

ZOOTAXA

1095

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Species of the genus *Munidopsis* (Crustacea, Decapoda, Galatheidae) from the deep Atlantic Ocean, including cold-seep and hydrothermal vent areas

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Abstract

Twenty-two species of the genus *Munidopsis* from the Atlantic Ocean are studied. Five new species are described (*M. anemia*, *M. exuta*, *M. hirtella*, *M. laurentae* and *M. truculenta*), and diagnoses and illustrations of some relatively rare species (*M. acuminata*, *M. bairdii*, *M. livida*, *M. parfaiti* and *M. thieli*) are provided. None of the species discussed here is restricted to a particular habitat, including species collected from hydrothermal vent (*M. acutispina*, *M. exuta*) and cold seep areas (*M. acutispina*, *M. geyeri*, *M. hirtella*, *M. livida*, *M. marionis*). The new records of some species greatly extend the previously known distribution range of the species (i.e., *M. abyssicola*, *M. aries*, *M. bairdii*, *M. geyeri*, *M. livida*, *M. parfaiti*, *M. thieli*). Finally, some biological and biogeographical data for the different species are discussed.

Key words: Crustacea, Decapoda, Anomura, Galatheidae, *Munidopsis*, new species, hydrothermal vents, cold-seeps, taxonomy

Introduction

The galatheid crabs of the genus *Munidopsis* Whiteaves, 1874, distributed worldwide in all deep-sea habitats, is one of the most diverse genera of the family Galatheidae (Baba 1988, 2005). Species of this genus are commonly found living on the continental slope, usually deeper than 500 m, and on the abyssal plain, > 2000 m (Chace 1942, Miyake & Baba 1970, Pequegnat & Pequegnat 1970, 1971, Baba 2005). They are frequently observed by submersibles during mid-oceanic ridge expeditions and some species have been observed in recently discovered vent and cold-seep communities (Williams 1988, Hashimoto *et al.* 1995, Chevaldonné & Olu 1996). Despite their ecological importance and high diversity, many aspects of their systematics and distribution are still poorly known (Baba 2005).

The genus *Munidopsis* is so far represented in the Atlantic Ocean by more than 70 species, living between 2 m (*M. polymorpha* Koelbel, 1892) and 5330 m (*M. parfaiti* (Filhol, 1885) and *M. thieli* Türkay, 1975). These species have been studied by many authors, either from specimens collected in the eastern Atlantic (e.g., A. Milne-Edwards & Bouvier 1894, 1900, Hansen 1908, Sivertsen & Holthuis 1956, Miyake & Baba 1970, de Saint-Laurent 1985, Tiefenbacher 2001) or the western Atlantic (e.g., A. Milne-Edwards 1880, Chace 1942, Pequegnat & Pequegnat 1970, 1971, Wenner 1982, Gore 1983, Takeda 1983, Pequegnat & Williams 1995, Tavares & Campinho 1998a, b, Navas *et al.* 2003). Sampling effort in the bathyal and abyssal plains (1000 m to 5330 m), where species of *Munidopsis* are more common (Baba 2005), has been very sporadic until recently, limiting our knowledge of the distributional ranges of different species, and few data on their biology have been available (Wenner 1982, Gore 1983, Samuelson 1972, Wilkens *et al.* 1990, Creasey *et al.* 2000).

After numerous expeditions carried out in the last decades in the deep-waters of the Atlantic Ocean, from Ireland to South Africa, including the hydrothermal vents of the Mid-Atlantic Ridge, and the cold seep areas of the Gulf of Mexico, eastern Mediterranean Sea and west African equatorial margin, a large number of specimens belonging to 22 species of *Munidopsis* were found. The present paper includes the occurrences of these species, the description of five new species (*M. anemia*, *M. exuta*, *M. hirtella*, *M. laurentae* and *M. truculenta*), and the diagnoses and illustrations of some relatively rare species (*M. acuminata* Benedict, 1902, *M. bairdii* (Smith, 1884), *M. livida* (Perrier, 1886), *M. parfaiti* (Filhol, 1885) and *M. thieli* Türkay, 1975). Finally, the biology and biogeography of various species are discussed.

Material and methods

Most specimens studied here were collected during a large number of French cruises between 1969 and 2004, and some British, German, Russian and American cruises (Table 1). Data collected during French cruises are stored in the database for deep-sea benthic ecological data BIOCEAN, and are available on the website: www.ifremer/isi/biocean. The specimens were caught using diverse kinds of trawls and dredges, by grab or slurp gun of the submersible Nautille and Remotely Operated Vehicle (ROV Victor), or, more rarely, by baited traps. They were initially fixed in formalin after capture and transferred to ethanol and sorted in the center Centob, LEP-Ifremer. These collections include specimens collected from the hydrothermal vent community of several Mid-Atlantic-Ridge (MAR, Van Dover 1995) sites: Snake Pit, (23°N, 3500 m), TAG-Kremlin Zone (26°N, 3650 m), Lost City site (15 km from the MAR spreading axis, 30°N, 830 m, Kelley *et al.* 2001, Gebruk *et al.* 2002); and the Battleship “Bismark” wreck site (35°N, 16°W, 4670 m, Sagalevich *et al.* 2002). Additional material was obtained at cold-seep sites: Florida Escarpment (3288 m; Turnipseed *et al.* 2004), Congo Fan (2417 m), Regab (west African equatorial margin, off Congo, 3155 m; Andersen *et al.* 2004, Ondréas *et al.* 2005), and also specimens from a long term colonisation tray, moored at ~2 km from this cold-seep area (A. Khripounoff, pers. com.), and from the Kazan mud volcano (eastern Mediterranean Sea, 1700–2030 m; Olu-Le Roy *et al.* 2004).

Some ecological data were obtained from the analyses of the video-tapes taken by the submersibles DS Nautille (HYDROSLAKE, 1988, hydrothermal MAR vent site Snake Pit; and FARANAUT, 1992, MAR valley, Fifteen Twenty Fracture Zone), DS Alvin (MAR 93, 1993, vent site Logatchev, 14°45'N, 3020 m), and ROV Victor (BIOZAIRE 2, 2001, cold-seep area Regab).

The specimens, including type material, are deposited in the collections of the Muséum National d'Histoire Naturelle, Paris (MNHN). The material collected during the M56 and MAR-ECO cruises has been deposited in the Senckenberg Institute (Frankfurt, Germany) and University of Bergen (Norway), respectively. The types of *M. acuminata*

Benedict, 1902 from the National Museum of Natural History (USNM, Smithsonian Institution, Washington D.C.) were also studied for comparison with *M. anemia* n. sp. Measurements of specimens represent the postorbital carapace length. Terminology used mainly follows Zariquiey-Alvarez (1952), Baba & de Saint-Laurent (1996), and Baba (2005).

TABLE 1. Cruises that collected galatheids studied in this paper.

Cruise	Chief Scientist	Ship/submarine	Region	Date
NORATLANTE	L. Laubier, Ifremer	Jean Charcot	NE Atlantic	03.08–02.11.1969
Congo	A. Crosnier, MNHN	NO Ombango	Gulf of Guinea	18.11.1969
WALDA	G. Pautot, Ifremer	NO Jean Charcot	SE Atlantic	26.05–24.08.1971
BIACORES	J. Forest, MNHN	NO Jean Charcot	N Atlantic	04.10–20.11.1971
BIOGAS 1	P. Chardy, Ifremer	NO La Perle	Bay of Biscay	03.08–10.08.1972
POLYGAS	L. Laubier, Ifremer	NO Jean Charcot	Bay of Biscay	23.10–04.11.1972
BIOGAS 2	D. Reyss, Ifremer	NO Jean Charcot	Bay of Biscay	14.04–21.04.1973
BIOGAS 3	L. Laubier, Ifremer	NO Jean Charcot	Bay of Biscay	23.08–03.09.1973
THALASSA 73	L. Cabioch, CNRS	NO La Thalassa	Bay of Biscay	21–30.10.1973
BIOGAS 4	P. Chardy, Ifremer	NO Jean Charcot	Bay of Biscay	16.02–27.02.1974
BIOGAS 5	L. Laubier, Ifremer	NO Cryos	Bay of Biscay	14.06–22.06.1974
BIOGAS 6	L. Laubier, Ifremer	NO Jean Charcot	Bay of Biscay	18.10–02.11.1974
INCAL	L. Laubier, Ifremer	NO Jean Charcot	N & S Irland	02.07–12.08.1976
WALVIS	M. Sibuet, Ifremer	NO Jean Charcot	SE Atlantic, off South-Africa	20.12.1978– 15.01.1979
SEABED 2	M. Sibuet, Ifremer	NO Jean Charcot	NE Atlantic	05–24.11.1980
ABYPLAINE	C. Monniot, MNHN	NO Cryos	NE Atlantic	11.05–16.06.1981
BIOGAS 11	D. Desbruyères, Ifremer	NO Jean Charcot	Bay of Biscay	23.09–13.10.1981
EPI 1	A. Khripounoff, Ifremer	NO Suroît	Bay of Biscay	27.03–02.04.1984
EPI 4	A. Khripounoff, Ifremer	NO Le Noroît	Bay of Biscay	01.09–07.09.1985
HYDROSNAKE	C. Mével, Paris VI	DSV Nautilie. NO L'Atalante	Mid-Atlantic Ridge, 23°N	10.06–14.07.1988
ECOFER	A. Dinet, Banyuls/Mer	NO Le Noroît	Bay of Biscay	19.06–17.07.1989
EUMELI 2	M. Sibuet, Ifremer	NO L'Atalante	NE Atlantic	09.01–22.02.1991
EUMELI 3	J. Guy, Banyuls/Mer	NO L'Atalante	NE Atlantic	14–30.09.1991
FARANAUT	H. Bougault, Ifremer	DSV Nautilie. NO L'Atalante	Mid-Atlantic Ridge, 15°N	15.03–14.04.1992
EUMELI 4	P. Buat-Ménard, Gif/Yvette	NO L'Atalante	NE Atlantic	21.05–09.06.1992

.....continued on the next page

TABLE 1 (continued)

Cruise	Chief Scientist	Ship/submarine	Region	Date
SEAMOUNT 2	S. Gofas, MNHN	NO Le Suroît	NE-Atlantic	04.01–13.02.1993
MAR 93	C. Van dover, USA & A. Fiala, Banyuls/Mer	Alvin/RV Atlantis II & NO Jean Charcot	Mid-Atlantic Ridge	05–30.06.1993
OCEANAUT	D. Bideau. Ifremer	Nautile/RV Atlantis II & NO Jean Charcot	Mid-Atlantic Ridge, 35°-33°N	23.08–20.09.1995
PROSPEC	J.-C. Brabant, Ifremer	NO Thalassa	NE Atlantic	26.06–20.07.1996
MEDINAUT	J.-P. Foucher, Ifremer	DSV Nautile. NO Nadir	Mediterranean	17.11–20.12.1998
BENGAL 2	A. Rice, Southampton	RV Discovery	NE Atlantic	12.03–10.04.1997
BENGAL 3	B. Bett, Southampton	RV Discovery	NE Atlantic	02–31.07.1997
BENGAL 5	A. Rice, Southampton	RV Discovery	NE Atlantic	01–31.03.1998
BENGAL 6	M. Sibuet, Ifremer	RV Discovery	NE Atlantic	25.09–08.10.1998
ALVIN	C. Van Dover, USA	RV Atlantis II	Florida Escarpment	28–30.10.2000
BIOZAÏRE 1	M. Sibuet, Ifremer	ROV Victor. NO L'Atalante	Gulf of Guinea	03.–15.01.2001
BIOZAÏRE 2	M. Sibuet, Ifremer	ROV Victor. NO L'Atalante	Gulf of Guinea	15.11–04.12.2001
AMK 47	A.M. Sagalevich, Moscow	RV Akademik Mstislav Keldysh	N-Atlantic	31.05–14.08.2002
M 56	V. Spiess, Bremen	RV Meteor	Gulf of Guinea	20.11–29.12.2002
BIOZAÏRE 3	A. Khripounoff, Ifremer	NO L'Atalante	Gulf of Guinea	12.12.2003– 10.01.2004
BIOZ-RECUP	P. Crassous, Ifremer	NO Le Suroît	Gulf of Guinea	20.01–06.02.2003
MAR-ECO	O. A. Bergstad, IMR, Norway	RV G.O. Sars	NW Atlantic	17.06–28.07.2004

Systematic account

Class Crustacea

Sub-class Eucarida

Order Decapoda

Family Galatheididae

Munidopsis abyssicola Baba, 2005

Munidopsis abyssicola Baba, 2005: 128, 284, figs 50, 51.

Munidopsis sp.—de Saint Laurent, 1985: 475.

Munidopsis convexa Noël, 1992 : 94 (nomen nudum).—Udekem d'Acoz, 1999: 167.

Material examined. Bay of Biscay, NORATLANTE, Stn 45-B16, 45°35'N, 03°51'W, 4152 m, 28.10.1969: 1 male 34.0 mm. Off Namibia, WALDA, Stn CY04, 21°59'S, 09°20'E, 4163 m, 09.06.1971: 1 female 30.5 mm. NE Atlantic, AMK-47, Stn 4422, 48°07'N, 16°08'W, 4670 m, 02.08.2002: 1 female 44.5 mm.

Remarks. This species was recently described by Baba (2005) from one ovigerous female collected in the Kermadec Deep (southwest Pacific) at 4520 m. The specimens from the Atlantic Ocean agree quite well with the original description. However, the three specimens examined have one antennal spine on each side of the front margin of the carapace, whereas these spines are absent in the holotype. This difference is considered to be intraspecific variation, although additional material from the type locality is needed to confirm this assumption.

Munidopsis abyssicola belongs to a group of species with some gastric spines, rostrum without pair of lateral spines, segment 6 of the abdomen having the posteromedian lobe strongly produced, extending beyond lateral lobes, the eyestalk short, with an eye spine on the mesial end of the eyestalk, the fixed finger of the chelipeds without a denticulated carina on the distolateral margin, the first pair of walking legs over-reaching the end of chelipeds, dactyli of walking legs not cristate on the lateral and mesial faces; epipods absent on chelipeds and walking legs.

The present records extend the known range of the species to the Atlantic Ocean. The specimen collected during the NORATLANTE cruise was identified as *Munidopsis* sp. by de Saint Laurent (1985) (see Udekem d'Acoz 1999, p. 167, under *M. convexa* Noel, 1992, nomen nudum).

***Munidopsis acuminata* Benedict, 1902 (Fig. 1)**

Munidopsis acuminata Benedict, 1902: 277, fig. 21.—Doflein & Balss, 1913: 177 (list).—Chace, 1942: 73 (key).—Pequegnat & Pequegnat, 1970: 139 (key); 1971: 6 (key).

Material examined. Off South Carolina, ALBATROSS, Stn 2663, 29°39'N, 79°49'W, 781 m, 04.05.1886: 1 male 11.3 mm, 1 ovig. female 10.8 mm (syntypes, USNM 11490).

Diagnosis. Carapace without dorsal spines, cervical groove indistinct; frontal margins between rostrum and antennal spine transverse, and oblique between antennal spine and anterolateral spine; anterolateral spine followed posteriorly by 2 or 3 spines on hepatic margin and 1 spine on anterior branchial margin. Rostrum wide, dorsally weakly carinated, distally trifid, nearly horizontal but slightly upturned distally. Sternites smooth, unarmed; anterior margin of third thoracic sternite with small granules, slightly wider than anterior margin of fourth sternite. Abdominal tergites unarmed; sixth segment bearing posterolateral lobes somewhat exceeding nearly straight transverse median margin. Telson composed of 7 plates. Eyestalk unarmed, slightly movable, partially concealed by rostrum. Antennal peduncle with distomesial and distolateral spines on articles 1 and 2, strong

distomesial spine on third segment. Merus of third maxilliped with strong distal spine on extensor margin and 2 spines on flexor border. Chelipeds elongate, longer than first walking legs; merus and carpus with well-developed spines on dorsal and distal borders. Walking legs with spines on extensor margins of merus and carpus; dactylus flexor margin with 7 low triangular teeth, each bearing movable spinule. Epipods on chelipeds, not on walking legs.

Remarks. This species was briefly described by Benedict (1902) from 2 specimens (male and female) collected off South Carolina at 781 m. No additional material has been reported.

Munidopsis acuminata belongs to the group of species having epipods on the chelipeds, unarmed eyestalks, the broad, flat and tridentate rostrum, and the unarmed dorsal surface of the carapace and abdomen (Chace 1942, Pequegnat & Pequegnat 1970, 1971). The closest congener is *M. anemia* n. sp. (see below).

***Munidopsis acutispina* Benedict, 1902**

Munidopsis aculeata A. Milne-Edwards & Bouvier, 1894: 275; 1899: 82, 97; 1900:327, pl. 31: figs 1–4) (not *M. aculeata* Henderson, 1888).

Munidopsis acutispina Benedict, 1902: 315.—Doflein & Balss, 1913: 177 (list).— d’Udekem d’Acoz, 1999: 166.—Frogliia *et al.*, 2002: 376, figs 1, 2.

Material examined. Mediterranean Sea, MEDINAUT, Stn MN12-BT3, 35°20’N, 30°16.30’E, 2030 m, 05.12.1998: 1 ovig. female 7.7 mm. NE Atlantic, SEAMOUNT 2, Stn DW158, 29°45.05’N, 29°44.93’W, 950 m, 12.01.1993: 1 female 3.6 mm. NE Atlantic, AMK 47, Stn 4368, MAR, Lost City vent area, 30°07’N, 42°07’W, 830 m, 04.07.2002, 1 male 8.0 mm. Off Mauritania, TALISMAN, 25°39’N, 18°18’W, 698 m, 09.07.1883: 1 male 7.8 mm (holotype, MNHN).

Remarks. This species was redescribed and figured by Frogliia *et al.* (2002) from specimens collected in the Mediterranean Sea. The specimens examined here agree quite well with the types (MNHN; see also Frogliia *et al.* 2002). *Munidopsis acutispina* is very close to *M. penescabra* Pequegnat & Williams, 1995, from the Caribbean Sea, and a careful comparison of the type material of both species is desirable in order to clarify their taxonomic status. *Munidopsis acutispina* is characterized by the carapace being convex from side to side, with numerous pointed tubercles, the rostrum narrow triangular, its basal width less than one-third the anterior width of the carapace, the frontal margin convex, the antennal spine small, segments 2 and 3 of the abdomen unarmed, the cornea well exposed and visible in dorsal view, the eye spine mesial and small, the walking legs not reaching the end of chelipeds, the propodi of walking legs of uniform width, with distinct spines, and no epipods on the pereopods.

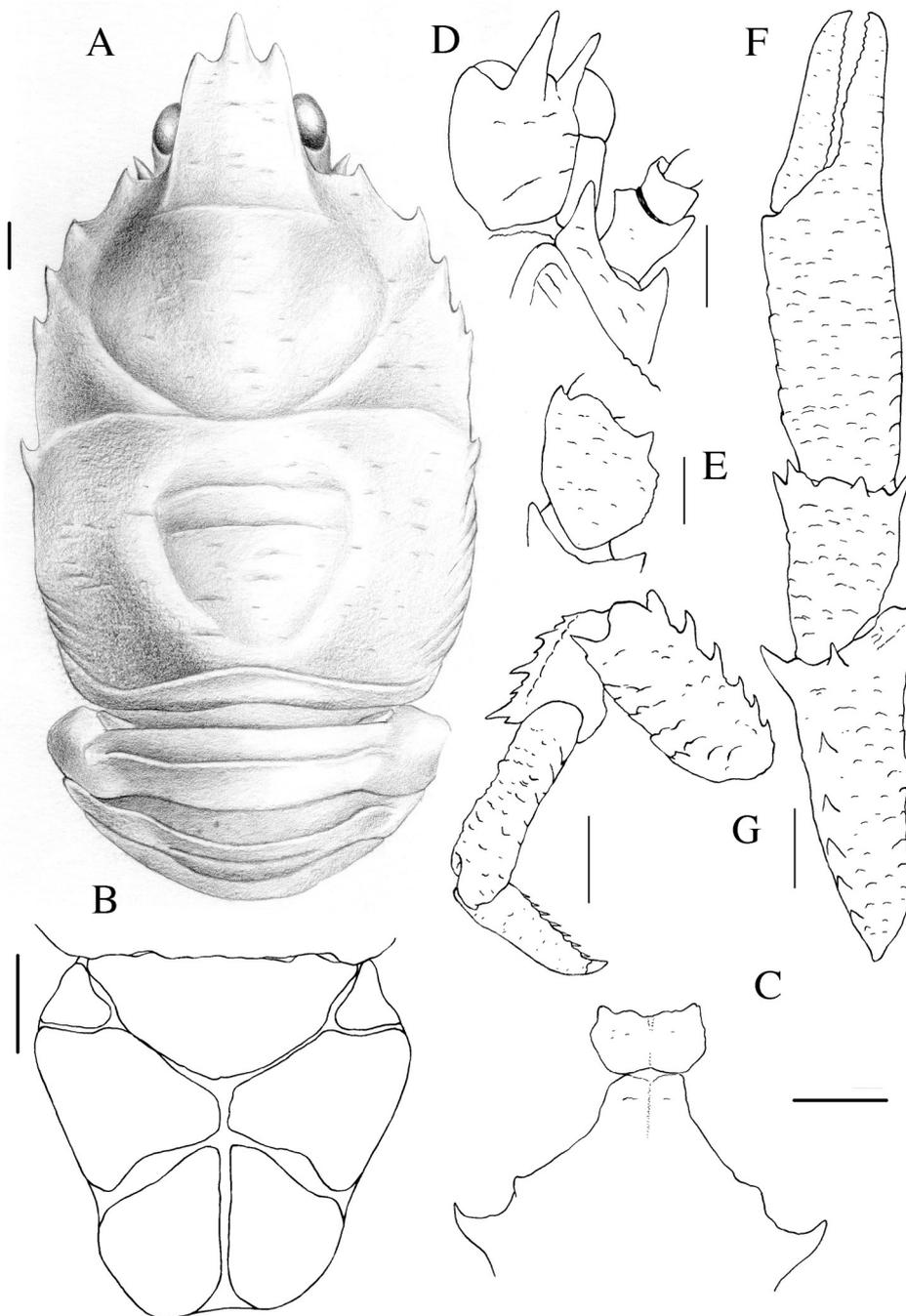


FIGURE 1. *Munidopsis acuminata* Benedict, 1902, syntypes, off South Carolina, ALBATROSS, Stn 2663, USNM 11490. A–E, male (11.3 mm), F–G, detached pereopods of two syntypes. A, carapace, dorsal. B, posterior part of sixth abdominal segment and telson. C, anterior part of sternal plastron. D, left antennule, antenna and ocular peduncle, ventral. E, endopod of right third maxilliped, lateral. F, right cheliped, lateral. G, left second pereopod, lateral. Scale: A = 4 mm, B–C = 1 mm, D–G = 2 mm.

Distribution and habitat. Previously known from off the western Sahara (type locality) and the Azores Islands, between 698 and 845 m (A. Milne-Edwards & Bouvier 1894, 1899, 1900), and from the Mediterranean Sea (W Tyrhenian Sea, Sardinia) between 374 and 1036 m (Frogliola *et al.* 2002). The present material was collected between 830 and 2030 m. *Munidopsis acutispina* occurs in both hydrothermal (Lost City, central Atlantic Ocean; Gebruk *et al.* 2002) and cold seep areas (Kazan mud volcano, eastern Mediterranean Sea; Olu-Le Roy *et al.* 2004).

***Munidopsis anemia* n. sp. (Fig. 2)**

Material examined. Bay of Biscay, BIOGAS 1, Stn CM01, 47°44.3'N, 08°51'W, 1010 m, 04.08.1972: holotype male 34.0 mm (MNHN-Ga 4620), paratype female 3.9 mm.

Etymology. From the Greek *aneimon*, naked, referring to the smooth surface of the carapace.

Description. Carapace surface unarmed, without epigastric spines, covered by small rugosities. Short striae on anterior branchial region, longer striae on posterior branchial region, as illustrated. Rostrum wide, dorsally weakly carinated, distally trifid, nearly horizontal but slightly upturned distally; antennal spine present. Oblique frontal margin leading to well-developed anterolateral spine (first spine) slightly larger than antennal spine, followed by 2 spines on anterior part of anterior branchial region, anterior (second spine) of these strong, posterior (third spine) smaller; another small spine (fourth) bordering anterior and posterior branchial regions. Anterior margin of third thoracic sternite with small granules, slightly wider than anterior margin of fourth sternite; fourth thoracic sternite subtriangular. Abdomen smooth; segments 2–4 each with anterior elevated transverse ridge; segment 6 bearing posterolateral lobes somewhat exceeding nearly straight transverse median margin. Telson composed of 7 plates; length-width ratio 0.8.

Eyes movable, unarmed; smoothly ovate cornea cupped within broad-based ocular peduncle; cornea relatively large, and slightly wider than third article of antennal peduncle.

Basal article of antennule with distolateral and shorter distodorsal spine; lateral margin slightly swollen. Article 1 of antennal peduncle with distal spines, distolateral spine slightly stronger than distomesial spines; article 2 with well-developed distolateral spine overreaching article 3, not exceeding article 2, clearly longer than distomesial spine; article 3 with strong distomesial spine, overreaching antennal peduncle.

Ischium of third maxillipeds with distal spine on flexor border, merus with strong distal spine on extensor margin, two well-developed spines on flexor border, proximal longer than distal; mesial crest with 21–23 denticles.

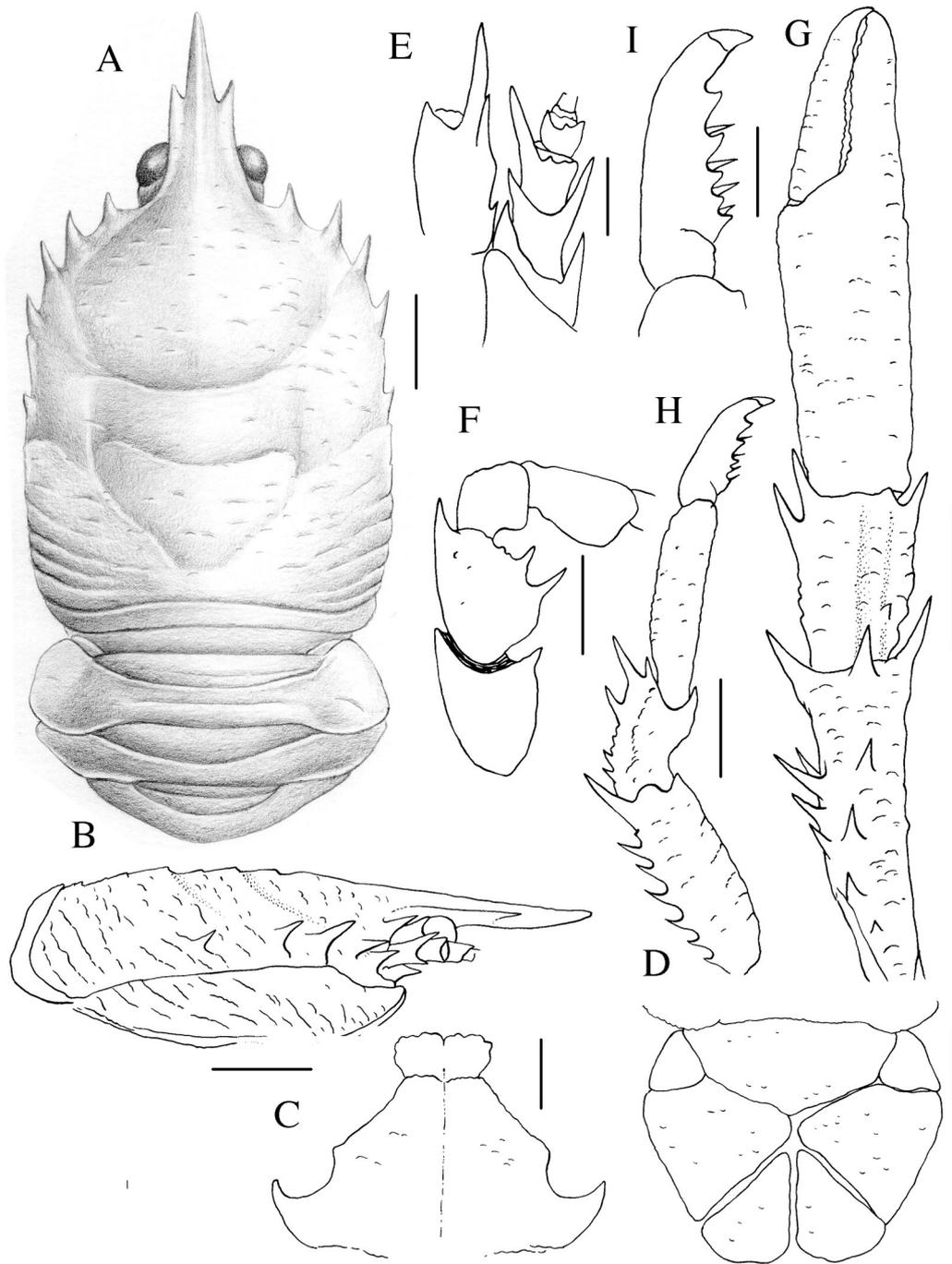


FIGURE 2. *Munidopsis anemia* n. sp. holotype, male (34.0 mm), Gulf of Biscay, BIOGAS, Stn CM01, MNHN-Ga 4620. A, carapace, dorsal. B, same, lateral. C, anterior part of sternal plastron. D, posterior part of sixth abdominal segment and telson. E, left antennule, antenna and ocular peduncle, ventral. F, endopod of right third maxilliped, lateral. G, right cheliped, lateral. H, right second pereopod, lateral. I, dactylus of right second pereopod, lateral. Scale: A–B, G–H = 5 mm, C–F, I = 2 mm.

Chelipeds 2.5 times carapace length; merus nearly reaching end of rostrum, with 4 strong terminal spines (2 dorsal, 1 mesial, 1 lateral), some well-developed spines on mesial and dorsal margins; carpus 1.4 times longer than broad, with several distal spines, one additional spine on mesial margin; palm spineless, 2.3 times longer than broad; fingers not acuminate, 0.7 times palm length, distally spooned, prehensile edges crenulated; fixed finger without distal crest on lateral margin.

First walking leg clearly not exceeding cheliped. Dorsal crest of meri of walking legs with row of well-developed spines, increasing in size distally; carpi with row of well-developed spines along dorsal border, granulate crest along lateral side and not continued on to propodi; propodi unarmed, ca. 1.3 times length of dactyli; each dactylus smoothly narrowed distally, ending in curved sharp spine, flexor margin slightly curving, bearing 5 proximally diminishing spines, each with small movable spinule, ultimate spine rather remote from end of dactylus and much closer to penultimate. Meri of walking legs progressively shorter posteriorly.

Epipod on cheliped; walking legs without epipod.

Remarks. *Munidopsis anemia* closely resembles *M. acuminata* from the northwest Atlantic (see above) in having a trifid rostrum, a smooth carapace surface and abdomen, and epipods on the chelipeds. *Munidopsis anemia* is readily distinguished from *M. acuminata* by the following characters:

- The rostrum is wider (ca. one-third carapace width, measured at base of rostrum in *M. anemia* compared to one-fourth carapace width in *M. acuminata*) and the spines smaller in *M. acuminata* than in the new species. The rostrum is also longer in the new species (rostrum ca. 0.5 times carapace length) than in *M. acuminata* (0.3 times carapace length).
- The antennal, anterolateral and anterobranchial spines of carapace margins are stronger in the new species than in *M. acuminata*.
- The sternum is narrower in *M. acuminata* than in *M. anemia*.
- The basal segment of the antennular peduncle is wider in *M. acuminata* than in *M. anemia*, with two subequal and long distodorsal and distolateral spines, whereas the distolateral spine is longer than the distodorsal spine in *M. anemia*.
- The spines on the segments of the antennal peduncle are longer in the new species than in *M. acuminata*. The third segment is armed with a well-developed distomesial spine in *M. anemia*, whereas this segment is unarmed in *M. acuminata*.
- The fingers are more acuminate in *M. acuminata* than in *M. anemia*.
- The walking legs are longer and more slender in *M. anemia* than in *M. acuminata*. The spines on the flexor border of the dactyli are better developed and less numerous in *M. anemia* (5) than in *M. acuminata* (7).

Distribution and habitat. The species is only known from the type locality, in the Bay of Biscay, at 1010 m, collected among an abundant bathyal community composed of corals, echinoderms and fishes.

***Munidopsis antonii* (Filhol, 1884)**

Galathodes antonii Filhol, 1884: 230, fig. 2.

Munidopsis beringana Benedict, 1902: 279, fig. 23.

Munidopsis antonii.—Baba, 2005, 132, 284, figs 52–54 (complete synonymy and references).

Material examined. NE Atlantic, NORATLANTE, Stn 43-B07, 58°49'N, 53°03'W, 3360 m, 14.09.1969: 2 males 17.0–35.1 mm, 1 female 29.2 mm. Off Namibia, WALDA. Stn CY08, 22°06'S, 10°20'E, 3806 m, 22.06.1971: 1 ovig. female 36.8 mm, 2 females 36.1–37.5 mm.—Stn CY10, 18°28'S, 10°31'E, 3530 m, 28.06.1971: 3 males 20.7–27.1 mm, 3 females 14.9–25.9 mm.—Stn CY11, 17°30'S, 09°27'E, 4335 m, 30.06.1971: 2 males 28.5–29.2 mm. Gulf of Guinea, WALDA Stn CY22, 00°20'S, 05°48'E, 3244 m, 30.07.1971: 1 male 28.8 mm.—Stn CW2, 02°49'N, 04°24'E, 3694 m, 12.08.1971: 1 female 42.7 mm. N Atlantic, BIACORES, Stn 245, 40°57.9'N, 22°14'W, 4270 m, 14.11.1971: 1 male 34.7 mm.—Stn 251, 47°38' N, , 08°56'W, 3590 m, 18.11.1971: 1 male 21.8 mm. Bay of Biscay, BIOGAS 3, Stn CV28, 47°25'N, 09°36'W, 4023 m, 28.08.1973: 1 male 30.0 mm. Bay of Biscay, BIOGAS 5, Stn CP06, 44°20'N, 04°54'W, 4460 m, 20.06.1974: 1 male 10.0 mm. Bay of Biscay, BIOGAS 6, Stn CP19, 44°25'N, 04°51'W, 4434 m, 28.10.1974: 1 male 13.5 mm. Off South Africa, WALVIS, Stn CP14, 32°29'S, 13°26'E, 3675 m, 13.01.1979: 1 ovig. female 39.6 mm, 1 female 14.5 mm.—Stn CP15, 32°29.4'S, 13°22'E, 3675 m, 13.01.1979: 1 female 30.6 mm. NE Tropical Atlantic, EUMELI 2, Stn CP02, 18°35.90'N, 20°59.40'W, 3134 m, 27.01.1991: 1 male 35.4 mm. Azores Islands, TALISMAN, 42°15'N, 23°37'W, 3975 m, 24.08.1883: 1 syntype male 23.8 mm (MNHN). NW Atlantic, MAR-ECO, Stn 50 (Lstn 373), 43°68'N, 28° 34'W, 2598 m, 12.07.2004: 16 M 20.0–34.1 mm, 2 ovig. females 32.5–33.6 mm, 2 females 31.5–36.1 mm.—Stn 50 (Lstn 374), 43°68'N, 28° 34'W, 2977 m, 13.07.2004: 1 male 8.5 mm.

Remarks. A complete redescription and revision of the species is included in Baba (2005). *Munidopsis antonii* belongs to the group of species that have some gastric spines on the carapace, the rostrum without pair of lateral spines, the eyestalk slender, with the main eye-spine on the mesial end of eyestalk, the fixed finger of chelipeds without denticulated carinae on the distolateral margin, the first pair of walking legs overreaching the end of chelipeds, dactyli of walking legs bearing a cristiform ridge fringed with setae on each of the lateral and mesial faces and epipods present on chelipeds. *Munidopsis beringana* Benedict, 1902, from the Bering Sea is considered to be a junior synonym of *M. antonii* by Baba (2005).

Distribution and habitat. Previously known from the Azores Islands (type locality) at 3975–4010 m (Filhol 1884, A. Milne-Edwards & Bouvier 1900), southwestern Australia, off Juan Fernandez (Henderson 1888), Bering Sea, 3241 m (Benedict 1902, as *M. beringana*), southern part of Davis Strait, 2626 m (Hansen 1908), Bay of Biscay, 3910–4510 m (Bouvier 1922; de Saint-Laurent 1985), off Oregon, 2800–3990 m (Ambler 1980,

as *M. beringana*), Japan, 3420–3960 m (Baba 1982), Mozambique, off Sri Lanka, Tasman Sea, off Zamboanga, Costa Rica, Gulf of Panama, 366–3800 m (Baba 2005). The present material was collected from the northwestern Atlantic (58°49'N) and Bay of Biscay to the southeastern Atlantic (off South Africa, 32°29'S) between 3134 and 4460 m. No specimens were collected in hydrothermal vent and cold-seep areas (Table 2).

TABLE 2. Species of *Munidopsis* collected at hydrothermal vent (V), and cold-seep (CS) sites.

Species	Cruise	Station	Latitude	Longitude	Depth (m)	Statut
<i>M. acutispina</i>	MEDINAUT	12-BT3	35°20'N	30°16.30'E	2030	CS
<i>M. acutispina</i>	AMK 47	4368	30°07'N	42°07'W	830	V
<i>M. exuta</i>	HYDROSLAKE	HS08	23°22.15'N	44°57.15'W	3502	V
<i>M. exuta</i>	MAR93	Alvin 2617	23°22.1'N	44°56.9'W	3500	V
<i>M. exuta</i>	AMK 47	4343	26°08'N	44°49'W	3648	V
<i>M. geyeri</i>	ALVIN 3637	Pots 4-6	26°01.8'N	84°54.9'W	3288	CS
<i>M. geyeri</i>	BIOZAIRE 2	147-10	05°47.80'S	09°42.60'E	3151	CS
<i>M. geyeri</i> , <i>M. hirtella</i>	BIOZAIRE 3	CP20	05°46.89'S	09°44.66'E	3113	CS
<i>M. livida</i>	GEOMAR	B 8215	06°11.04'S	10°25.53'E	2417	CS
<i>M. marionis</i>	MEDINAUT	10-BT1	35°26'N	30°33.30'E	1700	CS

Munidopsis aries (A. Milne-Edwards, 1880) (Fig. 3)

Orophorhynchus aries A. Milne-Edwards, 1880: 58.—A. Milne-Edwards & Bouvier, 1894: 209; 1897: 111, pl. 9: figs 7–11, pl. 10: figs 1–2.

Munidopsis aries.—Benedict, 1902: 316 (key).—Doflein & Balss, 1913: 177 (list).—Chace, 1942: 74 (key).—Pequegnat & Pequegnat, 1970: 139 (key); 1971: 5 (key), fig. 12B.—Wenner, 1982: 367.—Gore, 1983: 203, fig. 2 (see complete list of references).

Munidopsis sundi Sivertsen & Holthuis, 1956: 4, pl. 4: figs 2, 4.—Pequegnat & Pequegnat, 1971: 22, fig. 13.—Wenner, 1982: 371.—Udekem d'Acoz, 1999: 169.

Material examined. Off South Africa, WALVIS, Stn CP14, 32°28.9'S, 32°28.6'E, 3675 m, 13.01.1979: 1 female (broken). Iberian Abyssal Plain, ABYPLAINE, Stn CP15, 39°59.2'N, 15°00.21'W, 5320 m, 09.06.1981: 1 male 30.5 mm. Off Mauritania, EUMELI 2, Stn MVN 02 (baited trap), 18°33.98'N, 20°59.16'W, 3130 m, 27.01.1991: 1 female 91.6 mm. NE Atlantic. EUMELI 4, Stn CPH15, 18°53'N, 21°08'W, 3124 m, 01.06.1992: 1 male 74.9 mm. Off Angola, BIOZAIRE 3, Stn CP15, 05°51'S, 09°43.02'E, 3166 m, 28.12.2003: 2 males 18.5–29.2 mm, 1 female 19.0 mm. NW Atlantic, MAR-ECO, Stn 65 (Lstn 382), 53°20'N, 33°36'W, 3015 m, 24.07.2004: 2 males 34.8–54.7 mm, 1 female 63.2 mm.



FIGURE 3. *Munidopsis aries* (A. Milne-Edwards, 1880). Female (91.6 mm), off Mauritania, EUMELI 2, Stn MVN02. Carapace, abdomen and pereopods, dorsal view.

Remarks. This species was previously known from relatively few specimens: the holotype, a juvenile male collected off Bequia (Caribbean Sea) at 2912 m (A. Milne-Edwards 1880), 6 males, 3 females, and one large ovigerous female collected in the Azores Islands (Sivertsen & Holthuis 1956), Middle Atlantic Bight (Wenner 1982), Colombia and Venezuela Basins and Gulf of Mexico (Pequegnat & Pequegnat 1971, Gore 1983), between 2615 and 4095 m. The species was considered to be a senior synonym of *M. sundi* by Gore (1983), which was described by Sivertsen & Holthuis (1956) from a large female collected south of Azores Islands. The species is the largest known galatheid. *Munidopsis aries* belongs to the group of species that have the carapace covered with small granules, without gastric spines, the branchial margin of the carapace posteriorly convergent, the anterolateral corner of the carapace angular, the rostrum with distinctly convex lateral margins, ocular peduncles movable, the main eye-spine on the mesial end of eyestalk well produced, without lateral eye-spine, the cornea relatively small, the first walking leg overreaching end of cheliped, the fixed finger of cheliped without denticulate carina on the distolateral margin, and epipods absent on pereopods.

Distribution and habitat. The present material extends the distribution range of this species from the North Atlantic to the South Atlantic, with a depth range of 2615–5320 m.

The WALVIS specimen was collected among actiniarians, gorgonians, polychaetes, gastropods, and macrurid and zoarcid fishes. The ABYPLAINE specimen was found among a low diversity fauna of actiniarians, shrimps, bivalves, and tunicates (Monniot & Segonzac 1985). The BIOZAIRE specimens were obtained in the northern edge of the Zaire River channel, 6 km south of Regab cold-seep area. During the diving cruise FARANAUT, exploring the axial valley of the Mid-Atlantic Ridge, on both sides of the Fifteen Twenty Fracture Zone, two large specimens were filmed *in situ* from the submersible Nautile: dive FR13, 31.03.1992, 15°28.50'N, 46°34.10'W, 3824 m, on muddy bottoms, and dive FR20, 07.04.1992, 15°32.80'N, 46°41.20'W, 3226 m, on a basalt outcrop (Table 2).

The female from EUMELI 2, collected off Mauritania, is the largest known specimen of the species. The species was collected together with *M. antonii* and *M. hirtella* (this paper), and with *M. bermudezi* and *M. crassa* in the western Atlantic (Gore 1983).

Munidopsis bairdii (Smith, 1884) (Fig. 4)

Galacantha bairdii Smith, 1884: 356.

Munidopsis bairdii.—Baba, 2005: 285 (complete synonymy and references).

Material examined. NE Atlantic, NORATLANTE, Stn 16-B01, 55°07.7'N, 15°11.2'W, 2220 m, 10.08.1969: 2 males 10.2–20.0 mm. N Atlantic, BIACORES, Stn 252, 47°35.5'N, 08°47'W, 2640 m, 18.11.1971: 1 male 22.2 mm. Bay of Biscay, BIOGAS 6, Stn CP10, 47°30'N, 09°04'W, 2878 m, 21.10.1974: 1 male, 1 juv. 8.7 mm. Off Ireland, INCAL, Stn CP04, 56°33.2'N, 11°11.3'W, 2483 m, 17.07.1976: 3 males 10.9–23.8 mm, 1 female 11.9 mm.—Stn CP08, 50°14.7'N, 13°13.5'W, 2644 m, 27.07.1976: 2 males 18.6–20.9 mm. NW Atlantic, MAR-ECO, Stn 72 (Lstn 386), 53°10'N, 35°53'W, 2534 m, 27.07.2004: 3 males 23.7–26.0 mm, 1 ovig. female 31.5 mm, 6 females 10.5–31.4 mm.

Diagnosis. Body covered with fine, stiff setae. Carapace moderately granulose on anterior half, bearing short granulate ridges on posterior half. Gastric region rather well defined, convex, bearing 3 pairs of spines: median pair of spines smaller than other pairs. Cervical groove distinct. Cardiac region with anterior ridge preceded by distinct groove, bearing pair of spines followed by 1–2 spines in midline. Posterior margin with 4–10 spines and elevated ridge. Front margin strongly oblique; antennal spine absent. Lateral margins slightly convex, each with 4 spines: first slender, present at anterolateral angle, directed anterolaterad, second strong, directed more laterad than first, third and fourth short. Rostrum curving dorsad, dorsally moderately carinate, bearing 2–4 lateral teeth. Abdomen unarmed; segment 6 having well-developed posterolateral lobes distinctly overreaching nearly transverse posteromedian margin. Telson divided into 8 plates. Ocular peduncles slender, slightly movable, with well-produced, anterolaterally directed eye-spine. Antennular basal article with strong distolateral and distodorsal spines and 2 small disto-

mesial spines. Article 1 of antennal peduncle with distomesial and distolateral spines, both short, somewhat depressed, article 2 with strong distolateral and small distomesial spines,

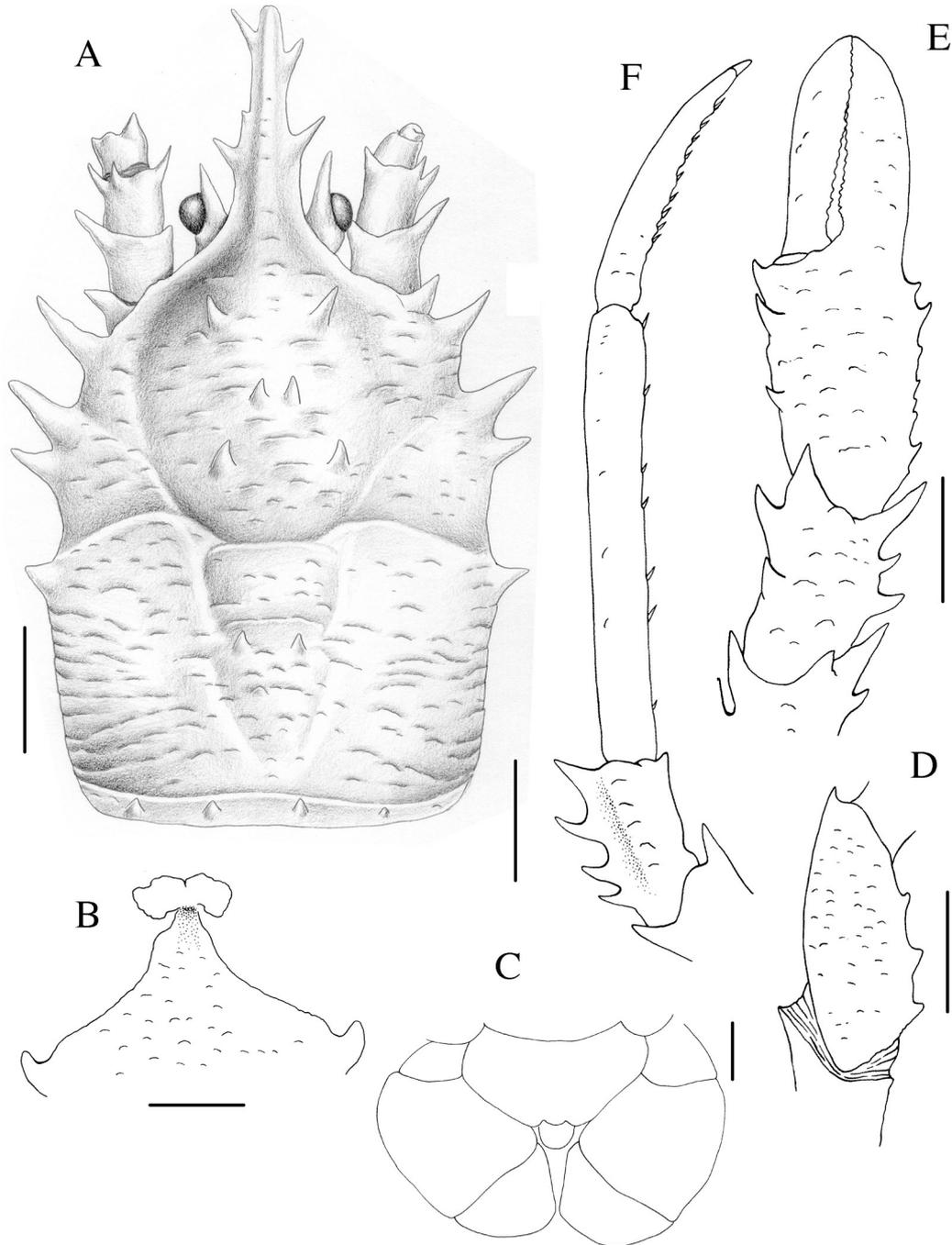


FIGURE 4. *Munidopsis bairdii* (Smith, 1884), male (20.0 mm), NE Atlantic, NORATLANTE, Stn 16-B01. A, carapace, dorsal. B, posterior part of sixth abdominal segment and telson. C, anterior part of sternal plastron. D, endopod of right third maxilliped, lateral. E, right cheliped, lateral. F, right second pereopod, lateral. Scale: A–E, F = 4 mm, B–D = 2 mm.

article 3 with small distolateral, distomesial and distodorsal spines. Mxp 3 merus with 2–4 spines on flexor margin and 1 distinct spine on extensor distal margin. Pereopods covered with short setae nearly perpendicular to surface. P1 merus with dorsal and lateral marginal rows of spines, and some acute terminal spines; carpus with several terminal and mesial marginal spines; palm barely as long as fingers, mesial margin with 2 or 3 spines; fingers distally fitting each other with few intermeshing teeth, distolateral margin of fixed finger smooth, not serrate. P2–4 subcylindrical; meri spinose along dorsal and ventral margins; carpi with spines on dorsal margin; each dactylus two-thirds as long as propodus, gently curving, flexor margin with 9–11 distinct teeth, each supporting stiff seta, ultimate tooth more remote from end of article than from penultimate tooth. First walking leg overreaching end of chelipeds. Epipod absent from pereopods.

Remarks. *Munidopsis bairdii* belongs to the group of species having the carapace with a longitudinal row of submedian spines, the posterior-most transverse ridge with spines, the rostrum with lateral spines, the abdomen unarmed, the ocular peduncle movable and short relative to length, the eye-spine directed straight forward, the fixed finger of the chelipeds without a denticulate carina on the distolateral margin, the first walking leg overreaching the cheliped, the dactylus of the first walking leg three-quarters as long as the propodus, and no epipods on the pereopods.

Distribution. Northwest Atlantic, off Delaware Bay, 2738 m (type locality, Smith 1884), Gulf of Panama, 3243 m (Faxon 1895), Ecuador, 2150 m (Khodkina 1975), Baja California, 1986–2008 m (Luke 1977), (off Oregon, 2377–2940 m (Ambler 1980), off New England, Middle Atlantic Bight, 2125–2933 m (Wenner 1982), Bay of Biscay, 3992–4260 m (de Saint-Laurent 1985). The present material was collected from the northeastern Atlantic (off British Isles, 55°07'N) to Bay of Biscay (47°30'S) between 2220 and 2878 m.

Munidopsis bermudezi Chace, 1939

Munidopsis bermudezi Chace, 1939: 46.— Baba, 2005: 285 (complete synonymy and references).

Material examined. NE Atlantic, EUMELI 4, Stn CPH15, 18°35'N, 21°08'W, 3124 m, 01.06.1992: 1 male 40.0 mm. NW Atlantic, MAR-ECO, Stn 65 (Lstn 382), 53°20'N, 33°36'W, 3015 m, 24.07.2004: 1 female 26.2 mm.

Remarks. The material examined agrees quite well with the type description and additional illustrations provided by the different authors (Baba 2005, and references).

Distribution. Caribbean Sea, off Cuba (type locality), 2434–3020 m (Chace 1939, 1942), N of Azores, 3120 m (Sivertsen & Holthuis 1956), Gulf of Mexico, 3246 m (Pequegnat & Pequegnat 1970, 1971), off coast of Virginia, 2620–2955 m (Laird et al. 1976), Middle Atlantic Bight, 2575 m (Wenner 1982), Venezuela Basin, 3411–4064 m (Gore 1983). The present material was collected in the N Atlantic between 3015 and 3124 m.

***Munidopsis crassa* Smith, 1885**

Munidopsis crassa Smith, 1885: 494.

Munidopsis crassa.—Baba, 2005: 140, 286, figs 58–60 (complete synonymy and references).

Not *Munidopsis crassa* Segonzac, 1992: 596 (= *M. exuta* n. sp.).

Material examined. Off Namibia, WALDA, Stn CY09, 19°10'S, 09°18'E, 4613 m, 23.06.1971: 1 ovig. female 42.4 mm.—Stn CY10, 18°28'S, 10°31'E, 3530 m, 28.06.1971: 1 male 20.7 mm, 1 female 16.2 mm.—Stn CY11, 17°30'S, 09°27'E, 4335 m, 30.06.1971: 1 ovig. female 50.6 mm. Bay of Biscay, BIOGAS 2, Stn CV18, 47°32'N, 09°36'W, 4120 m, 18.04.1973: 1 juv. Bay of Biscay, BIOGAS 5, Stn CP06, 44°20'N, 04°54'W, 4460 m, 20.06.1974: 1 female 25.4 mm. Bay of Biscay, BIOGAS 6, Stn CP20, 44°23'N, 04°51'W, 4459 m, 29.10.1974: 1 male 34.0 mm, 1 female 20.9 mm. Bay of Biscay, ECOFER 1, Stn CP01, 44°05.09'N, 02°34.05'W, 3058 m, 05.07.1989: 1 female 13.9 mm. NE Tropical Atlantic, EUMELI 3, Stn MAC4, 21°03.81'N, 31°12.21'W, 4626 m, 21.09.1991: 1 female 18.7 mm. NE Atlantic, BENGAL 3, Stn 13200/70, 48°51.62'N, 16°31.80'W, 4847 m, 20.07.1997: 2 males 34.3–49.5 mm.—Stn 13200/93, 48°50.55'N, 16°25.30'W, 4846 m, 25.07.1997: 1 male 19.5 mm. NE Atlantic, BENGAL 5, Stn 13368/52, 48°48.30'N, 16°25.97'W, 4839 m, 19.03.1998: 2 males 32.4–50.1 mm.—Stn 13368/53, 48°49.98'N, 16°33.53'W, 4844 m, 19.03.1998: 1 ovig. female 32.1 mm, 1 female 11.4 mm. NE Atlantic, BENGAL 6, Stn 13627/11, 48°47.82'N, 16°40.37'W, 4847 m, 01.10.1998; 1 male 24.9 mm, 1 female 24.7 mm.

Remarks. The species was redescribed by Baba (2005), providing a complete list of synonymies and occurrences. *Munidopsis crassa* is characterized by the presence of distinct spines on the gastric and anterior branchial regions, the rostrum is somewhat upcurved, the cornea is relatively small with its greatest width clearly less than the width of antennal article 3 at midlength, abdominal segment 6 with a strongly produced posteromedian flap, the eyestalk is short relative to length, with mesial eye-spine, the fixed finger of the chelipeds without a denticulate carina on the distolateral margin, the first walking leg overreaching end of the cheliped, the dactyli of the walking legs with the length-breadth ratio at most 5, the flexor margin having ultimate tooth closer to the penultimate than the tip of the terminal claw, and epipods on the chelipeds. The specimens collected on the Mid-Atlantic-Ridge and identified as *M. crassa* by the late M. de Saint Laurent (Segonzac 1992) correspond to *M. exuta* (see below).

Distribution. North and Central Atlantic, from North Carolina (type locality) to the Bay of Biscay, Azores, Canary Islands, Middle Atlantic Bight, Caribbean Sea, between 2679 and 5315 m (Smith 1885, A. Milne-Edwards & Bouvier 1899, Bouvier 1922, Gordon 1955, Sivertsen & Holthuis 1956, Pequegnat & Pequegnat 1971, Türkay 1975, Wenner 1982). Recently the species has been cited in the Tasman Sea, at 3580 m (Baba 2005). The specimens examined here were collected from the northeast Atlantic, off France (48°51'N), to the southeast Atlantic (off Namibia, 23°10'S), between 3058 and 4847 m.

The occurrence of this species at the Atlantic hydrothermal vents (Mid-Atlantic Ridge) is not confirmed.

***Munidopsis curvirostra* Whiteaves, 1874**

Munidopsis curvirostra Whiteaves, 1874: 212.—Udekem d'Acoz, 1999: 167 (list of occurrences).—Baba, 2005: 287 (list of occurrences and references).

Material examined. Bay of Biscay, BIOGAS 1, Stn CM01, 47°44.3'N, 08°51'W, 1010 m, 04.08.1972: 1 male 6.0 mm, 1 female 4.6 mm.—Stn CW3, 47°31'N, 08°17'W, 1100 m, 05.08.1972: 2 ovig. females 8.0–10.4 mm. Off Ireland, INCAL, Stn DS01, 57°59.2'N, 10°41.3'W, 2091 m, 15.07.1976: 1 male 4.5 mm, 2 females 3.3 mm, 3 juveniles 2.6–3.0 mm.—Stn DS02, 57°58.5'N, 10°49.2'W, 2081 m, 16.07.1976: 1 female 3.0 mm. NE Tropical Atlantic, EUMELI 2, Stn CP03, 20°41.30'N, 18°32.60'W, 2114 m, 05.02.1991: 12 males 7.1–9.8 mm, 16 ovig. females 7.0–11.2 mm, 3 females 6.5–6.9 mm.—Stn CP04, 20°33'N, 18°35'W, 2003 m, 06.02.1991: 17 males 4.7–8.4 mm, 9 ovig. females 8.0–11.1 mm, 3 females 5.7–5.8 mm, 3 juv. 2.2–2.4 mm.—Stn CP05, 20°30.51'N, 18°33.74'W, 1855 m, 06.02.1991: 11 males 4.6–9.0 mm, 9 ovig. females 7.2–9.5 mm, 2 juv. 3.6–3.7 mm. NE Tropical Atlantic, EUMELI 4, Stn CP16, 20°32'N, 18°36'W, 2042 m, 05.06.1992: 8 males 5.4–11.0 mm, 13 ovig. females 7.1–12.7 mm, 2 females 7.4–8.1 mm. NE Atlantic, PROSPEC, Stn CPH 06, 56°39.970'N, 09°45.378'W, 1734 m, 08.07.1996: 5 males 8.0–11.8 mm, 4 ovig. females 9.9–10.5 mm.—Stn CPH 07, 56°41.710'N, 09°36.924'W, 1607 m, 08.07.1996: 6 males 8.3–10.3 mm.—Stn CPH 10, 55°18.687'N, 10°14.833'W, 1589 m, 12.07.1996: 1 ovig. female 8.5 mm.

Remarks. *Munidopsis curvirostra* belongs to the group of species with the carapace lateral margin with an anterolateral spine only, two epigastric spines and a row of spines in the dorsal midline, the rostrum spiniform being more than two-thirds as long as the remainder of the carapace and strongly upcurved, the front margin without antennal spine, abdominal segments 2 and 3 with median spine, segment 4 unarmed; the cornea oval, about half or slightly more than half the length of the ocular peduncle, the eye-spine absent, the first walking leg not reaching end of the cheliped, the merus of the cheliped lacking spines, other than distal spines, the meri of the walking legs relatively slender, not keeled dorsally, and epipods absent from pereopods.

The species is very close to *M. acuta* (A. Milne Edwards, 1881) from the Bay of Biscay, and *M. longirostris* (A. Milne Edwards & Bouvier, 1897) from Morocco, respectively. These two species are considered to be junior synonyms of *M. curvirostra* (Hansen 1908, see A. Milne Edwards 1883, edition of 1997). However, a complete revision of the type material of these species would be desirable in order to confirm the existence of one or several taxa (Udekem d'Acoz 1999).

Distribution. Northwest Atlantic, Gulf of St Lawrence, 146–403 m (type locality,

Whiteaves 1874, see also Smith 1886, Squires 1990), Davis Straits, Iceland, 349–975 m (Hansen 1908), Ireland, 1797 m (Selbie 1914), S of Greenland (Heegaard 1941), southeast of Newfoundland, 1100 m (Sivertsen & Holthuis 1956), Portugal and Morocco, 1716–1912 m (Türkay 1976), Middle Atlantic Bight, 636–2200 m (Wenner 1982), Bay of Biscay, 1845–2430 m (de Saint Laurent 1985); British Isles (Moyses & Smaldon 1990), Morocco (Garcia-Raso 1996). The species has been also cited at the Lord Howe Ridge, southwest Pacific, at 1210 m (Khodkina 1981). The present material has been collected in the northeast Atlantic, from Ireland (57°59'N) to Mauritania (20°30'N), between 1010 and 2114 m.

***Munidopsis exuta* n. sp. (Fig. 5)**

Munidopsis subsquamosa.—de Saint-Laurent, 1985: 475 (not *M. subsquamosa* Henderson, 1885)
Munidopsis crassa.—Segonzac, 1992: 596 (not *M. crassa* Smith, 1885).

Material examined. Bay of Biscay, BIOGAS 5, Stn CV40, 47°33'N, 09°02'W, 2860 m, 15.06.1974: 1 ovig. female 29.2 mm, 1 female 18.2 mm. Bay of Biscay, BIOGAS 6, Stn CP10, 47°30'N, 09°04'W, 2878 m, 21.10.1974: 1 male 17.1 mm. Mid-Atlantic-Ridge, MAR vent site Snake Pit-Les Ruches, HYDROSLAKE, Stn HS08, baited trap PT01, 23°22'N, 45°57'W, 3502 m, 26.06.1988: 1 ovig. female 34.7 mm. Mid-Atlantic-Ridge, MAR vent site Snake Pit-Elan. MAR93, Dive 2617, 23°23' N, 44°56' W, 3500 m, 18.06.1993: 1 female 32.0 mm. Mid-Atlantic-Ridge, MAR vent site TAG. AMK47, Stn 4343, slurp gun 4, 26°08'N, 44°49'W, 3650 m, 26.06.2002: 1 ovig. female 39.5 mm, 1 female 31.6 mm.

Types. The ovigerous female of 34.7 mm from HYDROSLAKE, Stn HS08 (MNHN-Ga 4621) has been selected as holotype, the other specimens are paratypes.

Etymology. From the Latin *exutus*, bared, naked, in reference to the absence of spines (except epigastric spines) on the carapace and abdomen.

Description. Carapace, exclusive of rostrum, longer than broad, moderately convex from side to side. Cervical groove distinct. Gastric region distinct, posterior part delimited by shallow groove; surface with pair of epigastric spines (2 or 3 additional small spines in one specimen), covered by scale-like rugosities much larger on posterior triangle than on remainder. Anterior branchial region also with scale-like rugosities, as illustrated. Rostrum broad at base, distally narrowed and upturned, weakly carinated dorsally, with fine rugosities, sometimes with 1–4 small lateral spines on each side; antennal spine absent. Oblique frontal margin leading to short anterolateral spine (first spine) directed straight forward, followed by 2 spines on anterior part of anterior branchial region, anterior (second spine) of these strong, directed anterolaterally, situated lateral to level of anterolateral spine, posterior (third spine) much smaller, followed by a few knobs and another small spine (fourth) bordering anterior and posterior branchial regions.

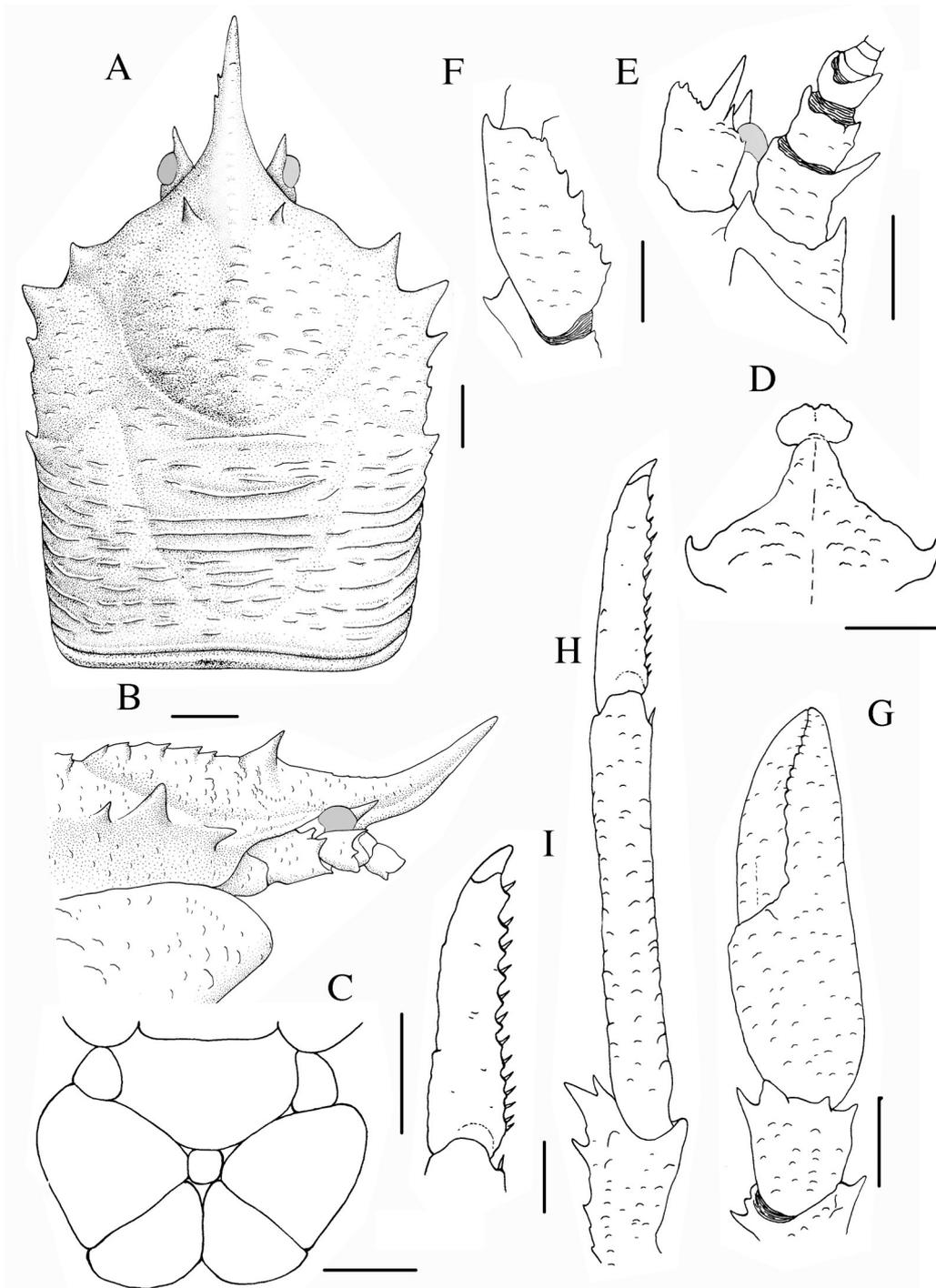


FIGURE 5. *Munidopsis exuta* n. sp., holotype, ovigerous female (34.7 mm), Mid-Atlantic Ridge, HYDROSLAKE, Stn HS08, MNHN-Ga 4621. A, carapace, dorsal. B, same, lateral. C, posterior part of sixth abdominal segment and telson. D, anterior part of sternal plastron. E, left antennule, antenna and ocular peduncle, ventral. F, endopod of right third maxilliped, lateral. G, right cheliped, lateral. H, right second pereiopod, lateral. I, dactylus of right second pereiopod, lateral. Scale: A–B, D–E, G, I = 5 mm, C, F, H = 2 mm.

Thoracic sternites with a few arcuate setiferous ridges; third thoracic sternite posteriorly narrowed, anterior margin with acute submedian granules and small anterolateral spine on each side; fourth thoracic sternite subtriangular, anteriorly narrow elongate.

Abdomen smooth, with few granules on pleura; segments 2–4 each with 2 elevated transverse ridges; segment 6 bearing posterolateral lobes somewhat exceeding nearly straight transverse median margin. Telson composed of 8 plates; length-width ratio 0.78; midlateral plate convex on distolateral margin.

Eyes not movable; smoothly ovate cornea cupped within broad-based ocular peduncle; peduncle extended into strong but relatively short mesiodorsal spine directed upward at low angle; cornea relatively large, clearly wider than eyespine, and as wide as third article of antennal peduncle.

Basal article of antennule having dorsolateral spine much smaller than ventrolateral. Article 1 of antennal peduncle distomesially bearing flattish process rather straight laterally, somewhat convex mesially, distolateral spine well-developed; article 2 with strong distolateral spine.

Third maxillipeds with weak spination; ischium with distodorsal and distoventral spines, both small, latter in particular; mesial crest with 21–23 denticles. Flexor margin of merus with 5 small spines, extensor distal marginal spine small.

Chelipeds longer than carapace including rostrum. Merus nearly reaching end of rostrum, with 4 terminal spines (2 dorsal, 1 mesial, 1 lateral), a few small spines on dorsal sides, covered with scale-like elevated rugosities. Carpus with a few distal and mesial spines. Palm spineless, slightly longer than broad, with small granules along mesial margin. Fingers slightly longer than palm, distally spooned, prehensile edges crenulated; fixed finger moderately ridged along distal third of lateral margin.

First walking leg slightly exceeding cheliped by half length of dactylus; dorsal crest of merus with row of small spines, lateral side with granules; carpus with row of spines along dorsal border, two granulate crests along lateral side and continued on to propodus, ventrolateral crest less conspicuous than dorsolateral; propodus nearly twice as long as dactylus, sometimes with spines on proximal half of dorsal margin; dactylus smoothly narrowed distally, ending in curved sharp spine, flexor margin slightly curving, bearing 13 or 14 proximally diminishing low spines, ultimate spine rather remote from end of dactylus and much closer to penultimate. Meri of walking legs progressively shorter posteriorly.

Epipods on chelipeds, but absent on walking legs.

Eggs diameter: 2.6 mm.

Remarks. The new species belongs to the group of species having (usually) 2 epigastric spines, epipods on the chelipeds, the cornea distinctly broader than the eyespine, the fixed finger of the cheliped without a denticulate carina on the distolateral margin, the first walking leg overreaching end of the cheliped, the dactyli of the walking legs slightly curving on flexor margin, and the abdominal segment 6 with the posteromedian margin

weakly convex, not produced. *Munidopsis geyeri* Pequegnat & Pequegnat, 1970 from the Caribbean Sea and South and Central Atlantic (see below) is the most similar species geographically and taxonomically, but it is readily differentiated by the following characters (see also Baba 2005):

- The rostrum is triangular with a marked dorsal carina in *M. geyeri*, whereas the rostrum is clearly spiniform, without marked dorsal carina in the new species.
- The antennal spine is always present in *M. geyeri*, but absent in the new species.
- The eyespine is usually longer in *M. geyeri* than in the new species.
- The posterolateral lobes of the abdominal segment 6 do not reach the posterior median margin in *M. geyeri*, whereas in *M. exuta* it distinctly overreaches that margin.
- The propodus of the walking legs is nearly as long as the dactylus in *M. exuta*, whereas in *M. geyeri* the propodus is 1.3–1.4 times the length of dactylus.

M. exuta is also close to *M. crassa* (see above), but they can be differentiated by the shape of the distal margin of abdominal segment 6: weakly convex in the new species and strongly produced in *M. crassa*. Furthermore, *M. exuta* is characterized by the presence of two epigastric spines, the absence of antennal spine, the rostrum not triangular, and the dactyli of the walking legs slightly curving on the flexor margin, whereas *M. crassa* has some gastric spines, the antennal spine present, the rostrum moderately broadly triangular, and the dactyli of the walking legs clearly curving on the flexor margin.

Distribution and habitat. The species is only known from the northeast Atlantic at 2860–3502 m. This species occurs in both abyssal and hydrothermal vent environments. The BIOGAS specimens were collected in the Bay of Biscay, among actinarians, polychaetes, brachiopods, molluscans and echinoderms. Two specimens were collected in the vent area of Snake Pit (HYDROSNAKE and MAR93 cruises). The HYDROSNAKE specimen was caught by a baited trap 100 m north of the site Les Ruches, together with the nephropid lobster *Thymopides laurentae* Segonzac & Macpherson, and the macrurid fish *Coryphaenoides armatus* (Hector) (Segonzac & Macpherson 2003). The MAR93 specimen was collected from the site Elan, about 100 m west of Les Ruches, at the base of the active edifice, on sulfide rocks, among scattered sea anemones, chaetopterid tubeworms and alvinocaridid shrimps. The two specimens from the AMK47 cruise were collected at the base of an inactive chimney complex, among dead mytilid bivalves. An additional specimen (unfortunately lost) was collected during the cruise BRIDGE 1993, at the hydrothermal vent site Broken Spur site (dive Alvin 2625, 27.06.1993, 29°10'N, 43°10'W, 3056 m; E. Southward, Marine Biological Association of the U.K., Plymouth, personal communication).

***Munidopsis geyeri* Pequegnat & Pequegnat, 1970 (Fig. 6)**

Munidopsis geyeri Pequegnat & Pequegnat, 1970: 149, figs 5–9, 5–10; 1971: 19.— Baba, 2005: 163, fig. 76.

Material examined. Azores Islands, BIACORES, Stn 202, 37°26.5'N, 25°00'W, 2900 m, 06.11.1971: 1 female 13.0 mm. Florida Escarpment, ALVIN 3637, 26°01.8'N, 84°54.9'W, 3288 m, 30.10.2000: 1 male 17.6 mm, 2 females 8.1–10.2 mm. Off Angola, BIOZAIRE 1, Stn PL 81-5, 05°47.80'S, 09°42.60'E, 3151 m, 10.01.2001: 1 male 32.2 mm. Off Angola, BIOZAIRE 2, Stn PL 147-10, 05°47.80'S, 09°42.60'E, 3151 m, 01.12.2001: 5 males 25.7–42.0 mm, 2 females 27.5–28.2 mm. Off Angola, BIOZ-RECUP, Stn MAC 10, 05°51'S, 09°41.98'E, 3155 m, 31.01.2003: 5 juv. 3.3–4.2 mm. Off Angola, BIOZAIRE 3, Stn CP16, 05°49.79'S, 09°44.08'E, 3172 m, 28.12.2003: 1 female 6.8 mm.—Stn CP19, 05°48.07'S, 09°41.60'E, 3184 m, 31.12.2003: 1 male 35 mm.—Stn CP20, 05°46.89'S, 09°44.66'E, 3113 m, 02.01.2004: 39 males 8.9–40.5 mm, 14 ovigerous females 31.5–46.9 mm, 39 females 19.9–46.9 mm.

Remarks. The species was synonymized with *M. subsquamosa* Henderson, 1885 by Ambler (1980). However, more recent studies have demonstrated the validity of *M. geyeri* as a separate species (Gore 1983; see Baba 2005, for a complete discussion of the taxonomic status of the species).

Munidopsis geyeri belongs to the group of species having the carapace with 2 epigastric spines only, the anterolateral spine small, subequal to the antennal spine in size, directed straight forward, the rostrum spiniform, the abdominal segment 6 with the posteromedian margin weakly convex, not produced, the eyestalks short relative to length, the mesial eye-spine present, the first walking leg overreaching the end of the chelipeds, the fixed finger of the chelipeds without denticulate carina on the distolateral margin, the dactyli of the walking legs strongly curved distally, the ultimate flexor marginal tooth much closer to the penultimate than to the tip of the article, and epipods on the chelipeds.

Size distribution. The specimens collected on the west African equatorial margin, north of the Zaïre River channel, were mostly caught in the trawl CP 20 during the BIOZAIRE 3 Cruise carried out on the Regab cold-seep area. The sex ratio of these specimens was not significantly different from 1:1 (chi-square, $p > 0.05$). However, males were more abundant in the smaller size classes than females (Fig. 6). The ovigerous females were first measured at 31.5 mm.

Distribution and habitat. *Munidopsis geyeri* was described from specimens collected in the southwest Gulf of Mexico, Colombia and Venezuela Basins and south of Jamaica, between 2650 and 4151 m, (Pequegnat & Pequegnat 1970, 1971, Gore 1983, Baba 2005). The specimens from the Caribbean Sea were caught on bottoms of yellow clay mud, with vegetable debris, and with abundant sponges and holothurians (Gore 1983). The present record extends the geographical range of the species to the South (Gulf of Guinea) and Central Atlantic (Azores Islands). The depth range is 2650 to 4151 m.

The species also occurs the Florida Escarpment (Gulf of Mexico, 3288 m; Turnipseed *et al.* 2004) and at the Regab site (Gulf of Guinea, 3150 m, Fig. 14; Andersen *et al.* 2004, Komai & Segonzac 2005, Ondréas *et al.* 2005), among an abundant chemosynthetic community associated with cold-seeps. These two communities are similar, characterized

by the presence of sea anemones, dense populations of vestimentiferan tubeworms, large mytilid bivalves, gastropods, alvinocaridid shrimps, chiridotid holothurians and zoarcid fish.

The stomach contents of five specimens collected in the Regab site (BIOZAIRE 3, CP20) showed very small quantities of fine gray sediments. The SEM observations also showed agglomerations of some mineral particles, diatoms, and decapod crustacean remnants, a few small sea-urchin spicules, and five micro-gastropod shells. One micro-gastropod shell contained flesh probably belonging to *Hyalogyrina* sp. (Vetigastropoda, Skeneiformes), an inhabitant of reduced environments, and known to graze bacterial film (A. Warén, personal communication).

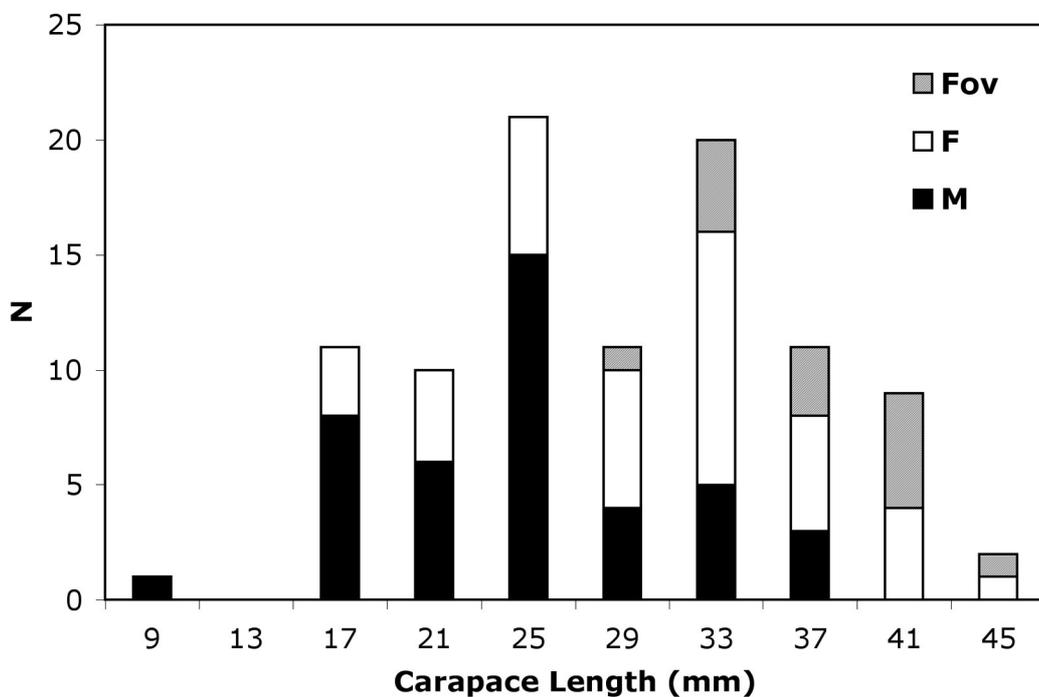


FIGURE 6. Size-frequency distribution (carapace length, mm) of males (M), ovigerous females (F ov) and females (F) of *Munidopsis geyeri* from the trawl CP20, Cruise BIOZAIRE 3 (Gulf of Guinea), n= 92.

***Munidopsis hirtella* n. sp. (Fig. 7)**

Material examined. Off Mauritania, EUMELI 2, Stn CP08, 18°29'N, 20°59'W, 3126 m, 10.02.1991: 2 males 29.0–32.6 mm. —Stn CP09, 18°37'N, 21°03'W, 3125 m, 11.02.1991: 1 ovig. female 36.5 mm. Off Angola, BIOZAIRE 3, Stn CP 15, 05°51'S, 09°43.02'E, 3166 m, 28.12.2003: 3 females 27.8–33.8 mm.—Stn CP16, 05°49.79'S, 09°44.08'E, 3172 m, 28.12.2003: 1 male 20.3 mm, 1 ovig. female 27.5 mm, 3 females 24.4–34.9 mm.—Stn

CP17, 05°48.69'S, 09°43.98'E, 3156 m, 30.12.2003: 1 male 21.9 mm.—Stn CP19, 05°48.07'S, 09°41.60'E, 3184 m, 31.12.2003: 1 male 20.4 mm, 1 female 21.4 mm.—Stn CP20, 05°46.89'S, 09°44.66'E, 3113 m, 02.01.2004: 1 male 16.1 mm.—Stn CP22, 05°46.97'S, 09°44.18'E, 3121 m, 03.01.2004: 1 male 26.5 mm, 1 female 28.2 mm.

Types. The ovigerous male of 32.6 mm from EUMELI 2, Stn CP08 (MNHN-Ga 4622) has been selected as holotype, the other specimens are paratypes.

Etymology. From the diminutive of the Latin *hirtus*, hairy, in reference to the numerous setae on the carapace and abdomen.

Description. Carapace, exclusive of rostrum, slightly longer than wide, anterior and posterior cervical grooves evident but not deep, gastro-cardiac groove well-defined. Gastric and cardiac regions slightly convex, with both small and moderate-sized spines and tubercles as figured. Hepatic region and anterior half of branchial region each with small numerous spines and tubercles. Posterior half of carapace bearing elevated, interrupted transverse ridges. Spines, tubercles and ridges on carapace surface with numerous uniramous setae. Frontal margin oblique. Antennal spine well-developed. Posterior margin unarmed. Lateral margins nearly straight and subparallel, bearing strong spines on anterior half, first anterolateral, slightly smaller than second, divergent anteriorly, located distinctly mesial to level of remaining spines, second spine largest, directed slightly more laterad than preceding, 6 or 7 spines behind second spine, 2 or 3 of them about as large as first spine. Rostrum moderately narrow, somewhat upturned, middorsal ridge wide, length about one-third remaining carapace. Pterygostomial flap anteriorly ending in rounded tip, with numerous granules and short ridges.

Third thoracic sternite narrow, forming apposed lobe bearing anteromedian process at either side of deep median groove; depressed below level of, and, separated by deep groove from, anteriorly narrowed fourth thoracic sternite.

Abdomen spineless; segments 2–4 each with 2 moderately elevated transverse ridges, somewhat granulate, and with numerous uniramous setae; no ridge on segments 5–6; segment 6 having well-developed posterolateral lobes, slightly overreaching transverse posteromedian margin. Telson divided into 8 plates, length-width ratio 0.7.

Eyes slightly movable dorsoventrally, bearing distomesial eyespine strongly produced forward; cornea well-developed and lateral, distinctly broader than eyespine.

Article 1 of antennular peduncle with strong distodorsal and distolateral spines, with small tubercle-like spines distomesially. Article 1 of antennal peduncle bearing sharp, distolateral and distolateral spines; article 2 with sharp distolateral spine only exceeding midlength of article 3; article 3 narrower than 2, with small distomesial spine and a few distolateral tubercles.

Ischium of third maxilliped more than half as long as merus, bearing strong short spine on extensor distal margin and small spine on flexor distal margin, mesial crest with row of 21 denticles; merus with 3 or 4 spines and 2 or 3 acute granules on flexor margin, and one sharp extensor distal marginal spine; carpus unarmed, propodus relatively slender.

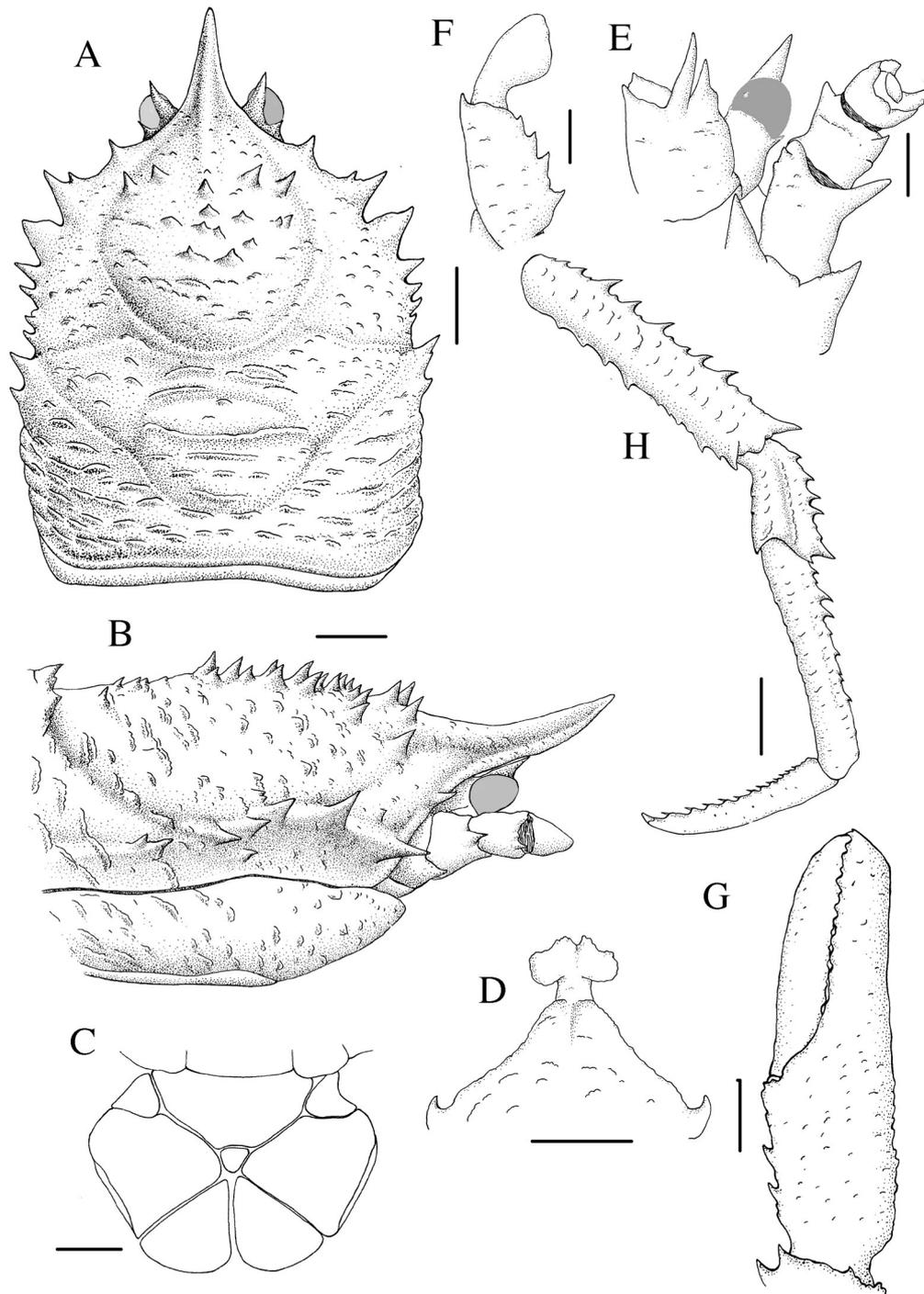


FIGURE 7. *Munidopsis hirtella* n. sp., holotype, male (32.6 mm), off Mauritania, EUMELI 2, Stn CP08, MNHN-Ga 4622. A: carapace, setae omitted, dorsal; B: same, lateral; C: posterior part of sixth abdominal segment and telson; D: anterior part of sternal plastron; E: left antennule, antenna and ocular peduncle, ventral; F: endopod of right third maxilliped, lateral; G: right cheliped, lateral; H: right second pereopod, lateral. Scale: A–C, G–H = 5 mm, D–F = 2 mm.

Chelipeds covered with small rugae and granules, uniramous setae more dense along mesial and lateral margins; about 1.9 times as long as postorbital carapace length. Basischium with 2–4 spines on mesial margin, distodorsally with strong spine, distoventral margin at juncture with merus bearing several small spines. Merus slightly overreaching rostrum, armed with spines in rows, distomesial spine strongest. Carpus bearing row of mesial and lateral spines, a few distal spines on dorsal border. Palm with acute granules on dorsal margin, a few small spines along mesial margin, slightly shorter than fingers, less than twice as long as broad. Fingers unarmed, not gaping, distally spooned, prehensile edges crenulate.

Walking legs rather long, slender, subcylindrical; first walking leg overreaching chela. Merus longer on first leg than on second leg, shorter on third than on preceding legs, each bearing dorsal crest with row of spines continued on to corresponding crest on carpus, ventral margin with some spines; each carpus having dorsolateral and dorsoventral granulate crests without spines continued on to corresponding crests on propodus. Each propodus with proximal mesial crest with spines; propodus slightly longer than dactylus. Dactyli slender, gently but distinctly curved, terminating in acute corneous spine preceded by row of 13 or 14 very low, proximally diminishing processes, each process supporting corneous seta, ultimate process clearly closer to tip of dactylus than to penultimate process.

Epipods present on chelipeds.

Eggs: Diameter, 2.9 mm

Remarks. The sixth abdominal segment without produced posteromedian flap, the first walking leg exceeding the tip of the chela, eyes bearing a well-developed, anteriorly directed distomesial eyespine, and absence of a denticulate carina on the distolateral margin of the chela, link *M. hirtella* to *M. subsquamosa* Henderson, 1885 from the Pacific, Indian and Southern Oceans, between 2516 and 4260 m and *M. recta* Baba, 2005 from the Gulf of Panama, at 2950–3190 m (see Baba, 2005).

The new species is easily differentiated from *M. subsquamosa* by the size of the cornea: it is as broad as the eye spine in *M. subsquamosa*, instead of being distinctly broader in the new species. Furthermore, the gastric region has more spines in the new species than in *M. subsquamosa*, and the length of the dactylus of the walking legs is 0.61 that of propodus in *M. subsquamosa*, whereas in the new species, the dactylus is slightly shorter than the propodus. Finally, the body of the new species has numerous simple setae, whereas these setae are absent in *M. subsquamosa*.

Munidospis hirtella is differentiated from *M. recta* by the following characters:

- The gastric region and the lateral margins of the carapace have more spines in the new species than in *M. recta*.
- The body has few uniramous setae in *M. recta*, whereas in *M. hirtella* the carapace, abdomen and appendages have numerous uniramous setae.
- The flexor margin of the dactylus of the walking legs is nearly straight in *M. recta*,

being considerably curving in the new species. Furthermore, the dactylus of the walking legs is about 0.5 times the length of the propodus in *M. recta*, whereas in the new species the dactylus is three-quarter the length of the propodus.

Distribution and habitat. The species has only been reported off western Africa, between Mauritania and Congo, at 3125–3166 m. The EUMELI specimens were collected in a sedimentary area, together with actinarians, polychaetes, molluscs, shrimps, pagurids, echinoderms and tunicates (Galéron *et al.*, 2000). The species was collected in the cold-seep site Regab, and away from the influence of seepage (1.5 km north and 7.5 km south of the site).

***Munidopsis laurentae* n. sp. (Fig. 8)**

Material examined. Off South Africa, WALVIS, Stn 13, 32°18.2'S, 13°15.9'E, 3550 m, 12.01.1979: female holotype 24.7 mm (MNHN-Ga 5295), female paratype 20.0 mm

Etymology. The species is dedicated to our late colleague Michèle de Saint Laurent in recognition of her exceptional contributions to the knowledge of Decapoda, including numerous unpublished notes on the species of the genus *Munidopsis*.

Description. Carapace exclusive of rostrum about 1.5 times longer than broad, anterior and posterior cervical grooves distinct but not deep. Gastric region moderately convex, with both small and moderate-sized spines and tubercles as figured, lacking elevated rugae. Hepatic region with tubercles. Anterior half of branchial region also with small spines. Posterior half of carapace bearing elevated, interrupted transverse ridges. Frontal margin strongly oblique, slightly convex. Antennal spine present. Posterior margin preceded by row of spines. Lateral margins nearly straight and subparallel, bearing 5 strong spines on anterior half, first anterolateral, smaller than others, somewhat divergent anteriorly, located distinctly mesial to level of remaining spines, second and third spines largest, directed more laterad than preceding, 1 or 3 small additional spines between large spines. Rostrum moderately narrow, with middorsal ridge, somewhat upturned, length one-fourth that of remaining carapace.

Pterygostomian flap anteriorly ending in acute tip.

Sternite 3 narrow, forming apposed lobe bearing anteromedian process at either side of slightly deep median groove, depressed below level of, and, separated by deep groove from, anteriorly narrowed sternite 4.

Abdomen spineless; somites 2 and 3 each with 2 moderately elevated transverse ridges; somites 4–6 without transverse ridge; somite 6 with posteromedian lobe transverse, not produced. Telson consisting of 8 plates, length-width ratio 1.01.

Ocular peduncles slightly movable dorsoventrally, bearing distomesial eye-spine strongly produced forward. Cornea small and lateral.

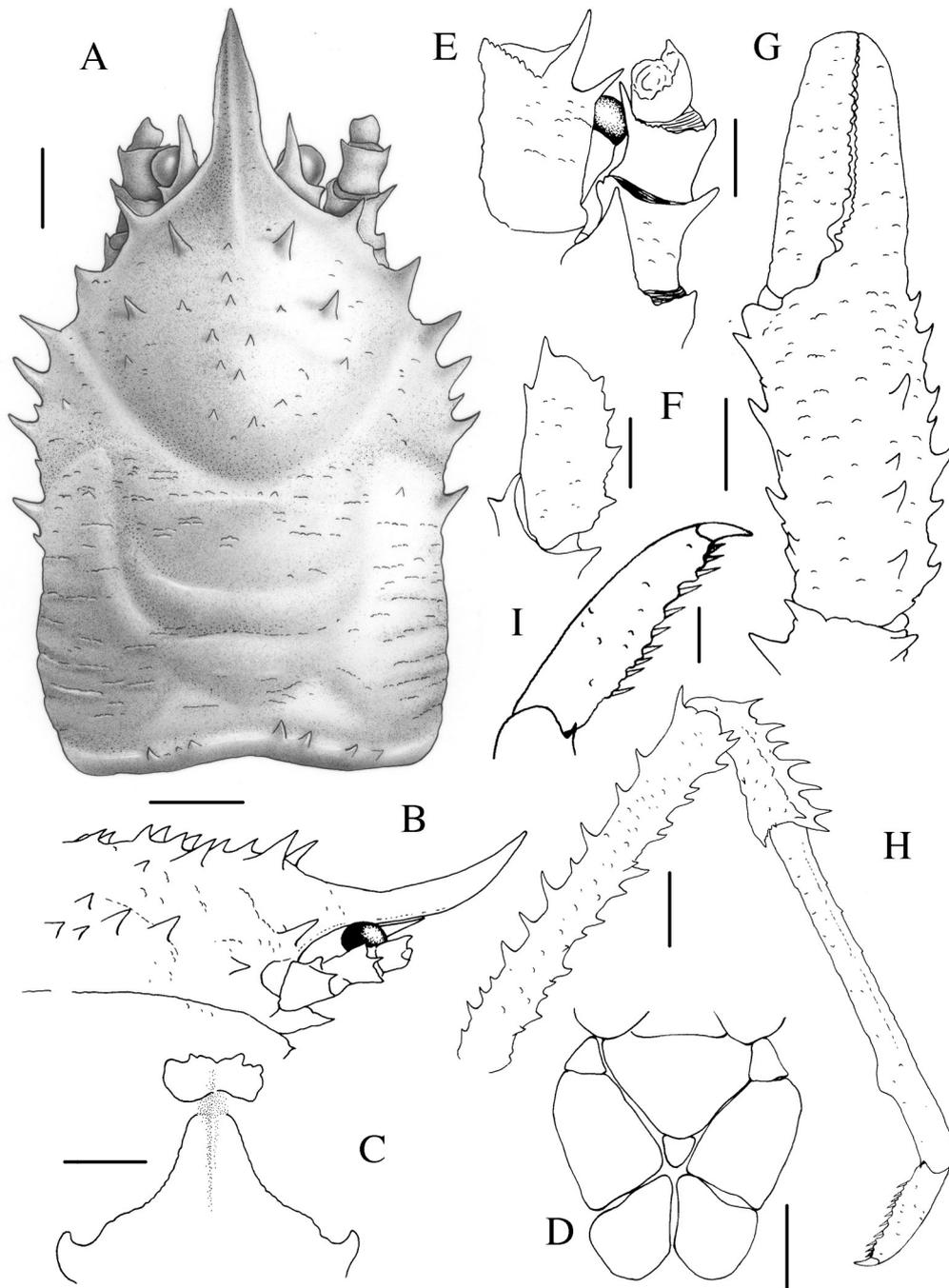


FIGURE 8. *Munidopsis laurentae* n. sp., holotype, female (24.7 mm), off South Africa, WALVIS, Stn 13, MNHN-Ga 5295. A, carapace, dorsal. B, same, lateral. C, sternal plastron. D, posterior part of sixth abdominal segment and telson. E, left antennule, antenna and ocular peduncle, ventral. F, endopod of right third maxilliped, lateral. G, right cheliped, lateral. H, right second pereiopod, lateral. I, dactylus of right second pereiopod, lateral. Scale: A–B, D, G–H = 5 mm, C–F, I = 2 mm.

Basal article of antennular peduncle with strong distodorsal and distolateral spines, distomesially with a few tubercles. Article 1 of antennal peduncle bearing sharp, basally flattish distomesial spine and very small distolateral spine. Article 2 with sharp distolateral spine only. Article 3 narrower than article 2, with distomesial spine distinctly larger than distolateral spine.

Ischium of third maxilliped as long as merus, bearing spine on extensor distal margin and small one on flexor distal margin, mesial crest with row of 16–20 denticles. Merus with 4 sharp flexor marginal spines and 2 sharp extensor distal marginal spines. Carpus unarmed. Propodus relatively slender.

Chelipeds covered with small rugae, 2.2 times as long as postorbital carapace length. Basi-ischium unarmed on mesial margin, distodorsally with strong spine, distoventral margin bearing several small spines at juncture with merus. Merus clearly over-reaching rostrum, armed with spines in 3 rows, distomesial spine strongest. Carpus one-third merus length, bearing row of mesial and dorsal spines. Palm with row of mesial, dorsal and lateral spines, as long as fingers, slightly less than twice as long as broad. Fingers unarmed, not gaping, distally spooned, prehensile edge crenulate. Fixed finger without denticulate carina on distolateral margin.

Walking legs rather long, slender, subcylindrical; first walking leg (P2) over-reaching chelipeds and 2.5 times postorbital carapace length. Meri of P2 slightly longer than that of P3 and 1.3 times that of P4, overreaching rostrum, each bearing dorsal crest with row of well developed spines continued on to corresponding crest on carpus, ventral margin with row of spines. Each carpus having dorsolateral crest without spines, continued on to corresponding crest on propodus. Propodus slightly shorter than merus, about 3 times dactylus length, flexor margin with 2 distal movable spinules, extensor margin sometimes with proximal spine. Dactyli slender, gently but distinctly curved, terminating in acute corneous spine preceded by row of 9 or 10 very low, proximally diminishing processes, each process supporting corneous spine, ultimate process slightly more remote from tip of dactylus than from penultimate process; flexor border nearly straight.

Epipods absent from P1–4.

Remarks. The presence of gastric spines on the carapace, the unarmed abdomen, the absence of pereopodal, the second walking legs overreaching the tip of the chelipeds, the ocular peduncles bearing a well-developed, anteriorly directed distomesial eye-spine, and the absence of a denticulate carina on the distolateral margin of the fixed finger of the cheliped link the species to *M. reynoldsi* (A. Milne Edwards, 1880) from the Caribbean Sea and Colombian Basin (3700–4277 m), and *M. starmer* Baba & de Saint Laurent, 1992, from North Fiji Basin at 2750 m (Baba & de Saint Laurent 1992, Tavares & Campinho 1998). *Munidopsis laurentae* is readily distinguished from *M. reynoldsi* by the following differences:

- The antennal spine is always present in the new species, whereas this spine is absent in *M. reynoldsi*.

- The first anterolateral spine of the carapace in *M. laurentae* is clearly shorter than the second and third lateral spines, whereas this spine is as long as the second spine in *M. reynoldsi*.
- The gastric and lateral spines of the carapace are more numerous and better developed in *M. laurentae* than in *M. reynoldsi*.
- The propodus of the walking legs is about three times the dactylus length in *M. laurentae*, instead of being about two times in *M. reynoldsi*.

The new species is also easily distinguishable from *M. starmer* by the presence of numerous spines on the gastric region and along the posterior border of the carapace. *Munidopsis starmer* has only two epigastric spines and the posterior border of the carapace is unarmed.

The two specimens were collected together with an abundant fauna composed of octocorals, decapods including one *Munidopsis bairdii*, echinoderms, tunicates and fishes.

Distribution. Only known from the type locality, off South Africa at 3550 m. Specific habitat data are not available.

Munidopsis livida (Perrier, 1886) (Fig. 9)

Elasmonotus lividus Perrier, 1886: fig. 242.

Orophorhynchus lividus.—A. Milne Edwards & Bouvier, 1894: 287, fig. 12; 1900: 343, pl. 4: fig. 3, pl. 31: figs 17–22.

Munidopsis lividus—Doflein & Balss, 1913: 178 (list).

Munidopsis livida—Miyake & Baba, 1970: 94.—Pequegnat & Pequegnat, 1971: 19, fig. 12.—Udekem d'Acoz, 1999: 167.

Material examined. Off Congo, M56, Stn GeoB 8215-2, TV-grab, 06°11.04'S, 10°25.53'E, 2417 m, 21.12.2002: 1 ovig. female 10.7 mm. Off Angola, BIOZAIRE 3, Stn CP20, 05°46.89'S, 09°44.66'E, 3113 m, 02.01.2004: 2 males 9.7–14.6 mm, 3 ovig. females 15.1–20.0 mm, 2 females 10.5–12.3 mm.

Diagnosis. Carapace surface unarmed, nearly devoid of setae. Frontal margin oblique lateral to eyestalks; lateral border convex, cristate, overhanging pterygostomian flap. Rostrum very broadly triangular, about one-third as long as remaining carapace, constricted between eyes, horizontal, dorsal carina continued onto anterior gastric region; lateral margin finely serrate. Third sternite with two anterior lobes; fourth sternite narrowly elongate anteriorly, lateral margins concave. Abdominal somites unarmed; posterolateral lobes of somites 6 distinct but not overreaching somewhat convex transverse posteromedian margin. Telson divided into 8 plates, posterior plates combined more than twice as wide as long. Ocular peduncles slightly movable, eyestalks produced anteriorly beyond cornea; cornea moderately small. Antennal peduncle having article 1 with anteriorly produced spine ventrally, dorsolateral margin broadly produced; article 2

sometimes with distolateral spine, article 3 distolaterally produced, with small distomesial spine. Merus of third maxilliped with small denticular spines of irregular sizes on flexor margin, extensor distal margin with small, acute spine. Chelipeds granulate, spineless, relatively stout, short, about as long as postorbital carapace length; fixed finger with denticulate carina on distolateral margin. First walking legs longer than chelipeds; merus somewhat cristate along extensor margin; extensor margin of carpus cristate; propodus with weak granulate ridge along lateral surface; dactylus ending in curved claw preceded by 13 proximally diminishing spines on nearly straight flexor margin, each spine bearing short seta. Epipods present on chelipeds. Egg diameter 1.8 mm

Remarks. *Munidopsis livida* belongs to the group of species having the dorsal surface of the carapace and abdomen unarmed, the rostrum wide and carinated dorsally, the main eyespine situated on the mesial end of the eyestalk, the fixed finger of the cheliped with denticulate carina on the distolateral margin, the first walking leg overreaching the end of the cheliped, and epipods present on the chelipeds. The closest species of the genus are *M. ceratophthalma* Alcock, 1901 from the Andaman Sea and West of Sumatra, between 677 and 878 m (Alcock 1901, Doflein & Balss 1913), *M. edwardsii* Wood-Mason, 1891 from the Bay of Bengal and New South Wales, Australia, between 1379 and 2610 m (Wood-Mason 1891, Alcock 1901, Baba & Poore 2002, Baba 2005), and *M. profunda* Baba, 2005 from the Celebes Sea, between 5163 and 5243 m (Baba 2005). However, the three species can be easily distinguished from *M. livida* by the following characters:

- The shape of the rostrum is different. *Munidopsis ceratophthalma*, *M. edwardsii* and *M. profunda* have a triangular rostrum, not covering the eyes, whereas in *M. livida* the rostrum is wide, nearly covering the eyes.
- The dorsal margins of merus and carpus of the walking legs have some spines in *M. ceratophthalma*, *M. edwardsii* and *M. profunda*, whereas these spines are absent in *M. livida*.
- The epipods on the chelipeds are present in *M. livida*, *M. edwardsii* and *M. profunda*, whereas they are absent in *M. ceratophthalma*. Additionally, *M. edwardsii* has two epigastric processes, that are absent in *M. livida*, *M. ceratophthalma* and *M. profunda*.

Distribution and habitat. *Munidopsis livida* was described from two specimens (one male and one ovigerous female) collected off the Canary Islands at 2115 m (A. Milne Edwards & Bouvier 1894). The species was subsequently recorded from the Gulf of Mexico, between 2070 and 2790 m (Pequegnat & Pequegnat 1971). The present material extends the known range to the central eastern Atlantic (off Congo).

The M56 specimen was collected with a TV grab at Congo Fan, about 90 km south of the cold-seep site Regab. The photographs taken around the location of the capture show that the faunal community is similar to that of Regab site, except that mytilid bivalves are apparently absent.

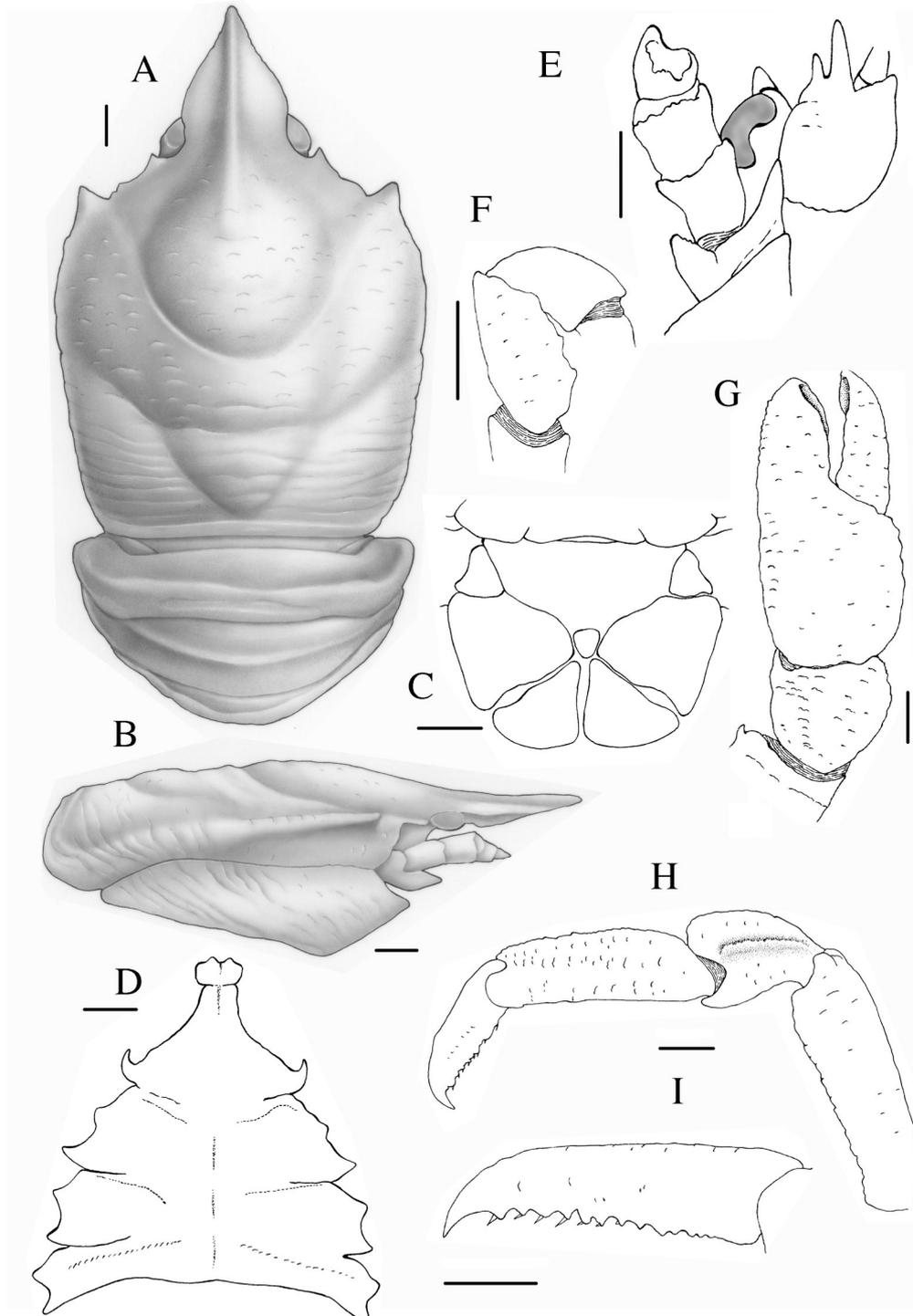


FIGURE 9. *Munidopsis livida* (Perrier, 1886), ovigerous female (10.7 mm), off Congo, M56, Stn GeoB 8215-2. A, carapace, dorsal. B, same, lateral. C, posterior part of sixth abdominal segment and telson. D, sternal plastron. E, right antennule, antenna and ocular peduncle, ventral. F, endopod of right third maxilliped, setae omitted, lateral. G, left cheliped, lateral. H, left second pereopod, lateral. I, dactylus of left second pereopod, lateral. Scale: 1 mm.

***Munidopsis marionis* (A. Milne-Edwards, 1882)**

Galathodes Marionis A. Milne-Edwards, 1882: 17; 1883: pl. 15, fig. 2 (ed. 1997, p. 81).

Orophorhynchus Marionis.—A. Milne-Edwards & Bouvier, 1894: 198, 287, 325; 1900: 340, pl. 331: figs 14–16.

Munidopsis marionis.—Doflein & Balss, 1913: 177 (list).—Bouvier, 1922: 175, pl. 6: fig. 5.—Zariquiey-Alvarez, 1968: 269.—Carpine, 1970: 54, 101, 134.—Fredj, 1974: 34.—Galil & Goren, 1994: 45, figs 3, 4a, b.—Frogliia *et al.* 2002: 380.

Material examined. Oriental Mediterranean Sea, MEDINAUT, Stn MN10-BT1, 35°26'N, 30°33.30'E, 1700 m, 01.11.1998: 1 male (broken), 2 females 3.4–4.3 mm.

Remarks. The species was originally known from a few specimens, all collected in the Mediterranean Sea (type locality: Planier Island, near Marseille, northwestern Mediterranean, 450 m). Galil & Goren (1994) redescribed the species from specimens collected in the eastern Mediterranean. *Munidopsis marionis* belongs to the group of species having the dorsal surface of the carapace granulated, without spines, the rostrum triangular, with the lateral margins weakly convex, the antennal spine absent, the anterolateral spine of the carapace bluntly produced, the abdominal segments spineless, the eyes large, not movable, the eyestalks short, unarmed, the first ambulatory leg reaching the end of the cheliped, and epipods present on the chelipeds and first two pairs of the ambulatory legs.

Munidopsis marionis is very close to *M. allae* Khodkina & Duris, 1989, known only from one specimen collected southwest of Spain (470–660 m). After the capture of new material of *M. marionis* (Galil & Goren 1994; this paper), the distinguishing features of *M. allae* indicated by Khodkina & Duris (1989), e.g., length of pereopods, eye size, armature of gastric region of the carapace, seem to be invalid. A complete revision of the type material of *M. marionis* and *M. allae* is desirable in order to confirm the existence of one or two taxa.

Distribution. Mediterranean Sea, between 374 and 1000 m (A. Milne-Edwards & Bouvier 1894, Galil & Goren 1994, Frogliia *et al.* 2002). The present material was collected in cold-seep areas (Olu-Le Roy *et al.* 2004).

***Munidopsis parfaiti* (Filhol, 1885) (Figs 10, 11)**

Elasmonotus Parfaiti Filhol, 1885: pl. 7.—Perrier, 1886: 295, 324.

Orophorhynchus Parfaiti.—A. Milne-Edwards & Bouvier, 1894: 287, fig. 4, 13, 34; 1899: 85; 1900: 336, pl. 3: fig. 1, pl. 31: figs 11–13.—Nobre, 1931: 188 (cite); 1936: 117 (cite).

Munidopsis parfaiti.—Benedict, 1902: 324 (list).—Doflein & Balss, 1913: 177 (list).—Gordon, 1955: 244 (list).—Zariquiey-Alvarez, 1968: 271.—Türkay, 1975: 67.—de Saint Laurent, 1985: 475.—Udekem d'Acoz, 1999: 168.

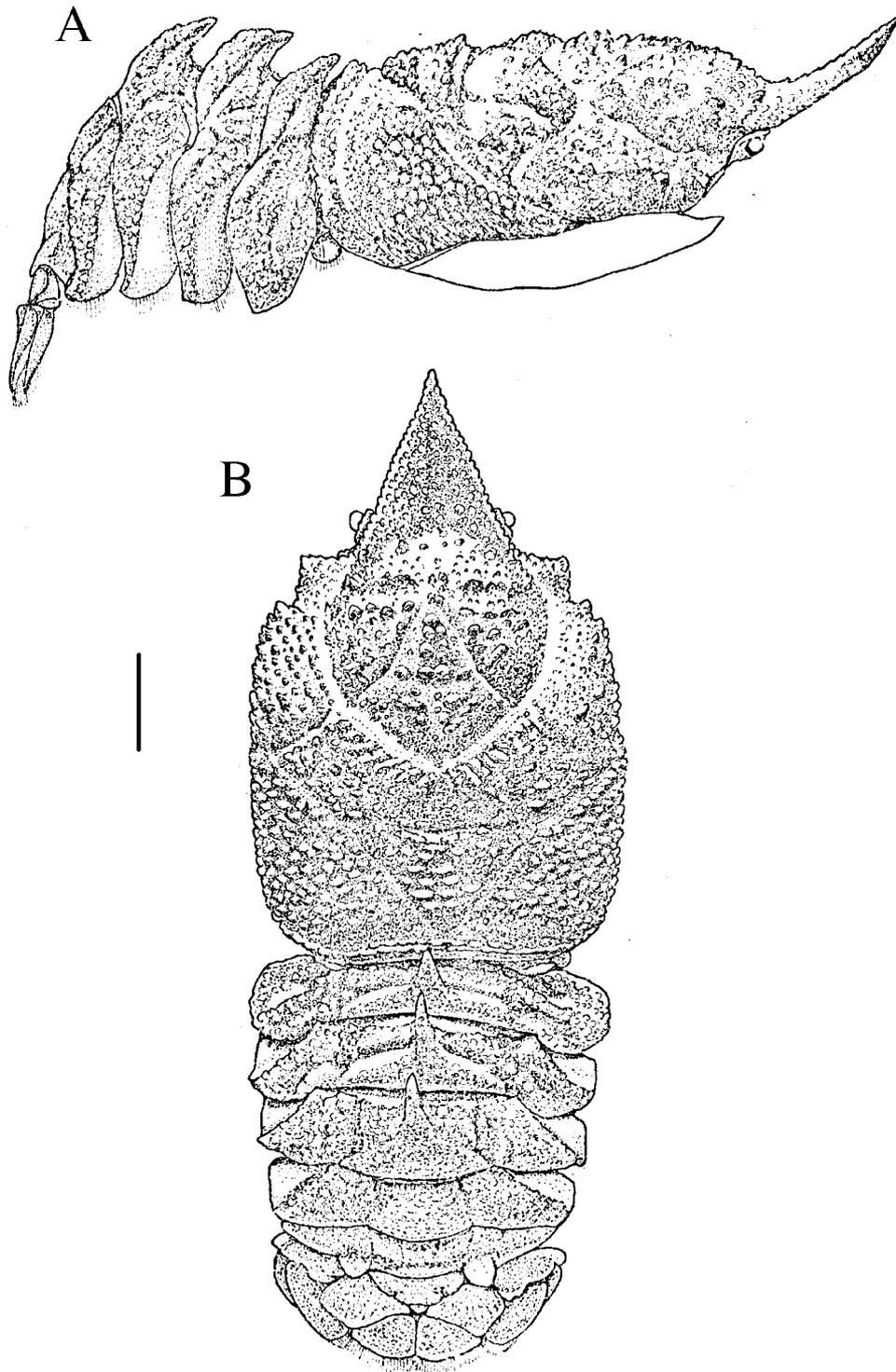


FIGURE 10. *Munidopsis parviti* (Filhol, 1885), female (15.8 mm), NE Atlantic, NORATLANTE, Stn 116-B18. A, carapace and abdomen, lateral. B, same, dorsal. Scale: 4 mm.

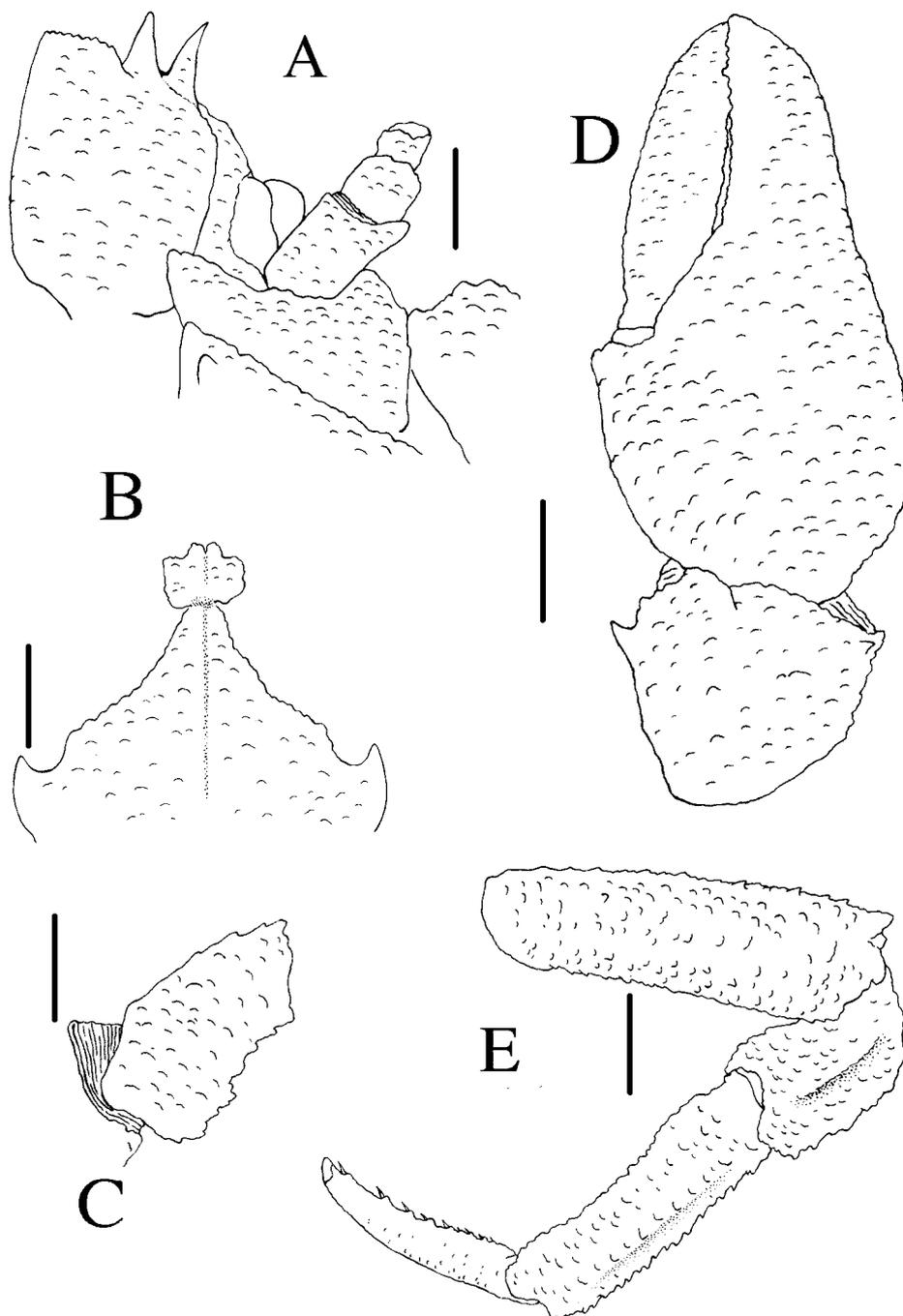


FIGURE 11. *Munidopsis parfai* (Filhol, 1885), male (31.9 mm), NE Atlantic, BENGAL 2, Stn 13078/6. A, right antennule, antenna and ocular peduncle, ventral. B, anterior part of sternal plastron. C, endopod of right third maxilliped, lateral. D, right cheliped, lateral. E, right second pereopod, lateral. Scale: A–C = 2 mm, D–E = 4 mm.

Material examined. NE Atlantic, NORATLANTE, Stn 115-B17, 43°13'N, 05°30'W, 4700 m, 29.10.1969: 1 female 24.6 mm.—Stn 116-B18, 46°40.2'N, 10°05.8'W, 4690 m, 30.10.1969: 1 female 15.8 mm. Bay of Biscay, BIACORES, Stn 249, 45°50'N, 17°32.5'W, 4650 m, 16.11.1971: 1 female 28.2 mm. Bay of Biscay, BIOGAS 3, Stn CV28, 47°25'N, 09°36'W, 4023 m, 28.08.1973: 1 male 29.7 mm. Bay of Biscay, BIOGAS 5, Stn CP04, 47°35'N, 09°31'W, 4200 m, 18.06.1974: 1 male 31.9 mm. Bay of Biscay, BIOGAS 6, Stn CP14, 47°32'N, 09°35.9'W, 4237 m, 25.10.1974: 2 males 28.3–32.5 mm.—Stn CP19, 44°25'N, 04°51'W, 4434 m, 28.10.1974: 1 male 22.3 mm.—Stn CP20, 44°23'N, 04°51'W, 4459 m, 29.10.1974: 2 males 22.5–30.1 mm, 1 female 30.8 mm, 1 juv. 8.0 mm. Off Ireland, INCAL, Stn CP07, 55°03.4'N, 12°46.2'W, 2895 m, 20.07.1976: 1 male 29.2 mm, 1 female 33.1 mm. Off South Africa/Namibia, WALVIS, Stn CP05, 33°23'S, 02°36'E, 4500 m, 30.12.1978: 1 male 29.6 mm, 1 female 29.3 mm.—Stn CP06, 33°22.5'S, 02°35.9'E, 4550 m, 30.12.1978: 1 male (broken), 2 females 13.1–31.0 mm.—Stn CP08, 27°00'S, 01°07'E, 5210 m, 05.01.1979: 1 ovig. female 30.4 mm, 1 female 28.7 mm. NE Atlantic, ABYPLAINE, Stn CP03, 36°49.4'N, 19°09.8'W, 4900 m, 20.05.1981: 1 male 32.2 mm.—Stn CP14, 39°59.2'N, 15°02.1'W, 5330 m, 08.06.1981: 1 male 23.1 mm, 1 female 25.9 mm. —Stn CP22, 44°41.8'W, 18°01.8'W, 4990 m, 21.07.1981: 2 males 30.0–31.2 mm. NE Atlantic, BENGAL 2, Stn 13078/6, 48°44.55'N, 16°32.77'W, 4838 m, 30.03.1997: 1 male 31.9 mm. NE Atlantic, BENGAL 3, Stn 13200/84, 48°47.95'N, 16°33.28'W, 4842 m, 23.07.1997: 2 males 29.7–32.2 mm.—Stn 13200/93, 48°50.55'N, 16°25.30'W, 4846 m, 25.07.1997: 1 female 34.1 mm.—Stn 13200/94, 48°50.99'N, 16°26.03'W, 4847 m, 25.07.1997: 2 males 32.7–34.6 mm. NE Atlantic, BENGAL 5, Stn 13368/48, 48°49.6'N, 16°30.1'W, 4843 m, 17.03.1998: 3 males, 27.4–31.9 mm, 6 females 18.8–32.0 mm.—Stn 13368/52, 48°48.30'N, 16°25.97'W, 4839 m, 19.03.1998: 1 male 29.1 mm, 1 female 33.9 mm. NE Atlantic, BENGAL 6, 13627/11, 48°47.82'N, 16°40.37'W, 4847 m, 01.10.1998: 1 male 32.1 mm, 1 female 34.0 mm.—Stn 13627/24, 48°50.47'N, 16°44.37'W, 4839 m, 05.10.1998: 1 male 34.7 mm.

Diagnosis. Carapace, abdomen, chelipeds and walking legs spineless, covered with tubercles. Carapace nearly devoid of setae, areas well delineated and convex. Lateral margins convex on hepatic regions, subparallel on branchial regions. Rostrum very broadly triangular, about 1/3 as long as remaining carapace, weakly carinated dorsally, carina not continued onto anterior half gastric region. Abdominal segments 2–4 each with blunt, low median process; posterolateral lobes of segment 6 distinct, and clearly overreaching nearly straight transverse posteromedian margin. Telson divided into 8 plates, posterior plates combined more than twice as broad as long. Ocular peduncles not movable, distally ending in blunt process; cornea lateral. Chelipeds slightly longer than carapace in both sexes, few small spines on mesial and distal borders of merus and carpus; fingers as long as palm, distally hoof-shaped, fixed finger sometimes with low denticulate carina on distolateral margin, movable finger slightly shorter than fixed finger. Walking legs subcylindrical, relatively stout; each dactylus nearly 3/4 as long as propodus, distally

curving, ending in strong spine, flexor margin with 8–10 teeth (each with accompanying seta-like spine) diminishing toward base of article, ultimate tooth slightly remote from end of dactylus and much closer to end than to penultimate tooth; propodi and often carpi with plumose setae on dorsal face. First walking legs overreaching distal end of chelipeds. Epipods on chelipeds, absent on walking legs.

Distribution. The holotype of *M. parfaiti* was collected from the Azores Islands (one male, LC=25 mm, Talisman expedition, Stn 136, 44°20'N, 19°31'W, 4255 m, 26.08.1883) and is apparently lost. The species was later collected between the Azores and the coast of Portugal at 4360 m (A. Milne-Edwards & Bouvier 1894, 1899, 1900), Bay of Biscay, 3992–4510 m (de Saint-Laurent 1985), Iberian coast, 5260–5275 m (Türkyay 1975). The present material was collected between the northeast Atlantic (off Ireland, 55°03'N) and southeast Atlantic (off South Africa, 33°23'S), at depths between 2895 and 5330 m. The species has not been found in hydrothermal vents or cold seep areas (Table 2).

Munidopsis rostrata (A. Milne-Edwards, 1880)

Galacantha rostrata A. Milne-Edwards, 1880: 52.

Munidopsis rostrata.—Baba, 2005: 180, 294 (complete synonymy and references).

Material examined. NE Atlantic, NORATLANTE, Stn 44-B15, 44°07'N, 04°09'W, 1884 m, 26.10.1969: 2 males 14.0–15.9 mm, 1 female 16.7 mm. Gulf of Guinea, WALDA, Stn CY23, 0°45'N, 08°27'E, 2231 m, 02.08.1971: 1 male 24.0 mm. Azores Islands, BIACORES, Stn 171, 37°58.5'N, 26°07'W, 3215 m, 01.11.1971: 2 males 24.8 mm and broken.—Stn 174, 38°06'N, 26°15'W, 3070 m, 02.11.1971: 1 male 23.2 mm.—Stn 176, 38°00.5'N, 26°21.5'W, 2700 m, 02.11.1971: 9 males 8.9–18.6 mm, 7 females 9.3–17.9 mm.—Stn 252, 47°35.5'N, 08°47'W, 2640 m, 18.11.1971: 3 males 14.8–24.7 mm. Bay of Biscay, BIOGAS 1, Stn CV07, 47°33'N, 08°13'W, 2190 m, 07.08.1972: 1 female 13.3 mm. Bay of Biscay, POLYGAS, Stn CV11, 47°29'N, 08°16'W, 2141 m, 23.10.1972: 2 females 10.1–12.3 mm.—Stn DS15, 47°37.2'N, 08°40.1'W, 2246 m, 24.10.1972: 1 female 27.8 mm.—Stn DS16, 47°36'N, 08°40'W, 2325 m, 21.10.1972: 2 males 21.4 mm. Bay of Biscay, BIOGAS 2, Stn CV20, 47°37'N, 08°34'W, 2282 m, 19.04.1973: 1 male 19.8 mm, 2 ovig. females 26.6–34.3 mm. Bay of Biscay, BIOGAS 4, Stn CP01, 47°35'N, 08°39'W, 2245 m, 25.02.1974: 13 males 8.4–25.4 mm, 2 ovig. females 27.8–30.2 mm, 13 females 10.0–28.3 mm, 1 juv. 7.8 mm.—Stn CP02, 47°33'N, 08°41'W, 2177 m, 26.02.1974: 1 female 9.9 mm. Bay of Biscay, BIOGAS 5, Stn CV39, 47°33'N, 08°45'W, 2350 m, 14.06.1974: 1 male 26.7 mm, 4 females 13.0–24.7 mm. Bay of Biscay, BIOGAS 6, Stn CP08, 47°33'N, 08°38'W, 2177 m, 20.10.1974: 2 males 11.8–13.3 mm.—Stn CP09, 47°33'N, 08°44'W, 2177 m, 20.10.1974: 1 male 12.1 mm. Off Ireland, INCAL, Stn DS03, 57°25.5'N, 11°03.4'W, 609 m, 17.07.1976: 1 male 27.7 mm.—Stn CP09, 10°15.4'N, 13°15.8'W, 2659 m, 27.07.1976: 3 males 14.0–21.2 mm, 2 ovig. females 22.6–29.2 mm, 1

female 18.2 mm. Bay of Biscay, BIOGAS 11, Stn CP37, 44°34.10'N, 08°40.5'W, 2175 m, 11.10.1981: 5 males 13.1–26.1 mm, 1 female 12.6 mm. Bay of Biscay, EPI I, Stn CP38, 47°33.75'N, 08°42.16'W, 2100 m, 29.03.1984: 6 males 10.5–25.0 mm. Bay of Biscay, EPI IV, Stn CP40, 47°34'N, 08°41'W, 2100 m, 04.09.1985: 1 male 20.4 mm, 3 females 8.1–24.2 mm. NW Atlantic, MAR-ECO, Stn 50 (Lstn 373), 43°12'N, 28°19'W, 2598 m, 12.07.2004: 1 male 11.7 mm, 2 females 17.5–18.2 mm. —Stn 50 (Lstn 374), 42°33'N, 28°35'W, 2977 m, 13.07.2004: 1 ovig. female 26.9 mm. —Stn 65 (Lstn 382), 53°20'N, 33°36'W, 3015 m, 24.07.2004: 1 male 24.2 mm. —Stn 72 (Lstn 386), 53°10'N, 35°19'W, 2534 m, 27.07.2004: 9 males 7.9–27.0 mm, 3 females 9.6–16.6 mm.

Remarks. The species was described from specimens collected in Bequia (Lesser Antilles) at 2912 m (A. Milne-Edwards 1880). *Munidopsis rostrata* has been redescribed and figured in numerous papers, see for instance Khodkina (1975: 263), Baba (1988: 161), Baba & Poore (2002: 239), Baba (2005: 180) and references cited therein. Furthermore, the species has been considered the senior synonym of some species described later, i.e., *Galacantha bellis* Henderson, 1885 (type locality: off Juan Fernandez, 2516 m), *G. talismani* Filhol, 1885 (type locality: north of Canary Islands, 2075–2085 m), *G. areolata* Wood-Mason, 1891 (type locality: Bay of Bengal, 2397 m), *G. investigatoris* Alcock & Anderson, 1894 (type locality: Laccadive Sea, 2200 m). However, the specimens from the different localities show some morphological differences that could indicate the existence of several different species (unpublished data). A revision of the material from different localities is needed to confirm the specific identity of the specimens from different areas.

Munidopsis rostrata is characterized by the carapace surface covered with simple or scale-like tubercles, one prominent median spine on gastric region, 2 prominent spines on anterior lateral margin of carapace, the rostrum bearing lateral spines, with its proximal portion horizontal, distal portion directed strongly upwards, and epipods present on the chelipeds and first two pairs of walking legs.

Distribution. As Baba (2005) pointed out, *M. rostrata* is a widespread species, known from the western and eastern Atlantic, Indian Ocean, and western and eastern Pacific, from low to high latitudes (see Baba, 2005 for the list of localities). The species occurs between 1600 and 3294 m. The present material was collected in the northern Atlantic, from off Ireland (57°25.5'N) to the Gulf of Guinea (0°45'N), between 1884 and 3215 m.

Munidopsis serricornis (Loven, 1852)

Galathea serricornis Loven, 1852: 22.

Munidopsis serricornis.—Baba, 2005: 185, 295 (complete list of synonymies and occurrences).

Material examined. Bay of Biscay, BIOGAS 2, Stn CV21, 47°42'N, 08°03'W, 994 m, 20.04.1973: 2 males 6.3–7.6 mm, 2 ovig. females 6.4–6.7 mm. 1 female 7.0 mm. THALASSA 73, Stn Z435, 48°37.7'W, 09°53.2'W, 1050 m, 26.10.1973: 1 male 6.0 mm,

1 female 4.5 mm. Off Ireland, THALASSA 75, Stn B210, 59°17.9'N, 15°39.7'W, 626 m, 25.04.1975: 3 males 7.6–10.9 mm, 4 ovig. females 6.3–11.8 mm.—Stn B246, 56°50.9'N, 19°43.3'W, 850 m, 21.05.1975: 6 males 5.7–10.5 mm, 8 ovig. females 9.3–13.0 mm, 9 females 5.7–9.2 mm. Off Ireland, INCAL. Stn DS01, 57°59.2'N, 10°41.3'W, 2091 m, 15.07.1976: 1 male 2.6 mm, 1 female 3.4 mm. NE Atlantic, SEAMOUNT 2, Stn DW 200, 31°19.07'N, 28°36.01'W, 1060 m, 18.01.1993: 2 males 4.1–7.3 mm, 1 female 6.6 mm.—Stn DW 203, 31°09.52'N, 28°43.52'W, 990 m, 19.01.1993: 1 male 4.9 mm, 2 ovig. females 5.6–6.0 mm.—Stn DW 275, 34°03.49'N, 28°18.07'W, 1665 m, 06.02.1993: 1 male 6.5 mm.—Stn DW 276, 34°02.06'N, 28°18.96'W, 1520 m, 06.02.1993: 3 males 4.5–8.8 mm, 3 females 4.5–8.8 mm.—Stn DW 277, 33°59.92'N, 28°20.56'W, 1000 m, 06.02.1993: 1 male 9.4 mm. Mid-Atlantic-Ridge, OCEANAUT, Stn OT-B04, 34°50.41'N, 36°13'W, 961 m, 30.08.1995: 1 male 7.4 mm, 4 ovig. females 7.0–8.6 mm, 3 females 4.2–6.1 mm.

Remarks. The species was redescribed and figured by Pequegnat & Pequegnat (1970), Baba (1988, 2005) and Baba & Poore (2002). *Munidopsis serricornis* belongs to the group of species bearing a pair of lateral spines at the anterior end of the horizontal portion of the rostrum, the carapace unarmed on the dorsal surface, bearing 4 spines on the lateral margin, the last spine located at the midlength, the abdomen unarmed, the eyespine absent, the mesial margin of cheliped carpus with 2 distal spines, the proximal larger, the walking legs with a row of spines on the dorsal crest, and no epipods on the pereopods.

Distribution and habitat. Eastern Atlantic from Iceland and Norway to Cape Verde Islands, northwestern Mediterranean; Caribbean Sea in the western Atlantic; Indian Ocean from Somalia to Saya de Malha Bank, and from the Maldives Islands to west of Sumatra; western Pacific from Philippines to Tasmania and Victoria (see Baba 2005). Depth of occurrence between 100 and 2165 m. The OCEANAUT specimens were extracted from a gorgonian *Acanthogorgia* sp. (M. Grasshoff, personal communication) which sheltered several other specimens, filmed by the submarine at the moment of collection. This species can derive nourishment from organic particles, or perhaps even the polyps of this gorgonian.

Munidopsis subsquamosa Henderson, 1885

Munidopsis subsquamosa Henderson, 1885: 414.

Munidopsis subsquamosa.—Baba, 2005: 186, 296, figs 88, 89 (complete list of synonymies and references).

Not *Munidopsis subsquamosa* fide de Saint-Laurent, 1885: 475 (= *M. exuta* n. sp.)

Material examined. Off Namibia, WALDA, Stn CY05, 21°46.3'S, 11°08.3'E, 2953 m, 11.06.1971: 12 males 23.0–27.0 mm, 1 ovig. female 30.2 mm, 3 females 31.9–41.7 mm.—Stn CY07, 22°53'S, 11°56'E, 2840 m, 17.06.1971: 1 ovig. female 34.8 mm.—Stn CY11, 17°30'S, 09°27'E, 4335, 30.06.1971: 1 female 20.0 mm.

Remarks. Baba (2005) provided an excellent analysis of the material collected in different localities and identified as different species or subspecies. The specimens collected off Namibia agree quite well with the description and figures of the type material. Our material is also similar to *M. subsquamosa aculeata* Henderson, 1885 (between Marion Island and Crozet islands and off Chile, 2516–2654 m) and *M. barnardi* Kensley, 1968 (W of Cape Point, 2708–2965 m). As Baba (2005) pointed out both taxa are junior names of *M. subsquamosa*. The specimens collected in the Bay of Biscay and identified provisionally as *M. subsquamosa* by de Saint-Laurent (1985) correspond to *M. exuta* (see above). The species is characterized by the carapace having low scale-like ridges on the gastric region, the presence of a group of gastric spines, including 2 epigastric spines, the anterolateral spine of the carapace larger than antennal spine in size, directed anterolaterad, the rostrum spiniform, the abdominal segment 6 with posteromedian margin weakly convex, not produced, the eyestalks short relative to length, the mesial eye-spine present, the cornea relatively small, as broad as the eyespine, the first walking leg overreaching the end of the cheliped, the fixed finger of the cheliped without a denticulate carina on the distolateral margin, the dactyli of walking legs strongly curved distally, the ultimate flexor marginal tooth much closer to the penultimate than to tip of the article, and epipods present on the chelipeds.

Distribution. Japan, eastern Australia, Chile, Marion Island, Crozet Islands, South Africa, between 2516 and 3960 m. The present material was collected off Namibia, between 2840 and 2953 m.

Munidopsis thieli Türkay, 1975 (Fig. 12)

Munidopsis thieli Türkay, 1975: 67, figs 3, 5, 6.—d'Udekem d'Acoz, 1999: 169.

Material examined. Iberic abyssal plain, NORATLANTE, Stn 38-B14, 37°21.1'N, 18°46.6'W, 5110 m, 18.10.1969: 1 female 40.0 mm. Off Mauritania, SEABED 2, Stn CP19, 19°15.31'N, 29°49.39'W, 4958 m, 15.11.1980: 1 female 16.6 mm. Iberic abyssal plain, ABYPLAINE, Stn CP 13, 40°00.8' N, 15°05'W, 5270 m, 08.06.1983: 1 male 30.0 mm.—Stn CP 14, 39°59.1'N, 15°00.2'W, 5330 m, 08.06.1983: 1 male 21.7 mm.— Stn CP 15, 39°59.2'N, 15°02.1'W, 5320 m, 09.06.1983: 1 male 21.7 mm.

Diagnosis. Dorsal carapace surface with some short setae, lateral carapace, abdomen and appendages covered with short fine setae. Carapace with scattered tubercles and faint rugae, more numerous and prominent on branchial regions, without epigastric spines or tubercles. Lateral margin with anterolateral spine directed somewhat anterolaterad, as long as second lateral spine, and followed by posteriorly diminishing spines on anterior branchial region and more laterally expanded posterior branchial region anteriorly bearing distally pointed process followed by smaller process. Rostrum broadly triangular, about 1/3 length of remaining carapace. Frontal margin oblique, antennal spine well developed,

slightly smaller than anterolateral spine. Third sternite narrow, fourth sternite sub-triangular. Abdomen spineless; posterior margin of sixth somite nearly transverse, postero-

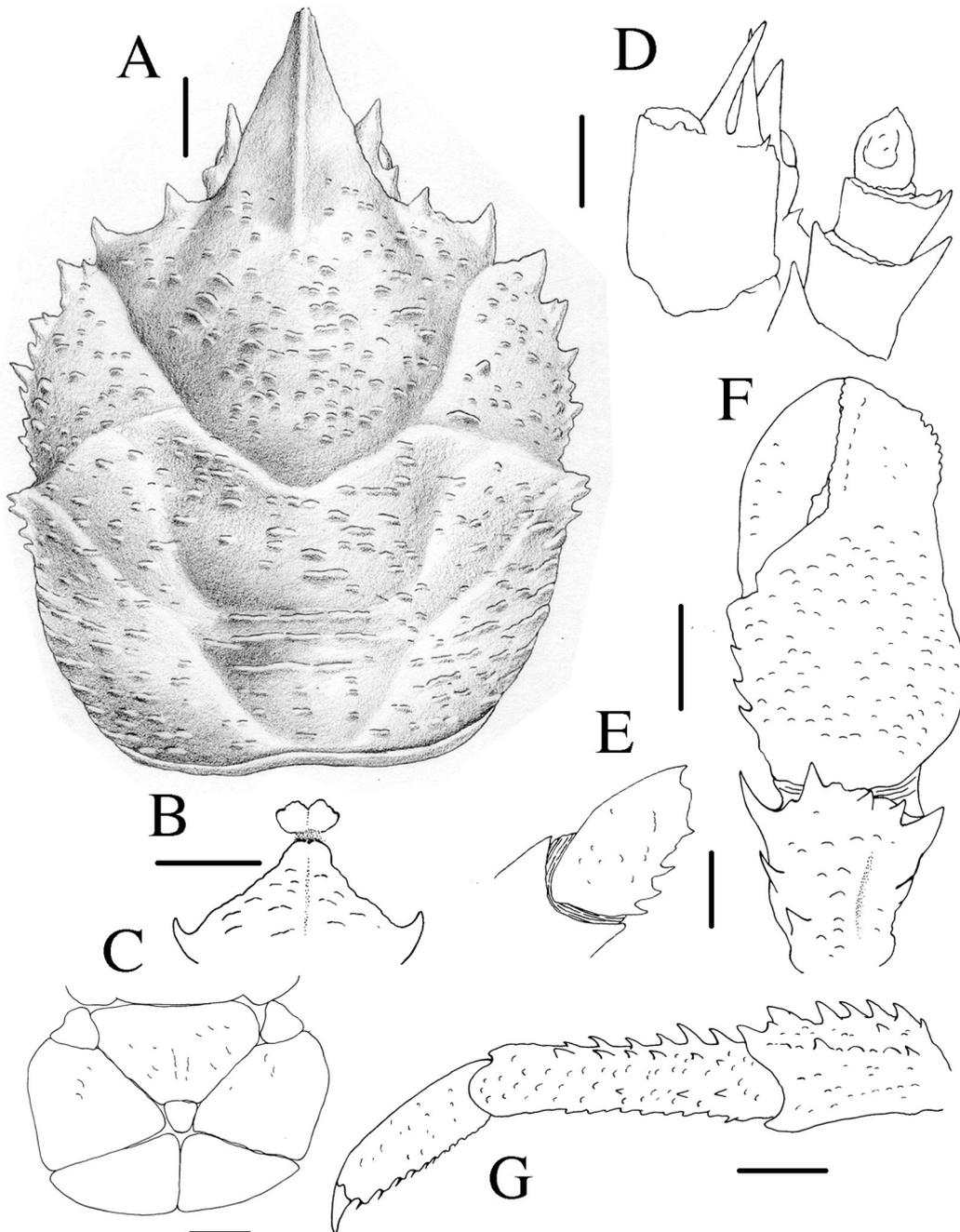


FIGURE 12. *Munidopsis thieli* Türkay, 1975, male (30.0 mm), Iberic abyssal plain, ABYPLAINE, Stn CP13. A, carapace, dorsal. B, anterior part of sternal plastron. C, posterior part of sixth abdominal segment and telson. D, right antennule, antenna and ocular peduncle, ventral. E, endopod of right third maxilliped, setae omitted, lateral. F, right cheliped, lateral. H, left second pereiopod, lateral. Scale: A–C, F–G = 4 mm, D–E = 2 mm.

lateral lobes feebly bordered from posteromedian margin. Telson divided into 8 plates, midlateral plates without coarse setae in males. Ocular peduncles hardly movable, basally broad, with strong eye-spine produced distomesially; cornea small and lateral. Third maxilliped merus relatively long, flexor margin with 4 or 5 spines of irregular size, extensor margin bearing distinct distal spine. Chelipeds longer than carapace, merus and carpus with some spines on mesial and distal margins, palm with scattered tubercles and few small mesial spines; fixed finger with denticulate carina on distolateral margin. Walking legs relatively short, granulate; each merus with row of dorsal spines, row of ventral spines on first leg; each propodus with row of dorsal marginal spines, 2 lateral crests with row of tubercles or spines; each dactylus slightly shorter than propodus, terminal claw curving, flexor margin nearly straight; flexor margin with 10–12 teeth (each with accompanying seta-like spine) diminishing toward base of article, ultimate tooth slightly remote from end of dactylus and more remote from tip of dactylus than from penultimate process. First walking legs slightly overreaching end of chelipeds. Epipod present on chelipeds, absent from walking legs.

Distribution and habitat. *Munidopsis thieli* was described from specimens collected off northwestern Spain (approximately 42°27'N) between 5215 and 5330 m (Türky 1975). The present material agrees quite well with the original description. The present record extends the geographical range of the species further south (off Mauritania). The species is one of the deepest-living representatives of the genus (Baba 2005). The specimens were collected in areas of low faunal diversity, among actiniarians, bivalves, some echinoderms and numerous tunicates. On the Iberic abyssal plain, the density of *M. thieli* is very low (1 individual/km², Monniot & Segonzac 1985).

***Munidopsis truculenta* n. sp. (Fig. 13)**

Material examined. Off Congo, 05°06'S, 11°18'E, 800–900 m, 18.11.1969: ovig. female holotype, 9.2 mm (MNHN-Ga 4623).

Etymology. From the Latin *truculentus*, savage, harsh, in reference to the processes on the carapace.

Description. Carapace quadrangular, dorsal surface sparsely granulose, areas distinct. Gastric region anteriorly elevated from level of rostrum, bearing pair of obtuse, large epigastric processes. Cardiac region with slightly elevated ridge preceded by deep depression; granules of different sizes. Branchial regions with numerous granules, as figured. Frontal margin oblique near rostrum, and transverse lateral to antennal peduncle, without antennal spine. Lateral margins with obtuse processes or lobes separated by well-defined furrows, lobes without spines, with small granules of different sizes. Rostrum relatively wide at base, distally spiniform, nearly horizontal, dorsal surface convex and granulate, length one-third that of remaining carapace. Third thoracic sternite short and wide, width about half that of following sternite.

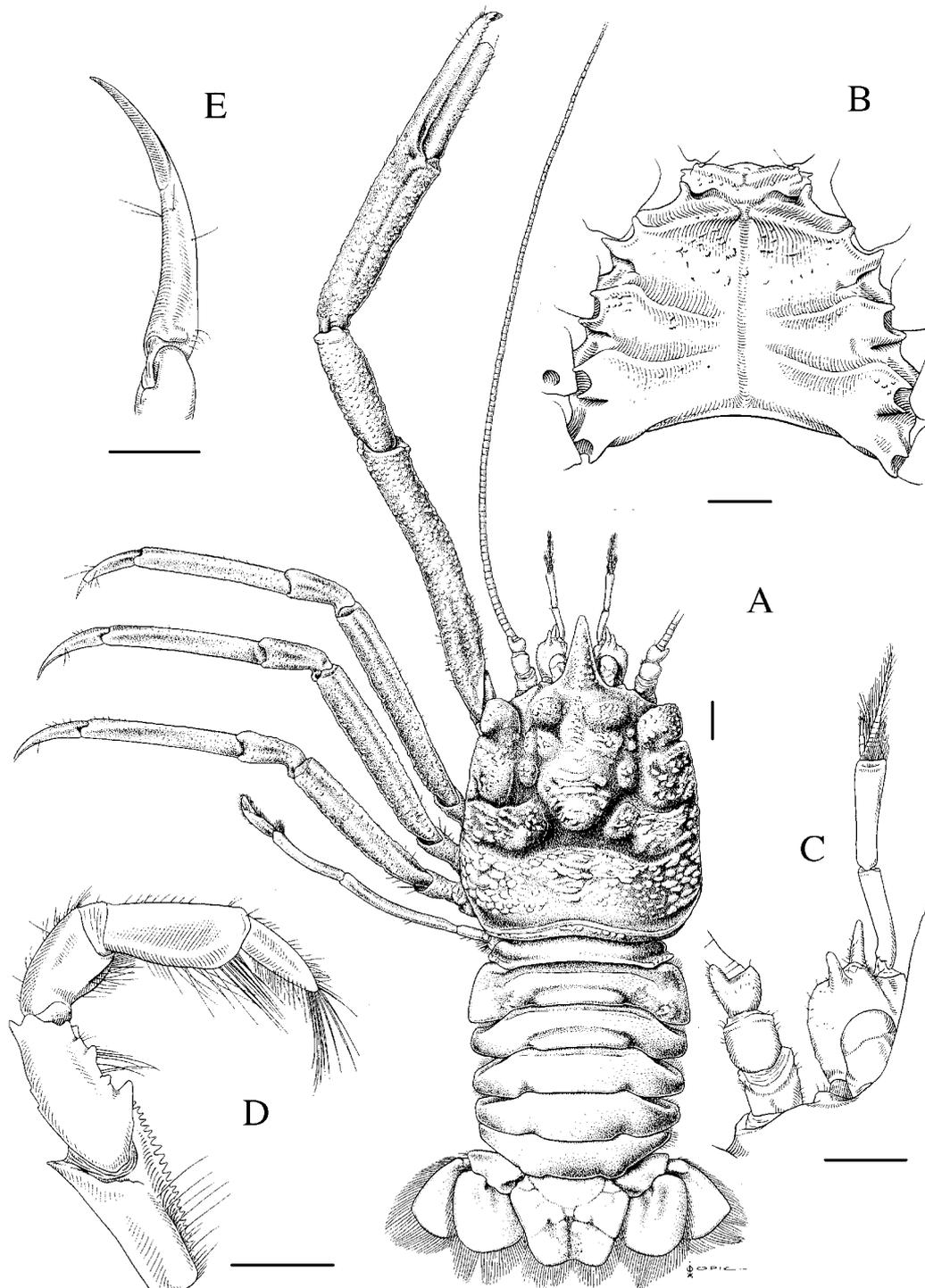


FIGURE 13. *Munidopsis truculenta* n. sp. holotype, ovigerous female (9.2 mm), off Congo, MNHN-Ga 4623. A, general view, dorsal. B, right antennule, antenna and ocular peduncle, ventral. C, sternal plastron. D, endopod of right third maxilliped, lateral. E, dactylus of left second pereiopod, lateral. Scale: 1 mm.

Abdomen spineless, somites 2 and 3 each with 2 transverse ridges, each anterior ridge elevated; somite 6 with posterolateral lobes distinctly bordered from nearly transverse posteromedian margin. Telson divided into 8 plates, midlateral plates in male with coarse setae on lateral margin, length-width ratio 0.7.

Eyes unarmed, small, movable; cornea distal, slightly wider than eyestalk.

Basal article of antennule with two spines (distomesial and distodorsal), mesial distal margin somewhat produced, lacinate. Antennal peduncle unarmed, with strong blunt distolateral process on article 3 only.

Ischium of third maxilliped more than half as long as merus, extensor margin with distal spine, mesial crest with row of 24 or 25 denticles; merus with 5 flexor marginal spines or acute granules, proximal one larger; extensor margin with spine on distal end; carpus unarmed, propodus relatively slender.

Left cheliped (right missing) slender, subcylindrical, 3.2 times as long as postorbital carapace length, clearly longer than first walking legs; unarmed, with numerous small granules; fingers slightly shorter than palm. Merus clearly overreaching end of rostrum, 2.5 times longer than carpus, nearly 1.7 times as long as palm.

Walking legs similar, slender, spineless. Some granules on merus and carpus. Meri subequal on first and second legs, shorter on third than on preceding legs. First walking leg overreaching end of carpus of cheliped but barely reaching midlength of palm; merus slightly overreaching end of rostrum; length 3.3 times that of carpus and 1.5 times that of propodus; dactyli curving, very slender and sharp, with smooth margins, length about two-thirds of propodus. Epipods absent from all pereopods.

Eggs: Diameter, 1.2 mm.

Remarks. The spineless and granular carapace, and slender pereopods with smooth dactyli on the flexor margin link *M. truculenta* to *M. polita* (Smith, 1883) from the Caribbean Sea and the eastern coast of United States (145–860 m), *M. granulata* Miyake & Baba, 1967 from Sagami Bay, Japan (110–200 m), and *M. palmatus* Khodkina, 1973 from the coasts of Chile, Gulf of Panama and Gulf of California, between 660 and 1245 m (Khodkina 1973, Hendrickx 2001, Baba 2005).

The new species is easily distinguished from *M. polita* by the following characters:

- The dorsal carapace surface is clearly smoother in *M. polita* than in *M. truculenta*.
- The rostrum has a dorsal, longitudinal carina in *M. polita*, this carina is absent in the new species.
- The chelipeds and merus of the walking legs have numerous small granules in *M. truculenta*, whereas these granules are practically absent in *M. polita*.

The new species is distinctive from *M. granulata* in the following characters:

- The dorsal carapace surface is more granulated in *M. granulata* than in *M. truculenta*.
- The spines of the antennular peduncle are more developed in *M. granulata* than in *M. truculenta*. Furthermore, the antennal peduncle has some distal spines on each article in *M. granulata*, instead of being unarmed in the new species.

- The ischium and merus of the third maxilliped each bears an extremely strong spine on the distal end of the extensor margin in *M. granulata*, instead of a small spine as in *M. truculenta*.
 - The merus of the walking legs has a row of spines along the dorsal border in *M. granulata*, whereas these spines are absent in *M. truculenta*.
- Munidopsis truculenta* is distinguished from *M. palmatus* by the following characters:
- The anterolateral angle of the carapace bears a distinct spine in *M. palmatus*, whereas this spine is absent in the new species.
 - The merus of the chelipeds in *M. palmatus* bears two rows of spines on the mesial margin, which are absent in *M. truculenta*.

Distribution. Only known from the type locality, off Congo, at 800–900 m. Specific habitat data are not available.

Discussion

About 70 species of *Munidopsis* are known from the Atlantic Ocean, although only a few of the deep areas have been sampled to any great extent: Western Atlantic and Caribbean Sea (Chace 1942, Pequegnat & Pequegnat 1970, 1971, Gore 1983, Williams & Turner 1986, Pequegnat & Williams 1995, Navas *et al.* 2003), Middle Atlantic Bight (Werner 1982), Eastern Atlantic (Miyake & Baba 1970, Udekem d’Acoz 1999, Tiefenbacher 2001), Mediterranean Sea (Galil & Goren 1994, Frogliia *et al.* 2002). This suggests that additional species will be discovered as explorations continue.

There are many taxonomic problems in this genus, and although some recent works (e.g., Ahyong & Poore 2004, Baba 2005) have clarified the status of numerous species, a revision of the Atlantic species is desirable. The recent description of new species closely related to *M. subsquamosa*, e.g., *M. exuta*, *M. geyeri*, *M. panamae*, *M. recta* (see Pequegnat & Pequegnat 1971, Baba 2005) exemplifies the complexity of the genus. Other closely related species pairs (e.g., *M. acutispina*-*M. penescabra*, *M. curvirostra*-*M. acuta*) need revision.

The most abundant species of *Munidopsis* collected in this study, i.e., *M. crassa*, *M. curvirostra*, *M. geyeri*, *M. rostrata*, and *M. serricornis*, are sexually dimorphic, with males smaller than females. Males and females of *M. parfaiti* reach similarly large sizes. Sexual dimorphism in size has been observed in other galatheids (Baba 1988, 2005, Macpherson 1994), and is attributed to differential growth rate between sexes (Wenner 1982, Creasey *et al.* 2000). The overall sex ratios for males and females of the species examined are not different from unity (Table 3), in agreement with the results provided by Wenner (1982) for *M. bairdii*, *M. curvirostra* and *M. rostrata* from the Middle Atlantic Bight. In *Munidopsis scobina* Alcock, 1894, males are more abundant than females (Creasey *et al.* 2000).

TABLE 3. Size range (postorbital carapace length, without rostrum, in mm) by sex and season of occurrence of ovigerous females in the most abundant species of *Munidopsis*. In parentheses, number of specimens. Sex-ratio (Males: Females) are not significantly different from unity in all cases (chi-square, $p > 0.05$). (A) Austral season, (N) Boreal season.

Species	Males	Females	Ovigerous females	Sex-ratio (M: F)	Ovigerous season (this study)	Ovigerous season (previous data)
<i>M. antonii</i>	10.0–35.4 (8)	14.5–42.7 (7)	36.8–39.6 (2)	1:1.1	Summer (A, N), Winter (A)	
<i>M. crassa</i>	19.5–50.1 (8)	11.4–25.4 (6)	32.1–50.6 (2)	1:1	Spring (N), Winter (A)	
<i>M. curvirostra</i>	4.6–11.8 (59)	5.7–11.2 (8)	7.0–12.7 (54)	1:1	Winter to Summer (N)	All seasons (Werner 1982)
<i>M. geyeri</i>	8.9–40.5 (46)	19.9–39.7 (43)	31.5–53.0 (14)	1:0.8	Summer (A)	
<i>M. parfaiti</i>	22.3–34.7 (19)	18.8–34.1 (12)	30.4 (1)	1:1.5	Summer (A)	
<i>M. rostrata</i>	8.4–26.7 (25)	10.0–28.3 (25)	26.6–34.3 (4)	1:0.9	Winter–Spring (N)	All seasons (Werner 1982)
<i>M. serricornis</i>	5.7–10.9 (20)	4.2–9.2 (16)	6.3–13.0 (14)	1:0.7	Winter–Spring (N)	

Ovigerous females of *Munidopsis* species are usually found year round (Werner 1982). There is evidence for prolonged brooding periods, and they produce only a few large eggs, probably related to an abbreviated or direct larval development, e.g., *M. polymorpha*, *M. rostrata*, *M. scobina*, *M. serricornis* (Samuelson 1972, Van Dover *et al.* 1985, Wilkens *et al.* 1990, Creasey *et al.* 2000). Eggs and larvae of marine decapods tend to be larger in cold and deep waters, providing a higher investment per offspring that results in higher larval survival probabilities in an environment of low food availability and high mortality risk (Gorny *et al.* 1992, Ramirez-Llodra 2002). This increase in egg size is related to a reduction in fecundity (Anger 2001, Thatje *et al.* 2003). However, shrimp (e.g., *Alvinocaris lusca*) and crabs of the family Bythograeidae (e.g., *Bythograea thermydron*) from deep-sea hydrothermal vents have high fecundity and planktotrophic larval development, suggesting that the reduction in fecundity is not ubiquitous in deep-living decapods (Van Dover *et al.* 1985).

None of the species included in this paper is restricted to a specific habitat, including the species collected at hydrothermal vents (*M. acutispina*, *M. exuta*) and cold seeps (*M. abyssicola*, *M. acutispina*, *M. geyeri*, *M. livida*, *M. marionis*, *M. parfaiti*) (Table 2). The abundance of these species in vent and seep environments probably reflects the benefit derived from the organic matter produced by the chemosynthetic community inhabiting these zones (Van Dover 1995, Sibuet & Olu 1998). Isotopic analyses of *M. geyeri*, the

most abundant species collected in Regab seep site, show that this species is trophically dependent on the chemosynthetic production at this site (K. Olu, personal communication).



FIGURE 14. *Munidopsis geyeri* Pequegnat & Pequegnat, 1970, in situ observations. A, two specimens among cold-seep community at the base of Florida Escarpment (Gulf of Mexico, 3266 m) with tubeworms vestimentiferan *Escarpia laminata* (Jones, 1985); substratum: carbon crust. Photo taken by the submarine Alvin in Oct. 2000 (I. MacDonald, USA). B, two specimens on reduced sediment and outcrops of white gas hydrates; with a dead turrid gastropod *Phymorhynchus* sp.? Photo taken at the Regab cold-seep site (Gulf of Guinea, 3150 m) by the ROV Victor in Jan. 2001 (Ifremer/Biozaire 2).

In situ observations by submersibles or ROV cameras during diving explorations of the Atlantic abyssal plains indicate that the individual *Munidopsis* are typically isolated and occur at very low densities, e.g., one specimen per km traversed over sediment areas along the axial valley studied during the FARANAUT cruise (M. S., personal observation). On the neovolcanic ridges formed by pillow lavas on the Mid-Atlantic Ridge, *Munidopsis* species were very rare. Abundances increased in the vicinity of active hydrothermal sites (about 10–50 m from the site), although abundances decrease again in the center of the hydrothermal activity (i.e., on active chimneys). At the Snake Pit site, specimens of *M. exuta* were observed near the active site “Les Ruches”, along the slopes covered by hydrothermal sediments (Segonzac & Macpherson 2003) and also in the site «Elan», situated 200 m east off “Les Ruches”, on mussel beds (*Bathymodiolus puteoserpentis*, Cosel *et al.*, 1994). Other unidentified individuals were observed among aggregations of the vesicomid clam *Calyptogena (Ectenagena) aff. kaikoi* at MAR site Logatchev-Anya’s Garden (Gebruk *et al.* 2000), and ALVIN 1997 (Florida Escarpment site, Fig. 14). In the cold-seeps of the eastern Mediterranean, two species were found in very low densities around the active sites (*M. acutispina* and *M. marionis*), and are assumed to benefit from local, chemoautotrophic production (Olu-Le Roy *et al.* 2004). Other galatheid species are known to occur exclusively in hydrothermally active areas [e.g., off Baja California, *Munidopsis lentigo* Williams & Van Dover, 1983, Bismark Archipelago, *Shinkaia crosnieri* Baba & Williams, 1998, Galapagos Islands (unidentified species)], and are found in locally higher densities (Williams & Van Dover 1983, Chevaldonné & Olu 1996, Baba & Williams 1998, Chan *et al.* 2000).

The number of species collected per station is very low (mostly one species), probably related to their low densities. In several samples, as many as three species were found, indicating that they coexist in the same zone/habitat. The absence of representatives of this genus in collections from some deep-sea cruises confirms the low densities of these species. For instance, the genus was not observed in the deep Norwegian Sea (NORBI Cruise, 2465–3718 m, Dahl *et al.* 1977), in the Demerara abyssal plain (west equatorial Atlantic Ocean), from the north of the Amazon alluvial cone to the foot of the Mid-Atlantic Ridge (DEMERABY Cruise, 4400 to 4800 m, Sibuet *et al.* 1984), or on the Vema fault (VEMA Cruise, MAR-10°N, 5091–5880 m), which connects with the abyssal plain of Gambia (M. S., personal observation).

Information on the geographic distribution of *Munidopsis* in the Atlantic is still limited and incomplete. Figures 15 and 16 show the geographic and bathymetric distributions of *Munidopsis* included in this study. Most species have broad geographic and bathymetric distributions, and some can be considered as eurybathic species, e.g., *M. antonii*, *M. curvirostra*, *M. serricornis* (see Werner 1982). Some species have a wider depth range at high latitudes than at low latitudes, e.g., *M. serricornis* can be found shallower than 300 m depth only in Scandinavian waters (Udekem d’Acoz 1999). This pattern has also been observed in other decapods, e.g., *Neolithodes grimaldii* (A. Milne Edwards & Bouvier,

1894) (Macpherson 1988). Some species are exclusively deep-sea inhabitants, occurring at depths > 2000 m: *M. abyssicola*, *M. aries*, *M. bairdii*, *M. crassa*, *M. exuta*, *M. geyeri*, *M. hirtella*, *M. livida*, *M. parfaiti*, *M. subsquamosa*, and *M. thieli*. There is not a clear relationship between depth and geographical (latitudinal or longitudinal) ranges, as has been observed in other marine taxa (Macpherson 2003). This lack of relationship could be a result of the limited knowledge of the distribution of these deep-sea species, and the existence of some doubts in the identity of species collected in different oceans, e.g., *M. rostrata*, *M. subsquamosa*, *M. serricornis* (Ahyong & Poore 2004, Baba 2005, unpublished data).

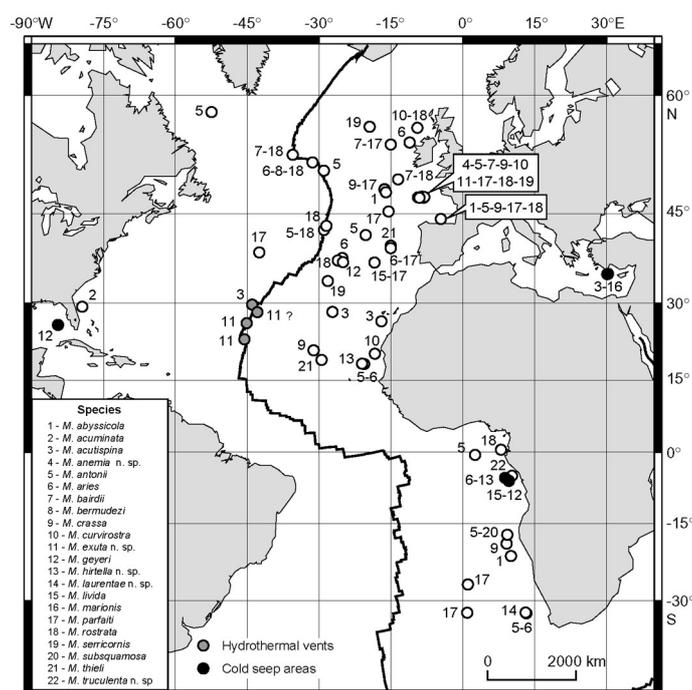


FIGURE 15. Geographic distribution for the specimens of *Munidopsis* considered in the study.

Several species have an amphi-Atlantic distribution (Miyake & Baba 1970), as has been shown for a number of deep-sea decapod taxa, such as nematocarcinid (Crosnier & Forest 1973), bathypalaemonellid (Crosnier & Forest 1973, Cleve 2001), glyphocrangonid (Holthuis 1971), crangonid (Gore 1985, d'Udekem d'Acoz 1999), and alvinocaridid (Komai & Segonzac 2005) shrimps, and parapagurid hermit crabs (Lemaitre 1989). The broad geographic distribution of these species is still difficult to explain satisfactorily, and additional studies on molecular data and larval dispersal processes are desirable.

The number of species of *Munidopsis* occurring in the Atlantic (around 70) is higher than in other oceans, probably related to a greater sampling effort in the Atlantic. Baba (2005) provided a complete list of species from the Indo-Pacific, where 122 species are

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References

- Ahyong, S.T. & Poore, G.C.B. (2004) Deep-water Galatheidae (Crustacea: Decapoda: Anomura) from southern and eastern Australia. *Zootaxa*, 472, 1–76.
- Alcock, A. (1894) Natural history notes from H.M. Indian Marine Survey Steamer “Investigator,” Commander R.F. Hoskyn, R.N., commanding. Series II, No. 1. On the results of deep-sea dredging during the season 1890–91 (continued). *Annals and Magazine of Natural History*, (6) 13, 321–334.
- Alcock, A. (1901) *A Descriptive Catalogue of the Indian Deep-Sea Crustacea Decapoda and Anomala in the Indian Museum: Being a Revised Account of the Deep-Sea Species Collected by the Royal Indian Marine Survey Ship Investigator*. Indian Museum, Calcutta, 300 pp.
- Ambler, J.W. (1980) Species of *Munidopsis* (Crustacea, Galatheidae) occurring off Oregon and in adjacent waters. *Fishery Bulletin*, 78, 13–34.
- Andersen, A.C., Hourdez, S., Marie, B., Jollivet, D., Lallier, F.H. & Sibuet, M. (2004) *Escarpiia southwardae* n. sp., a new species of vestimentiferan tubeworm (Annelida, Siboglinidae) from West African cold seeps. *Canadian Journal of Zoology*, 82: 980–999.
- Anger, K. (2001) *The biology of decapod crustacean larvae*. *Crustacean issues Vol 14*. A.A. Balkema, Lisse, 420 pp.
- Baba, K. (1988) Chirostylid and galatheid crustaceans (Decapoda: Anomura) of the “Albatross” Philippine Expedition, 1907–1910. *Researches on Crustacea*, Special Number, 2, v + 203 pp.
- Baba, K. (2005) Deep-sea chirostylid and galatheid crustaceans (Decapoda: Anomura) from the Indo-Pacific, with a list of species. *Galathea Report*, 20, 317 pp.
- Baba, K. & Poore, G.C.B. (2002) *Munidopsis* (Decapoda, Anomura) from south-eastern Australia. *Crustaceana*, 75, 231–252.
- Baba, K. & Saint Laurent, M. de (1992) Chirostylid and galatheid crustaceans (Decapoda: Anomura) from active thermal vent areas in the southwest Pacific. *Scientia Marina*, 56, 321–332.
- Baba, K. & Saint Laurent, M. de (1996) Crustacea Decapoda: Revision of the genus *Bathymunida* Balss, 1914, and description of six new related genera (Galatheidae). In: Crosnier, A. (Ed.) *Résultats des Campagnes MUSORSTOM, Volume 15. Mémoires du Muséum national d'Histoire naturelle*, 168, 433–502.
- Baba, K. & Williams, A.B. (1998) New Galatheaidea (Crustacea, Decapoda, Anomura) from hydrothermal systems in the West Pacific Ocean: Bismarck Archipelago and Okinawa Trough. *Zoosystema*, 20, 143–156.
- Benedict, J.E. (1902) Descriptions of a new genus and forty-six new species of crustaceans of the family Galatheidae, with a list of the known marine species. *Proceedings of the United States National Museum*, 26, 243–334.
- Bouvier, E.L. (1922) Observations complémentaires sur les Crustacés Décapodes (Abstraction faite

- des Carides) provenant des Campagnes de S.A.S. le Prince de Monaco. *Résultats des Campagnes scientifiques Yacht Albert I Monaco*, 62, 1–106.
- Carpine, C. (1970) Ecologie de l'étage bathyal dans la Méditerranée occidentale. *Mémoires de l'Institut océanographique de Monaco*, 2, 1–146.
- Chace, F.A. Jr. (1942) The Anomuran Crustacea. I. Galatheidea. Reports on the scientific results of the Atlantis Expeditions to the West Indies, under the joint auspices of the University of Havana and Harvard University. *Torreia*, 11, 1–106.
- Chan, T.Y., Lee, D.A. & Lee, C.S. (2000) The first deep-sea hydrothermal animal reported from Taiwan: *Shinkaia crosnieri* Baba and Williams, 1998 (Crustacea : Decapoda : Galatheidae). *Bulletin of Marine Science*, 67, 799–804.
- Chevaldonné, P. & Olu, K. (1996) Occurrence of Anomuran crabs (Crustacea: Decapoda) in hydrothermal vent and cold-seep communities: a review. *Proceedings of the Biological Society of Washington*, 109, 286–298.
- Cleva, R. (2001) Les Bathypalaemonellidae de Saint-Laurent, 1985 (Crustacea, Decapoda, Caridea) avec description d'une espèce nouvelle et définition d'un genre nouveau. *Zoosystema*, 23, 757–782.
- Creasey, S., Rogers, A., Tyler, P., Gage, J., & Jollivet, D. (2000) Genetic and morphometric comparisons of squat lobster, *Munidopsis scobina* (Decapoda: Anomura: Galatheidae) populations, with notes on the phylogeny of the genus *Munidopsis*. *Deep-Sea Research II*, 47, 87–118.
- Crosnier, A. & Forest, J. (1973) Les crevettes profondes de l'Atlantique oriental tropical. *Faune Tropicale*, 19, 1–409.
- Dahl, E., Laubier, L., Sibuet, M. & Strömberg, J.O. (1977) Some quantitative results on benthic communities of the deep Norwegian Sea. *Astarte*, 5, 61–79.
- Doflein, F. & Balss, H. (1913) Die Galatheiden der Deutschen Tiefsee-Expedition. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf Dampfer "Valdivia" 1898–1899*, Jena, 20, 125–184.
- Faxon, W. (1895) Reports on an exploration off the west coasts of Mexico, Central and South America, and off the Galapagos Islands, etc. XV. The stalk eyed Crustacea. *Memoirs of the Museum of Comparative Zoology, at Harvard College*, 18: 1–292.
- Filhol, H. (1884) Explorations sous-marines. Voyage du Talisman. *La Nature, Paris*, 12, 119–122, 134–138, 147–151, 161–164, 182–186, 198–202, 230–234, 278–282, 326–330, 391–394.
- Filhol, H. (1885) *La vie au fond des mers. Les explorations sous-marines et les voyages du Travailleur et du Talisman*. Masson ed. Paris, 303 pp.
- Fredj, G. (1974) Stockage et exploration des données en écologie marine. C. Considérations biogéographiques sur les peuplements benthiques de la Méditerranée. *Mémoires de l'Institut océanographique de Monaco*, 7, 1–88.
- Frogliola, C., Mura, M. & Bonfitto, A. (2002) First record of *Munidopsis acutispina* Benedict, 1902 (Decapoda, Anomura, Galatheidae) in the Mediterranean Sea. *Crustaceana*, 75, 375–382.
- Galéron, J., Sibuet, M., Mahaut, M.-L. & Dinet, A. (2000) Variation in structure and biomass of the benthic communities at three contrasting sites in the tropical Northeast Atlantic. *Marine Ecology Progress Series*, 197: 121–137.
- Galil, B.S. & Goren, M. (1994) The deep sea Levantine fauna. New records and rare occurrences. *Senckenbergiana maritima*, 25, 41–52.
- García-Raso, E.C. (1996) Crustacea Decapoda (excl. Sergestidae) from Ibero-Maroccan waters. Results of Balgim-84 expedition. *Bulletin of Marine Science*, 58, 730–752.
- Gebruk, A.V., Galkin, S.V., Krylova, E.M., Vereshchaka, A.L. & Vinogradov, G.M. (2002) Hydrothermal fauna discovered at Lost City (30°N, Mid-Atlantic Ridge). *InterRidge News*, 11(2), 18–19.
- Gonzalez-Perez, J.A. (1995) *Crustáceos decápodos de las islas Canarias*. Turquesa Ed. Sta. Cruz de Tenerife, 282 pp.
- Gordon, I. (1955) Crustacea Decapoda. *Report of the Swedish Deep-Sea Expedition*, 2, 237–245.
- Gore, R.H. (1983) Notes on rare species of *Munidopsis* (Anomura: Galatheidae) and *Ethusina*

- (Brachyura: Dorippidae) collected by the USNS Bartlett in the Venezuela Basin, Caribbean Sea. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 135, 200–217.
- Gore, R.H. (1985) Some rare species of abyssobenthic shrimp (Families Crangonidae, Glyphocrangonidae and Nematocarinidae) from the Venezuela Basin, Caribbean Sea (Decapoda, Caridea). *Crustaceana*, 48, 269–285.
- Gorny, M., Arntz, W.E., Clarke, A. & Gore, D.J. (1992) Reproductive biology of caridean decapods from the Weddell Sea. *Polar Biology*, 12, 111–120.
- Hansen, H.J. (1908) Crustacea Malacostraca. I. *Danish Ingolf Expedition*, 3, 1–120.
- Holthuis, L.B. (1971) The Atlantic shrimps of the deep-sea genus *Glyphocrangon*. *Bulletin of Marine Science*, 21, 267–273.
- Henderson, J.R. (1885) Diagnoses of the new species of Galatheidea collected during the “Challenger” Expedition. *Annals and Magazine of natural History*, (5) 16, 407–421.
- Henderson, J.R. (1888) Report on the Anomura Collected by H.M.S. Challenger During the Years 1873–76. *Report on the Scientific Results of the Voyage of H.M.S. Challenger during the years 1873-76, Zoology*, 27, vi + 221 pp., 21 pls.
- Hashimoto, J., Ohta, S., Fujikura, F. & Miura, T. (1995) Microdistribution pattern and biogeography of the hydrothermal vent communities of the Minami-Ensei Knoll in the Mid-Okinawa Trough, Western Pacific. *Deep-Sea Research I*, 42, 577–598.
- Heegaard, P.E. (1941) The zoology of East Greenland. Decapod crustaceans. *Meddelser om Gronland, Kobenhavn*, 126, 1–72.
- Hendrickx, M.E. (2001) Occurrence of a continental slope decapod crustacean community along the edge of the minimum oxygen zone in the south eastern Gulf of California, Mexico. *Belgium Journal of Zoology*, 131 (suppl. 2), 95–109.
- Kensley, B. (1968) Deep sea decapod Crustacea from west coast of Cape Point, South Africa. *Annals of the South African Museum*, 50, 283–323.
- Khodkina, I.V. (1973) New species of the genus *Munidopsis* (Decapoda, Anomura) from the east Pacific. *Zoologicheskii Zhurnal*, 52, 1156–1167. (In Russian with English summary)
- Khodkina, I.V. (1981) A contribution to the fauna of the family Galatheidae (Decapoda) of the south-west Pacific. *Zoologicheskii Zhurnal*, 60, 1261–1264. (In Russian with English summary)
- Khodkina, I.V. & Duris, Z. (1989) A new species of the genus *Munidopsis* (Crustacea: Anomura, Galatheidae) from the north-east Atlantic. *Zoologicheskii Zhurnal*, 68, 135–138. (In Russian with English summary)
- Koelbel, K. (1892) Beiträge zur Kenntnis der Crustaceen der Canarischen Inseln, *Annual kaiserlich-königlichen naturhistorischen Hofmuseums, Wien*, 7, 105–116.
- Komai, T. & Segonzac, M. (2005) A revision of the genus *Alvinocaris* Williams and Chace (Crustacea: Decapoda: Caridea: Alvinocarididae), with descriptions of a new genus and a new species of *Alvinocaris*. *Journal of Natural History*, 39: 1111–1175.
- Lemaitre, R. (1989) Revision of the genus *Parapagurus* (Anomura: Paguroidea: Parapaguridae), including redescription of the Western Atlantic species. *Zoologische Verhandelingen*, 253, 1–106.
- Lovén, S. (1852) De svenska arterna af slägtet *Galathea*. [The Swedish species of the genus *Galathea*]. *Ofversigt Kungliga Vetenskapsakademiens Handlingar*, 9, 20–23.
- Luke, S.R. (1977) Catalog of the benthic invertebrate collections. I. Decapod Crustacea and Stomatopoda. *Scripps Institution of Oceanography Reference No. 77-9*, 1–72.
- Macpherson, E. (1988) Revision of family Lithodidae Samouelle, 1819 (Crustacea, Decapoda, Anomura) in the Atlantic Ocean. *Monografías de Zoología Marina*, 2, 1–153.
- Macpherson, E. (1994) Crustacea Decapoda: Studies on the genus *Munida* Leach, 1820 (Galatheidae) in New Caledonian and adjacent waters with descriptions of 56 new species. In: Crosnier, A. (Ed.) *Résultats des Campagnes MUSORSTOM, Volume 12. Mémoires du Muséum national d'Histoire naturelle*, 161, 421–569.
- Macpherson, E. (2003) Species range size distributions for some marine taxa in the Atlantic Ocean.

- Effect of latitude and depth. *Biological Journal of the Linnean Society*, 80, 437–455.
- 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. Etudes préliminaires sur les Crustacés. *Memoirs of the Museum of Comparative Zoology, at Harvard College*, 8, 1–68.
- Milne Edwards, A. (1881) Compte rendu sommaire d'une exploration zoologique faite dans l'Atlantique, a bord du navire le Travailleur. *Comptes Rendus de l'Académie des Sciences de Paris*, 93, 931–936.
- Milne Edwards, A. (1882) Summary report upon a zoological exploration made in the Mediterranean and the Atlantic on board the "Travailleur". *Annals and Magazine of Natural History*, (5) 9, 37–46.
- Milne Edwards, A. (1883) *Recueil de figures de crustacés nouveaux ou peu connus, 1883*. (Ed. Forest, J. & Holthuis, L. B., 1997). Backhuys Publishers, Leiden, 128 pp.
- Milne Edwards, A. & Bouvier, E.L. (1894) Considerations générales sur la famille des Galathéidés. *Annales des Sciences Naturelles, Zoologie*, (7) 16, 191–327.
- Milne Edwards, A. & Bouvier, E.L. (1897) XXXV. Description des Crustacés de la famille des Galathéidés recueillis pendant l'Expédition. In: 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.—Commander J.R. Bartlett, U.S.N., Commanding. XXXV. Description des Crustacés de la famille des Galathéides recueillis pendant l'expédition. *Memoirs of the Museum of Comparative Zoology, at Harvard College*, 19, 1–141.
- Milne Edwards, A. & Bouvier, E.L. (1899) Crustacés Décapodes provenant des campagnes de l'Hirondelle (supplément) et de la Princesse-Alice (1891–1897). *Résultats des Campagnes scientifiques Yacht Albert I Monaco*, 13, 1–106.
- Milne Edwards, A. & Bouvier, E.L. (1900) *Crustacés Décapodes. Première partie. Brachyures et Anomoures. Expéditions scientifiques du Travailleur et du Talisman*, Paris, 396 pp.
- Miyake, S. & Baba, K. (1967) Descriptions of new species of galatheids from the Western Pacific. *Journal of the Faculty of Agriculture of the Kyushu University*, 14, 203–212.
- Miyake, S. & Baba, K. (1970) The Crustacea Galatheidae from the tropical-subtropical region of West Africa, with a list of the known species. *Atlantide Report*, 11, 61–97.
- Monniot, C. & Segonzac, M. (1985) The deep-sea cruise Abyplaine. Characteristics of stations and benthic assemblages. *Oceanologica Acta*, 8, 67–76.
- Moyle, J. & Smaldon, G. (1990) Crustacea III. Malacostraca Eucarida. In: Hayward, P.J. & Ryland, J.S. (Eds.) *The marine fauna of the British Isles and North-West Europe*. Oxford Science Publications, chapter 10, 510–552.
- Navas, G.R., Bermudez, A., Cruz, N. & Campos, N.H. (2003) Galatéidos (Decapoda, Anomura, Galatheidae) del Caribe colombiano, incluyendo doce primeros registros. *Boletín de Investigaciones Marinas y Costeras*, 32, 183–218.
- Nobre, A. (1931) *Crustaceos Decapodes e Stomatopodes marinhos de Portugal*. Instituto de Zoologie, Universidad de Porto. Porto, 311 pp.
- Nobre, A. (1936) *Crustaceos Decapodes e Stomatopodes marinhos de Portugal. Fauna marinha de Portugal*, 4, 1–213.
- Noël, P.Y. (1992) *Clé préliminaire d'identification des Crustacea Decapoda de France et des principales autres espèces d'Europe*. Secrétariat de la Faune et de la Flore. Muséum national d'Histoire naturelle, Paris. *Collection Patrimoines Naturels*, 9, 1–145.
- Olu-Le Roy, K., Sibuet, M., Fiala-Medioni, A., Gofas, S., Salas, C., Mariotti, A., Foucher, J.P. & Woodside, J. (2004) Cold seep communities in the deep eastern Mediterranean Sea: composition, symbiosis and spatial distribution on mud volcanoes. *Deep-Sea Research I*, 51, 1915–1936.
- Ondréas, H., Olu, K., Fouquet, Y., Charlou, J.-L., Gay, A., Dennielou, B., Donval, J.-P., Fifis, A., Nadalig, T., Cochonat, P., Cauquil, E., Bourillet, J.-F., Le Moigne, M. & Sibuet, M. (2005) ROV study of a giant pockmark on the Gabon continental margin. *Geo-Marine Letters*, 25,

- Pequegnat, L.H. & Pequegnat, W.E. (1970) Deep-sea anomurans of superfamily Galatheoidea with description of three new species. Part 5. Contributions on the Biology of the Gulf of Mexico. *Texas A&M University oceanographic Studies*, 1, 125–170.
- Pequegnat, L.H. & Pequegnat, W.E. (1971) New species and new records of *Munidopsis* (Decapoda: Galatheidae) from the Gulf of Mexico and Caribbean Sea. *Texas A&M University oceanographic Studies*, 1 (supplement), 1–24.
- Pequegnat, L.H. & Williams, A.B. (1995) Two new species of *Munidopsis* (Decapoda: Anomura: Galatheidae) from the western Atlantic Ocean. *Journal of Crustacean Biology*, 15, 786–792.
- Perrier, E. (1886) *Les explorations sous-marines*. Hachette & Cie., Paris, 352 pp.
- Ramirez Llodra, E. (2002) Fecundity and life-history strategies in marine invertebrates. *Advances in Marine Biology*, 43, 88–170.
- Sagalevich, A.M., Bogdanov, Y.A., Lukashin, V.N., Chernayaev, E.S., Gordeev, V.Y., Peresyppkin, V.I. (2002) Deep-water search and geological studies at the site of the shipwreck of the battleship Bismark. *Oceanology*, 42, 741–748.
- Saint Laurent, M. de (1985) Remarques sur la distribution des Crustacés Décapodes. In: Laubier, L. & Monniot, C. (Eds.), *Peuplements profonds du Golfe de Gascogne campagnes Biogas*, Institut Français de Recherche pour l'Exploitation de la Mer, Plouzane, 469–478.
- Samuelsen, T.J. (1972) Larvae of *Munidopsis tridentata* (Esmark) (Decapoda, Anomura) reared in the laboratory. *Sarsia*, 48, 91–98.
- Segonzac, M. (1992) Les peuplements associés à l'hydrothermalisme océanique du Snake Pit (dorsale médio-atlantique; 23°N, 3480 m): composition et microdistribution de la mégafaune. *Comptes Rendus de l'Académie des Sciences de Paris, Série III*, 314, 593–600.
- Segonzac, M. & Macpherson, E. (2003) A new deep-sea lobster of the genus *Thymopides* (Crustacea: Decapoda: Nephropidae) collected near the hydrothermal vent Snake-Pit, Mid-Atlantic Ridge. *Cahiers de Biologie Marine*, 44, 361–367.
- Sibuet, M. & Olu, K. (1998) Biogeography, biodiversity and fluid dependence of deep-sea cold-seep communities at active and passive margin. *Deep-sea Research II*, 45, 517–567.
- Sibuet, M., Monniot, C., Desbruyères, D., Dinet, A., Khripounoff, A., Rowe, G. & Segonzac, M. (1984) Peuplements benthiques et caractéristiques trophiques du milieu dans la plaine abyssale de Demerara. *Oceanologica Acta*, 7, 345–358.
- Sivertsen, E. & Holthuis, L.B. (1956) Crustacea Decapoda (The Penaeidea and Stenopodidea excepted). *Report on the Scientific Results of the "Michael Sars" North Atlantic Deep-sea Expedition, 1910*, 5, 1–54.
- 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.
- Smith, S.I. (1884) Report on the decapod Crustacea of the Albatross dredgings off the east coast of the United States in 1883. *Report of the Commission on Fish and Fisheries*, 10, 345–426.
- Smith, S.I. (1885) On some new or little known decapod Crustacea, from recent Fish Commission dredging off the east coast of the United States. *Proceedings of the United States National Museum*, 7, 493–511.
- Smith, S.I. (1886) Report on the decapod Crustacea of the Albatross dredgings off the east coast of the United States during the summer and autumn of 1884. *Report of the Commission on Fish and Fisheries*, 13, 605–705.
- Squires, H.J. (1990) Decapod Crustacea of the Atlantic coast of Canada. *Canadian Bulletin of Fisheries and Aquatic Sciences*, 221, 1–532.
- Takeda, M. (1983) Crustaceans. In: Takeda, M. & Okutani, T. (Eds.) *Crustaceans and Molluscs Trawled off Suriname and French Guiana*. Japan Marine Fishery Resource Research Center, Tokyo. Pp. 19–180.
- Tavares, M. & Campinho, P. (1998a) *Munidopsis reynoldsi* (A. Milne-Edwards, 1880) (Crustacea, Decapoda, Galatheidae): lectotype designation and redescription. *Zoosystema*, 20, 411–417.

- Tavares, M. & Campinho, P. (1998b) Three new records of deep-sea squat lobsters of the genus *Munidopsis* Whiteaves from the southwestern Atlantic Ocean (Decapoda: Galatheidae). *Crustacean Research*, 27, 88–100.
- Thatje, S., Schnack, S. & Arntz, W.E. (2003) Developmental trade-offs in Subantarctic meroplankton communities and the enigma of low decapod diversity in high southern latitudes. *Marine Ecology Progress Series*, 260, 195–207.
- Tiefenbacher, L. (2001) Recent samples of mainly rare decapod Crustacea taken from deep-sea floor of the southern West Europe Basin. *Hydrobiologia*, 449, 59–70.
- Türkay, M. (1975) Decapoda Reptantia aus den Iberischen Tiefseebecken Auswertung der Fahrten 3(1966) und 15 (1968) von F.S. "Meteor." "Meteor" *Forschungs-Ergebnisse, Reihe D*, 20, 66–70.
- Türkay, M. (1976) Decapoda Reptantia von der portugiesischen und marokkanischen Küste. Auswertung der Fahrten 8, 9c (1967), 19 (1970), 23 (1971) und 36 (1975) von F.S. "Meteor." "Meteor" *Forschungs-Ergebnisse, Reihe D*, 23, 23–44.
- Turnipseed, M., Jenkins, C.D. & Van Dover, C.L. (2004) Community structure in Florida Escarpment seep and Snake Pit (Mid-Atlantic Ridge) vent mussel beds. *Marine Biology*, 145, 121–132.
- d'Udekem d'Acoz, C. (1999) Inventaire et distribution des crustacés décapodes de l'Atlantique nord-oriental, de la Méditerranée et des eaux continentales adjacentes au nord de 25°N. *Patrimoines naturels (M.N.H.N./S.P.N.)*, 40, 1–383.
- Van Dover, C.L. (1995) Ecology of Mid-Atlantic Ridge hydrothermal vents. In: Parson, L.M., Walker, C.L. & Dixon, D.R. (Eds.) *Hydrothermal vents and processes*. Geological Society Special Publication, London, 87, 257–294.
- Van Dover, C.L., Factor, J.R., Williams, A.B., & Berg, C.J. Jr. (1985) Reproductive patterns of decapod crustaceans from hydrothermal vents. In: Jones, M.L. (Ed.) *Hydrothermal vents of the eastern Pacific: an overview. Bulletin of the Biological Society of Washington*, 6 223–227.
- Wenner, E.L. (1982) Notes on the distribution and biology of Galatheidae and Chirostylidae (Decapoda: Anomura) from the Middle Atlantic Bight. *Journal of Crustacean Biology*, 2, 360–377.
- Whiteaves, J.F. (1874) On recent deep-sea dredging operations in the Gulf of St. Lawrence. *The American Journal of Science*, series 3, 7, 210–219.
- Williams, A.B. (1988) New marine decapod crustaceans from waters influenced by hydrothermal discharge, brine, and hydrocarbon seepage. *Fishery Bulletin*, 86, 263–287.
- Williams, A.B. & Turner, R.D. (1986) Squat lobsters (Galatheidae, *Munidopsis*) associated with mesh-enclosed wood panels submerged in the deep-sea. *Journal of Crustacean Biology*, 6, 617–624.
- Williams, A.B., & Van Dover, C.L. (1983) A new species of *Munidopsis* from submarine thermal vents of the east Pacific Rise at 21°N (Anomura: Galatheidae). *Proceedings of the Biological Society of Washington*, 96, 481–488.
- Wilkens, H., Parzefall, J. & Ribowski, A. (1990) Population biology and larvae of the anchialine crab *Munidopsis polymorpha* (Galatheidae) from Lanzarote (Canary Islands). *Journal of Crustacean Biology*, 10, 667–675.
- Wood-Mason, J. & Alcock, A. (1891) Natural history notes from H.M. Indian Marine Survey Steamer "Investigator," Commander R.F. Hoskyn, R.N., commanding. No. 21. Note on the results of the last season's deep-sea dredging. *Annals and Magazine of Natural History*, (6) 7, 186–202.
- Zariquiey Alvarez, R. (1952) Estudio de las especies europeas del gen. *Munida* Leach 1818. *Eos*, 28, 143–31.
- Zariquiey Alvarez, R. (1968) Crustáceos Decápodos ibéricos. *Investigación Pesquera*, 32, 1–510.