

دور بعض المفترسات الحشرية في خفض تعداد بعض الحشرات الثاقبة الماصة التي تصيب محصول الطماطم

رسالة مقدمة من

ندا زينهم سيد سلامة

بكالوريوس علوم زراعية (حشرات)، جامعة القاهرة، 2010

للحصول على

درجة الماجستير في العلوم الزراعية

(حشرات إقتصادية)

قسم وقاية النبات

كلية الزراعة

جامعة عين شمس

2017

صفحة الموافقة على الرسالة

**دور بعض المفترسات الحشرية في خفض تعداد بعض الحشرات الثاقبة
الماصة التي تصيب محصول الطماطم**

رسالة مقدمة من

ندا زينهم سيد سلامة

بكالوريوس علوم زراعية (حشرات)، جامعة القاهرة، 2010

للحصول على

درجة الماجستير في العلوم الزراعية

(حشرات إقتصادية)

وقد تم مناقشة الرسالة والموافقة عليها

اللجنة

د. عزت فرج الخياط

.....

أستاذ الحشرات الإقتصادية، كلية الزراعة بمشتهر، جامعة بنها

د. محمد سالم عبد الواحد

.....

أستاذ الحشرات الإقتصادية المتفرغ، كلية الزراعة، جامعة عين شمس

د. حمدي السعيد محمد حنفى

.....

أستاذ الحشرات الإقتصادية، كلية الزراعة، جامعة عين شمس

د. عزة كمال عبد الرحمن إمام

.....

أستاذ الحشرات الإقتصادية المتفرغ، كلية الزراعة، جامعة عين شمس

تاريخ المناقشة: 17 / 8 / 2017

جامعة عين شمس
كلية الزراعة

رسالة ماجستير

اسم الطالبة : ندا زينهم سيد سلامة
عنوان الرسالة : دور بعض المفترسات الحشرية في خفض تعداد بعض
الحشرات الثاقبة الماصة التي تصيب محصول
الطماطم
اسم الدرجة : ماجستير فى العلوم الزراعية (حشرات إقتصادية)

لجنة الإشراف

د. عزة كمال عبد الرحمن إمام
أستاذ الحشرات الإقتصادية المتفرغ، قسم وقاية النبات، كلية الزراعة، جامعة عين شمس
(المشرف الرئيسى)

د. حمدي السعيد محمد حنفى
أستاذ الحشرات الإقتصادية، قسم وقاية النبات، كلية الزراعة، جامعة عين شمس

د. سعد عبد الخالق إبراهيم جعفر
باحث أول المكافحة الحيوية، قسم وقاية النبات، المعمل المركزى للزراعة العضوية، مركز
البحوث الزراعية

تاريخ التسجيل: 2013/2/11

الدراسات العليا

أجيزت الرسالة بتاريخ
2017/ /

الإجازة

موافقة مجلس الجامعة

موافقة مجلس الكلية

2017/ /

2017/ /

ABSTRACT

Nada Zeinoh Sayied Salama: The Role of Some Insect Predators in Reducing The Population of Certain Piercing Sucking Insects Infesting Tomato Crop. Unpublished MS.C. Thesis, Department of Plant Protection, Faculty of Agriculture, Ain Shams University, 2017.

Survey of piercing sucking insects and associated predators were conducted on tomato cultivars, Alissa and Super Jackal (*Lycopersicon esculentum* L.). Seasonal abundance were carried out during two successive years 2014 and 2015, from 17th of March to 2nd of June for spring plantation and 21st of June to 6th of September for summer plantation, at kafr El- Rjalat Village, Tikh, Qalyubiya Governorate. The results indicated that thirteen insect species belonging to seven insect families of five orders were recorded. In addition, seasonal abundance of certain piercing sucking pests, *Bemisia tabaci* Genn., aphids (*Aphis gossypii* Glover and *Myzus persicae* Sulz.) and *Empoasca decipiens* Paoli was studied. The peaks of activities of these pests changed in number according to the two tested cultivars through spring and summer plantations in both years. The relation between the temperature (minimum and maximum) and relative humidity as abiotic factors and plant stages and predators as biotic factors were also studied. The relation between these factors and the mean numbers of the four pests species differed from insignificant relations to positive or negative significant relations.

The effect of two different preys (*Aphis gossypii* and *Myzus persicae* nymphs) at three different temperatures (20, 25 and 30 °C) on the development, fecundity, life table parameters and predation capacity of *Ch. Carnea* and *C. septempunctata* predators were also studied. Results showed that prey species had insignificant effect on the most of the developmental stages and fecundity while temperatures had a significant effect on all developmental stages and fecundity of both predators. In spite, prey species had significant effect on the most of instar larvae predation capacity for both predators and insignificant effect on male and female for *C. septempunctata* while temperature factor had significant effect on the predation capacity of both predators. In addition the

interaction of preys and temperatures had insignificant effect on the development and fecundity of *Ch. Carnea* and *C. septempunctata* while it had a significant effect on the predation capacity of both predators in all stages except the third instar larvae for *Ch. carnea* and the fourth instar larvae for *C. septempunctata*. The values of life table parameters didn't differ between the two prey species. Also, it could be stated that temperatures of 20 and 25°C produced a high values of Ro, while at 30 °C it had the highest Rm and (λ), the shortest doubling time (Dt) and generation time (Gt)) when comparing with 20 and 25°C when larvae reared on the two prey species. So the temperature zone 20- 25°C seemed to be the most favorable conditions for *Ch. carnea* and *C. septempunctata* reproduction depending on the net reproductive rate values (Ro).

Four applications at three release rates of 2nd instar larvae of *Coccinella septempunctata* and *Chrysoperla carnea* were applied by releasing together for controlling the piercing sucking insects, *Myzus persicae* (Sulzer) and *Bemisia tabaci* (Genn.) infesting tomato plants (Castle Rock cultivar) planted in four greenhouses during spring plantation in 2015 at the Agriculture Research Center (ARC), Giza Governorate. For each predator, two, four and six larvae were released per plant and repeated 4 times at 21-day intervals. Obtained results indicated that the 3rd release rate (6 larvae of each predator species) gave the highest reduction percent in pest numbers while the 1st release rate (2 larvae of each predator) caused the lowest reduction percent.

Keywords: Survey, Seasonal abundance, *Bemisia tabaci*, *Aphis gossypii*, *Myzus persicae*, *Empoasca decipiens*, predators, tomato, life cycle, life table, *Chrysoperla carnea*, *Coccinella septempunctata*, control, greenhouse.

ACKNOWLEDGEMENT

Firstly, ultimate and great thanks to Allah, who guide me and supported me with patience and perseverance to complete this work. All words, all feelings and all praise will not be enough to thank Allah.

I want to express my deepest appreciation and gratitude to Prof. Dr. Azza Kamal Emam, Professor Emeritus of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Ain Shams University for her supervision, continuous efforts, guidance, concern, devoted efforts, encouragement and guidance during the experimental work and kind assistance in the review of this manuscript.

Sincere thanks to Prof. Dr. Hamdy El-Sayed Mohamed, Professor of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Ain Shams University and Dr. Saad Abd-El Khalek Gafar, Senior Researcher of Biological Control, Plant Protection Department, Central Lab of Organic Agriculture (CLOA), Agriculture Research Center for support and encouragement during the experimental work.

Deep thanks to Dr. Mohamed Abo-Setta for his efforts in data analysis and members of Insect Taxonomy Department at Plant Protection Research Institute for their help in identification of the collected insects.

My thanks to Dr. Atef Aab El-aziz, Director of the central laboratory of Organic Agriculture, Agriculture Research Center and Dr. Tawfik Hafez Professor of biological control in the central laboratory of Organic Agriculture, Agriculture Research Center for help, encouragement and financial support to complete the experimental work.

My deep thanks to my family who supported and encouragement me specially my mother who gave the assistance during all my life.

Many thanks to my colleagues in the central laboratory of Organic Agriculture, Agriculture Research Center for help, support and encouragement.

CONTENTS

	Page
LIST OF TABLES.....	VII
LIST OF FIGURES.....	XV
INTRODUCTION.....	1
REVIEW OF LITERATURE.....	5
1. Survey of Piercing sucking insect pests and their associated predatory insects on tomato plant.....	5
1. 1. Piercing sucking insects pests.....	5
1.1.1. <i>Bemisia tabaci</i>	5
1.1.2. Aphids.....	6
1.1.3. <i>Empoasca decipiens</i>	10
1. 2. Predatory insects.....	11
1. 3. Sampling techniques.....	13
1. 3. 1. <i>Bemisia tabaci</i>	13
1. 3. 2. Aphids.....	14
1. 3. 3. <i>Empoasca decipiens</i>	16
1. 4. Effect of abiotic factors	17
1. 4.1. <i>Bemisia tabaci</i>	17
1. 4. 2. Aphids.....	19
1. 4. 3. <i>Empoasca decipiens</i>	21
1. 4. 4. Predators.....	23
2. Laboratory experiments.....	24
2.1. Rearing of <i>Myzus persicae</i> and <i>Aphis gossypii</i>	24
2.2. Effect of temperature and prays on life cycle and life table parameters of <i>Chrysoperla carnea</i> and <i>Coccinella</i> <i>septempunctata</i>	24
2.2.1. <i>Chrysoperla carnea</i>	24
2.2.1.1. Life cycle and life table parameters.....	24
2.2.1.2. Predatory efficiency.....	27
2.2.2. <i>Coccinella septempunctata</i>	28

	Page
2.2.2.1. Life cycle and life table parameters.....	28
2.2.2.2. Predatory efficiency.....	30
3.3. Release of two insect predators, <i>Chrysoprela carnea</i> and <i>Coccinella septempunctata</i> to control <i>Myzus persicae</i> and <i>Bemisia tabaci</i> on tomato plants under greenhouse conditions.....	31
MATERIALS AND METHODS.....	38
1. Ecological studies.....	38
1.1. Survey studies.....	38
1.1.1. Sampling techniques.....	38
1.1.1.1. Leaves samples.....	38
1.1.1.2. Yellow sticky traps.....	38
1.1.1.3. Sweep-net.....	39
1.2. Seasonal abundance of certain insect pests infesting tomato plants (Elissa and Super Jackal) varieties and its associated predators insects.....	39
1.3. Relationship between population density of insect pests and growth stages of plant infesting two tomato cultivars	41
2. Laboratory experiments.....	41
2.1. Rearing of <i>Myzus persicae</i> and <i>Aphis gossypii</i>	41
2.2. Effect of temperature and preys on life cycle and life table parameters of <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i>	42
2.2.1. Rearing of <i>Ch. carnea</i> and <i>C. septempunctata</i>	42
2.2.2. Developmental durations of immature stages and survival rate of <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i> on <i>Myzus persicae</i> or <i>Aphis gossypii</i>	42
2.2.3. Longevity and fecundity of <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i> female.....	43
2.2.4. Statistical analysis.....	44

	Page
2.2.3. Assessing zero of development, rate of development and thermal units required for immature and mature stages of <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i> predators....	44
2.2.4. Life table parameters of <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i> predators.....	46
2.2.5. Construction of life table.....	47
3. Release of two insect predators, <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i> to control aphids (<i>Aphis gossypii</i> and <i>Myzus persicae</i>) and <i>Bemisia tabaci</i> on tomato plants under greenhouse conditions.....	48
3.1. Experimental design.....	48
3.2. Collective release rates for the two predators <i>Ch. carnea</i> and <i>C. septempunctata</i>	49
3.3. Estimation of aphid and whitefly populations on tomato plants under greenhouse conditions.....	49
3.4. Statistical analysis.....	49
RESULTS AND DISCUSSION.....	50
I. Ecological studies.....	50
1. Survey studies.....	50
1. 1. 1 Order: Hemiptera.....	50
1.1.2. Order: Coleoptera.....	50
1.1.3. Order: Neuroptera.....	51
1.1.4. Order: Diptera.....	51
1.2. Seasonal abundance of piercing sucking insects infesting Alissa and Super Jackal cultivars on tomato plants at kafr El- rjalat village, El- Qanater, Qalyubiya Governorate.....	53
1.2.1 Spring plantation.....	53
1.2.1.1. Alissa cultivar.....	53
1.2.1.1.1. <i>Bemisia tabaci</i>	53
1.2.1.1.2. <i>Empoasca decipiens</i>	56
1.2.1.1.3. <i>Aphis gossypii</i>	60

	Page
1.2.1.1.4. <i>Myzus persicae</i>	63
1.2.1. Spring plantation.....	66
1.2.1.2. Super Jackal cultivar.....	66
1.2.1.2.1. <i>Bemisia tabaci</i>	66
1.2.1.2.2. <i>Empoasca decipiens</i>	69
1.2.1.2.3. <i>Aphis gossypii</i>	72
1.2.1.2.4. <i>Myzus persicae</i>	75
1.2.2. Summer plantation.....	78
1.2.2.1. Alissa cultivar.....	78
1.2.2.1.1. <i>Bemisia tabaci</i>	78
1.2.2.1.2. <i>Empoasca decipiens</i>	81
1.2.2. Summer plantation.....	84
1.2.2.2. Super Jackal cultivar.....	84
1.2.2.2.1. <i>Bemisia tabaci</i>	84
1.2.2.2.2. <i>Empoasca decipiens</i>	87
1.3. Effect of some ecological factors on population dynamics of certain piercing sucking insects infesting two cultivars of tomato plants during two successive years 2014 & 2015.....	95
1.3.1. Spring plantation.....	95
1.3.1.1. Alissa cultivar.....	95
1.3.1.1.1. <i>Bemisia tabaci</i>	95
1.3.1.1.2. <i>Empoasca decipiens</i>	97
1.3.1.1.3. Aphid (<i>A. gossypii</i> + <i>M. persicae</i>)	99
1.3.1. Spring plantation.....	101
1.3.1.2. Super Jackal cultivar.....	101
1.3.1.2.1. <i>Bemisia tabaci</i>	101
1.3.1.2.2. <i>Empoasca deicpiens</i>	102
1.3.1.2.3. Aphid (<i>A. gossypii</i> + <i>M. persicae</i>)	104
1.3.2. Summer plantation.....	106
1.3.2.1. Alissa cultivar.....	106
1.3.2.1.1. <i>Bemisia tabaci</i> (nymphs and adults).....	106

	Page
1.3.2.1.2. <i>Empoasca decipiens</i>	107
1.3.2. Summer plantation.....	109
1.3.2.2. Super Jackal cultivar.....	109
1.3.2.2.1. <i>Bemisia tabaci</i>	109
1.3.2.2.2. <i>Empoasca deicpiens</i>	111
II. Laboratory studies.....	114
2. 1. Effect of rearing temperatures and preys on <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i> instar larvae and adults development.....	114
2. 1. 1. Duration of predators' immature stages.....	114
2.1.1.1. Egg incubation period.....	114
2.1.1.1.1. Percentage of egg hatchability.....	116
2.1.1.1.2. Zero of development for egg stage.....	116
2.1.1.1.3 . Rate of development and thermal units (DD's).....	117
2.1.1.2. Larval stage.....	122
2.1.1.2.1. Larval duration.....	122
2.1.1.2.2. Percentage of larval mortality.....	123
2.1.1.2.3. Zero of development for larval stage.....	123
2.1.1.2.3. Rate of development and thermal units (DD's)	123
2.1.1.3. Pupal stage.....	129
2.1.1.3.1. pre-pupal and pupal durations.....	129
2.1.1.3.2. Percentage of adult's emergence	130
2.1.1.3.3. Percentage of pre- pupal and pupal mortalities.....	135
2.1.1.3.4. Zero of development for pupal stage.....	135
2.1.1.3.5. Rate of development and thermal units (DD's).....	135
2.1.1.4. Sex ratio.....	136
2.1.1.5. Adult stage.....	139
2.1.1.5.1. Pre-oviposition period.....	139
2.1.1.5.2. Oviposition period.....	140
2.1.1.5.3. Post-oviposition period.....	141
2.1.1.5.4. Longevity.....	142

	Page
2.1.1.3.4. Zero of development for female and male.....	144
2.1.1.3.4.1. Female.....	144
2.1.1.3.4.2. Male.....	144
2.1.1.3.5. Rate of development and thermal units (DD's) for female and male.....	145
2.1.1.3.5.1. Femal.....	145
2.1.1.3.5.2. Male.....	145
2.1.1.5.5. Female fecundity.....	155
2.2. Life table studies on <i>Ch. carnea</i> and <i>C. septempunctata</i>	158
2.2.1. Percentages of apparent and real mortalities.....	158
2.2.2. Life table parameters.....	163
2.2.2.1. Net reproduction rate (Ro).....	163
2. 2. 2. 2. Generation time (Gt).....	163
2. 2. 2. 3. Intrinsic rate of increase (rm).....	164
2. 2. 2. 4. Finite rate of increase (λ).....	164
2. 2. 2. 5. Population double time (Dt).....	165
2.3. Feeding capacity of <i>Ch. carnea</i> and <i>C. septempunctata</i> on different raring temperatures and preys.....	167
2.3.1. <i>Ch. carnea</i>	167
2.3.2. <i>C. septempunctata</i>	169
III. Release of two predators, <i>Chrysoperla carnea</i> and <i>Coccinella septempunctata</i> together to control aphids (<i>Aphis gossypii</i> and <i>Myzus persicae</i>) and <i>Bemisia tabaci</i> on tomato plants under greenhouse conditions.....	173
1. Effect of <i>C. septempunctata</i> and <i>Ch. carnea</i> releases on aphids (<i>Aphis gossypii</i> and <i>Myzus persicae</i>) populations.....	173
2. Effect of <i>C. septempunctata</i> and <i>Ch. carnea</i> releases on cotton whitefly <i>B. tabaci</i> populations.....	178
SUMMERY.....	185
REFERENCES.....	200
Index.....	218
ARABIC SUMMERY.....	

LIST OF TABLES

Table	Page
1 Definitions and formulae for life table parameters of <i>Chrysoperla carnea</i> and <i>C. septempunctata</i> predators....	47
2 Survey of piercing sucking insect pests infesting tomato plants at Tukh, Qalyubiya Governorate throughout two successive years, 2014&2015.....	51
3 Survey of predatory insects associated with piercing sucking insects infesting tomato plants at Tukh, Qalyubiya Governorate throughout two successive years 2014 & 2015	52
4 Weekly mean numbers of <i>Bemisia tabaci</i> / using three method of sampling on Alissa tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	54
5 Weekly mean numbers of <i>Empoasca decipiens</i> /using three method of sampling on Alissa tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	58
6 Weekly total mean numbers of <i>Aphis gossypii</i> /using three method of sampling on Alissa tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	61
7 Weekly total mean numbers of <i>Myzus persicae</i> /using three method of sampling on Alissa tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	64

Table	Page
8 Weekly mean numbers of <i>Bemisia tabaci</i> /using three method of sampling on Super Jackal tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	67
9 Weekly mean numbers of <i>Empoasca decipiens</i> /using three method of sampling on Super Jackal tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	70
10 Weekly mean numbers of <i>Aphis gossypii</i> /using three method of sampling on Super Jackal tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	73
11 Weekly mean numbers of <i>Myzus persicae</i> /using three method of sampling on Super Jackal tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during spring plantation of 2014 & 2015.....	76
12 Weekly total mean numbers of <i>Bemisia tabaci</i> / using three method of sampling on Alissa tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during summer plantation of 2014 & 2015.....	79
13 Weekly total mean numbers of <i>Empoasca decipiens</i> / using three method of sampling on Alissa tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during summer plantation of 2014 & 2015.....	82

Table	Page
14 Weekly total mean numbers of <i>Bemisia tabaci</i> /using three method of sampling on Super Jackal tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during summer plantation of 2014 & 2015.....	85
15 Weekly total mean numbers of <i>Empoasca decipiens</i> /using three method of sampling on Super Jackal tomato cultivar and the corresponding maximum, minimum temperatures and relative humidity during summer plantation of 2014 & 2015.....	88
16 Weekly mean total number of four piercing sucking insects infesting Alissa and Super Jackal tomato cultivars during spring and summer plantations, throughout years, 2014&2015	91
17 General weekly mean number of four piercing sucking insects infesting Alissa and Super Jackal tomato cultivars during spring and summer plantations, throughout years, 2014&2015	91
18 Simple correlation and partial regression values of the three main weather factors and five biotic factors with <i>Bemisia tabaci</i> population and percentage of explained variance on tomato plant Alissa cultivar during spring plantation	96
19 Simple correlation and partial regression values of the three main weather factors and four biotic factors with <i>Empoasca decipiens</i> population and percentage of explained variance on tomato plant Alissa cultivar during spring plantation.....	98
20 Simple correlation and partial regression values of the three main weather factors and five biotic factors with aphid population (<i>Aphis gossypii</i> + <i>Myzus persicae</i>) and	