, Kakheti, Imereti. Medium distribution zone: Mtskheta -Mtianeti, Samegrelo-Zemo Svaneti, Ajara and weak distribution zone: Racha-Lechhumi, Guria, Samtskhe-Javakheti.

In the newly emerged populations was studied the number of males and females and the fertility of females. The development of the larvae pest was studied in all four larvae ages (the first, second, third and fourth) as well as the period of pupating.

The studies were conducted at five levels of temperature 10°C, 15°C, 20°C, 25°C and 30^{0}C. The Effective of temperature was determined by the Warner formula (Warner, 1992): $1 / D = a + bT$, where $1/D$ is the development rate (1/development time). T is the temperature (^{0}C) and a and b are the angular and linear coefficients of the line [3].

For the feeding, the larvae were given the healthy leaves of tomato treated in sodium solution and covered with cotton wetted in water with honey, to avoid premature wilting of the leaves. At the end of feeding, the larvae entered the pupae phase, after which it became possible to establish the number of female and male individuals using the Bremer method: $L = \frac{f}{m+f}$ where, f is the number of female individuals in the population, m- the number

of male individuals as a result of which was established the sex ratio.

II. Main Text

Tuta absoluta M. is a micro Lepidoptera leaf miner with a high reproductive potential, capable of up to 10-12 generation per year under optimal conditions. Its life cycle is completed within 29-38 days.

In the conditions of Georgia the optimal temperature of pest development was determined 20°C and 25°C. The lower developmental threshold (the lower temperature threshold) was estimated 10.0 °C. [1], [3].

Even under the natural temperature fluctuations, the pest can damage the tomatoes. As a result of studies carried out in greenhouse farms of the regions Mtskheta-Mtianeti and Kvemo Kartli (Eastern Georgia), it was found that eggs are small, cylindrical, length 0.35 mm, intensity-0.22 mm. Yellowish-white (at the beginning) and yellowish-orange (before hatching). Eggs are laid on the underside of the leaf individually or in soapy groups, less frequently on the stem and very rarely on the fruit (see Table 1).

Table 1. Distribution of sex products according to the plant organs 2018.

Leaves	73%
Stems	21%
Flowers	5%
Green fruits	1%

III. Results and Discussion

The ontogenesis phases of *Tuta absoluta* M. -egg, larvae, pups and imago, i.e. are characterized by complete metamorphosis (Fig. 1). The laying of eggs by female individuals on the different organs of the plant is recorded as follows: 73% on the leaves, 21% -on the stems, 5% -on the calux leaves and 1% on green fruits (see Fig. 1) [4]. *Tuta absoluta* (Meyrick) Life cycle Fig. 1.

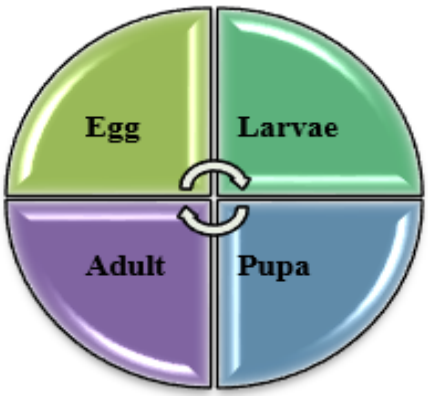

Fig. 1. Development time (days) of the different life stages of *Tuta absoluta* recorded at five constant temperatures 2019.

The experiments were carried out at temperatures of 10°C, 15°C, 20°C, 25°C and 30^0C. As the study shows, the South American tomato moth develop in a wide range of temperatures. *Tutaabsoluta* completed its development at all these temperatures in the conditions of the natural temperature fluctuations, the pest still can damage the tomatoes and develop (see Fig. 2) [1].

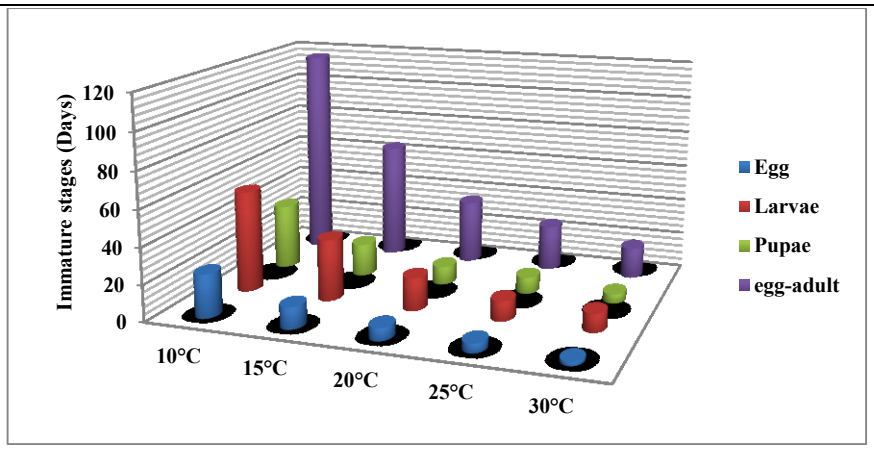

Fig. 2. Estimated parameters of the models used to describe the relationship between the adult life history traits of *Tuta absoluta* and temperature.

The *Tuta absoluta M* is more intensively multiplied at 20°C and 25°C. For the feeding, the larvae were given the healthy leaves of tomato treated in sodium solution and covered with cotton wetted in water with honey, to avoid premature wilting of the leaves. At the end of feeding, the larvae entered the pupae phase, after which it became possible to establish the number of female and male individuals using the Bremer method. There were no significant differences in the lifespan of males and females.

Tuta absoluta M. refers to polyvoltine insect species in which the phases of development of different generations are mixed with each other, so it is almost impossible to make an exact phenogram (see Fig. 3).

Mean longevity of females and males of *Tuta absoluta* recorded at five constant temperatures 2019 Fig. 3.

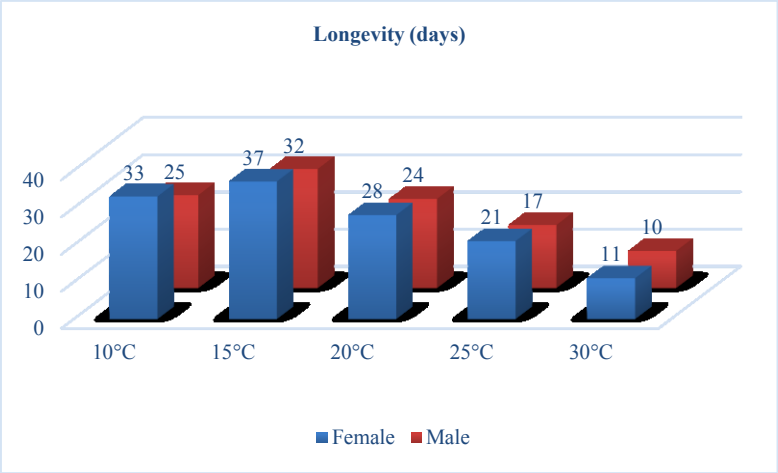

Fig. 3. The longevity of females kept at 30°C was significantly less than that of those kept at 10, 15 and 20°C. There were no significant differences in the lifespan of males and females.

REFERENCES

[1] T. Khositashvili, M. Lobzhanidze, "Modern technologies to produce ecologically pure products for sustainable development of Agriculture", " Study of South American tomato moth (*Tuta absoluta* M) in Georgian conditions and elaboration of measures for diminishing the harm", Tbilisi, Georgia, 2016, pp. 321-323.

[2] European and Mediterranean Plant Protection Organization Organisation Europeenne et Mediterraneenne pour la Protection des Plantes, *Tuta absoluta* „ OEPP/EPPO, Bulletin OEPP/EPPO, Bulletin 35, 2005, pp. 434–435 (European and Mediterranean Plant Protection Organization European and Mediterranean Organization for the Protection of Plants, *Tuta absoluta* „OEPP / EPPO, Bulletin OEPP / EPPO, Bulletin 35, 2005, pp. 434-435).

[3] Eur. J. Entomol. 112(4): *Tuta absoluta* (lepidoptera: Gelechiidae): thermal requirements and effect of temperature on development, survival, reproduction and longevity ,2015,pp. 658-659.

[4] T. Khositashvili, N. Lomidze, Georgian Academy of Agricultural sciences Bulletin N 1(41), Life cycle of South American tomato leaf miner (*Tuta absoluta* M.)", Tbilisi, Georgia, 2019, pp.76-77.

[5] APHIS-USDA (06/2011-1) New pest response guidelines for tomato leaf miner (*Tuta absoluta*), Published Online, Transmittal, pp.2-3; 7-14.
[6] M. Lobzhanidze, M. Beruashvili, Journal #2, Agrobasis,"South American tomato leaf miner", 2015, pp.18-20.
[7] Anonymous (2010) http://www.econatur.eu/index.php?sec=26&y=2010&a=491, 16/09/2010 Control de *Tuta absoluta* (Absolute Total Control). Accessed June 24, 2011.
[8] *Tuta absoluta* information network www.tutaabsoluta.com
[9] EPPO. (2005) Data sheet *Tuta absoluta* datasheet. OEPP/EPPO Bulletin 35: 434- 435. CIP, 1996.
[10] EPPO. (2008b) Additional information provided by Spain on EPPO A1 pests. EPPO reporting service (ESTa/2008-01).

AUTHOR'S PROFILE

First Author

Tatia Khositashvili, was born on July 20, 1990 she is 29 years old, unmarried. Graduated from Agricultural University of Georgia, faculty of Agronomy, the specialty of Agro-ecology BA degree. At the same University she received Master's degree at Agro-biotechnology. Tatia enrolled as a PhD student in Technical University of Georgia, 2017-till now, faculty of Agricultural Sciences and Bio Systems Engineering. Tatia's working experience includes eight years of being in Ministry of Environmental Protection Agriculture of Georgia, as an Agronomist in mining system, participation, more than 30 international and locally certified trainings in the field of agriculture. Published five publications in the fi--eld of plant protection, including two South American tomato leaf miner *Tuta absoluta* (Meyrick, 1917). Other Skills: Computer Programs Microsoft Office Word, Excel, Power Point, Outlook, Internet, eDocument. Adress: Vil Digomi, Baratashvili str. 38 Georgia, Tbilisi.

Second Author

Nino Lomidze, was born on October 23, 1968 she is 52 years old, unmarried. Graduated from Agricultural University of Georgia, specialty Plant Protection Master's degree. Academic degree/PHD L. kanchaveli Research Institute of Plant Protection, specialty Plant Protection. Nino's working in Technical University of Georgia, Position Associate Professor, Acting Head of the Department of Agrarian technologies, Other work experience Tbilisi city hall, Head of division, Ecology and green spaces department, National Forestry Agency, Forest Maintenance and Reforestation Department. Published six publications in the field of plant protection. More then 35 international and locally certified trainings in the field of agriculture. Other Skills: Computer Programs Microsoft Office Word, Excel, PowerPoint, Internet. Adress: #18. I Varketili 3, Georgia, Tbilisi. email id: nnlomidze@yahoo.com