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Two new species of *Coelostoma* Brullé, 1835 from South Xizang, China (Coleoptera: Hydrophilidae: Sphaeridiinae)

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Abstract

Two new species of the water scavenger beetle subgenus *Lachnocoelostoma* Mouchamps, 1958, belonging to the genus *Coelostoma* Brullé, 1835 are described from southern Xizang Autonomous Region of China. Among the new species, *Coelostoma* (*Lachnocoelostoma*) *change* **sp. nov.** from Mêdog County is notable for its small body size (3.4–3.6 mm in length) and capitate-shaped median lobe of aedeagus. *Coelostoma* (*Lachnocoelostoma*) *yi* **sp. nov.** from Zhangmu County was co-occurring with *Coelostoma* (*Lachnocoelostoma*) *gentilii* Jia, Aston & Fikáček, 2014, but elytra without serial punctures laterally, male genitalia with median lobe rather slim. Seven species of the genus are known from Xizang up to now. Species diagnoses, detailed descriptions and illustrations of the new species are provided.

Key words: *Coelostoma*, Hydrophilidae, Xizang, Himalaya, taxonomy, China

Introduction

Coelostoma Brullé, 1835 is an Old World, semi-aquatic genus of hydrophilid beetles, comprising more than 120 species classified into 4 subgenera. (Hansen 1999; Short & Hebauer 2006; Fikáček 2010; Short & Fikáček 2011; Fikáček *et al*. 2019; Jia *et al.* 2014, 2017, 2019; Liu *et al.* 2020; Sheth *et al*. 2020; Przewoźny 2022; Mai *et al*. 2022). Species of this genus are more abundant in the Oriental and Afrotropical regions than in the Palaearctic and Australian regions. In the Nearctic and Neotropical regions, species that resemble *Coelostoma* belong to the genera *Phaenonotum* Sharp, 1882, *Phaenostoma* d'Orchymont, 1937 and *Lachnodacnum* d'Orchymont, 1937 (Gustafson & Short 2010; Deler-Hernández *et al*. 2013; Clarkson *et al.* 2014; Mai *et al.* 2022).

Most species of *Coelostoma* in the same subgenus exhibit high morphological similarity, and species identification often relies on unique characters of the male genitalia. The characters of the aedeagus were not used to distinguish different species until 1940 (d'Orchymont 1940). Hence, it was inevitable that some species were misidentified and incorrectly recorded in some areas. In the case of the Chinese fauna, it is highly likely that the records of *Coelostoma* (s. str.) *fabricii* (Montrouzier, 1860) from Fujian (d'Orchymont 1935) and *C.* (*Lachnocoelostoma*) *transcaspicum* Reitter, 1906 from Shandong (d'Orchymont 1925) were based on misidentification, and these records were replicated by other researchers, such as Hansen (1999). These two were later excluded from the Chinese fauna (Jia *et al.* 2014; Mai *et al.* 2022). Similarly, the record of *Coelostoma* (*Lachnocoelostoma*) *horni* (Régimbart, 1902) from Hong Kong (d'Orchymont 1925) is also likely based on misidentification. However, this species is known from Yunnan (Jia *et al.* 2014).

The fauna of *Coelostoma* from China was poorly known before 2014. Only nine valid species had been recorded from China (Hansen 1999; Jia 2005; Hebauer 2006). Since then, 22 additional species have been described or reported from China. Up to now, 30 species are known, of which two species are assigned to the subgenus *Holocoelostoma* Mouchamps, 1958, five species to *Coelostoma* (s. str.) and 23 species to *Lachnocoelostoma* Mouchamps, 1958. Southern Xizang, especially the Yarlung Tsangpo Grand Canyon and the southern foothills

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of the Himalaya—part of the Himalayan biodiversity hotspot (Xing & Ree 2017)—is characterized by extreme altitudinal variation. Warm, humid monsoons from the Indian Ocean bring high levels of precipitation to the region, resulting in exceptionally high species diversity (e.g., Xu *et al.* 2009). Based on specimens collected from this area in recent years, two previously undescribed species were discovered. Here, we describe these two new species in detail. For a comprehensive identification key to other Chinese species, see Mai *et al.* (2022).

Material and methods

Representative specimens of all studied species were dissected. After 10 min in 10% KOH at 70°C, dissected male genitalia were transferred to a drop of distilled water, and the cleaned genitalia were subsequently mounted in a drop of soluble resin on a piece of paper card attached below the respective specimen. For taking photographs, the cleaned and relaxed male genitalia were placed in a drop of glycerine. Photographs of genitalia were taken using a Zeiss AxioCam HRc camera mounted on a Zeiss AX10 microscope with the Axio Vision SE64 software. These images were then stacked in Helicon focus (v7.0.2). Habitus photographs were taken using a Nikon DS-Ri2 mounted on a Nikon SMZ25; layers were captured and stacked in the NIS-Elements software. Habitat images were taken using a Canon 7D digital camera. Morphological terminology used in the description follows Mai *et al.* (2022).

All type specimens are deposited in the following collections:

NACRC National Animal Collection Resource Center, Chinese Academy of Sciences, Institute of Zoology, Beijing, China (Jun Chen, Hong-Bin Liang);

NMP National Museum, Prague, Czech Republic (Martin Fikáček, Jiří Hájek, Lukáš Sekerka);

SYSU Sun Yat-sen University, Guangzhou, China (Feng-Long Jia, Wei-Cai Xie).

Taxonomy

Subgenus *Coelostoma* (*Lachnocoelostoma*) Mouchamps, 1958

Lachnocoelostoma Mouchamps, 1958: 4 (as subgenus of *Coelostoma*). Type species: *Cyclonotum horni* Régimbart, 1902, by monotypy.

Diagnosis. Prosternum moderately convex or carinate medially. Elytra without serial punctures in most species. Mesofemora densely pubescent, except on extreme apex. Abdominal ventrite 1 with or without carina.

Coelostoma (*Lachnocoelostoma*) *change* sp. nov.

(Figs 1A–F, 3A, B)

Type material. HOLOTYPE: CHINA: ♂ (NACRC), 'Xizang, Roadside of 20 km away to Beibeng from Mêdog (中国西藏, 墨脱至背崩20 km处), 29.2657°N, 95.2035°E, 785 m, 5.viii.2017, Hong-Bin Liang (梁红斌) leg.'. **PARATYPES: CHINA:** 1 ♀, 3 unsexed exx. (NACRC), with same label data as holotype (all data transcribed from Chinese).

Diagnosis. Length 3.4–3.6 mm. Head, pronotum and elytra with similar punctation; lateral portion of elytra with same punctures as those on disc, without serial punctures laterally (Fig. 1A, C). Prosternum carinate medially, with a prominent tooth anteromedially (Fig. 3A). Mesofemora densely pubescent, except on extreme apex (Fig. 3A). Abdominal ventrite 1 with carina almost reaching posterior margin (Fig. 3B). Ventrite 5 not emarginate, without stout setae apically. *Aedeagus* (Fig. 1E, F). Median lobe capitate-shaped, as long as parameres, widest basally, narrowest at midlength, apex widely rounded; gonopore situated on basal third of median lobe. Parameres broadly truncate apically.

Description. ***Form and colour*** (Fig. 1A–D)**.** Body length 3.4–3.6 mm, width 2.1–2.3 mm. Body oval, moderately convex. Dorsum black, anterior and posterior margins of pronotum and posterior of elytra somewhat paler. Labrum, maxillary and labial palpi yellowish to reddish brown, antennae yellowish to reddish brown with dark club. Ventral surface dark reddish brown to black. Legs dark reddish brown, tarsi yellowish.

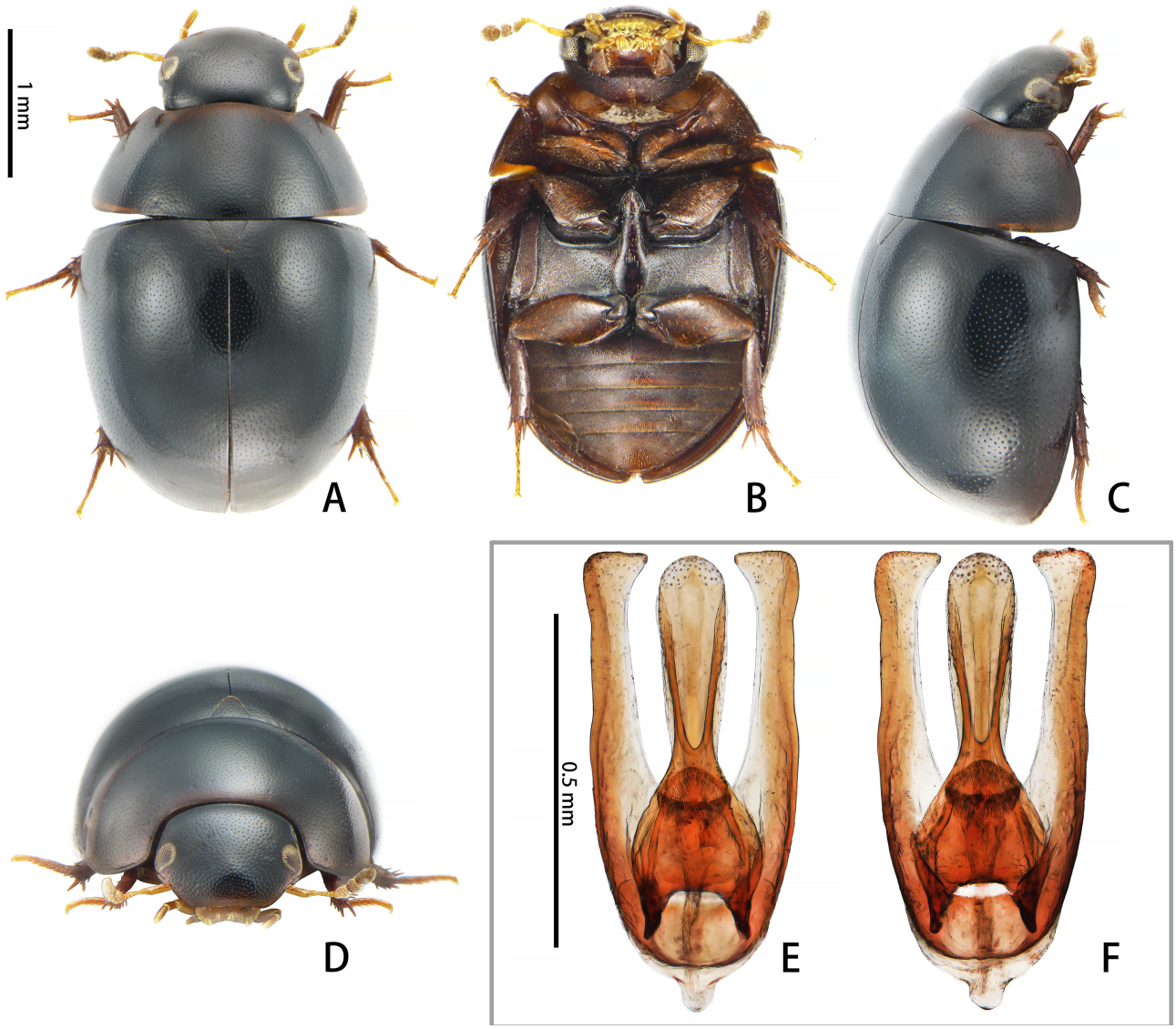

FIGURE 1. *Coelostoma* (*Lachnocoelostoma*) *change* **sp. nov.** (holotype). **A–D.** Habitus. **E, F.** Aedeagus. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view. **D.** Frontal view. **E.** Dorsal view. **F.** Ventral view.

Head. Dorsal surface with sparse and moderately strong punctures; without microsculpture, except posterior part with dense transverse microsculptures. Clypeus slightly concave anteromedially. Eyes moderate size, separated by ca 5× width of one eye, slightly emarginated anteriorly. Mentum almost straight anteriorly and depressed in anterior half, with sparse and fine punctures. Antennae with nine antennomeres, antennal club (antennomeres 7–9) densely pubescent. Maxillary palpomere 2 strongly swollen, palpomere 4 almost truncate apically, slightly longer than palpomere 3. Gula narrow and glabrous.

Thorax. Pronotum widest posteriorly, gradually narrowed anteriad, with similar punctures to those on head. Lateral margins of pronotum narrowly rimmed; rim overlapping anterior and posterior corners, anterior and almost all of posterior margin without rim. Posterolateral angles of pronotum blunt. Prosternum with a carina medially and a prominent tooth anteromedially. Mesoventral process arrowhead-shaped, with a rounded apex; surface with sparse and fine setae. Middle area of metaventrite with sparse and fine punctures, strongly raised and projecting anteriorly between mesocoxae and broadly contacting posterior margin of mesoventral process; lateral areas of metaventrite densely pubescent and punctate. Metepisternum densely pubescent, ca 4.5× as long as wide, parallel-sided. Scutellar shield slightly longer than wide, with punctation as those on pronotum. Elytral ground punctures as those on pronotum, without serial punctures. Elytral sutural stria fine, reaching anterior half of elytra.

Legs. Pro- and mesofemora bearing dense pubescence, except on extreme apex. Metafemora not pubescent, with dense microsculptures and sparse fine punctures. Meso- and metatibia slightly flattened, with strong apical spurs and series of sparse stout spines laterally. Tarsi with long dorsal setae and gold ventral setae; metatarsi with tarsomere 5 almost as long as tarsomeres 3 and 4 combined. Claws curved, with a pair of long setae beneath.

Abdomen. Abdominal ventrites densely pubescent. Ventrite 1 with distinct median carina almost reaching posterior margin. Ventrite 5 not emarginate apically.

Aedeagus (Fig. 1E, F)**.** Median lobe baseball bat-shaped, almost as long as parameres, widest basally, gradually narrowing towards midlength and narrowest in middle, then gradually widened apically, apex widely rounded; gonopore oval, situated on basal third. Parameres with basal half slightly arched outside, somewhat narrowed from middle to subapex, slightly expanded apically, inner face of paramere strongly protruding inwards apically, apex broadly truncate.

Remarks. This species can be recognised by the small body size (less than 4 mm in length) and median lobe of aedeagus. It is similar to *Coelostoma hongkongense* Jia, Aston & Fikáček, 2014 (3.5–3.8 mm in length). It can be distinguished from the latter by dorsum with uniform punctures (head and pronotum with much finer and sparser punctation than on elytra, elytra with lateral portion more or less strongly punctate in *C. hongkongense*), abdominal ventrite 1 with complete carina (abdominal ventrite 1 not carinate in *C. hongkongense*), median lobe of aedeagus without lateral projections (median lobe with distinct lateral projections in *C. hongkongense*. See Jia *et al.* 2014: fig. 23)

Etymology. The species name *change* is derived from "Chang'e (嫦娥)", a young lady in Chinese mythology who flew from the Earth to the Moon. The name also commemorates Chinese lunar exploration program, particularly the Chang'e spacecraft series.

Biology. Unknown.

Distribution. China (Xizang), only known from the type locality.

Coelostoma (*Lachnocoelostoma*) *yi* sp. nov.

(Figs 2A–F, 3C, D, 4A–C)

Type material. HOLOTYPE: CHINA: ♂ (SYSU), 'Xizang, Xigazé, Nyalam County (聂拉木县), Zhangmu Town (樟木镇), on wet rock with a fine film of flowing water at night. 27.9694°N, 85.9699°E, 2253 m, 30.VI.2023, Zu-Qi Mai, Yue-Zheng Tu & Cheng Liang'. **PARATYPES: CHINA:** 1 ♂ (NMP), 1 ♀ (SYSU), same data as the holotype.

Diagnosis. Length 4.4–4.7 mm. Head, pronotum and elytra with similar punctation; lateral portion of elytra with same punctures as those on disc, without serial punctures laterally (Fig. 2A, C). Prosternum carinate medially, with a prominent tooth anteromedially (Fig. 3C). Mesofemora densely pubescent, except on extreme apex (Fig. 3C). Abdominal ventrite 1 without carina (Fig. 3D). Ventrite 5 not emarginate, without stout setae apically. *Aedeagus* (Fig. 2E, F). Median lobe slightly shorter than parameres, widest basally and gradually narrowing towards apex, apex rounded; gonopore situated slightly below midlength. Parameres broadly truncate apically.

Description. *Form and colour* (Fig. 2A–D). Body length 4.4–4.7 mm, width 2.8–2.9 mm. Body oval, moderately convex. Dorsum black. Labrum, maxillary and labial palpi yellowish to reddish brown, antennae yellowish brown with club black. Ventral surface dark reddish brown to black. Legs dark reddish brown to black, tarsi yellowish to reddish brown.

Head. Dorsal surface with dense and moderately strong punctures; without microsculpture. Clypeus almost truncate anteromedially. Eyes moderate size, separated by ca 5× width of one eye, slightly emarginated anteriorly. Mentum almost straight anteriorly and depressed in anterior half, with sparse and fine punctures. Antennae with nine antennomeres, antennal club (antennomeres 7–9) densely pubescent. Maxillary palpomere 2 strongly swollen, palpomere 4 almost truncate apically, slightly longer than palpomere 3. Gula narrow and glabrous.

Thorax. Pronotum widest posteriorly, gradually narrowed anteriad, with similar punctures to those on head. Lateral margins of pronotum narrowly rimmed; rim overlapping anterior and posterior corners, anterior and almost all of posterior margin without rim. Posterolateral angles of pronotum blunt. Prosternum with a carina medially and a prominent tooth anteromedially. Mesoventral process arrowhead-shaped, with a pointed apex; surface with sparse and fine setae. Middle area of metaventrite with very sparse and fine punctures, strongly raised and projecting

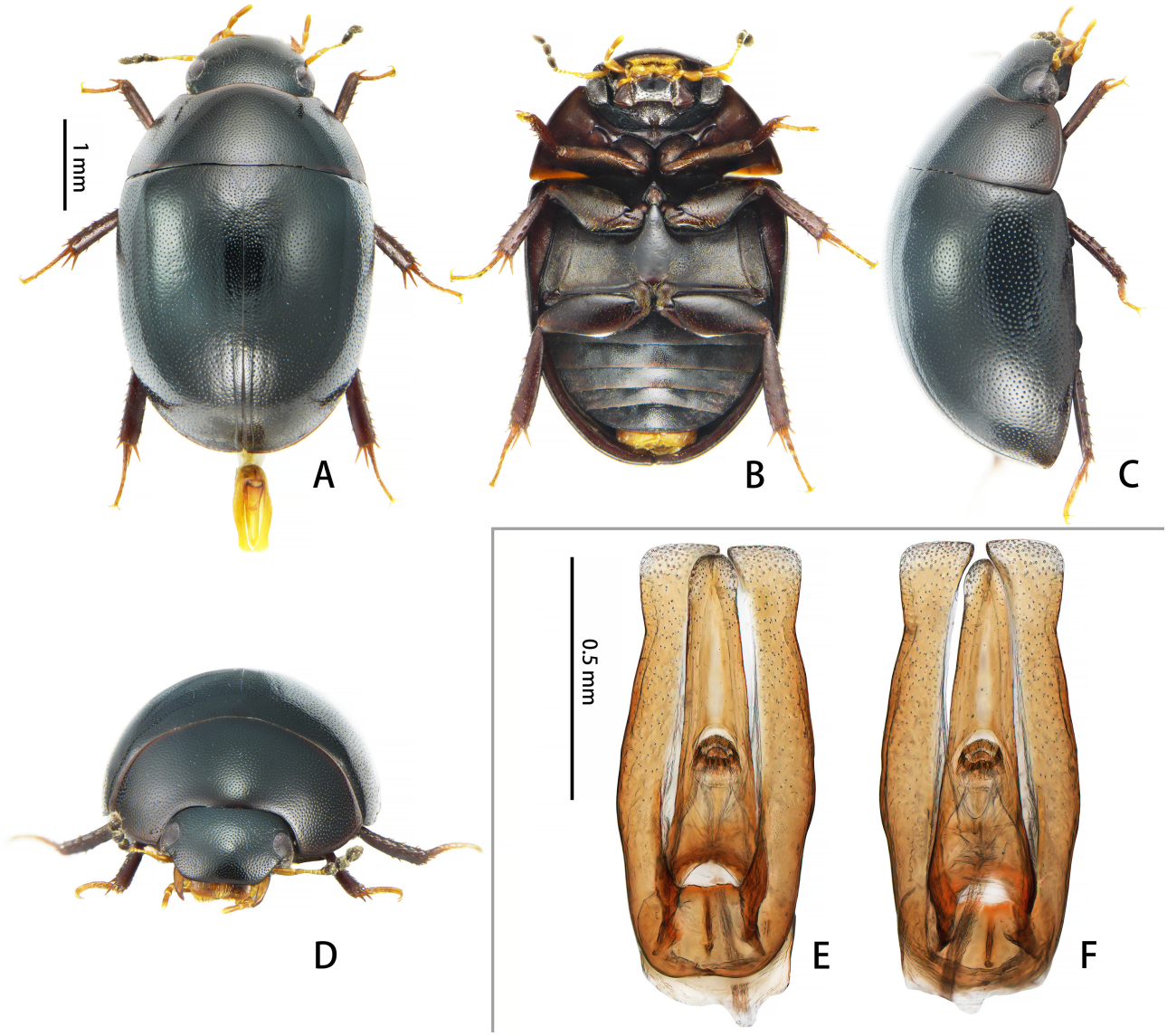

FIGURE 2. *Coelostoma* (*Lachnocoelostoma*) *yi* **sp. nov.** (holotype). **A–D.** Habitus. **E, F.** Aedeagus. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view. **D.** Frontal view. **E.** Dorsal view. **F.** Ventral view.

anteriorly between mesocoxae and broadly contacting posterior margin of mesoventral process; lateral areas of metaventrite densely pubescent and punctate. Metepisternum densely pubescent, ca 4.5× as long as wide, parallel-sided. Scutellar shield slightly longer than wide, with punctation as those on pronotum. Elytral ground punctures similar to those on pronotum, without serial punctures. Elytral sutural stria distinct, reaching anterior half of elytra.

Legs. Pro- and mesofemora bearing dense pubescence, except on extreme apex. Metafemora not pubescent, with dense microsculptures and sparse fine punctures. Meso- and metatibia slightly flattened, with strong apical spurs and series of sparse stout spines laterally. Tarsi with long dorsal setae and gold ventral setae; metatarsi with tarsomere 5 almost as long as tarsomeres 3 and 4 combined. Claws curved, with a pair of long setae beneath.

Abdomen. Abdominal ventrites densely pubescent. Ventrite 1 without median carina. Ventrite 5 not emarginate apically.

Aedeagus (Fig. 2E, F). Median lobe slightly shorter than parameres, widest basally, gradually narrowing towards apex, apex rounded; gonopore oval, situated slightly below middle part of median lobe. Parameres widest basally, slightly expanded from anterior fourth to apex, broadly truncate apically, outer apical angle rounded, inner apical angle bluntly pointed.

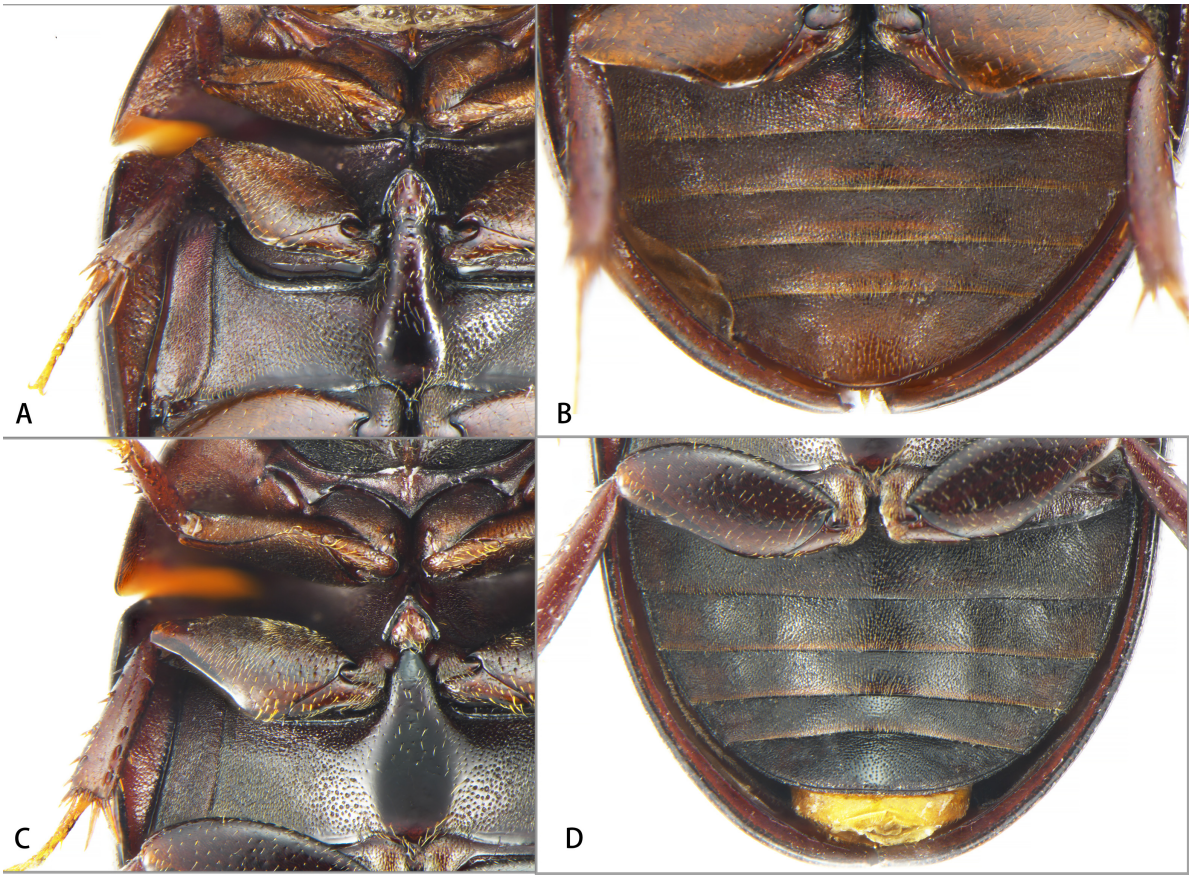

FIGURE 3. Morphological characters of *Coelostoma change* **sp. nov.** and *C. yi* **sp. nov. A, B.** *C. change* **sp. nov. C, D.** *C. yi* **sp. nov. A, C.** Pro-, meso- and metaventrites. **B, D.** Abdominal ventrites.

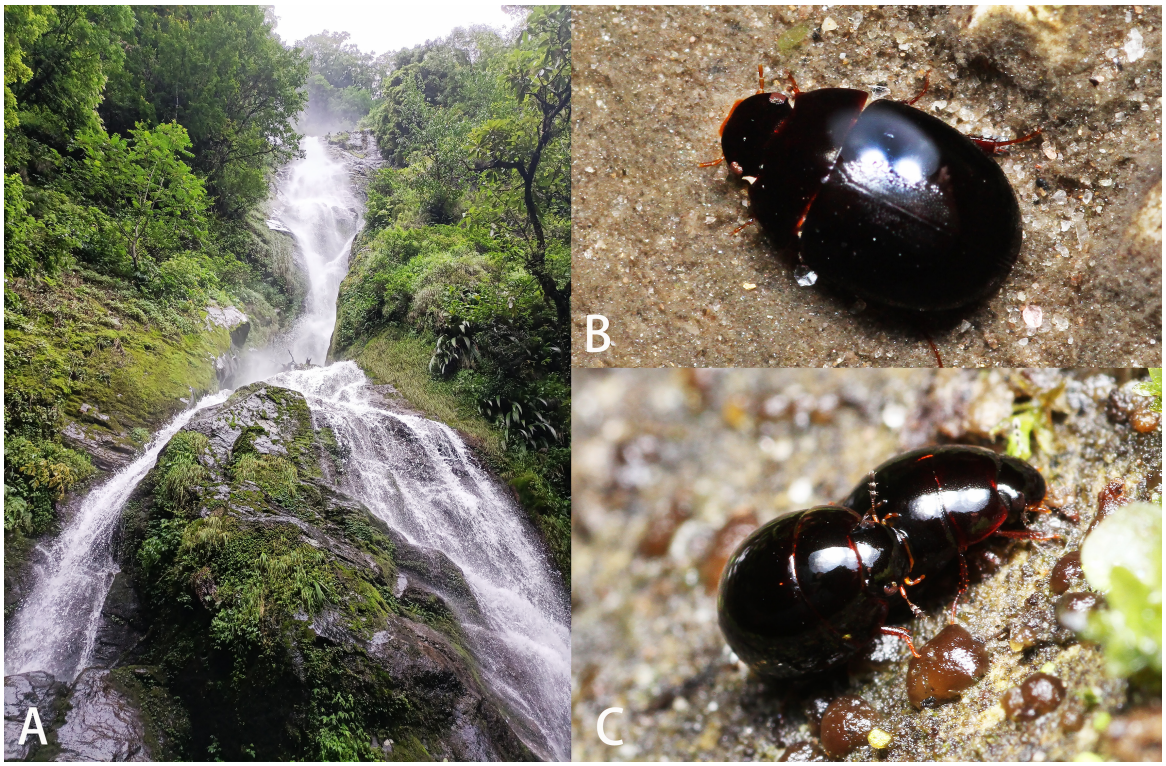

FIGURE 4. Habitats of *Coelostoma* (*Lachnocoelostoma*) *yi* **sp. nov. A.** A waterfall in Zhangmu Town. **B.** Adult in shallow water. **C.** Mating on wet rock.

Remarks. This species is very similar to *Coelostoma gentilii* Jia, Aston & Fikáček, 2014 in both external morphology and male genitalia. It can be distinguished from the latter by elytra without serial punctures laterally (elytron with 3 serial punctures laterally in *C. gentilii*), median lobe rather slim, gonopore of male genitalia situated slightly below middle part of median lobe (gonopore situated slightly above middle part of median lobe in *C. gentilii*).

Etymology. This species is named after "Hou Yi (后羿)", a mythological Chinese archer.

Biology (Fig. 4)**.** This species was found living on wet rock surface at the margins of a waterfall at night, it co-occurs with *Coelostoma gentilii* Jia, Aston & Fikáček, 2014 but rarer than the latter.

Distribution. China (Xizang), only known from the type locality.

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We are grateful to Dr Jun Chen and Dr Hong-Bin Liang (both at NACRC) for their generous loan of specimens of *Coelostoma change* sp. nov. We express our gratitude to Mr Yue-Zheng Tu (China Agricultural University, Beijing, China), Mr Cheng Liang (Nanjing Agricultural University, Nanjing, China) and Mr Mu-Yu Guo (SYSU) for their assistance during fieldwork in Xizang. Finally, we are grateful to Dr Emmanuel Arriaga-Varela (Instituto de Ecología A.C. (INECOL), Xalapa, Mexico) for his help in reviewing the manuscript and providing valuable suggestions. This study was financially supported by "Science & Technology Fundamental Resources Investigation Program (Grant No. 2022FY202100)" and "The Second Tibetan Plateau Scientific Expedition and Reseach Program (2024QZKK020200)".

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中国西藏南部陷口牙甲属*Coelostoma*二新种记述（鞘翅目：牙甲科：陆牙甲亚科）

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摘要：描述西藏南部陷口牙甲属*Coelostoma*下毛腿陷口牙甲亚属*Lachnocoelostoma*两新种。采集于墨脱县的嫦娥陷口牙甲*Coelostoma* (*Lachnocoelostoma*) *change* **sp. nov.**其重要鉴别特征为较小的体型（体长3.4–3.6 mm）和端部稍膨大的阳茎中叶。采集于樟木镇的羿陷口牙甲*Coelostoma* (*Lachnocoelostoma*) *yi* **sp. nov.**与珍氏陷口牙甲 *Coelostoma* (*Lachnocoelostoma*) *gentilii*混生，可以通过鞘翅两侧无线状刻点列和雄性外生殖器较细长与后者区分。目前西藏共记录该属牙甲7种。提供了新种的鉴别特征、详细的形态描述和图示。

关键词：陷口牙甲属；牙甲科；西藏；喜马拉雅山脉；分类；中国