Koleopterologische Rundschau	89	17–28	Wien, September 2019

Ochthebius (s.str.) *caudatus* FRIVALDSZKY, 1883: redescription, new records, and group assignation based on molecular data

(Coleoptera: Hydraenidae)

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Abstract

The halobiontic *Ochthebius* (s.str.) *caudatus* FRIVALDSZKY, 1883 is redescribed and recorded from Poland for the first time. Based on molecular data it is assigned to the *O. marinus* group. Its ecology is briefly described.

Key words: Coleoptera, Hydraenidae, *Ochthebius caudatus*, *Ochthebius marinus* group, DNA-sequencing, Croatia, Hungary, Poland, Romania, Carpathians, salinity, inland saline habitats.

Introduction

So far, *Ochthebius* (s.str.) *caudatus* FRIVALDSZKY, 1883 had never been redescribed, it had never been included in any of the modern taxonomic revisions of the genus, and it had never been assigned to any species group, because its morphological characteristics did not allow an unambiguous placement. In VILLASTRIGO et al. (2019) it was therefore listed under "species incertae sedis" within the subgenus *Ochthebius* sensu stricto.

Thanks to the fact that fresh material was collected in the last few years, we are now able to provide a redescription, a new country record and a group assignation based on DNA-sequencing data.

Material and methods

Line drawings were prepared with the aid of a camera lucida attached to a Nikon eclipse E600 microscope. Habitus photographs were taken with a Nikon DS-U2 unit Camera attached to a Leica MZ9S stereomicroscope. Images were stacked using CombineZP.

The DNA of two specimens was extracted non destructively with commercial kits (DNeasy Tissue Kit, Qiagen, Hilden, Germany), and a combination of mitochondrial and nuclear gene fragments sequenced (see VILLASTRIGO et al. 2019 for details on the primers used and reaction conditions). All genetic distances reported are uncorrected p-distances (i.e. the percentage of mismatches in the nucleotide sequence).

The material studied is deposited in the following collections:

CDM	Coll. J.A. Delgado, Murcia, Spain
CDR	Coll. W. Dorfer, Regensburg, Germany
CTB	Coll. D. Twardy, Brzozów, Poland
IBE	Institute of Evolutionary Biology, Barcelona, Spain
MHNP	Muséum national d'histoire naturelle, Paris, France
MNS	Staatliches Museum für Naturkunde, Stuttgart, Germany
NMW	Naturhistorisches Museum Wien, Vienna, Austria
TMB	Hungarian Natural History Museum, Budapest, Hungary

Ochthebius caudatus FRIVALDSZKY, 1883

Ochthebius caudatus FRIVALDSZKY 1883: 10. – GANGLBAUER 1904; KNISCH 1924; CHIESA 1959; ENDRŐDY-YOUNGA 1967; IENIŞTEA 1968, 1978; HANSEN 1998; JÄCH 1990; CSABAI & SZÉL 1999; JÄCH 2004; LŐKKÖS 2014; JÄCH & SKALE 2015; VILLASTRIGO et al. 2019.

TYPE LOCALITY: Ocna Sibiului, 10 km NW Sibiu, Sibiu County, Romania.

TYPE MATERIAL EXAMINED: Three female syntypes (TMB): "♀" [printed], "Vizakna [handwritten, Ocna Sibiului] Coll. Fuss.", "Fuss ///0". First three labels identical in all three specimens; one specimen with additional label: "O. caudatus J. Friv. [all handwritten] det.Dr.Endrödy-Younga 1964 [printed, but last two digits handwritten]". I have added a red printed syntype label to each of the three specimens: "Syntypus ♀ *Ochthebius caudatus* Friv. vid. Jäch 2019". Total number of syntypes unknown.

ADDITIONAL MATERIAL EXAMINED:

P O L A N D: 121 exs. (CTB), 8 exs. (NMW), 12 exs. (CDM), 5 exs. (IBE): Sanok County: Tyrawa Solna, 7 km NE Sanok, saline spring and salt marsh (spring B in DĘBIEC et al. (2015: figs. 2–3)), ca. 300 m a.s.l., 49°36'14"N 22°16'48"E, 19.V.2017, 29.V.2017, 5.VII.2017, leg. D. Twardy (Fig. 10) – one specimen (IBE) was used for DNA extraction and sequencing (voucher number IBE-AV112).

R O M A N I A: 7 exs. (NMW): "Transylvania", various collectors; 1 ♀ (TMB): Cluj County: "Kolozs" [= Cojocna], date not clearly legible (probably 1903), leg. E. Csiki; 22 exs. (NMW): Sibiu County: "Vizakna" [= Hungarian name of Ocna Sibiului], 22.V.1910, leg. R. Pinker; 6 exs. (TMB): "Salzburg" [= German name of Ocna Sibiului], leg. Weber; 27 exs. (NMW): "Bassen" [= Bazna], saline soil, 17.VII.1900, leg. K. Petri; 1 ♀ (NMW): "Baassen" [= Bazna]; 2 ♂♂, 2 ♀♀ (NMW): "Hermannstadt" [= Sibiu], coll. Konschegg; 1 ♂, 2 ♀♀ (NMW), 2 exs. (MNS), 1 ♀ (TMB): Prahova County: Slănic, 20.IX.1959, leg. M.-A. Ieniştea; 1 ex. (MHNP): Buzău County: "Buzeu" [= Buzău], Meledic, leg. A.L. Montandon; 18 exs. (TMB): Mureş County: Szóváta [= Sovata], leg. E. Csiki; 2 exs. (TMB): Szováta [= Sovata], leg. K. Petri; 5 exs. (MNS): Sovata, IV.1982, leg. H. Gräf; 1 ♂, 1 ♀ (NMW), 1 ♂, 1 ♀ (IBE): NE of Sovata, margin of Lacul Mierlei (small saline lake), ca. 510 m a.s.l., 46°36.315'N 25°4.845'E, 13.IX.2018, leg. W. Dorfer (Fig. 8) – one specimen (IBE) was used for DNA extraction and sequencing (voucher number IBE-AN1237); ca. 20 exs. (CDR): NE of Sovata, effluent of Lacul Ursu (just before flowing into Lacul Aluniş), shallow, slowly flowing, strongly saline, ca. 510 m a.s.l., 46°36.233'N 25°4.983'E, 13.IX.2018, leg. W. Dorfer (Fig. 9).

H U N G A R Y: 11 exs. (TMB): Csongrád County: Szeged, Központ [= city center], 8.V.1905, leg. E. Csiki.

[C R O A T I A: 1 ♂ (NMW): "INSEL BRAZZA [= island of Brač] DALMATIEN [= Dalmatia]", typed label, date and collector unknown.]

REDESCRIPTION: Habitus as in Figs. 1–4. Length (from tip of labrum to elytral apex): 1.75–2.10 mm.

Coloration brown to dark brown, or black, legs and palpi lighter; in brownish specimens the head is usually darker; head and pronotum sometimes with very faint metallic (usually coppery-red or purplish) reflections.

Surface of head almost glabrous, without microreticulation, very sparsely micropunctate; anterior margin of labrum entire or slightly emarginate, in males, tip of labrum often more or less strongly upturned forming a small tooth.

Pronotum subcordiform, distinctly constricted posteriorly; anterior angles rectangular or slightly produced, anterior margin slightly excised between anterior angles and the small postocular tooth. Interfoveal areas of pronotum usually very smooth and glabrous, very sparsely micropunctate, impressions micropunctate/microreticulate; anterior foveae small and almost round, posterior foveae large, oblique and oval, very rarely basally connected by a very shallow depression; median groove usually well developed, but occasionally medially interrupted; lateral depression arched; hyaline border well developed and wide, especially in posterior half.

Elytra elongate, oval, with five rows of punctures between suture and shoulder, intervals flat to moderately convex; punctures usually large; explanate margin moderately wide in ♂, very wide in ♀; elytral apices slightly acuminate in ♂, usually distinctly produced and acuminate in ♀; pubescence of epipleura reaching posterior margin of metaventrite.

Middle of metaventrite glabrous posteriorly.

Legs comparatively long and slender. Basal protarsomeres of male slightly enlarged.

Aedeagus (Figs. 5–7): Main piece ca. 480 µm long, slender, very slightly curved in lateral view, more or less straight in strictly ventral view. Distal lobe short, recurved, ventral margin distinctly convex. Parameres long and slender, almost symmetrical, inserted near basal 0.4, apically widened with short but distinct bristles.

VARIABILITY: In specimens from Poland the elytral apices are on average less strongly acuminate than in specimens from Romania (see Figs. 1–4). Originally, we thought that the population from Poland might therefore represent a different species. However, after a thorough examination of numerous aedeagi from all populations available and after comparison of molecular data (the uncorrected p-distance between the specimens from Poland and Romania for the 3' end of the gene cytochrome oxidase subunit I is 0.6%), we can conclude that they actually all belong to the same species. Slight aedeagal differences (Fig. 7) in the shape of the distal lobe and the dorsal subapical angle of the main piece are obviously intra-populational and not of taxonomic significance. Differences in the elytral apices possibly could be explained by habitat differences, e.g. salinity. Differences in the coloration as seen in Figs. 1–4 might be due to the fact that historical specimens (Fig. 1–2) have paled over time.

ECOLOGY: *Ochthebius caudatus* is obviously a halobiontic species. It is found in salt marshes, salt springs, salt streams and hypersaline lakes (see also IENIȘTEA 1968: 773).

The salinity of Lacul Ursu (Sovata, Romania) is about 26 %. (https://lab42.architektur.uni-siegen.de/j3/index.php/lehre/verwunschene-orte/484-titel?start=2).

In the area of Tyrawa Solna (Sanok, Poland) there were originally four salt springs, which were mapped by JODŁOWSKI (1985) and DĘBIEC et al. (2015); two of them were measured by TOKARSKI (1921), who reported a salinity of 11 %; *O. caudatus* was collected in the largest of these springs (spring B in DĘBIEC et al. (2015: figs. 2–3)) together with *O. pusillus* STEPHENS, 1835 (Hydraenidae), *Helophorus dorsalis* (MARSHAM, 1802) (Helophoridae), *Coelostoma orbiculare* (FABRICIUS, 1775) and *Laccobius bipunctatus* (FABRICIUS, 1775) (Hydrophilidae); one of these four springs (spring C in DĘBIEC et al. (2015: figs. 2–3)) has already been destroyed; the remaining two springs, which are largely overgrown by bushes and trees, have not been sampled.

The specimens from Hungary (Szeged) were collected at light (ENDRŐDY-YOUNGA 1967: 15: "fényre repült").

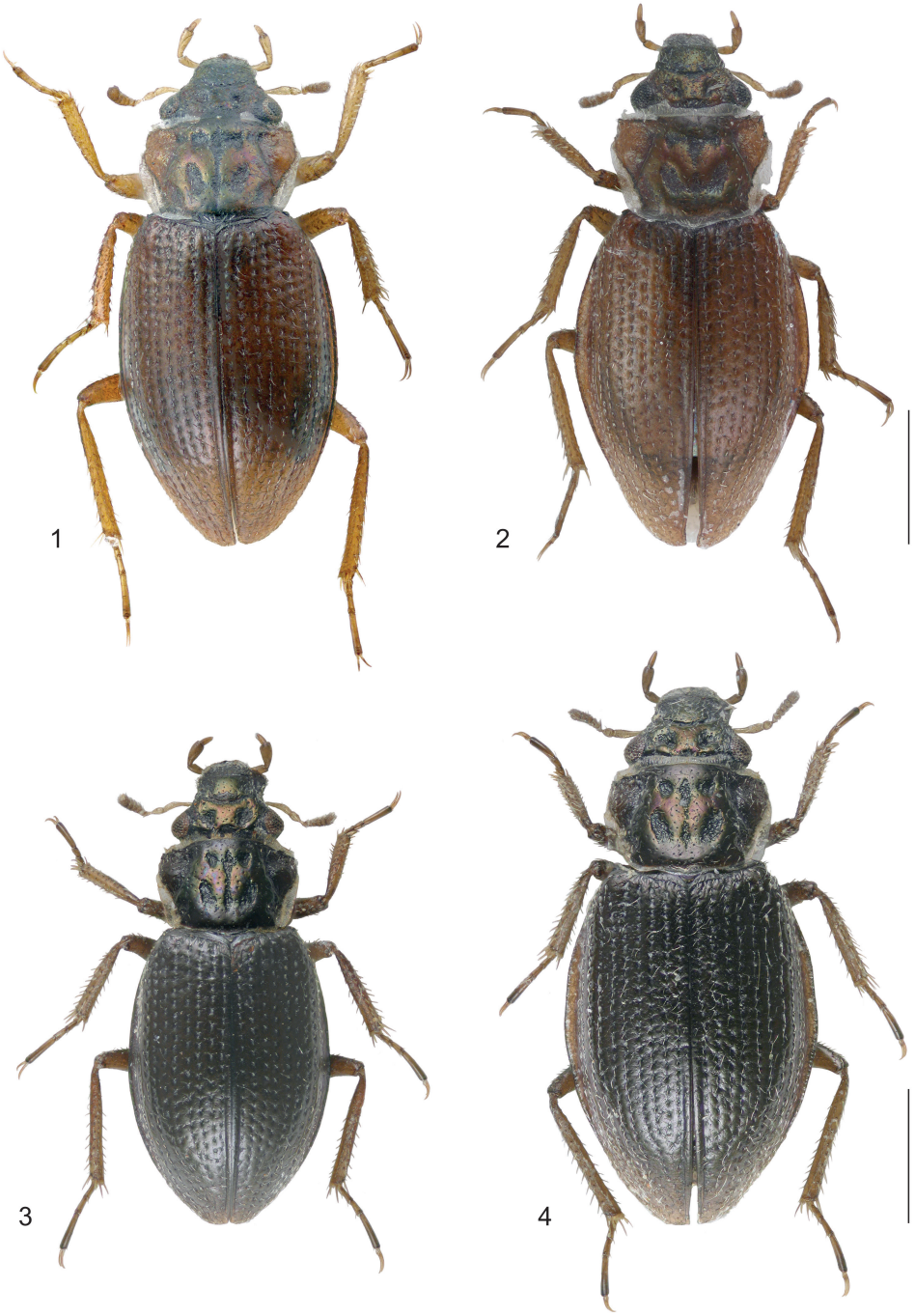
DISTRIBUTION (Fig. 11): At present confirmed only for the Carpathian Mountains in Romania and Poland.

Wide-spread in Romania, where its occurrence is confirmed for five counties (Buzău, Cluj, Mureș, Prahova, Sibiu).

Recorded for the first time from Poland, where it was collected in the very southeastern tip of the country.

In Hungary it was collected only once in 1905. Since all specimens were collected in a city center at light (see above), not far from the Romanian border, there is no real evidence that an autochthonous population ever existed in Hungary.

The single male from the island of Brač (Croatia) remains enigmatic as well. Since there is no information about date and collector, and since the island of Brač is far away from the main distribution area of *Ochthebius caudatus*, the Carpathian Mountains of Poland and Romania, there is no real evidence that this species does or ever did occur in Croatia. This specimen may have been incorrectly labelled.



Figs. 1–4: Habitus of *Ochthebius caudatus*, 1) ♂, Romania, Bazna, 2) ♀, Romania, Bazna, 3) ♂, Poland, Tyrawa Solna, 4) ♀, Poland, Tyrawa Solna. Scale bars: 0.5 mm.

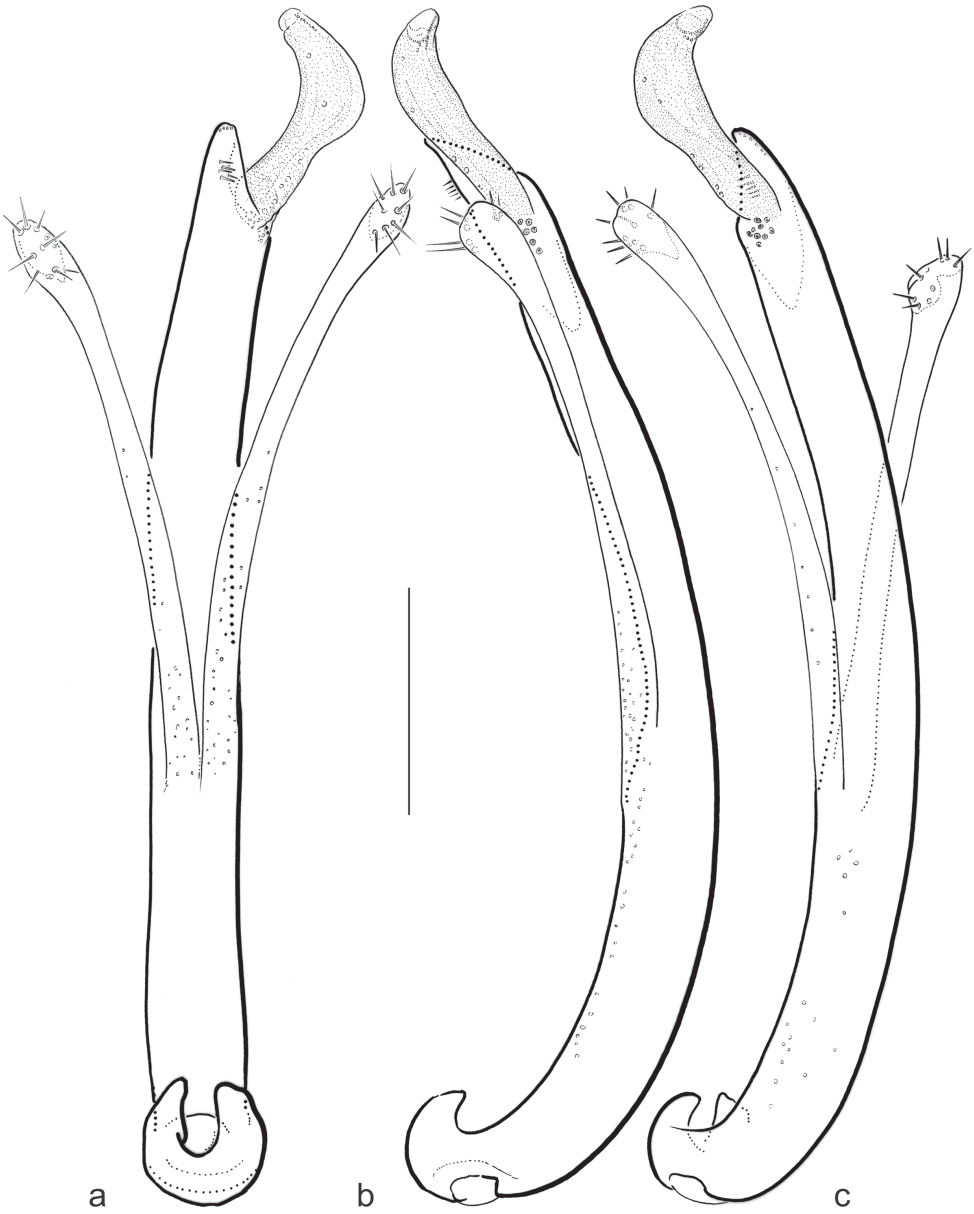


Fig. 5: *Ochthebius caudatus*, aedeagus, Romania, Bazna, a) ventral, b) lateral, and c) dorso-lateral view. Scale bar: 0.1 mm.

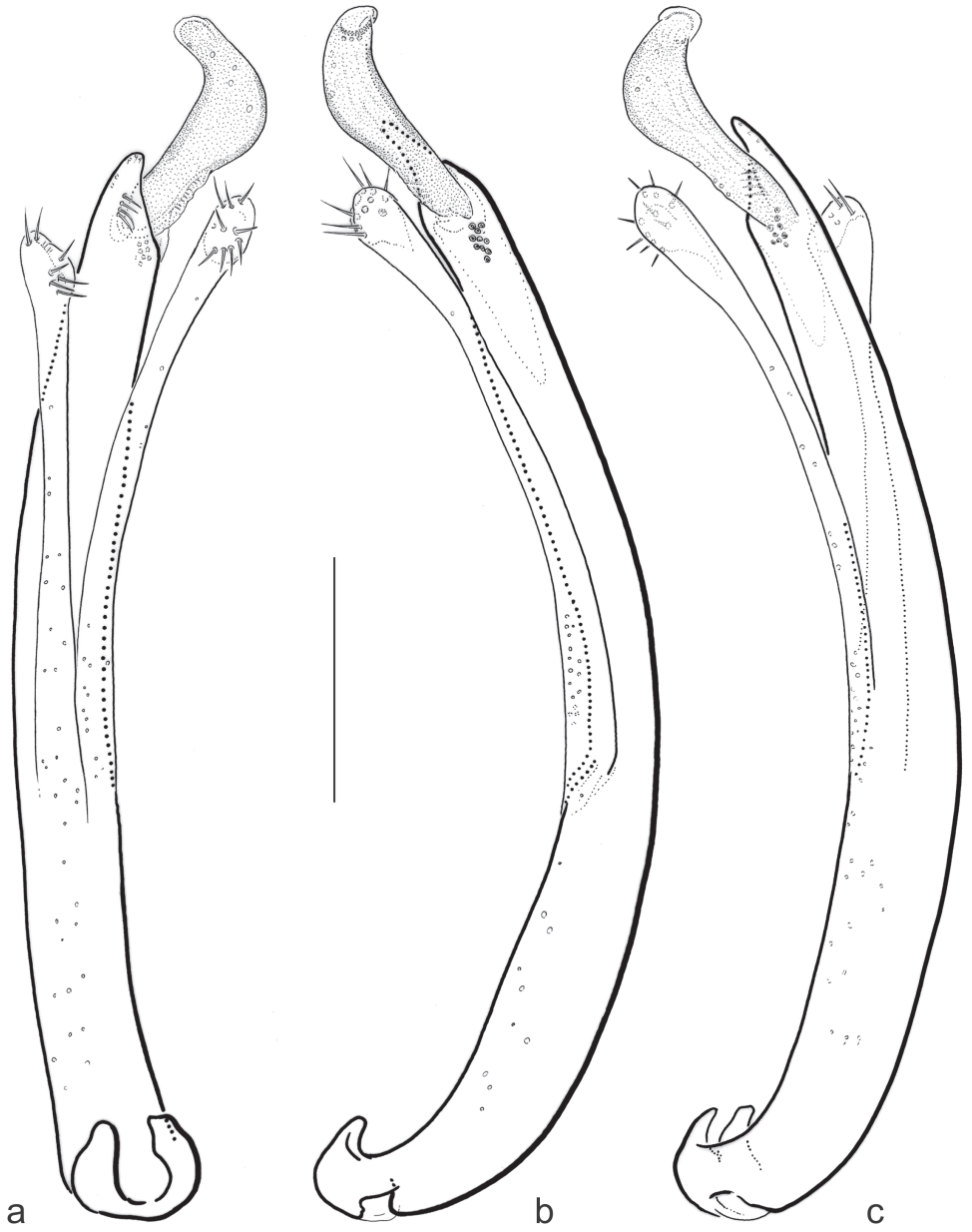


Fig. 6: *Ochthebius caudatus*, aedeagus, Poland, Tyrawa Solna, a) ventral (very slightly rotated to right side to show maximum outlines of distal lobe), b) lateral, and c) dorso-lateral view. Scale bar: 0.1 mm.

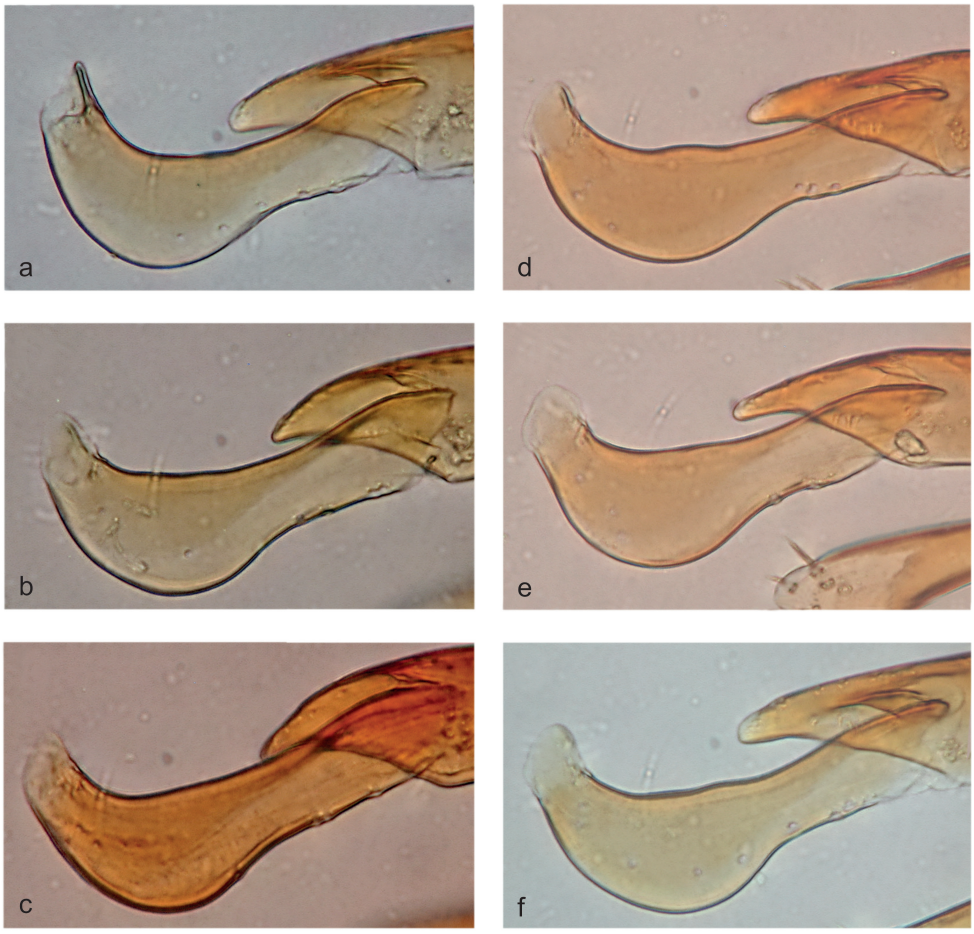


Fig. 7: *Ochthebius caudatus*, aedeagal apices, dorso-lateral view, a) Romania, Bazna, b) same locality, different specimen, c) Romania, Ocna Sibiului, d–f) Poland, Tyrawa Solna, three different specimens.

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Fig. 8: Lake Mierlei near Sovata (Romania, Mureș County). Arrows point at spots, where specimens were collected.

Fig. 9: Effluent of Lake Ursu near Sovata (Romania, Mureș County). Arrows point at spots, where specimens were collected.

Fig. 10: Salt spring near Tyrawa Solna (Poland, Sanok County). Arrow points at a spot, where some of the specimens were collected.

PHYLOGENETIC POSITION: VILLASTRIGO et al. (2019: 283) listed *Ochthebius* (s.str.) *caudatus* still under "species incertae sedis", because it was not possible to assign this species unambiguously to any of the 17 species groups of *Ochthebius* s.str. based on morphological features.

According to our molecular data, this species belongs to the *Ochthebius marinus* group with good support (posterior probability 0.99 in a Bayesian analysis). Inside the *O. marinus* group it is isolated without support.

DISCUSSION: The *Ochthebius marinus* group is by far the most speciose (ca. 80 spp.) and most wide-spread species group of *Ochthebius* s.str. It is the only species group which occurs in all major biogeographic regions.

Many species of this group are easily recognizable by the admedian pronotal foveae (at least the posterior ones) being transversally connected (see for instance JÄCH 2003: Fig. 5). However, there are several exceptions, and some species deviate even considerably from other group members in their external (and partly genital) morphology, as for instance *Ochthebius capicola* PERINGUEY, 1892 and *O. rectus* LECONTE, 1878.

In *O. caudatus* the admedian pronotal foveae are usually rather well separated, although in a few specimens a very faint transverse depression can be observed at the base between the posterior admedian foveae. The strongly acuminate and widely explanate female elytra (vaguely

resembling some species of the *O. notabilis* group) are, as far as we are aware, a unique character in the *O. marinus* group.

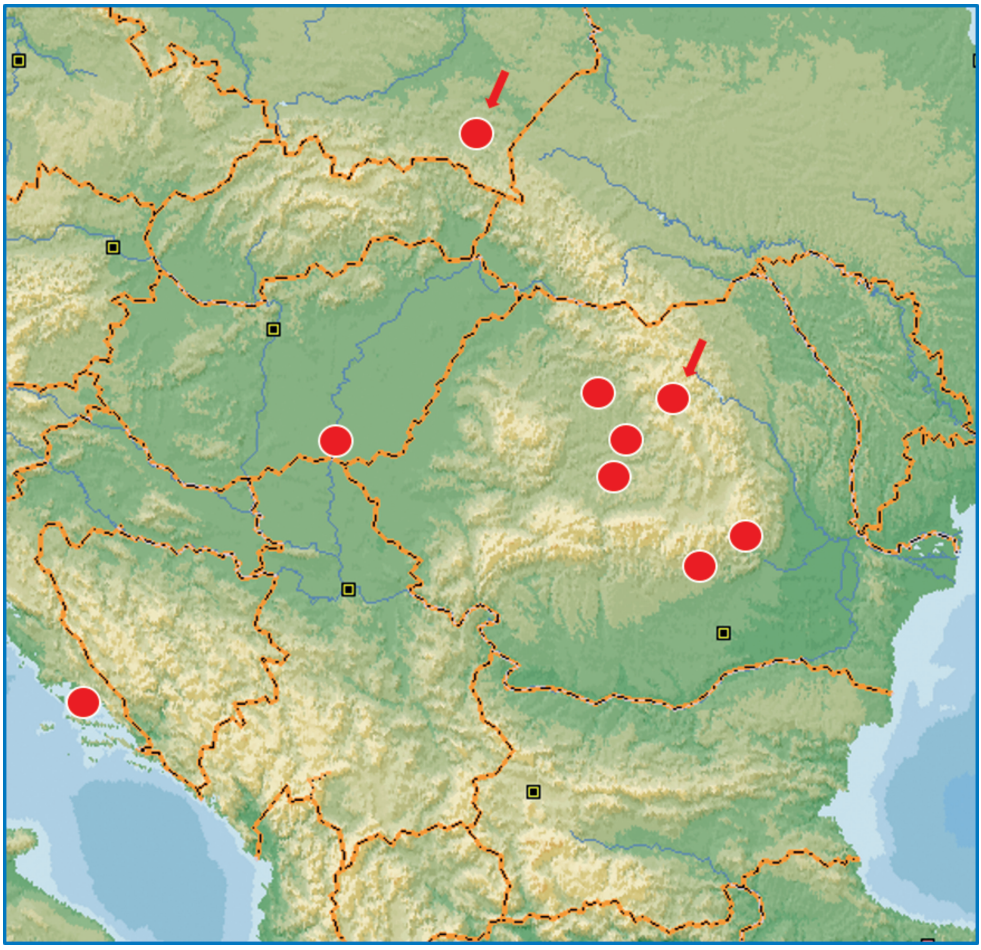

Fig. 11: Distribution of *Ochthebius caudatus*. Arrows point at localities, where specimens were collected recently.

With regard to aedeagal characters, *O. caudatus* fits quite well into the *O. marinus* group. The distal lobe is not unsimilar to some species of the *O. viridis* complex. The aedeagus of *O. romanicus* IENIŞTEA, 1968 (tentatively assigned to the *O. marinus* group by VILLASTRIGO et al. (2019) because of its external similarity with *O. pusillus* STEPHENS, 1835) is almost identical with that of *O. caudatus*, except for its much smaller size.

Unfortunately, *O. romanicus* has not been collected in recent decades and molecular data are therefore not available.

Acknowledgements

Thanks are due to A. Faille (MNS), G. Makranczy (TMB), and A. Lőkkös (Csopak, Hungary) for valuable information resp. for providing specimens. We are most grateful to A. Cardoso (IBE) and I. Ribera (IBE) for their help concerning the molecular data.

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