Ass. Univ. Bull. Environ. Res. Vol. 12 No. 2, October 2009

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POPULATION FLUCTUATIONS, RELATIVE SUSCEPTIBILITY AND CONTROL OF *THRIPS TABACI* (LIND.) ON SOME ONION AND GARLIC CULTIVARS AND STRAINS

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ABSTRACT:

Bulb yield characters of two onion cultivars and two strains was determined. The total yield was arranged in descending order as follows: El-Azhar noua by 15.62> Giza 20 by 14.16> El-Baraka noua by 13.48> Giza 6 Mohassan by 13.06 ton/feddan. Exportable yield and culls yield were also determined. Population fluctuations of *Thrips tabaci* (Lind.) and resistance status of some onion and garlic cultivars and strains to this insect pest were determined in more details. In respect to the pest incidence, no significant difference was obtained between the tested onion cultivars or strains. However, significant difference was obtained between the inspection dates. The pest incidence on onion during the entire period of study showed that Giza 6 Mohassan harbored 25.60, El-Azhar noua 23.55, Giza 20 22.86 and El-Baraka noua 22.09 individuals/plant. Consequently, Giza 6 Mohassan and El-Azhar noua appeared as susceptible (S) cultivars, while Giza 20 and El-Baraka noua showed some sort of resistance and appeared as low resistant (LR) cultivars. Local garlic harbored 1.53 times of the pest more than Chinese cultivar. Consequently, the local garlic appeared as susceptible (S) cultivar, while the Chinese garlic appeared as moderately resistant (MR) cultivar. The ability of chemical and safe alternative insecticides in reducing the pest infestation on onion plantations arranged in descending order as follows: Spinosad by 85.67%> Sumithion by 80.89%> Achook by 64.05%> Kemsol oil by 48.25%. Application of the tested compounds increased the yield by 21% more than untreated plants.

INTRODUCTION:

Onion (*Allium cepa* L.) and garlic (*Allium sativum* L.) are considered as the most important vegetable crops in Egypt for export, as well as, local consumption. Many factors control the production of onion bulbs yield, e.g. cultivars, fertilization, plant population and irrigation (Bolasos, 1989). Recently, onion and garlic are cultivated in a wide area in Assiut Governorate (7785 and 159 feddan, respectively) for bulb yield and green use.

Thrips are mainly phytophagous, mycophagous, or predatory insects that inhabit a wide range of habitats, generally in the tropical, subtropical and temperate regions.

They frequently inhabit flowers or inflorescences of various kinds, shoots and tender leaves. Because of their high population, low mobility and confined and gregarious feeding, larvae do more damage than adults (Ananthakrishnan, 1993). High thrips populations cause up to 40% loss in onion yield (Fournier *et al*., 1995; Jensen *et al*., 2003). Onion thrips is one of the main pests of garlic, causing sever damage and reduce its yield (El-Sherief, 1971). Effect of insecticides against *Thrips tabaci*, has been studied in upper Egypt by Sallam and Hosseny (2003). However, the efficacy of some non-chemical insecticides against this pest was evaluated in Fayoum Governorate by Sabra *et al*. (2005). Scarce information about onion and garlic varietal resistance against *T. tabaci* were obtained. Therefore, the present investigation was initiated with the aim of measuring some onion yield characters and to evaluate *T. tabaci* infestation on onion and garlic cultivars and strains, with reference to their varietal resistance to this insect pest. Also, to evaluate the impact of certain chemical and non-chemical (safe alternative) insecticides in reducing the pest populations.

MATERIALS AND METHODS:

This work was carried out in the Experimental Farm of the Faculty of Agriculture, El-Azhar University campus, during two successive growing seasons 2007/2008 and 2008/2009 in a loan clay soil. The source of the tested onion and garlic cultivars and strains presented in Table (1). An area of about $^1/_2$ feddan was cultivated with the tested onion and garlic cultivars and strains. The experiment was conducted in complete randomized block design with three replicates 3x3.5 m (1/400 feddan). Transplants were 55-60 days old in 18 rows with three meter long. The spacing between plants was 6-7 cm in each row. Regular conventional practices were performed and no insecticides were applied. The plants were fertilized with a rate of 200 kg/feddan of urea (46.5% N) in two equal split dose, the first was after one month from transplanting and the second was after one month later. Calcium super phosphate was broadcast at a rate of 100 Kg/feddan before transplanting. Irrigation was applied when necessary. Plants were pulled out when 75% of tops fall down. Plants were cured in the field for two weeks. Roots and tops were cut.

Table (1): The tested host plants and compounds and application rate used for insect control

The tested host plants		The tested compounds	
Cultivars and strains	Source	Common name	Used rate
Onion:		Chemical (Phosphorus) compound:	
1-Giza 6 mohassan	El-Baraka Company	1- Sumithion 50% EC	1 Lit./fed.
2- Giza 20	Agricultural Research Center	Safe alternative compounds:	
3- El-Azhar noua	Faculty of Agriculture, El-Azhar Univ.	1- Spinosad (Natural Compound)	35 c^3/fed.
4- El-Baraka noua	El-Baraka Company	2- Achook 0.15% (Azadirachtin)	100 c^3/100 Lit.
Garlic:		3- Kemsol 95%EC (Mineral oil)	1.5 Lit./100 Lit.
1- Local	El-Baraka Company		

2- Chinese	Agricultural Research Center		

A-Horticultural practices:

To evaluate onion bulb characters of the tested cultivars and strains, the following measurements were taken:

1-Total bulb yields (ton/feddan): contains all types of bulbs.

2-Exportable yield (ton/feddan): Bulbs of 3-7 cm in diameter free from any culls bulbs.

3-Culls yield (ton/feddan): Includes less of 3 cm diameter+doubles+bolters+off color+ damage bulbs.

B-Entomological practices:

1-Population fluctuations of *T. tabaci*:

Fluctuations of *T. tabaci* population infested onion and garlic cultivars and strains was determined by picking up 5 separated plants from 3 replicates and transferred to the laboratory in muslin bags. Plants were dissected and examined under stereomicroscope to count thrips nymphs and adults inhabiting each plant. Samples were taken weekly from the beginning of February till harvesting.

2-Relative susceptibility of onion and garlic cultivars to *T. tabaci*:

Mean numbers of *T. tabaci* encountered in the abovementioned practice were used to determine the relative susceptibility degree of the tested cultivars and strains by using Chiang and Talekar (1980) and Abdel-Galil *et al*. (2002) equation. Relative susceptibility degree was dependent on the general mean number of the pest ($\overline{X}$) and the standard deviation (SD). Cultivars that had mean numbers more than $\overline{X}$+2SD, were considered highly susceptible (HS), between $\overline{X}$ and $\overline{X}$+2SD, susceptible (S), between $\overline{X}$ and $\overline{X}$-1SD, low resistant (LR), between $\overline{X}$-1SD and $\overline{X}$-2SD, moderately resistant (MR) and less than $\overline{X}$-2SD, were considered highly resistant (HR).

Data were statistically analyzed by using F test, means were compared according Duncan's multiple range test as described by Steel and Torrie (1982).

3-Efficacy of Sumithion and some safe alternative compounds in reducing *T. tabaci* infestation:

To determine the efficacy of the tested compounds in reducing *T. tabaci* infestation, three safe alternative compounds were chosen in addition to a chemical one, as shown in Table (1). Another $^1/_4$ feddan was cultivated by the onion cultivar Giza 6 Mohassan in completely randomized block design with 4 replicates (1/400 feddan) for each tested compound. To evaluate the reduction percentage of *T. tabaci* infestation caused by each compound, 5 plants were picked up from each replicate and transferred to the laboratory. Plants were dissected to encounter *T. tabaci* nymphs and adults. Samples were examined before spray and consequently after 1, 3, 7, 10 and 15 days of application. Reduction percentage in thrips infestation was calculated according to Henderson and Tilton (1955) equation.

RESULTS AND DISCUSSION:

A-Horticultural Practices:

1- Total yield:

The results for total yield of the different onion cultivars and strains are shown in Table (2). Significant variation in the total yield of cultivars and strains was observed in the two successive growing seasons of study. El-Azhar noua gave the highest total yield (15.62 ton/fed.) and followed by Giza 20 (14.16 ton/fed.). While Giza 6 Mohassan cv. gave the lowest total yield (13.06 ton/fed.). These results are in agreement with those obtained by Koriem and Farag (1990) who mentioned that Giza 20 gave the highest total yield under Mallawi conditions when compared with other cultivars. However, Gamie *et al.* (1996) showed that Giza 6 Mohassan cv. gave the highest total yield when sown on Sept. 20.

2-Exportable yield:

Data in Table (2) showed that, El-Azhar noua, El-Baraka noua and Giza 20, gave the highest exportable yield (11.28, 8.30 and 8.26 ton/fed.). However, Giza 6 Mohassan gave the lowest value (7.61 ton/fed.). These results are in disagreement with Abd El-Rahim and El-Aref, (2001) who reported that Giza 6 Mohassan gave the highest total yield and exportable yield than the other tested cultivars. They added that the exportable yield was not significantly affected by years.

The interaction between cultivars and seasons showed that El-Azhar noua gave the highest exportable yield in the second season (11.72 ton/fed.), while, Giza 6 Mohassan produced the lowest value (7.40 ton/fed.) in the first season.

3- Culls yield:

As shown in Table (2) culls yield significantly affected by cultivars and strains. The lowest culls yield was obtained with Giza 20 (3.70 ton/fed.). However, El-Baraka noua gave the highest yield (4.74 ton/fed.). The present results are in agreement with those obtained by Koriem and Farag (1990) who found that Giza 20 cultivar gave the highest values for total yield, exportable yield and gave the lowest values for yield of culls.

B-Entomological Practices:

1-Population fluctuations of *T. tabaci*:

Data in Table (3) exhibited the mean numbers of *T. tabaci* inhabiting onion cultivars and strains. The obtained results indicated that the highest numbers of the pest were recorded throughout the first week of February in most of the tested cultivars and strains, with an average of 46.00, 40.33 and 37.00 individuals/plant for Giza 6 Mohassan cv., El-Baraka noua and El-Azhar noua strains, respectively, however, Giza 20 cv. harbored the highest pest numbers in March 10, 2008 with an average of 35.33 individuals/plant. On the other hand, the lowest numbers of the pest were recorded during the first week of April during both seasons. In respect to the general mean number of *T. tabaci* recorded during 2008 growing season, non-significant difference was recorded between the tested onion cultivars and/or strains. Regardless the tested onion cultivar and/or strain, the pest population density recorded two peaks during February, 4 and March 17, 2008 with an average, 36.92 and 32.83 individuals/plant, respectively. The remaining inspection dates showed quietly equal numbers till the end of March. Statistical analysis of the data revealed highly significant

differences between the inspection dates collections.

Similar trend of the insect pest population fluctuations was recorded during the second year of study. The highest mean numbers of the pest were recorded during February, 2009 with an average of 36.00> 35.33> 26.67> 23.67 individuals/plant for El-Azhar noua strain, Giza 6 Mohassan cv., Giza 20 cv. and El-Baraka noua strain, respectively. The lowest mean numbers were recorded during mid April. Insignificant variation between cultivars and/or strains, was noticed. Regardless the onion cultivars and strains, two peaks of the pest infestation were recorded throughout corresponding inspection dates, with an average of 30.42 and 23.00 individuals/plant in February 8 and March 22, 2009, respectively. Also, statistical analysis of the data revealed highly significant difference between inspection dates for the pest infestation. In this approach, Sabra (2006) studied the infestation levels of *T. tabaci* on Giza 20 onion cultivar and the effect of the pest infestation on crop yield. He recorded 10.05-31.03 and 9.08-29.36 thrips/plant in 2003/4 and 2004/5 growing seasons, respectively. Also, he stated that the corresponding reduction of the yield due to thrips infestation ranged from 3.17 to 22.75% and from 7.52 to 40.6%.

Data in Table (4) exhibited the infestation levels of *T. tabaci* on garlic cultivars in the same area. The highest level of infestation was recorded during the beginning of February till mid March in both seasons. However, the lowest infestation level was recorded during April. In terms of the inspection dates, statistical analysis of the data revealed highly significant differences between the infestation levels during 2008 and 2009 growing seasons. Regardless the garlic cultivar, the pest showed its highest peak during February with an average of 44.83 and 32.17 individuals/plant in both growing seasons, respectively. Variations between the tested cultivars, showed that the local garlic harbored 1.32 and 1.85 individuals, more times than the Chinese cultivar during both seasons respectively, with significant difference.

2-Relative susceptibility of onion and garlic cultivars to *T. tabaci*:

Data in Table (5) summarized the relative susceptibility of the tested onion and garlic cultivars and strains to *T. tabaci*. The results dependent on the mean numbers of (adults + nymphs) inhabiting the host plants. Statistical analysis of the data revealed non-significant difference between onion cultivars and/or strains. However, highly significant difference was recorded between both growing seasons. Regardless the growing seasons, cultivars can be categorized according to their resistance status, whereas Giza 6 Mohassan, appeared as a susceptible (S) cultivar and El-Azhar noua appeared as susceptible (S) strain. However, Giza 20 cv. and El-Baraka noua strain, appeared as relatively resistant (RL) onions. On the other hand, highly significant difference was recorded between garlic cultivars, while a significant difference was recorded between growing seasons. The local garlic appeared as susceptible (S) cultivar since it harbored high population of the pest than the Chinese cultivar, which appeared as a moderately resistant (MR) cultivar. These varietal resistance variations to *T. tabaci* infestation may be due to the presence of antixenosis and/or antibiosis phenomena, as described by Van Emden (1987), who indicated that antixenotic plants can be avoid or less colonized by pests seeking food or oviposition site. Also, he described antibiosis as the position of some property by the plant, which directly or indirectly affects the performance of the pest in

terms of survival, growth, developmental rate, fecundity, etc. In this approach, Kendall and Capinera (1987) studied the susceptibility of onion growth stages to onion thrips. Recently scarce information were obtained about susceptibility of onion and/or garlic to *T. tabaci*. Therefore cultivars and strains that showed some sort of resistance can be included among advanced breeding programs to select new cultivars resistant to *T. tabaci*.

3-Efficacy of Sumithion and some safe alternative compounds in reducing *T. tabaci* infestation:

Data in Table (6) indicate the reduction percentage of thrips individuals inhabiting onion plantations by using the chemical insecticide Sumithion 50% EC and the tested safe alternative compounds. Also, the impact of using these compounds on the onion yield income was determined. The obtained data showed that the organophosphorus compound "Sumithion" and the natural compound "Spinosad" exhibited the highest initial kill with 97.24% and 93.56% reduction, respectively. However, Achook and Kemsol oil exhibited less than 50% reduction percentage after one day of spraying. Throughout 15 days after spraying, the used compounds showed different reduction percentages of the pest population. The general reduction percentage of the pest can be arranged in descending order as follows: Spinosad 85.67%> Sumithion 80.89%> Achook 64.05%> Kemsol oil 48.25%. Although, the reduction percentage of the pest numbers caused by using the first two compounds was higher than other compounds, there was no variation in crop yield. Also, it is of importance to notice that the yield income increased by 21% in treated than untreated onion. So, it may be recommended to replace the use of chemical compounds by using the tested natural compounds in controlling *T. tabaci* infesting onion plantations because they showed high reduction percentage of the pest and high percentage of the yield income.

In this approach, several investigators studied the role of chemical and non-chemical insecticides in reducing the incidence of thrips on onion plantations. In respect to the use of chemical compounds, Abd El-Aziz (2002) reported that Sulfur and Abamectin gave more than 60% reduction in thrips numbers over 20 days, with no significant difference between Abamectin and Sumithion. However, Omar and El-Kholy (2001) arranged the ability of chemical and non-chemical compounds in reducing thrips infestation as follows: Actellic (Primiphose methyl)> Jojoba oil > Biovar> Nemf compound. Similar results were obtained by Sallam and Hosseny (2003) who arranged the ability of chemical and non-chemical compounds in reducing thrips infestation as follows: Carbosulfan, Profenofos, Methomyl, Primiphos-methyl and Cabel-2 oil. On the other hand, the natural compound "Spinosad" succeeded in controlling the western flower thrips *Frinkliniella occidentalis* with no impact on its associated biological control agents as described by Jones *et al*. (2005). Therefore, the role of Spinosad and Achook in reducing onion thrips numbers mustn't be neglected.

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تذبذبات المجاميع ، درجات الحساسية ومكافحة تربس البصل على بعض أصناف وسلالات البصل والثوم

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تم اختبار الصفات الإنتاجية لأبصال صنفين وسلالتين من البصل. وقد أمكن ترتيب الإنتاج المحصولى لهذه الأبصال كالتالى: نوية الأزهر 15.6 > جيزه 20 بمتوسط 14.16 > نوية البركة 13.48 > جيزه 6 محسن 13.06 طن/فدان. كما تم اختبار مقدار المحصول التصديرى ومحصول النقضة لهذه الأصناف والسلالات. تم تقدير تذبذبات مجاميع حشرة التربس ودرجات حساسية أصناف وسلالات البصل والثوم المختبرة لهذه الآفة. أظهرت النتائج أن الفروق فى تواجد الآفة على أصناف وسلالات البصل كانت غير معنوية بينما كانت معنوية بين صنفى الثوم و كانت معنوية جداً بين مواعيد أخذ العينات. وعلى مدار عامى الدراسة أمكن ترتيب متوسط أعداد الآفة على أصناف وسلالات البصل كالآتى : جيزه 6 محسن 25.60 > نوية الأزهر 23.55 > جيزه 20 بمتوسط 22.86 > نوية البركة بمتوسط 22.59 فرد/نبات. وقد أظهر الصنف جيزه 6 محسن والسلالة نوية الأزهر بعض الحساسية للإصابة. بينما أظهر الصنف جيزه 20 والسلالة نوية البركة درجة متوسطة من المقاومة للإصابة. أما الثوم البلدى فقد ظهر كصنف حساس بينما ظهر الثوم الصينى كصنف معتدل المقاومة . قدرة المركبات المستخدمة على خفض تعداد الآفة حقلياً أمكن ترتيبها تنازلياً حسب نسبة الخفض كالتالى : سبينوساد 85.67% > سومثيون 80.89% > أشوك 64.05% > زيت الكيمسول 48.25% . كما أن استخدام هذه المركبات أدى إلى زيادة المحصول بمقدر يزيد عن 21% بالمقارنة بالنباتات غير المعاملة.