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BIOLOGICAL ASPECTS AND LIFE TABLE PARAMETERS OF THE PREDACIOUS MITE, *AGISTEMUS EXSERTUS* GONZALEZ (ACARI: PROSTIGMATA: STIGMAEIDAE) FED ON FIFE FOOD TYPES

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ABSTRACT: ***The biology of Agistemus exsertus Gonzalez was studied using five different types of diets, eggs and nymph of Tetranychus urticae Koch, eggs and larva of Bemisia tabaci, and eggs of Ephestia kuehniella as the food source . The development was faster and reproduction was higher when A. exsertus fed on eggs of E. kuehniella. A diet of T.urticae, eggs provided the longest female longevity and mean total fecundity which resulted in the highest net reproductive rate (R_0) value (93.71), intrinsic rate of natural increase (r_m = 0.25), finite rate of increase (e^{rm} = 1.28) per day , and Gross reproduction rate (GRR =104.8) for A. exsertus.whereas the lowest value of all parameters achieved with a diet of B. tabaci larva.***

Key words: ***Acari, Agistemus exsertus, Tetranychus urticae, Bemisia tabaci, Ephestia kuehniella, life table.***

INTRODUCTION

Mites of the family Stigmaeidae are considered predators of mites which found in the soil, stored products, and plants (Momen, 2001). Most of them are effective and widespread predators that react a basic role in the biological control of phytophagous mites (Nawar, 1992). *Agistemus exsertus* Gonzalez considerable the most common stigmaeid mite species collected from fruit trees, vegetables, ornamentals and field crops (Fouly and Al- Rehiayani 2011). The predacious mite *A. exsert*us feeds on several diets not only tetranychid mites, pollen grains, eriophyid and tenuipalpid mites (El-Bagoury and Reda, 1985; Santos and Laing, 1985) but also the eggs of both white-flies (Khan, *et al*., 2016) and stored product moth Ephestia kuehniella Zeller (Momen, 2001). Therefore, The major objective of this study was to determine the effect of several types of diets on the biological aspects and life table parameters of *A. exsertus.*

MATERIALS AND METHODS

Maintenance of mite stock cultures:

Adult females of *A. exsertus* utilized within this study were picked up carefully from vigorously swarmed Ploughman's spikenard plant In Dakahlia Governorate, Egypt during 2017; and reared on eggs and immature stages of the two-spotted spider mite *Tetranychus urticae* Koch at 27 ºC and 70 ± 5% R. H.

Diets:

Five diets were evaluated for their effect on development survival, oviposition, and life table parameter: (Eggs and nymph of the two- spotted spider mite *T.urticae* were reared at the laboratory, Eggs and larva of the whitefly, *B. tabaci* were obtained from heavy infestation of beans, *Phaseolusvulgaris*. and the eggs of the stored product moth *E. kuehniella* were obtained from stock culture kept at the laboratory for many years).

Effects of diet on development:

The rearing arena (3 x 3 cm) from claiming excised raspberry leaves, put on immersed cotton over plastic Petri dishes, were used to keep the predator. A strip of moistened absorbent cotton might have been put around the outside edge of the leaves. A single recently deposited egg might have been exchanged to each arena and the recently hatched larvae were supplied with the food resource to be evaluated. All handling of mites and host eggs was performed with a very fine, moistened, squirrel hairbrush. Arenas were inspected every day and predator improvement Also survival were recorded. Prey eggs consumed devoured were traded every day toward new eggs should keep up a plentiful food supply.

Recently emerged female, mated, restricted separately around test arenas, alongside with the food to be tested. A few strands of cotton wool were given concerning illustration an ovipositor site in each arena. Oviposition and survival parameters were recorded additionally, stigmaeid eggs uprooted every day for sex determination. Twenty- five eggs of *A. exsertus* for each analyze were observed daily.

Life table parameters as defined by Birch (1948) were calculated according to A BASIC computer program (Abou-Setta *et al*., 1986).

RESULTS AND DISCUSSION

Effects of diet on development :

Individuals *of A. exsertus* successfully developed from larva to adult when fed on all kinds of food. Data in the Table (1) showed that there were no significant between the incubation period of the egg when *A. exsertus* fed on nymph of *T.urticae*, Eggs, and larva of *B. tabaci* , and eggs of *E. kuehniella.* which were 2.4, 2.3,2.0, and 2.0 days respectively.But, it was significant when fed on the egg of *T.urticae* which was 1.4 days. The life cycle of *A. exsertus* had the same trend when fed on the 5 types of dites. Although, the adult longevity of *A. exsertus* was differed significantly among the various kinds of food. Adult longevity was too longer when fed on the eggs of *T.urticae* that was 29.5 days and decreased to 26.2, 22.9 , and 20.1 days when fed on the eggs of *E. kuehniella,* nymph of *T.urticae,* and eggs of *B. tabaci,* respectively, while it was too shorter when fed on the larvae of *B. tabaci,* which durated 13.2 days.

Table (1): Comparative duration (x ± S.D.) of the female of *A. exsertus* on different kinds of food at 27± 2°C and 70 ± 5% R.H.

Developmental stages	*T. urticae* (eggs)	*T. urticae* (nymph)	*B. tabaci* (eggs)	*B. tabaci* (larva)	*E. kuehniella* (eggs)	L.S.D
Egg	1.4^{c} ±0.50	2.4^{a}±0.50	2.3^{a} ±0.47	2.0^{b} ±0.56	2.0^{b} ±0.56	3.84
Larva	1.6^{c} ±0.50	2.6^{a} ±0.51	2.4^{a} ±0.50	2.3^{a} ±0.47	2.1^{b} ±0.64	1.18
Protonymph	1.8^{d} ±0.41	2.4^{c} ±0.49	2.4^{c} ±0.50	2.8^{b} ±0.83	3.9^{a} ±0.64	1.61
Deutonymph	3.3^{c} ±0.47	4.4^{b} ±0.49	3.9^{c} ±0.67	5.2^{a} ±o.70	4.5^{b} ±0.51	1.26
Life cycle	8.1^{c} ±1.07	11.7^{b}±0.68	11.1^{b}±1.23	12.3^{a} ±1.08	12.5^{a} ±1.28	1.92
Preoviposition period	1.8^{c} ±0.77	3.5^{a} ±0.51	3.3^{a} ±0.72	2.2^{b} ±0.75	2.4^{b} ±0.82	1.03
Oviposition period	24.3^{a}±3.10	16.8^{c}±1.74	14.6^{c} ±1.54	8.5^{d} ±1.28	20.2^{b} ±2.33	3.42
Adult longevity	29.5^{a}±2.80	22.9^{c}±1.88	20.1^{c} ±2.04	13.2^{d} ±1.70	26..2^{b} ±1.95	3.69
Life span	37.6^{a}±2.91	34.6^{b}±1.98	31.1^{c} ±2.43	25.5^{d} ±1.96	38.7^{a} ±2.43	3.82

Means followed by the same letter in the same raw are not significantly different at 0.01 level.

These data were in agreement with (Momen, 2001), who used a diet of *E. kuehniella* (eggs) which provided the longest female longevity and mean total fecundity. Rasmy *et al*., 1987, reported that *A. exsertus* has been reported to feed on dates pollen and the acarid mite *Tyreophagous casei* Oudemans and the daily rate of reproductively averaged 3.0 eggs / °+/ day for both diets.

Data illustrated in Fig. (1) proved an actual compared with both life cycle and life span of *A. exsertus* when fed on the fife types of food under the same conditions 27± 2°C and 70 ± 5% R.H at the laboratory.

The life cycle of *A. exsertus* recorded the longest period when fed on nymphs of *T.urticae*, eggs, and larvae of *B. tabaci*, and eggs of *E. kuehniella.*On the other hand , when the predacious mite fed on the eggs of *T.urticae,* the life spanof A. *exsertus* had the same trend*,* Momen, 2001. In addition , Momen (2001) reporetd that the development was faster and reproduction was higher when *A.exsertus* fed on eggs of *E.kuehniella*. A total of 97.78 and 75.27 eggs per female were obtained when eggs of *E.kuehniella* and *P. zizyphus* were provided respectively.

Effects of diet on the life table parameters:

Data in Table (2) showed that, the highly net reproduction rate (R0) of *A. exsertus* females occurred with adite of *T.urticae eggs* which were 93.71 females per female, whereas the lower value of (R0) was 13.16 females per female with a dite of *T.urticae* larva. Mean generation time (T) of *A. exsertus* did not very much between the fifth diets mentioned before.

The intrinsic rate of increase (rm) and, subsequently, the finite rate of increase (erm)were relatively equal between all types of food . (rm) meager between 0. 14 and 0.25 while (erm) was between 1.15 and 1.28. The highest value of a developmental rate (0.15) was obtained with a dite of *T.urticae* eggs, whereas the other diets relatively equal.

The highest Gross Reproduction Rate (GRR) (104.8) occurred with a dite of *T.urticae* eggs but the lowest (14.76) was recorded with a dite of *B. tabaci*larva.

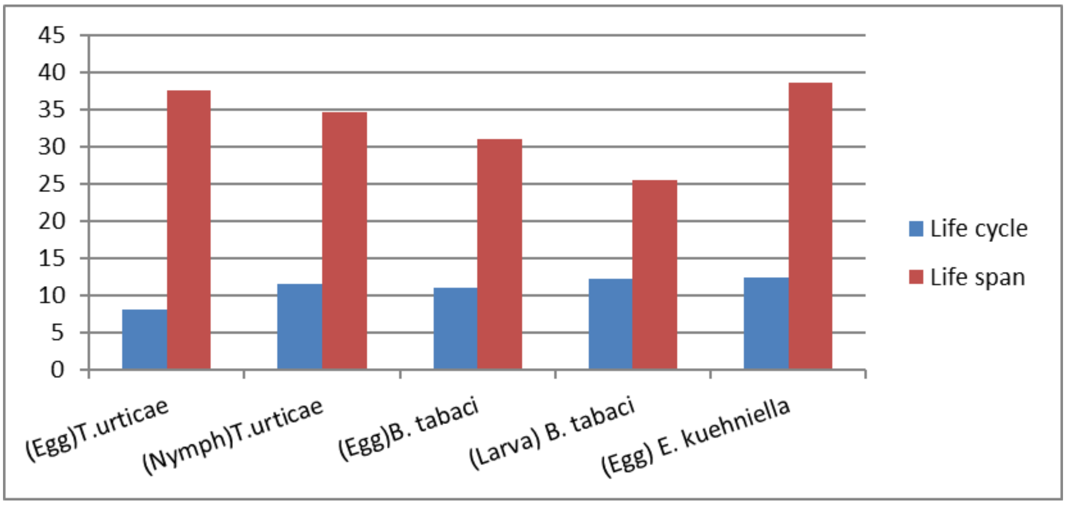

Fig (1): Comparative between life cycle and life span of *A. exsertus* females at different kinds of food at 27± 2°C and 70 ± 5% R.H.

Table (2): Life Table Parameters of *A. exsertus* females at different kinds of food at 27± 2°C and 70 ± 5% R.H.

Parameters	Prey species				
	T.urticae (eggs)	*T.urticae* (nymphs)	*B. tabaci* (eggs)	*B. tabaci* (larvae)	*E. kuehniella* (eggs)
Net reproduction rate (R_0)	93.71	31.86	29.66	13.16	46.60
Mean generation time (T)	18.17	22.71	20.82	18.18	23.41
Intrinsic rate of increase (r_m)	0.25	0.15	0.16	0.14	0.16
Finite rate of increase (e^{rm})	1.28	1.16	1.18	1.15	1.18
Generation doubling time (DT= ln 2 /r_m)	5.66	9.43	8.84	10.10	8.84
Developmental rate	0.15	0.11	0.11	0.10	0.10
Gross reproduction rate (GRR)	104.8	35.67	33.26	14.76	51.92

Abou-Awad and El-Sawi, 1993, studied the intrinsic rate ofincrease which was higher on the diet as *E. Kuehniella* eggs over the individuals for tetranychoid compared with whitefly eggs.

Bruce-Oliver and Hoy, 1990, showed that the eggs of *E. Kuehniella* was the favoriate for the most of predacious mites. The finite rate of increase (e^{rm}) were relatively higher (0.196 and 1.22 respectively) when individuals were fed *E. kuehniella* eggs and lower when fed *P. zizyphus* eggs (0.174 and 1.19). The higher (r_m) for *A. exsertus* reared on eggs of *E. kuehniella* could be attributed to differences in nutritive quality (Bruce *et al*., 1990).

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الخصائص البيولوجية وجداول الحياة للمفترس الأكاروسى *Agistemus exsertus* Gonzalez (Acari : Prostigmata: Stigmaeidae) عند تغذيته على خمسة انواع من الغذاء

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الملخص العربى

أجريت الدراسات البيولوجية للمفترس الاكاروسى *Agistemus exsertus* Gonzalez (Acari : Prostigmata: Stigmaeidae) بتغذيته على خمس انواع مختلفة من التغذيه وهى : بيض وحوريات العنكبوت الاحمر ذو البقعتين ، و بيض ويرقات الذبابة البيضاء ،و بيض فراشة الحبوب المخزونة كمصادر اساسية للغذاء. و من خلال هذه الدراسه تحقق اكبر معدل للنمو والتطور للمفترس الاكاروسى بتغذيته على بيض فراشة الحبوب . وبالتغذية على بيض العنكبوت الاحمر تم الحصول على اكبر فترة حياه للانثى لوضع البيض و نتج عنها اكبر معدل خصوبة للاناث و كانتاعلى قيمة لمعدل التضاعف للاناث 93.71 وكان معدل الزيادة الطبيعى يساوى 0.25 و معدل الزيادة النهائى يساوى 1.28/ انثى / يوم ، و كان اجمالى معدل الانتاج/ انثى خلال مدة حياتها خلال جيل واحد يساوى 104.8 ، وعلى النقيض من ذلك عند التغذية على يرقات الذبابة البيضاء تم الحصول على اقل المعدلات مقارنة بالنتائج السابقة .

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