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Population dynamics of certain mites infesting sugar beet at Beheira and Sharkia Governorates in Egypt

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Abstract:

The population dynamics of the spider mite *Tetranychus cucurbitacearum* (Sayed) (Acari: Tetranychidae) and the predaceous mite *Amblyseius swirskii* Athias-Henriot (Acari:Phytoseiidae) associated with sugar beet plants, *Beta vulgaris* L. were recorded at Nobaria and Diarb- Nigm districts in Beheira and Sharkia Governorates, respectively, in Egypt during two seasons 2016-2017 and 2017-2018. The population of the mite *T. cucurbitacearum* had five peaks at Sharkia and four peaks at Beheira during both seasons, showing a highly infestation on sugar beet at Sharkia compared to Beheira district. The predaceous mite *A. swirskii* had one peak in both Governorates during the two seasons. Statistical analysis showed significant correlation coefficient between the population of *T. cucurbitacearum* and temperature during both seasons at two Governorates and it was highly significant at the second season at Sharkia Governorate.

Introduction

Despite the newness of sugar beet in Egypt (Leilah *et al*. 2005 and Fouad, 2011), it ranks the second important sugar crop after sugar cane, *Saccharum officinarum* L. producing annually about 48.1 % of sugar production all over the world (Anonymous, 2012). So, the Egyptian Government policy aims to encourage the farmers to increase its cultivation to conserve water and for its high concentration of sugar. This crop attacks by several numbers of insect pests causing the considerable damage in the yield (Bassyouny, 1987; Shaheen, 1992; Shalaby, 2001 and El-Zoghbey *et al.*, 2003). The total loss in the yield caused by the insect pests recorded 8.2 % in 1954 and 12.4 % in 1965 (Kolbe, 1967 and Sherief *et al*., 2013). The spider mite *Tetranychus cucurbitacearum* (Sayed) (Acari :Tetranychidae) has recently become a more serious pest for sugar beet plants (Al-Habshy *et al*., 2014). The predators of mites and spiders are the

most important elements to reduce the number of different pests (Kalmosh *et al*., 2018).

So, it was felt necessary to throw light on mites associated with sugar beet in Sharkia and Beheira Governorates in Egypt. The population dynamic of mites infesting sugar beets and their relationship with climatic factors were studied.

Materials and methods

The present work was carried out on sugar beet (*Beta vulgaris* L.) at Diarb-Nigm district, Sharkia Governorate and Beheira district, Beheira Governorate during 2016/2017and 2017/2018 seasons. Samples were weekly taken from (October 2016 to February 2017) during the two seasons from fields of the crop to study mites associated with sugar beet. One fedden (4200m^2) was chosen and divided into three plots. The crop was planted in the fourth week of August during the two seasons. Samples started after month of sowing and continued at weekly intervals until the end of season. The normal agricultural practical was followed, and no pesticides treatments were applied during the whole experiment period.

Samples were randomly collected from diagnosis of the inner sugar beet area of each experimental plot for counting mite species. Samples were collected weekly in early morning. Each sample consisted from 20 leaves, collected randomly. Samples were directly transferred to the laboratory and examined carefully using a stereoscopic binocular microscope and the number of phytophagous mite and its predator were counted. Effects of certain weather factors such as temperature and atmospheric relative humidity on the population dynamic of mites were studied. Number of mites was counted per square inch (4 square / leaf). The daily means of the two factors were provided by the Meteorological Central Laboratory for Agricultural Climate, Agricultural Research Center during the whole period of the two seasons (2016/2017 and 2017/ 2018).

The obtained data were statistically analyzed according to Snedecor and Cochran (1980) using Costat (2004) statistical analysis software, microcomputer program.

Results and discussion

The present study recorded five mite species (*T. cucurbitacearum*, *Amblyseius swirskii* Athias-Henriot (Acari:Phytoseiidae), *Phytoseiulus macropilis* Banks (Acari: Phytoseiidae), *Tydeus californicus* (Banks) (Acari :Tydeidae) and *Tydeus* sp.) belonging to four genera and three families during 2016/2017 and 2017/2018 growing seasons. The common species were *T. cucurbitacearum* and *A. swirskii*

1. Population dynamics of *Tetranychus cucurbitacearum* at Beheira Governorate:

During the first season, 2016/2017 the infestation with mite was started at 13th of October 2016 with 11.33 mites/ square. The population was increased gradually to record the first peak at 27th of October. Then after that the population was decreased till 13th June to reach 1.66 individual/square inch; after that the number was increased gradually to reach the second peak recording 29.8 mite/ square inch on 11th of February. In the second season 2017/2018 the infestation also started on 13th of October with 13.56 mite/square inch. The population was increased gradually forming two peaks on 17th of October and 11th of February, with a mean number of 29.43 and 27.9 mite/ square inch, respectively; then the

population was decreased until the end of the season (Figure, 1).

2. Population dynamics of *Amblyseius swirskii* at Beheira Governorate:

The species appeared for the first time during the first season 2016/2017 on 11th of November 2016 with mean number of 4.2 mite/ square inch. The population was increased gradually to record one peak on 2nd of December with mean number of 19.4 mite/ square inch. Afterwards the population was declined to reach 2.6 mite/square inch on 30th of December 2016, then it dropped to zero on 6th and 13th of January 2017. The population was increased gradually to record 12.6 mite/square inch on 18th Feb. 2017 (Figure 1).

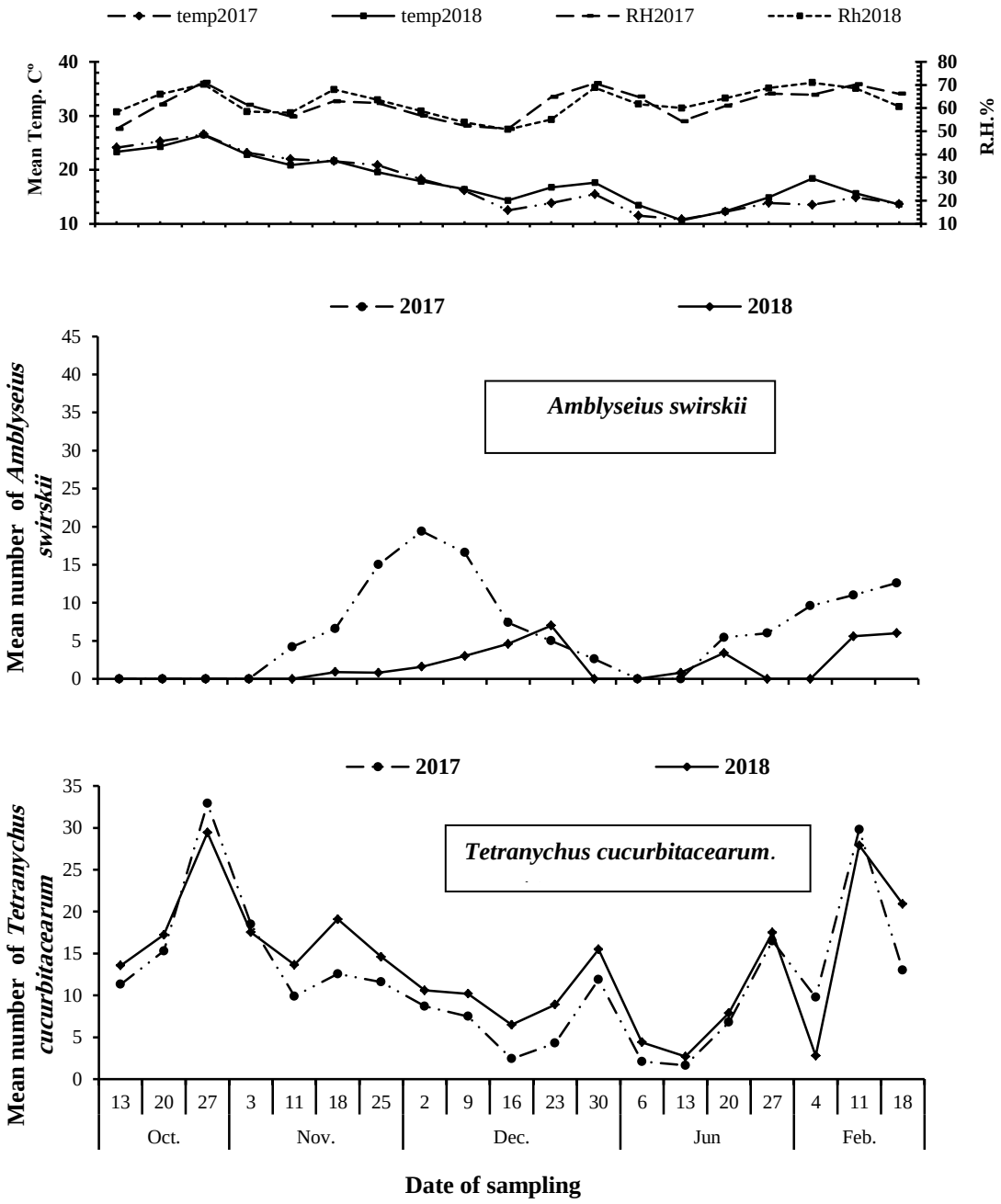

Figure (1): Population dynamics of *Tetranychus cucurbitacearum* and *Amblyseius swirskii* on sugar beet at Beheira Governorate during 2016/2017 and 2017/2018.

Regarding the second season 2017/2018 the predator appeared for the first time on 18th Nov.2017 with mean number of 0.9 individual/square inch. The mean number increased gradually to reach the first peak at 23rd December 2017 and the second peak at 20th Jan. 2018 with mean number of 7.00 and 3.4 individual/square inch, respectively. The population was dropped to zero two times during the growing season, after that the population was increased gradually at the end of the season on 18th Feb. 2018 reaching 6.00 mite/square inch.

3. Population dynamic of *Tetranychus cucurbitacearum* at Sharkia Governorate:

Results in Figure (2) cleared that the infestation with spider mite, *T. cucurbitacearum* occurred from 11th October to 16th February during the two seasons, respectively. During the season, the infestation of mites started after 35 days of sowing at 11th October. the population increased gradually to record 5 peaks during the two sowing seasons at 18th October., 23th November; 28th December; 11th January; and 2nd February with mean number of 28.56, 22.3, 21, 19 and 22.3 mite / square inch; respectively. Afterwards the population was fluctuated to reach value of 21.2 mite/ square inch at the end of the season 16th February 2017.

The same trend was observed during the second season 2017-2018 recorded five peaks at 18th October.; 16th November; 14th December; 28th December; and 2nd February;2018 with mean number of 32.45, 30.9, 30, 32.9 and 37.5 mite/ square inch; respectively. Afterwards, the population was increased until the end of the growing season recording 31.2 mite/ square inch on 16th February (Figure, 2).

4.Population dynamic of *Amblyseius swirskii* at Sharkia Governorate:

Data presented in Figure (2) indicated that predator mite appeared for the first time in 9th November 2017 with mean number of 2.6 mite/ square inch. The population was increased gradually to record one peak on 28th December 2016 with mean number of 16.4 mite/square inch. Afterwards the population was declined abruptly to reach 4.2 mite/square inch on 9th February 2017, then increased gradually to record 14.4 mite/square inch at the end of growing season at 16th February.

On the other side, in the second season predator recorded for the first time on 9th November 2017 with mean number of 0.9 mite/ square inch. The population was fluctuated to record 2.8 mite/ square inch in 30th November, then declined abruptly to reach zero in 7th December and being increased to record 1.4 mite / square inch on 21st December; then population was declined abruptly to zero on 28th December. Afterwards the population was increased quickly showing one peak on 18th January 2018 with mean number of 9.6 mite/ square inch; after that the population decreased till 9th February 2018 with population was 4.2 mite/ square inch, then increased to record 6.6 mite/ square inch at the end of the season on 16th February.

From the previous data it is cleared that *T. cucurbitacearum* infested sugar beet at Sharkia more than at Beheira. This observation may be due to that Sharkia is older than Beheira distract in the date of reclamation. Al-Habshy *et al*. (2014) recorded the same conclusion when studied the seasonal abundance of *T. cucurbitacearum* and *A. swirskii* on sugar beet.

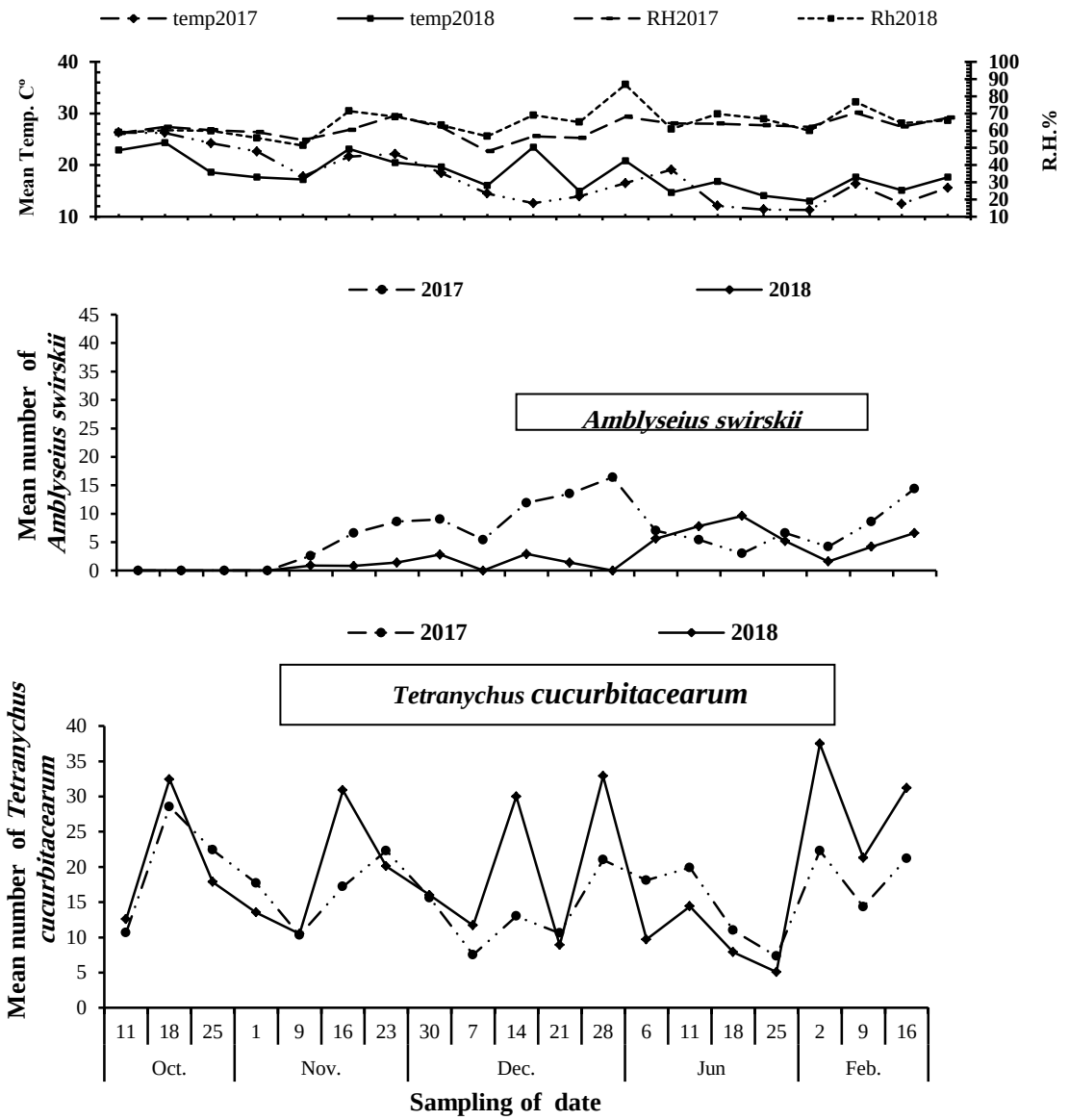

Figure (2): Population dynamic of *Tetranychus cucurbitacearum* and *Amblyseius swirskii* on sugar beet at Sharkia Governorate during 2016/2017 and 2017/2018

5. Interrelation between mite species and temperature and relative humidity:

As shown in Table (3), data and statistical analysis cleared that the correlation between *T. cucurbitacearum* with temperature at Beheira during the two seasons and at Sharkia during the first season was significant, but it was highly significant during the second season at Sharkia Governorate. Also, the correlation between the population of *T. cucurbitacearum* and relative humidity was highly significant during the first season at Beheira and during the two growing seasons at Sharkia, while it was non-significant at the second season at Beheira.

Table (3): Matrix correlation and regreation between *Tetranychus cucurbitacearum* and *Amblyseius swirskii* on sugar beet with temperature and relative humidity at Beheira and Sharkia Governortes during 2016/2017 and 2017/2018 seasons.

Species	Locality	Beheira						Sharkia					
	Season	2016/2017			2017/2018			2016/2017			2017/2018		
	Reliable	r	b	P	R	b	p	r	B	p	r	b	P
Tetranychus cucurbitacearum	Mean temp.	0.54	0.33	*	0.51	0.29	*	0.48	0.41	*	0.63	0.21	**
	Mean R.H.	0.58	0.45	**	0.45	0.34	ns	0.65	0.6	**	0.62	0.49	**
	Combined effect %	0.649			0.367			0.643			0.648		
Amblyseius swirskii	Mean temp.	-0.21	-0.11	ns	-0.47	-0.26	*	-0.51	-0.51	*	-0.54	0.62	*
	Mean RH.	-0.1	-0.11	ns	-0.39	-0.97	ns	0.23	0.25	ns	0.09	0.26	Ns
	Combined effect %	0.059			0.306			0.238			0.346		

The correlation between the populations of *A. swirskii* with temperature it was significant during the second season at Beheira and during the two growing seasons at Sharkia, although it was non- significant at the first season at Beheira. But regarding to the correlation between the populations and relative humidity, it was non- significant during the two growing seasons at both distracts.

6.Predator – pest mite interrelation:

Data given in Table (4) indicated that it was non- significant correlation between *T. cucurbitacearum* as a pest and its predator mite *A. swirskii* during the two growing seasons at both distracts.

Table (4): Matrix correlation between *Tetranychus cucurbitacearum* with *Amblyseius swirskii* at Beheira and Sharkia Gvernorates during 2016/2017 and 2017/2018 seasons.

locality	Beheira		Sharkia	
seasons	2016/2017	2017/2018	2016/2017	2017/2018
r	-0.069 ns	0.05 ns	-0.044 ns	-0.261ns
b	-0.051	0.051	-0.037	-0.076

r = simple correlation of coefficients b = regression of coefficient p = significant probability.
Ns= non-significant *significant and ** highly significant

These results with those obtained by Mohamed (2004), who studied the population of *T. cucurbitacearum* on sugar beet at El- Salheia and San-Alhagar during 1999- 2001. Also, he studied the simple correlation between the population dynamic with some climatic factors and found that, *T. cucurbitacearum* recorded a highly infestation on sugar beet at San-Alhagar more than El- Salheia. Legrand *et al*. (2000) declared that T. urticae was very occasional in sugar beet crop. Muchembled (1999) discussed the conditions which favor that development of *T. urticae* in sugar beet crop and used acaricides for the control of this pest are presented. Al – Habshy *et al*. (2014) recorded the same conclusion when studied some ecological studies on sucking pests infesting sugar beet crop and their associated natural enemies in Sharkia Governorate.

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