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Limnius stygius sp.nov., the first stygobiontic riffle beetle from the Palearctic Region (Coleoptera: Elmidae)

Carles HERNANDO[1], Pedro AGUILERA[1] & Ignacio RIBERA[2]

[1]Museu de Zoologia, P.O. Box 593, 08080 Barcelona, Spain.
[2]Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK.

HERNANDO, C., AGUILERA, P. & RIBERA, I. 2001. *Limnius stygius* sp.nov., the first stygobiontic riffle beetle from the Palearctic Region (Coleoptera: Elmidae). *Entomol. Probl.* 32 (1): 00 – 00. – The first Palearctic stygobiontic species of Elmidae, *Limnius stygius* sp.nov., is described from a karstic river in SW Morocco. It has the typical morphology of other subterranean elmids: it is weakly pigmented, microphthalmic, brachypterous, with an extended plastron, and has a flattened and slender body. A single male was found in an upwelling zone in an intermittent river, which originates in the nearby cave of Win-Timdouine.

Key words: Elmidae, taxonomy, *Limnius stygius* sp.nov., groundwater, Morocco.

Introduction

Among the stygobiontic beetles, family Elmidae is scarcely represented, with only five species so far recognised: *Troglelmis leleupi* JEANNEL, 1950, from central Africa; *Anommatelmis botosaneanui* SPANGLER, 1981, *Lemalelmis minyops* SPANGLER, 1981 and *L. fontana* SPANGLER, 1981, all three from Haiti; and *Neoelmis sketi* SPANGLER, 1996, from Ecuador (SPANGLER & DECU 1998).

Here we report the first Palearctic species of a stygobiontic elmid, collected in an upwelling zone in an intermittent river in southwest Morocco. Its morphology (very similar to that of other stygobiontic elmids), the habitat (an intermittent river mostly running underground, and originating in a cave) and the accompanying fauna (typical stygobiontic Crustacea) are strong indications of its subterranean habits.

***Limnius stygius* sp.nov.** (Figs. 1 – 6)

Type locality. River Assif Tanit, ca. Immouzèr-des-Ida-Outanane, 30º39'456"N, 9º21'134"W, ca. 30 km NE of Agadir, Morocco.

Type material. Male holotype (Naturhistorisches Museum, Wien): "60 MOROCCO 21.4.2001 / 30º39'456"N 9º21'134"W / Immouzèr-des-Ida-Outanane / Assif Tanit, 550 m. Aguilera, / Hernando, Millan & Ribera leg."

Description. Habitus as in Figs. 1 – 3; 2.0 mm long, 0.8 mm wide. General colour light reddish brown, except a darker ring surrounding the eyes (Fig. 4). Elytra translucent, allowing observation of hind wings and abdominal sternites when submerged in alcohol (Fig. 2). Cuticle apparently well sclerotised. Head with fine, dense punctation, with overlapping punctures giving a rough aspect to the surface. Dorsal surface of head with very short, sparse, decumbent golden setae. Antenna with 11 segments, left antenna broken from 5th segment, distal half of 11th segment of right antenna damaged; slender, antennomeres cylindrical and symmetrical. Eyes flat, reduced, with 10–15 unpigmented ommatidia (Fig. 4), surrounded by a narrow, smooth and shiny area.

Pronotum as long as wide, parallel-sided, slightly convex in lateral view; disk with two longitudinal, straight, well impressed carinae; sides of pronotum finely bordered; anterior angles produced; posterior angles straight; punctation less strong than in head, punctures indistinct, with a rough aspect; pubescence similar to that of head.

Elytra elongated, depressed, maximum width clearly behind middle, approximately double long than wide; eight series of uniform, not very impressed punctures; surface between striae with dense, finely rugose punctation, arranged in small transverse strioles; sides finely bordered; pubescence very short, similar to that of the pronotum; apparently fused. Metasternal wings (seen through elytra by transparency when immersed in alcohol) reduced, only reaching metafemur (Fig. 2).

Ventral surface strongly shagreened. Prosternal apophysis broadly triangular, flat, wide, apex truncated (Fig. 3). Metasternum with a poorly impressed medial longitudinal sulcus; punctation similar to that of prosternum; finely bordered anteriorly. Abdominal sternites with same punctation as rest of body, last sternite acuminate, with longer setae in distal margin.

Plastron formed by small, very dense hydrofuge setae with golden reflections, covering internal side of femora except apical part, ventral side of head (except mouth region), hypomera, pro- meso- and metasternum (except prosternal aphophysis and metasternal plaque), epipleura, all sternites except medial part (Fig. 3). Surface of plastron covered with sparse longer setae.

Legs long and slender; anterior tibiae slightly curved, internal side with a dense narrow fringe of erect setae from

middle region to short before apex, hind tibia with a similar fringe of setae, restricted to apical part. Two hind tarsi, left middle leg, and anterior right tarsus missing. All areas close to fragmented segments darker than rest of the body, showing signs of necrosis and suggesting a pre-mortem damage.

Aedeagus as in Figs 5 – 6, with typical *Limnius* appearance (see OLMI 1976). Parameres broad, with two and one apical setae respectively; median lobe broad, apex acuminate; internal sac with longitudinal striae and papillae.

Distribution. So far known only from the type locality.

Ecology. The single specimen was found in an upwelling zone in an intermittent river, among large cobbles and gravel (Fig. 7). The river originates in the cave of Win-Timdouine some kilometres upstream from the collecting locality, filters in the karstic substratum and runs most of its length underwater, with occasional upwelling zones running on the surface for a few hundred meters (Fig. 8). Only one specimen was found in the pool in which the water came into the surface, despite intensive search in the area for a few hours. It was found together with stygobiontic Crustacea (cirolanids and amphipods, all blind and totally unpigmented). It may be speculated that the loss of four of its six tarsi resulted in the drift of the specimen away of its natural, underground habitat, allowing its collection in the pool in which the river re-surfaced.

Etymology. Stygius (Latin: stygial), pertaining to the river Styx in the Greek Hades (lower world), over which the souls of the dead were ferried. Named in reference to the likely subterranean habits of the species.

Remarks. All characters of the new species agree with that of the genus *Limnius*, except in those related with the likely adaptations to the subterranean environment (namely, lack of pigmentation, slender shape, smaller size, more extended plastron surface, reduced eyes and metasternal wings). According to the external morphology, and admittedly based only in superficial resemblance, *L. surcoufi* (PIC, 1905), from Algeria, seems to be closely related, due to its small size, relatively flat elytra, and similar punctation (although in *L. surcoufi* is still pos-

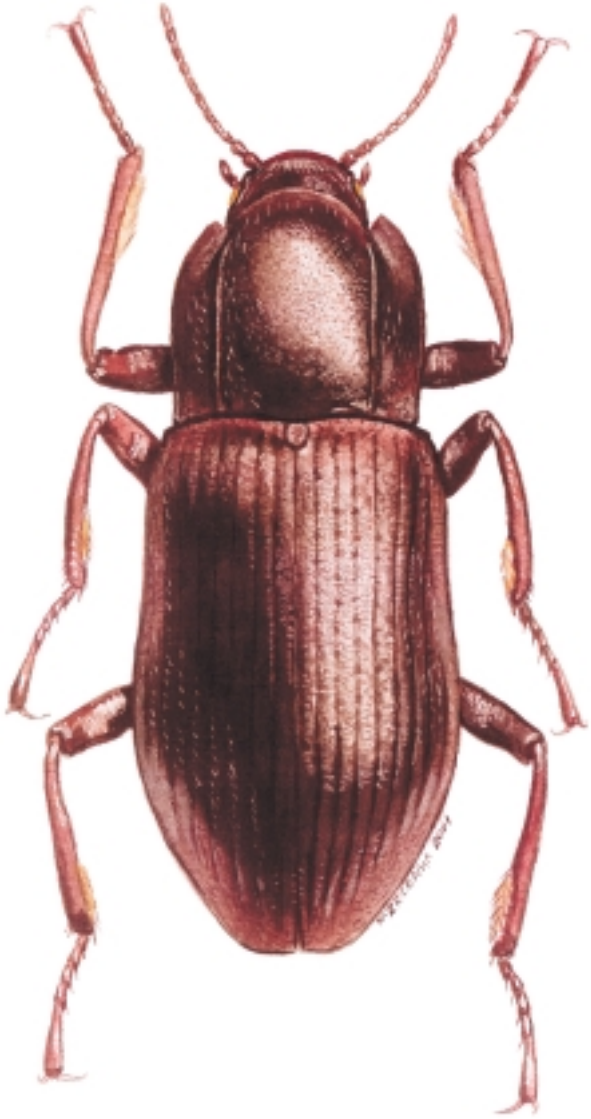


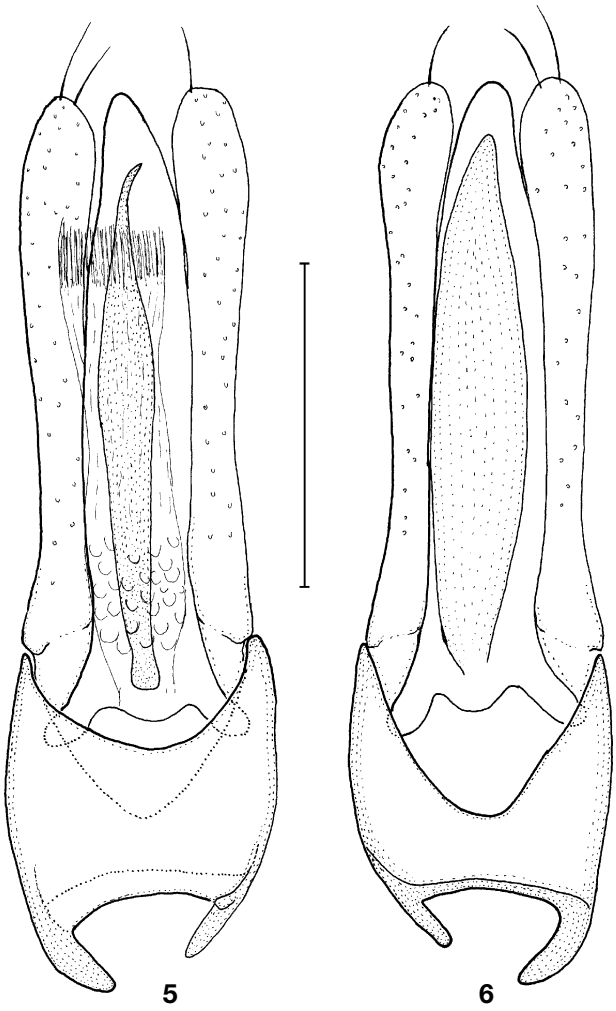
Fig. 1: *Limnius stygius* sp. nov.: habitus of the Holotype. Missing body parts were reconstructed by the artist (W. Zelenka).

Figs 2 – 4: *Limnius stygius* sp. nov: 2), dorsal view, submersed in alcohol; 3) ventral view; 4) head, ventro-lateral view.

sible to distinguish individual punctures). *Limnius surcoufi* has, however, well developed, very convex eyes (> 70 ommatidia); body less parallel, more robust and convex, almost black; pronotum with more impressed striae, with less protruded anterior angles; maximum width of the elytra before the middle, elytral series more impressed; and the fringe of the anterior tibia more developed. On the contrary, based on the morphology of the aedeagus the closest species seem to be *L. volckmari* (PANZER, 1793) and *L. intermedius* FAIRMAIRE, 1881, due to the presence of longitudinal striae and papillae in the median lobe (*L. surcoufi* has transversal striae, see OLMI 1976).

The morphological modifications of *L. stygius* sp.nov. are similar to that of the other known stygobiontic species of the family. All are poorly pigmented, with extended plastron (with the possible exception of *Troglelmis*, which, according to JEANNEL (1953), does not have plastron, something highly unlikely), reduced or absent eyes (between 10 and 25 ommatidia in *Troglelmis*, *Lemalelmis* and *Neoelmis sketi*, anophthalmic in *Anommatelmis*), and with reduced or absent metasternal wings (absent in *Anommatelmis*, *Lemalelmis* and *N. sketi*, brachypterous in *Troglelmis*) (JEANNEL 1950, SPANGLER 1981, 1996).

Some of these species have been found directly in underground water, either in caves (*Troglelmis, N. sketi*) or wells (*Anommatelmis*), while others have been found in springs or in upwellings zones of karstic underground water (both species of *Lemalelmis*, and *L. stygius* sp.nov.). Most of them have also been found in company of stygobiontic Crustacea, mainly Amphipoda and Cirolanidae (as is also the case of *L. stygius* sp.nov.) (JEANNEL 1950, SPANGLER 1981, 1996).



Figs 5 – 6: *Limnius stygius* sp. nov: 5) aedeagus, ventral view; 6) aedeagus, dorsal view (traced from photographs). Scale bar: 100 µm.

Figs 7 – 8: Type locality of *Limnius stygius* sp. nov.: 7) upwelling zone in the Assif Tanit; 8) general view of the river Assif Tanit (mostly dry).

The invasion of the subterranean waters by *L. stygius* sp.nov. is thus not likely to be exceedingly old, based both on its relatively unmodified morphology and its clear relationships within an otherwise completely "surface" genus. This seems to be a general pattern among the few known species of stygobiontic elmids. Contrary to what happens with Dytiscidae, stygobiontic elmids are not strongly deviating from their surface relatives (other than in the characters clearly associated with the subterranean life, see above), and thus their phyletic relationships are more easily established. Despite having been described under separate genera, both *Anommatelmis* and *Lemalelmis* have clear close relationships with some species of the genus *Cylloepus*. In fact, in their description it is suggested that they are derived from an Haitian species of *Cylloepus* (SPANGLER 1981), which would make this genus paraphyletic. *Neoelmis sketi* is part of a genus with otherwise surface species, and *Trogelmis* has also clear relationships with *Protelmis* (JEANNEL 1950), although it this case the diagnostic characters do not exclusively include likely adaptations to the subterranean environment (as is the case of *Anommatelmis* and *Lemalelmis*, see SPANGLER 1981, 1996).

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