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SUSCEPTIBILITY OF CUCUMBER VARIETIES TO THE BROAD MITE *Polyphagotarsonemus latus* (Banks) INFESTATION AND ITS RELATION TO LEAF PHYTOCHEMICAL COMPONENTS.

Hassan, M. F.[1]; M. A. Zaher[1]; M. E. E. El-Nagar[2] and Enas, M. K. Mostafa [2]

1- Faculty of Agriculture, Cairo University, Giza, Egypt.

2- Plant Protection Research Institute, Agric. Res. Center, Giza, Egypt.

ABSTRACT

Three cucumber varieties namely Zena, Thamin and Sweet crunch were cultivated during nili 2005 and summer 2006 seasons on the farm of Plant Protection Research Institute, Dokki, Giza to evaluate its susceptibility to the tarsonemid pest *P.latus* infestation. The relationship between the mite different stages populations and some plant leaves phytochemical components were also investigated.

Sweet crunch proved to be the most susceptible variety to mite infestation, while Zena variety was tolerant and Thamin was moderately infested.

The relationship between the population density of *P.latus* eggs, immatures and adults on the three tested varieties was significantly positive with true protein, but significantly negative with total hydrolysable carbohydrate, total sugars, non- reducing sugars and total phenolic compound. On the other extreme, the relationship was insignificantly negative with phosphorous and potassium elements, but it was insignificantly positive with reducing sugars.

INTRODUCTION

Cucumber occupies an important position among vegetable crops in Egypt. According to Ministry of Agriculture records of 2005, the cultivated area was 11043 feddans in the open field and 5404924 m^2 in plastic houses. Throughout the growing season, the cucumber plants are attacked by some phytophagous mites which cause enormous losses in both open field and plastic houses such as the red spider mite, *Tetranychus urticae* Koch, and *T. cucurbitacearum* (Sayed) (Tetranychidae) and the broad mite, *Polyphagotarsonemus latus* (Banks), (Tarsonemidae).

This tarsonemid mite *P. latus* (Banks) is one of the most injurious mites with different common names (yellow, yellow broad, tropical and white cotton or jute mite) (Jeppson *et al*, 1975, Gerson, 1992 and Masoud *et al*, 2001). This mite is a minute herbivorous that attacks numerous plant crops belong to different families in tropical and subtropical regions (Gerson, 1992 and Grinberg *et al*, 2004). Also this mite may act as a vector of leaf curl virus (Chakraborti, 2000).

MATERIALS AND METHODS

Field studies:

An area of about 144 m^2 on the farm of Plant Protection Research Institute, Dokki, Giza Governorate, was cultivated with three cucumber

varieties (Zena, Thamin and Sweet crunch) during nili 2005 and summer 2006 seasons. The normal agricultural practices were undertaken without using pesticides. Throughout the two studied seasons, weekly samples of fifteen new leaves per each of the three tested replicates of every variety (45 leaves per each variety) were collected from epical leaves and examined for the different broad mite stages in two square inches per the lower leaf surface. Daily maximum, minimum temperature and daily mean relative humidity were recorded during the experimental period.

Laboratory studies

This study was carried out during 2006 summer season to determine the relationship between the broad mite *P.latus* populations at two levels of infestations "start and peak" and eight estimated / leaf phytochemical contents of the three studied cucumber varieties.

The samples were dried in an oven at $105C^0$ overnight, until a constant weight was obtained. Total nitrogen and potassium contents were determined according to the methods of AOAC, 1995; percentages of carbohydrates and total sugars according to the method of Dubois *et al,* 1956; reducing sugars according to Bernfeld, 1955; and non- reducing sugars were calculated by difference between the total sugars and the reducing sugars. On the other hand, the phosphorous content was determined according to the method described by David, 1966.

Data were analyzed according to SAS program (1988) which was run under WIN computer system and mean separation was conducted by using Duncan's multiple rang in this program.

RESULT AND DISCUSSION

The susceptibility of different cucumber varieties to the broad mite *P.latus* infestation.

Data presented in tables (1 & 2) showed the degree of infestation of three cucumber varieties with *P .latus* different stages during nili 2005 and summer 2006 seasons.

1-Eggs:

In the nili season, the mean numbers of *P.latus* eggs infesting leaves of cucumber varieties were 20.29, 23.77 and 25.21eggs/ $inch^2$ for Zena, Thamin and Sweet crunch, respectively. The corresponding numbers of *P.latus* for the summer season were 9.36, 14.45 and 21.28eggs /$inch^2$, respectively.

Analysis of variance of the obtained results revealed that no significance occurred between mean number of eggs/ leaf inch2 of Thamin and Sweet crunch in the nili season, while in the summer season there were significant differences between the three tested varieties, as they can be arranged in a descending order according to mite infestation to Sweet Crunch, Thamin and Zena being 21.28, 14.45 and 9.36 egg/ $inch^2$, respectively.

Table (1): Susceptibility of cucumber varieties to *P.latus* infestation during nili season 2005 at daily mean temperature (18.2-29.7) and daily mean relative humidity (46.0-56.7%).

Sampling date	EGG			IMMATURES			ADULT		
	Zena	Thamin	Sweet crunch	Zena	Thamin	Sweet crunch	Zena	Thamin	Sweet crunch
05/09/2005	19.73	25.67	26.70	12.93	29.17	15.03	3.87	7.30	10.23
12/09/2005	36.23	34.57	34.20	20.40	35.20	22.60	4.50	7.03	13.43
19/09/2005	40.13	33.47	41.67	32.13	31.17	30.13	5.70	6.70	16.57
26/09/2005	52.67	38.00	44.87	43.70	35.57	50.47	3.60	7.87	22.27
03/10/2005	27.57	45.83	48.00	45.87	29.90	70.77	3.33	9.43	27.90
10/10/2005	16.00	28.93	21.57	44.90	21.73	18.40	2.20	6.27	7.13
17/10/2005	13.50	20.47	17.30	12.93	14.33	11.57	1.43	4.40	3.47
24/10/2005	11.17	19.37	13.20	8.80	13.13	14.10	1.80	3.93	2.20
31/10/2005	3.17	7.73	14.90	10.53	4.43	6.10	3.20	3.03	1.70
07/11/2005	2.10	4.97	11.13	6.13	2.57	3.23	4.57	2.57	1.83
14/11/2005	0.93	2.43	3.80	1.00	1.50	3.93	0.40	1.47	0.93
Mean	20.29^{b}	23.77^{a}	25.21^{a}	21.76^{a}	19.88^{a}	22.39^{a}	3.15^{c}	5.45^{b}	9.79^{a}
F	6.07			0.82			22.06		
L.S.D	2.7796			4.0556			2.0187		

Table (2): Susceptibility of cucumber varieties to *P.latus* infestation during summer season 2006 at daily mean temperature (26.4-30.8) and daily mean relative humidity (44.1- 52.3%).

Sampling date	EGG			IMMATURES			ADULT		
	Zena	Thamin	Sweet crunch	Zena	Thamin	Sweet crunch	Zena	Thamin	Sweet crunch
08/06/2006	2.97	6.97	6.53	0.30	3.40	9.97	3.70	0.07	0.00
15/06/2006	4.00	9.37	14.87	0.87	4.73	12.63	4.90	0.37	0.17
22/06/2006	8.63	20.50	24.13	8.00	16.97	28.53	11.50	1.07	7.37
29/06/2006	16.20	26.47	33.33	11.10	24.57	32.13	9.33	14.30	10.03
06/07/2006	20.80	28.47	38.93	21.17	25.17	41.43	10.10	24.80	25.50
13/07/2006	19.90	23.63	38.40	15.20	32.37	29.87	13.10	17.47	18.03
20/07/2006	17.93	21.70	41.87	9.20	18.93	18.27	6.93	10.07	10.50
27/07/2006	5.87	9.13	16.27	3.93	5.97	11.63	1.93	4.70	16.27
03/08/2006	3.83	6.40	9.13	3.20	5.83	9.43	1.43	2.50	12.63
10/08/2006	2.83	4.17	7.13	2.20	5.50	7.10	1.30	0.83	8.97
17/08/2006	0.00	2.20	3.53	1.57	2.37	2.70	0.00	0.00	3.90
Mean	9.36^{c}	14.45^{b}	21.28^{a}	6.98^{c}	13.25^{b}	18.52^{a}	5.84^{b}	6.92^{b}	10.31^{a}
F	82.39			69.29			10.55		
L.S.D	1.8531			1.9517			2.0168		

Means followed by the same letter are not significantly different at 5%, based on L.S.D. test.

2- Immatures:

According to the statistical analysis of the obtained data, in the nili season there were insignificant differences between the mean numbers, as they were 21.76, 19.88 and 22.39 immatures / inch^2 for Zena, Thamin and Sweet crunch, respectively. On the contrary, in the summer season, there were significant differences between the obtained means, as the order of the varieties susceptibilities to the infestation of *P.latus* were Sweet crunch, Thamin and Zena being 18.52, 13.25 and 6.98 immatures/inch^2, respectively.

3-Adults:

The results indicated that there were significant differences between the investigated varieties in their infestations with *P.latus*. In the nili season the highest infestation was observed on samples collected from Sweet crunch with mean number of 9.79 adults /inch^2, while the lowest infestation was recorded on Zena being 3.15 adults /inch^2, Thamin occupied the moderate infested variety, as the corresponding mean number was 5.45 adults /inch^2. In the summer season, although no significant difference appeared between Thamin and Sweet crunch, yet still a significant difference occurred between Zena and each one of them, as the mean number/ leaf inch^2 was 10.31, 6.92 and 5.84 adults /inch^2, for Sweet crunch, Thamin and Zena, respectively.

Thus, it is quite evident from the two studied growing seasons, cucumber variety Sweet crunch was the most susceptible to mite infestation, while Zena was tolerant, and Thamin was intermediate.

It is of interest to note that, mean numbers of eggs were nearly equal to immatures, but those of adults sharply decreased. This might be due to the transfer of pharate females carried by males to epical margin of the leaves. Moreover, white flies carried some adults to other places outside the field (Fan-YuQing *et al*, 1998 and Palevsky *et al*, 2001)

Table (3) showed that the Sweet crunch which had the highest amounts of true protein (58.16%), phosphorous (3.44mg/dl), total sugars (6.07g/100g) and non- reducing sugars (4.56g/100g) and had the lowest amount of potassium (0.258g/100g) and total phenolic compound (5.31g/100g), infested with the highest numbers of *P.latus* different stages.

On the other extreme, the least susceptible variety (Zena) contained the lowest level of true protein (53.42%), total sugars (2.93g/100g) and non-reducing sugars (1.15g/100g) and the highest amount of potassium (0.264g/100g), reducing sugars (1.79g/100g) and total phenolic compound (5.89g/100g). The third variety (Thamin) occupied the moderate level of infestation and their leaves contained the moderate quantity of the most tested phytochemical components.

The relationship between the population density of *P.latus* eggs, immatures and adults on the three tested varieties was significantly positive with true protein, but significantly negative with total hydrolysable carbohydrate, total sugars, non- reducing sugars and total phenolic compound. On the other extreme, the relationship was insignificantly negative with phosphorous and potassium elements, and insignificantly positive with reducing sugars. Nevertheless, the direction of these insignificant relationships whether positive or negative might be considered due to its constancy (repetition) in the different items.

The above mentioned results of *P.latus* infestation partially agree with those obtained by Pradhan, and Saha. 1997 in India who reported that there was no significant difference in N, P and K content of healthy and infested leaves of the tossa jute varieties and also in their interaction between variety and infestation.

However, in other phytophagous mites, (on bottle ground, cucumber, sponge gourds, ridge gourds, pumpkins and bitter gourds Sharma and Pande (1986), on sour orange Ibrahim (1988), on strawberry Luczynski *et al*. (1990), on maize Sawires (1992), on cucumber Ahmed (1994) and on cucumber Abou Zaid (2003)) found that the relationship between *Tetranychus spp*. and nitrogen and reducing sugars was positive, while it was negative with potassium, phosphorous and phenol contents.

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حساسية بعض أصناف الخيار للإصابة بالحلم العريض والعلاقة بين المحتوي الكيميائي للأوراق ودرجات الإصابة بالحلم

مراد فهمي حسن[١] ، محمد عبد العزيز زاهر[١] ، محمود السيد النجار[٢] و ايناس مصطفي قطب مصطفي[٢]

١- كلية الزراعة – جامعة القاهرة

٢- معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الدقي

أجريت دراسات حقليه بمزرعة معهد بحوث وقاية النباتات بالدقي خلال العروة النيلي ٢٠٠٥ والعروة الصيفي ٢٠٠٦ كما أجريت دراسات معملية بالمعمل المركزي بكلية الزراعة جامعة القاهرة بهدف دراسة التركيب الكيماوي للأوراق.

وكانت النتائج كالآتي:

١- وجد أن الصنف سويت كرانشي كان أكثر الأصناف حساسية للإصابة بالحلم بينما الصنف زينه أكثر الأصناف مقاومة وكان الصنف ثمين متوسطاً في درجة الإصابة.

٢- وجد أن الإصابة بالحلم العريض ترتبط ارتباطاً موجباً و معنوياً مع البروتين في حين أنها ترتبط ارتباطاً معنوياً وسالباً مع الكربوهيدرات والسكريات الكلية وغير المختزلة و الفينولات وقد وجد أيضا أن الإصابة بالحلم العريض ترتبط ارتباطاً سالباً وغير معنوياً مع الفوسفور والبوتاسيوم ولكن مع السكريات المختزلة كان الارتباط موجباً وغير معنوياً.

٣- الكثافة العددية للأطوار المختلفة "بيض – أطوار غير كاملة – أطوار كاملة " للحلم العريض تزيد بزيادة نسبة كلاً من البروتين والسكريات المختزلة وبانخفاض نسبة كلاً من الكربوهيدرات و الفوسفور والبوتاسيوم و السكريات الكلية وغير المختزلة و الفينولات.

Table (3): Relationship between mite infestation and phytochemical components of cucumber leaves

variety	stages		Phytochemical components (%)								
			mean	True Protein%	P (mg/dL)	K (g/100g)	Total Hydrolysable Carbohydrate (g/100g)	T.Soluble Sugars (g/100g)	Reducing Sugars (g/100g)	Non Reducing Sugars (g/100g)	T. phenolic Compound (g/100g)
Zena			mean	53.424[a]	3.235[a]	0.264[a]	14.59[b]	2.925[b]	1.786[a]	1.15[b]	5.895[a]
	(r) values	Eggs		0.851*	-0.514	-0.781	–0.893**	-0.660	-0.390	-0.734	-0.584
		Immatures		0.848*	-0.481	–0.839*	–.9102**	-0.696	-0.393	-0.785	-0.570
		Adults		0.716	-0.532	-0.880	-0.888	-0.709	-0.452	-0.767	-0.457
Thamin			mean	52.855[a]	3.005[a]	0.262[a]	15.91[a]	4.365[ab]	1.335[a]	3.03[a]	5.735[a]
	(r) values	Eggs		0.921**	-0.739	-0.696	–0.935**	–0.795*	0.427	–0.832*	–0.931**
		Immatures		0.839*	–0.823*	-0.747	–0.932**	–0.815*	0.237	–0.820*	–0.81*
		Adults		0.927**	–0.805*	-0.772	–0.972**	–0.832*	0.477	–0.876*	–0.937**
Sweet crunch			mean	58.157[a]	3.439[a]	0.258[a]	14.99[ab]	6.065[a]	1.505[a]	4.56[a]	5.305[a]
	(r) values	Eggs		0.977***	-0.251	-0.683	–0.979***	–0.949**	0.370	–0.984***	–0.928**
		Immatures		0.978***	-0.210	-0.677	–0.977***	–0.936**	0.394	–0.975***	–0.945**
		Adults		0.969***	-0.250	-0.705	–0.978***	–0.949**	0.372	–0.984***	–0.929**

Means followed by the same letter are not significantly different at 5%, based on L.S.D. test

3771 3772 3773 3774 3775 3776 3777