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PLANKTONIC DEEP-WATER COPEPODS OF THE FAMILY
MORMONILLIDAE GIESBRECHT, 1893 FROM THE EAST PACIFIC RISE
(13°N), THE NORTHEASTERN ATLANTIC, AND NEAR THE NORTH POLE
(COPEPODA, MORMONILLOIDA)

BY

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ABSTRACT

This paper is the first comparative study of females of the order Mormonilloida Boxshall, 1979 from three distinct localities. New taxonomic characters of mormonillids are distinguished; the diagnoses of females of the family Mormonillidae Giesbrecht, 1893, and the diagnoses of females of the genus *Mormonilla* Giesbrecht, 1891 (emended) as well as the newly established genus *Neomormonilla* gen. nov. are presented. A new species, *N. extremata* sp. nov. is described, based on a female collected from a hydrothermal vent community of the East Pacific Rise (13°N, depth 2514 m, 50 m over bottom). Females of the type species, *N. minor* (Giesbrecht, 1891) comb. nov., common in plankton of the northeastern Atlantic, are studied anew. Females of *N. polaris* (G.O. Sars, 1900) comb. nov., from plankton near the North Pole (Arctic Ocean, depths 300-1000 m) are re-examined and the validity of the species is re-established.

RÉSUMÉ

Ce travail est la première étude comparative des femelles de l'ordre des Mormonilloida Boxshall, 1979, à partir de matériel provenant de trois localités distinctes. De nouveaux caractères taxonomiques sont distingués; la diagnose des femelles de la famille des Mormonillidae Giesbrecht, 1893 et celle des femelles du genre *Mormonilla* Giesbrecht, 1891 (émendé) ainsi que du genre nouvellement établi, *Neomormonilla* gen. nov. sont présentées. Une nouvelle espèce, *N. extremata* sp. nov. est décrite à partir d'une femelle collectée sur le site d'une source hydrothermale de la Ride Est Pacifique (13° N, profondeur 2514 m), à 50 m au-dessus du fond. Les femelles de l'espèce-type *N. minor* (Giesbrecht, 1891) comb. nov., communes dans le plancton du Pacifique nord-oriental, sont ré-étudiées. Des femelles de *N. polaris* (G.O. Sars, 1900) comb. nov. collectées dans le plancton près

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du pôle Nord (océan Arctique, profondeurs 300-1000 m) sont également étudiées et la validité de l'espèce est rétablie.

INTRODUCTION

The diversity of the fragile copepods of the cosmopolitan, meso-bathypelagic family Mormonillidae Giesbrecht, 1893, comprised in the order Mormonilloida Boxshall, 1979, was restricted until now to two valid species, *Mormonilla phasma* Giesbrecht, 1891 and *Mormonilla minor* Giesbrecht, 1891. The females of both species were considered to be small particle-feeders, possessing filter baskets formed by feeding appendages (Boxshall, 1985). The males, characterized by reduced feeding appendages and modified antennules, are interpreted as non-feeding (Huys et al., 1992). The complete and detailed description of mormonillid females common in deep water is limited to the description of one species designated by Boxshall in 1979 as *Mormonilla phasma* Giesbrecht, 1891 (cf. Boxshall, 1979, 1985; Huys & Boxshall, 1991). The other original descriptions and redescrptions of mormonillid females are not complete or not detailed (Giesbrecht, 1893; G. O. Sars, 1900; T. Scott, 1894; Boxshall, 1979; Huys & Boxshall, 1991). Under these circumstances, the present study of mormonillid females from the Arctic Ocean, from the northeastern Atlantic, and from the East Pacific Rise is the first comparative study of copepods of the order Mormonilloida Boxshall, 1979 from different localities. In this paper, we describe a new species, establish a new genus, and introduce some new taxonomic characters for the mormonillid females. A diagnosis for the females of the family Mormonillidae and diagnoses for the females of the genera *Mormonilla* Giesbrecht, 1891 (emended) and *Neomormonilla* gen. nov. are given.

We herein follow the recent recommendation of Holthuis & Vervoort (2006) to refer to the monograph of W. Giesbrecht in "Fauna und Flora des Golfes von Neapel" as published in 1893, not 1892 as has been common use for well over a century.

MATERIAL AND METHODS

Copepods from the East Pacific Rise (13°N) were collected in 1999 with a specially designed trap anchored over the bottom near hydrothermal vents to collect particles of detritus and small plankton organisms (M. Segonzac, pers. comm.). Copepods from the Arctic Ocean were collected in 2005 with a plankton net (mesh size 150 μm) during the drift of the ice camp NP-33 in the framework of the long-term programme exploring environmental changes in the Arctic Ocean

(Melnikov & Kolosova, 2001). Copepods from the northeastern Atlantic were collected near the Cape Verde Islands in plankton samples examined by Boxshall (1979).

The copepods were studied mainly using the “hanging drop method” (Humes & Gooding, 1964; Ivanenko & Defaye, 2004). Prior to light microscopy, specimens were cleared in lactic acid and subsequently stained in a solution of Chlorazol Black E. Material was examined using bright-field or differential interference contrast optics. All measurements and dissections were made in lactic acid. Dissections were made under a Leica MZ8 dissecting microscope. Drawings were made with a camera lucida mounted on a Leica DMLB compound microscope. The description of the new species is based on the holotype female. For long-term preservation, the holotype was mounted on slides in glycerol and sealed with Eukitt (O. Kindler GmbH & Co.).

Abbreviations: in the setae and spine-formulae of the legs, Roman numerals indicate spines and Arabic numerals indicate setae.

DESCRIPTION

Class COPEPODA H. Milne Edwards, 1830

Order MORMONILLOIDA Boxshall, 1979

Family MORMONILLIDAE Giesbrecht, 1893

Diagnosis of female. — Body slender. Prosome comprising cephalothorax and 3 pedigerous somites. Urosome 4-segmented, genital double-somite with midventral gonopores. Rostrum shaped as a short and broad frontal plate, largely fused to the cephalothorax, and ending in one acute, semi-free point on each lateral side. Labrum massive, distal part subdivided into 3 lobes covered with long setules. Caudal rami as long as urosome, each ramus bearing 6 setae, i.e., 5 distal and 1 proximolateral setae.

Antennule 3-segmented, extending to genital somite, first segment as long as distal two combined; formula for armature 9, 1, 9. Antenna biramous; coxa unarmed, basis with 1 inner seta; endopod 2-segmented, longer than exopod, first segment with 2 setae, second with groups of 5 internal proximal and 11 terminal setae; exopod 8-segmented, armed with 2, 1, 1, 1, 1, 1, 1, and 3 setae.

Mandible biramous; masticatory blade of gnathobase with 8 teeth, 1 lateral tooth large and separated from the others; basis with 3 inner setae; endopod 1-segmented, armed with 6 setae; exopod 4-segmented, with 2, 1, 1, and 2 setae. Maxillule: praecoxal arthrite with 7 spines; protopod, representing fused coxa and basis, bearing 2 outer and 6 inner setae; endopod and exopod 1-segmented, armed with

9 and 7 setae, respectively. Maxilla 5-segmented; first segment elongate, with 4 endites armed with 2, 3, 3, and 3 setae, first two endites close to each other; second segment with proximal endite bearing 2 setae and with 1 inner seta, inserted medially; segments 3-5 armed with 1, 1, and 4 setae. Maxilliped 3- or 4-segmented; first segment armed with groups of 2, 1, 3, and 1 (or 0) setae; distal segments armed with 2 (or 1), 1, and 4 setae; segments 2 and 3 separate or fused.

Swimming legs 1-4 biramous, exopods of legs 1-2 and endopod of leg 1, all 2- or 3-segmented, exopods of legs 3-4, 2-segmented, endopod of leg 2, 1- or 2-segmented, endopods of legs 3-4, 1-segmented. Coxa and basis unarmed. Leg 1: inner margin of coxa, basis, and proximal endopodal segment(s) ornamented with stout spinules or slender setules; distal segment of endopod with 4 or 3 setae; distomedial seta on endopod curved, its proximal part ornamented with a row of long setules, middle part barbed. Exopodal segments 1-3 of leg 1 with 1, 1, and 3 stout distolateral spine-like outgrowths, respectively; distal exopodal segment of leg 2 with distolateral spine-like outgrowth. Legs 2-3: inner margin of first exopodal segment ornamented with spinules. Legs 2-4: distal endopodal segment with 3 setae; formula for armature: 0, 2, 1. Formula for armature of legs 1-4 distal exopodal segment 0,I,3; 0,I,4; 0,I,4; 0,I,3, respectively, from leg 1 to leg 4. Leg 5 absent, or represented by 2 pairs of setae on ventral midline.

Type genus. — *Mormonilla* Giesbrecht, 1891.

Other genus included. — *Neomormonilla* gen. nov.

Distribution. — Cosmopolitan, meso-bathypelagic (Razouls, 1996; and C. Razouls, pers. comm.).

Remarks. — The correct identification of mormonillids in a number of published records is questionable. We assume that records with identification to genus level are more reliable to the family level and should be referred to the family Mormonillidae. In a similar way, the records with identification to species level are in fact more reliable to a generic level, and should be referred to one of two genera included in the family Mormonillidae. For the distinctive morphological details of mormonillid males, we will currently follow the original description of the males of *Mormonilla phasma* Giesbrecht, 1891 and *Neomormonilla minor* (Giesbrecht, 1891) found in the Arabian Sea, the Red Sea, the eastern Mediterranean, and the eastern Indian Ocean (Huys et al., 1992) even if we did not re-examine the mormonillid material from those localities.

Genus *Neomormonilla* gen. nov.

Diagnosis of female. — Genital double-somite swollen midventrally. Maxilliped 3 or 4-segmented; first segment armed with groups of 2, 1, 3, and 1 setae; distal segments armed with 1, 1, and 4 setae; segments 2 and 3 separate or

fused. Exopods of legs 1-2 and endopod of leg 1, 3-segmented, endopod of leg 2, 2-segmented. First exopodal segment of legs 1-3 elongate. Leg 1: inner margin of coxa, basis, and proximal endopodal segments ornamented with groups of stout spinules or slender setules; distal segment of endopod with 3 setae.

Etymology. — The generic name is a combination of the Latin word “neo” (= new) and the name of the type genus. Gender feminine.

Type species. — *Mormonilla minor* Giesbrecht, 1891.

Other species included. — *Neomormonilla polaris* (G. O. Sars, 1900) comb. nov. and *Neomormonilla extremata* sp. nov.

Distribution. — Cosmopolitan, meso-bathypelagic (Razouls, 1996; C. Razouls, pers. comm.).

***Neomormonilla extremata* sp. nov. (figs. 1-4)**

Type material. — Dissected holotype ♀ (MNHN-Cp2309), locality as below. The type material is deposited in the Museum national d'Histoire naturelle, Paris.

Additional material. — Three stage V copepodids (MNHN-Cp2310). The material is in the Museum national d'Histoire naturelle, Paris.

Type locality. — East Pacific Rise, 50 m over the Seamount “Marginal High”, 12°42.78'N 103°51.9'W, depth 2514 m. Date of depositing trap 13.iv.1999, of lifting 6.vi.1999. Vessel: R/V “Atalante”; cruises: HOPE 99 (trap depositing) and AMISTAD (trap lifting). Holotype female found in sample PPS 40 D11, copepodids found in following 3 samples: PPS 40 D2, PPS 40 D4, and PPS 40 D6.

Etymology. — The species name is latinized from the English word “extreme” referring to the extreme environment of the copepod.

Description. — Adult female. Body (fig. 1A) slender, with thin transparent integument, ornamented with pores and sensilla. Lateral margins of somites bearing legs 2-4, first somite of urosome and genital double somite with rows of long setules. Total length of holotype female (body plus caudal rami, caudal setae excluded) 1.7 mm; greatest width 0.26 mm. Prosoma comprising cephalothorax and 3 somites bearing legs 2-4. Cephalothorax oblong, with greatest width near its middle. Midventral area posterior to paragnaths ornamented with small setules (fig. 1B). Urosome (figs. 1C, 2B-C) 4-segmented comprising pedigerous somite lacking leg 5, genital double-somite, and 2 abdominal somites. Genital double-somite elongate, 2 times as long as wide, swollen midventrally, with median genital area on ventral side and groups of setules on sides. Anal somite elongate, about 2 times as long as first abdominal somite, with anal opening on dorsal side, and groups of slender ventrolateral setules.

Rostrum (fig. 1B) shaped as a short and broad frontal plate, largely fused to the cephalothorax, and ending in one acute, semi-free point on each lateral side, and with 2 sensilla.

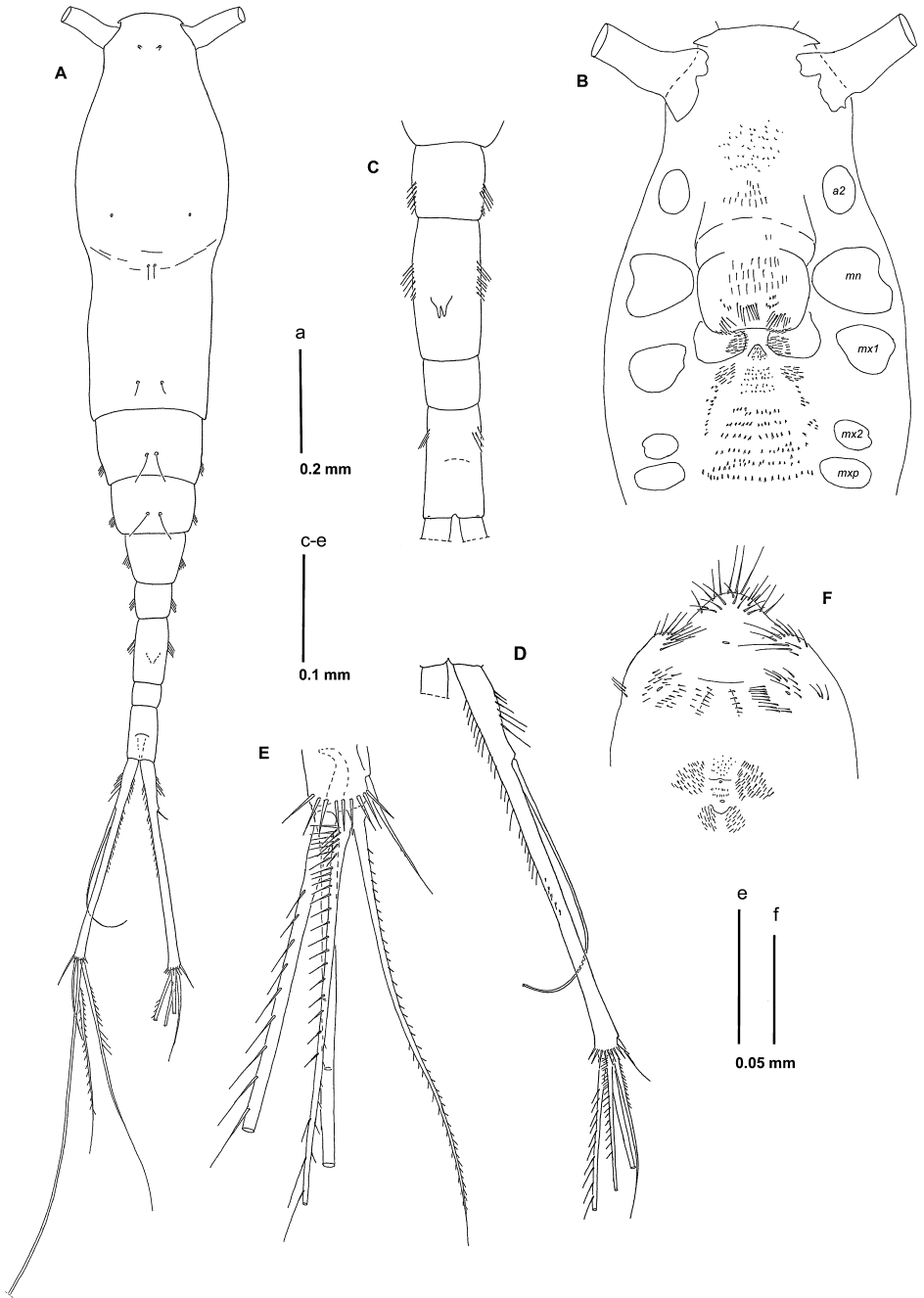


Fig. 1. *Neomormonilla extremata* sp. nov., holotype ♀: A, habitus, dorsal; B, cephalothorax, ventral; C, urosome, ventral; D, left caudal ramus, ventral; E, distal part of left caudal ramus, ventral; F, labrum, inner side.

Labrum (fig. 1B, F) massive, proximal part ornamented with slender setules, distal part subdivided into 3 lobes and ornamented with long, stout setules.

Paragnaths (fig. 1B) with lobes ornamented with setules, separated by a conical protrusion of the cephalon.

Caudal rami (fig. 1A, D, E) as long as urosome, about 20 times as long as wide, each ramus bearing 6 setae, i.e., 5 distal and 1 proximolateral setae. Longest terminal seta as long as body plus caudal ramus (not shown), subterminal lateral seta short and slender. Distal margin ornamented with a row of stout setules, proximal part with medial and lateral setules.

Antennule (fig. 2D) 3-segmented, long and slender, extending to genital somite, total length about 1.2 mm. Surface of segments ornamented with rows of small setules as illustrated. First segment as long as two distal segments combined, armed with 3 short and 6 long setae; second segment with 1 long distal seta; distal part of third segment with 3 short and 6 very long setae. Formula for armature 9, 1, 9.

Antenna (fig. 2E) comprising coxa, basis, 2-segmented endopod, and 8-segmented exopod. Coxa unarmed; basis with 1 inner seta. Endopodal segments ornamented with slender setules; first segment with 2 setae, one of which exceeding distal edge of endopod; second segment with a proximal group of 5 proximomedial setae and 11 terminal setae, one of which small. Exopodal segments ornamented with small setules and armed with 2, 1, 1, 1, 1, 1, 1, and 3 setae; first exopodal segment composed of two, fused segments, proximal seta as long as endopod.

Mandible (fig. 3A, A₁) biramous, comprising coxal gnathobase, basis, 1-segmented endopod, and 4-segmented exopod. Masticatory blade of gnathobase ornamented with small setules and armed with 8 teeth; lateral tooth large and separated from the others. Basis ornamented with setules and armed with 3 inner setae, 1 proximal and 2 distal. Endopod bearing 6 setae. Exopodal segments armed with 2, 1, 1, and 2 setae.

Maxillule (fig. 3B, B₁) comprising praecoxal arthrite bearing 7 spines; protopod, representing fused coxa and basis; and 1-segmented rami. Praecoxal arthrite ornamented with spinules and bearing 7 terminal setae of different lengths. Protopod with 6 inner and 2 outer setae. Endopod bearing 8 long and 1 short setae. Exopod ornamented with spinules and bearing 6 long and 1 short setae.

Maxilla (fig. 3C) 5-segmented. First segment elongate, with setules in proximal part and 4 endites armed with 2, 3, 3, and 3 setae. Second segment bearing 2 setae and 1 inner seta, inner margin ornamented with setules. Segments 3-5 armed with 1, 1, and 4 setae; distal segment with a row of setules.

Maxilliped (fig. 3D) 3-segmented. First segment armed with groups of 2, 1, 3, and 1 setae, outer margin with slender setules; second segment composed of two, fused segments, armed with 2 setae. Third segment short, armed with 4 setae, one of which is small and naked.

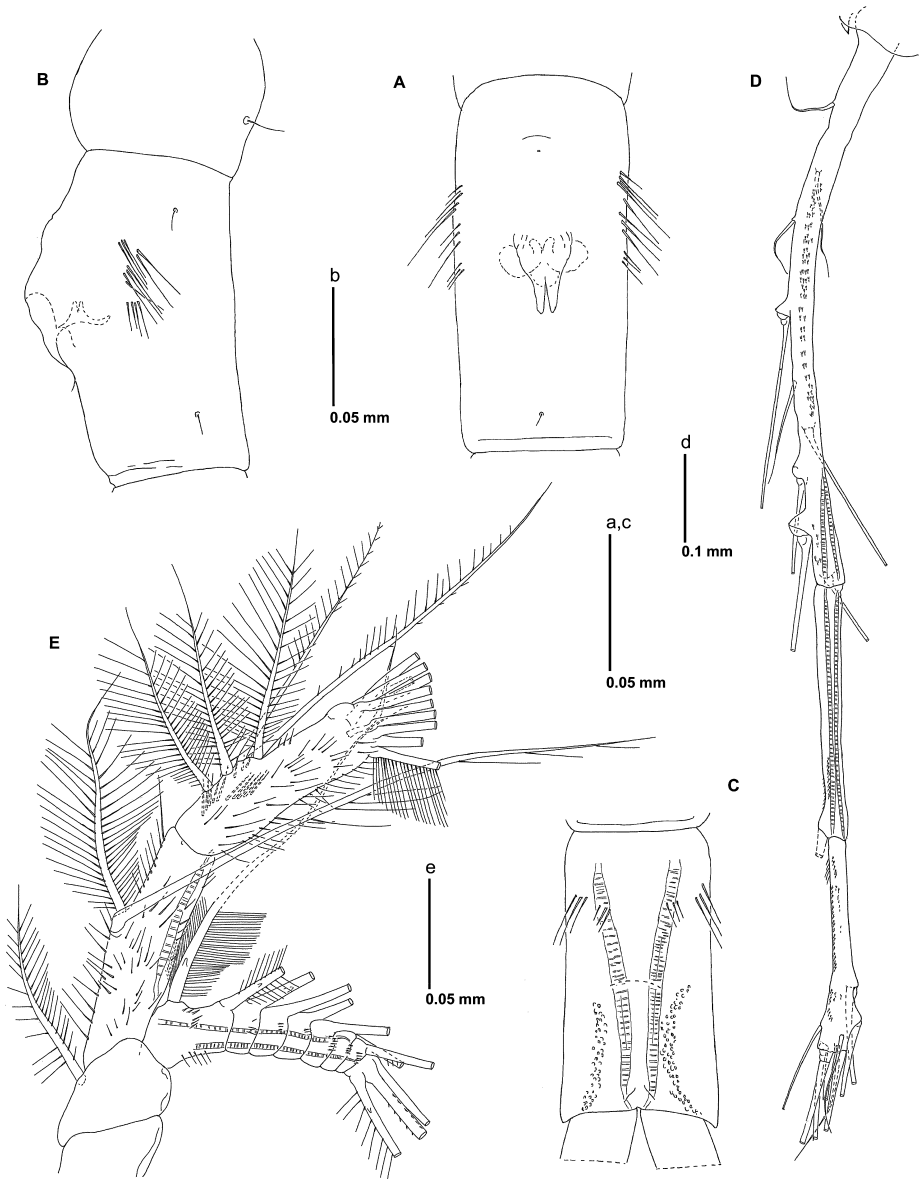


Fig. 2. *Neomormonilla extremata* sp. nov., holotype ♀: A, genital double-somite, ventral; B, first somite of urosome and genital double-somite, lateral; C, anal somite, ventral; D, antennule; E, antenna.

Swimming legs 1-4 (fig. 4A-D) with exopods of legs 1-2 and endopod of leg 1, all 3-segmented; exopods of legs 3-4, 2-segmented; endopod of leg 2, 2-segmented, endopods of legs 3-4, 1-segmented. Coxa and basis of legs 1-4 unarmed. Musculature of rami and ornamentation of segments as illustrated.

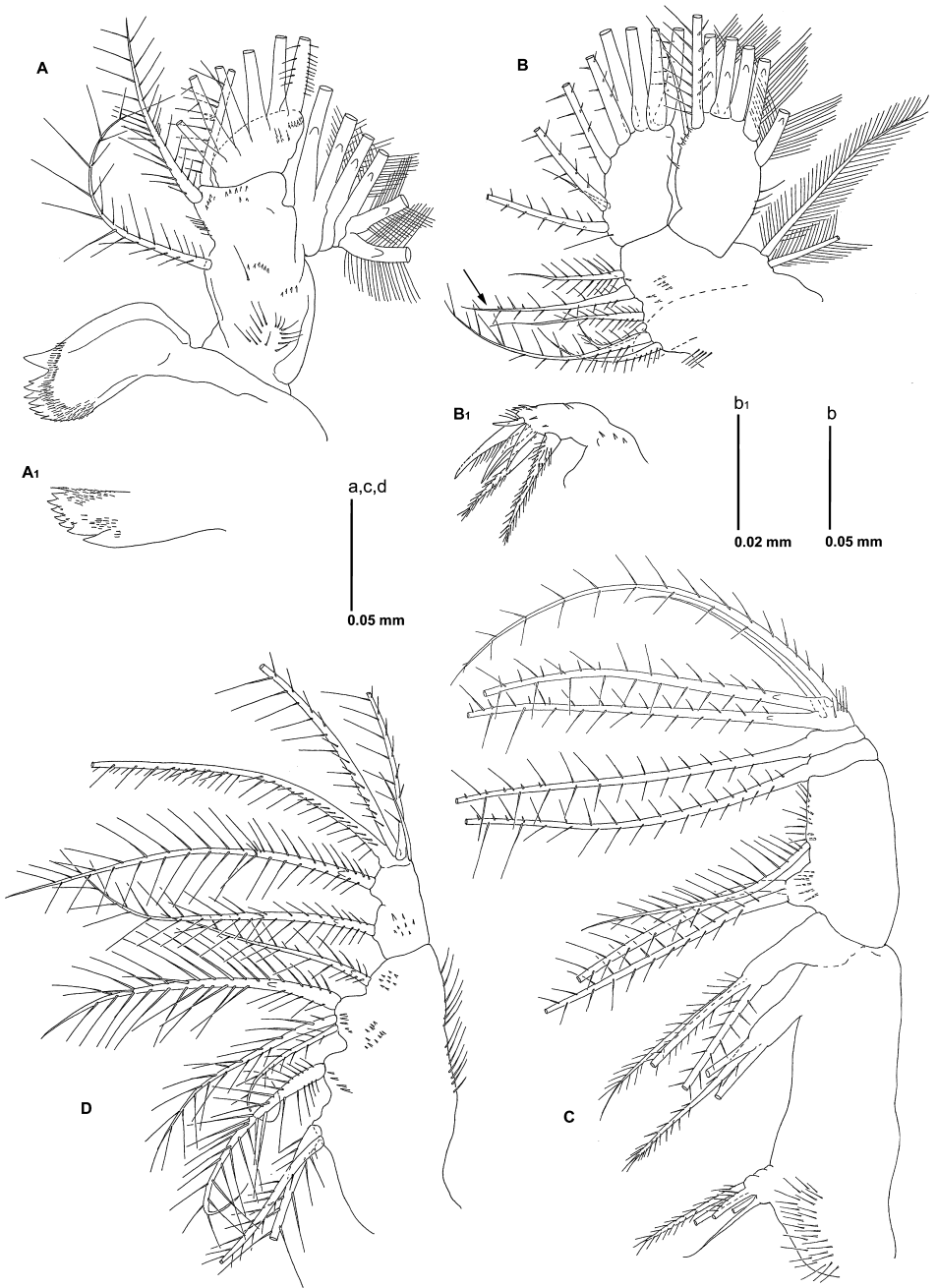


Fig. 3. *Neomormonilla extremata* sp. nov., holotype ♀: A, mandible; A₁, gnathobase of mandible; B, maxillule, distinctive seta arrowed, posterior; B₁, praecoxal endite of maxillule; C, maxilla, anterior; D, maxilliped, anterior.

TABLE I

Formula of the armature of swimming legs 1-4, holotype ♀ of *Neomormonilla extremata* sp. nov.
Roman numerals indicate spines, Arabic numerals setae

	Coxa	Basis	Endopod	Exopod
Leg 1	0-0	0-0	0-0; 0-0; 0,2,1	0-0; 0-1; 0,I,3
Leg 2	0-0	0-0	0-0; 0,2,1	0-0; 0-1; 0,I,4
Leg 3	0-0	0-0	0,2,1	0-0; 0,I,4
Leg 4	0-0	0-0	0,2,1	0-1; 0,I,3

Leg 1: inner margin of coxa, basis, and proximal endopodal segments ornamented with stout spinules; distal segment of endopod with 3 setae; distomedial setae curved, proximal part ornamented with row of long setules, middle part with barbs. Legs 2-4: distal endopodal segment with 3 setae; formula for armature: 0, 2, 1. Distal exopodal segment of legs 1-4 bearing 0,I,3; 0,I,4; 0,I,4; 0,I,3, respectively, from leg 1 to leg 4. Exopodal segments 1-3 of leg 1 with 1, 1, and 3 stout distolateral spine-like outgrowths, respectively; distal exopodal segment of leg 2 with distolateral, spine-like outgrowth. Formula for armature of legs 1-4 summarized in table I.

Leg 5 absent.

Leg 6 (fig. 2A) represented as a pair of triangular flaps covering the gonopores. Egg-sacs unknown.

Remarks. — The new species, *N. extremata* sp. nov. is more closely similar to *N. polaris* (G. O. Sars, 1900) than to *N. minor* (Giesbrecht, 1891). It differs from *N. polaris* in:

- having a longer proximomedial seta of the mandibular basis (figs. 3A, 7A);
- having shorter medial setae on the inner margin of the maxillule basis (arrows in figs. 3B and 7C);
- provided with ornamentation on the outer margin of the first maxillipedal segment by a row of slender setules (figs. 3D, 7D);
- showing a number of small, curved spinules on the outer margin of the two distal exopodal segments of leg 1 (in *N. extremata* sp. nov. 3 and 2 spinules on the second and third exopodal segments, see arrows in fig. 4A₁; in *N. polaris*, 1 spinule on the second and third exopodal segments, one of which indicated with an arrow in fig. 8A);
- the ornamentation on the inner margin of the first exopodal segment of leg 2 (in *N. extremata* sp. nov. proximal part with spinules, distal part with setules as

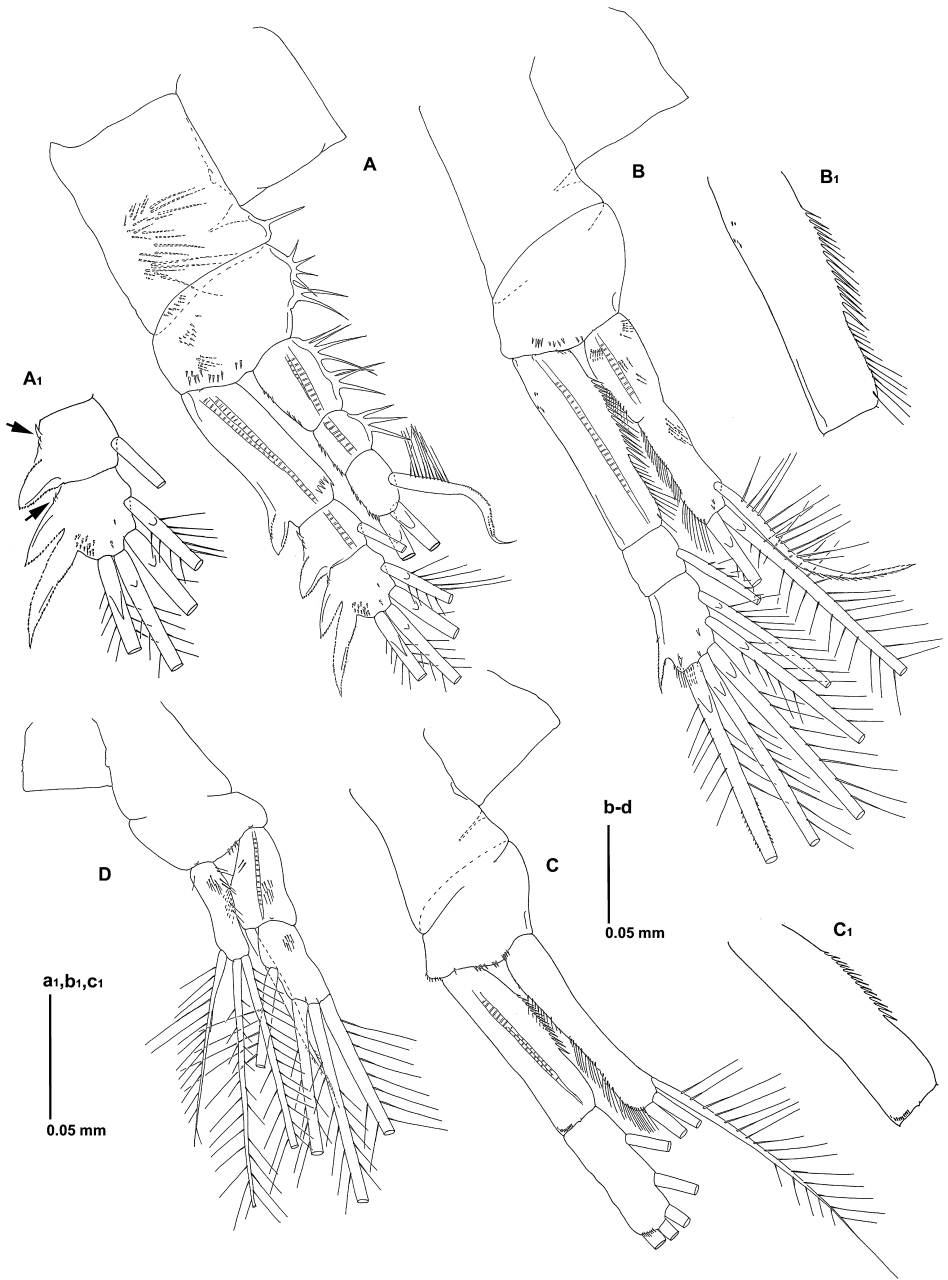


Fig. 4. *Neomormonilla extremata* sp. nov., holotype ♀: A, leg 1, posterior; A₁, distal exopodal segments of leg 1, small curved spinules arrowed, posterior; B, leg 2; B₁, proximal exopodal segment of leg 2, posterior; C, leg 3, posterior; C₁, proximal exopodal segment of leg 3, posterior; D, leg 4, posterior.

illustrated in fig. 4B₁; in *N. polaris*, inner margin with a row of stout spinules as in fig. 8B);

- ornamentation on the inner margin of the first exopodal segment of leg 3 (in *N. extremata* sp. nov. only middle part of segment ornamented with a row of spinules as in fig. 4C₁; in *N. polaris* inner margin ornamented with a row of spinules on both the proximal and distal parts of the segment as in fig. 8C).

Both species, *N. extremata* sp. nov. and *N. polaris*, differ from *N. minor* in:

- a lack of setules on the ventral side of the first somite of the urosome (see the ornamentation of *N. minor* in fig. 5A);
- a lack of short spinules on the third segment of the antennula and of setules on the ventral side of the first somite of the urosome (see ornamentation of the antennular segment by spinules of *N. polaris* in fig. 6E, of *N. minor* in fig. 5B);
- ornamentation of the middle part of the distomedial seta of the distal exopodal segment of leg 1 with small barbs (in contrast to the stout barbs of *N. minor* as in fig. 5C);
- ornamentation of the distal endopodal segments of swimming legs 2-3 (in contrast to the stout spinules of *N. minor* as in fig. 6B, D).

Ecological comments. — The finding of *N. extremata* sp. nov. constitutes the first record of mormonillids from deep sea chemosynthetic (hydrothermal vent) communities (Ivanenko & Defaye, 2006). The mormonillids were found at the periphery of the hydrothermal vent community and were accompanied by other planktonic and near-bottom copepods (adults and subadults of Calanoida, Cyclopoida (Cyclopinidae and Oncaeididae), subadults of Siphonostomatoida (Dirivultidae)). We consider this species as a facultative (= non-obligate) member of this community. Only copepods of the diverse siphonostomatoid family Dirivultidae Humes & Dojiri, 1980 and two species of the calanoid family Spinocalanidae Vervoort, 1951 can be interpreted unambiguously as usual (= obligate) members of deep-sea chemosynthetic communities (Heptner & Ivanenko, 2002; Ivanenko & Defaye, 2006). The monotypic spinocalanid genus, *Isaacsicalanus* Fleminger, 1983 was found at the East Pacific Rise, while another new spinocalanid was found over hydrocarbon seeps at the Congo Basin of the Atlantic Ocean (Ivanenko et al., in prep.).

***Neomormonilla minor* (Giesbrecht, 1891) comb. nov. (fig. 6A-D)**

Mormonilla minor Giesbrecht, 1891: 474-475; Giesbrecht, 1893: 536, p. 43 figs. 34-41; Boxshall, 1979: 258 fig. 27 A-F [urosome, genital double-somite, antennule, maxilliped, legs 1 and 2]; Huys & Boxshall, 1991: 171-172, figs. 2.6.2.D-E [urosome]; 2.6.3.B, C [antennule]; 2.6.6.C, D [maxilliped]; 2.6.12.A-D [genital double-somite].

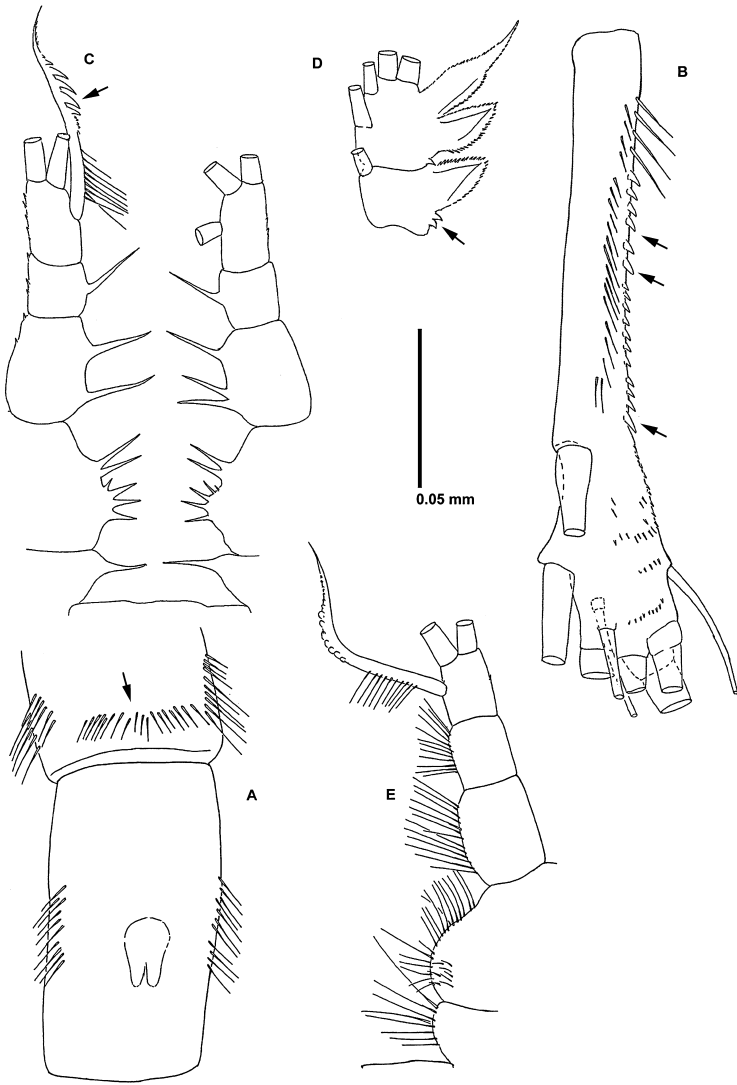


Fig. 5. *Neomormonilla minor* (Giesbrecht, 1891) comb. nov., ♀ no. 1: A, first somite of urosome and genital double-somite, ventral view, ventral setae arrowed; B, distal segment of antennule, short spinules arrowed; C, leg 1: endopods, coxal and basal inner margins, anterior, serrated margin of distomedial seta arrowed; D, leg 1: distal exopodal segments, anterior, small curved spinules arrowed. *Neomormonilla minor*, ♀ no. 2: E, leg 1: inner margins of coxa and basis, endopods, posterior.

Mormonilla atlantica Wolfenden, 1905: 16.

Material examined. — Eight ♀♀ (BMNH registration number 1977-272-281).

Locality of specimens studied. — Northeastern Atlantic, 18°N 25°W, depth 410-1250 m (Boxshall, 1979).

Type locality. — Pacific Ocean, 3°S 99°W, depth 1800 m.

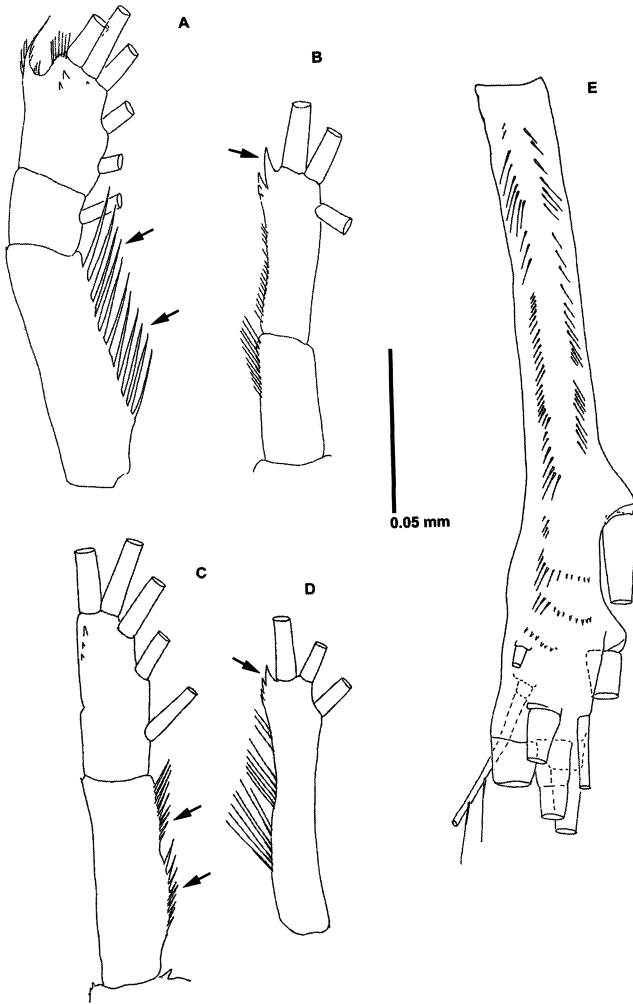


Fig. 6. *Neomormonilla minor* (Giesbrecht, 1891) comb. nov., ♀ no. 1: A, exopod of leg 2, posterior, ornamentation with spinules (arrow); B, endopod of leg 2, distolateral spinules (arrow), posterior; C, exopod of leg 3, ornamentation with spinules (arrow), posterior; D, endopod of leg 3, distolateral spinules (arrow), posterior. *Neomormonilla polaris* (G. O. Sars, 1900) comb. nov., ♀ no. 1: E, distal (third) segment of antennule.

Diagnosis of female. — Body length 1.25-1.35 mm (Giesbrecht, 1893), 1.2-1.38 mm (Boxshall, 1979). Urosome: first somite (fig. 5A) with rows of setules on ventral and lateral sides; genital double somite (fig. 5A) with lateral setules. Antennules (fig. 5B): third segment ornamented with rows of setules and row of short stout spinules, bearing 9 setae. Mandible (fig. 7A, B): masticatory blade of gnathobase with 8 serrated teeth; lateral tooth large and separated from others; basis armed with 3 inner setae. Maxillule (fig. 7C): one of 6 inner setae of protopod

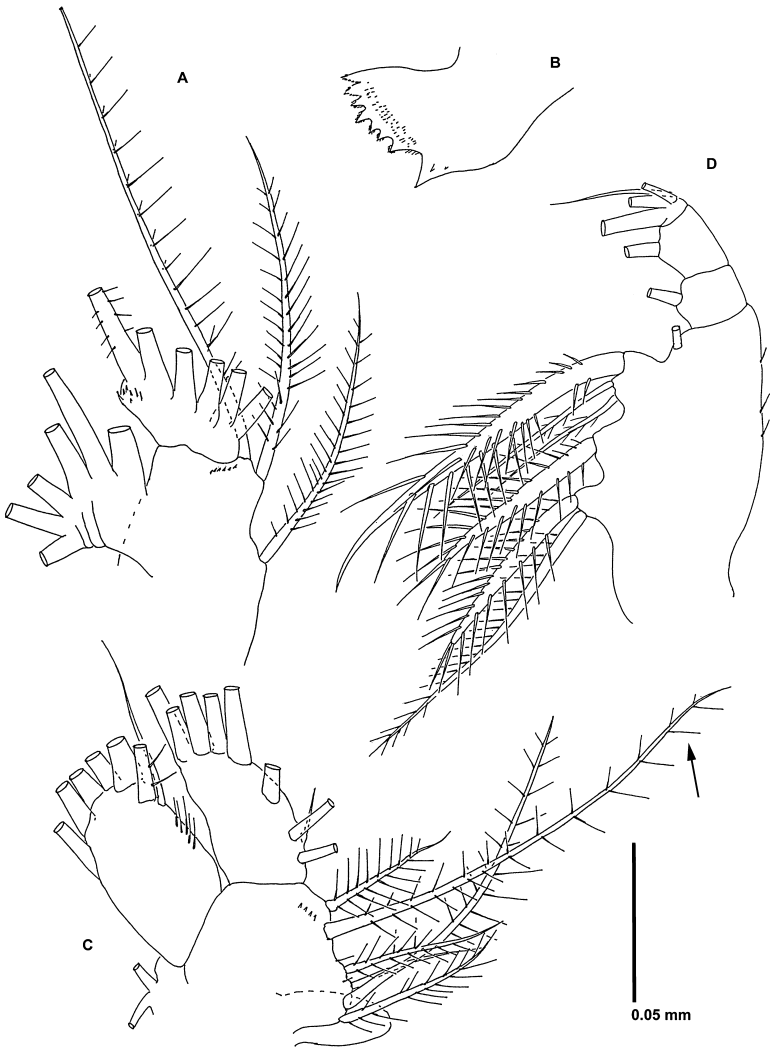


Fig. 7. *Neomormonilla polaris* (G. O. Sars, 1900) comb. nov., ♀ no. 1: A, mandibular palp; B, masticatory edge of mandibular gnathobase; C, maxillule, distinctive seta indicated by arrow; D, maxilliped.

elongate. Maxilliped (fig. 7D): 4-segmented; outer margin of first segment with a few setules. Leg 1 (fig. 5C-E): inner margin of coxa, basis, and proximal endopodal segments ornamented with groups of stout spinules or slender setules; middle part of distomedial seta of distal exopodal segment with stout barbs. Leg 2 (fig. 6A, B): distal endopodal segment with distomedial spinules; inner margin of first exopodal segment with a row of stout spinules. Leg 3 (fig. 6C, D): distal endopodal segment with 4 distomedial spinules; inner margin of first exopodal segment with a row of spinules in distal part and a row in proximal part of segment.

Remarks. — The type species, *Neomormonilla minor* was originally described as *Mormonilla minor* by Giesbrecht (1891, 1893) from the tropical part of the Pacific Ocean, and the redescription of this species was based on specimens from the northeastern Atlantic (Boxshall, 1979; Huys & Boxshall, 1991). Farran (1908) synonymized *Mormonilla atlantica* Wolfenden, 1905, lacking illustrations, with *Mormonilla minor* Giesbrecht, 1891. Further re-examination of mormonillids from the type locality and comparison with mormonillids from the northeastern Atlantic are necessary to confirm the identity of copepods from the two oceans referred to *Mormonilla minor*, as well as the proposed synonymy with *Mormonilla atlantica*.

Neomormonilla polaris (G. O. Sars, 1900) comb. nov. (figs. 6E, 7, 8)

Mormonilla polaris G. O. Sars, 1900: 120-126, pl. 34 figs. 1-12.

Material examined. — Eight ♀♀ deposited in the Museum national d'Histoire naturelle, Paris (MNHN-Cp2311).

Locality of specimens studied. — Arctic, 86.46°73'N 136.51°03'E, depth 300-1000 m, date 03.iii.2005.

Type locality. — Arctic, between 81° and 82°N 134° and 96°E, depth 100 m.

Diagnosis of female. — Body length 1.38 mm (G. O. Sars, 1900), 1.41-1.56 mm (our measurement of 3 females). Urosome: first somite with or without leg 5 represented by two pairs of long setae on the ventral side, observed only in one aberrant female (fig. 8D). Antennule (fig. 6E): third segment ornamented with rows of setules. Leg 1 (fig. 8A): inner margin of coxa, basis, and proximal endopodal segments ornamented with groups of stout spinules; middle part of distomedial seta of distal exopodal segment with stout barbs; distal exopodal segments with small, curved proximolateral spinules. Leg 2 (fig. 8B): distomedial margin of distal endopodal segment ornamented with setules; inner margin of first exopodal segment with row of spinules. Leg 3 (fig. 8C): distomedial margin of distal endopodal segment ornamented with setules; inner margin of first exopodal segment with a row of spinules in distal and one in proximal parts of segment.

Remarks. — G. O. Sars (1900) described *Mormonilla polaris* from the Arctic Ocean and indicated the lack of differences between this species and *Mormonilla minor* Giesbrecht, 1891. Later, Farran (1908) synonymized this species with *Mormonilla minor*. The clear distinction of *N. polaris* from other mormonillids is revealed here for the first time, and requires re-establishing the validity of *Mormonilla polaris* and placing it in the new genus *Neomormonilla* as has been executed, above.

Genus ***Mormonilla*** Giesbrecht, 1891, emended

Corynuropsis T. Scott, 1894 [nomen nudum].

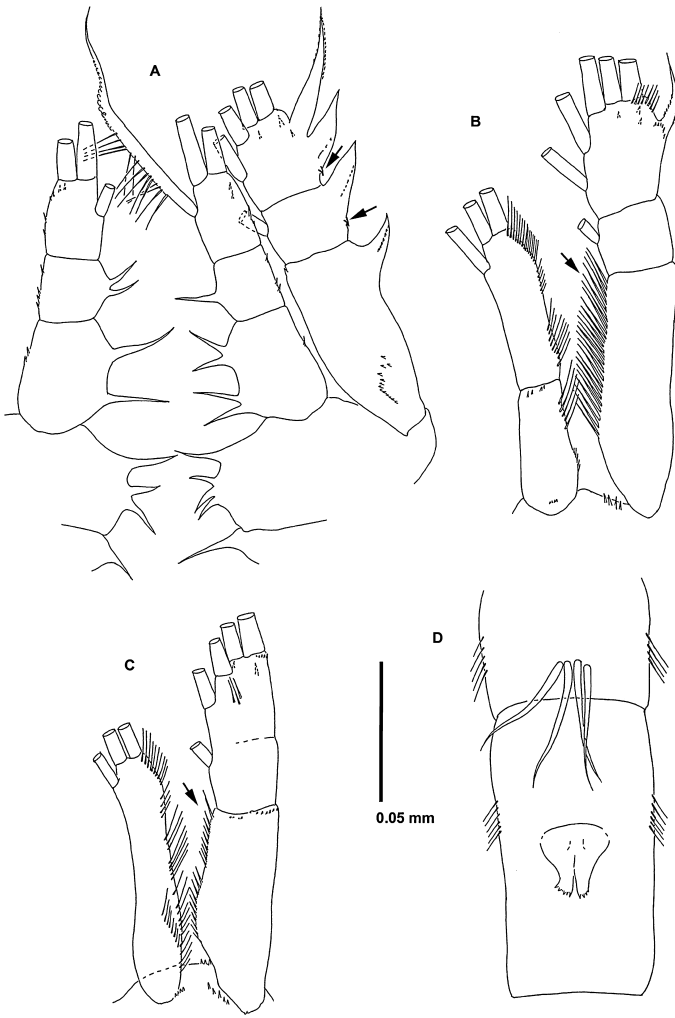


Fig. 8. *Neomormonilla polaris* (G. O. Sars, 1900) comb. nov., ♀ no. 1: A, leg 1: endopods, exopod, coxal and basal inner margins, posterior, small curved spinule of exopod arrowed; B, endopod and exopod of leg 2, ornamentation with spinules (arrow), posterior; C, endopod and exopod of leg 3, ornamentation with spinules (arrow), posterior; ♀ no. 2 (aberrant): D, first somite of urosome and genital double-somite, ventral.

Diagnosis of female. — Genital double-somite swollen anteroventrally. Maxil-liped 3-segmented; first segment armed with groups of 2, 1, 3, and 0 setae; second segment composed of two, fused segments, armed with groups of 2 and 1 setae; third segment with 4 setae. Exopods of legs 1-2 and endopod of leg 1, 2-segmented, endopod of leg 2, 1-segmented. Leg 1: inner margin of coxa, basis, and proximal endopodal segments ornamented with groups of stout spinules; distal segment of endopod with 4 setae.

Type species. — *Mormonilla phasma* Giesbrecht, 1891.

Distribution. — Cosmopolitan, meso-bathypelagic (Razouls, 1996; and C. Razouls, pers. comm.).

***Mormonilla phasma* Giesbrecht, 1891**

Mormonilla phasma Giesbrecht, 1891: 474-475; Giesbrecht, 1893: 536, pl. 43 figs. 28-32; T. Scott, 1894: 64-65, pl. 7 figs. 11-21; Boxshall, 1979: 256-257, fig. 26A-H; Boxshall, 1985: 310-311, 330-337, 351-358, figs. 5, 25-31, 50-68; Huys & Boxshall, 1991: 171-172, figs. 2.6.2.A-B; 2.6.3.A, D-F; 2.6.5.A-F; 2.6.6.A, B, E; 2.6.7.A-E; 2.6.11. A-D.

Corynuropsis tenuicaudatus T. Scott, 1892 "(MS Name)".

Type locality. — Pacific Ocean, 3°S 99°W, depth 1800 m.

Locality of redescribed females. — Northeastern Atlantic, 18°N 25°W, depth 410-1250 m (Boxshall, 1979).

Remarks. — *Mormonilla phasma* was originally described by Giesbrecht (1891, 1893) from the tropical part of the Pacific Ocean and redescribed in detail from specimens of the northeastern Atlantic (Boxshall, 1979, 1985; Huys & Boxshall, 1991). T. Scott (1894) briefly redescribed *M. phasma* from material of the Gulf of Guinea and synonymized *Corynuropsis tenuicaudatus* T. Scott, 1892 with this species. Further re-examination of mormonillids from the type locality and comparisons with mormonillids from the northeastern Atlantic are necessary to confirm the identity of copepods from the two oceans, currently referred to *M. phasma* Giesbrecht, 1891.

KEY TO THE FEMALES OF THE FAMILY MORMONILLIDAE GIESBRECHT, 1893

1. Swimming leg 1 with 2-segmented endopod, distal segment of endopod bearing 4 setae ... *Mormonilla phasma* Giesbrecht, 1891
- Swimming leg 1 with 3-segmented endopod, distal segment of endopod bearing 3 setae ... 2 (*Neomormonilla* gen. nov.)
2. Third segment of antennule with rows of slender setules 3
- Third segment of antennule with row of short, stout spinules and slender setules *Neomormonilla minor* (Giesbrecht, 1891) comb. nov.
3. Inner margin of first exopodal segment of swimming leg 3 with a row of spinules in the middle part of the segment *Neomormonilla extremata* sp. nov.
- Inner margin of first exopodal segment of swimming leg 3 with one row of spinules each in the proximal and distal parts of the segment *Neomormonilla polaris* (G. O. Sars, 1900) comb. nov.

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