Ain Shams University
Faculty of Education

Morphological and biochemical effects of insect growth regulators; Diflubenzuron and chromafenozide on the cotton leaf worm *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae)

***Thesis** Submitted By*

Taha Abdel-Shafy Abd-Rabbo Saleh

Associate Lecturer of Zoology
Department of Biological and Geological Sciences
Faculty of Education, Ain-Shams University

For

THE AWARD OF THE Ph.D. DEGREE
IN SCIENCE TEACHER'S PREPARATION
(ZOOLOGY)

Supervised by

Prof. Dr. Khalafalla Saber Ahmed
Prof. of Entomology
Faculty of Education- Ain Shams University

Prof. Dr. Saadya Mohamed El-Bermawy
Prof. of Insect Physiology
Faculty of Education- Ain Shams University

Dr. Eman Hassan Ismail
Lecturer of Zoology
Faculty of Education- Ain Shams University

2018

APPROVAL SHEET

Name: **Taha Abdel-Shafy Abd-Rabbo Saleh**

Title: **Morphological and biochemical effects of insect growth regulators; Diflubenzuron and Chromafenozide on the cotton leafworm *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae)**

Supervisors

Prof. Dr. Khalafalla Saber Ahmed

Professor of Entomology,
Faculty of Education, Ain-Shams University.

Prof. Dr. Saadya Mohamed El-Bermawy

Professor of Insect Physiology,
Faculty of Education, Ain-Shams University.

Dr. Eman Hassan Ismail

Lecturer of Zoology,
Faculty of Education, Ain-Shams University

First and Foremost,

Great Thankful To ALLAH

For Helping Me

To Finish This Work

ACKNOWLEDGEMENT

I would like to express my deepest gratitude and my heartfelt thanks to ***Prof. Dr. Khalafalla Saber Ahmed***, Professor of Insect Taxonomy, Department of Biological and Geological Sciences, Faculty of Education, Ain Shams University for his supervision, suggesting the point of the work, valuable guidance, continuous support, reading, correcting and criticizing the manuscript, great help during the present work, reviewing the thesis and continuous encouragement. Really, my words cannot express my sincere appreciation to his honorable personality.

Also, I send my deep thanks to ***Prof. Dr. Saadya Mohamed El-Bermawy***, Professor of Insect Physiology, Department of Biological and Geological Sciences, Faculty of Education, Ain Shams University, for her supervision, continuous encouragement, kind and valuable help through this investigation, and in reading the manuscript, in addition, to express my deep thanks for her sincere and useful advice during the present work and reviewing the thesis.

Moreover, my deep gratitude to ***Dr. Eman Hassan Ismail and Dr. Rabab Magdy Abdel-Gawad***, Lecturers of Zoology, Department of Biological and Geological Sciences, Faculty of Education, Ain Shams University, for their sincere, unceasing encouragement, reading the manuscript, reviewing the thesis and for their advantageous guidance, gentle and valuable support through this work.

I also feel thankful and grateful to ***Prof. Dr. Mohamed Hamed Abdel-Aal***, the head of the Department of Biological and Geological Sciences, Faculty of Education, Ain Shams University for encouragement and for the facilities presented to me while carrying out this work.

Thanks also for all the staff members of the Department of Biological and Geological Sciences, for their help, support and encouragement.

ABSTRACT

The present study was undertaken to investigate the possible harmful impacts of the LC_{50} of the IGRs: the chitin synthesis inhibitor, Dimilin® (Diflubenzuron**),** and the ecdysone agonist, Virtu® (Chromafenozide) on the susceptibility, biology, biochemistry, ovarian tissue of adult female and larval corpus allatum of *Spodoptera littoralis*. The LC_{50} (1.3 & 3 ppm of Dimilin® and 0.1 & 0.1 ppm of Virtu®) were applied to the 2nd and 4th larval instars, respectively. Treatments caused a reduction in pupal weight, adult emergence, fecundity, fertility and male & female longevity. Sex-ratio was directed to female rise with Dimilin® treated larvae but to males in Virtu® treated cases.

Quantitative and qualitative analysis of 6th instar larval haemolymph and whole-body homogenate revealed an increase of total protein content with Dimilin® in haemolymph but a decrease of total protein content in the rest. Total carbohydrate and lipid contents were decreased in all treated samples. However, native protein, glycoprotein, lipoprotein as well as alcohol dehydrogenase (ADH), aldehyde oxidase (AO), α- and β-Est and fractional protein were differed in banding patterns compared to control.

Histopathological study of the ovary showed that the ovarian follicles of treated F1 females with Dimilin® exhibited vacuolization, stuffing of follicular sheath, loss of vitellin and degeneration of many cell components of follicular epithelium and oocytes. These obvious signs of damage were increased when using 4th larval instars treatment than the 2nd. Also, damage was pronounced in the ovarioles of the Virtu® treated F1 females. Ovariole growth was stunted and vitellogenesis and chorion formation were inhibited.

While at the ultrastructural level, the moth ovary from treated 2nd instar larvae with Dimilin® **(D II)** showed separation of outer sheath and shrunk of tunica propria as well as pyknotic follicular nuclei. The

moth ovary from treated 4th instar larvae with Dimilin® **(D IV)** illustrated irregular shaped and pyknotic follicular nuclei, degenerated microvillar region, degenerated yolk granuoles and signs of autolysis. In 2nd instar larvae treated with Virtu® **(V II)**, pyknotic follicular nuclei with irregular shape, ruptured of nuclear envelope and degenerated yolk granuoles were observed in moth ovary. However, the 4th instar larvae treated with Virtu® **(V IV)** showed follicular nuclei with irregular shape and pyknosis and the cytoplasm appeared with fragmentation of RER with loss of ribosomes.

Corpus allatum of 6th larval instar treated with LC_{50} of diflubenzuron appeared with oval shape and decreased size. Contradictory, an increase was observed in cellular cortex and glandular cell numbers and their nuclei lost their spheroid shape. Also, damage was pronounced in the CA of the LC_{50} chromafenozide treated larvae.

Therefore, this work shows the high potency and efficacy of the two IGRs on developed ova of *S. littoralis*. Also, results indicated that the Virtu® was more effective than Dimilin® on the pupal weight, fecundity, egg hatchability and percentage of emergence. Moreover, 2nd instar larvae were more susceptible than 4th instar larvae.

Key words: Cotton leafworm *S. littoralis*, diflubenzuron, chromafenozide, toxicity, biology, biochemistry, histology, ultrastructure, ovary, corpus allatum

CONTENTS

LIST OF TABLES

LIST OF FIGURES

No. of Figures and explanations

Page No.