EFFECT OF DIFFERENT HOST PLANTS ON SOME BIOLOGICAL ASPECTS OF THE SPIDER MITE *TETRANYCHUS CUCURBITACEARUM* (SAYED)

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Abstract

The influence of three host plants (peanut, cotton and maize) on the developmental stages and fecundity of *Tetranychus cucurbitacearum* (Sayed) was significant effect on some biological aspects of *T. cucurbitacearum* (Sayed). Peanut was the most favorite one for *T. cucurbitacearum*, giving high fecundity (120.61 egg / female) while maize was the least favorite; while the total deposited eggs was 61.84 eggs.

INTRODUCTION

Field crops are considered the great economic important plantations for local consumption and/or exportation. Peanut occupy an important position among oil crops in Egypt; which used mainly as raw materials in several industrial products as well as oil extraction – during the last few decades. Maize also play an important role as feeding crop, and also of its several uses. In U.S.A maize is the king of grain crops El-Kawas (2000). While cotton till near time was an important fiber crop in Egypt and the leading agricultural export crop. Mites especially family Tetranychidae are common pests in agricultural systems resulted, an economic reduction in yields than any other arthropod pests. The two spotted spider mite, *T. cucurbitacearum* (Sayed) is considered one of the major pests attacking different field crops in Egypt (Farrag *et al.*, 1998).

The high population of, *T. cucurbitacearum* can rapidly decline the quality of the host plants. Direct and indirect effects of mite feeding was recorded. Defoliation, leaf burning, and even plant death are examples of direct effects. Indirect effects, which may lead to other problems in the plant, include decreases in photosynthesis and transpiration. This combination of effects on the host plant often reduces the amount of yield for that crop (Huffaker *et al.*, 1969). Therefore, this study dealt with monitoring of some biological aspects of the two spotted spider mite *T. cucurbitacearum* on the leaves of the three host plant (peanut, cotton and maize) to get an indication of differences among them in their acceptance by this pest.

MATERIALS AND METHODS

Biological Studies:

Effect of some host plants on some biological aspects of *Tetranychus cucurbitacearum* (sayed) at 27±2˚C and 65±5%R.H:

Laboratory studies were carried out to study the effect of some host plants on mite biology under controlled temperature (27±2˚C) and relative humidity (65±5%). *T.cucurbitacearum* from a culture maintained in the laboratory on sweet potato was reared on peanut, cotton and maize. Fifteen newly emerged females were transferred with adult males in couples on clean fresh leaves of each host plant. Such females served as source of eggs of known age. Fifty emerged larvae of the same age were confined to leaf disks, one inch in diameter. Each leaf disk was put upside down on a wet cotton wool pad in a Petri dish. Mite individuals were left to develop and the resultant females were left to deposit eggs. Examination was made twice daily and plant leaf disks were replaced by fresh ones when necessary. Duration and development of a live stage were recorded. These techniques were carried out according to (Ebeling, 1960).

Statistical analysis:

Data were analyzed by using ANOVA test to determine the significant differences between host plants. In addition, fecundity of mites was calculated.

RESULTS AND DISCUSSION

Effect of feeding of *T. cucurbitacearum* on some host plant leaves on certain biological aspects under laboratory conditions:

The biological aspects of *T. cucurbitacearum* were studied when reared on leaves of three field crops i.e. peanut, cotton and maize under controlled temperature (27±2˚C and 65±5 %R.H.) (females were seminated).

Data presented in Table (1) indicated that incubation period of egg stage of seminated female and male were 3.61±0.104, 3.10±0.070; 3.22±0.88 3.00±0.000 and 3.36±0.098, 3.43±0.202 days for peanut, cotton and maize, respectively.

The active and quiescent larvae periods for female were 2.17±081 1.09±0.060; 2.09±0.060, 0.93±0.028 and 1.94±0.043, 0.97±0.031 days for peanut, cotton and maize, respectively. While the parallel values for male were 1.80±0.167, 0.99±0.053; 1.72±0.069, 0.90±0.029 and 1.91±0.066, 0.94±0.036 days, respectively.

The duration of active protonymph of seminated female and male lasted 2.00±0.000, 1.46±0.144 days on peanut; 1.91±0.060, 1.62±0.097 days on cotton and 1.88±0.059, 1.79±0.147days on maize, respectively.

Regarding the quiescent protonymph periods of female and male were 1.26±0.094 and 1.00±0.000 days on peanut, 0.84±0.030 and 0.77±0,089 days on cotton and 1.12±0.044 and 0.99±0.011 days on maize, respectively.

The periods of active deutonymph and quiescent deutonymph of female were 1.73±0.081 and 1.00±0.000 days on peanut and 0.87±0.028 days on cotton and 1.71±0.081 and 1.20±0.082 days on maize while the parallel values for male were 1.62±0.140 and 0.9±0.00 days on peanut; 1.55±0.138 and 0.84±0.673 days on cotton and 1.84±0.141 and 1.19±0.155 days on maize, respectively.

The duration of total immature stages for female and male averaged 9.22±0.163, 7.77±0.310; 8.37±0.125, 7.04±0.177; 8.82±0.100 and 8.66±0.293 days for peanut, cotton and maize, respectively.

The development periods for seminated female and male were 12.83±0.162, 10.87±0.346; 11.59±0.152, 10.04±0.177 and 12.18±0.133, 12.09±0.396days for peanut, cotton and maize, respectively.

As for the longevity of seminated female and male were 21.70±0.580 and 24.46±0.538 days on peanut, 18.74±0.580 and 20.25±0.559 days on cotton and 15.88±0.664 and 13.71±0.606 days on maize, respectively.

When the life span of seminated female and male calculated on peanut, cotton and maize, it recorded 34.53±0.572, 35.33±0.457; 30.33±0.589, 30.65±0.537 and 28.06±0.604, 25.80±0.545 days, respectively.

The pre-oviposition, oviposition and post-oviposition periods of *T. cucurbitacearum* when fed on leaves of different host plants were shown in Table (2). Data obtained indicated that the pre-oviposition periods were 1.35±0.102, 1.65±0.102 and 1.92±0.099 days when female fed on peanut, cotton and maize, respectively. Regarding the oviposition periods, the periods lasted 16.26±0.346, 11.90±0.311 and 9.84±0.506 days for peanut, cotton and maize, respectively. The post-oviposition periods were 4.09±0.198, 5.13±0.368 and 4.12±0.156 days, respectively.

Data in Table (3) showed that the number of deposited eggs by female of *T. cucurbitacearum* were 120.61±1.735, 79.04±1.926 and 61.84±1.505 eggs when fed on leaves of peanut, cotton and maize, respectively; with daily mean of deposited eggs 7.42±0.078, 6.63±0.112 and 6.57±0.244 eggs on the same food types, respectively.

Table 1. Developmental periods of *Tetranychus cucurbitacearum* (Sayed) adult seminated female and male when fed on leaves of different host plants at 27±2˚C and 65±5 %R.H.

Duration	Sex	Peanut	Cotton	Maize	L.S.D$_{0.05}$
Incubation period	Female	3.61±0.104	3.22±0.088	3.36±0.098	
	Male	3.10±0.070	3.00±0.000	3.43±0.202	
Active larvae	Female	2.17±0.081	2.09±0.060	1.94±0.043	
	Male	1.80±0.167	1.72±0.069	1.91±0.066	
Quiescent larvae	Female	1.09±0.060	0.93±0.028	0.97±0.031	
	Male	0.99±0.053	0.90±0.029	0.94±0.036	
Active protonymph	Female	2.00±0.000	1.91±0.060	1.88±0.059	
	Male	1.46±0.144	1.62±0.097	1.79±0.147	
Quiescent protonymph	Female	1.26±0.094	0.84±0.030	1.12±0.044	
	Male	1.00±0.000	0.77±0.089	0.99±0.011	
Active deutonymph	Female	1.70±0.098	1.73±0.081	1.71±0.081	
	Male	1.62±0.140	1.55±0.138	1.84±0.141	
Quiescent deutonymph	Female	1.00±0.000	0.87±0.028	1.20±0.082	
	Male	0.9±0.000	0.84±0.073	1.19±0.155	
Total immature	Female	9.22±0.153	8.37±0.125	8.82±0.100	
	Male	7.77±0.310	7.04±0.177	8.66±0.293	
Developmental time (life cycle)	Female	12.83±0.162a	11.59±0.152c	12.18±0.133b	0.362**
	Male	10.87±0.346b	10.04±0.177b	12.09±0.396a	0.992**
Adult longevity	Female	21.70±0.509a	18.74±0.580b	15.88±0.664c	1.697**
	Male	24.46±0.538a	20.25±0.559b	13.71±0.606c	1.946**
Life span	Female	34.53±0.572a	30.33±0.589b	28.06±0.604c	1.688**
	Male	35.33±0.457a	30.65±0.537b	25.80±0.545c	1.721**

*= Significant

**= high Significant

Generally, the data obtained show that there are significant difference between the tested host plants. These difference was clear on fecundity, longevity, life cycle and life span of *T cucurbitacearum*. These difference may be due to the difference of crop rotation, food preference and chemical component of plants.

Table 2. Pre-oviposition, oviposition and post- oviposition period (in days) of*Tetranychus cucurbitacearum* females when fed on leaves of different host plants at 27±2 ºC and 65 ± 5 % R.H.

Host plant	Pre-oviposition period	Oviposition period	Post- oviposition period	Adult longevity
Peanut	1.35±0.102	16.26±0.346	4.09±0.198	21.70±0.509
Cotton	1.65±0.102	11.96±0.311	5.13±0.368	18.74±0.580
Maize	1.92±0.099	9.84±0.506	4.12±0.156	15.88±0.664

Table 3. Fecundity and daily egg numbers of *Tetranychus cucurbitacearum* (Sayed) females when fed on leaves of different host plants at 27±2 ºC and 65 ± 5 % R.H.

Host plant	Fecundity	Daily rate
Peanut	120.61±1.735	7.42±0.078
Cotton	79.04±1.926	6.63±0.112
Maize	61.84±1.505	6.57±0.244

2.2. Effect of feeding on some host plant leaves on certain biological aspects of un-seminated females of *T. cucurbitacearum* under laboratory conditions:

The biological aspects of *T. cucurbitacearum* were studied when un-seminated females reared on leaves of three field crops i.e. peanut, cotton and maize under controlled temperature 27±2 ° c and 65±5% R.H.

Data tabulated in Table (4) revealed that the incubation period of un-seminated female were 3.75±0.143, 3.39±0.141 and 3.40±0.149 days for peanut, cotton and maize, respectively. The active and quiescent larval periods for un-seminated female were 2.18±0.122, 1.05±0.077, 2.33±0.142, 1.03±0.076 and 2.00±0.038, 0.90±0.036 days for three tested field crops, respectively.

The duration of active protonymph and quiescent protonymph of un-seminated female were 2.00±0.00 and 1.17±0.112 days on peanut and 1.92±0.083 and 0.92±0.030 days on cotton and 1.80±0.112 and 1.10±0.065 days when fed on maize, respectively.

Regarding the periods of active deutonymph and quiescent deutonymph of un-seminated female were 1.73±0.141, 1.00±0.00; 1.88±0.089, 0.89±0.043 and 1.80±0.133, 1.20±0.104days for peanut, cotton and maize, respectively.

The duration of total immature stages for un-seminated females were 9.13±0.210, 8.97±0.220 and 8.80±0.176 days for peanut, cotton and maize, respectively. On the other hand, the developmental periods of un-seminated female were 12.88±0.229 days on peanut, 12.36±0.333 days on cotton and 12.2±0.238 days on maize.

The longevity of un-seminated female were 27.91±0.543, 26.17±0.490 and 26.00±0.302 days when fed on peanut, cotton and maize, respectively. Finally, the life span of un-seminated female were 40.79±0.644, 38.53±0.600 and 38.20±0.218 days when fed on peanut, cotton and maize, respectively.

Table 4. Developmental periods of *Tetranychus cucurbitacearum* (Sayed) un-seminated female when fed on leaves of different host plants at 27±2˚C and 65±5 %R.H.

Duration (in days)	Peanut	Cotton	Maize	L.S.D$_{0.05}$
Incubation period	3.75±0.143	3.39±0.141	3.40±0.149	
Active larvae	2.18±0.122	2.33±0.142	2.00±0.038	
Quiescent larvae	1.05±0.077	1.03±0.076	0.90±0.036	
Active protonymph	2.00±0.000	1.92±0.083	1.80±0.112	
Quiescent protonymph	1.17±0.112	0.92±0.030	1.10±0.065	
Active deutonymph	1.73±0.141	1.88±0.089	1.80±0.113	
Quiescent deutonymph	1.00±0.000	0.89±0.043	1.20±0.104	
Total immature	9.13±0.210	8.97±0.220	8.80±0.176	
Developmental period (Life cycle)	12.88±0.229	12.36±0.333	12.2±0.238	n.s
Adult longevity	27.91±0.547a	26.17±0.490b	26.00±0.302c	1.343*
Life span	40.79±0.644a	38.53±0.600b	38.20±0.218b	1.530**

Data presented in Table (5) showed the pre-oviposition, oviposition and post-oviposition period of un-seminated females when reared on peanut, cotton and maize leaves under laboratory conditions. Obtained data indicated that pre-oviposition periods were 1.36±0.152, 1.50±0.151 and 2.00±0.174 days for peanut, cotton and maize, respectively.

Regarding oviposition periods, it noticed that gave 20.91±0.791, 18.17±0.575 and 17.80±0.297 days when fed on the three previous food types, respectively. Post-oviposition periods ranged between 5.64±0.338 days on peanut, 6.20±0.207 days on maize and 6.50±0.485 days on cotton. Female longevity was gave 27.91±0.547, 26.17±0.490 and 26.00±0.302 days for peanut, cotton and maize, respectively.

Data in Table (6) showed that the number of deposited eggs by un-seminated female of *T. cucurbitacearum* were 96.36±6.35 eggs with daily rate egg production/female (4.59±0.204 egg) on peanut and 63.33±2.789 with daily eggs production/female (3.48±0.089 days) on cotton and 51.10±1.338 with daily egg production/female (2.90±0.051days), on maize. Generally it could be concluded that when un-seminated female fed on peanut, cotton and maize. The adult longevity, life span, oviposition period and female longevity were longer than when seminated female fed on the same food types.

Table 5. Pre-oviposition, oviposition and post- oviposition period (in days) of *Tetranychus cucurbitacearum* (Sayed) un-seminated females when fed on leaves of different host plants:

Host plant	Pre-oviposition period	Oviposition period	Post- oviposition period	Adult longevity
Peanut	1.36±0.152	20.91±0.791	5.64±0.338	27.91±0.547
Cotton	1.50±0.151	18.17±0.575	6.50±0.485	26.17±0.490
Maize	2.00±0.174	17.80±0.297	6.20±0.207	26.00±0.302

Table 6. Fecundity and daily egg numbers of *Tetranychus cucurbitacearum* (Sayed) un-seminated females when fed on leaves of different plants:

Host plant	Fecundity	Daily rate
Peanut	96.36±6.354	4.59±0.204
Cotton	63.33±2.789	3.48±0.089
Maize	51.10±1.334	2.90±0.051

Regarding the total deposited eggs laid by un-seminated females were laid number of eggs lower than seminated females where gave 96.36±6.354, 63.33±2.789 and 51.10±1.338 eggs for un-seminated female. While the parallel values were 120.61±1.739, 79.04±1.926 and 61.84±1.505 eggs for peanut, cotton and maize, respectively.

These results agree with Mohamed (2004) who studied life span for *Tetranychus cucurbitacearum* reared on leaves of two lupin varieties (Giza1 and Balady) at 18±1°C and 70±5 %R.H., Hanna *et al.*, (1982) in a laboratory study in Egypt, noticed that cuticular thickness and nitrogen, phosphorus and potassium contents of economically important food-plants were evaluated as possible causes of host preference by the tetranychids.

During the period of the experiment it was observed that longevity was the longest and fecundity was the highest when mites fed on peanut leaves for seminated females and un-seminated females. On the other hand, the shortest longevity and the lowest fecundity were recorded when mites fed on maize leaves, while the fecundity was longer and longevity was greater for seminated females than un- seminated females.

2.3. Effect of some host plants on progeny sex ratio of *Tetranychus cucurbitacearum* (Sayed) at 27±2 ºC and 65 ± 5 % R.H.

The effect of three food types i.e. peanut, cotton and maize on progeny sex ratio of *T. cucurbitacearum* was determined under laboratory condition. Data presented in Table (7) indicated that fertilized females gave more sex ratio (females: males) as compared to those un- fertilized females where gave 70.14±1.229, 69.80±1.193 and 60.72±0.968% females on peanut, cotton and maize, respectively., while the parallel values in un-fertilized females case were 1.9±0.333, 2.35±0.174 and 1.68±0.207 for the three tested food types, respectively.

The statistical analysis for seminated females revealed highly significant differences between the different hosts, while it was no significant differences between cotton and maize. Also revealed no significant differences between the different hosts for un-seminated females. The adult females lived longer days than males similar results were also obtained by Banerjee (1978), Pillaiand Jolly (1986) also recorded an irregular combination of males and females in tetranychids. Overmear (1972) reported that a ratio of 1:3 was often found in tetranychid mites and it may be considered as normal.

Table 7. Effect of some host plant on progeny sex ratio of *Tetranychus cucurbitacearum* (Sayed) at 27±2 ºC and 65 ± 5 % R.H.

Host plants	Sex ratio progeny	
	Females	Male
Fertilized female		
Peanut	70.14±1.229a	29.86±0.527b
Cotton	69.80±1.193b	30.20±0.783a
Maize	60.72±0.968b	29.28±0.519b
L.S.D.0.05	1.066**	1.002**
Un-fertilized females		
Peanut	1.9±0.333	98.10±5.912
Cotton	2.35±0.174	97.65±2.851
Maize	1. 68±0.207	98.32±1.246
L.S.D.0.05	n.s	n.s

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تأثير بعض العوائل النباتية المختلفة علي بعض المظاهر البيولوجية للحلم العنكبوتي *Tetranychus cucurbitacearum* (Sayed)

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أجريت هذه الدراسة البيولوجية بمعمل بحوث أكاروس القطن والمحاصيل، معهد بحوث وقاية النباتات، فرع الشرقية؛ لمعرفة تأثير التغذية على بعض أنواع المحاصيل الحقلية على بيولوجية النوع *T. cucurbitacearum* وقد أوضحت النتائج أن الفول السوداني كان أكثر تفضيلا لهذا النوع حيث أعطى أعلى عدد من البيض وصل إلى ١٢٠,٦١ بيضة أما الذرة الشامية كان أقلها تفضيلا حيث وصل عدد البيض إلى ٦١,٨٤ بيضه.