THE NATURAL ENEMIES OF DIFFERENT SCARABAEIDS INFESTING CERTAIN ECONOMIC CROPS IN EGYPT

BY

HAMDY EL-SAIED MOHAMED HANAFY

B. Sc., Agric. in Plant Protection, 1992 Fac. of Agric., Ain Shams University

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Agriculture (Economic Entomology)

632 7649 H. E 96262

Department of Plant Protection Faculty of Agriculture Ain Shams University

1997



APPROVAL SHEET

THE NATURAL ENEMIES OF DIFFERENT SCARABAFIDS INFESTING CERTAIN ECONOMIC CROPS IN EGYPT

BY

HAMDY EL-SAIED MOHAMED HANAFY

B. Sc., Agric. in Plant Protection, 1992 Fac. of Agric., Ain Shams University

This thesis for M. Sc. degree has been approved by:

Prof. Dr. Ahmed Raof Hamed A. R. Hamed Chief Researcher and Head of Department of Biological Control, Plant Protection Research Institute, Giza

Prof. Dr. Madieha Aboul Makarem Rezk. M.A. Rest, Prof. of Economic Entomology

Fac. of Agric., Ain Shams University

Prof. Dr. George Nasrallah Rezk... De rog. O. Reg. Prof. of Economic Entomology
Fac. of Agric., Ain Shams University. (Supervisor)
Date of examination: //1997

THE NATURAL ENEMIES OF DIFFERENT SCARABAEIDS INFESTING CERTAIN ECONOMIC CROPS IN EGYPT

BY

HAMDY EL-SAIED MOHAMED HANAFY

B. Sc., Agric. in Plant Protection, 1992 Fac. of Agric., Ain Shams University

Under the supervision of:

Prof. Dr. **George Nasrallah Rezk**Prof. of Economic Entomology

Prof. Dr. **Abdel Mohsen Mohamed Hekal**Prof. of Economic Entomology

Dr. Azza Kamal Abdel Rhman
Assist. Prof. of Economic Entomology



ACKNOWLEDGEMENT

The author would like to express his deep gratitude and appreciation to Prof. Dr. George Nasralla Rezk, Professor of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Ain Shams University, for suggesting the problems, his supervision, constructive criticism, useful advices, suppling lures substances and unfailing help during the whole course of this study.

Sincere thanks and gratitude to Prof. Dr. Abd El-Mohsen Mohamed Hekal, Professor of Economic Entomology, at the same Faculty for his supervision, progressive criticism during the study and the cooperation through the whole work.

Thanks are due to **Dr. Azza Kamal Abd El-Rhman**, Assistant Professor of Economic Entomology at the same Faculty for her supervision and kind help throughout the course of this study.

Sincere thanks and gratitude to **Prof. Dr. S.M.** Hafez, Professor of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Ain Shams University, for making the best out of this work and their assistance.

The author wishes to express his deep gratitude and appreciation to **Prof. Dr. Roushdy Rezkalla Isshak,** Professor of Economic Entomology Department of Plant Protection, Faculty of Agriculture, Ain Shams University, for his valuable supervision.

Deep thanks are offered to **Dr. Nagy Yassin Abd El-Ghaffar**, Lecture of Plant Pathology; Department of Plant Pathology, Faculty of Agriculture, Ain Shams University for his encouragement through the progress of the this work.

Thanks are due to **Dr. Khaled Mohammed Abdel Kader**, Lecture of Economic Entomology, Department of Plant Protection Faculty of Agriculture, Ain Shams University, for his assistance.

Thanks due to all the staff members and colleagues in the Department of Plant Protection, Faculty of Agriculture, Ain Shams University, for their kind helps and encouragements during the study.



ABSTRACT

Hamdy El-Saied Mohamed. The natural enemies of different scarabaeids infesting certain economic crops in Egypt. Published for Master of Science, Ain Shams University, Faculty of Agriculture, Department of Plant Protection, Egypt, 1997. The present work was on certain ecological and biological studies on three different scarabaeid species namely, the hairy rose beetle (*Tropinota squalida* Scop.), the peach cockchafer (*Pachnoda fasciata* F.) and the rose chafer (*Potosia cuprea* F.). Survey of natural enemies associated with larvae of *T. squalida* and *P. fasciata* at El-Khatatba, El-Behaira Governorate for two years and Bioassay experiments on the 1st and 2nd larval instars of *T. squalida*, *P. fasciata* and *P. cuprea* by using Dipel-2X (*Bacillus thuringiensis* var. *Kurstaki*).

Key words:

Natural enemies - Ecological - Biological - Tropinota squalida - Pachnoda fasciata - Potosia cuprea - Survey - Bioassay - Dipel 2X- Bacillus thuringiensis var. Kurstaki.



CONTENTS

	Page
List of Tables	
List of Figures	
1- INTRODUCTION	1
2- REVIEW OF LITERATURE	4
2.1- Ecological studies on scarabaeid beetles	4
2.2- Biological aspects of scarabaeid beeltes	7
2.3- Natural enemies of Scarabaeids	13
2.3.1- Mites	13
2.3.2- Nematods	13
2.3.3- Bacteria	18
2.3.4- Fungi	19
2.4- Bioassay studies on bacteria	19
3- MATERIALS AND METHODS	22
3.1- Ecological studies on three different scarabaeid	
species	22
3.1.1- Seasonal abundance of adults and larvae	22
3.1.2- The preferable sites and occurrence levels of the	
adult beetles	23
3.1.3- Sex ratio of adults in the fields	23
3.2- Biological studies on three scarabaeid species	23
3.2.1- Rearing technique	23
3.2.2- Number of copulations	24
3.2.3- Effect of nutrition on the adult fecundity	24
3.2.4- Immature stages of three different scarabaeid	
species under laboratory and controlled	
conditions	24

3.3- Natural enemies of Tropinota squalida and Pachnoda	
fasciata larvae	25
3.3.1- Survey,	25
3.3.2- Isolation and mounting	25
3.4- Bioassay experiments	27
4- RESULTS AND DISCUSSION	29
4.1- Ecological studies on three different scarabaeid	
beetles namely, Tropinota squalida Scop, Pachnoda	
fasciata F. and Potosia cuprea F	29
4.1.1- Tropinota squalida	29
4.1.1.1 Flactuations of population densities	29
4.1.1.2- Vertical distribution of T. squalida adults on	
different fruit trees	37
4.1.1.3- Distribution of T. squalida adults on different	
sites of fruit trees	44
4.1.1.4- Natural sex ratio of T. squalida	51
4.1.1.5- Occurrence of 3rd instar larvae at different	
soil depth	55
4.1.2- Pachnoda fasciata	61
4.1.2.1- Flactuations of population densities	61
4.1.2.2- Vertical distribution of P. fasciata adults on	
apple trees	61
4.1.2.3- Distribution of <i>P. fasciata</i> adults on different	
sides of apple trees	70
4.1.2.4- Natural sex ratio of P. fasciata	70
4.1.2.5- Occurrence of 3rd instar larvae at different	
soil depths	76
4.1.3- Potosia cuprea	-81
4.1.3.1- Flactuations of population densities	81

4.1.3.2- Vertical distribution of P. cuprea on citrus	
trees	81
4.1.3.3- Distribution of P. cuprea adults on different	
sides of citrus trees	85
4.1.3.4- Natural sex ratio of P. cuprea	85
4.2- Biological studies on the three different scarabaeid	00
beetles namely Tropinota squalida, Pachnoda	
fasciata and Potosia cuprea	91
4.2.1- Tropinota squalida	91
4.2.1.1 Life cycle	91
4.2.1-1.1- The egg stage	91
4.2.1.1-2- Larval stage	91
4.2.1.1-3- pre-pupa and pupal stages	95
4.2.1.1-4- Adult stage	95
4.2.1.1-5-Pre-mating, mating and post-mating	
periods	100
4.2.1.1-6-pre-oviposition, oviposition and post-ovi-	
postition periods	100
4.2.1.1-7- Longevity	103
4.2.1.1-8- Fecundity	103
4.2.1.2- Effect of different temperatures (20, 25, 30 and	
35 °C) on certain biological aspects	104
4.2.1.2.1- Incubation period and egg hatchability.	104
4.2.1.2-2- Durations of the larval instars	104
4.2.1.2-3- Durations of pre-pupa and pupal stages	108
4.2.1.3- Effect of nutrition on the number of eggs	
laid/female	108
4.2.2- Pachnoda fasciata	110
4.2.2.1- Life cycle	110
4.2.2.1-1- The egg stage	110

4.2.2.1-2- Larval stage	110
4.2.2.1-3- pre-pupa and pupal stages	116
4.2.2.1-4- Adult stage	116
4.2.2.1-5-Pre-mating, mating and post-mating	
periods	121
4.2.2.1-6-pre-oviposition, oviposition and post-	
ovipostition periods	121
4.2.2.1-7- Longevity	124
4.2.2.1-8- Fecundity	124
4.2.2.2 Effect of different temperatures (20, 25, 30	
and 35 °C) on certain biological aspects	124
4.2.2.2-1- Incubation period and egg hatchability	124
4.2.2.2-2- Durations of the larval instars	125
4.2.2.2-3- Durations of pre-pupa and pupal stages	125
4.2.2.3- Effect of nutrition on the number of eggs	
laid/female	128
4.2.3- Potosia cuprea	131
4.2.3.1- Life cycle	131
4.2. 3.1-1- The egg stage	131
4.2.3.1-2- Larval stage	131
4.2.3.1-3- pre-pupa and pupal stages	136
4.2.3.1-4- Adult stage	136
4.2.3.1-5-Pre-mating, mating and post-mating	
periods	139
4.2.3.1-6-pre-oviposition, oviposition and post-ovi-	
postition periods	139
4.2.3.1-7- Longevity	139
4.2.3.1-8- Fecundity	112
4.2.3.2- Effect of different temperatures (20, 25, 30	
and 35°C) on certain biological aspects	142