

POPULATION DENSITY OF CERTAIN PIERCING SUCKING PESTS INFESTING SOME OF SOLANACEAE PLANTS IN ISMAILIA GOVERNORATE, EGYPT

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ABSTRACT

*The present work was conducted during two successive seasons 2011 / 2012 and 2012/2013 in order to study the population dynamics of aphids, leafhoppers and whitefly insect species infesting Solanaceae plants Eggplant, (*Solanum melongena* L.), Pepper (*Capsicum annuum* L.) and Tomato (*Lycopersicum esculentum*), in Kasasine district, Ismailia Governorate, Egypt. Aphid species *Aphis gossypii* (Glov.), leafhopper insect species included *Empoasca decipiens* (Paoli), *Empoasca decedens* (Paoli), whitefly insect species was *Bemesia tabaci* (Genn.) and mites *Tetranychus* sp. The seasonal population abundance of *A. gossypii* on Eggplant, Pepper and Tomato plants showed two peaks. The first one occurred at 2nd of Oct., 4th of Oct. and 4th of Sept. on Eggplant, pepper and tomato plants, respectively. The second peak was recorded at 3rd of Dec. on Eggplant and Pepper, while Tomato plants at 4th of Dec. Two peaks occurred for both *E. decipiens* and *E. decedens* during the two seasons on Eggplant the first peak on 1st of Nov. and the second peak 2nd of Dec for the two seasons respectively. On Pepper the first peak 4th of Oct. , and the second peak 2nd of Dec for *E. decipiens* and 1th of Dec while the first peak occurred on tomato plant 2nd of Oct ts . Whitefly, *B. tabaci* on eggplant and Tomato plants in nymph at 4th Sept. in the first peak on Eggplant and Tomato plants , 4th of Nov. on Eggplant plants and 1st of Dec. in Tomato plants for the two seasons, respectively. While, adult stage the first one 2nd of Oct. for the two season , while the second season 2nd of Dec. on eggplant and 4th of Dec. on Tomato plants on both seasons. Mite *Tetranychus* sp., on Eggplant and tomato plants was recorded two peaks. The first on 2nd of Oct., 1st of Oct. and 1st of Oct., 4th of Sept. respectively. The second peak 3rd of Dec. on both seasons. The obtained results attributed in forecasting of the infestation of these pests on Solanaceae plants.*

***Conclusively**, from these results it could be concluded that through knowledge of the number of pests' generations under study*

that can be used in a program to forecasting pests injuries and using it in an integrated pest management program.

Key words: Eggplant, Pepper, Tomato, aphid, leafhopper, whitefly, mite.

INTRODUCTION

The Solanaceae plants `eggplant, pepper and tomato are considered the most important vegetable crops which used as human food. The homopterous insects, aphid, leafhoppers, whitefly and mite *Tetranychus* sp. are economic pests of many vegetable crops, which affect on the quantity of yield as results of their direct feeding on plants. The fauna of these pests on Solanaceae plants has been studied in Egypt by several authors, (Hegab *et al.*, 1989; Hashem, 1997; El-Gindy, 2002 and Abd-alla and Hashem, 2009). They mentioned that *A. gossypii* (Glov.), and *B. tabaci* (Genn.) has two peaks on eggplant, pepper and tomato plants.

Therefore, present study aimed to investigate the population density of certain sucking pests infesting Solanaceae plants in relation to some climatic factors.

MATERIALS AND METHODS

An area about one feddan (1/3 feddan to each crop) was chosen to carry out this study in Ksaien district, Ismailia Governorate. Treatments were presented by three replicates. Each replicate was 450 m². Sowing date was during the second week of August, during the two seasons of 2011/2012 and 2012/2013. Normal agricultural practices were followed in due time and all plots were kept free of any insecticide treatments.

Sampling started when plants reached one month after as sowing and continued at weekly intervals throughout the growing seasons in 2011/2012 and 2012/2013. The following procedures of sampling were used:

Sample technique

- a) Plant samples of 30 leaves were picked up randomly from the plants. These leaves were examined in the laboratory by a stereoscopic binocular microscope and the total number of *A. gossypii* and the immature stages Adult *B. tabaci* was directly counted on plant samples. The mite *Tetranychus cucurbitacearum* (Sayed). was counted on both surfaces of the leaves were recorded.
- b) Sweeping net, (30 cm diameter and 60 cm deep) each sample consisted of 100 double strokes, were taken from both diagonal directions of the experimental area. Each sample was kept in a tight closed paper bag and transferred to the laboratory for inspection by a stereoscopic binocular microscope and the collected leafhoppers were killed by chlorophorm,

sorted into species and identified according to (Hegab *et al.*, 1989; Herakly, 1970; Carrizo, 2000 and Karungi *et al.*, 2012). For clearing the effect of certain weather factors such as temperature and relative humidity on the population density of these pests, the daily means of the two factors were provided by the Meteorological Central Laboratory for Agricultural Climate, Agricultural Research Center during the whole period of the two seasons. To show the effect of each factor as well as their total effect on insects population density, obtained data were statistically analyzed using Costat Software Microcomputer Program (Anonyms, 1990).

RESULTS AND DISCUSSIONS

1) Survey of homopterous insects on Solanaceous plants:

Survey studies on Solanaceous plants in Ksasien district, Ismailia Governorate during 2011/2012 and 2012/2013 seasons.

1) Eggplant plants:

- a) Aphids** *Aphis gossypii* (Glover): Survey studies on Eggplant plants revealed the presence of aphid specie *A. gossypii* recorded mean number of 2830 and 2024 leaves / plant sample for the two seasons, respectively.
- b) Leafhopper insects:** The data presented in Table (1) show the incidence of two leafhopper species belonging to family Cicadellidae on Eggplant. The collected leafhopper species *Empoasca decipiens* (Paoli) and *Empoasca decedens* (Paoli) recorded mean number of 5201, 6741 and 2221, 3341 insects / sweep net for the two seasons, respectively.
- c) Whitefly insects:** The following whitefly species namely *Bemisia tabaci* (Genn.) adult stage was collected, mean number of 737 and 425 leaves / plant sample from Eggplant plants for the two seasons, respectively. Immature stage was recorded, mean number of 2052 and 1304 leaves / plant sample for the two seasons, respectively.
- D) Mite** *Tetranychus cucurbitacearum* (Sayed): Survey studies on Eggplant plants revealed the presence of mite was recorded mean number of 1400 and 1021 leaves / plant sample for the two seasons, respectively.

2) Pepper

- a) Aphid** *A. gossypii*: Survey studies on Pepper plants revealed the presence of aphid species *A. gossypii* recorded mean number of 1306 and 1708 insects/ plant sample for the two seasons, respectively Table 1.
- b) Leafhopper insects:** The data presented in Table (1) show the incidence of two leafhopper species belonging to family Cicadellidae on Pepper. The collected leafhopper species *E. decipiens* and *E. decedens* recorded mean number of 197,131 and 92, 80 insects / sweep net for the two seasons, respectively.

Table 1. Total number of some piercing sucking insects and mite collected from solanaceous plants by using plant samples and sweeping nets at Ksaien district, Ismailia Governorate, during 2011/2012 and 2012/2013 seasons.

Insect		Plant sample	2011/2012		2012/2013	
			Plant samples	Sweeping net	Plant samples	Sweeping net
<i>A. gossypii</i>		Eggplants	2830	55	2024	73
		Tomato	292	14	155	18
		Pepper	1306	37	1708	22
<i>E. decipiens</i>		Eggplants	-	5201	-	6741
		Tomato	-	363	-	411
		Pepper	-	197	-	131
<i>E. decedens</i>		Eggplants	-	2221	-	3341
		Tomato	-	206	-	160
		Pepper	-	92	-	80
Whitefly	Adult*	Eggplants	737	41	425	26
		Tomato	280	21	335	9
	Nymph	Eggplants	2052	-	1304	-
		Tomato	586	-	641	-
Mite <i>T. cucurbitacearum</i>		Eggplants	1400	-	1021	-
		Tomato	2354	-	2594	-

* Direct, count plant sample.

3) Tomato:

- a) **Aphid** *A. gossypii*: Survey studies on Tomato plants revealed the presence of aphid species *A. gossypii* recorded mean number of 292 and 155 insects/ plant sample for the two seasons, respectively Table 1.
- b) **Leafhopper insects**: The data presented in Table (1) show the incidence of two leafhopper species belonging to family Cicadellidae on Tomato. The collected leafhopper species *E. decipiens* and *E. decedens* recorded mean number of 363, 411 and 206, 160 insects / sweep net for the two seasons, respectively.
- c) **Whitefly insects**: The following whitefly species namely *B. tabaci* adult stage was collected, mean number of 280 and 335 insects/ plant sample for the two seasons, respectively. Immature stage was recorded mean number of 586 and 641 leaves/plant sample for the two seasons, respectively.
- d) **Mites**: The collected mite was *Tetranychus cucurbitacearum* (Sayed), mean number of 2354 and 2594 mites/ plant sample for the two seasons, respectively. The results consistent that of Robert *et al.* (2008); Abd-alla and Hashem (2009).

II) Seasonal abundance

1) *A. gossypii*:

The seasonal population abundance of *A. gossypii* on eggplant plants, pepper plants and tomato plants are shown in Figure 1. Two peaks of population abundance were recorded for *A. gossypii* during 2011/2012 and 2012/2013 seasons. The first one occurred at 2nd week of October with a total number of 302 and 215 insects/ sample on eggplant plants, at 4th week of September and 3rd week of October with a total number of 17 and 17 insects/sample on pepper plants and at 4th week of September with a total number of 39 and 33 insects/sample on tomato plants for *A. gossypii* for the two seasons, respectively. The second peak was recorded at 3rd week of December and with a total number of 522 and 421, 355 and 514 insects/sample on eggplant plants and pepper plants and 4th week of December with a total number of 55 and 27 insects/sample on tomato plants for *A. gossypii* for the two seasons, respectively.

2) Whitefly *B. tabaci* (Genn.)

The whitefly *B. tabaci* was the most abundant species on eggplant plants and tomato plants during the two seasons.

Two peaks of population density were recorded for *B. tabaci* adult stage during 2011/2012 and 2012/2013 seasons are shown in Figure 2. The first one occurred at 1st week of October with a total number of 187 and 121 insects/sample on eggplant plants and at 3rd week and 4th week of September with a total number of 58 and 63 insects/sample on tomato plants for *B. tabaci* adult stage for the two seasons, respectively. The second peak was recorded in 1st week and 2nd week of December with a total number of 98 and 35 insects/sample on eggplant plants and at 3rd week and 4th week of December with a total number of 22 and 18 insects/sample on tomato plants for the two seasons, respectively.

Two peaks of population density were recorded for *B. tabaci* nymph stages during 2011/2012 and 2012/2013 seasons are shown in Figure 3.

The first one occurred at 2nd week of October with a total number of 401 and 115 insects/sample on eggplant plants and at 1st week of October with a total number of 112 and 99 insects/sample on tomato plants for the two seasons, respectively. The second peak was recorded at 1st week of December and 2nd week of November with a total number of 310 and 155 insects/sample on eggplant plants and 4th week and 2nd week of December with a total number of 86 and 79 insects/sample on tomato for *B. tabaci* nymph stages for the two seasons, respectively.

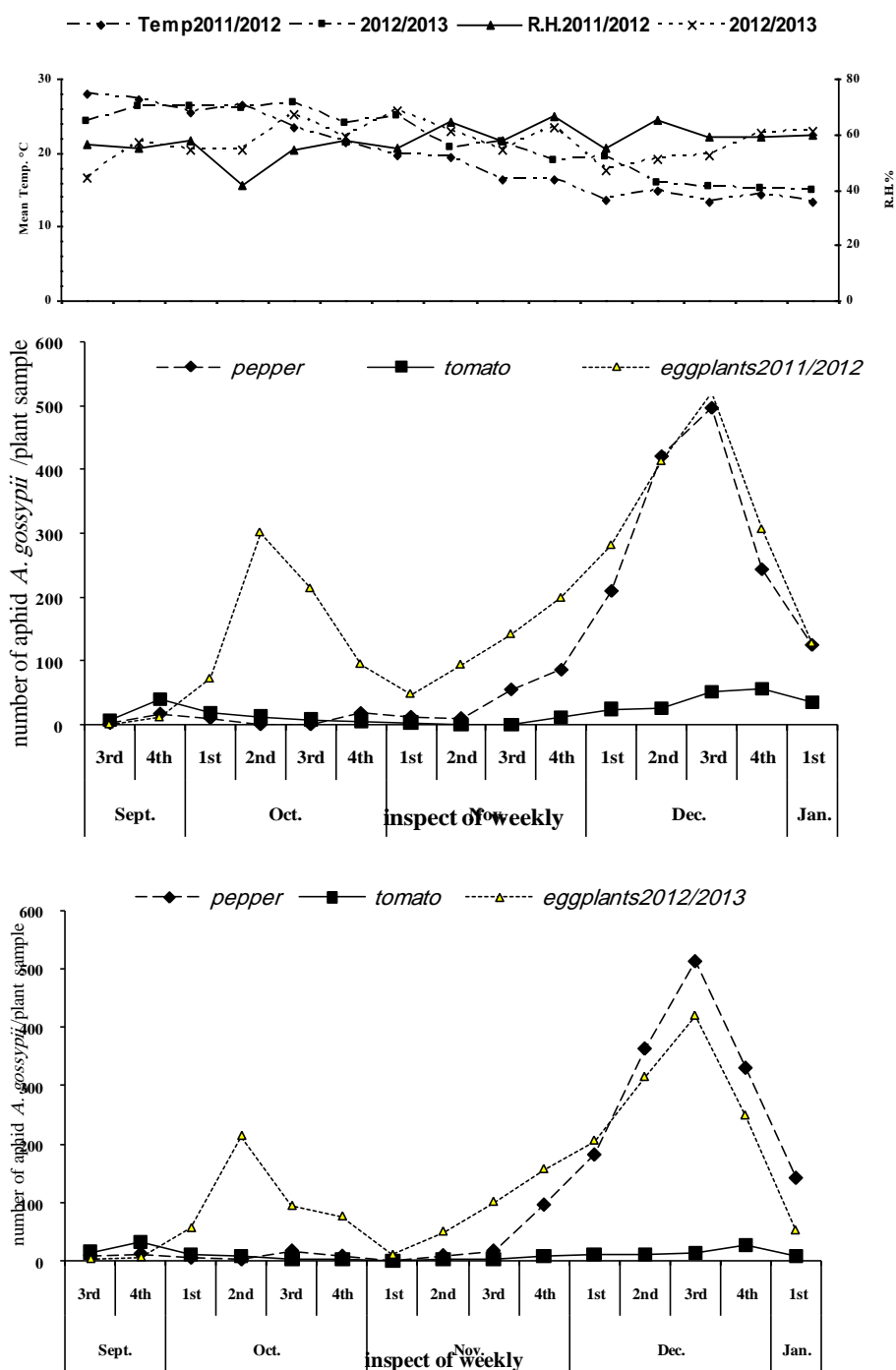


Figure 1 :Seasonal abundance of *A. gossypii* infesting pepper plants, tomato plants and eggplants collected by plant samples at Ksaien district, Ismailia Governorate during 2011/012 and 012/013 seasons.

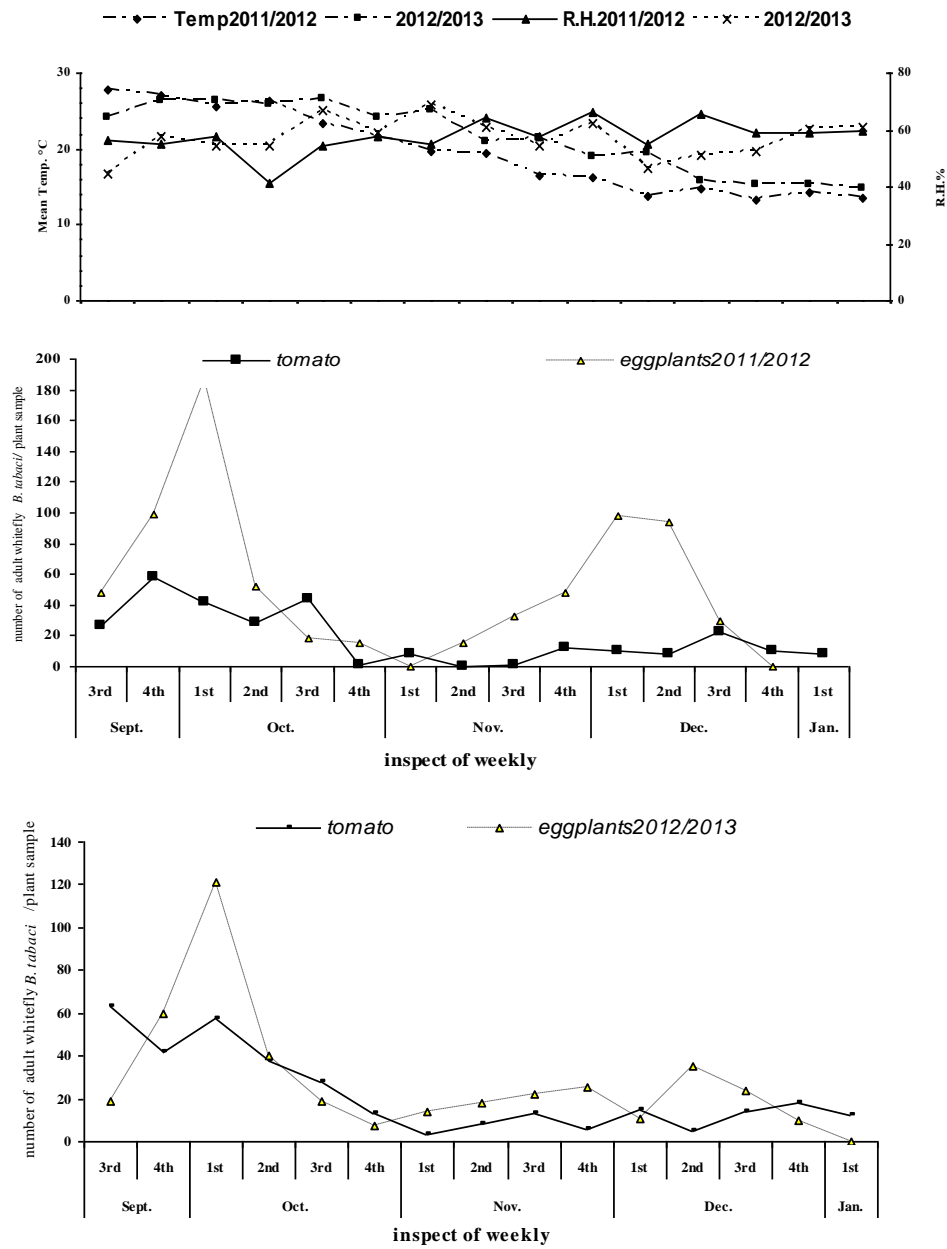


Figure 2: Seasonal abundance of adult whitefly *B. tabaci* (Genn.) infesting tomato plants and eggplants collected by plant sample at Ksaien district, Ismailia Governorate during 2011/012 and 2012/013 seasons.

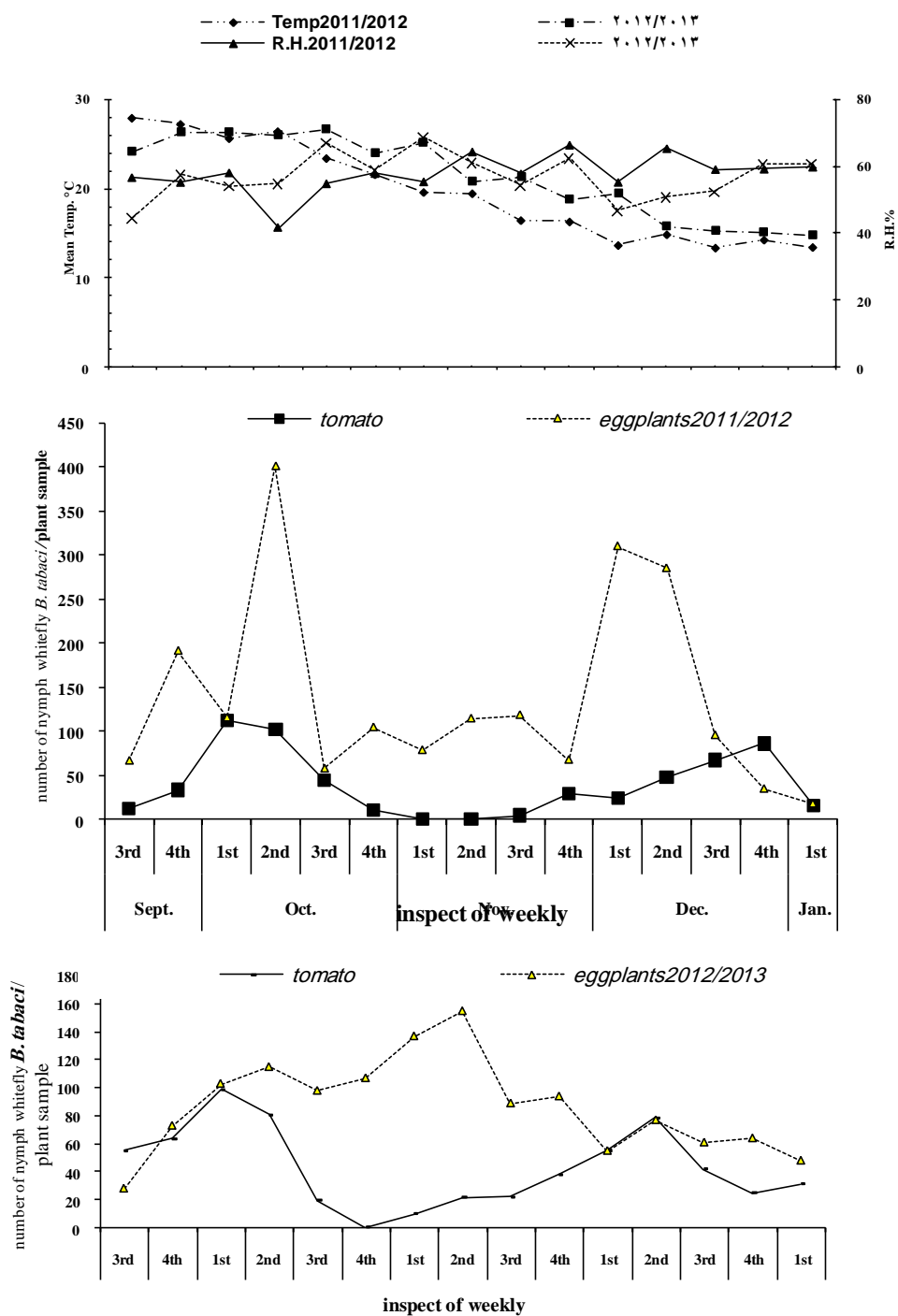


Figure 3 : Seasonal abundance of whitefly nymph *B. tabaci* (Genn.) infesting tomato plants and eggplants collected by plant sample at Ksaien district, Ismailia Governorate during 2011/012 and 2012/013 seasons.

These results were in agreement with finding of (Fouda and Mohammed, 1994; Metwally *et al.*, 1999; Russell and Klungness, 2001; Kaplan and Eubanks, 2002; Laura *et al.*, 2007; Robert *et al.*, 2008 and Samara and Qubbaj, 2012).

3) Leafhopper insects:

The weekly numbers of leafhopper insects collected from eggplant plants, Pepper plants tomato plants in 2011/2012 and 2012/2013 seasons showed two peaks on eggplant plants and Pepper plants and three peaks on tomato plants for *E. decipiens* and *E. decedens* during the two seasons Figures (4 &5).

The first peak occurred at 1st week of November with a total number of 378, 410 and 176, 209 insects/sample on eggplant plants for *E. decipiens* and *E. decedens* for the two seasons, respectively. The second peak was recorded in 2nd week of December with a total number of 714, 897 and 314, 443 insects/sample for *E. decipiens* and *E. decedens* on eggplant plants for the two seasons, respectively.

The first one occurred at 4th week of October with a total number of 30 and 19 insects/ sample for *E. decipiens* on pepper plants for the two seasons, respectively. The second peak was recorded in 1st week of December with a total number of 21 and 16 insects / sample for *E. decipiens* on pepper plants for the two seasons, respectively. While the first peak was recorded for *E. decedens* at 3rd week of October with a total number of 12 and 13 insects/sample for *E. decedens* on pepper plants for the first season.

The second peak was recorded in 3rd week and 2nd week of November with a total number of 21 and 8 insects/sample for *E. decedens* on pepper plants for the two seasons, respectively. While three peaks of population density were recorded for *E. decipiens* and *E. decedens* on tomato plants during the two seasons. The first one occurred at 2nd week of October with a total number of 33, 45 and 18, 15 insects / sample for *E. decipiens* and *E. decedens* for the two seasons, respectively. The second peak was recorded in 2nd week of November with a total number of 62, 75 and 31, 32 insects/sample for *E. decipiens* and *E. decedens* for the two seasons, respectively. The third peak was recorded in 2nd week of December with a total number of 41 for *E. decipiens* for the first season, while the third peak was recorded in 2nd week and 1st week of December with a total number of 22, 14 insects/sample for *E. decedens* for the two seasons, respectively. These results agree with those obtained by (Herakly, 1970; Hegab *et al.*, 1989; Hamdi and Emam, 1994 and El-Gendy, 2002).

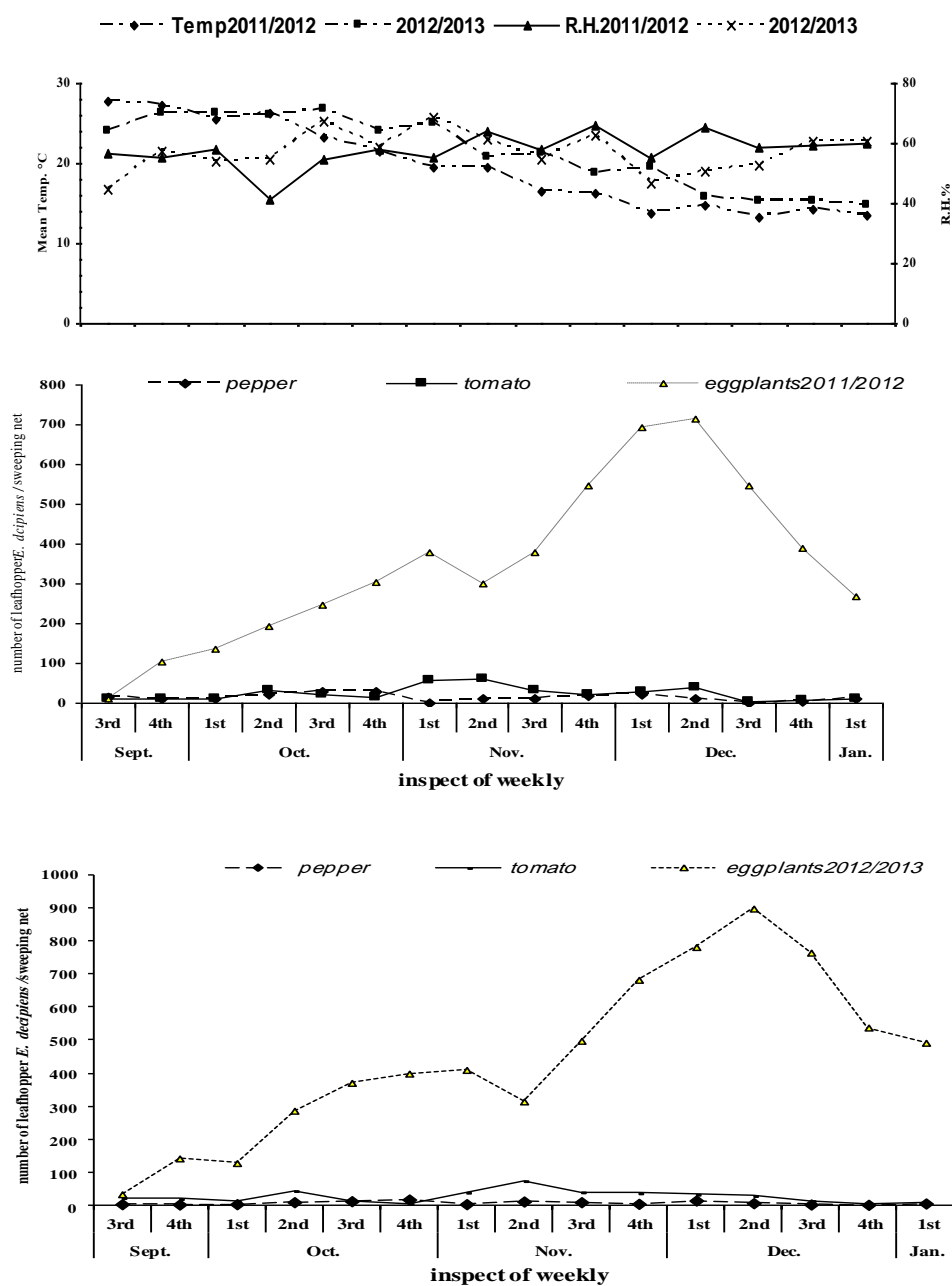


Figure 4 :Seasonal abundance of *Empoasca decepiens* (Paoli) infesting pepper plants, tomato plants and eggplants collected by sweeping nets respectively at Ksaien district, Ismailia Governorate during 2011/012 and 2012/013 seasons.

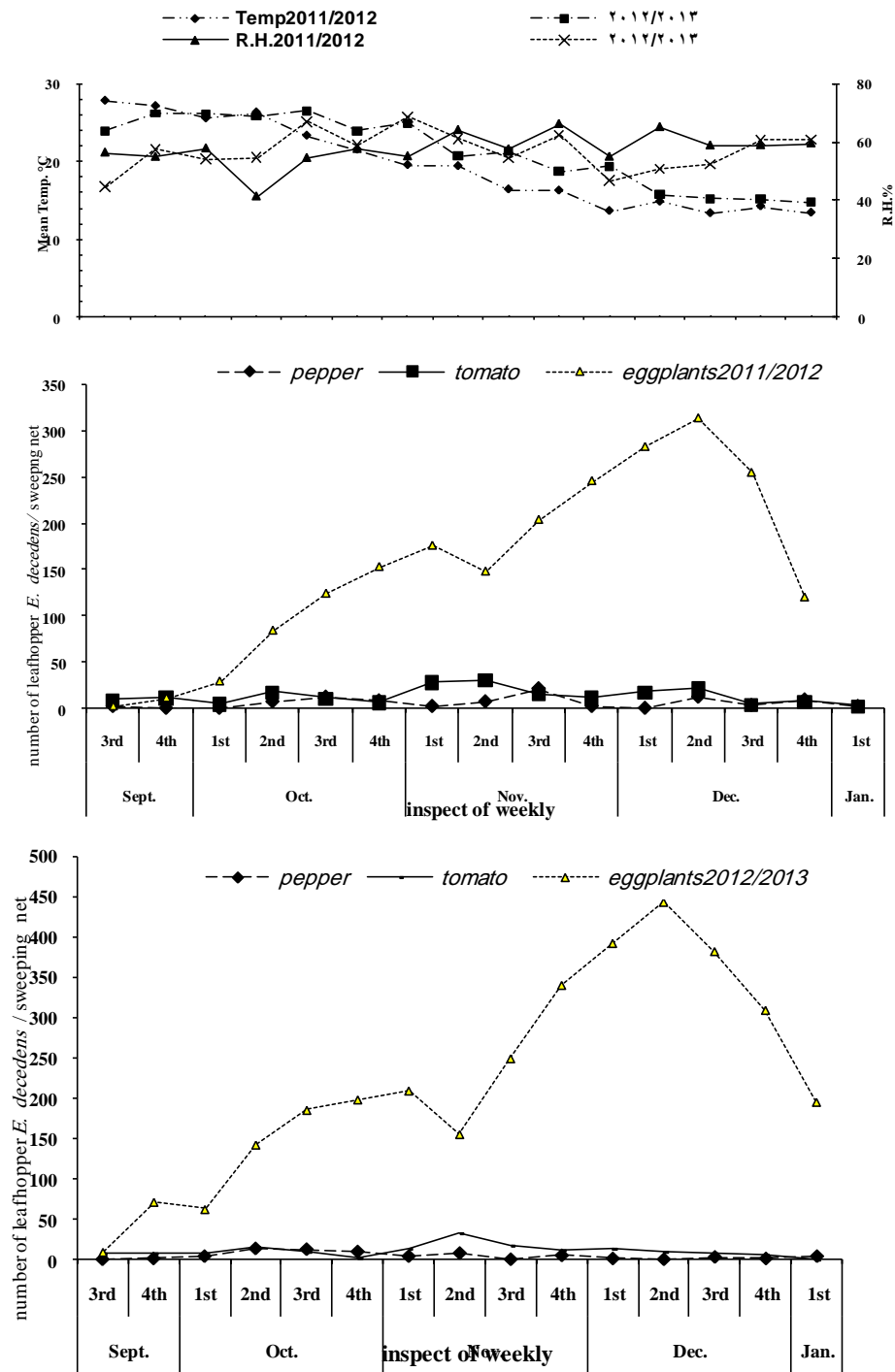


Figure 5. Seasonal abundance of *Empoasca decedens* (Paoli) infesting pepper plants, tomato plants and eggplants collected by sweeping nets at Ksaien district, Ismailia Governorate, during 2011/012 and 2012/013 seasons.

4) Mite , *T. cucurbitacearum*

The mites recorded three peaks on eggplant plants and tomato plants during the first and the second seasons Figure 6. The first one occurred at 2nd week of October and 1st week of October with a total number of 141 and 120 mites/ sample on eggplant plants and at 1st week of October and 4th week of September with a total number of 83 and 50 mites/sample on tomato plants for the two seasons, respectively. The second peak was recorded at 3rd week of November and 3rd week of December with a total number of 88 and 220 mites /sample on eggplant plants and at 1st week and 2nd week of November with a total number of 42 and 25 mites/sample on tomato plants for the two seasons, respectively. The third peak was recorded at 3rd week of December with a total number of 342 mites/sample on eggplant plants for the first season and at 3rd week of December with a total number of 621 and 750 mites /sample on tomato plants for the two seasons, respectively. The obtained results are in agreement with those obtained by (Ghais *et al.*, 2013; EL-Saiedy *et al.*, 2013 and Hassan *et al.*, 2013).

2. Effect of weather factors

- 1- *A. gossypii*: The results obtained appeared that the correlation coefficient between *A. gossypii* and maximum temperature was significant (Max. Temp.= -0.568*, - 0.629*) in two seasons, respectively, Table 2. The number of *A. gossypii* showed significant correlation with minimum temperature (Min Temp. = -0.607*, -0.578*) in 2011/2012 and 2012/2013 seasons, respectively. While, relative humidity was insignificant in the two seasons, respectively.
- 2- *E. decipiens*: The correlation coefficient between *E. decipiens* and maximum temperature was highly significant (Max. Temp. = -0.814** and -0.741**) in the two seasons, respectively. But concerning the relationship between *E. decipiens* and minimum temperature, there was highly significance (Min .Temp. = -0.834**, -0.719**) in the two seasons. While, relative humidity was insignificant, during the two seasons, respectively.
- 3- *E. decedens*: The correlation coefficient between *E. decedens* and maximum temperature was highly significant (r1= -0.742** and -0.682**) in the two seasons, respectively. Concerning the relationship between *E. decedens* and minimum temperature, there was highly significance (r2 = -0.758**, -0.695**) during the two seasons. But relative humidity was insignificant in the two seasons, respectively.
- 4- *B. tabaci*: The correlation coefficient found between adult stages of *B. tabaci* and maximum temperature was highly significant and significant (r1 = 0.683**, 0.572*) in the two seasons, respectively. The correlation coefficient between adult stages *B. tabaci* and minimum temperature

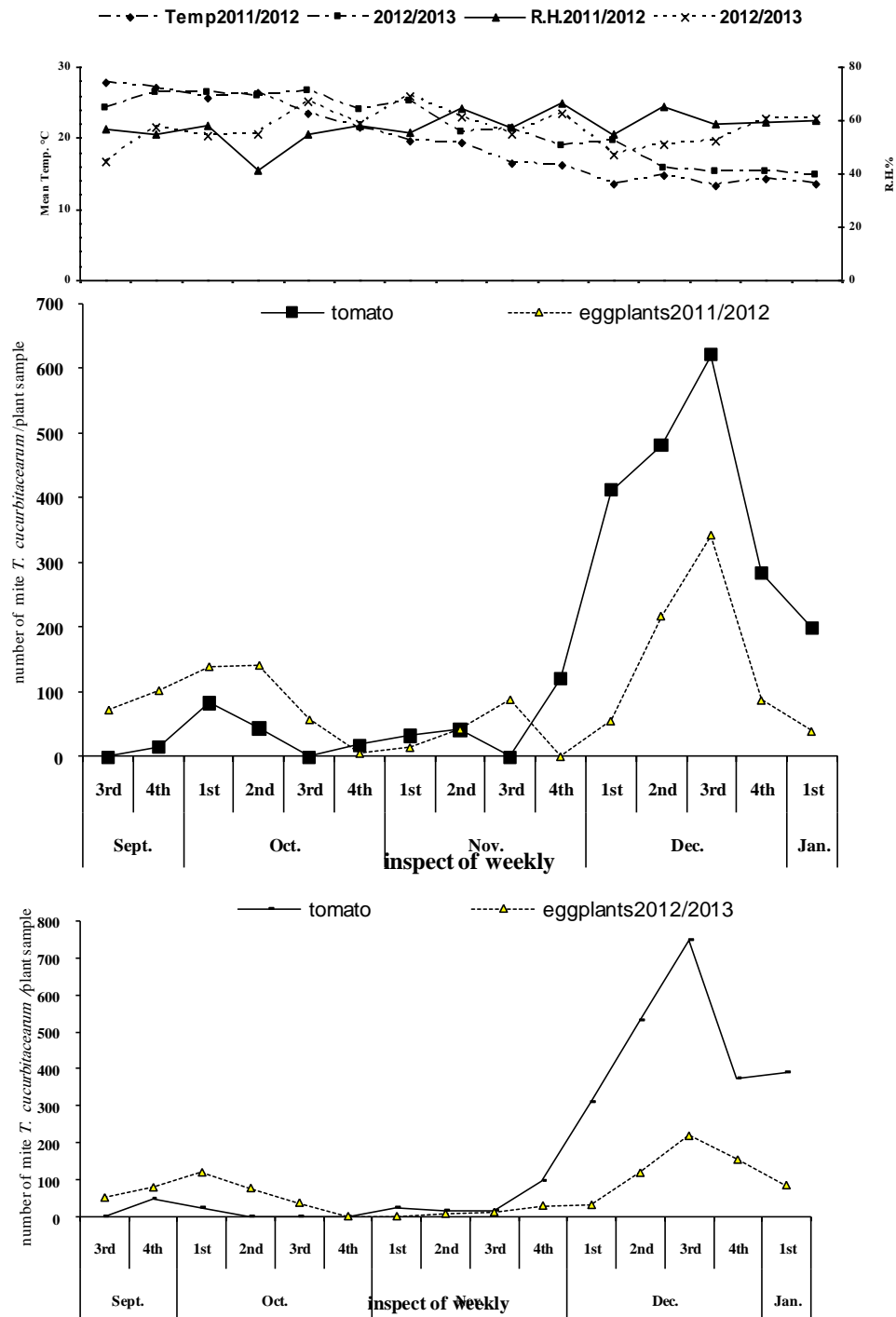


Figure 6 :Seasonal abundance of mite *T. cucurbitacearum* infesting tomato plants and eggplants collected by plant sample at Ksaien district, Ismailia Governorate during 2011/012 and 2012/013 seasons.

was highly significant and significant ($r^2 = 0.693^{**}$ and 0.547^*) in the two seasons, respectively. But relative humidity was insignificant in the two seasons, respectively.

But relative humidity was insignificant and significant ($r^3 = 0.277$, -0.601^*) in the two seasons, respectively. The correlation coefficient between nymph of *B. tabaci* and maximum temperature was insignificant in the two seasons, respectively. The correlation coefficient between nymph stages of *B. tabaci* and minimum temperature was insignificant and significant ($r^2 = 0.276$, 0.569^*) in the two seasons, respectively. But relative humidity was insignificant in the two seasons, respectively.

5- Mite, *T. cucurbitacearum*

The correlation coefficient between the Mite and maximum temperature was highly significant (Max.Temp. = -0.681^{**} , -0.833^{**}) in the two seasons, respectively. While it had highly significant (Min. Temp. = -0.725^{**} , -0.831^{**}) between *T. cucurbitacearum* and minimum temperature. The correlation coefficient between *T. cucurbitacearum* and relative humidity was insignificant in the two seasons, respectively.

Combined effects of meteorological factors on the numbers of aphid, leafhoppers, whitefly and mite:

The effect of (maximum and minimum) temperatures and mean relative humidity on aphid, leafhoppers, whitefly and mites numbers were estimated by calculating the partial regression analysis. E.V.% values, (Table 1) demonstrate that the population of both *E. decipiens* in 2011/2012 season and nymph of *B. tabaci* in 2012/2013 more sensitive to changes in the considered weather factors (mean temperature and relative humidity) recording highest values of 70.60 and 73.95%, respectively. On the other hand, the least combined effects (E.V. %) were with nymphs of *B. tabaci* and *A. gossypii* with lowest values of 31.38 and 43.93 % in the two seasons, respectively.

Conclusively, from these results it could be concluded that through knowledge of the number of pests' generations under study that can be used in a program to forecasting pests injuries and using it in an integrated pest management program.

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كثافة التعداد لبعض الافات الثاقبة الماصة التي تصيب بعض نباتات العائلة الباذنجانية في محافظة الاسماعيلية - مصر

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معهد بحوث وقاية النباتات- مركز البحوث الزراعية - الدقي -جيزة- مصر

أجريت الدراسة في منطقة القصاصين بمحافظة الاسماعيلية خلال موسمي ٢٠١٢/٢٠١١ - ٢٠١٣/٢٠١٢ وذلك بغرض الحصر والتوزيع الموسمي لبعض الافات الثاقبة الماصة (المن - نطاطات الأوراق - الذبابة البيضاء و الاكاروس). ولقد أوضحت النتائج وجود حشرات من القطن *Aphis gossypii* (Glover) و سجل ذروتين الأولى في الأسبوع الثاني من أكتوبر في كلا من موسمي الدراسة و الثانية في الاسبوع الثالث من ديسمبر على نباتات الباذنجان و سجل من القطن على نباتات الفلفل ذروتين في الرابع من أكتوبر و الثالث من ديسمبر ، بينما سجل على نباتات الطماطم قمتى نشاط في الاسبوع الرابع من سبتمبر و ديسمبر خلال موسمي الدراسة

أما نطاطات الاوراق فقد سجلت حشرات *Emopasca decipiens* و *Emopasca decedens* قمتى نشاط على الباذنجان و الفلفل و ثلاث قمم على نباتات الطماطم خلال موسمي الدراسة. أما الذبابة البيضاء *Bemisia tabaci* سجل أعلى تعداد للحوريات فى الرابع من سبتمبر على كلا من الباذنجان و الطماطم و سجلت القمة الثانية في الأسبوع الرابع من نوفمبر على نباتات الباذنجان و الاول من ديسمبر على الطماطم فى الموسم الثاني. أما الحشرة الكاملة سجل أعلى تعداد فى الاسبوع الثاني من أكتوبر وسجلت قمة النشاط الثانية في الثاني من ديسمبر على الباذنجان و الرابع من ديسمبر على الطماطم خلال الموسمين. الاكاروس *Tetranychus cucurbitacearum* فقد سجلت قمتين نشاط على النباتات موضع الدراسة القمة الأولى في الثاني من أكتوبر في الموسم الأول و الأول من أكتوبر في الموسم الثاني على نباتات الباذنجان بينما في الأسبوع الأول من أكتوبر في الموسم الأول والأسبوع الرابع من سبتمبر في الموسم الثاني على نباتات الطماطم وسجل قمة النشاط الثانية في الثالث من ديسمبر على نباتات تحت الدراسة خلال الموسمين. ومن دراسة تأثير كل من درجة الحرارة العظمى والصغرى وكذلك الرطوبة النسبية على تعداد الحشرات أوضحت النتائج أن التأثير كان أكبر بالنسبة لدرجات الحرارة يتبعها الرطوبة النسبية.

التوصية: بمعرفة عدد الأجيال لكل من الآفات تحت الدراسة يمكن استخدام ذلك في برنامج التنبؤ للإصابة بالآفات موضع الدراسة و استخدام ذلك فى برنامج مكافحة المتكاملة.