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Population Fluctuation of *Tetranychus urticae* on Sweet Potato (*Ipomoea batatas* L.) and Effect of Some Insecticides

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ABSTRACT

Sweet potato (*Ipomoea batatas* L.) is one of the important crops that were infected by many pests. One of these pests is two spotted spider mites (*Tetranychus urticae*), which is considered a serious pest that caused a high reduction to the infested crop causing a loss in quantity and quality of the yield. So, in this study, there was one peak on the leaves of sweet potato plants, which was on 7 August during the two years 2021/ 2022. However, Areka (abamectin) is the most effective tested insecticide reported 97.78 and 100% for 2021 and 2022 but Clinser (Pyridaben) recorded 89.82 and 96.67, respectively.

INTRODUCTION

The sweet potato (*Ipomoea batatas* L.) plantation is an important crop that contains many calories. It is considered one of the most important seven crops around the world (Chalfant, *et al.*, 1990 and FAO 2015). The raw material of sweet potato is used for the production of alcohol, starch and alcohol (Chalfant, *et al.*, 1990), and the tubers are used as food (Mukhopadhyay *et al*., 2011). It's attacked widely by the two-spotted spider mite *Tetranychus urticae* Koch (Jakubowska *et al.*, 2018).

T. urticae is an economic pest of various agricultural crops in Egypt. It's a polyphagous spider mite and observed on the sweet potato for many years (Jakubowska and Fiedler, 2014). The adults, nymphs and larvae of *T. urticae* feed mostly on sweet potato leaves leading to its complete destruction (Muluken *et al*., 2016).

The cultivation of sweet potatoes requires effective protection against pests. The effects of the feeding of the spider mite can be seen on both the upper and lower side of the leaves in light spots. However, the intensive feeding of *T. urticae*, results in the appearance of small shiny spots ordered as a mosaic on the surface of the leaves (Legrand *et al.*, 2000 and Bocianowski *et al.*, 2022). In this case, chemical control should be applied to protect the cultivation from this pest.

Chemical control is an effective method for the management of pests especially when the infestation becomes high (Rahmouni *et al*., 2019).

This study aims to evaluate the population of *T. urticae* on sweet potato leaves during two successive seasons 2021/ 2022 and manage it with chemical insecticides.

MATERIALS AND METHODS

1.**Field Population Density:**

The experiment was planted on the farm at Mansoura City, Dakahlia Governorate during two successive seasons 2021/ 2022. This field was free of pesticides and the plantation started on 5 April at every tested year and the leaves examination started after 1 month from a plantation. For population fluctuation, the tested area was about feddan however the area used for control was three kirates, one for control and the others for the application of insecticides. Every week, the population density of *T. urticae* on the leaves was counted/at 100 leaves.

For counting the pest, 120 leaves were taken from 10 plants/replicate (which were picked up from the top, middle and base of the plants). Then, the leaves were transferred to the laboratory to examine the population of *Tetranychus* sp. using a binocular microscope.

2.The Used Insecticides In Field Experiment:

In this experiment, two chemical insecticides were used and pointed in Table (1). Each insecticide was applied in an area about kirate that was divided into four replicates and one kirate was used for control. 10 leaves in each replicate were checked and when the infection of *T. urticae* reached 3- 4 individuals/inch, spraying with insecticides started and the results were taken before spraying and after 7, 10 & 14 days after spraying as protocol.

Table 1: The tested insecticides and dose of each:

Common name	Trade name	Dose/ 100 L water
Abamectin	**Areka 1.8% EC**	**40 cm^3**
Pyridaben	**Clinser 70% WP**	**30 gm**

Statistical Analysis:

- The population density results were analyzed with Excel program.
- However, data in the experiment of reduction was analyzed by the equation of Henderson and Tilton (1955) as follows:

$$\text{Reduction mortality \%} = \left(1 - \frac{\text{Ta}}{\text{Tb}} \times \frac{\text{Cb}}{\text{Ca}}\right) x\ 100$$

Whether:

C_b= the number of alive pest individuals in control before treatment.

C_a= the number of alive pest individuals in control after treatment.

T_a= the number of alive pest individuals after treatment.

T_b= the number of alive pest individuals before treatment.

RESULTS AND DISCUSSION

Population Density:

Results in Fig. (1) detected that there was one peak of population density of *T. urticae* on the sweet potato leaves, this peak was on 7 August reported 50 individuals in 2021 and 43 individuals in 2022. The total population was 350 individuals in 2021 and 290 individuals in 2022. Hendawy *et al.* (2017) illustrated that the average population density of *T. urticae* on sweet potato plants was 73.06 individuals in the 2015 and 2016 seasons.

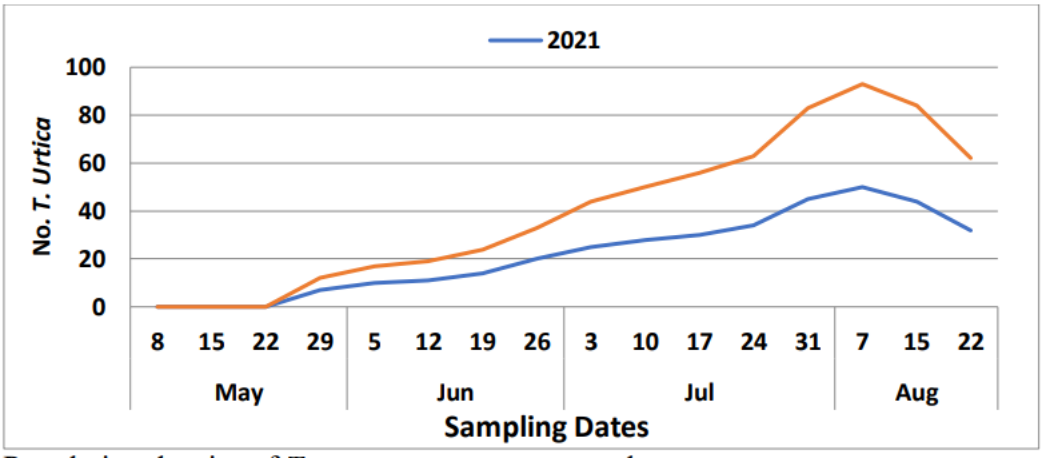

Fig. 1: Population density of *T. urticae* on sweet potato leaves.

2- Field Experiment:

2.1. During 2021:

Results in Table (2) showed that, after 7 days of treatment, the total reduction was 93.33 & 84.45 % for Areka and Clinser, respectively. However, after 10 days of treatment, the reduction was 100 & 90 % for the two insecticides, respectively. In addition, after 14 days of treatment, Areka was 100% and Clinser 95%. Kavallieratos (2007) and Mwandila *et al.* (2013) recorded that the increase in dosage enhanced the efficacy of abamectin.

Table 2: Reduction of *T. urticae* due to insecticide treatment during 2021:

Treat.	1st replicate			2nd replicate			3rd replicate			4th replicate			Treatment efficiency		
	Pest number		Red. %	Pest number		Red. %	Pest number		Red . %	Pest number		Red. %	Pest number		Total Red. %
	Before	After		Before	After		Before	After		Before	After		Before	After	
After 7 days															
Areka	4	0	100	4	0	100	3	1	73.33	3	0	100	14	1	93.33
Clinser	4	1	80	3	1	77.78	4	1	80	4	0	100	15	3	84.45
Control	4	5		4	6		4	5		4	6		16	22	
After 10 days															
Areka	4	0	100	4	0	100	3	0	100	3	0	100	14	0	100
Clinser	4	1	80	3	0	100	4	1	80	4	0	100	15	2	90
Control	4	5		4	4		4	5		4	6		16	20	
After 14 days															
Areka	4	0	100	4	0	100	3	0	100	3	0	100	14	0	100
Clinser	4	0	100	3	0	100	4	1	80	4	0	100	15	1	95
Control	4	6		4	5		4	5		4	7		16	23	

2.2. During 2022:

Results in Table (3) detected that, after 7 days of treatment, the total reduction was 100 & 90 % for Areka and Clinser, respectively. However, after 10 days of treatment, the reduction was 100 & 100 % for the two insecticides, respectively. In addition, after 14 days of treatment, Areka and Clinser were 100%. Moscardini *et al.* (2013) recorded that abamectin causes partial paralysis of the invertebrate nervous system, which can decrease feeding, leading to death.

Table 3: Reduction of *T. urticae* due to insecticide treatment during 2022:

Treat.	1st replicate			2nd replicate			3rd replicate			4th replicate			Treatment efficiency		
	Pest number		Red. %	Pest number		Red. %	Pest number		Red . %	Pest number		Red. %	Pest number		Total Red. %
	Before	After		Before	After		Before	After		Before	After		Before	After	
After 7 days															
Areka	4	0	100	4	0	100	3	0	100	3	0	100	14	0	100
Clinser	4	0	80	4	0	100	4	0	80	4	0	100	16	4	90
Control	4	5		4	4		4	5		4	6		16	20	
After 10 days															
Areka	4	0	100	4	0	100	3	0	100	3	0	100	14	0	100
Clinser	4	0	100	4	0	100	4	0	100	4	0	100	16	0	100
Control	4	5		4	8		4	5		4	7		16	25	
After 14 days															
Areka	4	0	100	4	0	100	3	0	100	3	0	100	14	0	100
Clinser	4	0	100	4	0	100	4	0	100	4	0	100	16	0	100
Control	4	8		4	6		4	6		4	7		16	27	

2.3. Comparison of the Effect of Tested Insecticides in The Two Years:

Results in Table (4) demonstrated that Areka (abamectin) had the highest reduction reported at 97.78 & 100 % in 2021& 2022, respectively. Then Clinser recorded 89.82 & 96.67 % in 2021& 2022, respectively. Mitch *et al*., (2022) proved the effectiveness of abamectin against carmine spider mites when applied on it on tomato. Rasha and Bassem (2022) estimated that pyridaben is less stable than other insecticides when applied to *T. urticae.*

Table 4: Mean of the total reduction of *T. urticae* during 2021/ 2022:

Year	Treatments	Mean reduction after 7 days	Mean reduction after 10 days	Mean reduction after 14 days	Mean of total reduction
2021	**Areka**	93.33	100	100	97.78
	Clinser	84.45	90	95	89.82
2022	**Areka**	100	100	100	100
	Clinser	90	100	100	96.67

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