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

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Abstract

South American tomato leaf miner *Tuta absoluta* 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°C. *Tuta absoluta* 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.

1. Introduction

Throughout the world, the provision of vegetables to the population is of utmost importance, and a large part of it are the products, which are produced in closed ground. Considerable experience acquired by farmers engaged in agriculture confirms, that growing vegetables in closed ground provides protection of plants from severe climatic conditions, greenhouse farming makes it possible to produce vegetables in the zone where farming is rather hazardous throughout the year, at different temperature conditions. Over the past years, the importance of vegetable crops has increased, as a large part of the population in our country is often fasting and also some are willing simply to eat dietary products. Given all this, it is important to provide the population with vegetable crops not only in summer, but also in winter, when vegetables are in short supply and they are mainly grown in closed ground.

The purpose of our research was 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

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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°C. The Effective of temperature was determined by the Warner formula: $1/D = a + bT$, where $1/D$ is the development rate (1/development time). T is the temperature (°C) and a and b are the angular and linear coefficients of the line (Krechemer, Foerster, 2015).

2. Materials and methods

The research objects. 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.

By official method used Bremer method. 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.

3. Results

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

Plant parts	Percentage Distribution, %
Leaves	73
Stems	21
Flowers	5
Green fruits	1

The ontogenesis phases of *Tuta absoluta* M.-egg, larvae, pups and imago, i.e. are characterized by complete metamorphosis (Figure 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 calyx leaves and 1 % on green fruits (see Figure 1) (Khositashvili, Lobzhanidze, 2019).

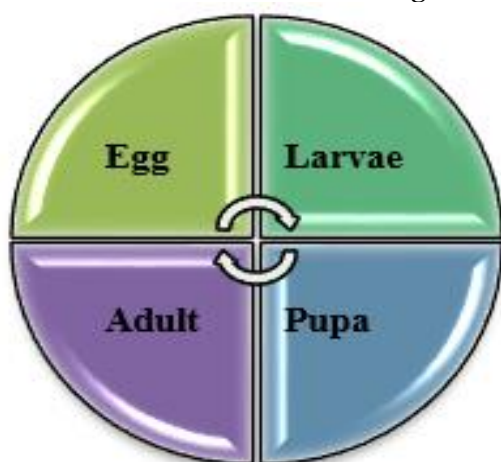


Fig. 1. Development time (days) of the different life stages of *Tuta absoluta* recorded at five constant temperatures 2019

The experiments were carried out at temperatures of 10°C, 15°C, 20°C, 25°C and 30°C. As the study shows, the South American tomato moth develop in a wide range of temperatures. *Tuta absoluta* 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 Figure 2) (Khositashvili, Lobzhanidze, 2016).

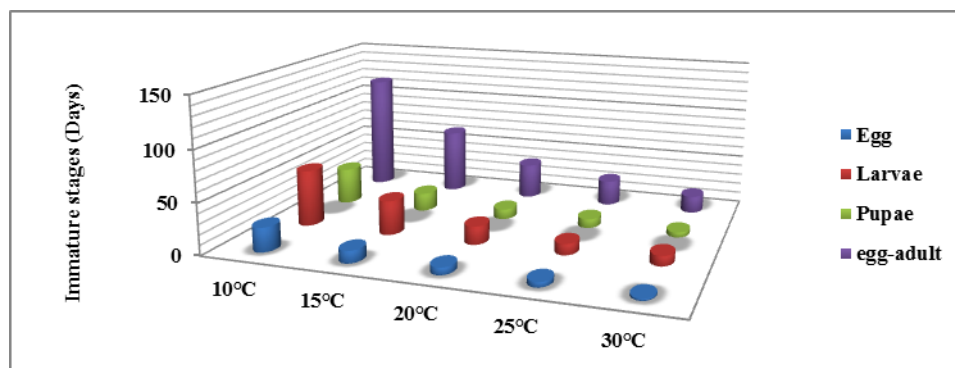


Fig. 2. Estimated parameters of the models used to describe the relationship between the adult life history traits of *Tuta absoluta* and temperature

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 Figure 3).

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

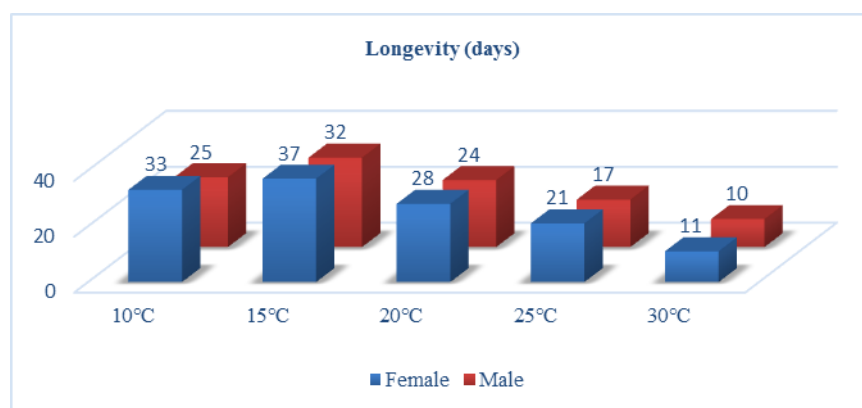


Fig. 3. The longevity of females kept at 30°C was significantly less than that of those kept at 10, 15 and 20°C. There were no significant differences in the lifespan of males and females

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. (Khositashvili, Lobzhanidze, 2016; Krechmer, Foerster, 2015).

3. Conclusion

The most important aim of our study is the new invasion species of the South American tomato mining moth (*Tuta absoluta* M.), harming cultural and wild plant species of the Solanum family.

The relevance of the issue is largely determined by the fact that the South American tomato mining moth (*Tuta absoluta* M.) is also ranked twelfth in the list of restrictedly widespread pests by the Resolution No. 429 of the Government of Georgia (document dated 31 December 2010, on conducting veterinary border-quarantine control and phyto sanitary border-quarantine control).

It was very important to study in detail the reproduction features of the noted pest, as this species has recently been advented in our country and it is natural that in the conditions of Georgia the pest revealed completely different biological features. Basing the above mentioned, it's impossible to outline rational measures and implement them timely and effectively. At the same time, it is important to take into account that the pest has high reproductive potential (can produce 9.0-12.0 generations, sexual production 160-260 eggs). The biological cycle is completed in 31.0-39.0 days. The optimum temperature was set to 20-25.0°C and the upper and lower limits of temperature – 8.0 ° C and 35 ° C.

References

- APHIS-USDA, 2011 – APHIS-USDA (06/2011-1). New pest response guidelines for tomato leaf miner (*Tuta absoluta*). Published Online, Transmittal, pp. 2-3, 7-14.
- EPPO, 2005 – EPPO (2005). Data sheet *Tuta absoluta* datasheet. *OEPP/EPPO Bulletin*. 35: 434-435.
- EPPO, 2008 – EPPO (2008). Additional information provided by Spain on EPPO A1 pests. EPPO reporting service (ESTa/2008-01).
- European and Mediterranean Plant..., 2005 – 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.
- Khositashvili, Lobzhanidze, 2016 – Khositashvili, T., Lobzhanidze, M. (2016). 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 neasures for diminishing the harm, Tbilisi, Georgia, pp. 321-323.
- Khositashvili, Lobzhanidze, 2019 – Khositashvili, T., Lobzhanidze, M. (2019). Life cycle of South American tomato leaf miner (*Tuta absoluta* M.). *Bulletin of Georgian Academy of Agricultural sciences*. 1(41): 76-77.
- Krechemer, Foerster, 2015 – Krechemer, F.d.S., Foerster, L.A. (2015). *Tuta absoluta* (Lepidoptera: Gelechiidae): thermal requirements and effect of temperature on development, survival, reproduction and longevity. *Eur. J. Entomol.* 112(4): 658-663.
- Lobzhanidze, Beruashvili, 2015 – Lobzhanidze, M., Beruashvili, M. (2015). South American tomato leaf miner. *Agrobasis*. 2: 18-20.
- Nuestros IV Pilares – Nuestros IV Pilares. Control de *Tuta absoluta* (Absolute Total Control). [Electronic resource]. URL: <http://www.econatur.eu/index.php?sec=26&y=2010 &a=491> (date of access: 24.06.2011).
- Tuta absoluta*... – *Tuta absoluta* information network. [Electronic resource]. URL: www.tutaabsoluta.com