

## WINKLERITES SERBICUS, A NEW ENDOGEAN SPECIES OF GROUND BEETLES (COLEOPTERA: CARABIDAE: BEMBIDIINI) FROM SOUTHEASTERN SERBIA

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**Abstract** – A new endogean bembidiine ground beetle species, *Winklerites serbicus* sp. n., from a cave in the southeastern part of Serbia is both described and diagnosed. Male and female genital structures and other taxonomically important characters are illustrated. The new species is clearly distinct from its closest congeners. Fifteen species of the genus so far known are arranged in six groups. The new species is both endemic and relict, inhabiting southeastern Serbia only.

**Key words:** Carabidae, Bembidiini, *Winklerites*, new species, endogean fauna, Serbia, taxonomy

### INTRODUCTION

Representatives of the genus *Winklerites* Jeannel 1937 are very tiny, blind and depigmented ground beetles that do not possess hind wings. Males have pentamerous protarsi, with the first two protarsomeres dilated. Adult specimens are endogean and are found under deeply buried stones and by sieving soil (Arndt et al., 2011). The genus *Winklerites* comprises 14 species [*W. hercegovinensis* (Winkler, 1925) from Mt. Bjelašnica, Herzegovina, Bosnia and Herzegovina, *W. paganettii* (Müller, 1911) from the Dobroštica and Radoštak Hills, Krivošije area, Bay of Kotor, Montenegro, *W. durmitorensis* Nonveiller & Pavićević, 1987 from Mt. Durmitor, Montenegro, *W. kuciensis* Nonveiller & Pavićević, 1987 from Mt. Komovi, Montenegro, *W. fodori* Guéorguiev, 2007 from Mt. Šar Planina, Republic of Macedonia, *W. casalei* Giachino & Vailati, 2011 from Mt. Vérmio, Greece, *W. imathiae* Giachino & Vailati, 2011 from Mt. Piéria, Greece, *W. luisae* Giachino & Vailati, 2011 from Mt. Páiko, Greece, *W. weiratheri* (Müller, 1935) from

Mt. Falakró, Greece, *W. andreae* Giachino & Vailati, 2011 from Mt. Áskio, Greece, *W. lagrecai* Casale, Giachino & Etonti, 1990 from Mt. Vrontoús, Greece, *W. vailatii* Giachino, 2000 from the neighborhood of Édessa, Greece, *W. zaballosi* Giachino & Vailati, 2011 from Mt. Vitsi, Greece, and *W. thracicus* Giachino & Vailati, 2011 from the surroundings of Gérakas, Greece], which are distributed on the Balkan Peninsula, from Herzegovina and Dalmatia in the north, to northern Greece in the south (Müller, 1911; Winkler, 1925; Jeannel, 1937, 1963; Jeanne, 1973; Nonveiller and Pavićević, 1987; Giachino, 2000; Zaballos, 2003; Guéorguiev, 2007; Arndt et al., 2011; Giachino and Vailati, 2011). All *Winklerites* taxa are endemics and inhabit only endogean mountain habitats (Jeannel, 1937, 1963; Arndt et al., 2011; Giachino and Vailati, 2011).

Three field trips in southeastern Serbia, organized by the authors of this paper, resulted in the discovery of a new species of the genus *Winklerites*: *W. serbicus* sp. n. A description and diagnosis of the new

*Winklerites* species is given in the present study. The diagnosis of *Winklerites serbicus* sp. n. is based on a thorough analysis of the type series of three males and four females collected during 2011 and 2012 in the Velika Pećina Cave near Pirot, southeastern Serbia.

## MATERIAL AND METHODS

The specimens of *Winklerites serbicus* sp. n. were collected by hand from under deeply buried stones in the entrance-lit part of the Velika Pećina Cave near Pirot, southeastern Serbia.

The type specimens were analyzed in the laboratories of the Institute of Zoology, University of Belgrade – Faculty of Biology, Belgrade. They were dissected, thoroughly studied and illustrated. Dry specimens were adhered onto paper labels, while the genital structures were fixed in a medium composed of Canada balsam and xylol.

All taxonomically important morphological characters were studied for comparison. Carl Zeiss-Stemi 2000 and Carl Zeiss-Ergaval binocular stereomicroscopes were used, together with a special monitor and accessories for drawing.

## RESULTS AND DISCUSSION

FAMILY CARABIDAE LATREILLE, 1802  
SUBFAMILY TRECHINAE BONELLI, 1810  
TRIBE BEMBIDIINI STEPHENS, 1827

WINKLERITES JEANNEL, 1937  
WINKLERITES SERBICUS, SP. N. (Figs. 1-5)

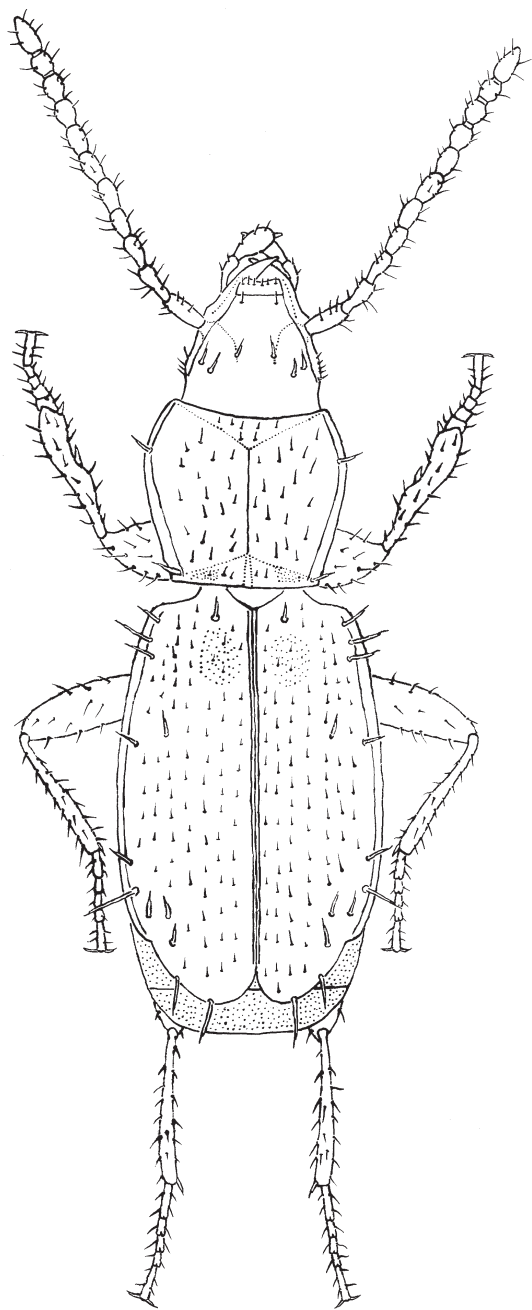
*Etymology* – After Serbia, its *terra typica*.

*Material examined* – Holotype male, Velika Pećina Cave, village of Držina, near Pirot, southeastern Serbia, 17.07.2012, leg. D. Antić & S. Makarov; two paratype males and two allotype females, same data as for the holotype; one allotype female, same locality as for the holotype, 23.04.2011, leg. T. Rađa; one allotype female, same locality as for the holo-

type, 26.06.2012, leg. D. Antić & S. Ćurčić. The type specimens are deposited in the collection of the Institute of Zoology, University of Belgrade – Faculty of Biology.

*Diagnosis* – The new species clearly differs from all other congeners. Among the other 14 existing species there are five species morphologically most similar to it (group “*hercegovinensis*” according to Guéorguiev, 2007), all from endogean habitats from the Dinaric mountain range on the Balkan Peninsula. However, there are numerous distinctions between the new species and these five morphologically similar ones.

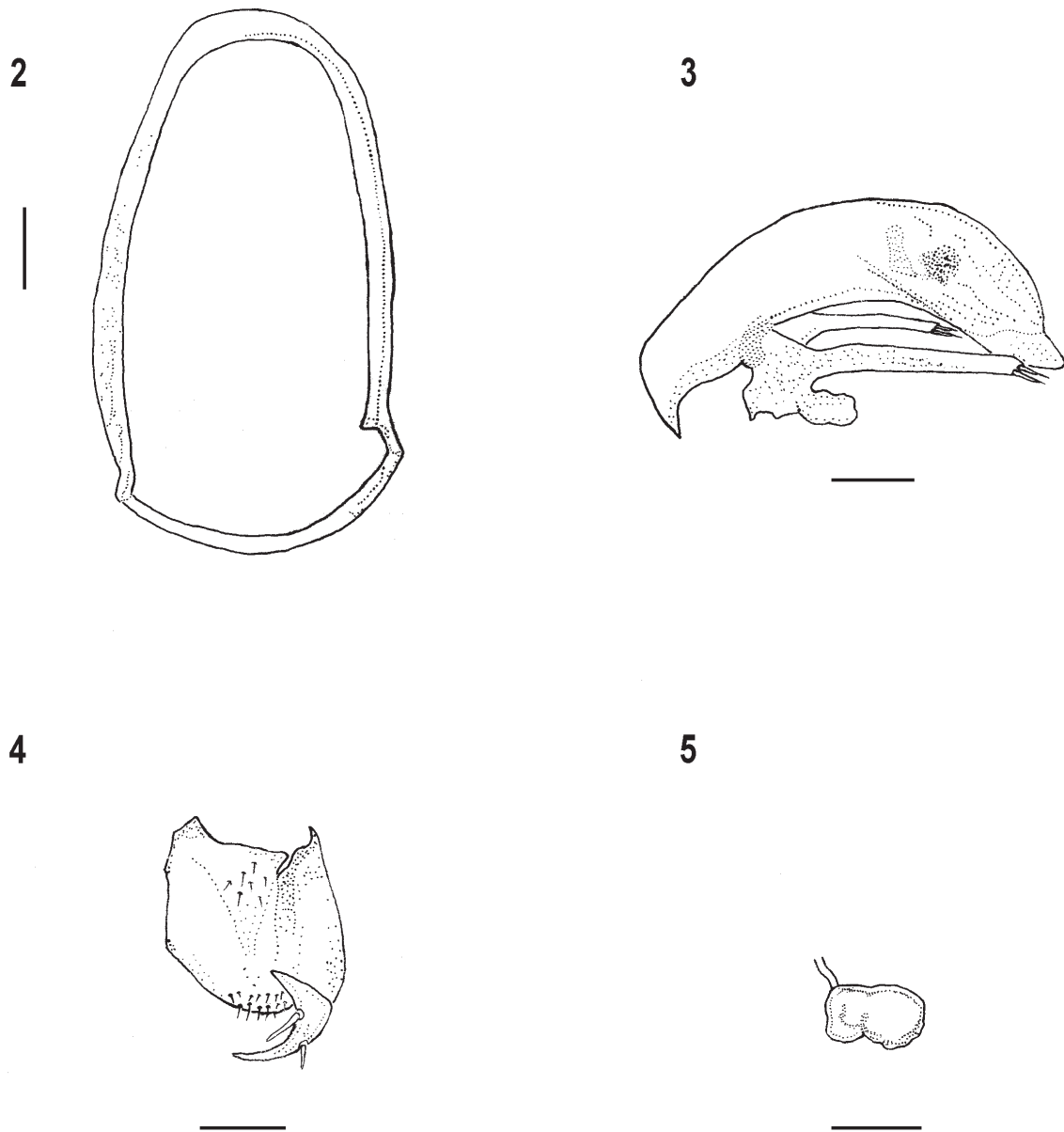
*Winklerites serbicus* sp. n. clearly differs from *W. hercegovinensis* in total body length (2.23-2.47 mm vs. 1.60-1.90 mm), shape of the head (robust vs. more elongate), length of the frontal furrows (exceeding the mid-head length vs. very short), length/width ratio of the third antennomere (twice as long as broad vs. 1.5 times as long as broad), width/length ratio of pronotum (wider than long vs. not wider than long), maximum width of the pronotum (slightly above the anterior third vs. slightly above the mid-length), shape of the lateral pronotal margins (a minute sinuosity before the hind pronotal angles vs. a long sinuosity before the hind pronotal angles), form of the hind pronotal angles (obtuse vs. rectangular), shape of the minute structure before the hind pronotal angles (dilation-like vs. denticle-like), length/width ratio of elytra (1.56 vs. 2.00), form of the shoulders (distinct vs. rounded), form of the elytral apex (a smaller emargination in the preapical part and a rounded apex vs. a deep emargination in the preapical part and a prominent apex), different position of some umbilicate and discal elytral setae, different shape of the aedeagus (wider basal bulb, narrower sub-apical part, longer parameres and a two-part copulatory piece which is not hook-formed vs. a narrower basal bulb, wider sub-apical part, shorter parameres and a unique hook-formed copulatory piece), and species distribution (near Pirot, southeastern Serbia vs. Mt. Bjelašnica, Herzegovina) (Winkler, 1925; Jeannel, 1937, 1963; Nonveiller and Pavićević, 1987; present study) (Figs. 1 and 3).



**Fig. 1.** *Winklerites serbicus* sp. n. from the Velika Pećina Cave, village of Držina, near Pirot, southeastern Serbia. Holotype male, habitus (dorsal view). Scale line = 1.00 mm.

*Winklerites serbicus* sp. n. clearly differs from *W. durmitorensis* in total body length (2.23-2.47 mm vs. 2.10-2.20 mm), length of the antennae (reaching the level of around 1/4 elytral length when stretched backwards vs. reaching humeral angle when stretched backwards), length ratios of the first three antennomeres (7:6:4.67 vs. 8:6:5), shape of the pronotum (less constricted before the hind angles vs. more constricted before the hind angles), width/length ratio of the pronotum (1.12 vs. 1.20), maximum width of the pronotum (slightly above the anterior third vs. at the anterior third), position of the anterior pronotal marginal setae (slightly below the anterior fourth of the pronotum vs. at the anterior third of the pronotum), shape of the elytra (more oval vs. more subparallel), elytra/pronotum length ratio (2.30 vs. 3.00), presence/absence of the elytral discal impressions (present vs. absent), different position of some umbilicate and discal elytral setae, shape of the aedeagus (regularly curved, with a robust basal part, longer and somewhat elevated apex, longer paramerae and a two-part copulatory piece which is not hook-formed vs. abruptly curved basally, with a narrow basal part, shorter and straight apex, shorter paramerae and an unique hook-formed copulatory piece), shape of the female genital armature (gonocoxite IX more curved, somewhat thicker, gonosubcoxite IX elongate vs. gonocoxite IX less curved, somewhat narrower, gonosubcoxite IX rounded), and species distribution (near Pirot, southeastern Serbia vs. Mt. Durmitor, northern Montenegro) (Nonveiller and Pavićević, 1987; present study) (Figs. 1, 3, and 4).

*Winklerites serbicus* sp. n. clearly differs from *W. kuciensis* in total body length (2.23-2.47 mm vs. 2.00 mm), length ratios of the first three antennomeres (7:6:4.67 vs. 7:5:4), form of the frontal furrows (elongate, prolonged backwards vs. not elongate, nor prolonged backwards), shape of the hind pronotal angles (less prominent vs. more prominent), presence/absence of the minute dilation before the hind pronotal angles (present vs. absent), elytra/pronotum length ratio (2.30 vs. 2.00), form of the shoulders (distinct vs. rounded), shape of the elytra (more oval vs. more ovate), development of the emargination in the preapical zone of the elytra (more expressed vs. less



**Figs. 2-5.** *Winklerites serbicus* sp. n. from the Velika Pećina Cave, village of Držina, near Pirot, southeastern Serbia. 2 – holotype male, ninth abdominal sternite (urite) (ventral view); 3 – paratype male, aedeagus with copulatory piece (lateral view); 4 – allotype female, left gonocoxite IX and gonosubcoxite IX (dorsal view); 5 – allotype female, spermatheca (lateral view). Scale line = 0.10 mm.

expressed), different position of some umbilicate and discal elytral setae, presence/absence of the elytral discal impressions (present vs. absent), shape of the aedeagus (regularly curved, with a robust convex basal bulb and a narrower regularly rounded sub-apical

part, a longer and somewhat elevated apex, longer paramerae and a two-part copulatory piece which is not hook-formed vs. regularly curved basally, while straight apically, with a narrower curved basal bulb and a dilated obliquely truncate sub-apical part, a

shorter and straight apex, shorter paramerae and an unique hook-formed copulatory piece), and species distribution (near Pirot, southeastern Serbia vs. Mt. Komovi, southeastern Montenegro) (Nonveiller and Pavićević, 1987; present study) (Figs. 1 and 3).

*Winklerites serbicus* sp. n. clearly differs from *W. fodori* in total body length (2.23–2.47 mm vs. 2.10–2.30 mm), length/width ratio of the head (slightly longer than wide vs. more than 1/4 longer than wide), head/pronotum length ratio (head slightly shorter than pronotum vs. head slightly longer than pronotum), form of the pronotum (weakly concave before the hind angles vs. distinctly concave before the hind angles), maximum width of the pronotum (slightly above the anterior third vs. at the anterior third), width/length ratio of the pronotum (1.12 vs. 1.23), presence/absence of the minute dilation before the hind pronotal angles (present vs. absent), elytra/pronotum width ratio (1.290 vs. 1.335), length/width ratio of the elytra (1.56 vs. 1.40), presence/absence of the elytral discal impressions (present vs. absent), form of the urite (more elongate vs. less elongate), shape of the aedeagus (regularly curved, with a regularly rounded basal bulb and a narrower regularly rounded sub-apical part, a shorter and somewhat elevated apex, narrower paramerae and a two-part copulatory piece which is not hook-formed vs. regularly curved basally, while straight apically, with a massive dilated basal bulb and a wider obtuse sub-apical part, a longer and straight apex, wider paramerae and an unique hook-formed copulatory piece), and species distribution (near Pirot, southeastern Serbia vs. Mt. Šar Planina, northern Republic of Macedonia) (Guéorguiev, 2007; present study) (Figs. 1–3).

Finally, *Winklerites serbicus* sp. n. clearly differs from *W. paganettii* in total body length (2.23–2.47 mm vs. 1.80–2.00 mm), length of the frontal furrows (exceeding the mid-head length vs. somewhat shorter), length/width ratio of the third antennomere (twice as long as broad vs. 1.5 times as long as broad), maximum width of the pronotum (slightly above the anterior third vs. at the anterior third), shape of the lateral pronotal margins (less dilated

proximally and with a minute sinuosity before the hind pronotal angles vs. more dilated proximally and with a long deeper sinuosity before the hind pronotal angles), form of the hind pronotal angles (obtuse vs. rectangular), depth of the pronotum midline (shallow vs. deep), presence/absence of the minute dilation before the hind pronotal angles (present vs. absent), shape of the elytra (more oval vs. more ovate), form of the shoulders (distinct vs. rounded), form of the elytral apex (smaller emargination in the preapical part and a rounded apex vs. a deep emargination in the preapical part and a prominent apex), different position of some umbilicate and discal elytral setae, different shape of the aedeagus (gradually narrowing distally, then suddenly narrowed in an apex dragged upwards vs. abruptly constricted apically), and species distribution (near Pirot, southeastern Serbia vs. Dobroštica and Radoštak Hills, Krivošije area, southern Montenegro) (Müller, 1911; Winkler, 1925; Jeannel, 1937, 1963; Nonveiller and Pavićević, 1987; present study) (Figs. 1 and 3).

*Description* – Length from the tip of the mandibles to the end of the elytra 2.08–2.28 mm (length from the tip of the mandibles to the end of the abdomen 2.23–2.47 mm). The body (Fig. 1) is elongated, narrow, depigmented, yellow-brownish. Integument shiny, with a distinct isodiametric microsculpture, covered with a sparse and short pubescence.

The head is robust, narrower than the pronotum (head/pronotum width ratio 0.70), without eyes. The antennae are robust, moniliform, reaching the level of around 1/4 of the elytral length when stretched backwards, with spherical antennomeres 8–10. The length ratios of the first three antennomeres are 7:6:4.67. Antennomere III is twice as long as broad. The head is slightly longer than wide, visibly wider than pronotum at anterior margin. The frontal furrows are moderately deep, exceeding the mid-head length. The penultimate palpomere of the maxillary palp is fusiform. Anterior margin of the epistome is subrectilinear. Two supraorbital setae on each side are close to each other. The mandibles are long and sharply pointed. The labrum is concave, with six an-



terior marginal setae. The head is slightly shorter than the pronotum.

Pronotum cordate, transverse (width/length ratio 1.12), with the maximum width slightly above the anterior third, narrow at the base, with lateral margins slightly and regularly arcuate, abruptly and briefly sinuate before the base, not denticulate (Fig. 1). A minute dilation occurs before the sub-basal sinuation of the pronotum at each side. The anterior margin is slightly concave. The base is slightly obliquely truncate at the sides. Anterior angles rounded, poorly prominent, the posterior ones prominent, obtuse, but nearly rectangular. Disc weakly convex, with a short and sparse pubescence. The midline is distinct but shallow. The basal foveae are relatively shallow, deepened near the pronotal base. The marginal groove is wide and flattened, widening towards the base. Anterior marginal setae are inserted inside the marginal groove, slightly below the anterior fourth of the pronotum. Posterior marginal setae inserted just before the hind angles.

The elytra is elongate, oval, sub-parallel-sided (length/width ratio 1.56), irregularly punctato-striate, with the maximum width at the half level, moderately emarginate in the preapical zone (Fig. 1). The elytra/pronotum length ratio is 2.30, while the elytra/pronotum width ratio 1.29. Disc barely convex, sub-flat, with a short, sparse and erect pubescence, with two sub-basal shallow impressions. Shoulders are distinct, rounded, lateral margins indistinctly denticulate in the anterior third. Elytral apices separated and broadly rounded. The marginal groove relatively narrow and visible up to the preapical emargination. Scutellum sub-triangular.

Legs are long, pubescent and slender (Fig. 1). The first two male protarsomeres are dilated. Protibiae are wider and robust (especially in the anterior parts) in comparison with meso- and metatibiae. The hind tibiae distinctly longer than pro- and mesotibiae.

Chaetotaxy. Similar to that of the other species of the “*hercegovinensis*” group. Basal umbilicate pore big, foveate. Umbilicate series of type B (Jeannel,

1937, 1963; Jeanne, 1973). The distance between the 1<sup>st</sup> and 2<sup>nd</sup> pores of the umbilicate series are longer than the distance between the 2<sup>nd</sup> and 3<sup>rd</sup> pores of the same series. The 4<sup>th</sup> pore lies further along and is inserted somewhat below the level of 1/3 elytral length and slightly beyond the anterior discal seta. Third pore slightly shifted towards the disc. The 5<sup>th</sup> pore is placed at 2/3 of elytral length. The 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> pores are equidistant from each other. There are two discal pores on each elytron. The 1<sup>st</sup> pore is placed slightly above the level of the 4<sup>th</sup> umbilicate pore, while the 2<sup>nd</sup> one is located at the level of the 7<sup>th</sup> umbilicate pore.

Male genital armature. Ninth abdominal sternite (urite) ovate, short, consisting of two sclerites, briefly rounded apically and widely rounded basally (Fig. 2). Aedeagus relatively big (Fig. 3). The median lobe is twisted at the right side, sharply curved apically, while less curved basally, sub-apically wider than basally. The basal bulb not massive, rounded. Apex beak-shaped, dragged upwards. The internal sac is provided with a small copulatory piece situated in sub-apical part of the median lobe, consisting of two units – a sub-globular strongly chitinized part and an elongated less chitinized part. Parameres are unequal, elongated, thin, the right one longer, as long as 2/3 of the median lobe, almost reaching the median lobe apex, more sclerotized than the left one. Parameres provided with two apical setae each.

Female genital armature. Gonocoxites IX are strongly curved, narrow and pointed apically (Fig. 4), well chitinized and bearing a single seta on the convex surface and a single seta on the opposite side each. Gonosubcoxites IX are huge and elongate.

The spermatheca (Fig. 5) is saccular, weakly sclerotized, dilating somewhat distally, with a rounded apex.

*Remarks* – All known species of *Winklerites* are arranged in six groups (Casale et al., 1990; Guéorguiev, 2007; Giachino and Etonti, 2011). The “*hercegovinensis*” group includes *Winklerites hercegovinensis*, *W. durmitorensis*, *W. kuciensis*, *W. fodori*, and *W. pagan-*

*ettii* (Guéorguiev, 2007). We sort the new species in the “*hercegovinensis*” group according to the presence of indistinct serration of the shoulders and anterior lateral elytral margins, the shape of the aedeagus, the position of the copulatory piece, and the presence of a distinct emargination on the posterior lateral margin of each elytron. The presence of a small denticle/dilation before the hind pronotal angles is common for *W. hercegovinensis*, *W. durmitorensis*, and *W. serbicus* sp. n. Furthermore, the presence of elytral discal impressions is common for *W. hercegovinensis*, *W. paganettii*, and *W. serbicus* sp. n.

Species of the genus *Winklerites* are distributed from Herzegovina (Bosnia and Herzegovina) and the Krivošije area (southern Montenegro), through Mts. Komovi, Durmitor (southeastern and northern Montenegro, respectively), Šar Planina (northern Republic of Macedonia), with the southern limit in Greece, occupying the mountain ranges along the northern country border, from the O. Vitsi to the west up to the neighborhood of Gérakas to the east (Giachino and Etonti, 2011). The discovery of the new species in southeastern Serbia is surprising, since species of the genus were believed to be restricted to the Dinaric range and to the north Greek mountains. The discovery of a representative of the genus *Winklerites* in Serbia has changed our previous understanding of its range type. It is worth mentioning that a few additional *Winklerites* taxa were already recorded in the country, but unfortunately these have not been described so far (Ćurčić et al., 2007).

**Bionomy and distribution** – The specimens of the new species were found under deeply buried stones in the Velika Pećina Cave near Pirot, southeastern Serbia. The type habitat is the anterior part of the cave lit by the entrance, where stones are distributed over the floor. Additionally, it is interesting to note that we did not capture any specimens by means of deep traps baited with rotten meat that were placed in deep soil in the same part of the cave, which is in accordance with the results of Giachino and Etonti (2011). Our finding is the first one within the genus *Winklerites* found in a cave, but the new species can be probably found outside as well.

This species is both relict and endemic to southeastern Serbia only and is currently known from just one site.

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