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A NEW DIET FOR THE BIOLOGICAL ASPECTS OF THE PREDACEOUS MITE, *Agistemus exsertus* Gonzalez (Acari: Stigmaeidae)

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ABSTRACT

The biology of Agistemus exsertus Gonzalez was studied using an eggs of Schizotetranychus tuttleii Zaher, Gomaa and El-Enany as a new diet at 28±2˚C and 65±5% R.H.. The results showed that A. exsertus completed its life span in (39.22 & 35.15) days for female and male, respectively.

The average number of eggs consumed by female and male during the life span were (182.6 & 99.16) eggs with a daily mean (4.66 & 2.82) eggs for female and male, respectively. The fecundity was 63.58 eggs when fed on eggs of the mite, Sch. tuttleii with a daily mean 2.51 eggs at 28±2ºC and 65 ±5 % R.H..

***Conclusively,** the eggs of the mite, Sch. Tuttleii represent an effective and successful diet for rearing the predaceous mite, A. exsertus; whereas the average number of consumed significantly eggs during the life span were (182.6 & 99.16) eggs by female and male, respectively. The fecundity was 63.58 eggs with a daily mean 2.51 eggs at 28±2ºC and 65 ±5 % R.H.*

Keywords: *Agistemus exsertus*; *Schizotetranychus tuttleii*; diet; biology; fecundity

INTRODUCTION

Mites of the family Stigmaeidae are considered predators of mite pests which found in the soil, stored products and plant crops (Momen, 2001). Most of them are amenable to laboratory culturing using phytophagous mites. Some of these may play a role in controlling phytophagus mite pests and scale insects in the world (Nawar, 1992; Childers *et al*., 2001; Goldarazena *et al*., 2004; Krantz & Walter, 2009).

Mites of the genus, *Agistemus* Summers have been reported as an egg predators of tetranychid mites (Childers & Enns, 1975). The predaceous mite, *Agistemus exsertus* Gonzalez fed on several diets as tetranychid, eriophyid, tenuipalpid mites, and pollen grains (Santos & Laing, 1985; Momen, 2001; Khan *et al*., 2016)

In Egypt, the predatory mite, *A. exsertus* is an important natural enemy of acarine pests (Sholla, 2012). It's documented by many authors as an predatory eggs of tetranychid and tenupalpid mites (El-Badry *et al.*, 1969; Hafez *et al*., 1983; El-Bagoury *et al.*, 1989; Abou-Awad & El-Sawi 1993) and researched by

Momen (2001); Romeih *et al*. (2004); Momen and El-Sawi (2006); one of these tetranychid mites is *Schizotrtanychus* sp.whereas many literature review indicated that the result of *Shizotetranychus* sp. caused deficiency in the chlorophyll content in bamboo leaves by 11% (Zhang *et al*., 1998; Zhang *et al*., 2000).

Therefore, the aim of this study to determine the effect of eggs of the phytophagous mite, *Sch. tuttleii* Zaher, Gomaa and El-Enany on the developmental periods and fecundity of the predacious mite, *A. exsertus.*

MATERIALS AND METHODS

Adult females of the predatory mite, *Agistemus exsertus* was collected from leaves of the white willow trees, *Salix alba* 'Tristis' located in Diarb-Negm, Sharkia Governorate, Egypt. The tetranychid mite species, *Schizotrtanychus tuttleii* was collected from leaves of the white willow trees and reared on mulberry leaves using their eggs as food for the predatory mite, *A. exsertus*. The mite culture of *A. exsertus* was established by placing a copulated female on the mulberry leave discs, *Morus alba* L. (3 cm in diameter) infested with *Sch. tuttleii* as prey using the method by Khodayari *et al*. (2008).

Discs were put on cotton wood soaked in water in Petri discs (15 cm in diameter). Newly deposited predator eggs were transferred singly to mulberry leaf discs. Then, hatched larva was left to till reaching maturity. Observation concerning all biological aspects were recorded during the predatory life span. The experiment was undertaken in room condition of 28±2˚C and 65±5% R.H.. Data were statistically analyzed using the analysis of variance according to Sendecor and Cochran (1982).

RESULTS AND DISCUSSION

Effect of diet on the biological aspects of Agistemus exsertus:

Individuals of *A. exsertus* (sexes separately) were developed from larva to adult when fed on eggs of the phytophagous species, *Schizotrtanychus tuttleii* Zaher, Gomaa and El-Enany. Duration of larva, protonymph, and deutonymph were (2.91 & 2.87); (2.95 & 2.93) and (2.82 & 2.83) days at 28±2 ºC and 65 +5 % R.H. for female and male, respectively. Therefore, the developmental time of *A. exsertus* lasted (8.68 & 8.63) days for female and male, respectively as shown in Table 1.

The same data was obtained by Omar (2014) who recorded that the developmental time of the predator, *Agistemus vulgaris* was significantly affected by food source and lasted (8.75 & 8.31) days when predator immature stages fed on immatures of *Oligonychus sayedi* and *Aculops lycopersici*,

Table 1: Average developmental time (in days) of *A. exsertus* on eggs of *Schizotrtanychus tuttleii* as food sources at 28±2 ºC and 65±5 % R.H.

Stages	Duration in days ± S.E.	
	Females	Males
eggs	4.02±0.11	3.17±0.10
Larva	2.91±0.11	2.87±0.14
Protonymph	2.95±0.11	2.93±0.15
deutonymph	2.82±0.14	2.83±0.12
Immature	8.68±0.16	8.63±0.14
Life cycle	12.69±0.24	11.80±.34

±S.E.= Standard Error.

respectively. The current data indicated that the life cycle of the mite, *A. exsertus* was (12.69 & 11.80) days for female and male when fed on eggs of *Sch. Tuttleii* as prey at room temperature, respectively. The data have been reported to the same trend by Hafez *et al*. (1983); El-Bagoury *et al*. (1989); Momen (2011); Sholla (2012); Tawfik (2018).

Adult longevity and fecundity were resulted in Table 2. The mean of oviposition period of the predatory female was 21.95 days; the fecundity was 63.58 eggs when fed on eggs of the mite, *Sch. tuttleii* with a daily mean 2.51 eggs at 28±2ºC and 65 ±5 % R.H.. Also, the mean of life span of the predaceous mite, *A. exsertus* was (39.22 & 35.15) days for female and male, respectively. These results are similar to the findings of Hafez *et al*. (1983); Abou-Awad and El-Sawy (1993); Sholla (2012) and Tawfik (2018).

Table 2: Average duration (in days) of various adult periods of *A. exsertus* on eggs of *Schizotrtanychus tuttleii* as food sources at 28±2ºC and 65±5 % R.H.

Stages	Duration in days ± S.E.	
	Females	Males
Preoviposition	2.18±0.12	-
Oviposition	21.95±0.17	-
Postoviposition	2.40±0.17	-
Generation time	14.87±0.28	-
Adult longevity	26.53±0.69	23.35±0.90
Life span	39.22±0.75	35.15±0.96
No of eggs	63.58±2.54	-
No of eggs/day	2.89±0.27	-

±S.E.= Standard Error.

Efficiency consumption rate on different stages of A. exsertus

Food consumption of *A. exsertus* on eggs of the mite pest, *Sch. tuttleii* at 28±2˚C and 65±5 % R.H. are summarized in Tables (3 & 4). With the advance of the developmental stages of the predatory mite, *A. exsertus*, the average number consumed eggs of *Sch. tuttleii* was increased. This information is in agreement with Sholla (2012). The average number of eggs consumed by *A. exsertus* were (34.45, 148.15 & 182.60) and (30.04, 68.99 & 99.16) eggs for female and male immatures, adult longevity and life span, respectively. During the pre-oviposition, oviposition and post-oviposition periods, the predator devoured (14.55, 128.5 & 5.10) eggs as an prey with a daily rate (6.67, 5.85 & 2.13) eggs, respectively. Similar results were obtained by El-Halawany and El-Naggar (1984). The females during oviposition consumed a significantly higher number of prey, suggesting that females need extra food for egg production during this period. This information is in agreement with other findings (Sengonca *et al*., 2003; Kouhjani *et al*., 2009).

Table 3: Food comsumption on (Eggs of *Schizotrtanychus tuttleii*) by immature stages of predatory mite, *A. exsertus* at 28±2 ºC and 65±5 % R.H.

stages	Average No. of eggs consumed / individual			
	Female		Male	
	Total average	Daily mean	Total average	Daily mean
Larva	8.50±0.619^{c}	2.92	6.80±0.64^{c}	2.37
Protonymph	10.60±1.17^{c}	3.59	8.30±1.01^{c}	2.83
Deutonymph	15.35±1.24^{b}	5.44	14.94±1.56^{b}	5.28
Immature	34.45±0.91^{a}	11.95	30.04±1.17^{a}	10.48

± S.E.= Standard Error

Means in column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test **(Duncan, 1955)**.

Table 4: Food comsumption on (Eggs of *Schizotrtanychus tuttleii*) by adult longevity of predatory mite, *A. exsertus* at 28±2 ºC and 65±5 % R.H.

stages	Average No. of eggs consumed / individual			
	Female		Male	
	Total average	Daily mean	Total average	Daily mean
Preoviposition	14.55±.1.18^{d}	6.67	-	-
Oviposition	128.5±3.25^{c}	5.85	-	-
Postoviposition	5.10±0.76^{e}	2.13	-	-
Adult longevity	148.15±4.17^{b}	5.58	68.99±2.53^{b}	2.95
Life span	182.60±5.01^{a}	4.66	99.16±2.56^{a}	2.82

± S.E.= Standard Error

Means in column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test (Duncan, 1955).

***Conclusively*,** the eggs of the mite, Sch. Tuttleii represent an effective and successful diet for rearing the predaceous mite, A. exsertus; whereas the average number of consumed significantly eggs during the life span were (182.6 & 99.16) eggs by female and male, respectively. The fecundity was 63.58 eggs with a daily mean 2.51 eggs at 28±2ºC and 65 ±5 % R.H.

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نوع غذائي جديد للجوانب البيولوجية للمفترس الأكاروسي، *Agistemus exsertus* Gonzalez، (Acari: Stigmaeidae)

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تمت دراسة بيولوجيا المفترس الأكاروسي (*Agistemus exsertus*) معملياً باستخدام بيض الحلم العنكبوتي (*Schizotetranychus tuttleii*) كنوع غذائي جديد عند درجات حرارة (٢٨±٢)°م و درجات رطوبة نسبية (٦٥±٥)٪. و قد أوضحت النتائج أن فترة حياة المفترس الأكاروسي (*A. exsertus*) قد بلغت (٣٩.٢٢، ٣٥.١٥) يوماً للإناث و الذكور على التوالي. و كان متوسط تعداد البيض المُستهلك خلال فترة حياة المفترس (١٨٢.٦، ٩٩.١٦) بيضةً للإناث و الذكور على التوالي، بمتوسط إستهلاك يومي (٤.٦٦، ٢.٨٢) بيضات للإناث و الذكور على التوالي.

و قد بلغت معدلات الخصوبة للمفترس الأكاروسي حين تمت تغذيته على الحلم العنكبوتي (*Sch. tuttleii*) (٦٣.٥٨) بيضةً، بمعدل يومي (٢.٥١) بيضات عند درجات حرارة (٢٨±٢)°م و درجات رطوبة نسبية (٦٥±٥)٪.