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WORMLION *VERMILEO VERMILEO* (L.) (DIPTERA: VERMILEONIDAE) IN SLOVENIA AND CROATIA

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ABSTRACT

The occurrence of the wormlion species Vermileo vermileo (Linnaeus, 1758) is confirmed for the Mediterranean region of Slovenia and Croatia. Its predatory larvae were found in substrates consisting of fine sand or powder, where they construct pitfall traps similar to those of antlions. Wormlion larvae were reared in laboratory to study their biology.

Key words: wormlion, *Vermileo*, Diptera, Slovenia, Croatia

VERMILEONE, *VERMILEO VERMILEO* (L.) (DIPTERA: VERMILEONIDAE), IN SLOVENIA E CROAZIA

SINTESI

La presenza della specie chiamata vermileone, Vermileo vermileo (Linnaeus, 1758), è confermata per la regione mediterranea di Slovenia e Croazia. Le larve predatrici di tale specie sono state trovate in substrati composti da sabbia fine o polvere, dove esse costruiscono trappole a imbuto, simili a quelle dei formicaleone. Le larve di vermileone sono state allevate in laboratorio al fine di studiarne la biologia.

Parole chiave: vermileone, *Vermileo*, Diptera, Slovenia, Croazia

INTRODUCTION

Wormlions (Vermileonidae) constitute the only known dipteran family, whose larvae capture prey by constructing pitfall traps in loose soil (Fig. 1), similar to those in antlions (Neuroptera: Myrmeleontidae) (Wheeler, 1930; Ludwig *et al.*, 1996, 2001). This feature is unique among Diptera.

Adults ("wormflies") are small (about 5 mm long), slender, nearly bare flies with stylate antennae, slender legs, and long, slender abdomen. The wings are narrowed at the base, without an alula or a developed anal angle (Triplehorn & Johnson, 2005). Adults have a life span of only two to five days, and during this period they feed on nectar and mate. Eggs are laid under the surface of fine-grained sand or powder in which the larvae live.

Wormlion larvae have been described by Wheeler (1930) and Ludwig *et al.* (1996, 2001). They have a small, almost completely retracted head capsule. The wormlion larvae are specialized for prey capture, especially their mouthparts and pseudopodium (Ludwig *et al.*, 1996, 2001). The pseudopodium is probably involved in the mechanical detection and seizure of the prey. An abdominal comb composed of a transverse row of long spines is used to anchor the posterior part of the larval body in the sand (Ludwig *et al.*, 2001).

Larvae construct conically shaped pitfall traps in fine dry sands and powders at the bases of cliffs and other locations, protected against rainfall. When different substrates are available, the larvae prefer finest sands with the smallest sand particle size and avoid coarser sand (Devetak, 2008). The larvae build pits by throwing sand with their heads. Once the pit is complete, the larva positions its body across the bottom of the pit, ventral surface up, at or just below the surface where it waits for prey (Petersen & Baker, 2006). When an ant or another small arthropod falls into the trap, it is grasped by the larva, which consumes the prey's softer parts and then throws the carcass out of the pitfall trap. The larvae pupate and about a month later the adults emerge (Teskey, 1981; Petersen & Baker, 2006).

The vermilionids were once placed in the family Rhagionidae, but Nagatomi (1977) gave them family rank. Vermilionidae differ from the rhagionids in having the wings more narrowed at the base and in having apical spurs on the front tibiae (Triplehorn & Johnson, 2005). Griffiths (1994) established a new infraorder, Vermileonomorpha, for vermilionids as no certain relationships with other brachyceran families had been proved (see also Stuckenberg, 2004). Vermilionidae are distributed in the Mediterranean part of Europe, the Middle East, Asia, North and South Africa, and North and Central America (Ludwig *et al.*, 2001). About 55 species in 7 genera are known (Nagatomi *et al.*, 1999).



Fig. 1: Pitfall traps of larvae of the wormlion *Vermileo vermileo* in loose soil in Baška Voda (Dalmatia, Croatia).

Sl. 1: Lijakaste pasti ličink črvastega volkca *Vermileo vermileo* v rahli prsti v Baški Vodi (Dalmacija, Hrvatska).

In the monograph "Živalstvo Slovenije" (Fauna of Slovenia), Sivec *et al.* (2003) mention occurrence of a wormlion *Vermileo vermileo* in Slovenia without citing detailed location. The aim of the study is to provide detailed information on the species in the country and in the neighbouring regions of Croatia.

MATERIAL AND METHODS

Low abundance of adults makes them difficult to collect, so I was focused on the wormlion larvae, which are easily collected by looking for the pits in loose sands and powders. Larvae were taken from their pits by excavating the sand containing the pits with a spoon, and then by sieving the substrate.

Substrate particle size analysis. Mechanical analysis of particle size distribution of substrates from natural habitats was conducted using standard sieves (for details of the method see Devetak, 2008).

Rearing. The wormlion larvae were kept in the laboratory, at room temperature, in plastic containers (60 x 45 x 10 cm) filled with sand from natural habitats. Substrate particle size was ≤ 0.23 mm. Workers of the ant species *Lasius emarginatus* (Olivier) were used as food source for the wormlions. Feeding took place every day and one ant was delivered to each pit.

RESULTS

***Vermileo vermileo* (Linnaeus, 1758)**Material examined

Slovenia:

Osp: 11. VI. 2005, 3 larvae

Piran: 15. VII. 2005, 1 larva; VI. 2006, 3 larvae

Fiesa: 22. V. 2008, 7 larvae

Croatia:

Rovinj: Aquarium, 9. VI. 2005, 4 larvae; 3. VI. 2008
7 larvae

Premantura: 20. VII. 1984, 1 larva

Lošinj: Sv. Jakov, VI. 2000, 2 larvae

Podaca: VII. 2007, 3 larvae

Baška Voda: VIII. 2006 10 larvae; 2 adults emerged
in the laboratory on 10. VI. 2007

All individuals were collected by the author.

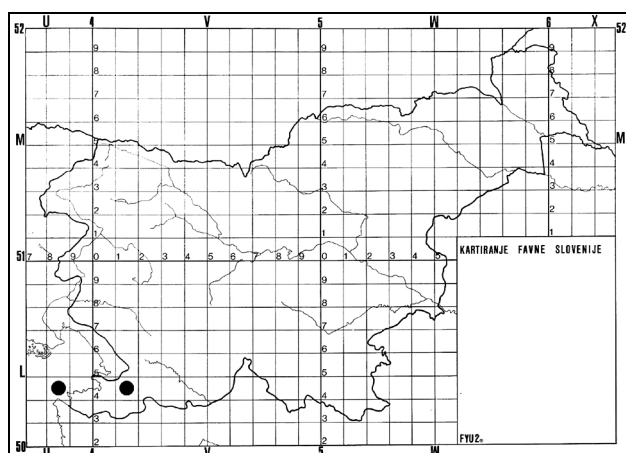


Fig. 2: Distribution of the wormlion *V. vermileo* in Slovenia.

Sl. 2: Razširjenost črvastega volkca *V. vermileo* v Sloveniji.

The distribution of wormlions in Slovenia is shown in figure 2. The larvae built their pits in sands or powders in crevices of stone walls (Piran, Osp; Fig. 3), in fine substrate at the bases of cliffs (Baška Voda, Podaca, Sv. Jakov on the island of Lošinj) or in places under tree crowns protected against rainfall (Fiesa, Rovinj). In Osp, sieving analysis revealed the following particle size composition of the substrate (expressed in weight %): 14.5% represent fraction with particle size ≤ 0.06 mm; 17% fraction 0.06–0.11 mm; 11.5% fraction 0.11–0.23 mm; 36% fraction 0.23–0.54 mm; the rest fractions 0.54–2.2 mm (see also Devetak, 2008).

DISCUSSION

Occurrence of wormlions in Slovenia has been confirmed for the Sub-Mediterranean region. Larvae were often found in substrates in crevices of stone walls, rarely in places under tree crowns. In natural habitats, the wormlion larvae construct their pits in finer substrates than antlion *Euroleon nostras* larvae.

Devetak (2008) tested substrate particle size-preference of *Vermileo vermileo* larvae. The pit-building decision of the larvae of the wormlions was observed in four substrates consisting of different sand fractions (particle sizes: ≤ 0.23 mm; 0.23–0.54 mm; 0.54–1 mm; 1–1.54 mm). Wormlions preferred the finest sand fraction (≤ 0.23 mm) and avoided two coarser fractions (0.54–1 mm; 1–1.54 mm) (Devetak, 2008).

In Piran, Rovinj and Baška Voda, co-existence of wormlions and antlions *Euroleon nostras* was noted (Devetak, 2008). In experiments when two species were placed in the same container with two different substrates, interspecific predation did not occur, but cannibalism in antlions did. In natural habitats, cannibalism in antlions is often recorded (Devetak, 2000) and other insects also prey on antlions. While wormlion larvae readily build pits in the finest sands, antlion larvae prefer coarser sands. Wormlion preference for the finest sands and powders, and antlion preference for sands of medium particle size was confirmed by field observations (Devetak, 2008). In the field it seems that antlions avoid areas inhabited by wormlions, and vice versa. Wormlions and antlions may simply prefer different substrates independent of the presence of heterospecifics.



Fig. 3: Habitat of wormlions in crevices of stone walls in the village of Osp (Slovenia).

Sl. 3: Habitat črvastega volkca v špranjah kamnitega zidu v Ospu (Slovenija).

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ČRVASTI VOLKEC *VERMILEO VERMILEO* (L.) (DIPTERA: VERMILEONIDAE) V SLOVENIJI IN NA HRVAŠKEM

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POVZETEK

Potrjeno je pojavljanje črvastega volkca *Vermileo vermileo* (Linnaeus, 1758) v mediteranskem območju Slovenije in Hrvaške. Predatorske ličinke živijo v substratih iz drobnega peska ali praška, v katerih gradijo lijakaste pasti, podobno kot volkci. Avtor je gojil ličinke črvastega volkca, da bi spremljal njihovo biologijo.

Ključne besede: črvasti volkec, *Vermileo*, dvokrilci, Slovenija, Hrvaška

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