Effects of Climatic Conditions on Distribution and Fluctuation of Some Pests on The Eggplant Plantations in Summer and Autumn Seasons

Ramadan M. Farrag and Ehsan A. Zakzouk[1]

ABSTRACT

The work aimed to indicate the differences in species and population densities of pests, which were found on the eggplant plantations (cv. Roma) in summer and autumn seasons in Alexandria.

The results showed that presence of the red spider mite (*Tetranychus urticae*), whitefly (*Bemisia tabaci*), potato tuber moth (*Phthorimae opercellula*), semi-looper (*Autographa* spp.), onion thrips (*Thrips tabaci*) and the predator aphid-lion (*Chrysopa vulgaris*) in autumn season. While, *T.urticae*, *B. tabaci* and *Autographa* spp. were found in summer.

***T.urticae* gave the highest number in the two seasons, especially in autumn. The general averages ($\overline{X}$) of eggs, nymphs and adults were 85, 57.1 and 38.8 individuals/plant, respectively. The corresponding figures were 47.2, 43.1 and 15.1 in summer.**

Few numbers of the other-mentioned pests were counted in comparison with *T. urticae* in the two seasons. Therefore, *T. urticae* constitutes the major pest on eggplant and increases in autumn due to high temperature and PSD (possible sunshine duration).

Therefore, effects of some climatic conditions in the two seasons on presence and numbers of pests were studied. In autumn, the simple correlation analysis indicated that PSD was the most effective on eggs of *T. urticae*. Also, amount of rain showed significantly negative correlations on *T. urticae* stages in autumn season. Concerning summer season, PSD had significantly effect on adults of *T. urticae*. It is evident that some climatic conditions have effects on population dynamics of some pests, and PSD was the most important factor on *T. urticae*.

Also, treatments of abamectin and micronized sulfur induced reduction in eggs, nymphs and adults of *T. urticae* after 2, 5 and 7 days of application with the highest effect of abamectin after 7 days. Significant differences were noticed between treatments and days post-treatment.

INTRODUCTION

The eggplant (*Solanum melongena*) is among the important vegetable crops in Egypt, therefore the cultivated areas increase annually. The cultivation of this crop require a deep knowledge of many variables such as the suitable soil, irrigaration, fertilization, climate and pests, which affect on yield. Nagai (1991), Ho and Chen (1992), Farrag and Zakzouk (1998) dealt with pests and their control on this crop.

The climatic changes could be effect on population density of pests. Therefore, the first aim of this work is to study the effects of climatic conditions in autumn and summer on species and density of pests on eggplant. The meteorological parameters during periods of inspection in years of 2012 and 2013 were obtained from the Egyptian Meteorological Authority, Egypt. Previous studies dealt with relationship between climatic conditions and population density of pests (El-Halawany *et al*., 1990; Abdel-Halim, 1994 and Zakzouk and Farrag, 1998).

In regard to chemical control, it has played major role in controlling pests, although it has harmful effect on environment. Consequently, the second aim is to compare the effects of biocide abamectin with inorganic compound sulfur on stages of *T. urticae* after several days of spraying.

MATERIALS AND METHODS

I- The test-treatments

-Sulfur (Micronized Soreil/Smark 70% WP, at the dose of 250 g/100 L. water.).

-Abamectin (Vertimec 1.8% EC, at the dose of 40 cm^3/100 L.).

II- Field experimets

The trials were achieved at the grower fields at El-Maamoura region, Alexandria. The long black eggplant (cv. Roma) was transplated on 23 Sept., 2012 and on 15 March, 2013 in the autumn and summer seasons, respectively. This variety tolerates the low temperature in open fields during growing periods.

The area was divided into plots ≅ 100 m^2 with 3 replicates. Thirty leaves of 10 plants were detached from lower, middle and upper parts of each plant per plot. The leaves were examined in laboratory to identify and count the present species. The work was done at 2 weeks intervals as indicated in Tables (1&2).

Also, effects of abamectin and sulfur on *T.urticae* stages were studied. The treatments were sprayed on plant using knaspack sprayer with 3 replicates per treatment and untreated plots as control. The efficacy was compared on eggs, nymphs and adults at 2, 5 and 7 days after treatment. The efficacy was determined by

[1]Plant Protection Research Institute, Agricultural Research Center, Sabahia, Alexandria
Received Febuary 6, 2014, Accepted March 9, 2014

calculating the percent reduction (%R) of these stages by using Henderson-Tilton's formula (Henderson and Tilton, 1955).

The data were analysed and means were separately with LSD test at 0.05 level (Steel and Torrie, 1980). Also, simple correlations between meteorological paratmers and population density of each pest species in the two seasons were estimated.

RESULTS AND DISCUSSIONS

1- Survey and population density

1.1- In autumn season

Data in Table (1) show the pest species and associated predator, which were found in this period on the eggplant. The pests of *T. urticae*, *B. tabaci*, *P. opercellula*, *T. tabaci*, *Autographa* spp. and the predator of *C. vulgaris* were found and varied in their densities during Oct. till Dec., 2012.

T. urticae was the dominant pest with the highest numbers during Oct., 11 - Nov., 9. The mean number of eggs, nymphs and adults were 237, 87.3 and 58 individuals/plant on Oct., 11 respectively. While, the values were 109, 107.7 and 33.7, resp. on Nov., 9. After that, declining number rates of the above-mentioned stages were noticed. Significant differences were estimated during this period. It seems that *T. urticae* is influenced by climatic conditions in the growing season.

Also, *B. tabaci* was varied during this period, showing 6.7 - 0.7 eggs/ plant during Oct.,11–Dec.,22. While, the values of pupae were 20.7–5/ plant. The little numbers of *P. opercellula* larvae, *Autographa* larvae, *T. tabaci* nymphs and *C. vulgaris* adults were counted and presented in Table (1).

1.2- In summer season

Data in Table (2) indicated presence of *T. urticae* and little numbers of *Autographa* spp. The highest infestation of *T. urticae* were occurred with means of 120.7 - 95.3 eggs/plant on May 12 and 26. The values of nymphs were 39.3–91, while adults reached 26.3 – 37.3 /plant. Also, larvae of *Autographa* spp. reached its max. number on May 26 with 8.7 individuals / plant. Negligible no. *B. tabaci* was noticed, while the natural enemies were not found.

In 1990, El-Halawany *et al*. mentioned that *T. urticae* appeared in few numbers on old leaves of apple in winter months (Jan. and Feb.), and the mite had two annual peaks of seasonal abundance, one in June and the other in October. Also, they stated that low temperature from Nov. to Feb. reduces fecundity and prolongs duration of development stages leading to reduction in mite populations. It seems that hot and dry weather cause significant mite outbreak.

Generally, it was noticed that numbers of pests were much higher in autumn season than in summer. *T. urticae* was the most pest on eggplant in the two seasons, particularly in autumn. This might be due to high temperature.

2- Simple correlation analysis

The simple correlations between the pest population and months in the two seasons are shown in Table (3).

2.1- In autumn season

The results show PSD (possible sunshine duration) has the highest positive correlation coefficient on eggs of *T. urticae* eggs followed by maximum and minimum temperature. The r-values were 0.993, 0.921 and 0.886, respectively. Also, min. and max. temp. showed significant positive correlation with nymphs.

On the other hand, amount of rain gave significantly negative correlations with stages of *T. urticae*. Also, % RH showed negative correlation on eggs and adults of this pest.

2.2- In summer season

Data in Table (3) show PSD had only significantly correlation with *Tetranychus* adults, giving r-value equal to 0.766. While, the other meteorological parameters did not have effect on the other pest stages.

Then, PSD is the major factor may limit the population densities of *T. urticae* in autumn and summer seasons.

3- Efficacy of the test-pesticides on *T. urticae*

Data in Table (4) indicated the variations in potentional activity of the treatments during the days after application. Sulfur gave higher reduction in eggs, nymphs and adults after 2 days in comparison with abamectin. But, the reduction increased with abamectin after 5 and 7 days induced 94.8, 95.3 and 82.0% reduction in eggs, nymphs and adults after 7 days, resp. While, they were 80.2, 83.2 and 39.5 with sulfur. Then, abamectin gave the best control after 7 days in the range of 82-95% reduction in the stages.

Generally, significantly differences were noticed among the treatments and days after application.

Similer findings were observed by using lime sulfur on *T. urticae* (Giraldo *et al*., 2013). In 2013, Nour El-Deen and Abdallah indicated that abamectin and micronized sulfur were the most effective compounds against *T. urticae* under laboratory conditions.

Table 2. Pest species and their densities on eggplant during summer season, 2013

Date of inspection	Mean no. individuals / plant (3 leaves)						General Averages ($\overline{X}$)
	B. tabaci		*T. urticae*			*Autographa*	
	eggs	pupae	eggs	nymphs	Adults	Spp.	
April 14,	0.0 a	1.7 a	5.3 c	31.3 b	1.0 e	0.3 b	6.6 C
28,	0.0 a	0.0 a	23.7 c	6.0 b	6.0 de	0.0 b	6.0 C
May 12,	0.0 a	0.0 a	120.7 a	39.3 ab	26.3 b	0.7 b	31.2 B
26,	0.0 a	1.3 a	95.3 b	91.0 a	37.3 a	8.7 a	38.9 A
June 9,	0.0 a	0.0 a	70.9 b	39.0 ab	18.3 c	0.0 b	21.4 B
23	0.0 a	0.0 a	5.3 c	64.2 ab	5.2 de	0.0 b	12.5 C
July 7	0.0 a	0.0 a	9.0 c	31.0 b	11.3 d	0.0 b	8.6 C
$\overline{X}$	0.0 C	0.4 C	47.2 A	43.1 A	15.1 B	1.4 C	17.9

Means followed by the same letter in each column are not significantly different at 0.05 level by LSD test.

Table 3. Simple correlations between average no. pests on eggplant and some meteorological parameters in autumn season of 2012 and summer of 2013, Alex

Pests & Predator	Stages	Meteorological parameters				
		Min. temp. (C^o)	Max. temp. (C^o)	PSD	% RH	Amm. rain (mm)
Autumn 2012						
B. tabaci	eggs	0.082	0.261	0.305	- 0.175	0.020
	pupae	0.721	0.789	0.783	- 0.229	- 0.810
T. urticae	eggs	0.886*	0.921**	0.993***	- 0.246	- 0.860*
	nymphs	0.843*	0.853*	0.776	0.004	- 0.893*
	adults	0.586	0.695	0.688	- 0.239	- 0.732*
P. operculella	larvae	0.607	0.620	0.807	- 0.340	- 0.474
Autographa spp.	larvae	0.555	0.649	0.604	- 0.167	- 0.708
T. tabaci	nymphs	0.578	0.422	0.176	0.565	- 0.524
C. vulgaris	adults	0.547	0.580	0.786	- 0.398	- 0.428
$\overline{X}$		0.850*	0.903*	0.913*	- 0.819	- 0.892*
Summer 2013						
B. tabaci	pupae	- 0.616	- 0.442	- 0.659	- 0.039	
T. urticae	eggs	0.117	0.426	- 0.075	- 0.085	
	nymphs	0.399	- 0.256	0.137	0.469	
	adults	0.506	0.463	0.766*	0.142	
Autographa spp.	larvae	0.020	0.164	0.100	- 0.110	
$\overline{X}$		0.256	0.253	0.016	0.231	

* , ** , *** significant at 0.05 , 0.01 and 0.001.

Table 4. Potentional activity of abamectin and sulfur on *T. urticae* stages after 2, 5 and 7 days of spraying

Pesticides	Days after Application	Percent reduction (% R)		
		Eggs	Nymphs	Adults
Abamectin	2	10.7 d	10.0 d	11.7 d
	5	76.7 b	82.1 b	88.5 a
	7	94.8 a	95.3 a	82.0 a
Sulfur	2	50.3 c	47.3 c	63.7 b
	5	79.5 b	48.2 c	65.9 b
	7	80.2 b	83.2 b	39.5 c

Means followed by the same letter in each column are not significantly different at 0.05 level by LSD test.

From the foregoing results, *T. urticae* was the major pest on eggplant during autumn and summer seasons. Regarding meteorological parameters, PSD was the main factor effecting on stages of *T. urticae*. Also, treatments of abamectin and micronized had promise effect on this pest.

REFERENCES

Abdel-Halim, S.M. (1994). The simultaneous effect of four weather factors on the field infestation of the cotton leafworm *Spodoptera littoralis* (Boisd.) in six successive years. Egypt. J. Agric. Res., 72(1): 81-89.

El-Halawany, M.E.; R.G. Abou-El-Ela and H.M. Esmail (1990). Population dymanics of mites and their natural enemies on apple and apricot trees. Agric. Res. Rev., 68: 59-66.

Farrag, R.M. and E.A. Zakzouk (1998). Effects of some pesticides on pests and their predators in eggplant fields. Alex. Sci. Exch. 19(3): 507-512.

Giraldo, A.S.; A. Pallini and M. Venzon (2013). Efficacy of lime sulphur in control of mites *Tetranychus evansi* Baker and Pritchard and *Tetranychus urticae* Koch (acari: tetranychidae). Revista Luna Azul, 37: 63-73.

Henderson, C.F. and E. Tilton (1955). Tests with acaricides against the brown wheat mite. J. Econ.Entomol. 48: 157-161.

Ho, C.C. and W.H. Chen (1992). Species survey of spider mites and seasonal occurrence of *Thrips palmi*, *Chlorita biguttula* and *Tetranychus cinnabarinus* on eggplant. Chinese J. Entomol. 12(4): 259-268.

Nagai, K. (1991). Integrated control of programs for *Thrips palmi* on eggplant (*Solanum melongena* L.) in an open field. Japanase J. App. Entomol. & Zoology 35(4): 283-289.

Nour El-Deen, M.E.M. and A.A.M. Abdallah (2013). Effect of different compounds against *Tetranychus urticae* Koch and its predatory mite *Phytoseiulus persimilis* A.H. under laboratory conditions. J. App. Sci. Res., 9 (6): 3965-3973.

Steel, R.G. and J.H. Torrie (1980). Principles and procedures of statistics. A. Biometrical approch, 2nd ed. Mc Graw-Hill Book Co., New York.

Zakzouk, E.A. and R.M. Farrag (1998). Effect of climatic conditions on some mite species on orange trees in Alexandria. Alex. Sci. Exch., 19(3): 455-463.

الملخص العربي

تأثيرات الظروف المناخية على توزيع وتذبذب بعض الآفات على نباتات الباذنجان خلال العروتين الصيفى والخريفى

رمضان محمد فراج، إحسان أحمد زقزوق

أستهدف البحث إظهار الإختلافات فى أنواع وتعداد الآفات والأعداء الحيوية المتواجدة على نباتات الباذنجان الأسود الطويل(صنف روما) خلال العروتين الصيفى والخريفى فى الإسكندرية.

وأظهرت النتائج تواجد الأكاروس الأحمر والذبابة البيضاء وفراشة درنات البطاطس والدودة النصف قياسة وتربس البصل بالإضافة إلى مفترس أسد المن فى العروة الخريفى. بينما إنخفضت الأنواع والتعداد المتواجدة فى العروة الصيفى حيث تواجدت والأنتشار النسبى للأكاروس الأحمر بالإضافة إلى أعداد قليلة من الذبابة البيضاء والدودة النصف قياسة. كذلك لوحظ تزايد تعداد الأكاروس الأحمر فى كلا العروتين خاصة فى الخريفى مع فروق معنوية خلال فترات الفحص. حيث بلغ المتوسط العام لتعداد البيض والحوريات والحيوان الكامل ٨٥، ٥٧.١ ٣٨.٨ فرد/نبات على التوالى فى العروة الخريفى بينما كانت ١٧.٢، ٤٣.١، ١٥.١ على التوالى فى العروة الصيفى.

كذلك أنخفضت تعداد الآفات الأخرى المتواجدة مقارنة مع تعداد الأكاروس الأحمر فى كلا العروتين. مما سبق يتضح أن الأكاروس الأحمر تعتبر الآفة الرئيسية على نباتات الباذنجان الأسود فى العروتين.

ولذا تناولت الدراسة الأرتباط البسيط لعدد من قياسات المناخ مع أعداد الآفات حيث أظهرت النتائج فى العروة الخريفى التأثير المعنوى العالى لمدة سطوع الشمس على بيض الأكاروس الأحمر يليها درجات الحرارة القصوى والدنيا على بيض وحوريات الأكاروس. كذلك أظهرت كميات الأمطار فى العروة الخريفى تأثيرات معنوية سالبة على تعداد أطوار الأكاروس الأحمر. بينما فى العروة الصيفى لوحظ الأرتباط المعنوى بين مدة سطوع الشمس والحيوان الكامل للأكاروس.

كذلك تناولت الدراسة فعالية كلا من الكبريت والمبيد الحيوى(أبامكتين) ضد أطوار الأكاروس بعد أيام من المعاملة. حيث أظهرت النتائج الفروق المعنوية بين المركبين ضد تلك الأطوار وبعد أيام من المعاملة مع التأثير الواضح الفعال للمبيد الحيوى بعد ٧ أيام من المعاملة.