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Beneficial Insectary Plants and Habitat Management for Enhancing Activity of Some Insect Predators of *Bemisia tabaci* and *Tuta absoluta* in Tomato Fields.

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ABSTRACT

During the course of the present study, five insect predators were recorded with relatively high numbers on chamomile (*Matricaria chamomilla* L), namely *Nesidiocoris tenuis* (Reuter), *Macrolophus caliginosus* Wagner. , *Coccinella undecimpunctata* L., *Chrysoperla carnea* Steph. and *Syrphus corollae* Fabr. Only three insect predators were inhabiting marigold plants (*Callendula officinalis* L.) with relatively high abundance, namely *N. tenuis*, *M. caliginosus* and *C. undecimpunctata*. The obtained results indicated that intercropping chamomile and marigold plants with tomato crop significantly increased the abundance of the mirid bugs, *N. tenuis* and *M. caliginosus* in comparison with those in check plots. In addition, floral resource plant caused considerable reduction of both *Bemisia tabaci* and *Tuta absoluta* populations in comparison with no forbs field. Therefore, our results suggest that chamomile, and marigold are beneficial insectary plants and could be used as conservative biological control agents against *B. tabaci* and *T. absoluta* in tomato crops.

INTRODUCTION

Tomato plants, *Lycopersicon esculentum* are attacked by several insect pests throughout their different stages of their growth. The tomato whitefly, *Bemisia tabaci* Gennadius (Luo and Zhang,2000), and the tomato leaf miner, *Tuta absoluta* (Meyrick) (Sannino and Espinosa,2010) are very injurious and cause serious damage to the yield in both quantity and quality in many parts of the world. *B. tabaci* is one of the greatest economic insects which causes serious damage either directly by sucking plant juice or indirectly as vectors of virus diseases. It largely affects many major crops resulting in considereble yield losses every year (Luo and Zhang, 2000). *T. absoluta* larvae feed on all parts of tomato plants and can damage all the growth stages, it can also attack other plants in Solanaceae family (Abdul-Rassoul ,2014). The potential damage can reach to 100% yield loss depending on environmental conditions (Sannino and Espinosa,2010, & Assaf *et al*. (2013).

Conservative biological control consists of managing habitats in the agricultural environment to conserve and enhance local natural enemy populations to reduce the negative effects of pests on crops (Eilenberg *et al*., 2001, Zehnder *et.al.* 2007 and Letourneau *et al*., 2009 and 2010).). Beneficial insectary plants is a form of conservative biological control that involves introducing flowering plants into agricultural system to increase nectar and pollen resources required by some natural enemies of insect pests (Jervis *et.al*., 1996). That is because in diversified habitats natural enemies can use different types of resources as shelter, suitable microclimatic conditions, oviposition sites and plant-provided food (pollen and nectar), leading to higher pressure on the populations of herbivores (Letourneau *et al*., 2009). Some flowering plant species are highly attractive to natural enemies (Rebek *et al* ,2006) and can enhance predatism and parasitism rates of herbivorous pests (Gontijo *et al* 2012). So, flowers must be carefully chosen to provide resources easily accessed by natural enemies but not by pests that also use nectar or pollen (Géneau *et al*., 2012),

In vegetable crops, understanding the dynamics of natural enemies and pest control could be especially important, because these vegetables have a short crop duration. For example, the duration of tomato crop is approximately 180 days. In such ephemeral crops, the efficiency of pest control by natural enemies could be directly related to the species pool available in the farm that could rapidly colonize a new habitat in response to an increase in herbivore populations (Tylianakis *et al.* 2005).

More research is still needed to identify which plants have the greatest potential as beneficial insectary plants are not attractive to all insects equally, rather they exhibit selectivity for the flowers from which they feed (Cowgill *et al*., 1993).

So, the present study aimed to: evaluate the role of some flowering medicinal plants (*Matricaria chamomilla* L and, *Callendula officinalis* L) as beneficial insectary plants to predator insect species, and usage of these plant species to increase the efficiency of the insect predators against *B. tabaci* and *T. absoluta*.

MATERIALS AND METHODS

1. Survey of predaceous insect species inhabiting chamomile, and marigold plants

Field experiments were conducted at the Experimental Farm, Faculty of Agriculture, Mansoura University at Mansoura region during 2014/2015 and 2015/2016.

An area of about 400 m^2 (about 200 m^2 / host plant) was prepared and divided into three plots (each plot about 60 m^2) for growing chamomile, *Matricaria chamomilla*; and marigold, *Callendula officinalis* L. Chamomile and marigold were purchased as seedlings from a local nursery and transplanted in rows in each plot, on 1st of January, and 28th of December , respectively, 2014. The cultivated area received normal agricultural practices and was not subjected to any chemical control applications.

Sampling techniques: Sweep net method have been used to survey predaceous insects inhabiting chamomile and marigold plantations throughout two successive growing seasons (2014 and 2015). Sampling started on 4th of February in the first season and on 1st of February in the second season till harvesting. A standard sweep net (0.35 m. diam.), as described by Borror and Delong (1981), was used. Fifteen double strokes /plot (6 x 10 meter) were taken weekly. Each catch was emptied into a labeled collecting muslin bag and transferred to the laboratory; specimens were killed by chloroform and examined under stereomicroscope. Number of individuals and species composition of each sample was determined and the percentage of occurrence was estimated.

Bugs species were identified by. Prof. Dr. Eman El-Sebaie, Plant Protection Research Institute, Agricultural Research Center, Ministry of Agriculture.

2. Impact of habitat management on natural enemies of tomato insect pests

Effect of incorporating flowering plants (chamomile and marigold plants) into tomato (*Solanum lycopersicum*) fields on insect predators (*Nesidiocoris tenuis* (Reuter) and *Macrolophus caliginosus*) and on population densities of tomato white fly, *Bemisia tabaci* and *Tuta absoluta was evaluated*. An area of about 700 m^2 at the Experimental Farm, Faculty of Agriculture, Mansoura University was prepared and divided into 9 plots (each plot about 70 m^2) for growing tomato plants. A set of plots was centered by forbs, (each containing a central bed (3m^2) of chamomile or marigold as well as a set with no forbs. Each set consisted of three plots. Tomato plants were transferred as seedlings to the experimental area at 15 days old on 25th of December, 2014 and on 15th of December, 2015. Chamomile and marigold were purchased as seedlings from a local nursery and transplanted in rows in the center of each plot. All the usual agricultural practices were followed and no chemical insecticides were used during the period of study.

Sampling program

To estimate the density of *B. tabaci* and *T. absoluta* populations in tomato plants centered by forbs or no forbs (control),samples of tomato leaves were collected weekly from 14/2/2015 (in the first season) and from 16/1/2016 (in the second season) till harvesting. Each sample consisted of 45 leaflets / treatment (15 leaflets / replicate) picked at random. Collected samples were transferred to the laboratory in polyethylene bags (containing a piece of cotton saturated with chloroform) for investigations by using a binocular microscope. The numbers of each insect species were counted and recorded. The data was analyzed with variance (one way ANOVA) and the means were separated using Dancan's Multiple Range Test (CoStat Software, 1990).

To estimate the population of insect predators the standard sweep net was used. Fifteen double strokes per replicate were taken weekly till harvesting. Each catch was emptied into labeled collecting muslin bag and transferred into laboratory. Specimens were killed by chloroform and examined under stereomicroscope. Insect species were identified and number of individuals per each species was determined.

RESULTS AND DISCUSSION

I. Predaceous insects inhabiting chamomile and marigold plants

chamomile plants

Data in Table (1) show the total number and relative abundance of insect predators inhabiting chamomile plantations during 2014 and 2015 growing seasons. Eight insect predator species were recorded on chamomile plants throughout 2014 and 2015/2016 seasons. Heteropteran predators, namely, *Nesidiocoris tenuis* (Reuter) and *Macrolophus caliginosus*, Wagner were the highest abundance (Table, 1), followed by three species (*Coccinella undecimpunctata* L., *Chrysoperlla carnea* Steph. and *Syrphus corollae* Fabr,) were recorded with a moderate number. However, the least dominant predators were *Podisus maculiventris*, (Say,) followed by *Orius* sp. and *Scymnus* sp.

As shown in Table (1) in both growing seasons 2014 and 2015, heteropteran predatory, *N. tenuis* showed the highest percent of occurrence (28.07 and 26.27 %) of the total number of predaceous insects, followed by *M. caliginosus* (21.81 & 17.69 %),*C. undecimpunctata* (12.99 & 15.82 %) , *Chry. Carnea* (11.83 & 15.01 %), *S. corolla* (9.28 &9.12 %), *P. maculiventris*(6.73 & 6.43 %),*Orius* sp(5.57 & 4.02 %), and *Scymnus* sp (3.71 & 5.63 %), respectively.

Table 1. Total number and relative abundance of predaceous insect species dominant in chamomile plantations collected during 2014and 2015 seasons

Predator species	2014 season		2015 season	
	No.	%	No.	%
Nesidiocoris tenuis (Reuter)	121	28.07	98	26.27
Macrolophus caliginosus Wagner	94	21.81	66	17.69
Coccinella undecimpunctata L.	56	12.99	59	15.82
Chrysoperla carnea Steph	51	11.83	56	15.01
Syrphus corollae Fabr	40	9.28	34	9.12
Podisus maculiventris	29	6.73	24	6.43
Orius sp	24	5.57	15	4.02
Scymnus sp	16	3.71	21	5.63
Total	431		373	

Marigold plants

The greatest abundance percentages in 2014 growing season were 44.44% and 26.98% in the case of *N. tenuis* and *M.caliginosus*, consequently. They occupied the first rank of predators occurring on marigold plantations However, *C. undecimpunctata*, *Chry. Carnea*, *Orius* sp, and S.*corolla* occupied the second rank, with abundances of 9.52, 7.41, 6.35 and 5.29%, respectively Table (2). The same trend has been found during 2015 growing season. The results of the present work indicated that the relative abundance of the prevalent insect predators inhabitant marigold was less than that of chamomile plants.

Table 2. Total number and relative abundance of predaceous insect species dominant in marigold plantations collected during 2014 and 2015 seasons

Predator species	2014 season		2015 season	
	No.	%	No.	%
Nesidiocoris tenuis (Reuter)	84	44.44	55	36.18
Macrolophus caliginosus wagner	51	26.98	48	31.53
Coccinella undecimpunctata L.	18	9.52	15	9.87
Chrysoperla carnea Steph	14	7.41	14	9.21
Orius sp.	12	6.35	12	7.89
Syrphus corollae Fabr	10	5.29	8	5.26
Total	189		152	

2. Influence of intercropping floral resource plants with tomato crop on the seasonal abundance of mirid predators and pests (*B. tabaci* and *T. absoluta*) populations

The numbers of predaceous species (*N. tenuis*, *M. caliginosus*) and insect pests (*B. tabaci* and *T. absoluta*), in tomato plots mediated with chamomile and marigold plants or no forbs (control) ,are summarized and illustrated in Figures (1 and 2).

In the first season

In treated plots, the number of each predaceous species was obviously high in comparison with those in check plots. As shown in Figure (1a and b), in the first season (2015), the populations of *N. tenuis*. and *M. caliginosus* were high on tomato plants mediated with chamomile or marigold plants during the experimental period. Meanwhile, on the check plants (Fig.1c), the number of each predator species was initially low and fluctuated irregularly during the investigation period. The mean numbers of collected predators (*N. tenuis* and *M. caliginosus*) in check plots (Table, 3) were 1.01 ± 0.56 &1.09 ± 1.12 individuals/ *15* double strocks. While, they were significantly higher in mediated tomato plots with chamomile (2.23 ± 1.10 & 4.26 ± 2.19) and marigold (2.81 ± 1.90 & 2.78 ± 2.59 individuals/ 15 stroke), respectively.

With respect to *B. tabaci* and *T. absoluta* populations, they were recorded with significantly low numbers on tomato plants mediated with chamomile (4.69 ± 3.67 & 1.17 ± 1.43) and marigold (6.04 ± 5.48 & 1.14 ± 0.94) in comparison with check plants (10.08 ± 6.31 & 3.85 ± 3.09 individuals/ 15 leaflets), respectively (Table, 4).

Data illustrated in Figures (1a and b) obviously indicated that in tomato plots mediated with chamomile or marigold plants, the highest abundance of the predators (*N. tenuis* and *M. caliginosus*), coincided well with that of their prey (B. *tabaci* and *T. absoluta*) populations . However, both predators and their prey populations exhibited approximately similar trend of changes during the first season (2015). In tomato plots with no forbs, the reverse was true, where the population density of *B. tabaci* and *T. absoluta* increased, but, populations of both predators species fluctuated irregularly with few individuals.

Statistical analysis showed significant positive correlation between the population density of *N. tunis* and both preys, *B. tabaci* (r = 0.88 &0.73) and *T. aboluta* (r = 0.58 &.0,67) in mediated tomato plants with chamomile and marigold ,respectively . Also, positive correlation was obtained between *M. caliginosus* and each of *B. tabaci* (r = 0.75 & 0.67) and *T. aboluta* (r = 0.58 & 0.73) populations in tomato plants mediated with chamomile and marigold ,respectively . On contrary, as shown in Table(5), there was a insignificant correlation in check field between the prey (*B.tabaci* and *T. absoluta*) and predator populations (Table 5).

Table 3. General average numbers of *Nesidiocoris tenuis* (Reuter) and *Macrolophus caliginosus/* 15 double strokes on tomato plants mediated with chamomile and marigold or no forbs during 2015 and 2016 seasons.

Predator	Chamomile	Marigold	No forbs	L.S.D.(p=5%)
N. tunis				
2015	2.23 ± 1.10 b	4.26 ± 2.19 b	1.01 ± 0.56 a	0.83
2016	4.41 ± 2.48 b	3.96 ± 2.86 b	1.50 ± 1.41 a	0.52
M.caliginosa				
2015	2.81 ± 1.90 b	2.78 ± 2.59 b	1.09 ± 1.12 a	0.60
2016	3.89 ± 2.09 b	5.04 ± 3.54 b	1.18 ± 0.98 a	1.33

Table 4. General average numbers of *Bemisia tabaci* and *Tuta absoluta/* 15 leaflets on tomato plants mediated with chamomile and marigold or no forbs during 2015 and 2016 seasons. .

Insect pest	Chamomile	Marigold	No forbs	L.S.D. (p=5%)
Bemisia tabaci				
2015	4.69 ± 3.67 a	6.04 ± 5.48 a	10.08 ± 6.31 b	2.31
2016	9.74 ± 7.51 a	12.38 ± 10.04 a	20.88 ± 8.24 b	4.52
T. absoluta				
2015	1.17 ± 1.43 a	1.14 ± 0.94 a	3.85 ± 3.09 b	0.74
2016	1.33 ± 1.03 a	0.92 ± 0.84 a	2.92±1.53 b	0.57

In the second season

Data illustrated in Figure 2 show the population densities of *B. tabaci* and *T. absoluta* as well as the relative abundance of their associated predators (*N. tenuis*., *M. caliginosus*) on different tomato fields (added with either chamomile or marigold plants or no forbs) during 2016 season.

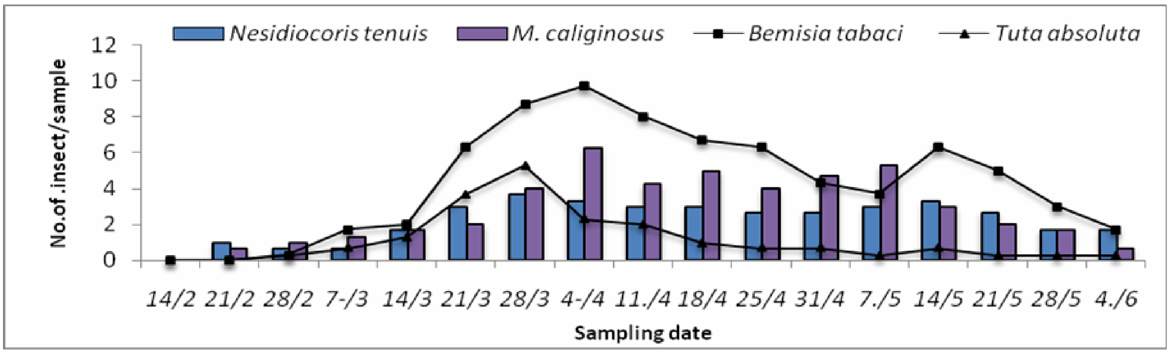
Population levels and trend of all prey and predators were nearly similar as in 2015 season. In tomato fields mediated with chamomile or marigold, the number of each predaceous species was obviously higher in comparison with those in check plots. as shown in Figures (2a, b and c), However, the populations of *N. tenuis* and *M. caliginosus*, was high on tomato plants mediated with flowering plants during the experimental period. Meanwhile, on the check plants (Fig.2c), the numbers of both predators were initially low and fluctuated irregularly during the investigation period. The mean numbers of collected predators (*N. tenuis* and *M. caliginosus*)in check plots (Table, 3) were 1.50 ± 1.41 and 1.18 ± 0.98 individuals/ 15 double strocks respectively, While, they were significantly higher in mediated tomato plots with chamomile (4.41 ± 2.48 & 3.89 ± 2.09) and marigold (3.96 ± 2.86 and 5.04 ± 3.54 individuals/ 15 stroke), respectively.

With respect to *B. tabaci* and *T. absoluta* populations, they were recorded with significantly low numbers on tomato plants mediated with chamomile (9.74 ± 7.51 and 1.33 ± 1.03) and marigold (12.38 ± 10.04 and 0.92 ± 0.84) in comparison with check plant

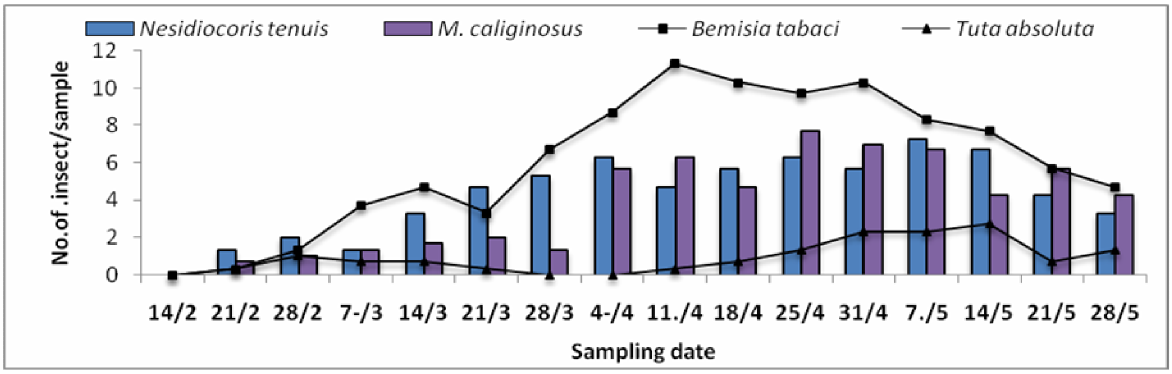
(20.88 ± 8.24 and 2.92±1.53 individuals/ 15 leaflets), respectively (Table, 4).

As shown in Figure, 2, the changes of *N. tenuis* and *M. caliginosus* populations synchronized with that of their prey populations (B. *tabaci* and *T. absoluta*).in both intercropping fields. However, both predators and their prey populations exhibited approximately similar trend of changes. In tomato plots with no forbs, the reverse was true, where, the population density of *B. tabaci* and *T. absoluta* was high, while, both predator population species fluctuated irregularly with few individuals.

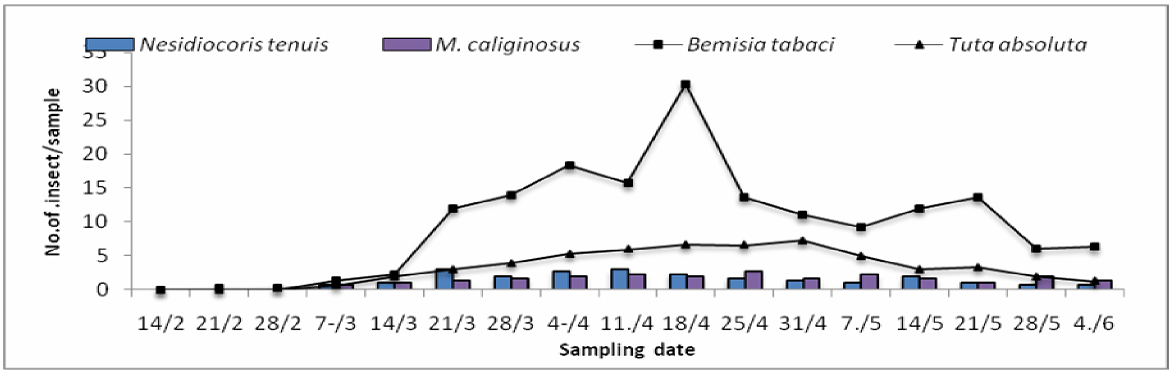
According to statistical analysis, there was significantly positive correlation between *N. tunis* and *B. tabaci* (r = 0.55 & 0.62) and *T. aboluta* (r = 0.56 & 0.76) in tomato plants mediated with chamomile and marigold ,respectively . Also, *M. caliginosus* population exhibited positive correlation with *B. tabaci* (r = 0.66 & 0.79) and *T. aboluta* (r = 0.66 & 0. 67) in mediated tomato plants with chamomile and marigold ,respectively during 2016 season. On contrary, there was insignificant correlations between the prey (*B.tabaci* and *T. absoluta*) and predator populations (Table,5) in case of check (without chamomile or marigold).



A



B



C

Figure 1. Seasonal abundance of *Nesidiocoris tenuis* and *Macrolophus. caliginosus* in response to population density of *Bemisia tabaci* and *Tuta absoluta* in tomato fields added either with chamomile, and marigold plants (Treated) (A, B)or no forbs (Control) (C) in the first year (2015).

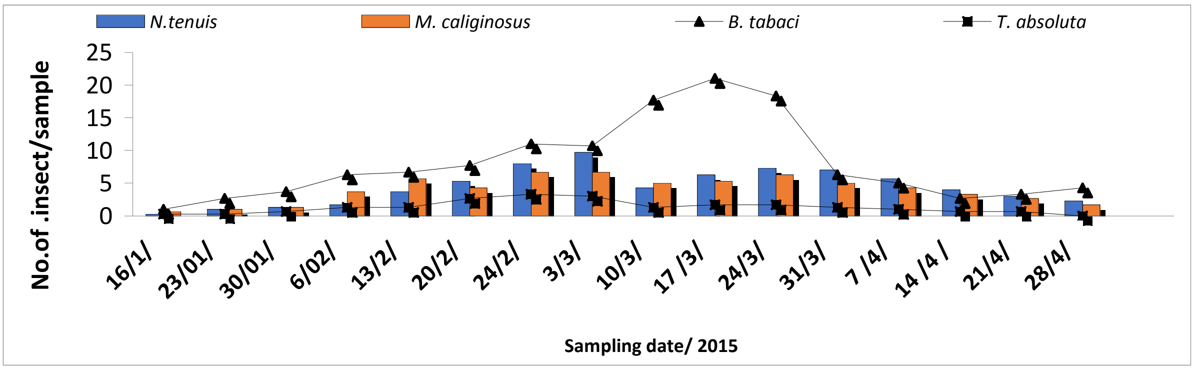
3- Evaluation the role of chamomile and marigold plants on the efficiency of insect predators.

Reduction rate of prey populations:

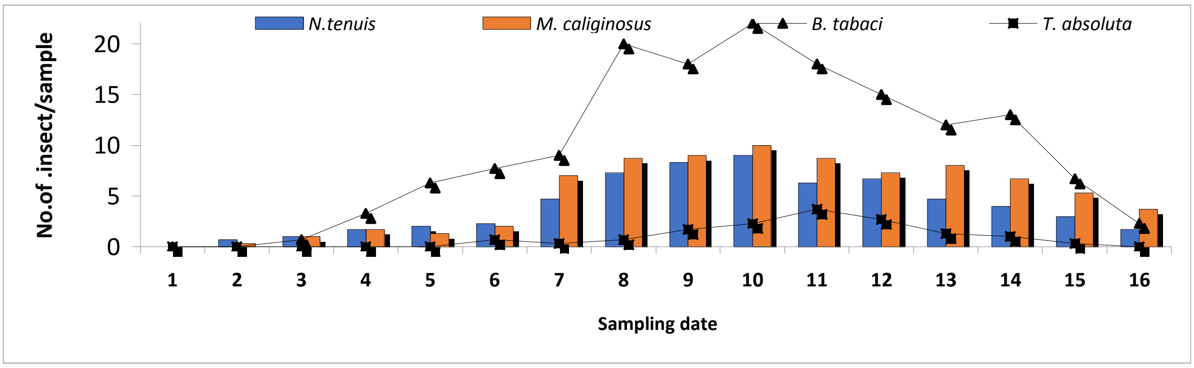
Figure (3) shows the regression of log abundance of tomato whitefly, *B. tabaci* and *T. absoluta* populations on times (days) in both tomato fields added with either chamomile or marigold plants or no forbs during the growing seasons; 2015 and 2016.

***B. tabaci* population**

In the intercropping chamomile and marigold with tomato fields, as shown in Figure (3) *B. tabaci* population was sharply lower in comparison with check tomato field. The slope of regression line was significantly (f-test) below zero in the first (b =- 0.0003 and - 0.0014) and second seasons (b = -0.0029 and -0.0006), respectively. From Fig.3, an increase by one day would reduce the mean number of *B. tabaci* population in mediated tomato plants with chamomile and marigold by (0.0003 and 0.0014) and (0.0029 and 0.0006 individual/ day) in the first and second seasons, respectively. On contrary, *B. tabaci* population in check tomato field exhibited a tendency to increase (-Fig. 3). The slope of regression line was significantly higher over zero during the first (b = 0.0108) and second (b = 0.0085) seasons.



A



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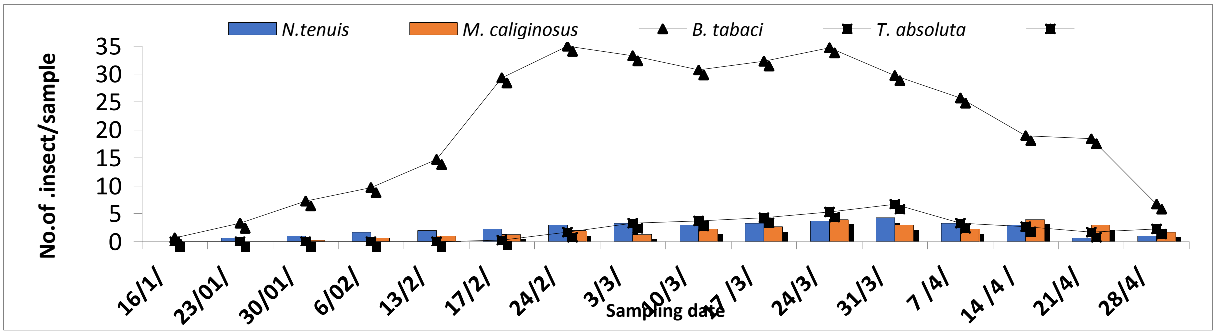


C

Figure 2. Seasonal abundance of *Nesidiocoris tenuis* and *Macrolophus caliginosus* in response to population density of *Bemisia tabaci* and *Tuta absoluta* in tomato fields added either with chamomile, and marigold plants (Treated) (A,B)or no forbs (control) (C) in the second year (2016).

Table 5. Simple correlation (r) between the predator (*Nesidiocoris tenuis* (Reuter) and *Macrolophus caliginosus*) and prey (*Bemisia tabaci* and *Tuta absoluta*) populations in different tomato fields mediated with chamomile and marigold or no forbs during 2015 and 2016.

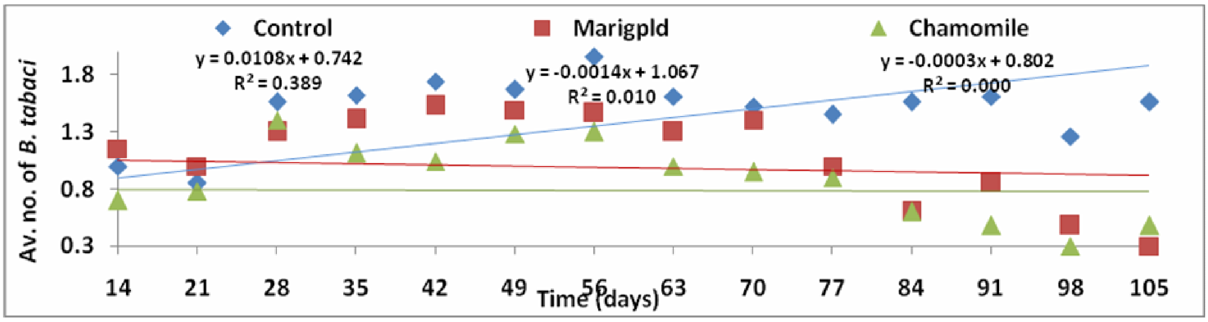
Insect pests	Chamomile		Marigold		No forbs	
	r	p	r	p	r	p
			***Nesidiocoris tenuis* (Reuter)**			
Bemisia tabaci 2015	0.88	0.000	0.73	0.001	0.07	0.788
2016	0.55	0.021	0.62	0.011	-0.22	0.407
Tuta absoluta 2015	0.58	0.015	0.67	0.004	-0.15	0.585
2016	0.56	0.042	0.76	0.001	-0.05	0.854
Bemisia tabaci			*Macrolophus caliginosus*			
2015	0.75	0.001	0.67	0.044	0.38	0.143
2016	0.66	0.042	0.79	0.000	0.46	0.155
Tuta absoluta						
2015	0.58	0.015	0.73	0.001	0.49	0.059
2016	0.66	0.032	0.67	0.020	0.33	0.122

***T. absoluta* population**

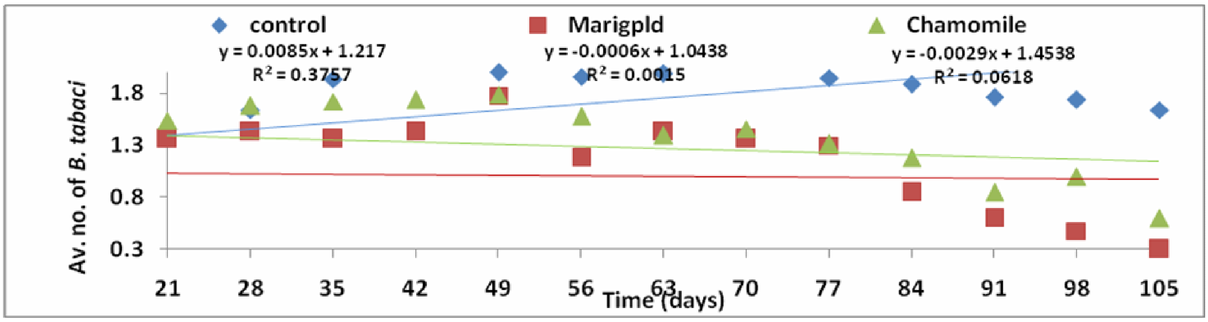
As shown in Fig. 3, *T. absoluta* population in the intercropping chamomile and marigold with tomato plants fields was sharply lower in comparison with check tomato field. The slope of the regression line of the log abundance of *T. absoluta* against time in tomato plants mediated with chamomile and marigold *was* (b= -0.0011 and -0.0001) and (b= 0.0001 and 0.0013) in the first and second seasons, respectively. Over the same period, the slope in check fields was high in 2015 (b= 0.007) and 2016 (b= 0.0113), respectively.

Increasing rate of predator populations:

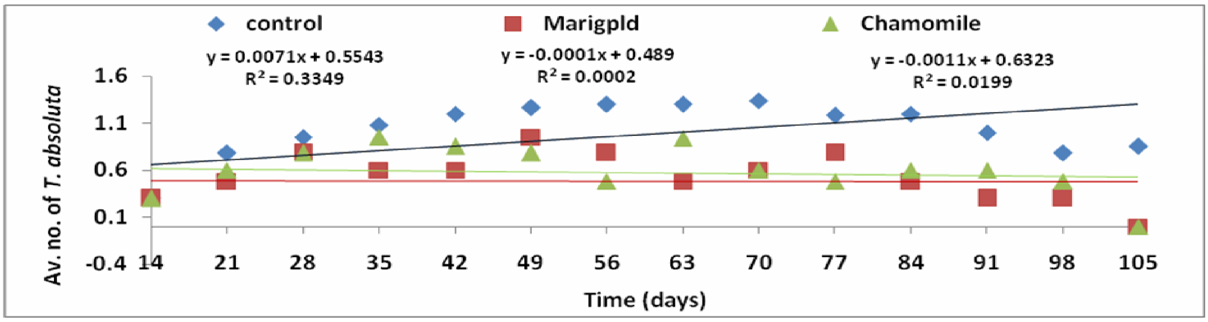
Data in Fig. 4 illustrated the regression of log number of the predatory *N. tunis* and *M. caliginosa* on time in tomato fields mediated with chamomile and marigold or no forbs (control). The slope of the regression line indicated that both predator populations increased by time in intercropping fields than check fields. The rate of increase of both predators (*N. tunis* and *M. caliginosa*) as represented by the slope value was significantly high in tomato fields mediated with chamomile (in the 1st (0.0082 & 0.0061) and 2nd seasons (0.0086 &0.0079), respectively) and marigold (b- value = (0.0076 & 0.0075) and (0.0087 &0.0116), respectively). Over the same period, the slope in check fields was (0.0007 & 0.004) and (0.0008 & 0.0039) during the 1st and 2nd seasons, respectively



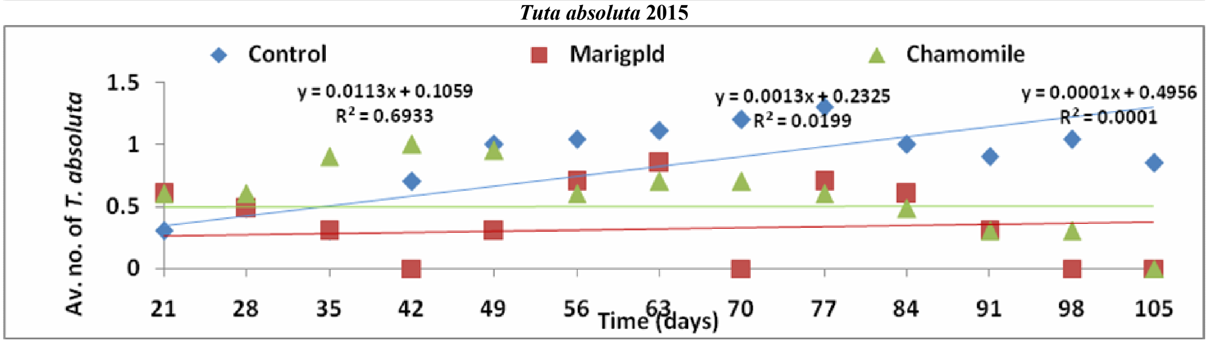
***Bemisia tabaci* 2015**



***Bemisia tabaci* 2016**

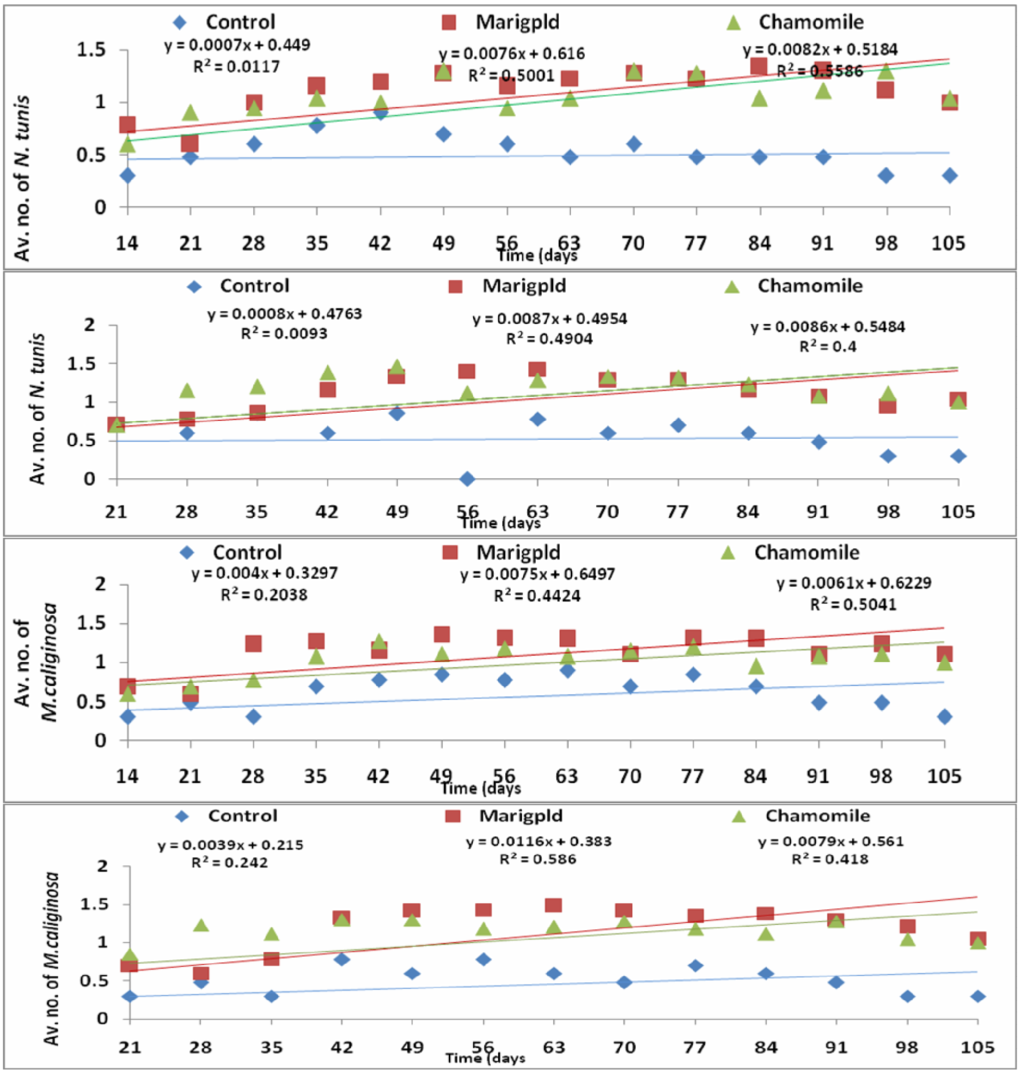


***Tuta absoluta* 2015**



***Tuta absoluta* 2016**

Figure 3. The regression of logistic population of *Bemisia tabaci* and *Tuta absoluta* in days in tomato fields added with either chamomile, marigold plants or no forbs (control) during 2015 and 2016 seasons.



A

B

C

D

Figure 4. The regression of logistic population of *N. tunus* (A and B) and *M. caliginosa* (C and D) in days in tomato fields added with either chamomile, marigold plants or no forbs (control) during 2015 and 2016 years respectively.

Discussion:

The present investigation indicated that the predaceous insects showed differences in their response to host plant species. However, *N. tenuis* and *M.caliginosus* exhibited high preference to chamomile and marigold plants in comparison with the other collected predators (*C. undecimpunctata, Chry. Carnea* , and *S. corolla*). According to Colley and Luna (2000) natural enemies are selective in their flower feeding and show preferences for certain plant species. Difference in predator response to the tested host plants may be attributed to physical (color) or chemical stimulants (kairomone) produced by the plant species and may explain variation of natural enemy's preference (Abd El-Kareim *et al* ,2007).

Surveying the insect predators associated with chamomile, and marigold plants assured that the most dominant predators were *N. tenuis*, *M. caliginosus*.. As mentioned by other authors, these predators were recorded as important natural enemies associated with chamomile and marigold plants (Hammad, 2006 and Marouf (2011). According to Khafagy (2015), *N.tenuis* is considered a major natural enemy of insect pests on tomato crops in the Mediterranean region. Abd El-Kareim *et al* (2007), Rannback (2008) and Marouf (2011) demonstrated that the beneficial insectary plant species are selective towards natural enemies and not favor pest insects in addition the attraction to nectar of the tested plant species were found to be both attractive and having accessible nectar to predators. So, the present study indicates that flowers differ in both accessibility and attractiveness.

The obtained data obviously cleared that the presence of flowering (chamomile and marigold) plants in *Solanum lycopersicum* plots increases the abundance of insect predators (*N. tenuis* and *M.caliginosus*). They caused considerable reduction of *Bemisia tabaci* and *Tuta absoluta* populations in treated plots compared to the control. The present data agree with those obtained by Khafagy (2015) that intercropping aromatic plants (geranium, spearmint, rosemary and sweet basil) with tomato plantations reduces the infestation percentage with *T. absoluta* . Also, Calvo *et al*. (2012) and Perez-Hedo and Uraneja (2015)indicated that the mirid predators (*Macrolophus pyamaeus, N. Tunis*) proved to be efficient predators against *B tabaci* and *T. absoluta* in tomato fields. *N.tenuis* is considered a major natural enemy of insect pests on tomato crops and contributes to the control of whitefly and other tomato pests), perdikis *et al* (2009), Similar conclusion was obtained by Irvin *et al*. (2006) Rebek *et a*l. (2006) and (Marouf,2011) that flower in *Pisum .sativum* plots increase the abundance of insect predators.

So, it could be concluded that both chamomile and marigold proved to be a useful tools in conservation of insect predators through habitat management to have the potential to increase biological control against *B tabaci* and *T. absoluta* in tomato fields.

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النباتات الآوية للحشرات و إدارة الموطن لتعزيز نشاط بعض المفترسات الحشرية على الذبابة البيضاء والتوتا ابسليوتا فى حقول الطماطم

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تم تقييم كل من نبات شيح البابونج *Matricaria chamomilla* L, ونبات الاقحوان *Callendula officinalis* كنباتات آوية للمفترسات ودورها فى خفض تعداد الذبابة البيضاء و التوتا ابسليوتا فى حقول الطماطم. أوضحت النتائج خلال موسمين متتالين (2016/2015,2015/2014) أن نبات شيح البابونج يأوى خمسة أنواع من المفترسات بوفرة عددية وهى: (Reuter) *Nsidiocoris tenuis* و Wagner *Macrolophus caliginosus*, يليهما ابو العيد 11 نقطة وأسد المن وذبابة السرفس على التوالى. بينما تم تسجيل ثلاثة أنواع من المفترسات على نبات الاقحوان وهى: *N. tenuis, M. caliginosus* و أبو العيد 11 نقطة على التوالى. كما أثبتت الدراسة أن زراعة بعض المساحات من نبات شيح البابونج أو الأقحوان فى حقول الطماطم أدت إلى زيادة فى الوفرة العددية لأنواع البق المفترس *M. caliginosus*, يل*N. tenuis* بالإضافة إلى حدوث إنخفاض معنوى فى تعداد كل من الذبابة البيضاء و التوتا ابسليوتا بالمقارنه بالكنترول. ولهذا تشير الدراسة إلى أن البابونج و الاقحوان من النباتات الآوية للمفترسات والتى يمكن استخدامها فى صيانة المفترسات كعوامل مكافحة حيوية ضد الذبابة البيضاء والتوتا ابسليوتا على محصول الطماطم . .