



POPULATION DENSITY OF *Thrips tabaci* Lindeman ON ONION IN RELATION TO PLANTING DISTANCES, INTERCROPPING SYSTEMS WITH GARLIC VARIETIES, AND YIELD

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ABSTRACT

The present study was conducted to determine the effect of planting distances (5, 10 and 15 cm.), intercropping with onion plants and two garlic varieties (Egyptian and Chinese) on population fluctuation of *Thrips tabaci* Lindeman on onion plants during two successive seasons (2017 /2018 and 2018 / 2019) in Assiut Governorate, Egypt. Results indicated that the three mentioned variables showed significant results on the population of *T. tabaci* . The plant distances were the most significant factor, with the highest numbers of thrips closest spacing (5 cm.) between plants. The intercropped garlic with onion showed that the garlic harbored lowest numbers of the pest. Meanwhile, in onion solo the density of pest was higher in onion compared to intercropped one with garlic. Onion with Egyptian garlic variety showed lower numbers of the pest than the onion with chinese garlic variety. The highest yield of onions was gained when the distance between plants was (10 cm.). However, onions loaded with garlic showed lower yield than onions grown separately during the seasons of study.

Keywords: *Onion, garlic, planting distances, intercropping with garlic varieties, Thrips tabaci , population, yield.*

INTRODUCTION

In Egypt, onion (*Allium cepa* L.) is an important field crop for local consumption and exportation. Onion plantations are subjected to infestation with various insect pests that affect crop quality and quantity (Mahmoud, 2008). Onion plantations are target for insect pests attack throughout their different growth stages. However, onion plantations are subject to be infested by among which dominate *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) in onion fields. According to the statistics of the Ministry of Agriculture and Land Reclamation the total area cultivated with garlic in Assiut Governorate in 2018 exceeded 3743 feddan.

Recently, great attention has been given to increase cultivated area of onion. Increasing the crop production could be achieved by planting heavy yielding varieties and / or improving the agricultural practices (Nassar *et al.*, 1972) and Foda *et al.*, 1977). Onion thrips *T. tabaci* is one of the main insect pests infesting onion crops causing severe damage by it always reduces the yield (El-Sherif, 1971) and (Shoeib and Hosny, 1972) in Egypt reported that *T. tabaci* was the major insect pest attacking onion plants. Also, Abd-El- Wahab (2004) reported that *Thrips tabaci* occurs on all Alliaceae crops. This pest is a worldwide one and has an extensive host range that

includes more than 200 plant species in Egypt include the works of Karaman (1970), Khalil *et al.* (1971), Haydar and Sherif (1987), Abd El-Ghany (1997), El-Gendi (1998), Salman (2000), Massry (2002), Sabra *et al.* (2007), Mahmoud (2008), El-Sherif and Mahmoud (2008), Amro *et al.* (2009), Awadalla *et al.* (2011) and El-Fakharany *et al.* (2012). Relevant investigations abroad include the studies of El-Serwi *et al.* (1985) in Iraq, Kalafchi *et al.* (2006) in Iran Edelson *et al.* (1986), Duchovskiene (2006), John Diaz *et al.* (2011) and Elaine *et al.* (2014) in USA, Lu and Lee (1987) in Taiwan, Lorine and Dunier (1988) in Brazil, Maher & Shafiq (2014), Neetu & Virendra (2016) in India and Tadele & Amin (2014), Gebretsadkan (2017) in Ethiopia.

Most of investigations dealt with biology and ecology of *T. tabaci*, while little attention was given to the effect of some agricultural practices on the onion thrips infestations. The present study was undertaken to study the effect of different planting distances of onion, and intercropping onion plantations with two garlic varieties on the density of *T. tabaci* with reference to onion yield.

MATERIALS AND METHODS

This work was carried out in selected farmer fields planted with the commonly grown onion cultivar "Giza 6 Mohassan" at Assiut Governorate during the two successive onion growing seasons of 2017 /2018 and 2018 / 2019. An area of about 1/4 feddan was divided into three experiments. onion were sown on early-November. Each experiment was designed in (RCBD) randomized complete block design with four replications. The first

experiment for investigate different planting distances (5, 10 and 15 cm.). The second experiment used for study the effect of intercropping of onion plants with garlic varieties (1 : 1, onion : garlic Egyptian and Chinese varieties alternate rows compared with sole onion). Normal agricultural practices of growing onion were followed and no insecticides were applied during the study period. One month after planting, five onion plants were collected from replicate at quarter – monthly intervals, thus making a total sample size of 20 plants from the whole treatment. Samples were collected at 7- 8 a.m. from the beginning of December until the early of April. Samples were introduced into clean cloth bags, and then transferred to the laboratory where they were examined for the occurrence and count the adults and larvae of Thrips. The obtained data were statistically analyzed for variance according to Sndecor and Cochran (1967). The mean values were compared at 5% levels of least significant differences, for each season.

RESULTS AND DISCUSSION

The mean numbers of the pest in each treatment were counted and recorded in Tables (1, 2, 3, and 4). The effect of the three factors (i. e. planting distances of onion, intercropping with two garlic varieties) on the population density of *T. tabaci* on onion plants during the two successive seasons were presented as follows:

1. Planting distances of onion and population density of *T. tabaci*:

The planting distance affected significantly the mean numbers of *T. tabaci* infesting garlic plants (Table 1). The mean numbers of *T. tabaci* per plant in 2017 /

2018 season were 302.0, 263.7 and 208.2 individuals / plant, when planted 5, 10 and 15 cm. apart, respectively. In the second season (2018 / 2019) the corresponding means were high than those of the first season (327.4, 262.9 and 219.1 individuals / plant) in onion plants. Statistical analysis of thrips numbers per onion plant at the three planting distances produced highly significant differences between the mean numbers of thrips at tested planting distances in the both seasons. The results indicated that the widest distances for planting garlic of (15 cm.) led to the lowest infestation levels by *T. tabaci* in both seasons (208.2 and 219.1) thrips individuals / plant,

during two seasons, respectively. Whereas the highest numbers of thrips closest spacing (5 cm.) between plants (302.0 and 327.4) thrips individuals / plant, during two seasons, respectively. While there was a distance of (10 cm.) between onion plants with moderate infestation, where thrips numbers were recorded (263.7 and 262.9) individuals / plant, during the two seasons, respectively. Similar results were reported by Abd El- Ghany (1997), Maksoud et al. (1983) and Mahmoud (2014) who found that, increasing the crop production of onion could be achieved by planting at wider space.

Table (1): Effect of planting distances of onion on the population of *T. tabaci*, during two seasons in Assiut Governorate, Egypt.

Planting distances (cm)		Mean number of <i>T. tabaci</i> / plant					
		5	10	15	5	10	15
Month	Quarter	2017 /2018			2018 / 2019		
Dec.	1	1.3	1.1	0.9	1.9	1.5	1.6
	2	2.5	2.3	1.3	2.3	2.8	1.9
	3	2.9	2.5	2.8	5.5	3.7	3.3
	4	4.1	4.2	2.9	5.1	5.7	2.9
Jan.	1	7.4	6.5	5.4	4.8	4.7	4.4
	2	5.9	8.5	6.2	8.4	4.6	5.7
	3	12.8	8.9	12.1	13.7	9.4	8.8
	4	13.4	12.7	8.4	16.9	13.8	7.6
Feb.	1	16.0	15.6	13.3	27.8	20.4	12.6
	2	21.5	20.8	20.2	34.6	25.0	18.1
	3	24.5	23.9	16.0	33.2	27.4	22.7
	4	29.5	25.6	19.2	41.8	35.8	34.6
March	1	39.6	31.4	26.4	37.1	34.2	29.9
	2	51.8	42.9	33.6	45.3	32.2	28.4
	3	39.7	33.8	22.2	25.8	17.8	18.7
	4	15.6	12.0	9.4	15.6	14.3	11.4
April	1	13.5	11.0	7.9	7.6	9.6	6.5
Total		302.0 a	263.7 b	208.2 c	327.4 a	262.9 b	219.1 c
F.(0.05) Between treatments		39.89**			27.54**		
L.S.D.(0.05) Between treatments		9.36			11.89		

* Significant at 5 % level of probability

2- Planting distances and population density of *T. tabaci*, and yield:

Data in Table (2) and Fig. (1) showed that, plant distance (10 cm.) gave the highest total yield (14.235 and 13.875 ; out of total mean 14.055 ton / fed. of both seasons; respectively). However, (5 cm.) distance gave the lowest value (11.915 and 11.584 out of total mean 11.7495 ton / fed. of both seasons; respectively). The present

results are in agreement with those obtained by [Stoffella *et al.* (2000), Kanton *et al.* (2003), Nasir *et al.* (2007), Amro *et al.* (2009), Xingang Zhou *et al.* (2011), Haider *et al.* (2014), Bleasdale (2015), McGeary (2015), Harsimran *et al.* (2015), Maher *et al.* (2017). who reported that the increase in plant density resulted reduction in plant size, mean bulb weight, plant fresh and dry weights and number of leaves.

Table (2): Effect of planting distances of onion plants and population density of *T.tabaci*, on yield (ton / fed) in during 2017 /2018 and 2018 / 2019 seasons at Assiut Governorate.

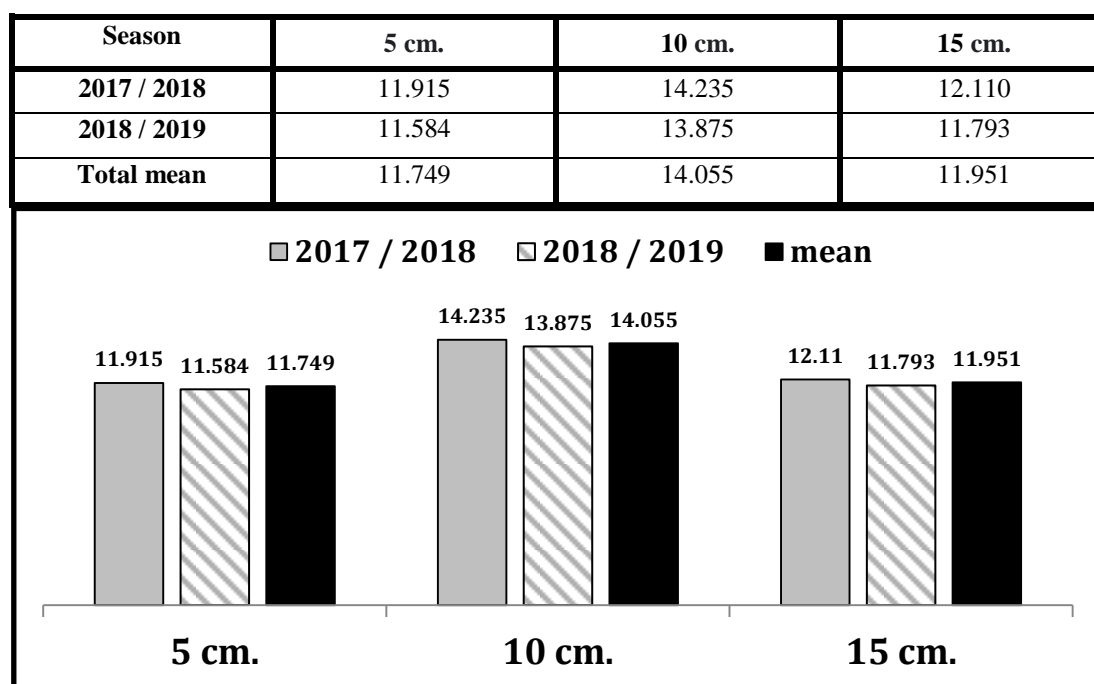


Fig. (1): Effect of planting distances of onion plants and the population density of *T. tabaci*, on yield (ton / fed) during 2017 /2018 and 2018 / 2019 seasons at Assiut Governorate.

3- Effect of intercropping of onion plants with garlic varieties on the population density of *T. tabaci*:

The effect of intercropping of onion with garlic plants on *T. tabaci* population

(Table 3). Showed that the high significant differences in

Table (3): Effect of intercropping of onion plants with garlic varieties (Egyptian and Chinese) on the population of *T. tabaci* compared with the solely onion plants, during 2017 /2018 and 2018 / 2019 seasons at Assiut Governorate.

Intercropping system Inspection date		Mean number of <i>T. tabaci</i> / plant							
		Onion with Egyptian Garlic		Onion solely		Onion with Chinese Garlic		Onion solely	
Month	Quarter	2017 / 2018	2018 / 2019	2017 / 2018	2018 / 2019	2017 / 2018	2018 / 2019	2017 / 2018	2018 / 2019
Dec.	1	0.6	0.9	1.0	1.4	0.8	0.7	1.2	1.1
	2	1.3	1.5	1.7	2.1	1.5	1.3	2.2	2.5
	3	1.7	1.9	2.9	3.5	1.6	1.3	3.8	4.9
	4	1.9	2.2	4.1	3.8	2.6	2.7	9.4	11.2
Jan.	1	2.6	2.6	7.3	4.7	2.8	4.3	12.0	15.2
	2	3.1	2.7	5.8	6.4	4.2	6.4	19.3	20.0
	3	4.9	3.4	12.3	11.5	7.4	7.1	25.2	19.3
	4	4.8	4.7	11.4	16.1	7.6	17.1	27.5	24.3
Feb.	1	5.5	7.0	14.0	26.4	11.2	12.2	47.6	34.2
	2	6.3	7.9	19.5	27.6	19.1	16.0	48.1	32.5
	3	6.9	9.8	25.5	30.2	23.2	14.0	47.7	44.7
	4	9.0	8.9	32.5	39.4	32.5	17.5	57.2	49.5
Mar.	1	8.9	11.5	39.4	36.1	31.2	27.0	55.7	44.4
	2	5.5	7.6	37.3	38.2	16.8	17.7	49.0	47.7
	3	5.7	8.9	29.6	25.8	11.9	10.2	21.1	36.8
	4	4.5	6.1	11.9	13.6	8.4	11.4	15.7	27.4
April	1	1.7	2.3	9.8	8.4	4.8	5.3	12.5	12.9
Total		74.9	93.6	266	295.2	187.6	172.2	455.2	428.6
F.(0.05) Between treatments		365.2**				321.7**			
L.S.D.(0.05) Between treatments		6.48				8.57			

* Significant at 5 % level of probability

onion characters in mono and maxed cultures during 2017 / 2018 and 2018 / 2019, seasons. Similar results were recorded in both varieties (onion with garlic Egyptian and garlic Chinese) during both seasons. Also, data illustrated in Table (3) showed that, the rate of infestation was higher on the sole onion plants [(266 & 295.2) and (74.9 & 93.6) individuals / plant] compared with intercropping Egyptian garlic, respectively in both seasons. The same trend was noticed throughout the Chinese garlic variety. The results indicate that the rate of infestation was higher on the sole onion than on these intercropped with Chinese garlic plants [(455.2 & 428.6) and (187.6 & 172.2) individuals / plant] compared with

intercropping garlic Chinese, respectively in both seasons. Generally the obtained data indicated that the lowest mean of *T. tabaci* occurred in the intercropped onion plants with two garlic varieties in both seasons.

4- Effect of intercropping of onion plants with garlic varieties and the population density of *T. tabaci*, on yield:

The data presented in (Table 4; Fig. 2) showed decrease in all results of yield due to intercropping onion on Egyptian garlic and onion on Chinese garlic (7.412 and 6.724 ton / fed.) in season 2017 / 2018. Also, gave the result in season 2018 / 2019 (7.220 and 6.820 ton / fed.), respectively for Egyptian and Chinese variety. The highest values of yield were observed in onion solely

during the seasons (14.343, 13.975 and 13.910, 13.678 ton / fed. respectively for the first and second season). Similar results are

in agreement with the findings of Stanislav Trdan et al.(2006) and Abou-Keriasha *et al.* (2013).

Table (4):Effect of intercropping of onion plants with garlic varieties and the population density of *T. tabaci*, on yield (ton / fed) during 2017 / 2018 and 2018 / 2019 seasons at Assiut Governorate.

Season	Onion with Egyptian Garlic	Onion solely.	Onion with Chinese Garlic	Onion solely
2017 / 2018	7.412	14.343	6.724	13.910
2018 / 2019	7.220	13.975	6.820	13.678
Total mean	7.316	14.159	6.772	13.794

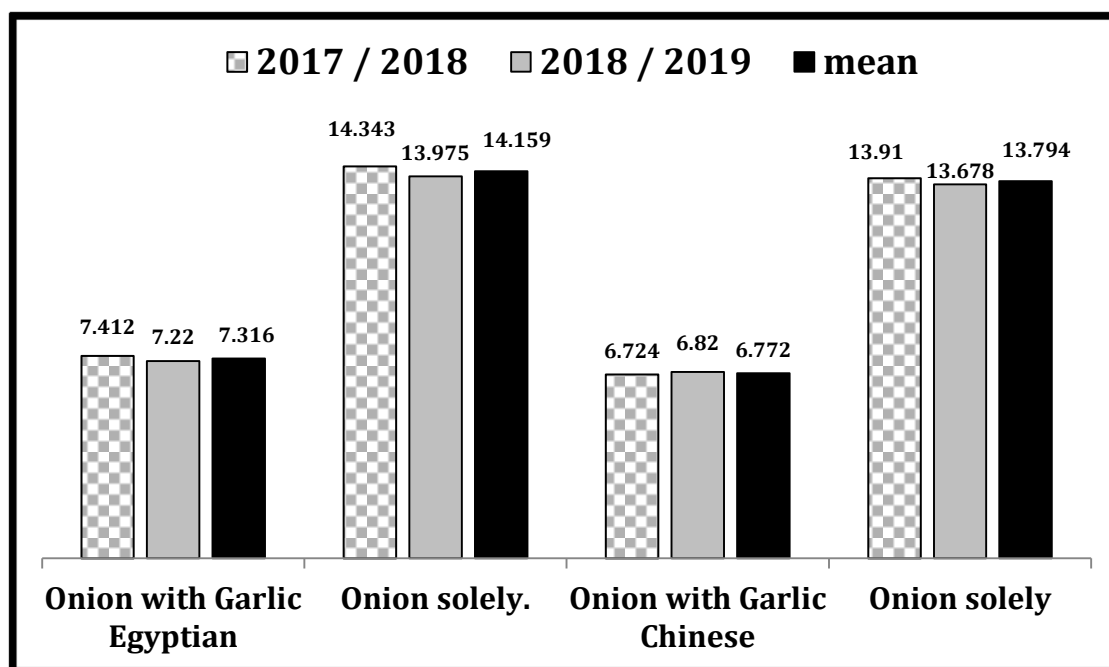


Fig. (2):Effect of intercropping of onion plants with garlic varieties and the population density of *Thrips tabaci*, on yield (ton / fed) during 2017 / 2018 and 2018 / 2019 seasons at Assiut Governorate.

5- Effect of garlic varieties on the population density of *T. tabaci*:

Both garlic varieties showed highly susceptible to the infestation by *T. tabaci* (Table 5).. At the beginning of the season, means of thrips individuals on garlic plants started with low fluctuation numbers ranged from 1.1- 1.4 individuals / plant of Egyptian variety and 1.6 - 1.8 on Chinese variety. The individuals of *T. tabaci* increased gradually throughout the growing

period of both varieties. The highest denesity of thrips was detected during the period from February till harvesting. These results may be confirmed those previously reported by Lorine and Dunier (1988), in Brazil, who indicated that with low *T. tabaci* infestation rate to garlic plants (less than 1.0 means of individuals/ plant) occurred at early time, then infestation increased to reach 174.6 means of individuals / plant. Additionally, similar results were reported

by Abd El-Ghany (1997), Massry (2002), El-Fakharany *et al.* (2012) and Mahmoud (2014) in Egypt, whom indicated that the population of *T. tabaci* at the beginning of

the season was in low fluctuation then increased throughout the growing season (Extending from February to end of the season).

Table (5): Effect of garlic varieties on the population of *T. tabaci*, during 2017 / 2018 and 2018 / 2019 seasons at Assiut Governorate.

Garlic Varieties		Mean number of <i>T. tabaci</i> / plant			
		Egyptian Garlic	Chinese Garlic	Egyptian Garlic	Chinese Garlic
Inspection date	Month	2017 / 2018		2018 / 2019	
		Quarter			
Dec.	1	1.1	1.6	1.4	1.8
	2	1.7	2.4	2.0	3.6
	3	2.9	3.4	3.5	5.5
	4	5.1	7.4	3.9	12.2
Jan.	1	7.3	12.0	6.3	13.7
	2	9.5	15.3	6.4	20.3
	3	12.3	27.2	11.8	19.3
	4	11.4	24.5	16.1	30.3
Feb.	1	17.0	39.6	25.4	33.2
	2	21.5	45.1	32.6	36.5
	3	27.3	53.3	30.2	42.7
	4	32.2	55.2	41.6	46.7
Mar.	1	39.5	53.7	36.1	44.1
	2	41.4	40.0	42.4	41.5
	3	31.7	21.2	24.9	36.3
	4	11.5	13.8	14.7	17.6
April	1	11.1	12.1	9.2	12.8
Total		284.5	427.8	308.5	418.1
F.(0.05) Between treatments		120.3**		59.34**	
L.S.D.(0.05) Between treatments		10.02		10.86	

* Significant at 5 % level of probability

Finally, it can be concluded that the tested garlic varieties showed different significance in their susceptibility to pest invasion. The whole season mean numbers of thrips on Egyptian variety were 284.5 and 308.5 individuals per plant in 2017 / 2018 and 2018 / 2019 seasons, respectively. The corresponding counts on the Chinese variety were 427.8 and 418.1 individuals per plant, respectively for the same mentioned order of seasons. The differences of these counts on plants of the two varieties were significant. Generally the obtained data

indicated that the lowest mean of *T. tabaci* infestation on Egyptian variety, while the Chinese variety was the most susceptibility to the pest. The present results are in agreement with the findings of Abd El-Ghany (1997) and Amro *et al.* (2009) in Egypt, mentioned that the differences of these counts of thrips on plants of the two garlic varieties were shown to be significant. In this regard Darshan *et al.* (1986) found that the varieties of onion and garlic, in the field in Punjab, showed great differences in their natural infestation by *Thrips tabaci*.

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الكثافة العددية لحشرات تريبس البصل على البصل وعلاقتها بمسافات الزراعة والتحميل مع أصناف الثوم والمحصول

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الملخص العربى

تضمنت هذه الدراسة تأثير بعض العمليات الزراعية مثل مسافات الزراعة (٥ ، ١٠ ، ١٥ سم) و تحميل البصل على أصناف الثوم (المصرى والصينى) وكذلك تأثير أصناف الثوم على تعداد حشرات التريبس وذلك خلال موسمين متعاقبين (٢٠١٧ - ٢٠١٨ ، ٢٠١٨ - ٢٠١٩) في محافظة أسيوط. أوضحت النتائج أن جميع العوامل المختبرة كانت مؤثرة بدرجة معنوية على تعداد حشرة التريبس في حقول البصل. كما أوضحت النتائج أن مسافات الزراعة كان لها تأثير معنوى جدا على تعداد التريبس حيث سجل أعلى تعداد للتريبس عند الزراعة على مسافة (٥ سم) بين النباتات. كما أظهرت نتائج تحميل البصل على الثوم أن لنباتات الثوم لة تأثير واضح ومعنوى على تعداد حشرة التريبس حيث وجد أن متوسط أعداد هذه الافة أنخفضت على نباتات البصل المحملة على الثوم عن تلك المنزرعة منفردا. أيضا وجد أن حشرة تريبس البصل لها القدرة على اصابة جميع أصناف الثوم المختبرة ولكن تتفاوت شدة الاصابة من صنف لآخر حيث أظهرت النتائج أن صنف الثوم الصينى سجل أعلى اصابة بالتريبس عن الصنف المصرى. كما لوحظ أن اعلى محصول من البصل أعطى عندما كانت المسافة بين النباتات (١٠ سم) ، كما أدى تحميل البصل مع الثوم الى الحصول على محصول أقل عن البصل المنزرع منفردا وذلك خلال موسمى الدراسة.