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FIRST FINDING OF THE FAMILY AMATHILLOPSIDAE (AMPHIPODA: AMPHILOCHIDEA) IN THE GULF OF MEXICO, WITH THE DESCRIPTION OF A NEW SPECIES

Primer hallazgo de la familia Amathillopsidae (Amphipoda: Amphilochidea) en el golfo de México con la descripción de una especie nueva

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ABSTRACT

The genus *Amathillopsis* Heller, 1875 represents a group of 13 species of amphipods that live predominantly in the Pacific and Atlantic Oceans. Many amathillopsids inhabit both mesopelagic, bathyal, and abyssal zones. We describe *Amathillopsis colemani* **n. sp.**, a new species of marine deepwater amphipod collected at 1200 meters depth. This is the first record of the family Amathillopsidae for the Gulf of Mexico. The new species possesses similar characteristics to other members of the genus. Still, it differs from all other species in terms of the presence of eyes, accessory flagellum of antenna 1 unarticulate, telson notched, and characters in the *lacinia mobilis* of the mandible. The finding of *A. colemani* **n. sp.**, emphasizes that new species of amphipods exist in deep-sea habitats and that associations between crustaceans and deep-sea invertebrates need further investigation.

Keywords: *Amathillopsis,* deep-sea, new species.

RESUMEN

El género *Amathillopsis* Heller, 1875 representa un grupo de 13 especies de anfípodos que viven predominantemente en los océanos Pacífico y Atlántico. Muchos de estos anfipodos han sido colectados tanto en zonas mesopelágicas como abisales. En este trabajo se describe *Amathillopsis colemani* **n. sp.**, una nueva especie de anfípodo marino de aguas profundas, colectado a 1200 metros de profundidad. Esta es la primera ocasión en que se registra una especie perteneciente a la familia Amathillopsidae para el golfo de México. Esta especie posee caracteres comunes con otras especies del género, sin embargo, se diferencia de todas las demás especies por la presencia de ojos, flagelo accesorio de la antena 1, uniarticulado, telson con una muesca terminal y caracteristicas en la *lacinia mobilis* en la mandíbula. El hallazgo de *A. colemani* **n. sp.** sugiere que existen varias especies nuevas de anfípodos en las profundidades del mar y que las asociaciones entre crustáceos e invertebrados de aguas profundas necesitan más investigación.

Palabras clave: *Amathillopsis*, mar profundo, especie nueva.

INTRODUCTION

The family Amathillopsidae comprises three genera and more than 20 species distributed worldwide from the littoral to abyssal zones. *Amathillopsis* Heller, 1875 is the largest genus within the family, with 13 species (Horton et al., 2021; Lorz & Horton, 2021; Varela, 2015). The genus is globally distributed with three species in the Atlantic, five in the Pacific, two in the Indian Ocean, two in the Antarctic, and one in the Arctic. Many species within *Amathillopsis* are found throughout the mesopelagic, bathyal, and abyssal zones, with three species reported at depths greater than 3500 m (Lorz & Horton, 2021; Wakabara & Serejo, 1999). The collection of amphipods from the deep sea often renders rare and new species to science. However, collection from deepwater is difficult as a result of the technical demands and taxonomic knowledge required (Cook et al., 2020; Duffy et al., 2016; Havermans et al., 2013; Ortiz et al., 2018; Patel et al., 2018; Poore & Bruce, 2012; Varela & Bracken-Grissom, 2021). The deepwater distribution, lack of sampling, and potential for discoveries argue for continued global exploration of *Amathillopsis* within the deep sea.

Previous accounts for the tropical western Atlantic have only recorded one species, *Amathillopsis antillensis* Varela, 2015, from the deepwater of Jamaica in the Caribbean Sea. Because members of the family Amathillopsidae inhabit deep waters, many specimens are rarely collected, and the description of new species is commonly based on a single or very few specimens (Lorz & Horton, 2021; Varela, 2015). Little is known about the biology and ecology of these deepwater amphipods. However, a recent study has begun to expand our knowledge of the group (Lorz & Horton, 2021). In this study, the authors observed the genus *Amathillopsis* to have a "clinging lifestyle." They reported species frequently associated with sponges, worm tubes, and corals attached to hard substrates. This behavior is suggested to have evolved to position the amphipods higher in the water column for feeding. The morphology of pereopods 5–7 allows these amphipods to "cling" to various surfaces and are adapted to this lifestyle (Lorz & Horton, 2021; this study). Lorz and Horton suggest species of *Amathillopsis* are likely predators deriving their color pattern from prey consumed. They also note the well-developed eyes in species that live below 3000 m suggest they may use bioluminescence for communication, food capture, predator avoidance, or finding mates. It is very likely species of *Amathillopsis* are much more common in the deep sea than previously documented, and recent studies, including this one, demonstrate the remarkable potential for new species discovery.

In 2019, while conducting deep-sea research in the Gulf of Mexico as part of the Journey into Midnight expedition, we collected a remarkable amphipod. We present the first occurrence of the family *Amathillopsidae* within the Gulf of Mexico and herein describe the new material accompanied by a photograph of the new species.

OBJECTIVES

- To provide the first record of the family Amathillopsidae for the Gulf of Mexico and the description of a new deep-sea amphipod species.

MATERIALS AND METHODS

The material used in this study came from a 2019 research expedition into the Gulf of Mexico on the R/V Point Sur. As part of this expedition the ROV "Global Explorer" was used to make observations and collect animals. The expedition was titled *Journey Into Midnight: Light and Life Below the Twilight Zone* and funded by the National Oceanic and Atmospheric Administration (NOAA), Ocean Exploration Research Program (OER).

Initially, the voucher specimen was preserved at room temperature in 80% EtOH and deposited in the Florida International Crustacean Collection (FICC) with the number HBG 9257. The vouchered material was deposited in the Marine Invertebrate Museum of Rosenstiel School of Marine and Atmospheric Science (RSMAS) from the University of Miami (UMML 32.10450).

Several DNA extractions were performed to collect genetic data for the specimen. However, all attempts to acquire the DNA barcoding gene, cytochrome oxidase 1 (COI), were unsuccessful as a consequence of low DNA yield. Additional attempts were not made to preserve the morphology of the specimen.

The specimen was drawn using a Wild M5 dissecting microscope with a camera lucida (Figs. 1–3). Total length (tl) was measured in millimeters (mm) from the tip of the rostrum to the posterior margin of the telson.

RESULTS

Order Amphipoda Latreille, 1816
Suborder Amphilochidea Boeck, 1871
Family Amathillopsidae Pirlot, 1934
Genus *Amathillopsis* Heller, 1875
Amathillopsis colemani **sp. nov**.

(Figs. 1–4)

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Diagnosis (English). Specimen with eyes, accessory flagellum of antenna one uniarticulate and telson with distal margin emarginated, the mid-dorsal projections on pereonites 5–7 are acute, the relative length of mandibular palp article 3 to article 2 is 0.5 and the relative length of the outer ramus to the inner ramus in the uropod 1 is 0.8. Telson with one pair of dorsolateral spines.

Diagnosis (Spanish). Espécimen con ojos, flagelo accesorio de la antena 1 uniarticulado y telson con muesca terminal, las proyecciones medio dorsales en los pereonitos 5–7 son puntiagudas, la longitud relativa del artejo 3 del palpo mandibular contra el artejo 2 es 0.5 y la longitud relativa de la rama externa contra la rama interior en el urópodo 1 es 0.8. Telson con un par de espinas dorsolaterales.

Figure 1. *Amathillopsis colemani* **n. sp.**, female holotype (UMML 32.10450). Lateral view, collected from ROV Global Explorer in the northern Gulf of Mexico. ©Danté Fenolio. Scale bar: 2 mm.

Type Material. Holotype: non-ovigerous female, 17 mm (tl), Gulf of Mexico (27° 16'N and 85° 49'W), Collected 15 June 2019. 1200 meters deep; ROV submersible. (OER2019-15JUN19-TTD7-ROV6). R/V Point Sur. Invertebrate Marine Collection RSMAS (UMML 32.10450) and Florida International University Crustacean Collection (FICC), HBG 9257.

Description of holotype. Head with short rostrum, anteroventral angle deeply excavated, with ridge parallel to the ventral margin; eyes small, rounded, no ommatidia visible. Pereonite 1 subequal to 2, 3, and 4, not keeled dorsally. Pereonites 5–7 and pleonites 1–2 each with a strong posterior curved dorsal tooth (Fig. 1). Pleonite 3 with a dorsal short, rather upright tooth. Epimeral plate 1 ventrally truncate, rounded posteroventrally; plate 2 posteroventrally angular; posterolateral margin of plate 3 sinuous, posteroventral margin angular. Urosomite 1 as long as urosomite 2 and 3 combined; urosomite 2 shortest; urosomite 3 with 2 shallow depressions in lateral view (Fig. 2A).

Epimera 1–3 with anteroventral and posteroventral angles evenly rounded (Fig. 2B).

Antenna 1 (Fig. 2C): peduncular article 1 subequal in length to article 2, article 3 more than 1/3 the length of article 2; accessory flagellum uniarticulate, somewhat longer than 1st flagellar article; flagellum consisting of numerous short articles. Antenna 2 (Fig. 2D): peduncular article 2 with produced gland cone; article 3 subequal to 1–2 combined; article 4 longest, weakly tapering; article 5 slender, subequal to article 1–3 combined; flagellum consisting of numerous, short articles.

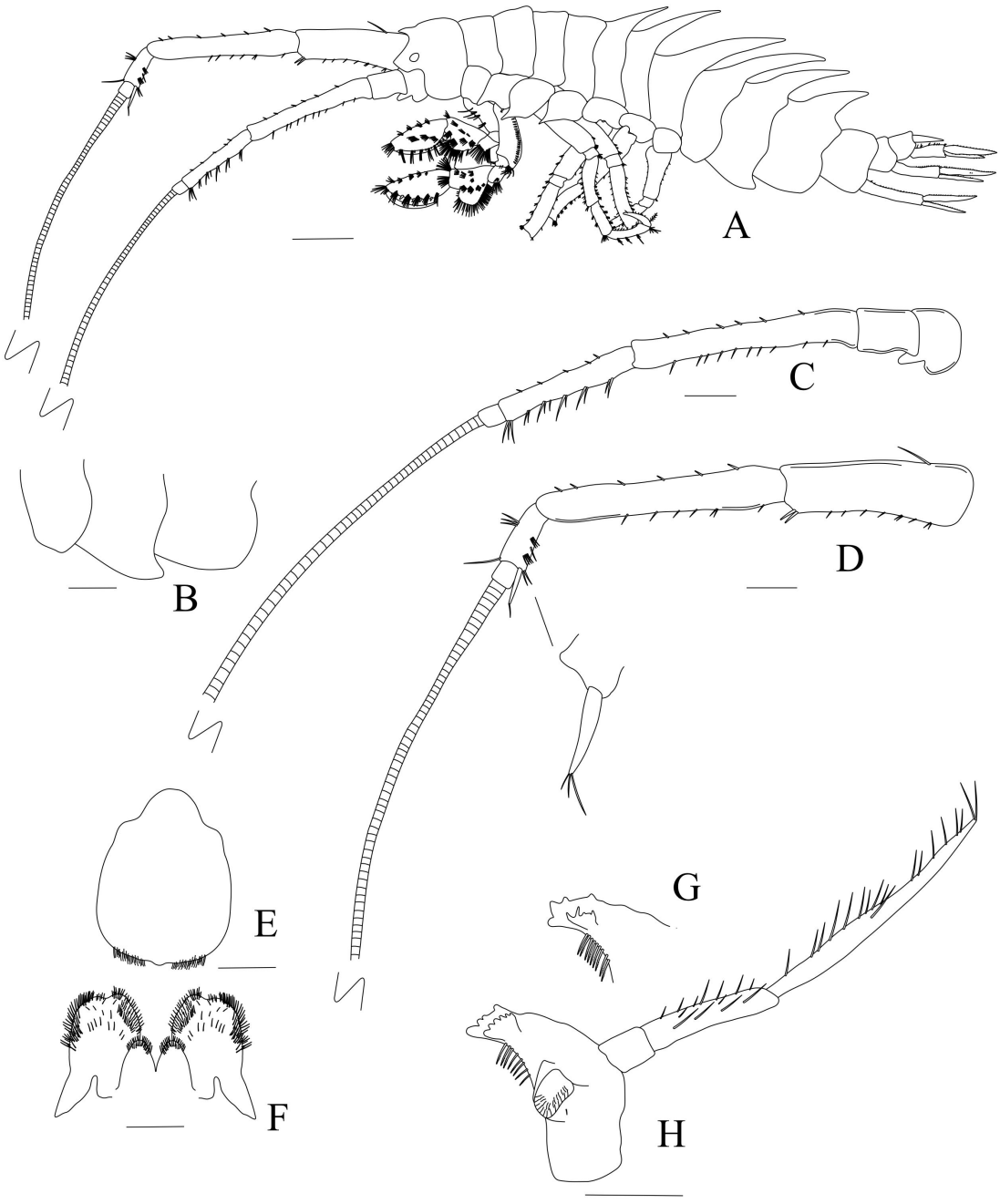

Figure 2. *Amathillopsis colemani* **n. sp.**, female holotype (UMML 32.10450). **A)** habitus; **B)** epimera; **C)** antenna 1; **D)** antenna 2; **E)** upper lip; **F)** lower lip; **G)** left mandible (cutting edge and *lacinia mobilis*) and **H)** right mandible. Scale bars: A, 2 mm; B-D, 1 mm and E-H, 0.5 mm.

Upper lip (Fig. 2E): slightly wider than long with rounded to truncate margin, entire.

Lower lip (Fig. 2F): small inner lobes present, outer lobes wide and distally rounded, with groups of stout setae.

Left mandible (Fig. 2H), incisor with 4 teeth; *lacinia mobilis* wide, with 6 similar teeth; raker row present; *pars molaris* weakly ridged; palp with elongate articles 2–3, bordered with setae on ventral margin, article 3 longest, slender and tapering. Right mandible (Fig. 2G), incisor with 4 teeth, *lacinia mobilis* wide, with 4 pointed teeth.

Maxilla 1 (Fig. 3A): inner lobe wide distally, with 4 plumose setae; outer plate with 11 slender apical setae; palp 2- articulate, article 1 expanded distally, article 2 tapering, with a row of setae laterally and a group of setae mediodistally.

Maxilla 2 (Fig. 3B): outer plate longer than inner one; inner plate expanded; both plates with long setae distally and medially.

Maxillipeds (Fig. 3C): slender and covered with numerous setae; inner plates short, distally truncate, with 3 nodular setae medioapically; outer plates slender with a row of setae medially and long apical setae; palp articles 2–4 elongate, article 3 and 4 subequals in length; article 4 with long setae on anterior surface, dactylus stout.

Gnathopod 1 (Fig. 3D) subchelate: coxa 2/3 the length of coxa 2–4 and narrower, with anteroventral shallow excavation; basis anterior margin straight, posterior margin convex, drawn out into a short, rounded lobe posterodistally, submarginal short setae, medial face proximally with few setae; ischium shorter than wide, with long setae on distal margin; merus with long setae apically; carpus distally expanded with posterior wide lobe and covered with setae medially and posteromarginally; propodus with convex posterior margin, with a row of stout setae posteromarginally and groups of long setae on medial and lateral face; dactylus long, with row of minute hair-like setae on posterior and few on anterior margin.

Gnathopod 2 (Fig. 3E) subchelate: coxa with shallow ventral excavation, anteroventrally subacute; basis anterior margin straight, posterior margin convex, drawn out into a rounded lobe posterodistally, submarginal short setae, medial face proximally with few setae; ischium narrower than on pereopod 1, subquadrate; merus longer than wide with group of setae apically; carpus distally expanded, with setae on medial face and posteromarginally, carpus drawn out into lobe posteriorly; propodus narrower and longer than that of gnathopod 1, posterior margin convex with stout short setae; dactylus long, with row of minute hair-like setae on posterior and few on anterior margin.

Pereopod 3 (Fig. 3F): coxa longer than on preceding appendages, apex oblique with shallow depression, subacute; basis subrectangular with oblique apex; ischium narrow; merus subequal to propodus; propodus without stout spine on posterior margin; dactylus falcate.

Pereopod 4 (Fig. 4A): coxa with oblique rather straight apex, subacute to rounded, slightly longer compared to pereopod 3; basis with straight anterior and weakly convex posterior margins; ischium shortest; merus curved posteriorly with groups of long setae on posterior margin; carpus slightly expanded distally; propodus about the length of basis, without stout spine in distal half of posterior margin, dactylus falcate.

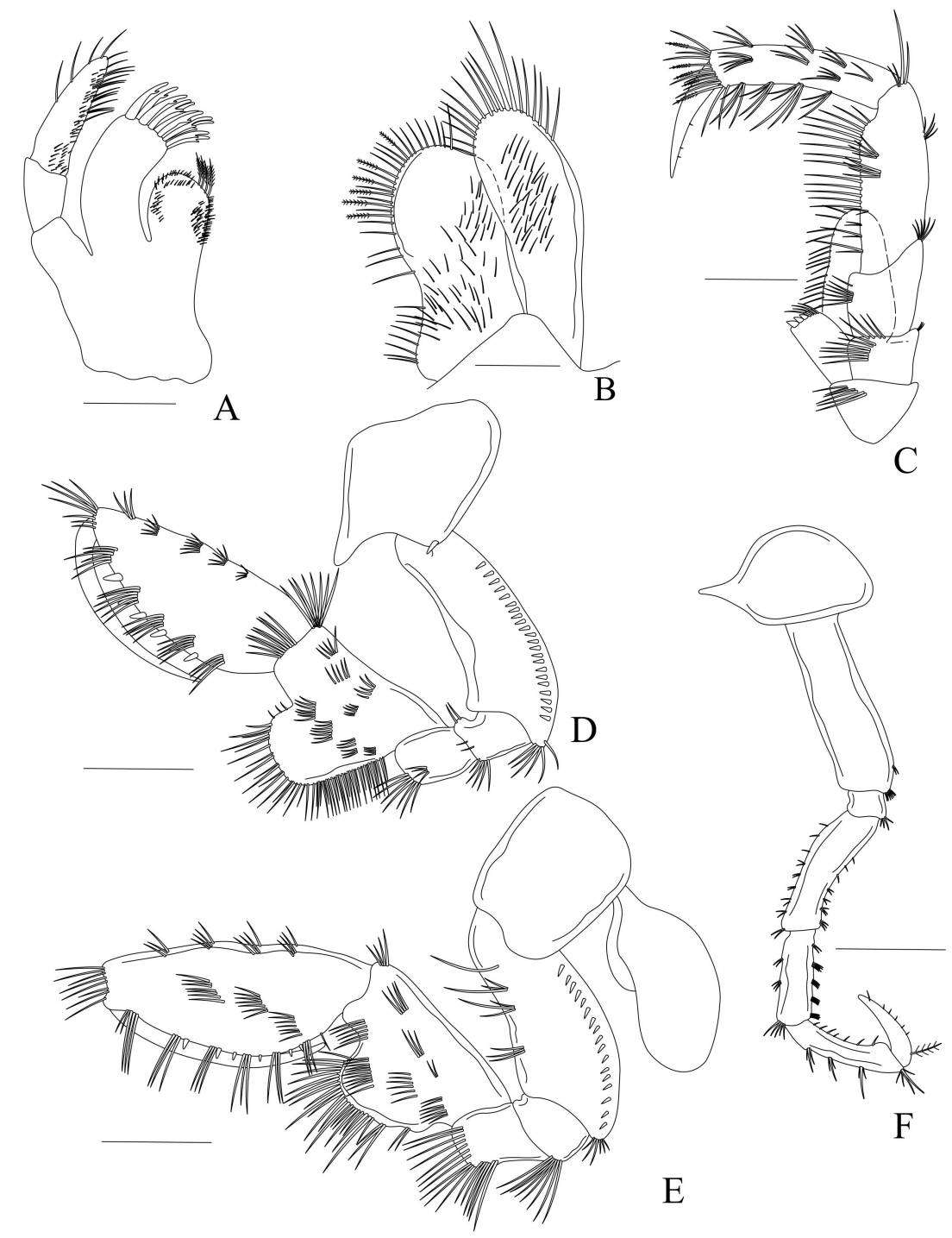

Figure 3. *Amathillopsis colemani* **n. sp.**, female holotype (UMML 32.10450). **A)** maxilla 1; **B)** maxilla 2; **C)** maxilliped; **D)** gnathopod 1; **E)** gnathopod 2 and **F)** pereopod 3. Scale bars: 0.5 mm.

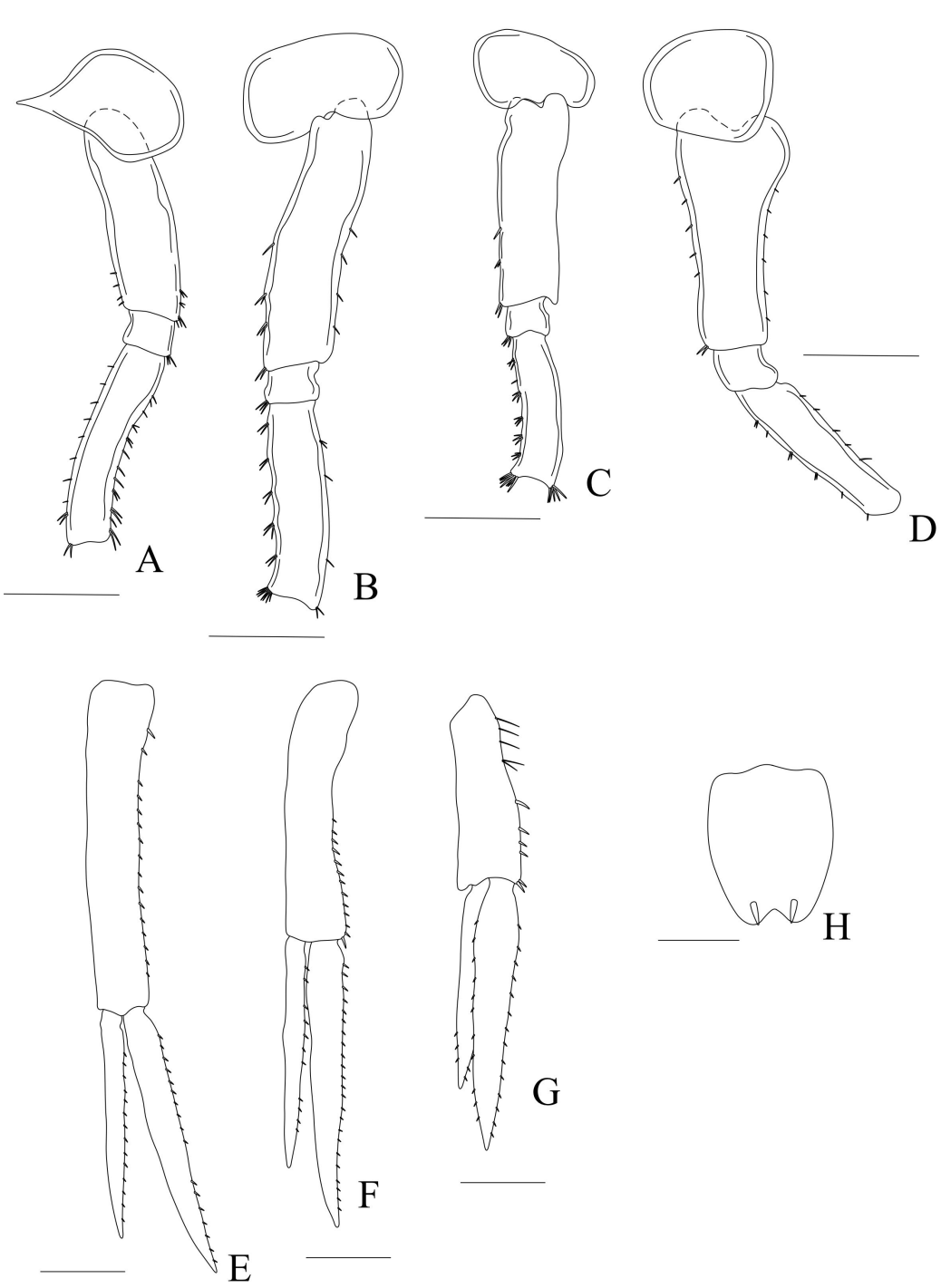

Figure 4. *Amathillopsis colemani* **n. sp.**, female holotype (UMML 32.10450). **A)** pereopod 4; **B)** pereopod 5; **C)** pereopod 6; **D)** pereopod 7; **E)** uropod 1; **F)** uropod 2; **G)** uropod 3 and **H)** telson. Scale bars: 0.5 mm.

Pereopod 5 (Fig. 4B): longest; coxa wider than long; basis sub-rectangular with proximal short rounded lobe, directed dorsally; ischium posteriorly excavate; merus and carpus somewhat expanded distally with groups of long stout setae anteromarginally; propodus subequal to those of preceding appendages, slightly curved anteriorly; dactylus long, slender and falcate.

Pereopod 6 (Fig. 4C): shorter than pereopod 5; coxa similar in shape to that of pereopod 5, but anterior margin straight; ischium shortest with excavation posteromarginally; merus and carpus weakly expanded distally; propodus curved anteriorly; long setae on anterior margin of merus to propodus; dactylus falcate.

Pereopod 7 (Fig. 4D): shorter than pereopods 5 and 6; coxa smallest of all pereopods, with short ventral lobe; basis shorter and wider proximally compared to pereopods 5 and 6, tapering distally; ischium to dactylus of similar shape as pereopod 6.

Uropod 1 (Fig. 4E): peduncle larger than inner ramus. Uropod 2 (Fig. 4F): peduncle almost larger than inner rami. Uropod 3 (Fig. 4G): peduncle wide with some stouter spines on outer margin, outer ramus shortened.

Telson (Fig. 4H): longer than wide, with shallow excavation distally, with one pair of spines.

Color: antenna pale white to translucent at distal ends, darken to pale orange closer to the body; mouthparts and anterior part of the body dark orange to reddish; body fades to light, pale orange moving posteriorly along the body to telson (Fig 1).

Size: total length 17 mm.

Habitat. Deep waters of the Gulf of Mexico (1200 m), associated with octocorals.

Distribution. Only known for the type locality.

Type Locality. Northern Gulf of Mexico (27° 16’ N and 85° 49’ W).

Etymology.This species is dedicated to Dr. Charles Oliver Coleman for his contribution to the knowledge of Amphipoda.

Remarks. *Amathillopsis colemani* **n. sp.** is characterized by the presence of eyes, a trait shared by four species within the genus including *A. charlottae* Coleman, 1998 from the Antarctic Ocean, *A. septemdentata* Ledoyer, 1978 from Madagascar, *A. spinigera* Heller, 1875, from the North Atlantic Ocean, and *A. takahashiae* Tomikawa & Mawatari, 2006 from Japan. However, the new species can be distinguished from all others when comparing additional morphological features. In *A. charlottae*, pereonites 2–4 have a middorsal keel and the telson is entire, whereas in *A colemani* **n. sp.** there is no middorsal keel on pereonites 2–4 and the telson is notched. In *A. septemdentata*, urosomite 1 has a middorsal tooth and the telson rounded, whereas *A. colemani* **n. sp.** lacks a middorsal tooth on urosomite 1 and the telson is notched. In *A. spinigera,* pereonites 1–4 have middorsal teeth and a 2-articulate accessory flagellum, whereas *A. colemani* **n. sp.** lacks middorsal teeth on pereonites 1–4 and has a uniarticulate antenna 1 accessory flagellum. In *A. takahashiae*, the mid-dorsal projections on pereonites 5–7 appear as

one rounded hump on 5 and acute on 6–7, the relative length of mandibular palp article 3 against article 2 is 0.9, the relative length of the outer ramus against the inner ramus of the uropod 1 is 1, and telson with dorsolateral margins with pair of penicillate setae. In *A. colemani* **n. sp.**, the mid-dorsal projections on pereonites 5–7 are acute across all, the relative length of mandibular palp article 3 against article 2 is 0.5, the relative length of the outer ramus against the inner ramus of the uropod 1 is 0.8, and telson with one pair of dorsolateral spines These morphological differences, combined with the geographical distance between all species, provides evidence that the Gulf of Mexico specimen represents a new species. However, a detailed molecular study across all species should be conducted.

This is the first species of the genus *Amathillopsis* recorded for the Gulf of Mexico. This study reveals the untapped diversity left in the deep sea and highlights the need to study the ecological associations between deep-sea organisms.

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