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EFFECT OF PREY TYPE ON THE BIOLOGICAL ASPECTS OF THE PREDATORY MITE, *Agistemus exertus*

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ABSTRACT

The biological aspects of the predatory mite, *Agistemus exsertus* Gonzalez (Acarina : Stigmaeidae) were studied at different types of food (the two spotted-spider mite, *Tetranychus urticae* Koch eggs, and immature stages, the purple scale, *Lepidosaphes beckii* (Newm.) eggs and pollen grains of the date palm). Generally, the biological aspects of the predatory mite were affected by food types. The incubation period of *A. exsertus* was (3.95±0.54, 4.75±0.17, 4.57±0.47 and 4.42±0.30 days at 28°C, when fed on eggs, immature stages of *T. urticae,* eggs of *L. beckii* and pollen grains of date palm, respectively. Similar results obtained for larval, protonymphal and deutonymphal stages. Female and male longevities were long with feeding on pollens, while, it was short with feeding on *T. urticae* eggs at 28°C. It could be concluded that *T. urticae* eggs or immature stages were more favourable diets for female and male under constant temperature. Also, female and male life span of *A. exsertus* affected by kind of food, the longest period was recorded when fed on date palm pollens. The pre-oviposition, oviposition and post- oviposition periods for female were affected by types of food. The total numbers of deposited eggs/female of *A. exsertus* was affected by the types of food offered to adult female. The number of deposited eggs/female increased with supporting the suitable prey for adult female. Sex ratio was affected by kind of food. The highest percentage of female's percentages of *A. exsertus* was (66.24%) recorded when fed on *T. urticae* eggs, while the lowest one was recorded (61.05%) when fed on fed on pollens. Feeding capacity of *A. exsertus* was affected by predator stage sex. The average number and daily rate of consumed prey increase with the successive predator developmental stages. Also, the immature of female fed on greater number of prey than of those of male. Male followed similar trend as that of female, but in smaller numbers. Concerning the feeding capacity of adult's it is clear that the female consumed higher numbers of prey than male, these due to those females eggs production.

INTRODUCTION

The tetranychid mites are the most important pests and plant feeders of considerable economic important attacking field crops, cotton, fruits and vegetable crops (Adbel-Rahman, 1990). The spotted-spider mite, *Tetranychus urticae* Koch (Acarina : Tetranychidae), is a major economic pest attacking several kinds of field crops and vegetables especially strawberry, cucumber and cantaloupe. *T. urticae* is the economic mite pest; all stages of this mite are pests as plant feeders, except eggs. The life cycle of this pests including [eggs, postembryonic stages (larvae, protonymph, deutonymph and mature stages]. They have ability to produce webs on the host plants that coating them with a shiny dust which reduces the plant photosynthetic abilities. Its damage results from the sucking plant juices with its piercing-sucking mouth parts, causing bronzed and off-coloured foliage spots. Under heavy infestations, defoliations and undersized poorly coloured fruit are produced. It affects on the quantity and the size of fruits and also reduces their quality (Wilson *et al.,* 1991).

The purple scale, *Lepidosaphes beckii* (Newman) (Homoptera : Diaspididae) is the principal armoured scale insect pests of the world (Beardsley and Gonzales, 1975). Also, it is a dominant pest on citrus trees in Egypt (Hafez *et al.*, 1987).

The predatory mite, *Agistemus exsertus* Gonzalez (Acarina : Stigmaeidae) is widely distributed on different fruit trees and some vegetable crops

The present work is an attempt to study the biological aspects of the predatory mite, *Agistemus exsertus* Gonzalez feeding on different stages of the two-spotted spider mite, *Tetranychus urticae* Koch, eggs of the purple scale, *L. beckii* and date palm pollen at temperature (28±1°C and 70±5% RH).

MATERIALS AND METHODS

1. Source of the predatory mite, *Agistemus exsertus*:

The predatory mite, *A. exsertus* individuals were collected from the Navel orange trees (*Citrus sinensis* var. *washing*) at Qalubiya Governorate and were identified by mounted on glass slides after clearing in nesbitt's solution by using Hoyer's medium, then microscopically examined for identification by members of taxonomy, Acarology Dept., Plant Protection Research Institute, by aid of terminology and key of prostigmata

2. Mass rearing of the predatory mite, *A. exsertus*:

Citrus leaves were used as substrate for rearing the predatory mite fed on the different stages of *T. urticae*, eggs of *L. beckii* and pollen grains. Newly deposited predator eggs were transferred singly each to a mulberry or citrus disc (1.5 cm diameter). Each hatched larvae were used in biological experiments.

3. Biological studies of the predatory mite, *A. exsertus*:

Laboratory experiments were carried out to study the biological aspects of *A. exsertus* attacking mites and scale insects on Navel orange trees.

3.1. Effect of kind of food on incubation, oviposition periods, adult longevity, fecundity and feeding capacity of the predatory mite, *A. exsertus*:

Effect of different types of diets (*T. urticae* eggs, immature stages, *L. beckii* eggs and date palm pollen grains) on some biological aspects of *A. exsertus* at 28±1°C and 70±5 R.H.

Twenty newly deposited eggs of *A. exsertus* predator were collected from a laboratory culture and placed on citrus leaf discs for the latter in Petri dishes of 5 cm in diameter with wet cotton wool pad. Relative humidity was maintained by adding few water drops when needed. Eight Petri dishes were kept in the incubator (28±1°C) fecundity of these females were examined and feeding capacity of both females and males were also estimated. The obtained data were statistically analyzed at 5%.

RESULTS AND DISCUSSION

1. Durations of immature stages:

The durations of immature stages of *A. exsertus* were studied under different kinds of diet (*T. urticae* stages, *L. beckii* eggs and pollens of the date palm).

1.1. Egg stage (incubation period):

Results in Table (1) indicate that the incubation period of the predator, *A. exsertus* was slightly affected by food types. Therefore the incubation period lasted (3.95±0.54, 4.75±0.17, 4.57±0.47 and 4.42±0.30 days at 28°C, when fed on eggs, immature stages of *T. urticae,* eggs of *L. beckii* and pollen grains, respectively.

In this respect, Ibrahim (1971) found that the incubation period, immature stages and longevity of the predacious mite, *S. nudus* fed on eggs of *L. beckii* were affected by temperature.

Table (1): Durations of the developmental stages of the predator, *Agistemus exsertus* Gonzalez fed on eggs, immature stages of *T. urticae,* eggs of *L. beckii* and pollen grains at 28±1°C and 70±5% R.H.

Duration		sex	Eggs of *T. urticae*	immature stages of *T. urticae*	Eggs of *L. beckii*	Pollens of date palm
Egg (incubation period)			3.95±0.54	4.75±0.17	4.57±0.47	4.42±0.30
Larval period		♀	2.43±0.40	2.70±0.46	3.60±0.36	3.23±0.45
		♂	2.47±0.35	3.03±0.25	2.83±0.35	3.90±0.46
Nymphal period	Protonymph	♀	2.53±0.21	3.10±0.36	3.97±0.25	3.60±0.36
		♂	2.60±0.40	3.47±0.50	2.53±0.45	4.17±0.47
	Deutonymph	♀	2.93±0.31	3.10±0.56	3.63±0.35	4.03±0.25
		♂	3.00±0.20	3.10±0.30	2.97±0.25	4.10±0.46
Total immature period		♀	7.90±0.87	8.90±1.35	11.20±0.61	10.87±1.06
		♂	8.07±0.68	9.60±0.10	8.33±0.96	12.17±1.39
Total developmental period		♀	11.47±1.23	13.53±1.52	16.10±0.78	15.50±1.51
		♂	12.40±1.01	14.47±0.35	12.56±1.62	16.37±1.55
Longevity		♀	17.78±0.33	20.47±0.32	28.47±1.46	31.93±1.60
		♂	13.77±0.12	15.97±1.06	22.60±2.35	26.67±3.33
Adult's life span		♀	29.25±1.56	34.00±1.55	44.57±2.24	47.43±2.83
		♂	26.17±2.10	30.44±1.26	35.16±3.96	43.04±4.76

1.2. Larval and nymphal periods:

As shown in Tables (1) the duration of larval stage of the predator, *A. exsertus* of female averaged (2.43±0.40, 2.70±0.46, 3.60±0.36 and 3.23±0.45 days) at 28°C when fed on eggs, immature stages of *T. urticae,* eggs of *L. beckii* and pollen grains, respectively, while, these periods lasted (2.47±0.35, 3.03±0.25, 2.83±0.35 and 3.90±0.46 days) for male, respectively.

On the other hand, female and male immature stages (protonymphs and deutonymphs) these periods reached (2.53±0.21, 3.10±0.36, 3.97±0.25 and 3.60±0.36 days) for protonymphal female, while reached to (2.60±0.40, 3.47±0.50, 2.53±0.45 and 4.17±0.47 days) for protonymphal male at 28°C when fed on eggs, immature stages of *T. urticae,* eggs of *L. beckii* and pollen grains, respectively. Also, these periods reached (2.93±0.31, 3.10±0.56, 3.63±0.35 and 4.03±0.25 days) for deutonymph of female, while reached to

(3.00±0.20, 3.10±0.30, 2.97±0.25 and 4.10±0.46 days) for deutonymph male at 28°C when fed on eggs, immature stages of *T. urticae,* eggs of *L. beckii* and pollen grains, respectively.

Statically analysis showed that no significant differences between the different kinds of diets at 28°C for female and male.

1.3. Total developmental periods of immature stages:

According to the aforementioned results of larval and nymphal stages, the total developmental period of immature stages were affected by kinds of food. It could be concluded that *T. urticae* eggs was more favourable diet for female and male it was (11.47±1.23 and 12.40±1.01 days) at 28°C, while reached (13.53±1.52 and 14.47±0.35 days) when fed on *T. urticae* immature. On the other hand, this period reached (16.10±0.78 and 12.56±1.62 days) when fed on *L. beckii* eggs, while reached (15.50±1.51 and 16.37±1.55 days) when fed on pollens, respectively.

Statically analysis revealed that life cycle of female and male was affected by food types.

1.5. Adult's longevity:

At 28°C temperature and 70 % R. H. when the predacious mite, *A. exsertus* adults fed on pollens of date palms, the adult female and male lived for the long times averaged 31.93±1.60 and 26.67±3.33, respectively, while when fed on *T. urticae* eggs the adult female and male lived short time averaged (17.78±0.33 and 13.77±0.12 days), respectively.

Statically analysis revealed that, there are significantly effects on the adult longevity of female and male, when they fed on eggs, immature stages of *T. urticae,* eggs of *L. beckii* and pollen grains.

1.6. Adult's life span:

From the mentioned data, life span of *A. exsertus* female and male, the longest period (47.43±2.83 and 43.04±4.76 days) was recorded when fed on date palm pollens, while it was shorter (29.25±1.56 and 26.17±2.10 days) when fed on *T. urticae* eggs, respectively. Also, life span take the same trend of female and male when fed on immature stages of *T. urticae* (34.00±1.55 and 30.44±1.26 days), while when fed on *L. beckii* eggs lasted (35.16±3.96 and 44.57±2.24 days), respectively.

The results are not agreement with those obtained by Hanna *et al.* (1980) they studied that the effect of food type on the lifespan of the predatory mite, *Agistemus exsertus*. They found that, the eggs of *Tetranychus urticae* afforded longer lifespan to the predator.

1.7. Oviposition periods:

1.7.1. Pre-oviposition period:

Table (2) shows the pre-oviposition period of *A. exsertus* was affected by the kind of food. The pre-oviposition period was short with averaged 2.53±0.21 and 2.77±0.25 days at 28°C when fed on eggs or immature stages of *T. urticae*, while it was long when fed on *L. beckii* eggs or date palm pollens (4.10±0.36 and 4.97±0.42), respectively.

1.7.2. Oviposition period:

Also, the oviposition period of *A. exsertus* was affected by the kind of food. The oviposition period was short with averaged 11.22±0.13 and 12.50±0.30 days at 28°C when fed on eggs or immature stages of *T. urticae*,

while it was long when fed on *L. beckii* eggs or date palm pollens (17.90±0.66 and 18.53±0.45), respectively.

Table (2): Effect of type of food on oviposition periods, longevity and number of eggs and fecundity of the predator, *Agistemus exsertus* Gonzalez fed on eggs, immature stages of *T. urticae*, eggs of *L. beckii* and pollen grains at 28±1°C and 70±5% R.H.

Duration		Eggs of *T. urticae*	immature stages of *T. urticae*	Eggs of *L. beckii*	Pollens of date palm
Pre-oviposition		2.53±0.21	2.77±0.25	4.10±0.36	4.97±0.42
Oviposition		11.22±0.13	12.50±0.30	17.90±0.66	18.53±0.45
Post-oviposition		4.03±0.15	5.20±0.26	6.47±0.65	8.43±0.93
Longevity		17.78±0.33	20.47±0.32	28.47±4.46	31.93±1.60
No. of eggs/female	Daily	6.46±0.13	5.24±0.50	3.27±0.20	3.02±0.16
	Total	72.43±2.27	65.43±4.60	58.50±2.49	56.10±3.64
Sex ratio females/total (%)		66.24	65.04	63.03	61.05

1.7.3. Post-oviposition period:

With the same trend, the post-oviposition period of *A. exsertus* was affected by the kind of food. The post-oviposition period was short with averaged 4.03±0.15 and 5.20±0.26 days at 28°C when fed on eggs or immature stages of *T. urticae*, while it was long when fed on *L. beckii* eggs or date palm pollens (6.47±0.65 and 8.43±0.93), respectively.

1.8. Fecundity:

Data in Table (2) shows that the daily and total numbers of deposited eggs/female of *A. exsertus* are affected by the types of food offered to adult female. The number of deposited eggs/female increased with gave the suitable prey for adult female and male, it was reached to 6.46±0.13 deposited eggs/female daily, and 72.43±2.27 total deposited eggs/female when fed on eggs of *T. urticae*, while reached to 3.02±0.16 deposited eggs/female daily, and 56.10±3.64 total deposited eggs/female when fed on date palm pollens. On the intermediate, it was reached to 5.24±0.50 deposited eggs/female daily, and 65.43±4.60 total deposited eggs/female when fed on immature stages of *T. urticae*, while reached to 3.27±0.20 deposited eggs/female daily, and 58.50±2.49 total deposited eggs/female when fed on *L. beckii* eggs.

1.9. Sex ratio:

Data in Table (2) show that sex ratio was affected by kind of food. The highest percentage of female's percentages as (females/total) of *A. exsertus* (66.24%) was recorded at 28°C when fed on *T. urticae* eggs, while the lowest one (61.05%) was recorded when fed on fed on pollens

1.10. Feeding capacity of *A. exsertus* on different prey:

Data in Tables (3&4) revealed that, feeding capacity of *A. exsertus* was affected by predator stage sex. The average number and daily rate of consumed prey increase with the successive predator developmental stages. Also, the immature of female fed on greater number of prey than of those of male. Throughout the whole period of the immature stages, female consumed

an average of 180.83±7.29, 81.00±6.67, and 194.33±12.11 individuals at 28°C when fed on *T. urticae* eggs and immature stages and *L. beckii* eggs, respective. Male followed similar trend as that of female, but in smaller numbers. Concerning the feeding capacity of adult's it is clear that the female consumed higher numbers of prey than male, these due to those females eggs production.

Hassan (1976) reported that the adult female of the predator consumed an average of 180.8 and 158.3 crawlers of *C. ficus* and *L. tableyi*, respectively.

Table (3): Rate of consumed prey/female of the predator, *Agistemus exsertus* Gonzalez fed on eggs, immature stages of *T. urticae*, and eggs of *L. beckii* at 28±1°C and 70±5% R.H.

Duration		Eggs of *T. urticae*		Immature stages of *T. urticae*		Eggs of *L. beckii*	
		Total consumption	Daily consumption	Total consumption	Daily consumption	Total consumption	Daily consumption
Larvae		8.17±1.26	3.43±0.81	4.17±1.04	1.54±0.33	9.33±1.04	2.59±0.03
Protonymph		11.93±1.29	4.71±0.25	6.00±0.50	1.94±0.17	13.33±1.26	3.38±0.48
Deutonymph		18.50±1.32	6.34±0.62	8.33±2.02	2.67±0.22	17.67±2.75	4.85±0.29
Total consumption of immature		38.60±2.33	-	18.50±3.0	-	40.33±2.02	-
Adult's female	Pre-oviposition	8.14±0.49	8.14±0.49	12.33±2.02	4.46±0.62	26.00±4.27	6.36±1.10
	Oviposition	12.07±0.54	12.07±0.54	56.83±7.59	4.56±0.72	144.17±5.75	8.05±0.06
	Post-oviposition	6.17±0.88	6.17±0.88	11.83±1.04	2.28±0.24	24.17±3.82	3.73±0.43
Total consumption/female		180.83±7.29	-	81.00±6.67	-	194.33±12.11	-

Table (4): Rate of consumed prey/male of the predator, *Agistemus exsertus* Gonzalez fed on eggs, immature stages of *T. urticae*, and eggs of *L. beckii* at 28±1°C and 70±5% R.H.

Duration	Eggs of *T. urticae*		Immature stages of *T. urticae*		Eggs of *L. beckii*	
	Total consumption	Daily consumption	Total consumption	Daily consumption	Total consumption	Daily consumption
Larvae	7.50±1.32	3.08±0.67	3.33±0.76	1.09±0.17	8.33±1.04	2.98±0.56
Protonymph	12.17±1.04	4.72±0.48	5.33±1.04	1.54±0.19	11.33±0.76	4.60±1.11
Deutonymph	16.67±1.26	5.58±0.73	7.50±1.32	2.41±0.28	14.50±1.32	4.90±0.35
Total consumption of immature	36.33±2.57	-	16.17±7.64	-	34.17±0.76	-
Total consumption/female	129.33±8.14	-	63.50±7.70	-	125.50±4.27	-

REFERENCES

Abd-Allah, Amira, M. S. 1996. Biological and ecological studies on some predacious mites. Ph. D. Thesis, Fac. of Agric. Cairo, Univ., 151 pp.

Abdel-Rahman, Soheir, I. (1996): Studies on the Tetranychoi mites. Ph. D. Thesis, Fac. Agric. Cairo Uinv., 350 pp.

Hafez, M. B.; A. M. El-Minshawy and A. R. Donia 1987. Population fluctuations of parasites of *Lepidosaphes beckii* Newm. and *Ceroplastes floridensis* Gomst. Anz. Shadlingskde., Pflanzenschutz, 60: 6-9.

Hassan, M. F. 1976. Studies on prostigmatid mites. M.Sc. Thesis, Fac. of Agric. Cairo, Univ., 70 pp.

Ibrahim, M. A. 1971. Studies on predacious mites associated with scale insects in Egypt. M.Sc. Thesis, Fac. of Agric. Cairo, Univ., 71 pp.

تـأثير نـوع الفريسـة علـى بعـض الخصـائص البيولوجيـة للمفتـرس الاكاروسـى *Agistemus exsertus*

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المظاهر البيولوجية للمفترس *Agistemus exsertus* حيث تم دراستها علي عدة أنواع مـن الفرائس وهي بيض والأعمار غير الكاملة للعنكبوت الاحمر ذوالبقعتين وبيض الحشرة القشرية الأرجوانيـة وحبوب لقاح نخيل البلح. بصفة عامة المظاهر البيولوجية لهذا المفترس تأثرت بنوع الغذاء حيث تاثرت فترة الحضانة بتنوع الفرائس. حيث سجلت أطول فترة للحضانة عند التغذية علي حبوب لقاح نخيل البلح. وفتـرة الأعمار غير الكاملة لهذا المفترس تأثرت بنوع الغذاء كما وجد أن أطول فترة حياة كانت عند التغذية علـي حبوب لقاح نخيل البلح.. ايضا وجد أن فترة ما قبل وضع البيض وفترة وضع البيض وفترة ما بعـد وضـع البيض تتأثر جميعها بتغير نوع الغذاء. كما وجد أن كمية البيض الموضوعة يوميا تتأثر بتنوع الغذاء حيـث وجد أن بيض العنكبوت الأحمر من أفضل أنواع الغذاء المقدمة للاكاروس المفترس. وكمية وضـع البـيض تاثرت أيضا بنوع الغذاء المقدم مع ثبات درجات الحرارة فوجد أن كمية البيض تتأثر بنوع الفريسة المقدمـة لها. في حين تتأثر النسبة الجنسية تبعا للتغذية وتبعا لطورالمفترس وجنسه.

مما سبق يمكن أن يستفاد بهذا المفترس في برامج المكافحة المتكاملة كأحـد عناصـر المكافحـة الحيوية.