Effect of Different Varieties of Cucumber Plants on the Attractive of some Homopterous Insect Pests

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ABSTRACT

The investigation was carried out to study the influence of three varieties of cucumber plant (F1 hybrid Myadine , F1 hybrid Hayal and F1 hybrid Reda) on the population dynamics of aphids, leafhoppers and whitefly insects .The obtained results showed pronounced differences in the population dynamics of these insects on the tested plant varieties. Chemical analysis results recorded a positive relationship between protein ,carbohydrate contents and aforementioned insects infestation in all varieties. While, a reserve relationship was recorded between pH values and insects infestation. According to these results the resistant varieties can be recommended in the integrated pest management programs for depressing all tested piercing - sucking insects on cucumber plants.

Keywords: Homopterous insects, seasonal fluctuation ,cucumber varieties.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) belongs to the family curcubitaceae and is one of the most important vegetable crops in Egypt . Homopterous insects are great economic pests of cucurbitaceous vegetable plants which cause serious damage directly by sucking plant juice and indirect damage by phytopathogenic transmission (Salehi *et al*.,2007 ; Fereres and Moreno , 2009 and Moura *et al*., 2012) . The fauna of these insects on most field vegetable crops has been studied in Egypt (Fawzy *et al*., 2007 and Al- Saleh *et al*., 2015). Further studies are needed to assess the relationship between chemical constituents of plant varieties and the levels of population densities of aforementioned homopterous insects. So the resistant cucumber varieties played a very important role impressing insect population and should be considered in the integrated pest management programs. (Han *et al*., 1991 and Nossier, 1996).Therefore, the current study aims to determine the effect of three cucumber varieties to attractive the main homopterous insect pests .

MATERIALS AND METHODS

An experimental area about 600 m2 was chosen for this investigation at the farm belonging to the faculty of agriculture , Zagazig university , Ghazala district , Sharkia Governorate during 2016 and 2017 seasons. The experimental design used was a completely randomized blocks for tested varieties of cucumber plant with three replicates. Each plot was about 10 meters wide and 5 meters long . The sowing date was during the second week of May in the two successive seasons of 2016 and 2017. The normal agricultural practices were followed in due time and all plots were kept without any insecticidal treatments. The tested cucumber varieties were F1 hybrid Mayadine, F1 hybrid Reda and F1 hybrid Hayel. Sampling started after one month from sowing and continued weekly thought the growing seasons until the fourth week of August during the aforementioned seasons.

The following two methods of sampling were used:

1) Plant samples, Weekly samples of 20 leaves were randomly picked-up from each replicate and examined in the laboratory using a hand lens and the numbers of individuals of aphids and whitefly were counted and recorded.

2) The sweeping net was used and each sample was consisted of 50 double strokes taken from diagonal directions of the field. The collected samples were transferred to plastic sacs containing pieces of cotton saturated with ether for anesthetizing the collected insects. The plastic sacs were tied well by rubber bands and taken to the laboratory for inspection, the collected species were identified according to the work of Nielson (1968) and Hegab *et al*.,(1989) .The captured leafhoppers were counted and recorded for each sample. The relationship between different cucumber plants varieties and the population density of the aforementioned homopterous insects were estimated to calculate the influence of different cucumber plant varieties on the aforementioned insects infestation .

The daily means of temperature and relative humidity were provided by the Agrometeorological Station which is located nearly to the experimental areas during 2016 and 2017 seasons. Correlation coefficient (r) and explained variances (E.V%) values were calculated.

Chemical analysis of the aforementioned cucurbitaceous plants were carried out in Central Laboratory, Faculty of Agriculture, Zagazig University. plant leaves were taken at random from each replicate at the start of flowering- stage of different cucumber plant varieties in 2017 season to determine the total protein and carbohydrate contents according to (Bremner and Mulvaney 1982 and Dubois *et al*., 1956) and estimated pH values in the plants sap by using pH meter according to the method of AOAC(1970).

Statistical analysis

All data were analyzed by statistically analysis of variance using LSD 5% and 1 % according to COSTAT (2005) computer program .

RESULTS AND DISCUSSION

1- Seasonal population fluctuations of the most dominant insect species

The seasonal fluctuation studies of the population density of the dominant homopterous insect pests concerned on the Reda F1 cucumber plant variety because it was commonly in Sharkia Governorate.

a- The dominant aphid insects

The data in Table 1, illustrated that the seasonal fluctuations of *Aphis gossypii* (Glover) and *Myzus persicae* (Sulzer) on cucumber plants showed one peak of population density for the two seasons . One peak occurred for *A. gossypii* during the 2nd week of July with a total numbers of 669 and 579 insects/ 60 leaves at means of 26.9 ˚C, 28.80 ˚C with 65.9% and 69.0% R.H. for the experimented

seasons 2016 and 2017 , respectively. On the other hand , the peak of *M. persicae* was recorded in the 3rd week of July with a total numbers of 453 and 364 insects /60 leaves at means of 27.9 ˚C,28.0 ˚C with 67.1% and 69.0% R.H. for

the two seasons, consecutively. Similar results were obtained by Hegab-Ola and Hegab (2009), in Egypt, who indicated that, the peak of aphid, *Aphid gossypii* were recorded on cucumber plants during the month of July.

Table 1. Total number of aphids, *A.gossypii* and *M. persicae* infesting cucumber plants collected by plant samples at Ghazala Farm, Sharkia Governorate during 2016 and 2017 seasons

Date of inspection (Weeks)		Total number of insects/ 60 leaves							
		A. gossypii		*M. persicae*		Mean. of Temp. %		Mean of R.H.%	
		2016	2017	2016	2017	2016	2017	2016	2017
Jun.	2nd	52	10	0	0	26.55	28.30	62,30	66,20
	3rd	158	78	47	36	28.65	28.90	63,60	65,70
	4th	224	167	109	83	28.15	28.20	64,70	66,11
Jul.	1st	353	274	222	193	28.30	28.50	65,40	68,60
	2nd	669	579	261	219	26.90	28.80	65,90	69,00
	3rd	452	367	453	364	27.90	28.00	67.11	69,00
	4th	398	312	297	261	29.30	28.75	66.00	68.30
Aug.	1st	236	207	176	159	28.10	28.50	65,60	67.00
	2nd	160	172	97	89	26.40	27.50	63,10	66.00
	3rd	97	63	65	58	26.70	28.05	64,80	66,50
	4th	38	33	27	22	28.20	28.50	66,60	67.00
Total		2837	2262	1754	1484				

Table 2. Total number of leafhoppers , *E. decipiens* and *E .decedens* infesting cucumber plants collected by sweeping net at Ghazala Farm, Sharkia Governorate during 2016 and 2017 seasons

Date of inspection (Weeks)		Total number of insects/ 150 double strokes							
		E. decipiens		*E .decedens*		Mean. of Temp. %		Mean of R.H.%	
		2016	2017	2016	2017	2016	2017	2016	2017
Jun.	2nd	0	0	0	0	26.55	28.30	62,30	66,20
	3rd	7	0	0	0	28.65	28.90	63,60	65,70
	4th	28	37	29	31	28.15	28.20	64,70	66,11
Jul.	1st	51	66	57	65	28.30	28.50	65,40	68,60
	2nd	67	74	78	89	26.90	28.80	65,90	69,00
	3rd	107	113	110	123	27.90	28.00	67.11	69,00
	4th	143	171	153	191	29.30	28.75	66.00	68.30
Aug.	1st	89	94	98	108	28.10	28.50	65,60	67.00
	2nd	53	78	87	94	26.40	27.50	63,10	66.00
	3rd	27	38	32	47	26.70	28.05	64,80	66,50
	4th	11	12	14	19	28.20	28.50	66,60	67.00
Total		583	683	658	767				

Table 3. Total number of whitefly insect, *B.tabaci* infesting cucumber plants collected by plant samples at Ghazala Farm, Sharkia Governorate during 2016 and 2017 seasons

Date of inspection (Weeks)		Total number of insects/ 60 leaves						
		B. tabaci (Adults andNymphs)		Mean. of Temp. %		Mean of R.H.%		
		2016	2017	2016	2017	2016	2017	
Jun.	2nd	54	81	26.55	28.30	62,30	66,20	
	3rd	95	111	28.65	28.90	63,60	65,70	
	4th	169	191	28.15	28.20	64,70	66,11	
Jul.	1st	217	283	28.30	28.50	65,40	68,60	
	2nd	349	476	26.90	28.80	65,90	69,00	
	3rd	523	641	27.90	28.00	67.11	69,00	
	4th	398	578	29.30	28.75	66.00	68.30	
Aug.	1st	191	251	28.10	28.50	65,60	67.00	
	2nd	87	133	26.40	27.50	63,10	66.00	
	3rd	43	87	26.70	28.05	64,80	66,50	
	4th	21	34	28.20	28.50	66,60	67.00	
Total		2147	2866					

b-The dominant leafhopper insects

Data illustrated in Table 2, showed that the total numbers of *Empoasca decipiens* (Paoli) and *E. decedens* (Paoli) were the most abundant species on cucumber plants. Only one peak was recorded for the aforementioned insects during 2016 and 2017 seasons. The peak of the population density occurred at the 4th week of July and represented by 143, 171 and 153,191 insects/ 150 double strokes during 2016 and 2017 seasons at means of 29.30˚C, 28.75 ˚C and 66.0 %,68.30 % for R.H. during 2016 and2017 seasons

,successively . The obtained data are in agreement with Hashem. (2005), in Egypt, who stated that *E. decipiens* and *E. decedens* are the most leafhopper species abundant on cucurbitaceous vegetable plants.

c-The dominant whitefly insect *Bemisia tabaci* (Gennadius)

The population density of *B. tabaci* (adult and nymph stages) fluctuated with general tendency to increase until reaching the peak. As shown in Table 3, one peak was observed at the 3rd week of July with a total numbers of 523 and 641 individuals /60 leaves at means of 27.9˚C, 28.0 ˚C

with 67.1% , 69% for R.H. for two seasons, respectively. The present results disagree with the findings of Abdel-Khalek (2005), who reported that the population density of *B. tabaci* was low in early September ,gradually increased and reaching the maximum in October.

Regarding, it is cleared the population density of aphid insects were more abundant on cucumber plants during the first season than the second one, On the other hand, the infestation with the leafhoppers and whitefly species were fluctuated in 2017 season than 2016 season, this may be due to the moderated values of temperatures and highly values of R.H. .

2- Effect of certain climatic factors on the population density

a-Effect of temperature

Data given in Table5, showed that the temperature had a positive insignificant effect with aphids, leafhoppers and B.tabaci in the first seasons (r =0.156, 0.307, 0.388, 0.294 and 0.345, respectively).while in the second year, it had a positive insignificant effect with aphids and B. tabaci (r =0.222 ,0.055 and 0.179, respectively),and it had a negative insignificant effect with leafhopper insects , where r = -0.025 and -0. 023 , successively.

b- Effect of relative humidity

As shown in Table5, the relative humidity had a positive significant effect in the first season with M.persicae and B.tabaci (r = 0.688** and 0.608*).while in the second season it had post significant effect with all insects except E. decedens, where r =0.860**,0.863** , 0.605* and 0.858**, respectively.

c- Explained variance (E.V. %)

Explained variance percentage clearly showed the two weather factors affected percentage of *A.gossypii* by 13.4 and 67.5 % during the two seasons, successively. E.V. % demonstrated that the *M. persicae* was influenced by 34.5 and 72.8% during the first and second years, consecutively. According to E.V. % *E. decipiens* population were affected by 15.3 and 26.2 % during the aforementioned seasons, respectively. E.V. % showed that the tested factors affected *E. decedens* population by 17.1 and 21.8 %, successively. E.V. % obviously cleared that the considered weather factors affected *B. tabaci* population by 21.5 and 67.2 % in the first and second seasons, respectively.

Table 4. Statistical analysis based on simple correlation coefficient and explained variance percentage (E.V.%) between Mean of temperatures , Mean of relative humidity and the total number of certain piercing-sucking insects infesting cucumber plants at Ghazala Farm, Sharkia Governorate during 2016 and 2017 seasons

Insect species	2016			2017		
	r_1	r_2	E.V(%)	r_1	r_2	E.V(%)
A. gossypii	0.156	0.538	13.4	0.222	0.860**	67.5
M. persicae	0.307	0.688*	34.5	0.055	0.863**	72.9
E. decipiens	0.388	0.553	15.3	-0.025	0.605	26.2
E. decedens	0.294	0.481	17.1	-0.023	0.579	21.8
B. tabaci	0.345	0.608*	21.5	0.179	0.858**	67.2

r_1 = Simple correlation coefficients between mean of temperature and the total numbers of insects .
r_2 = Simple correlation coefficients between mean of relative humidity and the total numbers of insects .
E.V.(%)= Explained variance
** = Highly significant at 0.01 level of probability.   * = significant at 0.05 level of probability

3- Effect of cucumber plant varieties on the main homopterous insect pests .

a-Aphid species (Aphididae: Homoptera)

The following three aphid species were occurred on cucumber plants by plant sample: Aphis gossypii , Myzus persicae and Rhopalosiphum maidis(Fish). Data in Table 5, revealed that the most extensive infestations by A. gossypii were recorded on the varieties of cucumber with a total numbers of 7169,5876 individuals for 2016 and 2017 seasons, respectively. Concerning the total numbers of M. persicae occurred on cucumber plant varieties (4295, 3575 individuals) during the experimental seasons ,respectively. These results agree with Kozma *et al*.(2001) , Webb (2007) and Idriss (2011) who recorded that the onion aphid, Aphis gossypii, and the green peach aphid, Myzus persicae, are the dominant aphid insects on cucumber plants.

b- Leafhopper species (Cicadellidae: Homoptera)

Data given in Table 1, showed that the total numbers of the leafhoppers species collected by sweeping net arranged descending according to their abundant as follows: Empoasca decipiens, E. decedens and Cicadulina china (Ghauri).The data also cleared that the high infestation by the leafhoppers E. decipiens and E. decedens were recorded with a total numbers of 1681,

2128 (for E. decipiens) and 1510,2071 individuals for (E. decedens) during t 2016 and 2017seasons , respectively . These results agree with Hashem (2005), in Egypt, who surveyed the aforementioned insects on some cucurbitaceous vegetable plants.

Table 5. Total number of the main homopterous insect species collected from different cucumber plant varieties at Ghazala Farm , Sharkia governorate during 2016 and 2017 seasons

Insects species	Seasons	Total number of insect pests on cucumber varieties			
		V_1	V_2	V_3	Total
A. gossypii	2016	2837	2405	1927	7169
	2017	2262	1991	1623	5876
M. persicae	2016	1754	1397	1144	4295
	2017	1484	1160	931	3575
R.maidis	2016	246	197	169	612
	2017	278	209	190	670
E. decipiens	2016	658	550	473	1681
	2017	762	705	661	2128
E. decedens	2016	583	495	432	1510
	2017	767	706	598	2071
C. chinai	2016	137	108	97	342
	2017	161	123	112	396
B. tabaci	2016	2147	1859	1643	5643
(Ad. and Ny.)	2017	2866	2487	2030	7383

V_1= F1 hybrid Reda. V_2= F1 hybrid Hayel.
V_3= F1 hybrid Mayadine. Ad.=Adult.   Ny.= Nymphs.

Whitefly insect, *B. tabaci*

From Table 1, the total numbers of the whitefly B. tabaci collected by plant samples. High infestation by B. tabaci was recorded in the second season of 2017 than the first season of 2016 with a total numbers of 7383 and 5643 individuals , respectively. The present results agree with the findings of those Lee *et al*. (2012) and Zanadi *et al*.(2012), in Iran, who mentioned that, the tomato whitefly, Bemisia tabaci ,is considered as one of the most important insect pest of cucumber plants.

4-Effect of cucumber varieties on the main insect species and the yield quantity.

The effect of attacking some homopterous insects on certain varieties of cucumber was studied under the field conditions, Ghazala district, Sharkia Governorate during 2016 and 2017 seasons.

Data obtained in Table 6, it could noticed that Mayadine F1 was the lowest susceptible with all insect pest species . The tested insects recorded the following means: 58.393 and 49.181 /20leaves for *A.gossypii* and 34.666 and 28.212 /20 leaves for *M. persicae* during both studying seasons , while the leafhoppers, *E. decipiens* and *E. decedens* showed 13.090 ,15.727, 14.333 and 18.121 /50 double strokes for the two experimented seasons, respectively. The whitefly, *B. tabaci* recorded 49.787 and 61.515 /20leaves during 2016/2017 seasons.

Data given in Table 6, revealed that the Reda F1 was the most susceptible for all examined insects. The mean numbers were 85.969 and 68.545 /20 leaves for *A. gossypii* and 53.151 and 44.969 for *M. persicae* during both experimented seasons 2016 and 2017.While,the leafhoppers, *E. decipiens* and *E. decedens* recorded 17.666 and19.939 /50 double strokes in the first season and 20.697 and 23.243 / 50 double strokes in the second one. While, *B. tabaci* ranked the first position as the means were 65.060 and 86.848 /20 leaves during 2016/2017 seasons.

Concerning the effect of cucumber varieties on yield, data in Table 6, showed that Mayadine F1yielded the highest mean of yield 62.00 and 58.66 kg/ plot in 2016 and 2017 seasons, respectively. While the Reda F1 yielded the lowest mean of yield (40.33 kg /plot in 2016 season and 36.17 kg/ plot in 2017 season). The Hayel F1 yielded the moderate of yield (53.83 and 50.17 kg /plot in 2016 and 2017 seasons, respectively). Hegab-Ola and Hegab (2009), who found that there are the differences between cucumber varieties and the aphid, leafhopper and whitefly insects infestation.

Generally, it could be concluded that Maydine F1 were infested with the least number of aphid, leafhopper and whitefly species and produced the highest quantity of yield, while Reda F1 showed the highest number of the aforementioned insects infestation and produced the least quantity of yield. The other tested variety Hayel F1 proved to be moderately susceptible to infestation by with all tested insects .Therefore Maydine F1 could be recommended to be cultivated successfully in Sharkia Governorate.

Table 6. Mean number of aphids, *A.gossypii* and *M. persicae* leafhoppers, *E. decipiens* and *E .decedens* and whitefly insect, *B. tabaci* infesting different varieties of cucumber plants at Ghazal Farm, Sharkia Governorate during 2016 and 2017 seasons

Varieties	Mean numbers of insects / sample											
	Aphid insects (P.S.)				Leafhopper insects (S.W.)				Whitefly insect(P.S.) *B. tabaci* (Ad. and Ny.)		Mean of yield kg/plot	
	A.gossypii		*M.persicae*		*E. decipiens*		*E. decedens*					
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
V1	85.969	68.545	53.151	44.969	17.666	20.697	19.939	23.243	65.060	86.848	40.33	36.166
V2	72.878	60.333	42.333	35.151	15.000	18.393	16.666	21.393	56.333	75.363	53.83	50.166
V3	58.393	49.181	34.666	28.212	13.090	15.727	14.333	18.121	49.787	61.515	62.00	58.666
L.S.D.$_{005}$	6.86**	4.979**	3.230**	3.368**	2.071**	3.038*	2.404**	2.43**	7.48**	10.506**	5.891**	9.598*

P.S. = Plant sample. S.W. = Sweeping net. ** = Highly significant at 0.01 level of pr0bability. * = significant at 0.05 level of pr0bability.
V$_1$= F1 hybrid Reda. V$_2$= F1 hybrid Hayel. V$_3$= F1 hybrid Mayadine. Ny.= Nymphs. Ad.=Adult.

5- Effect of some chemical constituents of three varieties of cucumber plants on population density of aphids, leafhopper and whitefly
Total protein, carbohydrate contents and pH values

Data arranged in Table 7, revealed that the protein and carbohydrates values differed significantly in cucumber varieties, while pH values were highly significant in sap plants.

The mean numbers of all tested insects varied significantly and highly significant on all cucumber tested varieties.

It is worth to mention that the mean number of the aforementioned insects was increased gradually by increasing the protein and carbohydrate values and decreasing pH values of all tested varieties. These results agree with the findings of Saleh and Al-Shareef (2010), who mentioned that there is a negative correlation between the infestation of B. tabaci and the pH values in vegetable plants. Awadalla *et al*. (2014), who mentioned that homopterous insects infestations was correlated with the chemical constituents of their host plants.

Table 7. Effect of certain chemical constituents of three varieties of cucumber plants on the population density of the main homopterous insect pests during 2017 season.

varieties	Total protein (%)	Total Carbohydrate (%)	pH	Mean number of aphids		Mean number of leafhoppers		Mean number of whitefly
				A. gossypii	*M. persicae*	*E. decipiens*	*E. decedens*	*B. tabaci*
V$_1$	27.50	36.33	6.87	68.545	44.969	20.697	23.243	86.848
V$_2$	28.00	33.33	7.11	60.333	35.151	18.393	21.393	75.363
V$_3$	28.75	31.00	7.43	49.181	28.212	15.727	18.121	61.515
L.S.D$_{0.05}$	0.830*	3.19*	0.031**	4.979**	3.368**	3.038*	2.43**	10.506**

** = Highly significant at 0.01 level of probability. *= significant at 0.05 level of probability .
V$_1$=F1 hybrid Reda. V$_2$=F1 hybrid Hayel. V$_3$=F1 hybrid Mayadine.

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تأثير الأصناف المختلفة من نباتات الخيار على جاذبية بعض الآفات الحشرية متشابهة الاجنحة

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أجرى هذا البحث لدراسة تأثير ثلاثة أصناف من نبات الخيار وهى الهجين (F1) ميادين ، الهجين (F1) هايل و الهجين (F1) رضا على ديناميكية التغير فى تعداد حشرات المن ونطاطات الأوراق والذبابة البيضاء ، وأوضحت النتائج إن هناك اختلافات واضحة فى ديناميكية التغير فى تعداد تلك الحشرات على تلك الأصناف المختبرة ،كما سُجلت نتائج التحليل الكيماوى إن هناك أرتباط موجب ما بين المحتوى البروتينى والكربوهيدراتى وبين الاصابة بتلك الحشرات سالفة الذكر، بينما يوجد أرتباط سالب بين قيم الـ pH والاصابة بتلك الحشرات ، ومن هذة النتائج ينصح بإستخدام أصناف الخيار المقاومة فى برامج المكافحة المتكاملة للحد من انتشار تلك الحشرات المختبرة.