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A new genus and species of subterranean diving beetle from Laos (Coleoptera, Dytiscidae, Hydroporinae, Hydroporini)

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http://zoobank.org/3060D42E-8223-4D72-8B8C-3C4793DD7E15

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Abstract. – The first stygobiontic diving beetle known from Laos, *Laodytes lapiei* n. gen., n. sp., is described from a cave located in the Vientiane province. Its morphological characters lead to its placement, among Hydroporinae, in Hydroporini. Inside these, the new species could not be assigned to an existing genus. As a result, a new genus has been defined without it being possible, at the present stage, to assign it to one of the currently recognized subtribes.

Résumé. – **Nouveaux genre et espèce de Coléoptère aquatique souterrain du Laos (Coleoptera, Dytiscidae, Hydroporinae, Hydroporini)**. Le premier Dytiscidae stygobie connu du Laos, *Laodytes lapiei* n. gen., n. sp., est décrit d'une grotte de la province de Vientiane. Ses caractères morphologiques conduisent à le placer, parmi les Hydroporinae, dans les Hydroporini. À l'intérieur de ceux-ci, la nouvelle espèce n'a pu trouver place dans aucun genre existant. En conséquence, un nouveau genre a été défini, sans qu'il soit possible, à ce stade, de le rattacher à l'une des sous-tribus actuellement reconnues.

Keywords. – Stygobiontic, speleology, oriental region, aquatic beetle.

During a speleological expedition to Laos, which took place in March 2019, the third author (MF) collected three specimens of a small diving beetle in a cave of the Pha Lay mountain range, near Kasi. Since this was the dry season, she was able to progress in this cave along several fossil levels (fig. 1) for more than 2 km under the range. At the intersection with a muddy system of galleries, she reached a more humid lower floor, climbing down a block chaos followed by a calcite flow; there, water from the last floods remained in residual pools and even flew along a small channel. The calcite flow was darkened by guano deposits: although no bats were seen during the visit, they should rest at times in the overhanging fault crack on in the ceiling. The beetles were found swimming in one of the pools (fig. 2). More recently, during an expedition in March 2020 to the same cave, eight more specimens were found in the lower fossil level (fig. 17). There also, a little water was flowing along calcite cascades, coming from the upper level where a lake stands.

Subterranean genera of beetles are rather numerous in Dytiscidae, and the recent book of Miller & Bergsten (2016) has cleared up their classification. However, convergences in morphology due to stygobiontic life are so prominent that determination keys cannot avoid calling upon geographic distribution. Most of the discovered Dytiscidae belong to Hydroporinae and the Laotian species is no exception. Nonetheless, a few Copelatinae are also stygobiontic, in particular *Exocelina sugayai* Balke & Ribera, 2020, recently described from the Malay Peninsula (Balke & Ribera, 2020). In the Oriental region, a few Bidessini and Hyphydrini are known, and also the genus *Siamoporus* Spangler, 1996, placed among Hydroporini by its

Fig. 1. – View of the Tham Pha cave.

author, but considered as *incertae sedis* in this tribe, and possibly in Hydroporinae as a whole (Miller & Bergsten, 2016 : 152).

The morphological features of our specimens have been compared with those of all known genera of Dytiscidae. A detailed analysis is given below. It appears that they do not properly fit in any known genus. Therefore, a new taxon is described below as *Laodytes lapiei* n. gen., n. sp.

Material and methods

The first three specimens were collected by hand and immediately put in an Eppendorf vial containing 70° ethanol. Back in France, MF sent the beetles to the second author (JML) for study, together with pictures she had taken of them in the preserving fluid. One picture (fig. 3) shows the long sensory hairs surrounding the body, which unfortunately did not withstood the dry mounting.

With Miller & Bergsten (2016) at hand, JML recognized that those diving beetles, two males and one female, did not appear to fit any species mentioned in this book; he therefore asked the first author (PQ) to lend a helping hand. PQ succeeded in extracting the genitalia of one male. Given its tiny size (0.2 mm), we decided to mount it on a glass slide in DMHF resin; we thus could obtain a clear view of the organ (fig. 14), at the cost of some flattening by the coverslip. Later, with eight more specimens available, JML mounted another male genitalia in a drop of mounting media DMHF without coverslip, to obtain more natural views of the organ (fig. 15-16). These pictures were taken with an Olympus™ TG4 camera, adapted to an Olympus CX21 optical microscope through a LM-Scope™ adapter. High-resolution pictures of the external morphology (fig. 4-12) have been kindly taken by Michel Perreau on a Keyence™ VHX5000 microscope equipped with a VH-Z250T camera lens. The lateral view (fig. 13) was obtained with a Toupcam™ 14 Mp CMOS camera mounted on an Olympus™ SZX9 stereomicroscope, from several shots assembled with HeliconFocus™ v.7.6.

Taxonomy

Laodytes n. gen.

http://zoobank.org/374332F7-4F3C-444E-AEE4-B49AD388A795
Type species: *Laodytes lapiei* n. sp.

Diagnosis. – The new genus is distinguished by the following combination of characters: Body very small (< 1.5 mm), broad, parallel-sided; dorsal and ventral surfaces mainly reticulate and matt. Head wide, encased between strongly protruding pronotal angles. Second antennomere conspicuously wider than the first, the middle ones ovoid, the last one elongated and tapered. Pronotum transverse, without a lateral longitudinal stria on each side, its lateral edges in continuity with those of fused elytra. Prosternal process lanceolate, with apex not reaching metaventral process. Metacoxal lines absent; interlaminary bridge of metacoxae broadly exposed; hind margin obtusely emarginate medially, lateral lobes incised and not rounded. Ventrites (visible sternites) 2 and 3 fused. Fore and mid legs rather thick, hind legs slender. Sucker cups on male pro- and mesotarsus absent. Median lobe of aedeagus gutter-like, nearly symmetrical in sagittal view, and almost straight beyond the basal bend in lateral view; apex rounded; parameres symmetrical, single segmented, slightly longer that the median lobe, each lobe in the shape of an elongated triangle, narrowly tapered with a single bristle at tip.

Etymology. – A combination of *Lao*, the name of the people and language of Laos, and *dytes* (δύτης), diver in Greek.

Laodytes lapiei n. sp.

http://zoobank.org/069B1979-6A73-4F79-81D6-953C20F7B14D

Holotype: ♂, grotte Tham Pha, Ban Phato, Laos, alt. 460 m, 19.III.2020, *Marina Ferrand leg*., deposited in Muséum national d'Histoire naturelle, Paris.

Paratypes: 4 ♂, 3 ♀, same data; 2 ♂, 1 ♀, same locality, 18.III.2019, *Marina Ferrand leg*., in coll. P. Queney and J.-M. Lemaire.

Type locality. – Laos, district of Kasi, province of Vientiane: cave Tham Pha, near Ban Phato, 17 km SW to Kasi, 19.13204°N 102.12079°E, altitude 460 m.

Description of male. – Habitus (fig. 4-5): body length 1.35 mm, maximum width 0.62 mm; species blind and depigmented, uniformly pale orange; body stocky, parallel-sided, weakly convex in lateral view; in dorsal view, lateral outline showing an almost perfect continuity between pronotum and elytra.

Head (fig. 6-7) wide, front margin semicircular, very deeply inserted in pronotum. Eyes totally absent; clypeal suture reduced to a short depression on the sides. Surface glabrous, with an isodiametral reticulation, forming a rather regular hexagonal lattice, strong on frons but vanishing on clypeus and sides. Antennae with a cylindrical scape and a thicker and swollen pedicel (fig. 6-7), middle segments globular (fig. 4-5), segments 6-10 slightly thicker than 3-5, apical segment elongate and conical in the distal half; clypeus slightly and shortly rimmed above antennae. Maxillary palpi four-segmented, with the last segment 2.5 times longer than wide, ovoid basally and acuminated at tip. Ligula triangular and acute, labial palpi three-segmented, the last segment twice longer than wide (fig. 7).

Pronotum (fig. 6) not cordiform but widely rectangular, almost parallel-sided seen from above, but strongly sinuated in lateral view: edge strongly concave bottomwards, in the basal third, then slightly concave upwards to the front angles; almost as wide as elytra and strongly wider than the head, with protruding front angles encasing the head to the basal third; front margin straight along the posterior part of head; base V-shaped in the middle, sinuated towards right posterior angles; sides with a rimmed gutter, the anterior two-thirds of which contain 6-7 setigerous punctures, provided with deciduous sensory bristles; in lateral view (fig. 13), the side edge sinuated and not in continuity with the elytral edge. Surface strongly reticulated as on hind part of head, the meshes polygonal but a little wider, reticulation vanishing on sides; the posterior margin showing a short and faint notch near the external third, followed externally by

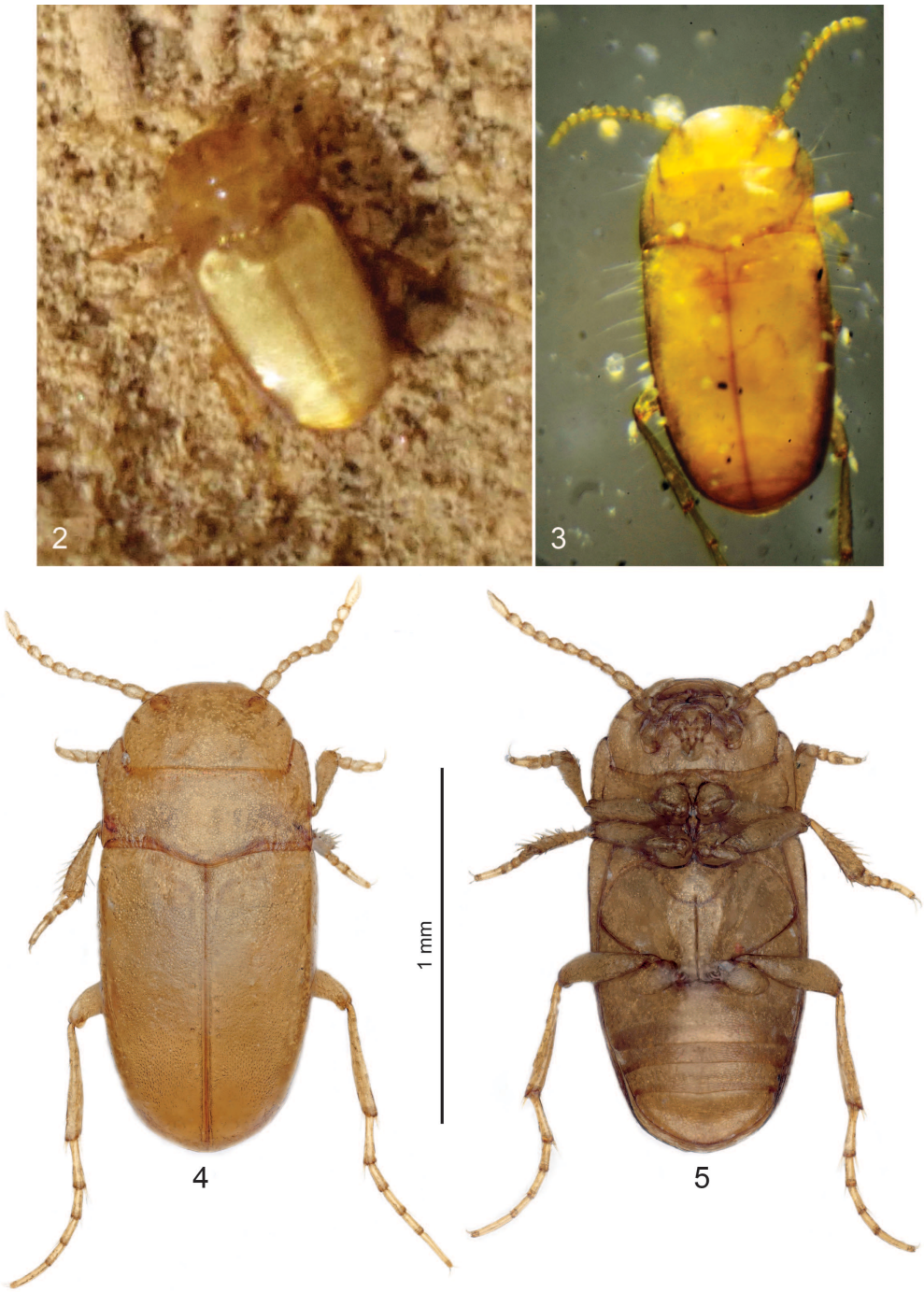

Fig 2-5. – *Laodytes lapiei* n. gen., n. sp. – **2**, Specimen alive, *in situ*. – **3**, Specimen in preserving fluid. – **4-5**, Habitus, male: **4**, dorsal view; **5**, ventral view.

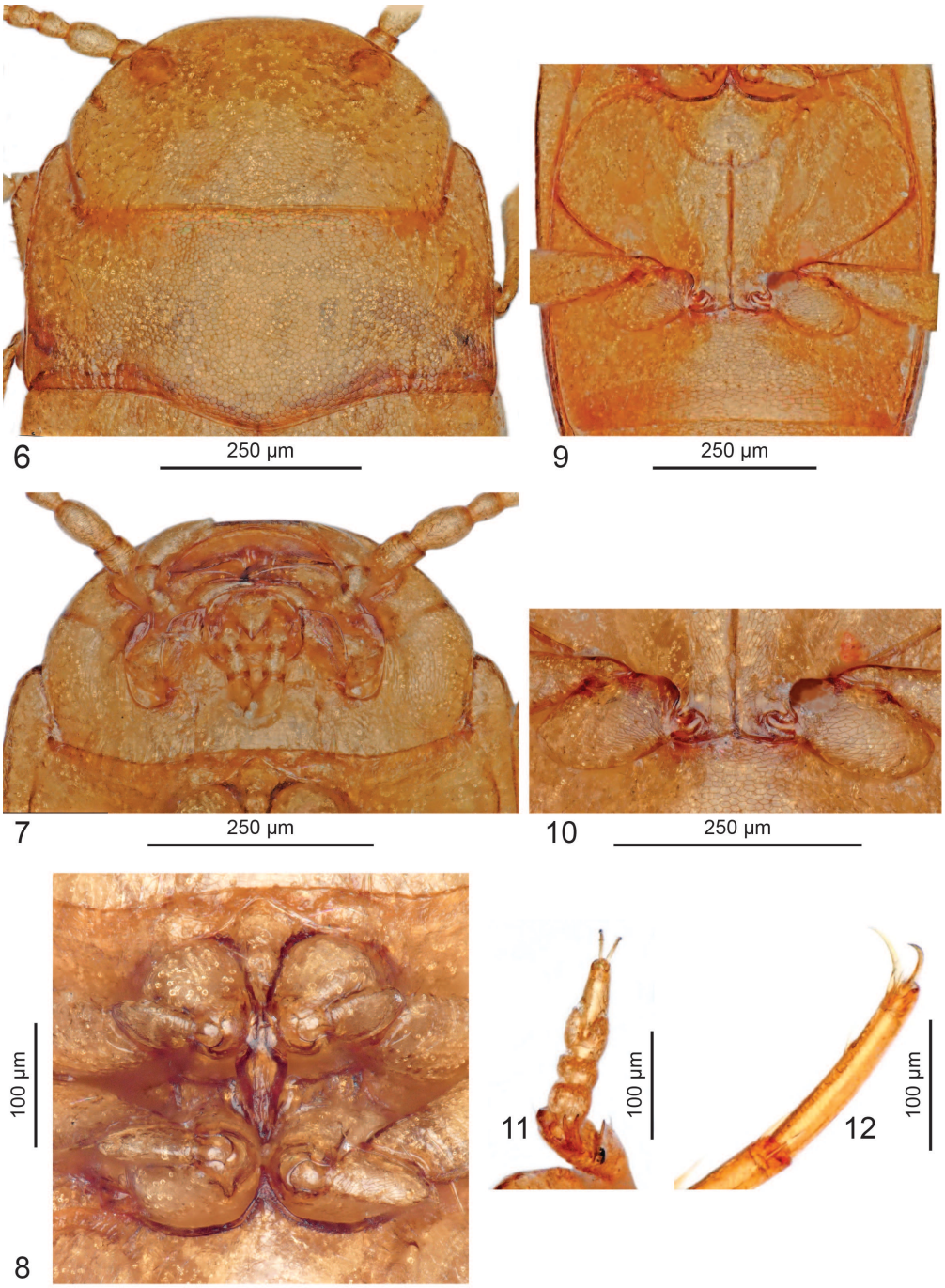

Fig. 6-12. – *Laodytes lapiei* n. gen., n. sp., ♂. – **6**, Head and pronotum, dorsal view. – **7**, Head, ventral view. – **8**, Prosternal process. – **9**, Metaventrite and metacoxae. – **10**, Metacoxal process. – **11**, Protarsus. – **12**, Metatarsus.

Fig. 13. – *Laodytes lapiei* n. gen., n. sp., habitus, right lateral view.

shorter and weaker creases; small punctures distributed along an irregular row along the front margin, other smaller punctures scattered on the disk. Pronotum and elytra seem welded together.

Elytra (fig. 4) 1.45 times as long as wide together and fused, sides almost parallel on basal third, then regularly narrowing into a semi-circular apex when seen from above; basal surface reticulated, with larger meshes than on the pronotum; on the disk, those meshes turning into small round cavities, getting longer than wide and then fading apically; a vestigial sutural stria visible on the distal half; about 25 pores, provided with long sensory bristles, distributed along the lateral edges. Hind wings absent.

Ventral surface (fig. 5) uniformly pale, like the dorsal surface, and largely reticulate; prosternal process (fig. 8) lanceolate with acuminate apex not reaching anteromedial metaventral process (fig. 9); epipleuron getting regularly narrower to the metacoxae level, without oblique carina near shoulder; metepisternum in right triangle, about twice longer than wide; metaventral wings very narrow; metacoxal lines absent (fig. 9): only a flattened raised plate visible on each side of the median groove; metacoxal process (fig. 10) with median part extended backwards; hind margin obtusely emarginate medially, with each side obliquely cut and both margins converging forward; lateral lobes not rounded, deeply incised and flat; disk of metacoxae reticulated; metacoxal process with median part extended backwards slightly above the abdomen; the latter with five visible ventrites, the second and third, usually distinct in Dytiscidae, being fused; reticulation isodiametral on the anterior part of this second ventrite, transverse on its posterior part and on the next two ventrites, isodiametral on the last.

Legs. Pro- and mesotarsi four-segmented, rather wide, pro- and mesotibiae short and dilated on the distal half (fig. 5), pro- and mesotarsomeres 1-2 with adhesive setae but without distinct sucker cups (fig. 11), hind legs thinner with oblong femora and large oval hind trochanters (fig. 10); mesotibiae densely adorned with spiny setae; metatrochanters reticulated with transversely elongated meshes; metatarsal claws of subequal length (fig. 12).

Aedeagus (Figs. 14–16): as described in the genus diagnosis.

Fig. 14-16. – *Laodytes lapiei* n. gen., n. sp., aedeagus. – **14**, Ventral view (slide with coverslip). – **15**, Oblique view (with genital segment). – **16**, Lateral view.

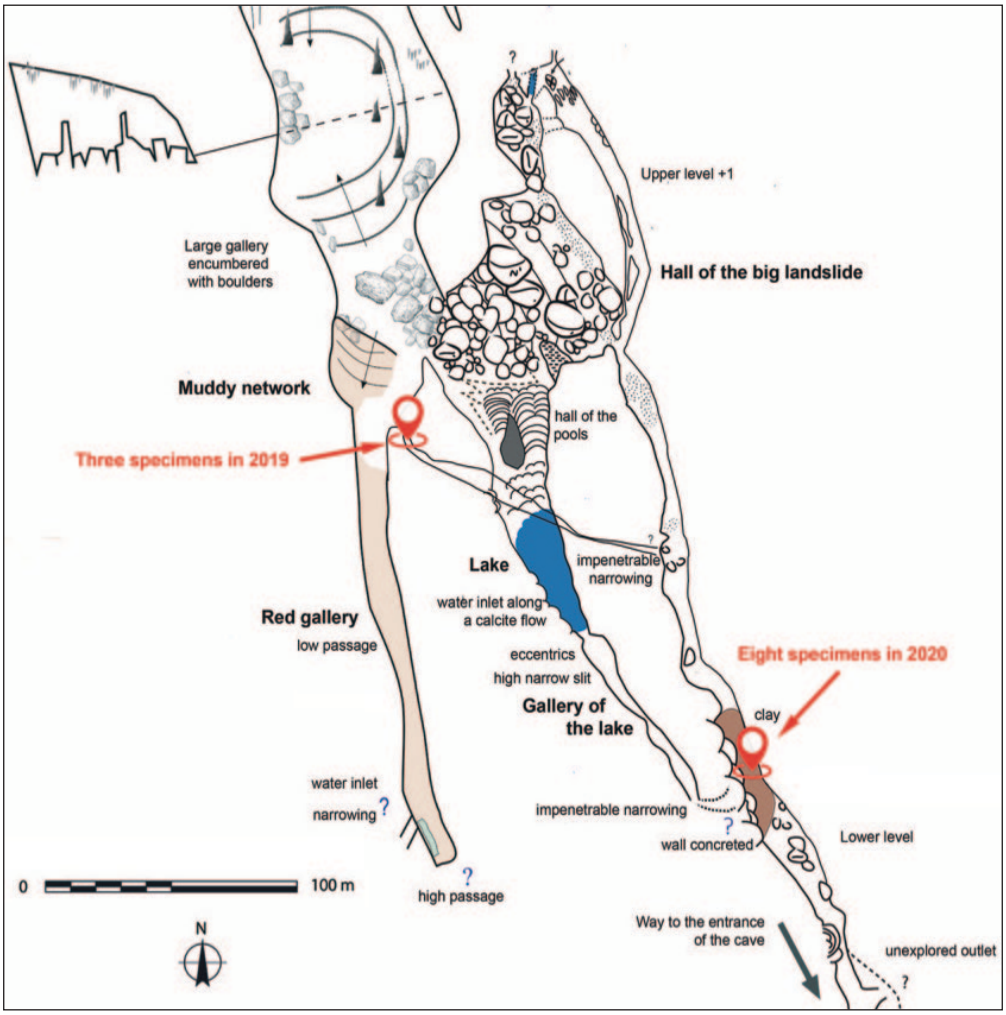

Fig. 17. – Topography of the Tham Pha cave (© EEGC 2020).

Female. – External sexual dimorphism limited to the protarsi, thinner than those of the male and without visible adhesive setae.

Etymology. – We dedicate the new species to Guillaume Lapie, biospeleologist and team partner of the discoverer. The specific epithet is a substantive in the genitive case.

Habitat. – Stygobiontic, found swimming in calcite pools.

Distribution. – So far, only known from the type locality in Laos.

Discussion

Following Miller & Bergsten (2016) and the presentation given by Fery & Ribera (2018), the new taxon clearly belongs to Hydroporinae, in view of the following characteristic features:

– scutellum invisible;
– anteromedial part of prosternum not on the same plane as its process;
– pro- and mesotarsi with four visible segments;
– metatarsomeres with distal margins not lobed.

Table I. – Comparison of *Sinodytes hubbardi* Spangler, 1996, and *Laodytes lapiei* n. gen., n. sp. Main differences noted from SPANGLER (1996) and present description.

	Laodytes lapiei	***Sinodytes hubbardi***
Measurements		
– total length	1.35 mm	1.68 mm
– maximum width	0.62 mm	0.72 mm
– total length/ maximum width	2.17	2.33
Outline of the body	angle between pronotum and elytron sides inconspicuous	angle between pronotum and elytron sides very notable
Dorsal surface		
– head	width/ height: 2.02 head height/pronotum height: 0.86 discal area reticulate	width/ height: 1.57 head height/pronotum height: 1.15 discal area punctured
– pronotum	sides parallel; protruding front angles encasing higher and straighter the head; base V-shaped in the middle but very rounded strongly reticulate with small punctures scattered on the disk	sides converging towards the base; protruding front angles little encasing the head; base V-shaped and angular in the middle disk reticulate and coarsely punctured
– elytra	sides not parallel and narrowing downwards fairly regularly basal surface reticulate, on the disk meshes turning into small round cavities	sides parallel then strongly rounded downwards coarsely punctured
Antennae	antennomere II very big and nearly twice longer than III; antennomeres II-X short and ovoid-shaped	antennomere II only 1.33 longer than III; antennomeres II- X long and not ovoid-shaped
Maxillary palps	last segment elongated	last segment dilated
Ventral surface		
– labium	gula and gena narrow in height	gula and gena wide in height
– prosternal process	lanceolate with acuminate apex behind mesocoxae	ending in an acute apex but widening in a curve behind mesocoxae
– metacoxal plates	a flattened raised area visible on each side of the median groove	no raised area visible in the middle
– metepisternum	very wide	narrow
– metaventral wing	very narrow	narrow
– metaventrite	suture between metaventrite and metacoxae broadly rounded medially	suture between metaventrite and metacoxae angular medially
– last ventrite	regularly rounded	pointed in shape
Legs		
– metatrochanter	ovoid-shaped	slightly pointed in shape

Within Hydroporinae, the following combination of characters rules out all other tribes than Hydroporini:

– pronotum and elytra without a pair of basal striae (or plicae);

– metepisternum reaching mesocoxal cavities;

– metafemur along the dorsal margin broadly separated from the metacoxal lobe by metatrochanter;

– metatarsal claws subequal in length;

– medial portion of metacoxae in a different plane from the base of abdomen;

– parameres of aedeagus single-segmented.

Assigning the new taxon to one of the presently admitted subtribes of Hydroporini, Hydroporina, Siettitiina and Deronectina, is not obvious. After taking into account the key of Miller & Bergsten (2016) and the arguments of Fery & Ribera (2018), we were unable to conclude to which subtribe the new genus should be attached. We encountered difficulties that other subterranean genera have already met in the past. The closest case to the new genus is probably that of *Siamoporus* Spangler, 1996, from Thailand, currently considered as *incertae sedis* (Miller & Bergsten, 2016 : 152) among Hydroporinae.

Indeed, *Siamoporus* shows some similarities with the new species: male pro- and mesotarsi four-segmented, pro- and mesotarsomeres 1-2 with adhesive setae but without distinct sucker cups, metacoxal process medially emarginate and strongly incised posterolaterally for reception of metatrochanter, the latter large, elongate and inflated, ventrites (visible sternites) 2 and 3 fused; on the other hand, the Laotian insect differs from *Siamoporus* in many ways: pronotum not cordiform but rectangular, elytra fused, metacoxal lines absent, aedeagus very different.

Another case of *incertae sedis* genus is *Sinodytes* Spangler, 1996. It was described on a single female, which seems to be lost (Miller & Bergsten, 2016 : 253), and was provisionally assigned to Bidessini by its author. The Laotian species cannot belong to this tribe because of its non-segmented parameres, but one must acknowledge that it bears a strong similarity of habitus with *Sinodytes hubbardi* Spangler, 1996, at least on the basis of the only known representation of this species (Spangler, 1996: fig. 39-40).

If Spangler's drawing is accurate, the outline of the body, and proportions of the head and prothorax are so different that the Laotian species cannot be the same as *Sinodytes hubbardi*. We detail in table I the main differences we noted in the comparison of the two species. Nevertheless, although many features in Spangler's description seem to differ from ours, the assignment of our species to *Sinodytes* remains plausible and supported by biogeography. However, this would imply redefining the genus *Sinodytes* and in particular moving it away from Bidessini. In the absence of a male specimen and even of the holotype, we feel more appropriate to create the new genus *Laodytes* on the Laotian specimens, keeping in mind that the discovery of a male from Jiazhai Taiping cave may lead to synonymizing *Laodytes* with *Sinodytes*, or not !

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