Efficiency of Some Chemical and Bio-Insecticides Against Onion Thrips, *Thrips Tabaci* Lindeman (Thysanoptera: Thripidae)

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ABSTRACT

Onion thrips, *Thrips tabaci* (Thysanoptera: Thripidae) is one of the main problems and yields limiting factors in the onion fields (*Allium cepa* L.). In the present work, an effort was made to study the relative susceptibility of different onion cultivars to infestation with the onion thrips, evaluation of some chemical and bio-insecticides against *T. tabaci* and to study the effect of meteorological factors on its population density. The results showed that *T. tabaci* infest all the tested cultivars more or less, however cultivar Red Giza showed to be the most tolerant against *T. tabaci* infestation among the other cultivars. Giza 6 was the most susceptible among the cultivars followed by Beheri, Giza 20 and finally White Giza. However, there were no significant different among the White Giza and Red Giza cultivars. The tested insecticides can be arranged according to their efficacy against nymphs of *T. tabaci* in descending order as follows; spinetoram, pyridalyl, imidacloprid, thiamethoxam, lambda-cyhalothrin, dinotefuran, pyriproxyfen, malathion, azadirachtin and finally *Beauvaria bassiana*. On the other hand, these insecticides can be arranged according to the general means of reduction percentages of *T. tabaci* adults in a descending order as follows; pyridalyl, spinetoram, thiamethoxam, imidacloprid, lambda-cyhalothrin, dinotefuran, pyriproxyfen, malathion, *Beauvaria bassiana* and azadirachtin. The results of the population trends of *T. tabaci* revealed that the onion thrips had two generations during the onion growing period. There was a significantly negative correlation (P<0.05) between population density of onion thrips and relative humidity. The results also revealed that the temperature positively and significantly affect *T. tabaci* population in both seasons 2020 and 2021.

Key words: *Thrips tabaci, Allium cepa*, insecticides, population dynamic, onion cultivars.

INTRODUCTION

Throughout the world, the onion thrips, *Thrips tabaci* L. (Thysanoptera: Thripidae), is one of the most destructive insect pests to a wide variety of crops (Ananthakrishnan 1973; Afaf, El- Roby, 2018). It is consider a key pest in the onion (*Allium cepa*) producing areas worldwide (Diaz-Montano, *et al*., 2011; Gill, *et al*. 2015; Darwish, 2015). Severe infestation with the adults and nymphs of *T. tabaci* kill onion seedlings. While in the old plants, the severe infestation may cause onion crops to mature early, leading to smaller bulb sizes and subsequently reduce yields (Mahmoud 2008; Boateng, *et al*., 2014 and Darwish, 2015). The severity of this insect pest can be attributed to its nature as a polyphagous insect pest, large number of annual generations, high reproductive rate, the ability to produce offspring from unfertilized eggs (parthenogenetic reproduction), ability to transmit numerous plant-infecting pathogens as vectors, and development of resistance to chemical insecticides (Morse and Hoddle 2006, Diaz-Montano *et al*. 2011). Use of resistant or less favorable plant cultivars is considered one of the major components of integrated pest management for an ecological and economic pest control program. Therefore, it is very important to select resistant or at least non preferred onion cultivars at the beginning of the onion thrips integrated pest management program. In onion fields, due to the irruptive outbreaks of onion thrips, the synthetic insecticides have been the most important tools employed for the management of this pest (Morse and Hoddle 2006; Nault and Hessney, 2010; Shah, 2015). Many authors such as, Omar and El-Kholy 2001; Saleh 2004; Sabra *et al.* 2005; Amro *et al.* 2009 and Mahmoud, 2011 studied the efficiency of different insecticides on onion thrips in different plant species. The information about either the interaction between onion thrips and resistant onion cultivars or the chemical control of onion thrips is very important for any integrated pest management program. The objective of this work was to study the relative susceptibility of different onion cultivars to the infestation with *T. tabaci*, evaluate some insecticides for controlling *T. tabaci* and to study the population dynamic of *T. tabaci* in onion plants.

MATERIAL AND METHODS

Susceptibility of different experiment onion cultivars:

In the current experiment five main onion (*Allium cepa* L.) cultivars namely White Giza, Red Giza, Beheri (red), Giza 6 (red) and Giza 20 (yellow) were cultivated in a private farm at Nobaria district, Beheira Governorate, Egypt during onion growing seasons of 2020 and 2021. This experiment was conducted to study the susceptibility of onion cultivars for the onion thrips. Plants were transplanting in December 14^{th}, 2019 (2020

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season) and December 18th 2020 (2021 season). The five Onion cultivars were obtained from Agriculture Research Station. The experimental area was about 2000 m^2 and divided into 20 plots (four replicates for each cultivar). The replicates (about 100 m^2) arranged in Completely Randomized Block Design. The sampling (4 plants from each replicate) was started 21 days post-planting and continues up to the harvest. During the growing seasons, except the use of insecticides, all the recommended agriculture practices were performed as usual.

Efficacy of insecticides experiment:

Field experiments were conducted to evaluate the effect of ten insecticides on the population density of adults and nymphs of onion thrips, *T. tabaci*. Onion seedlings (*Allium cepa* L. *cv.* Giza 20) were sown in December 14th, 2019 and December 18th, 2020. An area of (4200 m^2) was divided into equal plots of 60 m^2 (10 × 6). Eleven treatments (ten insecticides and control) were distributed using a randomized complete block design (CRBD) with 55 replicates (five replicates for each treatment). Before the start of the experiment, the experiment area did not treated with any insecticide. The trade name, active ingredient and recommended field rates of the used insecticides are shown in Table (1). The tested compounds were sprayed once on March 20th in both seasons at their label recommended rates at the rate of 200 liter per feddan. A Knapsack sprayer, CP^3 was used for spraying with the different treatment. The control plots were sprayed with water only. Randomly five onion plants of each replicate (25 plants from each treatment) were picked and kept in paper bags for the further examination in the laboratory. The number of adult and nymphs *T. tabaci* were counted and recorded just before spraying with insecticides and after one, four, seven and fourteen days after spraying. The reduction percentages of the thrips population were calculated according to the equation Henderson and Tilton (1955) as follows:

Corrected % = (1 –((ncb*nta)/(nca*ntb)))*100

Where:

nta = mean numbers of *T. tabaci* in treatment after application

ncb = mean number of *T. tabaci* in control before application.

ntb = mean number of *T. tabaci* in treatment before application

nca = mean number of *T. tabaci* in control after application

Table 1. The active ingredients, trade names, formulations and recommended rates of the used insecticides

Trade name	Active ingredient (% and formulation)	Manufacturer	Recommended rates
Actara®	Thiamethoxam 25% WDG	Syngenta Agro	50 mg L^{-1}
Confidor®	Imidacloprid 20% SL	Bayer CropScience	200 ml / Fed
Radiant®	Spinetoram 120 SC	Dow AgroSciences, LLC, Indianapolis, IN	120 mi /200 L
Admiral®	Pyriproxyfen 10% EC	Sumitomo Chemical Co. Ltd	75 ml/100 liter
Malathion®	Malathon 57% EC	Sinochem Ningbo Chemicals	5 ml /liter
Pleo®	Pyridalyl (50% EC)	Sumitomo Chemical Co. Ltd	100 ml /fed
Lambada®	Lambda-cyhalothrin 5% EC	DowAgro Sciences Co., Ltd	100cm/Fed
Biover®	*Beauvaria bassiana* (Biover 10 % WP.)	Plant Protection Institute , ARC , Giza , Egypt	200 gm. / 100 lit. water
Nimbecidine®	Azadirachtin 0.03% EC	Botanical Extract	5 Cm3 L^{-1}
Ochin®	Dinotefuran 20% SG	Mitsui Chemicals	50 mg L^{-1}

*The used recommended rates were determined based on the recommendations of Egyptian Ministry of Agriculture

Statistical Analysis:

Statistical analysis was conducted using SAS program (1989). The ANOVA test was used to evaluate the significant differences among onion cultivars and the reduction percentages of different insecticides. The means were separated using Least Significant Differences Test LSD. Also, correlation coefficient (r) was used to determine the relation of different metrological factors and *T. tabaci* population density.

RESULTS AND DISCUSSION

Relative susceptibility of certain onion cultivars to the infestation with onion *T. tabaci*:

The results shown in Figs. 1 and 2 reveals the seasonally mean number of thrips per plant on five onion cultivars. It was found that, more or less all the tested onion cultivars were attacked by the thrips. During the 1st season, 2020, the cultivar Giza 6 was the most susceptible cultivar to the thrips infestation. The maximum mean number of thrips per plant (23.53 individual/plant) was recorded on this cultivar followed by Beheri (19.56), Giza 20 (14.9), White Giza (12.15), Red Giza (10.1). Similar results were obtained during the 2nd season, 2021 whereas the cultivar Red Giza (9.74 individual/plant) was the most resistant variety to infestation with onion thrips followed by White Giza (11.91), Giza 20 (15.98), Beheri (20.38) and finally the cultivar Giza 6 (25.22). The present results are in agreement with those of Awadalla *et. al.*, (2017) who found highest average numbers of *T. tabaci* on Giza 6 compared with Giza 20 and Giza Red. Salman (2000) in Upper Egypt studies the relative susceptibility of certain onion varieties to infestation with *T. tabaci* and found that the onion variety shandweel 1 was the most susceptible variety, meanwhile Giza 20 variety was the least. In the same frame, Malik *et al*. (2004) studied the susceptibility of six onion varieties (Red Creole, Chiltan-89, Local, Sariab Surkh, White Globe and Local Kandhari) for the infestation with onion thrips in Quetta, Pakistan. They found that the Local Kandhari followed by Sariab Surkh were the most susceptible varieties to thrips infestation while Chiltan-89 was the least. The cultivar preference may be attributed the fact that thrips prefer darker colors. Ellis *et al*. (1996) reported that thrips attracted to those plants which have darker in color. In the same trend, Quratulain *et al*., (2019) in Islamabad found that the variety Saryab red was relatively susceptible against thrips while Red imposta was relatively resistant with maximum mean population of 52.41±15.42 and 37.02±9.97 individuals per plant infestation, respectively.

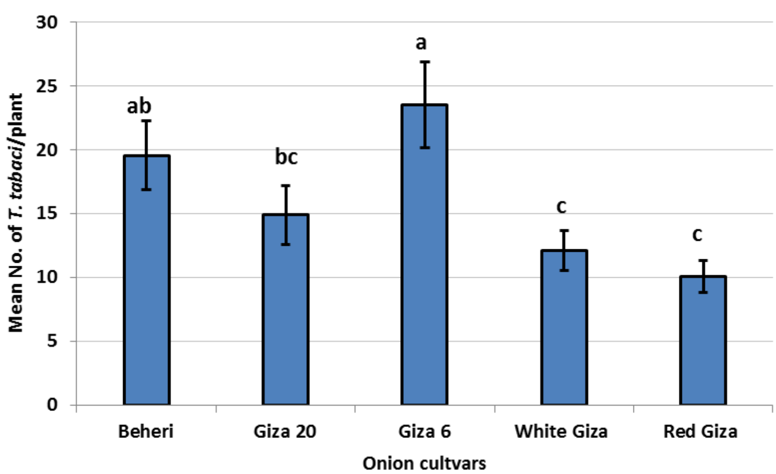

Fig. 1. Susceptibility of different onion cultivars to infestation with onion thrips, *T. tabaci* during the 1st season, 2020 at Beheira Governorate. (F= 5.39, L.S.D.= 6.64)
Bars with the same letter(s) are not significantly different at P < 0.05.

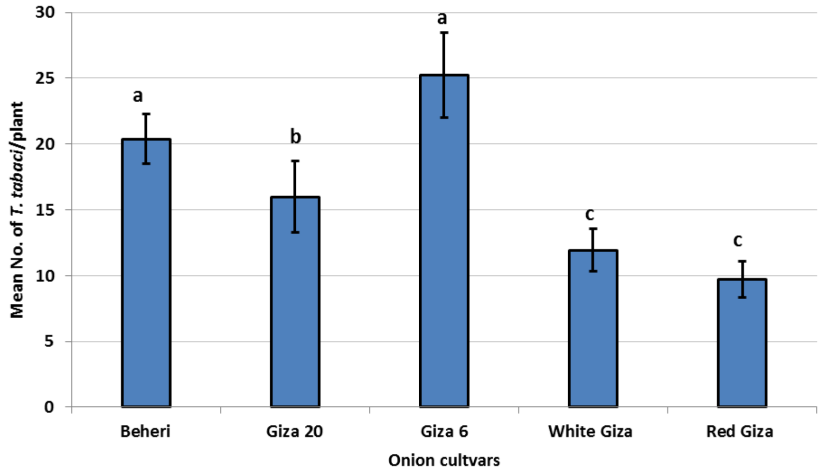

Fig. 2. Susceptibility of different onion cultivars to infestation with onion thrips, T. tabaci during the 2nd season, 2021 at Beheira Governorate. (F= 7.69, L.S.D.= 6.37)
Bars with the same letter(s) are not significantly different at P > 0.05.

Efficacy of synthetic chemical and bio-insecticides against onion thrips, *T. tabaci*:

During the 1st season, 2020 the control efficacy of spinetoram and pyridalyl was significantly higher than that of the other tested insecticides against the nymphs population of *T. tabaci* (as shown in Table 2). The reduction percentages of spinetoram after 1, 4, 7 and 14 days from treatment were 98.48, 96.82, 93.87 and 86.57 %, respectively with a general mean of 93.94 %. The insecticides, pyridalyl, achieved 94.49, 96.21, 91.36 and 88.25 % after 1, 4, 7 and 14 days from treatment with a general mean of 92.58 %. According to the statistical analysis, imidacloprid came in the third rank with reduction of 94.93, 92.42, 86.95 and 80.62 % after 1day, 4 days, 7 days and 2 weeks, respectively with a general mean of 88.73%. Thiamethoxam came in the fourth rank with reduction of 90.46 (after 1 day), 88.44 (after 4 day), 83.86 (after 1 week) and 73.06 % (after 2 weeks) with a general mean of 83.96%. The reduction percentages of nymphs of *T. tabaci* recorded 89.28, 86.7, 72.83 and 60.15 by using the insecticide lambda-cyhalothrin and 82.74, 78.51, 69.24 and 63.65 by using dinotefuran after 1, 4, 7 and 14 days, respectively with a general mean of 77.24 for lambda-cyhalothrin and 73.54 % for dinotefuran. The insect growth regulator, pyriproxyfen came in the seven rank (83.05, 74.17, 63.32 and 51.53 % after 1, 3, 4 and 14 days with a general mean of 68.02%) followed by malathion, azadirachtin and finally *Beauvaria bassiana* with general means of 59.51, 50.88 and 49.87 %, respectively.

Concerning the potency of the same tested insecticides against the adults of T. tabaci (Table 3), the highest reduction percentages were achieved by pyridalyl (91.24%), spinetoram (84.68%), thiamethoxam (83.51%), imidacloprid (82.37%), lambda-cyhalothrin (72.19), dinotefuran (69.47 %) malathion (65.87%), pyriproxyfen (61.84%), biover (Beauvaria bassiana) (56.06 %) and azadirachtin (45.74%).

During the 2nd season, results shown in Tables (4) revealed that, all the tested insecticides achieved considerable reduction percentages in *T. tabaci* nymphs. spinetoram achieved the highest efficiency, it gave the following reduction percentages (98.8, 97.8, 95.86 and 91.67 % after 1, 4, 7 and 14 days, respectively) with general mean 96.03 %. The insecticide pyridalyl came in the 2nd rank giving 98.74, 97.38, 91.93 and 88.46 % after 1, 4, 7 and 14 % days, respectively with a general mean of 94.13 %. In the 3rd place come the insecticide imidacloprid which achieved (93.99, 91.25, 84.87 and 82.23 % after 1, 4, 7 and 14 days, respectively) followed by thiamethoxam (91.58, 90.3, 86.71 and 79.46 % after 1, 4, 7 and 14 days, respectively) with a general mean of 88.09% and 87.01 for imidacloprid thiamethoxam, respectively. The insecticides lambda-cyhalothrin gave reduction percentages of 89.05, 86.24, 74.83 and 68.95with a general mean of 79.77% followed by dinotefuran which gave reduction percentages of (89.27, 82.13, 72.74 and 61.48 % after 1, 4, 7 and 14 days, respectively) with general mean 76.4 %. The reduction percentages of insect growth regulator pyriproxyfen recorded 85.91 (after 1 day), 71.69 (after 4 days), 68.91 (after one week) and 60.65% (after two weeks). Malathion comes in the eights rank followed by azadirachtin and

Table 2. Efficacy of ten synthetic and bio-insecticides on the nymphs of T. tabaci on onion plants under field conditions during 2020 season

Insecticide	Days post treatment Mean No. of nymphs / plant (Reduction %)				General mean
	1	4	7	14	
Control	(39.8)	(44.16)	(42.24)	(45.24)	
Pyriproxyfen	(6.6) 83.05±3.9^{c}	(11.04) 74.17±5.43^{c}	(15.04) 63.32±3.45^{c}	(21.28) 51.53±4.55^{e}	68.02±12.77^{d}
Pyridalyl	(2.28) 94.49±1.29^{ab}	(1.76) 96.21±1.78^{a}	(3.68) 91.36±2.56^{ab}	(5.4) 88.25±2.68^{a}	92.58±3.7^{a}
Malathion	(11.68) 69.36±7.65^{d}	(14.72) 65.56±6.65^{d}	(19.8) 51.91±4.08^{d}	(20.88) 51.2±14.44^{e}	59.51±11.73^{e}
Lambda-cyhalothrin	(4.24) 89.28±1.5^{b}	(5.84) 86.7±2.83^{b}	(11.4) 72.83±10.81^{c}	(17.84) 60.15±5.68^{de}	77.24±13.31^{c}
Spinetoram	(0.64) 98.48±1.44^{a}	(1.04) 96.82±1.85^{a}	(2.68) 93.87±1.59^{a}	(6.24) 86.57±2.65^{a}	93.94±5.01^{a}
Azadirachtin	(16.24) 60.79±7.06^{e}	(19.84) 57.1±5.99^{e}	(23.8) 46.08±7.614^{de}	(28.52) 39.53±9.91^{f}	50.88±11.27^{f}
Thiamethoxam	(3.92) 90.46±4.1^{b}	(5.36) 88.44±3.15^{b}	(6.88) 83.86±8.34^{b}	(12.6) 73.06±7.53^{bc}	83.96±8.94^{b}
Imidacloprid	(2.08) 94.93±3.423^{ab}	(3.44) 92.42±3.78^{ab}	(5.68) 86.95±3.06^{ab}	(9.08) 80.62±2.9a^{b}	88.73±6.41^{ab}
Beauvaria bassiana	(14.24) 63.54±6.65^{de}	(18.28) 58.45±4.22^{e}	(25.12) 38.5±16.14^{e}	(27.04) 38.98±11.28^{f}	49.87±15.11^{f}
Dinotefuran	(7.04) 82.74±4.26^{c}	(9.64) 78.51±6.35^{c}	(13.48) 69.24±3.45^{c}	(16.72) 63.65±7.68^{cd}	73.54±9.31^{cd}
F value	41.993	55.049	33.998	26.745	50.064
L.S.D.	6.002	5.81	9.597	10.11	6.48

The reduction percentages followed by the same letter(s) in the column are not significantly different ($P< 0.05$).

Beauvaria bassiana with a general means of 57.05, 55.77 and 47.42 %, respectively. Concerning the efficiency of the insecticides against the adults of *T. tabaci*, the tested insecticides can be arranged according to the general means of reduction percentage in a descending order as follows pyridalyl, spinetoram, thiamethoxam, imidacloprid, lambda-cyhalothrin, dinotefuran, pyriproxyfen, malathion, *Beauvaria bassiana* and azadirachtin with general means of 95.16, 93.65, 89.75, 80.38, 68.69, 65.9, 63.81, 63.37, 58.28 and 51.86%, respectively (Table 5).

From the current experiments, it appears that spinetoram and pyridalyl were the most effective compounds tested to control *T. tabaci*. These results are in harmony with the results of Khaliq *et al*. (2014); Srivastava *et al*. (2014); Marasigan *et al*. (2016) and Renkema, *et al.* (2018) who stated that spinetoram is an effective insecticide for control of different thrips species in a different variety of crops, providing rapid-knockdown and sustained suppression of populations. According to Gholami and Sadeghi, (2016) each of spinosad, pyridalyl, and azadirachtin are new and effective insecticides for the control of western flower thrips in vegetable greenhouses. In this study, imidacloprid was highly effective and had a strong residual activity during the two seasons which gave a significant reduction to nymphs and adults population of *T. tabaci* population after 1, 7, 10 and 14 day after treatment compared to the control. Similar results were obtained by Omar and El-Kholy (2001) who compared bioefficacy of some traditional and non-traditional insecticides against *T. tabaci* on onion plants, they found imidacloprid gave the highest reduction percentages of the onion thrips. In our experiments the bioinsecticide, *Beauvaria bassiana* was the least effective insecticides against the *T. tabaci* (nymphs) in agreement with the results of Mahmoud, (2011) who studied efficacy of some chemical (actellic and marsal) and non-chemical (*Beauvaria bassiana*) insecticides against onion thrips and found that Biover 10% WP was the lowest effectiveness. Also, the current results support the results of Zepa, *et al.* (2011) who found that the most efficient in controlling *T. tabaci* were the products Actara (thiamethoxam) and Confidor Energy (imidacloprid) which having an efficiency of over 97%. On the other hand, Sallam *et al.* (2018) studied the efficacy of certain insecticides against onion thrips under field conditions compared to selected alternatives. They found that the lowest thrips reduction percentages were observed in plots treated with azadirachtin and the highest reduction percentages were observed in plots treated methomyl.

Table 3. Efficacy of ten synthetic and bio-insecticides on the adults of T. tabaci on onion plants under field conditions during 2020 season

Insecticides	Days post treatment Mean No. of adults / plant (Reduction %)				General mean
	1	4	7	14	
Control	(10)	(8)	(11.6)	(13.08)	
Pyriproxyfen	(2.96) 73.59±12.91^{de}	(2.36) 62.11±13.51^{de}	(3.84) 57.34±23.58^{de}	(4) 54.3±21.69^{de}	61.84±18.6d^{e}
Pyridalyl	(0.92) 95.95±6.81^{a}	(1.08) 92.55±10.31^{a}	(1.92) 91.33±4.97^{a}	(1.84) 85.12±7.1^{a}	91.24±8.01^{a}
Malathion	(2.36) 68.55±5.99^{ef}	(2.56) 66.52±15.71^{cd}	(3.96) 61.95±17.5^{cde}	(4.96) 66.48±10.23^{bcd}	65.87±12.34^{cd}
Lambda-cyhalothrin	(1.68) 82.67±7.88^{bcd}	(1.76) 76.2±10.22^{bc}	(3.84) 63.14±17.43^{cd}	(3.96) 66.51±15.42^{bcd}	72.19±14.57^{c}
Spinetoram	(0.28) 88.54±9.59^{abc}	(0.44) 85.07±5.97^{ab}	(0.8) 81.6±6.86^{a}	(1.68) 83.5±8.1^{ab}	84.68±7.58a^{b}
Azadirachtin	(3.88) 61.34±11.77^{f}	(4.08) 49.59±8.38^{e}	(7.16) 38.66±13.26^{f}	(8.92) 33.35±10.22^{f}	45.74±14.98^{f}
Thiamethoxam	(0.6) 94.25±4.4^{ab}	(1.36) 86.06±4.56^{ab}	(2.64) 78.54±13.48^{abc}	(3.4) 75.19±11.54^{abc}	83.51±11.47^{ab}
Imidacloprid	(1.2) 90.51±5.93^{abc}	(1.4) 86.89±6.39^{ab}	(2.68) 80.82±6.29^{ab}	(4.32) 71.27±14.92^{abcd}	82.37±11.27^{b}
Beauvaria bassiana	(3.04) 62.58±15.07^{ef}	(2.12) 69.94±12.13^{cd}	(5.64) 44.68±13.038^{ef}	(5.8) 47.06±19.02^{ef}	56.06±17.55^{e}
Dinotefuran	(1.92) 81.32±8.37^{cd}	(2.16) 73.78±10.51^{bcd}	(4.4) 63.57±9.58^{bcd}	(5.64) 59.22±8.82^{cde}	69.47±12.34^{cd}
F value	9.165	8.270	7.524	7.170	23.241
L.S.D.	12.08	13.19	17.38	17.28	8.31

The reduction percentages followed by the same letter(s) in the column are not significantly different (P< 0.05).

Table 4. Efficacy of ten synthetic and bio-insecticides on the nymphs of T. tabaci on onion plants under field conditions during 2021 season

Insecticide	Days post treatment Mean No. of nymphs / plant (Reduction %)				General mean
	1	4	7	14	
Control	(33.68)	(36.4)	(35.28)	(37.8)	
Pyriproxyfen	(4.52) 85.91±2.66^{c}	(9.82) 71.69±6.09^{d}	(10.4) 68.91±4.35^{c}	(14.08) 60.65±6.06^{c}	71.79±10.41^{e}
Pyridalyl	(0.44) 98.74±2.07^{a}	(0.88) 97.38±2.88^{a}	(1.56) 91.93±5.73^{ab}	(3.16) 88.46±6.84^{ab}	94.13±6.13^{ab}
Malathion	(10.08) 68.53±3.89^{d}	(13.16) 62.05±2.78^{e}	(15.24) 54.53±8.53^{d}	(20.28) 43.1±9.68^{d}	57.05±11.58^{f}
Lambda-cyhalothrin	(3.48) 89.05±6.36^{bc}	(4.8) 86.24±4.77^{bc}	(8.52) 74.83±6.73^{c}	(11.08) 68.95±7.74^{c}	79.77±10.31^{d}
Spinetoram	(0.4) 98.8±1.83^{a}	(0.96) 97.8±2.31^{a}	(3.04) 95.86±2.54^{a}	(4.4) 91.67±4.46^{a}	96.03±3.9^{a}
Azadirachtin	(10.76) 68.23±8.97^{d}	(14.28) 60.68±7.23^{e}	(15.6) 56.14±6.8^{d}	(23.52) 38.03±8.99^{d}	55.77±13.59^{f}
Thiamethoxam	(2.16) 91.58±7ab^{c}	(3.2) 90.3±4.93^{ab}	(5.36) 86.71±4.45^{b}	(6.76) 79.46±4.1^{b}	87.01±6.82^{c}
Imidacloprid	(2.92) 93.99±3.73^{ab}	(3.72) 91.25±4.99^{ab}	(4.76) 84.87±5.11^{b}	(8.08) 82.23±5.35^{b}	88.09±6.58^{bc}
Beauvaria bassiana	(13.12) 60.43±10.28^{e}	(17.04) 51.99±13.27^{f}	(20.36) 41.15±10.21^{e}	(23.88) 36.09±9.15^{d}	47.42±13.9^{g}
Dinotefuran	(3.8) 89.27±4.33^{bc}	(6.68) 82.13±6.84^{c}	(10.2) 72.74±7.2^{c}	(15.4) 61.48±7.5^{c}	76.4±12.29d^{e}
F value	27.795	33.375	37.555	40.913	56.870
L.S.D.	7.43	8.14	8.33	9.25	6.3

The reduction percentages followed by the same letter(s) in the column are not significantly different (P< 0.05).

Table 5. Efficacy of ten synthetic and bio-insecticides on the adults of T. tabaci on onion plants under field conditions during 2021 season

Insecticide	Days post treatment Mean No. of adults / plant (Reduction %)				General mean
	1	4	7	14	
Control	(4.16)	(3.16)	(5)	(5.64)	
Pyriproxyfen	(1.18) 70.38±9.87^{cd}	(1.12) 64.49±6.09^{c}	(1.88) 63.25±6.37^{cd}	(2.36) 57.12±5.92^{c}	63.81±8.22^{cd}
Pyridalyl	(0.08) 97.82±4.87^{a}	(0.08) 97.54±3.37^{a}	(0.28) 94.49±5.7^{a}	(0.6) 90.8±3.31^{a}	95.16±5^{a}
Malathion	(0.96) 71.93±5.02^{bcd}	(1) 64.64±6.22^{c}	(1.68) 59.42±14.41^{cd}	(2.12) 57.48±6.88^{c}	63.37±10^{cd}
Lambda-cyhalothrin	(0.8) 78.77±7.95^{bc}	(0.96) 69.69±6.76^{c}	(1.64) 67.65±3.5^{bc}	(2.24) 58.65±11.97^{c}	68.69±10.46^{c}
Spinetoram	(0.08) 97.75±5.02^{a}	(0.08) 96.26±8.35^{a}	(0.24) 91.89±9.13^{a}	(0.44) 88.68±5.8^{a}	93.65±7.63^{a}
Azadirachtin	(1.28) 64.65±7.56^{d}	(1.08) 52.89±7.37^{d}	(2.32) 49.5±4.77^{e}	(3.44) 40.41±6^{d}	51.86±10.73^{e}
Thiamethoxam	(0.28) 94.21±3.98^{a}	(0.28) 92.38±2.59^{ab}	(0.76) 89.28±3.26^{a}	(1.16) 83.15±4.53^{a}	89.75±5.47^{a}
Imidacloprid	(0.6) 89.67±6.52^{a}	(0.72) 83.93±6.72^{b}	(1.48) 76.7±6.72^{b}	(2.04) 71.22±10.11^{b}	80.38±10.06^{b}
Beauvaria bassiana	(1.16) 67.82±8.19^{d}	(1.32) 68.38±10.89^{c}	(2.36) 55.66±4.47^{de}	(2.96) 41.27±4.21^{d}	58.28±13.26^{d}
Dinotefuran	(0.84) 80.23±6.31^{b}	(1.08) 68.35±8.26^{c}	(2.28) 59.57±6.44^{cd}	(2.8) 55.45±6.95^{c}	65.9±11.68^{c}
F value	17.665	24.185	25.693	33.760	52.291
L.S.D.	8.64	8.998	9.185	8.99	5.98

The reduction percentages followed by the same letter(s) in the column are not significantly different (P< 0.05).

Population dynamic of onion thrips:

The onion thrips, *T. tabaci* remained a regular pest on onion plants during the growing season. The population buildup started from the 2nd week of January and remained active up to the 2nd week of May. Data shown in Table 6 and 7 revealed that *T. tabaci* first observed on 11th January 2020 (2.53 individuals / plant) and on 9th January 2021 (2.48 individuals / plant). In February the population of onion thrips were increased from 6.76 individuals/ plant to 19.89) and from 10.88 to 17.76 in the 1st and 2nd season, respectively. The first population peek was recorded on 3rd week of March with average of 30.19 individuals plant^{-1} in the 1st season (2020) and in mid-March with average of 24.81 individuals plant^{-1} in the 2nd season (2021). Later, as the onion crop started to mature, the population dropped to 8.44 thrips /plant in the 2020 and 10.04 thrips /plant in 2021 towards the end of May. The current results support the results of Darwish, 2015 and El-Sheikh, 2017 who found that in January and February the population density of onion thrips was relatively with low numbers. The population density increased rapidly to reach maximum abundance in April. The results of the population trends of nymphs and adults of *T. tabaci* revealed that the insect had two generations during the onion growing period.

Table 6. The population density of onion thrips, *T. tabaci* (mean /plant) infesting onion plants during the 1st season, 2020 at Nobaria district in relation to abiotic factors

Investigation date	Nymphs	Adults	Total population	Weekly mean of			Weekly mean of		
				Mini. Temp.	Maxi. Temp.	Mean Temp.	Mini. R.H.%	Maxi. R.H.%	Mean R.H.%
11-Jan	1.94	0.59	2.53	17.14	10	13.57	79.5	51.4	65.45
18-Jan	2.88	1.31	4.19	18	11.43	14.71	81.02	57.23	69.13
25-Jan	3.94	1.21	5.15	17.29	11.43	14.36	80.43	53.85	67.14
01-Feb	4.81	1.95	6.76	18.43	10.43	14.43	79.75	49.43	64.59
08-Feb	4.75	3.93	8.68	19.29	11.29	15.29	70.69	38.04	54.36
15-Feb	10.5	2.44	12.94	18.57	10.43	14.5	79.57	45.99	62.78
22-Feb	10.94	3.14	14.08	18.14	12.29	15.21	79.43	48.93	64.18
29-Feb	13.25	6.64	19.89	20.14	10.57	15.36	76.71	41.31	59.01
07-Mar	12.83	11	23.83	21.14	10.43	15.79	78.63	39.8	59.21
14-Mar	18.44	8.73	27.16	20.86	12	16.43	81.01	42.94	61.98
21-Mar	20.06	10.13	30.19	19.57	12.71	16.14	80.67	40.6	60.64
28-Mar	12.875	9.2	22.08	21.29	13.43	17.36	81.3	40.43	60.86
04-Apr	12.31	10.21	22.53	25.71	13	19.36	79.76	41.61	60.69
11-Apr	18.78	8.06	26.84	21	13.86	17.43	80.16	43.01	61.59
18-Apr	14.14	9.88	24.01	23.14286	13.57	18.36	82.74	41.53	62.14
25-Apr	10.31	7.11	17.43	24.14286	15.71	19.93	81.37	41.91	61.64
02-May	6.19	6	12.19	24.71429	15	19.86	83.76	49.64	66.7
09-May	4.38	4.06	8.44	25.42857	15.14	20.29	78.63	39.8	59.21

Table 7. The population density of onion thrips, *T. tabaci* (mean /plant) infesting onion plants during the 2nd season, 2021 at Nobaria district in relation to abiotic factors

Investigation date	Nymphs	Adults	Total population	Weekly mean of			Weekly mean of		
				Mini. Temp.	Maxi. Temp.	Mean Temp.	Mini. R.H.%	Maxi. R.H.%	Mean R.H.%
09-Jan	1.29	1.19	2.475	21.71	12.86	17.29	80.43	52.63	66.53
16-Jan	1.25	2.16	3.413	21.14	12.43	16.79	78.04	48.2	63.12
23-Jan	2.54	2.44	4.975	17.29	10.57	13.93	77.03	50.53	63.78
30-Jan	2.88	5.75	8.625	19.43	10.29	14.86	77.59	50.41	64
05-Feb	3.5	7.38	10.875	22.86	12.57	17.71	75.99	42.33	59.16
12-Feb	4.53	8.63	13.15	22	10.43	16.21	76.8	43.46	60.13
19-Feb	7.43	9.44	16.86	17	8.857	12.93	74.96	38.79	56.87
26-Feb	8	9.76	17.763	18.57	11.14	14.86	77.6	44.23	60.91
04-Mar	6.31	13.13	19.438	19.71	11.14	15.43	78.63	39.8	59.21
11-Mar	5.88	12.69	24.813	22.71	12.86	17.79	78.1	40.37	59.24
18-Mar	5.06	17.88	22.938	21	10.43	15.71	78.93	50.07	64.5
25-Mar	7.15	15	22.15	21.29	14.43	17.86	78.14	45.89	62.01
01-Apr	5.54	18.38	23.913	20	11.57	15.79	79.97	44.04	62.01
08-Apr	10.31	21.5	31.813	23.71	13.43	18.57	80.89	45.04	62.96
15-Apr	10.74	18.44	29.175	18.43	11.86	15.143	78.76	43.99	61.37
22-Apr	6.56	18	24.563	27.43	16.14	21.79	78.17	38.3	58.24
29-Apr	6.06	6.59	12.65	30	15.43	22.71	80.9	41.76	61.33
06-May	4.6	5.44	10.04	34.29	17.714	26	78.63	39.8	59.21

Table 8. The correlation coefficient between different meteorological factors and adult, nymphs and total population of *T. tabaci*

Seasons	Stage	Mini. Temp.	Maxi. Temp.	Mean Temp.	Mini. R.H.%	Maxi. R.H.%	Mean R.H.%
2020	Nymphs	0.216	0.191	0.218	0.206	-0.566*	-0.366
	Adults	0.592**	0.374	0.536*	0.200	-0.726**	-0.495*
	Total population	0.461	0.454	0.484*	0.223	-0.551*	-0.348
2021	Nymphs	0.049	0.056	0.014	0.237	-0.423	-0.297
	Adults	0.059	0.040	0.026	0.272	-0.327	-0.202
	Total population	0.040	0.065	0.005	0.154	-0.492*	-0.385

Significant correlation (P<0.05) ** highly significant (P<0.01)

Influence of abiotic factors on population dynamics of onion thrips, *T. tabaci* in onion plants:

As shown in Table 8 the correlation coefficient between different meteorological factors and adults, nymphs and total population of *T. tabaci* revealed that the onion thrips exhibited a highly significant negative correlation with maximum, mean relative humidity. However, these stages were positively correlated with minimum, maximum and mean of temperature. These results support the results of Gill, *et al*. (2015) who stated that the dry and hot weather can lead to an increase in the populations of *T. tabaci* and the severity of thrips injury to onion and other crops. Also, the current results confirm that the nymph stage was more affected by the weather factors than adult stage as indicated by with Hendawy, *et al*., (2011) and Moraiet and Ansari, (2014). The findings of Hamdy and Salem, (1994) (relatively high temperature have been associated with increase in onion thrips population, while high relative humidity and rainfall reduce thrips population) are consistent to our results.

CONCLUSIONS

In the light of above mentioned results and numerical data, it is concluded that Red Giza and Giza 6 were the most tolerant and susceptible cultivars against *T. tabaci* infestation. Also, it is concluded that spinetoram and pyridalyl insecticides approved to be most effective against cotton thrips, *T. tabaci*. The onion thrips had two generations during the onion growing period. There was a significantly negative correlation (P<0.05) between population density of onion thrips and relative humidity. The results also revealed that the temperature positively and significantly affect *T. tabaci* population in both seasons 2020 and 2021.

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الملخص العربي

كفاءة بعض المبيدات الحشرية الكيميائية والحيوية علي حشرة تربس البصل *Thrips tabaci* Lindeman

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تعتبر حشرة تربس البصل *Thrips tabaci* واحدة من المشاكل الرئيسية والعوامل المحددة لزراعة وانتاج البصل *Allium cepa* L. في هذا العمل تم دراسة الحساسية النسبية لبعض أصناف البصل المختلفة للاصابة بحشرة تربس البصل، كذلك تم عمل مسح حقلي لكفاءة بعض المبيدات الحشرية علي حشرة تربس البصل، بالاضافة لدراسة التقلبات العددية ودراسة تاثير بعض العوامل الجوية علي تعداد الحشرة. لذلك قد تساعد هذه الدراسة في برامج المكافحة المتكاملة للحشرة. أوضحت النتائج أن حشرة تربس البصل تصيب كل الاصناف المختبرة وان الصنف Red Giza كان أكثر الاصناف مقاومة للاصابة بالحشرة. من ناحية أخري كان الصنف Giza 6 هو الصنف الاكثر حساسية للاصابة ويليه الصنف Beheri ثم Giza 20 وأخيرا الصنف White Giza. هذا ولا توجد فروق معنوية بين الصنفين White Giza و Red Giza. وأوضحت النتائج أيضا انه يمكن ترتيب المبيدات المختبرة ترتيبا تنازليا حسب كفاءتها في خفض تعداد حوريات حشرة تربس البصل كالآتي: spinetoram، pyridalyl، imidacloprid، thiamethoxam، lambda-cyhalothrin، dinotefuran، pyriproxyfen، malathion، azadirachtin وأخيرا *Beauvaria bassiana*. من ناحية أخري يمكن ترتيب هذه المبيدات ترتيبا تنازليا حسب كفاءتها في خفض تعداد الحشرات الكاملة لتربس البصل الي pyridalyl، spinetoram، thiamethoxam، imidacloprid، Lambda-cyhalothrin، dinotefuran، pyriproxyfen، malathion، *Beauvaria bassiana* وأخيرا azadirachtin. أظهرت النتائج أيضا أن حشرة تربس البصل كان لها جيلين خلال فترة النمو الخضري لنباتات البصل. ووجد أن هناك ارتباط معنوي سالب بين تعداد حشرة التربس وبين الرطوبة النسبية وعلاقة ارتباط موجب بين درجات الحرارة وتعداد الحشرة.