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Godzilliognomus schrami, a new species of Remipedia (Crustacea) from Eleuthera, Bahamas

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Abstract

Godzilliognomus schrami, a new species of the crustacean class Remipedia, Yager, 1981 is the second species assigned to the genus. The new species, with an average body length of 6.8 mm, was collected from an anchialine cave on the Bahamian island of Eleuthera. *Godzilliognomus schrami* can be distinguished from the other species in the genus, *Godzilliognomus frondosus* Yager, 1989 by narrower and less trapezoidal tergites, frontal filaments that differ regarding the shape and insertion of the medial process, and dorsal antennular rami composed of only ten segments.

Key words: Godzilliidae, anchialine caves, blue holes

Introduction

During a diving expedition to investigate the biology of anchialine and marine caves in Eleuthera, Bahamas, a new species of remipede belonging to the previously monotypic genus *Godzilliognomus* was discovered and described based on eleven specimens collected from an anchialine cave, Windermere Abyss, in August 2007. *Godzilliognomus schrami* **n. sp.** brings the number of described species of extant remipedes to 24 and represents the fifth species from the family Godzilliidae. Like its only congener, *Godzilliognomus frondosus* Yager, 1989, *G. schrami* possesses the lower limit of 16 trunk somites observed in adult remipedes (Koenemann et al. 2006) and is one of the smallest species.

While *Godzilliognomus frondosus* occurs in several anchialine caves on the islands of Grand Bahama and Abaco on the Little Bahama Bank, *G. schrami* inhabits only a single cave on Eleuthera on the Great Bahama Bank (Fig. 1). *G. schrami* is the second species of remipede, after *Cryptocorynetes elmorei* Haserli, Koenemann, Iliffe, 2010, to be described from anchialine blue holes on Eleuthera.

The Bahama Banks are made up of limestone of shallow-water origins that have been deposited since the Early Cretaceous, reaching a depth of at least 4500 m. The Great and Little Bahama Banks are separated by the Northeast (up to 8700 m deep) and Northwest (up to 5200 m deep) Providence Channels that have been in existence since the earliest stages of the formation of the Bahamas. The presence of stygobiontic remipede species from the same genus on both banks implies relatively recent dispersal events through open waters and/or the deep sea, or ancient cave colonization that occurred while the banks were initially forming during the Cretaceous coupled with continuing isolation of populations.

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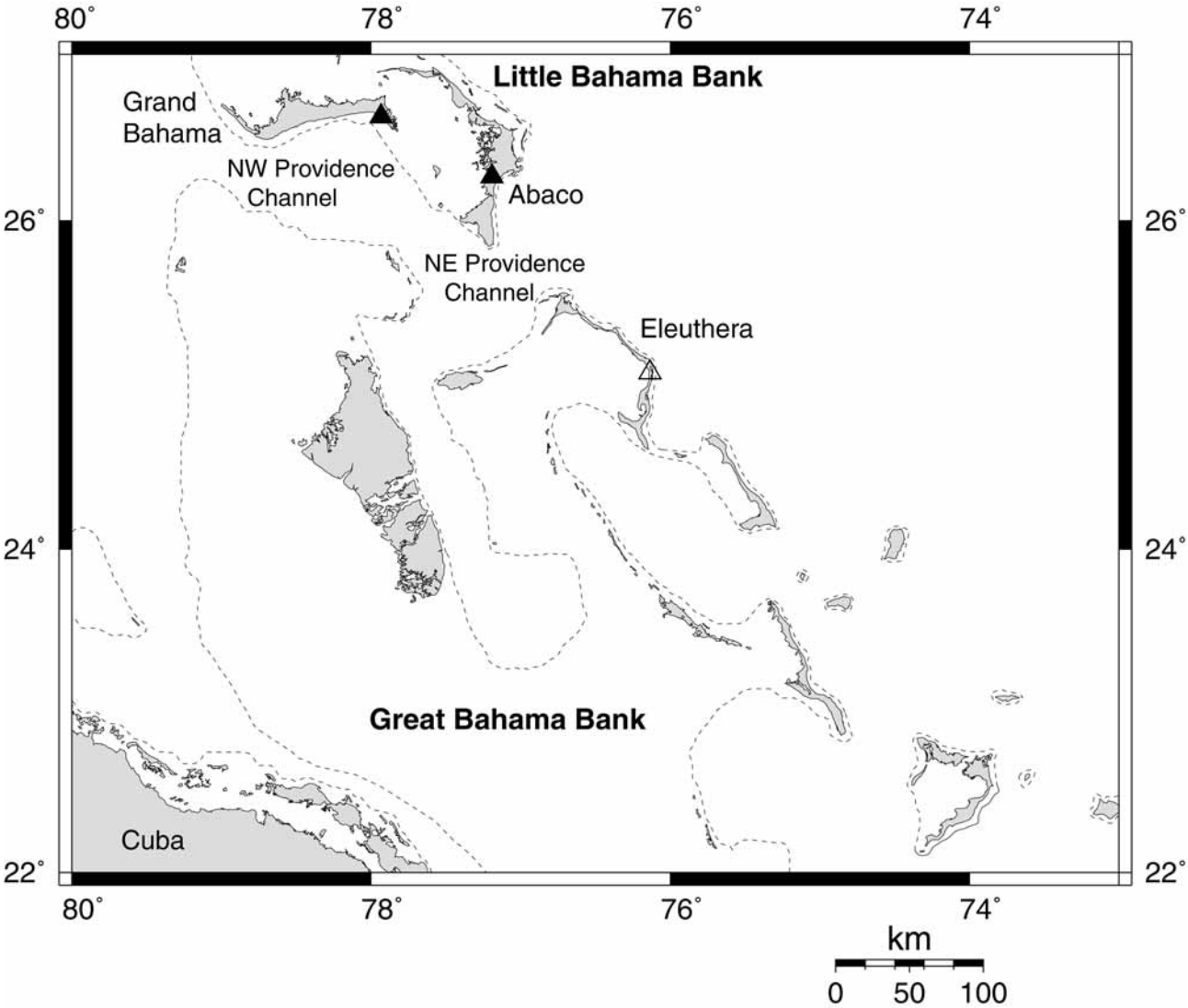

FIGURE 1. Map of the Bahamas showing the locations on the Little Bahama Bank from which specimens of *Godzilliognomus frondosus* (▲) have been collected and on the Great Bahama Bank from which *Godzilliognomus schrami* (△) has been reported. Dashed lines represent the 100 m depth contour marking the bank margins. Map (modified) with kind permission of Online Map Creation (www.aquarius.geomar.de).

Systematics

Godzilliognomus schrami, new species

(Figs. 2–5)

Type locality: Windermere Abyss, Eleuthera, Bahamas.

Material examined: Eleven specimens, including a 7.9 mm holotype and ten paratypes, were collected from the type locality on August 24, 2007 by Thomas M. Iliffe. All specimens with 16 trunk segments. Paratypes 1–3 (7.4 mm, 6.8 mm, and 7.3 mm, respectively) were dissected for examination and preserved in glycerine (retained in research collection of SK). Paratypes 4–10 (5.6 to 7.2 mm; ZMB 27739) and the holotype (ZMB 27739), all preserved in alcohol as whole specimens, were deposited at the Museum für Naturkunde, Berlin (ZMB).

Etymology: In honor of Professor Emeritus Frederick R. Schram, formerly of the San Diego Natural History Museum and the Zoological Museum of the University of Amsterdam, the epithet *schrami* has been chosen. Professor Schram is renowned for his contributions to crustacean biology, including Remipedia.

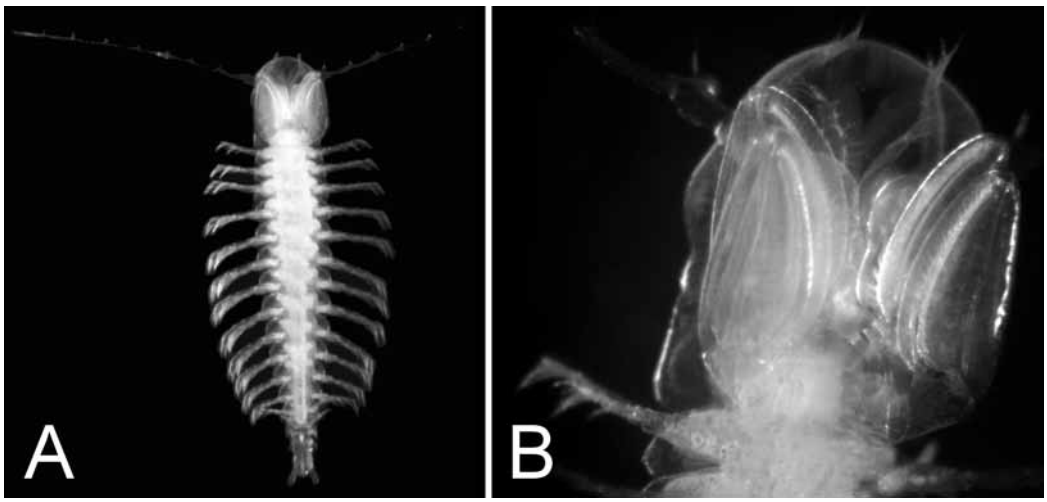

FIGURE 2. *Godzilliognomus schrami* **n. sp.** from Eleuthera, Bahamas. 7.3 mm paratype. A, ventral view of living individual. B, ventral view of head region.

Diagnosis: A very small-sized and slender species, body length up to 8 mm, adult specimens composed of 16 trunk segments; dorsal ramus of antennule 10-segmented, ventral flagellum with 2 segments; maxilla and maxilliped robust, pseudochelate, distal segments partly fused, very narrow; claw of maxilla and maxilliped composed of 5 denticles; anal segment longer than wide; caudal rami reaching approximately 75% of length of anal segment.

Description: Based on holotype and paratypes. Body small with a maximum length of 8 mm and 16 trunk segments (Fig. 2). Sternal bars isomorphic. Pleural tergites comparatively narrow, with acuminate posterolateral corners, becoming more angular in posterior part of trunk (Fig. 3A). Cephalic shield with convex lateral margins at insertion of antennule, approximately as long as trunk segments 1–3 (Fig. 3A). First trunk segment very narrow, partly covered by head shield. Frontal filaments (Fig. 4C) long, cylindrical, with slender distomedial process being approximately half as long as main filament, ending below tip of main filament.

Antennule (Fig. 4A): Peduncle bears few aesthetascs. Dorsal ramus 10-segmented, reaching up to 2/3 of length of body. Ventral flagellum 2-segmented, reaching 1/7 of length of dorsal ramus.

Antenna (Fig. 4B): Proximal segment of protopod with about 4 marginal setae; distal segment with ca. 8 marginal setae. Exopod with oval shape, approximately as long and wide as adjacent distal segment of protopod, bearing about 16 long setae. Endopod slightly bent, 3-segmented; first two proximal segments with about 6 and 4 setae, respectively; distal segment with 10 setae. All setae plumose.

Mandible (Fig. 4E–G): Molar process slightly oval; bearing dense plumose setae. Left incisor process with four large denticles; left lacinia mobilis slightly crescent-shaped. Right incisor process and lacinia mobilis with three large denticles.

Labrum (Fig. 4D): Bearing a distinct median, and two smaller lateral clusters of fine setules on apical margin.

Maxillule (Fig. 5A): Segment 1 with slender endite, bearing 7 stout setae on distal margin, two of which serrated (Fig. 5D). Second segment with spatulate, broad endite, with several setae of unequal length and short stout setae along apical and subapical margins. Segment 3 short; without endite; bearing 1–2 short setae. Segment 4 (lacertus) robust, bearing two rows of about 8 setae, respectively. Segment 5 shorter than lacertus. Sixth segment very short, with two distomedial clusters of long, slender setae. Claw long, about 3–4 times longer than sixth segment.

Maxilla (Fig. 5B): Robust, pseudochelate, distal segments partly fused. Segment 1 with 3 endites, each with 1 prominent apical stout seta accompanied by several short and medium-long, naked setae along subapical margins. Endite of second segment rounded, bearing 2 long setae. Segment 3 (lacertus) robust, medial margin expanded, with dense rows of long and short plumose setae (Fig. 5E). Segments 4–6 of

brachium fused, very narrow, bearing medial rows of foliaceous setae (Fig. 5F). Division between fourth segment and adjacent distal part of brachium weakly defined. Claw with 5 acuminate denticles and thumb-like pad bearing a few apical setae (Fig. 5G).

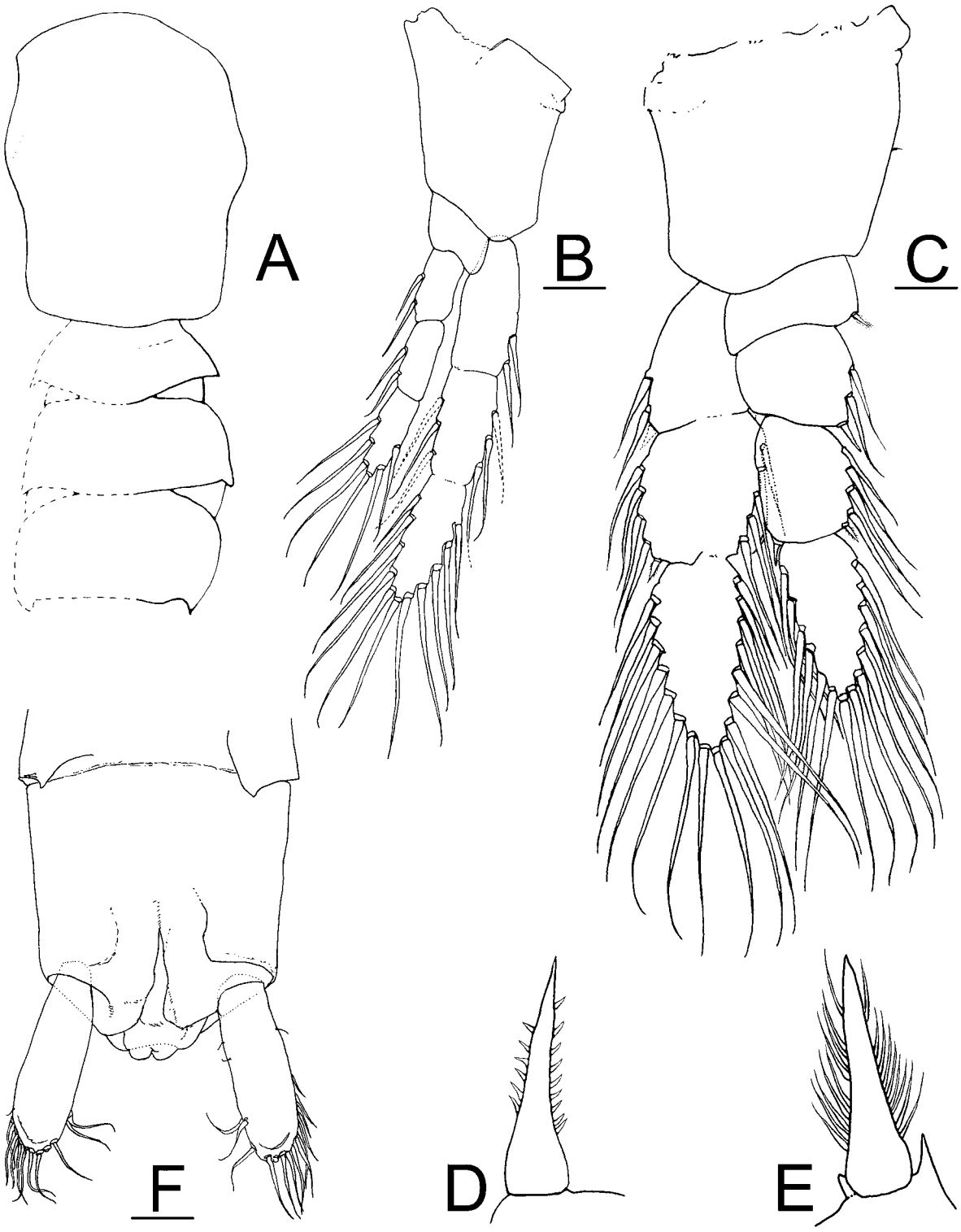

FIGURE 3. *Godzilliognomus schrami* **n. sp.** from Eleuthera, Bahamas. (A, D) 7.4 mm paratype; (B, C, F) 7.3 mm paratype. A, dorsal view of head shield with trunk segments 1–3. B, 1st trunk limb. C, 7th trunk limb. D, spine-like serrate seta from 7th trunk limb. E, spine-like plumose seta from 7th trunk limb. F, anal segment and caudal rami. Scale bars B, C and F = 0.1 mm.

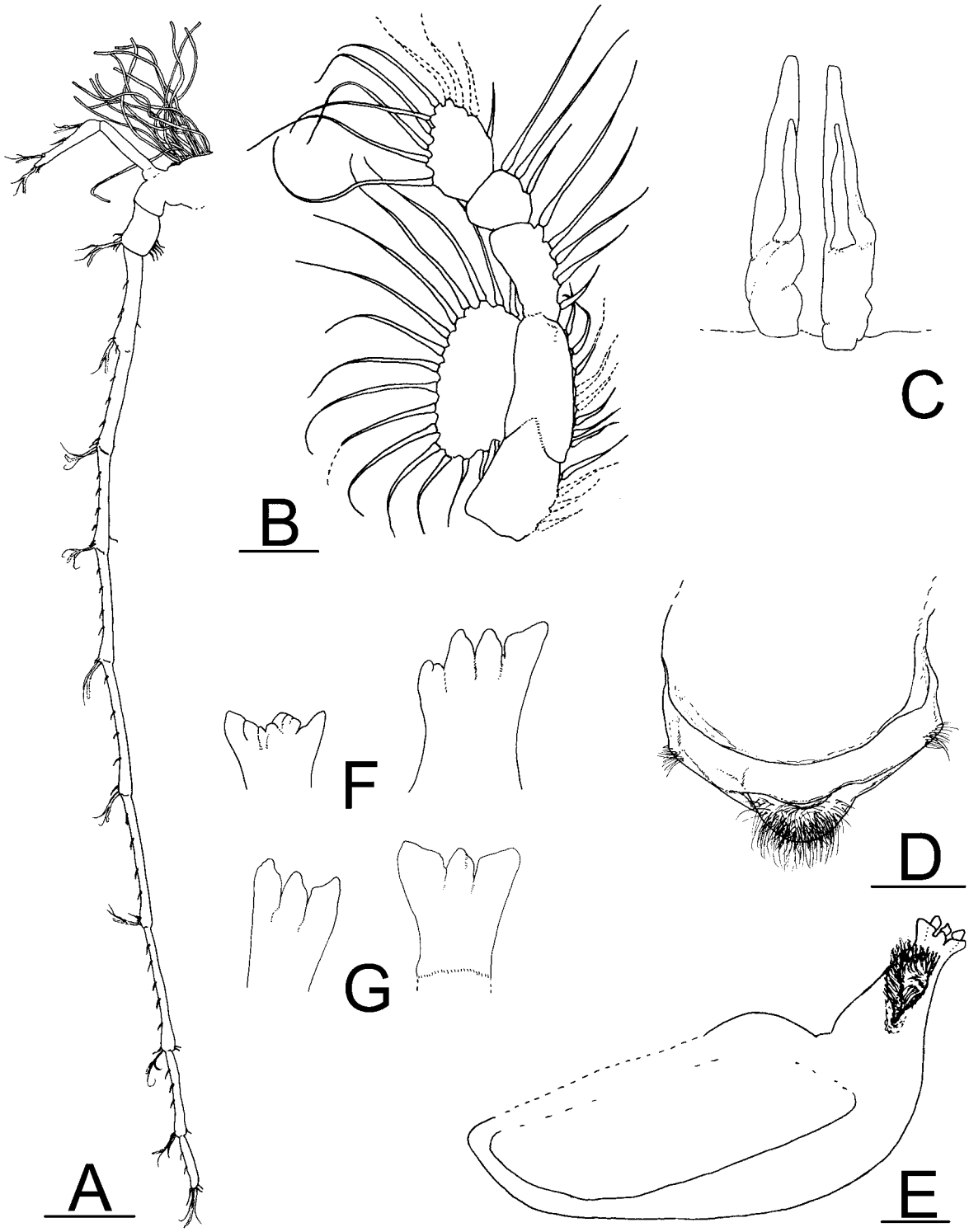

FIGURE 4. *Godzilliognomus schrami* **n. sp.** from Eleuthera, Bahamas, (A) 7.3 mm paratype; (B-G) 6.8 mm paratype. A, antennule. B, antenna. C, frontal filaments. D, labrum. E, right mandible. F, enlarged lacinia mobilis (left) and incisor process (right) of left mandible. G, enlarged lacinia mobilis (left) and incisor process (right) of right mandible. Scale bars: A = 0.5 mm; B–E = 0.1 mm.

Maxilliped (Fig. 5C): Robust, similar to maxilla, but more slender. Suture between proximal segments indistinct. Segment 1-3 with short, rounded endites bearing several setae. Segment 4 (lacertus) robust, medial surface with dense rows of plumose setae and simple setae of unequal length. Brachium very narrow, bearing medial rows of foliaceous setae, distal part naked; segments 5–8 fused. Claw similar to that of maxilla.

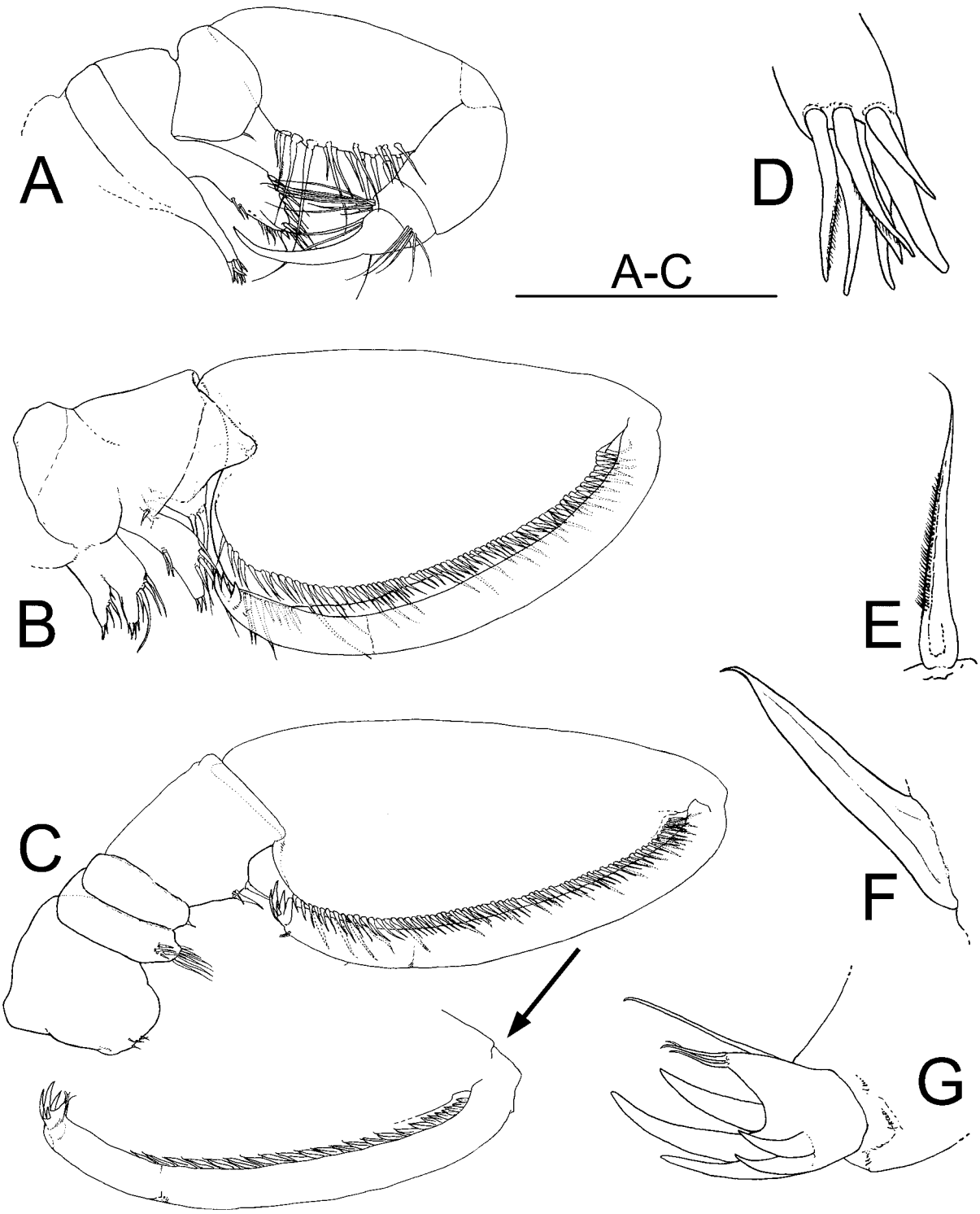

FIGURE 5. *Godzilliognomus schrami* **n. sp.** from Eleuthera, Bahamas, 7.3 mm paratype. A, maxillule. B, maxilla. C, maxilliped (arrow indicates brachium with foliaceous setae shown). D, endite of 1st segment of maxillule. E, plumose stout seta of maxilla. F, foliaceous seta of maxilla. G, claw of maxilla. Scale bars A–C, G = 0.5 mm. Please note that E and F are shown at different scales.

Trunk appendages (Fig. 3B, C): Becoming smaller and less setose posteriorly. Endopod of first trunk appendage (Fig. 3B) small; segments 2 and 3 with a few long setae along lateral margins; segment 4 with long setae along lateral and apical margins. Exopod almost 1.3 times longer than endopod; segments bearing long setae along lateral and medial margins. Trunk appendages of seventh trunk somite (Fig. 3C) robust, large.

First segment of endopod with single spine-like plumose seta on distolateral corner (Fig. 3E); segments 2–4 bearing long setae along lateral and/or medial margins; segment 3 with single spine-like serrate seta on distolateral margin (Fig. 3D). Exopod slightly longer than endopod; first segment with several lateral setae; segments 2-3 with long setae along lateral and medial margins. All long and slender setae on trunk limbs plumose.

Discussion

Morphological comparison with other species

The relatively small-sized *Godzilliognomus schrami* is the fifth species to be placed in the family Godzilliidae Schram, Yager, Emerson, 1986. Its assignment to the genus *Godzilliognomus* is based on the following characteristics: 1) the shape of the cephalic shield, characterized by convex lateral margins; 2) the number of trunk segments (16); 3) the reduced length of the two-segmented ventral flagellum of the antennule (about 1/7 of length of dorsal ramus); 4) the fusion of brachia in maxilla and maxilliped; 5) the grappling hook-type claw of the maxillule; and 6) the reduced third maxillular endite.

Morphological affinities and differences with *Godzilliognomus frondosus*: The foliaceous setae on the brachia of maxillae and maxillipeds in *G. schrami* are much longer and slender than the short, ribbed foliaceous setae in *G. frondosus* (Yager 1989: fig. 7c). Moreover, the pleurotergites of *G. schrami* are slender and narrower than the cephalic shield, while those of *G. frondosus* exceed the width of the cephalic shield. In addition, the dorsal ramus of the antennule of *G. schrami* is 10-segmented, while it is 11-segmented in *G. frondosus*, and the spatulate endite on the second maxillulary segment seems more setose in the new species. Another, minor difference can be found in the frontal filaments. Both *G. frondosus* and *G. schrami* have long, cylindrical frontal filaments, but the medial process of *G. schrami* has its source at about 1/3 of the length of the filament, while the medial process of *G. frondosus* has its source at about 1/2 of the length of the filament and ends at the same height as the filament.

Locality profile

Windermere Abyss is an inland blue hole located on the mainland of Eleuthera, south of the settlement of Savannah Sound and adjacent to the reverse osmosis water purification plant for Windermere Island estates. An intake pipe for the plant leads directly to this 30 m diameter blue hole surrounded by red mangroves. Surface water is brown with a H_2S layer at 3 m depth. The bottom slopes steeply off to a vertical cliff at 12 m and continues down to a ledge at 50 m depth. The water clears substantially and the H_2S disappears below about 30 m. The ledge drops away into a second and larger chasm that is offset from the entrance shaft. This second shaft is floored by boulders at about 80 m but appears to slope down to an apparent archway at a depth of about 100 m. A side tunnel extends off the main shaft at 45 m depth, first through breakdown and then to a room containing stalagmites. Most observed animals, especially remipedes and thermosbaenaceans, were just below the sulfide layer at depths of 33–36 m.

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