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PARAPROPUS JASMINKOI SP. N., A NEW LEPTODIRINE BEETLE (COLEOPTERA: LEIODIDAE, CHOLEVINAE) FROM BOSNIA AND HERZEGOVINA

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Abstract – New species of leptodirine beetle *Parapropus jasminkoi* sp.n. is described from Otlovića pećina on Čemernica planina in Northern Bosnia. Identification key to similar small species that share short pronotum, *P. brevicollis* Müller, *P. nonveilleri* Müller and *P. vitorogensis* Ćurčić S., Pešić & Ćurčić B.P.M. is provided.

Key words: Leptodirini, *Parapropus*, new species, troglobiont, Bosnia and Herzegovina.

Izvleček – *PARAPROPUS JASMINKOI* SP. N., NOVA VRSTA HROŠČA PODZEMLJARJA (COLEOPTERA: LEIODIDAE, CHOLEVINAE) IZ BOSNE IN HERCEGOVINE

Opisana je nova vrsta hrošča podzemljarja *Parapropus jasminkoi* sp.n., odkrita v jami Otlovića pećina na planini Čemernica v severni Bosni. Podan je ključ za določanje podobnih vrst tega rodu, *P. brevicollis* Müller, *P. nonveilleri* Müller in *P. vitorogensis* Ćurčić S., Pešić in Ćurčić B.P.M., za katere je značilen kratek ovratnik.

Ključne besede: Leptodirini, *Parapropus*, nova vrsta, troglobiont, Bosna in Hercegovina.

Introduction

Soon after discovery and description of the first cave beetle *Leptodirus hochenwartii* from Postojnska jama by Ferdinand Schmidt on 1832 (Polak, 2005), he found and described similar species under the name *Leptoderus sericeus* (Schmidt, 1852), from Slugova jama in Dolenjsko region in Slovenia. Later Hampe (1870) described another species *Leptoderus intermedius* from caves near Ozalj in Croatia.

Ganglbauer (1899) established a new genus name *Parapropus* for this species and described third species *P. ganglbaueri* from caves near Glamoč in Western Bosnia. After that more new species and subspecies of the genus *Parapropus* have been discovered and described (Apfelbeck, 1907, 1908; Müller, 1911a, b, c; Reitter, 1914). On the basis of *Parapropus* specimens collected in Dragišica pećina near Smoljana by Leander Pfeifer (Sarajevo), Müller (1911a) described *P. brevicollis*. In his short description without figures, he noticed small size (4 mm) and pronotum only slightly longer than wide which is, as well as the short head, densely and strongly punctuated and densely pubescent. He did not describe genital structures. First revision, more or less still respected today was Jeannel's (1924) who recognised five species, among them *P. sericeus* with five subspecies and *P. ganglbaueri* with two subspecies. Later Müller (1937) described additional species *P. insignis* and *P. nonveilleri* from cave Trljica near Mlinište in NW Bosnia and *P. s. augustae* from Cerovačke pećine near Gračac in Croatia (Müller, 1941). He reviewed taxonomical significance of morphological characters used by Jeannel and noticed informal group "brevicollis" consisted of two small species, *P. brevicollis* and *P. nonveilleri*, both with short pronotum. On the basis of material preserved in collection of Karel Absolon three additional subspecies were described (Absolon & Mařan, 1943). Quite recently, the last species *P. vitorogensis* (Ćurčić et al., 2012) had been described from the Vaganska pećina near Šipovo, Mt. Vitorog in NW Bosnia, with statement of its close relation to the small "brevicollis" group of species. Currently eight *Parapropus* species are known, among them *P. sericeus* with nine subspecies and *P. ganglbaueri* with five subspecies distributed from southern Dinaric part of Slovenia, through Croatia to north and western part of Bosnia and Herzegovina (Pretner, 1968; Perreau, 2000; Ćurčić et al., 2012).

Materials and methods

We visited Dragišica pećina and nearby Ciganska pećina in 2004 and Trljica pećina and nearby Jama Trljica in 2007 and succeeded to collect topotypic material of two similar small species that share short pronotum. In summer 2015, Jasminko Mulaomerović from Sarajevo gave me a specimen of an unknown leptodirine beetle collected in Otlovića pećina in Čemernica planina. Accompanied by young speleologists Ivan Napotnik and Mirko Vidović from Banja Luka, we visited Otlovića pećina and collected additional specimens described in this paper as a new *Parapropus* species. Studying recently collected specimens from Otlovića pećina it became evident that the new species belongs to informal "brevicollis" group as well. Unfortunately we did not obtain *P. vitorogensis* specimens and in this study we referenced and used data from Ćurčić et al. (2012).

Beside the type series of new species, declared under new species description section, following specimens were studied, some of them dissected.

Parapropus brevicollis; Ciganska pećina, Smoljana, Bosanski Petrovac (Muratovac), B&H, 2 ♂♂, 2 ♀♀, 19.7.2004, Polak, S. & Trontelj, P. leg.

Parapropus nonveilleri; Jama Trljica, kod Trljica pećine, Mlinište, Mrkonjić Grad, B&H, 19.4.2007, 5 ♂♂, 5 ♀♀, Polak, S. & Mihevc, A. leg.

Parapropus sericeus simplicipes; Mačkića pećina, Sitnica, Ključ, B&H, 5 ♂♂, 5 ♀♀, 20.7.2004, Polak, S. & Trontelj, P. leg.

Parapropus sericeus muelleri; Hrustovača, Hrustovo, Sanski Most, B&H, 5 ♂♂, 5 ♀♀, 14.7.2007, Polak, S. & Mihevc, A. leg.

Parapropus sericeus sericeus; Slugova jama, Dolnji Globodol, Slovenia, 2 ♂♂, 2♀♀, 11.4.2007, Polak, S. leg.

Parapropus pfeiferi; Pećina uz Sanu, G. Kamičak, Sanski Most, B&H, 5 ♂♂, 5 ♀♀, 25.7.2004, Polak, S. & Trontelj, P. leg.

Part of the specimens were prepared as classical dried museum specimens. Some of selected specimens were dissected and studied under the microscope. Specimens were macerated in not heated 10 % KOH for 8 hours, washed in pure water and dehydrogenated in increasing ethanol concentration (50 – 96%). In concentrated ethanol specimens were dissected and studied, measured and photographed using Leica MZ7.5 stereomicroscope (0.63-5.0x). Significant morphological parts as antennae, protarsi and genital parts have been separated and immersed in glycerine or Solakryl BMX on microscope glass slides. Details have been studied, measured and photographed using Euromex ME2665 microscope (10x04, 10x10, 10x40). The photographs have been made using Nikon Coolpix 4500 digital camera and measured using "Image J" software program. Digital microscopic images were finalised to figures using Adobe Photoshop and CorelDRAW software programs. All measurements are in millimetres (mm). Voucher specimens of studied species, pinned dry and on microscopic slides, are deposited in the collection of Notranjska museum Postojna (NMPO). Two paratype specimens are deposited in Zemaljski muzej Bosne i Hercegovine in Sarajevo as stated in species description.

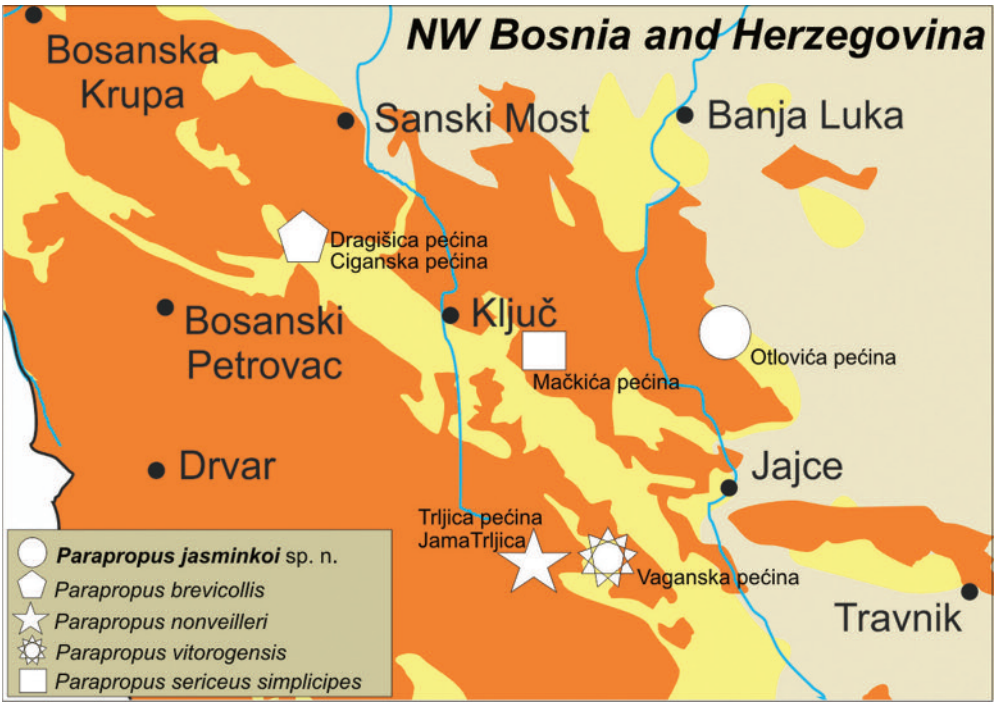
***Parapropus jasminkoi* sp.n.**

Type locality: Otlovića pećina (= Pećina na Visu), Marići, Otlovići, on the eastern slope of Čemernica planina on right bank of Vrbas river (not Čemernica near Glamoč), Kneževo, Republic of Srpska, Bosnia and Herzegovina (Map).

Type series:

Holotype (HT): ♂, Otlovića pećina, Marići, Čemernica pl., Kneževo, BIH; 26.7.2015, Polak, S. leg. Pinned dry, locality printed on white label; *Parapropus jasminkoi* sp.n. HOLOTYPE, printed on red label, deposited in Notranjska museum Postojna, Slovenia (Inv. No. NMPO: C-4533),

Paratypes (PT): 1 ♂, 6 ♀, same data as holotype, pinned dry, partly dissected (right antennae, protarsi, genital segments) preserved on microscope slides, locality printed on white labels; *Parapropus jasminkoi* sp.n. PARATYPE, printed on yellow labels, deposited in Notranjska museum Postojna, Slovenia (Inv. No. NMPO: C-4534, 4535, 4536, 4537, 4538, 4539, 4540).



Map: Map of NW Bosnia and Herzegovina with distribution of *Parapropus* "brevicollis" group of species and *Parapropus sericeus simplicipes* as the geographically closest species to the *P. jasminkoi* sp. n. (Map after Milanolo).

1 ♀, same data as holotype and 1 ♂, Otlovića pećina, Marići, Čemernica pl., Kneževo, BIH; 24.3.2011, Napotnik, I. & Friščić J. leg, pinned dry, not dissected, locality printed on white label, *Parapropus jasminkoi* sp.n. PARATYPE pinned on yellow labels, deposited in Entomological collection, Zemaljski muzej Bosne i Hercegovine, Sarajevo.

Diagnosis: *Parapropus jasminkoi* sp. n. differs from most other *Parapropus* species by smaller body size (less than 4.9 mm) and pronotum only slightly longer than wide (index pronotum length/pronotum width less than 1.25) except for the species *P. brevicollis*, *P. nonveilleri* and *P. vitorogensis* which are of similar size and have similar pronotum outline (Figs. 3 – 8). From those, new species clearly differs by male 1st protarsomere which is of prolonged trapezoidal shape, 1.70 – 1.81 times longer than wide (long 25 % of total male protarsi length) (Fig. 18) and female 1st protarsomere short (long 26 % of total female protarsi length) (Fig. 17). Among other *Parapropus* species new species has unique shape of male aedeagus that is in dorsal view widest at the apex (Fig. 21), tegmen in lateral view strongly curved on the apical half (Fig. 22), inner sac (endophallus) of median lobe without significant sclerotised

Fig. 1: *Parapropus jasminkoi* sp.n. in Otlovića pećina (Photo: S. Polak).

structures, only with well developed strong stylus in basal part and paramere apex with three long, equally strong setae (Fig. 23).

Description: Habitus leptodiroid as in Figs.1, 2. Total body length (BL – measured with head in natural position) 4.10–4.40 mm in ♂♂ and 4.20–4.49 mm in ♀♀. Colour yellowish in young individuals or reddish-brown (Fig. 1), antennae and legs same colour.

Head rounded, slightly less wide than pronotum, covered with decumbent pale pubescence. Mouthparts as in other *Parapropus* not specialised for hygropetric style of filtering water. Antennae inserted in the middle of the head. Antennae total length (AtL – from scape to terminal segment), 4.59 – 4.66 mm in ♂♂ (longer than body), 3.78 – 3.80 mm in ♀♀ (shorter than body).

Lengths of antennomeres (AmL in mm)

♂♂: 0.21; 0.33; 0.35; 0.40; 0.45; 0.47; 0.50; 0.40; 0.49; 0.44; 0.56

♀♀: 0.21; 0.30; 0.28; 0.34; 0.42; 0.40; 0.40; 0.32; 0.38; 0.33; 0.42

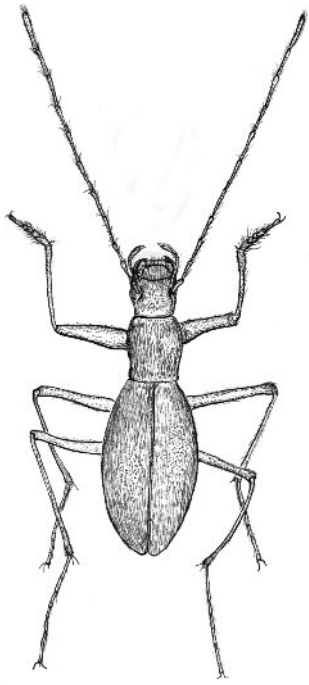
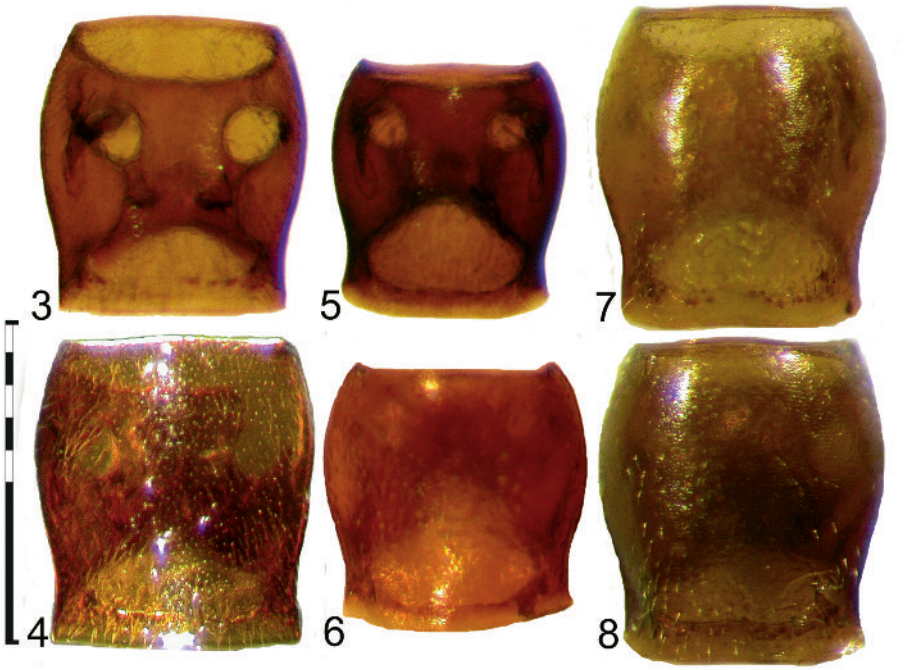


Fig. 2: *Parapropus jasminkoi* sp.n ♂ HOLOTYPE habitus.

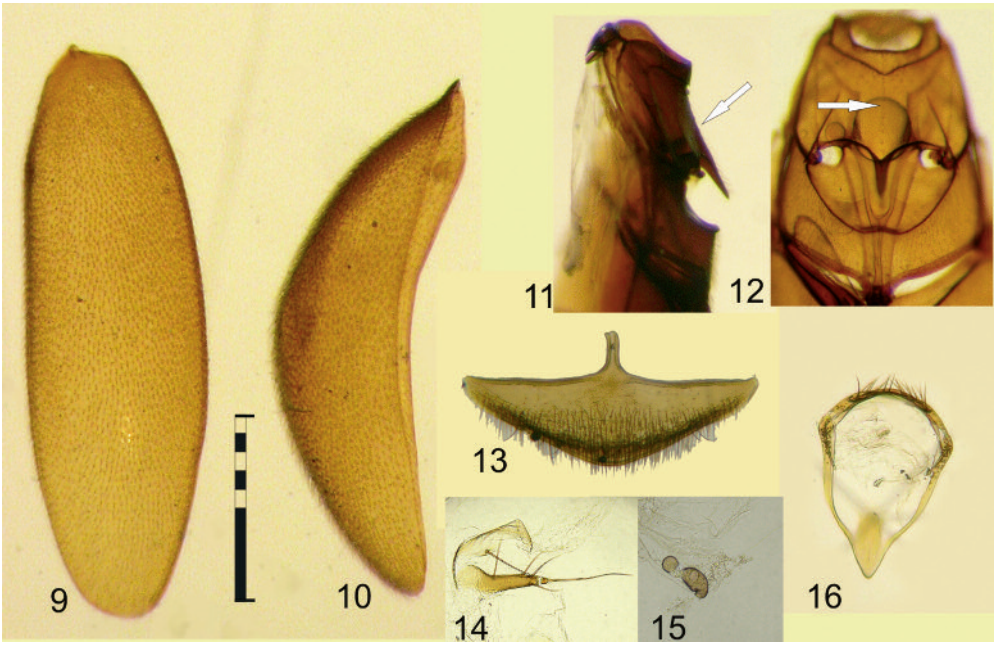
Antennomere ratio (AtL /AmL in %)
♂♂: 4.58; 6.85; 7.67; 8.74; 10.48; 9.86; 10.70; 8.83; 10.57; 9.67; 12.05
♀♀: 5.61; 7.70; 7.38; 8.62; 11.32; 10.61; 10.45; 8.44; 10.26; 8.67; 10.95
Ratio Antennae total length (AtL) / body length (BL): 1.06 – 1.12 in ♂♂, 0.87 – 0.91 in ♀♀.

Pronotum in dorsal view slightly longer than wide, maximal length (PL) 0.89–0.96 mm in ♂♂, 0.88–0.99 mm in ♀♀, maximal width (PW) 0.79 – 0.83 mm in ♂♂, 0.81 – 0.92 mm in ♀♀. Index PL / PW 1.12 – 1.17 in ♂♂ and 1.02 – 1.21 ♀♀. Lateral edge rounded on anterior half, only slightly sinuate concave in posterior half (♂ Fig. 3; ♀ Fig. 4), maximal width on anterior third. Punctuation and pubescence on dorsal face of pronotum evident, sparse, decumbent and regular on the whole pronotum.

Elytra elongate-ovate, strongly convex in ♂♂ and ♀♀ (Figs. 9, 10), maximum width approximately in the middle of elytra length, covered with pale, short, fine, dense pubescence on whole surface. Elytra length (EL) 2.65 – 3.07 mm in ♂♂, 2.92 – 3.15 mm in ♀♀. Elytra width (EW) 1.40 – 1.50 mm in ♂♂, 1.45 – 1.58 mm in ♀♀.



Figs. 3 – 8: Pronotum in dorsal view, 3 – *P. jasminkoi* sp.n. ♂; 4 – *P. jasminkoi* sp.n. ♀; 5 – *P. brevicollis* ♂; 6 – *P. brevicollis* ♀; 7 – *P. nonveilleri* ♂; 8 – *P. nonveilleri* ♀. (Scale bar =1.0 mm).



Figs. 9 – 16: *Paraprous jasminkoi* sp.n., 9 – elytra ♂ dorsal view; 10 – elytra ♂ lateral view (slightly bent artificially); 11 – ♀ mesosternum in lateral view; 12 – ♂ mesosternum in ventral view, arrow indicates mesosternal carina; 13 – ♀ ventrite VIII; 14 –♀ genital segment – ventrite IX; 15 – spermatheca; 16 – ♂ genital segment. (Figs. 9, 10, 11, 12 Scale bar =1.0 mm; Figs. 13, 14, 16 Scale bar = 0.5 mm; Fig. 15 Scale bar = 0.1 mm).

Mesothorax, abdomen: Mesocoxal cavities strongly confluent (Figs. 11, 12). Mesosternal carina not elevated (absent), limited to the central line of strong, backwards curved bristles on the mesosternum and prolonged to the strong and straight dent protruding to the middle of mesocoxal cavities. Ventrite VIII at ♀♀ simple, apically strongly pubescent, with narrow, short and straight median expansion on anterior edge (Fig. 13).

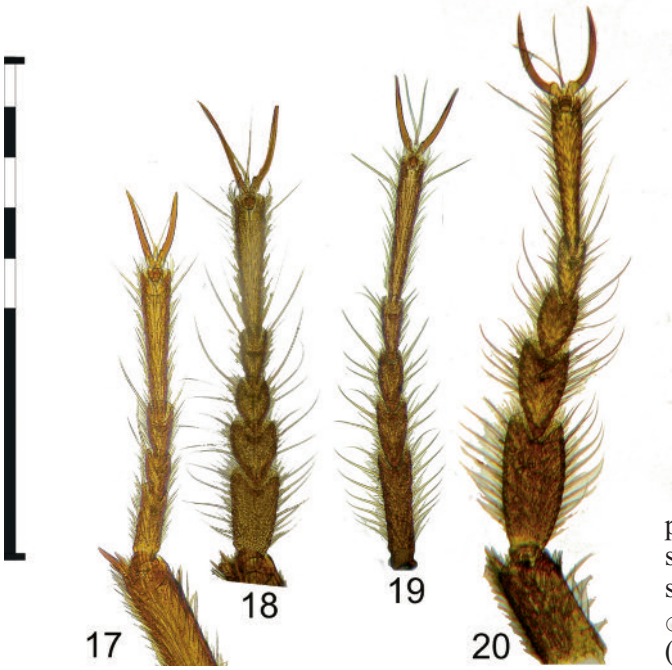
Legs long and slender (Figs. 1, 2), covered with sparse decumbent pubescence. Femora straight, weakly widened at the base. Tibiae slim and straight, slightly curved inwards, strongly pubescent. Apex of protibia armed with trident spur on inner side. Apex of mesotibiae and metatibiae armed with 2 long spurs on inner side. Male protarsi 5-segmented, protarsomeres I – III significantly dilated (Fig. 18), female protarsi 4-segmented (Fig. 17) not dilated. All tarsomeres strongly chaetose, laterally with long bristles. Tarsal empodium bisetose. Claws long, sharp, not dilated (Figs. 17, 18).

♂♂ protarsomere length in mm (TL): 0.17; 0.13; 0.12; 0.11; 0.29
Total length in natural tarsomere overlapping position TtL = 0.72

♂♂ protarsomere ratio (TL / TtL in %): 25.63; 20.59; 15.97; 18.07; 41.60
♂♂ protarsomere length / width ratio (TL / TW): 1.70 – 1.81; 1.41 – 1.58; 1.65 – 1.179; 2.13 – 2.43; 4.92 – 5.03
♀♀ protarsomere length in mm (TL): 0.15; 0.09; 0.12; 0.27
Total length in natural tarsomere overlapping position TtL = 0.58
♀♀ protarsomere ratio (TL / TtL in %): 26.16; 16.01; 19.97; 47.16

Male genitalia: Aedeagus in dorsal view (Fig. 21) 0.86–0.98 mm long, straight and wide, widest and rounded at the apex. Aedeagus in lateral view (Fig. 22) wide, moderately curved at the apical third of length. Median lobe apex in lateral view finishes with short, sharp curved beak (Fig. 22). Inner sac (endophallus) of median lobe without significant sclerotised structures only with well developed strong stylus in basal part. Parameres strong, of same length as median lobe, laterally flattened, parallel with median lobe curves, curved inwards apically, armed with three equally strong setae; one apical and two preapical (one external and one internal respectively) (Fig. 23). Male genital segment reduced to angulated ring (Fig. 16), with long, slim sclerotised lateral processes and with wide triangular apophysis on ventral side.

Female genitalia: Genital segment – ventrite IX (urite) normally developed, with one long bristle on gonocoxites and in gonostylus three bristles laterally and one longest apically (Fig. 14). Spermatheca bi-bulbose (Fig.15), strongly sclerotised on proximal and on rounded distal part.



Figs. 17 – 20: Right protarsi, 17 – *P. jasminkoi* sp.n. ♀; 18 – *P. jasminkoi* sp.n. ♂; 19 – *P. brevicollis* ♂; 20 – *P. nonveilleri* ♂. (Scale bar =1.0 mm).

Figs. 21 – 29: Aedeagus, 21 – *P. jasminkoi* sp.n. dorsal view (arrow indicates stylus); 22 – *P. jasminkoi* sp.n. lateral view; 23 – *P. jasminkoi* sp.n. paramere apex; 24 – *P. brevicollis* dorsal view; 25 – *P. brevicollis* lateral view; 26 – *P. brevicollis* paramere apex; 27 – *P. nonveilleri* dorsal view; 28 – *P. nonveilleri* lateral view; 29 – *P. nonveilleri* paramere apex (Figs. 21, 22, 24, 25, 27, 28 Scale bar =1.0 mm; Figs. 23, 26, 29. Scale bar = 0.5 mm).

Geographical distribution: So far the new species is known only from the type locality Otlovića pećina (= Pećina na Visu) (described in: Dujaković, G. 2004), Otlovići, Marići, Kneževo, Republic of Srpska, Bosna and Herzegovina (Fig. 30). Otlovića pećina is situated on the eastern slope of Čemernica planina near to the road Kneževo (ex Skender Vakuf) to Banja Luka, on right bank of Vrbas river. Type locality is situated about 64 km SE from Ciganska pećina (SW edge of Grmeč planina) where *P. brevicollis* and *P. neumanni* live and about 53 km NE from Trljica pećina with *P. nonveilleri* and *P. insignis* and from Vaganska pećina where *P. vitorogensis* was found. The closest other *Parapropus* species is *P. sericeus simplicipes* from Mačkića pećina (Manjača planina, left bank of Vrbas river) which is situated about 30 km W from Otloviči pećina (Fig. 30). Mountain Čemernica planina seems to be geographically isolated from other *Parapropus* species localities. Presence of *P. jasminkoi* sp. n. is to be expected in this mountain from other cavities as well.

Bionomy (ecology): Specimens of the new species were collected on wet flowstone deposits in the deeper part of Otlovića pećina in total darkness together with numerous leptodirine *Adelopidius* cf. *kuchtae* Breit.

Etymology: New species is named after Dr. Jasminko Mulaomerović from Sarajevo (Centar za Krš i Speleologiju), the tireless promoter of speleology and karstology in Bosnia and Herzegovina.

Identification key to the *Parapropus* "brevicollis" group of species

1. Pronotum in dorsal view slightly longer than wide, index pronotum length / pronotum width less than 1.25. Punctuation and pubescence on pronotum regular and evident on the whole pronotum. Smaller species, total body length less than 4.9 mm ..... 2 ("brevicollis" group)

- Pronotum in dorsal view more or less elongated, index pronotum length/pronotum width more than 1.26. Punctuation and pubescence on pronotum weak and not equal, sometimes almost absent. Bigger species, total body length more than 5.0 mm ..... other species (***P. sericeus*** Schmidt, ***ganglbaueri*** Ganglbauer, ***pfeiferi*** Apfelbeck, ***neumanni*** Müller, ***insignis*** Müller)

2. Pronotum lateral edges in dorsal view strongly rounded on anterior edge and deeply sinusoid on posterior edge (Figs. 5, 6). Male anterior 1st protarsomere elongated, weakly dilated (Fig. 19), 3.36 – 3.48 times longer than wide. Long 28.5 % of total male protarse length. Female 1st protarsomere long, long 37 % of total female protarse length. Aedeagus in dorsal view widest at the middle part (Fig. 24), tegmen in lateral view strongly curved on the middle part (Fig. 25). Antennomere VIII equally long as antennomere IX. Small species (4.0 mm)..... ***brevicollis*** Müller

- Pronotum lateral edges in dorsal view less strongly rounded on anterior edge and less sinusoid on posterior edge (Figs. 3, 4, 7, 8). Male anterior tarsi strongly dilated (Figs. 18, 20). Antennomere VIII shorter than antennomere IV. Bigger species (4.1 – 4.75 mm)..... 3.

3. Male 1st protarsomere prolonged trapezoidal (Fig. 18), 1.7 – 1.8 times longer than wide. Long 25 % of total male protarse length. Female 1st protarsomere short (Fig. 17), long only 26 % of total female protarse length. Aedeagus in dorsal view widest at the apex (Fig. 21), tegmen in lateral view strongly curved on the apical half (Fig. 22), paramere apex with three long, equally strong setae..... ***jasminkoi*** **sp. n**.

- Male aedeagus tegmen in lateral view straight, weakly curved in basal half (Fig. 28), parameres strongly flattened laterally, armed with one strong widest apical seta, one inner thin short and one outer long in pre-apical position (Fig. 29).....4.

4. Male 1st protarsomere prolonged elliptical, 2.26 – 2.39 times longer than wide, equally broad as tibia apex. Long 29 % of total male protarsomere length (Fig. 20). Female 1st protarsomere long, more than 39 % of total female protarsomere length. Aedeagus as in Figs. 27, 28, 29..... ***nonveilleri*** Müller

- Male 1st protarsomere 2.20 times longer than wide, broader than the tibia apex (according to original description) ..... ***vitorogensis*** Ćurčić S., Pešić & B.P.M. Ćurčić

Discussion

With description of new *Parapropus* species and subspecies since Jeannel's monograph (1924), taxonomy and systematics of this genus became rather chaotic. It is evident that at least three groups of taxa exist; "sericeus" group on NW part of the genus distribution and "ganglbaueri" on SE part of genus distribution. These two groups meet directly in NW Bosnia where the third group "brevicollis" is present and morphological characters used by Jeannel are mixed here. From this reason serious morphologic revision, supported by molecular phylogenetic methods, is critically needed. Since we did not yet obtain specimens of all described taxa, in this paper we were therefore limited to description of the new species. We described for the first time particular morphological characters of *P. brevicollis* and *P. nonveilleri* needed to put new species into the context.

Despite similarities in size and pronotum dimensions it seems that informal group "brevicollis" is not phylogenetic one. Species *P. brevicollis* and *P. jasmnikoi* sp.n. seems to be closely related, sharing together shape of aedeagus, lack of internal sclerotised structures in endophallus and presence of evident stylus in basal part of tegmen as well as the equally strong setae on paramere apex. In contrary, closely related species *P. nonveilleri* and *P. vitorogensis* have aedeagus much more similar to other groups of *Parapropus* species, making relative shortening of pronotum a result of probable homoplasy. From this reason proposed identification key to "brevicollis" species have to be considered provisional until all *Parapropus* species will be revised.

Acknowledgements

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