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The larva of *Tricholeon relictus* Hölzel & Monserrat, 2002 a synanthropic antlion (Neuroptera, Myrmeleontidae)

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Abstract

The larva of *Tricholeon relictus*, a Spanish endemic antlion of Afrotropical affinities, is described and illustrated for the first time also providing a comparison with the only other European member of the tribe Dendroleontini, *Dendroleon pantherinus*. The larva of this species is synanthropic but probably originally lived in cave-like habitats.

Key words: larval morphology, Neuropterida, Myrmeleontiformia, Mediterranean, Iberian peninsula

Introduction

The tribe Dendroleontini Banks, 1899 includes 35 genera of antlions distributed in Eurasia, Africa and Australia, where its maximum diversity is attained, but comprising very few species in North America (Stange 2004). Exclusively two species belonging to this group are reported for Europe: *Dendroleon pantherinus* (Fabricius, 1787), an Eurosibirian faunal element, and *Tricholeon relictus* Hölzel & Monserrat, 2002, a rare and recently discovered species only known for southern Spain (Hölzel & Monserrat 2002; Monserrat 2010; Monserrat & Acevedo 2011; Monserrat & Triviño 2013). The latter is undoubtedly the most interesting European antlion for a biogeographical point of view, as the genus *Tricholeon* Esben-Petersen, 1925 comprises only two other described species, both limited to southern Africa: *T. hirtellus* Esben-Petersen, 1925 and *T. nigripes* Kimmins, 1948 (Mansell 1988, 2000; Stange 2004). The members of this genus are average sized antlions with a mimetic body colouring, whose larval stages are closely associated with cave mouths and rock overhangs.

Mediterranean – southern Africa disjunctions in distribution are well documented for many animal and plant groups and probably imputable to periods of homogeneous climatic and environmental conditions between these regions, before the progressive desertification of the African continent (Bologna *et al.* 2008, Kirk-Spriggs & McGregor 2009). Most Mediterranean genera of Myrmeleontidae and in a few cases even species (e. g. *Nemoleon notatus* Rambur) are shared with the Afrotropical region, where they normally reach their maximum diversity and probably take origin. Nevertheless this type of disjunct distribution pattern is rare among antlions and only reported for *Tricholeon* and very recently *Solter*, despite the latter also penetrates in the northern part of the Afrotropical region (Mansell 2013), while the other genera are considerably more widespread.

The southernmost part of the Iberian Peninsula also represented a primary refuge for numerous animals and plants species during the Pleistocene glaciations (Hewitt 1993, 1996, 1999) and the present distribution of *T. relictus* indeed suggests that it is a remnant of former warmer climates which persisted in this area; its cave-dwelling habits may have contributed to its survival during the most extreme glacial periods.

Mansell (1988) revised the two southern African species, detailing their larval morphology and ecology, while the larva of *T. relictus* is described for the first time in the present work.

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Material and methods

First and second instar larvae of *T. relictus* were reared in order to obtain the diagnostic last instar or to observe their behaviour. They were placed in plastic containers filled with fine sand and kept in laboratory at room conditions. The provided nourishment was composed by live insects of appropriate size, such as: silverfishes (*Lepisma saccharina* Linnaeus and *Ctenolepisma* sp.), cockroaches (*Ectobius* spp.), termites (*Kalotermes flavicollis* Fabricius) and ants (*Messor barbarus*, Linnaeus); based on field observations some of them are also the natural preys of this species. Some first instar larvae were retained in their natural habitat where they were observed to prey on Psocoptera. Morphological observations were made with an Olympus® SZX7 stereomicroscope and a Leica® MZ 9.5 stereomicroscope. Measurements were taken using an ocular micrometer and following the morphometric protocol of Badano & Pantaleoni (2014). The larvae were photographed with a digital camera Canon® EOS 600D equipped with Canon® macrolens MP-E 65 mm. The obtained images were processed with Zerene® Stacker software and finally elaborated with Adobe® Photoshop.
The specimens were preserved in 70º ethanol with glicerine and stored in the collection of the authors. Morphological terminology mainly follows Badano & Pantaleoni (2014).

Description

Tricholeon Esben-Petersen, 1925

Diagnosis. Head capsule with small but prominent ocular tubercles; mandibles gently curved upward, provided with 3 equidistant and relatively large teeth, the apical tooth is the largest; labial palpi four-articulated, segments 2–4 elongated, noticeably longer than the width of the mandible; mesothoracic spiracles sessile; mesonotum with a median tuft of hair-like setae, mesothorax equipped with pedunculated setiferous processes; metathorax with sub-pedunculated setiferous processes; abdominal setiferous processes sessile; VIII abdominal sternite without odontoid processes; IX abdominal sternite sub-triangular in shape, longer than wide, lacking prominent rastra.

Tricholeon relictus Hölzel & Monserrat, 2002
(Figs. 1–4)

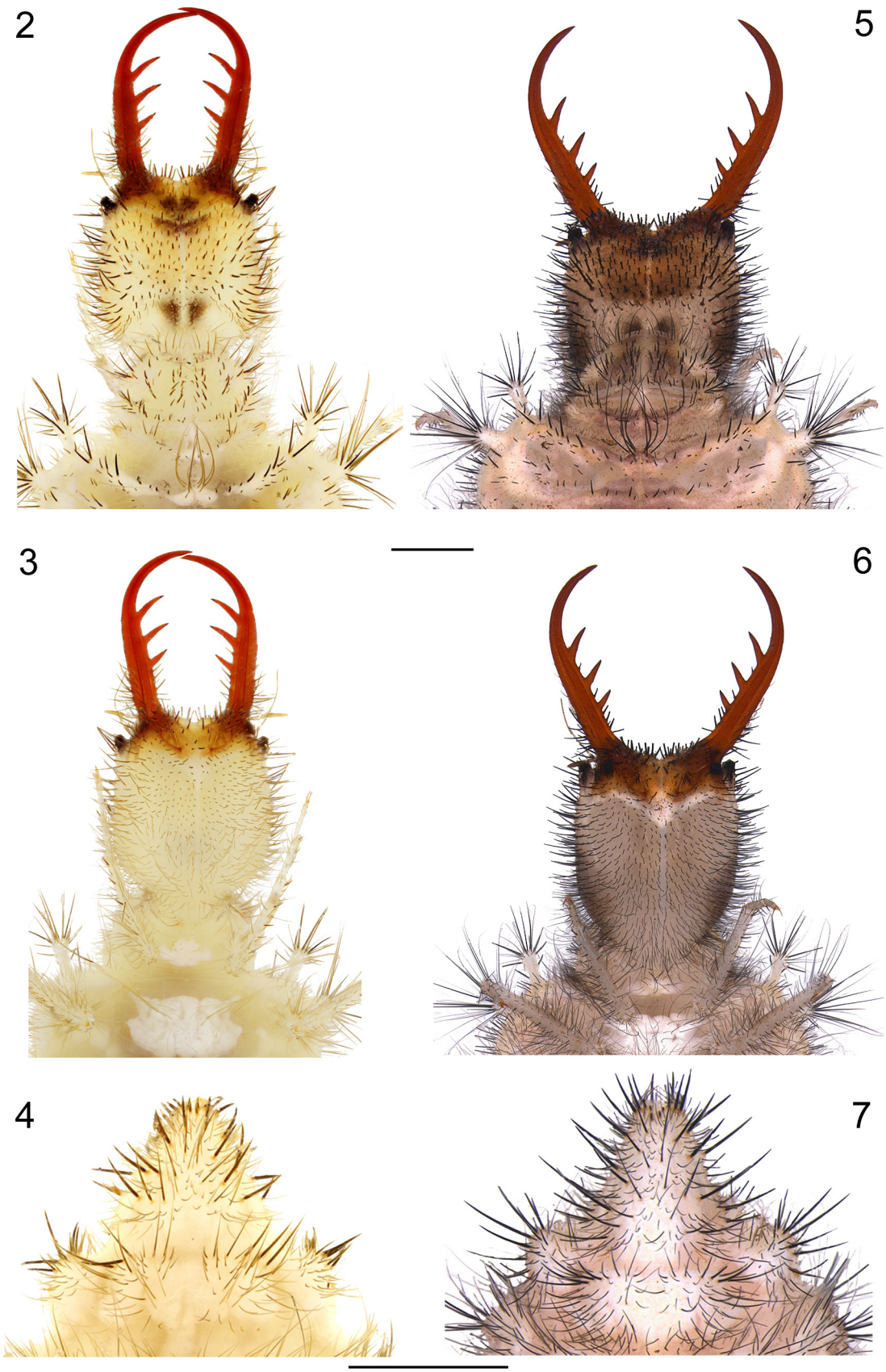
Examined specimens. S Spain, Granada: La Herradura, Punta de la Mona, 4 first instar larvae obtained from a female collected 24.VIII.2011, born 11.IX.2011, F. Acevedo & V. J. Monserrat leg.; same locality, 2 third instar larvae and 1 second instar larva laboratory-reared to the third instar, reached 10.IX.2013, D. Badano, F. Acevedo and V. J. Monserrat leg.; same locality, 5 first instar larvae obtained from a female collected VIII.2013, born 19.IX.2013, F. Acevedo and V. J. Monserrat leg., presently kept in their natural site.

Description of 3rd instar larva. Medium sized antlion larva (Table 1). General colouring very pale, whitish (Fig. 1), dorsal side of head capsule very pale ochre with a dark area in proximity of the base of the mandible and with small median markings on the clypeo-labrum and after the frontal sutures, a further pair of small markings are present in the occipital area (Fig. 2), ventral side of the head unmarked (Fig. 3), ocular tubercles black, mandibles dark reddish brown, setae on the dorsal side of the body and on the setiferous processes black while the setae disposed on the lateral and ventral sides are mainly pale brown (Fig. 1).

TABLE 1. Average size measurements (mm) of examined 3rd instar larvae of *Tricholeon relictus* (3 specimens) and *Dendroleon pantherinus* (2 specimens). The size range (min–max) of sclerotized body parts is reported after mean. Abbreviations: body length (excluding mandibles) BL, head length HL, head width HW, mandible length ML, ratio head capsule width/length HW/HL, ratio mandible length/head capsule length ML/HL.

	BL	HL	HW	ML	HW/HL	ML/HL
T. relictus	10.60	2.09 (2.02–2.15)	1.90 (1.82–1.95)	1.95 (1.85–2.15)	0.90	0.93
D. pantherinus	11.00	2.32–2.49	1.9–2.01	1.79–2.01	0.82	0.79

FIGURE 1. *Tricholeon relictus* Hölzel & Monserrat, 2002, 3rd instar larva, live specimen (Spain: Granada, La Herradura, Punta de la Mona). A: dorsal view, B: ventral view, C: lateral view.



FIGURES 2–7. Morphological comparisons between 3rd instar larvae of *Tricholeon relictus* Hölzel & Monserrat, 2002 and *Dendroleon pantherinus* (Fabricius, 1787). **2.** *T. relictus*, dorsal view of the head. **3.** *T. relictus*, ventral view of the head. **4.** *T. relictus*, VIII and IX urites. **5.** *D. pantherinus*, dorsal view of the head. **6.** *D. pantherinus*, ventral view of the head. **7.** *D. pantherinus*, VIII and IX urites. Scale bar: 1 mm.

Head. Sub-rectangular in shape, longer than wide (Figs. 2, 3); anterior margin of the labrum with a small median incision; antennae very long and thin, composed by at least 14 flagellomeres; dorsal side of the head covered with dolichasters, paler in proximity of the mouthparts; mandible upturned but relatively straight, similar in length to the head capsule, equipped with 3 pairs of comparatively large teeth; 2–3 pseudo-teeth interspersed with at least 4 dolichasters between the base of the mandible and the basal tooth, 0–2 setae between the basal and median teeth, no setae between the median and apical teeth; external margin of the mandible with a group of stout setae at the base; labial palps elongated, basal segment covered by brown dolichasters (Fig. 3) .

Thorax. Pronotum covered with sparse and relatively stout pale brown setae (Fig. 2); mesothoracic spiracles not borne on tubercle; mesonotum with a conspicuous median tuft of hair-like, pale brown setae (Fig. 2), in live specimens a clot of sand grains is retained at its apex; mesothoracic setiferous processes pedunculated, of which the first pair is particularly elongated, metathoracic setiferous processes sub-pedunculated (Fig. 2).

Legs. Pale in colour, covered with black and stout setae on the ventral side.

Abdomen. Dorsal series of setiferous processes bearing stout black setae; abdominal spiracles very small, not prominent; ventral side of the abdomen covered with light brown hair-like setae; IX abdominal sternite longer than wide, covered with long setae interspersed with hair-like ones (Fig. 4).

Differences between larval instars. As typical of myrmeleontid larvae, striking morphological differences are not observable between the first and later instars excluding size, therefore the diagnostic characters are always evident. Anyway the first instar larva is covered with a much sparser setation and the body cuticle is remarkably hyaline.

Ecological notes. *T. relictus* is a Spanish endemism so far only known for a small coastal area characterized by a very mild and relatively humid climate, situated south of Granada: La Herradura and the neighbouring mount of Cerro Gordo. The type locality of the species is the residential area of Punta de la Mona in La Herradura, a hill site with sparse buildings interspersed with extensive gardens and remnants of the original Mediterranean vegetation, composed by open woods of Aleppo pine with thick undergrowth. The larvae were collected in the foundations of a house located in this site, in a peculiar situation resembling a cave, as this room communicates with the exterior only by small openings thus creating a dark, moist and warm microhabitat characterized by constant conditions (Monserrat 2010; Monserrat & Acevedo 2011). Despite the obvious artificial origin of this place, a notable resemblance to the natural caves of the area is evident in the geological substratum and overall characteristics. The foundations harbor a rich fauna of synanthropic arthropods of which some represent potential prey for *Tricholeon* larvae such as: Isopoda Oniscoidea, Collembola Arthropleona, Zygentoma Lepismatidae, Psocoptera, Coleoptera Lathridiidae, Lepidoptera Tineidae and Hymenoptera Formicidae while Diplopoda and Coleoptera Tenebrionidae are improbable due to their hard cuticles; various cohabiting predators have been observed, including Chilopoda Scutigeridae, Araneae Dysderidae and Scythodidae, Opilionida, Coleoptera Carabidae and Hymenoptera Vespidae (Monserrat & Acevedo 2011). The presence of *T. relictus* in this site, though apparently surprising, is not occasional as it is confirmed by 21 empty cocoons discovered. Despite accurate field research the larvae have still not been detected in the natural caves of the area, as potentially suggested by the ecology of the African congeners.

Behavioural notes. *Tricholeon* larvae are ambush predators as the other members of the tribe. The larvae usually lay where the dust layer is thin, allowing to anchor themselves to the substrate and enhancing their camouflage covering the body with soil debris. They are normally very motionless, often remaining immobile for long periods in laboratory conditions and they are able to feign death for several minutes if disturbed, nevertheless they are agile climbers.

Comparative remarks. The larvae of *Tricholeon* show the typical set of characters of most Dendroleontini: upturned mandibles, small but prominent ocular tubercles, mesothoracic tuft of hair-like setae and elongated IX abdominal sternite. The larval stages of southern African species *T. hirtellus* and *T. nigripes* differ from the closely related genera *Dendroleon* and *Cymothales* for the very long and thin anterior mesothoracic setiferous process (Mansell 1988; Stange 2004). According to Stange (2004), they are also distinguishable from *Dendroleon* because the median tooth of the mandible is shorter than mandibular width at its insertion. Remarkably the larva of *T. relictus* is much more similar to *Dendroleon* than to African congeners in both characters, as the anterior setiferous process is no more than three times longer than wide and the median tooth is noticeably longer than mandibular width.

Comparison with *Dendroleon pantherinus*. *D. pantherinus* is a widespread species in central and southern Europe, though generally highly localized. Notably this antlion has never been reported from the Iberian Peninsula

despite its presence there is actually possible, especially in the northern half, as suggested by the presence of this species in Mediterranean woody biotopes in Italy (Badano & Pantaleoni 2014; Badano pers. obs.). The larva of this species remained poorly known despite its early description (Brauer 1867) and it has been deeply treated only recently by Badano & Pantaleoni (2014). As underlined above, the larvae of *T. relictus* and *D. pantherinus* are noticeably similar in overall morphology, differing in relatively minor details. *D. pantherinus* is a proportionally larger species than *T. relictus* and it is also evident in the dimensions of the larvae (Table 1). *T. relictus* is instead characterized by comparatively stouter jaws. In *D. pantherinus*, one interdental mandibular seta is present between the median and apical teeth (Fig. 5) while it is always absent in *T. relictus*. Regarding body colouring both species are very pale, whitish antlion larvae but in *D. pantherinus* the head capsule is much more pigmented, with a typical reddish hue (Figs. 5, 6) while *T. relictus* shows median dark markings in the anterior part (Fig. 2). The colour of the setae is diagnostic: in *D. pantherinus* all the setae of the body are blackish, while in *T. relictus* the stouter setae on the dorsal side of the body and on the setiferous processes are black but the hair like setae (mainly ventro-lateral in position) are pale brown; this difference is immediately evident observing the tuft of hair-like setae on the mesonotum: black in the first species (Fig. 5) and pale brown in the second (Fig. 2). On the contrary, IX urite does not show remarkable differences between the two species (Figs. 4, 7).

From an ecological point view both species are specialized sit-and-wait predators in dark, protected environments. *D. pantherinus* is typically associated with tree holes but it is also able to colonize different micro-habitats, including human buildings (Gepp 2010; Badano & Pantaleoni 2014); as other species of *Dendroleon* are also cave dwellers (Stange *et al*. 2003) the larvae of this antlion may be at least potentially found in caves or similar environments.

Conclusion

The systematics of the genera of Dendroleontini is particularly complex and the placement of some genera is unclear (Stange 2004). Stange (1994, 2004) re-defined the tribe mainly on larval morphology, underlining the importance of some apomorphic characters, in particular the tuft of setae on mesonotum which is exclusive of this group. Nevertheless the larvae are exclusively known for a minority of genera and some of them are not even equipped with this peculiar structure, thus resembling those of Nemoleontini, implying the necessity of additional studies. The genus *Tricholeon* is a typical member of the tribe and it is particularly close to *Dendroleon* as suggested by both adult and larval characters and the larva of *T. relictus* further corroborates a strict relationship between these two genera. The known larvae of most Dendroleontini appear to be associated with dark and sheltered habitats, such as tree holes, rock overhangs and caves, (Badano & Pantaleoni 2014; Mansell 1988, 2000; Stange, 2004; Stange *et al*. 2003) potentially allowing them to colonize buildings as documented in *Dendroleon* and *Tricholeon*. Ultimately the cave-dwelling habits of the larva of *T. relictus* probably contributed not only to survive during adverse climatic events of the past but also to colonize the new habitats created by the anthropic activity of the present.

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