NAT. CROAT. | VOL. 13 | No 4 | 301–317 | ZAGREB | December 31, 2004

original scientific paper / izvorni znanstveni rad

THREE NEW SPECIES AND ONE NEW GENUS OF ULTRASPECIALIZED CAVE DWELLING LEPTODIRINAE FROM CROATIA (COLEOPTERA, CHOLEVIDAE)

ACHILLE CASALE[1], PIER MAURO GIACHINO[2] & BRANKO JALŽIĆ[3]

[1]Dipartimento di Zoologia e Antropologia Biologica dell'Università, Via Muroni 25, 07100 Sassari, Italy

[2]Settore Fitosanitario Regionale, Environment Park, Palazzina A2, Via Livorno 60, 10144 Torino, Italy

[3]Department of Zoology, Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia

Casale, A., Giachino, P. M. & Jalžić, B.: Three new species and one new genus of ultraspecialized cave dwelling Leptodirinae from Croatia (Coleoptera, Cholevidae). Nat. Croat., Vol. 13, No. 4., 301–317, 2004, Zagreb.

Croatodirus casalei Giachino & Jalžić, new species from N Velebit, Lubenovac, Slovačka jama pothole, and *C. ozimeci* Casale, Giachino & Jalžić new species, from Lokve, Lokvarka špilja cave, are described. The morphological features of the new taxa are compared with those of the type species of the genus (*C. bozicevici* Casale, Giachino & Jalžić, 2000). The genus is confirmed as a homogeneous, well characterized and monophyletic unit, and is attributed to the phyletic lineage of *Anthroherpon*.

Velebitodromus, new genus, *smidai* new species, is described from N Velebit, Lubenovac, Mali kuk, Slovačka jama pothole. Owing to both external features and structures of male and female genitalia, the genus is attributed to the phyletic lineage of *Anthroherpon*, and is recognized as related to the genera *Anthroherpon* Reitter, 1889, and *Paranthrophilon* Reitter, 1889.

Key words: Coleoptera, Cholevidae, troglobitic, cave, Croatia

Casale, A., Giachino, P. M. & Jalžić, B.: Tri nove vrste i jedan novi rod ultraspecijaliziranih špiljskih leptodirina iz Hrvatske (Coleoptera, Cholevidae). Nat. Croat., Vol. 13, No. 4., 301–317, 2004, Zagreb.

U radu su opisane *Croatodirus casalei* Giachino & Jalžić, nova vrsta sa Sjevernog Velebita (Lubenovac, Mali kuk, Slovačka jama) i *C. ozimeci* Casale, Giachino & Jalžić, nova vrsta iz Lokava (špilja Lokvarka). Njihova morfološka svojstva uspoređuju se s onima tipske vrste ovog roda (*C. bozicevici*

Casale, Giachino & Jalžić, 2000). Rod se potvrđuje kao homogen, jasno raspoznatljiv i monofiletički, te je pridodan filetičkoj liniji *Anthroherpon*.

Novi rod *Velebitodromus* s novom vrstom *smidai* opisan je također sa Sjevernog Velebita (Lubenovac, Slovačka jama). Zbog vanjskih osobina i zbog građe muških i ženskih genitalija, rod je pridodan filetičkoj liniji *Anthroherpon*, i prepoznaje se kao srodan rodovima *Anthroherpon* Reitter, 1889 i *Paranthrophilon* Reitter, 1889.

Ključne riječi: Coleoptera, Cholevidae, troglobiont, špilja, Hrvatska

INTRODUCTION

The richness and the high interest of the subterranean fauna of the Dinaric area are a well known fact. Nevertheless, as has been recently pointed out (CASALE *et al.*, 2000b), in spite of extensive investigations in the last two centuries (NONVEILLER, 1999), discoveries of new, ultraspecialized taxa in this region have markedly increased in recent years, thanks to investigations performed by local speleologists in very deep, previously unexplored caves (see, for instance, NONVEILLER & PAVIČEVIĆ, 1999; PERREAU, 1999; MORAVEC & MLEJNEK, 2002).

The present contribution deals with the description of two new species of leptodirine beetles that, owing to their character states, can be attributed to the genus *Croatodirus* Casale, Giachino & Jalžić, 2000 recently proposed as a monobasic genus. Thus, the genus is confirmed as a valid, monophyletic and homogeneous unit, including so far three well characterized, allopatric, troglobitic species.

Furthermore, a new ultraspecialized leptodirine beetle from a cave in the Velebit chain is described: owing to the peculiar character state, it is attributed to a new genus of the phyletic series of *Anthroherpon*.

MATERIALS AND METHODS

The following acronyms for type material have been used:

HT: Holotype

PT, PTT: Paratype(s)

The following abbreviations for morphological measurements and ratios have been used:

tl: total length, from the anterior apex of head (in natural position) to apex of elytra

a/l: antennal elongation index = antennal length/pronotum length + elytral length

pw/l: width/length of pronotum

ew/l: width/length of elytra

Specimens are deposited in collections identified by the following acronyms:

CNHM: Coll. Jalžić in Croatian Natural History Museum, Zagreb

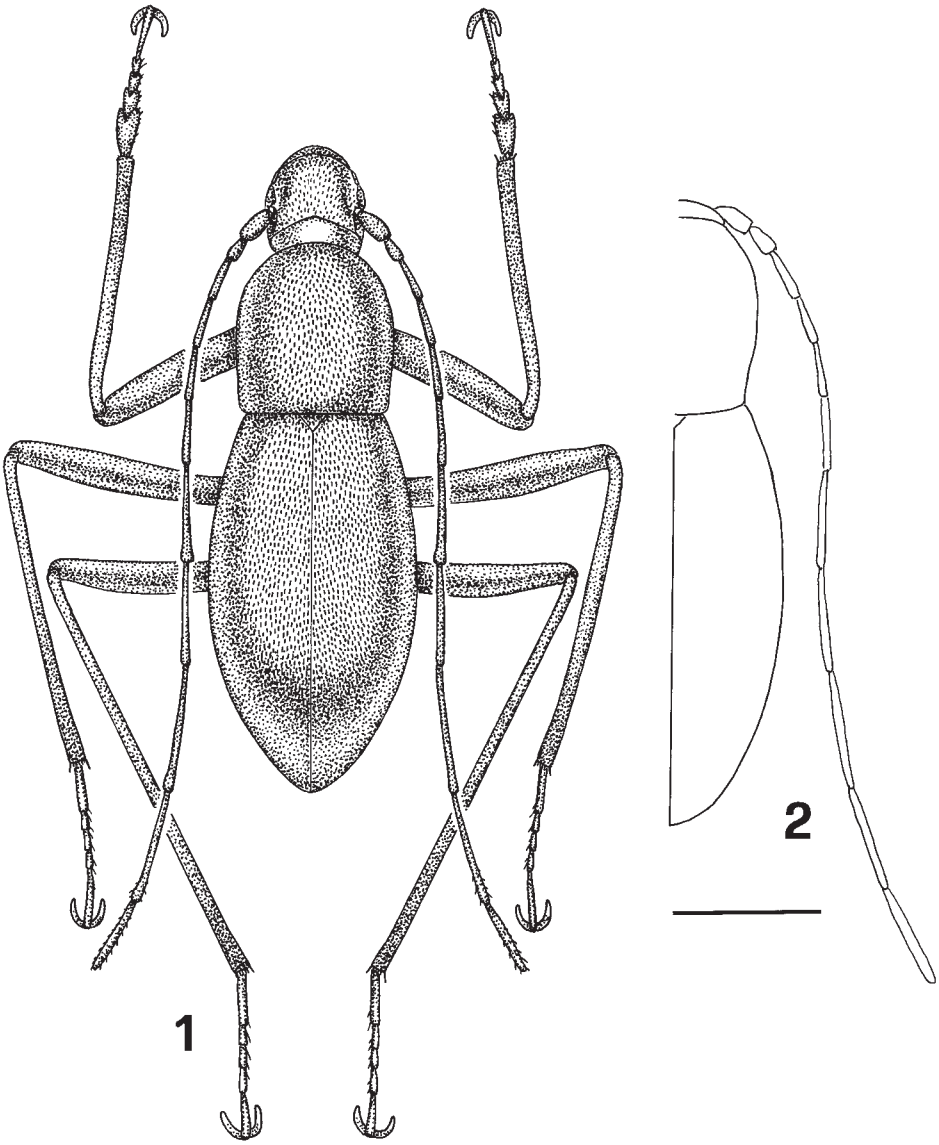
CCa: Coll. Casale, Torino

CGi: Coll. Giachino, Torino

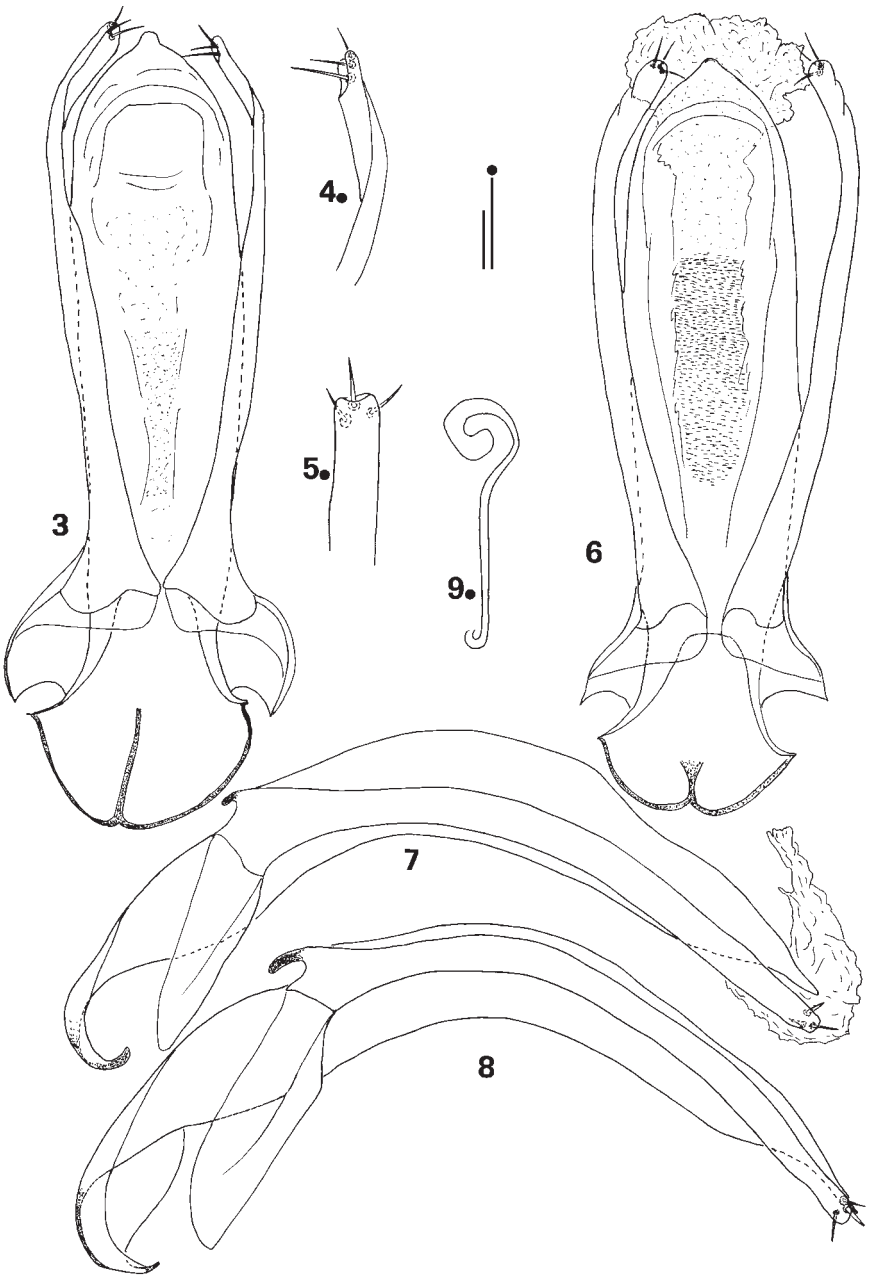
Croatodirus casalei Giachino & Jalžić n. sp. (Figs. 1, 3, 4, 5, 8, 9, 9a)

Loc. Typ.: Croatia, N Velebit, Lubenovac, Slovačka jama, WK06

Type material: HT ♂, Hrvatska, N Velebit, Lubenovac, Slovačka jama, 6.VIII.1998, B. Jalžić leg. (CNHM). PTT: 1 ♀, remnants of 1 specimen ♂ and remnants of 3 speci-



Figs. 1–2. *Croatodirus* spp.: habitus (HT ♂). 1) *C. casalei* n. sp.; 2) *C. ozimeci* n. sp. Scale: 1 mm.



Figs. 3–9. *Croatodirus* spp.: aedeagus and spermatheca. *C. casalei* n. sp.: 3) aedeagus dorsal view (HT ♂); 8) aedeagus lateral view (HT ♂); 4) left paramere, dorsal view (HT ♂); 5) right paramere, lateral view (HT ♂); 9) spermatheca (PT ♀). *C. ozimeci* n. sp.: 6) aedeagus dorsal view (HT ♂); 7) aedeagus lateral view (HT ♂). Scale: 0.1 mm.

mens, Croatia, N Velebit, Lubenovac, Slovačka jama, 6.VIII.1998, B. Jalžić leg.; remnants of 2 specimens, Croatia, N Velebit, Lubenovac, Slovačka jama, 26.X.1996, B. Jalžić leg.; 1 ♂ 1 ♀, Croatia, N Velebit, Lubenovac, Slovačka jama, 03.VIII.2002, B. Jalžić leg. (CNHM, CCa, CGi).

Diagnosis

A medium sized (mm 4.37–5.8) *Croatodirus* species closely related to *C. bozicevici* Casale, Giachino & Jalžić, 2000, type species of the genus, and *C. ozimeci* n. sp., described below. It is markedly separated from *C. bozicevici* by the following combination of morphological features: larger size, pronotum less elongate, antennae markedly longer, and different structure of aedeagus the median lobe of which, in dorsal view, is distally non-truncate and, in lateral view, more regularly arcuate. It is markedly distinct from *C. ozimeci* Casale, Giachino & Jalžić, n. sp., described below, by the following combination of morphological features: antennae more elongate, with antennomere 11 shorter than 10, pronotum with lateral sides slightly sinuate basally, elytra acutely attenuate, not truncate at apex, and different structure of aedeagus with median lobe, in dorsal view, markedly protruding and, in lateral view, not sinuate at the apical third and distinctly longer than parameres.

Description

A medium sized (tl: mm 4.37 – 5.41 ♂♂; 4.90 – 5.80 ♀♀), pholeuonoid, highly specialized leptodirine beetle. Colour dark reddish, integument opaque, pubescent.

Head elongate, not retractile, anophthalmous, without occipital carina. Mouth parts taking long setae, i.e. for filtering water and organic matter. Antennae very long and slender (a/l: 1.44 ♂, 1.38 ♀).

Antennomere ratio:

HT ♂: 4.98; 2.94; 5.28; 6.16; 6.74; 7.63; 12.32; 12.90; 16.42; 14.66; 9.97

PT ♀: 4.63; 3.38; 5.53; 5.86; 6.76; 8.92; 13.53; 13.53; 15.40; 13.23; 9.23

Pronotum large in size, slightly longer than wide (pw/l: 0.84 ♂; 0.82 ♀), with its maximum width just before the middle, slightly constricted to the base; lateral sides regularly rounded anteriorly, slightly sinuate basally, with hind angles obtuse but evident; basal margin wider than the base of elytra. Disc subconvex, covered by dense, short, decumbent pubescence.

Pterothorax not pedunculate. Mesosternal carina absent; mesocoxal cavities contiguous.

Elytra elongate-ovate, distally attenuate, stouter in females (ew/l: 0.54 – 0.59 ♂♂; 0.57 – 0.59 ♀♀), with maximum width at the middle. Microsculpture not forming transversal rows; disc very convex, with short, thin pubescence; sutural stria absent.

Legs very long and slender, with femora thickened basally. Protibiae widened at apex, without apical comb and outer and inner spurs, meso- and metatibiae with inner, unifid apical spur and apical row of short apical spines; tarsal claws long, slightly widened. Male protarsi 5-segmented, with three basal tarsomeres dilated.

Male genital segment reduced in size. Aedeagus (Figs. 3, 4, 5, 8) medium sized, stout; basal lamina of median lobe very arcuate, curly shaped, with a little evident

ventral carina. Median lobe, in dorsal view, with protruding, tongue-like apex; in lateral view regularly arcuate, slightly depressed dorsally in the apical third, distally acuminate. Parameres as long as the median lobe, each furnished with three short setae (one in apical position, the others in pre-apical position, respectively), similar in size and length. Inner sac unarmed.

Fig. 9a. *Croatodirus casalei* from Slovačka jama, depth –1200 m (Photo: B. Jalžić)

Female genital segment membranous, ovipositor fully atrophied, ventrite slightly sclerotized and furnished with a group of short, thickened setae on each side. Spermatheca (Fig. 9) ialine, tubular, ductus like.

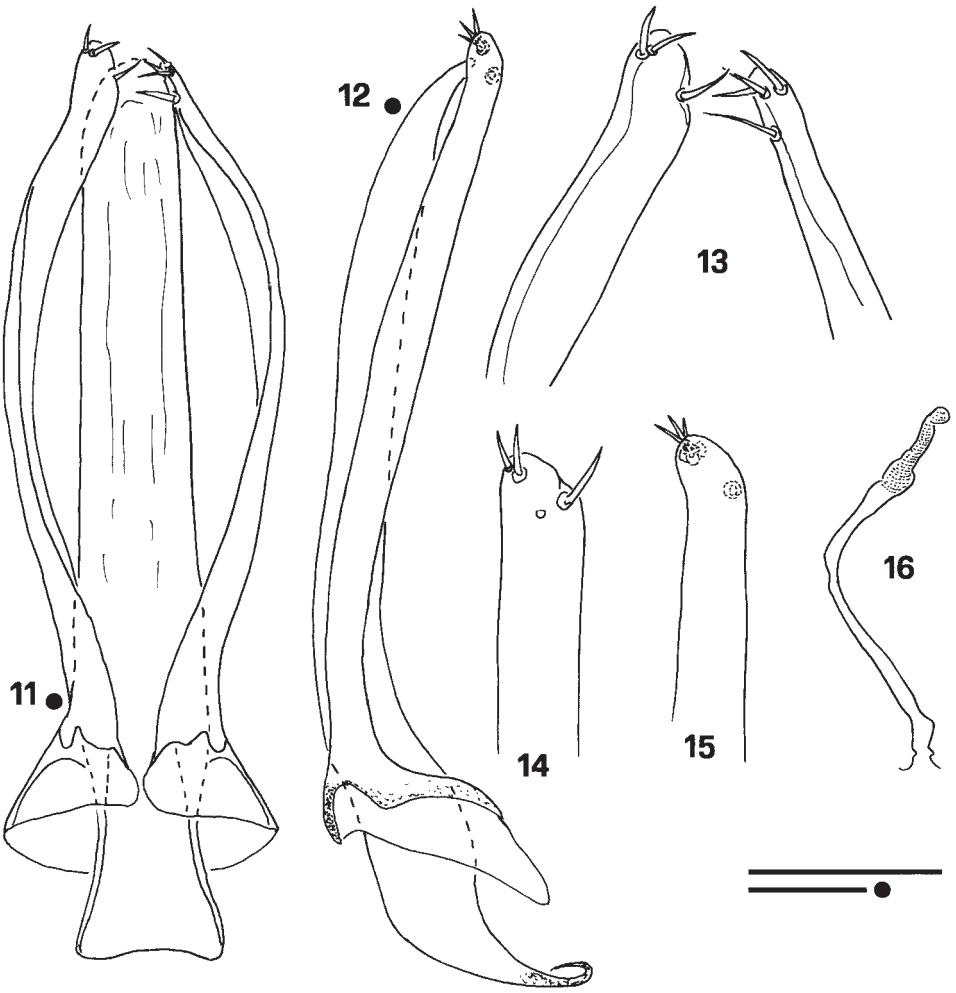
Etymology

The new species is dedicated in friendship by Pier Mauro Giachino and Branko Jalžić to Achille Casale, in recognition of his enthusiastic activity in the study of subterranean organisms.

Croatodirus ozimeci Casale, Giachino & Jalžić n. sp. (Figs. 2, 6, 7)

Loc. Typ.: Croatia, Lokve, Lokvarka špilja, VL82

Type material: HT ♂, Croatia, Lokve, Lokvarka špilja, 12.IX.1996, R. Ozimec leg. (CNHM).



Figs. 11–16. *Velebitodromus* (nov. gen.) *smidai* n. sp.: 11) aedeagus dorsal view (HT ♂); 12) aedeagus lateral view (HT ♂); 13) right and left parameres, dorsal view (HT ♂); 14) right paramere, lateral view (HT ♂); 15) left paramere, lateral view (HT ♂); 16) spermatheca (PT ♀). Scale: 0.1 mm.

Diagnosis

A *Croatodirus* species closely related to the other species of the genus (*C. bozicevici* e *C. casalei*) known so far. It is markedly distinct from *C. bozicevici* by its larger size (mm 4.02 in *ozimeci*, male holotype, mm 3.48–3.52 in *bozicevici*), the much more elongate antennae, the less elongate, basally sinuate pronotum, the elytra more rounded apically; furthermore, the median lobe of the aedeagus is obtusely rounded, not

Fig. 17. Map of Croatia. 1. Kaverna cave in the Učka Tunnel (*Croatodirus bozicevici*) 2. Lokvarka cave (*C. ozimeci*) 3. Lukina jama – Trojama pothole system (*Velebitodromus smidai*) 4. Slovačka jama pothole (*C. casalei*, *V. smidai*)

sub-truncate distally in dorsal view, and less arcuate in lateral view. From *C. casalei* it differs by the shorter antennae, the different shape of the pronotum, with lateral sides shortly sinuate basally, the less abruptly attenuate elytra, and the different shape of aedeagus, the median lobe of which is obtusely attenuate at apex, distinctly shorter than parameres, and markedly sinuate at the apical third in lateral view.

Description of the holotype ♂

A medium sized (tl: mm 4.02), pholeuonoid, highly specialized leptodirine beetle. Colour dark reddish, integument opaque, pubescent.

Head elongate, not retractile, anophthalmous, without occipital carina. Mouth parts taking long setae, i.e. got filtering water and organic matter. Antennae very long and slender (a/l: 1.33).

Antennomere ratio:

HT ♂: 4.57; 4.00; 6.28; 5.72; 6.57; 9.14; 12.02; 12.57; 14.57; 13.14; 11.42

Pronotum large in size, moderately longer than wide (pw/l: 0.85), with its maximum width at the middle, slightly constricted to the base; lateral sides regularly rounded anteriorly, distinctly sinuate basally, with hind angles obtuse but evident; basal margin as wide as the base of elytra. Disc subconvex, covered by dense, short, decumbent pubescence.

Pterothorax not pedunculate. Mesosternal carina absent; mesocoxal cavities contiguous.

Elytra elongate ovate, truncate at apex, (ew/l: 0.54), with maximum width at middle. Microsculpture not forming transversal rows; disc very convex, with short, thin pubescence; sutural stria absent.

Legs very long and slender, with femora thickened basally. Protibiae widened at apex, without apical comb and outer and inner spurs, meso- and metatibiae with inner unifid apical spur and apical row of short apical spines; tarsal claws long and slightly widened. Male protarsi 5-segmented, with three dilated basal tarsomeres.

Male genital segment reduced in size. Aedeagus (Figs. 6–7) medium sized, stout; basal lamina of median lobe very arcuate, curly shaped, with a little evident ventral carina. Median lobe, in dorsal view, slightly protruding at apex with a short, rounded lobe; in lateral view moderately arcuate, markedly depressed dorsally in the apical third, acuminate at apex. Parameres slightly longer than the median lobe, each furnished with three short setae (one apical, the others pre-apical, respectively), similar in size and length. Inner sac unarmed.

Female unknown.

Etymology

The new species is dedicated in friendship to Roman Ozimec, in recognition of his enthusiastic investigations of the subterranean fauna of Croatia.

Distribution and ecology of genus *Croatodirus*

Although first and so far the only finding of one specimen of the genus *Croatodirus* (*C. ozimeci*) is connected to the Lokvarka cave (Fig. 17/2), this new genus was described only after the finding of a larger population of another species (*C. bozicevici*) in the Kaverna cave in the Učka Tunnel (Fig. 17/1). The latest locality where the genus *Croatodirus* and the new species (*C. casalei*) were found is the Slovačka jama pothole (Fig. 17/4).

All the specimens were found mostly at places where water drains (hygropetric), or very near to such places. The general features of the body, and modified, setose mouth parts, suggest also for these beetles a »hadesian« way of life, i.e. it is adapted to filtering water and organic matter on stalagmitic walls, such as supposed for

other highly specialized cholevids like *Hadesia vasiceki* by JEANNEL (1924) and *Radziella styx*, CASALE & JALŽIĆ (1988), CASALE *et al*. (2000a).

They are more likely to be found at the greater depths, where the flow of the water from the surface is more constant.

The ecological characteristics of the Kaverna cave in the Učka Tunnel (loc. typ.) with a list of its registered fauna have been given along with description of the genus and species (CASALE *et al*., 2000b).

Lokvarka špilja (loc. typ.)

Length of the cave 1200 m

Depth 275 m

The upper part of the cave is accessible to tourists. After the discovery of the lower part, large subterranean spaces with a strong water flow were found. *C. ozimeci* was found in the vertical part of the cave, which connects the upper to the lower part. In this particular part, only a smaller water flow occurs, formed by the drainage water.

The air temperature in this part is ca 8 °C. In the lower part the air temperature is 9.6 °C and water temperature 4.6 °C.

The list of the taxa found in the Lokvarka cave:

GASTROPODA
Zospeum kusceri (A. J. Wagner, 1912)

HIRUDINEA
? *Dina* sp.

AMPHIPODA
Niphargus sp.

ISOPODA
Alpioniscus strasseri Verhoeff, 1927
Titanethes dahli Verhoeff, 1926

ARANEAE
Parastalita stygia (Joseph, 1882)
Nesticus cellulans (Clerck, 1757)

PSEUDOSCORPIONES
Chthonius spelaeophilus Hadži, 1930
Neobisium stygium Beier, 1931

DIPLOPODA
?Attemsia coniuncta Strasser, 1966
Brachydesmus inferus inferus Latzel, 1884
Brachydesmus subterraneus Heller, 1858

DIPLURA
Plusiocampa cfr. nivea

COLEOPTERA
Anophthalmus kerteszi kerteszi Csiki, 1912
Typhlotrechus bilimeki (Sturm, 1848)
Bathyscimorphus byssinus Schiödte, 1848
Parapropus sericeus stilleri (Reitter, 1914)
Leptodirus hochenwarti croaticus Pretner, 1955
Croatodirus ozimeci n.sp.
Leptinus testaceus Müller, 1817

ORTHOPTERA
Troglophilus cavicola (Kollar, 1833)
Troglophilus neglectus (Kraus, 1879)

CHIROPTERA
Rhinolophus ferrumequinum (Schreber, 1774)

GENERAL REMARKS ON THE GENUS *CROATODIRUS*

As recalled in the introduction to this paper, the discovery of two new species that, owing to their character state, can be attributed to the recently described genus *Croatodirus* (CASALE *et al*., 2000b), is interesting from several points of view.

First of all the genus, previously monobasic, appears now to be a monophyletic, homogeneous taxon, including three allopatric species. Furthermore the genus, the relationships of which were unclear at time of the original description, seems now confirmed as a member of the phyletic lineage of *Anthroherpon* (sensu CASALE *et al*., 1991, and GIACHINO *et al*., 1998) (Anthroherponina of PERREAU, 2000 = Antroherponina of authors).

Second, the relationships among the three specific taxa appear clear from several morphological features illustrated above. In particular *C. casalei*, which is the most isolated species from the geographical point of view, presents the most evident diagnostic features in comparison with the other two species of the genus, although *C. bozicevici* and *C. ozimeci* appear more closely related each to other.

Finally, a general fact well known in ultraspecialized cave dwelling Leptodirinae has been confirmed in *Croatodirus*: in this genus too, the morphological features of male genitalia are very homogeneous, although the diagnostic characters among the different species are much more evident, sometimes impressive, in body shape and antennal length (see, as paradigmatic examples, the genera *Apholeuonus* Reitter, 1889 and *Anthroherpon* Reitter, 1889: GIACHINO & GUÉORGUIEV, 1993; 1995).

Velebitodromus Casale, Giachino, Jalžić nov. gen.

Type species: *Velebitodromus smidai* n. sp.

Diagnosis and description

A genus of small-medium sized, eyeless, pubescent, infraflagellate Leptodirinae (sensu CASALE *et al*., 1991 and GIACHINO *et al*. 1998; = section Antroherpona of JEANNEL, 1924; Antroherponina of GUÉORGUIEV, 1976, and NEWTON, 1998 = subtribus Antroherponina of PERREAU, 2000) with sub-leptodiroid body, large, subrectangular pronotum, ovate elytra, and antennae longer than the body length.

Head elongate, not retractile, without occipital carina; clypeus and labrum with dense, long pubescence. Penultimate labial palpomere long and apically dilated; apical palpomere very short. Antennae inserted on the posterior 3rd of head, very long, similar in both sexes, and widely exceeding the elytron apex; antennomere 1 widened, longer than antennomere 2; antennomere 11 shorter than antennomere 10.

Pronotum large, with its maximum width just before the middle, subrectangular in shape; lateral sides regularly rounded anteriorly, distinctly sinuated basally, with hind angles obtuse but evident; basal margin as wide as the base of elytra.

Pterothorax not pedunculate. Mesosternal carina absent; mesocoxal cavities contiguous.

Elytra elongate-ovate, moderately attenuate at apex, similar in both sexes. Microsculpture not forming transversal rows; disc with short, thin pubescence; sutural stria absent.

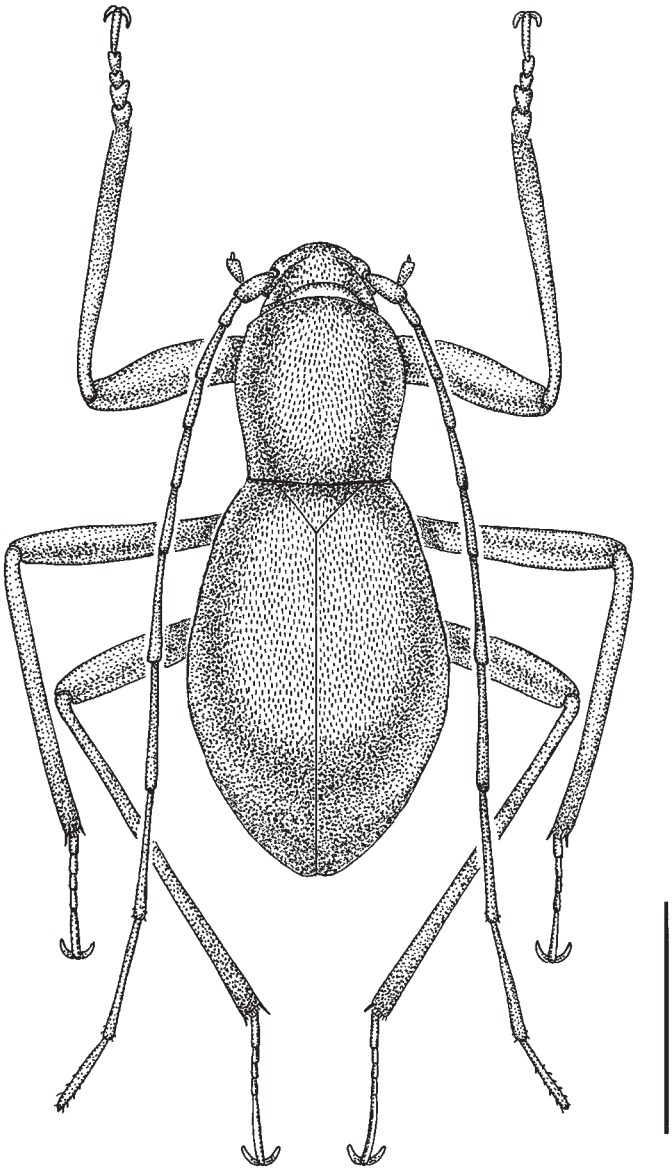


Fig. 10. *Velebitodromus* (nov. gen.) *smidai* n. sp.: habitus (HT ♂). Scale: 1 mm.

Legs very long and slender, with femora thickened basally. Protibiae not widened at apex, without apical comb of spines and without outer and inner spurs. Male protarsi 5-segmented, with three dilated basal tarsomeres. Meso- and metatibiae with inner, unifid apical spur and apical row of very short apical spines; tarsal claws long, slightly widened.

Male genital segment reduced in size. Aedeagus (Figs. 11–15) small sized, slender, not arcuate; basal lamina of median lobe arcuate, curly shaped, without ventral carina; parameres longer than the median lobe, each furnished with three or four short, sub-apical setae. Inner sac unarmed.

Ovipositor fully atrophied, genital segment membranous. Spermatheca (Fig. 16) membranous, sac–like, slightly sclerotized only at apex.

Etymology

Velebitodromus: similar to *Spelaeodromus* and other names of subterranean taxa, epithet composed by »Velebit«, the mountain chain in which the new taxon has been discovered and by the name of the Velebit Mountaineering Club (PDS »Velebit«, Speleological section), and »*drómos*«, run in Ancient Greek.

Velebitodromus smidai Casale, Giachino, Jalžić n. sp. (Figs. 10–16)

Loc. Typ.: Croatia, N Velebit, Lubenovac, Slovačka jama, WK06

Type material: HT ♂, Croatia, N Velebit, Lubenovac, Slovačka jama, 6.VIII.1998, B. Jalžić leg. (CNHM). PTT: 1 ♂ 1 ♀, Croatia, N Velebit, Lubenovac, Slovačka jama, 6.VIII.1998, B. Jalžić leg.; 1 ♂ 2 ♀♀, Croatia, N Velebit, Lubenovac, Slovačka jama, 03.VIII.2002, B. Jalžić leg.; 1 ♀, Croatia, Velebit, pothole system Lukina jama – Trojama, 5.VIII.1993 (CNHM, CCa, CGi).

Description

A small-medium sized (tl: mm 2.72 – 3.18 ♂♂ 3.20 – 3.36 ♀♀), sub-leptodiroid, highly specialized leptodirine beetle. Colour dark reddish, integument opaque, pubescent.

Head elongate, not retractile, anophthalmous, without occipital carina. Mouth parts taking long setae, i.e. for filtering water and organic matter (JEANNEL, 1924; CASALE & JALŽIĆ, 1988; NONVEILLER & PAVIČEVIĆ, 1999; CASALE *et al*., 2000a; MORAVEC & MLEJNEK, 2002; MLEJNEK & MORAVEC, 2003; MOLDOVAN *et al*., 2004). Antennae very long and slender, more elongate in the male (a/l: 1.49 ♂; 1.34 ♀).

Antennomere ratio:

HT ♂: 5.14; 3.47; 6.28; 5.76; 6.65; 8.05; 12.57; 14.33; 14.85; 13.76; 9.14

PT ♀: 4.66; 4.10; 5.64; 6.15; 7.17; 9.23; 13.33; 13.84; 14.35; 12.30; 9.23

Pronotum large in size, moderately elongate, slightly longer than it is wide (pw/l: 0.92 – 0.94 ♂♂ 0.82 – 0.84 ♀♀), with its maximum width in the anterior half, slightly constricted to the base; lateral sides regularly rounded anteriorly, deeply sinuate basally; basal margin as wide as the base of elytra. Disc subconvex, covered by dense, short, decumbent pubescence.

Elytra elongate-ovate, not truncate at apex (ew/l: 0.62 – 0.65 ♂♂ 0.60 – 0.68 ♀♀), with their maximum width at the apical third.

Legs as in the description of the genus; male protarsi with three basal tarsomeres markedly dilated, the basal tarsomere wider than the apex of protibia.

Aedeagus (Figs. 11–15) small sized, stout; basal lamina of median lobe very arcuate, curly shaped. Median lobe, in dorsal view, parallel sided and distally rounded;

in lateral view slightly arcuate, moderately depressed dorsally at the middle, bent and acuminate at apex. Parameres widened and slightly longer than the median lobe, moderately dilated at apex, each furnished with three or four short, stout setae (two or three in apical position, one in pre-apical position, respectively) (Figs. 13–15), similar in size and length. Inner sac unarmed.

Female genitalia as in the description of the genus.

Etymology

The new species is dedicated in friendship to the speleologist Branislav Šmida, in recognition of his explorations of the pits Lukina jama and Slovačka jama (having in mind also his »running« through Mt Velebit – »*drómos*«, run).

GENERAL REMARKS ON THE GENUS *VELEBITODROMUS*

With the *Croatodirus* previously treated, *Velebitodromus* new genus is a member of the phyletic lineage of *Anthroherpon* owing to the combination of some features recognized as synapomorphic characters, i.e. 1, first antennomere inserted on the posterior 3rd of head; 2, second antennomere markedly shorter than the first; 3, protibiae without external apical comb of spines; 4, male protarsi 5-segmented; 5, tarsal claws widened; 6, general shape of aedeagus, which is small, with median lobe scarcely curved and inner sac without sclerotized pieces; and, 7, the sac-like, membranous spermatheca.

Owing to its smaller, straight aedeagus, this genus seems to be much more closely related to *Anthroherpon* and *Paranthrophilon* than to *Croatodirus*, in which the median lobe is larger in size and distinctly arcuate. It is however markedly distinct from *Anthroherpon* and *Paranthrophilon* by the sub-leptodiroid body shape, by the insertion of the antennae in the posterior 3rd of the head (posterior 4th in *Anthroherpon* and *Paranthrophilon*) and by the mesothorax not pedunculate.

It is a fact that all recent researches performed in deep subterranean environments are revealing, in different parts of the Dinaric area, the presence of ultraspecialized, »hadesian« isolated taxa, or possibly not yet formalized phyletic lineages of Leptodirinae, geographically overlapping with lineages (of *Leptodirus* and *Anthroherpon*) recognized so far as the most specialized to the subterranean way of life. These discoveries confirm in this area too the existence of multiple colonization of the subterranean environment by different lineages in different chronological phases, scattered in different periods of the Tertiary, and in tropical or sub-tropical karst condition.

Distribution and ecology of the genus *Velebitodromus*

The new genus *Velebitodromus* with species *V. smidai* has been found only at two localities so far – in the pothole system Lukina jama – Trojama and in the Slovačka jama potholes in Mt Northern Velebit (Fig. 17/3 and 4). Like *Croatodirus*, specimens were found at places where water drains.

Lukina jama – Trojama pothole system

Depth 1392 m
Length 1078 m
Altitude of entrance 1475 m a.s.l.

The exceptional feature of Lukina jama pothole lies in its morphology. It is characterized by a very vertical shape and the great depth of –1392 m. So far it is the most vertical pothole in the world.

From the ecological point of view, the pothole is interesting because of its three microclimatic parts. The icy entrance part extends to ca –350m, with a temperature of ca 1°C during the whole year, which makes it unsuitable for subterranean fauna. Because of the »ice block« at the entrance, organic material is not likely to fall into the deeper parts of the pit. In the middle part the temperature is somewhat higher, but not more than 4°C in the warmest part of the year. It extends from –400 and –950 m and is characterized by only scarce findings of subterranean species. Drain water also occurs in the pit; in the deeper parts they can form a stronger flow. The lower part, in the bottom part of the pit, has the same air and water temperatures of 4°C. The deepest part is the richest in biospeleological findings. The main reason is the subterranean water that probably originates from Lika region. There are various organic traces on the rocks in this part of the pit that are evidence of its flooding, even a few meters above the lowest water level in the summer.

The list of taxa found in Lukina jama:

GASTROPODA
Lanzaia sp.
Hauffenia sp.
Zospeum subobesum Bole, 1974

BIVALVIA
Congeria kusceri Bole, 1962

POLYCHAETA
Marifugia cavatica Absolon & Hrabe, 1930

HIRUDINAE
Croatobranchus mestrovi Kerovec, Kučinić & Jalžić, 1999

AMPHIPODA
Niphargus croaticus (Jurinac, 1888)

ISOPODA
Alpioniscus sp.

DIPLOPODA
Hassia stenopodium Strasser, 1966

COLEOPTERA
Astagobius angustatus (Schmidt, 1852)
Velebitodromus smidai n.sp.

CHIROPTERA
Myotis mystacinus (Kuhl, 1817)

Slovačka jama pothole (loc. typ.)

Depth 1320 m
Length 2519 m
Altitude of entrance 1520 m a.s.l.

Because of its morphological features this pothole is much more suitable for subterranean life than Lukina jama. The entrance is horizontal and dry, preventing snow from entering the pit and thus the formation of ice. This pit is also more diversified and ecological characteristics are more favourable – i.e. temperatures are higher – temperature of air is 5.9°C, and of water 5.3°C at –1230 m. Because of the absence of ice, subterranean animals can make use of many earth, mud and sandy sediments containing organic and mineral substances. That makes Slovačka jama

faunistically richer than any other potholes of Northern Velebit so far explored. In the upper part of the pit coleopterans known from other pits were found, while at depths greater than 600 m, the above mentioned hygropetric, *Croatodirus casalei* and *Velebitodromus smidai* can be found.

The list of the taxa found in Slovačka jama:

GASTROPODA
Zospeum isselianum Pollonera 1886
Zospeum likanum Bole, 1960
Zospeum amoenum (Frauenfeld, 1886)
Zospeum pretneri Bole, 1961

HIRUDINAE
Croatobranchus mestrovi Kerovec, Kučinić & Jalžić, 1999

ISOPODA
Alpioniscus sp.

ARANEAE
Stalita pretneri C. L. Deeleman, 1971

PSEUDOSCORPIONES
Neobisium svetovidi Ćurčić, 1988

DIPLOPODA
Hassia stenopodium Strasser, 1966

COLEOPTERA
Typhlotrechus bilimeki (Sturm, 1847)
Redensekia likana Z. Karaman, 1953
Astagobius angustatus (Schmidt, 1852)
Croatodirus casalei n.sp.
Velebitodromus smidai n.sp.

CHIROPTERA
Myotis blythi (Tomes, 1857)
Myotis brandti (Eversmann, 1845)
Plecotus auritus (L., 1758)

ACKNOWLEDGEMENTS

We are very grateful to the members of the Speleological Section of the Velebit PDS for their help in subterranean research. We thank Dr Nikola Tvrtković, director of the Croatian Natural History Museum at the time, for continuing support to our field work. We also thank Dr Rajko Slapnik for identifying the material and Roman Ozimec for making the list of Lokvarka cave fauna.

Received August 2, 2004

REFERENCES

CASALE, A. & JALŽIĆ, B., 1988: *Radziella* (new genus) *styx* n. sp., a new exceptional troglobitic Bathysciinae (Coleoptera, Catopidae) from the Dinaric Region, Jugoslavia. Boll. Mus. reg. Sci. nat., Torino, **6**(2), 349–358.

CASALE, A., GIACHINO, P. M. & VAILATI, D., 1991: Brevi considerazioni per una sistematica filogenetica dei Bathysciinae (Coleoptera: Cholevidae). Atti XVI Congr. naz. ital. entomol., Bari-Martina Franca (TA), 857–865.

CASALE, A., M. CARCUPINO, I. MANCA & P. M. GIACHINO, 2000a: Ultrastructure of filtering mouth parts in highly specialized troglobitic Leptodirinae (Coleoptera, Cholevidae). Proc. XXI International Congress of Entomology (Foz do Iguassu, Brazil, 2000), Abstract Book, 936.

CASALE, A., GIACHINO, P. M. & JALŽIĆ, B., 2000b: *Croatodirus* (nov. gen.) *bozicevici* n. sp., an enigmatic new Leptodirine beetle from Croatia (Coleoptera, Cholevidae). Nat. Croat. **9**(2), 83–92.

GIACHINO, P. M. & GUÉORGUIEV, V. B., 1993: Note sul genere *Antroherpon* Reitter (Coleoptera Cholevidae Leptodirinae). Natura Bresciana, Ann. Mus. Civ. Sc. Nat., **28**(1992), 287–329.

GIACHINO, P. M & GUÉORGUIEV, V. B., 1995: Il genere *Apholeuonus* Reitter, 1889 (Coleoptera, Cholevidae, Leptodirinae). Riv. Piem. St. Nat., **16**, 169–216.

GIACHINO, P. M., VAILATI, D. & CASALE, A., 1998: Major questions in the phylogeny and biogeography of Cholevidae (Coleoptera), with emphasis on the subfamily Leptodirinae. In: Giachino, P. M., Peck, S. B. (eds.), Phylogeny and Evolution of Subterranean and Endogean Cholevidae (=Leiodidae Cholevinae). Proceedings of a Symposium (30 August, 1996, Florence, Italy). XX International Congress of Entomology. Atti Mus. reg. Sci. nat., 179–209.

GUÉORGUIEV, V. B., 1976: Recherches sur la taxonomie, la classification et la phylogénie des Bathysciinae. Dissert., Acad. Sci. Artium Slov. **19**(4), 91–147 (1–59).

JEANNEL, R., 1924: Monographie des Bathysciinae. Biospeologica. L. Arch. zool. exp. génér. **63**, 1–436.

MLEJNEK, R. & MORAVEC, J., 2003: Description of the female of *Nauticiella stygivaga* (Coleoptera: Leiodidae: Cholevinae: Leptodirini). Acta Soc. Zool. Bohem., **67**, 199–202.

MOLDOVAN, O. T., JALŽIĆ, B. & ERICHSEN, E., 2004: Adaption of the mouthparts in some subterranean Cholevinae, (Coleoptera, Leiodidae). Nat. Croat. **13**(1), 1–18.

MORAVEC, J. & MLEJNEK, R., 2002: *Nauticiella stygivaga* gen. n. et sp. n., a new amphibiontic cavernicolous beetle from the Vjetrenica Cave, Herzegovina (Coleoptera: Leiodidae: Cholevinae: Leptodirini). Acta Soc. Zool. Bohem., **66**, 293–302.

NEWTON, A. F., 1998: Phylogenetic problems, current classification and generic catalog of world Leiodidae (including Cholevidae). In: Giachino, P. M., Peck, S. B. (eds.), Phylogeny and Evolution of Subterranean and Endogean Cholevidae (=Leiodidae Cholevinae). Proceedings of a Symposium (30 August, 1996, Florence, Italy). XX International Congress of Entomology. Atti Mus. reg. Sci. nat., 41–178.

NONVEILLER, G., 1999: The Pioneers of the research on the Insects of Dalmatia. Croatian Natural History Museum, Zagreb, 390 pp.

NONVEILLER, G. & PAVIČEVIĆ, D., 1999: *Tartariella durmitorensis* n. gen. et n. sp., troisième Leptodirini de la chaîne Dinarique à moeurs hadésiennes (Coleoptera, Leiodidae). Bull. Soc. ent. Fr., **104**(4), 315–326.

PERREAU, M., 1999: Nouveaux genres et nouvelles espèces de Leptodirini (Coleoptera, Leiodidae). Bull. Soc. ent. Fr., **104**(4), 399–406.

PERREAU, M., 2000: Catalogue des Coléoptères Leiodidae Cholevinae et Platypsyllinae. Mém. Soc. ent. Fr., 4, 460 pp.