



**POPULATION DYNAMICS OF CERTAIN PIERCING SUCKING PESTS
AND THEIR CONTROL WITH NON TRADITIONAL MEANS ON
CUCUMBER PLANTS IN SHARKIA GOVERNORATE**

BY

EMAN MOHAMED FIKRY ARAFA

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

DOCTOR OF PHILOSOPHY

In

**Agricultural Sciences
(Economic Entomology)**

**Plant Protection Department
Faculty of Agriculture
Benha University**

2020

CONTENTS

Content	Page
1- Introduction	1
2- Review of literature	3
2.1. Ecological studies	3
2.2. Susceptibility of plant varieties of cucumber to certain piercing sucking insects infestation	13
2.3. Relationship between certain chemical contents of cucumber plant varieties and its relationship with certain piercing sucking insect infestations.	15
2.4. Effect of some bioinsecticides and biological agents on the population of pests infesting cucumber plants	20
2.5. Effect of the tested pesticides on chlorophyll content of cucumber leaves.	44
2.6. Effect of the different treatments some agricultural practices and control means on the yield of cucumber.	49
3- Materials and methods	53
3.1. Ecological studies on certain piercing sucking insects infesting cucumber plants and their associated predators.	53
3.1.1. Survey and seasonal abundance of some piercing sucking insects on cucumber plants.	54
3.1.1.1. Aphids <i>Aphis gossypii</i> (Aphididae: Hemiptera)	55
3.1.1.2. Leafhoppers (Auchenorrhynca , Hemiptera).	55
3.1.1.3. Whitefly, (Aleyrodidae, Hemiptera)	55
3.1.1.4. <i>Thrips tabaci</i>	55
3.1.1.5. Mite <i>Teranychus cucurbitacearum</i>	56

Content	Page
3.1.2. Survey and population density of the predators associated with certain piercing sucking insects infesting cucumber plants.	56
3.1.3. Effect of certain climatic factors (maximum, minimum temperature and relative humidity) on the population density of certain piercing sucking insects infesting cucumber plants and their associated predators	56
3.2. Effect chemical contents of certain cucumber varieties and its relation with the population density of aphid, leafhopper, whitefly, thrip insects and mites.	57
3.3.1 Effect of some bioinsecticides on the population of <i>A. gossyii</i>, <i>T. tabaci</i>, <i>B. tabaci</i> and <i>T. urticae</i> infesting cucumber plants	58
3.3.2. Effect of the tested pesticides on chlorophyll content of cucumber leaves	59
3.3.3. Effect of the different compounds on the yield of cucumber.	60
3.4. Statistical analysis:	60
4- Result and Discussion	61
4.1. Ecological studies :	61
4. 1.1. Survey of certain piercing sucking insects infesting cucumber plants and their associated predators.	61
4.1.2. Survey of predators associated with piercing sucking insects infesting cucumber plants.	63
4.1.3. Seasonal abundance of certain piercing sucking insects infesting cucumber plants.	66

Content	Page
4.1.4. Seasonal abundance of the predatory insects associated with insects infesting cucumber plants in 2016 and 2017 seasons.	88
4.1.5 Effect of certain climatic factors, (maximum temperature, minimum temperature and mean relative humidity) on the population density of certain piercing sucking insects infesting cucumber plants.	97
4.1.6. Effect of certain climatic factors, (maximum temperature, minimum temperature and mean relative humidity) on the population density of the predacious insects associated with certain piercing sucking on cucumber plants.	104
4.1.7. Combined effects of certain climatic factors (maximum, minimum temperature and relative humidity) and path analysis.	108
4.2.1. Susceptabilty of cucumber varieties to insect infestation .	110
4.2.2. Effect of the insect infestation on the mean yield of the tested cucumber varities (kg/plot)	113
4.2.3. Relationship between certain chemical contents of cucumber plant varieties and their infestation with certain piercing sucking insects infestations.	115
4.3.1 Effect of some bioinsecticides on the population of aphid infesting cucumber plants	129
4.3.2 Effect of some bioinsecticides on the population of <i>T. tabaci</i> infesting cucumber plants	133

Content	Page
4.3.3 Effect of some bioinsecticides on the population of <i>B. tabaci</i> infesting cucumber plants	137
4.3.4 Effect of some bioinsecticides and on the population of <i>T. urticae</i> infesting cucumber plants	141
4.4. Effect of the tested pesticides on chlorophyll content of cucumber leaves:	145
4.5. Effect of the different treatments on the yield of cucumber.	150
Summary	153
References	159
Arabic Summary	1

LIST OF TABLES

No.	Title of Tables	Page No.
1	Total number of tested the surveyed insect pests and mites infesting cucumber plants and their associated predators in Minia El-Kamh district, Sharkia Governorate collected by using plant samples and Sweeping net during 2016 and 2017 seasons.	65
2	Total number of aphid <i>A. gossypii</i> infesting cucumber Beit alpha plants collected by using plant samples at Minia El-Kamh district, Sharkia Governorate during 2016 and 2017seasons.	67
3	Total number of leafhopper infesting cucumber Beit alpha plants collected by using sweep net at Minia El-kamh, Sharkia Governorate during 2016 and 2017seasons.	71
4	Total number of whitefly <i>B. tabaci</i> infesting cucumber Beit alpha plants collected by using plant samples at Minia El-kamh, Sharkia Governorate during 2016 and 2017seasons.	77
5	Total numbers of <i>T. tabaci</i> infesting cucumber Beit alpha plants collected by using plant samples at Minia El-kamh, Sharkia Governorate during 2016 and 2017seasons.	81
6	Total number of mite eggs and adults infesting cucumber Beit alpha plants collected by using plant samples at Minia El-kamh, Sharkia Governorate during 2016 and 2017seasons.	85
7	Total number of some predators associated with piercing sucking insects infesting cucumber plants. Beit alpha plants collected by using plant samples at menia El-Kamh district, Sharkia Governorate during 2016 and 2017seasons.	89
8	Partial regression and simple correlation coefficients between maximum and minimum temperature relative humidity and total number of hemipterous insects infesting cucumber plants at menia El-kamh, Sharkia Governorate during 2016 and 2017 seasons.	103
9	Partial regression and simple correlation coefficients between maximum temperature, minimum temperature and relative humidity and total number of certain predacious insects on cucumber plants at menia Elkamh, Sharkia Governorate during 2016 and 2017 seasons.	107

No.	Title of Tables	Page No.
10	Explained and unexplained variance and the effects of maximum , minimum temperature and mean relative humidity on the total numbers of certain piercing sucking and predacious insects on cucumber plants at Menia El-Kamah , Sharkia, Governorate during 2016 and 2017 seasons.	109
11	Susceptibility of cucumber varieties to the infestation with certain piercing sucking insects along with yield during 2016 and 2017 seasons at menia Elkamh district in Sharkia Governorate.	114
12	Relationship between some chemical contents of cucumber varieties and mean number of tested piercing sucking insects during 2017 season.	128
13	Effect of tested pesticides against the aphid <i>A. gossypii</i> infesting cucumber plants after the first and second sprays in 2017 season.	132
14	Effect of tested pesticides against <i>T. tabaci</i> infesting on cucumber plants during after the first and second sprays in 2017 season.	136
15	Effect of tested pesticides against <i>B. tabaci</i> infesting on cucumber plants during after the first and second sprays in 2017 season	140
16	Effect of tested pesticides against <i>T. urticae</i> infesting on cucumber plants during after the first and second sprays in 2017 season.	144
17	Effect of different treatments on chlorophyll content (unit) of cucumber cultivator sahim leaves during 2017 season.	147
18	Effect of different treatments on chlorophyll content (unit) of cucumber cultivator El- brince leaves during 2017 season.	148
19	Effect of different treatments on chlorophyll content (unit) of cucumber cultivator Beit alpha leaves during 2017 season.	149
20	Effect of the different compound on the yield of cucumber	152

LIST OF FIGURE

No. of Fig.	Title of Tables	Page No.
1	Seasonal abundances of aphid insects <i>A. gossypii</i> on cucumber plants by plant samples at Minia Al-kamh district, Sharkia governorate during 2016 and 2017 seasons	68
2	Seasonal abundances of <i>E. decepiens</i> insects on cucumber plants by sweep net samples at Minia Al-kamh district Sharkia Governorate during 2016 and 2017 seasons.	72
3	Seasonal abundances of <i>E. decedens</i> insects on cucumber plants by sweep net samples at Minia Al-kamh district Sharkia governorate during 2016 and 2017 seasons.	73
4	Seasonal abundances of whitefly immature stage <i>B. tabaci</i> on cucumber plants by plant samples at Minia Al-kamh district, Sharkia Ggovernorate during 2016 and 2017 seasons.	78
5	Seasonal abundances of whitefly adult stage <i>B. tabaci</i> on cucumber plants by direct count at Minia Al-kamh district, Sharkia Governorate during 2016 and 2017 seasons	79
6	Seasonal abundances of <i>T. tabaci</i> on cucumber plants by plant samples at Minia Al-kamh district Sharkia Governorate during 2016 and 2017 seasons	82
7	Seasonal abundances of mite <i>Tetranychus</i> spp. adult on cucumber plants by plant samples at Minia Al-kamh district Sharkia governorate during 2016 and 2017 seasons.	88
8	Seasonal abundances of mite egg <i>Tetranychus</i> spp. on cucumber plants by plant samples at Minia Al-kamh district, Sharkia Governorate during 2016 and 2017 seasons.	87
9	Seasonal abundances of <i>C. undecimpunctata</i> on cucumber plants collected by plant samples at Minia Al-Qamh district Sharkia governorate during 2016 and 2017 seasons.	89
10	Seasonal abundances of <i>C. carnea</i> on cucumber plants collected by plant samples at Minia Al-Qamh district Sharkia governorate during 2016 and 2017 seasons.	91
11	Seasonal abundances of <i>Syrphus</i> sp on cucumber plants collected by plant samples at Minia Al-kamh district Sharkia governorate 2016 and 2017 seasons.	93
12	Seasonal abundances of <i>Orius</i> sp. on cucumber plants collected by plant samples at Minia Al-kamh district Sharkia governorate during 2016 and 2017 seasons	95

SUMMARY

The present work was conducted during 2016 and 2017 seasons to survey some of hemipterous insects (aphids, leafhoppers, whitefly) and mite infesting cucumber Minia El-kamh district Sharia Governorate Egypt. The seasonal abundance of the aforementioned dominant species and the effect of some insecticides, bioinsecticides and extracts were also studied.

4.1. Ecological studies :

These insect pests were collected by different methods from cucumber plants under field conditions. For this purpose, the sweeping net and plant samples were used.

Results showed that the sweeping net proved to be the best method to collect all the leafhopper species.

4. 1.1. Survey of certain piercing sucking insects infesting cucumber plants and their associated predators.

1) Aphid *Aphis gossypii* (Glover).

In the present work the aphid *A. gossypii* was surveyed using plant sample method of collections.

2) Leafhoppers

Two leafhopper species were collected and arranged descendingly according to their abundance:

Empoasca decipiens (Paoli) and *Empoasca decedens* (Paoli) were collected by sweeping net.

The present data indicated that the sweeping net technique proved to be the most efficient method to collect more leafhopper species than the other method for the cereal field crops.

3) The cotton whitefly, *Bemisia tabaci* (Genn.)

a) Immature stage

In the present work the *B. tabaci* (immature) was surveyed using plant sample method of collections.

b) Adult stage

In the present work the *B. tabaci* (adult) was surveyed using direct count sample method of collections.

4) *Thrips tabaci*

In the present work the *T. tabaci* (adult) was surveyed using direct count sample method of collections.

5) Mite *Tetranychus* spp

a) egg stage

In the present work the *Tetranychus* spp (egg) was surveyed using direct count sample method of collections.

a) Immature stage

In the present work the *T. cucurbitacearum* (immature) was surveyed using plant sample method of collections.

4. 1.2. Survey of their associated predators to piercing sucking insects infesting cucumber plants.

i) *Coccinella undecimpunctata* (L.)

In the present work the *C. undecimpunctata* was surveyed using direct count sample method of collections.

ii) *Chrysoperla carnea* (Steph.)

In the present work the *Ch. carnea* was surveyed using direct count sample method of collections.

iii) *Syrphus* sp.

In the present work the *Syrphus* sp. was surveyed using direct count sample method of collections.

iv) *Orius* sp.

In the present work the *Orius* sp. was surveyed using direct count sample method of collections.

4.1.3. Seasonal abundance of certain piercing sucking insects infesting cucumber plants.

1) Aphids (Hemiptera: Aphididae)

The Cotton Aphid, *Aphis gossypii* (Glover)

A. gossypii had two peaks were recorded during 2016 and 2017 seasons on cucumber plants. The first peak was occurred at the end of May for the two seasons. The second one was noticed at the first of July, for the two seasons.

2) The Green Leafhopper

E. decipiens and *E. decedens* two peaks were recorded for cucumber on cucumber plants. The first peak occurred at the frist of June for the two seasons. The second peak the 2nd of July for the two seasons.

3) The cotton whitefly, *Bemisia tabaci* (Genn.)

a) Immature stage

Whitefly, *Bemisia tabaci* had two peaks were recorded. The first peak was occurred at the frist week of June, while second one was noticed at the frist of July for the two seasons.

b) Adult stage

Whitefly, *Bemisia tabaci* (Adult stage) had two peaks. The first peak was occurred at the end of May, while second one was noticed at the end of June for the two seasons.

4) *Thrips tabaci*

T. tabaci had one peak of population density on cucumber plants were occurred at the 2nd week of May for the two seasons.

5) Mite *Tetranychus cucurbitacearum*

a) egg stage

Mite *T. cucurbitacearum* had one peak were recorded at the frist of June for the two seasons.

b) Adult stage

T. cucurbitacearum (Adult stage) had two peaks during 2016 and 2017 seasons. The first peak was occurred at the second week of June, while the second peak of 2nd week of June.

4.1.4 Effect of certain climatic factors, (Maximum temperature, minimum temperature and relative humidity) on the population density of dominant hemipterous, Acari and Thripis insects infesting cucumber plants.

The effects of the maximum temperature, minimum temperature and relative humidity on the population density and the abundant of aphid, leafhopper, whitefly, trips species and mite infesting cucumbre plants were studied under field conditions. The results clearly indicated that significant and insignificant correlation coefficient and partial regression were obtained between numbers of different insect species and maximum temperature & relative humidity during the two investigation seasons, respectively.

4.2.1. Effect of certain agricultural practices on the population density of certain insects, (Aphids, leafhoppers whitefly, thrips and mite.

2) Varieties:

Sahim variety, proved to be the least susceptible host for insects, (Aphids, leafhoppers, whitfly, thrips and mite) infestation, followed by Elprince variety, while the Betia alfa variety appeared to be the most susceptible cucumber variety.

4.2.2. Effect of chemical contents of cucumber plants on insects infestation.

1- Protein :

The obtained results revealed positive correlation between number insects levels and protein content in cucumber plants.

2- Carbohydrate:

Positive correlation was found between number insects and carbohydrate content.

3- pH value:

There was negative correlation was found between pH value and insects infestation.

4- phosphorous and potassium

There were no significant changes in phosphorous and potassium content by number insects

4.3.1 Effect of some chemical insecticides, bioinsecticides and plant extract on the population of aphid, *T. tabaci* , *B. tabaci* and *T.urticae* infesting cucumber plants.

The tested insecticides were Azadirachitn, Camphor oil, K.Z. oil, Abazeen and Dipel 2x. Results showed that Abazeen compound was the highest effective compound against pests cucumber followed discerningly by Azadirachitn, K.Z. oil, Camphor oil and Dipel.

4.4. Effect of the tested pesticides on chlorophyll content of cucumber leaves
Effect of the tested pesticides on chlorophyll content of leaves of cucumber plants :

Data concerning the effect of different tested insecticides (Azadirachtin); camphor oil, Kzoil; A bazeen (Abamectin) and Dipel 2x (*B- Thurngensis*) on the chlorophyll content of cucumber plant leaves of three cultivars Sahim Beit alpha and El-brince during 2016-2017 seasons .

Sahim cultivar showed higher chlorophyll content after Azadirachtin treatment at the concentration and higher application rate compared with control at the first spray and second spray cultivars at the second spray higher chlorophyll content after treatment compared with control

Also, significant increase in chlorophyll content means of cucumber plant leaves of Sahim and cultivar was observed after the application of Azadirachtin treatment compared with the means of the untreated plots control. El-brince and Biet alpha cultivars showed the lowest chlorophyll content and no significant, for all compounds compared with control at the first and second sprays of summer 2017 season

4.2.4 Effect of the different treatments on the yield of cucumber.

All tested materials showed high yield of cucumber at 1st and 2nd spray during 2017 season. Concerning fruits weight for Prince, Sahim and Beitalpha cultivars, there were significant increase in fruits weight for all mixtures as compared with the control during 2017 season.