

Field Studies on the Tomato Bug *Nesidiocoris tenuis* (Reuter) (Heteroptera : Miridae) on Different Solanaceous Crops

Awadalla, S. S.¹; L. M. Shanab¹; S. A. Kassem² and M. F. Olyme²

¹Economic Entomology Department, Faculty of Agricultural, Mansoura University.

²Plant Protection Research Institute, Agriculture Research Center, Doki, Giza.



ABSTRACT

The tomato bug *Nesidiocoris tenuis* (Heteroptera: Miridae) is a mirid bug with zoophytophagous feeding behavior (feed on plants and several insect pests of solanaceous crops). A field experiment in farm located in Kafr El Sheikh region were carried out during two seasons (2015 /16 and 2016 /17). During February and May plantation in years of 2015 and 2016, the highest peak of abundance of tomato bug recorded in May plantation in tomato plants during the two years and represented by 198 and 177 individuals, respectively. A significant difference was found between February plantation and May plantation on the populations of tomato bug. Eggplant and pepper showed no significant differences during the two plantations. The population abundance of *N. tenuis* increased with the weekly increasing of insect pest's populations which gives a strong typical predator response to prey availability. Predator: Prey ratio showed a narrowed range for the tomato bug and main insect pests in tomato plants during February plantation and ranged about 1:11 in year 2015 and 1:10 in year 2016. Meanwhile, in May plantation during the two years and recorded a very narrowed ratio 1:5 during the two successive years 2015 and 2016 . During the two year in February plantations there were highly positive correlations effects among the total main insect pests and *N. tenuis* on tomato plants. While low and negative correlations were found on eggplant and pepper plants. Meanwhile in May plantations a highly positive correlation was found between the total main insect pests and *N. tenuis* on tomato and eggplant .Results revealed that, the tomato bug *N. tenuis* not appear on pepper plants in May plantation during the two years .

INTRODUCTION

Tomato bug *Nesidiocoris tenuis* (Ruet.) (Heteroptera: Miridae) seemed to be widely distributed all over the Egyptian field on tomato, eggplant and other solanaceous plants (Priesner and Alfieri 1953; El Dessouki et al.1976; Awadalla ,1980; El Arnauty et al. 2012 ;karman et al. 2017). In the Mediterranean origin, there is a different identification about the tomato bug, as a pest feed and laying egg on solanaceous plants (El Dessouki et al. 1976; Awadalla, 1980; De Puyssleyn et al. 2012; Biondi et al .2016) and also consider a predator use to controlling several insect pests such as the cotton whitefly *Bemisia tabaci*, the plant hoppers *Empoasca decipiens*, the tomato leafminer *Tuta absoluta* ,the cotton cutworm *Spodoptera littoralis* and others pests (Abdelmaksoud et al. 2016, Arno et al. 2013, El Arnauty et al. 2012 , Molla et al. 2009 , Urbaneja et al. 2008). The present study aims to evaluate the population densities of *N. tenuis* in three solanaceous plants (tomato, eggplant and pepper) the: predator :r prey ratio among the total main insect pests of solanaceous crops and the tomato bug *N. tenuis* and the correlation between tomato bug and the main insect pests.

MATERIALS AND METHODS

A field experiment in farm located in Kafr El Sheikh region was carried out during two seasons (2015/16 and 2016 /17) in one feddan divided to twenty four replicates in two planting dates .The size of each replicate was about 175 m² used to evaluate the population fluctuation of the major insect pests attacking tomato, eggplant and pepper and the tomato bug *N. tenuis* .Seeds of vegetable plants were sown in January and April in greenhouse to rear it till reaching 25-30 day old then transferred to the field aria experiment and planting in end of February and mid-May. The normal agricultural treatment of land preparation, irrigation, and mechanical weeds control were followed, as recommended and chemical control was neglected during the present study .Sampling started one week after plantation in filled experiment by using direct count of adults and immature stages of insect pests and counted for 16 week. The number of insect pests and *N. tenuis* on different host plants and during different plantation dates were analyzed using one - way ANOVA, Differences were considered significant

when P<0.05. Correlation coefficients between *N. tenuis* and total insect pests during plantations were also performed.

RESULTS AND DISCUSSION

The population abundance of tomato bugs on different solanaceous crops.

Data presented in Figure (1A) showed the population abundance of the tomato bugs *N. tenuis* on different solanaceous crops in February plantation during the first year 2015, the highest peak of abundance occurred on tomato followed by eggplant and pepper in the second week of June and presented by 46, 15 and 9 individuals, respectively. Meanwhile during the second year (2016) in Figure (1B), the highest peak of abundance WAS occurred on tomato followed by eggplant and pepper in the second week of June and presented by 51, 18 and 5 individuals respectively.

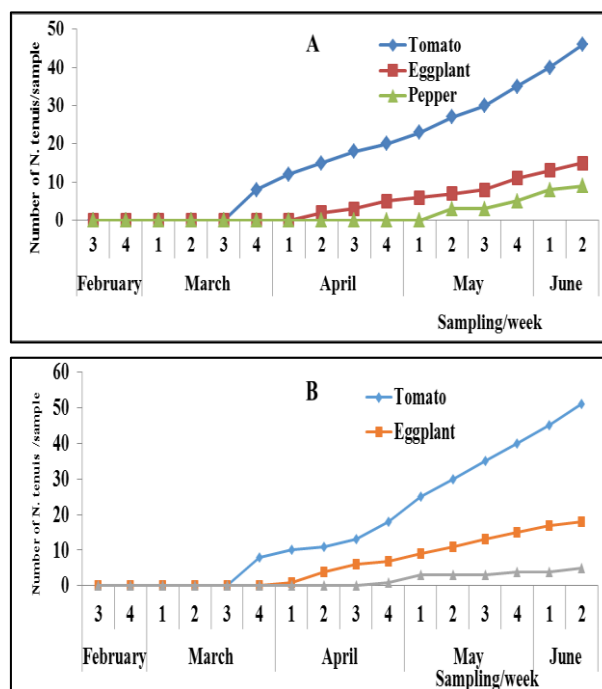


Fig. 1. Population abundance of the tomato bug *N. tenuis* on different solanaceous crops in February plantation during the two successive years 2015(A) and 2016(B) in Kafr El Sheikh region.

Data presented in Figure (2A) showed the population abundance of the tomato bugs *N. tenuis* on different solanaceous crops in May plantation during the first year 2015. The highest peak of abundance occurred on tomato in the second week of September followed by eggplant in the first week of September and presented by 198 and 15 individuals, respectively. Meanwhile during the second year 2016 in Figure (2B), the highest peak of abundance was occurred on tomato followed by eggplant in the same weeks and presented by 177 and 19 individuals respectively. No appearance on pepper plants during the two years in May plantation.

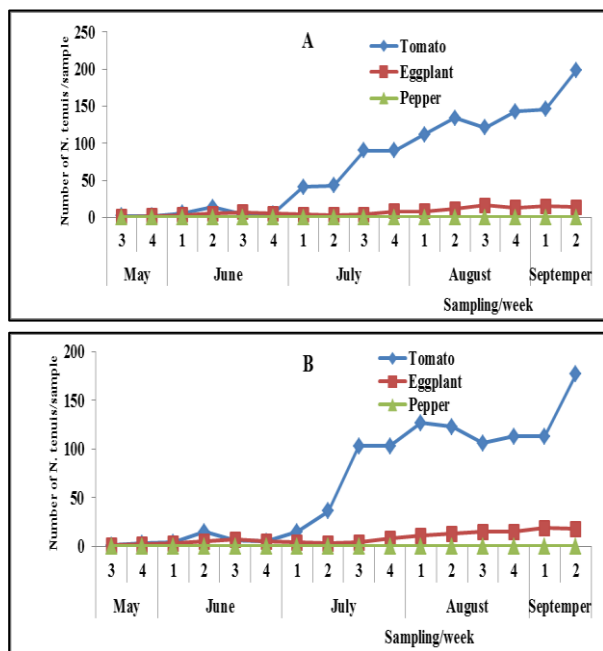


Fig. 2. Population abundance of the tomato bug *N. tenuis* on different solanaceous crops in May plantation during the two successive years 2015(A) and 2016(B) in Kafr El Sheikh region.

Data arranged in Table (1) showed the average numbers of the tomato bug *N. tenuis* in the two plantation dates during the two years 2015 and 2016. It can be noticed that the highest average number in February plantation found in tomato plants and represented by 17.12±3.8 in the first year (2015) and 17.87±4.39 in the second year(2016), respectively. Meanwhile in May plantation the average

highest numbers found in tomato and represented by 71.93±16.2 in the first year2015 and 65.62±14.9 in the second year 2016, respectively.

Table1. The average numbers of the tomato bug *N. tenuis* on different solanaceous crops in February and May plantations during the two successive years 2015 and 2016 in Kafr El Sheikh region .

Solanaceous crops	February plantation		May plantation		L.S.D
	2015	2016	2015	2016	
Tomato	17.12±3.8	17.87±4.39	71.93±16.2	65.62±14.9	32.28
Eggplant	4.37±1.28	6.31±1.6	7.43±1.23	8.31±1.49	4.05
Pepper	1.75±0.76	1.4±0.46	0.0±0.0	0.0±0.0	1.26
L.S.D	6.79	7.77	26.78	24.6	

Least significant differences factors were analyzed using Anova one way, Differences were considered significant when P<0.05.

As conclusion data represented in Figures (1 and 2) and Table (1) indicated that the highest peak of abundance of the tomato bug *N. tenuis* in February plantation recorded in the end of May and first of Jun which were agreed with Abdelmaksoud *et al.* (2016) and Abbes and Chermity (2012), while the highest peak in May plantation recorded in September which agreed with Sanchez (2008). Tomato plants recorded the highest averages numbers of the tomato bug *N. tenuis* from different solanaceous crops which agreed with Sanchez (2009), Urbaneja *et al.* (2009), Hassanpour *et al.* (2015), Nalselii *et al.* (2017).

The relationship between the main insect pests and *N. tenuis* as a Predator- Prey Ratio and simple correlations on different solanaceous crops in February and May plantation.

Data in Table (2) showed the weekly total numbers of the main insect pests (*Aphis gossypii* Glov., *Bemisia tabaci* Genn., *Nezara viridula* Linna., *Empoasca decipiens* Peoli., *Liriomyza trifolii* Burg. , *Spodoptera littoralis* Bosid. and *Tuta absoluta* Meyrick), attacking different solanaceous vegetable crops, total numbers of *N. tenuis* and the relationship between them as predator-prey ration (PP Ratio) in February plantation during the year 2015. The population abundance of *N. tenuis* increased with the weekly increasing of insect pest’s populations which gives a strong typical predator response to prey availability. It can be noticed that PP: ratio ranged about 11:1in tomato plants followed by eggplant 34:1 and pepper 65:1, respectively.

Table 2. The weekly total numbers of insect pests, the weekly numbers of *N. tenuis*, predator-prey ratio (P:P Ratio) on different solanaceous crops in February plantation during year 2015.

year	Month	week	Tomato			Eggplant			Pepper		
			T. insect pests	<i>N. tenuis</i>	P:P Ratio	T. insect pests	<i>N. tenuis</i>	P:P Ratio	T. insect pests	<i>N. tenuis</i>	P:P Ratio
2015	February	3	43	0	0	35	0	0	28	0	0
		4	69	0	0	50	0	0	44	0	0
	March	1	73	0	0	93	0	0	56	0	0
		2	91	0	0	126	0	0	61	0	0
		3	131	0	0	148	0	0	96	0	0
	April	4	178	8	22	189	0	0	111	0	0
		1	193	12	16	184	0	0	132	0	0
		2	199	15	13	197	2	99	163	0	0
		3	220	18	12	199	3	66	186	0	0
	May	4	236	20	12	207	5	41	182	0	164
		1	238	23	10	192	6	32	192	0	53
		2	228	27	8	188	7	27	152	3	50
		3	233	30	8	158	8	20	131	3	45
	June	4	254	35	7	142	11	13	108	5	31
1		266	40	7	138	13	11	88	8	25	
		2	267	46	6	128	15	9	80	9	18
Total			2919	274	11	2374	70	34	1810	28	65

Data in Table (3) showed the weekly total numbers of insect pests, (*A. gossypii*, *B. tabaci*, *N. viridula*, *E. decipiens*, *L. trifolii*, *S. littoralis* and *T. absoluta*), the weekly numbers of *N. tenuis* on different solanaceous vegetable crops in February plantation and the predator-prey ration (P:P Ratio) during year 2016. The highest total

population abundance of several insect pests and *N. tenuis* was found in tomato plants and represented by 2880 and 286 individuals, respectively. However, a much narrowed range for *N. tenuis* P: P ratio also was narrowed range in tomato and represented by 1:10 followed by eggplant 1:22 and pepper 1:70, respectively.

Table 3. The weekly total numbers of insect pests, the weekly numbers of *N. tenuis*, predator-prey ratio (P:P Ratio) on different solanaceous crops in February plantation during year 2016.

Sampling Dates			Tomato			Eggplant			Pepper			
year	Month	week	Total insect pests	<i>N. tenuis</i>	P:P Ratio	Total insect pests	<i>N. tenuis</i>	P:P Ratio	Total insect pests	<i>N. tenuis</i>	P:P Ratio	
2016	February	3	36	0	0	26	0	0	18	0	0	
		4	74	0	0	46	0	0	27	0	0	
	March	1	72	0	0	74	0	0	36	0	0	
		2	102	0	0	122	0	0	51	0	0	
		3	125	0	0	146	0	0	73	0	0	
		4	176	8	22	185	0	0	93	0	0	
	April	1	199	10	20	189	1	189	115	0	0	
		2	201	11	18	206	4	52	127	0	0	
		3	219	13	17	212	6	35	143	0	0	
		4	225	18	13	205	7	29	164	1	164	
	May	1	209	25	8	177	9	20	158	3	53	
		2	207	30	7	167	11	15	150	3	50	
		3	238	35	7	129	13	10	135	3	45	
		4	269	40	7	124	15	8	124	4	31	
	June	1	255	45	6	112	17	7	99	4	25	
		2	273	51	5	104	18	6	89	5	18	
	Total		16	2880	286	10	2224	101	22	1602	23	70

Data in Table (4) showed the weekly total numbers of insect pests, (*A. gossypii*, *B. tabaci*, *N. viridula*, *E. decipiens*, *L. trifolii*, *S. littoralis*, *T. absoluta* and *Heliothis armigra* Hubn.), the weekly numbers of *N. tenuis* on different solanaceous vegetable crops in May plantation and the predator-prey ration (P:P ratio) during year 2015. The highest total population abundance of several insect pests and *N. tenuis* was found in tomato plants and represented by 5259 and 1151 individuals, respectively. However a narrowed range of P: P ratio also was recorded in tomato and represented by 1:5, respectively. However, on eggplant the total insect pests and *N. tenuis* recorded 1858 and 119, individuals, respectively. Also a strong narrowed P: P: ratio (1:16) found between the total insect pests population n and *N. tenuis*.

Table 4. The weekly total numbers of insect pests, the weekly numbers of *N. tenuis*, prey-predator ratio (P:P Ratio) and simple correlations on different solanaceous crops in May plantation during year 2015.

Sampling Dates			Tomato			Eggplant		
year	Month	week	Total insect pests	<i>N. tenuis</i>	P:P Ratio	Total insect pests	<i>N. tenuis</i>	P:P Ratio
2015	May	3	36	2	18	81	1	81
		4	49	2	25	90	2	45
		1	87	6	15	95	3	32
	June	2	166	14	12	89	5	18
		3	218	4	55	103	7	15
		4	279	5	56	89	5	18
		1	292	41	7	79	4	20
	July	2	321	43	8	78	3	26
		3	328	90	4	79	4	20
		4	340	90	4	88	8	11
		1	403	112	4	123	8	15
	August	2	472	134	4	145	11	13
		3	507	121	4	148	16	9
		4	518	143	4	177	13	14
		1	591	146	4	194	15	13
	September	2	652	198	3	200	14	14
		Total	16	5259	1151	5	1858	119

Data in Table (5) showed the weekly total numbers of insect pests (*A.gossypii*, *B. tabaci*, *N. viridula*, *E. decipiens*, *L. trifolii*, *S. littoralis*, *T. absoluta* and *Heliothis armigra* Hubn.), the weekly numbers of *N. tenuis* on different solanaceous vegetable crops in May plantation and the predator-prey ration (PP ratio) during year 2016. The highest total population abundance of several insect pests and *N. tenuis* was found in tomato plants and represented by 5249 and 1050 individuals, respectively. However, a strong P: P ratio also was recorded in tomato and represented by 5:1, respectively. Also in eggplant a strong P: P: ratio (14:1) between the total insect pests population and *N. tenuis*. No appearance of tomato bug in pepper during May plantation.

Table 5. The weekly total numbers of insect pests, the weekly numbers of *N. tenuis*, predator-prey ratio (P:P Ratio) on different solanaceous crops in May plantation during year 2016.

Sampling Dates			Tomato			Eggplant			
years	month	week	Total insect pests	<i>N. tenuis</i>	P:P Ratio	Total insect pests	<i>N. tenuis</i>	P:P Ratio	
2016	May	3	40	1	40	64	1	64	
		4	55	3	18	79	2	40	
	June	1	98	4	25	86	3	29	
		2	156	15	10	93	5	19	
		3	228	6	38	99	7	14	
		4	336	5	67	98	5	20	
	July	1	325	15	22	90	4	23	
		2	352	36	10	89	3	30	
		3	351	103	3	97	4	24	
		4	355	103	3	106	8	13	
	August	1	394	127	3	119	11	11	
		2	412	123	3	136	13	11	
		3	471	106	4	152	15	10	
		4	443	113	4	161	15	11	
	September	1	579	113	5	169	19	9	
		2	654	177	4	182	18	10	
	Total			5249	1050	5	1820	133	14

As conclusion data represented in Tables (2, 3, 4 and 5) indicated that the population abundance of *N. tenuis* increased with the weekly increasing of insect pest's populations which gives a strong typical predator response to prey availability. On other hand P: P ratio showed a very narrowed range for the tomato bug and main insect pests in tomato plants during February and May plantation and ranged about 1:11 and 1:10 in February plantation and 1:5in May plantation during the two years .Results were agreed with Abdelmaksoud *et al.* (2016), Sanchez (2008) and De Puyssseleir *et al.* (2013).

Simple correlation coefficients between the total main solanaceous crops and the tomato bug *N. tenuis*.

Data represented in Table (6) shown the simple–correlation coefficient between the total main insect pests and *N. tenuis* on different Solanaceous plants during February and May plantations in year 2015 and 2016. During the two year in February plantations there were highly positive correlations effects among the total main insect pests and *N. tenuis* on tomato plants, while low and negative correlations found on eggplant and pepper plants. Meanwhile, in May plantations, a highly positive correlation found between the total main insect pests and *N. tenuis* on tomato and eggplant.

Table 6. Simple correlation coefficients between the main insect pests and the tomato bug *N. tenuis* on different solanaceous crops during different plantations in years 2015 and 2016.

Plantations /Year	Solanaceous host plants		
	Tomato	Eggplant	Pepper
February 2015	0.900***	0.16 ^{n.s.}	-0.148 ^{n.s.}
February 2016	0.857***	0.074 ^{n.s.}	0.397 ^{n.s.}
May 2015	0.937***	0.903	-
May 2016	0.846***	0.982	-

***Highly correlation significant at the level 0.001

^{n.s.} No correlation significant

As conclusions data in Table (6) indicated that a highly strong positive correlations found between the tomato bug and the total main insect pests on tomato plants during the two plantations dates, which were agreed with Sánchez 2008, Abbas and Chermiti (2012), Messelink, *et al.* (2014) and Molla *et al.*(2011) Moreno-Ripoll *et al.* (2014) , who mentioned that the abundance of *N. tenuis* is positively correlated with the abundance of prey.

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دراسات حقلية لحشرة بقعة الطماطم في الانواع المختلفة للعائلة الباذنجانية
سمير صالح عوض الله^١، لبيب محمود شنب^١، سمير السيد قاسم^٢ ومصطفى فاروق عليمي^٣
١قسم الحشرات الاقتصادية – كلية الزراعة جامعة المنصورة
٢معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي – الجيزة

حشرة بقعة الطماطم هي احدى حشرات نصفية الاجنحة ذات سلوك التغذية النباتية وتهدف الدراسة الى تقييم التعداد الحشري للحشرة على الطماطم والفلل والباذنجان وتقدير فترات ارتفاع التعداد الحشري لها. تم اجراء هذه الدراسة الحقلية بمنطقة تابعة لمحافظة كفر الشيخ خلال موسمين ٢٠١٥ و ٢٠١٦ خلال عروتين عروة فبراير وعروة مايو اوضحت النتائج ان اكبر تعداد حشري لبقعة الطماطم سجل على الطماطم في عروة مايو خلال العامين حيث بلغ عدد الحشرات الحشرة ١٩٨ و ١٧٧ على التوالي . اوضحت التحاليل الاحصائية وجود فروق معنوية لتعداد حشرة الطماطم بين نباتات الطماطم وكل من الفلفل والباذنجان بينما لم يتم تسجيل فروق معنوية بين الفلفل والباذنجان . اوضحت الدراسة ان الزيادة الاسبوعية للكثافة العددية لبقعة الطماطم وتزداد مع زيادة الكثافة العددية لأجمالي الأفات الحشرية الموجودة معها على نفس النوع النباتي والذي يوضح قدرة الحشرة على اقتراض تلك الأفات الحشرية ووجود علاقة مباشرة مع تعدادها الحشري. اوضحت الدراسة ايضا مدى ارتباط بقعة الطماطم مع عدد كبير من الأفات الحشرية لأنواع العائلة الباذنجانية والتي تؤكد على إمكانية استخدام بقعة الطماطم في خفض تعداد الأفات الحشرية المصاحبة لها على العائل النبات . اوضحت النتائج انه لا يوجد ظهور لبقعة الطماطم على نباتات الفلفل خلال عروة مايو في الموسمين.