

Libystes senckenberg sp.n., a new species of portunid crab (Crustacea: Decapoda: Portunoidea) from the Persian Gulf and Red Sea

Libystes senckenberg sp.n., новый вид крабов-портунид (Crustacea: Decapoda: Portunoidea) из Персидского залива и Красного моря

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КЛЮЧЕВЫЕ СЛОВА: биоразнообразие, таксономия, настоящие крабы, новые виды.

ABSTRACT. *Libystes senckenberg* sp.n. is described on the basis of the specimen long time known as *Libystes* aff. *nitidus* from the Persian Gulf. It differs from *L. nitidus* A. Milne-Edwards, 1867 and other *Libystes* species by a short and stout gonopod 1, with widened tip and the presence of prominences on the anterolateral margin. A peculiar characteristic of the species is incompletely symmetrized chelipeds. *Libystes senckenberg* sp.n. was found also in the southern Red Sea. Specimens from the South China Sea are tentatively assigned to the new species although they show some differences in carapace morphology.

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РЕЗЮМЕ. *Libystes senckenberg* sp.n. описан на основе экземпляра, долгое время известного как *Libystes* aff. *nitidus* из Персидского залива. Он отличается от *L. nitidus* A. Milne-Edwards, 1867 и других видов рода *Libystes* коротким и толстым гоноподом I, с расширенным кончиком и наличием выступов по переднебоковому краю. Характерной особенностью этого вида являются не полностью симметричные хелипеды. *Libystes senckenberg* sp.n. был также найден в южной части Красного моря. Экземпляры из Южно-Китайского моря также предположительно отнесены к новому виду, хотя они демонстрируют некоторые различия в морфологии карапакса.

Introduction

The genus *Libystes* A. Milne-Edwards, 1867 has a complicated taxonomic history in the Portunidae Rafinesque, 1815, which are commonly called “swimming crabs”. Many taxa are good swimmers [Schäfer, 1954; Stephenson, 1972; Steudel, 1998; Spiridonov *et al.*, 2014] but *Libystes* does not share the typical portunoid appearance and characters associated with swimming. In the original description, A. Milne-Edwards [1867] noted its affinities to the Portunidae in having a lobe on the endopodite of maxilliped 1, but remarked that the carapace morphology resembled species of *Carcinoplax* H. Milne Edwards, 1852, instead. Subsequently, *Libystes* was treated within the Goneplacidae [Alcock, 1900; Borradaile, 1903; Tesch, 1918]. The relationship of *Libystes* with portunids became more apparent, when its similarity to *Catoptrus* A. Milne-Edwards, 1870 (= *Goniocaphyra* de Man, 1888) was shown by several researchers [A. Milne-Edwards, 1870; Rathbun, 1906; Tesch, 1918]. Borradaile [1903] established the subfamily Catoptrinae Borradaile, 1903, within the Portunidae; and Sakai [1939] included *Libystes* and *Carupa* Dana, 1851, in the subfamily, while Balss [1957] and Stephenson & Campbell [1960] considered Carupinae Paulson, 1875, might be a separate subfamily. Stephenson & Campbell [1960] argued that there were transitional forms between *Libystes* and *Catoptrus* and called for merging them in a single genus, while Serène [1966] argued for their separation. Stephenson [1972] accepted Catoptrinae in his overview of the Portunidae, in the sense of Sakai [1939]. Apel & Spiridonov [1998] argued for the priority of Carupinae over Catoptrinae sensu Sakai, 1939, and this has since become generally accepted [Ng *et al.*, 2008]. Karasawa *et al.* [2008] discussed, based on

morphological cladistics, that the Catoptrinae sensu stricto likely merited the status of a family (Catoptridae) and should be separated from the Portunidae sensu stricto. Schubart & Reuschel [2009], Evans [2018] and Spiridonov [2020], however, provided molecular phylogenetic evidence for retaining the Carupinae in Portunidae. Although Stephenson & Campbell [1960] thought that *Libystes* and related genera are “primitive” portunids, there is growing evidence, that their unusual morphology is a result of specialization and transformation of an ancestral portunoid set of characters [Spiridonov *et al.*, 2014].

The species composition within *Libystes* per se is poorly studied [Apel and Spiridonov, 1998], partly because the genus is not very common in scientific collections. Even though a complete revision of the genus is highly recommended, a more realistic way is to proceed step by step via clarification of the status of particular species. *Libystes nitidus* A. Milne-Edwards, 1867, the type species of the genus, has been reported from various localities in the tropical Indo-West Pacific [Edmondson, 1954; Crosnier, 1962; Serène, 1966; Tien, 1970; Yang *et al.*, 2012] as well as in the Pleistocene deposits of the Tropical West Pacific [Karasawa, 2000; Schweitzer *et al.*, 2003]. It was the only species of the genus thought to occur throughout the Northwestern Indian Ocean, i.e., from the Persian Gulf to the Red Sea [Laurie, 1915; Stephensen, 1946]. However, published illustrations and descriptions caused doubt that all these records were conspecific. In particular, Apel & Spiridonov [1998] re-examined the material from the Persian Gulf identified as *L. nitidus* by Stephensen [1946]. Although having listed it as *L. aff. nitidus*, they neither assigned it to one of the known species nor described it as a new species. Several new records and additional material studied since that time provided strong evidence for a separate specific status of this *Libystes* from the north-western Indian Ocean, which we describe in the present paper as *Libystes senckenberg* sp.n.

The present paper is in two parts. The first author had intended to revise *Libystes* over time but events have since overtaken these plans. In the first paper [Spiridonov *et al.*, 2021, this volume], the type of the genus is examined and the taxonomy of this species is clarified; with the description of a new species from the Red Sea. In the present paper, the intent is primarily to resolve the identity of the “*L. aff. nitidus*” in Apel & Spiridonov [1998], which we regard as another new species.

Material and methods

The material originates from the following museums: Natural History Museum, London (NHM); Zoological Museum of the University of Copenhagen (ZMUC); Zoological Institute of Russian Academy of Sciences, St. Petersburg (ZIN-RAS); and Zoological Museum of University of Teheran, Teheran (ZUTC).

The terminology for morphological description follows Crosnier [1962], Apel & Spiridonov [1998], Ng *et al.* [2008],

Karasawa *et al.* [2008], Spiridonov *et al.* [2014] and Evans [2018]. Terms “pleon” and “pleomeres” are used in favour of “abdomen”, “abdominal segments” or “abdominal somites”.

Abbreviations: CL — carapace length; CB — carapace breadth.

Taxonomy

Order Decapoda Latreille, 1802
 Infraorder Brachyura Linnaeus, 1758
 Family Portunidae Rafinesque, 1815
Libystes senckenberg sp.n.
 Figs 1–4, 5a.

Libystes nitidus; Stephensen, 1946: 168–169, figs 45C–F; Serène, 1965: 994, 996 (part), figs 1–4.

Libystes aff. *nitidus* — Apel, Spiridonov, 1998: 176–178, fig. 6.

Libystes nitidus — Naderloo, 2017: 190, Figs. 20.21, 20.24.

? *Libystes nitidus* — Nobili, 1906b: 297.

nec *Libystes nitidus* A. Milne-Edwards, 1867.

? *Libystes alphonsi* — Serène, Soh, 1976: 17.

nec *Libystes alphonsi* Alcock, 1900.

MATERIAL. Holotype. Male (3.5×6.1 mm) (ZMUC CRU-3267, identified as *Libystes nitidus* by Stephensen), Persian Gulf, 63 nm SW of Bushehr (DSII-St. 25 A), 49 m, 14.03.1937, G. Thorson leg. Paratype. Female (5.0×9.5 mm) (ZUTC Brach1041), Iran, Persian Gulf, 60 m, 18.08.2004, R. Naderloo leg. Non-type material. Red Sea: 1 male (3.5×6.3 mm) (ZIN-RAS), Eritrea zone, RV “Odyssey”, Cruise 33, 15°36.6' N 48°17.2' E, pteropodous mud, 21.05.1984. B.I. Sirenko leg.

ETYMOLOGY. The species is dedicated to the Crustacean Section of the Senckenberg Research Institute in Frankfurt on Main, led by our friend, senior colleague and teacher Prof. Michael Türkay (1948–2015) in the years 1976–2015. We, who had the honor and pleasure to work there, will always remember the creative and inimitable atmosphere, the good discussions and the support by Michael Türkay and his team.

DIAGNOSIS. Carapace 1.7–1.8 times as broad as long in males, about 1.9 times as broad as long in females, subquadrilateral, dorsally and laterally convex, smooth. Dorsal surface with pair of short posterolateral granular ridges, quasi-perpendicular to poorly developed posterolateral reentrants. Anterolateral margins with 3 angular prominences; posterior margin about as broad as carapace length.

DESCRIPTION (based on holotype). Carapace 1.74 times as broad as long subquadrilateral, dorsally and laterally convex, smooth, without distinct dorsal regions, dorsal surface with pair of short granular ridges located nearly perpendicular to poorly developed posterolateral margin (Fig. 1a). Front entire, straight, without any median notch, smoothly deflecting and partly covering antennular fossae, about 1/3 of maximum carapace breadth (Figs. 1a, 2a). Orbits subquadrilateral, 1.85 times as long as broad, about half width of frontal breadth. Frontorbital margin about 57% of maximum carapace breadth (Figs. 1a, 2a).

Anterolateral margins subcristate, with 3 angular prominences, anterior one lowest. Pair of granular ridges running along posterolateral margins to posterolateral margin. Posterior margin nearly as broad as carapace length, slightly exceeds half carapace breadth (Fig. 1a). Carapace height to breadth ratio about 0.37.

Subhepatic regions convex, covered with fine scattered granules. Suture between subhepatic and pterygostomial regions present, running to posterolateral margin, with rows of

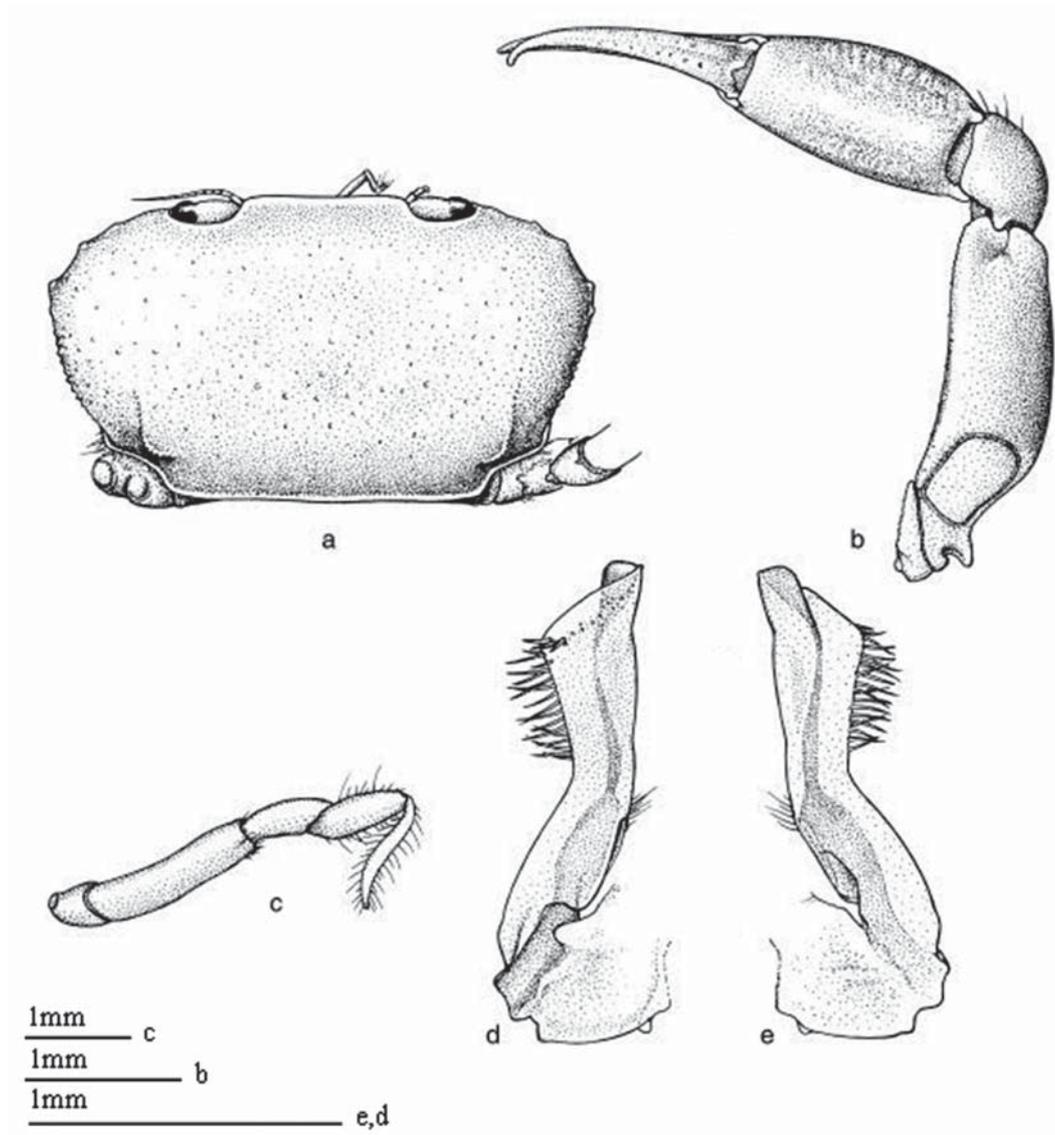


Fig. 1. *Libystes senckenberg* sp.n., holotype, male, CB 6.1 mm, ZMUC CRU-3267: a — carapace; b — right cheliped in dorsal view; c — last pereopod; d — left gonopod 1 in sternal view; e — left gonopod 1 in abdominal view. Drawing: G. Eder, from Apel, Spiridonov [1998]. Scale 1 mm.

Рис. 1. Голотип *Libystes senckenberg* sp.n., голотип, самец, CB 6.1 мм, ZMUC CRU-3267: а — карапакс; б — правая хелипеда, вид сверху; с — последняя переопода; д — левый гонопод 1, стернальный вид; е — левый гонопод 1, абдоминальный вид. Рисунок: G. Eder, из Apel, Spiridonov [1998]. Масштаб 1 мм.

fine granules on its both sides. Pterygostomial region relatively convex, smooth in anteromesial part, covered with short pile in remaining part (Fig. 2a).

Eyestalks robust, filling entire orbits, cornea reduced. Antennular fossae pear-shaped, gently constricting laterally. Basal antennular segment with distinct transverse rib on median part of ventral surface. Antennular flagellum relatively robust, folded transversely, extending to lateral margin of orbit when unfolded; terminal segment serrated with tuft of dense soft setae. Basal antennular segment with small distolateral extension, longer than broad, standing in orbital hiatus; second segment slightly shorter than basal segment, cylindrical, flagellum thin, extending beyond lateral margin of orbit (Fig. 2a).

Epistome narrow. Buccal cavern occupies about one third of respective part of cephalothorax. Third maxillipeds tightly cover buccal cavern; ischium broader than long; merus about as long as ischium, anterolateral corner round, expanded, anterior margin slightly convex; morphology of carpus, propodus and dactylus characteristic for *Libystes* (Fig. 2a).

Chelipeds about 1.5 times longer than other pereopods, smooth, nearly equal. Merus 3.1 times longer than broad, quasicylindrical, without spines, inner margin slightly concave, outer margin slightly convex. Carpus without spines, obtuse angle at inner angle, outer surface convex (Fig. 1b). Chelae long, nearly half cheliped length. Manus slightly swollen, not much broader than rest of cheliped, height to

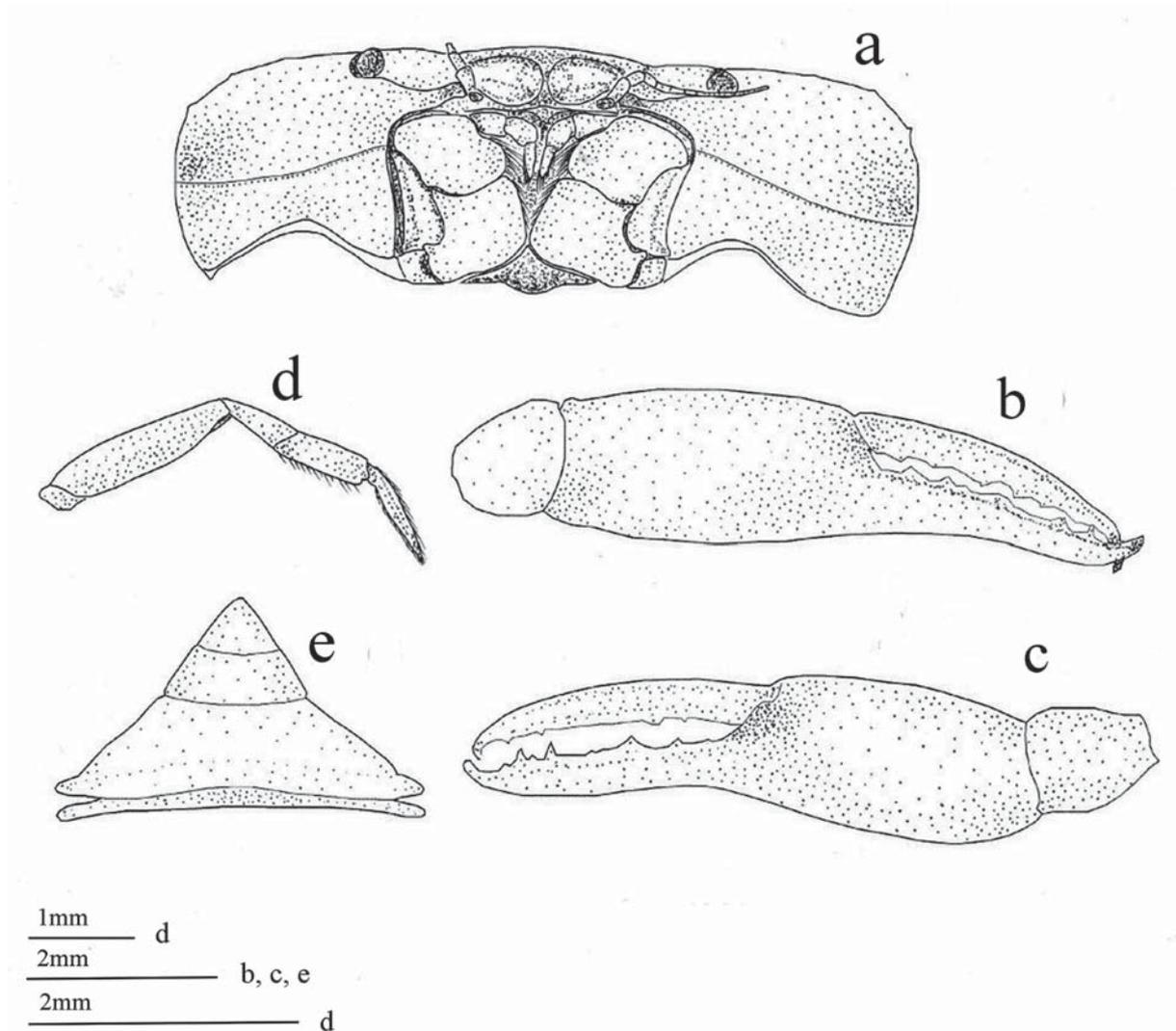


Fig. 2. *Libystes senckenberg* sp.n., holotype: a — frontal view; b — right chela, outer view; c — left chela, outer view; d — pereopod 3, dorsal view; e — pleon. Scale bar 5 mm (a), 1 mm (b–e).

Рис. 2. *Libystes senckenberg* sp.n., голотип: а — вид спереди; б — правая клешня, вид с внешней стороны; с — левая клешня, вид с внешней стороны; д — переопода 1, вид сверху; е — плеон. Масштаб 5 мм (а), 1 мм (б–е).

thickness ratio 1.0–1.1; without spines. Fingers slender, elongate, slightly longer than manus, crossing over apically when fingers closed (Figs. 1b, 2bc). Cutting edge of dactylus of right cheliped with 7 low, sharp conical teeth, with 6 similar teeth on cutting edge of pollex (Fig. 2b). Dactylus of left chela with 4 low papilliform teeth on cutting edge; cutting edge of immovable finger with 2 sharp conical teeth on proximal half, 2 large spiniform teeth on distal half, 2 small spiniform teeth on both sides of distalmost large tooth (Fig. 2c).

Pereopods 2–4 slender, generally smooth, of similar length and proportions; ischium short; merus longest, about 4.5 times as long as broad; carpus about 2 times as long as broad, somewhat narrower than merus, widening distally; propodus about 2.7 times as long as broad, without distinct grooves and costae, with short sparse setae on anterior and longer setae on posterior margin; dactylus grooved, ensiform, nearly as long as, 2 times less broad than propodus, bordered by relatively dense setae (Fig. 2d). Pereopods 5

articulates to supradorsal position, shorter than pereopods 2–4, articles from ischium to propodus similar to those of anterior pereopods; dactylus narrow, sinuous in outline, with fringe of relatively long sparse setae (Fig. 1c).

Thoracic sternum broad, smooth, sutures well expressed; sutures between smooth sternites 5 and 6, 6 and 7, and 7 and 8 extend for most sternal width (excluding sternopleonal cavity). Sternite 5 with locking button on anteromesial part; sternite 8 exposed posteriorly, only small lateral portion is visible in ventral view, anterior half of lateral part occupied by penial furrow with anterior wall at sternite margin; penis reaching to about 60% of sternite width; sutures between sternites and episternites practically fused; end of posterior episternite touches lateral margin of third pleomere.

Male abdomen subtriangular, smooth, pleomeres 3–5 fused without any traces of borders between pleomeres (Fig. 2e).

Gonopod 1 short, stout with widened tip, directed antero-mesially towards sixth thoracic sternites but not touching other gonopod. Basal lobe small, proximal part broad, tubu-

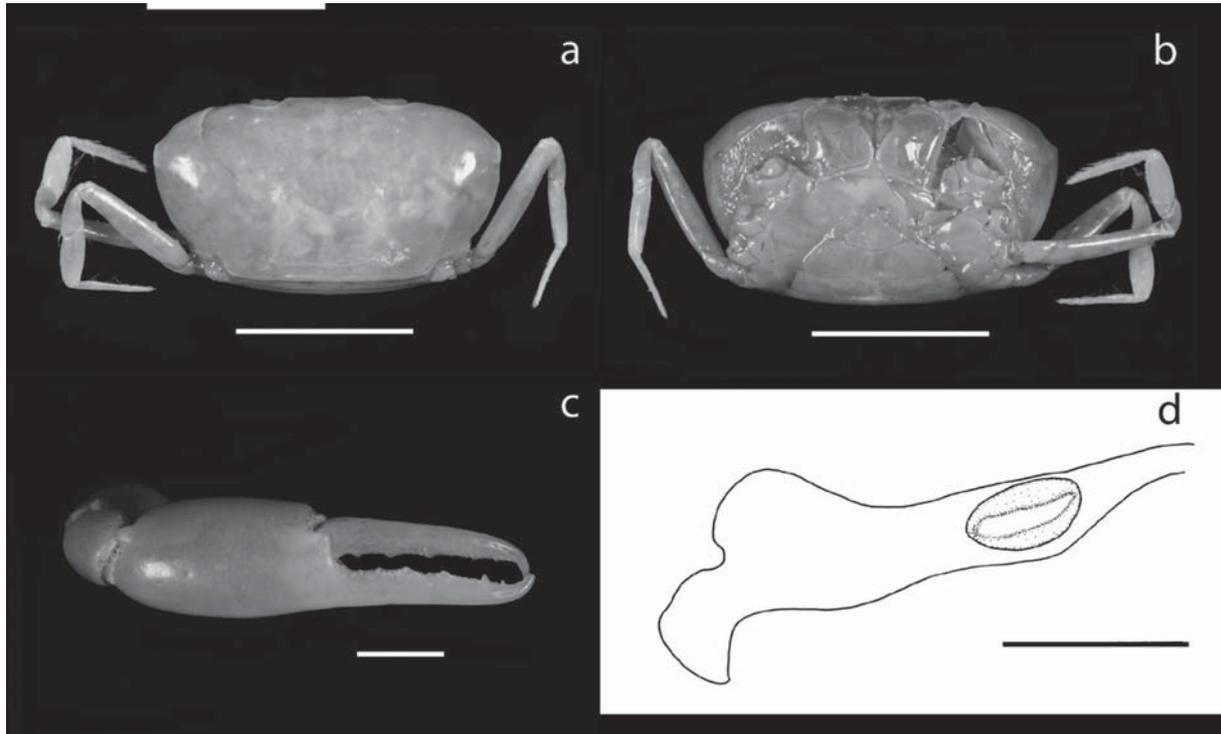


Fig. 3. *Libystes senckenberg* sp.n., female, paratype (ZUTC Brach1041): a — dorsal view; b — ventral view; c — right cheliped; d — genital sternite and vulva.

Рис. 3. *Libystes senckenberg* sp.n., самка, паратип (ZUTC Brach1041): а — вид сверху; б — вид снизу; в — правый хелипед; д — генитальный стернит и вульва.

lar, laterally convex, somewhat constricting medially, then broadening into faucet-like structure; tip broader than proximal part, opening directed anteriorly. A row of 18 relatively long, soft spinules along distal half of lateral face, supplemented with 23 long spinules and row of very short setae along opening margin on sternal face (Fig. 1d–e). Gonopod 2 about half length of gonopod 1, with terminal article thin, slender, strongly curved mesially in proximal part, sinuous in distal part.

FEMALE PARATYPE. Carapace 1.9 times as broad as long. First anterolateral margin prominence poorly distinguishable, median one most distinct, angular, margin between 2nd and 3rd prominence granulate (Fig. 3a, b). Posterolateral granular ridges more diffuse and posterolateral margin less granulated than in male holotype (Fig. 3a). Right chela (which is only one present) similar to male (Fig. 3c). Genital sternite strongly constricted mesially, vulva large, almond shaped, long axis parallel to sternite margin, occupying most of sternite length in proximal third (Fig. 3d).

VARIATION. Red Sea specimens. A male from the Red Sea (ZIN-RAS) (Figs. 4a–d, 5 a) has similar size proportions of the carapace to the holotype, CB/CL ratio 1.8, front comprises 30% and the posterior margin 63% of the CB. CH to CB ratio is 0.36. The anterior angular prominence is less distinct (similar in that respect to the female paratype from the Persian Gulf). The posterolateral ridge is finely granular and less expressed than in the holotype (Fig. 4a–b). Chelae are relatively higher (height to thickness ratio 1.25) than those of the holotype, and the right chela is more robust than the left. The most proximal tooth in the dactylus of right chela resembles to a tuberculate molariform tooth, the cut-

ting edge distally bears 3 sparsely set low conical teeth which are decreasing in size proximally, and with small papilliform teeth between them. On the pollex, there are three similar conical teeth are directed into the space between teeth of dactylus, with similar papilliform teeth in between (Fig. 5a). The fingers of the left chela are broken but no molariform tooth was observed in the proximal part of the dactylus cutting edge. The gonopod 1 is very similar to that of holotype.

REMARKS. In general appearance *Libystes senckenberg* sp.n. is similar to *Libystes nitidus* A. Milne-Edwards, 1867, *Libystes alphonsi* Alcock, 1900, *Libystes lepidus* Miyake et Takeda, 1970, and *Libystes villosus* Rathbun, 1924.

Libystes nitidus was described upon the female holotype (15×24 mm) from Zanzibar [Milne-Edwards, 1867; Apel, Spiridonov, 1998]. The characters of a male from Madagascar, in particular gonopod 1, were reported by Crosnier [1962: fig. 252], who also compared this specimen to the holotype. The new species differs from *L. nitidus* by a higher CB/CL ratio (1.9 in the female paratype of the former species vs. 1.6 in the female holotype of the latter), by the presence of clear angular prominences on the anterolateral margin vs. the rounded and finely granulated margin, by the straight vs. somewhat concave frontal margin [Milne-Edwards, 1868: pl. 2, fig. 5; Crosnier, 1962: fig. 5], and by the morphology of gonopod 1 which in *L. nitidus* is sinuous and elongated with a tapering tip [Crosnier, 1962: fig. 252]. Furthermore, *L. senckenberg* appears to be a smaller species than *L. nitidus*: the female holotype and the male of the latter species from Madagascar (CB 19.5 mm) [Crosnier, 1962] reach a size, that is not reported for the new species.

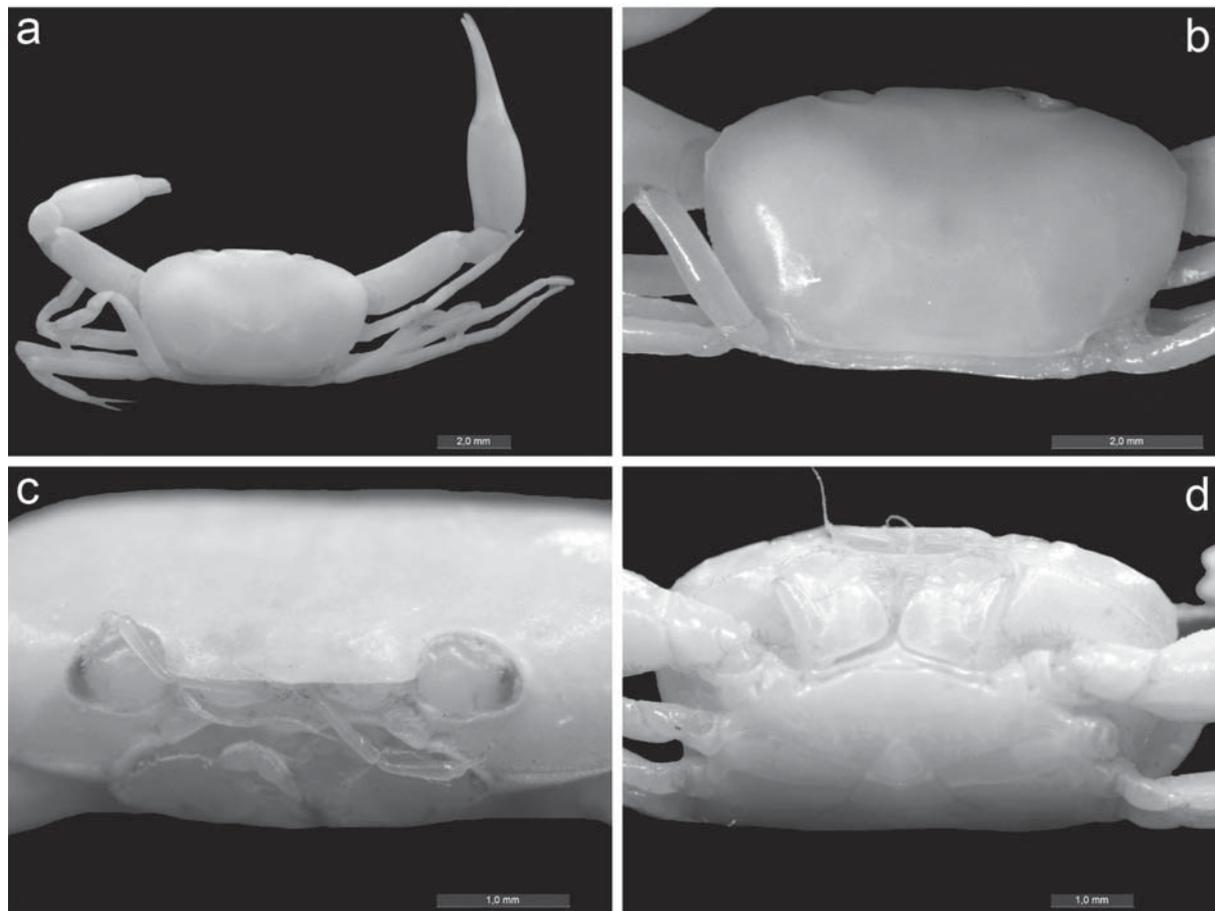


Fig. 4. *Libystes senckenberg* sp.n., male from the Red Sea, ZIN-RAS, non-type material: a — general appearance, dorsal view; b — carapace, dorsal view; c — anterior part of cephalothorax, frontal view; d — cephalothorax, ventral view.

Рис. 4. *Libystes senckenberg* sp.n., самец из Красного моря, ZIN-RAS, нетиповой материал: а — общий вид, вид сверху; б — карапакс, вид сверху; с — передняя часть цефалоторакса, вид спереди; д — цефалоторакс, вид снизу.

Libystes alphonsei was described from the Andaman Sea on the basis of a single female (4.0×7.0 mm). The holotype is most probably deposited in the Zoological Survey of India (ZSI) and is currently not available for study. Comparison to this species therefore could be only done using Alcock's [1900: 306–307] description and illustration in Alcock & McArdle [1903: pl. 61 fig. 2]. The new species differs from *L. alphonsei* in having a subquadrilateral carapace vs. quasi-quadrilateral one, the absence of the median hollow on the frontal region, and the presence of prominences on the anterolateral margin (see particularly a female paratype, Fig. 3a). Carapace ridges on the posterior region are not mentioned in Alcock's description nor figured by Alcock & McArdle [1903]. *Libystes senckenberg* also has a relatively more slender cheliped merus, which is about 3 times longer than broad, while *L. alphonsei* has a robust merus, which is (according to the measurements of the figure) about 2.4 times as long as broad. The cheliped manus in the new species is distinctly broader than the merus while it is about as broad as the merus in *L. alphonsei*.

Tesch [1918] questionably synonymized *L. alphonsei* to *L. nitidus* and this was followed by Edmondson [1954], Apel & Spiridonov [1998] and Ng *et al.* [2008].

Libystes lepidus Miyake et Takeda, 1970 has its type locality in Ogasawara Islands, Japan. *Libystes senckenberg*

differs from *L. lepidus* in having a relatively broader carapace (about 1.6 CB/CL in *L. lepidus*), smaller orbits, more slender and smoother vs. hairy cheliped [Fig. 1b; Miyake, Takeda, 1970: figs 1, 2], and morphology of the gonopod 1 which in *L. lepidus* is similar to that of *L. nitidus* figured by Crosnier [1962] but somewhat more robust [Miyake, Takeda, 1970: fig. 2E–F].

Libystes villosus was described from Apia, Samoa upon the female holotype [Rathbun, 1924]. The new species differs from *L. villosus* in a relatively broader carapace (CB/CL 1.9 vs. 1.7), in the presence of angular prominences on the anterolateral margin, the absence of a median notch on the front, practically naked frontal and anterolateral margins vs. “concealed by shaggy hair”; the right chela of *L. senckenberg* being relatively slender with fingers somewhat longer than the manus, while in *L. villosus* it is “very strong, fingers shorter than palm” [Rathbun, 1924: 127]. The specimen from Hawaii identified as *L. villosus* and illustrated by Edmondson [1951: fig. 25 a–f] is a male (CB 10.0 mm), which has a quasi-quadrilateral carapace and the gonopod 1 similar to the one illustrated by Crosnier [1962] for *L. nitidus*. Miyake & Takeda [1970: 32, fig. 3] recorded *L. villosus* from Ryukyu Islands, Japan. The specimen illustrated by them has a strongly concave and hairy frontal margin, no angular prominences on the anterolateral margin and mark-

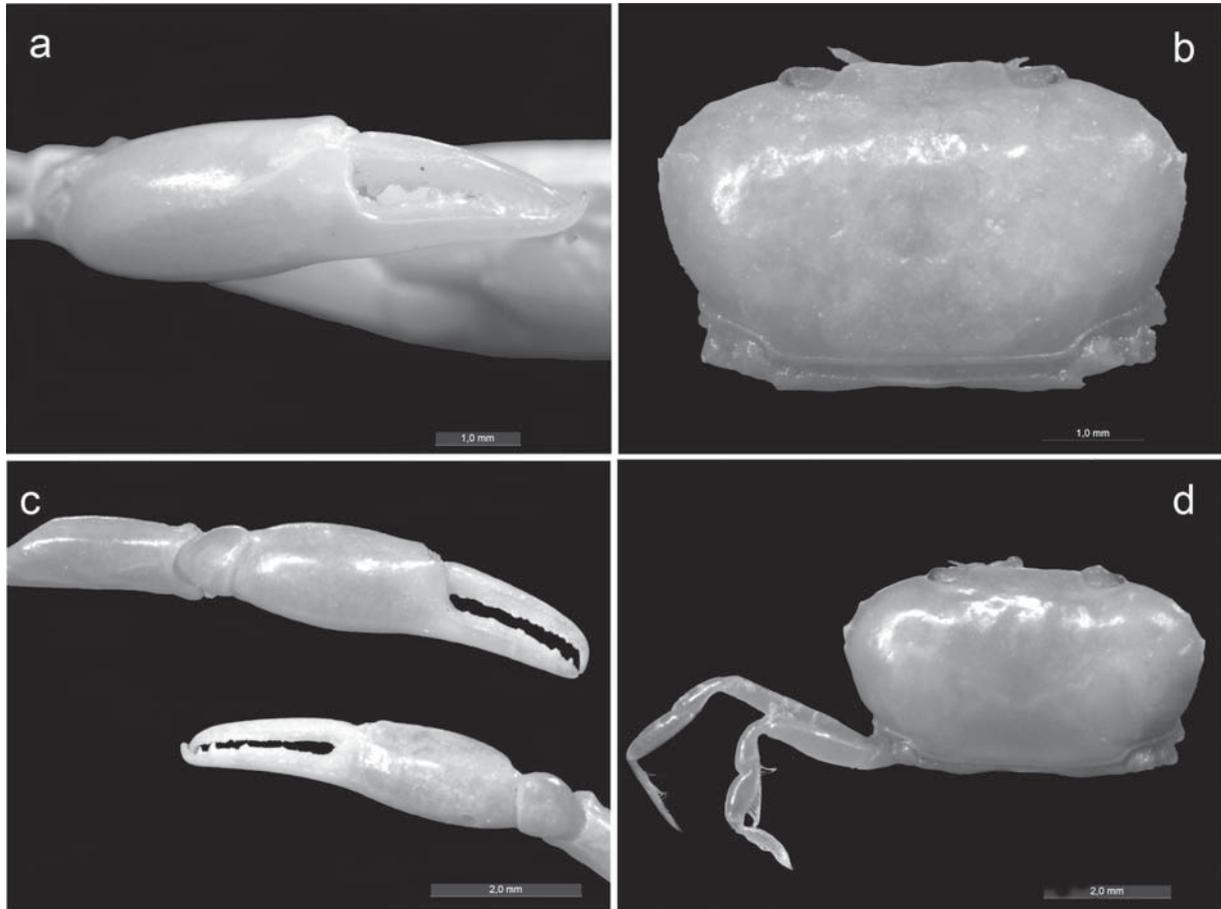


Fig. 5. Non-type material of *Libystes senckenberg* sp.n.: a — male specimen from the Red Sea, ZIN-RAS, right cheliped, frontal view; b — male specimen from Vietnam identified as *L. cf. senckenberg* (ZIN-RAS 1/79481), carapace, dorsal view; c — male specimen from Vietnam identified as *L. cf. senckenberg*, ZIN-RAS 1/79482, chelipeds, frontal view; d — same specimen as c, carapace and remaining pereiopods, dorsal view.

Рис. 5. Нетиповой материал *Libystes senckenberg* sp.n.: а — самец из Красного моря, ZIN-RAS, правая хелипеда, вид спереди; б — самец из Вьетнама, определенный как *L. cf. senckenberg* (ZIN-RAS 1/79481), карапакс, вид сверху; в — самец из Вьетнама, определенный как *L. cf. senckenberg*, ZIN-RAS 1/79482, хелипеда, вид спереди; д — тот же экземпляр, карапакс и остальные переоподы, вид сверху.

edly hairy carapace margins and pereiopods. The female from Ryukyu Islands appears to be conspecific to the specimen identified as *L. nitidus* by Yang *et al.* [2012: 79, fig. 27].

ECOLOGY. The holotype was trawled at depth 49 m on sandy-muddy substrate [Stephensen, 1946], the paratype originates from 60 m depth. The male from Eritrea was similarly recorded by trawling in the sublittoral.

DISTRIBUTION. Persian Gulf (type locality), southern Red Sea, probably Gulf of Aden [Nobili, 1906] and the Andaman Sea [Serène, Soh, 1976; as *Libystes alphonsi*, see below]. In the South China Sea (Gulf of Tonkin, Vietnam) a similar form occurs, which differs from the specimens from the Northwestern Indian Ocean in some characters. We tentatively assign it to the present species (see below). The provenance of the specimens presumably belonging to *L. senckenberg* and illustrated by Serène [1966: figs. 1–4] remains unknown.

REMARKS. Laurie [1915: 463] recorded *Libystes nitidus* from the Sudanese Red Sea. One specimen of a sample studied by him is present in the NHM collection (male

CB7.5×CL12.7 mm; NHM 1934.1.17.114, Sudan, Herdman leg). This specimen was considered to be conspecific to the present species by Apel and Spiridonov [1998]. A careful repetitive examination of this specimen, however, revealed significant differences between it and *L. senckenberg*, particularly in the morphology of gonopod 1 and pleon. These characters definitely call for a separate species status of the Sudanese specimen, and it is now under description by Spiridonov *et al.* [2021]. The Sudanese form also shows different ecological characteristics, i.e. occurrence at shallower depth. According to Crossland [1907], most of the material collected by Herdman was obtained by local divers and by trawling on coral mud.

Serène & Soh [1976] considered a single male specimen from the Andaman Sea with robust gonopods 1 (similar to that figured by Serène [1965: figs. 1–4]) as *L. alphonsi*. However, taking into account the differences between the female holotype of *L. alphonsi* and the female paratype of *L. senckenberg*, it is likely that this specimen can be referred to the latter species, or *L. cf. senckenberg* (see below).

Libystes cf. *senckenberg*
Fig. 5b–d.

MATERIAL. South China Sea, Vietnam: 1 male (3.2×5.9 mm) (ZIN-RAS 1/79481, identified as *Libystes nitidus* by Ya.I. Starobogatov), Gulf of Tonkin, R.V. “Pelamida”, St. 98, 36 m, grab, 07.1961; 1 male (3.0×5.2 mm) (ZIN-RAS 1/79481, identified as *L. nitidus* by Ya. I. Starobogatov), Gulf of Tonkin, R.V. “Pelamida” St. 53, 58 m, 31.07.1961. 1 female (4.0×7.8 mm) (ZMMU Ma 3553s), Gulf of Tonkin, R.V. “Orlik”, Stat 258, grab “Okean-25”, 25.04.1960, N.A. Zarenkov leg.

REMARKS. The specimens from the Gulf of Tonkin off Vietnam examined here are characterized by distinct angular prominences of the anterolateral carapace margin. The posterior prominence may be regarded as a true anterolateral tooth (Fig. 5b, d), which is present in some other species of *Libystes*, e.g., *L. edwardsi* Alcock, 1900 [Apel, Spiridonov, 1998: fig. 5a]. Its chelae are more similar to the type specimens from the Persian Gulf than to the Red Sea specimens, i.e., heterodonty is less expressed but proximal conical teeth are lower (Fig. 5c). However, there are distinct differences in the size of the chelae: in the male with carapace length 3.2 mm (ZIN-RAS1/79481) and in the female (ZMMU Ma 3553) the right chela is longer and higher than the left one, while in the male with CL 3.0 mm the left chela is longer. The chelae in the specimens from the Gulf of Tonkin are also relatively higher than in the holotype (height to thickness ratio 1.20–1.25). The pereiopods are relatively more setose than in the specimens from the northwestern Indian Ocean (Fig. 5c). In one of the male specimens (Fig. 5d), the frontal margin is straight while in the other male (Fig. 5b) and in the female specimen it is markedly concave. The anterior margin of the merus of maxilliped 3 is sparsely setose (ZIN-RAS 1/79481) or smooth (ZIN-RAS 1/79482). In addition, there are 20 bristles on the lateral face of gonopod 1 extend to slightly more than half of its length. Thus, the specimens from Vietnam show some differences from *L. senckenberg* sp.n. in the morphology of the frontal and anterolateral carapace margins, while their gonopods 1 are in most respects similar to the holotype and the specimen from the Red Sea. We therefore tentatively assign the specimens from Vietnam to *L. senckenbergi* sp.n., leaving the final decision to future revisions, which require more extensive comparative material of *Libystes* spp. from the tropical Pacific.

Discussion

Until the present description of *Libystes senckenberg* sp.n., the genus *Libystes* included six recognized species [Ng *et al.*, 2008]: *L. edwardsi*, *L. lepidus*, *L. nitidus*, *L. paucidentatus* Stephenson et Campbell, 1960, *L. vietnamensis* Tien, 1969 and *L. villosus*. With regard to general morphology, they can be divided into two groups. *Libystes edwardsi*, *L. paucidentatus* and *L. vietnamensis* retain several characters of a characteristic portunoid appearance, i.e. a distinctly quasi-hexagonal shape of the carapace, a varying in number anterolateral teeth, a notched frontal margin consisting of two lobes, relatively broader propodi and modified more flattened, broadly lanceolate or paddle-like dactyli of last pereiopods [Stephenson, Campbell, 1960; Tien, 1969; Apel, Spiridonov, 1998]. The other group is characterized by a more elliptical carapace shape, further reduction of the anterolateral teeth to small promi-

nences or a complete absence, and the non-paddle-like modification of the last pereiopods. *Libystes senckenberg* sp.n. belongs to the second group and is particularly characterized by a robust gonopod 1, unusual for Catoptrinae, and its small size, with a CB not exceeding 6.5 mm in males and 9.5 mm in females.

Some specimens from particular populations, i.e. those from the Red Sea (Fig. 5 A), retain a proximal molariform tooth in one chela which is reduced in the studied specimens in other localities. We interpret this as an atavistic character that supports the hypothesis of the origin of symmetrized chelipeds of *Libystes* from the ancestral heterodontic and heterochelic portunoid chelipeds.

The morphological adaptations of *Libystes* are probably the result of adaptation to living in specific environments, where anterolateral carapace teeth are no longer of functional importance for protecting a branchial chamber when crabs burrow in sediments [Garstang, 1897], while the asymmetry of chelipeds becomes disadvantageous in locomotion and/or feeding [Spiridonov *et al.*, 2014]. However, the habit and behavior of these crabs remains undescribed. Only few ecological observations on *Libystes* spp. have been published, i.e. notes on intertidal habitats under stones with burrows, where *L. villosus* occurs together with the goneplacid crab *Notonyx kumi* Naruse et Maenosono, 2009 and the xanthid *Etisus laevimanus* Randall, 1840 [Naruse, Maenosono, 2009]. Thus, there is a need to obtain more biological data on *Libystes* species, which are highly important for understanding their evolution and origin.

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Compliance with ethical standards

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

Ethical approval: No ethical issues were raised during our research.

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