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Two new subterranean, microphthalmous trechine beetles from the Mediterranean area, and a synonymic note (Coleoptera: Carabidae, Trechini)

Achille Casale

ABSTRACT

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Duvalius (Bihartrechus) huberi sp. nov. from Southern Turkey (Toros chain, Geyik Dağı Mt.), sampled at high altitude near the snow, is described and illustrated. Its relationships are discussed: in particular, the new species seems to be the adelphotaxon of *D. (B.) bortesii* CASALE & VIGNA TAGLIANTI, 1984, and forms with the latter an isolated, Anatolian lineage within a *Duvalius* group widely spread in the Balkan peninsula and the Carpathians.

Trechus (Trechus) messoulii sp. nov. from Northern Morocco (Rif massif, Taza, Toghobeit cave), sampled in one of the deepest caves of Africa, is described and illustrated. Its morphological features, both external and in male genitalia, are very close to those of *Trechus* of the *fulvus* species group, and of Rifean species currently attributed to genus *Antoinella* JEANNEL.

The significance of these characters, in a both taxonomic and biogeographical context, is discussed, and the new synonymy is here proposed:

Antoinella JEANNEL, 1937 = *Trechus* CLAIRVILLE, 1806, new synonymy.

Keywords: Coleoptera, Carabidae, Trechini, *Duvalius huberi*, new species, Turkey, *Trechus messoulii*, new species, Morocco, *Antoinella*, new synonymy.

Introduction

The discovery of new subterranean taxa in the Euro-Mediterranean area is frequent, and their descriptions are a current, every-day taxonomical practice. Nevertheless, some of these taxa are particularly interesting, because their morphological features, and their geographical patterns of distribution, permit postulating the history and evolution of some lineages, and better understanding the taxonomic position of previously described relatives.

This is the case of two new subterranean, microphthalmous trechine species here described, originating from Southern Turkey (Anatolia, Toros chain) and Northern Morocco (Rif massif), respectively.

Material and methods

The following data come from two examined male individuals (see: Type Material).

Male genitalia were dissected, dehydrated in ethanol, cleared in cold KOH, and examined and illustrated, using standard techniques before being mounted on microscope slides attached to the respective specimens.

Line drawings were made using a camera lucida attached to stereomicroscopes Wild M-3 and Wild M-5, and a microscope Leitz Orthoplan.

Acronyms of measurements:

TL: body Total Length, from the anterior margin of clypeus to the apex of elytra, measured along the suture.

L: overall Length, from apex of mandibles to apex of elytra, measured along the suture.

PL/PW: ratio Length of Pronotum, as linear distance from the anterior to the basal margin, measured along the midline/maximum Width of Pronotum, as greatest transverse distance.

EL/EW: ratio Length of Elytra, as linear distance from the basal ridge to the apex, measured along the suture/maximum Width of Elytra.

Collections:

NMBE Naturhistorisches Museum der Burgergemeinde Bern (Switzerland)

CCa Casale collection, Torino (Italy)

Results

Duvalius (Biharotrechus) huberi sp. nov.

Type locality: Turkey, Southern Anatolia: Geyik Dağı.

Type material :

Holotype ♂ with the following data: "TR – Antalya Geyik Dağı 2600 mt, N 36° 54' E 32° 11' 22.5.2007 leg. C. Huber" (NMBE).

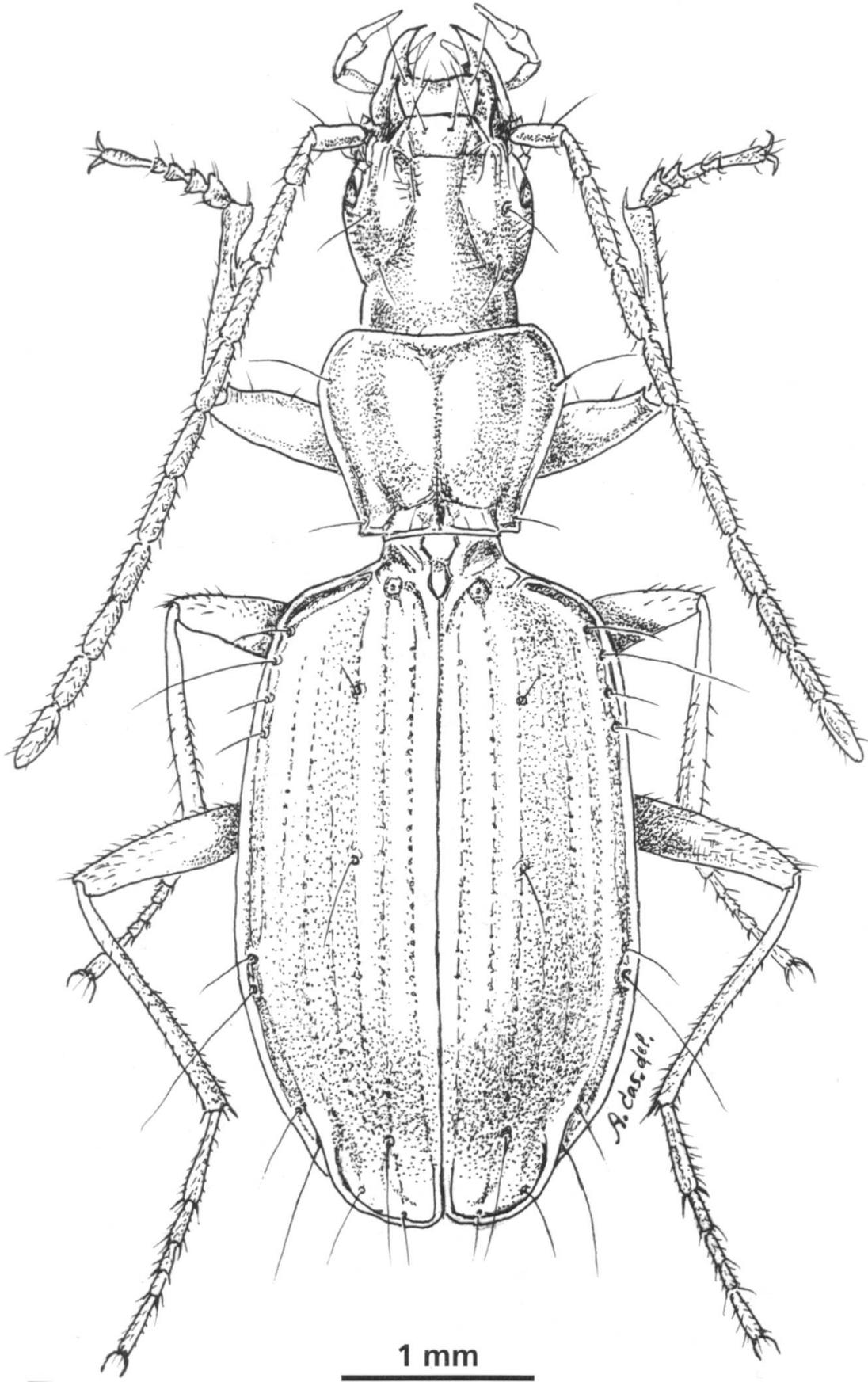


Fig. 1: *Duvalius (Biharotrechus) huberi* sp. nov., male holotype, habitus, dorsal aspect.

Diagnostic features

A medium sized (TL: 5.50 mm), glabrous, depigmented, microphthalmous trechine species (Fig. 1), with the character states of the genus *Duvalius* DELAROUZÉE, 1859 of Subgenus *Biharotrechus* BOKOR, 1922 (*Duvaliotes* JEANNEL, 1928, in the widest sense of Jeannel, 1928), Casale & Laneyrie (1982), and Casale & Vigna Taglianti (1984).

Colour dark reddish. Pronotum cordiform, widened in front, with lateral sides constricted to the base. Elytra elongate, depressed, with humeral angles rounded but evident. Chaetotaxy as in Fig. 1. Male genitalia as in Fig. 2.

Close to *D. (Biharotrechus) bortesii* CASALE & VIGNA TAGLIANTI, 1984, from which is distinguished by several different morphological features (see: Relationships).

Description

General features as in Fig. 1. Medium sized: TL: 5.50 mm ; L: 6.0 mm. Colour dark reddish, with paler yellow reddish palpi, antennae and legs.

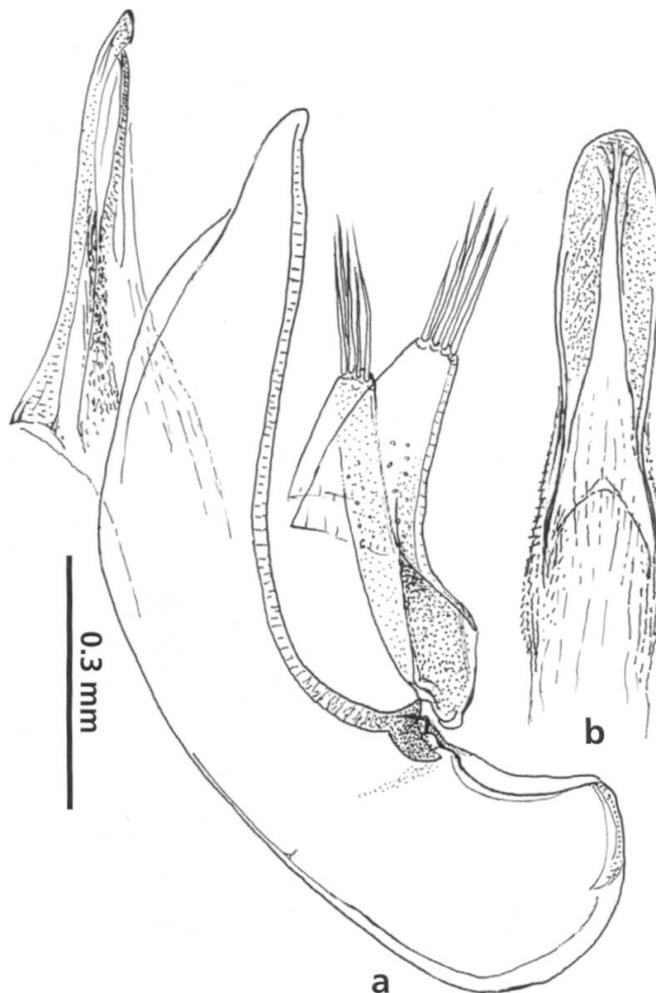
Dorsal surface moderately shiny; transversal cuticular microlines evident on frons and pronotum, scarcely visible as polygonal meshes on elytral intervals.

Head elongate, with frontal furrows markedly impressed, angulate in the anterior third, with evident transversal wrinkles; frons convex; supraorbital setiferous punctures inserted on ranges slightly convergent backwards; eyes small, as long as 1/4 of genae, flat, oblique and whitish, with slightly distinguishable ommatidia, pigmented only at margins; genae regularly curved, convex, with deep transversal wrinkles, narrowed to the neck constriction; labrum slightly emarginate at the anterior side; mentum tooth prominent, emarginate at apex; antennae elongate, exceeding backwards the level of the fourth humeral setiferous puncture.

Pronotum cordiform transverse (PL/PW: 0.80), widest at the anterior third; disc moderately convex; sides markedly arcuate in front, shortly and slightly sinuate towards hind angles, which are evident but not prominent outside; marginal furrows deep; anterior margin gently arcuate, front angles effaced; base straight, slightly emarginate in the centre, fully beaded; basal foveae deep.

Elytra elongate (EL/EW: 1.58), slightly widened at the apical third, much wider than prothorax; disc depressed; humeri rounded but evident, with pre-humeral margins oblique; lateral furrows relatively wide and deep; striae all visible: striae 1–4 much deeper, 5–6 reduced to series of punctures, stria 7

Fig. 2: *Duvalius (Biharotrechus) huberi* sp. nov., male holotype, aedeagus in left lateral aspect (a), copulatory piece in dorsal aspect (b).



almost effaced; apical striola very deep and curved, connected by some points with apex of stria 5; intervals flat; apical carina developed. Chaetotaxy as in Fig. 1: three setiferous discal punctures (two discal, one pre-apical) on stria 3; umbilicate pores 5 and 6 very close to each other; apical and angulo-apical punctures present, forming with the pre-apical puncture an apical triangle.

Legs long, slender; protibiae slightly dilated and sparsely pubescent at apex, each with a long groove on the external side; protarsi in the male each with two basal tarsomeres dilated and denticulate inwards.

Male genitalia as in Fig. 2. Median lobe of aedeagus relatively short (1.08 mm) and thickened, in lateral aspect regularly bent basally and slightly sinuate in the apical third, regularly narrowed at apex; basal bulb large, inflated, with wide basal orifice; sagittal carina absent. Endophallus armed with an elongate, "isotopic" copulatory piece, obliquely truncate at apex in lateral aspect, regularly rounded in dorsal aspect, bifid at base, and a series of small, sclerotized spines that fringe the basal tract of lateral sides of the copulatory piece. Parameres robust, each with five apical setae.

Female genitalia: unknown.

Specific epithet

I wish to dedicate this interesting new species to Dr. Charles Huber, curator of the Entomological Department at the Berne Museum (Switzerland) and well known specialist of carabids of the genus *Nebria*, who sampled with Dr. Werner Marggi the holotype specimen, and offered it to me for study.

Geographical distribution and habitat

The only male individual of the new species here described was sampled on the Northern slope of the Geyik Dağı Mt. (Southern Anatolia, Toros chain, Antalya) by Charles Huber and Werner Marggi at 2600 m of altitude, under stones near the snow (Fig. 3). As many *Duvalius* species of the Euro-Mediterranean area, it is an upper hypogean species in the alpine zone.

Relationships

D. (Biharotrechus) huberi sp. nov. is particularly interesting for both taxonomical and biogeographical aspects.

First, from the taxonomical point of view, it is apparently the first adelphotaxon known so far of *D. (Biharotrechus) bortesii* CASALE & VIGNA TAGLIANTI, 1984 – geographically vicariant in a massif (Bey Dağları Mt., Muğla province) at 80 kms SW of Geyik Dağı – to which it seems related by many morphological features, and the peculiar shape of both median lobe of aedeagus and copulatory piece. From the latter, *D. (Biharotrechus) huberi* sp. nov. is distinguished by the more elongate head, the wider pronotum with basal angles smaller and not prominent; the shorter, more depressed elytra, with shallower and less deeply punctuate striae; and the different shape of aedeagus: in *D. (B.) huberi* sp. nov. the median lobe is shorter and more thickened, and endophallus has reduced sclerotized spines and scales, and much more elongate copulatory piece. It should also be recalled that individuals of *D. (B.) bortesii* were sampled in a pit at 1200 m, whereas *D. huberi* sp. nov. in the alpine zone at 2600 m near the snow. But this datum is scarcely informative: in fact, species with this degree of low specialization to the subterranean environment can be found both in caves at lower altitude and in the shallow hypogean zone at high altitude.

Validity and limits of the Subgenus *Duvaliotes* JEANNEL, 1928, and its distinction from the Subgenus *Duvalidius* JEANNEL, 1928, currently treated as



Fig. 3: *Duvalius (Biharotrechus) huberi* sp. nov., type locality: Geyik Dağı Mt. (Southern Anatolia, Toros chain, Antalya) (a); detail of the habitat (b) (photo C. Huber).

synonyms of *Biharotrechus* BOKOR, 1922, and *Hungarotrechus* BOKOR, 1922, respectively (see Moravec & al. 2003, and Lorenz 2005) have been widely debated by Casale & Vigna Taglianti (1984). What is evident, is the fact that *D. (B.) huberi* sp. nov. and *D. (B.) bortesii* (the latter, described as *Duvaliotes*) form a homogeneous species group, and are so far the only representatives in Southern Anatolia of a lineage widely spread in the Carpathians, the Balkan peninsula and the Dinaric Alps.

Therefore, as shown by Casale & Vigna Taglianti (1999), in Anatolia the genus *Duvalius* includes so far representatives of some different lineages: in the central and eastern Pontic chain, and in eastern Anatolia, some forest dweller or troglomorphic species, all probably belonging to the Caucasian *antoniae* species group. Markedly isolated seem to be *D. bicikensis* PERRAULT, 1971, from the Giresun Dağları, apparently related to the Eastern-European *Hungarotrechus* (*Duvalidius* of authors) complex, and *D. bruschii* VIGNA TAGLIANTI, 1999, probably related to the southern Balkan *krueperi*-group. By contrast, in the Western Toros, the genus is represented by three peculiar, subterranean but oculate species, with very different relationships: *D. bortesii* and *D. huberi* sp. nov., treated in the present contribution, are apparently related to the Balkan *Biharotrechus* lineage; and *D. huetheri* JEANNEL, 1934, present in several caves of Antalya and Muğla provinces, redescribed with different names, is related to the "Southern Aegean" lineage of *D. diaphanus* ROTTENBERG, 1874, and *D. mirei* DEUVE, 2001, both endemic to Mt. Taygetos (Greece, Peloponnesus).

***Trechus (Trechus) messoulii* sp. nov.**

Type locality: Morocco, Rif (Taza): Toghobeit cave.

Type material:

Holotype ♂ with the following data: "Maroc, Rif, Gr. Toghobeit, 25–30.VII. 1999 leg. M. Messouli" (CCa).

Diagnostic features

A small-medium sized (TL: 4.25 mm), glabrous, depigmented, microphthalmous trechine species (Fig. 4), with the character states of the genus *Trechus* CLAIRVILLE, 1806 of the *fulvus* species group in the sense of Jeannel (1927), Casale (1983), Ortuño (2008), Reboleira & al. (2010), and in the widest sense that will be discussed in Conclusions.

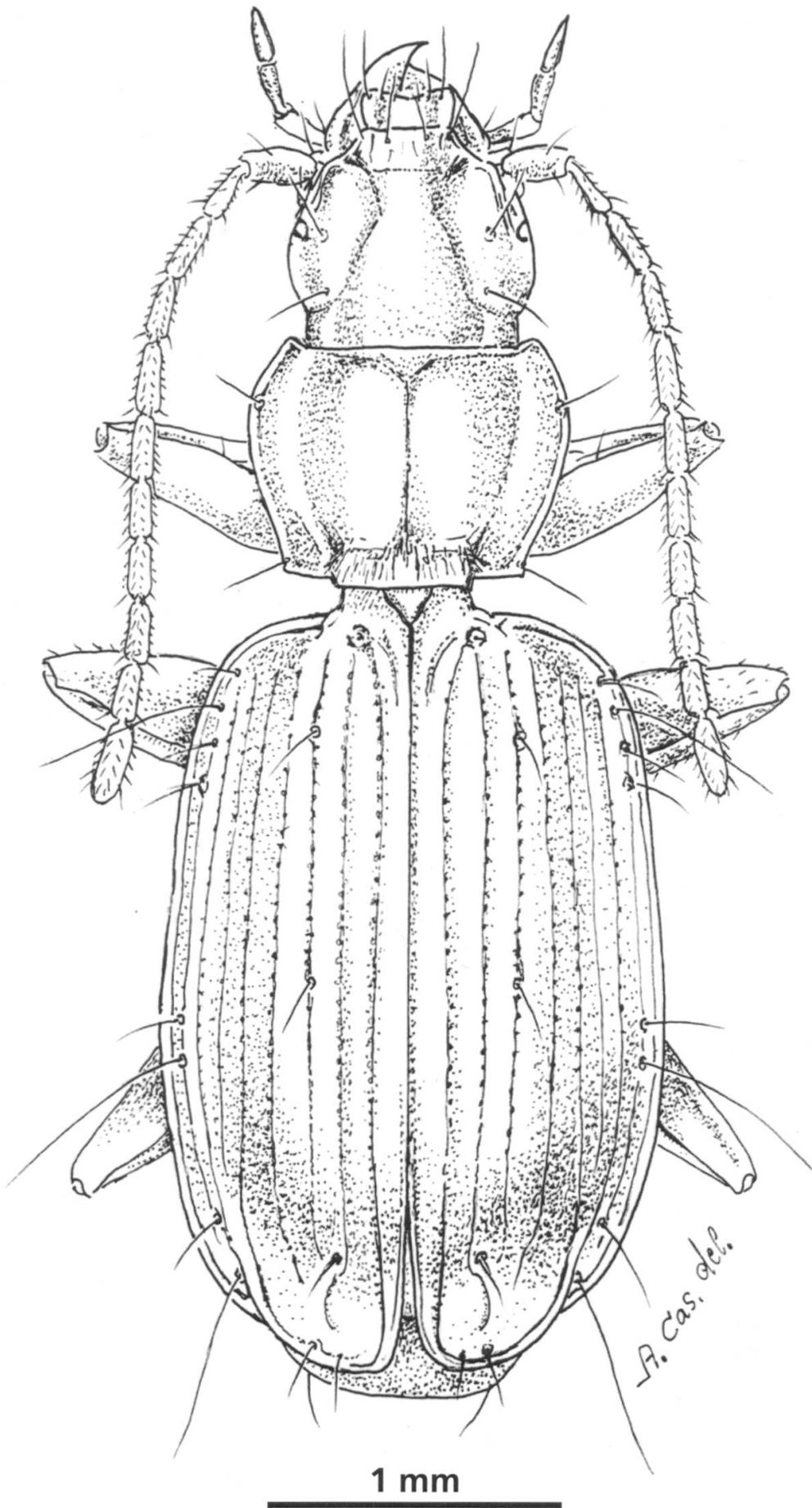


Fig. 4: *Trechus (Trechus) messoulii* sp. nov., male holotype, habitus, dorsal aspect.

Colour dark yellow reddish. Pronotum markedly transverse, widened in front, with lateral sides regularly curved, slightly constricted and sinuate towards hind angles, which are obtuse. Elytra elongate-ovate, widened in the apical third, depressed, with humeral angles rounded. Chaetotaxy as in Fig. 4. Male genitalia as in Fig. 5.

Close to some North African species attributed to the genus *Antoinella* JEANNEL, 1937, in the sense of Casale (1982), Mateu & Comas (2006) and Mateu & Escolà (2006), from which it is recognized by several different morphological features (see: Relationships).

Description

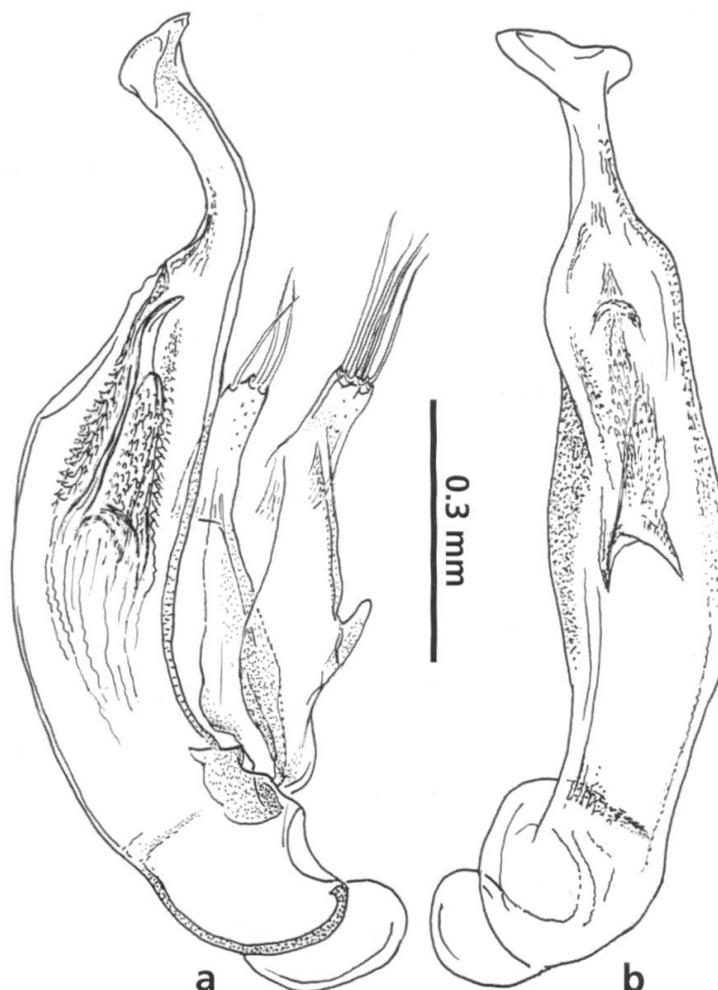
General features as in Fig. 4. Small-medium sized: TL: 4.25 mm; L: 4.50 mm. Colour uniformly dark yellow reddish. Dorsal surface moderately shiny; transversal cuticular microlines evident on frons and pronotum, scarcely visible as polygonal meshes on elytral intervals.

Head robust, stout, with frontal furrows markedly impressed, angulate in the anterior third; frons convex; supraorbital setiferous punctures inserted on ranges slightly convergent backwards; eyes very small, as long as 1/5 of genae, flat, oblique and whitish, with slightly distinguishable ommatidia, pigmented only at margins; genae regularly curved, slightly convex; neck wide, neck constriction moderate; labrum slightly emarginate at the anterior side; mentum tooth slightly scooped-out distally; antennae relatively long, exceeding backwards the level of the fourth humeral setiferous puncture.

Pronotum markedly transverse (PL/PW: 0.74), widened in front; disc convex; sides regularly curved, slightly constricted and shortly sinuate towards hind angles, which are obtuse; marginal furrows narrow and shallow; anterior margin almost straight, front angles effaced; base slightly oblique at sides, not beaded; basal foveae deep; basal area densely wrinkled.

Elytra elongate-ovate (EL/EW 1.47), widened in the apical third, depressed, with humeral angles rounded, widened at the apical third, much wider than prothorax; disc depressed; lateral furrows wide and deep; striae all complete and visible, moderately impressed, punctate; apical striola curved and connected with apex of stria 5; intervals flat; apical carina slightly prominent. Chaetotaxy as in Fig. 4: three setiferous discal punctures (two discal on stria 3, one pre-apical on apex of interval 3); umbilicate pores 5 and 6 very close to each other; apical and angulo-apical punctures present, forming with the pre-apical puncture an apical triangle.

Fig. 5: *Trechus (Trechus) messoulii* sp. nov., male holotype, aedeagus in left lateral aspect (a) and in dorsal aspect (b).



Legs long, slender; femora robust, thickened; protibiae dilated, very shallowly grooved on the external side, and sparsely pubescent at apex; protarsi in the male each with two basal tarsomeres dilated and denticulate inwards.

Male genitalia as in Fig. 5. Median lobe of aedeagus elongate (1.05 mm long, measured from apex to the posterior margin of basal bulb, basal carina excluded), slender, slightly thickened in the middle, markedly narrowed and curved on the dorsal side at apex, with apical lamina asymmetrical widened and ventrally hooked in lateral aspect; basal bulb with big, rounded sagittal carina, not extended on the ventral side of the bulb. Endophallus with complex structure: in left lateral view, it shows a dorsal group of scales that covers a sclerotized piece of subtriangular form; in the inner part, it shows a second sclerotized piece, covered with scarcely sclerotized scales, elongate, narrowed and bent distally. Parameres robust, asymmetrical; left paramere with an elongate, ventral basal lobe on the ventral side (as is typical in *Antoinella* species: see below), with five apical setae; right paramere shorter, with three apical setae.

Female genitalia: unknown.

Specific epithet

I wish to dedicate this interesting new species to Dr. Mohamed Messouli, active speleologist in Marrakesh, who sampled the holotype specimen several years ago, during an expedition with the Spéléo Club of Blois (France), and through our friend Lucien C. Genest offered it to me for study.

Geographical distribution and habitat

The male holotype of this new species was sampled in the cave Toghobeit (Northern Morocco, Rif Massif, Taza, near Chaouen or Chefchaouen). This subterranean system is so far one of the deepest caves of the African continent: located at 1700 m of altitude, its actual depth is -732 m, and the development reaches 3050 m (after: "Inventaire Spéléologique du Maroc", 1981: DC 5, Kef Toghobeit). The only examined individual was collected in the "salle Renner" at -120 m depth, but a second individual (not available at the moment) was collected in the "salle du bivouac" and entrusted to L. C. Genest (Messouli, personal communication).

Relationships

Trechus messoulii sp. nov., for both its external features and peculiar characters of male genitalia – in particular, the structure of copulatory pieces in endophallus (a sclerotized piece of triangular shape, a second elongate piece, and some groups of sclerotized scales) – is close to some *Trechus* species of the *fulvus* species group in the sense of Reboleira & al. (2010) (in particular, for the widened and hooked apical lamina of the median lobe of the aedeagus, it recalls *T. arribasi* JEANNE, 1988, endemic to the Northern Iberian peninsula).

But it is mostly related to Algerian species (Jeannel, 1927; Casale, 1983; Ortuño, 2008) and several subterranean North African species of the Rif massif (Morocco) currently treated as *Antoinella* JEANNEL, 1937 (Casale, 1982; Mateu & Comas, 2006; Mateu & Escolà, 2006). In particular, it seems to be close to *A. iblanensis* MATEU & ESCOLÀ, 2006, and *A. fadriquei* MATEU & ESCOLÀ, 2006. It is, however, markedly distinct by the smaller size (5.8–5.9 mm in *A. iblanensis* and *A. fadriquei*, respectively, about 4.5 mm in *T. messoulii* sp. nov.), and the shape of the median lobe of the aedeagus, which in *T. messoulii* sp. nov. is slender and elongate as in *A. iblanensis*, but shows an apical lamina similar to that of *A. fadriquei*, more curved dorsally and more obtusely truncate.

In this case, the combination of both morphological features and biogeographical considerations allows the following remarks:

1. From the taxonomical point of view, the so-called genus *Antoinella* JEANNEL, 1937, appears as a paraphyletic unit, without any relationships with the genus *Duvalius*. This datum is evident from both morphological features, as already supposed by Jeannel (1937) in the original description of the genus, and supported by Casale (1982, 1983); furthermore, it has been confirmed by a recent molecular phylogeny (Faille & al. 2010). Therefore, either it will be demonstrated that *Trechus* is a polyphyletic unit, and in this case the *T. fulvus* species group should merit the genus rank (named *Antoinella*), or the latter is a simple lineage within this group, and an objective junior synonym of *Trechus* (in the widest sense).
2. The only current distinctive character between *Antoinella* and *Trechus* of the *fulvus* species group, i.e. protibiae pubescent in *Antoinella* (as in *Duvalius* species), and glabrous in *Trechus*, is not a constant diagnostic feature: Reboleira & al. (2010) for instance, who have just described *T. tatai* from Portugal, specified that it has "conspicuously hairy (including the protibiae)" legs. Furthermore, the structure of the median lobe of aedeagus, endophallus, and asymmetrical parameres (the left one with an elongate, ventral basal lobe on the ventral side) is absolutely the same both in *Antoinella* species and in some Algerian *Trechus* of the *fulvus* species group, as illustrated by Jeannel (1927) and Casale (1983).
3. Finally Ortuño (2008) and Reboleira & al. (2010), in their excellent contributions, exhaustively showed that the *T. fulvus* species group, in its wide distribution along North Africa, the Iberian Peninsula and, thanks to the wide distribution of *T. fulvus*, also along the Atlantic coast of northern Europe (Jeannel 1927), is heterogeneous, and includes at least two lineages.

In this context, it is evident that the so-called *Antoinella* species, with the *martinezi*-lineage (sensu Ortuño & Arillo 2005; Ortuño 2008), form a typical subterranean lineage within the *Trechus fulvus* species group, which has survived in the south-western Mediterranean region. The present distribution of extant species suggests a Betic-Rifean origin (see also Ortuño 2008: fig. 4), with strong biogeographical coherence: a well known case in entomological literature. Another interesting fact is the surprising speciosity of this group in the Rif massif: in fact every cave, so far, revealed a separate species markedly distinct from its relatives, all with markedly reduced eyes, depigmented integument, and other troglomorphic features.

In conclusion, the following **new synonymy** is proposed:

Antoinella JEANNEL, 1937 (type species: *Duvalius groubei* ANTOINE, 1935)
junior synonym of *Trechus* CLAIRVILLE, 1806 (type species : *Carabus rubens*
FABRICIUS sensu CLAIRVILLE, 1806 = *Carabus quadristriatus* SCHRANK, 1781)

A separate question is the validity and rank of *Irinea* MATEU & COMAS, 2006, described as subgenus of *Antoinella*. The type species, *A. (I.) aurouxi* MATEU & COMAS, 2006, shows marked distinctive features: in particular, only one basal tarsomere is dilated in fore tarsi of males, median lobe of aedeagus without basal sagittal carina – typically present in all "*Antoinella*" species and *Trechus* of the *fulvus* species group – and endophallus of simple structure, with only one small copulatory piece.

Nevertheless, these characters are not unique and peculiar to *Irinea*, but present in several species attributed to *Trechus* in the current (and widest) sense. In a contribution dedicated to the Ethiopian *Trechus* species, Ortuño & Novoa (in press) discuss the sexual dimorphism in species of this genus, and stress that the occurrence of a single dilated articulation on the protarsus in males is present in the Nearctic subgenus *Microtrechus* JEANNEL, 1927, in *Trechus (Atlantotrechus) cautus* WOLLASTON, 1854, from Madeira and in some Ethiopian species (Ortuño, personal communication; Pawlowski 2003). Furthermore, it must be recalled that recently Vigna Taglianti & Magrini (2009) described the subgenus *Minitrechus* for *Trechus gypaeti*, new species from Ethiopia, in which only one basal tarsomere is dilated in fore tarsi of males. Therefore, given that the apomorphy of a single dilated tarsomere in males appears sporadically in *Trechus* belonging to different lineages and in different areas, this character seems not a valid characteristic able to distinguish just one group within *Trechus* in the widest sense (Ortuño & Novoa, in press; Ortuño, personal communication).

Therefore taxonomic position, validity, and phylogenetic relationships of *Irinea* merit further investigation.

Acknowledgements

For the material and information on which the present descriptions are based, I am particularly indebted to my colleagues Charles Huber (Bern, Switzerland) and Werner Marggi (Thun, Switzerland), and Mohamed Messouli (Marrakesh, Morocco). For notes, suggestions and information on *Trechus* of the *fulvus* species group, I am very grateful to Vicente Ortuño (Madrid, Spain), well known specialist of Trechini of the Iberian Peninsula and Northern Africa, who kindly

and amicably authorized me to anticipate some results of a not yet published contribution. Finally, for their constant help in the laboratory, I wish to thank my collaborators Ivo Manca and Paolo Marcia (Sassari, Italy).

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