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## Description of a new subterranean hyphydrine species from Hainan (China), based on morphology and DNA sequence data (Coleoptera: Dytiscidae)

G. WEWALKA, I. RIBERA & M. BALKE

### Abstract

*Microdytes trontelji* (Coleoptera: Dytiscidae, Hyphydrini) is described from a cave in Hainan, China. A molecular phylogenetic analysis groups this morphologically very aberrant species unambiguously with *Microdytes*, and it is therefore suggested that it represents a highly modified member of this genus, adapted to life in underground waters.

**Key words:** Coleoptera, Dytiscidae, *Microdytes*, new species, cave, stygobiont, mtDNA, phylogeny.

### Introduction

An expedition to caves in Hainan, China, by P. Trontelj and M. Zagamjster (Ljubljana, Slovenia) revealed an undescribed, rather derived hyphydrine dytiscid, which is presumably adapted to underground life. Morphologically, it hardly fits into one of the known genera but rather appears like a mosaic of *Microdytes* BALFOUR-BROWNE, *Allopachria* ZIMMERMANN and *Anginopachria* WEWALKA, BALKE & HENDRICH. The problem of generic assignment of such morphologically and ecologically highly derived species is well documented, and has often led to the description of new genera for species that would not fit current classification, and which had to be synonymized after phylogenetic analyses (RIBERA et al. 2003, BALKE & RIBERA 2004). Recently, it was shown that mtDNA sequence data can help to circumvent this problem (BALKE et al. 2004) and here, we provide an assessment based on such data as well.

### Material and Methods

Samples were taken at deeper sections of the creek by lifting stones and sediment. A nylon net with a mesh size of 0.3 mm was used. The samples were stored in 96% ethanol.

DNA laboratory techniques follow BALKE et al. (2004). DNA was extracted non-destructively from the beetles, and the vouchers were retrieved in perfect collection quality. DNA samples of the new species described here are housed in the Zoologische Staatssammlung München, extraction numbers MB1245 and MB1246. Sequences of the new species were added to the matrix used in RIBERA & BALKE (2007), manually aligned, and analysed using Bayesian methods as implemented in MrBayes 3.1.2 (HUELSENBECK & RONQUIST 2001, RONQUIST & HUELSENBECK 2003) (see RIBERA & BALKE 2007 for more details on the analytical methods).

### *Microdytes trontelji* sp.n.

**TYPE LOCALITY:** China, Hainan Province (for further details, see below, under “Biology and Habitat”).

**TYPE MATERIAL:** **Holotype** ♂ (Naturhistorisches Museum Wien): “China, Hainan, Qiantian Village \ Changjiang cnty. \ Si Haizi Dong cave, ii.2005 \ leg. Trontelj & Zagamjster”. **Paratypes:** 2 ♀♀, with same data as holotype

(Zoological Collection at the Biotehniška fakulteta Univerza v Ljubljani, Slovenia).

**DESCRIPTION:** Measurements: TL 1.90–2.20 mm; TL-h 1.50–1.70 mm; TW 1.00–1.10 mm. Body shape moderately elongate, apically truncate. Angle between pronotum and elytra moderately distinct. Pronotum broadest shortly behind anterior angle, slightly heart-shaped. Colour of entire beetle pale testaceous, translucent (Fig. 1). Metathoracic wings well developed.

**Head:** Very large; eyes strongly reduced, small and V-shaped; frontal part of head flattened with anterior margin unbeaded and almost straight; labrum not covered by anterior clypeal edge in anterior view; temples behind eyes laterally flattened and surrounded by fine keels; punctures very sparse and fine, rows of coarser punctures alongside of normal location of eyes, finely microreticulate; apical pair of sensilla of labial and maxillary palpi distinctly separated; antennomeres 1–2 wider than following segments; antennomeres 5–10 short and slightly expanded in apical half; antenna not modified in male.

**Pronotum:** Posterior angle slightly produced posteriorly; lateral bead fine, slightly broader anteriorly; punctures irregular, very sparse, moderately fine; coarse punctures along anterior and posterior margin, without microreticulation.

**Elytra:** Anterolateral angle not extended anteriorly; surface smooth; punctures irregular and very sparse and moderately fine, with traces of two rows of coarser punctures; without microreticulation.

**Ventral side:** Prosternal process dentate (i.e. its neck with fine border in ventral view), moderately broad in ventral view, apex rounded, lateral beads of process broad and in-between concave so that the lateral beads quasi form a container, apex reaching metaventricle; distance between metacoxal cavities narrow; metaventral wing medially narrow; base of metatrochanter covered by small lobe of metacoxal process; posterior margin of ventral lamina of metacoxal process visible; metacoxae not soldered to the abdomen. Coarser punctures limited to proximal part of metaventricle and only rudimentary on metaventral wings, without microreticulation. Ventral carina of elytron limited to posterior half; apical portion of ventrolateral carina of elytron not strongly modified, ligulate. Ventrites I–III strongly fused, sutures almost invisible; margin of last ventrite with fine border, distally very broadly rounded.

**Legs:** metatibia club-shaped; longer spur of metatibia smooth (not serrate); longitudinal row of punctures on disc of metatibia reduced; apical transverse row of spines on metatibia of medium length but discontinued medially; length of metatarsal claws unequal, size of anterior metatarsal claw reduced.

**Male:** penis bifurcate (Fig. 2); parameres slender, triangular (Fig. 3); antennae not modified; pro- and mesotarsal segments minimally enlarged.

**Female:** The two females are slightly smaller than the holotype.

**ETYMOLOGY:** This species is dedicated to Prof. Peter Trontelj, Ljubljana, Slovenia, who collected the type specimens of the new species.

**DIFFERENTIAL DIAGNOSIS:** Readily characterised by the following combination of characters: (1) eyes strongly reduced, V-shaped, (2) integument hardly pigmented, translucent, (3) body dorsoventrally depressed, elongate in dorsal view, (4) shape of male genitalia.

**GENERIC PLACEMENT:** The unequal length of metatarsal claws and the results of our DNA sequence analysis (Fig. 4) place this species in the tribe Hyphydrini. Generic placement according to the current morphological system was not unambiguous. The small lateral lobe of the metacoxal process which covers the base of the trochanter is shared with *Anginopachria*, *Allopachria* and *Microdytes* (see WEWALKA 2000: Fig. 127, WEWALKA, BALKE & HENDRICH 2001: Fig. 3). All other genera of Hyphydrini including *Agnoshydrus* BISTRÖM, NILSSON & WEWALKA have the metacoxal process fully reduced, not covering the base of the trochanter.

The new species has a dentate prosternal process (with “neck“ delimited by ridge; BISTRÖM et al. 1997: 60) and thus differs from *Anginopachria* and *Allopachria*.

*Microdytes trontelji* differs from *Allopachria* (WEWALKA 2000) also by the more elongate flattened body, punctures on metaventricle limited to proximal part, only rudimentary on metaventral wings while in species of the genus *Allopachria* punctures on metacoxal wings are very coarse (see WEWALKA 2000: Figs. 127–128). The space separating the mesocoxae is much narrower and the metaventricle is not bifurcate anteriorly as in *Allopachria* (see WEWALKA 2000: Fig. 128).

*Microdytes trontelji* can be differentiated from *Anginopachria* by the body less elongate, prosternal process and its lateral beads broader.

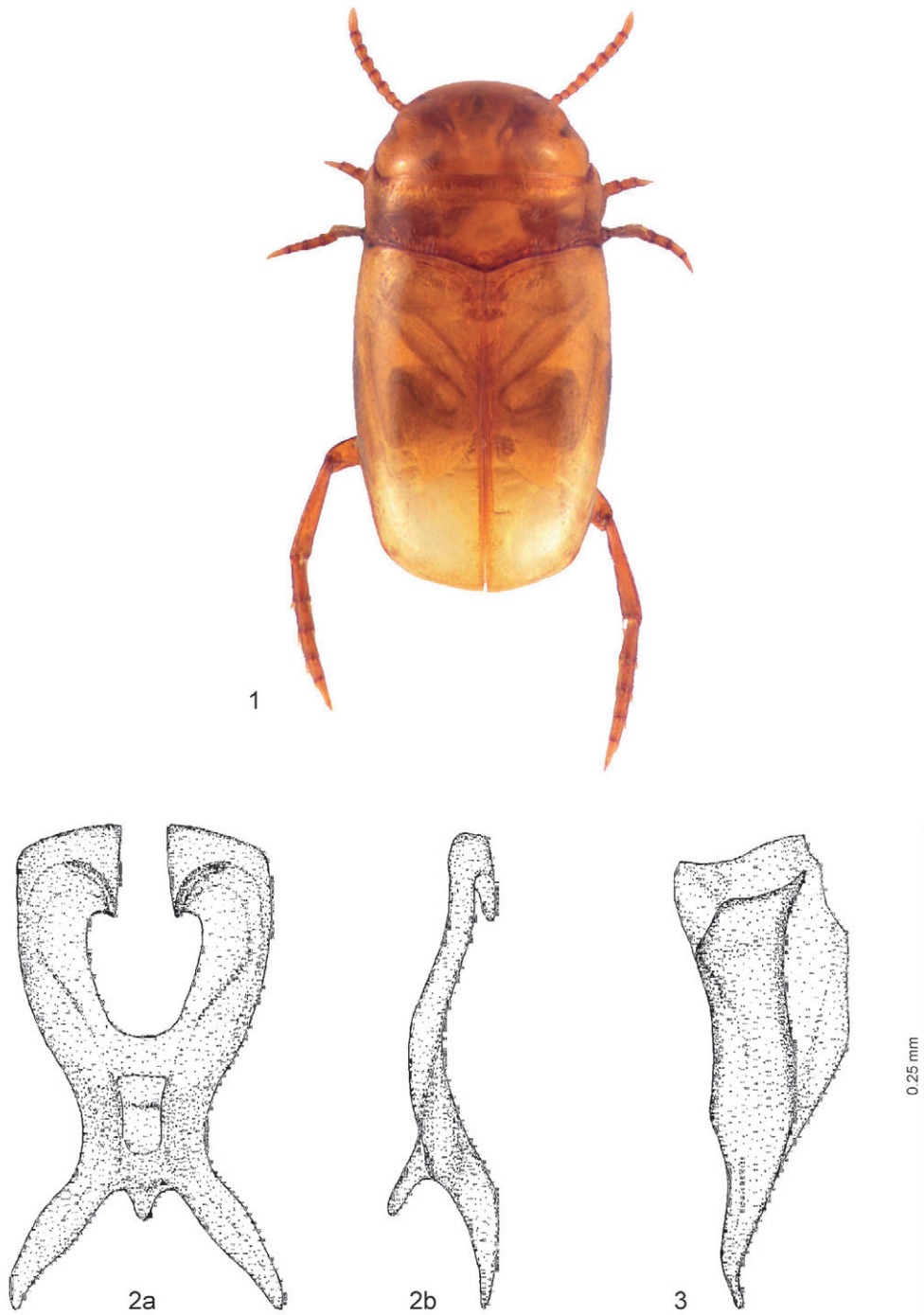
The new species differs from the remaining species of *Microdytes* (as presently defined) by its body being not globular. The molecular phylogenetic analysis, however, placed the new species unambiguously in the genus *Microdytes* (Fig. 4) and for that reason we decided to include it in this genus. The single species of *Allopachria* that was available for DNA sequencing was also unambiguously placed within *Microdytes*, indentifying a generic re-assessment of SE Asian Hyphydrini based on a larger sampling size as a future priority. As *Microdytes* is the oldest available genus name, and based on the outcomes of our study of DNA sequence data, classifying the new species as a *Microdytes* appears to be the taxonomically most stable option.

The only other known species of underground Hyphydrini, *Dimitshydrus typhlops* UÉNO, 1996 from Japan differs from *Microdytes trontelji* by representing the typical hyphydrine habitus, i.e. a globular body.

**BIOLOGY AND HABITAT:** All specimens of *Microdytes trontelji* were collected from the bottom of a lotic cave creek covered with clay and stones. No accessible stagnant water was found in the cave. Given the proximity of the surface and the direction of flow, it seems unlikely that the specimens caught could have originated from some larger body of stagnant groundwater.

Hainan is formed on old geological formations, with 60 % of the island being granites of Late Paleozoic to Mesozoic (XIANHUA et al. 2000). Cenozoic volcanics are distributed in the northern part of the island. Scattered patches of limestone harbor a moderate number of known caves. The cave where the new dytiscid beetle was found has no official name. In an unpublished report to the nearby Bawangling Forestry Bureau, it has been termed “Si Haizi Dong” (Four Children’s Cave). It is situated in Changjiang County just outside the Bawangling National Nature Reserve famous for the endangered Hainan gibbon (*Hylobates hainanensis*). The cave lies in a limestone hill some 300 m south from Qiantian village. The coordinates of the entrance, taken by GPS, are 18°57'28.3"N and 109°09'01.3"E. The entrance itself is very narrow (about 40 x 50 cm) and cannot be seen from the village. The length of the cave is approximately 120 m. There are two small, apparently endogenous creeks in the cave flowing over conglomeratic sediments and joining in a subterranean confluence. Their total discharge was estimated at about two liters per second. It should be noted that the explorations were carried out in February, which is still in the dry season. The bottom of the creeks is formed by small to medium sized stones and clay sediment. Other stygobionts include a new bathynellacean genus and species, *Sinobathynella decamera* CAMACHO, TRONTELJ & ZAGMAJSTER, 2006 (Crustacea, Syncarida, Parabathynellidae) and an amphipod (Crustacea, Bogidiellidae) (see CAMACHO, TRONTELJ & ZAGMAJSTER 2006). Aquatic samples taken from another cave (Dixia Gong) and a karst spring some 200 m west from a Cave called Huangdi Dong, both belonging to the same limestone area, yielded no dytiscids.

**DISTRIBUTION:** China, Hainan Province.



Figs. 1–3: *Microdytes trontelji*, holotype; 1) habitus; 2) penis, a: dorsal view, b: lateral view; 3) paramere.

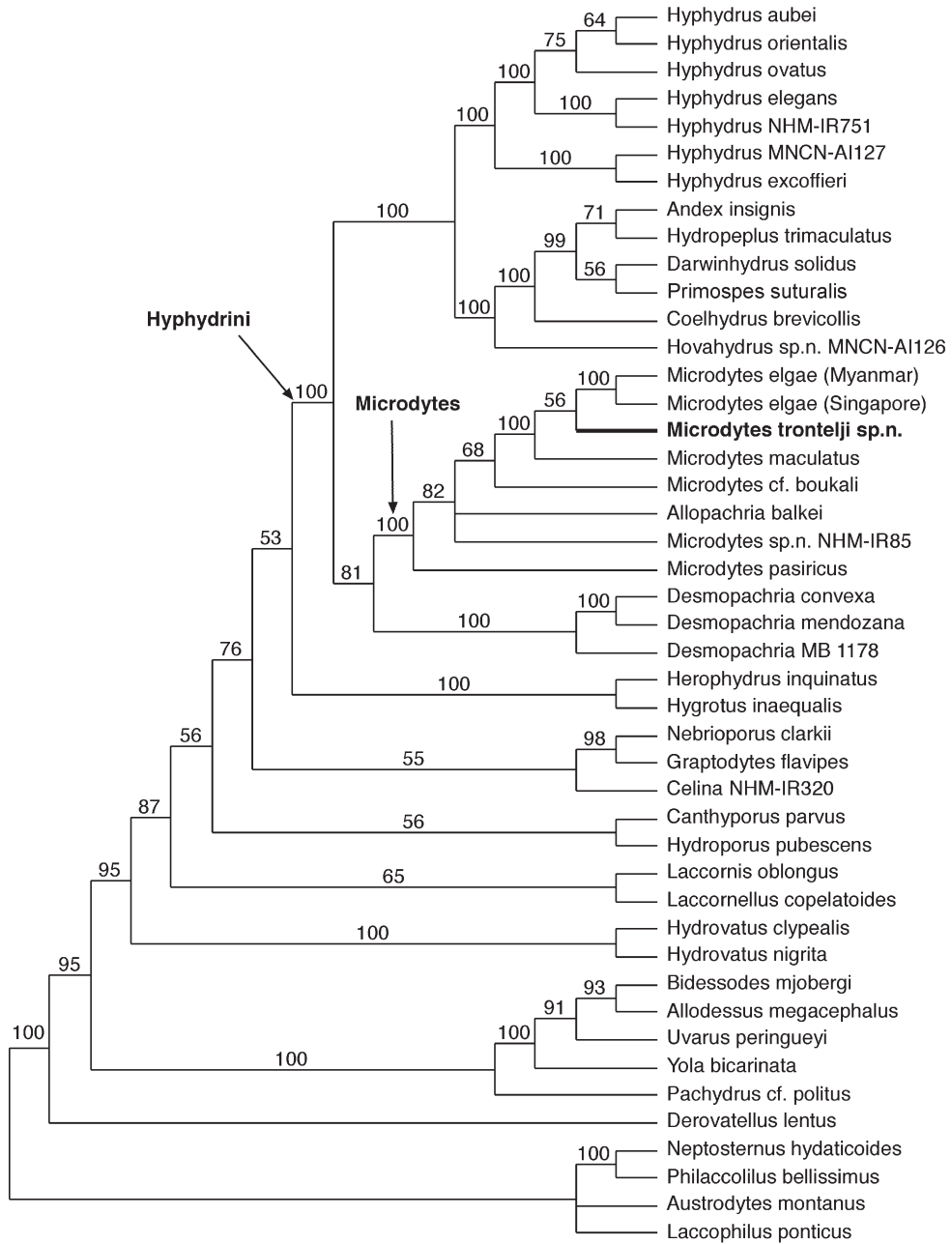


Fig. 4: Phylogenetic relationships of Hyphydrini and outgroups inferred through Bayesian analysis. Numbers above nodes are posterior probabilities.

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Prof. Dr. Günther WEWALKA  
Starkfriedgasse 16, A – 1190 Wien Austria (g.wewalka@gmx.at)

Dr. Ignacio RIBERA  
Departamento de Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales, José Gutiérrez  
Abascal 2, 28006 Madrid, Spain (i.ribera@mncn.csic.es)

Dr. Michael BALKE  
Zoologische Staatssammlung, Münchhausenstraße 21, D – 81247 München, Germany (michael\_balke@yahoo.de)