International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 23-07-2022, Accepted: 10-08-2022, Published: 27-08-2022
Volume 7, Issue 8, 2022, Page No. 160-163

Some biological aspects of *Typhlodromips swirskii* (*Amblyseius swirskii*) (Acari: Phytoseiidae) fed on *Prlatoria oleae* (Colvee) (Homoptera, Diaspididae)

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Abstract
Development, feeding capacity and life table parameters of the predatory mite *Typhlodromips swirskii* (Athias-Henriot) fed on *Prlatoria oleae* (Colvee) (Homoptera, Diaspididae) were studied under constant temperatures of 25 and 30ºC and 70% RH. Both organisms were collected from mango plant leaves growing in Giza governorate. In leaf disc assays, increasing number of prey eggs accelerated the development of *T. swirskii.* Duration of developmental stages and feeding capacity of *T. swirskii* were significantly affected by temperatures. During an ovipositional period of 11.85 and 9.25 days, adult female of *T. swirskii* consumed an average of 52.37 prey.Mean generation time (GT) of *T. swirskii* was 27.16 and 21.42 days while, the net reproductive rate (R_0) averaged 5.67 and 7.41female progeny/female and the intrinsic rate of increase (r_m) of *T. swirskii* was 0.063 and 0.093 at temperatures of 25 and 30ºC respectively. The finite rate of increase e^{rm} (λ) was at its highest level 1.09 when *T. swirskii* reared on *Prlatoria oleae* at 30ºC.

Keywords: some biological aspects of *T. swirskii,* fed on *Prlatoria oleae* (colvee) (homoptera, diaspididae)

Introduction
In Egypt, mango (*Mangifera indica* L.) occupies the third place in acreage after citrus and grapes [1]. Among several pests of mango trees, *Parlatoria oleae* is considered one of the main destructive ones [2].This pest injures the shoots, twigs, branches, leaves and fruits by sucking the plant sap with the mouthparts, causing thereafter deformations, defoliation, and dryness of young shoots twigs, dieback, poor blossoming and death of twig by the action of the toxic saliva and subsequently affecting the commercial value of fruits. Infestation causes conspicuous pink blemishes around the feeding sites of the scales [3]. A characteristic symptom of infestation by this pest is the appearance and accumulation of its scales on attacked mango parts [4].
Typhlodromips swirskii (Athias-Henriot) (=*Amblyseius swirskii* Athias-Henriot) has a significant role in the biological control of some mite pests in Egypt [5, 6]. It feeds not only on phytophagous mites, but also on coccids and mealy bugs [7, 8]. During the last decades, chemical control was the most efficient method to minimize *Prlatoria oleae damages* to crop production, although such practice is hazardous to water, soil, environment and human health. Therefore, new control tactics such as biological control using parasites and predators became necessary [9- 12]. Among predaceous organisms that can suppress insect populations, phytoseiid mites which considered effective biological agents against wide range of harmful insect and mite pests that are commercially used in biological control and IPM programs [12, 13- 16]. Some of phytoseiid mites feed mainly on tetranychid mites (specialists) but others can feed on mite preys and as well as insects species such as whiteflies, thrips and plant pollens (generalists) [13, 17- 19]. The present study reveals some biological aspects of *T. swirskii* reared on *Prlatoria oleae* (Colvee) infesting mango trees.

Materials and methods
Prey culture
The *Prlatoria oleae* (Colvee) *was* found on leaves of naturally infested mango trees at Giza Governorate, Egypt. Samples were taken and transferred to laboratory and reared under laboratory conditions.

Predator culture
A laboratory colony of *Typhlodromips swirskii* (*Amblyseius swirskii*) (Acari: Phytoseiidae) was collected from mango orchard at Giza Governorate at the same area. It was mass cultured in the laboratory on castor leaves infested with *Tetranychus urticae* as prey.

Experimental procedure

The experiments were conducted at two constant temperatures (25 and 30±1ºC) with relative humidity of 70±5%. Thirty gravid females of *Typhlodromips swirskii* were taken randomly and transferred to rearing substrates. Females were left 24 hours and their oviposited eggs were used to start biological aspects. Thereafter, when a sufficient number of eggs were laid, the adult females were removed and eggs from the same age were obtained to start the experiment. Observations were made at 6 hourly intervals to see if the eggs had hatched. After the eggs hatching to larvae, the larval individuals of larvae were transferred very carefully onto leaf disks of castor leaves (3 cm in diameter). Leaf discs were placed with the upper surface facing down on cotton layer in Petri-dishes (6 cm in diameter). Water was added when needed to maintain the suitable moisture. The leaf margin was surrounded by a cotton strip to prevent the mites escaping. A few cotton threads were placed on the surface of leaves to serve as shelter and oviposition sites. Ten replicates were maintained for each temperature, so 40 Petri dishes were maintained simultaneously. All the Petri dishes were kept in incubators maintaining the desired temperature. Immature stages of *Parlatoria oleae* which was given as food for the predatory mite, *Typhlodromips swirskii*. Duration of the developmental stages, preoviposition, oviposition, postoviposition periods, longevity, fecundity, lifespan and food consumption were recorded by taking observations using the stereomicroscope.

Statistical analysis

Data were subjected to statistical analysis using F-test and means were compared according to Duncan's multiple range test.

Results and Discussions

1. Developmental periods (duration) *Typhlodromips swirskii* (*Amblyseius swirskii*) (Acari: Phytoseiidae) fed on *Prlatoria oleae* (Colvee)

Duration of all stages of *Typhlodromips swirskii* (*Amblyseius swirskii*) reared on *Prlatoria oleae* (Colvee) at constant temperatures of 25 and 30ºC are presented in Tables (1 & 2). Developmental periods are generally decreased as temperature increase. *Typhlodromips swirskii* larvae hatched after a shortest egg incubation period of 5.85±0.80 and 5.60±0.55 days at 25ºC and 4.06±0.57 and 3.86±0.68 days 30ºC for females and males, respectively. The shortest duration of larval, protonymphal, deutonymphal stages for female and male (4.44 & 4.71), (4.75 & 3.57), and (4.19 & 3.29) days at 30°C, respectively, while the longest duration periods were (5.69 & 5.20), (5.62 & 2.20) and (5.15 & 2.80) days for female and male of the above mentioned stages at 25ºC, respectively. The longest life cycles were (22.31 and 15.80) days at 25 and 30ºC, while the shortest periods were (17.44 and 15.43) days at 30ºC for female and male, respectively. Generation time and longevity decreased as temperature increased. The shortest generation time was (19.38) days at 30ºC, while the longest one was (24.62) days at 25ºC. The shortest female longevity was observed at 30ºC (12.81) days, while the longest was (16.54) days at 25ºC. The highest mean number of eggs laid per female was (13.13 eggs/female) with a daily rate of (1.59 eggs/female/day) at 30ºC. The lowest fecundity was (12.69 eggs/female) at 25ºC. The life cycle of *O. punicae* differed among cultivars with average values ranged between (8.2) days on Tucupita leaves, and (9.1) days on Sirah. Relatively high fecundity was found on Tucupita leaves (2.8 eggs/female/day) during (11.4 oviposition day), while low fecundity values occurred on Sirah and Villanuera leaves, with (0.9) day and (1.8 eggs/female/day) during (7.9), and (6.7) days. These results are in agreement with Zaher [20], whom studied the biology of the *Brevipalpus phoenicis* (Geijskes, 1939), and found that the developmental time from egg to adult took (23.8-29.9) days at 23º-27oC. The fecundity was greatly influenced by temperature, more eggs are produced during summer (27 eggs) than winter (16 eggs). Abid and El-Haidari [21] studied some aspects of the biology and control of *T. punicae* on pomegranate. The generation time changed from (17.8) days at average temperature of 27.3 ℃ to (44.8) days at average temperature of 18.0℃. [22], showed that females may live for 1-2 months, for instance, *T. granati* the number of deposited eggs changed according to seasons. It averaged (10.5, 15.0 and 13.0 eggs/female) during spring, summer and autumn, respectively with a daily number ranging from zero to (4) eggs. *T. granati* reared on three different varieties of grape namely Cabernets, Farawla and Banaty the pre-oviposition period and the incubation period one were about (3) and (8) days. The life cycle lasted about (19) days on Cabernets, (24) days on Farawla and (30) days on Banaty [23, 24].

Table 1: Mean developmental periods in days (±SD) of *Typhlodromips swirskii* (*Amblyseius swirskii*) (Acari: Phytoseiidae) females reared on *Prlatoria oleae* (Colvee) at constant temperatures.

Stage	Temperatures	
	25ºC	30ºC
Egg	5.85±0.80	4.06±0.57
Larva	5.69±0.48	4.44±0.75
Protonymph	5.62±1.45	4.75±1.53
Deutonymph	5.15±0.90	4.19±0.75
Immature stages	16.46±1.66	13.38±1.50
Life cycle	22.31±1.70	17.44±1.50
Generation	24.62±1.94	19.38±1.96

Pre-oviposition	2.31±0.75	1.94±0.44
Oviposition	11.85±2.76	9.25±3.0
Post-oviposition	2.38±0.65	1.88±0.50
Longevity	16.54±3.07	12.81±3.2
Fecundity	12.69±3.15	13.13±3.12
Life span	38.85±3.54	30.25±3.86

Table 2: Mean developmental periods in days (±SD) of *Typhlodromips swirskii* (*Amblyseius swirskii*) (Acari: Phytoseiidae) males reared on *Prlatoria oleae* (Colvee) at constant temperatures.

Stage	Temperatures	
	25ºC	**30ºC**
Egg	5.60±0.55	3.86±0.68
Larva	5.20±1.30	4.71±1.38
Protonymph	2.20±1.10	3.57±2.30
Deutonymph	2.80±1.30	3.29±1.11
Immature stages	10.20±3.70	11.57±4.28
Life cycle	15.8±4.25	15.43±4.65
Longevity	14.17±1.47	12.14±1.35
Fecundity	30.50±3.08	27.57±4.58
Life span	5.6±0.55	3.86±.68

2. Predation efficiency of *Typhlodromips swirskii* fed on *Prlatoria oleae* (Colvee) adult and mobile stages

The average numbers of consumed *Typhlodromips swirskii* mobile stages by *Prlatoria oleae* larval, protonymphal and deutonymphal stages were respectively (3.93 & 3.50), and (5.30 & 4.83) individuals for female and male. *Typhlodromips swirskii* adult female consumed higher number of prey during its oviposition time (52.37*)* The total prey consumption for male during its life span was respectively (60.83) eggs and (102.63) individuals for females (Table 3).

Table 3: Number of consumed prey (Mean±SD) by *Typhlodromips swirskii* reared on *Prlatoria oleae* (Colvee) reared on temperature of 25ºC.

Aspects	No. of consumed prey	
	Female	**Male**
Larva	3.93±1.17a	3.50±1.87a
Protonymph	5.30±2.64a	4.83±3.31a
Deutonymph	7.04±4.67b	8.67±5.16a
Pre-oviposition	15.30±4.56b	-----
Oviposition	52.37±16.46b	**----**
Post-oviposition	18.70±4.37b	**-----**
Life span	102.63±15.63b	60.83±15.66b

Means within rows followed by the same letter were not significantly different at 0.05% level of probability.

3. Life table parameters

All major life table parameters are shown in Table (4). The mean generation time (GT) decreased as temperature increase, while the net reproductive rate (R_0) increased as temperature increased. The mean generation time decreased from (21.42) to (27.16) days at 30ºC and 25ºC. The net reproduction rate (R_0) occurred at 30ºC as 7.41 individuals/female, while the lowest one was (5.67) at 25°C (eggs/female/generation). The shortest time for population density to double (DT) (7.45) days at 30ºC, while the longest period was (11.00) days at 25ºC. The intrinsic rate of increase values (rm) ranged from (0.063) at 25ºC to 0.093) at 30ºC.

Table 4: Life table parameters of females reared on *P. oleae* at constant temperatures.

Stage	Temperatures	
	25º	**30ºC**
Mean generation time (GT)	27.16	21.42
Population Doubling time (DT)	11.00	7.45
Net reproductive rate (R_0)	5.67	7.41
Intrinsic rate of increase (rm)	0.063	0.093
Finite rate of increase (λ)	1.06	1.09

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