Faculty of Agriculture
Economic Entomology Department

Effect of some agricultural practices on the main piercing-sucking insect pests attacking cucumber crop in Fayoum governorate

By

Ahmed Mohamed Salah El-Deen Abd El-Fatah Abd El-Fatah Wahsh

Bsc in Agricultural Science (Plant Protection), El-Fayoum University 2008
Msc in Agricultural Science (Economic Entomology), El-Fayoum University 2016

Thesis
Submitted in partial fulfillment of the requirements for the PhD
In
Agriculture Sciences (Economic Entomology)

Supervisors

Prof. Dr.
Samir S. Awadalla
Professor of Economic Entomology
Faculty of Agriculture, Mansoura University

Prof. Dr.
Hala A. K. El-Serafi
Professor of Economic Entomology,
Faculty of Agriculture, Mansoura University

Prof.Dr.
Magdy A. El-Hariry
Head Researchers of Economic Entomology, Plant Protection Research Institute, Agricultural Research Center

Mansoura University

2021

CONTENTS

Subject	Page
I. Introduction……	1
II. Review of Literature……..	4
2.1. Influence of sowing dates	4
2.2. Influence of different cucumber varieties	8
2.3. Influence of fertilizations	11
2.4. Influence of weeds	13
III. Material and methods……	15
3.1. Influence of cucumber sowing dates	15
3.2.Influence of different cucumber hybrids	16
3.3. Influence of nitrogen fertilization levels	16
3.4. Influence of potassium fertilization levels	17
3.5. Influence of cucumber weed cover	17
3.6. Statistical analysis	17
IV. Result and Discussion	18
4.1.Survey and occurrence of the main piercing-sucking insect pests	18
4.2. Influence of sowing dates	21
4.2.1. On the cotton aphid *Aphis gossypii* and the green peach aphid, *Myzus persicae*	21
4.2.2. On the cotton whitefly *Bemisia tabaci*	27
4.2.3. On the onion thrips *Thrips tabaci*	32
4.2.4. On the cotton mealybug *Phenococcus solenopsis*	37
4.2.5. On the leafhoppers *Empoasca decipiens* and *E. decedens*	43
4.2.6. On the southern green sting bug *Nezara viridula*	49
4.3.Influence of different cucumber hybrids	55
4.4. Influence of nitrogen fertilization levels	58
4.5. Influence of potassium fertilization levels	61
4.6. Influence of different weeds grow in cucumber fields	65
V.Conclusion	71
IV. English summery.....	73
VII. References…….....	78
Arabic summery……..	١

LIST OF TABLES

Tables	Title	Page
1	**The total number and percentage of the main piercing-sucking insect pests on cucumber plants in March sowing date during the two years (2018 and 2019) in Fayoum governorate.**	19
2	**The total number and percentage of the main piercing-sucking insect pests on cucumber plants in August sowing date during the two years (2018 and 2019) in Fayoum governorate.**	19
3	**The total number and percentage of the main piercing-sucking insect pests on cucumber plants in October sowing date during the two years (2018 and 2019) in Fayoum governorate.**	20
4	**The seasonal number (Mean ± SE) of *A. gossypii* and *M. persicae* in different sowing dates of cucumber crop during the two successive seasons 2018 and 2019 in Fayoum governorate.**	26
5	**Simple correlation coefficient (r) between the weekly number of *A. gossypii* and *M. persicae* in different cucumber sowing dates and the average of temperature and relative humidity during the two successive years (2018 and 2019) in Fayoum governorate.**	26
6	**The seasonal average number of *B. tabaci* immature stages in different cucumber sowing dates during the two successive years (2018 and 2019) in Fayoum governorate.**	31
7	**Simple correlation coefficient (r) between the weekly number of *B. tabaci* immature stages in different cucumber sowing dates and the average of temperature and relative humidity during the two successive years (2018 and 2019) in Fayoum governorate.**	32
8	**The seasonal average number of *T. tabaci* nymphs in different cucumber sowing dates during the two successive years (2018 and 2019) in Fayoum governorate.**	36
9	**Simple correlation coefficient (r) between the weekly number of *T. tabaci* nymphs in different cucumber sowing dates and the average of temperature and relative humidity during the two successive years (2018 and 2019) in Fayoum governorate.**	36

10	**The seasonal average number of *P. solenopsis* in different cucumber sowing dates during the two successive years (2018 and 2019) in Fayoum governorate.**	**41**
11	**Simple correlation coefficient (r) between the weekly number of *P. solenopsis* in different cucumber sowing dates and the average of temperature and relative humidity during the two successive years (2018 and 2019) in Fayoum governorate.**	**41**
12	**The seasonal number (Mean ± SE) of *E. decipiens* and *E. decedens* in different sowing dates of cucumber crop during the two successive seasons 2018 and 2019 in Fayoum governorate.**	**46**
13	**Simple correlation coefficient (r) between the weekly number of *E. decipiens* and *E. decedens* in different cucumber sowing dates and the average of temperature and relative humidity during the two successive years(2018 and 2019) in Fayoum governorate.**	**47**
14	**The seasonal average number of *N. viridula* in different cucumber sowing dates during the two successive years (2018 and 2019) in Fayoum governorate.**	**53**
15	**Correlation coefficient (r) between the weekly number of *N. viridula* in different cucumber sowing dates and the average of temperature and relative humidity during the two successive years (2018 and 2019) in Fayoum governorate.**	**53**
16	**The average number of the major piercing-sucking insect pests of the various cucumber hybrids during the first year (2018) in Fayoum governorate.**	**56**
17	**The average number of the major piercing-sucking insect pests of the various cucumber hybrids during the second year (2019) in Fayoum governorate.**	**56**
18	**Effect of nitrogen fertilization levels on the average number of the main piercing-sucking insect pests in cucumber fields during the first year (2018) in Fayoum governorate.**	**60**
19	**Effect of nitrogen fertilization levels on the average number of the main piercing-sucking insect pests in cucumber fields during the second year (2019) in Fayoum governorate.**	**60**

20	**Effect of potassium fertilization levels on the average number of the main piercing-sucking insect pests in cucumber fields during the first year (2018) in Fayoum governorate.**	**62**
21	**Effect of potassium fertilization levels on the average number of the main piercing-sucking insect pests in cucumber fields during the second year (2019) in Fayoum governorate.**	**63**
22	**The common weeds grown in cucumber fields during the two successive years (2018 and 2019) in Fayoum governorate**	**66**
23	**Effect of weeds in cucumber fields on the average number and occurrence % of the major piercing-sucking insect pests during the first year (2018) in Fayoum governorate.**	**66**
24	**Effect of weeds in cucumber fields on the average number and occurrence % of the major piercing-sucking insect pests during the second year (2019) in Fayoum governorate.**	**67**
25	**The mean weekly temperature degrees and relative humidity for different seasons during year 2018.**	**69**
26	**The mean weekly temperature degrees and relative humidity for different seasons during year 2019.**	**70**

LIST OF FIGURES

Figure	Title	Page
1	**The population density of *A. gossypii* and *M. persicae* in relation to the different cucumber sowing dates (March, August, and October) during the first year 2018 in Fayoum governorate.**	22
2	**The population density of *A. gossypii* and *M. persicae* in relation to the different cucumber sowing dates (March, August, and October) during the second year 2019 in Fayoum governorate.**	23
3	**The seasonal dominance percentage of *A. gossypii* (A) and *Myzus persicae* (B) in different cucumber sowing dates (March, August, and October) during the first and second years (2018 and 2019) in Fayoum governorate.**	25
4	**The population density of *Bemisia tabaci immature stages* at different cucumber sowing dates (March, August, and October) during the first year 2018 in Fayoum governorate.**	29
5	**The population density of *Bemisia tabaci* immature stages at different cucumber sowing dates (March, August, and October) during the second year 2019 in Fayoum governorate.**	30
6	**The seasonal occurrence percentage of *B. tabaci* in different cucumber sowing dates (March, August, and October) during the first and second years (2018 and 2019) in Fayoum governorate.**	31
7	**The population density of *Thrips tabaci* nymphs at different cucumber sowing dates (March, August, and October) during the first year 2018 in Fayoum governorate.**	34
9	**The seasonal occurrence percentage of *T. tabaci* nymphs in different cucumber sowing dates (March, August, and October) during the first and second years (2018 and 2019) in Fayoum governorate.**	37

10	**The population density of *Phenococcus solenopsis* at different cucumber sowing dates (March, August, and October) during the first year 2018 in Fayoum governorate.**	**39**
11	**The population density of *Phenococcus solenopsis* at different cucumber sowing dates (March, August, and October) during the second year 2019 in Fayoum governorate.**	**40**
12	**The seasonal occurrence percentage in *P. solenopsis* in different cucumber sowing dates (March, August, and October) during the first and second years (2018 and 2019) in Fayoum governorate.**	**42**
13	**The population density of *E. decipiens* and *E. decedens* in relation to the different cucumber sowing dates (March, August, and October) during the first year 2018 in Fayoum governorate.**	**44**
14	**The population density of *E. decipiens* and *E. decedens* in relation to the different cucumber sowing dates (March, August, and October) during the second year 2019 in Fayoum governorate.**	**45**
15	**The seasonal dominance percentage of *E. decipiens* (A) and *E. decedens* (B) in different cucumber sowing dates (March, August, and October) during the first and second years (2018 and 2019) in Fayoum governorate.**	**48**
16	**The population density of *Nezara viridula* at different cucumber sowing dates (March, August, and October) during the first year 2018 in Fayoum governorate.**	**51**
17	**The population density of *Nezara viridula* at various cucumber sowing dates (March, August, and October) during the second year 2019 in Fayoum governorate.**	**52**
18	**The seasonal dominance percentage of *N. viridula* in different cucumber sowing dates (March, August, and October) during the first and second years (2018 and 2019) in Fayoum governorate.**	**54**

19	**The Occurrence rate for the major piercing-sucking insect pests on varying cucumber hybrids during the first (2018) and second (2019) years in Fayoum governorate.**	**57**
20	**The Occurrence rate for the major piercing-sucking insect pests in fields fertilized by varying nitrogen levels during the first (2018) and second (2019) years in Fayoum governorate.**	**61**
21	**The occurrence rate for the major piercing-sucking insect pests in fields fertilized by varying potassium levels during the first (2018) and second (2019) years in Fayoum governorate.**	**64**
22	**The occurrence rate for the major piercing-sucking insect pests in weedy fields (neglected) and free-weed fields (cleaned) during the first (2018) and second (2019) years in Fayoum governorate.**	**68**

VI- SUMMARY

The present experiments were conducted in a private cucumber field in Ibshwai, Fayoum governorate during the two successive years (2018 and 2019) to evaluate the influence of some agricultural practices on the population abundance of the main piercing-sucking insect pests attacking cucumber crop. This study aims to evaluate the following points:

- Influence of sowing cucumber dates on the population density of the main piercing-sucking insect pests.
- Influence of the various cucumber hybrids on the population density of the main piercing-sucking insect pests.
- Influence of nitrogen fertilization levels on the population density of the main piercing-sucking insect pests.
- Influence of potassium fertilization levels on the population density of the main piercing-sucking insect pests.
- Influence of weeds on the population density of the main piercing-sucking insect pests.

The obtained results could be summarized as follows:

6.1. Survey and occurrence of the main piercing-sucking insect pests:

In March cucumber sowing date, the cotton aphid *A. gossypii* recorded the highest rate of occurrence which presented by 30.7 and 36.1 % followed by the cotton whitefly *B. tabaci* which was 25.7 and 28.1 % during the first and second year, respectively.

In August cucumber sowing date, the cotton whitefly *B. tabaci* recorded the highest rate of occurrence which was 48.4 and 49.3 %, while the cotton aphid *A. gossypii* came in the second category and presented by 16.5 and 19.5 % during the first and second year, respectively.

In October cucumber sowing date, the cotton aphid, *A. gossypii* ranked the first category in the rate of insect occurrence which was 41.5 and 52.8 %, respectively. Meanwhile, the cotton whitefly *B. tabaci* ranked the second category which was 38.3 and 33.0 % during the first and second year, respectively.

On the other hand, the southern green sting bug *N. viridula* and the cotton mealybug *P. solenopsis* came in the last category in the three cucumber sowing dates during the two years of study in Fayoum governorate

As a conclusion, October sowing date attracted the highest total number 16538 and 17211 individuals followed by March sowing date which were 14535 and 15925 individuals during the first and second year, respectively. The cotton aphid *A. gossypii*, the cotton whitefly *B. tabaci* and the green peach aphid *M. persicae* recorded the highest occurrence in the three cucumber sowing dates in Fayoum governorate. The second year (2019) recorded the highest total number of the target insect pests in the three cucumber sowing dates in comparison with the first year (2018).

6.2. Influence of sowing dates:

6.2.1. The cotton aphid *Aphis gossypii* and the green peach aphid, *Myzus persicae*:

The cotton aphid *A. gossypii* reached the highest peak of abundance in March sowing date in the fourth week of April 2018 (916 individuals/sample) and in the first week of May 2019 (1083 individuals/sample). While, in August sowing date, *A. gossypii* reached the highest peak of abundance in the fourth week of October 2018 and 2019 with 671 and 783 individuals/sample, respectively. Moreover, in October sowing date, *A. gossypii* reached the highest peak of abundance in the second week of November 2018 and in the third week of November 2019 and represented by 934 and 1214 individuals/sample during the two years, respectively.

The green peach aphid, *M. persicae* recorded the highest peak of abundance in March sowing date in the second week of April 2018 (317 individuals/sample) and in the fourth week of April 2019 (324 individuals/sample). While in August sowing date M. persicae recorded the highest peak of abundance in the second week of October 2018 and in the fourth week of September 2019 and presented by 428 and 302 individuals/sample, respectively. Meanwhile, in October sowing date, *M. persicae* recorded the highest peak of abundance in the second week of November 2018 and 2019 and presented by 183 and 124 individuals/sample, respectively.

August sowing date revealed that *A. gossypii* recorded the lowest percentage of abundance during the two years and presented by 22.8 and 22.3%, respectively. While, October sowing date had the lowest percentage of *M. persicae* dominance during the two years and presented by 17.2 and 16.2%, respectively.

4.2.2. The cotton whitefly *Bemisia tabaci* :

The cotton whitefly *B. tabaci* reached the highest peak of abundance in March sowing date in the second week of May 2018 and in the fourth week of April 2019 and presented by 825 and 1086 individuals/sample, respectively. While, in August sowing date, *B. tabaci* recorded the highest peak of abundance in the second week of October 2018 and in the third week of October 2019 and presented by 1432 and 1656 individuals/sample, respectively. Moreover, in October sowing date, *B. tabaci* reached the highest peak of abundance in the first week of November 2018 and in the second week of October 2019 and presented by 924 and 1017 individuals/sample, respectively.

March sowing date recorded the lowest percentage of *B. tabaci* dominance during the two years 2018 and 2019 and presented by 23.7 and 25.3%, respectively.

6.2.3. The onion thrips *Thrips tabaci*:

March cucumber sowing date hosted the highest seasonal average number of *T. tabaci* nymphs during the two years (2018 and 2019) and presented by 118.5 ± 19.79 and 79.6 ± 18.99 individuals/sample. Further, the obtained results revealed that October sowing date recorded the lowest percentage of the insect dominance during the two years and presented by 15.2 and 17.6%, respectively.

6.2.4. The cotton mealybug *Phenococcus solenopsis*:

March cucumber sowing date hosted the highest seasonal average number of *P. solenopsis* nymphs during the two years (2018 and 2019) and presented by 71.7 ± 18.75 and 76.0 ± 19.37 individuals/sample. In addition, the obtained results revealed that October sowing date recorded the lowest percentage of the insect dominance during the two years and presented by 19.1 and 17.5%, respectively.

6.2.5. The leafhoppers *Empoasca decipiens* and *E. decedens*:

In March sowing date *E. decipiens* and *E. decedens* reached the highest peak of abundance in the second week of May during the first year 2018 and presented by 316 and 362 individuals/sample, respectively. Meanwhile, in August sowing date, *E. decipiens* and *E. decedens* reached the highest peak of abundance in the second week of October and with 183 and 235 individuals/sample, respectively. In respect to October sowing date, *E. decipiens* and *E. decedens* recorded the highest peak of abundance in the third week of November and represented by 63 and 96 individuals/sample, respectively.

In March sowing date during the second year 2019, *E. decipiens* and *E. decedens* reached the highest peak of abundance in the first week of May and presented by 292 and 326 individuals/sample, respectively. In August sowing date of 2019, *E. decipiens* and *E. decedens* reached the highest peak of abundance in the fourth week of October with 227 and 254 individuals/sample, respectively. In respect to October sowing date of 2019, *E. decipiens* and *E. decedens* recorded the highest peak of abundance in the second week of November and represented by 77 and 114 individuals/sample, respectively.

6.2.6. The southern green sting bug *Nezera viridula*:

March sowing date of cucumber hosted the highest seasonal average number of *N. viridula* during the two years (2018 and 2019) and presented by 33.5 ± 8.29 and 25.7 ± 6.90 individuals/sample, respectively. Moreover, the obtained results revealed that October sowing date recorded the lowest percentage of the insect dominance during the two years and presented by 18.2 and 20.0 %, respectively.

6.3. Influence of different cucumber hybrids:

Cucumber hybrid Reda F1 hybrid followed by hybrid Sweet Cransh F1 hybrid attracted the highest average number of the cotton aphid *A. gossypii* followed by the cotton whitefly *B. tabaci*, the leafhopper *E. decedens*, the green peach aphid *M. persicae* and the potato leafhopper *E. decipiens* during the two years 2018 and 2019.

Cucumber hybrid Hayel F1 hybrid followed hybrid Medina F1 hybrid hosted the lowest average number of the aforementioned insect pests during the two years.

Cucumber hybrid Hayel F1 hybrid followed by Medina F1 hybrid, Reda F1 hybrid and Sweet Cransh F1 hybrid hosted the lowest average number of the green sting bug *N. viridula* followed by the cotton mealybug *P. solenopsis* and the onion thrips *T. tabaci* during the two years.

Cucumber hybrid Hayel F1 hybrid had the lowest rate of occurrence (23.3 and 23.5 %) followed by Medina F1 hybrid (24.6 and 23.9 %) during the two years 2018 and 2019, respectively.

6.4. Influence of nitrogen fertilization levels:

With nitrogen fertilization level of 300 kg/feddan, the piercing-sucking insect pests recorded the highest average number for each insect pest during the two years in comparison with the other nitrogen fertilization levels.

The lowest average number for each examined insect pest was recorded by 0 kg of nitrogen fertilizer/feddan during the two years.

The rate of occurrence for the total number of all insect pests was increased by increasing the nitrogen fertilizer levels from 0 kg per feddan to 300 kg per feddan during the two years of the study. Statistical analysis revealed that there were significant differences in numbers of each examined insect species between levels of nitrogen fertilization.

6.5. Influence of potassium fertilization levels:

By using potassium fertilization level of 75 kg per feddan, the main piercing-sucking insect pests recorded the lowest average number for each examined insect species during the two years of study in comparison with other levels of potassium fertilization.

The highest average number for each insect pest was recorded in plots received 0 kg of potassium, followed by 25 and 50 kg per feddan during the two years of study.

The rate of occurrence for the total number of all examined insects was decreased by increasing the potassium fertilization levels from 0 kg per feddan to 75 kg per feddan during the two years of thestudy.

Statistical analysis revealed that there were significant differences in numbers of each examined insect species between levels of potassium fertilization during the two years of the study in Fayoum governorate.

6.6. Influence of different weeds grow in cucumber fields:

Cucumber weedy field or neglected field harbored the highest average number for each piercing-sucking insect with significant differences during the first and second year of study.

The cucumber weedy field or neglected field hosted the highest rate of occurrence for the total number of the main piercing-sucking insect pests during the two years and represented by 57.7 and 55.9 %, respectively.