



Hydnobius punctulatus Hampe, 1861 (Coleoptera: Leiodidae): Redescription of species, comments on variability and new distributional data for Central Europe

Ján Kodada¹ · Dávid Selnekovič¹ · Katarína Goffová¹

Received: 18 December 2018 / Accepted: 12 February 2019 / Published online: 25 February 2019
© Institute of Zoology, Slovak Academy of Sciences 2019

Abstract

The type specimens of *Hydnobius punctulatus* Hampe, 1861 were examined, redescribed and illustrated. Lectotype as well as paralectotypes were fixed by inference. The species is characterised by the form of the aedeagus with sinuate parameres and by the wide and pale antennal club. Variability is commented on basis of additional material collected in Slovakia. Records from Slovakia represent the northernmost distribution in Central Europe. Examination of other material revealed a new record of *Hydnobius claviger* Strand, 1943 for Slovakia.

Keywords *Hydnobius punctulatus* · *H. claviger* · Leiodidae · Taxonomy · Distribution

Introduction

The genus *Hydnobius* Schmidt, 1841 is distributed throughout the Holarctic region with 16 Palaearctic and 7 Nearctic species (Peck and Cook 2009; Perreau 2015). Species diversity is concentrated and rather high in Europe, while only four species are recorded exclusively from Asia. Some of the species show wide distributional patterns (e.g. *H. spinipes* Gyllenhal, 1813; *Hydnobius longidens* LeConte, 1879), however, there are also a few endemic species, e. g. *H. enomotoi* Hoshina, 2012 and *H. akitsuensis* Hoshina & Sunada, 2003 from the Kuril Islands and Japan (Honshu). The taxonomy of the Palaearctic species was studied by Daffner (1983) who revised material of more than 12,000 specimens of 320 Leiodidae species including the types of 234 species.

All *Hydnobius* species are small, reddish brown to dark brown and rather inconspicuous beetles usually difficult to

collect. The number of preserved specimens in European Museums is usually low. The bionomics and larval stages are still unknown; however, both larvae and adults seem to feed on subterranean fungi or grass roots infested by fungi (Daffner 1983; Peck and Cook 2009). Some species prefer well-drained sandy soils at margins of different types of forests, steppes or sandy-gravel banks of streams (Daffner 1983).

Use of flight intercept traps in a remnant of mixed riverine forest near the Danube River in proximity of Comenius university campus in Bratislava (Slovakia) and evening sweeping of grass near forest margin in the village of Virt (southern Slovakia) revealed several *Hydnobius* specimens. They were identified using the revision of the Palaearctic Leiodini (Daffner 1983), resulting in identification of *Hydnobius punctulatus* Hampe, 1861. This species is recorded rarely and is yet known from four European and two Asian countries (Perreau 2015), although Hoshina (2012) mentioned distribution in Russia including Far East. The previous schematic drawings of diagnostic characters based on limited sources of material showed need to re-examine the type specimens of *H. punctulatus* and to redescribe the species. Technical possibilities and progress in digital technologies enables us to newly illustrate all diagnostic characters in a more precise way, add comments on variability and new distribution data. Examination of *Hydnobius* specimens from different collections and samples surprisingly resulted in another new record of *Hydnobius claviger* Strand, 1943 for Slovakia.

✉ Katarína Goffová
katarina.goffova@uniba.sk

Ján Kodada
kodada@fns.uniba.sk

¹ Department of Zoology, Faculty of Natural Science, Comenius University, Ilkovičova 6, Mlynská dolina B-1, SK-842 15 Bratislava, Slovakia

Material and methods

The material used for the study was collected by the senior author and borrowed from the following collections (abbreviations used refer to collections in the text).

- CKB** Ján Kodada Collection, Bratislava, Slovakia
CMB Oto Majzlan Collection, Bratislava, Slovakia (O. Majzlan)
NMW Naturhistorisches Museum, Wien, Austria (H. Schillhammer)
SNM Natural History Museum of Slovak National Museum, Bratislava, Slovakia (V. Janský)

In addition to *Hydnobius punctulatus*, the following species were studied:

Hydnobius punctatus Sturm, 1807: 1 ♂, (SNM): “Čechoslovakia Trenč. Teplice Kočí, coll J. Laco”; 1 ♂ (SNM): “Čechoslovakia Trenčín, Selec Kočí, coll J. Laco”.

Hydnobius spinipes (Gyllenhal, 1813): 1 ♂ 2 ♀♀ (SNM): “M. Tatry 10. III Roubal 1927”; 2 ♂♂ 1 ♀ (CMB): “Slovakia bor. 6887 d Stará Lesná 2011, O. Majzlan lgt. 9.8.”

Hydnobius multistriatus (Gyllenhal, 1813): 2 ♂♂ (SNM): “Slov. Parkan Belá Roubal”.

Hydnobius claviger A. Strand, 1943: 1 ♂ (CKB): “Slovakia, 1988, 28.9. Suchý Vrch [eastern Slovakia, Lipovce village env.], J. Kodada lgt.”

Specimens studied were relaxed in warm water with several drops of concentrated acetic acid, cleaned and dissected; male genitalia and whole female abdomens were cleared subsequently for several days in lactic acid.

The external characters were examined with a stereomicroscope Leica M205C at magnifications from 10× to 160×. The metric characters were measured with an eyepiece graticule to the nearest 0.05 mm, or using LAS microscope software and Leica MC190 HD camera attached to a stereomicroscope.

The specimens as well as the aedeagus of the lectotype were photographed with a Zeiss Axio-Zoom V-16 stereomicroscope using diffuse LED lighting at magnifications up to 168× with a Canon 5D mark IV attached. Dissected male, female genitalia and pregenital segments were studied in a temporary microscope cavity slide covered with micro-glass slide at magnifications up to 640× with a Leica DM 1000 microscope. All drawings were made using a Leica drawing device.

The abbreviations for the measured characters used in the text [the characters were selected to be consistent with the reviews of Daffner 1983, Peck and Cook 2009 and Hoshina 2012]:

- ACL** antennal club length, combined length of antennomere 7–11 forming antennal club
ACW antennal club width, maximum width of widest antennomere
BL body length without head, length of pronotum and elytra measured along midline

- EL** elytral length along suture from the most anterior to the most posterior point
EW elytral width, maximum width combined
PL pronotal length along midline
PW maximum pronotal width

Hydnobius punctulatus Hampe, 1861

Hydnobius punctulatus Hampe, 1861: 66–67.

Hydnobius kaszabi Hlisnikovský, 1965: 57–59. The species was synonymised by Daffner (1983: 34).

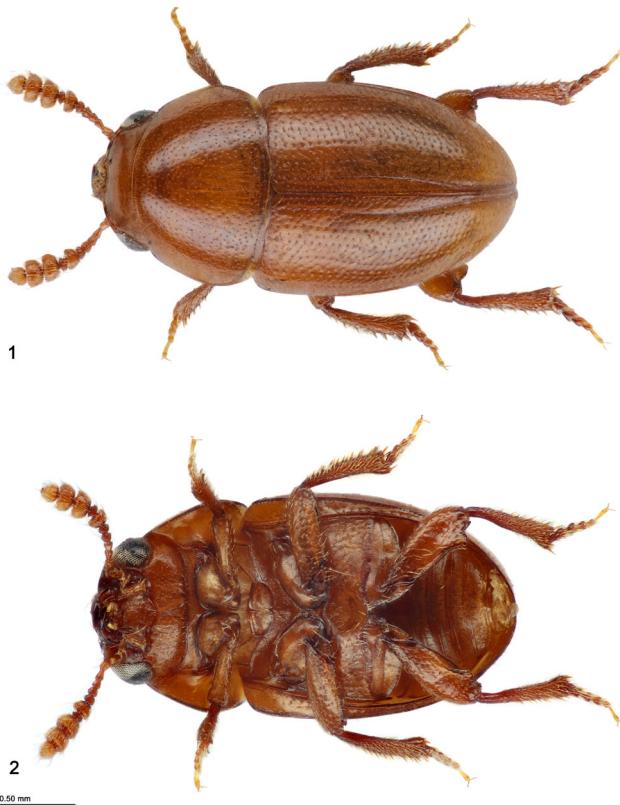
Redescription of the Lectotype male (Figs. 1, 2, 4, 5). Body form elongately obovate and moderately convex dorsally. Dorsum shining, unicoloured reddish brown; head and pronotum, antennae and legs reddish brown like the dorsum of body, only terminal tarsomeres slightly paler; entire ventral side reddish brown.

Length of pronotum and elytra (BL) 2.26 mm, body ca 1.8× as long as wide (BL/EW), moderately convex and almost glabrous except for sparse and very fine, short pubescence. Pubescence best visible along lateral margins and near apices of elytra. Head 0.83 mm wide, sparsely minutely punctate, ca 0.69× as wide as pronotum; right mandible tridentate, bearing one apical and one subapical small tooth and one large tooth near middle; left mandible bidentate with one apical and one subapical tooth [mandible description based on a male paralectotype (Fig. 3)].

Antennal club broad, ratio width: length = 1:2.47 (0.17:0.42 mm). Antennomeres 1–3 each longer than wide; remaining antennomeres wider than long; terminal antennomere large; lengths ratio of antennomeres 2–11 = 1.71:1.60:1.28:1.31:1.26:1.83:1.00:2.34:2.57:2.94; width ratio of antennomeres 2–11 = 0.56:0.64:0.75:0.81:0.90:1.41:1.00:1.94:2.03:1.27.

Pronotum ca 1.47× as wide as long, widest slightly posteriad of middle; sides rounded, basal angles obtuse; surface sparsely minutely irregularly punctate, puncture diameters moderately smaller than diameters of facets, transverse basal groove fine, distinct. Scutellum impunctate. Elytra ca 1.16× as long as wide, subequal in width with pronotum, widest ca at anterior 2/5, transversely and shortly strigose, punctate; EL = 1.45 mm, EW = 1.25 mm; punctures of elytra larger than those on head and pronotum; sutural stria distinct, arising from anterior third of elytral length and reaching apex, clearly impressed; remaining striae punctate, confused; puncture intervals slightly smaller than stria punctures.

Mesoventrite microsculptured, impunctate and almost glabrous; disc of metaventrite shiny with very sparse fine punctures, punctures with moderately long setae. Profemur and mesofemur simple (unarmed), metafemur with large tooth on posterior margin before apex (Fig. 4), middle one-third of



Figs. 1–2 *Hydnobius punctulatus*, lectotype. **1** Habitus, dorsal view. **2** Habitus, ventral view

posterior margin to apex of tooth serrulate. Protibia and mesotibia weakly widened apically, metatibia slender, weakly sinuate on inner margin; all tibiae spinose on outer margin.

Aedeagus (Figs. 5–7) robust; median lobe ca 2.3× as long as wide, widest near middle, gradually arcuately narrowing anterior to apical 0.15, then abruptly narrowed to subtriangular apex; apex rounded, not protruding. Posterior portion gradually narrowed, base narrow and bent (lateral view). Parameres broad at base, ca 1.5× as long as median lobe; sinuate, apex rounded with two setae. Internal sac with numerous short setae and small spines, distinct sclerites absent. [Fig. 5 shows aedeagus of the lectotype, Figs. 6 and 7 illustrate aedeagus of well-preserved male from Slovakia.]

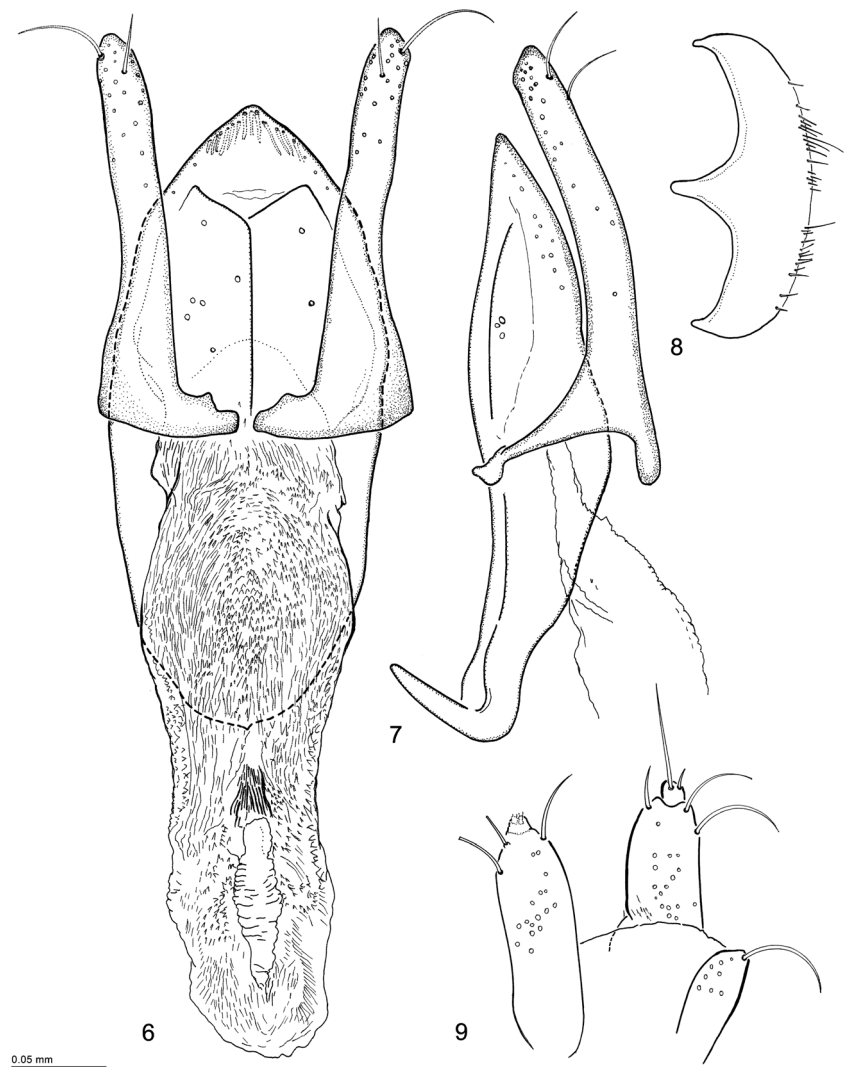
Female Externally similar to male except for simple metafemur lacking tooth. Coxites elongate, cylindrical, with apical setae; styli very short with long terminal seta (Fig. 9). Sternite VIII rounded apically; anterior apophysis moderately wide, apex rounded (Fig. 8).

Variability In addition to the variability in metric characters, specimens show also slight variability in the size of the punctures on the dorsal side of the body, even within the type specimens. Tooth on male metafemur slightly varies in size within small and large males. However, the form of the aedeagi and the sinuate parameres show almost no differences within examined specimens (Fig. 9).

Figs. 3–5 *Hydnobius punctulatus*. **3** Head and pronotum, paralectotype, dorsal view. **4** Male left hind-leg, lectotype, ventral view. **5** Aedeagus, lectotype, dorsal view



Figs. 6–9 *Hydnobius punctulatus*, specimens from Virt env. **6** Aedeagus, dorsal view. **7** Aedeagus, same specimen, lateral view, part of internal sac omitted. **8** Female sternite VIII, ventral view. **9** Female coxite and styli (some setae broken), ventral view



Metric characters show following variability. **Males:** BL: 1.72–2.21 mm; BL/EW: 1.67–1.79; PL: 0.61–0.82 mm; PW: 0.91–1.17 mm; PW/PL: 1.42–1.54; EL: 1.07–1.43 mm; EW: 1.00–1.29 mm; EL/EW: 1.05–1.17; HW: 0.63–0.83 mm; PW/HW: 1.38–1.49; ACL/ACW: 1:2.31–1:2.59. Lengths ratio of antennomere 2–11: 1.62–2.00:1.57–1.98:1.28–1.60:1.23–1.52:1.17–1.38:1.75–2.45:1.00:2.29–2.91:2.22–2.80:2.94–3.48 ($n = 7$). Width ratio of antennomere 2–11: 0.56–0.65:0.52–0.64:0.61–0.75:0.70–0.81:0.82–0.88:1.39–1.47:1.00:1.82–2.00:1.89–2.09:1.27–1.44 ($n = 7$).

Females BL: 1.85–2.23 mm; BL/EW: 1.71–1.77; PL: 0.63–0.75 mm; PW: 0.96–1.15 mm; PW/PL: 1.49–1.52; EL: 1.20–1.51 mm; EW: 1.04–1.25 mm; EL/EW: 1.14–1.21; HW: 0.52–0.80 mm; PW/HW: 1.43–1.84; ACL/ACW: 1:1.97–1:2.34. Length ratio of antennomere 2–11 = 2.06:2.00:1.59:1.52:2.32:1.00:2.77:2.79:3.04 ($n = 1$). Width ratio of antennomere 2–11 = 0.56:0.55:0.63:0.75:0.82:1.49:1.00:2.05:2.03:1.40 ($n = 1$).

Material examined. Type material Five original specimens (2 ♂♂, 3 ♀♀ all deposited in NHM) were available for study, one of them, a male bearing an original identification label with the mention “type”, was designated by Daffner (1983: 34) as the holotype being in fact a lectotype, fixed by inference (ICZN, Art. 74.6). **Lectotype** male bearing white handwritten label “*Hydnobius punctulatus* Hmpe Typ.”; red label “Holotypus / *Hydnobius* / *punctulatus* / Hampe and male symbol / det. Daffner XI. 1980”; larger white handwritten label “*punctulatus* / Hpe Croat”. Aedeagus of lectotype was dissected and mounted on a celluloid card in Canada balsam by Daffner, this label is pinned below the lectotype specimen. Paralectotypes (1 ♂ and 3 ♀♀) each bear only a single red label “Paratypus / *Hydnobius* / *punctulatus* / Hampe and male or female symbol / det. Daffner XI. 1980”. All paralectotypes were originally glued on a small narrow triangular card, one female and one male specimen were remounted on larger cards and the female was dissected.

Additional material examined 1 ♂, 2 ♀♀ (CKB): “Slovakia, Bratislava, Petržalka, Pečniansky les, FIT [Flight Intercept Trap], 28.5.-6.7.2015, J. Kodada leg.”; 9 ♂♂, 1 ♀ (CKB, NMW): “Slovakia, Virt env. 28.5.2017 ca 47°45′43.6” N, 18°20′21.5” E, J. Kodada & K. Goffová Lgt.”; 1 ♂ (NMW): “Ganglb. 95 Herkulesbad”.

Type locality Agram [Agram is the historic German name for Zagreb], Croatia.

Distribution The species was recorded from Bosnia and Hercegovina, Croatia, Hungary, Romania, Slovakia (new record), Turkey and Mongolia (Hampe 1861; Hlisnikovský 1965; Merkl 2006; Perreau 2015).

Hydnobius claviger Strand, 1943

Material examined 1 ♂ (CKB): “Slovakia, 1988, 28.9. Suchý Vrch [eastern Slovakia, Lipovce village env.], J. Kodada lgt.”

Widely distributed species *H. claviger* described from Norway [Gran-Hadeland, Daffner 1983], reported so far also from Austria, Germany, Hungary, Italy and Sweden (Merkl 2006; Perreau 2015). Generally, it is considered a rare species (Lompe 2002); the male specimen represents the first record for Slovakia.

Discussion

For correct species identifications it is necessary to examine the aedeagus; generally, the form of the aedeagus and the armature of the internal sac in everted position is very useful in defining taxa (Peck and Cook 2009). Unfortunately, it is not possible to evert the internal sac in all specimens, so often the structure appears as rather uninformative cluster of small spines. This was also probably the reason, why Daffner (1983) has not illustrated those structures. For most species the form of the parameres represents another, very useful identification character. The identification of single females may be difficult, even if the illustrations of coxites with styli and of sternite VIII are available. Width ratio of the terminal antennomere to the preterminal one used in the key by Daffner (1983) is rather less applicable due to the small size of these segments (e.g. 0.108:0.169 mm). Except for their small size, the club segments are elliptical in cross section so it is very difficult to compare different antennae at the same position.

The description of *H. kaszabi* is based on a unique female from Central Aimak in Mongolia (Hlisnikovský 1965); it is questionable if this specimen is truly conspecific with *H. punctulatus* because the distribution of

both taxa is poorly known and the material from Mongolia is scarce.

Hydnobius punctulatus resembles the widely distributed North American *H. longidens* in having distinctly sinuate parameres. In contrast, the internal sac of the aedeagus of *H. longidens* possesses a pair of sclerotised oblong lobes (Peck and Cook 2009).

Hydnobius punctulatus is keyed by Daffner (1983) with *H. claviger* Strand, 1943, based on the very large and wide antennal club with the terminal antennomere one-third narrower than the preterminal segment. *H. claviger* can be distinguished by the elongate aedeagus with nearly straight, not sinuated parameres, the larger size and the darker or black antennal club.

Another externally similar species is the widely distributed and variable *Hydnobius spinipes* (Gyllenhal, 1813), differing in the form of the aedeagus and the not sinuate parameres, in darker/black colour of the antennal club and, in some specimens, in darker head and pronotum (see Daffner 1983).

Hoshina (2012) considered *Hydnobius enomotoi* Hoshina, 2012 (Kuril Islands) similar to *H. punctulatus* based on a small tooth projection of the male metafemur. In fact, even the smallest males examined possess a larger metatibial tooth of different shapes.

Acknowledgments Oto Majzlan (Bratislava), Harald Schillhammer (NMW) and Vladimír Janský (SNM) are thanked for providing material of *H. punctulatus* as well as additional material of different *Hydnobius* species for examination. Ivan Löbl (Geneva) and Harald Schillhammer (NMW) read the manuscript, their comments are greatly appreciated. Ruben Berghmans (Wien) read the subfinal version and helped with language corrections. This study was partly supported by the Slovak Research and Development Agency, Project No. APVV-0213-10 and by the project BeeSandFish - LIFE12 NAT/SK/001137.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

- Daffner H (1983) Revision der paläarktischen Arten der Tribus Leiodini Leach (Coleoptera, Leiodidae). *Folia Entomol Hung* 44(2):9–163
- Hampe C (1861) Einige neue Käfer aus Croatien und Siebenbürgen. *Wien Entomol Monatsschr* 3(5):65–69
- Hlisnikovský J (1965) Leiodidae II. Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei (Coleoptera). *Reichenbachia* 7(5):57–61

- Hoshina H (2012) Review of the tribes Sogdini and Leiodini from Japan and north Chishima Islands. Part II. Genera *Hydnobius* and *Leiodes* (Coleoptera: Leiodidae). Acta Entomol Mus Nat Prag 52(1):1–168
- Lompe A (2002) Die Käfer Europas. Ein Bestimmungswerk im Internet. <http://coleonet.de/coleo/index.htm>. Accessed 05 February 2019
- Merkel O (2006) New beetle species in the Hungarian Fauna Coleoptera. Folia Entomol Hung 67:19–36
- Peck SB, Cook J (2009) Review of the Sogdini of north and Central America (Coleoptera: Leiodidae: Leiodinae) with descriptions of fourteen new species and three new genera. Zootaxa 2102:1–74
- Perreau M (2015) Family Leiodidae, subfamily Leiodinae. In: Löbl I, Löbl D (eds) Catalogue of Palaearctic Coleoptera. Hydrophiloidea – Staphyloidea. Revised and updated edition. Brill, Leiden, pp 254–290