Ecological Studyon three major Insect Pests of Tomato PlantationsInFayoumGovernorate.

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ABSTRACT

Tutaabsoluta(Meyrick), *Nesidiocoristenuis*(Reuter) and *Bemisiatabaci* (Genn.) activities on tomato plants at Fayoum Governorate were evident during (nili and summer 2011/2012 & 2012/2013). The highest number of immature stages (larvae) of *Tuta* occurred in November & December 2011 and 2012 (37 and 25 indiv./10 leaves) respectively during nili plantation , while the numbers of this insect were decreased during the summer plantation 2012 , the highest number recorded on June (20 indiv. / 10 leaves). There was highly significant correlation between the *Tuta* population and mean temp. duringnili plantation 2011 . On the other hand, the highest populations of *B.tabaci* (97 and 70 indiv./ 10 leaves) was recorded in 2ndand 4th week of Oct. during (nili 2011/2012) and (81 and 64 nymphs / 10 leaves) in 2nd week of June and July (summer 2012/2013), respectively.For *N. tenuis*, the highest number (47 ; 39; 50 and 39 individuals / 10 leaves) occurred during 1st and 2nd week of October during nili 2011 & 2012 and 2nd week of June, 1st week of July during summer 2012/2013, respectively. Also, sixspecies of predators were recorded in association with tomato plants,*Orius sp*., *Chrysopavulgaris* ,*Syrphuscorella*, *Coccinellaundecimpunctata, Mantis religiosa* and *Paedrusalfierii*.

Key words: Ecological Studies ; Insect Pests ; Tomato

INTRODUCTION

Tomato ,*Lycopersicomesculentum* L. is the main host plant of different pests , namely : some lepidapteransLepidoptera(leafminers), whiteflies, aphids and mealybug which cause considerable damage to both quantity and quality of the fruits**(Faragalla, 2005 andCheerapha 2005).** According to **Barrientos*et al.,* 1998 and EPPO 2005** the tomato leafminer, *Tutaabsoluta* (Meyrick), (Lepidoptera: Gelechiidae) isone of the most devastating pests for tomato crops**.** due to the serious damage inflicted to tomato in invaded areas where infestation was initially detected**(Germain*et al*., 2009)**. without control measures , the pest can cause up to 80- 100% yield losses where leaves, flowers, stems and especially fruits were attacked**(Lopez, 1991 and Andrew *et al.,* 2013).**the tomato plant bug, *Nesidiocoristenuis*(Reuter) (Hemiptera : Miridae)

and the tomato whitefly *Bemisiatabaci* (Genn.) (Hemiptera :Aleyrodidae) were also particularly important pests and were the major cause of the reduction in tomato production. **(Cheerapha 2005)**.*B.tabaci* direct damage is by sucking and devitalizing of plants, besides the spreading of leaf curlvirus disease that leads to huge loss of crop . **(Chaudhuri*et al.,* 2001).** During the past few years, high infestations of these pests were noticed in different regions in Egypt including Fayoum, where tomato crop which is considered one of the economically important produce of this governorate.

Therefore, the aim of the present study is to evaluate the population dynamics of these three major pests in tomato plantations in Fayoum in relation to the major prevailing weather factors (mean temperatures and mean relative humidity) during nili and summer seasons of 2011-2013.

MATERIALS AND METHODS

Experimentationwas carried out in Al- Mandara region, Fayoum Governorate, Egypt to evaluate the population fluctuations of immature stages of *T.absoluta*, and*B. tabaci* and of the nymphs and adults of*N. tenuis* in tomato (variety Helal) during four successive nili and summer plantations 2011/2012 and 2012/2013.

For this purpose, achosen area of about ¼ feddanwasindivided into four equal as a plots randomized complete block design. Tomato was cultivated as usual in two successive annual plantations (nili and summer seasons).

The data forthe maximum and minimum temperatures and for relative humidity were obtained from the Meteorological Station of Fayoum Governorate. The usual agricultural practices were practiced excluding pesticide treatments.

Estimation of population :

Inspection of tomato leaf samples started two weeks after seedling plantation and continued weakely until the end of the season such samples were taken in the early morning ,ten leaves per plot , picked randomly from different levels of the plants and separately transferred in special bags to the laboratory. The number of pests and predators contained in each samples

was counted in the same day by the aid of asteremicroscope. The total number of individuals of*N.tenuis* (nymphs and adults), *B.tabaci*(nymphs stages) and predators present were also counted.*T. absoluta* was counted as larvae and empty mines on the leaves.

Statistical analysis

The relationship between the populations of the insects recorded and prevailing weatherfactors(Temp.&R.H%) were obtained by using the simple correlation, **(Snedecor and Cochran, 1990)**.

RESULTS AND DISCUSSION

A. Population dynamics of *T.absoluta*

Nili plantations 2011 and 2012 :

Few numbers appeared during the period from late October to mid November(2011) ranging between 2-7 indiv./10 leaves. The population increased in the last week of November till reached a peak (26 indiv. /10 leaves), and a 2nd peak (37 indiv./10 leaves) on December 6 (2011). Positive highly significant correlation was found between the total population and mean temp. (r=0.64**)and relative humidity(r=0.62**) as shown intable 1 and fig. 1 .Also in 2012 the 1stbut smaller peak (11 indiv. /10 leaves) on Oct.7. the 2nd peak occurred in late Nov. (25 indiv./10 leaves). There was no significant relation between the numbers of insectsin this caseand the means of temp. and R.H.% (r=-0.41 and -0.24) as shown in table 1 and fig 1.

Summer plantations 2012 and 2013 :

This insect was mostly found during the period from Apr. 28 to July 9 of 2012. The 1st peak occurred on Apr. 28 (10 indiv. /10 leaves), also the 2ndpeak was found on May 18(14 indiv./10 plants) and the 3rd peak (20 indiv. /10 leaves) occurred on June 10 .Apositive insignificant correlation was found between the insect population and mean temp. and R.H. (r=0.16 and 0.054 , respectively). During 2013, few numbers of this insect was found. The population fluctuated between 2 and 9 indiv./10 leaves . Also , insignificant correlation was found (r=0.299 and -0.24) as shown in table 2andfig 2.

Table (1): Weekly numbers of Immature stage and mines of*Tutaabsoluta* /10 leaves of tomato during Nili plantations 2011 & 2012.

Nili 2011					Nili 2012				
Sampling date	Immature (Larvae)	Mines	Weather factors		Sampling date	Immature (Larvae)	Mines	Weather factors	
		Empty	Mean Temp.c	Mean R.H%			Empty	Mean Temp.c	Mean R.H%
14/8/2011	0	1	31	50	26/8/2012	0	0	31.3	50
21/8	0	0	31	48	3/9	0	0	30	49
28/8	1	3	30.7	47	10/9	0	0	29.6	50
4/9	0	1	29	50	17/9	0	0	28.5	48
11/9	0	0	29.3	49	23/9	0	1	29	50
18/9	0	0	29.4	46	30/9	0	0	29	52
25/9	0	0	28.9	49	7/10	11	0	29	52
2/10	0	0	26	51	14/10	0	0	28.5	50
9/10	0	0	25.9	49	21/10	0	0	29.8	48
16/10	0	0	24.7	49	28/10	4	0	27.5	48
25/10	7	0	23	54	4/11	0	0	27.5	47
1/11	4	2	22	53	11/11	0	0	23	47
8/11	0	0	22.2	53	18/11	1	0	20.5	45
15/11	2	8	19.5	55	25/11	25	15	19.4	45
22/11	26	6	19.9	51	2/12	4	9	19.4	45
29/11	9	3	17	56	9/12	10	12	19.4	49
6/12	37	10	16.4	61	16/12	5	18	17.7	49
13/12	23	15	15.4	62	23/12	6	14	17.7	49
21/12	15	8	16.9	60	30/12	3	7	16.9	49
27/12	8	13	16.9	61	6/1/2013	4	11	12	50
4/1/2012	3	6	15	61					
Total	135	76			Total	73	87		
Mean	6.43	3.62			Mean	3.65	4.35		

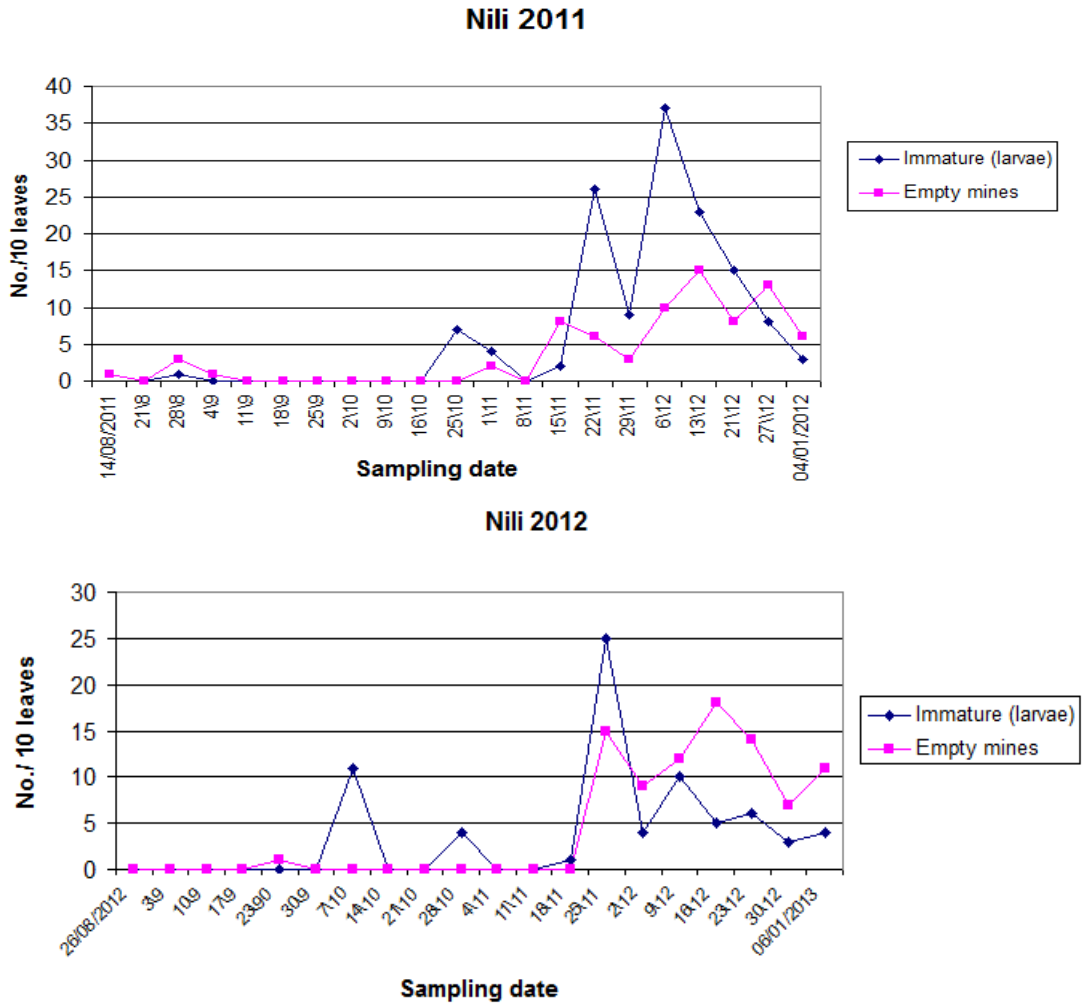

Fig. (1): Weekly numbers of Immaturestageand mines of *Tutaabsoluta* /10 leaves of tomato during Nili plantations 2011 & 2012

Table (2): Weekly numbers of Immaturestageand mines of*Tutaabsoluta* /10 leaves of tomato during Summer plantations 2012& 2013.

Summer 2012					Summer 2013				
Sampling date	Immature (Larvae)	Mines	Weather factors		Sampling date	Immature (Larvae)	Mines	Weather factors	
		Empty	Mean Temp.c°	Mean R.H%			Empty	Mean Temp.c°	Mean R.H%
21/4/2012	0	0	20.5	49	29/4/2013	1	4	22.3	45
28/4	10	13	19	32	7/5	0	2	25.4	45
4/5	5	7	22.9	48	16/5	0	0	29.3	43
11/5	4	5	23.6	43	22/5	3	10	28	43
18/5	14	8	27.7	52	29/5	3	7	30	41
26/5	7	1	29.7	42	5/6	2	1	31.8	41
3/6	6	2	27	44	12/6	0	1	32.8	42
10/6	20	13	29	47	19/6	7	13	30.8	43
17/6	14	27	30.5	43	26/6	5	5	30	45
24/6	7	10	31	42	3/7	9	7	32.3	44
1/7	5	8	31.4	46	9/7	0	0	29.8	45
9/7	4	7	31	49	16/7	0	0	31	47
16/7	0	1	30.7	40	23/7	0	2	30	48
Total	96	102			Total	30	52		
Mean	7.38	7.85			Mean	2.3	4		

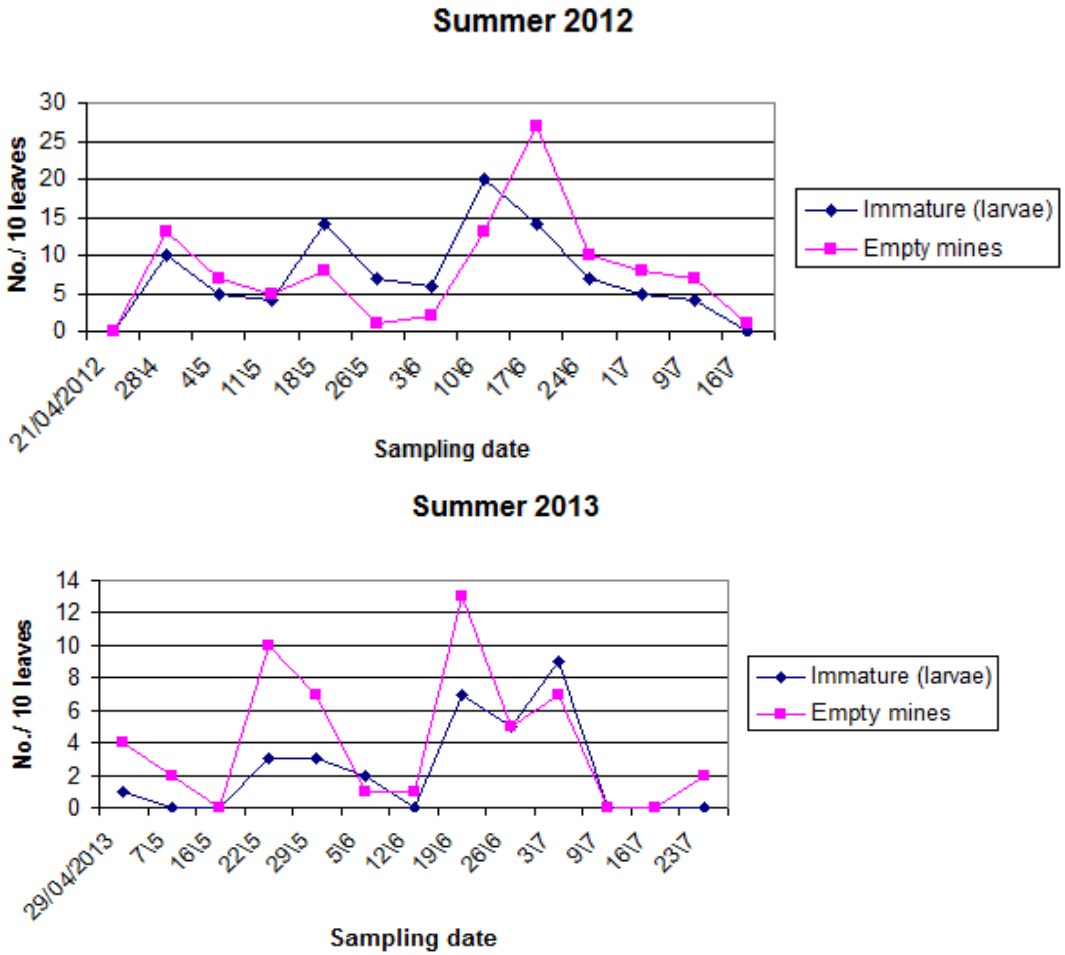

Fig. (2): Weekly numbers of Immaturestageand mines of *Tutaabsoluta* /10 leaves of tomato during Summer plantations 2012& 2013.

Similar result was reported by Lazgeen et al., 2013 in Iraq. where the number of mines started low in May and June and increased during August and September. The maximum number of leafminerstrating from late July .increasing of larvae numbers on leaves caused high infestation (72-100 %) in September .

Also Nanninie*t al*, (2011) in Italy found that the highest levels of tomato borer infestation occure in spring (30- 100 larvae / plant).

B. Population dynamics of *B. tabaci*

Nili population 2011 and2012 :

Infestation was observed in samples taken during the period from Sept. 4 to Nov. 22 , 2011. The 1st peak occurred on Sept. 18 (81 indiv. / 10 leaves) and the 2nd peak on Oct 9 (97 indiv./10 leaves). Insignificant correlation was found between this population density and mean temp. (r=0.39) with a negative significant effect of relative humidity (r=-0.51).

In 2012, the population began with 5 indiv./10 leaves on Sept. 3 , then fluctuated reaching the 1st peak on Oct. 14 (66 indiv./10 leaves) , and the 2nd peak on Oct. 28 (70 indiv./10 leaves) then laterdecreased to 3 indiv. /10 leaves on Dec. 2nd. A positive highly significant correlation was found between population and mean temp. (r= 0.57**). Insignificantwith relative humidity effect (r=0.31). as shown in table 3and fig.3 .

Summer population 2012 and 2013 :

Throughout the period from Apr. 21 to June 24 (2012), the population fluctuated reaching a single peak in June 10 (81 indiv./10 leaves). The correlation between population and mean temp. r=0.078 ,and R.H.% was insignificant with r= 0.11 .

Infestation in 2013 was spread, allover the season. The highest density occurred during June and July with two peaks on June 12 and July 9 (44 and 64 indiv./10 leaves) respectively. Positive highly significant correlation was found between .population and mean temp. (r=0.71**) mean while , for relative humidity a negative insignificant correlation was found with r=-0.032 (Table 4 fig 4).

Table (3): Weekly numbers of *Bemisiatabaci*&*Nesidocoristenuis* /10 leaves of tomato during Nili 2011 & 2012

Nili 2011					Nili 2012				
Sampling date	*B. tabaci* (nymph)	*N. tenuis* (N+A)	Weather factors		Sampling date	*B. tabaci* (nymph)	*N. tenuis* (N+A)	Weather factors	
			Mean Temp.c	Mean R.H%				Mean Temp.c	Mean R.H%
14/8/2011	0	5	31	50	26/8/2012	0	3	31.3	50
21/8	0	12	31	48	3/9	5	7	30	49
28/8	0	11	30.7	47	10/9	17	13	29.6	50
4/9	3	24	29	50	17/9	19	16	28.5	48
11/9	26	22	29.3	49	23/9	9	15	29	50
18/9	81	33	29.4	46	30/9	55	15	29	52
25/9	78	34	28.9	49	7/10	60	26	29	52
2/10	83	47	26	51	14/10	66	39	28.5	50
9/10	97	13	25.9	49	21/10	50	5	29.8	48
16/10	79	7	24.7	49	28/10	70	5	27.5	48
25/10	37	5	23	54	4/11	40	6	27.5	47
1/11	29	0	22	53	11/11	15	3	23	47
8/11	10	0	22.2	53	18/11	7	1	20.5	45
15/11	2	0	19.5	55	25/11	3	7	19.4	45
22/11	2	2	19.9	51	2/12	3	2	19.4	45
29/11	0	0	17	56	9/12	0	5	19.4	49
6/12	1	2	16.4	61	16/12	0	3	17.7	49
13/12	0	0	15.4	62	23/12	0	1	17.7	49
21/12	0	0	16.9	60	30/12	0	0	16.9	49
27/12	0	0	16.9	61	6/1/2013	0	0	12	50
4/1/2012	0	0	15	61					
Total	528	217			Total	419	172		
Mean	25.14	10.33			Mean	20.95	8.6		

N= nymph A=Adult

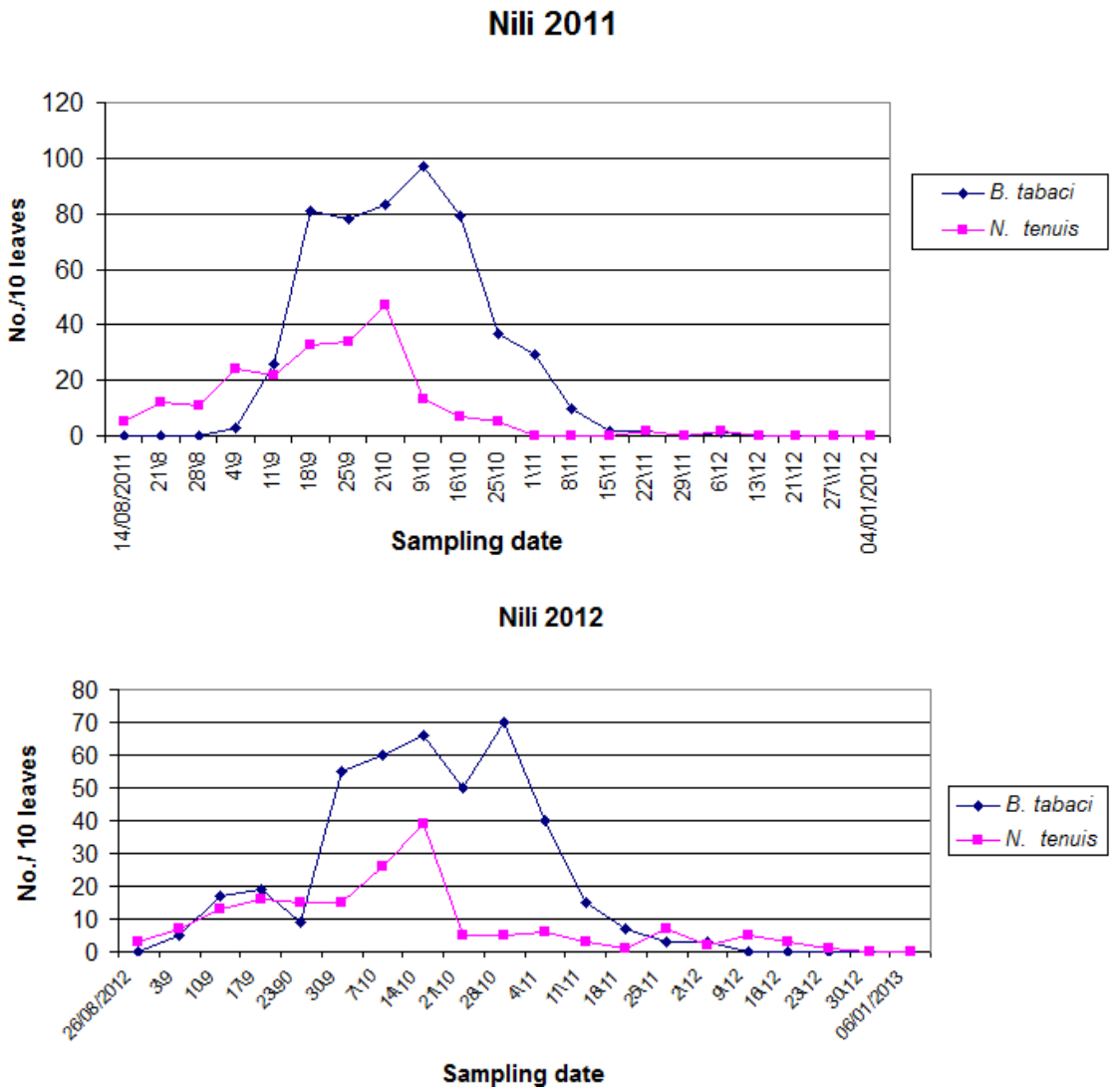

Fig. (3): Weekly numbers of *Bemisiatabaci*&*Nesidocoristenuis* /10 leaves of tomato during Nili 2011 & 2012

Table (4): Weekly numbers of *Bemisiatabaci*&*Nesidocoristenuis* /10 leaves of tomato during Summer 2012 & 2013

	Summer 2012					Summer 2013			
Sampling date	*B. tabaci* (nymph)	*N. tenuis* (N+A)	Weather factors		Sampling date	*B. tabaci* (nymph)	*N. tenuis* (N+A)	Weather factors	
			Mean Temp.c	Mean R.H%				Mean Temp.c	Mean R.H%
21/4/2012	7	4	20.5	49	29/4/2013	0	0	22.3	45
28/4	13	19	19	32	7/5	0	15	25.4	45
4/5	10	29	22.9	48	16/5	12	23	29.3	43
11/5	29	33	23.6	43	22/5	29	28	28	43
18/5	50	37	27.7	52	29/5	21	27	30	41
26/5	70	14	29.7	42	5/6	30	4	31.8	41
3/6	77	0	27	44	12/6	44	7	32.8	42
10/6	81	4	29	47	19/6	40	13	30.8	43
17/6	23	50	30.5	43	26/6	49	5	30	45
24/6	8	20	31	42	3/7	62	39	32.3	44
1/7	0	27	31.4	46	9/7	64	24	29.8	45
9/7	0	28	31	49	16/7	40	4	31	47
16/7	0	13	30.7	40	23/7	18	1	30	48
Total	368	278			Total	409	190		
Mean	28.31	21.38			Mean	31.46	14.62		

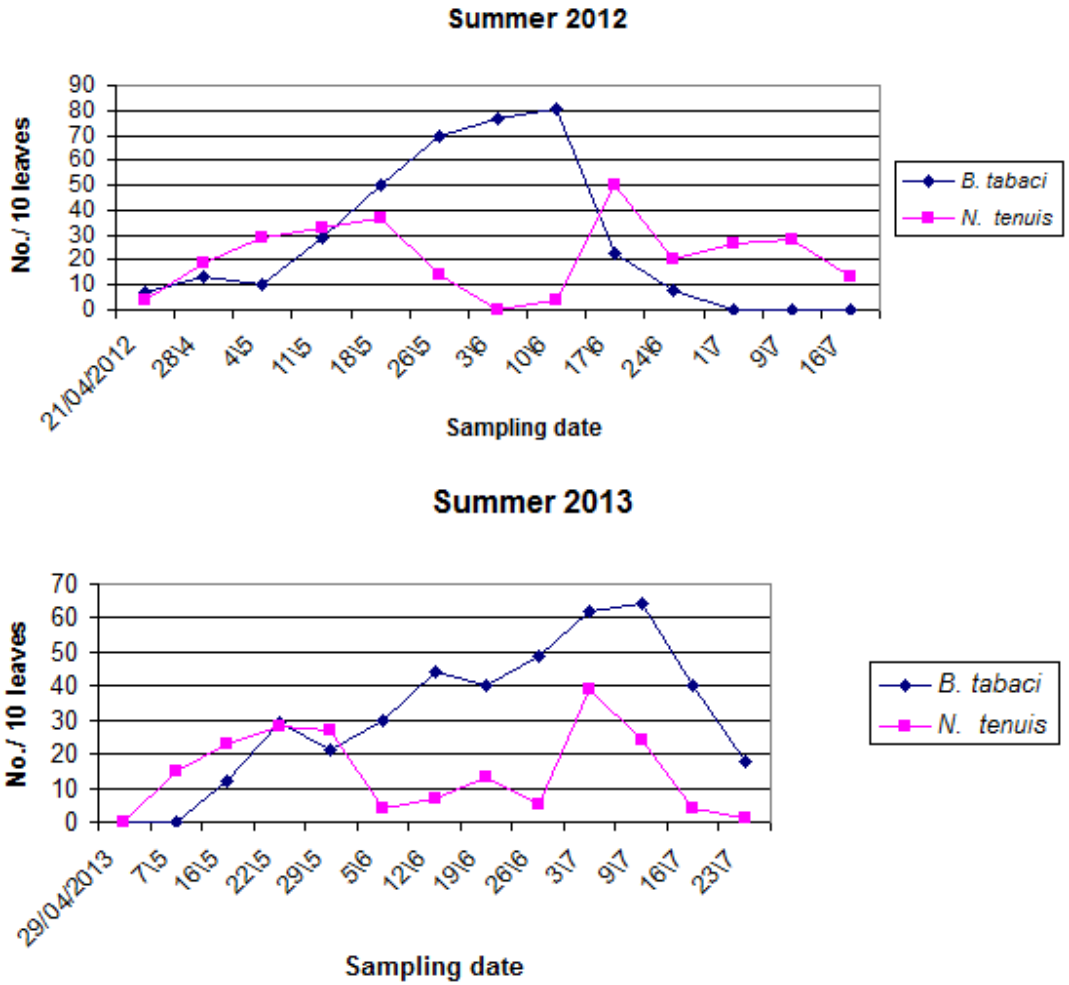

Fig. (4): Weekly numbers of *Bemisiatabaci*&*Nesidocoristenuis* /10 leaves of tomato during Summer 2012 & 2013

In this respect contradictingresults were reported by several investigated in Egypt where largest counts were observed in September;August to October;September to November and September by**(Shanab and Awad- Allah, 1982);(Shaheen, 1983;Shalaby*et al.,* 1990)(Abd-Ellah, 1994) and(Tantaway, 1995)**respectively**.**

C-Population dynamics of *N. tenuis*

Nili population 2011 and 2012 :

This tomato bug was abundant during the period from Aug. 14 to Oct. 25 (2011). With twopeaks ; the 1st occurred in Sept. 4 with 24 indiv. /10 leaves , and the 2nd peak occurred on Oct. 2 with 47 indiv./ 10 leaves . Highly significant correlation was found between the population density of this insect species and mean temp. and relative humidity (r=0.64** and -0.59** respectively).

The population fluctuated but in few numbers ,with a small peak (16 indiv./10 leaves) on Sept. 17, and a higher peak on Oct. 14 (39 indiv./10 leaves).Highly significant correlation was found between population and mean temp. (r=0.58**) whereas the relationship with relative humidity was positively significant with r=0.5* (Table 3 fig 3) .

Summer population 2012 and 2013 :

During summer plantation 2012, the insect was spread allover the summer season . The highest density occurred in mid May and mid June with two peaks on May 15 and June 17 (37 and 50 indiv./ 10 leaves, respectively). Positive insignificant correlation was found between population and both mean temp. and relative humidity (r=0.17 and 0.11, respectively).

In summer plantation 2013 , infestation occurred from the 1st week of May to late July , with two peaks , on May 22 (28 indiv. / 10 leaves) and on July (39 indiv. /10 leaves). Positive insignificant correlation was found between populationboth mean temp. and relative humidity (r=0.18 and -0.35, respectively) as shown in table 4 fig 4.

Similar corelations were reported by AL-Azawi and AL-Azawi (1988) in Iraq andAbd-Ellah (1994) in Egypt , this tomato bug attacks tomato plants nearly all over the year, and that population

fluctuation was high during summer season (June – September) then the rates of infestation drop sharply during December and January.

D- The relationship between insect population and predators :

Nili plantations 2011 and 2012 :

The population of predaceous insects was relatively at low level during nili plantations 2011 &2012 , therefore predation was not effective against the insect pests . as shown in Table 5 Fig 5 .

Summer plantations 2012 and 2013 :

The population of predaceous insects was high especially in summer 2013. The total number of predators fluctuated during the period from April 28 and May 7 to July 1 and 23 with total number ranging between 1-6 indiv./10 leaves , the highest level of predaceous number was (6 indiv./ 10 leaves) during July 17 and 9 through summer 2012\2013 , within the activity period of *T. absoluta*, *B. tabaci*and *N. tenuis* were found. as shown in Table 6 Fig 6

Table (5): Weekly numbers of tomato pests and associated natural enemies during Nili plantations 2011 & 2012

Nili 2011					Nili 2012				
Sampling date	*T. absoluta*	*B. tabaci*	*N. tenuis*	Natural enemies	Sampling date	*T. absoluta*	*B. tabaci*	*N. tenuis*	Natural enemies
14/8/2011	0	0	5	0	26/8/2012	0	0	3	0
21/8	0	0	12	0	3/9	0	5	7	0
28/8	1	0	11	0	10/9	0	17	13	0
4/9	0	3	24	0	17/9	0	19	16	0
11/9	0	26	22	0	23/9	0	9	15	0
18/9	0	81	33	1	30/9	0	55	15	1
25/9	0	78	34	1	7/10	11	60	26	2
2/10	0	83	47	1	14/10	0	66	39	0
9/10	0	97	13	0	21/10	0	50	5	0
16/10	0	79	7	0	28/10	4	70	5	1
25/10	7	37	5	1	4/11	0	40	6	0
1/11	4	29	0	0	11/11	0	15	3	0
8/11	0	10	0	0	18/11	1	7	1	1
15/11	2	2	0	0	25/11	25	3	7	4
22/11	26	2	2	0	2/12	4	3	2	2
29/11	9	0	0	1	9/12	10	0	5	2
6/12	37	1	2	0	16/12	5	0	3	0
13/12	23	0	0	0	23/12	6	0	1	0
21/12	15	0	0	0	30/12	3	0	0	0
27/12	8	0	0	2	6/1/2013	4	0	0	0
4/1/2012	3	0	0	0					
Total	135	528	217	7	Total	73	419	172	13
Mean	6.43	25.14	10.33	0.33	Mean	3.65	20.95	8.6	0.65

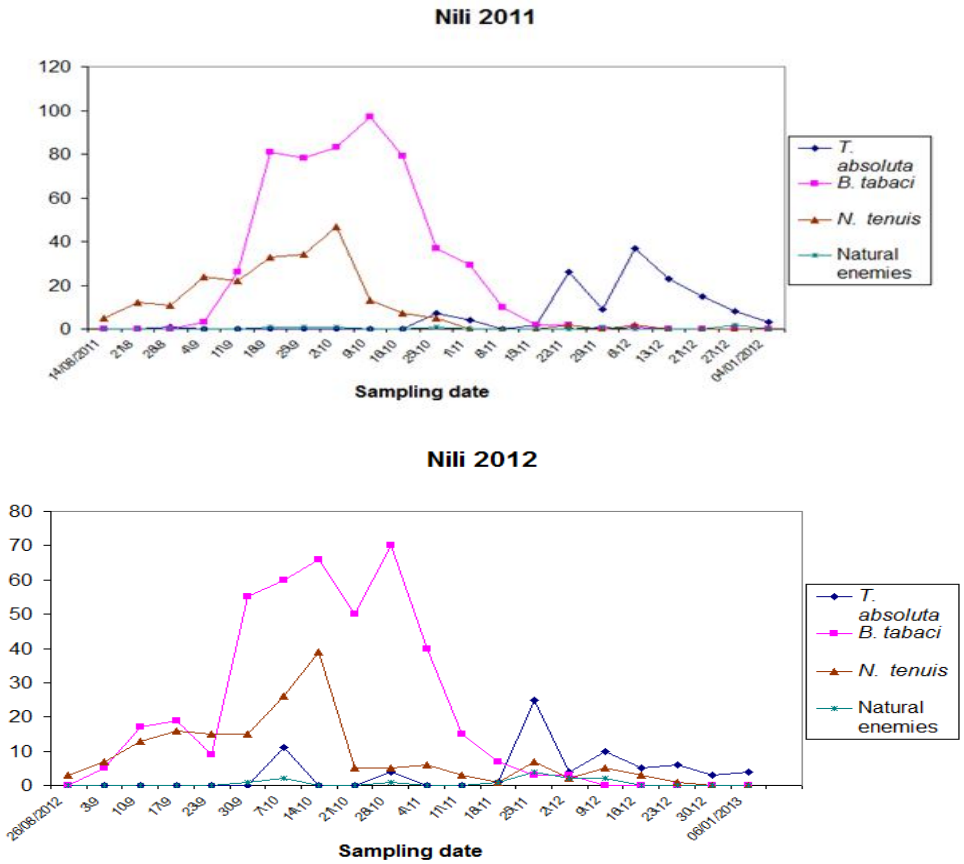

Fig (5): Weekly numbers of tomato pests and associated natural enemies during Nili plantations 2011 & 2012

Table (6): Weekly numbers of tomato pests and associated natural enemies during Summer plantations 2012 & 2013

Summer 2012					Summer 2013				
Sampling date	*T. absoluta*	*B. tabaci*	*N. tenuis*	Natural enemies	Sampling date	*T. absoluta*	*B. tabaci*	*N. tenuis*	Natural enemies
21/4/2012	0	7	4	0	29/4/2013	1	0	0	0
28/4	10	13	19	2	7/5	0	0	15	1
4/5	5	10	29	2	16/5	0	12	23	2
11/5	4	29	33	2	22/5	3	29	28	5
18/5	14	50	37	2	29/5	3	21	27	4
26/5	7	70	14	2	5/6	2	30	4	5
3/6	6	77	0	0	12/6	0	44	7	1
10/6	20	81	4	5	19/6	7	40	13	2
17/6	14	23	50	6	26/6	5	49	5	5
24/6	7	8	20	1	3/7	9	62	39	5
1/7	5	0	27	1	9/7	0	64	24	6
9/7	4	0	28	0	16/7	0	40	4	3
16/7	0	0	13	0	23/7	0	18	1	1
Total	96	368	278	23	Total	30	409	190	40
Mean	7.38	28.31	21.38	1.76	Mean	2.3	31.46	14.62	3.07

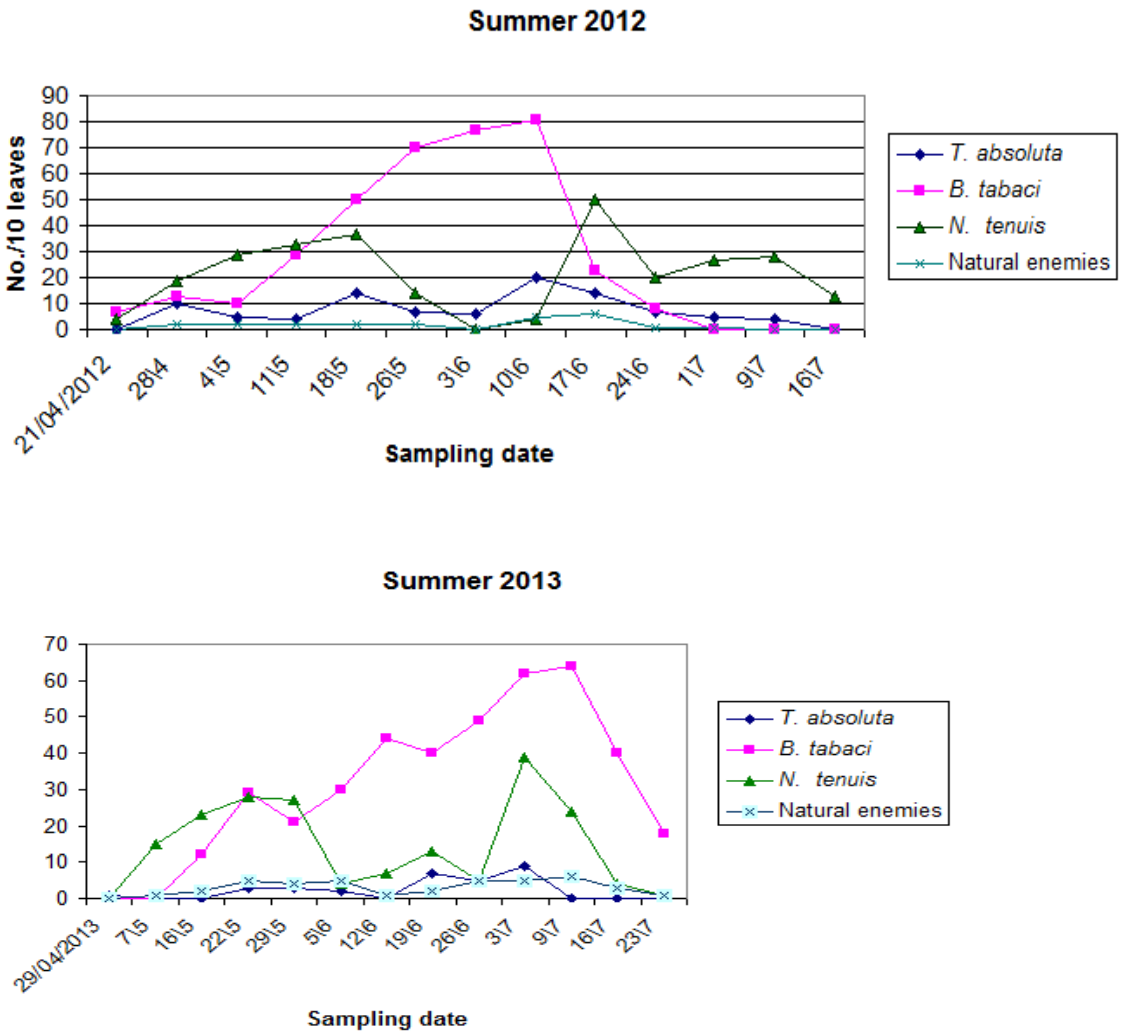

Fig (6): Weekly numbers of tomato pests and associated natural enemies during Summer plantations 2012 & 2013

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الملخص العربى

دراساتإيكولوجيةلثلاثة افات حشريةتهاجمنباتاتالطماطمفىمحافظةالفيوم

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تماجراءدراساتإيكولوجيةلتقديرتعدادونشاطثلاثة افات حشرية مرتبطةبنباتاتالطماطمفىمحافظةالفيومخلالالموسمى(٢٠١١\٢٠١٢ و ٢٠١٢\٢٠١٣).

تمتسجيلاعلىتعدادليرقاتحشرة *Tutaabsoluta*فى العروة النيلى للموسمين ٢٠١١ و ٢٠١٢ فىنوفمبروديسمبر (بمعدل ٣٧،٢٥فرد/١٠اوراق) علىالتوالىبينمااظهرت الدراسه انخفاضاالتعدادخلالالموسمالصيفى٢٠١٢ حيثسجلاعلىتعداد للحشرةفىيونيو (٢٠فرد/ ١٠اوراق). بينما اظهرت الدراسه فى العروة النيلى للموسمين محل الدراسه ان أعلىتعداداللاطوار الغير كامله لحشرة *Bemisiatabaci* (٩٧ و ٧٠ فرد /١٠اوراق) فىالاسبوعالثانىوالرابعمن اكتوبرو(٨١ و ٦٤ فرد/١٠اوراق)

فىالاسبوعالثانىمنيونيةويوليوخلالالموسم الصيفى٢٠١٢ و ٢٠١٣ علىالتوالى.

هذاوقدسجلتحشرة*Nesidocoristenuis*أعلىتعدادلها (٤٧و ٣٩ و ٥٠ و ٣٩ فرد/١٠اوراق)فىالاسبوعالاولوالثانىمناكتوبرخلال الموسم النيلى٢٠١١و٢٠١٢.والاسبوعالثانىمنيونية،الاسبوعالاولمنيوليةخلال الموسم الصيفى٢٠١٢ و ٢٠١٣علىالتوالى.

وقدتمتسجيلعددمنالمفترساتالمصاحبةلهذهالحشراتوكاناهمهاابوالعيدذواحدىعشرنقطة،ذبابةالسرفيس،بقةالاوريس،اسدالمن،الرواغة،فرسالنبى.

الكلمات الداله : دراسات ايكولوجيه ; الافات الحشريه ; الطماطم