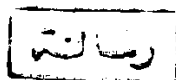


**THE ROLE OF BIOCIDES IN  
CONTROLLING POTATO  
TUBER MOTH *PHTHORIMAEA*  
*OPERCULELLA* (ZELLER) IN EGYPT**

**BY**



**El-Sayed Abdel-Ghafar Moharam**  
B.Sc. Agric. Sc. ( General), Alexandria Univ., 1971

**THESIS**

**Submitted in Partial Fulfillment  
of Requirement for the Degree of  
MASTER**

**In  
Environmental Science  
(Agricultural Science)**

**Department of  
Environmental Agricultural Science  
Institute of Environmental Studies and Research  
Ain Shams University**



**1997**

**THE ROLE OF BIOCIDES IN  
CONTROLLING POTATO  
TUBER MOTH *PHTHORIMAEA*  
*OPERCULELLA* (ZELLER) IN EGYPT**

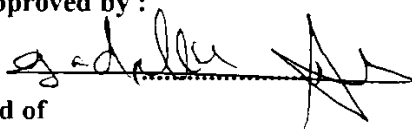
**BY**

**El-Sayed Abdel-Ghafar Moharam**  
B.Sc. Agric. Sc. ( General), Alexandria Univ., 1971

This Thesis for the M. Sc. degree has been approved by :

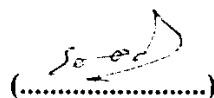
**Prof. Dr. Ahmed Ismail Gadallah**

Prof. of Economic Entomology and Head of  
Plant Protection Dept., Fac. of Agric.,  
Al-Azhar Univ.




**Prof. Dr. Soad Abu-Al-Sued El-Sayed**

Prof. of Entomology and, Fac. Of Science,  
Ain Shams Univ.

  
(.....)

**Prof. Dr. Mohamed Ibraheam Abdel-Megeed**

Prof. of Pesticides, Fac. of Agric., Ain Shams  
Univ. (Supervisor)

  
(.....)

**Date of Examination :    /    / 1997**



# **THE ROLE OF BIOCIDES IN CONTROLLING POTATO TUBER MOTH *PHTHORIMAEA* *OPERCULELLA* (ZELLER) IN EGYPT**

**El-Sayed Abdel-Ghafar Moharam**  
B.Sc. Agric. Sc. ( General), Alexandria Univ., 1971

**Under Supervision of**

**Prof. Dr. Mohamed Ibraheam Abdel-Megeed**

Prof. of Pesticides, Fac. of Agric., Ain Shams Univ.

**Prof. Dr. Samy Mohamed El-Sayes**

Prof. of Entomology, Institute of Environmental  
Studies and Research, Ain Shams University

**Prof. Dr. Mohamed Gomaa Abbas**

Director of Plant Protec., Res., Inst., Agric. Res. Centre

## **ABSTRACT**

The main goal of this study is controlling of potato tuber moth, *Phthorimaea operculella* (Zeller) (Gellechiidae : Lepidoptera) using biocides. Studies concern the fluctuation of the pest during summer season using pheromone traps throughout the period from February, 1996 & 1997 to May, 1996 & 1997. Studies concerning the susceptibility of 5 potato varieties to the infestation of *P. operculella*. Proved that Desiree was the least susceptible one to that pest infestation but Nicola, was the most susceptible one in this respect. Comparison between the efficacy of biocides viz., BT, virus and abamectin and recommended chemical pesticides on *P. operculella* in potato field and store had been done during the two seasons of 1996 & 1997. Data revealed that abamectin (fungi) was the most effective one in this respect.

---

**Key words :** Potato tuber moth, biocides, potato

## **ACKNOWLEDGEMENT**

**The author is greatly indebted with thanks and appreciation to Prof. Dr. Mohamed I. Abdel-Megeed, Professor of Pesticides, Faculty of Agriculture, Ain Shams University, Prof. Dr. Samy M. El-Sayes, Professor of Entomology, Institute of Environmental Studies and Research, Ain Shams University and Prof. Dr. Mohamed G. Abbas, Director of Plant Protection Research Institute, Agricultural Research Center, Ministry of Agriculture for suggesting the problem, supervision, useful advice and great help they offered during the progress of the work.**

**I wish to express my sincere thanks and appreciation to Dr. Khalil Gh. El-Malki, Senior Researcher, Plant Protection Research Institute, Agricultural Research Center, Ministry of Agriculture for his valuable help and guidance in preparing and reading the manuscript.**

**Thanks also, due to all staff members of Pesticides Evaluation Research Dept. Plant Protection Research Institute, Agricultural Research Center, Ministry of Agric. and all staff members of Dept. of Environmental Agricultural Sci., Inst. of Environmental Studies and Reserch, Ain Shams University for their kind helps throughout this work.**

# CONTENTS

	Page
<b>ACKNOWLEDGEMENT</b>	
<b>I. INTRODUCTION</b>	1
<b>II. REVIEW OF LITERATURE</b>	3
1. Monitoring the population dynamics of <i>Phthorimaea operculella</i> using pheromone traps .....	3
2. Susceptibility of potato to <i>P. operculella</i> infestation	6
3. Ecological aspects of <i>P. operculella</i> .....	9
4. Control of the potato tuber moth, <i>Phthorimaea operculella</i> (Seller.) in the field .....	14
5. Control of Potato Tuber Moth in store .....	29
<b>III. MATERIAL AND METHODS</b>	33
1. Abundance and population dynamics of potato tuber moth, <i>Phthorimaea operculella</i> during summer season in Menoufia Governorate .....	33
2. Pheromone-traps as a method of potato tuber moth monitoring .....	35
3. Susceptibility of certain potato cultivars to infestation of potato tuber moth .....	35
4. Efficacy of certain novel compounds against potato tuber moth .....	36
<b>IV. RESULTS AND DISCUSSION</b> .....	47
<b>1. ECOLOGICAL STUDIES ON POTATO TUBER MOTH, <i>PHTHORIMAEA OPERCULELLA</i> IN MENOUFIA GOVERNORATE</b> .....	47
1.1. Seasonal abundance and population dynamics .....	51
1.2. The effects of some weather factors on the activity and abundance of the potato tuber moth in Menoufia Governorate .....	53
1.2.1. Effect of day maximum temperature (D.Mx.T.)	53
1.2.2. Effect of night minimum temperature (N.Mn.T.)	58

## CONTENTS Cont.,

	<b>Page</b>
1.2.3. Effect of the day mean relative humidity (R.H.%)	<b>58</b>
1.2.4. The combined effect of the 3 weather factors on the seasonal activity of <i>P. operculella</i> .....	<b>60</b>
1.3. Efficacy of pheromone trap for monitoring potato tuber moths in the field .....	<b>62</b>
<b>2. SUSCEPTIBILITY OF CERTAIN POTATO CULTIVARS TO POTATO TUBER MOTH, <i>P. OPERCULELLA</i> INFESTATION .....</b>	<b>72</b>
<b>3. EFFICACY OF CERTAIN NOVEL COMPOUNDS AGAINST <i>P. OPERCULELLA</i> IN MENOUFIA GOVERNORATE .....</b>	<b>80</b>
3.1. Under Field Conditions .....	<b>80</b>
Effect of certain novel compounds on some potato tuber properties and crop yield .....	<b>86</b>
a) Crop yield .....	<b>86</b>
b) Tuber Properties .....	<b>87</b>
3.2. Under store condition .....	<b>92</b>
<b>SUMMARY .....</b>	<b>97</b>
<b>REFERENCES .....</b>	<b>100</b>
<b>ARABIC SUMMARY</b>	

## LIST OF TABLES

Table No :	Page
1 Three days catches of potato tuber moth, <i>P. operculella</i> by pheromone-traps in Menoufia Governorate during 1996 and 1997 seasons .....	52
2 Monthly Catches of Potato Tuber Moth, <i>P. operculella</i> by Pheromone-traps in Menoufia Governorate During 1996 and 1997 Seasons .....	53
3 Three days catches of potato tuber moth, <i>P. operculella</i> by pheromone-traps in Menoufia Governorate and the corresponding averages of 3 weather factors (1996) .....	55
4 Three days catches of potato tuber moth, <i>P. operculella</i> by pheromone-traps in Menoufia Governorate and the corresponding averages of 3 weather factors (1997) .....	56
5 Simple correlation ( $r$ ), simple regression (b) and partial regression (Pb) values indicating the relation between and effect of 3 weather factors on the catches of <i>P. operculella</i> in Menoufia Governorate during 1996 &1997 .....	59
6 Analysis of variance of the seasonal activity of <i>P. operculella</i> on 3 main weather factors along with percentage of explained variance, Menoufia Governorate (1996 &1997) .....	61
7 Three days catches of potato tuber moth, <i>operculella</i> in 3,4 and 5 pheromone-traps/ fed. In Menoufia Governorate (1996) .....	63



## LIST OF TABLES Cont.,

Table No :	Page
8 Three days catches of potato tuber moth, <i>P. operculella</i> in 3,4 and 5 pheromone-traps/ fed. In Menoufia Governorate (1997) .....	64
9 Effect of 3,4 and 5 pheromone-traps/ fed on trapping efficacy of potato tuber moth, <i>P. operculella</i> in Menoufia Governorate (1996) .....	68
10 Effect of 3,4 and 5 pheromone-traps/ fed on trapping efficacy of potato tuber moth, <i>P. operculella</i> in Menoufia Governorate (1997) .....	69
11 Susceptibility of certain potato varieties to the infestation of <i>P. operculella</i> , Menoufia Governorate during 1996 season .....	73
12 Susceptibility of certain potato varieties to the infestation of <i>P. operculella</i> , Menoufia Governorate during 1997 season .....	73
13 Crop yield of certain potato cultivars .....	78
14 No. of potato tuber worms before and 15 days after treatment with BT, granulosis virus, abamectin and profenofos and % reduction of larvae population in potato field in Menoufia Governorate, 1996 .....	81
15 No. of potato tuber worms before and 15 days after treatment with BT, granulosis virus, abamectin and profenofos and % reduction of larvae population in potato field in Menoufia Governorate, 1997 .....	81

**LIST OF TABLES Cont.,**

<b>Table No :</b>	<b>Page</b>
<b>16 Effect of certain novel compounds on some potato tuber properties and yield .....</b>	<b>87</b>
<b>17 No. of potato tuber worms before and 15 days intervals after treatment with BT, granulosis virus, abamectin and phenitrithion and % reduction of larvae population in potato store in Menoufia Governorate, 1996 .....</b>	<b>94</b>

## LIST OF PLATES

<b>Figure No :</b>	<b>Page</b>
<b>1 Nicola cultivar of potato</b>	<b>37</b>
<b>2 Spunta cultivar of potato</b>	<b>38</b>
<b>3 Cara cultivar of potato</b>	<b>39</b>
<b>4 King Edward cultivar of potato</b>	<b>40</b>
<b>5 Desiree cultivar of potato</b>	<b>41</b>
<b>6 Potato tuber worm inside its tunnels in tuber</b>	<b>48</b>
<b>7 Pupa inside its tunnels in tuber</b>	<b>49</b>
<b>8 External symptoms of infestation on tuber</b>	<b>50</b>

## LIST OF FIGURES

Figure No :	Page
1 Three days catches of potato tuber moth, <i>P. operculella</i> by pheromone-traps in Menoufia Governorate during 1996 and 1997 seasons .....	54
2 Monthly catches of potato tuber moth, <i>P. operculella</i> by pheromone-traps in Menoufia Governorate during 1996 and 1997 seasons .....	57
3 Monthly No. of potato tuber moth, <i>P. operculella</i> caught by 3,4 and 5 traps/fed. in Menoufia Governorate, 1996 .....	65
4 Monthly No. of potato tuber moth, <i>P. operculella</i> caught by 3,4 and 5 traps/fed. in Menoufia Governorate, 1997 .....	66
5 Monthly mean No. of potato tuber moth, <i>P. operculella</i> caught by pheromone-traps in Menoufia Governorate during 1996 and 1997 seasons .....	67
6 Effect of 3,4 and 5 pheromone-traps/fed. on trapping efficacy of tuber moth, <i>P. operculella</i> in Menoufia during 1996 and 1997 seasons .....	70
7 Susceptibility of Nicola, Spunta, Cara, Desiree and King Edward to the infestation of <i>P. operculella</i> , Menoufia Governorate, 1996 .....	74
8 Susceptibility of Nicola, Spunta, Cara, Desiree and King Edward to the infestation of <i>P. operculella</i> , Menoufia Governorate, 1997 .....	75

## LIST OF FIGURES Cont.,

Figure No :	Page
9 Mean % infestation of of <i>P. operculella</i> recorded on potato varieties of Nicola, Spunta, Cara, Desiree and King Edward to the infestation, Menoufia Governorate, 1996 and 1997 .....	76
10 Effect of certain potato cultivars susceptibility to potato tuber moth on potato yield .....	79
11 Effect of certain novel compounds on potato tuber worm population under field conditions, Menoufia Governorate, 1996 .....	82
12 Effect of certain novel compounds on potato tuber worm population under field conditions, Menoufia Governorate, 1997 .....	83
13 % increase of potato yield/fed. due to the effect of abamectin, profenofos, B.T. and G.V. on <i>P. operculella</i> under field condition .....	88
14 % increase of potato tuber weight due to the effect of abamectin, profenofos, B.T. and G.V. on <i>P. operculella</i> under field condition .....	89
15 % increase of potato tuber size due to the effect of abamectin, profenofos, B.T. and G.V. on <i>P. operculella</i> under field condition .....	91
16 Effect of certain novel compounds on potato tuber worm population under store conditions when applied once and twice, Menoufia Governorate, 1997 .....	95

## I. INTRODUCTION

Potato is considered one of the most important vegetable crops that are successfully grown under different ecosystems. It is the fourth most important food crop in the world after wheat, rice and maize. Every year, potato cultivation in Egypt is taken in three successive seasons (summer, autumn and winter) with total area about 200,000 feddan. Because of growth in output by improvements in production and postharvest infrastructure, it has increased at an annual rate of 5 percent for the last thirty years. For example, throughout the period from 1979 to 1981, Egyptian farmers harvested 1.1 million metric tons of potatoes; yields averaged 17.3 metric tons per feddan. For 1991-1993, production had climbed 65 percent to 1.7 million metric tons and yields averaged 21 metric tons. Egyptian sources estimated potato production in 1995 at 2 million metric tons and per-capita consumption at 32 kilos. A generation ago, per-capita consumption was only 8 kilos.

In Egypt, a number of factors threaten potato cultivation identified leaf-roll virus Y (PLRV), virus x as well as the nematode *Melodegyne javanica* (Treub). Among the fungal diseases present are stem canker (*Rhizoctonia solani* Kuhn) and early blight (*Alternaria solani* Sorauer). The insect pests include the potato tuber moth (*Phthorimaea operculella* Zeller), the black cut worm (*Agrotis ipsilon* Hfn), Aphid (*Aphis gossypii*), White fly (*Bemisia tabaci*).

The potato tuber moth, *Phthorimaea operculella* (Zeller) (gellechiidae : Lepidoptera) is a cosmopolitan insect-pest of stored potato

tuber and infests potatoes outdoor in the warm climates. Several investigations recognized the potato tuber moth as the most serious and destructive pest of potato in various countries (Ortu and Floris 1989, Chernii *et al.* 1994 and Ono 1994).

In general the potato tuber moth is the most common serious pest of potato plants and other solanceous crops. The use of chemical insecticides for controlling this insect pest is undesirable, to avoid health hazards and environmental pollution.

Therefore the present work was conducted to study the following :

- 1- Ecological studies on potato tuber moth in relation to pheromone traps.
- 2- Susceptibility of certain potato cultivars to potato tuber moth infestation.
- 3- Efficacy of certain novel compounds against potato tuber worms under field and store conditions.