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Alexandria University
Faculty of Agriculture (Saba-Basha)

**Latent effects of emamectin benzoate for controlling the cotton
leafworm *Spodoptera littoralis***

BY

EMAN KOTB ELSAYED KOTB

**A Thesis Submitted on Partial Fulfillment of the Requirements
Governing the Award of the Degree of**

**MASTER OF AGRICULTURAL SCIENCES
(PESTICIDES)**

PLANT PROTECTION DEPARTMENT

From

ALEXANDRIA UNIVERSITY

2011

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Faculty of Agriculture
(Saba Basha)
Plant protection Department

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ACKNOWLEDGEMENT

First of all, I would like to thank Allah most Gracious and most Merciful, without his willing and support this work would have never been possible.

I wish to express my deep gratitude to Professor **Abdel-Fattah Sayed A.Saad**, Emeritus professor of pesticides chemistry and toxicology , Faculty of Agriculture (Saba-Pacha) Alexandria University, for his supervision, continuous encouragement, and sincere efforts throughout this work .

I wish also to thank Professor **Magdy Abdel-zaher**, Professor of pesticides chemistry and toxicology, Faculty of Agriculture (Saba-Pacha), Alexandria University, for his supervision and encouragement.

I wish also to thank Dr. **Mohamed Khairy Abo Shloa**, Head Researcher, Agricultural Research Center, Plant Protection Institute

I would to express my sincere gratitude to **Dr. Hamdy K. Abou-Taleb**, Researcher, Plant Protection Research Institute, ARC, for his kind support during the course of research.

I would to express my sincere gratitude to **Dr. Safaa A. Moustafa**, Head researcher, Central Agricultural Pesticides Laboratory (CAPL), ARC, for her kind support during the course of research.

I would to express my sincere gratitude to **Dr. Manal A. Attia**, Researcher, Central Agricultural Pesticides Laboratory (CAPL), ARC, for her kind support during the course of research.

I would like to express my deep appreciation to my parents, husband, brothers and my sister for their everlasting support deep concern and encouragement during my research.

My thanks go also to my colleagues, technical staff and everyone ever supported me by any means of help to make this work come true.

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CHAPTER 1

INTRODUCTION

INTRODUCTION

As the world's population increases, the need to keep food and fiber crops free from insect infestation and destruction becomes even more urgent. On the other hand, the extensive use of insecticides causes insecticide resistance. The development of insecticide resistance often leads to failures in crop protection and severely increases the economic losses. To counteract resistance problems, compounds belonging to new insecticide classes must be used (Sauphanor *et al.*, 1998).

Long term exposure to modern synthetic insecticides has been associated to low or high extents with tumor, liver damage, immunotoxicity, birth defects and reproductive problems in humans and other animals. In addition, the massive application of pesticides results in adverse effects to beneficial organisms. These side effects of chemical pesticides necessitate the use of target specific compounds with low persistence, development of alternative or additional technologies and increase emphasis on integrated pest management. The availability of several new insecticides with different chemistry and mode of action would allow the implementation of management schemes designed to slow down the selection for resistance to insecticides. Enamectin benzoate is a new avermectin insecticide in development at Merck Research Laboratories targeted for control of lepidopterous pests on various crops (Leibee *et al.*, 1995).

Enamectin benzoate and avermectins modulate specific glutamate-gated anion channels in synapses and muscle cells (Dunbar *et al.*, 1998; Roberts and Hutson, 1999), thereby increasing the influx of chloride ions. This hyperpolarizes the cell, and prevents depolarization of the neuromuscular endplate beyond the threshold level (Davies and Rodger, 2000). Enamectin benzoate thus has neurotoxic properties, and it is more effective in arthropods following ingestion (Roberts and Hutson, 1999). Enamectin benzoate was found to stimulate the female of the American lobster (*Homarus americanus*) to enter an obligator proecdysis and molt prematurely (Waddy *et al.*, 2002). Therefore, emamectin benzoate may affect the molting process in insect-pests and may have latent effects at its sublethal concentrations.

Insecticides application may result in multiple sublethal effects on insect pests, along with direct mortality, since insects exposed to different doses in field and that would cause different effects on pests (Singh and Marwaha, 2000). Sublethal effects are defined as physiological or behavioral effects on individuals that survive exposure to a pesticide (Desneux *et al.*, 2007). Physiological effects may be manifested as reductions in life-span (Stark and Rangus, 1994), developmental rate (Cripe *et al.*, 2003), fertility (Liu and Trumble, 2005), fecundity (Zaliziniak and Nugegoda, 2006), Changes in sex ratio (Couty *et al.*, 2001). Behavioral changes may affect feeding (Stapel *et al.*, 2000), olfactory learning (El Hassani *et al.*, 2005 and Dabrowski, 1969) and oviposition (Fujiwara *et al.*, 2002). Direct or indirect contact of the insect or the host plant with an insecticide may even cause hormoligosis or trophobiosis, (Kerns and Stewart, 2000). Individuals that survive pesticide exposure may still sustain significant damage. Thus, multiple sublethal effects as well as mortality must be considered when examining the total effects of an insecticide.

Therefore, the objectives of this work were to study:

1. The toxicity of emamectin benzoate against the 2nd, 3rd and 4th larval instars of *Spodoptera littoralis* in comparison with two IGR's compounds (lufenuron and flufenoxuron).
2. The ovicidal activity of emamectin benzoate and two IGR compounds.
3. The joint action of emamectin benzoate with lufenuron or/and flufenoxuron on 4th instar larvae of *S. littoralis*.
4. The latent effects of sublethal concentrations of emamectin benzoate against *S. littoralis* larvae in comparison with the two tested IGR compounds.
5. The effect of emamectin benzoate and two IGR compounds on certain enzymes (alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase) of the 4th instar larvae of *S. littoralis*.

CHAPTER 2

REVIEW OF LITERATURE