Arch. Biol. Sci., Belgrade, 66 (1), 415-427, 2014 DOI:10.2298/ABS1401415C

THREE NEW CAVE-DWELLING TRECHINE GROUND BEETLES FROM EASTERN AND SOUTHEASTERN SERBIA (COLEOPTERA: CARABIDAE: TRECHINAE)

S.B. ĆURČIĆ, MAJA D. VRBICA, D. Ž. ANTIĆ, Đ. MARKOVIĆ, M. PETKOVIĆ and B.P.M. ĆURČIĆ

University of Belgrade - Faculty of Biology, Institute of Zoology, 11000 Belgrade, Serbia

Abstract –Three new troglobitic trechine ground beetle species are described from three caves in eastern and southeastern Serbia: *Duvalius* (*Paraduvalius*) *bogovinae* sp. n., from the Bogovinska Pećina Cave, village of Bogovina, Kučajske Planine Mts., near Boljevac, eastern Serbia; *D.* (*P.*) *milutini* sp. n., from the Samar cave system, village of Kopajkošara, Mt. Kalafat, near Svrljig, southeastern Serbia, and *D.* (*P.*) *beljanicae* sp. n., from the Velika Atula Cave, village of Strmosten, Mt. Beljanica, near Despotovac, eastern Serbia. The new species are easily distinguished from relatives. All important morphological features, along with the diagnoses and illustrations of the new taxa are presented. The new species are relicts and endemics of eastern and southeastern Serbia. They probably belong to old phyletic lineages of Tertiary or even pre-Tertiary origin.

Key words: Carabidae, Trechinae, *Duvalius*, *Paraduvalius*, new species, cave-dwelling fauna, eastern and southeastern Serbia

INTRODUCTION

Altogether 30 species and 3 subspecies of the subgenus *Paraduvalius* Knirsch, 1924 (genus *Duvalius* Delarouzée, 1859) are presently known. They inhabit eastern and southeastern Serbia, northern and southern Bulgaria, and northeastern Greece (Moravec et al., 2003; Guéorguiev, 2004, 2005; Guéorguiev and Lobo, 2006; Janák and Moravec, 2008; Vrbica et al., 2013). Of these, only four species have been established in Serbia so far – *Duvalius* (*Paraduvalius*) *winkleri* (Jeannel, 1923), from the Ravna Peć Cave, village of Prekonoga, near Svrljig, Svrljiške Planine Mts.; *D.* (*P.*) *stankovitchi* (Jeannel, 1923), from a few caves on Kučajske Planine Mts.; *D.* (*P.*) *trifunovici* Vrbica, S. Ćurčić, Antić & B. Ćurčić, 2013, from the Mandina Pećina Cave, village of Zlot, near Bor, Kučajske Planine Mts., and *D.* (*P.*) *rtanjensis* Vrbica, S. Ćurčić, Antić & B. Ćurčić, 2013, from the Golema Porica Pit, Mt. Rtanj (Jeannel, 1923, 1928; Vrbica et al., 2013). The species *Duvalius* (*Paraduvalius*) *stankovitchi* comprises three subspecies: *D.* (*P.*) *stankovitchi stankovitchi* (Jeannel, 1923) from the Ravanička Pećina Cave, village of Senje, near Ćuprija, *D.* (*P.*) *stankovitchi georgevitchi* (Jeannel, 1923) from the Lazareva Pećina Cave, village of Zlot, near Bor, and *D.* (*P.*) *stankovitchi devojensis* (Jeannel, 1923) from the Devojačka Pećina Cave, village of Podgorac, near Boljevac (Jeannel, 1923, 1928; Moravec et al., 2003).

Several new trechine genera have been described from Serbia in recent years – *Serboduvalius* S. Ćurčić, Pavićević & B. Ćurčić, 2001, *Rascioduvalius* S. Ćurčić, Brajković, Mitić & B. Ćurčić, 2003, *Curcicia* S. Ćurčić & Brajković, 2003, *Javorella* S. Ćurčić, Brajković & B. Ćurčić, 2003, and *Glabroduvalius* Vrbica, S. Ćurčić, Antić & B. Ćurčić, 2013 (Ćurčić et al., 2001, 2003a, 2003b, 2013; Ćurčić and Brajković, 2003; Vrbica et al., 2013). Large parts of the Dinaric and Carpatho-Balkan mountain ranges in Serbia, where some new

trechine taxa can be expected to be found in the future, have remained unexplored.

Field trips to eastern and southeastern Serbia in 2012 and 2013, organized by the Institute of Zoology, University of Belgrade - Faculty of Biology, resulted in the discovery of three new trechine ground beetle species. Descriptions and diagnoses of the new trechine taxa are presented in this study. The diagnosis of *Duvalius* (*Paraduvalius*) *bogovinae* sp. n. is based on a thorough analysis of the type series of two males and one female collected in the Bogovinska Pećina Cave, village of Bogovina, Kučajske Planine Mts., near Boljevac; the diagnosis of *D.* (*P.*) *milutini* sp. n. is based on a thorough analysis of the type series of two males and seven females collected in the Samar cave system, village of Kopajkošara, Mt. Kalafat, near Svrljig, and the diagnosis of *D.* (*P.*) *beljanicae* sp. n. is based on a thorough analysis of the type series of three males and seven females collected in the Velika Atula Cave, village of Strmosten, Mt. Beljanica, near Despotovac.

MATERIALS AND METHODS

The ground beetle specimens were analyzed in the laboratories of the Institute of Zoology, University of Belgrade - Faculty of Biology, Belgrade, Serbia. The male and female genitalia were removed from the bodies and fixed on microscope slides in a medium composed of Canada balsam and xylol. The beetle individuals were then glued onto paper and analyzed as dry specimens. All taxonomically important morphological characters were studied for comparison. A Carl Zeiss - Stemi 2000 binocular stereomicroscope and Carl Zeiss - Axioskop 40 microscope with a Canon PowerShot A80 digital camera attached were used in this study. A Canon PowerShot SX 130 IS 7 digital camera was used for photographing whole specimens.

RESULTS AND DISCUSSION

FAMILY CARABIDAE LATREILLE, 1802

SUBFAMILY TRECHINAE BONELLI, 1810

TRIBE TRECHINI BONELLI, 1810

GENUS *DUVALIUS* DELAROUZÉE, 1859

SUBGENUS *PARADUVALIUS* KNIRSCH, 1924

DUVALIUS (PARADUVALIUS) BOGOVINAE S. ĆURČIĆ, VRBICA, ANTIĆ & B. ĆURČIĆ, SP. N. (Figs. 1-5)

Fig. 1. *Duvalius* (*Paraduvalius*) *bogovinae* sp. n. from the Bogovinska Pećina Cave, village of Bogovina, near Boljevac, Kučajske Planine Mts., eastern Serbia. Holotype male, habitus (dorsal view). Scale = 1.00 mm.

Etymology – After the village of Bogovina, where the type locality of the new species described is located – Bogovinska Pećina Cave.

Type locality – Bogovinska Pećina Cave, village of Bogovina, near Boljevac, Kučajske Planine Mts., eastern Serbia, 07.07.2013, holotype male and a paratype male, collected by hand, leg. Đ. Marković; *idem*, 27.05.2013-07.07.2013, paratype female, collected from pitfall traps with rotten meat as bait, leg. M. Petković. The type specimens are deposited

Figs. 2-5. *Duvalius* (*Paraduvalius*) *bogovinae* sp. n. from the Bogovinska Pećina Cave, village of Bogovina, near Boljevac, Kučajske Planine Mts., eastern Serbia. 2 – holotype male, aedeagus (lateral view); 3 – holotype male, aedeagus (dorsal view); 4 – holotype male, abdominal sternite IX (urite); 5 – paratype female, genitalia. Scales = 0.20 mm.

in the collection of the Institute of Zoology, University of Belgrade - Faculty of Biology, Belgrade, Serbia (IZFB-13/41-43).

Diagnosis – *Duvalius* (*Paraduvalius*) *bogovinae* sp. n. clearly differs from its closest congeners from caves in eastern Serbia. These are *Duvalius* (*Paraduvalius*) *stankovitchi*, *D.* (*P.*) *trifunovici*, and *D.* (*P.*) *beljanicae* sp. n. However, there are numerous distinctions between the new species and the other three species and these are presented below. *Duvalius* (*Paraduvalius*) *bogovinae* sp. n. is easily distinguished from *D.* (*P.*) *stankovitchi* by its smaller size (4.43-4.59 mm *vs.* 5.00-6.20 mm), length/width ratio of the head (wider than longer *vs.* as long as wide), length of the antennae (reaching around the mid-elytra level *vs.* almost reaching the mid-elytra level), length/width ratio of the pronotum (wider than long *vs.* longer than wide), shape of the pronotum (widest around the anterior fourth *vs.* widest around the anterior third), shape of the posterior pronotal angles (somewhat acute-angled *vs.* almost right-angled), position of the first pair of pronotal setae (between the anterior fourth and third of the pronotum *vs.* at the anterior third of the pronotum), length/width ratio of the elytra (1.86 times as long as wide *vs.* 2.00 times as long as wide), shape of the elytra (sub-parallel, widest slightly above the mid level *vs.* not sub-parallel, widest somewhat below the mid level), position of the first pair of elytral discal setae (on third elytral striae, between the anterior fifth and fourth of elytral length, at the level between the third and fourth humeral setae *vs.* on fourth elytral interstriae, around the anterior fourth of elytral length, at the level of the fourth humeral setae), shape of the aedeagus (somewhat curved, median lobe slightly curved in the basal half, then almost straight, gradually narrowing towards the apex, basal bulb massive, rounded *vs.* abruptly bent around the basal third, convex dorsally in that part, then straight, median lobe of a constant width towards the apex, abruptly narrowing apically, basal bulb with a basal narrowing), and size and shape of the copulatory piece (almost as long as three-fifths of aedeagus length, apically pointed *vs.* as long as three-fourths of aedeagus length, apically narrowing, apex obtuse) (Jeannel, 1923, 1928; present study).

Duvalius (*Paraduvalius*) *bogovinae* sp. n. is easily distinguished from *D.* (*P.*) *trifunovici* by its smaller size (4.51 mm *vs*. 4.71 mm), depth of the frontal furrows (slightly deeper in the first third *vs*. of the same depth along its length), presence/absence of hairs on the head (with tiny, rare hairs *vs*. absence of hairs, except for cheeks), presence/absence, form and size of the eyes (atrophied, in rare cases visible, lenticular, 0.08 mm long and 0.03 mm wide *vs*. reduced, small, ellipsoid, 0.12 mm long and 0.06 mm wide), number of the ommatidia (2-9 *vs*. 15-20), length of the antennae (reaching around the middle of the elytra *vs*. exceeding slightly over the middle of the elytra), shape of the posterior pronotal angles (somewhat acute-angled *vs*. somewhat obtuse-angled), shape of the posterior pronotal margin (very slightly concave *vs*. mostly straight), shape of the lateral pronotal margins (less concave posteriorly *vs*. more concave posteriorly), position of the first pair of pronotal setae (between the anterior fourth and third of the pronotum *vs*. at the anterior third of the pronotum), shape of the elytra (sub-parallel, widest slightly above the mid level *vs*. not sub-parallel, widest slightly below the mid level), length/width ratio of the elytra (1.86 times as long as wide *vs*. 1.69 times as long as wide), shape of the shoulders (more elevated *vs*. less elevated), number of well-depressed elytral striae (four inner ones *vs*. three inner ones), position of the first (between the anterior fifth and fourth of elytral length, at the level between the third and fourth humeral setae *vs*. around the anterior fourth of elytral length, at the level of the fourth humeral setae) and second pairs of elytral discal setae (around three-fifths of elytral length *vs*. somewhat below the mid-elytra level), size and shape of the aedeagus (massive, somewhat curved, median lobe slightly curved in the basal half, then almost straight, gradually narrowing towards the apex, apex more curved downwards in lateral view and more rounded in dorsal view *vs*. medium-sized, almost forming a right angle somewhat after the basal third, then almost straight, median lobe basally slightly curved, then straight, at first gradually narrowing towards the apex, then abruptly narrowing apically, apex less curved downwards in lateral view and less rounded in dorsal view), and size of the copulatory piece (about as long as three-fifths of aedeagus length *vs*. about as long as two-thirds of aedeagus length) and urite (about the same size as aedeagus *vs*. slightly longer than aedeagus) (Vrbica et al., 2013; present study).

Duvalius (*Paraduvalius*) *bogovinae* sp. n. is easily distinguished from *D.* (*P.*) *beljanicae* sp. n. by its bigger size (4.51 mm *vs*. 4.32 mm), depth of the frontal furrows (slightly deeper in the first third *vs*. slightly deeper in the first two fifths), presence/absence of hairs on the head (with tiny, rare hairs *vs*. absence of hairs, except for cheeks), presence/absence, form and size of the eyes (atrophied, in rare cases visible, lenticular, 0.08 mm long and 0.03 mm wide *vs*. reduced to a different degree, from lenticular, small, with a darkened border, 0.07 mm long and 0.01 mm wide to almost atrophied, in the form of a line or completely absent), length of the antennae (reaching around the middle of the elytra *vs*. exceeding somewhat over the middle of the elytra), shape of the pronotum (widest around the anterior fourth *vs*. widest slightly above the anterior fourth), shape of the posterior pronotal angles (somewhat acute-angled *vs*. scarcely obtuse-angled), shape of the anterior pronotal margin (slightly concave *vs*. mostly straight), shape of the posterior pronotal margin (very slightly concave *vs*. mostly straight), shape of the lateral pronotal margins (rounded anteriorly and slightly concave posteriorly *vs*. rounded anteriorly, then almost straight, slightly concave right above the hind pronotal angles), shape of the marginal pronotal furrows (narrow and shallow *vs*. wide and deep at the level of anterior pronotal angles, then narrow and shallow), position of the first pair of pronotal setae (between the anterior fourth and third of the pronotum *vs*. around the anterior fourth of the pronotum), shape of the elytra (sub-parallel, widest slightly above the mid level *vs*. not sub-parallel, widest slightly below the mid level), length/width ratio of the elytra (1.86 times as long as wide *vs*. 1.71 times as long as wide), shape of the shoulders (more elevated *vs*. less elevated), distance between the humeral setae (the shortest distance is between the third and fourth setae *vs*. the shortest distance is between the first and second setae), number of well-depressed elytral striae (four inner ones *vs*. two inner ones), position of the first (between the anterior fifth

and fourth of elytral length, at the level between the third and fourth humeral setae *vs*. somewhat above the anterior third of elytral length, somewhat below the level of the fourth humeral setae) and second pairs of elytral discal setae (about three-fifths of elytral length *vs*. about two-thirds of elytral length), shape of the aedeagus (somewhat curved, median lobe slightly curved in the basal half, then almost straight, gradually narrowing towards the apex, apex shorter, more curved downwards in lateral view and rounded in dorsal view, basal bulb massive *vs*. bent around the basal third, median lobe slightly curved, at first gradually narrowing towards the apex, then abruptly narrowing apically, sub-apically with a small dorsal sloping, apex longer, less curved downwards in lateral view and dragged in dorsal view, basal bulb medium-sized), and size of the urite (about the same size as aedeagus *vs*. somewhat longer than aedeagus) (present study).

Description – Medium-sized. Total body length (without mandibles) 4.43-4.59 mm. Body elongated, covered with hairs of moderate length. Body color reddish-brown. Head and pronotum each with a polygonal microsculpture (Fig. 1).

Head stout, rounded, slightly wider than long. Frontal furrows complete, arcuate and deep, slightly deeper in the first third. Head covered with tiny rare hairs. Cheeks convex. Eyes atrophied, with two or three depigmented ommatidia, in rare cases eyes visible, lenticular, with up to nine depigmented ommatidia 0.08 mm long and 0.03 mm wide, with a darkened border. An arcuated preocular furrow present. Mentum tooth bifid. Antennae of moderate length, differing between males and females; in males, these exceed slightly over the middle of the elytra, while in females almost reaching the middle of the elytra. Antennomere II shorter than antennomere IV. Antennal article XI about three times as long as wide (Fig. 1).

Pronotum small, wider than longer, sub-cordate, widest around the anterior fourth, slightly wider than head, narrowing towards the base. Anterior pronotal margin slightly concave. Anterior pronotal angles prominent and rounded. Lateral pronotal margins rounded anteriorly and slightly concave posteriorly. Posterior pronotal angles prominent, somewhat acute-angled, sharp. Posterior pronotal margin very slightly concave. Pronotal disc convex, with a median furrow. Marginal furrows narrow and shallow. Basal foveae wide, deep, and slightly punctate (Fig. 1).

Elytra elongated, ovoid, sub-parallel, 1.86 times as long as wide, widest slightly above the mid level. Shoulders rounded, somewhat elevated. Elytral apex rounded. Marginal furrows narrow and deep. Elytral disc slightly convex. The first four inner striae developed, well-depressed. Outer striae present in a form of more or less pronounced rows of points. Inner interstrial spaces convex (Fig. 1).

Legs long and thin. Fore tibias with a longitudinal fissure each. Male protarsomeres I and II dilated (Fig. 1).

Chaetotaxy: Head with two pairs of supraorbital setae. Pronotum with two pairs of pronotal setae. The first pair located between the anterior fourth and third of the pronotum, while the second pair situated in posterior pronotal angles. Each humerus with four setae. The longest distance is between the second and third setae, while the shortest distance is between the third and fourth setae. The second seta right next to the marginal furrow. First, third and fourth setae away from the furrow, with the first being closest to it, and the fourth farthest. Two discal setae on each elytron. The first pair of elytral discal setae situated on third striae, between the anterior fifth and fourth of elytral length, at the level between the third and fourth humeral setae. The second pair of elytral discal setae situated on third striae, about three-fifths of elytral length (Fig. 1).

Aedeagus massive, somewhat curved in lateral view (Fig. 2). Median lobe slightly curved in the basal half, then almost straight, gradually narrowing towards the apex. Apex acute, somewhat curved downwards. Basal bulb massive, rounded (Fig. 2). Median lobe almost straight dorsally, very slightly narrowing towards the rounded apex (Fig. 3). Paramerae mod-

erately wide, narrowing towards the apices, with four setae each (Figs. 2 and 3). Copulatory piece about as long as three-fifths of aedeagus length, strongly chitinized, gutter-shaped, unifid, apically pointed.

Male abdominal sternite IX (urite) elongated, sub-triangular, about the same size as aedeagus (Fig. 4).

Female genitalia are presented in Fig. 5. Gonocoxites IX relatively small, thickened, curved, basally partly jointed with gonosubcoxites IX. Female paired genital structures somewhat separated (Fig. 5).

Bionomy and distribution – The new species was found on the floor, under rocks, and in pitfall traps baited with rotten meat in the posterior part of the Bogovinska Pećina Cave**, village of Bogovina,** near **Boljevac, Kučajske Planine Mts.**, eastern Serbia. For the time being, the species is known only from the type locality.

Remarks – The new species belongs to the "*stankovitchi*" group of species based on the shape of the elytra, presence of unpronounced shoulders (rounded, not angled), absence of laid hairs on the vertex, and presence of a longitudinal fissure on the fore tibias and the first elytral discal setae located below the level of the third humeral setae (Guéorguiev, 1971).

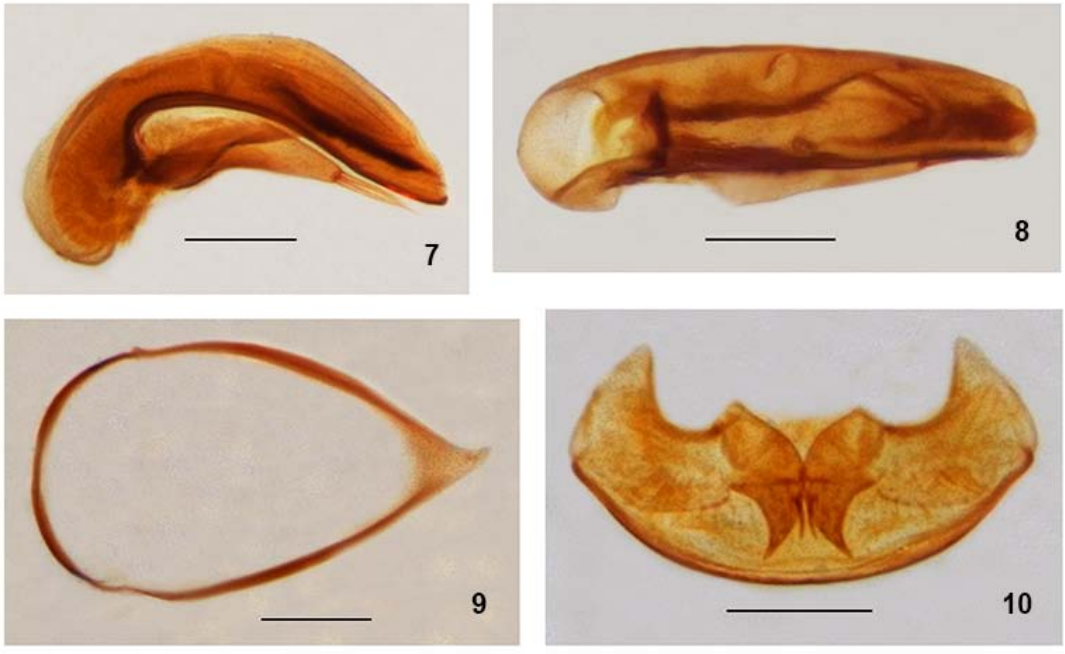
DUVALIUS (*PARADUVALIUS*) *MILUTINI*
S. ĆURČIĆ, VRBICA, ANTIĆ & B. ĆURČIĆ, SP. N.
(Figs. 6-10)

Etymology – After Mr. Milutin Veljković, a renowned Serbian speleologist who explored the Samar cave system, the type locality of the new species, and lived there continuously for 464 days in 1969 and 1970.

Type locality – Samar cave system, village of Kopajkošara, near Svrljig, Mt. Kalafat, southeastern Serbia, 23.09.2012, holotype male and paratype female, collected by hand, leg. D. Antić; *idem*, 25.06.2012-23.09.2012, four paratype females, collected from pitfall traps with rotten meat as bait, leg. S. Ćurčić & D. Antić; *idem*, 23.09.2012-02.12.2012, a paratype male and two paratype females, collected from pitfall traps with rotten meat as bait, leg. S. Ćurčić & D. Antić. The type specimens are deposited in the collection of the Institute of Zoology, University of Belgrade - Faculty of Biology, Belgrade, Serbia (IZFB-13/44-52).

Fig. 6. *Duvalius* (*Paraduvalius*) *milutini* sp. n. from the Samar cave system, village of Kopajkošara, near Svrljig, Mt. Kalafat, southeastern Serbia. Holotype male, habitus (dorsal view). Scale = 1.00 mm.

Diagnosis – *Duvalius* (*Paraduvalius*) *milutini* sp. n. clearly differs from its closest congeners from caves and pits in eastern and southeastern Serbia. These are *Duvalius* (*Paraduvalius*) *winkleri* and *D.* (*P.*) *rtanjensis*. However, there are numerous distinctions between the new species and the other two species and these are presented below. *Duvalius* (*Paraduvalius*) *milutini* sp. n. is easily distinguished from *D.* (*P.*) *winkleri* by its smaller size (4.02 mm *vs*. 4.20 mm), length/width ratio of the head (wider than long *vs*. as long as wide), form of the eyes (lenticular, with a darkened border *vs*. in the form of a whitish elongated ring, with no trace of pigment), length of the



Figs. 7-10. *Duvalius* (*Paraduvalius*) *milutini* sp. n. from the Samar cave system, village of Kopajkošara, near Svrljig, Mt. Kalafat, southeastern Serbia. 7 – holotype male, aedeagus (lateral view); 8 – holotype male, aedeagus (dorsal view); 9 – holotype male, abdominal sternite IX (urite); 10 – paratype female, genitalia. Scales = 0.20 mm.

antennae (reaching around the anterior third of the elytra *vs*. almost reaching the mid-elytra level), length/width ratio of the pronotum (wider than long *vs*. longer than wide), shape of the posterior pronotal angles (scarcely acute-angled *vs*. somewhat more expressed acute-angled), presence of hairs on the pronotum (present *vs*. absent), position of the first pair of pronotal setae (between the anterior fourth and third of the pronotum *vs*. slightly below the anterior fourth of the pronotum), form of the elytra (elongated, almost sub-parallel *vs*. shorter, oval), shape of the shoulders (slightly elevated *vs*. fairly prominent), position of the first (between the anterior sixth and fifth of elytral length *vs*. around the anterior fifth of elytral length) and second pairs of elytral discal setae (slightly above the mid-elytra level *vs*. somewhat below the mid-elytra level), size of the legs as compared to the body (long *vs*. short), size and shape of the aedeagus (small, almost forming a right angle somewhat after the basal third, then almost straight, with a dorsal widening starting before the middle and ending in the sub-apical part, apex rounded, basal bulb massive, more elongated *vs*. massive, elongated, curved along the whole its length, with a sub-apical widening, apex obtuse, basal bulb medium-sized, rounded), and shape of the copulatory piece (less widened, elongated, without spines, abruptly narrowing apically, deeper incised proximally *vs*. wide, less elongated, with a large number of fine spines apically, gradually narrowing apically, less incised proximally) (Jeannel, 1923, 1928; present study).

Duvalius (*Paraduvalius*) *milutini* sp. n. is easily distinguished from *D.* (*P.*) *rtanjensis* by its smaller size (3.95 mm *vs*. 4.35 mm), body color (reddish-brown *vs*. light brown), length of the antennae (reaching around a third of the elytral length *vs*. almost reaching the middle of the elytra), shape of the pronotum (widest between the anterior fourth and third *vs*. widest at the anterior third), shape of the posterior pronotal angles (scarcely acute-angled *vs*. almost right-angled), position of the first pair of pro-

notal setae (between the anterior fourth and third of the pronotum *vs*. around the anterior fourth of the pronotum), shape of the elytra (widest around the mid level *vs*. widest slightly below the mid level), shape of the shoulders (somewhat elevated, rounded *vs*. lowered, obtuse-angled), distance between the humeral setae and the position (the longest distance being between the third and fourth setae, while the distance between the first and second setae, and the second and third setae is about the same; the second seta right next to the marginal furrow; the first seta slightly away from the furrow *vs*. humeral setae equidistant; the first and second setae located at the edge of the marginal furrow), position of the first (between the anterior sixth and fifth of elytral length, at the level between the second and third humeral setae *vs*. around the anterior fifth of elytral length, at the level of the second humeral setae) and second pairs of the elytral discal setae (slightly above the mid-elytra level *vs*. somewhat below the mid-elytra level), and size and shape of the aedeagus (small, almost forming a right angle somewhat after the basal third, then almost straight, with a dorsal widening starting before the middle and ending in the sub-apical part, apex rounded, basal bulb massive, more elongated *vs*. medium-sized, regularly curved, slightly convex dorsally somewhat before the middle portion, in the sub-apical part suddenly narrowing towards the apex, apex acute, basal bulb rounded), copulatory piece (about as long as one-third of aedeagus length, unifid, apically pointed, deeply incised proximally *vs*. slightly shorter than half of aedeagus length, bifid, the apex in the form of two lobes, not incised proximally) and urite (less elongated, slightly longer than aedeagus *vs*. somewhat more elongated, nearly the same size as aedeagus) (Vrbica et al., 2013; present study).

Description – Medium-sized. Total body length (without mandibles) 3.52-4.52 mm. Body elongated, mostly covered with dense hairs of moderate length. Body color reddish-brown. Head and pronotum each with a polygonal microsculpture (Fig. 6).

Head stout, rounded, slightly wider than long. Frontal furrows complete, arcuate and deep, slightly deeper in the first half. Cheeks convex, covered with dense hairs. The rest of the head covered with tiny rare hairs. Eyes reduced, small, 0.09 mm long and 0.03 mm wide, lenticular, with a darkened border, the anterior margin convex, the posterior one scarcely convex, almost flattened, composed of 3-21 depigmented ommatidia. An arcuated preocular furrow present. Mentum tooth bifid. Antennae of moderate length, reaching about the anterior third of elytral length. Antennomere II slightly shorter than antennomere IV. Antennal article XI slightly more than twice as long as wide (Fig. 6).

Pronotum small, wider than long, sub-cordate, widest at the level between the anterior fourth and third, slightly wider than head, narrowing towards the base. Anterior pronotal margin mostly straight. Anterior pronotal angles slightly prominent and rounded. Lateral pronotal margins rounded anteriorly and somewhat concave posteriorly. Posterior pronotal angles prominent, scarcely acute-angled, sharp. Posterior pronotal margin slightly concave medially. Pronotal disc convex, with a median furrow. Marginal furrows narrow and shallow. Basal foveae wide, deep, and slightly punctate (Fig. 6).

Elytra elongated, ovoid, 1.73 times as long as wide, widest around the mid level. Shoulders rounded, somewhat elevated. Elytral apex rounded. Marginal furrows narrow and deep. Elytral disc slightly convex. The first three inner striae developed, well-depressed. Outer striae present in a form of more or less pronounced rows of points. Inner interstrial spaces convex (Fig. 6).

Legs long and thin. Fore tibias with a longitudinal fissure each. Male protarsomeres I and II dilated (Fig. 6).

Chaetotaxy: Head with two pairs of supraorbital setae. Pronotum with two pairs of pronotal setae. The first pair located between the anterior fourth and third, while the second pair situated in posterior pronotal angles. Each humerus with four setae. The longest distance is between the third and fourth setae, while the distance between the first and sec-

ond setae, and the second and third setae is about the same. The second seta right next to the marginal furrow. First, third and fourth setae away from the furrow, with the first being closest to it, and the fourth being farthest from it. With two discal setae on each elytron. The first pair of elytral discal setae situated on third striae, between the anterior sixth and fifth of elytral length, at the level between the second and third humeral setae. The second pair of elytral discal setae situated on third striae, slightly above the mid-elytra level (Fig. 6).

Aedeagus small, curved in lateral view (Fig. 7). Aedeagus regularly curved, slightly constricted proximally, before the middle to its sub-apical part convex dorsally, then narrowing apically. Apex rounded in lateral view (Fig. 7). Basal bulb medium-sized, slightly elongated (Fig. 7). Median lobe straight dorsally, with a rounded apex (Fig. 8). Paramerae moderately wide, narrowing towards the apices, with four setae each (Figs. 7 and 8). Copulatory piece about as long as one-third of aedeagus length, strongly chitinized, gutter-shaped, unifid, deeply incised basally, gradually narrowing towards the apex, then abruptly pointed apically.

Male abdominal sternite IX (urite) moderately elongated, sub-triangular, slightly longer than aedeagus (Fig. 9).

Female genitalia are presented in Fig. 10. Gonocoxites IX relatively small, thickened, curved, basally partly jointed with gonosubcoxites IX. Female paired genital structures scarcely separated (Fig. 10).

Bionomy and distribution – The new species was found on the floor, under rocks and pieces of rotten wood, and in pitfall traps baited with rotten meat in the posterior part of the Samar cave system, village of Kopajkošara, near Svrljig, Mt. Kalafat, southeastern Serbia. For the time being, the species is known only from the type locality.

Remarks – The new species belongs to the "*winkleri*" group of species based on the shape of the elytra, presence of unpronounced shoulders (rounded, not angled), absence of laid hairs on the vertex, presence of a longitudinal fissure on the fore tibias and the first elytral discal setae located above the level of the third humeral setae (Guéorguiev, 1971).

DUVALIUS (*PARADUVALIUS*) *BELJANICAE* S. ĆURČIĆ, VRBICA, ANTIĆ & B. ĆURČIĆ, SP. N. (Figs. 11-15)

Etymology – The new species is named after Mt. Beljanica, where its type locality is situated.

Fig. 11. *Duvalius* (*Paraduvalius*) *beljanicae* sp. n. from the Velika Atula Cave, village of Strmosten, near Despotovac, Mt. Beljanica, eastern Serbia. Holotype female, habitus (dorsal view). Scale = 1.00 mm.

Type locality – Velika Atula Cave, village of Strmosten, near Despotovac, Mt. Beljanica, eastern Serbia, 24.06.2012-25.09.2012, holotype female, collected from pitfall traps with rotten meat as bait, leg. Đ. Marković & M. Petković; *idem*, 25.09.2012-27.05.2013, three paratype males and six paratype females, collected from pitfall traps with rotten meat as bait, leg. Đ. Marković & M. Petković. The type specimens are deposited in the collection of the Institute

Figs. 12-15. *Duvalius* (*Paraduvalius*) *beljanicae* sp. n. from the Velika Atula Cave, village of Strmosten, near Despotovac, Mt. Beljanica, eastern Serbia. 12 – paratype male, aedeagus (lateral view); 13 – paratype male, aedeagus (dorsal view); 14 – paratype male, abdominal sternite IX (urite); 15 – holotype female, genitalia. Scales = 0.20 mm.

of Zoology, University of Belgrade - Faculty of Biology, Belgrade, Serbia (IZFB-13/53-62).

Diagnosis – *Duvalius* (*Paraduvalius*) *beljanicae* sp. n. clearly differs from its closest congeners from caves in eastern Serbia. These are *Duvalius* (*Paraduvalius*) *stankovitchi*, *D.* (*P.*) *trifunovici*, and *D.* (*P.*) *bogovinae* sp. n. However, there are numerous distinctions between the new species and the other three species, and these are presented below. *Duvalius* (*Paraduvalius*) *beljanicae* sp. n. is easily distinguished from *D.* (*P.*) *stankovitchi* by its smaller size (4.05-4.59 mm *vs.* 5.00-6.20 mm), length/width ratio of the head (wider than long *vs.* as long as wide), length of the antennae (more exceeding over the mid-elytra level *vs.* less exceeding over the mid-elytra level), length/width ratio of the pronotum (wider than long *vs.* longer than wide), shape of the pronotum (lateral pronotal margins rounded anteriorly, then almost straight, slightly concave right above the hind pronotal angles *vs.* lateral pronotal margins rounded anteriorly and somewhat concave posteriorly), shape of the posterior pronotal angles (scarcely obtuse-angled *vs.* almost right-angled), position of the first pair of pronotal setae (around the anterior fourth of the pronotum *vs.* at the anterior third of the pronotum), length/width ratio of the elytra (1.71 times as long as wide *vs.* 2.00 times as long as wide), shape of the elytra (widest slightly below the mid level *vs.* widest more below the mid level), shape of the shoulders (less elevated *vs.* more elevated), number of well-depressed elytral striae (two inner ones *vs.* four inner ones), position of the first (on third elytral striae, somewhat above the anterior third of elytral length, somewhat below the level of the fourth humeral setae *vs.* on fourth elytral interstriae, around the anterior fourth of elytral length, at the level of the fourth humeral setae) and second pairs of elytral discal setae (around two-thirds of elytral length *vs.* somewhat below the mid-elytra level), shape of the aedeagus (strongly bent around the basal third, median lobe slightly curved, at first gradually narrowing towards the apex, then abruptly narrowing apically, sub-apically with a small dorsal sloping, basal bulb medium-sized, rounded *vs.* abruptly bent around the basal third, convex dorsally in that part, then straight, median lobe of a constant width towards the apex, abruptly narrowing apically, without the

sub-apical dorsal sloping, basal bulb massive, with a basal narrowing), and size and shape of the copulatory piece (about as long as two-thirds of aedeagus length, apically pointed *vs*. as long as three-fourths of aedeagus length, with a rounded apex) (Jeannel, 1923, 1928; present study).

Duvalius (*Paraduvalius*) *beljanicae* sp. n. is easily distinguished from *D.* (*P.*) *trifunovici* by its smaller size (4.32 mm *vs*. 4.71 mm), depth of the frontal furrows (slightly deeper in the first two-fifths *vs*. of the same depth along its length), form and size of the eyes (from lenticular, 0.07 mm long and 0.01 mm wide, to almost atrophied, in the form of a line, or completely absent *vs*. ellipsoid, 0.12 mm long and 0.06 mm wide), number of the ommatidia (without or 2-12 *vs*. 15-20), length of the antennae (more exceeding over the middle of the elytra *vs*. slightly exceeding over the middle of the elytra), shape of the pronotum (widest slightly above the anterior fourth *vs*. widest around the anterior fourth), shape of the anterior pronotal margin (mostly straight *vs*. slightly concave), shape of the posterior pronotal angles (scarcely obtuse-angled *vs*. somewhat more expressed obtuse-angled), shape of the lateral pronotal margins (rounded anteriorly, then almost straight, slightly concave right above the hind pronotal angles *vs*. rounded anteriorly, somewhat concave posteriorly), shape of the marginal pronotal furrows (wide and deep at the level of anterior pronotal angles, then narrow and shallow *vs*. narrow and shallow), position of the first pair of pronotal setae (around the anterior fourth of the pronotum *vs*. at the anterior third of the pronotum), number of well-depressed elytral striae (two inner ones *vs*. three inner ones), distance between the humeral setae (the shortest distance is between the first and second setae *vs*. the shortest distance is between the third and fourth setae), position of the first (somewhat above the anterior third of elytral length, somewhat below the level of the fourth humeral setae *vs*. around the anterior fourth of elytral length, at the level of the fourth humeral setae) and second pairs of elytral discal setae (around two-thirds of elytral length *vs*. somewhat below the mid-elytra level), size and shape of the aedeagus (massive, bent around the basal third, median lobe slightly curved, at first gradually narrowing towards the apex, then abruptly narrowing apically, sub-apically with a small dorsal sloping, apex more acute, basal bulb medium-sized *vs*. medium-sized, almost forming a right angle somewhat after the basal third, then almost straight, median lobe slightly curved basally, then straight, at first gradually narrowing towards the apex, then abruptly narrowing apically, without the sub-apical dorsal sloping, apex less acute, basal bulb massive) and size of the urite (more longer than aedeagus *vs*. less longer than aedeagus) (Vrbica et al., 2013; present study).

All morphological differences between *Duvalius* (*Paraduvalius*) *beljanicae* sp. n. and *D.* (*P.*) *bogovinae* sp. n. were already mentioned in the previous text (Diagnosis of *D. bogovinae* sp. n.).

Description – Medium-sized. Total body length (without mandibles) 4.05-4.59 mm. Body elongated, covered with hairs of moderate length. Body color reddish-brown. Head and pronotum each with a polygonal microsculpture (Fig. 11).

Head stout, rounded, slightly wider than long. Frontal furrows complete, arcuate and deep, slightly deeper in the first two-fifths. Hairs lacking, except for cheeks. Cheeks convex. Eyes reduced to a different degree, from lenticular, small, with a darkened border, 0.07 mm long and 0.01 mm wide to almost atrophied, in the form of a line, or completely absent. Without ommatidia or with 2-12 depigmented ommatidia. An arcuated preocular furrow present. Mentum tooth bifid. Antennae of moderate length, exceeding somewhat over the middle of the elytra. Antennomere II shorter than antennomere IV. Antennal article XI about three times as long as wide (Fig. 11).

Pronotum small, wider than long, sub-cordate, widest slightly above the anterior fourth, slightly wider than head, narrowing towards the base. Anterior pronotal margin mostly straight. Anterior pronotal angles prominent and rounded. Lateral pronotal margins rounded anteriorly, then almost straight, slightly concave right above the hind pronotal an-

gles. Posterior pronotal angles prominent, scarcely obtuse-angled, sharp. Posterior pronotal margin mostly straight. Pronotal disc convex, with a median furrow. Marginal furrows wide and deep at the level of anterior pronotal angles, then narrow and shallow. Basal foveae wide, deep, and slightly punctate (Fig. 11).

Elytra elongated, ovoid, 1.71 times as long as wide, widest slightly below the mid level. Shoulders rounded, slightly elevated. Elytral apex rounded. Marginal furrows narrow and deep. Elytral disc slightly convex. The first two inner striae developed, well-depressed. Outer striae present in a form of more or less pronounced rows of points. Inner interstrial spaces convex (Fig. 11).

Legs long and thin (Fig. 11). Fore tibias with a longitudinal fissure each. Male protarsomeres I and II dilated.

Chaetotaxy: Head with two pairs of supraorbital setae. Pronotum with two pairs of pronotal setae. The first pair located around the anterior fourth, while the second pair situated in posterior pronotal angles. Each humerus with four setae. The longest distance is between the second and third setae, while the shortest distance is between the first and second setae. The second seta right next to the marginal furrow. First, third and fourth setae away from the furrow, with the first being closest to it, and the fourth farthest from it. With two discal setae on each elytron. The first pair of elytral discal setae situated on third striae, somewhat above the anterior third of elytral length, somewhat below the level of the fourth humeral setae. The second pair of elytral discal setae situated on third striae, around two-thirds of elytral length (Fig. 11).

Aedeagus massive, strongly bent around the basal third in lateral view (Fig. 12). Median lobe slightly curved, at first gradually narrowing towards the apex, then abruptly narrowing apically, sub-apically with a small dorsal sloping. Apex acute in lateral view, slightly curved downwards (Fig. 12). Basal bulb medium-sized, rounded (Fig. 12). Median lobe straight dorsally, with a dragged rounded apex (Fig. 13). Aedeagus apically narrowing (Fig. 13). Parameraе moderately wide, narrowing towards the apices, with four setae each (Figs. 12 and 13). Copulatory piece about as long as two-thirds of aedeagus length, strongly chitinized, gutter-shaped, unifid, apically pointed.

Male abdominal sternite IX (urite) elongated, sub-triangular, somewhat longer than aedeagus (Fig. 14).

Female genitalia are presented in Fig. 15. Gonocoxites IX relatively small, thickened, curved, basally partly jointed with gonosubcoxites IX. Female paired genital structures somewhat separated (Fig. 15).

Bionomy and distribution – The new species was found in pitfall traps baited with rotten meat in the posterior part of the Velika Atula Cave, village of Strmosten, near Despotovac, Mt. Beljanica, eastern Serbia. For the time being, the species is known only from the type locality.

Remarks – The new species belongs to the "*stankovitchi*" group of species based on the shape of the elytra, presence of unpronounced shoulders (rounded, not angled), absence of laid hairs on the vertex, presence of a longitudinal fissure on the fore tibias and the first elytral discal setae located below the level of the third humeral setae (Guéorguiev, 1971).

CONCLUSIONS

The new troglobitic trechine ground beetle species probably belong to old phyletic lineages of Tertiary or even pre-Tertiary origin (Guéorguiev, 1977). They are both relicts and endemics of the Carpatho-Balkan mountain system in eastern and southeastern Serbia. The endemic differentiation of the new species and relatives on the Balkan Peninsula was facilitated by the great Alpine Orogeny, paleoclimatic events, and subsequent evolution of the underground karstic relief, which yielded numerous new epigean and hypogean niches suitable for the preservation of the old and autochthonous fauna.

Acknowledgments. – We are thankful to Mr. Darko Dragulović (Podgorac Timok, Serbia) and Mr. Zvonko Trifunović (Rock and Ice Society of Extreme Sports, Bor, Serbia) for their help during the field trips. We are especially indebted to Mrs. Marina Žikić (Tourist Organization of the Boljevac Municipality, Boljevac, Serbia), who facilitated our investigations performed in the Bogovinska Pećina Cave. The study was financially supported by the Serbian Ministry of Education, Science, and Technological Development (Grant No. 173038).

REFERENCES

Ćurčić, *S. B.* and *M. M. Brajković* (2003). *Curcicia*, a new genus of endemic ground beetles (Trechini, Carabidae, Coleoptera) based on *Duvalius bolei* Pretner. *Archives of Biological Sciences* (*Belgrade*) **55 (3-4),** 27P-28P.

Ćurčić, *S. B.*, *Brajković*, *M. M.*, *Ćurčić*, *B. P. M.* and *B. M. Mitić* (2003a). *Javorella*, a new genus of endemic ground beetles (Trechini, Carabidae, Coleoptera) from West and Southwest Serbia. *Archives of Biological Sciences* (*Belgrade*) **55 (1-2),** 15-22.

Ćurčić, *S. B.*, *Brajković*, *M. M.*, *Mitić*, *B. M.* and *B. P. M. Ćurčić* (2003b). *Rascioduvalius*, a new genus of cave and endogean trechines (Trechini, Carabidae, Coleoptera) from the Balkan Peninsula. *Periodicum biologorum* **105 (4),** 483-486.

Ćurčić, *S. B.*, *Ćurčić*, *B. P. M.* and *M. Vrbica* (2013). Remarks on some trechine ground beetle taxa from the Balkan Peninsula (Coleoptera: Carabidae: Trechini). *Archives of Biological Sciences* (*Belgrade*) **65 (4),** 1675-1686.

Ćurčić, *S. B.*, *Pavićević*, *D.* and *B. P. M. Ćurčić* (2001). *Serboduvalius dragacevensis*, a new genus and a new species of trechines from caves in Southwestern Serbia (Trechinae, Carabidae, Coleoptera). *Archives of Biological Sciences* (*Belgrade*) **53 (1-2),** 51-56.

Guéorguiev, *B.* (2004). Contribution to the Bulgarian ground beetle fauna (Coleoptera: Carabidae). IV. Two new species of *Duvalius* (*Paraduvalius*) and notes on the other species of the subgenus. *Atti del Museo Civico di Storia Naturale di Trieste* **51,** 89-101.

Guéorguiev, *B.* (2005). Two new cave inhabiting trechine beetles from Albania and Bulgaria (Coleoptera, Carabidae). *Fragmenta entomologica* (*Roma*) **37 (1),** 33-46.

Guéorguiev, *B.* and *J. M. Lobo* (2006). Adephagous beetles (Insecta: Coleoptera: Adephaga) in the Western Rhodopes (Bulgaria and Greece). 283-346. *In*: *Beron*, *P.* (*ed.*): *Biodiversity of Bulgaria. 3. Biodiversity of Western Rhodopes* (*Bulgaria and Greece*) *I.* Pensoft Publishers and National Museum of Natural History in Sofia, Sofia-Moscow, 1-974.

Guéorguiev, *V. B.* (1971). Notes sur le sous-genre *Paraduvalius* Kn. et descriptions de deux espèces nouvelles (Coleoptera, Carabidae – genre *Duvalius*). *Bulletin de l'Institut de zoologie et Musée*, *Académie bulgare des sciences* **33,** 155-164.

Guéorguiev, *V. B.* (1977). *La faune troglobie terrestre de la péninsule Balkanique. Origine*, *formation et zoogéographie*. Special Edition. Bulgarian Academy of Sciences, Sofia, 1-182.

Janák, J. and *P. Moravec* (2008). Drei neue *Duvalius*-Arten aus Bulgarien und Serbien (Coleoptera: Carabidae: Trechinae). *Klapalekiana* **44,** 1-19.

Jeannel, *R.* (1923). Description préliminaires d'anophthalmes nouveaux de Serbie. *Buletinul Societății de Științe din Cluj* **2,** 1-12.

Jeannel, *R.* (1928). Monographie des Trechinae. Morphologie comparée et distribution géographique d'un groupe de Coléoptères (troisième livraison). *L'Abeille* **35,** 1-808.

Moravec, *P.*, *Uéno*, *S.-I.* and *I. A. Belousov* (2003). Tribe Trechini Bonelli, 1810. 288-346. In: Löbl, I. and A. Smetana (eds.): *Catalogue of Palaearctic Coleoptera. Volume 1. Archostemata - Myxophaga - Adephaga*. Apollo Books, Stenstrup, 1-819.

Vrbica, *M.*, *Ćurčić*, *S.*, *Antić*, *D.*, *Petrović*, *A.*, *Tomić*, *V.*, *Petković*, *M.*, *Marković*, *Đ.*, *Stojanović*, *D.* and *B. Ćurčić* (2013). On some new cave-dwelling ground beetles (Coleoptera: Carabidae: Trechini) from Eastern Serbia. *Archives of Biological Sciences* (*Belgrade*) **65 (4),** 1687-1701.