

**MORPHOLOGICAL AND BIOLOGICAL STUDIES
ON *CYDNOSEIUS VITIS* MOSTAFA (ACARI:
GAMASIDA: PHYTOSEIIDAE)**

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ABSTRACT: Immature stages and adult male of the phytoseiid mite, *Cydnoseius vitis* Mostafa are described and illustrated. *C. vitis* was reared on the immatures of the two-spotted spider mite, *Tetranychus urticae* Koch under laboratory conditions of $28\pm 3^{\circ}\text{C}$ and $73\pm 5\%$ R.H. . The total period of immature stages averaged 6.16 days for female and 5.02 days for male, during which they consumed an average of 22.37 and 13.73 prey individuals, respectively. The average generation period was 10.20 days. Adult female continued depositing eggs during a period of 16 days, where it fed on a total average of 156.80 prey individuals and laid a total average and daily rate of 38.40 and 2.40 eggs, respectively. Female and male life span averaged 28.29 and 18.25 days, where each attacked an average of 212.49 and 102.63 prey individuals, respectively.

Key words: Phytoseiidae, *Cydnoseius vitis*, morphology and biology.

INTRODUCTION

Because of the important role played by several species of the Phytoseiidae in controlling various agricultural pests, studies were largely made on the biology of these mites and their possible use as biological control agent (Barber *et al.*, 2003; Heikal & Fawzy, 2003; Sengonca *et al.*, 2003; Steiner *et al.*, 2003; Zhang-YanXuan *et al.* 2003; Gotoh *et al.*,

2004 and Opit *et al.*, 2004). Adult female of the phytoseiid mite *Cydnoseius vitis* Mostafa was previously described from Egypt by Mostafa (1998). It has been recorded in large numbers associated with phytophagous mite and insect infestations in different localities at Sharkia governorate. Its immature stages and adult male have not been described before, also nothing is known about its biology. Therefore, the present

work was generally undertaken to clarify the morphological characters of the immature stages and adult male of *C. vitis* Mostafa. Also, its life cycle, reproduction and predation efficiency were investigated, when reared on immatures of two-spotted spider mite, *Tetranychus urticae*. Koch.

MATERIALS AND METHODS

Laboratory culture of *C. vitis* Mostafa was established, using individuals collected from Bermuda grass, *Cynodon dactylon* (L.) Pres. at Zagazig district, and maintained on common bean *Phaseolus vulgaris* L. leaves infested with the two-spotted spider mite *T. urticae*. Leaf discs of mulberry, *Morus alba* L. one inch in diameter each were placed singly in open Petri dishes with the upper surface downwards on saturated cotton wool pads. Each leaf disc was surrounded by a cotton wool barrier saturated with water to prevent escaping mite individuals from rearing arenas. Suitable moisture was maintained by adding few drops of water as needed. A total of 30 mated females were individually isolated from stock culture and placed singly on 30 replicated leaf discs and left to deposit their eggs. Immediately after egg deposition, females were removed and return

to stock cultures. Hatched larvae were reared singly through their life span. All predator stages were supplied with sufficient known number of *T. urticae* immature stages. Observations were made twice a day and durations of developmental stages were recorded. Consumed prey individuals were daily counted and number of eggs laid by each female was recorded daily. Experiments were carried out under laboratory conditions of $28 \pm 3^\circ\text{C}$ and $71 \pm 5\%$ R.H. Immature stages and adult male obtained from stock cultures were mounted in Hoyer's medium, examined and drawn. All measurements were given in microns. The setal nomenclature followed in this manuscript is that of Chant & Mc Murtry (1994).

RESULTS AND DISCUSSION

I. Descriptions of immature stages and adult male of *Cydnoseius vitis* Mostafa

I.1. Larva (Fig. 1, A-D)

Body oval, with a much narrower anterior end, colour whitish when alive. Dorsal shield smooth of 181μ long and 114μ wide, divided into an anterior podonotal region and a posterior opisthonotal one. Podonotal shield of 128μ long and 114μ wide,

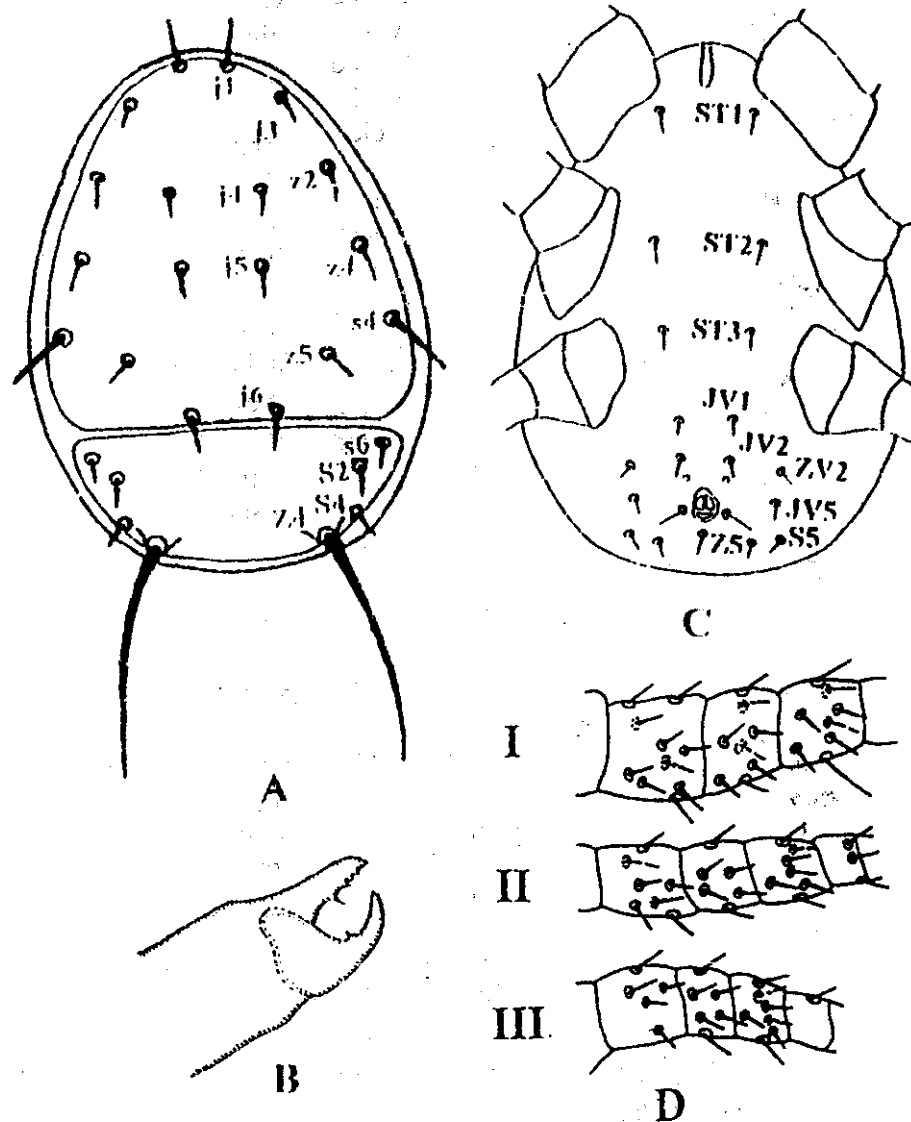


Fig. 1: *Cydnoseius vitis* Mostafa, larva. A. Dorsal view. B. Chelicera. C. Ventral view. D. Femora, genua and tibiae of legs I – III, respectively

bearing 9 pairs of simple setae j1, j3, j4, j5, j6, z2, z4, z5, and s4. Opisthotal shield of 52 μ long and 118 μ , broadest width, with 4 pairs of setae s6, S2, S4, and considerably whip-like setae Z4, which arise on stout tubercles. Setal measurements: j1=14; J3=12, j4=9; j5=10; j6=12; z2=13; z4=9; z5=9; Z4=82; s4=21; s6=6; S2=9; S4=6 μ . Sublateral setae r3 and R1 absent (Fig. 1, A). Venter of idiosoma smooth, with 10 pairs of setae and a single postal seta. Setae ST1, ST2, ST3, JV1, JV2, JV5, ZV2, S5, Z5. para-anal and postanal setae of 7, 8, 6, 5, 8, 5, 6, 5, 7, 13 and 10 μ , respectively. A pair of small circular pores located behind setae JV2. Stigmata and peritreme absent (Fig. 1, C). Cheliceral fixed digit with 3 teeth and a pilus dentilis, while movable one has one tooth (Fig. 1, B). Chaetotaxic formulae of femora, genua and tibiae of legs I, II and III, respectively as follows: 10-7-5; 8-6-6 and 8-7-7 (Fig. 1, D, I-III).

I.2. Protonymph (Fig. 2, A-D)

Body oval, colour whitish when alive. Dorsal shield smooth, 217 μ . long and 139 μ , wide. Eighteen pairs of simple smooth setae occurring on the dorsal shield; 10 lateral, 2 mediolateral and 6 dorsocentral pairs. Setae S5 and Z5 on distinct tubercles, where

the last pair seemed to be finely serrate. Four pairs of pores, of which a crescentic pair and 3 minute circular ones occurring on the dorsal shield. Sublateral setae r3 and R1 on lateral integument. Setal measurements: j 1=18; j3 = 15; j4=13; j5=16; j6=17; J2= 14; J5 = 10; z2 = 14; z4 = 19; z5=14; Z1=13; Z4=38; Z5=36; s4 - 15; s6 = 14; S2 = 21; S4=23; S5=20; r3=20; R1=13 μ . (Fig. 2, A). Venter of idiosoma smooth, with 8 pairs of setae and a single postanal seta, of which 3 pairs on podosoma and 5 pairs in addition to a single postanal seta present on the opisthosomal region. A crescentic pair of pores located posteriomedial to JV2. Setae ST1, ST2, ST3, JV1, JV2, JV5, ZV2, para-anal and postanal setae measuring 15, 12, 13, 12, 9, 20, 10, 10 and 11 μ respectively. Stigmata and peritreme present, end of peritreme not surpassing coxae III (Fig. 2, C). Cheliceral fixed digit with 3 teeth and a pilus dentilis, while movable digit with one tooth (Fig. 2, B). Chaetotaxic formulae of femora, genua and tibiae of legs I-IV, respectively as follows: 10-7-5-4, 8-6-6-5 and 8-7-7-6. A moderately long macroseta (42 μ) on basitarsus of leg IV. (Fig. 2, D, I-IV).

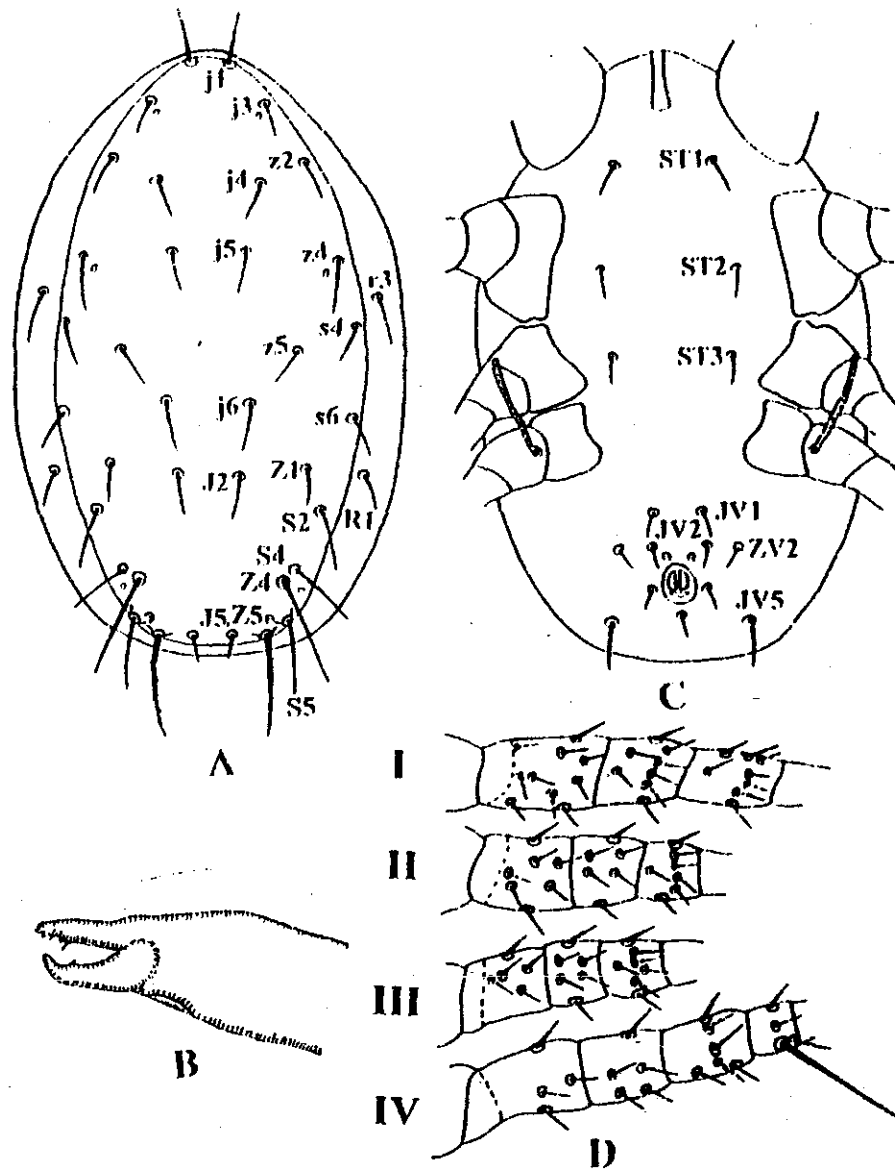


Fig. 2: *Cydnoseius vitis* Mostafa, protonymph. A. Dorsal view. B. Chelicera. C. Ventral view. D. Femora, genua and tibiae of legs I – IV, respectively and basitarsus IV

I.3. Deutonymph (Fig.3, A-D)

Similar to protonymph, except in being larger in size (303 μ long and 184 μ wide) and having a dark yellowish colour. Dorsal shield smooth, measuring 284 μ long and 117 μ wide and having 18 pairs of simple setae. Setae S5 and Z5 on distinct tubercles, where the last pairs seemed to be finely serrate. A pair of crescentic pores and 5 pairs of rather circular ones occurring on the dorsal shield (Fig.3,A). Setal measurements: j1=22; j3=19; j4=16; j5=17; j6=19; J2=20; J5=11; z2=21; z4=23; z5=18; Z1=19; Z4=34; Z5=37; s4=22; s6=22; S2=25; S4=27; S5=29; r3=23; R1=22 μ . Peritreme more developed, extending forwardly surpassing j3. Venter of idiosoma smooth, with 13 pairs of setae and a single postanal seta (Fig.3,C). The ventral setae ST1, ST2, ST3, ST4, ST5, JV1, JV2, JV4, JV5, ZV1, ZV2, ZV3, para-anal and postanal setae measuring 15, 16, 15, 12, 14, 13, 11, 9, 30, 14, 13, 10, 11 and 11 μ , respectively. A crescentic pair of pores located between setae JV2. Cheliceral fixed digit with 3 teeth and a pilus dentilis, while movable one with one tooth (Fig.3, B). Chaetotaxic formulae of femora, genua and tibiae of legs I - IV, respectively as follows: 12-10-6-6, 10-7-7-7 and 10-7-7-6; in addition

to macroseta on basitarsus IV of 48 μ (Fig.3, D, I-IV).

I.4. Male (Fig.4, A-D)

Body oval, pale yellow in colour when alive. Dorsal shield of 268 μ long and 156 μ wide, covered with distinct reticulations and having 18 pairs of simple setae except setae Z5 which seem to be slightly serrate. Sublateral setae r3 and R1 on the dorsal shield. Seven pairs of pores existed on the dorsal shield, of which 5 pairs being circular and 2 pairs seem to be crescentic in shape. Setae j1=15; j3=14; j4=13; j5=13; j6=16; J2=14; J5=8; z2=19; z4=12; z5=12; Z1=15; Z4=26; Z5=41; s4=13; s6=16; S2=14; S4=18; S5=19; r3=20; R1=18 μ . Apex of peritreme reaches anterior to setae j3 (Fig.4, A). Sternogenital shield smooth of 140 μ long and 76 μ wide, bearing 5 pairs of short setae and a pair of lyriform pores. The measurements of the sternogenital setae as follows: ST1=16; ST2=14; ST3=13; ST4=13; ST5=15 μ . Genital aperture near the anterior margin of sternogenital shield. Ventrianal shield subconical of 107 μ in length and 105 μ at the broadest width, covered with transverse striae, with 3 pairs of preanal setae and a pair of crescentic pores (Fig.4,C). Measurements of setae on the ventrianal shield as follows:

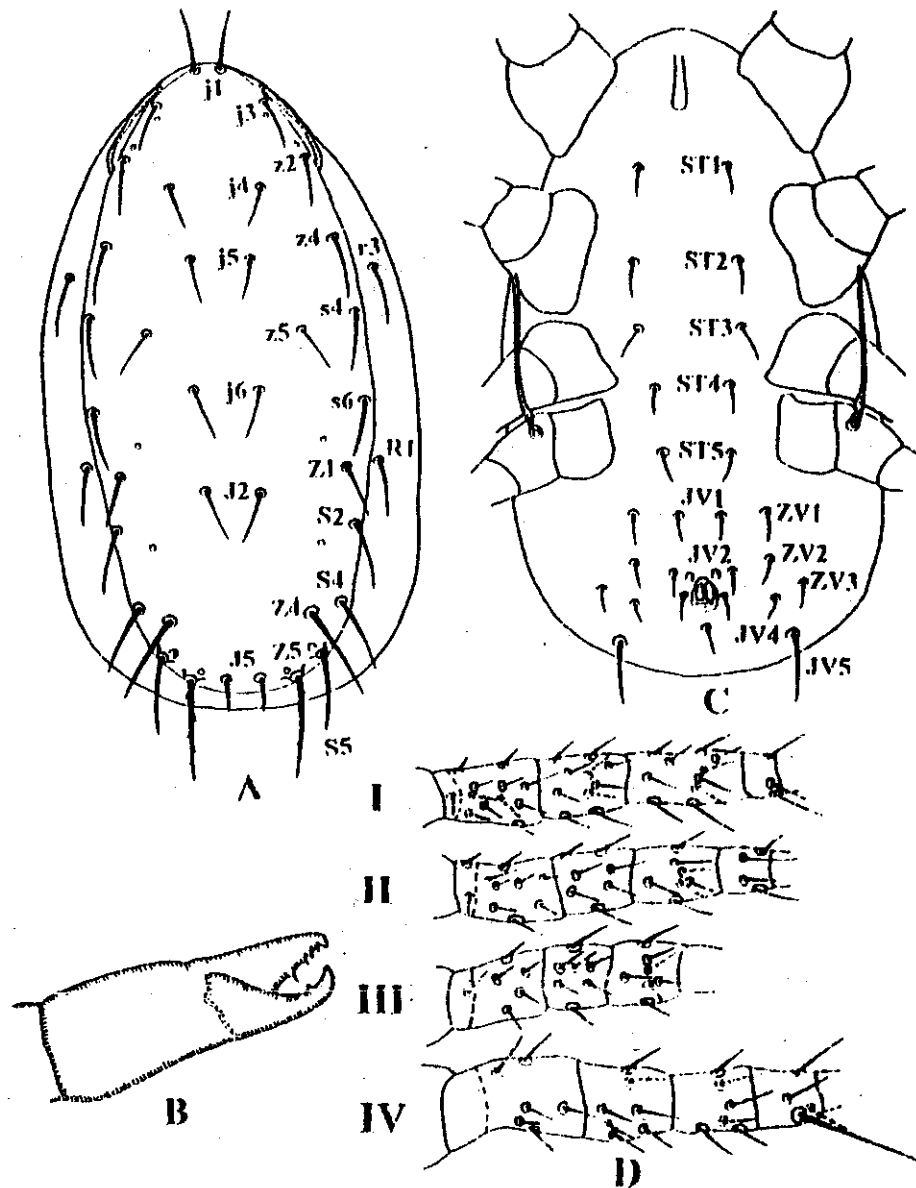


Fig. 3: *Cydnoseius vitis* Mostafa, deutonymph. A. Dorsal view. B. Chelicera. C. Ventral view. D. Femora, genua and tibiae of legs I – IV, respectively and basitarsus IV

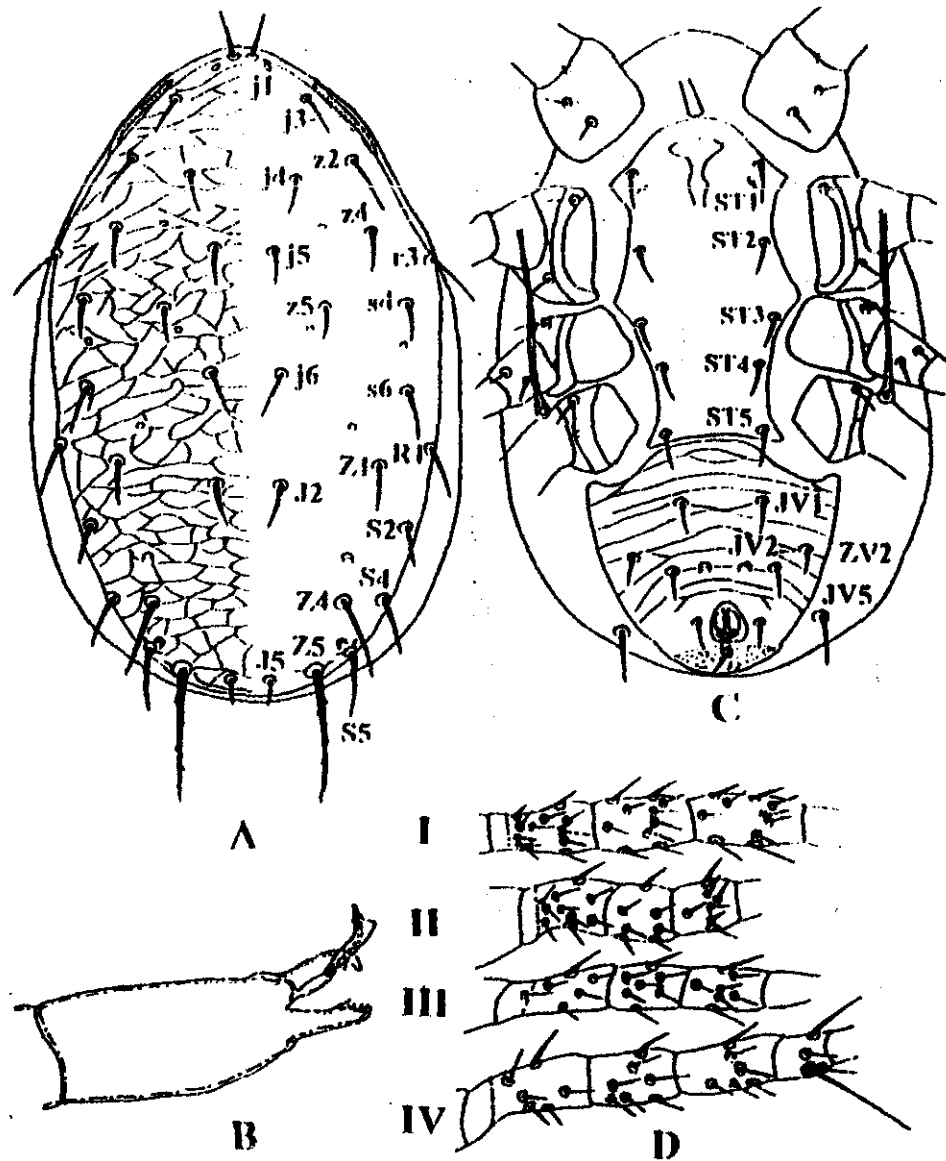


Fig. 4: *Cydnoseius vitis* Mostafa, adult male. A. Dorsal view. B. Chelicera. C. Ventral view. D. Femora, genua and tibiae of legs I – IV, respectively and basitarsus IV

JV1=13; JV2=12; ZV2=11; paranals = 10; postanal=13 μ . Setae JV5 on integument surrounding the shield of 20 μ in length. Spermatodactyl with a narrow short foot and short heel. Cheliceral fixed digit with 3 teeth and a pilus dentilis, while movable one having one tooth (Fig.4, B). Chaetotaxic formulae of femora, genua and tibiae of legs I-IV (Fig.4, D, I-IV), respectively as follows: 12-10-6-6, 10-7-7-7, 10-7-7-6. Basitarsus IV with macroseta of 31 μ long. Tracing the morphological characters of *C. vitis* immature stages, it was found that the dorsal, ventral and leg chaetotaxy introduced a quantitative changes during the mite ontogeny. Similar results were obtained by Papdoulis & Emmanouel (1993), Prasad (1973) and Fouly & El-Laithy (1992).

II. Biology of *Cydnoseius vitis* Mostafa

II.1. Duration of developmental stages

Data on developmental times in days of *C. vitis* fed on immature stages of the two-spotted spider mite *Tetranychus urticae* at 28 \pm 3 $^{\circ}$ c and 73 \pm 5% R.H are given in Table 1. The mean developmental time from egg to adult averaged 8.30 days for female and longer

than that of male (6.55). These results nearly agreed with those found for *Typhlodromus pyri* by Zaher and Shehata (1971) and *Euseius hutu* by Hassan (2000), in which the total developmental time was longer for female than male. Pre-oviposition and generation periods averaged 1.90 and 10.20 days, respectively. Fouly *et al.* (1995) reported that, generation period of *Typhlodromalus peregrinus* averaged 8.12 days when fed on *T. urticae* at 26 $^{\circ}$ c. Adult female continued ovipositing eggs for a period averaging 16.00 days, where it deposited 38.40 eggs as a total average, with a daily rate of 2.40 eggs (Table 2). The total number of eggs laid by *Cydnodromus picanus* female was 41.04 eggs, when reared on *T. urticae* at 26 \pm 1 $^{\circ}$ c and 70 \pm 5% R.H. (Ragusa *et al.*, 2000). Female died after 2.09 days from the end of oviposition (Table 1). The total life span of *C. vitis* averaged 28.29 days for female with about 10.00 days longer than male (18.26 days).

II.2. Predator efficiency

The total average and daily mean of the two-spotted spider mite *T. urticae* immature stages devoured by *C. vitis*

Table 1: Durations and prey consumption of *Cydnoseius vitis* Mostafa developmental stages, when fed on *Tetranychus urticae* Koch immature stages at 28±3°C and 73±5% R.H.

Predator stage	Durations (days)		Prey consumption			
	Female	Male	Female		Male	
			Total average	Daily rate	Total average	Daily rate
Egg	2.14±0.05	1.53±0.03	-	-	-	-
Larva	1.54±0.01	1.21±0.01	0.00	0.00	0.00	0.00
Protonymph	2.05±0.02	1.63±0.01	7.96±0.42	5.20±0.29	4.39±0.25	3.70±0.21
Deutonymph	2.57±0.02	2.19±0.02	14.40±0.48	7.30±0.21	9.04±0.56	5.60±0.22
Total immatures	6.16±0.02	5.02±0.03	22.37±0.63	6.25±0.17	13.73±0.51	4.65±0.17
Life cycle	8.30±0.05	6.55±0.04	-	-	-	-
Preoviposition	1.90±0.03	-	16.36±0.35	8.60±0.16	-	-
Generation period	10.20±0.07	-	-	-	-	-
Postoviposition	2.09±0.07	-	16.96±0.81	8.10±0.18	-	-
Longevity	19.99±0.28	11.70±0.30	190.12±3.70	8.83±0.11	88.90±2.87	7.60±0.16
Life span	28.29±0.30	18.25±0.30	212.49±3.87	7.55±0.10	102.63±3.02	6.13±0.09

± (SE) = standard error.

Table 2: Efficiency and fecundity of *C. vitis* Mostafa during oviposition period when fed on *T. urticae* Koch immature stages at 28±3°C and 73±5% R.H.

Oviposition period (days)	No. of consumed prey individuals per female		No. of deposited eggs per female	
	Total average	Daily mean	Total average	Daily mean
	16±0.26	156.80±4.03	9.80±0.20	38.40±2.70

± (SE) = standard error.

developmental stages are given in (Table 1). The predator larva does not feed, as it was sluggish during this stage. A marked change in activity occurred after changing to protonymph, as it began to feed voraciously. Averages of *T. urticae* immature stages consumed by the predator female and male immature stages were 22.37 and 13.73 prey individuals, respectively (Table 1). Yousef (1981) reported that female of *Typhlodromus africanus* Yousef immature stages fed on about twice as much as that devoured by male immature stages. During adulthood, predator female proved to be the most effective, as it fed on greater number of prey than male. The former devoured a total average and daily rate of 190.12 and 8.83 prey individuals, respectively. For the latter, these values were 102.63 and 6.13 prey individuals, respectively. Oviposition period was the most feeding period, during which female consumed greater total number and daily mean (156.8 and 9.80) of prey individuals (Table 2). *Amblyseius barkeri* adult female consumed 94.53% of the total prey consumption throughout life span when fed on *T. urticae* immature stages (Fouly and El-Laithy, 1992). During life span, average female and male of *C. vitis* attacked 212.49 and 102.63

immature stages of *T. urticae*, respectively. From these results, it could be concluded that *C. vitis* could play an important role in the control of the two-spotted spider mite in Egypt.

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دراسات مورفولوجية وبيولوجية على الحلم *CYDNOSEIUS VITIS* MOSTAFA (أكاري : جاماسيدا : فيتوسيدي)

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تضمنت هذه الدراسة وصفا مورفولوجياً تفصيلياً للأطوار غير الكاملة والذكر البالغ للحلم *Cydnoseius. vitis* لم تدرس من قبل، من خلال تربية الحلم على الأطوار غير الكاملة لحلم العنكبوت الأحمر ذو البقعين *Tetranychus urticae* تحت الظروف المعملية بمتوسط درجة حرارة 28 ± 3 م° ورطوبة نسبية 73 ± 5 %. ولقد وجد أن الحلم يتغذى ويتكاثر على الفريسة المذكورة، حيث بلغ المجموع الكلي لفترات الأطوار غير الكاملة للحلم 6,16 يوم للأثني، 5,02 يوم للذكر أستهلك كل منهما خلالها 22,37، 13,73 فرداً من الفريسة المقدمة على الترتيب، كما بلغت فترة الجيل 10,20 يوماً، بينما استغرقت فترة وضع البيض بالنسبة للأثني 16 يوماً استهلك خلالها 156,80 فريسة، ووضعت خلالها 28,40 بيضة بمتوسط يومي 2,40 بيضة، وقد بلغت فترة طول الحياة life span لكل من الأثني والذكر 28,29؛ 18,25 يوم على الترتيب استهلك كل منهما خلال تلك الفترة 102,63، 212,49 فرداً من الفريسة على الترتيب.