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Article

Redescription of the water mite *Eylais extendens* (Müller) (Acari, Eylaidae) larva based on material collected from Iran

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ABSTRACT

Larvae of water mite, *Eylais extendens* (Müller, 1776) (Acari, Eylaidae) were collected from water burrowing beetles (Noteridae), predaceous diving beetles (Dytiscidae) and variegated mud-living beetles (Heteroceridae) from Guilan province, Iran, captured by light traps. The redescription and illustration of taxonomic characters of the larva were made based on specimens collected from Guilan province, Northern Iran. This is the first record of larval hosts of *E. extendens* from Iran.

KEY WORDS: Dytiscidae; Guilan province; Heteroceridae; Noteridae; parasitism.

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INTRODUCTION

Larvae of water mites of the genera *Eylais*, *Hydrachna* and *Limnochaeres*, are ectoparasites on aquatic Hemiptera and aquatic Coleoptera (Davids 1972; Smith 1977, 1987; Wainstein 1980; Reilly and McCarthy 1993; Biesiadka and Cichocka 1994; Cichocka 1995; Zawal 2002; Sánchez *et al.* 2015; Céspedes *et al.* 2019). Water mite larvae of the genus *Eylais* are mostly found on beetles of the families Haliplidae, Dytiscidae, Gyrinidae, Hydraenidae, and Hydrophilidae (Zawal 2003). *Eylais extendens* is distributed in Western Palearctic; it is one of the most common species of the genus *Eylais* in Europe and Asia Minor (Anatolia) (Davids *et al.* 2017). This species is possibly bivoltine (Zawal 2003) and hibernates as egg or as parasitic larva (Nielsen and Davids 1975).

So far, different hosts have been reported for larva of *E. extendens*. Sparing (1959) found the larvae of *E. extendens* on the abdominal tergites of the corixids *Sigara falleni* (Fieb.), *S. striata* (L.) and *S. distincta* (Fieb.). However, there are doubts with regard to its correct taxonomic assignment (Davids *et al.* 2005). Lanciani (1970) found the larvae of this mite on *Hesperocorixa* (Corixidae). According to Easwari Amma (1967) the larva of *E. extendens* parasitizes the water stick-insect *Ranatra* (Nepidae). Nielsen and Davids (1975) found larvae of *E. extendens* on the water beetle *Haliphus ruficollis* (Coleoptera, Haliplidae). Zawal (2003) recorded 26 different water beetle species of the families Dytiscidae (*Acilius*, *Bidessus*, *Colymbetes*, *Graptodytes*, *Hydroporus*, *Hyphydrus*, and *Scarodytes*), Haliplidae (*Haliphus*, and *Peltodytes*), Noteridae (*Noterus*), Laccophilidae (*Laccophilus*) and Hydrophilidae (*Anacena*, *Laccobius*, *Helochares*, and *Enochrus*) as hosts for larvae of *E.*

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extendens. *Eylais extendens* has been permanently and temporarily found in all types of standing and slowly flowing waters (Lundblad 1968).

There are only a few records of water mites larvae from Iran and no comprehensive study has been done yet on larvae of water mites. Arjomandi *et al.* (2019) provided a new record of *Hydrachna* (Acari, Hydrachnidia) parasitizing water beetles of genus *Eretesgriseus*. Hajizadeh and Hosseini (2019) reported *Hydrachna skorikowi* Piersig on lesser water boatman species *Corixa punctata* (Illiger, 1807) and *Sigara* sp. (Corixidae) from Guilan province. Adult stage of *E. extendens* has been recorded from Bakhtiari and Khorasan provinces (Sepasgosarian 1999), but there is no report of the larval stage and its hosts from Iran. Only four species of the genus *Eylais* Latreille [*Eylais degenerata* Koenike, *Eylais extendens* (Müller), *Eylais hamata* Koenike, *Eylais planipons* Walter] were previously known from Iran (Sepasgosarian 1999; Pešić and Saboori 2007; Pešić *et al.* 2014). This study contributes to larval morphology of *E. extendens* based on specimens collected from Guilan province, Northern Iran and its parasitization on water burrowing beetles (Noteridae), predaceous diving beetles (Dytiscidae) and variegated mud-living beetles (Heteroceridae) from Iran.

MATERIALS AND METHODS

Parasitized specimens of water burrowing beetles (Noteridae), predaceous diving beetles (Dytiscidae) and variegated mud-living beetles (Heteroceridae) were collected by light traps installed in campus of University of Guilan (37° 11' 37.02" N, 49° 38' 27.49" E, 29 m a.s.l., June 25, 2014; September 18, 2019; July 5, 2020; July 7, 2021; July 18, 2021; July 26, 2021; August 9, 2021; leg. Jalil Hajizadeh and Reza Hosseini) near to a water stream and rice farms. Target specimens were preserved in 70% ethyl alcohol after separation from other specimens collected by light trap. Water mite larvae were cleared in Nesbitt's fluid and then mounted on microscope slides in Hoyer's medium and identified according to Wainstein (1980), Nielsen and Davids (1975) and personal communication with professor Andrzej Zawal (University of Szczecin, Poland). Photographs of host beetles and slide mounted larvae of water mites were taken using a stereomicroscope (SMP-180 CE) and phase contrast microscope (HP-41; Korea) equipped with a Canon camera (EOS Kiss X5; Japan). The figures were drawn using Adobe illustrator CC 21.0.0. Measurements are given in micrometers (µm); each measurement corresponds to the mean value followed (in parentheses) by the respective ranges. The examined material was deposited in the Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan, Iran.

RESULTS

Eylais extendens (Müller, 1776)

Syn.: *Hydrachna extendens* Müller, 1776: 190.

Eylais undulosa Koenike, 1897: 283.

Eylais extendens monofissa Szalay, 1934: 277.

Redescription (*n* = 5)

Dorsum – Body elongate oval, color in life red, body length 176 (175–178), width 124 (118–135) (Fig. 2A). Dorsal shield oval, length 147 (143–152), width 62 (58–68). Anterior margin triangular, posterior margin rounded, weakly narrowed, with seven pairs of setae, first pair is longer than the other pairs and six pairs of large pores; pores surrounded by radially arranged short furrows; longitudinal lateral furrows not developed, distinct only in the intervals between the anterior margin and first pairs of pores; third pair of pores connecting by a transverse furrow (Figs. 1A, 2A). The ocular plates lie on each side of the dorsal plate with two separate lens-like structures, length 33 (28–

38) (Fig. 2A). Two triangular-shaped lateral plates lie posterior to the ocular plates, each lateral plate bears two side-by-side arranged setae, length 29 (28–30) (Fig. 2A). Measurements of body parts are given in Table 1.

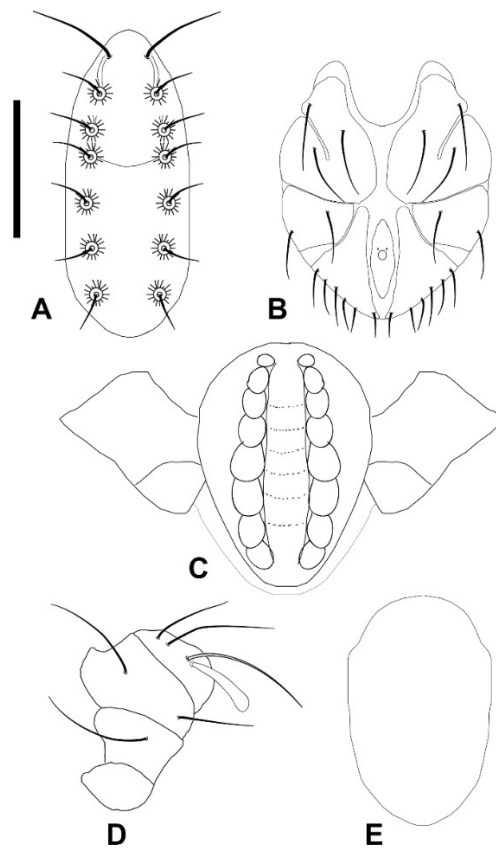


Figure 1. *Eylais extendens* (larva) – **A.** Dorsal plate; **B.** Ventral plate; **C.** Velum; **D.** Palp; **E.** Stylophore. Scale bar: 65 μm for A; 75 μm for B; 19 μm for C; 27 μm for D; 21 μm for E.

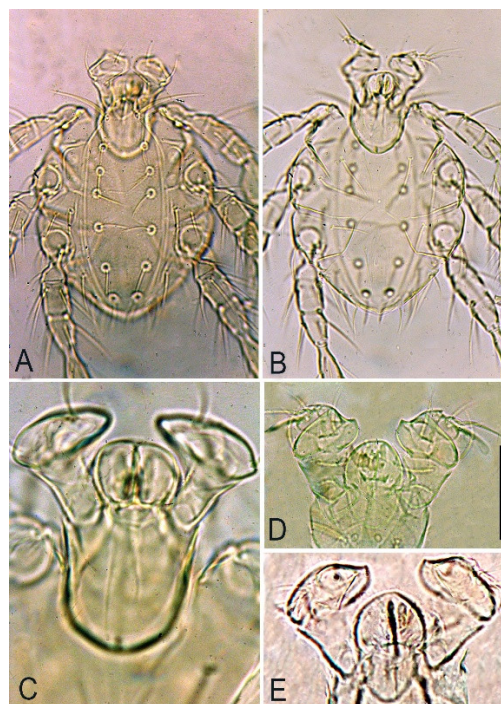
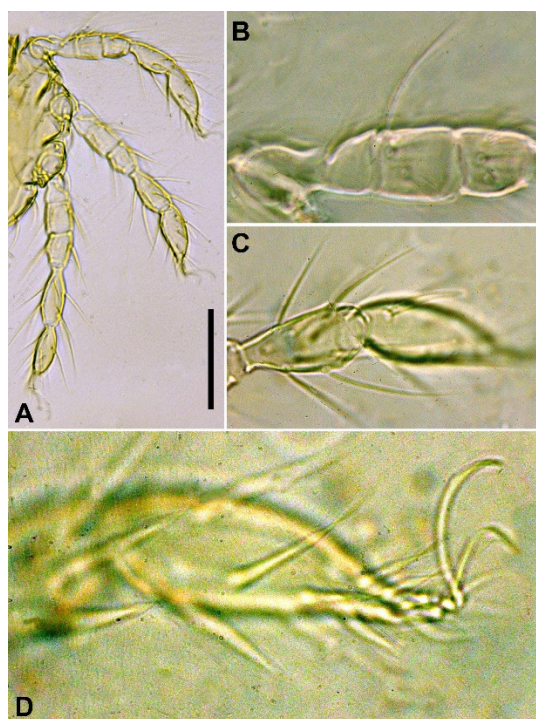


Figure 2. DIC micrographs of *Eylais extendens* (larvae) – **A.** Dorsal view of body; **B.** Ventral view of body; **C.** Gnathosoma; **D.** Palp; **E.** velum. Scale bar: 68 μm for A and B; 28 μm for C; 33 μm for D; 30 μm for E.

Table 1. Comparison of measurements of *Eylais extendens* larvae from different locations.

| Character | Nielsen & Davids (1976) | Wainstein (1980) | This study |
|------------------------------------|-------------------------|------------------|---------------|
| Body length | - | - | 176 (175–178) |
| Body width | - | - | 124 (118–135) |
| Dorsal shield length | 138–154 | 185 | 147 (143–152) |
| Dorsal shield width | 51–56 | 100 | 62 (58–68) |
| Ocular plate length | 27–30 | - | 33 (28–38) |
| Lateral plate length | 20–28 | - | 29 (28–30) |
| Stylophore length | 29–38 | 55 | 36 (33–42) |
| Anal plate length | 34–40 | 55 | 44 (35–50) |
| Palp tibial claw length | 18–20 | - | 23 (20–24) |
| Tarsus II solenidion length | 17–20 | - | 22 (18–23) |
| Leg I | | | |
| Trochanter | - | - | 20 (18–20) |
| Femur | 23–25 | - | 31 (30–33) |
| Genu | 13–16 | - | 17 (15–20) |
| Tibia | 23–28 | - | 32 (30–33) |
| Tarsus | 43–54 | - | 53 (50–55) |
| Total length | 102–123 | 105 | 152 (148–159) |
| Leg II | | | |
| Trochanter | - | - | 19 (18–20) |
| Femur | 23–25 | - | 30 (28–33) |
| Genu | 15–18 | - | 19 (18–20) |
| Tibia | 23–28 | - | 33 (33–35) |
| Tarsus | 43–45 | - | 55 (53–58) |
| Total length | 104–116 | 115 | 158 (152–163) |
| Leg III | | | |
| Trochanter | - | - | 21 (18–23) |
| Femur | 24–28 | - | 32 (28–37) |
| Genu | 15–19 | - | 21 (18–23) |
| Tibia | 30–35 | - | 41 (38–43) |
| Tarsus | 46–48 | - | 53 (50–55) |
| Total length | 115–130 | 120 | 168 (159–179) |

**Figure 3.** DIC micrographs of *Eylais extendens* (larva) – **A.** Legs; **B.** Trichobothrium on femur; **C.** Solenidion on tarsus II; **D.** Tarsus and pretarsus. Scale bar: 67 µm for A; 21 µm for B; 26 µm for C; 14 µm for D.

Venter (Fig. 2B) – Coxal plates I and II are fused together, each with 2 setae, coxal plate III separate contains 2 setae; anal shield long, narrowed at both ends, lying between the posterolateral plates, two small pores situated in front of the excretory pore; posterior lateral plates lie posterior to coxae III, tapering to a point beside the excretory plate, each with 4 setae (Figs. 1B, 2B).

Gnathosoma (Fig. 2C) – Mouthparts include the chelicerae, palps and rostrum that supported by basis capitulum. The stylophore consist of fused basal segments of the chelicerae that forms the dorsal cover for the mouthparts. Stylophore oviform, length 36 (33–42), anterior margin rounded, posterior margin weakly narrowed (Fig. 1E). The velum, which holds the mouthparts of the larva to the integument is on the ventral face of the rostrum. Velum with two rows of eight large papillae, proto- and tritorstral setae visible (Figs. 1C, 2E). Chelicera triangular in outline, pointed at tip, tip is weakly bent, its length exceeds than basal width. Pedipalp large, five segmented, trochanter short, discoid; femur and genu moderately developed, genu with a narrow medial crest, tibia with large furcate setae, with a developed wing-shaped branch, tibial claw length 23 (20–24), tarsus bilobed, with two normal setae and one solenidion (Figs. 1D, 2D).

Legs (Fig. 3) – The number of leg setae from coxa to tarsus is 2-1-5-4-9-18; epimera I and II partly fused (Figs. 1B, 2B); legs terminate in two sickle-shaped claws (Fig. 3D); all legs have a trichobothrium on the dorsal surface of the telofemur (Fig. 3B); solenidion on tarsus II 22 (18–23) long (Fig. 3C); length of legs I-III respectively: I, 153; II, 156; III, 168; length of leg segments given in Table 1.



Figure 4. Water beetles infected with larvae of *Eylais extendens* – **A.** Noteridae; **B.** Noteridae; **C.** Dytiscidae; **D.** Heteroceridae.

Material examined

Twenty larvae of *Eylais extendens* were separated from abdominal tergites of the water beetles of families Noteridae and Dytiscidae. Two larvae were separated from leg (femur) of water beetles of family Heteroceridae (Fig. 4).

REMARKS

Description of *Eylais extendens* specimens from Europe (Nielsen and Davids 1976) and specimens with unknown location (Wainstein 1980) indicates similarities and some differences between material examined in the current study and their descriptions and measurements including: 1. Dorsal shield in examined specimens have seven pairs of setae and the first pair of which is longer than the others (Figs. 1A, 2A) while in previous descriptions, only one pair of long setae was shown in front of dorsal shield; 2. In previous descriptions the lateral furrows developed from the anterior margin of the shield to the last pairs of dorsal pores but in our examined specimens lateral furrows observed only between the base of first long setae and the first pair of dorsal pores (Figs. 1A, 2A). In terms of other characteristics, our descriptions agree with Nielsen and Davids (1976) and Wainstein (1980) but a number of measures are somewhat different as shown in Table 1. Since the shapes of dorsal plate, coxal plates and pores are similar, we believe we are dealing with the same species.

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بازتوصیف لارو کنه آبی *Eylais extendens* (Müller) (Acari, Eylaidae) بر اساس نمونه‌های
جمع‌آوری شده از ایران

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چکیده

لاروهای کنه آبی *Eylais extendens* (Müller, 1776) (Acari, Eylaidae) از روی بدن سوسک‌های آبی خانواده‌های Noteridae، Dytiscidae و Heteroceridae از استان گیلان، ایران با تله نوری جمع‌آوری شدند. بازتوصیف و ترسیم ویژگی‌های رده‌بندی لارو بر اساس نمونه‌های جمع‌آوری شده از استان گیلان، شمال ایران انجام شد. این نخستین گزارش از میزبان‌های لارو *E. extendens* از ایران است.

واژگان کلیدی: Noteridae؛ Dytiscidae؛ Heteroceridae؛ ایران؛ انگلی شدن.

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