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INTEGRATION BETWEEN TRANSPLANTING DATE AND CULTIVAR TYPE IN MANAGEMENT POPULATION OF ONION THRIPS (THYSANOPTERA: THRIPIDAE) ATTACKING ONION PLANTS IN THE FIELD CONDITIONS

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Abstract

Onion thrips *Thripstabaci* (lind.) is one of the most economically important pests of onion for its high reproductively rate, short generation time and ability on damage onion plants during season growth. The main goal of this study is to evaluate the response of thrips population towards transplanting dates (early, middle and late transplanting date) and towards onion cultivars: Giza 20 (yellow onion) and Ahmartantawi (red onion) during winter seasons of 2013/ 2014, 2014/ 2015 and 2015/ 2016, as well as evaluate insect development and onion productivity. Results showed that *T.tabaci* passed by 1- 3 periods of activity on plants of both cultivars that transplanted on three dates during different seasons. Thrips population reached its maximum count in March, April and May, indicating to favorability of these periods for insect activity and reproduction. Seasonal average of thrips population on Giza 20 plants were ranged between 19.97 and 52.51 individual/ plant, whilst on Ahmartantawi plants, ranged between 16.77 and 44.17 individuals/ plant. It is argued that onion plants cultivar "Ahmartantawi" had attacked and harbored the lower population of thrips than Giza 20 plants, it was higher by 24.8% in Giza 20 comparing with another one. As well as plants transplanted in early date had attacked and harbored the lowest population of thrips among the transplanting dates, it was higher by 51.25 and 121.04% in plants of middle and late transplanting comparing with the early one.

Key words: *Thripstabaci*, Giza 20 cultivar, Ahmartantwi cultivar, population.

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INTRODUCTION

Onion, *Allium Cepa* L.(Alliaceae) is one of the most important crops in agricultural economy, in human feeding, processing and exportation. Onion consumption had been significantly increased in the world for its health benefits (wang*et al* 2006). Onion thrips *Thripstabaci* was consider the most economically insect injurious onion crops worldwide (Hill 1975, Ferrari 1980, Srinivasan *et al*1981, Sinha *et al* 184, Fournier *et al* 1995, Martin *et al* 2006, Shiberu and Mahammed 2014 and Gill *et al* 2015). Thrips are the most injurious insect on onion plants during their seasonal growthin Egypt (El-Saadany*et al* 1975, El-Serwy*et al* 1985, El-Saadany and Salman 2000, Sallam and Hosney 2003, Salem and Abdelaziz 2010 and Temerak*et al* 2015). Feeding injury by thrips resulted in punching leaf surface and extracting sap from plant cells, then attack plant contents and consume mesophyll cells, this followed by loss in chlorophyll and reduction in photosynthetic efficiency (Brooks and Halstead 1983, Kendall and Capinera 1987 and Boateng*et al* 2014). Damage represented in silvery-patches discoloration or streaks on the leaves (Rueda and Shetton 1995). Merene (2005) found that yield loss caused by onion thrips was ranged from 26 to 57%; another study revealed that yield losses were between 10 and 85%.

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Population density and fluctuation of *T.tabaci* on onion and other winter crops attracted the attention of many authors as Abou-Elhagag and Ezzel-Din (2002), Salem (2002)[a,b], Salem *et al* (2004), Kalafchi*et al* (2006), Douchovskene (2006), Amro*et al* (2009), Salem Abdelaziz (2010) and Temerak*et al* (2015).

Using insecticides in control of onion thrips on onion plants during season growth (from transplanting until harvesting bulbs) need at least 10 sprays or need weekly spraying (Edelson*et al* 1986, Edelson*et al* 1989 and Mohandessi*et al* (2015), this result in high costs and hazards. Therefore the main goal of this study is to evaluate the response of onion thrips population towards three transplantation dates (early, middle and late transplanting date) and towards two onion cultivars (Giza 20 from yellow onions, and Ahmartantawi from red onions) during winter seasons of 2013/2014 , 2014/2015 and 2015/2016; as well as evaluate thrips population development in different transplanting dates and cultivars and the resulted yield.

MATERIAL AND METHODS

Experiment preparation and transplanting: This work was carried out at Sharkeia Governorate during three winter seasons of 2013/2014, 2014/2015 and 2015/2016. To modify the onion cultivar and transplanting date aiming to management the onion thrips on onion fields, two onion cultivars were used: Giza 20 cultivar from yellow onions and Ahmartantawi from red onions. Seedlings of each cultivar was transplanted on three dates each year, the first transplanting date was done on 15 December (early transplanting date), the middle transplanting date was done after 25 days of the early one and the late transplanting had 25 days intervals from the middle one. Seedlings of the two cultivars transplanted at 8 weeks age. In early transplanting date, the seedlings of each cultivar were transplanted in four experimental plots (replicates) each plot about 20 m^2, experimental area for the early transplanting date was about (1/24 fed., Feddan = 4200 m^2).
The same treatments and replicates were accomplished in both middle and late transplanting dates by the same manner. All experimental plots were received normal and recommended agricultural practices; and no insecticides were used.

Thrips monitoring: Thrips density among different cultivars and transplanting dates as the plant grow (in relation to plant age) was done through in situ examination of the onion plants using hand lens, and opening the neck of plants for visual inspection and counting for onion thrips nymphs and adults, examined plants every week were selected randomly (Edelson*et al* 986, Shelton *et al* 1987, Fournier *et al* 1995, Salman 2000, Dent 2000, El-saadany and salman 2000 and Mohandessi*et al* 2015. Sample size of the six treatments were represented in 120 inspected plants by rate of 20 plants / treatment and 5 plants / replicate. Weekly mean counts of thrips individuals turned into seasonal average, percent of increase in insect population due to cultivar or transplanting date were also calculated.

Rate of increas in thrips population was calculated in days according to Freier (1983), $a = \frac{0.9}{p3 - p2}$

where: a = coefficient of daily rate of increase, P1=phase 1 (time passeduntil the first infestation appearance, P2=Phase 2 (time passed until the insect population reached 10% from the maximum population), P3=Phase3 (time passed until the insect population reached its maximum).

Evaluation the final damage and onion productivity: In season 2015/2015, at plant maturity, samples of 20 bulbs from each treatment were taken, inspected, dried and weighed, as well as bulbs diameter were measured according to Shilberu and Mahammed (2014). Then, onion productivity/fed. was evaluated; and turned into percents of decrease in productivity in onions comparing with the productivity of early transplanting date or Ahmartantawi cultivar. Impact of cultivar on infestation and production were considered, regardless the transplanting dates; as well as impact of transplanting dates on infestation and productions were considered regardless onion cultivar.

RESULTS AND DISCUSSION

Thrips density among different cultivars and transplanting dates: On early transplanting date and Giza 20 cultivar: Data in Table (1) clear that onion thrips *Thripstabaci* (Lind) infect onion plants of Giza 20 cultivar with seasonal average of 19.97 , 25.88 and 24.57 individuals / plant in the three successive seasons of 2013/2014, 2014/2015 and 2015/2016, respectively. During each season growth, insect completed two periods of activity. While the highest density of thrips recorded during seasons was 55.6, 58 and 47 individuals plant, when plant age was 98, 112 and 70 days at 22 March, 5 April and 22 February, respectively.

On middle transplanting date: Date in Table (2) clear that *T. tabaci* had seasonal average of 31.38 , 36.28 and 35.09 individuals / plant in three season, respectively. Insect completed three periods of activity during season growth. The highest density of thrips recorded during seasons was 77.2 , 72.0 and 72.8 individuals / plant when plant ages was 99,113 and 106 day at 19 April, 3 May and 26 April, respectively.

On late transplanting date: Date in Table (3) clear that onion thrips infest onion plants Giza 20 cultivar with seasonal average of 45.74, 54.49 and 52.51 individuals / plant in seasons of 2013/2014, 2014/2015, and 2015/2016, respectively. Insect completed two periods of activity / season. The highest density of thrips

recorded during seasons was 109.6, 145.4 and 120.0 individuals / plant, when plant ages was 108, 115 and 115 day at 24 May at 24 May, 31 May and 31 May, respectively.

On early transplanting date and Ahmartantawi cultivar: Data in Table (1) clear that onion thrips infest onion plants of Ahmartantawi cultivar with seasonal average equal 16.77, 19.05 and 18.01 individuals/plant in three successive winter seasons of 2013/2014, 2014/2015 and 2015/2016 respectively.

Table 1. Mean counts of *Thripstabaci* / plant on two onion cultivars transplanted on early date at sharkeia Governorate during 2013-2016 seasons.

Inspection date	Plant age (in days)	Mean counts of individuals / plant					
		Giza 20			Ahmartantawi		
		2013/ 2014	2014/ 2015	2015/ 2016	2013/ 2014	2014/ 2015	2015/ 2016
December 22	7	0.0	3.0	2.6	0.2	0.3	0.2
29	14	1.0	5.0	4.0	0.3	0.6	0.4
January 4	21	0.8	7.0	4.8	0.6	0.9	0.9
11	28	0.6	2.0	1.8	0.8	2.0	1.6
18	35	2.0	3.0	3.0	5.0	5.0	4.0
25	42	17.0	22.0	20.0	8.0	9.0	8.2
February 1	49	21.6	23.6	22.4	11.0	12.0	11.6
8	56	32.6	24	29.6	18.0	15.0	17.0
15	63	29.6	42.8	36.8	24.0	26.9	26.2
22	70	26.8	45.8	47	28	32	30
March 1	77	26.2	31	29	32	34	33.6
8	84	22.2	29.6	26.4	34	46	40
15	91	35	30	33	38	48	43.8
22	98	55.6	34	46.8	36	35	35.4
29	105	41.6	45	44	28	29	28
April 5	112	22.2	58	45	20	21	20
12	119	12.8	31.8	24	12	17.2	15.2
19	126	11.8	28.2	22	6	9	8
Total		359.4	465.8	442.2	301	342.9	324.1
Mean		19.97	25.88	24.57	16.77	19.05	18.01

Table 2. Mean counts of *Thripstabaci* / plant on two onion cultivars transplanted on middle date at Sharkeia Governorate during 2013-2016 seasons.

Inspection date	Plant age (in days)	Mean counts of individuals / plant					
		Giza 20			Ahmartantawi		
		2013/ 2014	2014/ 2015	2015/ 2016	2013/ 2014	2014/ 2015	2015/ 2016
January 18	8	0.8	0.2	0.6	0.2	0.2	0.4
25	15	9.2	5.8	7.6	0.6	0.8	0.6
February 1	22	15.0	18.0	17.0	1.2	1.8	1.4
8	29	10.2	15.0	14.6	1.8	2.6	2.2
15	36	11.2	13.0	12.6	13.8	15.8	14.8
22	43	15.8	22.0	19.8	14.8	17.6	16.2
March 1	50	22.2	25.0	24	27.2	29.8	28.6
8	57	41.6	37.0	39.6	38.0	51.4	45
15	64	45.6	62.8	56.0	50.0	43.6	47.2
22	71	39.2	49.8	47.0	52.0	34.6	43.6
29	78	40.8	50.2	46.0	55.0	51.8	53.6
April 5	85	30.2	42.8	37.8	59.0	69.2	64.2
12	92	61.2	48.0	57.0	53.0	62.6	58.0
19	99	77.2	50.0	65.0	42.0	54.6	49.0
26	106	71.6	71.8	72.8	32.0	38.2	35.2
May 3	113	34.8	72.0	58.0	19.0	21.2	20.2
10	120	25.6	56.8	42.6	15.0	21.0	18.0
17	127	12.6	12.8	13.6	11.0	19.0	15.0
Total		564.8	653	631.6	485.6	535.8	513.2
Mean		31.38	36.28	35.09	26.98	29.77	28.51

Table 3. Mean counts of *Thripstabaci* / plant on two onion cultivars transplanted on thelate date at Sharkeia Governorate during 2013-2016 seasons.

Inspection date	Plant age (in days)	Mean counts of individuals / plant					
		Giza 20			Ahmartantawi		
		2013/ 2014	2014/ 2015	2015/ 2016	2013/ 2014	2014/ 2015	2015/ 2016
February 15	10	8.0	7.0	8.0	1.0	7.0	4.0
22	17	10.0	14.0	13.0	2.4	2.0	2.2
March 1	24	22.0	22.0	23.0	4.0	1.0	2.6
8	31	25.8	20.2	24.2	4.4	2.0	3.4
15	38	27.0	18.6	24.2	5.0	6.0	5.6
22	45	31.2	47.6	41.8	5.8	9.0	8.0
29	52	39.2	49.6	46.8	15.4	10.0	13.0
April 5	59	50.2	69.8	68.2	18.2	24.0	20.2
12	66	65.6	84.2	78.2	68.2	28.0	48.2
19	73	62.6	77.8	72.8	92.0	141.0	118.0
26	80	58.2	66.6	63.2	83.0	127.0	109.8
May 3	87	59.8	63.2	62.2	71.0	101.0	87.0
10	94	44.2	61.6	59.2	66.6	87.0	77.8
17	101	83.2	71.47	79.8	60.0	81.0	70.8
24	108	109.6	90.6	104	54.0	64.0	59.2
31	115	79.6	145.4	120.0	41.0	40.0	40.4
June 7	122	32.2	47.8	42.2	40.0	40.0	39.8
14	129	14.8	23.4	19.8	32.0	25.0	28.8
Total		823.4	980.8	945.2	664	795	739
Mean		45.74	54.49	52.51	36.89	44.17	41.06

During each of the season growth, thrips did not able to complete more than one period of activity, reaching the highest density of 38, 48 and 43.8 individuals / plant, at plant ages 91 day in 22 March of three seasons, respectively.

On middle transplanting date: Data in Table (2) clear that thrips infest onions by the seasonal average equal 26.98, 29.77 and 28.51 individuals / plant in three seasons, respectively. Insect completed one or two periods of activity, reaching the highest density 59.0, 69.2 and 64.2 individuals / plant, when plant ages was 85 days in 5 April of three seasons, respectively.

On late transplanting date: Data in Table (3) clear that onion plants of Ahmartantawi cultivar were infested with thrips by seasonal average 36.89, 44.17 and 41.06 individuals / plant during winter seasons of 2013/2014, 2014/2015 and 2015/2016, respectively. Insect did not able to complete more than one period of activity in each season, recording its highest density 92.0, 141.0 and 118.0 individuals / plant at plant ages 73 days in 19 April of the three successive seasons, respectively.

In general, it can be concluded that *T.tabaci* completed 1-3 periods of activity in each seaon or each transplanting date on plants of two cuttivars (Tables 1,2 and 3). This agreed with results of Haydar and Sherif (1990), Hamdy and Salem (1994), Salman (2000)[a], Salem and Abd El-Aziz (2010) and Temerak et al (2015) who revealed that thrips had 1-3 peaks of activity on onion plants. On cabbage plants, thrips had one peak on seedlings (Salem 2002)[a] and completed three periods of activity on transplanted cabbage from transplantation time until head formation (Salem *at al* 2004).

Thrips reached its maximum counts on plants of different transplanting dates during March, April and May (Tables 1,2 and 3). This indicate that these periods more suitable for reproduction and activity of insect. This agreed with results of (Hassanein*et al* 1970, Edelson*et al* 1986, Lu and Lee 1987, Haydar and Sherif 1990, Hamdy and Salem 1994, Salem 2000[a], Salem and Abd El-Aziz 2010 and Temerak*et al* 2015) who revealed that the population density of *T. tabaci* was in its highest counts during period elongated from March to May.

Thrips counts on investigated cultivars, or transplanting dated and in the three experimental seasons was almost higher in the second and third seasons 2014/2015 and 2015/2016 than in the first one (Tables 1,2 and 3) this may be due to the prevailing weather factors and to the movement of thrips from neighboring crops to the planted onions; this agreed with Shrick (1951) who stated that thrips can moved from neighboring crops as clove and lucern to infest onion plants. Dent (1991) stated that insect phonology, generation numbers and its abundance in any location depend on environmental factors in this location. Fournier *et al* (1995) stated that climatic conditions between study years 1988 and 1989 had a major effect on the plant response to thrips infestation.

Response of thripsinfestation towards seedlings transplanting dates: Data in Table (4) clear that onion thrips infest onion plants with averages 20.72, 31.34 and 45.8 individuals / plant in the early, middle and

late transplanting dates, respectively, this indicate that middle transplanted plants encourage or attracted thrips infestation with higher population thrips more that occurred in the early one by 51.25%; plants of the late transplanted date attracted insect individuals more than occurred in plants of the early one by 121.04% It is concluded that transplanting of onion plants (any cultivar) able to reduce thrips infestation and density by considerable percents or able to mature plants and escape from heavy infestation and density of thrips occurred later. This agreed with results of Ibrahim (1996) and Salman (2000)[a,b] who reported that retardation in the planting date of onion plants increase incidence and infestation rate by *T. tabaci*. Ibrahim and Adesiyum (2008) revealed that thrips is a major pest of onion in Nigeria and can be managed successfully by early transplanting.

Table 4. Seasonal average of thrips population / plant in three experimental seasons; and the calculated increase in percent of thrips populationdue to the onion cultivar or transplanting date.

Transplanting date	Cultivar			
	Giza 20	Ahmartantawi	Mean	Increase%
Early	23.5	17.94	20.72	———
Middle	34.25	28.42	31.34	51.25
Late	50.91	40.71	45.8	121.04
Mean	36.22	29.02		
Increase %	24.8	———		

Response of thrips towards onion cultivar type: Data in Table (4) clear that thrips infest onion plants (without regarding to the transplanting dates) with averages 36.22 and 29.02 individuals / plant in plants of Giza 20 and Ahmartantawi cultivars, respectively. This indicate that plants of Giza 20 cultivar, attracted thrips and encourage infestation more that occurred in Ahmartantawi plants by 24.8% It is concluded that plants of Ahmertantawi cultivar (at any transplanting date) able to reduce thrips infestation and density by 24.8% than that on Giza 20 cultivar. This may be due to the architecture of onion plants that influence on level of thrips population, where cultivars has flat-sided leaves and compact neck (as Giza 20) protect thrips from natural (enemies and adverse weather factors, but cultivars had round and spaced leaves (as Ahmartantawi) can reduce thrips protection to a minimum level (Jones et al 1935, Coudreit*et al* 1979, Diaz-Monitano*et al* 2012 and Doman *et al* 2014).

Development of thrips population: Data in Tables (5 and 6) clear the developmental parameters of *T. tabaci* on Giza 20 and Ahmartantawi, respectively. In early transplanting date, initial infestation P1 had mean value (9.33 and 7.0), respectively; P2 period elapsed from initial infestation until reached 10% of maximum counts had mean value (11.67 and 16.33 days) respectively; P3 period elapsed until infestation reached its maximum counts (53.53 and 43.27 individuals / plants) was equal in two cultivars (84.0 days), the daily rate of increase in thrips population (a) was equal in both cultivars (0.013). In middle transplanting date P1 had mean value (8.0 days) in two cultivars, P2 was shorter in Giza 20 (2.33 days) than ahmartantwi (21.0 days), P3 was shorter in Ahmartantawi (77.0 days) than in Giza 20 (98.0 days); the maximum counts of thrips was 74.0 and 64.27 individuals / plant in Giza 20 and Ahmartantawi respectively; the daily increase in thrips population (a) was higher (0.016) in cultivar Ahmartantwi than Giza 20 (0.0094).

Table 5. Calculated the developmental parameters in population of *Thripstabaci* / onion plant "Giza 20" during different transplanting dates and seasons.

Variable	Early	date		Total	Mean	Middle date			Total	Mean	Late date			Total	Mean
	2013/2014	2014/2015	2015/2016			2013/2014	2014/2015	2015/2016			2013/2014	2014/2015	2015/2016		
P1	14.0	7.0	7.0	28.0	9.33	8.0	8.0	8.0	24.0	8.0	10.0	10.0	10.0	30.0	10.0
P2	21.0	7.0	7.0	35.0	11.67	0.0	7.0	0.0	7.0	2.33	7.0	7.0	0.0	14.0	4.67
P3	84.0	105.0	63.0	252.0	84.0	91.0	105.0	98.0	294	98.0	98.0	105.0	105.0	308.0	102.67
Maximum counts	55.6	58.0	47.0	160.6	53.53	77.2	72.0	72.8	222	74.0	109.6	145.4	120.0	375.5	125.0
P3-P1	70.0	98.0	56.0	224.0	74.67	83.0	97.0	90.0	270.0	90.0	88.0	95.0	95.0	278.0	92.67
P3-P2	63.0	98.0	56.0	217.0	72.33	91.0	98.0	98.0	287.0	95.67	91.0	98.0	105.0	294	98.0
a	0.014	0.009	0.016	0.039	0.013	0.0099	0.0092	0.0092	0.0283	0.0094	0.0099	0.0092	0.0096	0.0287	0.0096

Table 6. Calculated the developmental parameters in population of *Thripstabaci* / onion plant "Giza 20" during different transplanting dates and seasons.

Variable	Early	date		Total	Mean	Middle date			Total	Mean	Late date			Total	Mean
	2013/2014	2014/2015	2015/2016			2013/2014	2014/2015	2015/2016			2013/2014	2014/2015	2015/2016		
P1	7.0	7.0	7.0	21.0	7.0	8.0	8.0	8.0	24.0	8.0	10.0	10.0	10.0	30.0	10.0
P2	21.0	21.0	7.0	49.0	16.33	21.0	21.0	21.0	63.0	21.0	35.0	42.0	35.0	112.0	37.33
P3	84.0	84.0	84.0	252.0	84.0	77.0	77.0	77.0	231.0	77.0	63.0	63.0	63.0	189.0	63.0
Maximum counts	38.0	48.0	43.8	129.8	43.27	59.0	69.6	64.2	192.8	64.27	92.0	141.0	118.0	351.0	117.0
P3-P1	77.0	77.5	77.0	231.0	77.0	69.0	69.6	69.0	207.0	69.0	35.0	35.0	35.0	159.0	35.0
P3-P2	63.0	63.0	77.0	203	67.67	56.0	56.0	56.0	169.0	56.0	28.0	21.0	28.0	77.0	25.67
a	0.014	0.014	0.012	0.04	0.013	0.016	0.016	0.016	0.048	0.016	0.032	0.043	0.032	0.107	0.036

In the late transplanting date, the daily increase in thrips population (a) was higher in Ahmartantawi (0.036) than in Giza 20 (0.0096). This reveal that insect need longer period in Giza 20 cultivar to build up their population and reached its highest, this longer period which was necessary for reproduction and complete their life cycle can interfere with the bluing formation stage and reducing the bulb yield. This agreed with results of kendall and Capinera (1987) and Fournier *et al* who revealed that budging stage was the most susceptible stage towards the thrips damage.

Impact of thrips population on onion productivity: Data in Table (7) clear that plants of early transplanting date had the lowest population of thrips in both cultivars Giza 20 and Ahmartantawi, recording 24.57 and 18.01 individual / plant in 2015/2016; under this level of infestation, plants able to produce 11.0 and 14.0 ton / fed., respectively. In middle transplanting date, thrips population increased until became 35.09 and 28.51 individual / plant, and productivity decreased to be 8.01 and 9.6 ton / fed in plants of two cultivars respectively. Thrips population recorded most increase until became 52.51 and 41.06 individual / plant in two cultivars during the season growth of late transplanting date plants, this followed by the lowest productivity 6.6 and 7.9 to / fed., respectively. It can be concluded that middle and late transplanting date increase thrips population by 42.82 and 113.72% more than early transplanting date; and able to decrease diameter of bulbs, bulbs weight and productivity. Productivity decreased by 27.18 and 40.0% in both middle and late dates in comparison with that in early one of Giza 20.

Table 7. Relation between thrips counts / plant and the related yield parameters in each cultivar and transplanting dates during season 2015/2016.

Cultivar	Transplanting date	Thrips counts		Diameter / bulb (cm)	Weight / 20 bulbs (Kg)	Productivity	
		Average / plant	Increase% in counts			Yield (ton / fed)	Decrease% in yield
Giza 20	Early	24.57	——	8.8	3.9	11.0	----
	Middle	35.09	42.82	7.5	2.8	8.01	27.18
	Late	52.51	113.72	6.4	1.8	6.6	40.0
Ahmartantawi	Early	18.01	----	9.5	4.8	14.3	----
	Middle	28.51	58.3	8.1	3.2	9.6	32.87
	Late	41.06	128	6.7	2.1	7.9	44.76

Table 8. Single impact of each of transplanting dates or onion cultivars on thrips population and the related yield.

Studied factors	Thrips population	Increase% in population	Related yield (ton/fed.)	Decrease% in yield
Transplanting dates				
Early	21.29		12.65	
Middle	31.8	50.56	8.81	30.03
Late	46.79	120.86	3.25	42.38
Cultivars				
Ahmartantawi	29.2	93.15	10.6	38.82
Giza 20	37.4	78.3	8.54	33.6

In Ahmartantawi cultivar, plants of middle and late transplanting dates able to receive high population of thrips more than the early one by 58.3 and 128%, this followed by decrease in bulbs diameter, weights and final yield by 32.87 and 44.76%, respectively (Table 7).

Data in Table (8) clear that plants of early transplanting date can produce average of 12.65 ton/fed. at any cultivar, in spite of their infestation with average 21.29 individuals/plant. As well as plants of Ahmartantawi cultivar can produce average of 10.6 ton/fed. at any transplanting date, in spite of their infestation with average of 29.2 individuals/plant. Plants of Giza 20 cultivar and those transplanted in late date able to receive highest infestation of thrips estimated by average 37.4 and 46.79 individual/plant and produced the lowest yield 8.54 and 7.25 ton/fed with decreasing in yield by percent 42.38 and 33.6% respectively (Table 8). These findings are in agreement with findings of (Fournier *et al* 1995, Jensen *et al* 2003, Merene 2005, Bekele *et al* 2006, Nault and Shelton 2008 and Waiganjo*et al* 2005) who revealed that thrips infest all growing areas of onion causing severe damage ranged from 10 to 85% loss in onion bulb yield.

CONCLUSION

This work was planned mainly to evaluate the response of thrips population towards both transplanting dates and onion cultivars in three successive seasons; as well as evaluate insect development and onion productivity. Results can employed in management of insect population through transplanting of onion seedlings in early date to reduce insect population by average 50 or 100% at least, in comparing with middle or late date; and increase onion yield productivity by 30 or 42%, respectively this benefit can obtained without using any pesticides leading to minimizing cost production, preserving environment from contamination.

As well as results can employed in onion thrips management and increasing the previous percents of reduction in insect population by 25% through using seeds of Ahmartantawi cultivar in planting onion crops.

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