



## Research article

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# A new freshwater crab of the family Hymenosomatidae MacLeay, 1838 from New Caledonia (Crustacea, Decapoda, Brachyura) and an updated review of the hymenosomatid fauna of New Caledonia

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**Abstract.** A new genus and species, *Richerius marqueti* gen. et sp. nov., of a crab of the family Hymenosomatidae MacLeay, 1838 are described from the inland waters of New Caledonia based on several specimens collected in two streams at altitudes of 180 m and 500 m, respectively. *Richerius marqueti* gen. et sp. nov. was compared to the other freshwater species known in New Caledonia, *Odiomaris pilosus* (A. Milne-Edwards, 1873), and to species of *Amarinus* Lucas, 1980, a genus comprising many freshwater species in New Zealand, Australia, Indonesia, the Philippines, and Papua New Guinea, but never recorded in New Caledonia. The barcode fragment of the COI mitochondrial gene was sequenced for seven specimens of *R. marqueti* gen. et sp. nov., and all sequences were deposited in GenBank. A brief and updated review of the New Caledonian marine and freshwater hymenosomatid fauna is provided.

**Keywords.** *Richerius marqueti*, new genus, new species, New Caledonia, COI.

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## Introduction

Over the last five years, two French expeditions (Hydrobio expeditions), as part of “Our Planet Reviewed”, a major exploration program of the natural world that the Muséum national d'histoire naturelle (MNHN) has been leading since 2006, managed to collect a number of specimens belonging

to the family Hymenosomatidae MacLeay, 1838 from New Caledonia. They were caught in inland freshwaters in the North and South Provinces. To this material were added hymenosomatids obtained separately by some colleagues during previous biodiversity discovery expeditions led by the MNHN.

A hymenosomatid crab from two streams at altitudes of 180 m and 500 m, respectively, could not be assigned to the well known New Caledonian endemic freshwater species *Odiomaris pilosus* (A. Milne-Edwards, 1873) and appeared new to science. A new genus and a new species, *Richerius marqueti* gen. et sp. nov., are described within the subfamily Odiomarinae Guinot, 2011, and compared to *O. pilosus* and to the second species of the genus, *O. estuarius* Davie & Richer de Forges, 1996, exclusively brackish. The characters that differentiate *Richerius* gen. nov. from *Amarinus* Lucas, 1980, a genus known from the fresh and brackish waters of New Zealand, Australia, Indonesia, the Philippines, and Papua New Guinea, but never from New Caledonia, required a thorough examination. As the genus *Amarinus* appears to be paraphyletic, including a variable arrangement of the antennule and antenna, we have therefore limited our comparison to the type species, *A. lacustris* (Chilton, 1882), also freshwater.

## Material and methods

### Institutional abbreviations

MNHN = Muséum national d'histoire naturelle, Paris, France

RMNH = Nationaal Natuurhistorisch Museum (currently Naturalis Biodiversity Center, NBC), Leiden, the Netherlands

ZRC = Zoological Reference Collection of the Lee Kong Chian Natural History Museum (ex Raffles Museum of Biodiversity Research), National University of Singapore, Singapore

### Morphological study

Measurements are provided in millimetres and reported as carapace length (cl) × carapace width (cw), respectively. The following abbreviations are used:

cl = carapace length

cw = carapace width

G1 = male first pleopod

G2 = male second pleopod

m<sub>xp3</sub> = third maxillipeds

P1–P5 = pereopods 1–5 (P1: cheliped; P2–P5: walking legs), respectively

The terminology for carapace regions follows that proposed by Melrose (1975) and Lucas (1980), for the thoracic sternum that proposed by Guinot (2011a, 2011b). The thoracic somites are numbered from 1 to 8. Thoracic sternal sutures are referred to by the number of the two thoracic sternites involved and are therefore numbered from 1/2 to 7/8.

### DNA sequences

In order to ease future studies, we sequenced the barcode fragment of the COI mitochondrial gene (Folmer *et al.* 1994) for seven specimens of the new species *Richerius marqueti* gen. et sp. nov. (Table 1). DNA was extracted from pereopods using the semi-automatic Eppendorf epMotion 5075 robot. Fragments of the mitochondrial COI (~ 600 bp) were amplified using the standard Folmer primers (LCO1490: 5'-GGTCAACAAATCATAAAGATATTGG-3'; HCO2198: 5'-TAAACTTCAGGGTGACCAAAAAATCA-3') (Folmer *et al.* 1994). DNA amplifications were performed in 20 µl PCR reactions, containing approximately 3 ng of template DNA, 2.5 mM MgCl<sub>2</sub>, 0.26 mM of each nucleotide, 0.3 µM of each primer, 5% DMSO, 1 ng of BSA and 1.5 units of QBIOTAQ polymerase (MPBiomedicals). Amplification products were generated by an initial denaturation step

**Table 1.** Sequences data of *Richerius marqueti* gen. et sp. nov.

Collection number	Type status	Locality	GenBank number
MNHN-IU-2014-21500	Holotype	Bouïrou	MT364999
MNHN-IU-2014-21501	Paratype	Böua	MT365001
MNHN-IU-2014-21502	Paratype	Böua	MT365002
MNHN-IU-2014-21503	Paratype	Bouïrou	MT364998
MNHN-IU-2014-21504	Paratype	Bouïrou	MT365000
MNHN-IU-2014-21505	Paratype	Bouïrou	MT364996
MNHN-IU-2014-21506	Paratype	Bouïrou	MT364997

of 4 min at 94°C followed by 35 cycles of denaturation at 94°C for 30 s, annealing at 48°C for 40 s, extension at 72°C for 60 s and a final extension step at 72°C for 7 min.

PCR products were sequenced using the same primers and in both directions to ensure the accuracy of base calls. Chromatograms were edited using Geneious ver. 8 software (<http://www.geneious.com/> Kearse *et al.* 2012). All sequences were deposited in GenBank (Table 1).

## Results

### *Taxonomy account*

Infraorder Brachyura Latreille, 1802  
 Subsection Heterotremata Guinot, 1977  
 Superfamily Hymenosomatoidea MacLeay, 1838  
 Family Hymenosomatidae MacLeay, 1838  
 Subfamily Odiomarinae Guinot, 2011

Genus *Richerius* gen. nov.

urn:lsid:zoobank.org:act:5B6DC66F-A878-4511-8CF5-06DD245F1896

### Type species

*Richerius marqueti* sp. nov. by present designation.

### Diagnosis

Carapace circular to oval, width only slightly exceeding length; dorsal carapace surface not strongly outlined by grooves; only gastrodurocardiac and thoracic grooves well defined, not reaching antero- and posterolateral margins; carapace rim continuous across behind rostrum. Rostrum broadly rounded, spade-shaped, slightly deflexed but not ending in narrow triangular tip extending between antennules. Proepistome represented by ventral expansion of rostrum (and not rostrum itself). Antennules obliquely folded along hollowed ventral parts of rostrum, entirely hidden dorsally. Antennae well separated from antennules, at least at their bases; urinary article at level of moderately developed epistome. Proepistome represented by ventral expansion of rostrum (and not rostrum itself). Lower orbital margin with one

conspicuous knob, not visible dorsally. Mxp3 gaping at level of ischion/merus junction; merus and ischium broad, short, about subequal.

Sternum/pterygostome junction substantially developed due to extension of sternite 4. Milne-Edwards openings separated from chelipeds. Sternites 1 and 2 not separated by suture, with demarcation only visible on lateral margins; sternite 2 separated from sternite 3 by complete suture (suture 2/3); suture 3/4 tiny, only lateral, at level of extension of sternite 4. No longitudinal line. Sternopleonal cavity short, triangular. Pleons in both sexes without fused somites, except 6 fused to telson (pleotelson).

Male pleon widely triangular, regularly widening; pleotelson widely triangular, somewhat trilobed; intercalated plates salient, partially delineated, distinctly visible laterally. Male gonopore sternal. Press-button for pleonal-locking mechanism on lateral side of sternopleonal cavity. Female pleon oval, with five free somites plus pleotelson, discoid in ovigerous females with few, large eggs, not carried by pleopods. Vulvae located at level of sternite 6, as normally, thus not displaced anteriorly. Gonopods stout, filling most of sternopleonal cavity. G1 curved at base, otherwise with little curvature; terminal portion bearing fine setae, terminating in one lobe, without corneous process. Paired branchiosternal canal apertures posterolaterally on sternite 8, concealed.

Male chelipeds much stouter than walking legs; propodus inflated, covered with long soft setae partially extending on fingers; merus and carpus with stiff, regularly spaced setae; fingers not gaping. Female chelipeds narrow, propodus only slightly inflated, devoid of long setae; fingers very elongate and with finely denticulate cutting edges completely joined. Pereiopods in both sexes rather long, with margins bearing stiff, regularly spaced setae.

### Etymology

The genus name is in honour of Bertrand Richer de Forges for his lifetime commitment to carcinology, especially of New Caledonia, for having always been an excellent and untiring researcher, and for his friendship.

*Richerius marqueti* gen. et sp. nov.

[urn:lsid:zoobank.org:act:CFE7F3D1-10CD-4092-96C2-25B525020D85](https://zoobank.org/act:CFE7F3D1-10CD-4092-96C2-25B525020D85)

Figs 1–5

### Etymology

The species name is in honour of Gérard Marquet, who made extensive collections of freshwater crustaceans for more than 30 years in the Indo-Pacific islands and in particular in New Caledonia where he collected the new species here described, for his friendship and his constant enthusiasm in the field as well as in the laboratory.

### Type material

**Holotype** (Figs 1–2, 4)

NEW CALEDONIA • ♂, 4.9 × 5.0 mm; South Province, Bourail township, Bouïrou village, Pouéo River, tributary of the Néra; 21°26.326' S, 165°31.909' E; 180 m a.s.l.; 28 Sep. 2016; Valentin de Mazancourt and Gérard Marquet leg.; DNA voucher: CA2188; GenBank: MT364999; MNHN-IU-2014-21500.

**Paratypes**

NEW CALEDONIA – **South Province** • 1 ♂, 4.5 × 4.7 mm; same collection data as for holotype; DNA voucher: CA2189; GenBank: MT365000; MNHN-IU-2014-21504 • 1 immature; South Province, Bourail township, Bouïrou village, Pouéo River, tributary of the Néra, st. HYNC 799; 21°26.310' S, 165°31.917' E; 186 m a.s.l.; 17 Nov. 2017; “Our Planet Reviewed”, Hydrobio exped; Valentin de Mazancourt and Nicolas

Charpin leg.; MNHN-IU-2014-21188 • 1 ♀, 5.0 × 5.4 mm; same collection data as for preceding; DNA voucher: CA2185; GenBank: MT364996; MNHN-IU-2014-21505 • 1 ♂, 4.8 × 5.2 mm; same collection data as for preceding; DNA voucher: CA2186; GenBank: MT364997; MNHN-IU-2014-21506. – **North Province** • 1 ovigerous ♀, 7.0 × 7.1 mm; Houaïlou township, Creek stream, tributary of the Böua at level of the Néaoua dam, st. HYNC 1823; 21°21.890' S 165°32.683' E; 476 m a.s.l.; 9 Oct. 2017; “Our Planet Reviewed”, Hydrobio exped.; Nicolas Charpin leg.; DNA voucher: CA2197; GenBank: MT365001; MNHN-IU-2014-21501 • 1 ♂, 4.1 × 4.0 mm; same collection data as for preceding; DNA voucher: CA2198; GenBank: MT365002; MNHN-IU-2014-21502 • 3 immature specs; same collection data as for preceding; DNA voucher: CA2187; GenBak: MT364998; MNHN-IU-2014-21503.

### Comparative material

#### *Odiomaris pilosus* (A. Milne-Edwards, 1873) (Figs 6–7)

NEW CALEDONIA • 3 specs, syntypes of *Elamene* (for *Elamena*) *pilosa*, dry condition; M. Balansa leg.; MNHN-IU-2000-657 = MNHN-B657 • 3 specs, syntypes of *Elamene* (for *Elamena*) *pilosa*, in ethanol; M. Balansa leg.; MNHN-IU-2014-11869 = MNHN-B17725 • 2 specs, syntypes of *Elamene* (for *Elamena*) *pilosa*, in ethanol; M. Balansa leg.; MNHN-IU-2014-11870 = MNHN-B17726 • 2 specs, syntypes of *Elamene* (for *Elamena*) *pilosa*; RMNH D32 (see Fransen *et al.* 1997) • 2 ovigerous ♀♀; North Province, Pouébo township, Pwébalariuu stream; 20°30.135' S, 164°45.618' E; 12 m a.s.l.; 2 Feb. 2013; Laura Taillebois leg.; MNHN-IU-2017-9407 • 1 ♀; South Province, Thio township, Petit Borindi village, Ngoi River; 21°49.35'31" S, 166°27'28.23" E; 59 m a.s.l.; 16 Aug. 2017; Nicolas Charpin leg.; MNHN-IU-2018-2997 • 4 ♂♂; North Province, Kaala-Gomen township, Tegon locality, Iouanga River, st. HYNC 720; 20°41.032' S, 164°23.676' E; 4 m a.s.l.; 17 Nov. 2016; “Our Planet Reviewed”, Hydrobio exped.; Valentin de Mazancourt leg.; MNHN-IU-2018-2999.

#### *Odiomaris aff. pilosus*

See below ‘Remarks on *Odiomaris aff. pilosus* from the Iouanga River and two other streams’.

#### *Odiomaris estuarius* Davie & Richer de Forges, 1996 (Fig. 8A–B)

NEW CALEDONIA • ♂, holotype (4.5 × 4.3 mm); South Province, Dumbea estuary; 8 Dec. 1993; P. Davie and Richer de Forges leg.; MNHN-IU-2014-11855 = MNHN-B25278 • 4 ♂♂, paratypes (4.7 × 4.4 mm, 4.0 × 3.6 mm, 3.6 × 3.4 mm, 2.7 × 2.7 mm), 4 ♀♀, paratypes (5.4 × 5.0 mm, 4.1 × 3.9 mm, 4.0 × 3.5 mm, 3.8 × 3.4 mm); same collection data as for holotype; MNHN-IU-2014-11856 = MNHN-B25275.

#### *Amarinus lacustris* (Chilton, 1882)

AUSTRALIA • 2 ♂♂, 3 ♀♀; NE Tasmania, Scamander, Scamander River; 10 Feb. 1977; M. Takeda leg.; ZRC 1993.6513.6517.

#### *Neorhynchoplax euryrostris* Davie & Richer de Forges 1996 (Fig. 9A–B)

NEW CALEDONIA – **North Province** • 1 spec.; Kaala-Gomen township, Tegon locality, Iouanga River, st. HYNC 720; 20°41.032' S, 164°23.676' E; 4 m a.s.l.; 9 Nov. 2016; “Our Planet Reviewed”, Hydrobio exped.; Valentin de Mazancourt leg.; MNHN-IU-2014-21508 • 1 spec.; same collection data as for preceding; MNHN-IU-2014-21509 • 1 ♂, 1 ovigerous ♀, 1 spec.; Canala township, stream tributary of the Negropo River, st. HYNC 790; 21°30.765' S, 165°56.438' E; 4 m a.s.l.; 9 Nov. 2017; “Our Planet Reviewed”, Hydrobio exped.; Valentin de Mazancourt and Nicolas Charpin leg.; MNHN-IU-2014-21510 • 1 spec.; same collection data as for preceding; MNHN-IU-2014-21511 • 1 spec.; same collection data as for preceding; MNHN-IU-2014-21512 • 1 spec.; same collection data as for preceding; MNHN-IU-2014-21513. — **South Province** • 1 spec.; Bourail township, Rivière du Cap, st. HYNC 1801; 21°31.069' S, 165°17.287' E; 9 m a.s.l.; 4 Oct. 2017; “Our Planet Reviewed”, Hydrobio exped.; Nicolas Charpin leg.; MNHN-IU-2014-21514.

***Elamenopsis lineata*** A. Milne-Edwards, 1873

NEW CALEDONIA • ♀, holotype (2.6 × 2.0 mm); South Province, Dotio (sable du Dotio); M. Balansa leg.; MNHN-IU-2014-7783 = MNHN-B651 (see Ng & Richer de Forges 1996: 263, fig. 1a–b; Ng & Chuang 1996: 40, fig. 15a–b, e).

***Lucascinus keijibabai*** (Takeda & Miyake, 1971)

NEW CALEDONIA – South Province • 1 ♂; South Province, Thio; 1 m depth; MNHN IU-2014-7146 = MNHN-B25970 • 6 ♂♂, 7 ♀♀; Nouméa, Ricaudy Reef; MNHN IU-2014-7135 (see Poore *et al.* 2016).

***Micas minutus*** (A. Milne-Edwards, 1873)

NEW CALEDONIA • ♂, lectotype (designated by Ng & Richer de Forges 1996) (3.4 × 3.5 mm); M. Marie leg.; MNHN-IU-2014-7784 = MNHN-B656 (see Ng & Richer de Forges 1996: 265, 269, fig. 3, as MNHN-B656Sa).

***Micas falcipes*** Ng & Richer de Forges, 1996

NEW CALEDONIA • 1 ♂, paratype (2.8 × 2.7 mm), 1 ♀, paratype (3.1 × 2.6 mm); South Province, Nouméa, low tide at Ouemo; 2 Jul. 1992; B. Richer de Forges leg.; MNHN-B24915 (see Ng & Richer de Forges 1996: 269, fig. 4, as MNHN-B24915b).

***Elamena vesca*** Ng & Richer de Forges, 1996

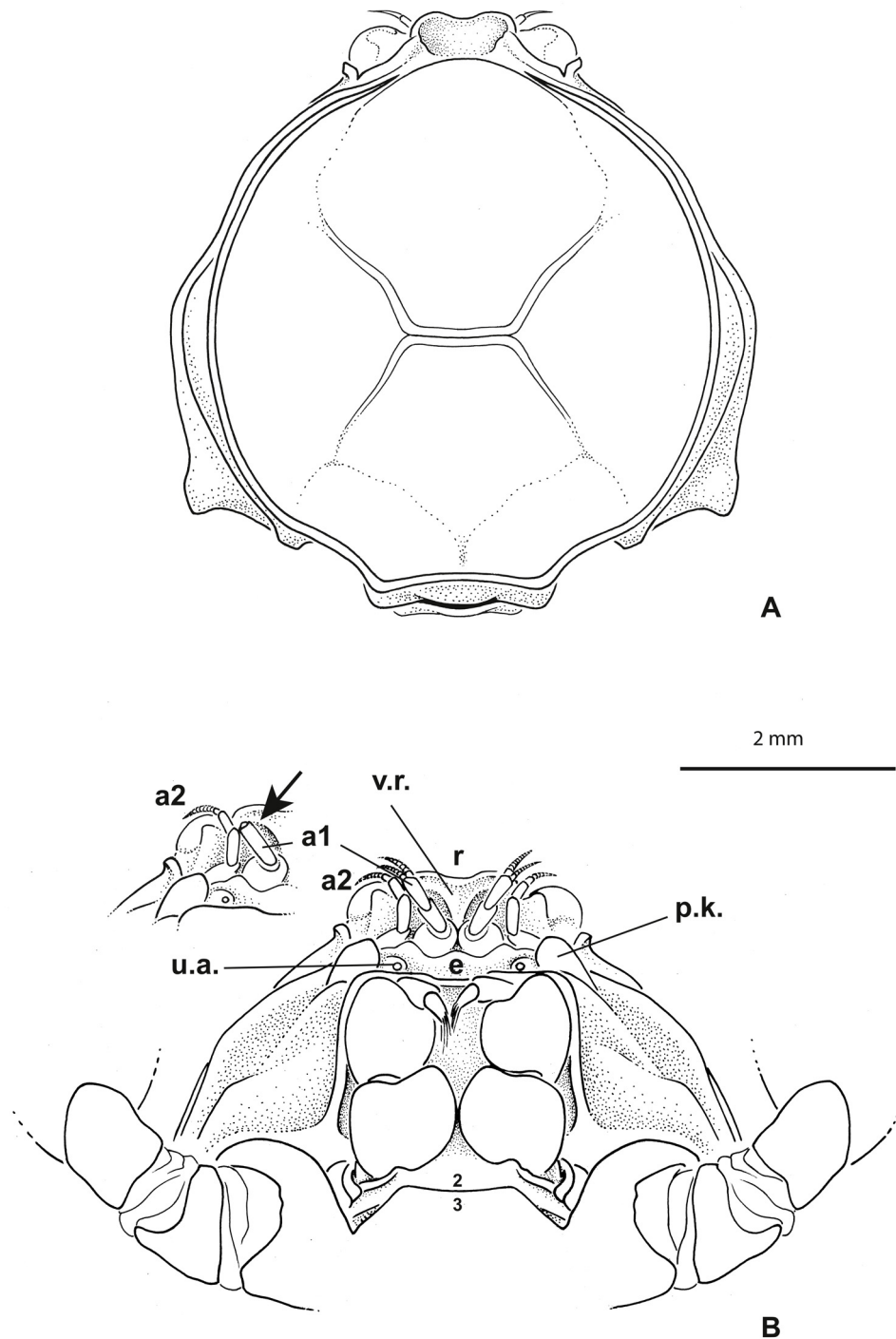
NEW CALEDONIA • ♂, holotype (6.0 × 5.4 mm); South Province, Nouméa, intertidal region, low tide at Ouemo; 2 Jul. 1992; B. Richer de Forges leg.; MNHN-IU-2014-7781 = MNHN-B22843 (see Ng & Richer de Forges 1996: fig. 8a, c–e, g–i).

## Description

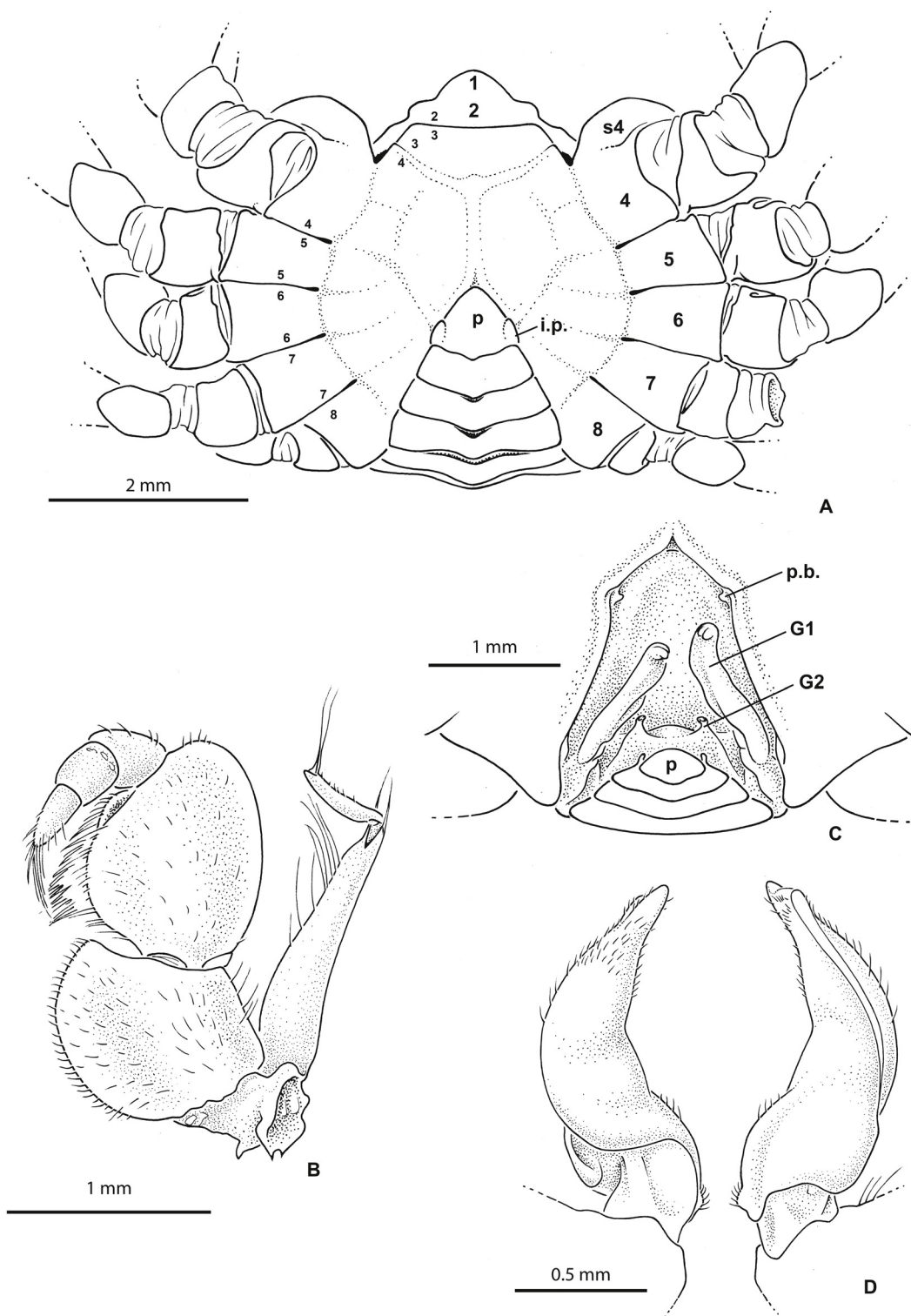
Carapace (Figs 1A, 5B) approximately circular to oval, slightly broader than long; dorsal carapace surface slightly concave, not strongly outlined by grooves, only with well defined gastrodurocardiac and thoracic grooves, approaching but not reaching antero- and posterolateral margins, respectively; no row of setae along lateral margins, except for some regularly mid-spaced setae in males; carapace angles not well marked. Anterolateral margin entire, without crenulations, lobes or teeth. Branchiostegite only weakly visible dorsally.

Eyes visible dorsally. Antennules (Fig. 1B) obliquely folded along hollowed ventral parts of rostrum and entirely hidden dorsally. Antennae well separated from antennules, at least at their bases; urinary article at level of epistome. Rostrum (Figs 1, 4, 5B–D) broadly rounded, spade-shaped, barely deflexed; dorsal surface spatulate with marked depression; carapace rim as a small ridge continuous across behind rostrum. Proepistome represented by triangular ventral expansion of rostrum (Fig. 1B). Epistome moderately developed; anterior margin undulated. Lower orbital margin with one conspicuous knob, not visible dorsally. Pterygostomial regions with setae, distinctly separated from subhepatic area by marked ridge. Mxp3 moderately gaping, broad; merus and ischium broad, short; midlength of merus slightly longer than that of ischium (Figs 1B, 2B). Sternum/pterygostome junction substantially developed due to extension of sternite 4. Milne-Edwards openings separated from chelipeds.

Male chelipeds much stouter than walking legs, particularly in large males (Fig. 4); merus and carpus with stiff, regularly spaced setae; propodus very inflated, covered with long soft setae partially extending on fingers; fingers with finely denticulate cutting edges, not gaping. Female chelipeds narrow, propodus moderately inflated, devoid of long setae; fingers proportionally rather long, with with finely denticulate cutting edges completely joined. Walking legs proportionally rather long, with margins bearing stiff, regularly spaced, scattered setae; dactyli slender but not distinctly longer than respective propodi, smoothly curved, setose, without teeth, ending in pointed tip.

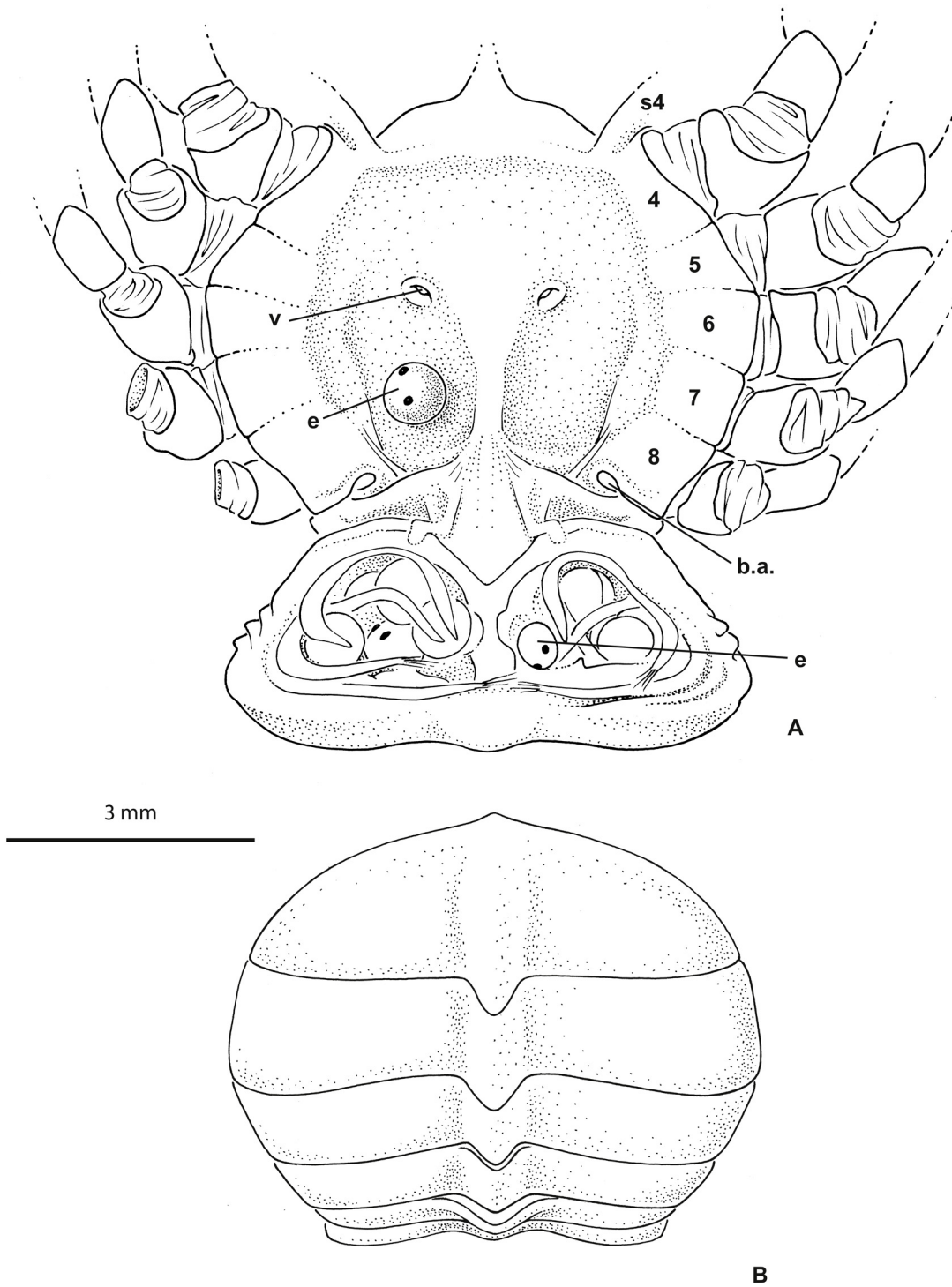


**Fig. 1.** *Richerius marqueti* gen. et sp. nov., holotype, ♂, New Caledonia, South Province, 21°26.326' S, 165°31.909' E, Pouéo River, tributary of the Néra, Bouïrou village, Bourail township, 180 m a.s.l., Valentin de Mazancourt and Gérard Marquet leg., 28 Sep. 2016, 4.9 × 5.0 mm (MNHN-IU-2014-21500). **A.** Carapace, dorsal view. **B.** Cephalothorax, ventral view, anterior part, with unfolded antennules, the arrow shows antennule with folded second article. Abbreviations: a1 = antennule; a2 = antenna; e = epistome; p.k. = postorbital knob; r = rostrum; u.a. = antennal urinary article; v.r. = ventral expansion of rostrum; 2/3 = thoracic sternal suture 2/3. Scale bar = 2 mm.



**Fig. 2.** *Richerius marqueti* gen. et sp. nov., holotype, ♂, 4.9 × 5.0 mm (MNHN-IU-2014-21500), same collection data as Fig. 1. **A.** Thoracic sternum. **B.** Mxp3. **C.** Sternopleonal cavity with G1s. **D.** G1, two views. Abbreviations: G1 = gonopod 1; G2 = gonopod 2; i = intercalated platelets; p = pleotelson; p.b. = press-button; s4 = expansion of sternite 4; 1–8 = thoracic sternites 1–8; 2/3–7/8 = thoracic sternal sutures 2/3–7/8. Scale bars: A = 2 mm; B–C = 1 mm; D = 0.5 mm.





**Fig. 3.** *Richerius marqueti* gen. et sp. nov., paratype, ovigerous ♀, New Caledonia: North Province, 21°21.890' S, 165°32.683' E, Creek stream, tributary of the Bōua at level of the Néaoua dam, Houaïlou township, st. HYNC 1823, 476 m a.s.l., “Our Planet Reviewed”, Hydrobio Expedition, Nicolas Charpin leg., 9 Oct. 2017, 7.0 × 7.1 mm (MNHN-IU-2014-21501). **A.** Thoracic sternum, with lowered pleon. **B.** Pleon. Abbreviations: b.a. = branchiosternal aperture; e = egg; s4 = expansion of sternite 4; v = vulva; 4–8 = thoracic sternites 4–8. Scale bar = 3 mm.

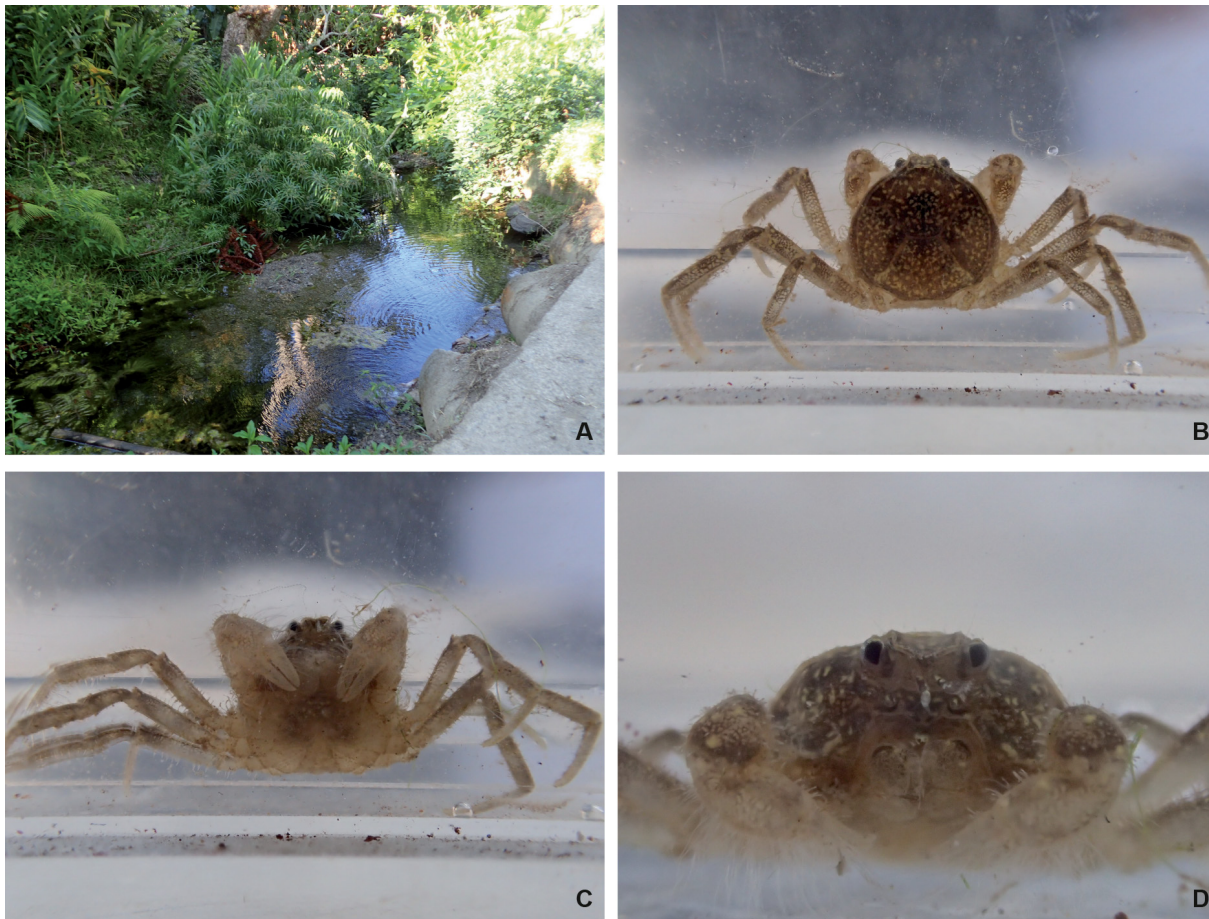


**Fig. 4.** *Richerius marqueti* gen. et sp. nov., holotype, ♂, New Caledonia, South Province, 21°26.326' S, 165°31.909' E, Pouéo River, tributary of the Néra, Bouïrou village, Bourail township, 180 m a.s.l., Valentin de Mazancourt and Gérard Marquet leg., 28 Sep. 2016, 4.9 × 5.0 mm (MNHN-IU-2014-21500). **A.** Dorsal view. **B.** Ventral view. Scale bars = 2 mm.

Thoracic sternum of male (Fig. 2A) with sternites 4–8 considerably enlarged, with suture 4/5 to 7/8 laterally confined. Sternites 1 and 2 not separated by suture but their demarcation visible on lateral margins; sternite 2 separated from sternite 3 by complete suture; sternite 3 as narrow pentagonal band; suture 3/4 tiny, only lateral, just at level of extension of sternite 4. No longitudinal line. Paired branchiosternal canal apertures located posterolaterally on sternite 8, concealed by pleon (Fig. 3A).

Sternopleonal cavity of male short, triangular, deep (Fig. 2C). Pleons in both sexes (Figs 2A, 3B) without fused somites, except 6 fused to telson, thus five somites plus pleotelson. Male pleon widely triangular, regularly widening from base to pleotelson; pleotelson widely triangular, somewhat trilobed, with intercalated plates partially delineated, salient and visible laterally at base, partially included. Press-button on lateral side of sternopleonal cavity (Fig. 2C). Male gonopore sternal.

Female pleon (Fig. 3A–B) oval to expanded in ovigerous females. Female pleopods 2–5 biramous. Ovigerous females with very few and large eggs measuring 0.96 mm in diameter (Fig. 3A). Vulvae located on undivided portion of thoracic sternum corresponding to sternite 6, thus not displaced anteriorly.



**Fig. 5.** *Richerius marqueti* gen. et sp. nov., holotype, ♂, New Caledonia, South Province, 21°26.326' S, 165°31.909' E, Pouéo River, tributary of the Néra, Bouïrou village, Bourail township, 180 m a.s.l., Valentin de Mazancourt and Gérard Marquet leg., 28 Sep. 2016, 4.9 × 5.0 mm (MNHN-IU-2014-21500). **A.** Type locality, stream where several specimens of the species were collected. **B–D.** Views of the holotype in vivo: dorsal (B), ventral (C) and frontal (D).

First gonopods stout, practically filling most of sternopleonal cavity (Fig. 2C). G1 curved at base, otherwise with little curvature, with terminal portion bearing fine setae, terminating in one lobe, without corneous process (Fig. 2D).

### Colour

In life (Fig. 5B–D), the colour is overall brown, mottled with yellowish dots.

### Distribution

*Richerius marqueti* gen. et sp. nov. is exclusively known from freshwaters in small flowing streams where it lives among the aquatic vegetation (Fig. 5A). It is found at an altitude of up 500 m, therefore further from the sea than *Odiomaris pilosus* (that is usually encountered in the lower course of rivers). By comparison, *Amarinus lacustris* (Chilton, 1882) has been reported from New Zealand freshwaters from Lord Howe Island at altitudes between 61–92 m (Etheridge 1889) and even about 800–900 m (Chilton 1915; Holthuis 1968); *A. angelicus* Holthuis, 1968, from the central mountain range of Papua New Guinea, was collected in pure freshwater of a watercress swamp at an altitude of 1600 m (Holthuis 1968, 1982).

### Remarks

The subfamily Odiomarinae was erected by Guinot (2011a) to receive two genera of the family Hymenosomatidae characterised by the presence on the male pleon of intercalated platelets, either articulated and moveable (Guinot 2011a: fig. 2) or relatively less well-demarcated: *Odiomaris* Ng & Richer de Forges, 1996, endemic to New Caledonia, and *Amarinu* (at least *pro parte*), mostly from fresh and estuarine waters of the Indo-West Pacific region. *Richerius* gen. nov. shows several plesiomorphic characters that include the male and female pleons without fused somites (except for pleotelson), thus consisting of six elements (namely the maximum of somites existing in Hymenosomatidae), the prominent, partially demarcated intercalated platelets, the thoracic sternum with the anterior sternites forming a small produced plate, the vulvae not anteriorly displaced, the G1 only gently curved and simple. *Richerius* gen. nov. can be assigned to the Odiomarinae.

*Odiomaris* is known from two species: the type species *Elamena pilosa* A. Milne-Edwards, 1873, referred to as *Halicarcinus* White, 1846 by Holthuis (1968), as *Amarinus* by Lucas (1980) then as *Odiomaris* by Ng & Richer de Forges (1996), mainly freshwater but also euryhaline; and *O. estuarius* Davie & Richer de Forges, 1996, exclusively brackish. An important difference between these two species is the rostrum: it is lowered ventrally as a triangular, V-shaped projection in *O. pilosus* so as to be positioned between the antennules (Fig. 7A) (A. Milne-Edwards 1873: pl. 18, fig. 6a, as *Elamene pilosa*; Ng & Richer de Forges 1996: fig. 6c–d), whereas it is spatulate and does not extend to form a ventral projection between the antennules in *O. estuarius* (Fig. 8A–B) (Davie & Richer de Forges 1996: fig. 1a–b).

*Richerius* gen. nov. shares with *Odiomaris* the same arrangement of the cephalic appendices. But its rostrum is spatulate without folding down ventrally (Figs 1, 4, 5D), instead of being lowered ventrally as a V-shaped projection located between the antennules as in *Odiomaris pilosus* (Fig. 7A). In *Richerius* gen. nov. (Fig. 1B), the proepistome is represented by a ventral expansion of the rostrum; therefore, the antennules are located along the proepistome, whereas in *Odiomaris pilosus* the antennules are obliquely folded in a fossa hollowed all along with the lateral parts of the V-shaped rostrum and the eye. *Richerius marqueti* gen. et sp. nov. actually has a rostrum and proepistome more similar to those of *O. estuarius* (Fig. 8) (Davie & Richer de Forges 1996: fig. 1) than to those of *O. pilosus*. In fact, the genus-level differences between *Richerius* gen. nov. and *Odiomaris* remain unclear. Actually, *O. estuarius* seems morphologically closer to *Richerius* gen. nov. than to *O. pilosus*, at least in some

characteristics. A possible transfer of *O. estuarius* to *Richerius* gen. nov. has been considered but needs to be decided later, especially when the status of *Odiomaris* aff. *pilosus* is resolved (see below, ‘Remarks on *Odiomaris* aff. *pilosus* from the Iouanga River and two other streams’).

Along the lower orbital margin there are two salient knobs in both species of *Odiomaris*, both prominent in dorsal view in *O. pilosus* (A. Milne-Edwards 1873: pl. 18, fig. 6a; Ng & Richer de Forges 1996: fig. 6a, d, not figured in fig. 6c; Guinot & Richer de Forges 1997: figs 1a, c, 2c), but shorter and not dorsally visible in *O. estuarius* (Davie & Richer de Forges 1996: fig. 1a; not figured in fig. 1b). In contrast, there is only one, smaller knob in *Richerius* gen. nov. (Fig. 1B). The cheliped palm of *R. marqueti* gen. et sp. nov. is covered with long, flexible setae (Fig. 5C–D), instead of numerous spinules (or stiff setae) in *O. pilosus* (Fig. 6) (A. Milne-Edwards, 1873: pl. 18, fig. 6d; Ng & Richer de Forges 1996: fig. 6f), and sparse, short setae in *O. estuarius* (Fig. 8). In fact, the whole body (including the margins of the rostrum) and legs of *O. pilosus* are covered with spiniform, stiff setae that give a bristle appearance (Ng & Richer de Forges 1996: figs 5a–b, 6a, d; Guinot & Richer de Forges 1997: fig. 1a), whereas *O. estuarius* has a carapace with soft, short setae and legs with longer setae (Davie & Richer de Forges 1996: fig. 1a). The male cheliped fingers are practically joining in *R. marqueti* gen. et sp. nov. (Fig. 5C), but with a broad proximal gap in *O. pilosus* (Fig. 6A–B) (A. Milne-Edwards 1873: 322, pl. 18, fig. 6, 6d, as *Elamene pilosa*; Ng & Richer de Forges 1996: fig. 6f); in *O. estuarius* the chelae are narrower, with long fingers without marked gap (Fig. 8A–B) (Davie & Richer de Forges 1996: fig. 1). The grooves on the carapace dorsal surface are very distinct in *O. pilosus*, well marked in *R. marqueti* gen. et sp. nov., whereas almost indiscernible in *O. estuarius*. The sterno-pleonal cavity is short in *Richerius* gen. nov. and in *Odiomaris*, and accordingly the pleon also. The male pleon is as a narrow triangle, with a long pleotelson in both *Odiomaris* species (A. Milne-Edwards 1873: pl. 18, fig. 6b, as *Elamene pilosa*; Ng & Richer de Forges 1996: fig. 7a–b; Guinot & Richer de Forges 1997: fig. 2a: *O. pilosus*; Davie & Richer de Forges 1996: fig. 2c: *O. estuarius*), markedly wider and with a much shorter pleotelson in *R. marqueti* gen. et sp. nov. (Fig. 2A). The intercalated platelets, which are completely demarcated and moveable in *O. pilosus* (Guinot 2011a: fig. 2), are only partially delineated in *R. marqueti* gen. et sp. nov., and not detached in *O. estuarius*. The female pleon is rather similar in *Richerius* gen. nov. and *Odiomaris*, with five somites plus pleotelson. The G1 of *Richerius* gen. nov. (Fig. 2D) is curved at the base, otherwise with little curvature, with a terminal portion bearing fine setae and ending in one lobe without corneous process, whereas the G1 of *Odiomaris* is characterised by two distinct distal processes, a longer corneous process and a shorter lobular elongation of the stem (Fig. 7B: *O. pilosus*) (Ng & Richer de Forges 1996: fig. 7c–d: *O. pilosus*; Davie & Richer de Forges 1996: fig. 2c: *O. estuarius*). *O. estuarius* is a much smaller species than *O. pilosus*, and *R. marqueti* gen. et sp. nov. seems to be nearly as small as *O. estuarius*.

The main differences to distinguish the two genera *Odiomaris* and *Amarinus* stated by Davie & Richer de Forges (1996: 259) were: 1) in *Odiomaris*, the G1 (see Fig. 7B) more slender, with two distinct distal processes, a longer corneous process and a shorter lobular elongation of the stem than in *Amarinus*; 2) in *Odiomaris*, the elongated triangular telson of the male pleon is significantly longer than wide at base, whereas in *Amarinus* the telson is more or less rounded and short, being much wider than long.

The genus *Amarinus* Lucas, 1980 (type species by original designation: *Elamena lacustris* Chilton, 1882) is known from more than ten species. They all inhabit low salinity environments, from brackish habitats to pure freshwater waters permanently (streams, lakes, swamps), and have a large distribution (New Zealand, Australia, Indonesia, the Philippines, Papua New Guinea). Cases where *Amarinus* has been reported from New Caledonia, as in Chuang & Ng (1994: 87, 90, table 1, under *A. pilosus*) and erroneously as in Guinot (2011a: 23), are attributable to the fact that the species *pilosus* was previously associated with the genus *Amarinus* (see Lucas 1980) until Ng & Richer de Forges (1996) made it the type species of their new genus *Odiomaris*. So far, no species of *Amarinus* has actually been reported in New Caledonia. Suspecting that our new species might belong to the genus *Amarinus*, we therefore

carefully compared *Richerius* gen. nov. to *Amarinus*, and in particular to its type species, *A. lacustris*, another freshwater hymenosomatid.

*Richerius marqueti* gen. et sp. nov. can be distinguished from *Amarinus lacustris* by: the wide male pleon, with prominent marks corresponding to intercalated platelets (Fig. 2A) (versus narrow and without intercalated platelets in *A. lacustris*, see Melrose 1975: fig. 42g; Lucas 1980: fig. 7b); the G1 rather narrow and with one distal lobe without corneous process (Fig. 2D) (versus stout and without lobes, see Melrose 1975: fig. 42h–i; Lucas 1980: fig. 10e); and by the arrangement of antennules and antennae.

In providing a key of the Southeast Asian hymenosomatids, Ng & Chuang (1996: 3–5, 6–12) have shown the presence of several groups of species within *Amarinus*, suggesting that the genus could be paraphyletic. Today, another problem arises, especially regarding the antennular morphology. Melrose (1975: 84, 87, figs 41–42, as *Halicarcinus lacustris*), who has thoroughly studied the type species *A. lacustris*, confined to lakes and non-tidal rivers of New Zealand and southeastern Australia, states that the antennules are “small, not visible dorsally when folded”. Her figure 41d actually seems to show a folded antennule, only with the broad basal article and the second cylindrical article, without the short, supposedly folded flagellum being seen [the frontal view of fig. 41e in Melrose (1975) shows a complete, unfolded antennule]. Our examination of *Amarinus lacustris*, on the other hand, reveals that both antennules and antennae are inserted very closely together at their bases and remain parallel, with both flagella visible dorsally, as represented by Lucas (1980: fig. 1d) for a generalised hymenosomatid or by Melrose (1975: fig. 43c) for *Halicarcinus tongi* Melrose, 1975. In fact, if it is possible for the antennule of *A. lacustris* to fold itself down [but not obliquely along the rostrum as in *Odiomaris* (Fig. 7A), see A. Milne-Edwards 1873: pl. 18, fig. 6a], this does not correspond to the resting position. In the seven specimens of *A. lacustris* examined, the antennule and antenna are very closely inserted and remain parallel, both being stretched forward; the unfolded flagellum is visible dorsally in all individuals. In any event, the disposition of the antennule and antenna differs from that *Odiomaris* (Fig. 7A: *O. pilosus*) (Ng & Richer de Forges 1996: fig. 6c–d: *O. pilosus*).

A picture of the cephalic region in ventral view of *Amarinus angelicus* (Holthuis 1968: 114, fig. 2b) shows an antennule “entirely hidden below the rostrum”, obliquely folded, which does not seem to correspond to the condition of *A. lacustris*. This character deserves to be reviewed for all species of *Amarinus*, and the allocation of *Amarinus* (including the type species and other included species) to the Odiomarinae needs further investigation. In the new species described here, *Richerius marqueti* gen. et sp. nov. (Fig. 1B), the antennule and antenna are separated at least at their insertion site, and only the antennal flagellum is visible dorsally; thus it shares an arrangement substantially similar to that of *Odiomaris*.

It was the study of spermatozoa carried out first in the two species of *Odiomaris*, *O. pilosus* and *O. estuarius*, by Richer de Forges *et al.* (1997) and later in *Elamena vesca* by Jamieson & Tudge (2000) that showed the very particular nature of the hymenosomatid sperm within the Brachyura. Indeed, they are distinguished by at least nine major characteristics from those of all the other Brachyura taxa studied, particularly the groups with which they have been associated, the Majoidea Samouelle, 1819 and the Thoracotremata Guinot, 1977. The ‘hymenosomatid-type of spermatozoon’ is unique within Brachyura (Tudge *et al.* 2014). The highly developed projection of the acrosome from the nucleus in hymenosomatid spermatozoon recalls the totally emergent acrosome of Podotremata Guinot, 1977 and may represent the plesiomorphic condition in the Eubrachyura Saint Laurent, 1980 (Guinot 2011a, 2011b).

### **Remarks on *Odiomaris aff. pilosus* from the Iouanga River and two other streams**

A lot of specimens obtained belatedly in the course of our research poses a problem: collected in the Iouanga River on 17 November 2016 (see Fig. 10) (MNHN-IU-2018-2999) and previously identified

to *Odiomaris pilosus*, they split into two species: four males are certainly *O. pilosus*, but about twenty individuals of various sizes (a few males and a larger number of females) do not correspond either to this species or to *Richerius marqueti* gen. et sp. nov.; nor is it identifiable with *Odiomaris estuarius*. The same unidentified species was found in another stream of the North Province and is believed to inhabit another stream in the South Province (Fig. 10) (manuscript in progress).

### Material examined

NEW CALEDONIA – **North Province** • 8 ♂♂, 7 ovigerous ♀♀, 13 subadults and immatures; Kaala-Gomen township, Tegon locality, Iouanga River, st. HYNC 720; 20°41.032' S, 164°23.676' E; 4 m a.s.l.; 17 Nov. 2016; “Our Planet Reviewed”, Hydrobio exped.; Valentin de Mazancourt leg.; MNHN-IU-2018-2999 • 1 ♂; Canala township, stream tributary of the Negropo River, st. HYNC 790; 21°30.765' S, 165°56.438' E; 4 m a.s.l.; 9 Nov. 2017; “Our Planet Reviewed”, Hydrobio exped.; Valentin de Mazancourt and Nicolas Charpin leg.; MNHN-IU-2018-3001.

### *The hymenosomatid fauna of New Caledonia*

The checklist of brachyuran crabs from New Caledonia (the area considered included the Loyalty Islands, Chesterfield and Bellona Plateau and Lord Howe seamounts, Matthew & Hunter Islands as well as the Norfolk Ridge seamounts) established by Ng & Richer de Forges (2007) included 558 species. New Caledonia (Fig. 10), a very old, isolated Darwinian island dating to 37 Ma (Grandcolas *et al.* 2008), does not host any of the exclusively freshwater crabs that undergo direct development and belong to various primarily freshwater families (Yeo *et al.* 2008). But crabs found in freshwater include also numerous euryhaline species or secondary freshwater species from primarily marine brachyuran stock, such as *Australocarcinus kanaka* Davie & Guinot, 1996 (Chasmocarcinidae Serène, 1964, Troglolacinae Guinot, 1986) recorded up to 400 m above sea level in various New Caledonian freshwater habitats (Davie & Guinot 1996). This is also the case of some species of the family Hymenosomatidae that, with 119 species in 19 genera (updated from Ng *et al.* 2008: 108; Davie *et al.* 2015b) distributed worldwide (also throughout the southern hemisphere, also circumpolar in the subantarctic region), is found in a wide variety of environments: from the open ocean: 244 m depth from Taupo Seamount, Tasman Sea, for *Micas lucasi* (Richer de Forges, 1993) (Richer de Forges 1993, as *Halicarcinus lucasi*); about 500 m depth for *Halicarcinus tongi* Melrose, 1975 (Melrose 1975); estuarine and brackish waters (Lucas & Davie 1982); inland freshwaters (e.g., Lucas 1980; Lucas & Davie 1982; McLay 1988; Ng & Chuang 1996); swamps at an altitude of 1600 m (Holthuis 1968); pools of arid zones (Kemp 1917; Ali *et al.* 1995; 2000); caves (Ng 1991; Naruse *et al.* 2008b); it may be also symbiotic with echinoderms (Lucas 1980; Poore 2004). Hymenosomatids are probably the most ecologically diverse group of crabs, indicative of successful morphological adaptations (Guinot 2011a). Freshwater taxa are present everywhere (including the Philippines, India, Sulawesi, New Guinea, New Caledonia, Australia and New Zealand).

Hymenosomatids have no more than three stages zoeae in marine species and display unique characters, including the absence of a megalopa stage in the larval development of all its members, as well as occurrence in marine, brackish and freshwater habitats (Rice 1980, 1981a, 1981b, 1983; Fukuda 1981; Rabalais & Gore 1985; Krishnan & Kannupandi 1988; Dornelas *et al.* 2003; Guinot 2011a, 2011b). Some estuarine species and all freshwater species have a direct development (Lucas 1971; Chuang & Ng 1994; Wear & Fielder 1985): for example, *Amarinus lacustris* is known to carry ca 35 eggs (Lucas 1980: 202, table 4); the cave-dwelling *Sulaplax ensifer* Naruse, Ng & Guinot, 2008 possesses the largest eggs (mean 1.19 mm, n = 10) and the smallest clutch size (17 eggs) known for any hymenosomatid crab (Naruse *et al.* 2008b). The troglobitic *Cancrocaeca xenomorpha* Ng, 1991, from Sulawesi and confined to freshwater and most common on pieces of driftwood brought into the caves by rivers, can only have a direct development (Ng 1991; Chuang & Ng 1994; Naruse *et al.* 2008a). A female of *Neorhynchoplax bovis* (Barnard, 1946), an estuarine species, contained 13 juveniles under the pleon (Barnard 1950: 72, as



**Fig. 6.** *Odiomaris pilosus* A. Milne-Edwards, 1873, living specimens. **A.** Collected from the river Hiit (North Province, Hienghène township). **B.** Collected from the Baie Nord creek (South Province, Mont-Dore township). Credit: Nicolas Charpin – Photographies Vies d'Ô douce.



*Rhynchoplax bovis*). In lower Mesopotamia, Iraq, *Elamenopsis kempi* is adapted to live among branches of a water plant in a habitat of oligohaline brackish water with a salinity of 1.3–2.7‰ and a temperature range of 12–35°C (Chuang & Ng 1994; Ali *et al.* 1995, 2000). Considering the habits and habitat of the New Caledonian freshwater species *Odiomaris pilosus* and *Richerius marqueti* gen. et sp. nov., which live even further from the sea and are found above sea level and even at relatively high altitude, it is likely that both have direct development. A few large eggs of about 1.0 mm in diameter and forming a small clutch are present under the female pleon of *R. marqueti* gen. et sp. nov. (Fig. 3A).

The present revision of the taxonomy of all the species of Hymenosomatidae known so far from New Caledonia provides interesting results. Until 1996, all species in New Caledonia had been known for more than 140 years, each described by A. Milne-Edwards (1873). And, with the exception of *Elamenopsis lineata* A. Milne-Edwards, 1873 that has remained unchanged over these years, all were assigned to new genera by Davie & Richer de Forges (1996), Ng & Richer de Forges (1996), Poore *et al.* (2016) and Komai & Poore (2016).

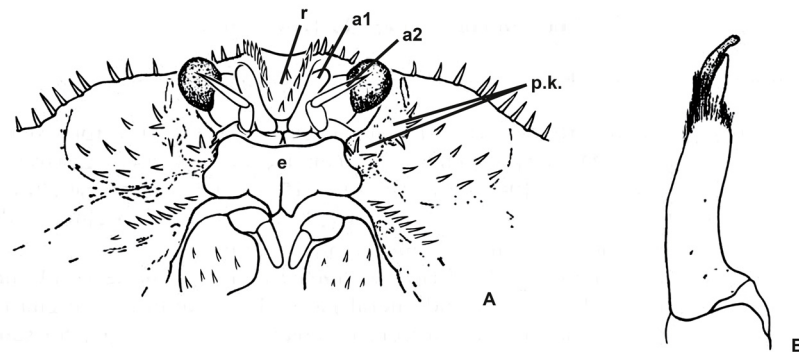
The hymenosomatid fauna of New Caledonia comprises secondary freshwater, brackish and marine species. To date, only one species, *Odiomaris pilosus*, has been known from shallow fresh waters of the Island, from the estuary inland for several kilometres, in rivers with rapid currents. *Richerius marqueti* gen. et sp. nov. is a more inland species found in two streams at 180 m and 500 m of altitude. A third species, here tentatively named *Odiomaris* aff. *pilosus*, also inhabits streams but close to the sea and is euryhaline (manuscript in progress).

It should be noted our revision is preliminary, as recent expeditions (KOUMAC 2018, 2019), aimed at updating the marine biodiversity inventory of New Caledonia, show the existence of more taxa to be studied.

The currently known genera and species are as follows.

Genus *Odiomaris* Ng & Richer de Forges, 1996

Type species by original designation: *Elamena pilosa* A. Milne-Edwards, 1873. With two species: *O. pilosus* (A. Milne-Edwards, 1873) and *O. estuarius* Davie & Richer de Forges, 1996, both described from New Caledonia and endemic.



**Fig. 7.** *Odiomaris pilosus* A. Milne-Edwards, 1873, syntype, ♂, New Caledonia, freshwater, B. Balansa leg. (RMNH D 32). **A.** Ventral anterior part. **B.** G1 (after Holthuis 1968: fig. 3a–b). Abbreviations: a1 = antennule, with folded second article; a2 = antenna; e = epistome; p.k. = postorbital knobs; r = rostrum.

***Odiomaris pilosus*** (A. Milne-Edwards, 1873)

Figs 6–7

Characterised by numerous thin, stiff spinules on carapace margins, rostrum, pterygostomial regions, walking legs and chelipeds, is the largest freshwater hymenosomatid crab known (Ng & Richer de Forges 1996: 6, figs 5–7; 2007: 317; Guinot & Richer de Forges 1997: 460, figs 1a–d, 2a–f; Richer de Forges *et al.* 1997: 234; Juncker & Poupin 2009: 11, pl. 5: two photos; Poupin 2010: 59; Davie *et al.* 2015a: fig. 71-2.1.e; 2015b: 947). According to Richer de Forges *et al.* (1997: 234), the species is common in New Caledonian rivers from the estuary inland for several kilometres, in shallow freshwaters, under or between rocks in rivers with rapid currents (G. Marquet, pers. com.); in some drainages, it is a dominant species (Marquet *et al.* 2003: 108, fig. p. 109).

***Odiomaris estuarius*** Davie & Richer de Forges, 1996

Fig. 8

*Odiomaris estuarius* Davie & Richer de Forges, 1996: 257, figs 1, 2a, c

A much smaller species, until now only known from the type locality on the west coast of New Caledonia, Dumbea estuary, under logs, has more marine tendencies than *O. pilosus* (Marquet *et al.* 2003: 108).

***Odiomaris* aff. *pilosus***

See above, ‘Remarks on *Odiomaris* aff. *pilosus* from the Iouanga River and two other streams’.

Genus ***Neorhynchoplax*** Sakai, 1938

Type species by subsequent designation by Holthuis (1968): *Rhynchoplax introversus* Kemp, 1917. The genus *Neorhynchoplax*, the richest hymenosomatid genus, currently contains more than 30 species, all from the Indo-West Pacific (Ng *et al.* 2008, 2011: 53; Hsueh 2018: table 1), with nine species described from Indian waters (Alcock 1900; Kemp 1917; Chopra & Das 1930; Ng *et al.* 2011: table 2; Rahayu *et al.* 2020).

Several species of *Neorhynchoplax* are regarded as true freshwater species: *N. dentata* Ng, 1995 (Sarawak, Malaysia), *N. inermis* Takeda & Miyake, 1971 (Palau Islands), *N. introversa* (Kemp, 1917) (Kiangsu, China), *N. kempii* (Chopra & Das, 1930) (Basra, Iraq), *N. prima* Ng & Chuang, 1996 (Pulau Bintan, Indonesia), *N. frontalis* (Lucas & Davie, 1982) (NE Queensland, Australia), *N. hirtirostris* (Lucas & Davie, 1982) (NE Queensland, Australia), *N. nasalis* (Kemp, 1917) (Kiangsu, China), *N. pageti* Pretzmann, 1975 (Madampe, Sri Lanka), *N. patnahi* Ng, Nesemann & Sharma, 2011 (Patna, Bihar, India), *N. thorsborneorum* (Lucas & Davie, 1982) (NE Queensland, Australia), *N. yaeyamaensis* Naruse, Shokita & Kawahara, 2005 (Yaeyama Islands, Japan) (see Shen 1932; Chuang & Ng 1994; Ng *et al.* 1999, 2008, 2011; Naruse *et al.* 2008b; Hsueh 2018). Others species are from brackish waters or are marine intertidal and marine subtidal.

***Neorhynchoplax euryrostris*** Davie & Richer de Forges, 1996

Fig. 9

*Neorhynchoplax euryrostris* Davie & Richer de Forges, 1996: 260, figs 2b, d, 3.

Belongs to the group of species of *Neorhynchoplax* in which the lateral carapace margin is armed with a distinct recurved spiniform tooth just above the first ambulatory leg (P2); a characteristic shared with *Richerius marqueti* gen. et sp. nov. is the long setae that cover the outer surface of the stout palm and the fingers of the chelipeds, especially in males (Fig. 9). It is estuarine to tidal freshwater. The species was



**Fig. 8.** *Odiomaris estuarius* Davie & Richer de Forges, 1996, holotype, ♂, New Caledonia, Dumbea estuary, Davie & Richer de Forges leg., 8 Dec. 1993, 4.5 × 4.3 mm (MNHN-IU-2014-11870 = MNHN-B25278). **A.** Dorsal view. **B.** Ventral view. Credit: RECOLNAT (ANR-11-INBS-0004) - Noémy MOLLARET – 2017.



**Fig. 9.** *Neorhynchoplax euryrostris* Davie & Richer de Forges 1996, living specimen collected in the Iouanga River, North Province, Kaala-Gomen township (MNHN-IU-2014-21508). **A–B.** Two views.

until now only known from the type material collected on the western coast of New Caledonia (Dumbea, Le Cap) where it inhabits crevices in rotting logs at the edge of the water at low tide; and under stones in freshwater (Davie & Richer de Forges 1996: 261). Thanks to the Hydrobio Expedition, “Our Planet Reviewed”, it was found in the Iouanga River and in a stream tributary of the Negropo river, at 4 m a.s.l., where it cohabits with *Odiomaris* aff. *pilosus*. These newly collected specimens were all found in a similar habitat, among aquatic vegetation in the lower part of the river under the marine influence, with a variable salinity ranging from freshwater to brackish water depending on the tide.

Genus *Elamenopsis* A. Milne-Edwards, 1873

Type species by monotypy: *Elamenopsis lineata* A. Milne-Edwards, 1873.

*Elamenopsis lineata* A. Milne-Edwards, 1873

*Elamenopsis lineatus* [sic] A. Milne-Edwards, 1873: 324, pl. 18, fig. 4

*Elamenopsis lineatus* – Kemp 1917: 250. — Tesch 1918: 26, pl. 1, fig. 5, 5a–c. — Serène & Umali 1970: 58, pl. 5, fig. 11. — Chuang & Ng 1994: 86, table 1.

*Elamenopsis lineata* – Lucas 1980: 192, figs 3j, 5j, 8e, 10j. — Ng & Richer de Forges 1996: 263, fig. 1. — Ng & Chuang 1996: 4 (key), 19, 40, figs 15–6. — Guinot & Richer de Forges 1997: 468, figs 4j–l, 7b.

Not *Elamenopsis lineata* Rahayu & Ng, 2004 (= *Elamenopsis gracilipes* Rahayu & Ng, 2019; see Rahayu & Ng 2019).

*Elamenopsis lineata*, based on one specimen collected at Dotio, New Caledonia (and whose holotype is not a male as reported by A. Milne-Edwards in 1873 but a female as noted by Lucas in 1980) and redescribed by Ng & Chuang (1996: 40, figs 15–16), was not collected by the Hydrobio Expedition. The species is known from Queensland (Australia) and Sulawesi (Indonesia) (Ng & Chuang 1996). It is an estuarine species, found in sandy mud, and in mangrove area.

Genus *Lucascinus* Poore, Guinot, Komai & Naruse, 2016

Type species by original designation: *Halicarcinus bedfordi* Montgomery, 1931.

*Lucascinus keijibabai* (Takeda & Miyake, 1971)

*Rhynchoplax keijibabai* Takeda & Miyake, 1971: 165–168, figs 1–2.

*Halicarcinus keijibabai* – Lucas 1980: 164. — Ng & Richer de Forges 1996: 265, fig. 2.

*Lucascinus keijibabai* – Poore *et al.* 2016: 506, fig. 10h.

This species, from “intertidal reef” according to Poore *et al.* (2016: 506), seems endemic to New Caledonia.

Genus *Micas* Ng & Richer de Forges, 1996

Type species by original designation: *Elamena minuta* A. Milne-Edwards, 1873.

*Micas falcipes* Ng & Richer de Forges, 1996

*Elamene* [sic] *minuta* A. Milne-Edwards, 1873: 324 (*pro parte*).

*Micas falcipes* Ng & Richer de Forges, 1996: 269–271, fig. 4.

*Elamena minuta* – Tesch 1918: 21 (*pro parte*).

*Halicarcinus minutus* – Lucas 1980: 177 (*pro parte*). — Chuang & Ng 1994: 88 (*pro parte*).

*Micas falcipes* – Poore *et al.* 2016: 494.

This species is only known from New Caledonian shallow reef.

***Micas minutus*** (A. Milne-Edwards, 1873)

*Elamene* [*sic*] *minuta* A. Milne-Edwards, 1873: 324 (*pro parte*), pl. 18, fig. 5.

*Elamena minuta* – Kemp 1917: 250. — Tesch 1918: 21 (*pro parte*).

*Halicarcinus minutus* – Takeda & Nunomura 1976: 65, fig. 2. — Lucas 1980: 177 (*pro parte*). —

Chuang & Ng 1994: 88 (*pro parte*).

*Micas minutus* – Ng & Richer de Forges 1996: 265–269, fig. 3. — Poore *et al.* 2016: 496.

This New Caledonian species has been collected under rocks in intertidal zone, along the shore or on the fringing reef of small coral islands.



**Fig. 10.** Map of New Caledonia, showing localities where *Richierius marqueti* gen. et sp. nov., *Odiomaris pilosus* A. Milne-Edwards, 1873, *Odiomaris estuarius* Davie & Richer de Forges, 1996 and *Odiomaris aff. pilosus* were collected.

Genus *Elamena* H. Milne-Edwards, 1837

Type species by monotypy: *Hymenosoma mathaei* Desmarest, 1823.

The genus *Elamena*, which, with 24 species, is one of the most species-rich in the family Hymenosomatidae, can be separated into two groups (Lucas 1980). *Elamena vesca* is included in the group with a truncated rostrum and a polygonal carapace (Rahayu & Nugroho 2019).

*Elamena vesca* Ng & Richer de Forges, 1996

*Elamene* [sic] *truncata* A. Milne-Edwards, 1873: 323 (junior homonym of *Trigonoplax truncata* Stimpson, 1858).

*Elamena vesca* Ng & Richer de Forges, 1996: 273, fig. 8.

Alphonse Milne-Edwards (1873) established *Elamene* [sic] *truncata* without giving figures and probably not aware of the existence of the *Trigonoplax truncata* of Stimpson (1858) from Japan. According to Kemp (1917), these similar specific names are due to coincidence. The two species are in fact different, and a new name, *E. vesca*, was created by Ng & Richer de Forges (1996) using fresh specimens from New Caledonia as holotype and paratypes. The species is cryptic, intertidal on rocky shores, in shallow waters (about 0.5 m).

## Discussion

The new hymenosomatid *Richerius marqueti* gen. et sp. nov., found in two streams at altitudes of 180 m and 500 m in the inland waters of New Caledonia, is distinguished from the long-established taxon *Odiomaris pilosus* (with which it had been confused in the collections), which is also freshwater (but usually encountered in the lower course of rivers of New Caledonia) and euryhaline. *Richerius* gen. nov. differs from *Amarinus*, and in particular from its type species *A. lacustris*, reported from New Zealand freshwaters at altitudes of 61–92 m and even about 800–900 m a.s.l. *Amarinus*, which comprises many freshwater species of New Zealand, Australia, Indonesia, the Philippines and Papua New Guinea, is for the moment not known from New Caledonia. Another species (*Odiomaris* aff. *pilosus*) previously identified as *Odiomaris pilosus*, collected close to the sea in the Iouanga River and in other streams of the North Province and South Province, does not correspond to this species or to *Richerius marqueti* gen. et sp. nov. either; nor is it identifiable with the brackish representative of the genus, *Odiomaris estuarius*. DNA sequences of all these species that are in preparation hopefully will provide satisfactory answers to outstanding questions.

The carcinological fauna of New Caledonia, which does not host any of the exclusively primarily freshwater families, includes secondary freshwater species from primarily marine hymenosomatid stock, euryhaline species and strictly marine species. Our updated review lists seven genera: *Richerius* gen. nov., exclusively freshwater; *Odiomaris*, endemic, with a freshwater and euryhaline species, *O. pilosus*, and one brackish species, *O. estuarius*; *Neorhynchoplax*, with *N. euryrostris*, estuarine to tidal freshwater; *Lucascinus*, with *L. keijibabai*, from intertidal reef and perhaps endemic to New Caledonia; *Micas*, endemic, with two species: *M. falcipes*, from shallow reef, and *M. minutus*, from the intertidal zone or fringing reef; *Elamenopsis*, with *E. lineata*, an estuarine species, found in sandy mud, and in mangrove area; and *Elamena*, with *E. vesca*, cryptic, intertidal, in shallow waters. Other newly collected marine species, in study, will soon increase our knowledge of New Caledonian hymenosomatid fauna.

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