

Action: respond to our copy-editing questions

Select each question and describe any changes we should make on the proof. Changes against journal style will not be made and proofs will not be sent back for further editing.

- AQ1. Please check all author names and affiliations. Please check that author surnames have been identified by a pink background. This is to ensure that forenames and surnames have been correctly tagged for online indexing.
- AQ2. If your manuscript has figures or text from other sources, please ensure you have permission from the copyright holder. For any questions about permissions contact jnl.author.support@oup.com.
- AQ3. Please check that funding is recorded in a separate funding section if applicable. Use the full official names of any funding bodies, and include any grant numbers.
- AQ4. You may need to include a “conflict of interest” section. This would cover any situations that might raise any questions of bias in your work and in your article’s conclusions, implications, or opinions. Please see [here](#).
- AQ5. Please note the year discrepancy “2020” in cross-reference and “2021” in reference.
- AQ6. Please note the year discrepancy “2020” in cross-reference and “2021” in reference.

These proofs are for checking purposes only. They are not in final publication format. Please do not distribute them in print or online. Do not publish this article, or any excerpts from it, anywhere else until the final version has been published with OUP. For further information, see <https://academic.oup.com/journals/pages/authors>

Figure resolution may be reduced in PDF proofs and in the online PDF, to manage the size of the file. Full-resolution figures will be used for print publication.

Action: check your manuscript information

Please check that the information in the table is correct. We use this information in the online version of your article and for sharing with third party indexing sites, where applicable.

Full affiliations Each unique affiliation should be listed separately; affiliations must contain only the applicable department, institution, city, territory, and country	1 Department of Organismic and Evolutionary Biology, Museum of Comparative Zoology, Harvard University, 26 Oxford St., Cambridge MA 02138, USA; 2 Centre d'Estudis Avançats de Blanes (CEAB-CSIC), C. acc. Cala Sant Francesc 14 17300 Blanes, Girona, Spain; and 3 Museo Nacional de Ciencias Naturales (MNCN-CSIC), José Gutiérrez Abascal, 2, 28006 Madrid, Spain
Group Contributors The name of the group and individuals in this group should be given, if applicable (e.g. The BFG Working Group: Simon Mason, Jane Bloggs)	NA
Supplementary data files cited	
Funder Name(s) Please give the full name of the main funding body/agency. This should be the full name of the funding body without abbreviation or translation, if unsure, see https://search.crossref.org/funding	NA

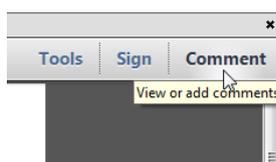
How to add your responses

These instructions show you how to add your responses to your proof using Adobe Acrobat Professional version 7 onwards, or Adobe Reader DC. To check what version you are using, go to 'Help', then 'About'. The latest version of Adobe Reader is available for free from <https://get.adobe.com/uk/reader/>.

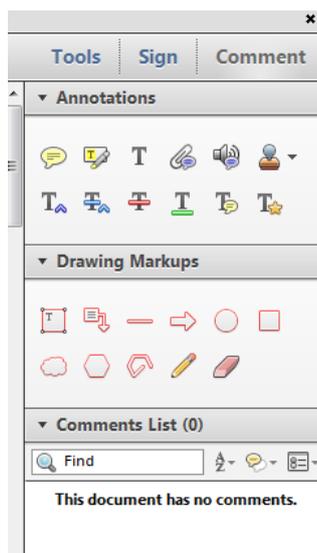
Displaying the toolbars

Adobe Reader DC

In Adobe Reader DC, the Comment toolbar can be found by clicking 'Comment' in the menu on the top-right-hand side of the page (shown below).

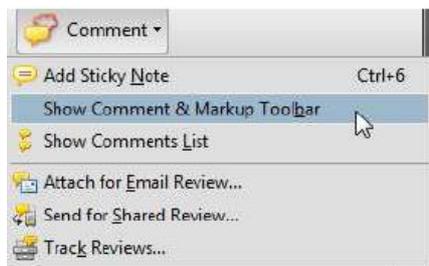


The toolbar shown below will then display along the right-hand-side of the page.



Acrobat Professional 7, 8 and 9

In Adobe Professional, the Comment toolbar can be found by clicking 'Comment(s)' in the top toolbar, and then clicking 'Show Comment & Markup Toolbar' (shown below).



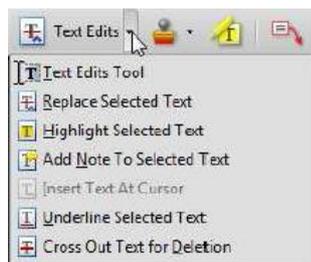
The toolbar shown below will then be displayed along the top of the page.



Using text edits and comments in Acrobat

This is the easiest method to both make changes, and for your changes to be transferred and checked.

1. Click 'Text Edits'
2. Select the text to be annotated or place your cursor at the insertion point and start typing.
3. Click the 'Text Edits' drop down arrow and select the required action.
4. You can also right click on selected text for a range of commenting options, or to add sticky notes.



Using commenting tools in Adobe Reader

All commenting tools are displayed in the toolbar. You cannot use text edits, however you can still use highlighter, sticky notes, and a variety of insert/replace text options.



Pop-up notes

In both Reader and Acrobat, when you insert or edit text, a pop-up box will appear.

Saving comments

In order to save your comments and notes, you need to save the file ('File', 'Save') before closing the document.

NB: Do not make any edits directly into the text, use commenting tools only



The Crustacean Society

Journal of Crustacean Biology

Journal of Crustacean Biology (2021) XX(XX), 1–14. <https://doi.org/10.1093/jcbiol/ruab070>
Version of Record, first published online XXXX XX, XXXX, with fixed content and layout in compliance with Art. 8.1.3.2 ICZN. LSID: urn:lsid:zoobank.org:pub:
BDCBD888-8BB7-4BE4-AA24-F8976ADB93DF

New species of deep-sea squat lobsters (Decapoda: Anomura: Galatheaidea: Munididae) from Guadeloupe, French West Indies, unveiled through integrative taxonomy

Paula C. Rodríguez-Flores^{1,2,3,*}, Enrique Macpherson^{2,*} and Annie Machordom^{3,*}

¹Department of Organismic and Evolutionary Biology, Museum of Comparative Zoology, Harvard University, 26 Oxford St., Cambridge MA 02138, USA;

²Centre d'Estudis Avançats de Blanes (CEAB-CSIC), C. acc. Cala Sant Francesc 14 17300 Blanes, Girona, Spain; and

³Museo Nacional de Ciencias Naturales (MNCN-CSIC), José Gutiérrez Abascal, 2, 28006 Madrid, Spain

Correspondence: P.C. Rodríguez-Flores; e-mail: paularodriguezflores@gh.harvard.edu

(Received 19 September 2021; accepted 21 November 2021)

ABSTRACT

During two deep-sea expeditions off the island of Guadeloupe, French West Indies, several specimens belonging to *Munida* Leach, 1820 and *Munidopsis* Whiteaves, 1874 (Galatheaidea, Munididae) were collected. Further study, integrating morphological and molecular data, indicated that some of the specimens belonged to three undescribed species, one to *Munida* and two to *Munidopsis*. *Munida antea* n. sp. is morphologically closely related to the Atlantic species *M. microphthalma* A. Milne-Edwards, 1880. Both species can be easily distinguished morphologically and represent independent evolutionary lineages. The closest relative to *Munidopsis balconi* n. sp. is *M. glabra* Pequegnat & Williams, 1995 from the Gulf of Mexico. They can be distinguished by the armature of the carapace and pereopods, among other differences. *Munidopsis pholidota* n. sp. is sister to *M. squamosa* (A. Milne-Edwards, 1880) and both are considered cryptic species, distinguished only by molecular characters and subtle morphological differences like the number of epipodites. Our phylogenetic results show some monophyletic groups within *Munidopsis* and *Munida*, and the existence of morphological convergences.

Key Words: Crustacea, cryptic species, mitochondrial genes, morphological stasis, Western Atlantic region

INTRODUCTION

With large areas still to be explored, the diversity of the vast ocean, particularly the deep sea (from 200 m onwards) remains underestimated (Schnabel *et al.*, 2020). High costs on both time and resources in exploration and sampling these habitats account for this but, even though thousands of new species have been described in the last 40 years of ocean exploration (Vrijenhoek, 2009). Squat lobsters are one of the most abundant and diverse crustacean deep-sea inhabitants and it is estimated that only around a third of the extant diversity is described (Appeltans *et al.*, 2012). The use of integrative taxonomy has improved our knowledge on the diversity of squat lobsters, since it has allowed to recognize sibling species and cryptic taxa that otherwise would have been overlooked with the use of morphological characters only (e.g., Poore & Andreakis, 2012). Recent expeditions have increased the available material of deep-sea squat lobsters (e.g., Richer de Forges *et al.*, 2013) and new species of squat lobsters are being re-curringly described (e.g., Vázquez-Bader *et al.*, 2014; Macpherson

et al., 2016; Poupin & Corbari, 2016; Rodríguez-Flores *et al.*, 2018) in relatively well-studied regions like the Caribbean Sea and the Gulf of Mexico.

More than 30 squat lobster species belonging to the family Munididae Ahyong, Baba, Macpherson & Poore, 2010 and over 50 species to Munidopsidae Ortmann, 1898 (Wicksten & Packard, 2005; Baba *et al.*, 2008) have been recorded from the Caribbean Sea and the Gulf of Mexico, harboring the richest species diversity after the Indo-West Pacific region (Schnabel *et al.*, 2011). Representatives of these two families have been collected by several expeditions to the region (e.g., A. Milne-Edwards, 1880; Benedict, 1902; Chace, 1942; Pequegnat & Pequegnat, 1970, 1971; Mayo, 1974) and more recently from the coasts of Florida to Brazil (e.g., Pequegnat & Williams, 1995; Tavares & Campinho, 1998; de Melo-Filho & de Melo, 2001; Campos *et al.*, 2005; Cardoso *et al.*, 2014; Poore, 2014; Vázquez-Bader *et al.*, 2014; Poupin & Corbari, 2016; Macpherson *et al.*, 2016). Both families are highly speciose, with more than 400 species in

2.5 the case of Munididae and nearly 300 species in Munidopsidae (Baba *et al.*, 2008, 2009; Ah Yong *et al.*, 2010; Rodríguez-Flores *et al.*, 2019; Schnabel, 2020). Several studies have pointed out that there is a need for taxonomic revision of supraspecific taxa within these families (Ahyong *et al.*, 2011; Rodríguez-Flores *et al.*, 2019; Miranda *et al.*, 2021), and most species have unknown phylogenetic placement. Thanks to integrative taxonomy studies, however, genetic data of several squat lobster species are available in public databases (e.g., Rodríguez-Flores *et al.*, 2019; Dong *et al.*, 2021), allowing us to perform comparisons among species and propose phylogenetic relationships.

2.15 During the molecular revision of the material collected during two surveys in the island of Guadeloupe, French West Indies (Poupin, 1994; Poupin & Corbari, 2016), we observed several cryptic and/or incorrectly identified species of *Munida* and *Munidopsis*. After the morphological comparison with type material and the analysis of molecular data, we found three new species: one species of *Munida* closely related to *M. microphthalma* A. Milne-Edwards, 1880, and two species of *Munidopsis* morphologically related to *M. squamosa* (A. Milne-Edwards, 1880). We herein 1) described the new *Munida* and *Munidopsis* species using morphological characters and molecular markers (COI, 16S), 2) redescribed the holotype of *M. squamosa*, and 3) investigated the phylogenetic placement of these species in a squat lobster's phylogenetic framework focused on the West Atlantic species.

MATERIAL AND METHODS

2.35 The terminology used for the descriptions follows Baba *et al.* (2009). The size of the specimens is indicated by the postorbital carapace length. Measurements of appendages are taken on dorsal (pereopod 1), lateral (antennule, pereopods 2–4), and ventral (antenna) midlines. Ranges of morphological and meristic variations are included in the description. Abbreviations used: Mxp, maxilliped; P1, pereopod 1 (cheliped); P2–4, pereopods 2–4 (walking legs 1–3); M, male; F, female; ovig., ovigerous. The examined material is deposited in the Muséum national d'Histoire naturelle, Paris, France (MNHN) and the Museum of Comparative Zoology, Cambridge, USA (MCZ).

2.45 We used tissue from one pereopod per specimen to extract genomic DNA with DNeasy kit (Qiagen, Hilden, Germany) following manufacturer's protocol, and adding RNase, with a previous proteinase K digestion overnight. Partial sequences of the mitochondrial cytochrome c oxidase subunit I (COI) and 16S ribosomal RNA (16S) were amplified by polymerase chain reaction (PCR) using the combination of several primers: LCO 1490 (Folmer *et al.*, 1994), tenuiCOIFwint (Rodríguez-Flores *et al.*, 2019), COI-H (Machordom *et al.*, 2003); 16SAR/16SBR (Palumbi *et al.*, 1991), and 16S1471/16S1472 (Crandall & Fitzpatrick, 1996), respectively. The amplified fragments were purified using ExoSAP-IT (Affymetrix, Santa Clara, CA, USA). We sequenced both strands using BigDye Terminator in an ABI 3730 genetic analyzer at SECUGEN (Madrid, Spain). Forward and reverse DNA sequences obtained for each specimen were checked and assembled using the program Sequencher v.5.4 (Gene Code Corporation, Ann Arbor, MI, USA) and aligned using MAFFT (Katoh *et al.*, 2002) with a posterior manual correction using AliView alignment editor (Larsson, 2014).

2.65 Uncorrected p-distances between species were calculated using PAUP v.4.0a (build 169) (Swofford, 2002). Some sequences from related species obtained in previous studies (Coykendall *et al.*, 2017; Mantelatto *et al.*, 2018; Rodríguez-Flores *et al.*, 2018, 2019, Dong *et al.*, 2021) were retrieved from GenBank and employed for comparisons.

2.70 Phylogenetic analyses were performed with the COI data matrix, which included a larger number of taxa, using

2.75 MrBayes v3. 2. 1 (Huelsenbeck & Ronquist, 2001). We selected *Munida microphthalma* A. Milne-Edwards, 1880 was selected as the outgroup for rooting the *Munidopsis* tree (MK138925) and *Munidopsis nitida* (A. Milne-Edwards, 1880) (MN397923) as outgroup of the *Munida* tree. To estimate posterior probabilities, four Markov Chains Monte Carlo (MCMC) were run for 2×10^7 generations, sampling trees and parameters every 20,000 generations. The initial 25% generations were discarded as burn-in. Bayesian analyses were run in CIPRES portal (Miller *et al.*, 2010). We also ran maximum-likelihood analyses in the IQtree web server (<http://iqtree.cibiv.univie.ac.at/>). Branch support analyses were run with 1,000 iterations. The phylogenetic trees were plotted and edited in FigTree v1. 4. 2 (Rambaut, 2012). Posterior probabilities from the Bayesian Inference and bootstrap support from ML were included in the final tree. 2.90

TAXONOMY

2.95 **Family Munididae** Ahyong, Baba, Macpherson & Poore, 2010

Munida Leach, 1820

***Munida antea* n. sp.**

Fig. 1

Munida? *microphthalma* –Poupin & Corbari, 2016: 40, fig. 10c. 2.105

Material examined: Holotype. Guadeloupe, KARUBENTHOS 2015, stn. DW4511, 8 June 2015, 16°13.9'N, 61°51.5'W, 630–660 m: 1 F 5.0 mm (MNHN-IU-2013-18893).

2.110 *Etymology:* The name refers to the R/V *Antea*, on which the cruise KARUBENTHOS was carried out.

2.115 *Description: Carapace:* 1.2× longer than wide. Ridges mostly interrupted, some scale-like, with conspicuously short non-iridescent setae. Gastric region with pair of small epigastric spines, without parahepatic spines. Postcervical spine on each side. Frontal margins oblique. Lateral margins slightly convex. Anterolateral spine small, at anterolateral angle, clearly not reaching level of sinus between rostrum and supraocular spines. Second marginal spine before cervical groove as long as preceding one. Branchial margins with 4 spines. Rostrum spiniform, about 0.5× as long as remaining carapace, straight, horizontal. Supraocular spines reaching midlength of rostrum, not reaching end of corneas, subparallel, slightly directed upwards. 2.120

2.125 *Sternum:* Surface of thoracic 4–6 sternites smooth, few striae on sternite 4 only. Anterior margin of sternite 4 clearly narrower than third. Sternite 3, 5.5× wider than long.

2.130 *Abdomen:* Somite 2 with row of 6 spines on anterior ridge, with transverse posterior ridge; somites 3–4 each with uninterrupted transverse ridge on tergite behind anterior ridge; posteromedian margin of somite 6 straight.

2.135 *Eyes:* Ocular peduncles as long as broad. Cornea not dilated. Maximum corneal diameter one-fourth distance between bases of anterolateral spines.

2.140 *Antennule:* Article 1 (distal spines excluded) conspicuously long, about 0.4× carapace length, 2.5× longer than wide (excluding spines), clearly overreaching end of corneas, with 2 distal spines, 2.142

NEW DEEP-SEA SQUAT LOBSTERS FROM GUADELOUPE

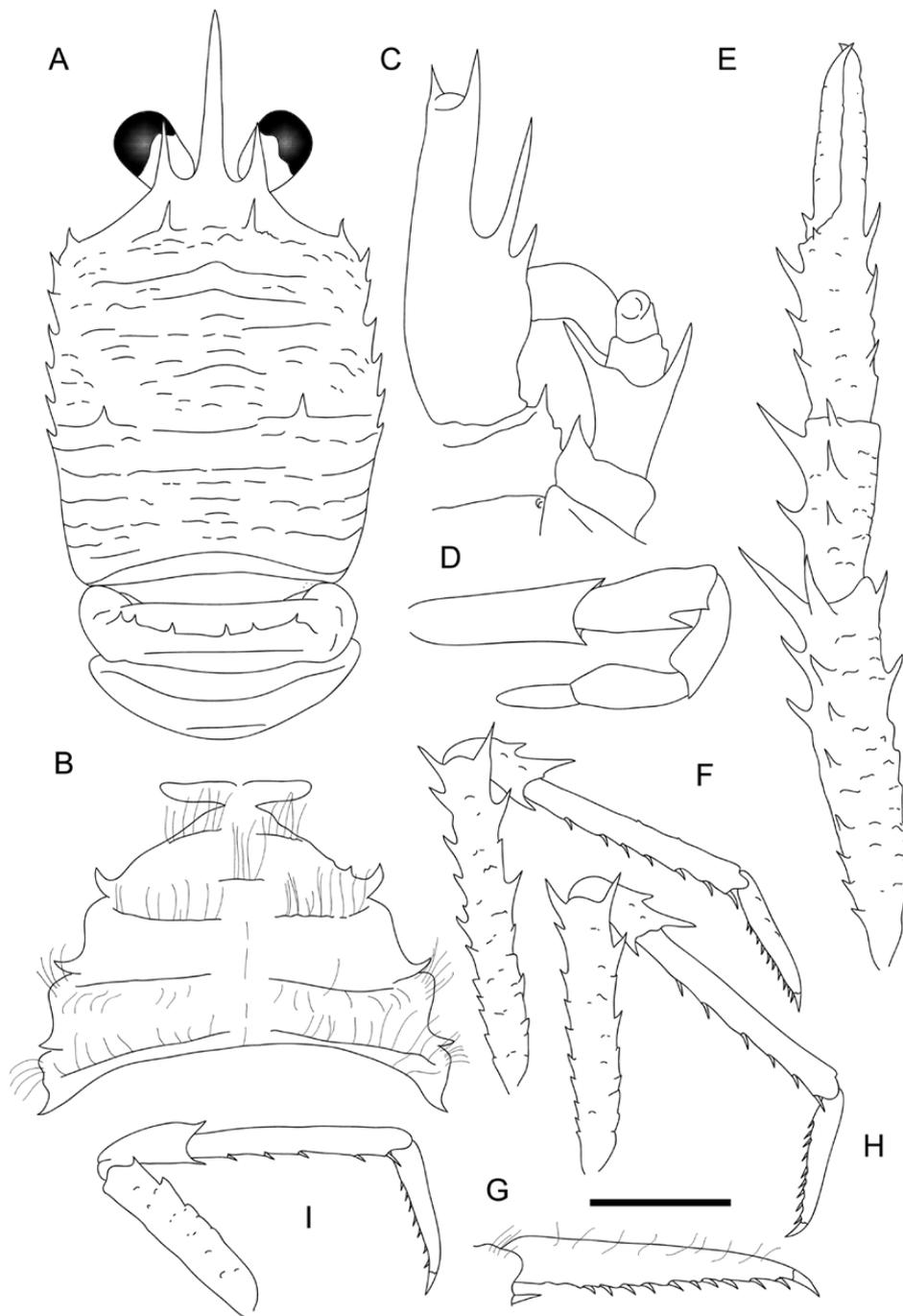


Figure 1. *Munida antea* n. sp. holotype, F 5.0 mm (MNHN-IU-2013-18893). Carapace and abdomen, dorsal view (A); sternal plastron (B); cephalic region, showing left antennular and antennal peduncles, ventral view (C); right Mxp3, lateral view (D); right P1, dorsal view (E); right P2 lateral view (F); dactylus of right P2, lateral view (G); right P3, lateral view (H); right P4, lateral view (I). Scale bars: A, E, F, H, I = 2.0 mm; B, C, D, G = 1.0 mm.

mesial spine shorter than lateral; 2 spines on lateral margin, proximal one short, at midlength of segment, distal one long, not reaching end of distolateral spine.

Antenna: Article 1 with short distomesial spine clearly not reaching end of article 2. Article 2 with subequal distomesial and distolateral spines, both exceeding article 3 falling short of end of article 4. Article 3 unarmed.

Mxp 3: Ischium about 1.5× length of merus measured along dorsal margin, distoventrally with spine; merus with 2 spines on flexor margin, distal smaller; extensor margin unarmed.

P1: Subequal in length, about 2.2× carapace length, with few scales, some scattered non-iridescent uniramous setae. Merus armed with row of spines, strongest spines on mesial and distal margins, reaching proximal quarter of carpus. Carpus 2.5× longer than high, as long as palm; palm slightly shorter than fingers, with several spines along mesial and dorsal margins. Palm slightly shorter than fingers, with some spines along mesial and lateral margins, dorsal surface unarmed. Fingers unarmed, except basal spine on movable finger, distally curving crossing, ending in sharp point.

P2–4: Moderately long, slender, with numerous plumose setae and some iridescent non-plumose setae along extensor margin of each

4.5 article. P2 about 2.2× carapace length. Meri decreasing in length posteriorly (P3 merus 0.8 length of P2 merus, P4 merus 0.7 length of P3 merus); P2 merus as long as carapace, ~8× as long as broad, 1.5× longer than P2 propodus; P3 merus 6.5× longer than broad, 1.2× longer than P3 propodus; P4 merus 4.5× as long as broad, as long as P4 propodus; P4 merocarpal articulation ending at level of anterior branch of cervical groove. Extensor margins of meri with row of 9 or 10 proximally diminishing spines on P2–3, unarmed on P4; flexor margins with strong distal spine followed by row of 5 or 6 proximally diminishing spines; lateral surfaces unarmed. Carpi with 1 or 2 spines on extensor margin; lateral surface with several granules sub-parallel to extensor margin on P2–3; flexor margin with distal spine. Propodi 7.5–7.8 (P2–3)–7.0 (P4)× as long as broad; extensor margin unarmed; flexor margin with 5–7 slender movable spines. Dactyli slender; length 0.6–0.7× length of propodi; flexor margin with 8–10 movable spinules along entire length; P2 dactylus 6× longer than wide.

Distribution: Guadeloupe, Caribbean Sea, depth 630 to 660 m.

4.25 *Genetic data:* COI and 16S. GenBank Accession numbers XXXX-XXXX

4.30 *Remarks:* *Munida antea* n. sp. belongs to the group of species having the maximum corneal diameter one-fourth the distance between bases of the anterolateral spines, second abdominal segment with spines, lateral parts of the posterior thoracic sternites without granules, a spiniform rostrum, article 1 of the antennular segment markedly elongated with the distomesial spine clearly shorter than the distolateral spine, distomesial spine of the antennular article 2 not exceeding the end of the fourth article, and dactylus with corneous spines on the entire flexor margin. Morphologically, the closest relative is *M. microphthalma* A. Milne-Edwards, 1880 from the Caribbean Sea (type locality), Brazil, south of Iceland, Bay of Biscay, NW Iberian Peninsula, Middle Atlantic Bight, Canary and Cape Verde islands at 677–2,094 m (de Melo-Filho & de Melo, 1992; García-Raso et al., 2018). The occurrences of this species in the Pacific Ocean are dubious (Baba et al., 2008). A comparison of type material of *M. microphthalma* from Yucatán (1 F, MNHN Ga 960) and Martinica (1 M, MNHN Ga 959), and additional material from Brazil (1 ovig. F) (see de Melo-Filho & de Melo, 2001) with the new species revealed that the two species can be distinguished morphologically and genetically. *Munida microphthalma* has five spines on the branchial margin of the carapace, whereas there are only four in the new species. Furthermore, the anterolateral spine of the carapace is very small in the new species, being clearly more developed in *M. microphthalma*. The epigastric region has several pairs of spines in *M. microphthalma*, whereas there is only one pair in *M. antea*. Article 1 of the antennular peduncle is clearly slenderer in the new species. The distal portion, from the lateral spines to the base of the distal spines, is more than twice longer than wide in *M. antea*, being as long as wide in *M. microphthalma*. The distal spines of the second segment of the antennular peduncle exceed the third segment in *M. antea*, whereas these spines never reach the end of the third segment in *M. microphthalma*.

4.60 The two species are genetically very different. The genetic divergence ranges were 12% in 16S and 16–17% in COI.

4.65 *Munida antea* n. sp. is also closely similar to *M. victoria* de Melo-Filho, 1996, from Espírito Santo, Brazil, from a depth of 960 m. The two species can be easily differentiated by similar characters distinguishing the new species and *M. microphthalma* (see de Melo-Filho, 1996). There is unfortunately no available molecular data from *M. victoria*. The new species is also very similar to *M. oblongata* Cabezas, Macpherson & Machordom, 2009 from the Solomon Islands. Both species can nevertheless be distinguished morphologically and genetically. Article 1 of the antennular peduncle is slenderer in *M. oblongata* than in the new species. The P1 palm is slightly shorter than the fingers in the new species, whereas

4.75 it is clearly larger in *M. oblongata*. The P1 carpus is 2.5× longer than high in the new species, whereas it is four times longer than high in *M. oblongata*.

4.80 The interspecific p-distance between both species is 9% for the 16S (*M. oblongata* GenBank Accession number EU417978, no data for COI).

Family Munidopsidae Ortmann, 1898

Munidopsis Whiteaves, 1874

***Munidopsis balconi* n. sp.**

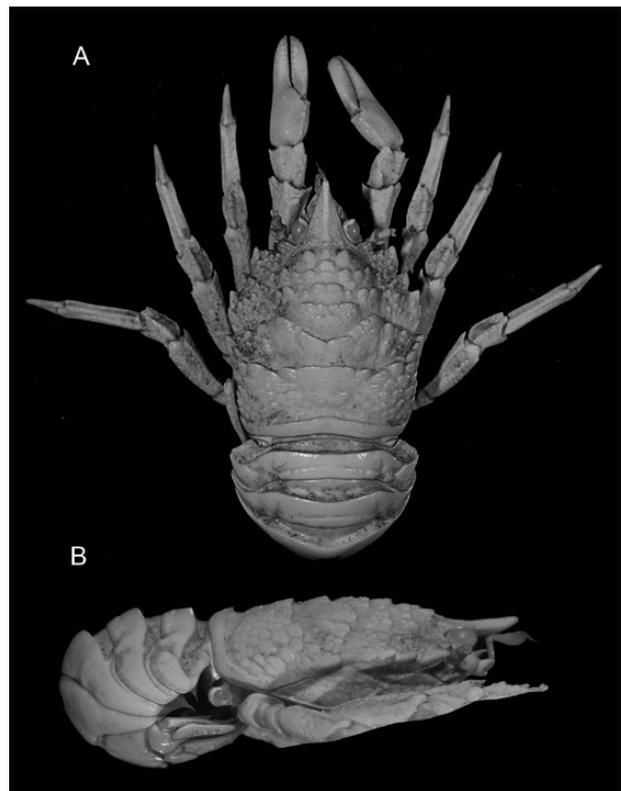
Figs. 2, 3

Munidopsis squamosa. –Poupin, 1994: 39.

Material examined: Holotype: POLKA, station without number, west coast of Guadeloupe, Basse Terre, January 1993, 500 m: ovig. F 14.3 mm (MNHN-IU-2014-23830).

Etymology. After Rémy Balcon, Head of Operations at GENAVIR, in recognition for his continuous support for the explorations of the Tropical Deep-Sea Benthos program.

4.100 *Description. Carapace:* Slightly longer than broad, widest at midlength; quadrangular; moderately convex across. Dorsal surface squamate; 2 thick epigastric protuberances; hepatic and anterior branchial areas with small scales, some acute granules. Regions well delineated by deep furrows including distinct anterior and posterior cervical grooves. Posterior cardiac region weakly triangular; preceded by deep transverse depression across. Posterior margin unarmed. Rostrum acutely triangular; 0.3× carapace length, width



4.110 **Figure 2.** *Munidopsis balconi* n. sp. holotype, ovig. F 14.3 mm (MNHN-IU-2014-23830). Carapace and abdomen, dorsal view (A); carapace and abdomen, lateral view (B).

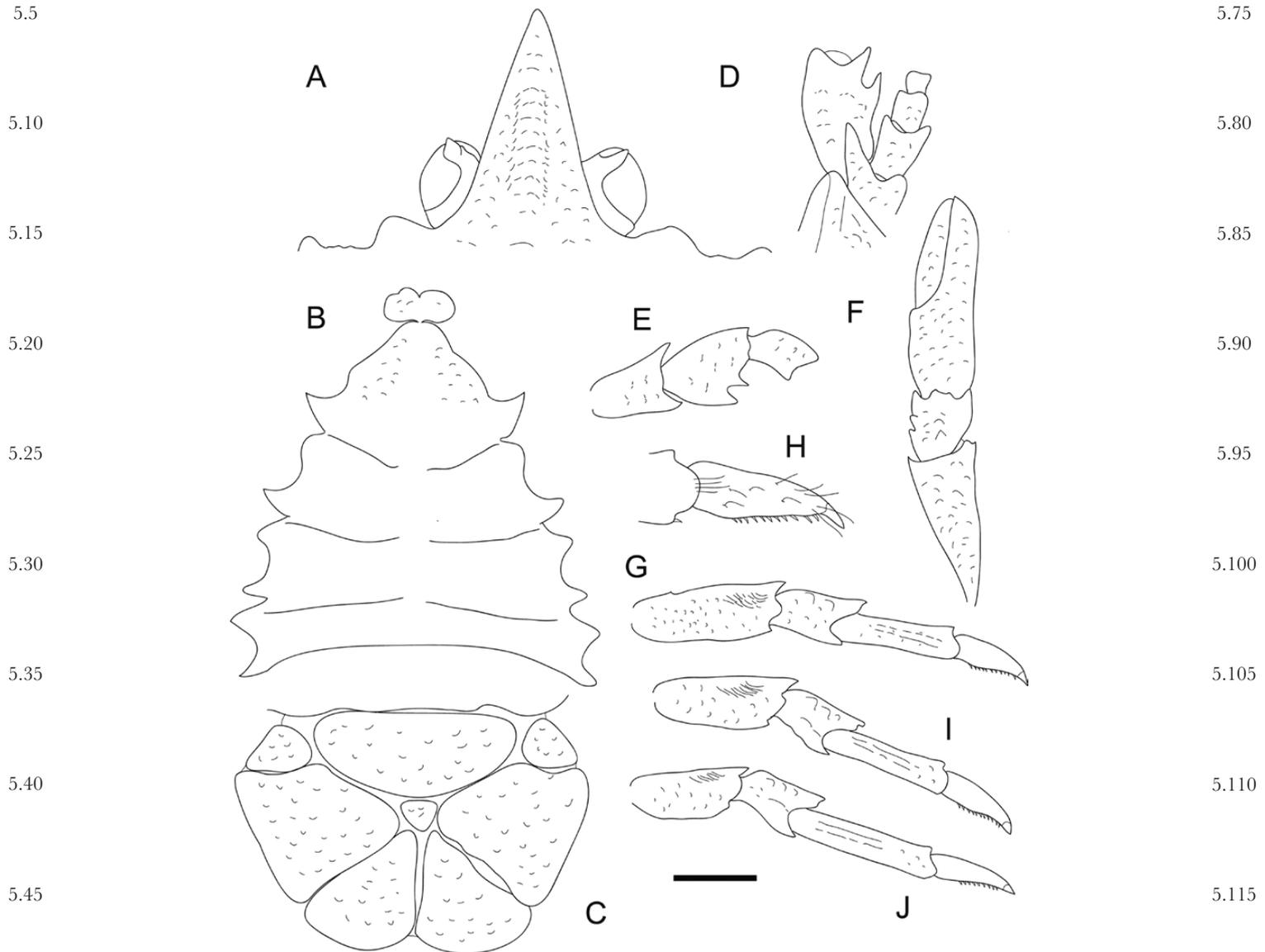


Figure 3. *Munidopsis balconi* n. sp. holotype, ovig. F 14. 3 mm (MNHN-IU-2014-23830). Carapace, anterior part, dorsal view (A); sternal plastron (B); telson (C); Cephalic region, showing left antennular and antennal peduncles, ventral view (D); right Mxp3, lateral view (E); right P1, dorsal view (F); right P2 lateral view (G); dactylus of right P2, lateral view (H); dight P3, lateral view (I); right P4, lateral view (J). Scale bars: A, B, C, D, E, H = 2.0 mm; F, G, I, J = 4.0 mm.

0.3× anterior width of carapace, directed slightly upwards, dorsally carinate, lateral margins straight. Frontal margin with orbit slightly concave behind ocular peduncle, limited laterally by rounded process, then slightly transverse toward anterolateral spine of carapace. Lateral margins slightly convex; anterolateral spine broad; anterior branchial margin with 2 broad spines; broad spine behind lateral end of posterior cervical groove. Pterygostomian flap smooth, with minute rugosities, anteriorly acute.

Sternum: As long as broad, maximum width at sternite 7. Sternite 3 moderately broad, 2× wider than long, anterolaterally angular; anterior margin with median notch flanked by 2 lobes. Sternite 4 narrowly elongated anteriorly; surface depressed in midline, smooth; greatest width 3× that of sternite 3, 1.5× wider than long.

Abdomen: Smooth, unarmed; tergites 2, 3 each with 2 slightly elevated transverse ridges, anterior more elevated than posterior; tergites 4–6 lacking posterior ridge; tergite 6 with weakly produced posterolateral lobes and nearly transverse posteromedian margin. Telson composed of 8 plates; 1.8× as wide as long.

Eye: Peduncle scarcely movable, with small tubercular process mediodorsally; cornea subglobular, as wide as eyestalk; blunt spine between eye and antennal peduncle.

Antennule: Article 1 of peduncle with dorsolateral and distolateral spines; distomesial margin slightly produced, granular.

Antenna: Peduncle slightly exceeding eye; article 1 with strong distomesial spine, reaching end of article 2, distolateral angle rounded; article 2 with well-developed distolateral spine, distomesial blunt; articles 3, 4 unarmed.

Mxp3: Surface smooth, with few granules. Ischium as long as merus measured on extensor margin; flexor margin of merus with 2 spines and several granules, proximal spine stronger than distal; extensor margin with small distal spine; 19 or 20 corneous denticles on crista dentata.

P1: Stout, granular, exceeding P2, with numerous minute granules and scales, each scale with few short setae, 1.5× longer than

- 6.5 carapace. Merus 2.5× carpus length, with some distal stout spines. Carpus 1.2× longer than broad, with some acute distal granules, few acute granules along dorsal side, some spines may be present along mesial margin. Palm unarmed, slender, slightly longer than carpus, 1.2× longer than broad. Fingers unarmed, 1.4× longer than palm, opposable margins nearly straight, not gaping, spooned; fixed finger without denticulate carina on distolateral margin.
- 6.10
- 6.15 *P2–4*: Stout, coarsely granular, nearly devoid of setae, somewhat compressed laterally, slightly decreasing in size posteriorly. P2 merus moderately elongated, 0.5× carapace length, nearly 3.0× longer than high and 1.5× length of P2 propodus. Extensor margin of P2–4 meri carinate, with small granules along entire border, distal part slightly flat, ending in thick spine; flexor margin granular. Carpi with thick distal spine on extensor margin, granular carina along lateral side. P2–4 propodi 3.1–3.6× as long as high, triangular in cross section, unarmed. Dactyli 0.7–0.9× length of propodi; distal claw short, moderately curved; flexor margin distally curved, with 9–11 minute teeth decreasing in size proximally, each with slender corneous spine, last tooth as close to penultimate tooth as to dactylar claw.
- 6.20
- 6.25
- Epipods present on P1 and P2.*
- 6.30 *Distribution.*
Guadeloupe, Caribbean Sea; depth 500 m.
- 6.35 *Genetic data:* COI and 16S. GenBank Accession numbers XXXX-XXXX.
- 6.40 *Remarks:* *Munidopsis balconi* n. sp. belongs to the group of species having a rostrum without lateral spines, triangular and dorsally carinated, the orbit slightly delimited by antennal spine or process two epigastric spines or protuberances, the abdominal segments unarmed, the telson with eight plates, one dorsal eye-spine, tubercle-like, and the P2 not reaching the end of the P1. This specimen was initially identified as *M. squamosa* (Poupin, 1994); however, a comparison with Guadeloupe specimens (Poupin & Corbari, 2016) and the examination of the type material and other material of *M. squamosa* from MCZ demonstrated that they can be distinguished by some important characters. The armature of the carapace surface is tuberculate in *M. squamosa*, whereas it is squamate in the new species. The eyes have The dorsomesial surface of the eye cornea has a large blunt granular projection reaching midlength of rostrum in *M. squamosa*, whereas the eyes only have a small tubercular process mediodorsally in the new species. The P1–4 have numerous spines, tubercles, and projections in the meri to propodi of *M. squamosa*, whereas these articles are barely smooth, with a few granules and small spines, in the new species. The epipods are present in the P1–3 in *M. squamosa*, but only in P1, 2 in *M. balconi* n. sp. *Munidopsis balconi* n. sp. is larger in size than *M. squamosa*.
- 6.45
- 6.50
- 6.55 *These two species diverge on 18–19% for the COI and 13% for the 16S.* The closest western Atlantic relative of the new species is *M. glabra* Pequegnat & Williams, 1995, from the continental slope of the northwestern Gulf of Mexico. The two species can be differentiated as follows. The dorsal carapace surface is smooth in *M. glabra*, but clearly squamate in *M. balconi* n. sp. The front margin has one antennal spine in *M. glabra* the spine is absent in *M. balconi* n. sp. Epipods are present in the P1–3 of *M. glabra*, but present only in the P1, 2 in *M. balconi* n. sp. The Mxp3 has two strong, nearly subequal spines along the flexor margin of the merus in *M. glabra*, whereas these spines are smaller and proximally larger than distally in the new species.
- 6.60
- 6.65 *Munidopsis balconi* n. sp. also resembles *M. mandelai* Macpherson, Amon & Clark, 2014 from the southwestern Indian Ocean and
- M. hemingi* Alcock & Anderson, 1899 from southwestern India. *Munidopsis balconi* n. sp. can be distinguished from these two species by having an eye dorsal spine that overreaches the cornea (not overreaching the cornea in *M. mandelai* and in *M. hemingi*) and the presence of blunt epigastric processes in the new species (well-developed epigastric spines in the other two species).
- 6.75
- 6.80 The new species also resembles to *M. tasmaniae* Ah Yong & Poore, 2004 from deep water of southeastern Australia. The two species can be clearly distinguished by the following characters. The pair of epigastric processes are blunt, flattened, and thicker in *M. tasmaniae*, but much smaller and thinner in the new species. The ornamentation of the carapace, abdomen, and appendages is overall more finely tuberculate in *M. tasmaniae*, whereas it is covered by large scales in the new species. The Mxp 3 merus and carpus has spines along the extensor margin in *M. tasmaniae*, but these margins are only armed with the distal spine in the new species.
- 6.85
- 6.90 There is unfortunately no genetic data available for *M. tasmaniae*, *M. mandelai*, and *M. hemingi*.
- Munidopsis pholidota* n. sp.**
- 6.95
- Figs. 4, 6B
- Material examined:* Holotype. Guadeloupe, KARUBENTHOS 2015, stn. DW4611, 24 June 2015, 16°20'N, 60°52'W, 263–242 m: 1 M 3.9 mm (MNHN-IU-2016-2365).
- 6.100
- Etymology:* From the Greek *pholidōtós*, meaning “scale bearing.”
- Description: Carapace:*
- 6.105 Slightly longer than broad, widest at midlength; quadrangular, moderately convex across. Dorsal surface heavily sculptured; thick protuberances on gastric area; hepatic and anterior branchial areas with scales and some acute granules. Regions well delineated by deep furrows including distinct anterior and posterior cervical grooves. Posterior cardiac region preceded by deep transverse depression. Posterior margin unarmed. Rostrum widely triangular, width 0.3× anterior width of carapace, directed slightly upwards, dorsally carinate, lateral margins straight; 0.3× carapace length. Frontal margin with orbit nearly transverse behind ocular peduncle, anterolaterally directed on lateral part, outer orbital spine/process (antennal spine) absent; tuberculate projections lateral to rostrum between eyes, fused with rostrum and eye projections. Lateral margins straight; anterolateral spine broad, acute; anterior branchial margin with broad small spine; broad spine behind lateral end of posterior cervical groove. Pterygostomian flap smooth, with rugosities, anteriorly acute.
- 6.110
- 6.115
- 6.120
- Sternum:* As long as broad, maximum width at sternite 7. Sternite 3 moderately broad, 2.5× wider than long, anterolaterally rounded, anterior margin nearly straight. Sternite 4 narrowly elongated anteriorly; surface depressed in midline, smooth; greatest width 2.9× that of sternite 3, 1.9× wider than long.
- 6.125
- Abdomen:* Smooth, unarmed; tergites 2, 3 each with 2 slightly elevated transverse ridges, anterior ridge more elevated than posterior one, covered by granules and scales; tergites 4–6 lacking posterior ridge; tergite 6 with weakly produced posterolateral lobes and nearly transverse posteromedian margin. Telson composed of 8 plates; 1.5× as wide as long.
- 6.130
- 6.135
- Eye:* With short peduncle fused to carapace, covered with granules; cornea subglobular, mesial surface with large granular projection.
- 6.140 The closest western Atlantic relative of the Article 1 of peduncle with dorsolateral and distolateral spines; distomesial margin slightly produced and granular.
- 6.142

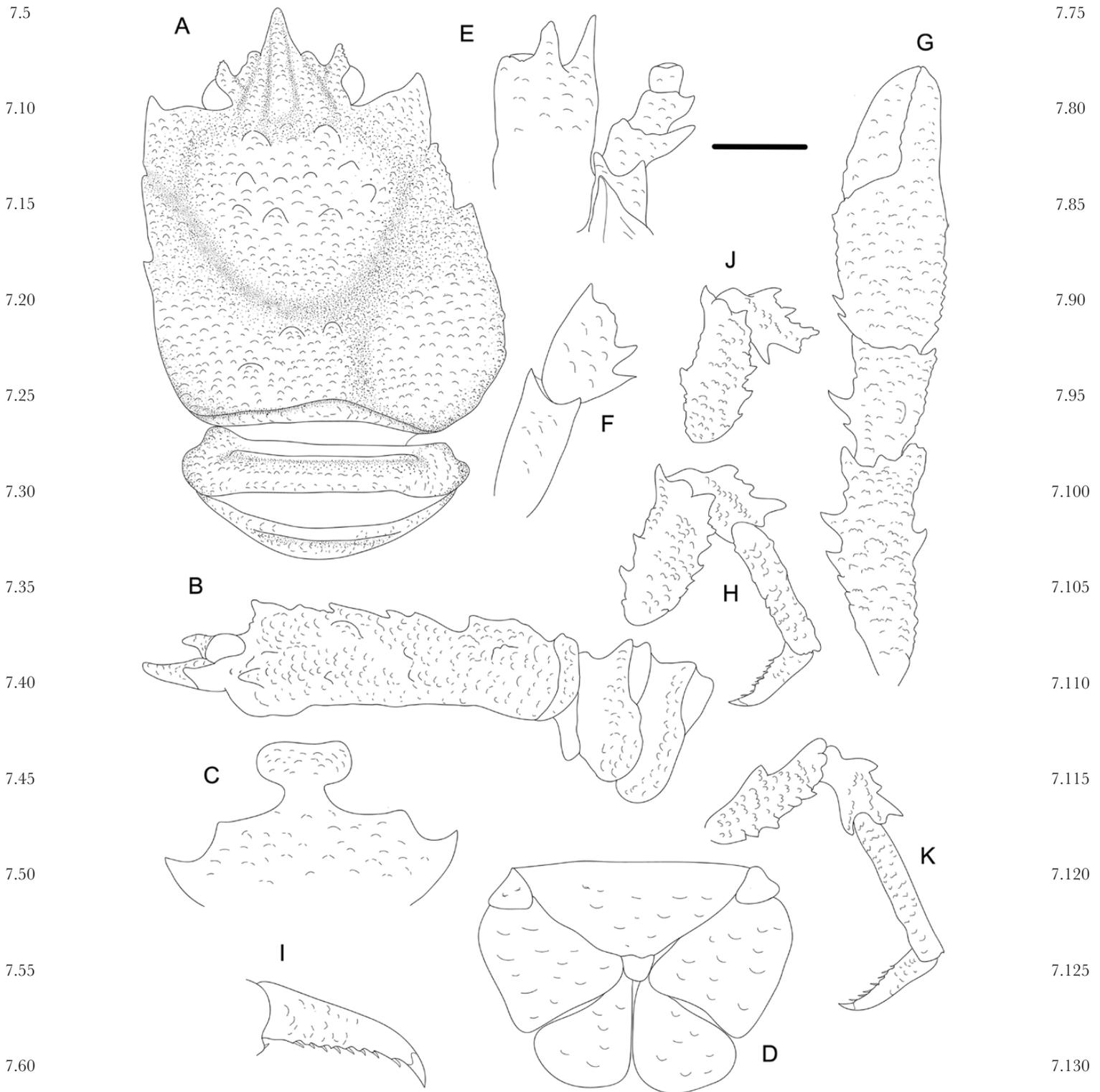


Figure 4. *Munidopsis pholidota* n. sp. holotype, M 3.9 mm (MNHN-IU-2016-2365). Carapace, dorsal view (A); carapace, lateral view (B); sternal plastron (C); telson (D); cephalic region, showing left antennular and antennal peduncles, ventral view (E); left Mxp3, lateral view (F); right P1, dorsal view (G); right P2, lateral view (H); dactylus of right P2, lateral view (I); merus and carpus of right P3, lateral view (J); right P4, lateral view (K). Scale bars: A, B, G, H, J, K = 1.0 mm; C, D, E, F, I = 0.5 mm.

Antenna: Peduncle slightly exceeding eye; article 1 with strong distomesial spine, not reaching end of article 2, distolateral angle acute; articles 2, 3 with well-developed distolateral spine, distomesial corner blunt; article 4 unarmed.

Mxp3: Surface with granules. Ischium as long as merus measured on extensor margin; flexor margin of merus with 2 spines and several granules, proximal spine stronger than distal; extensor margin with small distal spine; 19 or 20 corneous denticles on crista dentata.

- 8.5 *P1*: Stout, with numerous minute granules and scales, each scale with few short setae, 1.5× longer than carapace. Merus 2.5× carpus length, with some spines on mesial and lateral margins and a few distal stout spines. Carpus 1.4× longer than broad, with some distal stout spines, few acute granules along dorsal side.
- 8.10 Palm slender, slightly longer than carpus, 1.6× longer than broad, with some acute proximal spines on mesial margin. Fingers unarmed, 0.7× longer than palm, opposable margins nearly straight, not gaping, spooned; fixed finger without denticulate carina on distolateral margin.
- 8.15 *P2–4*: Stout, coarsely granular, nearly devoid of setae, slightly compressed laterally, slightly decreasing in size posteriorly. P2 merus moderately elongated, 0.5× carapace length, nearly 3.0× longer than high, 1.5× length of P2 propodus. Extensor margin of P2–4 meri carinate, with small granules along entire border, distal part slightly flat, ending in thick spine; flexor margin granular. Carpi with thick distal spine on extensor margin, granular carina along lateral side. Propodi 3.1–3.6× as long as high, triangular in cross section, unarmed. Dactyli 0.7–0.9× length of propodi; distal claw short, moderately curved; flexor margin distally curved, with 8 minute teeth decreasing in size proximally, each with slender corneous spine, ultimate tooth as close to penultimate tooth as to dactylar claw.
- 8.20 *Epipods present on P1 and P2.*
- 8.25 *Distribution*: Guadeloupe, French West Indies; depth 242–263 m.
- 8.30 *Genetic data*: COI and 16S. GenBank Accession numbers XXXX-XXXX
- 8.35 *Remarks*: *Munidopsis pholidota* n. sp. belongs to the group of species having triangular rostrum without lateral spines, with frontal margin with 2 granular projections lateral to rostrum, and often fused with rostrum and eye projections, orbit slightly excavated but without antennal (outer orbital) spine, the eyes with large granular projection, the abdominal segments unarmed, and the telson with 8 plates. This species is closely related to *M. squamosa* (see remarks for *M. squamosa*).
- 8.40 ***Munidopsis squamosa*** (A. Milne Edwards, 1880)
Figs. 5, 6C–E
- 8.45 *Orophorhynchus squamosus* A. Milne Edwards, 1880: 58 (Martinique, 350 m).
- 8.50 *Elasmonotus squamosus* – A. Milne Edwards & Bouvier, 1894: 282 (key). — A. Milne Edwards & Bouvier, 1897: 99, pl. 8, figs. 4–6 (Martinique, St. Lucia, 212–350 m). — Young, 1900: 414 (key).
- 8.55 *Munidopsis squamosa* – Benedict, 1902: 276 (key), 327 (list). — Doflein & Balss, 1913: 173 (list), 178 (table). — Chace, 1942: 73 (key). — Pequegnat & Pequegnat, 1970: 138 (key); 1971: 4 (key). — Poupin, 1994: 39 (French West Indies, 212–500 m). — Boschi, 2000: 98 (list). — Baba et al., 2008: 163 (catalogue). — Poupin & Corbari, 2016: 51, fig. 12d (Guadeloupe, 385–399 m).
- 8.60 *Material examined*. Holotype. Off Martinique, 12 February 1879, 14°29'10"N, 61°5'47"W, 350 m: 1 M broken, 4 mm (MCZ CRU-4756).
- 8.65 *Other material*. Off St. Lucia, 16 February 1879, 13°50.3'N, 61°3.8'W, 212 m: F 3.5 mm (MCZ CRU-9784). — Guadeloupe, KARUBENTHOS 2015, stn. DW4634, 27, June 2015, 15°48'N, 61°26'W, 310–304 m: ovig. F 3.5 mm (MNHN-IU-2016-2340). — stn. CP4543, 13 June 2015, 16°40'N 61°34'W, 385–399 m: ovig. F 3.9 mm (MNHN-IU-2013-18901).
- 8.70 *Description*. *Carapace*: Slightly longer than broad, widest at midlength; quadrangular, moderately convex across. Dorsal surface heavily sculptured; thick protuberances on gastric, posterior branchial, cardiac regions; hepatic and anterior branchial areas with scales and some acute granules. Regions well delineated by
- 8.75 deep furrows including distinct anterior and posterior cervical grooves. Posterior cardiac region preceded by deep transverse depression. Posterior margin unarmed. Rostrum widely triangular, width 0.3× anterior width of carapace, directed slightly upwards, dorsally carinate, lateral margins straight; 0.3× carapace length.
- 8.80 Frontal margin with orbit concave behind ocular peduncle, outer orbital spine/process (antennal spine) absent; tuberculate projections lateral to rostrum between eyes, fused with rostrum and eye projections. Lateral margins straight; anterolateral spine broad, small; anterior branchial margin with broad small spine; broad branchial spine behind lateral end of posterior cervical groove.
- 8.85 Pterygostomian flap smooth, with rugosities, anteriorly acute.
- 8.90 *Sternum*: As long as broad, maximum width at sternite 7. Sternite 3 moderately broad, 2.5× wider than long, anterolaterally rounded, anterior margin with median notch flanked by 2 lobes. Sternite 4 narrowly elongated anteriorly; surface depressed in midline, smooth; greatest width 2.9× that of sternite 3, 1.9× wider than long.
- 8.95 *Abdomen*: Smooth, unarmed; tergites 2, 3 each with 2 slightly elevated transverse ridges, anterior more elevated than posterior, covered by granules and scales; tergites 4–6 lacking posterior ridge; tergite 6 with weakly produced posterolateral lobes and nearly transverse posteromedian margin. Telson composed of 7 or 8 plates; 1.5× as wide as long.
- 8.100 *Eye*: With short peduncle fused to carapace, covered with granules; cornea subglobular, mesial surface with large granular projection.
- 8.105 *Antennule*: Article 1 of peduncle with dorsolateral and distolateral spines; distomesial margin slightly produced and granular.
- 8.110 *Antenna*: Peduncle slightly exceeding eye; article 1 with strong distomesial spine, not reaching end of article 2, distolateral angle acute; article 2, 3 with well-developed distolateral spine, distomesial non-acute; article 4 unarmed.
- 8.115 *Mxp3*: Surface with granules. Ischium as long as merus measured on extensor margin; flexor margin of merus with 3 acute spines, medial stronger, and several granules; extensor margin with small distal spine; 19 or 20 corneous denticles on crista dentata.
- 8.120 *P1*: Stout, with numerous minute granules and scales, each scale with few short setae, 1.5× longer than carapace. Merus 2.5× carpus length, with some spines at all surfaces including a few distal stout spines. Carpus 1.4× longer than broad, with some distal stout spines, a few acute granules along dorsal side. Palm with some acute proximal spines, slender, slightly longer than carpus, 1.6× longer than broad. Fingers unarmed, 0.7× longer than palm, opposable margins nearly straight, not gaping, spooned; fixed finger without denticulate carina on distolateral margin.
- 8.125 *P2–4 (lost in holotype, description of material from Guadeloupe)*: Stout, coarsely granular, devoid of setae, cylindrical in cross section, slightly decreasing in size posteriorly. P2 merus stout, 0.5× carapace length, nearly 2.0× longer than high, 1.5× length of P2 propodus. Extensor margin of P2–4 meri carinate, with small granules along entire border, distal part slightly flat, ending in thick spine; flexor margin granular. Carpi with thick distal spine on extensor margin, granular carina along lateral side. Propodi 3.1–3.6× as long as high, triangular in cross section, unarmed. Dactyli 0.7–0.9× length of propodi; distal claw short, moderately curved; flexor margin distally curved, with 8 minute teeth decreasing in size proximally, each with slender corneous spine, ultimate tooth as close to penultimate tooth as to dactylar claw.
- 8.130
- 8.135
- 8.140
- 8.142

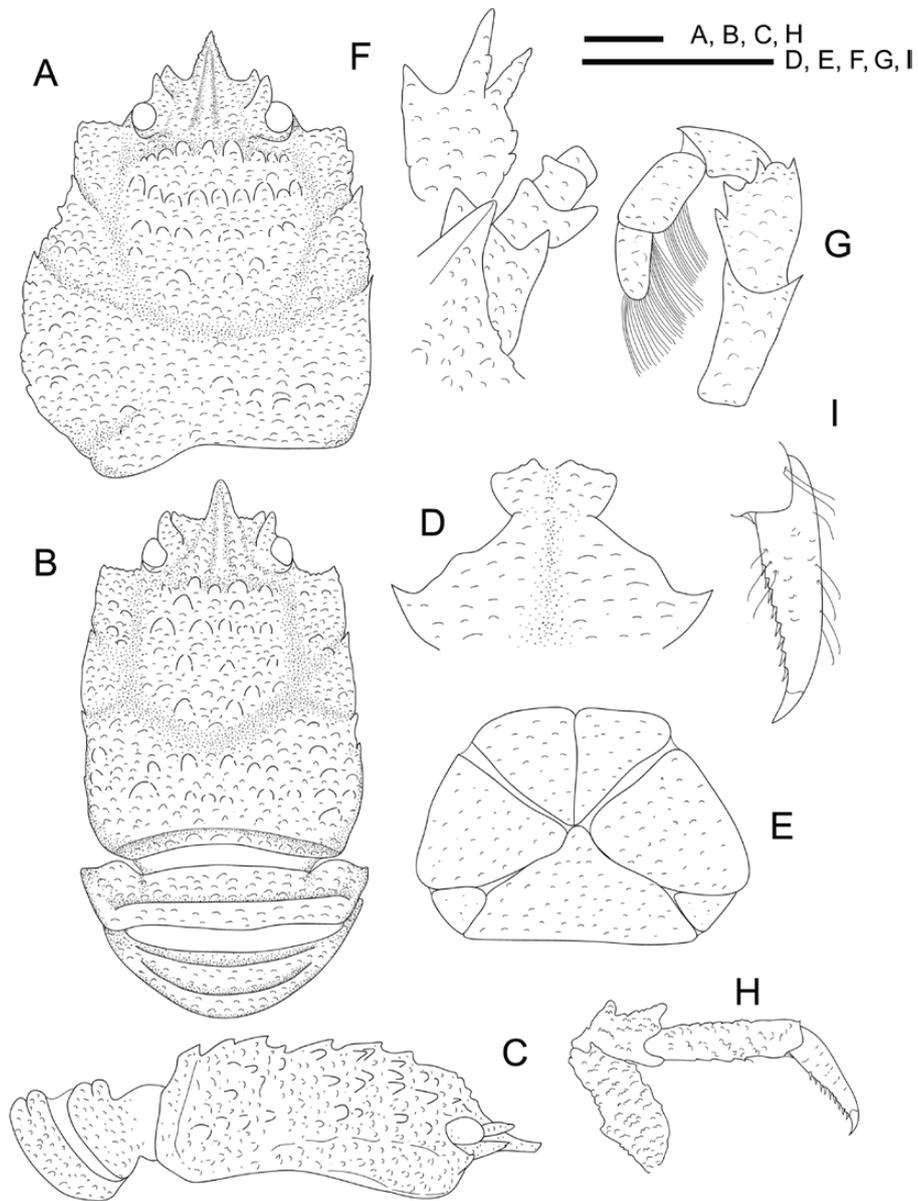


Figure 5. *Munidopsis squamosa* (A. Milne-Edwards, 1880). **A, D, F, G,**, holotype, M 4 mm (MCZ CRU-4756), **B, C, E, F** 3.5 mm. (MCZ CRU-9784). **H, I,** ovig. F 3.5 mm (MNHN-IU-2016-2340). Carapace, dorsal view (**A**); carapace, dorsal view (**B**); carapace, lateral view (**C**); sternal plastron (**D**); telson (**E**); cephalic region, showing left antennular and antennal peduncles, ventral view (**F**); right Mxp3 (**G**); merus and carpus of right P2, lateral view (**H**); right P2, lateral view (**I**). Scale bars = 1 mm.

Epipods present on P1–3. Distribution. Martinique, St. Lucia, and Guadeloupe, Caribbean Sea; depth 212–399.

Genetic data: COI and 16S. GenBank Accession numbers XXXX-XXXX

Remarks. *Munidopsis squamosa* was described by A. Milne Edwards (1880) in his preliminary report on the crustaceans collected by the Blake while trawling in the Caribbean Sea and Gulf of Mexico. The formal report of the *Blake* was published later (A. Milne-Edwards & Bouvier 1897). The species was nevertheless not collected again until much later by Mayo (1974), who exhaustively revised *Munidopsis* from the Caribbean Sea and the Gulf of Mexico, including *M. squamosa* from the Yucatán Channel and the Dominican Republic. This work, a dissertation, remains unpublished, and a redescription of *M. squamosa* is needed using the characters currently employed for the taxonomy of Munidopsidae. *Munidopsis squamosa* belongs to the group of species having

triangular rostrum without lateral spines, with frontal margin with two granular projections lateral to rostrum, and often fused with rostrum and eye projections, orbit slightly excavated but without antennal (outer orbital) spine, the eyes with large granular projection, the abdominal segments unarmed, the telson with eight plates and epipods on P1, 2 or P1–3. This group includes small and uncommon species from the Atlantic and the Pacific oceans: *M. amapa* Poore, 2014 and *M. brasilia* Poore, 2014, and *M. bajacalifornia* Poore, 2014, and *M. papanui* Schnabel & Bruce, 2006, respectively. The species of this group can be distinguished from each other by the armature pattern of the carapace (spines versus tubercules or scales), the armature on the pereopods and the fusion of the rostrum with the eye peduncles and ocular projections (Fig. 6).

The closest relative to *M. squamosa* is *M. pholidota* n. sp. Molecular comparison among specimens collected in Guadeloupe (Poupin & Corbari, 2016) revealed differences for genetic markers within

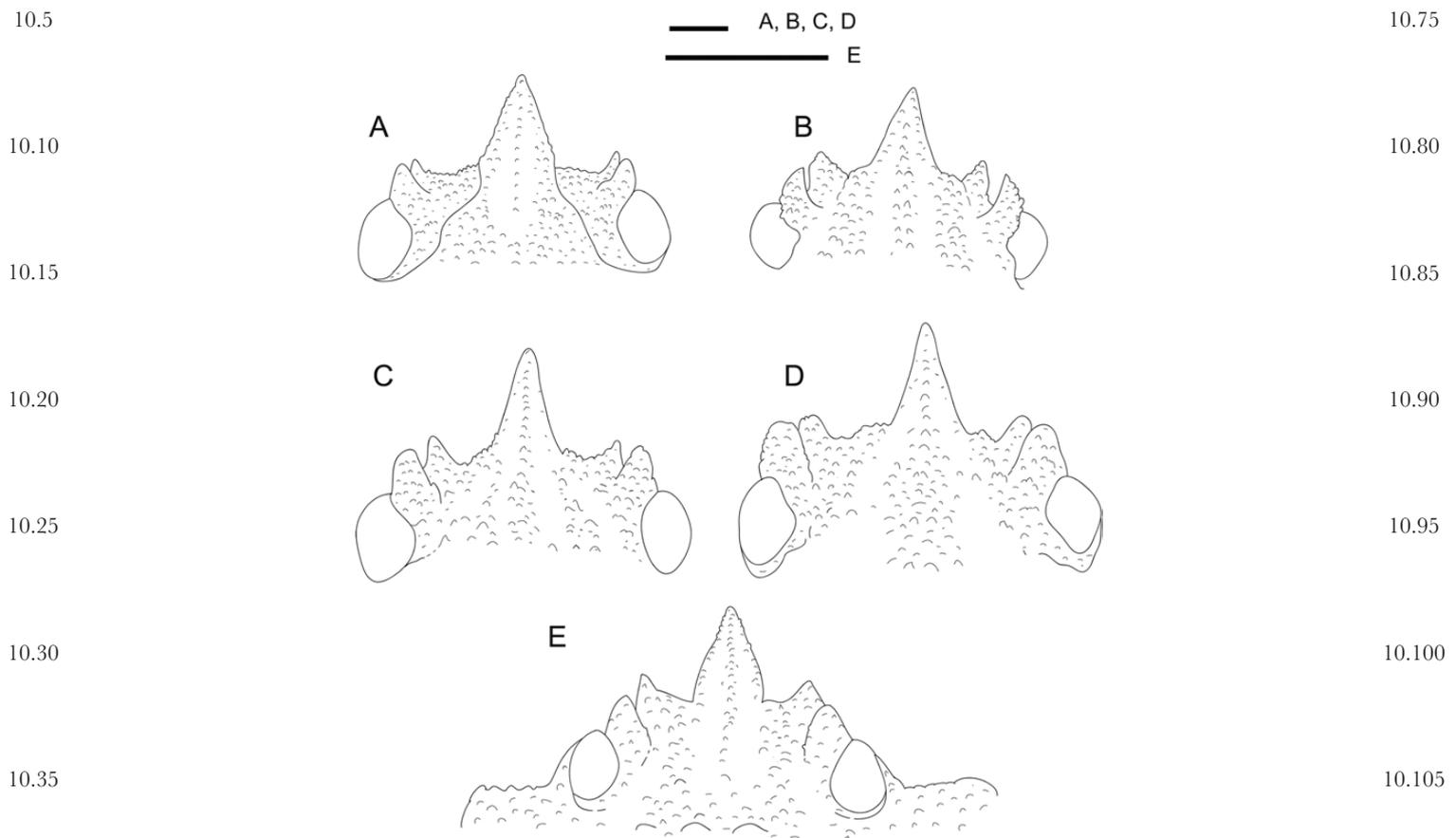


Figure 6. Rostrum and frontal margin of the carapace, dorsal view. *Munidopsis amapa* Poore, 2014 from Guadeloupe Island, KARUBENTHOS, DW4599, M 3.9 mm (MNHN-IU-2016-2446) (A); *M. pholidota* n. sp. holotype M 3.9 mm (MNHN-IU-2016-2365) (B); *M. squamosa* (A. Milne-Edwards, 1880) ovig. F 3.5 mm (MNHN-IU-2016-2340) (C); *M. squamosa* (A. Milne-Edwards, 1880) ovig. F 3.9 mm (MNHN-IU-2013-18901) (D); *M. squamosa* (A. Milne-Edwards, 1880) holotype M broken 4.0 mm (MCZ CRU-4756) (E). Scale bars: A, B, C, D = 0.4 mm, E = 1 mm.

specimens identified as *M. squamosa*. Further comparisons with the description and illustrations provided by Mayo (1974) and with the holotype and specimens deposited in the MCZ demonstrates that *M. pholidota* n. sp. and *M. squamosa* can be distinguished by subtle morphological characters. The epipods are present in the P1, 2 in the new species, but in the P1–3 in *M. squamosa*. The orbit is shallowly excavated in *M. squamosa* but transverse in the new species. The anterolateral angle of the carapace presents an acute spine in the new species, whereas this spine is blunt and small in *M. squamosa*. The anterior margin of the third sternite is nearly straight in the new species, but with a median notch and two lateral lobes in *M. squamosa*.

Specimens from Guadeloupe belonging to both species diverged on 5.5% for the COI and 1% for the 16S. The genetic divergence of these species with *M. amapa* was 15% for the COI and from 11 to 12% for the 16S. There is unfortunately no genetic data available for the other species.

Phylogenetic placement of new species of Munida and Munidopsis Results from the molecular phylogenetics analyses of Munididae, including close morphologically related species and other species from the Atlantic revealed that *Munida antea* n. sp. represent a highly divergent lineage (Fig. 7). In spite of the morphological resemblance between *Munida antea* and *M. microphthalmia*, the latter was more related with a clade including *M. valida* Smith, 1883 and *M. sanctipauli* Henderson, 1885 from the West Atlantic, and an eastern Atlantic clade is recovered as monophyletic. It is noteworthy that the clade that includes the new species is not phylogenetically close to the cluster from the eastern Atlantic, suggesting different evolutionary histories and lineage independence.

In the case of Munidopsidae, *Munidopsis squamosa* and *M. pholidota* n. sp. were phylogenetically close, forming a clade clustered with *M. amapa* with high Bayesian posterior probability and ML bootstrap support (Fig. 7B). This relationship was also congruent with morphology, these species having several similarities in the morphological characters used to distinguish taxa. The phylogenetic placement of *M. balconi* n. sp. in relation to other species of *Munidopsis* with available molecular data was still unknown, since this lineage was recovered as a part of an unsupported polytomy. This clade includes other species from the Atlantic plus *M. dispar* Dong Gan & Li, 2021 described from deep water in the Pacific, which has also a densely tuberculated carapace. Our reconstruction also showed that other species of *Munidopsis* recorded from Guadeloupe (e.g., *Munidopsis turgida* Rodríguez-Flores, Macpherson & Machordom, 2018, *M. granulens* Mayo, 1972, and *M. corniculata* Rodríguez-Flores, Macpherson & Machordom, 2018) represent highly divergent unrelated lineages, also considering the new species described herein. *Munidopsis granulens* and *M. turgida* were clustered together, *M. senticosa* was sister to a species complex including *M. barbarae* (Boone, 1927), and *M. corniculata* constituted a lineage with dubious phylogenetic position.

DISCUSSION

The species diversity of *Munida* and *Munidopsis* in the Caribbean Sea has been increased by the three new species, which are highly supported by phylogenetic analyses and morphological dissimilarities. Squat lobsters are characterized by a high degree

11.5 of morphological convergence and stasis, characteristics more common in species of Munididae, as pointed out in *Munida* by Machordom & Macpherson (2004), and in related genera (*Agonida* Baba & de Saint Laurent, 1996, *Paramunida* Baba, 1988, *Sadayoshia* Baba, 1969) by several other studies (Cabezas *et al.*, 2012; Macpherson & Baba, 2012; Poore & Andreakis, 2012). Although the molecular phylogenetic relationships show morphologically cohesive groups in some cases (e.g., the clade including *Munidopsis amapa*, *M. squamosa*, and *M. pholidota*), our phylogenetic reconstructions revealed that most morphological characters employed to distinguish species present convergent states. This is the case of *Munida microphthalma* versus *M. antea*, in which the existence of a reduced orbit and its relative size to the rostral spine seems to be convergent, whereas the armature pattern of the carapace and abdomen and the relative length of pereiopods are characters shared by all the species from the monophyletic eastern Atlantic lineage (Fig. 7).

11.20 *Munidopsis balconi* n. sp. as contrasted against *M. squamosa* is another example of evolutionary convergence in squat lobsters (Fig. 7), in which the existence of carapace sculpture, the reduction of the ocular orbits, the number and existence of epipods on pereiopods, and the presence of eye spines seem to be morphological homoplasies. In the case of *Munidopsis*, the existence of such a great morphological diversification appears to be more common than a pattern of morphological stasis like in many species of *Munida* (Machordom & Macpherson, 2004). Several authors have highlighted the high morphological disparity of the genus (e.g., Baba, 2005; Ahyong *et al.*, 2011), which is coupled in some cases with low genetic divergences (Jones & Macpherson, 2007; Dong *et al.*, 2019).

11.35 Either the high degree of morphological convergence or the high morphological diversification make difficult the establishment of new taxa in the absence of molecular data and phylogenetic analyses (Rodríguez-Flores *et al.*, 2019). For instance, the sister species, *Munidopsis squamosa* and *M. pholidota*, are hardly distinguishable when only using morphological characters; however, cryptic species are not commonly found in this family (but see Rodríguez-Flores *et al.*, 2020). Moreover, several previous works have indicated the polyphyletic nature of both *Munida* (Machordom & Macpherson, 2004; Rodríguez-Flores *et al.*, 2019; Miranda *et al.*, 2021) and *Munidopsis* (Ahyong *et al.*, 2011). Ongoing studies including a more complete taxonomic sampling and analyses of several molecular markers indicate that both are composite taxa, including multiple ancient lineages at genus level (Rodríguez-Flores, 2021; Machordom *et al.*, unpublished data).

11.50 New species of *Munida* and *Munidopsis* are described each year (Rodríguez-Flores *et al.*, 2018; Dong *et al.*, 2019, 2021; Macpherson *et al.*, 2020). Considering that only a small part of the deep sea is explored, the known diversity of squat lobsters would constitute just the peak of the iceberg (Appeltans *et al.*, 2012). Moreover, some of these squat lobster species are only known from the holotype or the type locality (e.g., Macpherson *et al.*, 2016, Rodríguez-Flores *et al.*, 2018), which is evidence of either uncommonness (endemic species or only found in a few seamounts), low abundances, or lack of exhaustive exploration of the deep-sea floor. The deep sea is of high interest as a source of several desirable resources, like the polymetallic nodules (Vanreusel *et al.*, 2016). Therefore, efforts in taxonomy and exploration should be increased in order to get to know these uncommon and vulnerable species to preserve them before any potential impact of human activity on their populations and habitats.

ACKNOWLEDGMENTS

11.70 We thank our colleagues who made specimens available for study: P. Bouchet, L. Corbari, and P. Martin-Lefèvre, all from the MNHN, Paris, and J. Poupin (Ecole Navale, Brest, France). Thanks also to

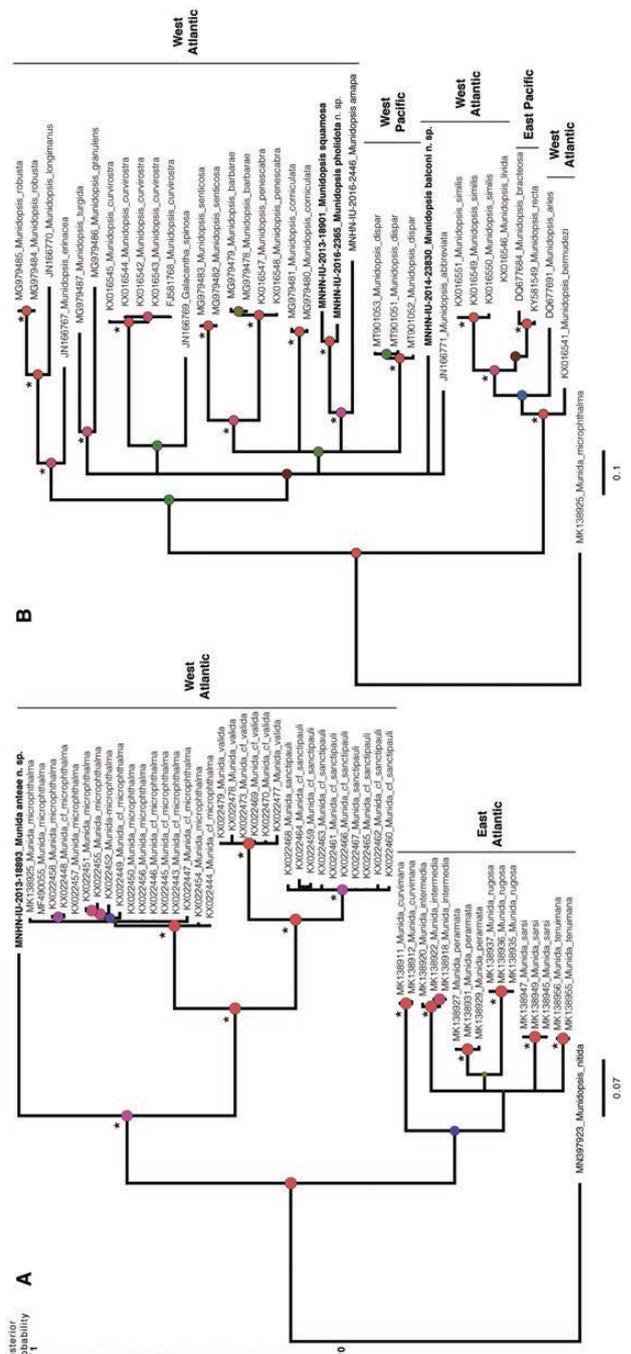


Figure 7. Phylogenetic placement of A. *Munida antea* n. sp. (A) and *Munidopsis* new species (B) according to Bayesian analyses of COI partial marker. Asterisks indicate nodes supported also by ML analyses (bootstrap support >70). Colours at nodes indicate values for posterior probabilities (see legend). GenBank accession numbers or voucher codes for the species analyzed in this study are at the tips of each branch.

Ricardo García for his help with the laboratory work. We are also indebted to all the chief scientists of KARUBENTHOS 2015 cruise (<https://doi.org/10.17600/15005400>), including the captains, crew, and scientists who sorted out material and provided the specimens used in this study. We thank A. Baldinger for his assistance when revising the MCZ collection. Thanks to the Editor-in-Chief and to the two anonymous reviewers for their helpful comments, corrections and suggestions on the manuscript. This study

12.5 was partially supported by a project of the Ministry of Economy, Industry and Competitiveness (CTM2014-57949-R) and by the GALETTE project (Galatheaidea lobster adaptations to deep sea environments), co-founded by CNRS (France) and CSIC (Spain) (2018FR0053). PCRF was provided graduate student support by the The Crustacean Society Fellowship Student Award (2020) and is currently funded by the E.O. Wilson Biodiversity Postdoctoral Fellowship at the Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA.

REFERENCES

- 12.15 Alcock, A. & Anderson, A.R.S. 1899. I. Natural history notes from HM Royal Indian Marine survey ship 'investigator,' Commander TH Heming, RN, Commanding. Series III., No. 2. An account of the deep-sea Crustacea dredged during the surveying-season of 1897-98. *Journal of Natural History*, **3**: 1-27.
- 12.20 Appeltans, W., Ah Yong, S.T., Anderson, G., Angel, M.V., Artois, T., Bailly, N., Bamber, R.N., Barber, A., Bartsch, I., Berta, A., Blažewicz-Paszkwyc, M., Bock, P., Boxshall, G.A., Boyko, C.B., Brandão, S.N., Bray, R.A., Bruce, N.L., Cairns, S.D., Chan, T.-Y., Chan, L., Collins, A.G., Cribb, T., Curini-Galletti, M., Dahdouh-Guebas, F., Davie, P.J.F., Dawson, M.N., De Clerck, O., Wim, D., De Grave, S., de Voogd, N.J., Doming, D.P., Emig, C., Ercsés, C., Eschmeyer, W., Fauchald, K., Fautin, D.G., Feist, S.W., Fransen, C.H.J.M., Furuya, H., Garcia-Alvarez, O., Gerken, S., Gibson, D., Gittenberger, A., Gofas, S., Gómez-Daglio, L., Gordon, D.P., Guiry, M.D., Hernandez, F., Hoeksema, B.W., Hopper, R., Jaume, D., Kirk, P., Koedam, N., Koenemann, S., Kolb, J.B., Kristensen, R.M., Kroh, A., Lambert, G., Lazarus, D.B., Lemaitre, R., Longshaw, M., Lowry, J.K., Macpherson, E., Madin, L.P., Mah, C., Mapstone, G., McLaughlin, P.A., Mees, J., Meland, K., Messing, C., Mills, C., Molodtsova, T., Mooi, R., Neuhaus, B., Ng, P.K.L., Nielsen, C., Norenburg, J., Opresko, D.M., Osawa, M., Paulay, G., Perrin, W., Pilger, J., Poore, G.C.B., Pugh, P., Read, G.B., Reimer, J.D., Rius, M., Rocha, R., Saiz-Salinas, J., Scarabino, V., Schierwater, B., Schmidt-Rhaesa, A., Schnabel, K., Schotte, M., Schuchert, P., Schwabe, E., Segers, H., Self-Sullivan, C., Schenkar, N., Siegel, V., Sterrer, W., Stöhr, S., Swalla, B., Tasker, M., Thuesen, E.V., Timm, T., Todaro, A., Turon, X., Tyler, S., Uetz, P., van der Land, J., Vanhoorne, B., van Ofwegen, L., van Soest, R., Vanaverbeke, J., Walker-Smith, G.K., Walter, T.C., Warren, A., Williams, G.C., Wilson, S. & Costello, M.J. 2012. The magnitude of global marine species diversity. *Current Biology*, **22**: 2189-2202.
- 12.25 Baba, K. 1969. Four new genera with their representatives and six new species of the Galatheaidea in the collection of the Zoological Laboratory, Kyushu University, with redefinition of the genus Galathea. *Ohmu*, **2**: 1-32.
- 12.30 Baba, K. 1988. Chirostyliid and galatheid crustaceans (Decapoda: Anomura) of the "Albatross" Philippine Expedition, 1907-1910. *Researches on Crustacea, Special Number*, **2**: 1-203.
- 12.35 Baba, K. & de Saint Laurent, M. 1996. Crustacea Decapoda: Revision of the genus Bathymunida Balss, 1914, and description of six new related genera (Galatheaidea). In: Résultats des Campagnes MUSORSTOM, 15. A. Crosnier (ed.), *Mémoires du Muséum National d'Histoire Naturelle*, **168**: 433-502.
- 12.40 Baba, K. 2005. Deep-sea chirostyliid and galatheid crustaceans (Decapoda: Anomura) from the Indo-Pacific, with a list of species. *Galathea Report*, **20**: 1-317.
- 12.45 Baba, K. & Camp, D.K. 1988. Two species of galatheid crustaceans (Decapoda: Anomura) new to Florida, *Munida spinifrons* Henderson, and *Munidopsis kucki*, new species. *Proceedings of the Biological Society of Washington*, **101**: 414-422.
- 12.50 Baba, K., Macpherson, E., Lin, C.W. & Chan, T.Y. 2009. *Crustacean fauna of Taiwan: Squat lobsters Chirostyliidae and Galatheaidea*. National Taiwan Ocean University, Keelung, Taiwan.
- 12.55 Baba, K., Macpherson, E., Poore, G.C.B., Ah Yong, S.T., Bermudez, A., Cabezas, P., Lin, C.W., Nizinski, M., Rodrigues, C. & Schnabel, K.E. 2008. Catalogue of squat lobsters of the world (Crustacea: Decapoda: Anomura families Chirostyliidae, Galatheaidea and Kiwaidea). *Zootaxa*, **1905**: 1-220.
- 12.60 Benedict, J.E. 1902. Description of a new genus and forty six new species of crustaceans of the family Galatheaidea with a list of the known marine species. *Proceedings of the Biological Society of Washington*, **26**: 243-334.
- 12.65 Boone, L. 1927. Scientific results of the first oceanographic expedition of the "Pawnee", 1925. Crustacea from the tropical east American Seas. *Bulletin of the Bingham Oceanographic Collection*, **1**: 1-147.
- 12.70 Boschi, E.E. 2000. Biodiversity of marine decapod brachyurans of the Americas. *Journal of Crustacean Biology*, **20**: 337-342.
- 12.75 Cabezas, P., Macpherson, E. & Machordom, A. 2009. Morphological and molecular Description of new species of squat lobster (Crustacea: Decapoda: Galatheaidea) from the Solomon and Fiji Islands (South-West Pacific). *Zoological Journal of the Linnean Society*, **156**: 465-493.
- 12.80 Cabezas, P., Sanmartín, I., Paulay, G., Macpherson, E. & Machordom, A. 2012. Deep under the sea: unraveling the evolutionary history of the deep sea squat lobster *Paramunida* (Decapoda, Munididae). *Evolution*, **66**: 1878-1896.
- 12.85 Campos, N.H., Navas, G.R., Bermúdez, A. & Cruz, N. 2005. *Los crustáceos decápodos de la franja superior del talud continental (300-500 m) del mar Caribe colombiano (Monografía 2 de la Fauna de Colombia)*. Instituto Nacional de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá.
- 12.90 Cardoso, I.E., Serejo, C.S. & Rodrigues, C. 2014. A new *Munidopsis* species (Galatheaidea, Munidopsidae) from the Southwestern Atlantic. *Zootaxa*, **3815**: 441-446.
- 12.95 Chace, F.A. 1942. The Anomura Crustacea. I. Galatheaidea. Reports of the scientific results of the Atlantis Expeditions to the West Indies, under the joint auspices of the University of Havana and Harvard University. *Torrea*, **11**: 1-106.
- 12.100 Coykendall, D.K., Nizinski, M.S. & Morrison, C.L. 2017. A phylogenetic perspective on diversity of Galatheaidea (Munida, Munidopsis) from cold-water coral and cold seep communities in the western North Atlantic Ocean. *Deep Sea Research Part II: Topical Studies in Oceanography*, **137**: 258-272.
- 12.105 Crandall, K.A. & Fitzpatrick, J. F. Jr. 1996. Crayfish molecular systematics: using a combination of procedures to estimate phylogeny. *Systematic Biology*, **45**: 1-26.
- 12.110 Doflein, F. & Balss, H. 1913. Die Galatheaidea der Deutschen Tiefsee-Expedition. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899*, **20**: 125-184, pls. 12-17.
- 12.115 Dong, D., Gan, Z. & Li, X. 2021. Descriptions of eleven new species of squat lobsters (Crustacea: Anomura) from seamounts around the Yap and Mariana Trenches with notes on DNA barcodes and phylogeny. *Zoological Journal of the Linnean Society*, **192**: 306-355.
- 12.120 Dong, D., Xu, P., Li, X.Z. & Wang, C. 2019. *Munidopsis* species (Crustacea: Decapoda: Munidopsidae) from carcass falls in Weijia Guyot, West Pacific, with recognition of a new species based on integrative taxonomy. *PeerJ*, **7**: e8089, doi: [10.7717/peerj.8089](https://doi.org/10.7717/peerj.8089)
- 12.125 Folmer, R.H.A., Nilges, M., Folkers, P.J.M., Konings, R.N.H. & Hilbers, C.W. 1994. A model of the complex between single-stranded DNA and the single-stranded DNA binding protein encoded by gene V of filamentous bacteriophage M13. *Journal of Molecular Biology*, **240**: 341-357.
- 12.130 García-Raso, J.E., Cuesta, J.A., Abelló, P. & Macpherson, E. 2018. Updating changes in the Iberian decapod crustacean fauna (excluding crabs) after 50 years. *Scientia Marina*, **82**: 207-229.
- 12.135 Henderson, J.R. 1885. Diagnoses of new species of Galatheaidea collected during the "Challenger" expedition. *Annals and Magazine of Natural History, Series 5*, **16**: 407-421.
- 12.140 Huelsenbeck, J.P. & Ronquist, F. 2001. MRBAYES: Bayesian inference of phylogenetic trees. *Bioinformatics*, **17**: 754-755.
- 12.142 Jones, W.J. & Macpherson, E. 2007. Molecular phylogeny of the East Pacific squat lobsters of the genus *Munidopsis* (Decapoda: Galatheaidea) with the descriptions of seven new species. *Journal of Crustacean Biology*, **27**: 477-501.
- 12.145 Katoh, K., Misawa, K., Kuma, K.I. & Miyata, T. 2002. MAFFT: a novel method for rapid multiple sequence alignment based on fast Fourier transform. *Nucleic Acids Research*, **30**: 3059-3066.
- 12.150 Larsson, A. 2014. AliView: a fast and lightweight alignment viewer and editor for large data sets. *Bioinformatics*, **30**: 3276-3278.

NEW DEEP-SEA SQUAT LOBSTERS FROM GUADELOUPE

- 13.5 Leach, W.E. 1820. Galatéadées. In: *Dictionnaire des Sciences Naturelles*, pp. 49–56. F. G. Leveault, Paris.
- Machordom, A. & Macpherson, E. 2004. Rapid radiation and cryptic speciation in squat lobsters of the genus *Munida* (Crustacea, Decapoda) and related genera in the South West Pacific: molecular and morphological evidence. *Molecular Phylogenetics and Evolution*, **33**: 259–279.
- 13.10 Machordom, A., Araujo, R., Erpenbeck, D. & Ramos, M.A. 2003. Phylogeography and conservation genetics of endangered European Margaritiferidae (Bivalvia: Unionoidea). *Biological Journal of the Linnean Society*, **78**: 235–252.
- Macpherson, E. & Baba, K. 2012. The squat lobsters of the genus *Sadychia* Baba, 1969 (Crustacea: Decapoda: Anomura: Munididae): new records including six new species from the Pacific Ocean. *Zootaxa*, **3589**(1): 30–48.
- 13.15 Macpherson, E., Amon, D. & Clark, P.F. 2014. A new species of *Munidopsis* from seamount of the Southwest Indian Ocean Ridge (Decapoda: Munidopsidae). *Zootaxa*, **3753**: 291–296.
- 13.20 Macpherson, E., Beuck, L. & Freiwald, A. 2016. Some species of *Munidopsis* from the Gulf of Mexico, Florida Straits and Caribbean Sea (Decapoda: Munidopsidae), with the description of two new species. *Zootaxa*, **4137**: 405–416.
- Macpherson, E., Rodríguez-Flores, P.C. & Machordom, A. 2020. Squat lobsters of the families Munididae and Munidopsidae from Papua New Guinea. In: *Deep-sea crustaceans from Papua New Guinea. Tropical Deep-Sea Benthos*, Vol. **31** (L. Corbari, S.T. Ah Yong & T.-Y. Chan, eds.), *Mémoires du Muséum national d'Histoire naturelle*, **213**: 11–120.
- 13.25 Mayo, B.S. 1974. *The systematics and distribution of the deep-sea genus Munidopsis (Crustacea, Galatheaidea) in the western Atlantic Ocean*. Ph. D. thesis, University of Miami, Miami, FL, USA.
- Mantelatto, F.L., Terossi, M., Negri, M., Buranelli, R.C., Robles, R., Magalhaes, T., Tamburus, A.F., Rossi, N. & Miyazaki, M.J. 2018. DNA sequence database as a tool to identify decapod crustaceans on the São Paulo coastline. *Mitochondrial DNA Part A*, **29**: 805–815.
- 13.30 Mayo, B.S. 1972. Three new species of the family Galatheaidea (Crustacea, Anomura) from the western Atlantic. *Bulletin of Marine Science*, **22**: 522–535.
- 13.35 Mayo, B.S. 1974. *The systematics and distribution of the deep-sea genus Munidopsis (Crustacea, Galatheaidea) in the western Atlantic Ocean*. Ph. D. thesis, University of Miami, Miami, FL, USA.
- Melo-Filho, G.A.S. de. 1996. Descrição de *Munida victoria* sp. n. e comparação com *M. micropthalma* A. Milne-Edwards, em sua primeira ocorrência na costa brasileira (Crustacea: Decapoda: Galatheaidea). *Papéis Avulsos de Zoologia*, **39**: 271–280.
- 13.40 Melo-Filho, G.A.S. de & Melo, G.A.S. de. 1992. Designation of lectotypes for the species of *Munida* (Crustacea: Anomura: Galatheaidea) collected by the U.S. Coast Survey Steamer Blake (1877–1879) and the description of a new species. *Proceedings of the Biological Society of Washington*, **105**: 512–520.
- 13.45 Melo-Filho, G.A.S. de & Melo, G.A.S. de. 2001. Espécies do gênero *Munida* Leach (Crustacea, Decapoda, Galatheaidea), distribuídas na costa do Brasil. *Revista Brasileira de Zoologia*, **18**: 1135–1176.
- Miller, M.A., Pfeiffer, W. & Schwartz, T. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. In: *Proceedings of the Gateway Computing Environments Workshop (GCE)*, 14 Nov. 2010, *New Orleans, LA*, pp. 1–8.
- 13.50 Milne-Edwards, A. 1880. Reports on the results of dredging under the supervision of Alexander Agassiz, in the Gulf of Mexico and in the Caribbean Sea, etc. VIII. Études préliminaires sur les Crustacés. *Bulletin of the Museum of Comparative Zoology at Harvard College*, **8**: 1–168, pls. 1, 2.
- 13.55 Milne-Edwards, A. & Bouvier, E.L. 1894. Crustacés décapodes provenant des campagnes du yacht l'Hirondelle (1886, 1887, 1888). I. Brachyures et Anomoures. *Résultats des Campagnes Scientifiques accomplies sur son Yacht par Albert Ier Prince Souverain de Monaco*, **7**: 3–112, pls. 1–11.
- 13.60 Milne-Edwards, A. & Bouvier, E.L. 1897. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877–78), in the Caribbean Sea (1878–79), and along the Atlantic coast of the United States (1880), by the U. S. Coast Survey steamer “Blake,” Lieut.-Com. C.D. Sigsbee, U.S.N., and Commander J.R. Bartlett, U.S.N., commanding XXXV: Description des Crustacés de la Famille des Galathéidés recueillis pendant l'expédition. *Memoirs of the Museum of Comparative Zoology at Harvard College*, **19**: 5–141.
- 13.65 Miranda, I., Peres, P.A., Tavares, M.D.S. & Mantelatto, F.L. 2020. New molecular data on squat lobster from the coast of São Paulo State (Brazil) (Anomura: Munida and Agononida) and insights on the systematics of the family Munididae. In: *Deep-Sea Pycnogonids and Crustaceans of the Americas* (M.E. Hendrickx, ed.) pp. 343–356. Springer, Cham, Switzerland.
- 13.70 Palumbi, S. 1991. *Simple fool's guide to PCR*. University of Hawaii, Honolulu.
- Pequegnat, L.H. & Pequegnat, W.E. 1970. Deep-sea anomurans of superfamily Galatheaidea with description of three new species. In: *Contributions to the Biology of the Gulf of Mexico* (W.E. Pequegnat & F.A. Chace, eds.), pp. 125–170. Texas A&M University, College Station, TX, USA.
- 13.80 Pequegnat, W.E. & Pequegnat, L.H. 1971. New species and new records of *Munidopsis* (Decapoda: Galatheaidea) from the Gulf of Mexico and Caribbean Sea. *Texas A&M University Oceanographic Studies*, **1**(Supplement): 3–24.
- Pequegnat, L.H. & Williams, A.B. 1995. Two new species of *Munidopsis* (Decapoda, Anomura, Galatheaidea) from the Western Atlantic Ocean. *Journal of Crustacean Biology*, **15**: 786–792.
- 13.85 Poore, G.C.B. 2014. Three new American species of *Munidopsis* (Crustacea: Anomura: Munidopsidae). *Nauplius*, **22**: 53–62.
- Poore, G.C.B. & Andreakis, N. 2012. The *Agononida incerta* species complex unravelled (Crustacea: Decapoda: Anomura: Munididae). *Zootaxa*, **3492**: 1–29.
- 13.90 Poupin, J. 1994. *Faune marine profonde des Antilles Françaises. Récoltes du navire Polka faites en 1993*. Collection Études et Thèses, ORSTOM, Paris 1.
- Poupin, J. & Corbari, L. 2016. A preliminary assessment of the deep-sea Decapoda collected during the KARUBENTHOS 2015 Expedition to Guadeloupe Island. *Zootaxa*, **4190**: 1–107.
- 13.95 Rambaut, A. 2012. Figtree 1.4.0 [<http://tree.bio.ed.ac.uk/software/figtree/>].
- Richer de Forges, B., Chan, T.Y., Corbari, L., Lemaitre, R., Macpherson, E., Ah Yong, S.T. & Ng, P.K. 2013. The MUSORSTOM TDSB Deep sea benthos exploration programme (1976–2012): an overview of crustacean discoveries and new perspectives on deep sea zoology and biogeography. *Tropical Deep-sea Benthos*, **185**: 1–13.
- 13.100 Rodríguez-Flores, P.C. 2021. *Biodiversidad, biogeografía y patrones evolutivos en crustáceos (Anomura, Galatheaidea) de zonas tropicales y templadas*. Ph.D. thesis, University of Barcelona, Barcelona, Spain.
- Rodríguez-Flores, P.C., Buckley, D., Macpherson, E., Corbari, L. & Machordom, A. 2020. Deep sea squat lobster biogeography (Munidopsidae: *Leiogalthea*) unveils Tethyan vicariance and evolutionary patterns shared by shallow water relatives. *Zoologica Scripta*, **49**: 340–356.
- Rodríguez-Flores, P.C., Machordom, A., Abelló, P., Cuesta, J.A. & Macpherson, E. 2019. Species delimitation and multi-locus species tree solve an old taxonomic problem for European squat lobsters of the genus *Munida* Leach, 1820. *Marine Biodiversity*, **49**: 1751–1773.
- 13.110 Rodríguez-Flores, P.C., Macpherson, E. & Machordom, A. 2018. Three new species of squat lobsters of the genus *Munidopsis* Whiteaves, 1874, from Guadeloupe Island, Caribbean Sea (Crustacea, Decapoda, Munidopsidae). *Zootaxa*, **4422**: 569–580.
- 13.115 Schnabel, K.E. 2020. *The marine fauna of New Zealand: Squat lobsters (Crustacea, Decapoda, Chirostyloidea)*. National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand.
- Schnabel, K.E. & Bruce, N.L. 2006. New records of *Munidopsis* (Crustacea: Anomura: Galatheaidea) from New Zealand with description of two new species from a seamount and underwater canyon. *Zootaxa*, **1172**: 49–67.
- 13.120 Schnabel, K.E., Ah Yong, S.T., Gomez, A.J., Hendrickx, M.E., Peart, R.A. & Weston, J.N.J. 2020. The deep-water crustacean and pycnogonid fauna of the Americas in a global context. In: *Deep-Sea Pycnogonids and Crustaceans of the Americas* (M.E. Hendrickx, ed.), pp. 1–24. Springer Nature, London.
- 13.125 Schnabel, K.E., Cabezas, P., McCallum, A., Macpherson, E., Ah Yong, S.T. & Baba, K. 2011. World-wide distribution patterns of squat lobsters. In: *The biology of squat lobsters*. (G.C.B. Poore, S.T. Ah Yong & J. Taylor) pp. 149–182. CSIRO Publishing, Melbourne, Australia and CRC Press, Boca Raton, FL, USA.
- 13.130 Smith, S.I. 1883. Preliminary report on the Brachyura and Anomura dredged in deep water off the south coast of New England by the United States Fish Commission in 1880, 1881, and 1882. *Proceedings of the United States National Museum*, **6**: 1–57, pls. 51–56.
- 13.135 Swofford, D.L. 2002. *PAUP: phylogenetic analysis using parsimony, version 4.0 b10*. Sinauer, MA, USA.
- Tavares, M. & Campinho, P. 1998. Three new records of deep-sea squat lobsters of the genus *Munidopsis* Whiteaves from the southwestern Atlantic Ocean (Decapoda: Galatheaidea). *Crustacean Research*, **27**: 88–100.
- Vázquez-Bader, A.R., Gracia, A. & Lemaitre, R. 2014. A new species of *Munidopsis* Whiteaves, 1874 (Crustacea: Anomura: Galatheaidea: Munidopsidae) from the Gulf of Mexico and Caribbean Sea. *Zootaxa*, **3821**: 354–362.
- 13.140
- 13.142

14.5	Vanreusel, A., Hilario, A., Ribeiro, P.A., Menot, L. & Arbizu, P.M. 2016. Threatened by mining, polymetallic nodules are required to preserve abyssal epifauna. <i>Scientific Reports</i> , 6 : doi: 10.1038/srep26808	Young, C.G. 1900. <i>The stalk-eyed Crustacea of British Guiana, West Indies, and Bermuda</i> . J.M. Watkins, London.	14.75
14.10	Vrijenhoek, R.C. 2009. Cryptic species, phenotypic plasticity, and complex life histories: assessing deep-sea faunal diversity with molecular markers. <i>Deep Sea Research Part II: Topical Studies in Oceanography</i> , 56 (19–20): 1713–1723.	Whiteaves, J.F. 1874. On recent deep-sea dredging operations in the Gulf of St. Lawrence. <i>American Journal of Science, Ser. 3</i> , 7 : 210–219.	14.80
14.15		Wicksten, M.K. & Packard, J.M. 2005. A qualitative zoogeographic analysis of decapod crustaceans of the continental slopes and abyssal plain of the Gulf of Mexico. <i>Deep Sea Research Part I: Oceanographic Research Papers</i> , 52 : 1745–1765.	14.85
14.20			14.90
14.25			14.95
14.30			14.100
14.35			14.105
14.40			14.110
14.45			14.115
14.50			14.120
14.55			14.125
14.60			14.130
14.65			14.135
14.70			14.140
14.72			14.142