

***Nauticiella stygivaga* gen. n. et sp. n., a new amphibiotic
cavernicolous beetle from the Vjetrenica Cave, Herzegovina
(Coleoptera: Leiodidae: Cholevinae: Leptodirini)**

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Abstract. A monobasic leptodirine genus *Nauticiella* gen. n. and species *N. stygivaga* sp. n. from the Vjetrenica Cave near Zavala in southern Herzegovina (Bosnia and Herzegovina) are described. *Nauticiella* gen. n. is keyed and its generic classification is discussed. The holotype habitus (male) and some adaptive morphological characters of *N. stygivaga* sp. n. are illustrated. It can be separated from other strictly cave dwelling species of the related troglomorphic leptodiroid genera *Hadesia* J. Müller, 1911, *Radziella* Casale et Jalžić, 1988 and *Croatodirus* Casale, Giachino et Jalžić, 2000 by its small body-size, moderately dilated basal protarsomeres and the peculiar form of the apical portion of its aedeagus. A description of the habitat and brief notes on the biology of *N. stygivaga* sp. n. are provided.

Taxonomy, descriptions, new genus, new species, key, Coleoptera, Leiodidae, Cholevinae, Leptodirini, Palaearctic region

INTRODUCTION

The subterranean cholevid beetles, especially the leptodirines are pre-eminently pre-adapted for cave life (see Peck 1998). Above all, Jeannel's monograph (1924) stimulated an intensive study of highly specialized cave dwelling Leptodirini (see, e.g. Casale & Jalžić 1988, Giachino & Guéorguiev 1993, Giachino & Etonti 1995, Nonveiller & Pavičević 1999, Casale et al. 2000). Guéorguiev (1976) formalized Jeannel's system of mostly informal groups into a system of subtribes. The biospeleological history of the world acclaimed cave Vjetrenica (= Wind Cave) near Zavala in Herzegovina is more than 100 years old (Absolon 1913, 1916a, b, Absolon & Hrabě 1930, Hadži 1932, 1933, Stammer 1936, Strouhal 1939, Buturović 1951, Karaman 1953, 1954, Matjašić 1960, Vandel 1965, etc.). Because of the rich species diversity of cave-limited terrestrial animals in the Vjetrenica Cave it is a potential hotbed of evolution in miniature (Culver 2001). Some of the important records, which made this cave famous, are for example the finding of new taxa of cavernicolous Coleoptera, namely, two ultra-evolved leptodirines, *Antroherpon apfelbecki apfelbecki* J. Müller, 1910 and *Hadesia vasiceki vasiceki* J. Müller, 1911 and the remarkable blind trechine carabids, *Scotoplanetes arenstorffianus* (Absolon, 1913) and *Adriaphaenops pretneri* (Scheibel, 1935).

In 1998, the junior author made an entomological search of the whole cave. It was primarily aimed at surveying the invertebrate fauna after a long period during which Vjetrenica was inaccessible to tourists (Ržehak 1965), because of the civil war that started in 1991. The most notable achievement of these collecting trips to Herzegovina was without question the discovery of a new

Dedicated to the memory of Prof. Dr Karel Absolon (1877–1960), well-known Czech biospeleologist, who initiated the pioneering zoological research of the caves in the Popovo polje karst region of Herzegovina.

genus and a new species of cave dwelling cholevine beetle, *Nauticiella stygivaga* gen. n. et sp. n., which is described below.

The suprageneric nomenclature of the family Leiodidae used here is that of Newton (1998), and the morphological terms follow Giachino et al. (1998) and Newton (1998).

TAXONOMIC PART

Nauticiella gen. n.

(Figs 1, 4–6, 12–14, 17–24)

TYPE SPECIES. *Nauticiella stygivaga* sp. n., by monotypy.

DESCRIPTION. Male (Fig. 1). Body small, flattened, scaphoid-shaped, semi-lustrous, yellowish-brown, sternites somewhat dark. Head and pronotum with very short, rather sparse yellow pubescence, elytra with relatively dense, short, decumbent, hydrophobous, yellow pubescence.

Head relatively large, not retractile, slightly convex and narrower than pronotum; preantennal part of head distinctly longer than the postantennal part. Mouthparts eminently preadapted to detritus filtering in a liquid medium. This degree of development of the mouthparts is similar to the general degree of specialization of cave species (see Figs 4, 5, 7–11; cf. Peck 1998). Labrum (Fig. 4) enlarged and rounded distally, densely covered with short, conspicuous hairs on its anterior edge. Epistoma transverse, uncurved anteriorly. Mandible (Fig. 5) subsymmetrical, its preapical part relatively short, sharply bent, with three distal teeth. Maxilla well-developed, stipes with minute setulae, galea membranous, lacinia very finely ciliate; maxillary palpus (Fig. 6) with three palpomeres, penultimate palpomere 1.6 times longer than ultimate, short, conical one. Labium truncate, covered with rather long bristles. Frons slightly convex, fronto-epistomal suture evident. Eyes totally absent. Antennal insertion on posterior quarter of head. Antennae (Fig. 12) rather long and slender, filiform, 1.7 times longer than length of elytra, distinctly longer than the body; the antennal segment I rhomboid, antennomere I longer than II (Fig. 13), antennomere VII and VIII dilated distally, apical segment subconical. Sculpture on head indistinct, very finely punctate.

Pronotum slightly convex, 1.5 times longer than its maximum width. Lateral pronotal margins bisinuate, only narrowly beaded, regularly arcuate in one half and very slightly curved in posterior third. Posterior angles subrectangular, not prominent laterally. Base of pronotum almost straight. Disc flatly vaulted, with medial depressions shallowly indicated. Pronotal sculpture similar to that on head, with fine, dense puncturation.

Scutellum small, triangular.

Elytra elongate, moderately convex, 2.1 times longer than their combined width, fully covering the apex of abdomen. Lateral margins regularly rounded, gradually tapering posteriorly, bordered, separately obtusely rounded at the apex. Sutural striae absent. Surface of elytra coarser than that of pronotum, without regular transverse striae, punctures somewhat rougher and denser. Mesosternum not pedunculate; mesosternal carina atrophic.

Legs rather long and slender. Anterior femora robust, expanded, thickened proximally. Protibiae moderately bent inwards, extended premedially, without apical comb of short spines, apical protibial basket or external and internal spurs (see Fig. 14). Protarsus pentamerous, basiprotarsomere long, moderately dilated, almost as wide as distal part of protibia (Fig. 14). Mesocoxal cavities confluent. Meso- and metatibiae slightly sinuous, with very small and short inner spurs. Basimesotarsomere simple, not dilated. Metacoxae free, separated by a large, broadly arcuate intercoxal apophysis. Tarsal claws simple.

Sternum VIII as in Fig. 19. Genital segment as in Fig. 20.



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Fig. 1. *Nauticiella stygivaga* gen. n. et sp. n., holotype (male). Dorsal view. Oil-painting by Jan Kobyřák.



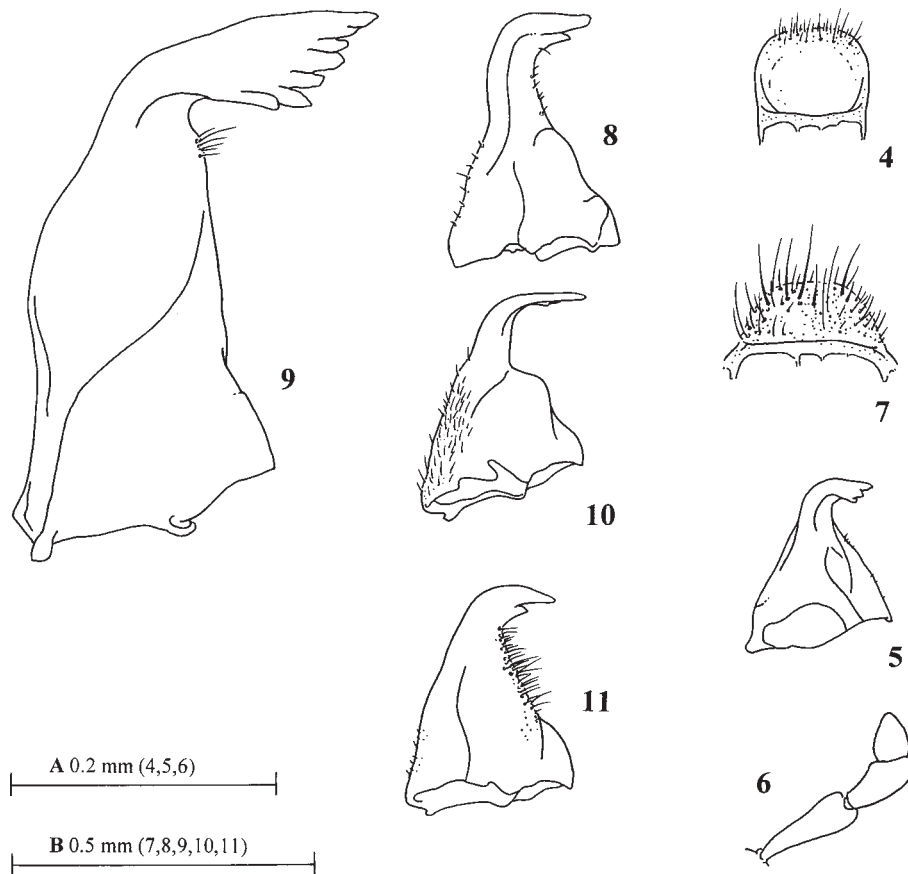
Figs 2, 3. 2 – Popovo polje karst-plateau surrounding the Vjetrenica Cave. Photo by Alena Hanelová. 3 – A sinter lake close to the waterfall in the Vjetrenica Cave. Photo by Ivan M. Jančok.

Male genitalia (Figs 20–24). Aedeagus relatively large, strongly sclerotized. Tegmen short. Median lobe of aedeagus subparallel-sided, enlarged medially, at apex distinctly bilobed in dorsal view (Fig. 21), regularly arched in lateral view (Fig. 22). Basal lamina of median lobe short, moderately expanded proximally. Apical portion of aedeagus modified as in Figs 21 and 23 (all males were dissected), widely dilated, bilobed and arcuately emarginate. Parameres long and very thin, never reaching the aedeagal apex, preapically sinuous, only slightly thickened caudally, armed with 3 setae (Fig. 24). Internal sac of aedeagus feebly indicated, without basal sclerites, hyaline.

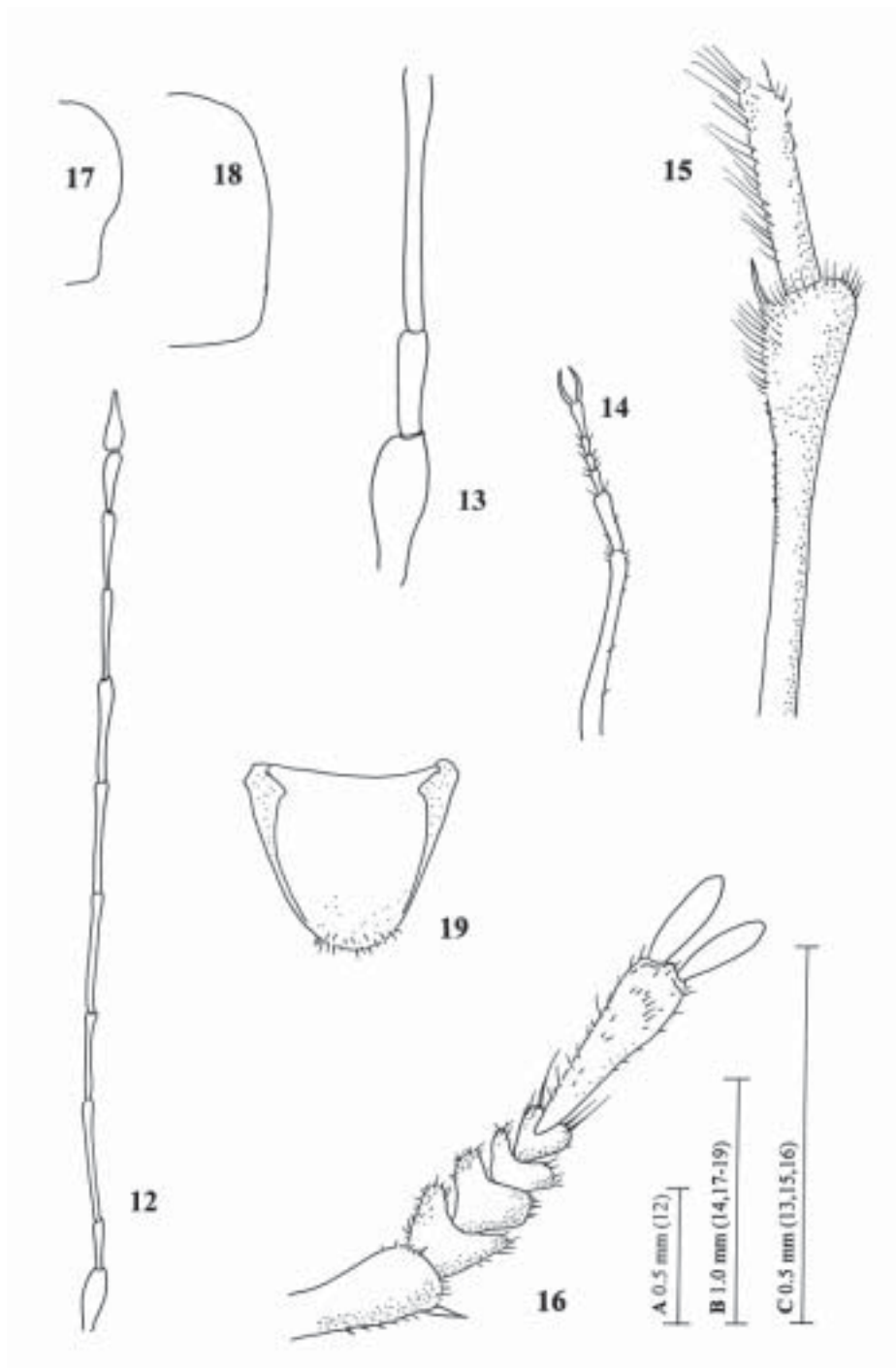
Female unknown.

DERIVATION OF NAME. The generic name *Nauticiella* gen. n. (feminine in gender) is derived from the Latin noun “nautici” (= the swimmers) in apposition, referring to the amphibiotic way of life of the new species in various cave habitats.

DIFFERENTIAL DIAGNOSIS. According to the generic classification of the world Leioidae by Newton (1998) the tribe Leptodirini consists of seven subtribes. Its morphological modifications and way

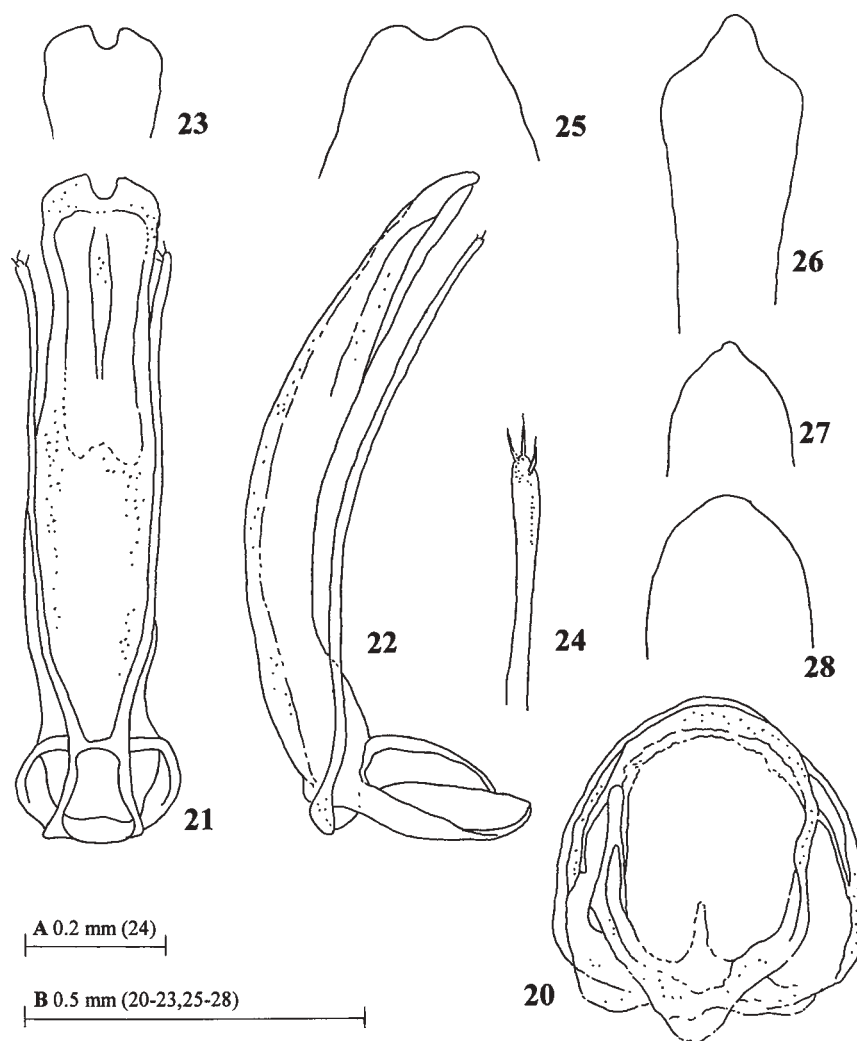


Figs 4–11. 4–6. *Nauticiella stygivaga* gen. n. et sp. n., paratype (male). 4 – labrum ventral view; 5 – mandible ventral view; 6 – maxillary palpus dorsal view; 7–8. *Radziella styx* Casale et Jalžić, 1988; 7 – labrum dorsal view; 8 – mandible dorsal view; 9–11. Mandibles of: 9 – *Hadesia vasiceki vasiceki* J. Müller, 1911; 10 – *Cansiliella servadeii* M. G. Paoletti, 1980; 11 – *Tartariella d. durmitorensis* Nonveiller & Pavičević, 1999. Scale 0.2 mm (A: Figs 4–6), 0.5 (B: Figs 7–11).



Figs 12–19. 12–14, 17, 19. *Nauticiella stygivaga* gen. n. et sp. n., paratype (male); 12 – antenna dorsal view; 13 – antennomeres I–III dorsal view; 14 – protarsus and apical part of protibia dorsal view; 15 – apical portion of protibia of *Hadesia vasiceki vasiceki* J. Müller; 16 – protarsus and apical part of protibia of *Radziella styx* Casale et Jalžić; 17 – outline of pronotum of *Nauticiella stygivaga* gen. n. et sp. n.; 18 – outline of pronotum of *Croatodirus bozicevici* Casale, Giachino et Jalžić; 19 – ventral view of sternum VIII of *Nauticiella stygivaga* gen. nov. and sp. n. Scale 0.5 mm (A: Fig. 12, C: Figs 13, 15, 16), 1.0 mm (B: Figs 14, 17–19).

of life are similar to those of *Radziella* Casale et Jalžić, 1988, which belongs to the large subtribe Leptodirina, characterized by antennae inserted on the middle third of the head. The genera *Antroherpon* Reitter, 1889 with 30 species (with *Leptomeson* Jeannel, 1924) and the monotypic *Hadesia* J. Müller, 1911, *Parantrophilon* Noesske, 1914, *Remyella* Jeannel, 1931, and *Nauticiella* gen. n., and evidently also *Croatodirus* Casale, Giachino et Jalžić, described in 2000, belong to the subtribe Antroherponina with antennae inserted on posterior third of the head, and males having five protarsomeres and a mesosternum without a carina.



Figs 20–28. 20–24. *Nauticiella stygivaga* gen. n. et sp. n., paratype (male); 20 – genital segment ventral view; 21 – aedeagus dorsal view; 22 – aedeagus lateral view; 23 – apical portion of aedeagus dorsal view; 24 – paramera dorsal view. 25–28 apex of aedeagus of: 25 – *Albanodirus trezzii* Giachino et Vailati, 1998; 26 – *Hadesia vasiceki* J. Müller; 27 – *Croatodirus bozicevici* Casale, Giachino et Jalžić, 2000; 28 – *Radziella styx* Casale et Jalžić. Scale 0.2 mm (A: Fig. 24), 0.5 mm (B: Figs 20–23, 25–28).

New ultra-evolved troglobite, *Nauticiella stygivaga* sp. n., is distinguished by its smaller body, moderately dilated basal protarsomeres and the extraordinary apical portion of its aedeagus. The genera *Antroherpon*, *Croatodirus*, *Hadesia*, *Parantrophilon* and *Remyella* can be distinguished from *Nauticiella* gen. n. by using the following key:

- 1 (12) Antennal insertion on posterior third of head; mesosternal carina absent; protarsomere IV not bilobed. Antroherponina
- 2 (3) Antennomere I as long as antennomere II. Serbia. *Remyella* Jeannel
- 3 (2) Antennomere I evidently longer than antennomere II.
- 4 (5) Head widely oval, clearly wider than pronotum. Length 3.3–3.5 mm. Herzegovina. *Parantrophilon* Noesske
- 5 (4) Head subcylindrical, elongate, at most slightly wider than pronotum. Length 2.5–9.1 mm.
- 6 (9) Pronotum glabrous or with widely spaced long setae.
- 7 (8) Labrum covered with numerous long bristles. Length about 7.5 mm. Herzegovina. *Hadesia* J. Müller
- 8 (7) Labrum with normal chaetotaxy. Length about 4.0–9.1 mm. Croatia, Bosnia, Herzegovina, Montenegro, Albania. *Antroherpon* Reitter, *Leptomeson* Jeannel
- 9 (6) Pronotum covered with dense decumbent pubescence.
- 10 (11) Lateral margin of pronotum slightly convex (Fig. 18); apex of aedeagus acuminate (Fig. 27); parameres reaching apex of median lobe. Length 3.5–3.7 mm. Croatia. *Croatodirus* Casale, Giachino et Jalžić
- 11 (10) Lateral margin of pronotum anterior to posterior angles emarginate (Fig. 17); apex of aedeagus bilobed and dilated (Fig. 23); parameres not reaching apex of median lobe (Fig. 21, 22). Length 2.5–2.9 mm. Herzegovina. *Nauticiella* gen. n.
- 12 (1) Antennal insertion on posterior third of head; mesosternal carina reduced, forming a small triangular plate; protarsomere IV deeply bilobed (Fig. 16). Croatia. Leptodirina, *Radziella* Casale et Jalžić

In its ecological requirements and the convergent adaptable morphological modifications of its mouthparts, especially the shape of the labrum and maxillae and dentate mandibles *N. stygivaga* gen. n. et sp. n. is similar to species of *Cansiliella* Paoletti, 1972 from Italy (see Fig. 10) and both taxa of *Tartariella* Nonveiller et Pavičević, 1999 from the Durmitor Mts (Montenegro) (see Fig. 11, cf. Nonveiller & Pavičević 1999: 323). The shape of the apex of the aedeagus of *Albanodirus trezzii* Giachino et Vailati, 1998, from Cave of Mt. Didja and Hali Salites (Oroshi, N. Albania) is also bilobed, but shallowly emarginate in dorsal view (Fig. 22).

Nauticiella stygivaga sp. n.

(Figs 1, 4–6, 12–14, 17–24)

TYPE MATERIAL. Holotype (male), labelled. “S Herzegovina, Popovo polje-plateau, Zavala Env., Pećina Vjetrenica Cave, 268 m a.s.l., 2.3 km from entrance, 27.viii.2001, R. Mlejnek lgt.”. Deposited in the collection of R. Mlejnek (Pardubice). Paratypes (4 males), the same data as holotype. In the collections of J. Moravec (Vrduj), M. Perreau (Paris) and R. Udržal (Pardubice).

DESCRIPTION. Male (habitus of holotype as in Fig. 1). Length of body (measured from anterior margin of epistoma to apex of elytra) 2.5–2.9 mm (in holotype 2.7 mm).

Head relatively large, narrower than pronotum; length/width ratio 1.17. Antenna (Fig. 12) rather long and slender, exceeding the apex of elytra; ratio of length of antenna/length of elytron 1.66–1.83 (in holotype 1.68); antennomere I longer than antennomere II (Fig. 13). Lengths of individual antennomeres I to XI (in mm) as follows: 0.20:0.16:0.32:0.29:0.39:0.34:1.02:0.27:0.27:0.18:0.22.

Pronotum: length/width ratio 1.44–1.75 (in holotype 1.74). Lateral margins regularly arcuate in anterior half and sinuate in posterior third.

Elytra elongate, moderately convex; length/width ratio 2.14–2.46 (in holotype 2.14). Lateral margins regularly rounded, bordered.

Legs rather long and slender. Protibiae considerably extended distally; length of protibia/length of protarsus ratio 1.7–1.79 (in holotype 1.78). Protarsus pentamerous, tarsomere I long,

moderately dilated (Fig. 14). Mesocoxal cavities confluent. Meso- and metatibiae slightly sinuous, with very small and short inner spurs. Tarsal claws simple.

Sternum VIII (Fig. 19). Genital segment (Fig. 20).

Aedeagus (Figs 21–24) relatively large, well-sclerotized, 1.0 mm long (measured from apex of median lobe to apex of tegmen). Length of elytron/length of aedeagus ratio 1.64–1.88 (in holotype 1.76). Tegmen short. Median lobe of aedeagus subparallel-sided, the apex dilated and bilobed in dorsal view (Fig. 21), regularly arched in lateral view (Fig. 22). Parameres long and thin, never reaching the aedeagal apex, with 3 setae apically – Fig. 24. Internal sac of aedeagus without basal sclerites, hyaline.

Female unknown.

DERIVATION OF NAME. The specific name “*stygivaga*” is from the Latin stygius (underground water) and vagus (running) indicates the extreme ecological conditions this new species lives in.

COLLECTION CIRCUMSTANCES AND BIOLOGY. All specimens of *N. stygivaga* gen. n. et sp. n. were collected in the Vjetrenica Cave, 2.3 km from the entrance (268 m in altitude), on the wall under a waterfall. Calcareous deposits form water reservoirs (rimstone pools), which surround the waterfall (Fig. 3). During the study, air temperature (measured on 27.viii.2001) was 11.5°C, and water temperature (in waterfall) about 11.2 °C. The type locality is Zavala village (Popovo polje-plateau, S Herzegovina – see Fig. 2, for details of geomorphology and cave hydrography – see e.g., Radovanović 1929). Adults were collected in association with the troglobiotic *Hadesia vasiceki vasiceki* J. Müller, 1911 (Leptodirini: Antroherponina) (det. R. Mlejnek, 2001). Adults of *N. stygivaga* gen. n. et sp. n. inhabit the limnic (sinter lakes) and/or lotic habitats in the cave, where water is relatively fast flowing in a film layer under waterfalls. It clearly prefers dripstone deposits (flowstone) and vertical walls of other sinters, where flowing detritus is probably available – stenohygrobiotic species according to Remy (1940), cf. Jeannel (1924), Casale & Jalžić (1988), Nonveiller & Pavičević (1999) and Casale et al. (2000).

A c k n o w l e d g e m e n t s

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REFERENCES

- ABSOLON K. 1913: [Results of explorational trips to Balkans. Next part]. *Čas. Morav. Mus. Zemského* **13**: 361–366 (in Czech).
- ABSOLON K. 1916a: [Results of explorational trips to Balkans. Part 4]. *Čas. Morav. Mus. Zemského* **15**: 242–309 (in Czech).
- ABSOLON K. 1916b: [From the explorational trips over the Balkan karst]. *Zlatá Praha* **33**: 574–576, 586–588, 597–600, 609–612, 622–624 (in Czech).
- ABSOLON K. & HRABĚ J. 1930: Ueber einen neuen Süßwasser-Polychaeten aus den Höhlengewässern der Herzogowina. *Zool. Anz.* **88**: 249–264.
- BUTUROVIĆ A. 1951: [Bibliography of caves and the cave animals of Bosnia and Herzegovina]. *Godišn. Biol. Inst. Sarajevo* **4**: 95–114 (in Serbo-Croatian).
- 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. Regional. Sci. Natur. Torino* **6**: 349–358.
- CASALE A., GIACHINO P. M. & JALŽIĆ B. 2000: Croatodirus (nov. gen.) bozicevici n. sp., an enigmatic new leptodirine beetle from Croatia (Coleoptera, Cholevidae). *Natura Croatica* **9**: 83–92.

- CULVER D. C. 2001: The dark zone. Caves offer biologists the chance to study how darkness, famine and isolation have forced the hand of evolution. *Science* **41**: 30–35.
- GIACHINO P. M. & GUÉORGUIEV V. B. 1993: Note sul genere *Antroherpon* Reitter (Coleoptera Cholevidae Leptodirinae). *Natura Bresciana, Ann. Mus. Civ. Sci. Natur. Brescia* **28**(1992): 287–329.
- GIACHINO P. M. & ETONTI M. 1995: Il genere *Remyella* Jeannel, 1931 (Coleoptera Cholevidae Leptodirinae). *Atti Mus. Civ. Stor. Natur. Trieste* **46**: 77–98.
- GIACHINO P. M. & VAILATI D. 1998: *Albanodirus trezzii* nuovo genere nuova specie di Leptodirinae dell'Albania settentrionale (Coleoptera Cholevidae). *Natura Bresciana, Ann. Mus. Civ. Sci. Natur. Brescia* **31**(1995): 113–119.
- GIACHINO P. M., VAILATI D. & CASALE A. 1998: Major questions in the phylogeny and biogeography of Cholevidae (Coleoptera), with emphasis on the subfamily Leptodirinae. Pp.: 179–209. In: GIACHINO P. M. & PECK S. B. (eds): *Phylogeny and Evolution of Subterranean and Endogean Cholevidae (=Leiodidae Cholevinae)*. *Proc. Symp. (30 August, 1996, Florence, Italy) XX Int. Congr. Entomol. Atti Mus. Reg. Sci. Natur., Torino 1998*: 1–295.
- GUÉORGUIEV V. B. 1976: Recherches sur la taxonomie, la classification et la phylogénie des Bathysciinae (Coleoptera: Catopidae). *Razprave Slovenska Akademija Znanosti in Umetnosti* **19**: 89–147.
- HADŽI J. 1932: [Contribution to the knowledge of the cave fauna of Vjetrenica (Pseudoscorpionidea: Neobisium (Blothrus) vjetrenicae sp. n., Opilionidea: Travunia vjetrenicae sp. n., Nelima troglodytes Roewer)] *Glasn. Srpske Kraljev. Akad. Nauka* **61**: 103–157 (in Slovenian).
- HADŽI J. 1933: Beitrag zur Kenntnis der Fauna der Höhle Vjetrenica. *Bull. Acad. Serbe, Sect. B, Sci. Natur.* **1**: 49–79.
- JEANNEL R. 1924: Monographie des Bathysciinae. *Biospeologica* No L. *Arch. Zool. Exp. Génér.* **63**: 1–436.
- KARAMAN S. L. 1953: Über subterrane Amphipoden und Isopoden des Karstes von Dubrovnik und seines Hinterlandes. *Acta Mus. Macedon. Sci. Natur.* **1**: 137–167.
- KARAMAN S. L. 1954: Über unsere unterirdische Fauna. *Acta Mus. Macedon. Sci. Natur.* **2**: 195–216 (in Serbo-Croatian, German abstr.).
- MATJAŠIČ J. 1960: [Cave animals of Vjetrenica]. *Biol. Vestnik* **7**: 75–80 (in Slovenian).
- NEWTON A. F. JR. 1998: Phylogenetic problems, current classification and generic catalog of world Leiodidae (including Cholevidae). Pp.: 41–177. In: GIACHINO P. M. & PECK S. B. (eds): *Phylogeny and Evolution of Subterranean and Endogean Cholevidae (=Leiodidae Cholevinae)*. *Proc. Symp. (30 August, 1996, Florence, Italy) XX Int. Congr. Entomol. Atti Mus. Reg. Sci. Natur., Torino 1998*: 1–295.
- NONVEILLER G. & PAVIČEVIĆ D. 1999: *Tartariella durmitorensis* n. gen. et n. sp., troisième Leptodirini de la chaîne Dinariquef moeurs hadésiennes (Coleoptera, Leiodidae). *Bull. Soc. Entomol. France* **104**: 315–326.
- PECK S. B. (1998): Phylogeny and evolution of subterranean and endogean Cholevidae (=Leiodidae, Cholevinae): an introduction. Pp.: 11–40. In: GIACHINO P. M. & PECK S. B. (eds): *Phylogeny and Evolution of Subterranean and Endogean Cholevidae (=Leiodidae Cholevinae)*. *Proc. Symp. (30 August, 1996, Florence, Italy) XX Int. Congr. Entomol. Atti Mus. Reg. Sci. Natur., Torino 1998*: 1–295.
- RADOVANOVIĆ S. M. 1929: [The cave Pećina Vjetrenica in Herzegovina. Morphological-hydrographical study]. *Spomenik Srpske Kraljev. Akad. Nauka* **67**(15): 1–113 (in Serbo-Croatian).
- REMY P. 1940: Sur le mode de vie des *Hadesia* dans la grotte Vjetrenica (Col. Bathysciinae). *Rev. Fr. Entomol.* **7**: 1–8.
- RŽEHAK V. 1965: The Arrangement and Opening of the Cave Vjetrenica in Zavala (Hercegovina – Yugoslavia). Pp.: 209–210. In: ŠTELCL O. (ed.): *Problems of the Speleological Research. Section 3 – Speleology. Proc. Int. Speleol. Confer. held in Brno June 29 – July 4, 1964*. Prague: Academia, 220 pp.
- STAMMER H.-J. 1936: Ein neuer Höhlenschizopode, *Troglomysis vjetrenicensis* n. g. n. sp. *Zool. Jahrb., Abt. Syst. Ökol. Geogr. Tiere* **68**: 53–104.
- STROUHAL H. 1939: *Titanethes Schiödti*. (Landasseln aus Balkanhöhlen in der Kollektion “Biospeologica balcanica” von Prof. Dr. Absolon. 6. Mitteilung). *Studien aus dem Gebiete der allgemeinen Karstforschung, der wissenschaftlichen Höhlenkunde, der Eiszeitforschung und den Nachbargebieten (Brünn), Biol. Ser. (B)* **5**: 1–34.
- VANDEL A. 1965: *Biospeology, the biology of cavernicolous animals*. Oxford, London, Edinburgh, New York, Paris, Frankfurt a. Main: Pergamon Press, xxiv +524 pp.