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POSSIBILITIES FOR MONITORING GUATEMALAN POTATO TUBER MOTH *TECIA SOLANIVORA* (POVOLNY) AND POTATO TUBERWORM *PHTHORIMAEA OPERCULELLA* (ZELLER) BY PHEROMONE TRAPS IN ZONA 1 OF ECUADOR

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Abstract

The Guatemalan moth (GTPM), *Tecia solanivora* Povolny (Lepidoptera: Gelechiidae), was first registered in Guatemala and most recently invaded and became a key pest of the potato, *Solanum tuberosum* L., in Central and South America. Larvae feed exclusively on potato tubers, in the field and in store. Tuber quality is much reduced and heavily infested tubers can no longer be used for human or animal consumption. Stocks can be totally destroyed in less than 3 months. The potato tuber moth (PTM), *Phthorimaea operculella* Zeller (Lepidoptera: Gelechiidae), is one of the most damaging pests of potatoes in field and storage and is generally of greatest importance in warmer climates. After pest detection, synthetic sex pheromones are principally used to monitor population levels and trigger applications of chemicals or other control methods. In this article we described our results for using pheromone traps Delta VI of the company of Trécé Inc. USA for monitoring of the both pests in a Carchi province in Zona 1 in Ecuador. We give conclusions and recommendation for using these pheromone traps for detection and monitoring of these very important pests on Solanaceae crops.

INTRODUCTION

The Guatemalan moth (GTPM), *Tecia solanivora* Povolny (Lepidoptera:Gelechiidae), was first registered in Guatemala and most recently invaded and became a key pest of the potato, *Solanum tuberosum* L., in Central and South America.

This pest is considered to be one of the most serious and destructive pests of potatoes. The larvae feed throughout the potato producing holes (galleries) that collect residues of food, waste (frass), and shed skin which contaminates the potato. An infestation can destroy many tubers within the season and there can be an unknown infestation unless the larvae exit the tubers leaving visible exit holes, potatoes are sliced to check the insides, or rotted potatoes are found. Larvae survive and often thrive, in storage facilities.

The potato tuberworm *Phthorimaea operculella* (Zeller) (Lepidoptera: *Gelechiidae*), also known as potato tuber moth or tobacco splitworm, is an oligophagous pest (an insect feeding on a restricted range of food plants) of crops belonging to the family Solanaceae (mainly potatoes [*Solanum tuberosum* L.], tomatoes [*Solanum lycopersicum* L.], and tobacco [*Nicotiana tabacum* L.]).

This pest has been reported in tropical, subtropical, and Mediterranean agro-zones (Westedt et al., 1998, Flanders et al., 1999, Visser, 2005, Golizadeh and Esmaeili, 2012).

Larvae feed on potato leaves, stems, petioles, and more importantly potato tubers in the field and in storage. The newly hatched larvae create mines on leaves by feeding on leaf tissue while leaving the upper and lower epidermis of the leaf intact. They prefer feeding on young foliage (Trivedi and Rajagopal 1992). Typical damage results from larvae boring tunnels in tubers. Larvae depositing their excreta make tubers unfit for consumption. Potato tuber eyes become pink due to

deposition of silk and excrement by potato tuberworm infestation. Severe infestations result in yield and quality losses during storage where previously infested tubers are stored with healthy potato tubers (Malakar and Tingey, 2006, Rondon, 2010). This generally destroys the entire crop of stored potatoes.

Domesticated plants such as tomatoes, eggplants, peppers, and tobacco and wild solanaceous plants have served as host plants for *P. operculella*. A total of 60 plant species have been recorded as its food sources (Alvarez et al., 2005).

After pest detection, syntheticsex pheromones are principally used to monitor population levels and trigger applications of chemicals or other control methods.

MATERIALS AND METHODS

The trials were carried out in a Carchi province in Zona 1 in Ecuador in 2015- 2016.

The pheromone traps were installed at the end of January till the second half of March during the Prometeo programme in Ecuador. The flight dynamic of the both pests, *Tecia solanivora and Phthorimaea operculella,* was monitored using pheromone traps Delta VI and baits of the company of Trécé Inc. USA.

RESULTS AND DISCUSSION

Monitoring of potato tuber moth is a critical part of its management. Pheromone traps that attract males have been effective for monitoring potato tuber moth populations. Monitoring is one of the most important components of an integrated pest management (IPM) plan for Guatemalan potato moth and potato tuber moth. Monitoring gives an indication of insect presence, population and distribution, and allows for timing of pesticide applications for its management. PHEROCON® DELTA VI trap, baited with the pheromone can be used for attracting and monitoring adult male populations. These traps are easy to use. No economic threshold level (ETL) has been determined for crop damage or yield loss in fields. However, checking traps twice a week is suggested and pesticide application is recommended in case of high population (e.g., 15 to 20 moths/trap/night) (Anonymous, 2013). In our trials during the years of study was established that *Tecia solanivora* and *Phthorimaea operculella* developed one generation for 47- 55 days. It depended from climatic condition and mainly from the temperature. The flight dynamics of the both pests are presented in the figures 1, 2, 3 and 4. During our experiments we may make the following recommendation for using pheromone trap Delta VI for *Tecia solanivora* (Povolny) (Lepidoptera: *Gelechiida*e) in Solanaceae crops.

- Field planting - 1 to 2 traps are needed per hectare for pest detection purposes.
- Surveys for this species should occur during the host plant growing season.
- Surveying in storage facilities can be done year round locations.
- The traps should be placed at the height of the host plant (around 30 to 60 cm (approx. 1 to 2 ft). More attention should be paid around the edges of the host crop as this is where populations increase the fastest.
- The traps should be checked twice weekly or minimum once.
- The lures should be changed every 8 weeks; it depended from the temperature of the region.
- The liners should be changed monthly, or when get dirty.

CONCLUSIONS FOR USING PHEROMONE TRAPS FOR *TECIA SOLANIVORA*

- The pheromone traps and lures for *Tecia solanivora* are very effective and selective.
- They should be used from the growers for detection the pest in Solanaceae crops.
- The pheromone traps are suitable for observation the appearance and flight dynamic of *Tecia solanivora.*
- Pheromone traps for *Tecia solanivora* may be used for the environmental friendly control with this pest in the places with not very high population density.
- They may be used for reducing chemical treatments and receiving ecological production.

CONCLUSIONS AND RECOMMENDATION FOR USING PHEROMONE TRAPS FOR *PHTHORIMAEA OPERCULELLA*

- The pheromone traps and lures for *Phthorimaea operculella* are very effective and selective.
- The traps should be placed when tubers begin to form or at least 60 days prior to harvest.
- Place one trap in each corner of the field, but at least 14 rows or 50 feet or 15.25 meters within the field on the top of the foliage.
- The pheromone traps should be used from the growers for detection the pest in Solanaceae crops.
- Field planting - 1 to 2 traps are needed per hectare for pest detection purposes, in the large places minimum 4 traps per field.
- The pheromone traps are suitable for observation the appearance and flight dynamic of *Phthorimaea operculella.*
- Pheromone traps for *Phthorimaea operculella* may be used for the environmental friendly control with this pest in the places with not very high population density.
- The pheromone traps may be used for reducing chemical treatments and receiving ecological production.

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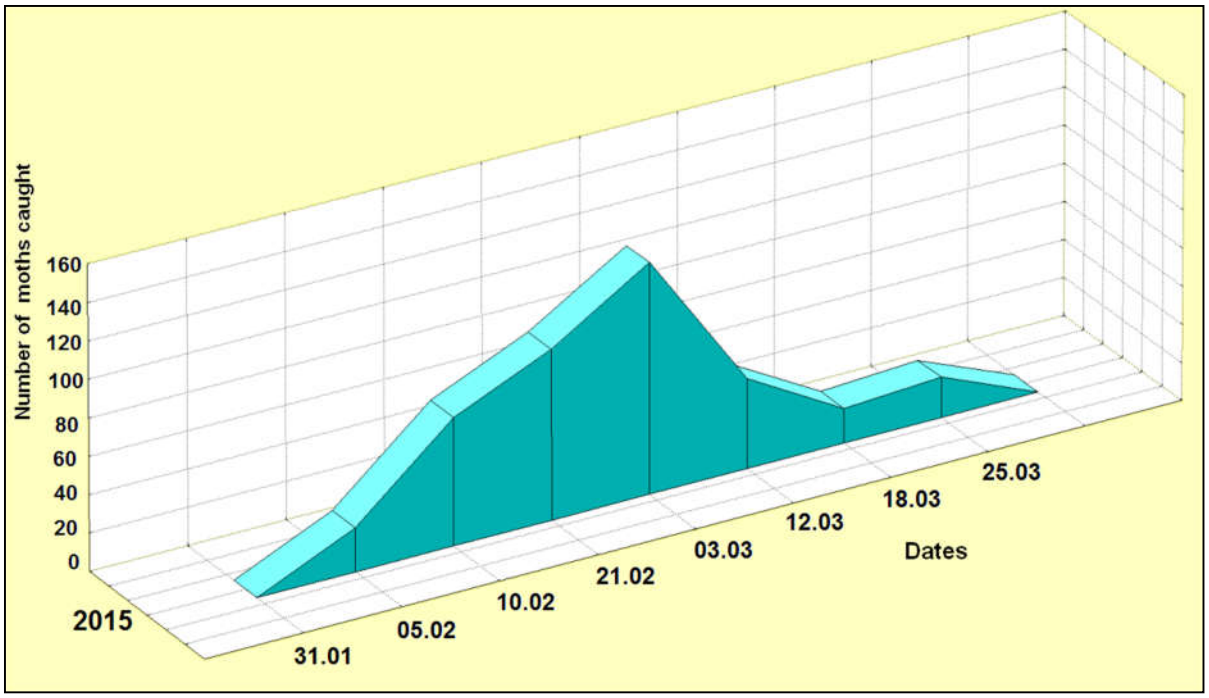

Fig.1. Flight dynamic of *Tecia solanivora in Carchi province in 2015*

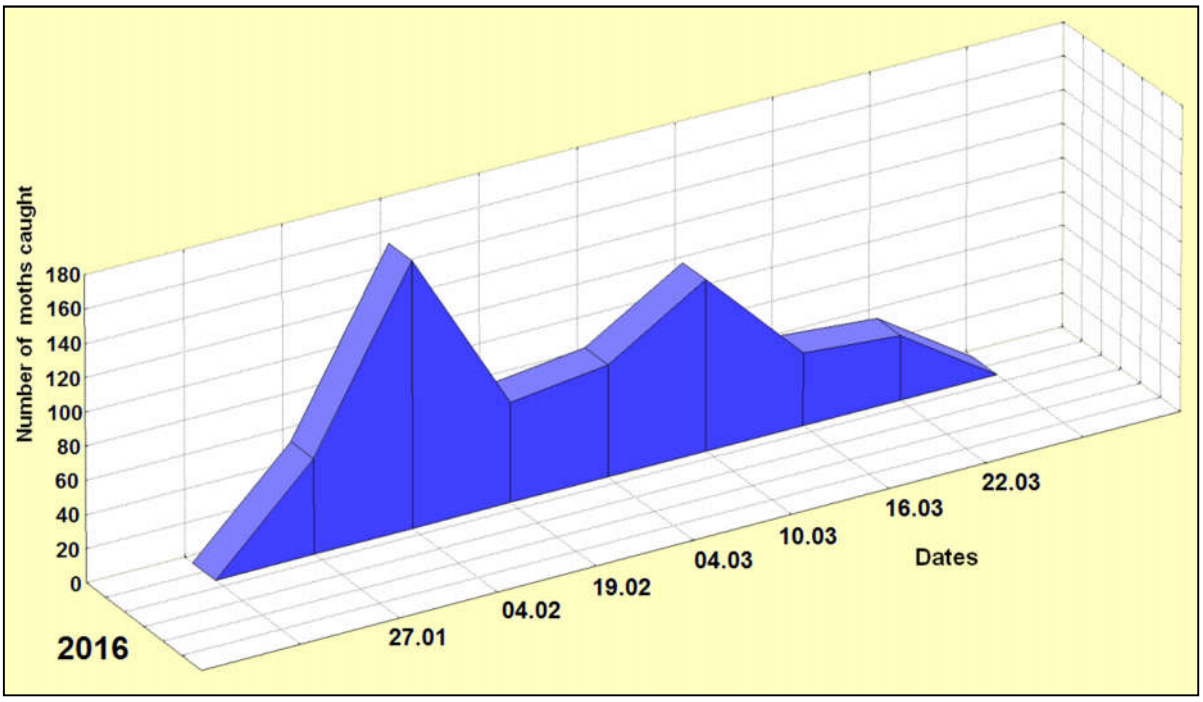

Fig.2. Flight dynamic of *Tecia solanivora in Carchi province in 2016*

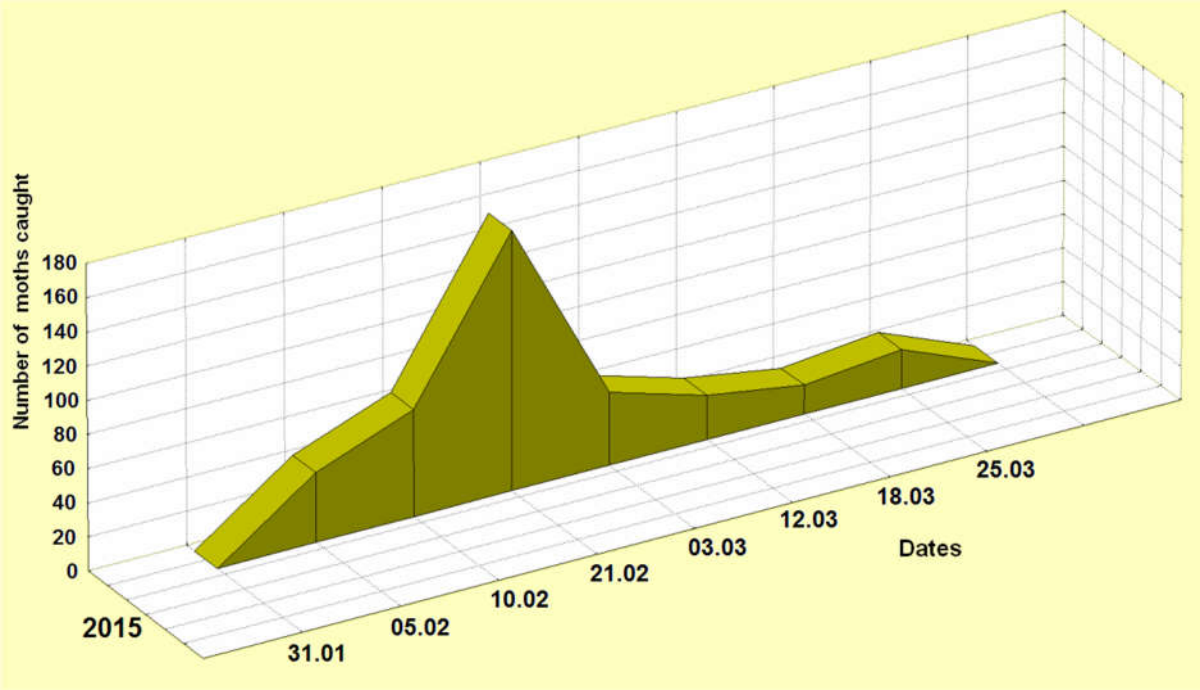

Fig. 3. Flight dynamic of *Phthorimaea operculella in Carchi province in 2015*

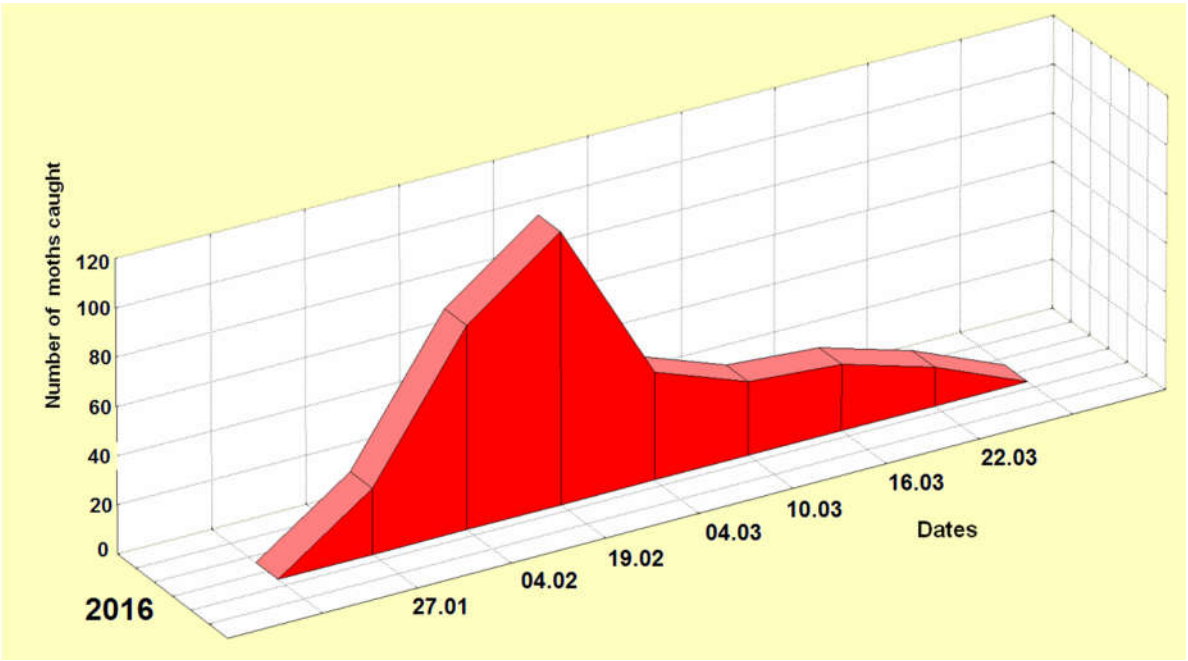

Fig. 4. Flight dynamic of *Phthorimaea operculella in Carchi province in 2016*

LITERATURE

1. Alvarez JM, Dotseth E, Nolte P. 2005. Potato tuberworm a threat for Idaho potatoes. University of Idaho Extension, Idaho Agricultural Experiment Station, Moscow, ID. (31 Jan 2014)

2. Anonymous 2013. Potato tuber moth- Tuberworm. CropWatch: Potato Education Guide, UNL Extension. University of Nebraska-Lincoln, Lincoln, NE. (31 Jan 2014)

3. Flanders K, Arnone S, Radcliffe E. 1999. The potato: genetic resources and insect resistance, pp. 207-239. In: Clement SL, Quisenberry SS (eds.), Global plant genetic resource for insect resistant crops. CRC, Boca Raton, FL.

4. Golizadeh A, Esmaeili N. 2012. Comparative life history and fecundity of *Phthorimaea operculella* (Lepidoptera: Gelechiidae) on leaves and tubers of different potato cultivars. Journal of Economic Entomology 105:1809-1815.

5. Malakar R, Tingey WM. 2006. Aspects of tuber resistance in hybrid potatoes to potato tuberworm. Entomologia Experimentalis et Applicata 120:131-137.
6. Trivedi TP, Rajagopal D. 1992. Distribution, biology, ecology and management of potato tuber moth, *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae): a review. Tropical Pest Management 38:279-285.
7. Visser D. 2005. Guide to potato pests and their natural enemies in South Africa. Arc- Roodeplaat Vegetable and Ornamental Plant Institute, Pretoria, South Africa.
8. Westedt AL, Douches DS, Pett W, Grafius EJ. 1998. Evaluation of natural and engineered resistance mechanisms in Solanum tuberosum L. for resistance to *Phthorimaea operculella* Zeller. Journal of Economic Entomology 91:552-556.