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# Notes on the biological aspects of the phytoseiid mite, *Typhlodromus tropicus* (Mesostigmata: Phytoseiidae) when fed on two tetranychid mite prey at laboratory conditions

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**Abstract**

This study was conducted to determine the effect of different temperatures and prey type on the biology of the phytoseiid mite, *Typhlodromus tropicus* (Chant) fed on *Tetranychus urticae* Koch and *Panonychus ulmi* Koch (Tetranychidae) at 20, 25 and 30 ºC. The different biological aspects (incubation period, immature stages, life cycle, and longevity) of *T. tropicus* were shortened with increasing the temperature from 20-30 ºC. The maximum average fecundity of adult female (66.5 eggs) was observed at 30 ºC, when females fed on *P. ulmi*, while the lowest number of deposited of eggs laying was recorded for females fed on *T. urticae* (45.6 eggs) at 20 ºC. Obtained relative values for males were less than hose of females. The obtained results also indicated that the number of devoured *T. urticae* and *P. ulmi* immature stages was differed according to the stage of the predatory mite and used temperature. The largest number of consumed prey was recorded for the predator on *P. ulmi* at 30 ºC, for adult sage (122.0 immatures of *P. ulmi*, while the lowest number of devoured prey was 55.68 immature sages of *T. urticae* when the predatory mite fed on them at 20 ºC.

**Key words:** ***Typhlodromus*** , *Tetranychus urticae* , *Panonychus ulmi* Koch,

## Introduction

Predatory mites of the family Phytoseiidae are important biological control agents of tetranychid and eriophyid mites in a number of Egyptian cropping systems (**Abou-EL-Ella**, 1998).Some Phytoseiidae are "generalized" predators, i.e. they consume a wide range of food such as mites, scale crawlers, pollen and honeydew (**Swirski and Dorzia**, 1968; **McMurtry *et al.***, 1970; **Kamburov**, 1971). A few of the Phytoseiidae are "specialized" predators feeding only on tetranychid mites {**Chant**, 1961; **Mori and Chant**, 1966). For some species of phytoseiids, eriophyid mites may be a more favorable food than tetranychids (**Chant**, 1959; **Burrell and McCormick**, 1964; **EL-Banhawy,** 1974; **Abou-Awad and EL-Banhawy**, 1986; **Momen and EL-Saway,** 1993; **Abou-EL-Ella**, 1998). *Typhlodromus* is a genus of predatory mites belonging to the family Phytoseiidae. Members of this genus feed largely on other mites such as red spider mites and several species are popular as biological control agents to control these pests. **El-Banhawy and El-Bagoury** (1991) reared the predacious mite *Typhlodromus pelargonicus* EI-Badry on the different developmental stages of the two spotted spider mite *Tetranychus urticae*. The development was quickest and the number of prey consumed was highest when individuals were maintained on eggs compared with nymphs or adult female stages. As a step towards evaluation of *T. tropicus* in bio-control., the effect of different temperatures on the biology of this species feeding on *T.urticae* and the European red mite, *Panonychus ulmi* (Acari:Tetranychidae) (immature stages) under the laboratory conditions 20, 25 and 30±2 ºC and relative humidity of 75±5 % R.H., was studied.

## Materials and methods

The predacious mite *T. tropicus* was collected from citrus plants in Qalubia Governorate (Qaha region) in Egypt. The predators were transferred by using camel hair brush to rearing substrates consisting of sweet potato leaves heavily infested with different stages of two spotted spider mite, *T. urticae*. Fresh eggs (24 h old) were used for the biological studies. Castor bean leaves, 3 cm in diameter, were used as rearing arenas in Petri dishes with the upper surfaces of the leaves placed face downwards on water-saturated cotton. Newly-hatched larvae of the predatory mite *T. tropicus* were confined, singly, in these arenas and supplied with the different diets. Observations of the development were done twice a day and reproduction, survival and food consumption once a day. After the last moulting, the male partners were put with the females for mating. The study included the biology of the predator when maintained on immature sages of both *T. urticae* and *Panonychus ulmi* (already taken from citrus orchard and maintain in the laboratory at the same conditions).Tests were carried out at laboratory conditions at 20, 25 and 30±2 ºC and relative humidity of 75±5 % R.H.

## Results and discussion

The present experiment was conducted to determine the effect of different temperatures and prey type on the duration of various life stages, adult

longevity and fecundity of the mite, *T. tropicus* fed on *T. urticae* and *P.ulmi.* Obtained results are presented in tables (1-3).

**Incubation period:**

Incubation period of *T. tropicus* as observed in data of table (1) averaged 2.74, 2.57 and 2.50 days when the predator female fed on *T. urticae* at 20 , 25 and 30 ºC, respectively, changed recorded 2.78, 2.7 and 2.55 days for the mites reared on *P. ulmi* at the same temperatures, respectively. However, the longest incubation period of the predator male lasted 2.75 days on *P. ulmi* a 20 ºC, but the shortest period recorded 2.34 das at 30 ºC on *T. urticae* immature stages.

**Laval stage**

At 20 ºC, *T. tropicus* female larval period was 2.35 and 2.44 days on *T. urticae* and *P. ulmi* at 20 ºC, slightly decreased and durated 2.25 and 2.33 days at 25 ºC & 2.34 and 2.22 days at 30 ºC, for female predatory mite respectively. However, the longest larval period of male individuals took 2.4 days on *P.ulmi* at 20 ºC, and the shortest larval period recoded 2.05 days at 30 ºC on *T. urticae*, table (1).

**Table 1.** Duration (mean±SD) of different stages of *Typhlodromus tropicus* when fed on *Tetranychus urticae* and *Panonychus ulmi*

| Predator stage | Sex | 20 ºC | | 25 ºC | | 30 ºC | |
|---|---|---|---|---|---|---|---|
| Egg | | *T.urticae* | *P.ulmi* | *T.urticae* | *P.ulmi* | *T.urticae* | *P.ulmi* |
| | ♀ | 2.74±0.28 | 2.78±0.31 | 2.57±0.42 | 2.77±0.28 | 2.50±0.31 | 2.55±0.3 |
| | ♂ | 2.65±0.36 | 2.70±0.36 | 2.55±0.33 | 2.65±0.36 | 2.34±0.3 | 2.54±0.27 |
| Larva | ♀ | 2.35±0.41 | 2.44±0.36 | 2.25±0.41 | 2.33±0.41 | 2.15±0.29 | 2.22±0.3 |
| | ♂ | 2.30±0.29 | 2.4±0.41 | 2.17±0.37 | 2.11±0.29 | 2.05±0.27 | 2.14±0.3 |
| Protonymph | ♀ | 2.84±0.41 | 2.94±0.4 | 2.67±0.43 | 2.88±0.3 | 2.58±0.29 | 2.66±0.2 |
| | ♂ | 2.70±0.37 | 2.64±0.6 | 2.46±0.39 | 2.57±0.31 | 2.50±0.28 | 2.44±0.3 |
| Deutonymph | ♀ | 3.77±0.5 | 3.85±0.54 | 3.58±0.51 | 3.60±0.41 | 3.32±0.35 | 3.50±0.4 |
| | ♂ | 3.60±0.48 | 3.71±0.44 | 3.25±0.44 | 3.33±0.41 | 3.11±0.4 | 3.22±0.4 |
| Total immature | ♀ | 8.85±0.79 | 9.23±0.69 | 8.5±0.68 | 8.81+0.7 | 8.05±0.68 | 8.38+0.81 |
| | ♂ | 8.55±0.81 | 8.75±0.8 | 7.88±0.88 | 8.01+0.68 | 7.66±0.7 | 7.8±0.77 |
| Life cycle | ♀ | 11.59+0.9 | 12.01+0.1 | 11.07±0.97 | 11.58+0.87 | 10.55±0.8 | 10.93±0.9 |
| | ♂ | 11.2±0.88 | 11.45±0.9 | 10.43+0.87 | 10.66±0.9 | 10.0±0.9 | 10.34±0.91 |
| Longevity | ♀ | 23.96±1.2 | 25.25±1.3 | 22.96+1.24 | 23.84+1.5 | 21.46+11.4 | 22.71±1.8 |
| | ♂ | 21.0±1.4 | 23.2±1.11 | 19.5±1.16 | 20.5±1.1 | 18.2±1.3 | 18.8±0.88 |
| Life span | ♀ | 35.55±1.8 | 37.26±1.6 | 34.03±1.6 | 35.42±2.0 | 32.01±1.4 | 33.64±1.54 |
| | ♂ | 32.2±1.54 | 34.65±1.5 | 29.93±1.9 | 31.16±1.78 | 28.2±1.3 | 28.69±1.39 |

**Table 2.** Longevity and fecundity of adult female of *Typhlodromus tropicus* when fed on *Tetranychus urticae* and *Panonychus ulmi*

| Biological aspect | 20 ºC | | 25 ºC | | 30 ºC | |
|---|---|---|---|---|---|---|
| | *T.urticae* | *P.ulmi* | *T.urticae* | *T.urticae* | *P.ulmi* | *T.urticae* |
| Preoviposition | 2.44±0.27 | 2.55±0.25 | 2.34±0.28 | 2.44±0.28 | 2.22±0.3 | 2.33±0.2 |
| Oviposition | 18.21±0.8 | 18.9±0.67 | 17.69±0.69 | 18.2±0.71 | 16.47±0.68 | 17.5±0.71 |
| Postoviposition | 3.31±0.32 | 3.8±0.32 | 2.93±0.29 | 3.2±0.35 | 2.77±0.28 | 2.88±0.3 |
| Fecundity (number of eggs/ ♀ | 45.6±2.4 | 50.2±2.51 | 50.7±2.6 | 55.2±4.4 | 61.2±3.8 | 66.5±3.9 |

**Protonymphal stage:**

The mean protonymphal period of *T. tropicus* female and male as shown in table (1) was 2.84 and 2.70 days on *T.urticae* at 20 ºC, respectively, changed to recorded 2.94 and 2.64 days on *P. ulmi*, respectively. However, when the temperature increased to 25 ºC, these periods lasted 2.67 and 2.46 days on *T. urticae* and 2.88 and 2.57 days on *P. ulmi*, respectively. On the her hand, at 30 ºC, the protonymphal stage of the predator averaged 2.58 and 2.5 days on *T. urticae* and 2.66 and 2.44 days on *P. ulmi*, respectively.

**Deutonymphal stage:**

The highest mean deutonymphal period of the phytoseiid mite, *T. tropicus* lasted in this study 3.85 days for the female individuals when reared on *P. ulmi* at 20 ºC, while the least recorded period was observed for the predatory males individuals on *T. urticae* at 30 ºC, table (1).

**Life cycle:**

The mean duration of life cycle for individuals of *T. tropicus* was 11.59 and 11.2 days for female and male members when fed on immature stages of *T. urticae* at 20 ºC, respectively, changed to 12.01 and 11.45 days on *P. ulmi* at the same temperature, respectively. On the other hand, these periods took 11.07 and 10.43 days on *T. urticae* and 11.58 and 10.66 days on *P. ulmi*, respectively. However, the life cycle of *T. tropicus* when reared at 30 ºC, averaged 155 and 10.0 days on *T. ur*ticae and 10.93 and 10.34 days on *P. ulmi*, respectively, table (1).

**Adult longevity**

As shown in table (1), the mean duration of longevity period of the predatory mite *T. tropics* was differed according to thee introduced prey and temperature. The longest time of the female adult stage of *T. tropicus* took 25.25 days when he individuals fed on *P. ulmi* at 20 ºC, which sharply decreased recoded the lowest level on *T. urticae* immature stages at 30 ºC (18.2 days). The obtained results in table (2) clearly demonstrated hat pre-oviposition; oviposition and post-oviposion periods of *T. tropicus* were longer on *P. ulmi* than *T. urticae*. Total fecundity, table (2) was also significantly higher when the mite reared on *P.ulmi* than on *T. urticae*. The largest number of laid eggs was noticed for female fed on *P. ulmi* at 30 ºC, (66.5 eggs), while the lowest egg umbers were recorded for mies eared on *T. urticae* at 20 ºC (45.6 eggs).

**Food consumption:**

The tabulated data in table (3) indicated that the number of devoured *T. urticae* and *P. ulmi* immature stages was differed according to the stage of the predatory mite and used temperature. The largest number of consumed pre was recorded for the predator on *P. ulmi* at 30 ºC for adult sage (122.0 immatures of *P. ulmi*, while the lowest number of devoured prey was 55.68 immatures of *T. urticae* when the predator fed on them at 20 ºC. As shown from the obtained results the life cycle, longevity, life span and female fecundity of the predatory mite, *T. tropicus* were obviously affected studied factors (prey type and temperature).The general trend was that obtained durations were significantly longer on *P. ulmi* than *T. urticae* and this indicated that *P.ulmi* was the preferred prey in this study. This applied to both females and males. These results indicated that the obtained values for males were generally less than of females. Similar results were obtained by **Zaher *et al.*,** (2001) when reared *Typhlodromus talbii* A.-H. on different prey and pollen. The mite *Tydeus californicus* (Banks) was found to be the most suitable diet, giving a shorter life cycle and higher fecundity (8.8 days and 33.4 eggs,), than the scale insect *Coccus acuminatum* (Gennadius) (10.0 days and 24.8 eggs).Other associates of *T. talbii*, the eriophyid *Cesaberoptus kenyae* Keifer, the tetranychid *Oligonychus mangiferus* (R. & S.) as well as date palm and castor oil pollen, were unsuitable diet.

**Table 3.** Food consumption of the predatory mite, *Typhlodromus tropicus* when fed on *Tetranychus urticae* and *Panonychus ulmi* at different temperatures

| Predator stages | 20 ºC | | 25 ºC | | 30 ºC | |
|---|---|---|---|---|---|---|
| | *T. urticae* | *P.ulmi* | *T. urticae* | *P.ulmi* | *T. urticae* | *P.ulmi* |
| Immatures | 55.68±3.5 | 62.54±3.9 | 64.6±3.8 | 72.0±4.5 | 72.6±4.6 | 76.8±4.4 |
| Adults | 86.45±5.2 | 95.2±5.7 | 103.2±6.4 | 109.0±4.2 | 111.3±5.8 | 122.0±6.4 |

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**ملاحظات على المظاهر البيولوجية للاكاروس الفيتوسيدى *Typhlodromus tropicus* عند تغذيته على اثنين من الفرائس المختلفة المنتمية لعائلة تترانيكيدى عند ظروف المعمل**

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – جيزة – مصر

اجريت هذه الدراسة لمعرفة تاثير درجات الحرارة المختلفة (20 و 25 و30م° والاغذية المختلفة (الاطوار الغير بالغة للاكاروسين *Tetranychus urticae* و *Panonychus ulmi*) المنتميان لعائلة Tetranychidae على المظاهر البيولوجية المختلفة للاكاروس المفترس *Typhlodromus tropicus* (Chant) والمنتمى لعائلة Phytoseiidae حيث اظهرت النتائج المتحصل عليها ان الاطوار المختلفة للمفترس (فترة حضانة البيض incubation period– دورة الحياة life cycle – طول الفترة الكلية للافراد البالغة longevity) كانت جميعا اقل فى المدة عند درجات الحرارة 30 م° واطول فى المدة عند التغذية على درجة الحرارة 20م° وان الافراد الذكور للمفترس قد استغرقت فترات اقل من مثيلاتها فى الافراد الاناث. كما تشير النتائج المتحصل عليها ايضا ان تغذية الافراد على يرقات الاكاروس *P. ulmi* قد اطالت الفترات المختلفة للمفترس عن التغذية على الاكاروس *T. urticae* والتى قلت عندها اما بالنسبة لعدد البيض الموضوع بواسطة اناث المفترس fecundity فقد اتضح ان اكبر عدد تم وضعه عند تغذية المفترس على الاطوار الغير بالغة للاكاروس *P. ulmi* (66.5 بيضة) عند 30 م° واقل الاعداد المسجلة كانت عند تغذية الاناث على *Tetranychus urticae* عند 20 م° مسجلة عددا مقداره 45.6 بيضة . وبالنسبة لمعدل الاستهلاك الغذائى اتضح ان افراد الاكاروس المفترس قد قامت بافتراس اكبر عدد من الفرائس عد التغذية على *P. ulmi* عند 30 م° بالمقارنة بالتغذية على الاطوار الغير بالغة لافراد*T. urticae* عند 20 و 25 م°.