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TWO NEW LEPTOCHITONS (MOLLUSCA, POLYPLACOPHORA, LEPTOCHITONIDAE) FROM MADAGASCAR AND MOZAMBIQUE

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Two new species of the genus *Leptochiton* are described: *L. madagascariensis* sp. n. from north Madagascar, depths 362 to 431 m, and *L. blikhshteyni* sp. n. from southern Mozambique Channel, depths 148 to 152 m. They are characterized by the relatively thick valves, the anteriorly located mucro and the longitudinal rows of granules in the central areas of the intermediate valves. *Leptochiton madagascariensis* sp. n. differs from similar species by having trapezoidal valves, closely set granules in the pleural areas of the intermediate valves, broad, dorsally bent scales with a wide bulbous base, and slender, numerous teeth of the radula. *Leptochiton blikhshteyni* sp. n. differs from other similar species from the southwestern Indian Ocean by having granules arranged staggered-order in the lateral and postmucronal areas and in elongate, flattened, sharply pointed dorsal spicules with 1–2 ribs.

Keywords: Mollusca, Polyplacophora, Indian Ocean, deep-sea chitons, new species

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Chitons studied here were collected during the two expeditions MIRIKY and MAINBAZA led by the Muséum national d'Histoire naturelle, Paris (MNHN), in 2009.

Specimens were prepared for scanning electron microscope (SEM) as usual (Sirenko, 2016).

Class Polyplacophora Gray 1821

Subclass Neoloricata Bergenhayn 1955

Order Lepidopleurida Thiele 1909

Family Leptochitonidae Dall 1889

Genus *Leptochiton* Gray 1847

Type species: *Chiton cinereus* of Montagu 1803 (non Linnaeus 1767) = *Leptochiton asellus* (Gmelin 1791) fide Lovén 1846, subsequent designation by Gray 1847.

Genus distribution: Worldwide, Carboniferous–Recent.

Leptochiton madagascariensis Sirenko sp. n.
(Figs 1–3)

Type material. Holotype (MNHN IM-2009-16616), now disarticulated consisting of SEM stub of valves I, II, IV, V, VIII, part of perinotum and radula, mount of part of perinotum and vial with other valves.

Type locality. Indian Ocean, North Madagascar, Ouest du Cap d'Ambre, 12°07' S, 48°58' E,

362–431 m (MIRIKY Stn DW3197, 28.06.2009, leg. P. Bouchet, N. Puillandre & B. Richer de Forges).

Description. Holotype (body length 8.5 mm) elongate oval in outline, valves thick, subcarinated, moderately elevated (dorsal elevation 0.42), posterior margin of intermediate valves damaged, side slopes convex, lateral areas raised; tegmentum white in color.

Head valve semicircular, almost as wide as the intermediate valves, posterior margin broadly V-shaped. Intermediate valves trapezoidal, anterior margin convex in jugal part and splayed laterally, side margins evenly rounded, hind margin damaged, lateral areas raised. Tail valve rather less than head valve anterior margin between apophyses protruding, with mucro anterior, posterior slope concave (Fig. 1D, 1H).

Tegmentum of head valve, lateral areas of intermediate valves and postmucronal area of tail valve sculptured with roundish, closely set granules arranged in a random manner. Central areas of intermediate valves and antemucronal area of tail valve sculptured with closely set longitudinal rows of small, roundish granules (about 60 rows in central areas and 32 rows in antemucronal area). Each granule with seven pores of aesthetes (Figs 1F; 3H).

Articulation well developed, white, apophyses narrow, triangular, with rounded top, wide apart in the intermediate valves, trapezoid in tail valve. There are excrescences between anterior margin of intermediate and tail valves and apophyses (Figs 1C, 1G).

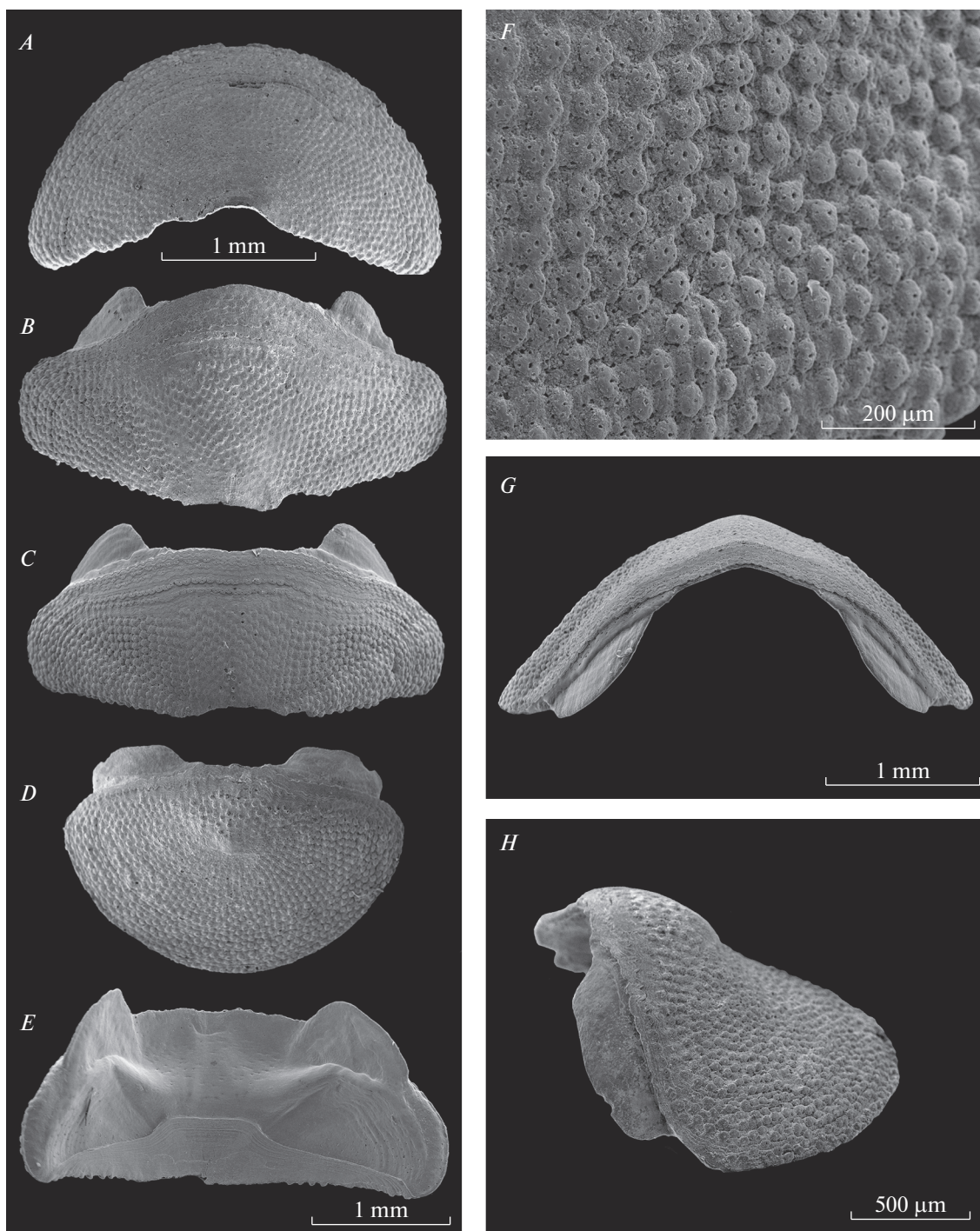


Fig. 1. *Leptochiton madagascariensis* sp. n., Indian Ocean, Madagascar, holotype (MNHN IM-2009-16616) BL – 8.5 mm: *A* – valve I, dorsal view; *B* – valve II, dorsal view; *C* – valve V, dorsal view; *D* – valve VIII, dorsal view; *E* – valve IV, ventral view; *F* – valve V, tegmentum sculpture in central area; *G* – valve V, rostral view; *H* – valve VIII, lateral view.

Girdle very narrow, dorsally densely covered with broad, bent scales ($55\text{--}85 \times 60\text{--}70 \mu\text{m}$) with wide bulbous base, each scale ornamented with six broad, sometimes double riblets, those near valves longer (up to $100 \times 60 \mu\text{m}$). Intersegmental areas with long smooth needles (up to $600 \times 12 \mu\text{m}$). Marginal needles

($95 \times 16 \mu\text{m}$) flattened with ribs. Ventrally, the girdle is covered with obtuse pointed scales ($52\text{--}65 \times 20 \mu\text{m}$) smooth in outer side and with 4–5 short riblets in inter side (Figs 2*A*, 2*C*; 3*A*–3*D*).

Enrico Schwabe (Zoologische Staatssammlung München, Germany, ZSM), who saw whole specimen

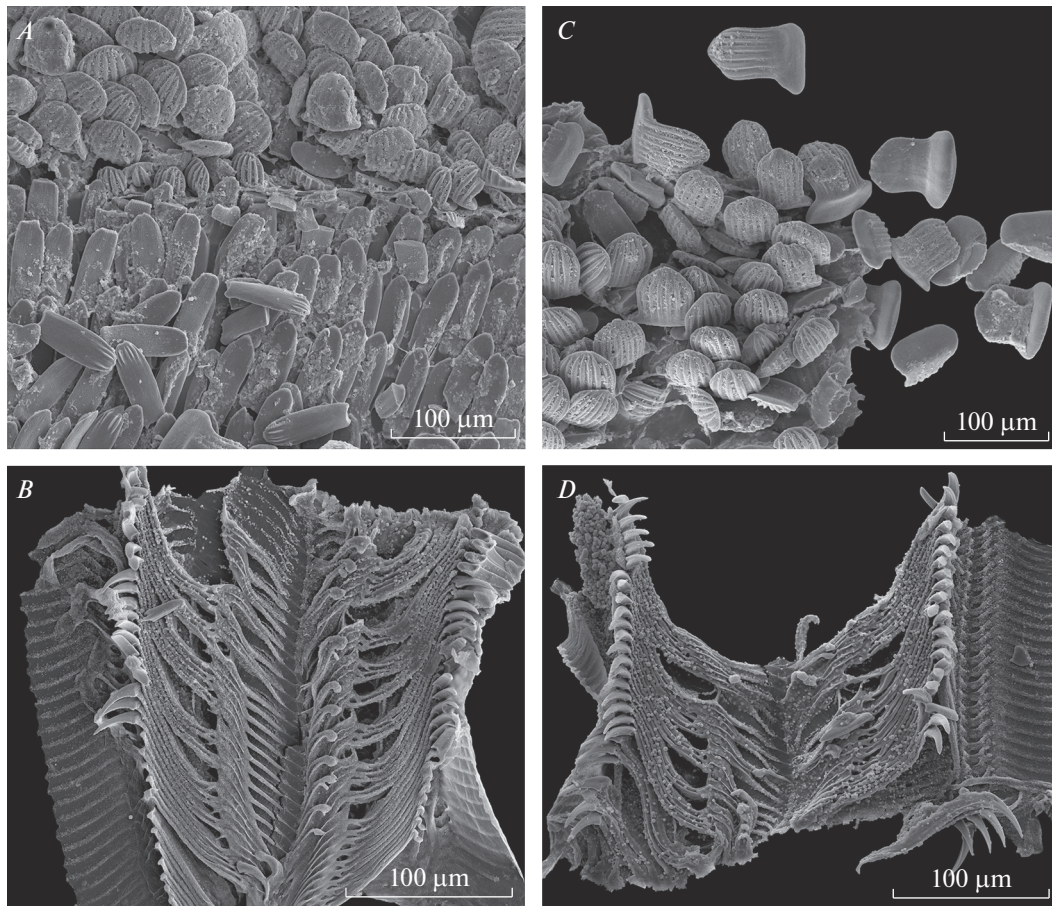


Fig. 2. *Leptochiton madagascariensis* sp. n. Indian Ocean, Madagascar, holotype (MNHN IM-2009-16616) BL – 8.5 mm: A – dorsal and ventral scales; B, D – radula; C – dorsal scales.

of the holotype before disarticulation kindly informed me about length of radula and number of transverse rows of radula, and number of gills.

Radula of holotype 2.5 mm long with 160–180 transverse rows of mature teeth. Central tooth narrowing in front to a small blade, first lateral tooth narrow at the base, gradually slightly widening to a convex blade, slender major lateral teeth bearing sharply pointed unidentate cusp (Figs 2B, 2D; 3E–3G).

The holotype has nine gills.

Diagnosis. Animal small, moderately elevated, valves subcarinated, intermediate valves trapezoidal, splayed laterally, tail valve mucro anterior, postmucronal slope slightly concave, tegmentum of central and antemucronal areas sculptured with longitudinal rows of granules, tegmentum of head valve, lateral and postmucronal areas sculptured with granules arranged in a random manner; seven aesthete pores in each granule; girdle dorsally covered with broad, bent scales with bulbous base, each scale ornamented with six broad, sometimes double riblets; radula with many transverse rows of very small teeth, central and first lateral teeth elongate and narrow, long and slender

major lateral teeth bearing sharply pointed unidentate cusp.

Distinctive diagnosis. This new species superficially resembles three species from southwestern and southern Indian Ocean: *Leptochiton chariessa*, *L. meiringae* and *L. dispersus*. *L. madagascariensis* sp. n. differs from *L. chariessa* in having granules in lateral and postmucronal areas arranged in a random manner (vs. in radial rows in *L. chariessa*), mucro anterior (vs. mucro slightly posterior in *L. chariessa*), 60 longitudinal rows on central areas (40–45 rows in *L. chariessa*).

The new species differs from *L. meiringae* by having trapezoidal intermediate valves (vs. broadly rectangular in *L. meiringae*), mucro anterior (vs. mucro posterior in *L. meiringae*), closely set granules on pleural areas (vs. wide interstices in *L. meiringae*), dorsal scales broad, bent with wide bulbous base (vs. elongate, bluntly pointed without bulbous base in *L. meiringae*).

L. madagascariensis sp. n. differs from *L. dispersus* by having regular longitudinal rows on central areas (vs. irregularly longitudinally displayed chains of small pustules in *L. dispersus*), mucro anterior (vs. mucro

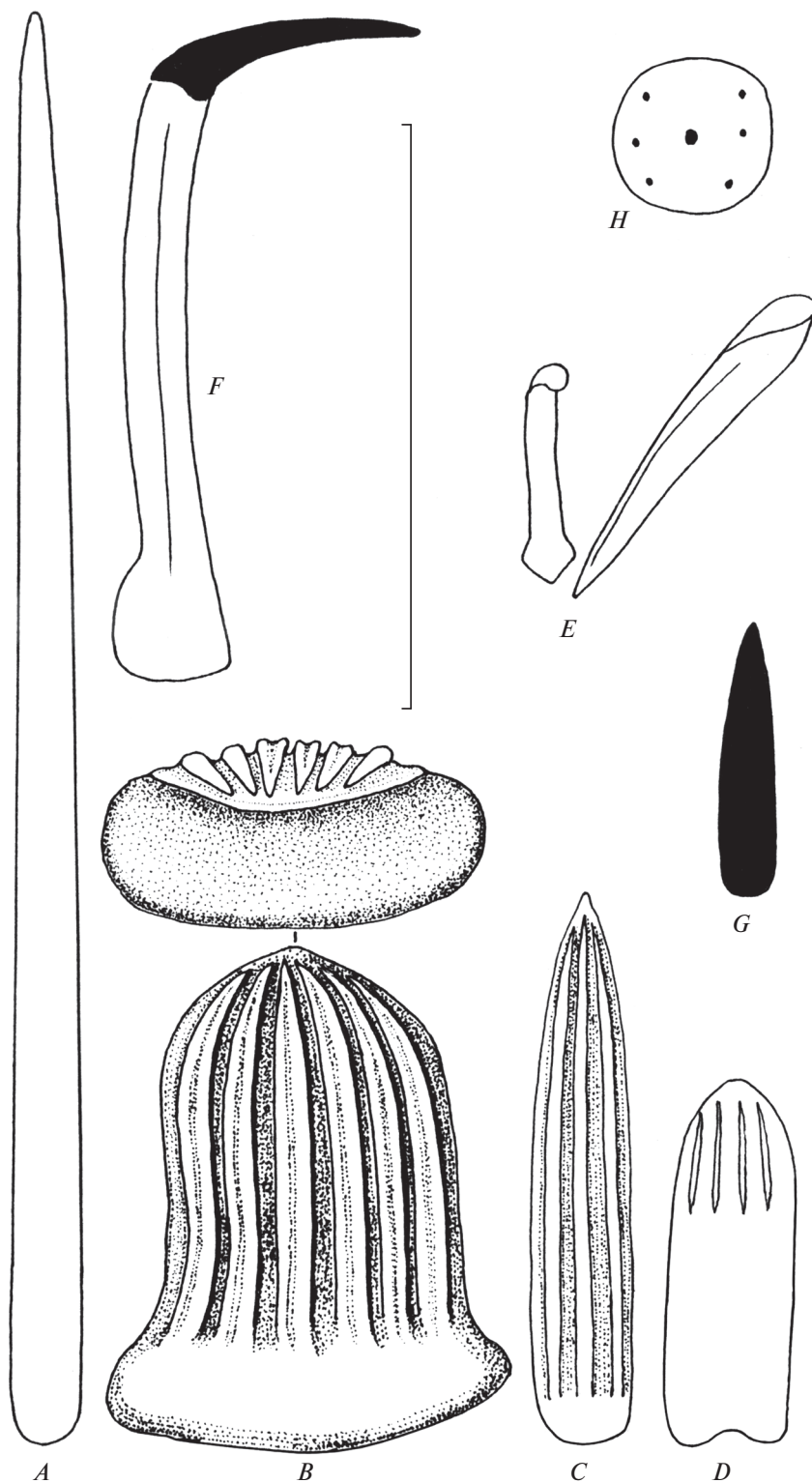


Fig. 3. *Leptochiton madagascariensis* sp. n., Indian Ocean, Madagascar, holotype (MNHN IM-2009-16616) BL – 8.5 mm: *A* – sutural needle; *B* – dorsal scale; *C* – marginal needle; *D* – ventral scale, ventral view; *E* – central and first lateral teeth of radula; *F* – major lateral tooth of radula; *G* – head of major lateral tooth of radula; *H* – aesthete group. Scale bar: *A* – *G* – 100 μ m.

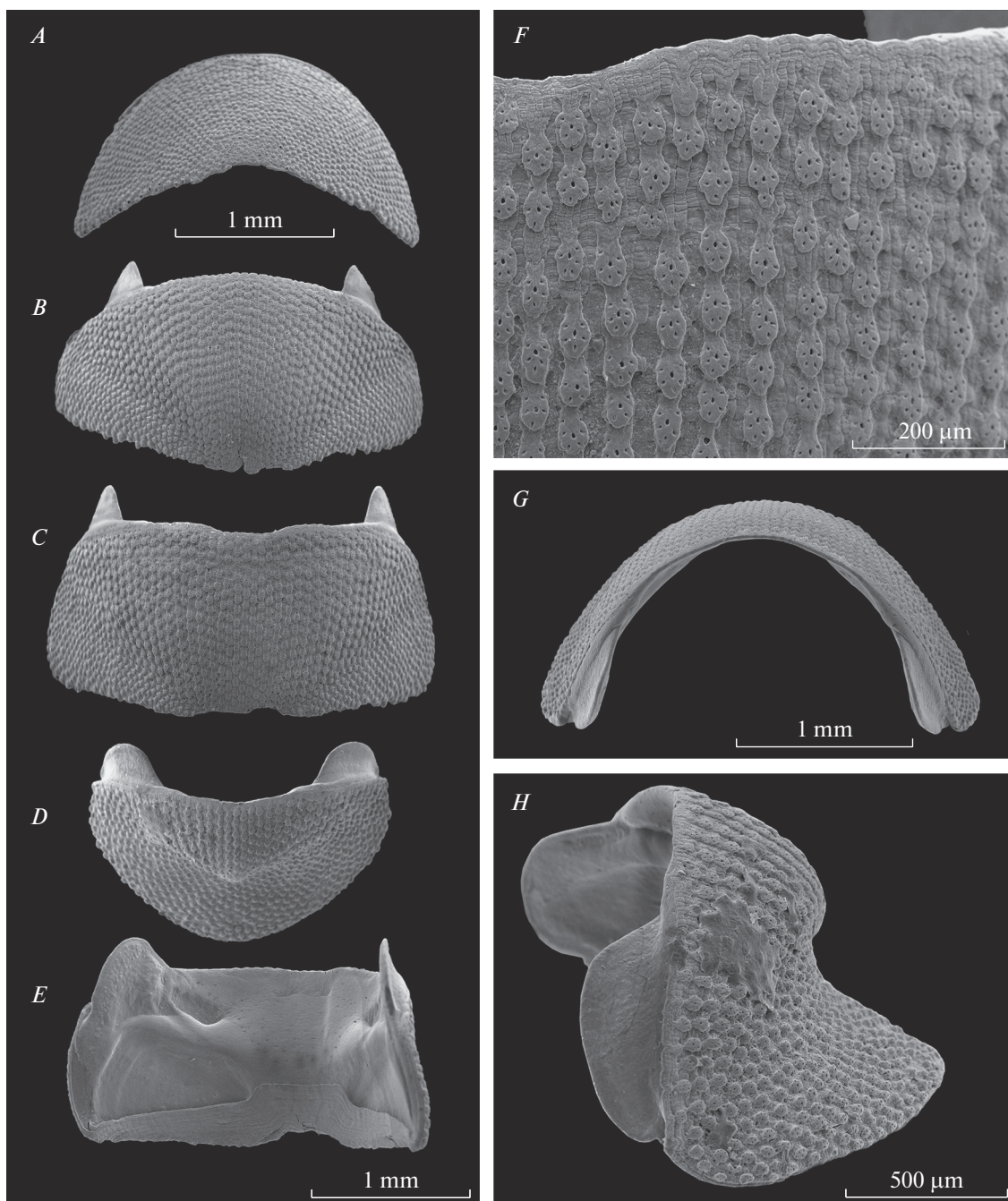


Fig. 4. *Leptochiton blikshteyni* sp. n., Indian Ocean, Mozambique, holotype (MNHN IM-2009-16613) BL – 6.0 mm: *A* – valve I, dorsal view; *B* – valve II, dorsal view; *C* – valve V, dorsal view; *D* – valve VIII, dorsal view; *E* – valve IV, ventral view; *F* – valve V, tegmentum sculpture in central area; *G* – valve V, rostral view; *H* – valve VIII, lateral view.

subcentral, but in fig. 5 (Kaas, Van Belle, 1987) mucro is posterior in *L. dispersus*), dorsal scales broad, bent with wide bulbous base (vs. elongated, bluntly pointed without bulbous base in *L. dispersus*).

Other leptochitons from southwestern Indian Ocean have granules in central area arranged quincuncially (vs. longitudinal rows in *L. madagascariensis* sp. n.).

New species is superficially similar to *Leptochiton gloriosus* which type locality is very close to that of *L. madagascariensis* sp. n., but differs from it by having longitudinal rows of granules in central areas of intermediate valves (vs. quincuncially in *L. gloriosus*), seven, rare nine aesthete pores (vs. eleven pores in *L. gloriosus*, six wide, often double riblets in dorsal scales (vs. 6–8 narrow riblets in *L. gloriosus*), narrow and

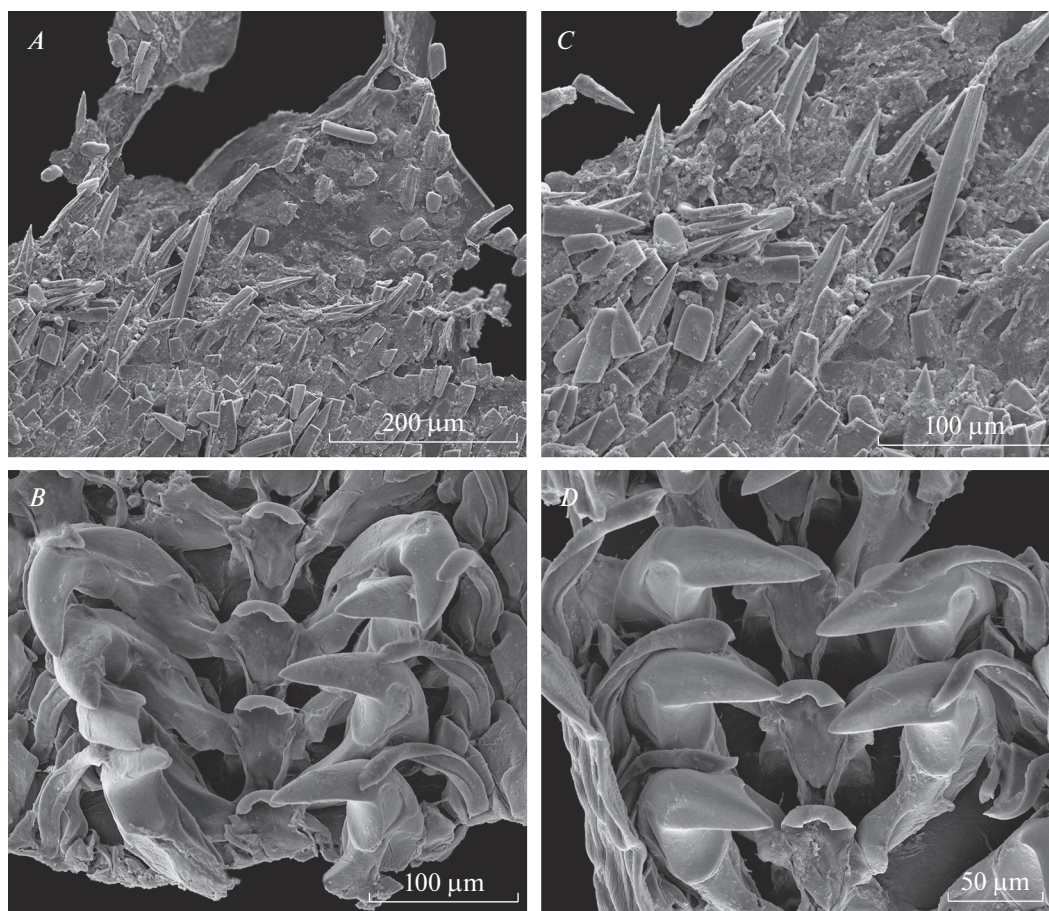


Fig. 5. *Leptochiton blikshsteini* sp. n., Indian Ocean, Mozambique, holotype (MNHN IM-2009-16613) BL – 6.0 mm: *A*, *C* – dorsal and ventral scales; *B*, *D* – radula.

long central, first lateral and major lateral teeth of radula (short teeth in *L. gloriosus*).

Distribution. Only known from the type locality.

Etymology. Named after the island Madagascar.

***Leptochiton blikshsteini* Sirenko sp. n.**

Figs 4–7

Type material. Holotype (MNHN IM-2009-16613) now disarticulated consisting of SEM stub of valves I, II, IV, V, VIII, part of perinotum and radula, mount of part of perinotum and vial with other valves.

Type locality. Indian Ocean, Mozambique Channel: 23°55' S, 35°37' E, 148–152 m (Inhambane transect, Campagne MAINBAZA, N.O. “Vizconde de Eza” Stn CC3159, 15.04.2009, leg. B. Bouchet, Rosado & H. Strong.

Description. Holotype 5.3 × 3.8 mm. Shell elongate-oval (Fig. 7), highly elevated (elevation ratio in valve V 0.50). Valves thick, rounded, not beaked, side slopes convex, lateral areas slightly raised color of tegmentum white.

Head valve semicircular. Intermediate valves almost rectangular, except valve II that trapezoidal, rather long and narrow, anterior and posterior margins in valves II–VII nearly straight, not beaked, lateral margins straight, valve II with convex anterior margin. Tail valve less than head valve, with slightly anterior mucro, antemucronal slope slightly convex, postmucronal slope decidedly concave near mucro (Figs 4*D*, 4*H*).

Tegmentum sculptured with flattened oval densely spaced granules, arranged in about 65 radial rows in head valve, in ca. 50 longitudinal rows in the central area of intermediate valves and antemucronal area of tail valve, and quincuncially in other areas. Each granule has one megal aesthete and six micraesthetes (Figs 4*F*; 6*I*).

Articulamentum moderately developed, apophyses short, narrow, width of apophyses more than 3 times less than width of jugal sinus.

Girdle very narrow, perinotum developed only from valve II to valve VII, and it is absent along head and tail valves, where hyponotum is present only, dorsally covered with elongate, flattened, sharply pointed



Fig. 6. *Leptochiton blikhshteyni* sp. n., Indian Ocean, Mozambique, holotype (MNHN IM-2009-16613) BL – 6.0 mm: A – sutural needle; B – dorsal spicules; C – marginal needle; D – ventral spicules, near margin and in middle; E – ventral spicule near pallial groove; F – central and first lateral teeth of radula; G, H – heads of major lateral teeth of radula; I – aesthete group. Scale bar: A – I – 100 μ m.



Fig. 7. *Leptochiton blikshsteini* sp. n., Indian Ocean, Mozambique, holotype (MNHN IM-2009-16613) BL – 6.0 mm: A – whole animal, dorsal view; B – whole animal, lateral view.

spicules ($85\text{--}103 \times 19 \mu\text{m}$) with 1–2 narrow ribs on the dorsal side. Intersegmental area with long smooth needles up to $200 \times 14 \mu\text{m}$. Marginal needles like intersegmental but shorter up to $160 \times 15 \mu\text{m}$. Ventrally girdle covered with elongate sharply pointed, smooth scales ($64\text{--}83 \times 20 \mu\text{m}$) (Figs 5A, 5C; 6A–6E).

Radula of holotype 1.8 mm long with 21 transverse rows of mature teeth. Central tooth wide and with short projection on base. Major lateral teeth with unidentate cusps (Figs 5B, 5D; 6A–6E).

Nine gills per side arranged from valve VI to anus.

D i a g n o s i s. Animal of a small size. Shell highly elevated, rounded. Intermediate valves almost rectangular except valve II that is trapezoidal. Tail valve narrower than the head valve, mucro slightly anterior, posterior slope decidedly concave. Tegmentum with flattened oval granules arranged in radial rows in the head valve, in longitudinal rows in the central area of intermediate valves and the antemucronal area of the tail valve and quincuncially in lateral and postmucronal areas. Each granule with seven pores of aesthetes. Girdle very narrow, perinotum developed only

from valve II to valve VII. Dorsal spicules elongate, flattened, sharply pointed with 1–2 narrow ribs. Central teeth of radula wide, major lateral teeth with unidentate cusp. Nine gills per side extending from valve VI to anus.

D i s t i n c t i v e d i a g n o s i s. The new species is similar to *Leptochiton madagascariensis* sp. n., *L. meiringae* and *L. chariessa*. *L. blikshsteini* sp. n. differs from *L. madagascariensis* sp. n. by having elongate, flattened, sharply pointed dorsal spicules with 1–2 ribs (vs. broad dorsal scales, bent with a wide bulbous base and 6 ribs in *L. madagascariensis* sp. n.), rounded valves (vs. subcarinated valves in *L. madagascariensis* sp. n.), a radula with few transverse rows of teeth (vs. a radula with numerous transverse rows of small teeth in *L. madagascariensis* sp. n.).

The new species differs from *L. meiringae* by having slightly anterior mucro (vs. posterior mucro in *L. meiringae*), closely set granules in pleural areas (vs. wide interstices in *L. meiringae*), granules arranged quincuncially in lateral and postmucronal areas (vs. in radial rows in *L. meiringae*).

L. blikshsteini sp. n. differs from *L. chariessa* by having rounded valves (vs. carinated valves in *L. chariessa*), granules arranged quincuncially in lateral and postmucronal areas (vs. in radial rows in *L. chariessa*), slightly anterior mucro (vs. slightly posterior mucro in *L. chariessa*).

Distribution. Only known from the type locality.

Etymology. Named after Mihael Blikshsteyn (Portland, Oregon, U.S.A.) for his continuous and unselfish help preparing my manuscripts for publications.

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ДВА НОВЫХ ЛЕПТОХИТОНА (MOLLUSCA, POLYPLACOPHORA, LEPTOCHITONIDAE) ИЗ МАДАГАСКАРА И МОЗАМБИКА

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Описаны два новых вида рода *Leptochiton*: *L. madagascariensis* sp. n. из северного Мадагаскара, с глубины 362–431 м, и *L. blikshsteini* sp. n. из южной части Мозамбикского канала, с глубины 148–152 м. Для них характерны довольно толстые щитки, впереди расположенное мукро и продольные ряды гранул на центральных полях промежуточных щитков. *L. madagascariensis* sp. n. отличается от сходных видов наличием трапецеидальных щитков раковины, близко расположенных гранул на плевральных полях промежуточных щитков, широкого бульбовидного основания на дорсальных чешуйках и многочисленных мелких зубов радулы. *L. blikshsteini* sp. n. отличается от других сходных видов юго-восточной части Индийского океана наличием расположенных в шахматном порядке гранул на латеральных и постмукрональных полях щитков раковины и удлинённых, уплощённых и заострённых дорсальных спикул с 1–2 ребрами.

Ключевые слова: Mollusca, Polyplacophora, Индийский океан, глубоководные хитоны, новые виды