Ruthenica, 2007, 17(1-2): 13-21.

New Chilean chiton-epizoophagus ***Gallardoia valdiviensis*** gen. et sp. nov. (Mollusca, Polyplacophora)

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ABSTRACT. A new genus and new species of the family Tonicellidae are described. This species inhabits Chilean waters near Provincia Valdivia at depths of 0.5-1.5 m where rough seas and nearshore currents are present. It lives among barnacles and feeds on them. This new genus has some features that are typical for genera of the family Mopaliidae, namely *Mopalia* and *Plaxiphora* (*Fremblia*), but it has no caudal sinus in the tail valve and has two petal-shaped processes between the valves.

The chiton fauna of Chile has been studied from the beginning of the XIX century when the first six species of this area were described [Frembly, 1827]. Since then more than forty species, all from the Chilean coast, have been described [Leloup, 1956, Castellanos, 1988]. At present, we know 38 valid species that inhabit Chilean waters from northern Chile to the Magellan Strait [Reid, Osorio, 2000; Osorio, Reid, 2004; Schwabe, Sellanes, 2004, Sirenko, 2006, Schwabe et al., 2006]. Up to now there are several groups of chiton species whose taxonomic positions are still indefinite. Among them are *Tonicia chilensis* (Frembly, 1827), *T. elegans* (Frembly, 1827) and *T. calbucensis* Plate, 1897, *T. smithi* Leloup, 1980 and *T. disjuncta* (Frembly, 1827), *Chaetopleura hennahi* (Gray, 1828), *Ch. fernandensis* Plate, 1899 and *Ch. benaventei* Plate, 1899, *Chiton magnificus* Deshayes, 1827 and *C. bowenii* King et Broderip, 1831, and other species.

At the beginning of 2005, the author was invited by Prof. Carlos Gallardo to lecture at the Instituto de Zoologia, Universidad Austral de Chile, Valdivia, and simultaneously to collect chitons. During a field trip near Mehuin (Provincia Valdivia), the author found two specimens that looked very unfamiliar because they did not appear to belong to any known Chilean genus of chitons. Two weeks later, the author, with Prof. Carlos Gallardo, found 29 specimens of this strange species and more in another location at Provincia Valdivia (Punta Pilolcura). When the specimens were studied, it turned out that they represented a new species that belongs to a new genus of the family Tonicellidae. Below, the description of new genus and new species are given.

Taxonomy

Class Polyplacophora Gray, 1821
Subclass Loricata Shumacher, 1817
Order Chitonida Thiele, 1910
Suborder Acanthochitonina Bergenhayn, 1930
Superfamily Mopalioidea Dall, 1889
Family Tonicellidae Simroth, 1894

Genus ***Gallardoia*** Sirenko gen. nov.

Diagnosis. Chitons of medium size, oval, tegmentum with granulose keel on the jugal area, with 8 radial ribs on the head valves, one radial rib on the lateral areas and more then 15 longitudinal ribs in the pleural areas, mucro of tail valve central, slit formula 8/1/many, gills abanal, girdle moderately wide with caudal notch covered with spicules distally crowned with a short ribbed spine and single or groups of 2-6 long curved spines.

[**Диагноз**. Хитоны средних размеров, овальные, тегментум с зернистым килем на югальном поле промежуточных и последнего щитков, с 8 радиальными ребрами на головном щитке, одним радиальным ребром на боковых полях и более чем 15 продольными ребрами на каждом плевральном поле, последний щиток с центральным мукро. Формула разрезов 8/1/много. Перинотум с каудальной вырезкой, сверху плотно покрыт мелкими спикулами с заостренным шипом на дистальном конце и разбросанными по всей поверхности одиночными или чаще собранными в пучки по 2-6 в каждом изогнутыми шипами.]

This new genus undoubtedly belongs to the family Tonicellidae because it has no posteromedian sinus in its tail valve but has some features that are typical of some genera of Mopaliidae (caudal notch in girdle, like in *Mopalia*, with distinct ribs in head valve and in lateral areas of intermediate valves, as in most of *Plaxiphora*, *Mopalia, Nuttallochiton, Placiphorina*) (Table 1).

Type species — ***Gallardoia valdiviensis*** sp. nov.

Gallardoia valdiviensis Sirenko sp. nov.

(Figs. 1-5)

Sirenko, Gallardo, 2005: 89 (Tonicellidae gen. sp.)

Diagnosis: Animals of medium size (largest 22.5 mm long and 16.0 mm wide), oval, moderately elevated (dorsal elevation ca. 0.35) back rounded to weakly carinated, jugal area of intermediate and tail valves with small granulose keel, girdle with caudal notch, with spicules dorsally crowned with pointed spine and scattered single or groups of curved spines, two petal-shaped processes between the valves, tegmentum and girdle dark- or light-grey colour.

[**Диагноз**: Животные средних размеров (длина тела до 22,5 мм, при ширине 16,0 мм), форма тела овальная, раковина сравнительно приподнятая (дорсальное поднятие около 0,35), спина закругленная или слегка угловатая, промежуточные и хвостовая пластинки с небольшим зернистым килем. Перинотум с каудальной вырезкой и плотно стоящими спикулами, увенчанными острым шипом, а также разбросанными по всей поверхности одиночными или собранными в пучки изогнутыми шипами. Между щитками имеются по два лепестковидных отростка. Тегментум и перинотум темно- или светло-серого цвета.]

Type material: Holotype 20 mm long, now disarticulated, and 27 paratypes, 7.6-22.5 mm long, one 10.4 mm long now disarticulated, at the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (N2153 and N2154 respectively); one paratype at the Museo Nacional de Historia Natural, Santiago, Chile.

Type locality: Punta Pilolcura, Provincia Valdivia, Chile, 39°40'S, 73°24'W, under rocky plates with barnacles that lay on sandy bottom, depth of 1-1.5 m. (leg. B. Sirenko, January 24, 2005).

Other material: Mehuin, Provincia Valdivia, Chile, under rocks embedded in sandy bottom, depth of 0.5 m, 2 specimens, largest 22 mm long. (Zoological Institute collection, leg. B. Sirenko, January 11, 2005).

Description of holotype. Chiton, preserved flat in alcohol, 20.0 mm long, 14.0 mm wide (including girdle). Valves rounded to weakly carinated. Head valve semicircular, anterior margin weakly festooned, posterior margin widely V-shaped, shallowly notched in the middle, tegmentum sculptured with eight clearly cut, rather strongly raised nodulose radiating ribs with a similar ribs at the sutures, the nodules regularly formed, those on the sutural ribs finely dentating the valve margin, interstices rather coarsely granulose. Intermediate valves short, 3 times wider than long (except II), front margin about straight, somewhat slanting at the anterolateral corners, hind margin slightly concave at both sides of the small apex, lateral areas do not rise, sculptured like head valve, clearly marked by a diagonal, tubercular rib, jugal area more or less differentiated, sculptured with granulose keel, pleural areas with 14-16 longitudinal subgranulose ribs, the 3-4 innermost ribs curving towards the jugum. Tail valve small, less wide than head valve, front margin straight, mucro slightly anterior, postmucronal slope slighty concave, antemucronal area sculptured like jugal and pleural areas of intermediate valves, postmucronal area with wide ridges in the middle and 4 radiating ribs from each side. There are two petal-shaped processes (ca. 1 mm long) between valves.

Colour of tegmentum dark-grey, with yellow

Table 1. Comparison of characters of shell and girdle in different genera of the families Tonicellidae and Mopaliidae.

Features Genera	Postero-median sinus in tail valve	Ribs in lateral areas	Ribs in head valve	Keel in jugal part of valves	Bristles in girdle	Tufts of spines in girdle	Petal-shaped processes between valves	Caudal notch in girdle
Gallardoia gen. n.	no	yes	yes	yes	no	yes	yes	yes
Tonicella Carpenter, 1873	no	no	no	no	yes	no	no	no
Spongioradsia Pilsbry, 1894	no	no	no	no	no	no	no	no
Lepidochitona Gray, 1821	no	no	no	no	yes	yes	no	no
Boreochiton Sars, 1878	no	no	no	no	yes	no	no	no
Nuttallina Dall, 1871	no	yes	yes	no	no	yes	no	no
Ceratozona Dall, 1882	no	yes	yes	no	yes	no	no	no
Particulazona Kaas, 1993	no	no	no	no	no	no	no	no
Placiphorina Kaas et Van Belle, 1993	yes	yes	no	no	no	no	no	no
Mopalia Gray, 1847	yes	yes	yes	no	yes	no	no	yes
Nuttallochiton Plate, 1899	yes	yes	yes	no	no	yes	no	no
Plaxiphora Gray, 1847	yes	yes	yes	no	yes	no	no	no

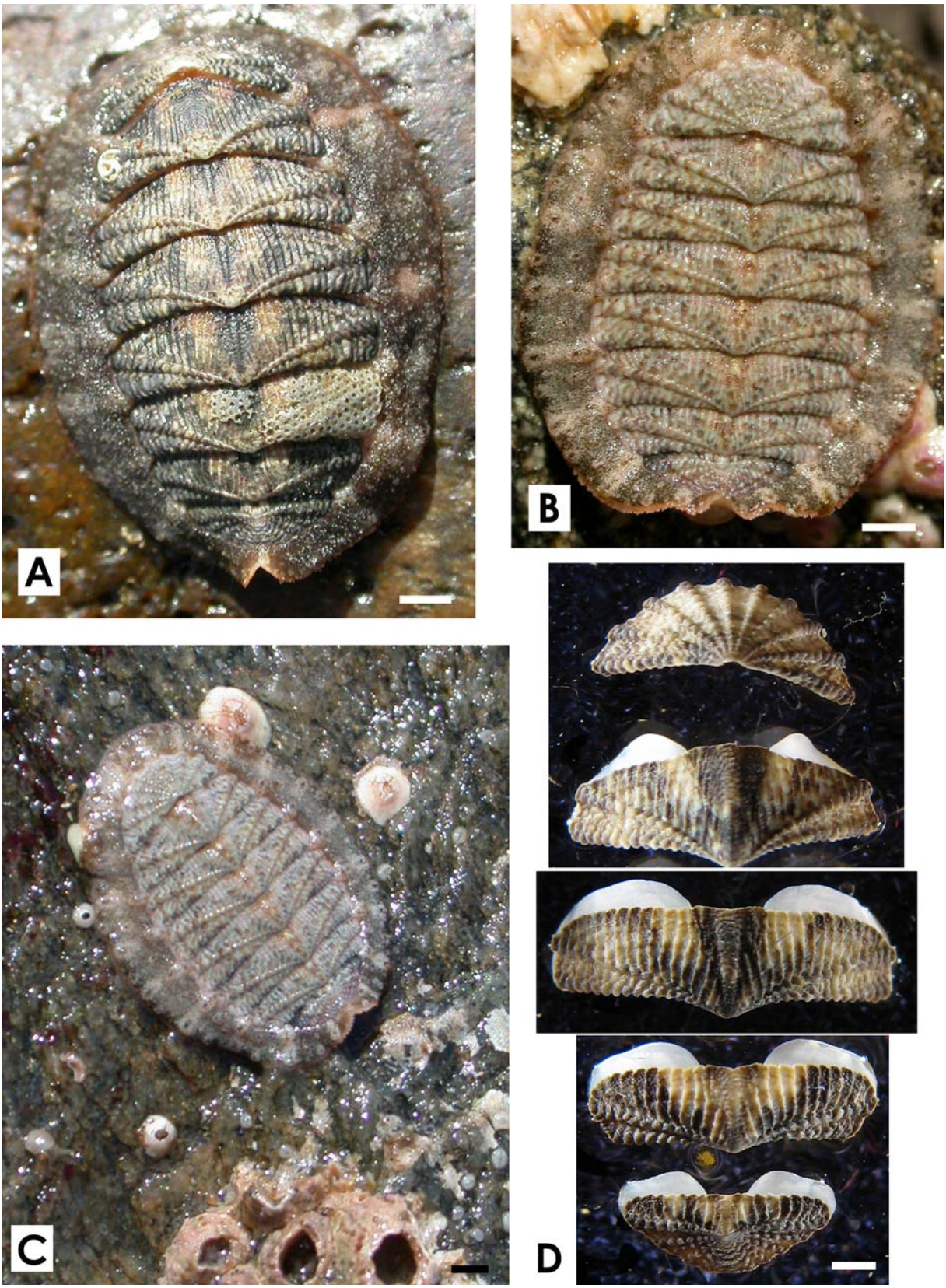


FIG. 1. ***Gallardoia valdiviensis*** gen. et sp. nov., paratypes (A-C), holotype (D).
A — dark grey specimen, dorsal view; B, C — light grey specimen, dorsal view, in situ; D — valves I, II, V, VII and VIII, dorsal view. Scale bar: A-C — 2 mm; D — 1 mm.

РИС. 1. ***Gallardoia valdiviensis*** gen.et sp. nov., паратипы (A-C), голотип (D).
A — темно-серый экземпляр, вид сверху; B, C — светло-серый экземпляр, вид сверху, в природе; D — щитки I, II, V, VII и VIII, вид сверху. Масштабная линейка: A-C — 2 мм; D — 1 мм.

spots near jugal area; colour of girdle dark-grey, with dirty white spots.

Articulamentum bluish-white, smooth, glossy, apophyses wide, short, rounded, jugal sinus fairly wide, straight, insertion plates relatively short, slit formula 8/1/8 corresponding to tegmental ribs, slit rays slightly grooved, teeth smooth, thickened at the side edges, eaves wide, coarsely and densely spongy.

Girdle wide, width near valve IV 2.5 times smaller than width of the valve, dorsally densely clothed with small bludgeon-shaped, smooth spicules distally crowned with small pointed spine, dark- or light-grey or white, up to 120-150 x 50-70 μm, and scattered single or 5-6 in tufts, curved spines, up to 400 x 50 μm, those of the caudal tuft more numerous (up to 7-8). There is a conspicuous marginal fringe of longitudinally ribbed, sharply pointed spicules up to 340 x 50 μm. Ventrally the girdle is covered with lanceolate, sharply pointed scales up to 60-100 μm.

Radula of holotype is 7.0 mm long, with 24 transverse rows of mature teeth, central tooth of radula tulip-shaped, with a narrow, slightly split blade, first lateral tooth with slender base, distally widening to a blade, major lateral with large tricuspid cap, the central denticle pointed and much longer than the others.

Gills merobranchial abanal, nephridiopore situated between last and penultimate gills, gonopore situated between penultimate and third from tail gills, holotype with 23 ctenidia on each side, gills extending from valve III to valve VII.

Variability. There is age-related and intraspecific variability in this species. Paratype (body length 10.4 mm) has slit formula 8/1/14, radula of this paratype with less differences in size of denticles of cap in major lateral tooth, and distal portion of spatulate uncinal tooth is fringed.

Dark-grey colour predominates in the type series: 26 specimens are dark-grey and 3 specimens are light-grey. Several paratypes have less developed tufts of spines in their girdle and shorter petal-shaped processes between valves than holotype.

Remarks. ***Gallardoia valdiviensis*** resembles species of *Mopalia* and *Plaxiphora* (*Fremblia*) in sculpture of tegmentum and form of spicules (*Mopalia phorminx* Berry, 1919 and *M. porifera* Pilsbry, 1893) but differs from them by the absence of caudal sinus in tail valve. New species differ from other species of family Tonicellidae by having coarser sculpture of tegmentum, the presence of two petal-shaped processes between adjacent valves, caudal notch in girdle, and caudal tuft of curved spines.

Gut of the holotype contained shells of barnacles including one whole specimen ca. 1.1 mm) and some sand. Gut of the paratype (body length 10.4 mm) contained detritus and small pieces of algae-like conferva. Taking into account that small paratypes have more delicate radula (spatulate uncinal tooth is fringed), one may speculate that small individuals of this new species feed mainly on detritus whereas adults feed mainly on small barnacles. Therefore, ***Gallardoia valdiviensis*** can be considered as epizoophagan.

Distribution. ***Gallardoia valdiviensis*** is a rather rare, shallow subtidal species living on rocky bottom often under rocky plates that lie on sandy bottom, among barnacles *Elminius kingii*, at depths of 0.5-1.5 m. It was found in two nearby localities: Punto Pilolcura and Mehuin, Provincia Valdivia, Chile.

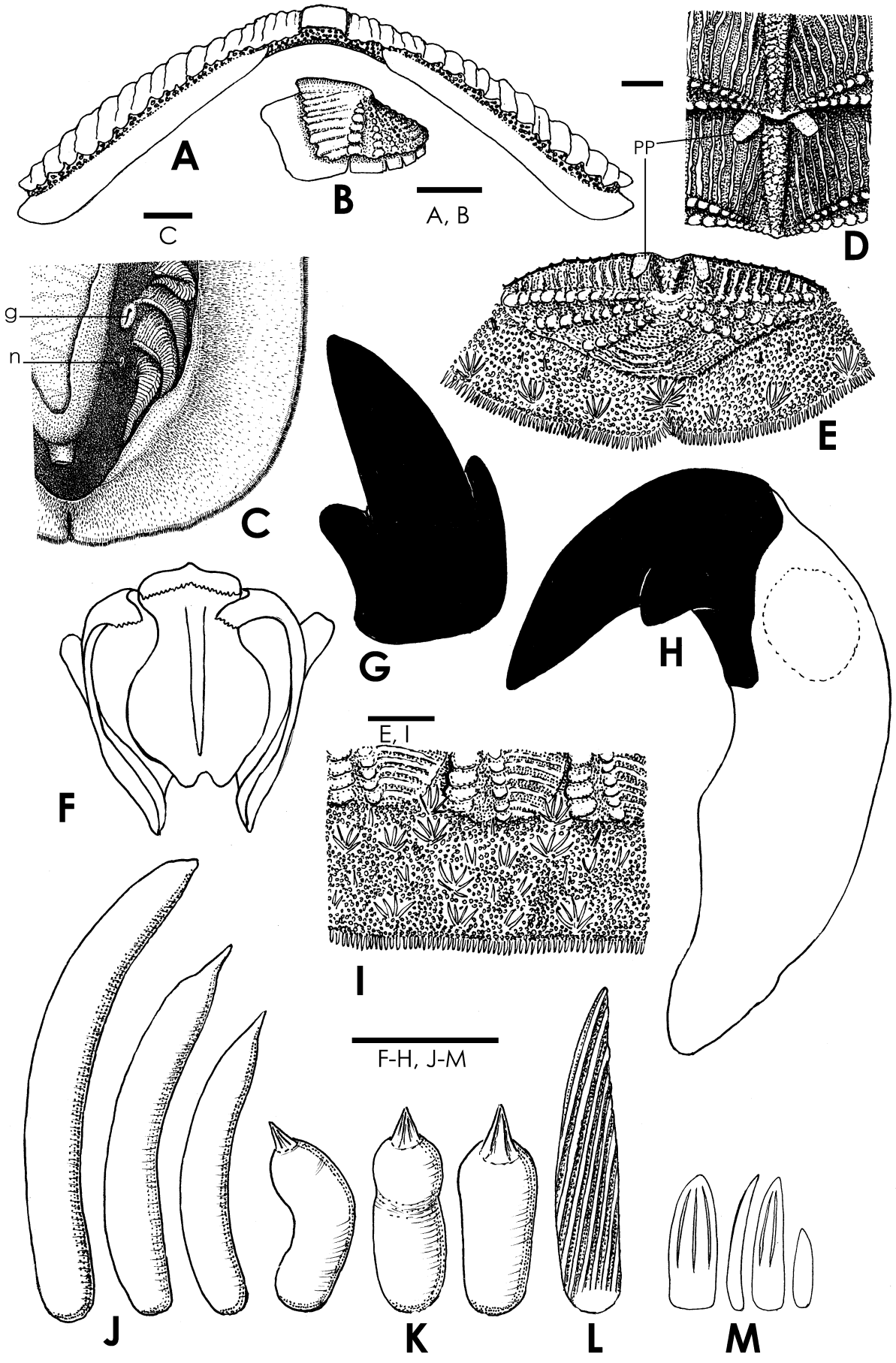
Etymology. This species was named after my good friend Prof. Dr. Carlos S. Gallardo, from the Instituto de Zoologia, Universidad Austral de Chile, Valdivia, Chile, who authored fruitful studies on the biology of Chilean marine mollusks and who invited me to visit Chile and organized my field trips where I found many species of chitons including specimens of this new genus.

Acknowledgements

I would like to thanks to Prof. Dr. Carlos S. Gallardo (Instituto de Zoologia, Universidad Austral de Chile, Valdivia) for his invitation to visit Chile and for his constant help in my field trips.

FIG. 2. ***Gallardoia valdiviensis*** gen. et sp. nov., holotype (A-C, F-H, J-M), paratype (D, E,).
A — valve V, rostral view; B — valve VIII, lateral view; C — position of nephridiopore and gonopore, ventral view of chiton; D — situation of petal-shaped processes between valves V and VI, dorsal view; E — position of caudal notch, caudal tuft in the girdle and petal-shaped processes between valves VII and VIII, dorsal view; F — central and first lateral teeth of radula; G — cap of major lateral tooth; H — major lateral tooth; I — position of tufts of curved spines in girdle near valves IV,V, VI; J — curved spines of tufts; K — dorsal spicules; L — marginal spicule; M — ventral scales, g — gonopore, n — nephridiopore, pp — petal-shaped processes. Scale bar: A-E, I — 1 mm; F-H, J-M — 100 μm.

РИС. 2. ***Gallardoia valdiviensis*** gen. et sp. nov., голотип (A-C, F-H, J-M), паратип (D, E ,I).
A — щиток V, вид спереди; B — щиток VIII, вид сбоку; C — положение нефридиопора и гонопора, вид хитона снизу; D — положение лентовидных отростков между щитками V и VI, вид хитона сверху; E — положение хвостовой выемки, хвостового пучка изогнутых шипов на перинотуме и лентовидных отростков между щитками VII и VIII, вид хитона сверху; F — центральный и первый латеральный зубы радулы; G — лезвие крючковой пластинки радулы; H — крючковая пластинка радулы; I — положение пучков изогнутых шипов на перинотуме у щитков IV, V, VI; J — изогнутые шипы пучков; K — дорсальные спикулы; L — маргинальная спикула; M — вентральные чешуйки, g — гонопор, н — нефридиопор, pp — лентовидные отростки. Масштабная линейка: A-E, I — 1 мм; F-H, J-M — 100 мкм.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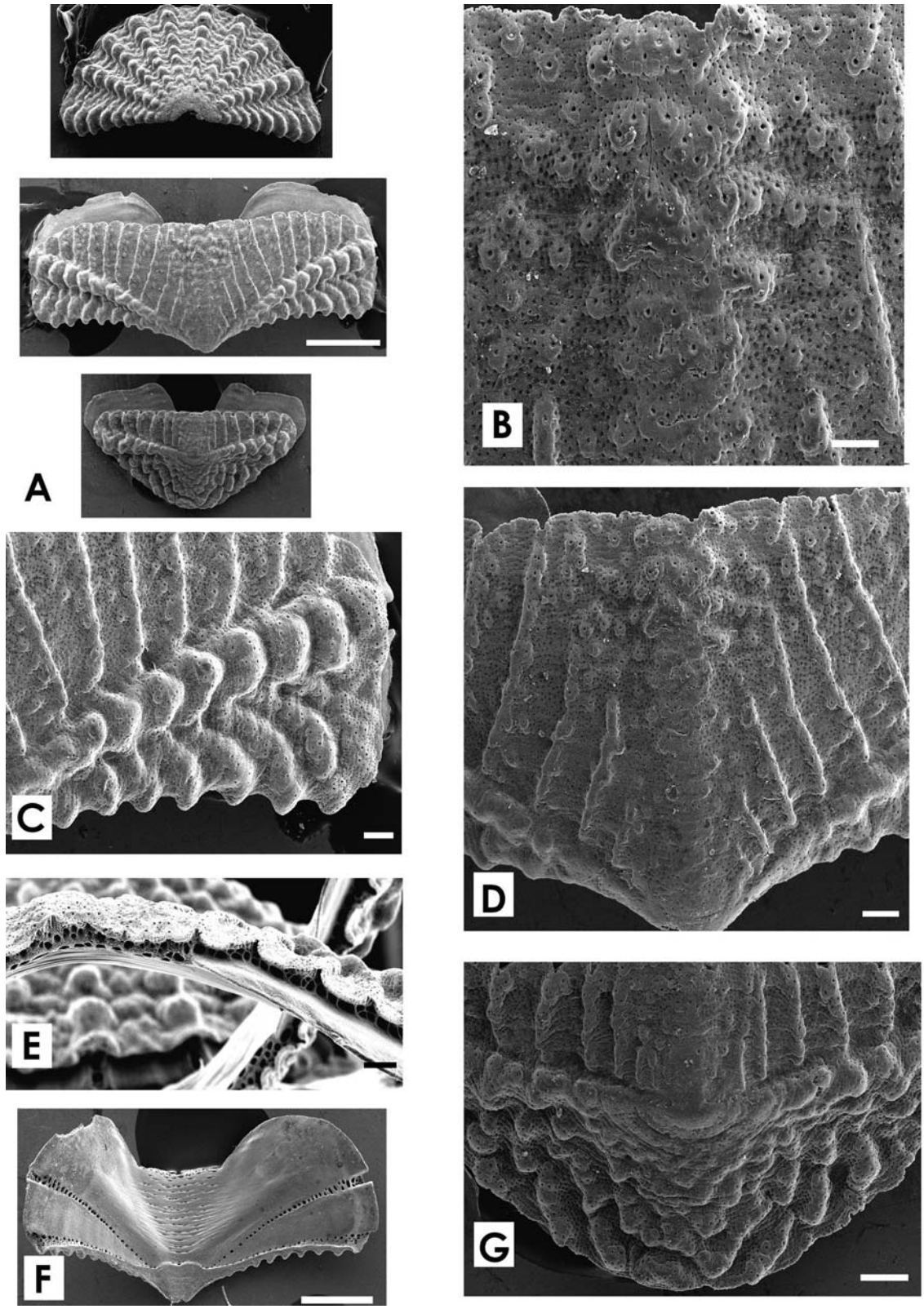

FIG. 3. ***Gallardoia valdiviensis*** gen. et sp. nov., paratype, body length 10.4 mm.
A — valves I, V and VIII, dorsal view; B — jugal area of valve V; C — lateral area of valve V; D — jugal and pleural areas of valve V; E — valve V, rostral view; F — valve IV, ventral view; G — antemucronal and postmucronal areas of valve VIII, dorsal view. Scale bar: A,F — 1 mm; B-E, G — 100 μm.

РИС. 3 ***Gallardoia valdiviensis*** gen. et sp. nov., паратип, длина тела 10,4 мм.
A — щитки I, V и VIII, вид сверху; B — югальное поле щитка V; C — боковое поле щитка V; D — югальное и плевральное поля щитка V; E — щиток V вид спереди; F — щиток VI, вид снизу; G — переднее и заднее поля щитка VIII, вид сверху; масштабная линейка: A,F — 1 мм; B-E, G — 100 мкм.

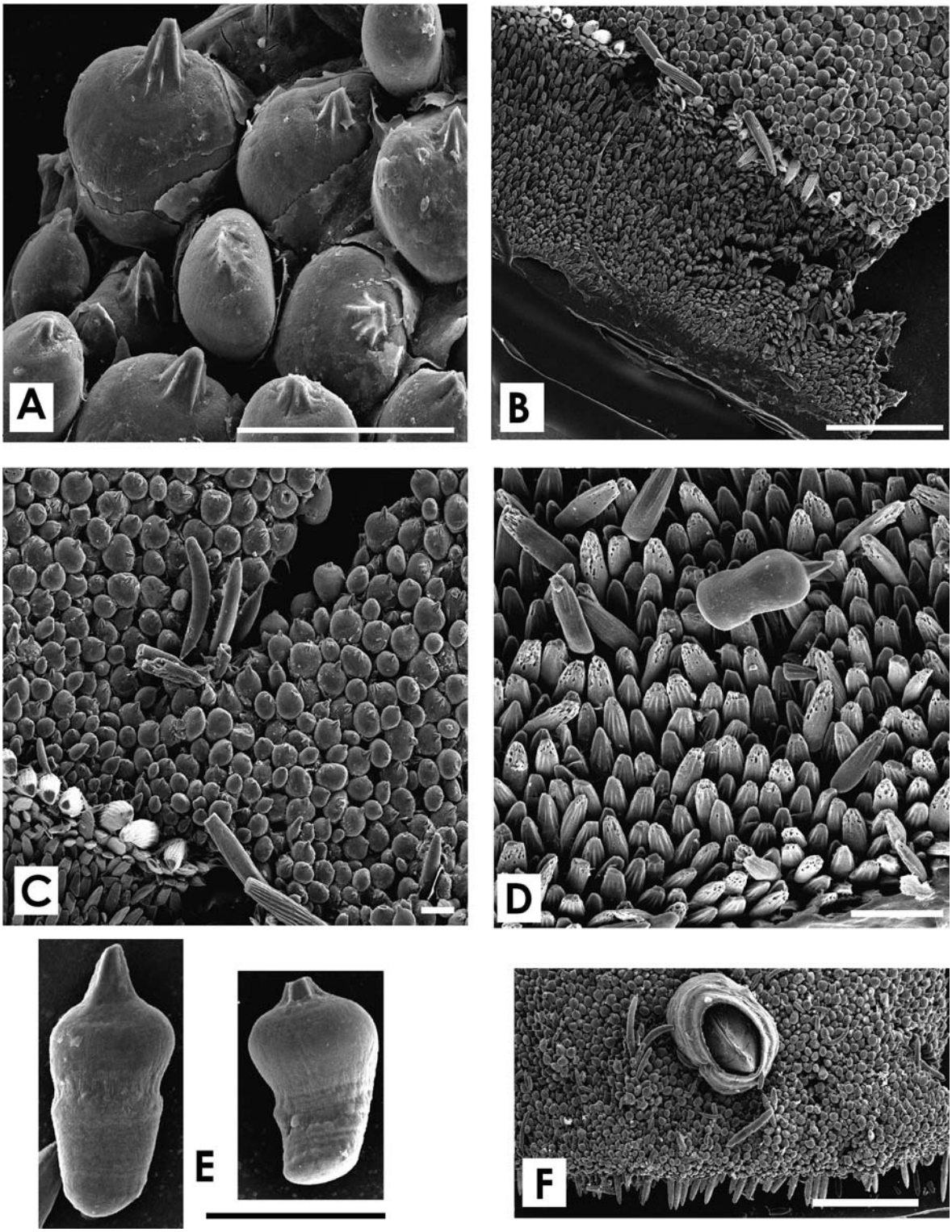

FIG. 4. ***Gallardoia valdiviensis*** gen. et sp. nov., holotype, (A-E); paratype, body length 10.4 mm (F).
A — dorsal spicules; B — dorsal and marginal spicules and ventral scales; C — dorsal and marginal spicules, ventral scales and curved spines; D — ventral scales and one dorsal spicule; E — dorsal spicules; F — prey of chitons — young barnacle sat on dorsal side of girdle of the predatory. Scale bar: A, C-E – 100 μm; B, F – 500 μm.

РИС. 4. ***Gallardoia valdiviensis*** gen. et sp. nov., голотип (A-E); паратип, длина тела 10,4 мм (F).
A — дорсальные спикулы; B — дорсальные и маргинальные спикулы и вентральные чешуйки; C — дорсальные и маргинальные спикулы, вентральные чешуйки и изогнутые шипы; D — вентральные чешуйки и одна дорсальная спикула; E — дорсальные спикулы; F — жертва хитонов — молодой балянус осел на дорсальную сторону перинотума хищника. Масштабная линейка: A, C-E – 100 мкм; B, F – 500 мкм.

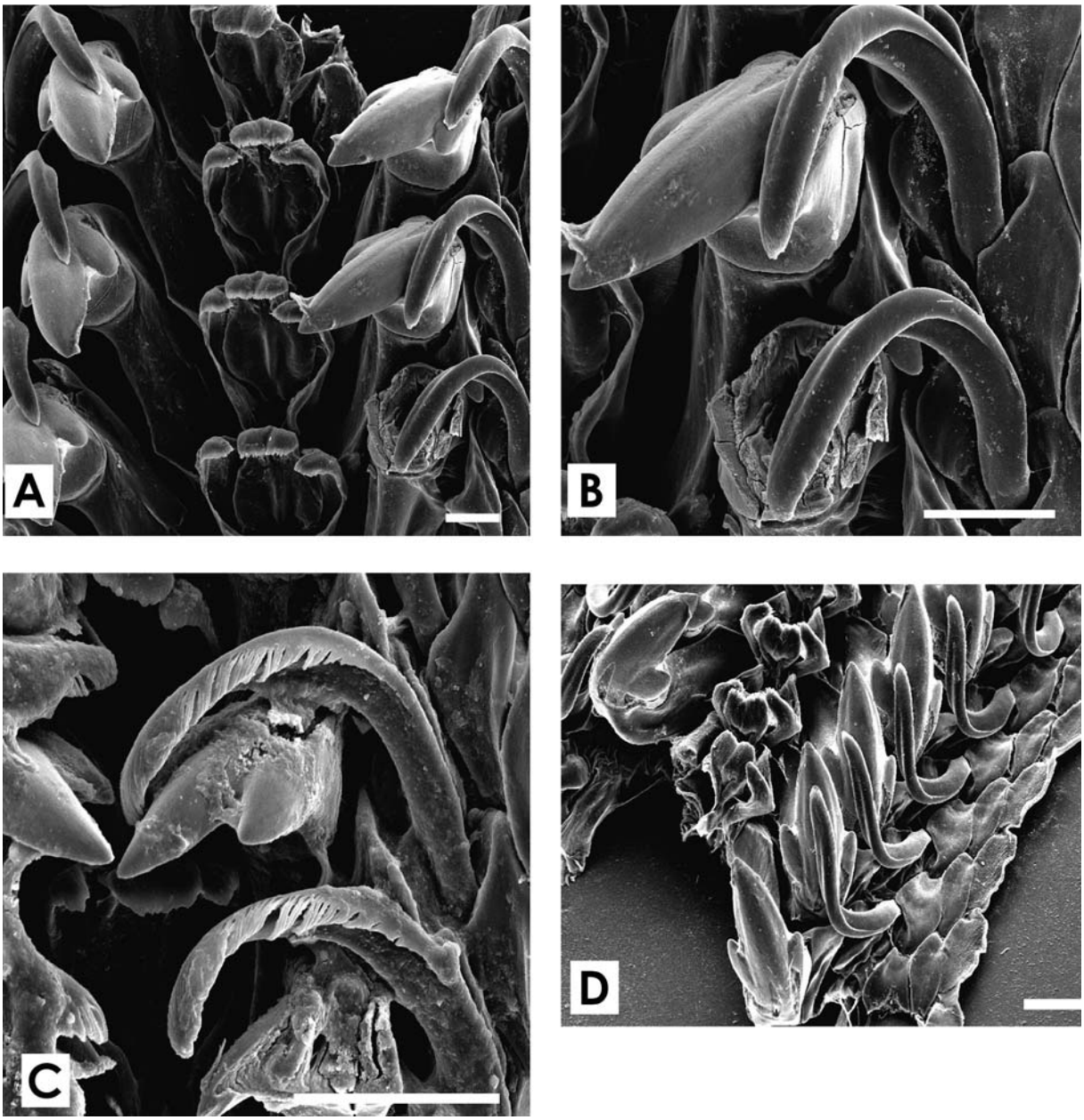

FIG. 5. ***Gallardoia valdiviensis*** gen. et sp. nov. holotype (A, B, D) and paratype, body length 10,4 мм (C).
A — central, first lateral, major lateral and spatulate uncinal teeth of radula; B, C — major lateral and spatulate uncinal teeth of radula; D — several teeth of radula, dorsal view. Scale bar: 100 μm.

РИС. 5. ***Gallardoia valdiviensis*** gen. et sp. nov., голотип (A, B, D) и паратип, длина тела 10,4 мм (C).
A — центральные промежуточные крючковые и первые маргинальные пластинки радулы; B, C — крючковые и первые маргинальные пластинки радулы; D — несколько зубов радулы, вид сверху. Масштабная линейка: 100 мкм.

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Новый чилийский хитон-эпизоофаг ***Gallardoia valdiviensis*** gen. et. sp. nov. (Mollusca, Polyplacophora).

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РЕЗЮМЕ. Описан новый род и новый вид семейства Tonicellidae. Он обитает в чилийских водах у берегов провинции Вальдивия на глубинах 0,5-1,5 м в участках, подверженных сильному прибою и с сильным прибрежным течением. Вид живет среди балянусов, которыми в основном и питается. Новый род имеет черты, характерные для родов семейства Mopaliidae, а именно *Mopalia* и *Plaxiphora* (*Fremblia*), однако у него отсутствует каудальный синус на последнем щитке и имеются два лепестковидных отростка между соседними щитками.