Description and Life History of *Typhlodromus citri* Hassan & Romeih sp. n. (Acari: Phytoseiidae)

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ABSTRACT

A new species of genus *Typhlodromus* was recorded and described. The developmental stages, reproduction and feeding behavior of *T. citri* was determined on different kinds of diets: eggs and immatures of *Eutetranychus orientalis* (Klein) and *Tetranychus urticae* Koch; immatures of *Oligonychus vitis* Zaher & Shehata, *Cenopalpus lanceolatisetae* (Attiah); acarid mites, *Tyrophagus putrescentiae* (Shrank) and *Rhizoglyphus robini* Claparede at 20, 25 and 30°C., and 70±5% R.H. The result showed that, *E. orientalis* eggs found to be the most suitable and nourishing diet giving a shorter life cycle, higher female fecundity and grater consumption number of prey (3.78 days, 50.93eggs/ female and 44.37 eggs/day) than the other prey tested. The predator *T. citri* refused to feed or develop on each of *C. lanceolatisetae*, *T. putrescentiae* and *R. robini.*

Key Words: *Typhlodromus citri*, description, life history, reproduction, feeding behavior.

INTRODUCTION

Phytoseiid mites have been studied under considerable attention due to their importance are natural enemies for herbivorous mite pests in agricultural ecosystems.

Certain species of these predatory mites feed, develop and reproduce on wide prey range of phytophagous mites, mainly belonging to species of tetranychids, pollens and honeydew.

Typhlodromus oasis El-Badry was recorded on grape in New valley, Tahreer Province and soil in Assuit Governorate, and described by El-Badry (1970).

Feeding preference, Short life cycle and the ability to survive periods of low prey density of tetranychid mites were studied by (McMurtry, 1982).

Many species belonging to different genera of mites preferentially select prey species on which they obtain maximum reproductive success (Sabelis, 1985; Dicke et al., 1990a).

Gnanvossou, D., *et al.*, (2003) studied life history of the phytoseiid predators *Typhlodromalus manihoti* and *T. aripo* on *Oligonychus gossypii* (Zacher), *Tetranychus urticae* Koch and *Mononychellus tanajoa* (Bondar) which found intrinsic (r_m) of *T. aripo* was 2.1 fold higher on *M. tanajoa* as prey compared with *T. urticae,* while it was almost nil on *O. gossypii.*

T. citri, recorded on leaves and debris of citrus, apricot and grapes in El-Fayoum Governorate.

MATERIALS AND METHODS

The stock culture of *T. citri* was started with gravid females, which collected from leaves of citrus trees in Fayoum Governorate. The predatory mites were reared on freshly mulberry leaves placed upside down on wet cotton in plastic trays. Water was added daily to maintain suitable moisture. Eggs and immatures stages of *T. urticae* were offered daily to immature and adult of *T. citri* as a diet. The stock culture was maintained at 30±2°C., R.H. 70±5%.

Every predator egg was put singly on one plant disk. Tangle-foot was put on the edges of each leaf to confine the mite and prevent it from escaping, and the newly hatched larvae were supplied with the food source. Disks were checked twice daily; during the entire developmental periods to determine the duration of developmental stages and remove shriveled prey. Numbers of sucked prey and deposited eggs were counted. Different diets were used for rearing *T. citri;* there diets were eggs and immatures of *E. orientalis and T. urticae*; immatures of *O. vitis* and acarid mites *T. putriscentiae* and *R. robini* and the adult of *C. lanceolatisetae.*

The predator was reared at 20, 25 and 30°C., and 70±5 % R.H.

RESULTS AND DISCUSSION

Diagnosis: this species is closely related to *T. oasis* El-Badry (1970), but differs in; the Peritreme is shorter, leg IV bears one knobbed macroseta and in the shape of the spermatheca.

Description of all stages:

Female: Dorsum (Fig.1): Dorsal shield moderately sclerotized and reticulate, (310µ) in length; (229µ) in width, with 5 pairs of distinct pores; and 18 pairs of setae, j_1 (26µ), j_3 (28.6µ), j_4 (18.2µ), j_5 (18.2µ), j_6 (23.4µ), J_2 (26µ), J_5 (10.4µ), z_2 (23.4µ), z_3 (28.6µ), z_4 (23.4µ), z_5 (20.8µ), Z_4 serrate (57.2µ), Z_5 serrate (65µ), s_4 (28.6µ), s_6 (31.2µ), S_2 (36.4µ), S_4 (44.2µ) and S_5 (26µ). On lateral membrane r_3 (28.6µ) and R_1 (23.4µ). Peritreme short and extending near to z_3 bases with projection curving around base of coax IV. Chelicera fixed digit with three teeth and pilus dintels; one tooth on movable digit (Table 1).

Ventrum (Fig. 2 & Table 2): Ventral shields well defined. Sternal shield with 3 pairs setae, ST_1 (28.6µ), ST_2 (28.6µ) and ST_3 (28.6µ). Metasternal setae on separate platelets, ST_4 (28.6µ); length of sternal shield at the medial section (85.8µ), with anterior lateral projection reaching the anterior region of coxa II, and posterior projection reaching the anterior region of coxa III. Genital shield length at the medial region (not including genital flap) (98.8µ), genital seta, ST_5 (28.6µ). Ventral shield subrectangular in shape, with reticulation, longer (117µ) than wide (88.4µ), with 4 pairs of preanal setae JV_1 (23.4µ), JV_2 (23.4µ), JV_3 (23.4µ) and ZV_2 (20.8µ). Anal opening surround with 3 setae, a_1 (18.2µ), a_2 (18.2µ) and a_3 (20.8µ), surrounded membrane of ventrianal shield with 4 pairs of setae JV_4 (20.8μ), JV_5 (78μ), ZV_1 (23.4μ), and ZV_3 (20.8μ). Two pairs of elongated metapodal plates, six pairs of small plates. Spermatheca as figured (Fig. 3). Leg IV with one knobbed macroseta on basitarsus. Chaetotaxy of femur, genu and tibia of legs as the follows:

	I	II	III	IV
Femur	2-3/1-2/2-1	1-3/1-2/1-1	1-2/0-1/0-1	1-2/1-1/0-1
Tibia	2-2/1-2/1-2	1-1/1-2/1-1	1-1/1-2/1-1	1-2/0-1/1-1
Genu	2-2/1-2/1-2	2-2/0-2/0-1	1-2/0-2/1-1	1-2/0-2/1-1

Male: Dorsum (Fig. 4)**:** Dorsal shield similar to female but smaller and strongly sclerotized reticulation, (252μ) in length; (184μ) in width, with 20 pairs of setae and five pairs of small pores.

Ventrum (Fig. 5)**:** Sterogenital shield lengthen at the medial section (153.4μ); with 5 pairs of setae (ST_1, ST_2, ST_3, ST_4 and ST_5). Genital opening at anterior margin of sterogenital shield. Ventrianal shield triangular, with reticulate, length at the medial section (109.2μ), with 4 pairs of preanal setae (JV_1, JV_2, JV_3 and ZV_2) anal opening is surrounded with 3 anal setae. Chelicerae with three teeth on fixed digit and pilus dentils, movable digit with curved, long spermatodactyle (22.5μ), terminally knobbed and slightly bluged on one side before the end.

Egg: (Fig. 6)**:** Oval, whitish translucent when deposited and measures (198μ) in length; (144μ) in width.

Larva: Dorsum (Fig. 7)**:** Two weakly sclerotized shields were present. Idiosoma (171μ) in length; (148.5μ) in width. Podonotal shield with 9 pairs of setae, j_1 (20.8μ), j_3 (10.4μ), j_4 (7.8μ), j_5 (7.8μ), j_6 (20.8μ), z_2 (10.4μ), z_4 (15.6μ), z_5 (7.8μ) and s_4 (57.2μ). Opithonotal shield with one pair of setae, Z_5 (153.4μ). Fixed digit of chelicera with one tooth and pilus dintels, movable digit without teeth (Table 1).

Ventrum (Fig. 8 & Table 2)**:** Shields absent, sterogenital region with 3 pairs setae, ST_1 (20.8μ), ST_2 (20.8μ) and ST_3 (15.6μ). Ventral region with 4 pairs of setae, JV_1 (7.8μ), JV_2 (20.8μ), ZV_3 (7.8μ) and ZV_4 (5.2μ) μ. Anal opening surround with 3 setae, a_1 (26 μ), a_2 (26 μ) and a_3 (18.2 μ). Chaetotaxy of femur, genu and tibia of legs as the follows:

	I	II	III
Femur	2-2/1-2/1-2	1-2/1-2/0-1	1-2/1-1/0-0
Tibia	1-2/1-2/1-1	1-1/1-2/1-1	1-1/1-2/1-1
Genu	1-2/1-2/1-1	1-2/0-2/0-1	1-2/0-2/0-1

Protonymph: Dorsum (Fig. 9)**:** Dorsal shield entire, (193.5μ) in length; (144μ) in width, with 17 pairs of setae, j_1 (18.2μ), j_3 (20.3μ), j_4 (15.6μ), j_5 (15.6μ), j_6 (18.2μ), J_2 (20.8μ), J_5 (7.8μ), z_2 (18.2μ), z_4 (18.2μ), z_5 (13μ), Z_4 serrate (49.4μ), Z_5 serrate (41.6μ), s_4 (26μ), s_6 (26μ), S_2 (33.8μ), S_4 (26μ) and S_5 (18.2μ). On lateral membrane r_3 (23.4μ) and R_1 (20.8μ). Fixed digit of chelicera with two teeth and pilus dintels; one tooth on movable digit. Peritreme reached to s_6 (Table 1).

Ventrum (Fig. 10 & Table 2)**:** Sterogenital region bears 3 pairs of sternal setae, ST_1 (23.4μ), ST_2 (23.4μ) and ST_3 (23.4μ). Ventral region bears 4 pairs of setae JV_1 (18.2μ), JV_2 (18.2μ), ZV_3 (20.8μ) and ZV_5 (31.2μ). Anal opening surround with 3 setae, a_1 (13μ), a_2 (13μ) and a_3 (15.6μ). Chaetotaxy of femur, genu and tibia of legs as the follows

	I	II	III	IV
Femur	2-2/1-2/1-2	1-2/1-2/0-1	1-2/1-1/0-0	1-2/0-1/0-0
Tibia	1-2/1-2/1-1	1-1/1-2/1-1	1-1/1-2/1-1	1-1/1-2/0-1
Genu	1-2/1-2/1-1	1-2/0-2/0-1	1-2/0-2/0-1	1-2/0-2/0-0

Female deutonymph: Dorsum (Fig. 11)**:** Dorsal shield has light reticulation, (265.5 μ) in length; (202.5μ) in width, with 3 pairs of pores and 18 pairs of setae, j_1 (23.4μ), j_3 (20.8μ), j_4 (18.2μ), j_5 (15.6μ), j_6 (20.8μ), J_2 (23.4μ), J_5 (10.4μ), z_2 (20.8μ), z_3 (23.4μ), z_4 (23.4μ), z_5 (15.6μ), Z_4 serrate (57.2μ), Z_5 serrate (59.8μ), s_4 (23.4μ), s_6 (31.2μ), S_2 (36.4μ), S_4 (36.4μ) and S_5 (15.6μ). r_3 (28.6μ) and R_1 (20.8μ). Fixed digit of chelicera with three teeth and pilus dintels; one tooth on movable digit. Peritreme reached at z_4 (Table 1).

Ventrum (Fig. 1 and Table 2)**:** Sterogenital region bears 5 pairs setae, ST_1 (23.4μ), ST_2 (23.4μ), ST_3 (23.4μ), ST_4 (15.6μ) and ST_5 (20.8μ). Ventral region bears 8 pairs of setae JV_1 (23.4μ), JV_2 (23.4μ), JV3 (23.4μ) JV_4 (10.4μ), JV_5 (44.2μ) and ZV_1 (18.2μ), ZV_2 (18.2μ) and ZV_3 (15.6μ). Anal opening surround with 3 setae, a_1 (13 μ), a_2 (13μ) and a_3 (15.6μ). Chaetotaxy of femur, genu and tibia of legs as the follows:

	I	II	III	IV
Femur	2-3/1-2/2-1	1-3/1-2/1-1	1-2/0-1/0-1	1-2/1-1/0-1
Tibia	2-2/1-2/1-2	1-1/1-2/1-1	1-1/1-2/1-1	1-2/0-1/1-1
Genu	2-2/1-2/1-2	2-2/0-2/0-1	1-2/0-2/1-1	1-2/0-2/1-1

Male deutonymph (Fig. 13)**:** Is resembling to female but smaller and differs in absence of setae JV_4, ZV_1 and ZV_3 at the ventral surface.

Table: (1) Development of chelicera in *T. citri* sp. n.

Stage	No. of teeth	
	Fixed digit	Movable digit
Larva	1	0
Protonymph	2	1
Deutonymph	3	1
Female	3	1

(Table 2): Ontogentic development of the idiosoma chaetotaxy in *T. citri* sp. n.

Stage	Dorsal			Integument
Larva	j_1, j_3, j_4, j_5, j_6	z_2 , z_4, z_5, Z_5	s_4	0
Protonymph	$j_1, j_3, j_4, j_5, j_6, J_2, J_5$	z_2, z_4, z_5, Z_4, Z_5	s_4, s_6, S_2, S_4, S_5	r_3, R_1
Deutonymph	$j_1, j_3, j_4, j_5, j_6, J_2, J_5$	$z_2, z_3, z_4, z_5, Z_4, Z_5$	s_4, s_6, S_2, S_4, S_5	r_3, R_1
Female	$j_1, j_3, j_4, j_5, j_6, J_2, J_5$	$z_2, z_3, z_4, z_5, Z_4, Z_5$	s_4, s_6, S_2, S_4, S_5	r_3, R_1
Stage	**Ventrum**			
Larva	ST_1, ST_2, ST_3	JV_1, JV_2		ZV_3, ZV_4
Protonymph	ST_1, ST_2, ST_3	JV_1, JV_2		ZV_3, ZV_5
Deutonymph	$ST_1, ST_2, ST_3, ST_4, ST_5$	JV_1, JV_2, JV3, JV_4, JV_5		ZV_1, ZV_2, ZV_3
Female	$ST_1, ST_2, ST_3, ST_4, ST_5$	$JV_1, JV_2, JV_3, JV_4, JV_5$		ZV_1, ZV_2, ZV_3

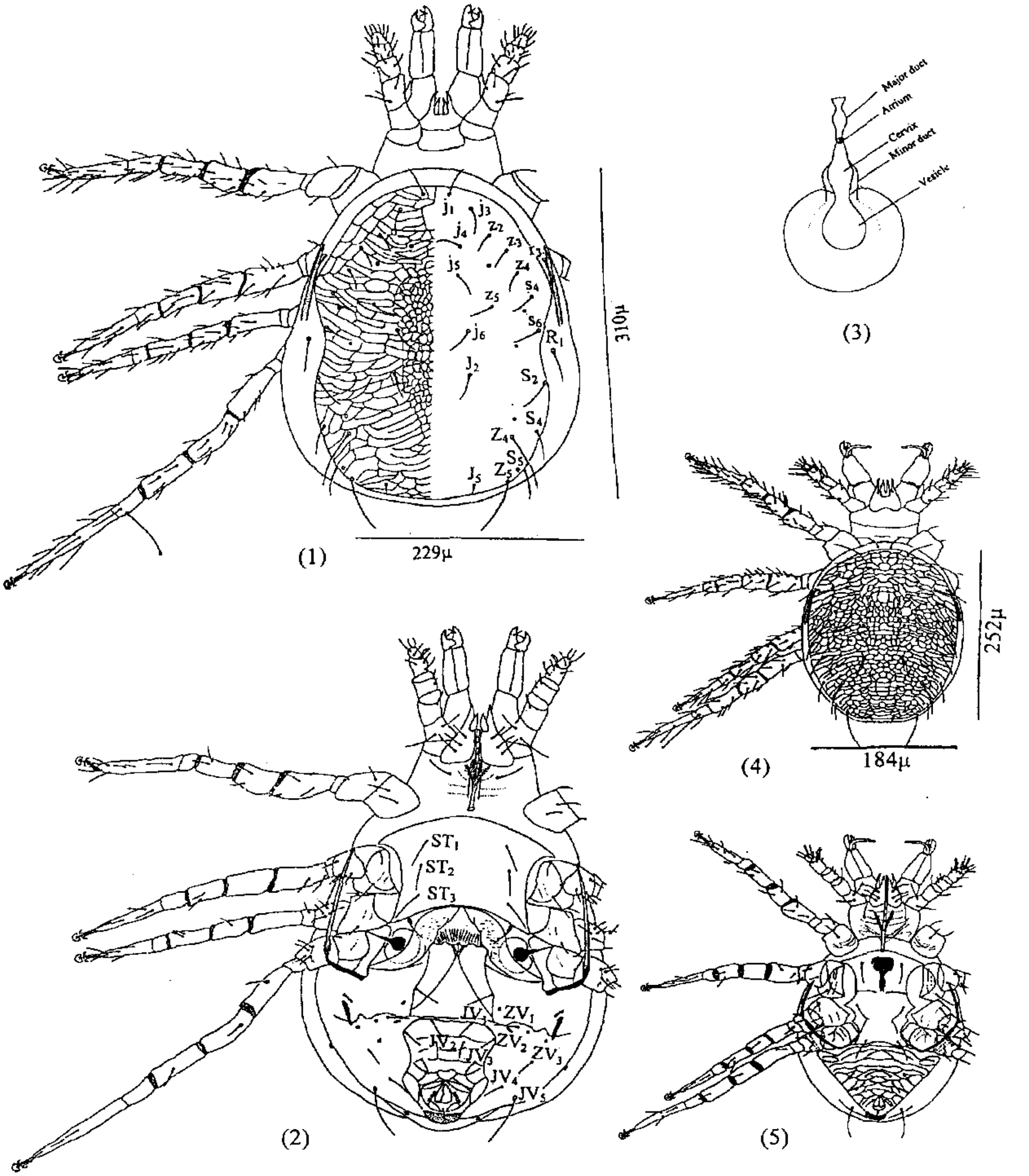

Fig. (1-5): *Typhlodromus citri* sp. n., (1) Female dorsal view. (2) Ventral view. (3) Spermatheca. (4) Male dorsal view. (5) Ventral view.

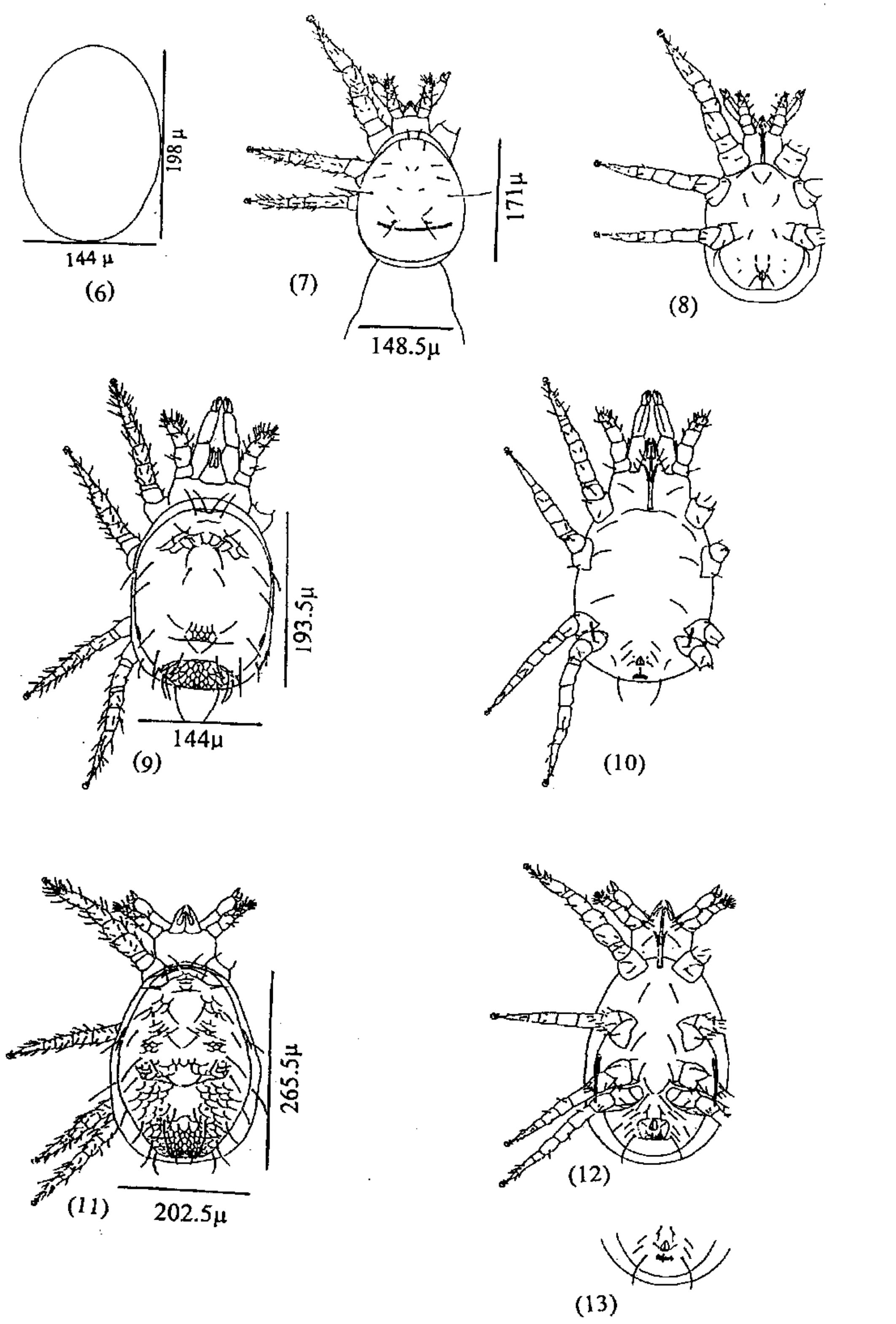

Fig. (6-13): *Typhlodromus citri* sp. n., (6) Egg. (7) Larva dorsal view. (8) Ventral view. (9) Protonymph dorsal view. (10) Ventral view. (11) Female deutonumph dorsal view. (12) Ventral view. (13) Male deutonymph venteral view.

Table (3): Effect of prey type on different stages of *T. citri* (in days), at three temperature degrees and R.H. 70±5%.

Temp.	Stages	Sex		Prey				
				T. urticae		*E. orientalis*		*O. vitis*
				Eggs	Immatures	Eggs	Immatures	Immatures
20	Egg	♀		5.00±0.00	5.00±0.00	5.00±0.00	5.00±0.00	6.00±0.00
		♂		5.00±0.00	5.00±0.00	5.00±0.00	5.00±0.00	6.00±0.00
	Larva	♀	A.	0.68±0.14	0.90±0.19	0.65±0.13	0.88±0.15	0.92±0.21
			Q.	1.05±0.15	1.08±0.19	0.97±0.12	0.98±0.14	1.75±0.29
		♂	A.	0.58±0.12	0.77±0.13	0.54±0.09	0.58±0.12	0.77±0.14
			Q.	0.85±0.13	0.96±0.16	0.82±0.12	0.95±0.13	0.98±0.25
	Protonymph	♀	A.	2.15±0.17	2.15±0.19	1.22±0.14	1.66±0.15	2.25±0.29
			Q.	1.11±0.19	1.15±0.22	1.06±0.14	1.14±0.17	1.83±0.24
		♂	A.	2.08±0.16	2.09±0.18	1.14±0.13	1.61±0.13	2.17±0.22
			Q.	1.06±0.15	1.07±0.19	1.04±0.13	1.05±0.15	1.44±0.23
	Deutonymph	♀	A.	3.29±0.17	3.31±0.21	2.53±0.16	2.63±0.17	3.37±0.22
			Q.	1.75±0.20	2.62±0.22	1.17±0.18	2.41±0.20	2.75±0.25
		♂	A.	3.25±0.16	3.27±0.17	2.38±0.13	2.50±0.16	3.33±0.18
			Q.	1.60±0.19	1.68±0.22	1.09±0.16	1.25±0.18	1.72±0.24
	Total immatures	♀		10.03±0.51	11.21±0.55	7.60±0.41	9.69±0.44	12.87±0.55
		♂		9.40±0.43	9.84±0.44	7.00±0.35	7.94±0.40	10.41±0.46
	Life cycle	♀		15.03±0.51	16.21±0.55	12.60±0.41	14.69±0.44	18.87±0.55
		♂		14.40±0.43	14.84±0.44	12.00±0.35	12.94±0.40	16.41±0.46
25	Egg	♀		2.00±0.00	2.00±0.00	2.00±0.00	2.00±0.00	2.50±0.00
		♂		2.00±0.00	2.00±0.00	2.00±0.00	2.00±0.00	2.50±0.00
	Larva	♀	A.	0.29±0.10	0.31±0.11	0.28±0.08	0.30±0.10	0.33±0.12
			Q.	0.74±0.14	0.76±0.17	0.30±0.11	0.45±0.15	0.81±0.21
		♂	A.	0.28±0.09	0.29±0.10	0.27±0.08	0.27±0.08	0.30±0.11
			Q.	0.52±0.13	0.69±0.16	0.27±0.08	0.39±0.13	0.70±0.20
	Protonymph	♀	A.	0.83±0.19	1.44±0.25	0.65±0.13	0.80±0.19	1.58±0.26
			Q.	0.79±0.22	0.96±0.25	0.55±0.16	0.61±0.17	0.98±0.26
		♂	A.	0.64±0.15	1.25±0.23	0.57±0.12	0.70±0.15	1.33±0.24
			Q.	0.56±0.15	0.81±0.18	0.36±0.13	0.55±0.15	0.83±0.24
	Deutonymph	♀	A.	0.95±0.23	1.64±0.24	0.88±0.21	1.61±0.23	1.65±0.26
			Q.	0.80±0.16	0.82±0.18	0.60±0.13	0.61±0.17	1.75±0.20
		♂	A.	0.89±0.18	1.42±0.19	0.82±0.16	1.39±0.17	1.43±0.24
			Q.	0.70±0.13	0.75±0.15	0.52±0.08	0.57±0.12	1.13±0.18
	Total immatures	♀		4.41±0.43	5.93±0.45	3.25±0.35	4.39±0.41	7.10±0.52
		♂		3.59±0.31	5.21±0.41	2.82±0.30	3.86±0.38	5.70±0.47
	Life cycle	♀		6.41±0.43	7.93±0.45	5.25±0.35	6.39±0.41	9.60±0.52
		♂		5.59±0.31	7.21±0.41	4.82±0.30	5.86±0.38	8.20±0.47
30	Egg	♀		1.50±0.00	1.50±0.00	1.50±0.00	1.50±0.00	2.00±0.00
		♂		1.50±0.00	1.50±0.00	1.50±0.00	1.50±0.00	2.00±0.00
	Larva	♀	A.	0.26±0.06	0.28±0.08	0.25±0.00	0.25±0.00	0.31±0.11
			Q.	0.31±0.11	0.31±0.11	0.28±0.08	0.31±0.11	0.36±0.13
		♂	A.	0.25±0.00	0.28±0.08	0.25±0.00	0.25±0.00	0.29±0.10
			Q.	0.30±0.10	0.31±0.11	0.27±0.07	0.28±0.09	0.32±0.12
	Protonymph	♀	A.	0.68±0.17	0.80±0.19	0.43±0.12	0.56±0.15	0.82±0.22
			Q.	0.56±0.19	0.58±0.22	0.38±0.13	0.40±0.16	0.63±0.23
		♂	A.	0.66±0.13	0.78±0.15	0.27±0.07	0.55±0.10	0.79±0.16
			Q.	0.48±0.13	0.56±0.17	0.33±0.12	0.34±0.13	0.57±0.21
	Deutonymph	♀	A.	0.72±0.16	0.93±0.18	0.48±0.14	0.71±0.17	1.10±0.23
			Q.	0.66±0.19	0.68±0.21	0.48±0.14	0.52±0.16	0.68±0.23
		♂	A.	0.70±0.15	0.81±0.17	0.40±0.13	0.70±0.14	0.90±0.22
			Q.	0.61±0.17	0.61±0.18	0.37±0.13	0.41±0.15	0.63±0.20
	Total immatures	♀		3.19±0.43	3.61±0.47	2.28±0.18	2.75±0.32	3.90±0.50
		♂		3.00±0.27	3.33±0.43	1.88±0.17	2.53±0.22	3.51±0.47
	Life cycle	♀		4.69±0.43	5.11±0.47	3.78±0.18	4.25±0.32	5.90±0.50
		♂		4.50±0.27	4.83±0.43	3.38±0.17	4.03±0.22	5.51±0.47

Type: Female holotype was collected from citrus leaf, at El-Fayoum Governorate, in December 2003. The holotype was one adult female observed in Laboratory of Acarology, Zoology and Agricultural Nematology Department for biological experiments. This new specie was named from the host plant, citrus trees, which collected from.

Biological studies:

Egg incubation periods decreased with arise in temperature as shown in (Table 3 and Fig. 14).

Immatures of *T. citri* were able to complete its development and reproduce when eggs and immatures of *E. orientalis*, *T. urticae* and immatures of *O. vitis*, were provided as a prey exclusively. *T. citri* did not feed on immatures of each *C. lanceolatisetae*, *T. putrescentiae* and *R. robini*, this results agree with Zhange *et al.*, (1999) who noted that, *Typhlodromus banbusae* females could not survive to lay eggs when reared on eggs and larvae of *T. putrescentiae*.

Large effects of prey species on immatures development were noted, whereas rates of development changed slightly from 20 to 30°C., the shortest period from egg-adult was faster on a diet of eggs of *E. orientalis* at 30°C., (3.78 days), on the other hand, the lowest on immatures of *O. vitis* diet (18.87 days) at 20°C.

When adult female of *T. citri* feed on eggs of *E. orientalis*, the pre-oviposition period shorted (1.95 days) at 30°C., while, the oviposition period was lengthened (39 days) at 20°C., (Table 4).

Mating was usually essential to induce oviposition and frequent mating was important to complete reproduction, where it takes place after final moult (Hoy and Smilanick, 1979). The data showed the same which, mating took approximately 5h., initial mating lasted 6h. and subsequent mating lasted 4 h., this agree also with those noted by Aponte and McMurtry (1992) who stated that, initial mating lasted for an average of 6h. and subsequent mating lasted for an average of 3 h.

The rate of reproduction was highly significant on eggs of *E. orientalis*; the total number of eggs deposited per female were (50.93 eggs) with daily rate (2.53 eggs) at 25°C. On the other hand, a lower rate of fecundity was occurred on immatures of *O. vitis* at 30°C., (7 eggs/female) (Table 5 and Fig. 15).

Takafuji and Chant (1976) and Momen (1995) stated that, some species had been reported to feed in larval stage. At this work larvae feed and consumed (4.9 eggs) considerably with an average of (17.5 eggs/day) of *E. orientalis* at 25°C., (Table 6), the larva failed to sucked eggs of *T. urticae* while succeed on *E. orientalis* may due to the *T. urticae* eggs, are much higher (282μ) than *E. orientalis* eggs (192μ), and its texture is smooth, on the other hand there are a cape on the top of *E. orientalis* eggs may be helped the larva to contact with it and sucked the egg contents; that is agree with those recorded by Momen and El-Borolossy (1999) who noted that larva of *T. transvalensis* feeding successfully on *E. orientalis* nymphs. This agrees also with those noted by (Schausberger and Croft, 1999) who mentioned that, some individuals of phytoseiid mites reached protonymphal stage without feeding.

The food consumption rate increased through the developmental stages. After mating, the adult female sucked relatively higher number of *E. orientalis* eggs at 30°C., which average (44.37 eggs/day) (Table 6 and Fig 16); Immatures of *O. vitis* gave considerably lower nutritional value, which average (4.36 individual/day) at 20°C.

Finally we can conclude that, eggs of *E. orientalis* considered being the most favorable prey species for *T. citri.*, while *O. vitis* is the lowest.

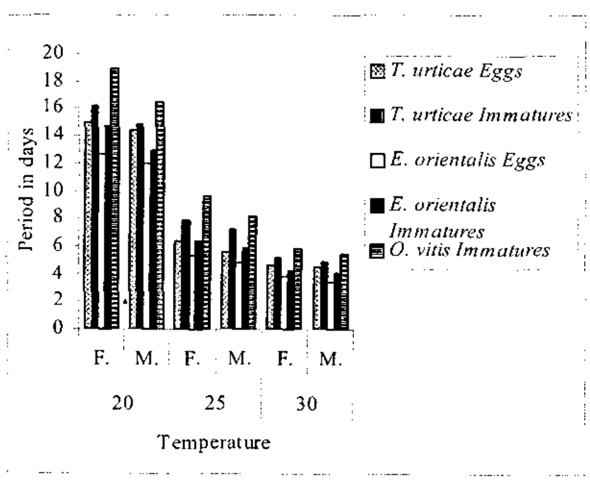

Fig. (14): Life cycle of *T. citri* (in days), at three temperature degrees and R.H. 70±5%.

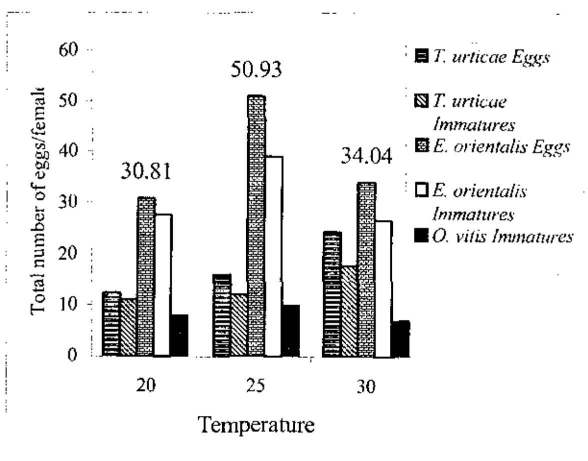

Fig. (15): Fecundity of the predator mite T. citri on different prey at three temperature degrees and R.H. 70±5%.

Table (4): Oviposition periods and life span of *T. citri* on different prey at three temperature degrees and R.H. 70±5%.

Temp.	Stages	Prey				
		T. urticae		*E. orientalis*		*O. vitis*
		Eggs	Immatures	Eggs	Immatures	Immatures
20	Pre-oviposition	7.25±0.26	5.17±0.19	5.17±0.24	4.33±0.18	5.50±0.20
	Oviposition	16.40±0.27	14.87±0.24	39.00±0.53	35.50±0.36	12.33±0.12
	Post-oviposition	2.50±0.18	3.67±0.28	1.01±0.16	0.83±0.14	2.75±0.20
	Female longevity	26.15±0.32	23.71±0.29	45.16±0.59	40.65±0.43	20.58±0.26
	Male longevity	21.83±0.27	20.33±0.21	43.63±0.38	33.34±0.22	18.30±0.16
	Female life span	41.18±0.55	39.92±0.53	57.76±0.64	55.34±0.59	39.44±0.52
	Male life span	36.23±0.44	35.16±0.39	55.63±0.52	46.28±0.47	34.70±0.38
25	Pre-oviposition	3.93±0.16	4.83±0.17	2.38±0.13	3.82±0.16	5.71±0.27
	Oviposition	14.25±0.18	11.00±0.17	20.13±0.32	18.75±0.25	10.50±0.14
	Post-oviposition	3.33±0.20	4.04±0.22	3.23±0.18	2.00±0.16	1.77±0.12
	Female longevity	21.51±0.31	19.88±0.27	25.73±0.48	25.57±0.30	17.98±0.28
	Male longevity	18.63±0.28	16.75±0.26	23.89±0.44	18.05±0.27	12.25±0.12
	Female life span	27.92±0.61	27.80±0.57	30.98±0.67	30.95±0.66	27.58±0.56
	Male life span	24.22±0.46	23.96±0.44	28.70±0.56	23.91±0.45	20.45±0.40
30	Pre-oviposition	4.00±0.12	4.13±0.13	1.95±0.11	2.58±0.12	5.09±0.20
	Oviposition	15.00±0.24	11.50±0.18	18.50±0.53	16.00±0.38	6.25±0.13
	Post-oviposition	1.66±0.18	1.88±0.24	1.40±0.13	1.33±0.12	1.88±0.23
	Female longevity	20.66±0.25	17.50±0.23	21.85±0.50	19.90±0.44	13.22±0.22
	Male longevity	14.00±0.22	12.25±0.18	17.50±0.44	15.19±0.42	11.69±0.17
	Female life span	25.34±0.51	22.62±0.46	25.63±0.58	24.15±0.57	19.11±0.44
	Male life span	18.50±0.46	17.08±0.43	20.88±0.53	19.22±0.50	17.21±0.41

Table (5): Fecundity of the predator mite *T. citri* on different prey at three temperature degrees and R.H. 70±5%.

Temp.	Stages	Prey				
		T. urticae		*E. orientalis*		O. vitis
		Eggs	Immatures	Eggs	Immatures	Immatures
20	Total no. of deposited eggs	12.46±0.51	11.15±0.49	30.81±0.57	27.69±0.52	8.01±0.41
	Average no. of eggs deposited/female/day	0.76±0.05	0.75±0.04	0.79±0.02	0.78±0.02	0.65±0.03
25	Total no. of deposited eggs	15.96±0.51	11.99±0.47	50.93±0.67	39.00±0.63	9.98±0.28
	Average no. of eggs deposited/female/day	1.12±0.04	1.09±0.05	2.53±0.05	2.08±0.04	0.95±0.03
30	Total no. of deposited eggs	24.30±0.48	17.71±0.47	34.04±0.67	26.56±0.52	7.00±0.31
	Average no. of eggs deposited/female/day	1.62±0.04	1.54±0.05	1.84±0.06	1.66±0.04	1.12±0.05

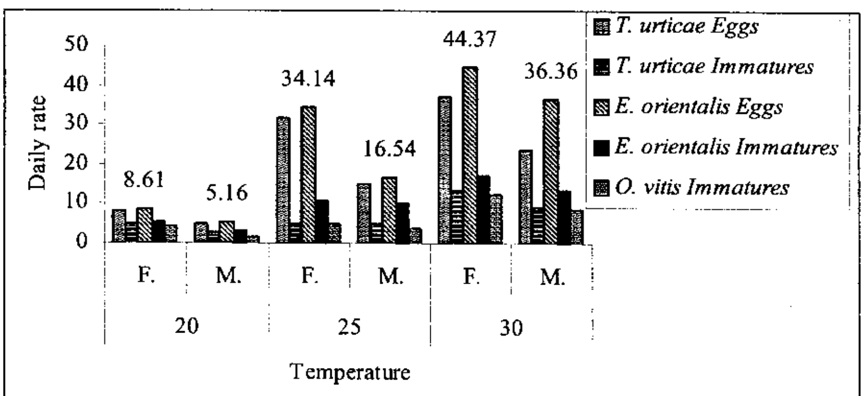

Fig. (16): Daily rate of different prey consumed by *T. citri* at three temperature degrees and R.H. 70±5%.

Table (6): Consumption rate per day of *T. citri* on different prey at three temperature degrees and R.H. 70±5%.

Temp.	Stages	Sex	Prey: *T. urticae* Eggs	*T. urticae* Immatures	*E. orientalis* Eggs	*E. orientalis* Immatures	*O. vitis* Immatures
20	Larva	♀	0.00±0.00	1.62±0.57	4.73±1.16	2.57±0.89	1.42±0.52
		♂	0.00±0.00	0.29±0.55	2.65±0.95	1.37±0.85	0.16±0.44
	Protonymph	♀	4.21±0.40	2.95±0.30	6.67±0.84	3.27±0.45	1.55±0.26
		♂	2.64±0.25	0.82±0.24	3.47±0.57	2.36±0.28	0.78±0.22
	Deutonymph	♀	5.40±0.43	3.23±0.27	7.52±0.44	4.21±0.28	2.55±0.25
		♂	3.14±0.27	1.15±0.16	4.64±0.31	2.81±0.23	0.98±0.15
	Adult	♀	8.08±0.10	4.79±0.05	8.61±0.12	5.19±0.06	4.36±0.05
		♂	4.63±0.03	2.43±0.03	5.16±0.05	3.05±0.04	1.56±0.03
25	Larva	♀	0.00±0.00	2.64±0.93	17.50±1.13	3.64±1.01	2.16±0.87
		♂	0.00±0.00	2.22±0.52	7.74±1.12	2.69±0.97	1.92±0.56
	Protonymph	♀	15.83±0.35	3.52±0.21	21.54±0.73	5.00±0.56	2.92±0.19
		♂	8.70±0.27	3.16±0.19	10.53±0.68	4.81±0.46	1.96±0.16
	Deutonymph	♀	22.48±0.53	4.53±0.26	23.07±0.55	7.50±0.28	4.06±0.23
		♂	10.11±0.30	3.95±0.23	12.31±0.37	6.54±0.27	3.57±0.22
	Adult	♀	31.48±0.45	5.08±0.09	34.14±0.63	10.63±0.18	4.67±0.09
		♂	14.98±0.24	4.60±0.08	16.54±0.30	10.44±0.17	4.00±0.07
30	Larva	♀	0.00±0.00	4.05±0.84	11.60±1.26	4.31±1.11	2.94±0.58
		♂	0.00±0.00	3.12±0.70	7.69±1.11	3.75±1.00	2.05±0.47
	Protonymph	♀	25.13±0.42	7.59±0.37	34.73±1.60	7.69±0.86	4.96±0.29
		♂	16.64±0.37	5.30±0.34	21.65±0.89	6.74±0.83	2.91±0.24
	Deutonymph	♀	29.30±0.46	9.64±0.38	39.43±0.91	10.73±0.71	7.44±0.36
		♂	18.50±0.39	7.41±0.31	25.10±0.81	8.13±0.68	5.62±0.27
	Adult	♀	37.18±0.46	13..32±0.18	44.37±1.02	17.24±0.39	12.40±0.17
		♂	23.65±0.43	9.28±0.17	36.36±0.92	13.44±0.38	8.73±0.12

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