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THE RELATIONSHIP BETWEEN PLANTING DATES AND SOME CLIMATIC FACTORS ON THE INFESTATION OF EGGPLANT CULTIVARS WITH THE TWO-SPOTTED SPIDER MITE, *Tetranychus urticae* KOCH.

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ABSTRACT

Field studies were carried out at the Experimental Farm, Faculty of Agriculture, Assiut University, during two successive seasons of 2014 and 2015 used three planting dates (early summer, summer and nili plantations) in order to study the relationship between planting dates as well as some of the climatic factors (temperatures and relative humidity) on the census of the two-spotted spider mite, *Tetranychus urticae* Koch on some eggplant cultivars (i.e., black balady, white balady and romy).

The results obtained showed that the three tested planting dates gave significant and highly significant differences between mean numbers of *T. urticae* Koch recorded on the eggplant cultivars. The highest general mean number of *T. urticae* was recorded on the nili plantation followed by summer and early summer ones during the two growing seasons of 2014 and 2015. On the other side, the Max. and Min. temperatures gave highly significant and significant correlation values on the census of *T. urticae* through the three tested planting dates. While, the relative humidity showed negative insignificant correlations with the *T. urticae* census in the early summer plantation and positive significant in summer and nili ones on the three tested eggplant cultivars during 2014 and 2015 growing seasons.

It can be concluded that, the planting dates and climatic factors have a strong effect on the rate of eggplant cultivars infestation with *T. urticae*. Therefore, severe injury of the pest can be avoided by using the early summer plantation date.

Keywords: eggplant – planting dates - climatic factors - *Tetranychus urticae* Koch.

INTRODUCTION

Among 1250 species of spider mites known in the world, the two-spotted spider mite (TSSM), *Tetranychus urticae* Koch (Acari: Tetranychidae) is the most important phytophagous species. It attacks more than 300 host plants including vegetables (e.g. beans, eggplant, pepper, tomato, potato etc.); fruits (e.g. strawberry, raspberry, current, pear etc.) and ornamental plants, as shown in (Le Goff *et al*., 2009).

This scourge is causing yellowing and death of the infested plant leaves. This results in the lack of leaf surface less the energy used in maturing fruit. Entire plants in heavy infested areas of the field may be defoliated. These mites also produce webbing on plants where they feed. Damage frequently occurs in high temperature and hot spots such as areas of the field near dusty roads (Abdel-Aziz *et al*., 2002; Ibrahim, 2009; Aziza *et al*., 2012 and Gadi and Miller, 2014).

Solanaceous vegetable plants are very important in all agricultural regime, which used as important food in many countries of the world. Eggplant (*Solanum melongena* L.) is considered one of the most important solanaceous vegetable crop in Egypt (Abdel-Megied, 1998; Al-Said and Kamal, 2005; Solieman *et al*., 2012 and Sadek *et al*., 2013).

On the other hand, the influence of planting dates and climatic factors on the census of the two-spotted spider mite on eggplant could be used as an items in integrated pest management programs (El-Khateeb *et al*., 2001; Habashy and Saweeres, 2005; Baradaran *et al*., 2007 and Mubammad *et al*., 2010).

Thus, the aim of the present work is to study the relationship of planting dates and climatic factors on eggplant cultivars infestation with *T. urticae* Koch during two successive seasons of 2014 and 2015, to severe as an introduction to the use of integrated pest management.

MATERIALS AND METHODS

The work herein was carried out in the Experimental Farm of the Faculty of Agriculture, Assiut University, during two successive growing seasons of 2014 and 2015 in a loam clay soil. An area of about ⅜ feddan was cultivated with three eggplant cultivars (e.g., black balady, white balady and romy). The experiments conducted in complete randomized block design with three replicates 3x3.5 (1/400 feddan). Seeds of each cultivar were sown in three planting dates (the first in March 1st for early summer, the second in May 1st for summer and the third in July 1st for nili plantation) during 2014 and 2015 growing seasons.

Normal agricultural practices were applied a part from the use of any pesticides transactions. Sampling started after three weeks from planting date and prolonged to the harvest time, each sample comprised 5 leaflets picked at random representing the plant levels from each replicate.

Samples were put in plastic bags and transferred to the laboratory in the same day for examination and counting the mobile stages of *T. urticae* by the aid of stereoscopic microscope.

The meteorological data (maximum & minimum temperature and relative humidity) were recorded during each inspection date. Records were obtained from the meteorological station located at Assiut University.

The obtained data were statistically analyzed according to Snedecor and Cochran (1971) and the means were compared by using Least Significant Difference (L.S.D.) at level of 5%.

The relationships between the population density of *T. urticae* and planting dates & certain prevailing climatic factors (maximum & minimum temperature and relative humidity) were statistically analyzed by

using simple correlation according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

I- Planting dates:

Data presented in Tables (1 & 2) show the relationship of planting dates on the infestation of eggplant cultivars; (black balady, white balady and romy) with *T. urticae* during 2014 and 2015 growing seasons.

1- The first planting date (early summer plantation):

Data of the 2014 season (Table 1) show that the mean numbers of *T. urticae* began to appear on the eggplant cultivars; (black balady, white balady and romy) in the fourth week of March in low numbers (2.33, 3.33 and 1.00 individuals/15 leaflets), then the numbers increased gradually to reach its maximum in the fourth week of May with almost high numbers (38.33, 50.33 and 25.67 ind./15 leaflets) for the three cultivars mentioned above, respectively.

During 2015 season (Table 2), the numbers of *T. urticae* individuals were high as compared with that in 2014 season. The first appearance of mite was occurred in the fourth week of March on the three eggplant cultivars with scarce numbers (3.33, 5.00 and 1.67 ind./15 leaflets), then the numbers increased gradually to reach its maximum in the fourth week of May with almost high numbers (52.33, 59.67 and 26.67 ind./15 leaflets) for the three cultivars, respectively.

Table (1). Relationship between planting dates and the infestation of eggplant cultivars with *T. urticae* during 2014 growing season.

Cultivar 1st planting date	Black balady	White balady	Romy	Cultivar 2nd planting date	Black balady	White balady	Romy	Cultivar 3rd planting date	Black balady	White balady	Romy
22/3/2014	2.33	3.33	1.00	22/5/2014	35.67	42.00	25.00	22/7/2014	51.67	65.67	31.33
29	2.67	4.67	1.00	29	38.00	47.33	29.33	29	61.33	70.33	38.67
Mean	2.50	4.00	1.00	Mean	36.83	44.66	27.16	Mean	56.50	68.00	35.00
5/4	3.67	7.00	1.67	5/6	48.33	59.00	36.33	5/8	67.67	78.00	41.67
12	5.33	8.67	2.67	12	50.33	64.67	37.33	12	69.67	82.00	47.67
19	7.00	11.33	3.00	19	55.67	68.33	41.00	19	73.67	89.00	52.00
26	8.67	15.00	5.67	26	59.33	72.33	44.00	26	81.00	95.00	55.33
Mean	6.17	10.50	3.25	Mean	53.41	66.08	39.66	Mean	73.00	86.00	49.17
3/5	13.00	15.67	10.00	3/7	67.00	82.00	48.00	2/9	84.00	97.00	59.00
10	20.33	26.00	15.33	10	74.67	90.33	53.33	9	69.67	86.00	45.00
17	30.33	43.67	23.67	17	79.33	97.00	56.00	16	62.00	81.33	38.67
24	38.33	50.33	25.67	24	61.00	68.00	44.33	23	59.00	75.33	33.67
31	26.67	39.67	17.00	31	47.00	57.67	38.00	30	50.00	74.00	29.67
Mean	25.73	35.07	18.33	Mean	65.80	79.00	47.93	Mean	64.93	82.73	41.20
7/6	20.67	31.33	15.67	7/8	40.67	49.67	31.00	7/10	41.33	68.00	24.67
14	16.67	22.33	13.00	14	38.00	45.67	23.33	14	37.67	61.00	20.67
Mean	18.67	26.83	14.33	Mean	39.33	47.67	27.16	Mean	39.50	64.50	22.67
G. mean	15.05 C'	21.46 C	10.41 B"	G. mean	53.46 B'	64.92 B	39.00 A"	G. mean	62.21 A'	78.67 A	39.85 A"

Generally, the average mean numbers of *T. urticae* were variable according to months, on the three eggplant cultivars the numerical density of *T. urticae* of season 2014 was significantly low during March and April and increased significantly to attain its maximum peak during May (25.73, 35.07 and 18.33 ind.) and (39.13, 48.40 and 21.53 ind.) for 2015 season, respectively.

2- The second planting date (summer plantation):

During 2014 season (Table 1), data revealed that the first appearance of mite individuals was recorded in the fourth week of May with an average numbers of 35.67, 42.00 and 25.00 individuals/15 leaflets, then the numbers increased gradually to reach its maximum in third week of July with an average of 79.33, 97.00 and 56.00 ind./15 leaflets, on eggplant cultivars, respectively.

At 2015 season, data in Table (2) showed that the mean numbers of *T. urticae* started to appear on eggplant cultivars in the fourth week of May with an average of 39.00, 48.67 and 26.67 ind./15 leaflets), then the numbers increased gradually to reach its maximum in third week of July with an average of 82.33, 123.33 and 69.67 ind./15 leaflets, for the three cultivars, respectively.

Generally, the average numbers of mite were variable on eggplant cultivars according to months, the highest density of mite was recorded in July with an average of 65.80, 79.00 and 47.93 ind. during 2014 season and 72.40, 105.00 and 58.27 ind. during 2015 growing season, for the three eggplant cultivars, respectively.

3- The third planting date (nili plantation):

In 2014 growing season, data (Table 1) data showed that the numbers of *T. urticae* started to appear on eggplant cultivars in the fourth week of July with mean numbers an average of 51.67, 65.67 and 31.33 individuals/15 leaflets, then the numbers increased gradually to reach their maximum in first week of September with mean numbers of 84.00, 97.00 and 59.00 ind./15 leaflets, for the three cultivars, respectively.

During the second season (Table 2), the numbers of *T. urticae* individuals were the highest as compared with that in the first season. The first appearance of mite was recorded in the fourth week of July with an average mean numbers of 57.33, 77.67 and 36.67 ind./15 leaflets, then the numbers increased gradually to reach their maximum in first week of September with an average numbers of 110.00, 118.67 and 77.33 ind./15 leaflets, for the three eggplant cultivars, respectively.

Table (2). Relationship between planting dates and the infestation of eggplant cultivars with *T. urticae* during 2015 growing season.

Cultivar 1st planting date	Black balady	White balady	Romy	Cultivar 2nd planting date	Black balady	White balady	Romy	Cultivar 3rd planting date	Black balady	White balady	Romy
22/3/2015	3.33	5.00	1.67	22/5/2015	39.00	48.67	26.67	22/7/2015	57.33	77.67	36.67
29	6.00	9.33	2.67	29	41.33	54.33	33.33	29	69.67	85.67	43.33
Mean	4.66	7.16	2.17	Mean	40.16	51.50	30.00	Mean	63.50	81.67	40.00
5/4	9.00	12.67	4.33	5/6	52.33	68.00	39.00	5/8	80.00	90.33	49.00
12	12.33	18.33	7.00	12	57.33	73.33	25.00	12	87.33	93.67	54.00
19	19.00	23.67	9.67	19	62.67	84.67	48.67	19	91.00	97.00	62.33
26	24.33	30.33	14.67	26	70.33	96.33	52.00	26	99.33	107.67	70.33
Mean	16.16	21.25	8.92	Mean	60.66	80.58	41.17	Mean	89.41	97.17	58.91
3/5	27.33	38.67	17.33	3/7	74.00	104.00	58.67	2/9	110.00	118.67	77.33
10	33.00	44.33	19.67	10	79.00	119.00	66.00	9	88.67	106.33	60.67
17	44.00	53.33	23.67	17	82.33	123.33	69.67	16	76.33	92.00	47.67
24	52.33	59.67	26.67	24	65.67	99.67	53.00	23	69.00	84.00	36.33
31	39.00	46.00	20.33	31	61.00	79.00	44.00	30	58.33	80.00	33.33
Mean	39.13	48.40	21.53	Mean	72.40	105.00	58.27	Mean	80.47	96.20	51.07
7/6	33.67	39.00	17.33	7/8	48.00	63.00	35.33	7/10	43.17	74.33	29.67
14	29.67	32.33	14.00	14	42.33	56.33	29.00	14	34.00	69.00	25.33
Mean	31.67	35.66	15.66	Mean	45.16	59.66	32.16	Mean	38.83	71.66	27.50
G. mean	25.61 C'	31.74 C	13.77 C"	G. mean	59.64 B'	82.28 B	44.64 B"	G. mean	74.20 A'	90.49 A	48.15 A"

Generally, the average numbers of the two-spotted spider mite were variable according to months on the three eggplant cultivars; the number of mite were the highest during August of the first year (73.00, 86.00 and 49.17 ind.) and (89.41, 97.17 and 58.91 ind.) in the second year, respectively.

Also, data in Tables (1 & 2) showed significant and highly significant differences recorded between general mean numbers of *T. urticae* on the three eggplant cultivars, whereas the highest general mean numbers of mite (62.21, 78.67 and 39.85 ind.) recorded on the nili plantation followed by summer plantation (53.46, 64.92 and 39.00 ind.) and early summer one (15.05, 21.46 and 10.41 ind.) during the first season, and (74.20, 90.49 and 48.15 ind.) followed by summer plantation (59.64, 82.28 and 44.64 ind.) and early summer plantation (25.61, 31.74 and 13.77 ind.) during 2015 season, respectively.

The variation between mean numbers of mite on the three eggplant cultivars and planting dates (through March, May and July) may be due mainly to the leaf characteristics and some biotic and climatic factors.

Similar results were obtained by many authors such as; Abou-Attia *et al*. (2004) who found that the peak number of the two-spotted spider mite were recorded on cucumber and tomato through April and May. While, El-Khayat *et al*. (2010) when tested three planting dates (April 1st, 15th and 30th) of cowpea on the levels of infestation with two mite species (*T. urticae* & *T. cucurbitacearum*) whereas data found that the mean numbers of different stages of mites were increased by delaying the planting date and Awadalla *et al*. (2011) showed that the two spotted spider mite, *T. urticae* reached the highest number on kidney bean plants in late summer plantation during the two seasons of 2009 & 2010. Mohamed (2011) studied the effect of four planting dates of squash seeds (March 15th, April 1st, 15th and May 1st) on levels of infestation with three piercing sucking pests, the results showed that the degree of infestation by previous pests increased significantly by delaying planting date.

II- Climatic factors:

Data in Table (3) recorded the correlation coefficient between main climatic factors (max., min. temperature and relative humidity) and the census of the pest on the three eggplant cultivars (black balady, white balady and romy) through the three planting dates (March 1st, May 1st and July 1st) during the two seasons of 2014 & 2015.

The results in the first season showed highly significant correlations (r= 0.739, 0.721; 0.792, 0.761 and 0.682, 0.602) and 0.845, 0.810; 0.869, 0.851 and 0.703, 0.688 between temperature (max. & min.) and the population density of mite on the three eggplant cultivars during the first & the second planting dates, respectively, while significant correlations (r= 0.331, 0.301; 0.349, 0.313 and 0.229, 0.181) were recorded between temperature (max. & min.) and the census of mite on black balady, white balady and romy, cultivars during the third planting date, respectively.

On the other hand, negative insignificant correlations (r= -0.233, -0.196 and -0.236) were counted between relative humidity and the numbers of mite on black balady, white balady and romy cultivars, during

the first planting date, respectively. While, positive significant correlations (r= 0.234, 0.341 and 0.196 and 0.291, 0.352 and 0.241) were counted between relative humidity and the numbers of mite on black balady, white balady and romy during second and third planting dates, respectively.

During 2015 season, data in Table (3) showed highly significant correlations (r= 0.752, 0.734; 0.801, 0.783; 0.707, 0.674 and 0.861, 0.819; 0.883, 0.864 and 0.723, 0.701) recorded between temperature (max. & min.) and the population density of mite on the three eggplant cultivars during the first and the second planting dates, respectively. While, significant correlations (r= 0.349, 0.321; 0.372, 0.343 and 0.281, 0.217) were accounted between max. & min. temperature and the mite population on black balady, white balady and romy cultivars during the third planting date, respectively.

Table (3). The relationship between main climatic factors (temperature and relative humidity) and the population density of *T. urticae* on the eggplant cultivars through three planting dates during 2014 and 2015 seasons.

Planting date & cultivars	2014			2015		
	Max. temp.	Min. temp.	R.H.	Max. temp.	Min. temp.	R.H.
First planting date:						
Black balady	0.739**	0.721**	-0.223	0.752**	0.734**	-0.193
White balady	0.792**	0.761**	-0.196	0.801**	0.783**	-0.171
Romy	0.682**	0.602**	-0.236	0.707**	0.674**	-0.214
Second planting date:						
Black balady	0.845**	0.810**	0.234*	0.861**	0.819**	0.251*
White balady	0.869**	0.851**	0.341*	0.883**	0.864**	0.373*
Romy	0.703**	0.688**	0.196*	0.723**	0.701**	0.213*
Third planting date:						
Black balady	0.331*	0.301*	0.291*	0.349*	0.321*	0.305*
White balady	0.349*	0.313*	0.352*	0.372*	0.343*	0.366*
Romy	0.229*	0.181*	0.241*	0.281*	0.217*	0.269*

*** Significant at 0.05 probability level.** **** Significant at 0.01 probability level.**

Also, the relative humidity during the first planting date showed negative insignificant correlations (r= -0.193, -0.171 and -0.214) with the mite population on the three cultivars and positive significant correlations (r= 0.251, 0.373 and 0.213 and 0.305, 0.366 and 0.269) were recorded between relative humidity and the mite populations on black balady, white balady and romy during second and third planting dates, respectively.

The results of the correlation coefficient between some environmental conditions and the population density of the two-spotted spider mite were studied by many authors, Taha *et al*. (2001) recorded significant correlations among infestation levels of soybean with mite population and the climatic factors (temperature and relative humidity); El-Doksh (2006) recorded positive and significant correlations between mite population and max., min. temperature and relative humidity on Giza 111 soybean variety in 2003 season, respectively. While, the author recorded negative and highly significant correlations occurred between mite populations and max. temperature and relative humidity in 2004, on Giza 21 soybean variety, respectively and Bedawy *et al*. (2011) showed significant and insignificant positive and/or negative correlations recorded between (temperature and relative humidity) and the population density of the spider mite on eggplant.

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العلاقة بين مواعيد الزراعة وبعض العوامل الجوية علي إصابة أصناف الباذنجان بأكاروس العنكبوت الأحمر

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي - الجيزة – مصر

أجريت هذه الدراسة بالمزرعة البحثية – كلية الزراعة – جامعة أسيوط خلال عامي ٢٠١٤ و ٢٠١٥ وذلك في ثلاثة مواعيد زراعة، الميعاد الأول خلال الأسبوع الأول من شهر مارس (صيفي مبكر)، الميعاد الثاني خلال الأسبوع الأول من شهر مايو (صيفي) والميعاد الثالث خلال الأسبوع الأول من شهر يوليو (نيلي)، حيث تم دراسة علاقة مواعيد الزراعة السابقة وبعض العوامل الجوية (درجة الحرارة والرطوبة النسبية) علي إصابة ثلاث أصناف من الباذنجان (الأسود البلدي، الأبيض البلدي والرومي) بأكاروس العنكبوت الأحمر خلال موسمي الدراسة.

وقد أوضحت نتائج مواعيد الزراعة الثلاثة المختبرة عن وجود معنوية ومعنوية عالية للفروق بين متوسطات أعداد الأكاروس علي أصناف الباذنجان الثلاثة، حيث كانت العروة النيلية قد سجلت أكثر تعداد للأكاروس يليها العروة الصيفية ثم العروة الصيفية المبكرة والتي سجلت أقل تعداد للأكاروس خلال موسمي الدراسة.

كما أوضحت النتائج أيضاً أنه من خلال دراسة الارتباط البسيط بين كل من درجة حرارة الجو العظمي والصغري والرطوبة النسبية مع الكثافة العددية لأكاروس العنكبوت الأحمر خلال موسمي الدراسة ٢٠١٤ ، ٢٠١٥ فقد وجد إرتباط عالي المعنوية ومعنوي بين درجة الحرارة العظمي والصغري وتعداد الأكاروس، وإرتباط سالب غير معنوي بين الرطوبة النسبية وتعداد الأكاروس في العروة الصيفية المبكرة، إرتباط موجب معنوي خلال العروة النيلية وذلك علي أصناف الباذنجان الثلاثة خلال موسمي الدراسة، حيث أن التأثير كان أعلي بالنسبة لدرجات الحرارة يتبعها الرطوبة النسبية.

من خلال نتائج الدراسة فقد أتضح أن هناك تأثير وعلاقة بين مواعيد زراعة الباذنجان والعوامل الجوية من ناحية ودرجة الإصابة بالأكاروس من ناحية أخري، فلقد أوضحت من النتائج السابقة أن أنسب ميعاد لزراعة الباذنجان لتجنب الإصابة بأكاروس العنكبوت الأحمر هو خلال شهر مارس (العروة الصيفية المبكرة).