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 (R0) value (93.71), intrinsic rate of natural increase (rm = 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. exsertus 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 °C 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, Phaseolus vulgaris. 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.

<table>
<thead>
<tr>
<th>Developmental stages</th>
<th>T. urticae (eggs)</th>
<th>T. urticae (nymph)</th>
<th>B. tabaci (eggs)</th>
<th>B. tabaci (larva)</th>
<th>E. kuehniella (eggs)</th>
<th>L.S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>1.4 ±0.50</td>
<td>2.4 ±0.50</td>
<td>2.3 ±0.47</td>
<td>2.0 ±0.56</td>
<td>2.0 ±0.56</td>
<td>3.84</td>
</tr>
<tr>
<td>Larva</td>
<td>1.6 ±0.50</td>
<td>2.6 ±0.51</td>
<td>2.4 ±0.50</td>
<td>2.3 ±0.47</td>
<td>2.1 ±0.64</td>
<td>1.18</td>
</tr>
<tr>
<td>Protonymph</td>
<td>1.8 ±0.41</td>
<td>2.4 ±0.49</td>
<td>2.4 ±0.50</td>
<td>2.8 ±0.83</td>
<td>3.9 ±0.64</td>
<td>1.61</td>
</tr>
<tr>
<td>Deutonymph</td>
<td>3.3 ±0.47</td>
<td>4.4 ±0.49</td>
<td>3.9 ±0.67</td>
<td>5.2 ±0.70</td>
<td>4.5 ±0.51</td>
<td>1.26</td>
</tr>
<tr>
<td>Life cycle</td>
<td>8.1 ±1.07</td>
<td>11.7 ±0.68</td>
<td>11.1 ±1.23</td>
<td>12.3 ±1.08</td>
<td>12.5 ±1.28</td>
<td>1.92</td>
</tr>
<tr>
<td>Preoviposition period</td>
<td>1.8 ±0.77</td>
<td>3.5 ±0.51</td>
<td>3.3 ±0.72</td>
<td>2.2 ±0.75</td>
<td>2.4 ±0.82</td>
<td>1.03</td>
</tr>
<tr>
<td>Oviposition period</td>
<td>24.3 ±3.10</td>
<td>16.8 ±1.74</td>
<td>14.6 ±1.54</td>
<td>8.5 ±1.28</td>
<td>20.2 ±2.33</td>
<td>3.42</td>
</tr>
<tr>
<td>Adult longevity</td>
<td>29.5 ±2.80</td>
<td>22.9 ±1.88</td>
<td>20.1 ±2.04</td>
<td>13.2 ±1.70</td>
<td>26.2 ±1.95</td>
<td>3.69</td>
</tr>
<tr>
<td>Life span</td>
<td>37.6 ±2.91</td>
<td>34.6 ±1.98</td>
<td>31.1 ±2.43</td>
<td>25.5 ±1.96</td>
<td>38.7 ±2.43</td>
<td>3.82</td>
</tr>
</tbody>
</table>

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.

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 *Tyrophagous 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 five 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 span of *A. exsertus* had the same trend, Momen, 2001. In addition, Momen (2001) reported 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.](image-url)
Table (2): Life Table Parameters of *A. exsertus* females at different kinds of food at 27± 2°C and 70 ± 5% R.H.

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

Abou-Awad and El-Sawi, 1993, studied the intrinsic rate of increase 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 favorite for the most of predacious mites. The finite rate of increase ($e^{r_m}$) 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).

REFERENCES
Biological aspects and life table parameters of the predacious mite, ...........


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**Agistemus exsertus**

The biological characteristics and life span of the mite *Agistemus exsertus* Gonzalez (Acari: Prostigmata: Stigmaeidae) when fed on five different food sources.

**Abstract**

The biological characteristics and life span of the mite *Agistemus exsertus* Gonzalez (Acari: Prostigmata: Stigmaeidae) when fed on five different food sources were studied. The results showed that the highest rate of survival and development of the mite was when fed on red eggs. The coefficient of development of females and the values of the increase in development were 93.71% and 0.25, respectively. The overall increase in productivity was 104.8% during the life cycle. The lowest food sources were the yellow eggs, and the values were 28 ± 1% and 104.8% for the increase in development of females and the overall increase in productivity, respectively.

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**References**


Biological aspects and life table parameters of the predacious mite, ........