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NEW SPECIES OF THE GENUS *TYPHLATYA* (DECAPODA: ATYIDAE) FROM ANCHIALINE CAVES IN MEXICO, THE BAHAMAS, AND HONDURAS

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A B S T R A C T

Three new species of the genus *Typhlatya* from anchialine caves in Mexico (*T. dzilamensis*), the Bahamas (*T. kakuki*), and Honduras (*T. utilaensis*) are described. *Typhlatya dzilamensis* is the fourth species to be described from the Yucatan Peninsula, Mexico, and is morphologically similar to *T. mitchelli*. *Typhlatya kakuki* is the first species of the genus to be described from the Bahamas archipelago. Its morphology departs from the patterns showed by the Cuban species, which are the closest geographically. *Typhlatya utilaensis* is the first species described from Central America, and is found in Utila, one of the Honduras Bay Islands. Morphologically, *T. utilaensis* is related to *T. monae* from Mona Island, Puerto Rico, and Barbuda. A revised diagnosis of the genus and a key for the 17 known species are provided.

The genus *Typhlatya* is composed of 17 species of small shrimps of less than 20 mm in total length, all troglobitic, inhabiting caves and cenotes. Of these, 14 species were previously reported as follows: *T. iliffei* Hart and Manning, 1981 (Bermuda); *T. garciai* Chace, 1942 (Cuba, Caicos Islands); *T. consobrina* Botosaneanu and Holthuis, 1970 (Cuba); *T. taina* Estrada and Gómez, 1987 (Cuba); *T. elenae* Juarrero de Varona, 1994 (Cuba); *T. garciadebrasi* Juarrero de Varona and Ortiz, 2000 (Cuba); *T. pearsei* Creaser, 1936 (Mexico); *T. mitchelli* Hobbs and Hobbs, 1976 (Mexico); *T. campecheae* Hobbs and Hobbs, 1976 (Mexico); *T. monae* Chace, 1954 (Puerto Rico, Barbuda, Dominican Republic); *T. rogersi* Chace and Manning, 1972 (Ascension Island); *T. galapagensis* Monod and Cals, 1970 (Galapagos Islands); *T. pretneri* (Matjašič, 1956) (Hercegovina); and *T. miravetensis* Sanz and Platvoet, 1995 (Spain). The remaining three species herein described are *T. dzilamensis* from northern Yucatan, Mexico; *T. kakuki* from Acklins Island, Bahamas; and *T. utilaensis* from Utila Island, Honduras.

The disjunct distribution of the genus around the Caribbean, in Europe, and the Galapagos and Ascension Islands, together with an ability to thrive in a variety of salinity conditions, from completely fresh to full strength marine water, makes *Typhlatya* an interesting group to test biogeographical hypotheses. There has been discussion of how species of *Typhlatya* have managed to invade caves, sometimes located along the coast, but also at considerable distances inland (Hobbs and Hobbs, 1976), in geologically related but geographically distant areas (Sanz and Platvoet, 1995). The description of new species from more new areas in the Caribbean provides more distributional data, and information on the probable age of each species because the geology of the region has been intensively studied (Dengo and Case, 1990; Graham, 2003). In this study, we describe three new anchialine species from Mexico, Bahamas, and Honduras, and provide an updated diagnosis of the genus and a key to all the species in the genus.

Materials and Methods

Specimens of *Typhlatya dzilamensis* were collected during a documentary filming expedition to the Yucatan Peninsula of Mexico in March and April 2002. They were hand collected by divers using individual vials from three caves as follows: Cenote Cervera (21°22.506′N, 88° 50.011′W), Dzilam de Bravo, Yucatan, 31 March 2002 (Fig. 1). The water-filled cave is located 3.6 km inland from the northern, Gulf of Mexico coast of the Yucatan Peninsula. The entrance consists of a 6 m wide by 12 m long open-air pool. Surface water in the pool was murky but cleared up below about 10 m. Passages at 20 to 25 m depth extended from the south side of the pool, reaching a maximum depth of 27 m. Surface water was fresh, but a halocline occurred at about 25 m depth and was underlain by fully marine waters. Shrimp were typically observed walking on the silt bottom below the halocline. Also collected from the cave were cirolanid isopods (*Creaseriella anops*), mysids, and thermosbaenaceans. Cenote Dzilamway, Dzilam de Bravo, Yucatan, 3 April 2002. This cave is located in a mangrove swamp east of the town of Dzilam de Bravo about 100 m inland from the Gulf of Mexico. The entrance consists of a 20 m diameter and 5 m deep, basin-like spring with a submerged cave passage extending horizontally off at the bottom. This low passage was explored for several hundred meters at a maximum depth of 11 m. Water at depth was fully marine. Shrimps were observed walking about on the sediment, but were most numerous around several depressions that contained milky, sulfurous waters. Cenote Buya Uno, Dzilam de Bravo, Yucatan, 3 April 2002. The submarine cave entrance is located about 300 m offshore from the coast in open waters of the Gulf of Mexico. The entrance of this tidal spring consists of a collapsed depression in 3 m water depth with a horizontal cave passage extending towards land at a maximum depth of 10 m. The first 100 m or so of cave passage was extremely low (about 50 cm), but the cave began to enlarge past this point. One shrimp was collected from bottom sediments and rocks. Also collected from the cave were cirolanid isopods (*Creaseriella anops*).

Specimens of *Typhlatya kakuki* were collected from two caves during an expedition to Crooked and Acklins Islands, Bahamas, in January 1999. Shrimp Hole (22°13.074′N, 74°11.945′W), Salinas Point, Acklins Island, Bahamas, 14 January 1999. It is located one kilometer northeast of Liza Bay Cave on the west side of the main highway to the Salinas Point settlement. It consists of a 5 m long by 3 m wide and 2 m deep anchialine pool in a shallow karstic depression. The cave appeared to extend off from the main pool as a low crack about a silt bottom. Surface salinity as measured with a refractometer was 10.5‰, but below a well -defined halocline at 15 cm depth, it increased to 35‰ at 2 m. A plankton net was used to collect very abundant shrimp and copepods from the water column, rock walls and bottom sediments. Liza Bay Cave (22°12.795′N,

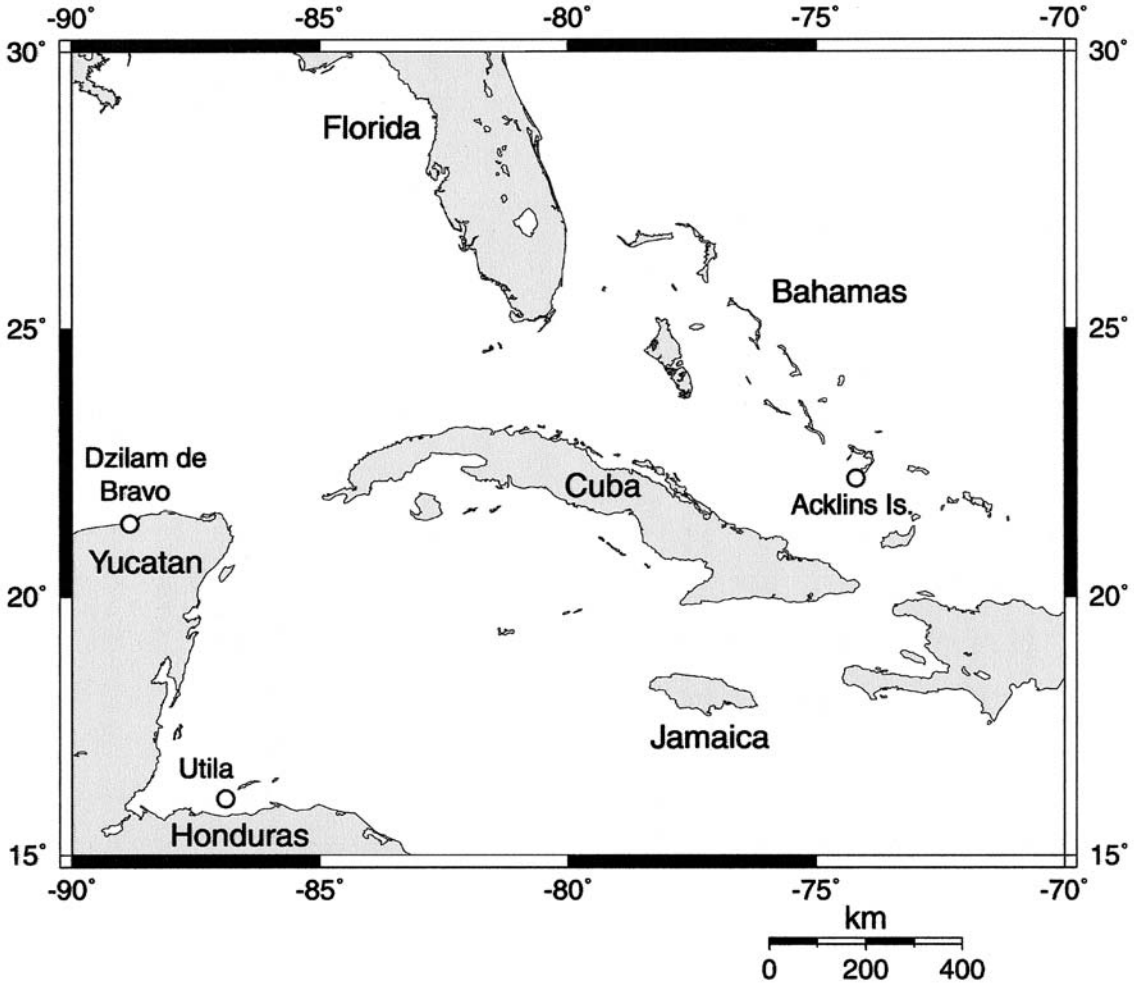

Fig. 1. The northern Caribbean Sea and Bahamas, showing the locations of principal caves from which new *Typhlatya* were collected. Map from Online Map Creation at: http://www.aquarius.geomar.de/omc/.

74°12.402′W), Salinas Point, Acklins Island, Bahamas, 14 January 1999. This large cave, which is inhabited by bats, contains a series of interconnected rooms and shallow, high-salinity (34‰) pools. The cave is the type locality for the stygobitic laomediid shrimp *Naushonia manningi*; see Alvarez *et al*. (2000) for a description of this cave and map showing its location. Specimens of *Typhlatya*, along with copepods and amphipods, were collected with a plankton net from a 5 m deep pool in one corner of the cave. The copepods include the epacteriscid *Cryptonectes brachyceratus*, recently described as a new genus (Fosshagen and Iliffe, 2004).

Specimens of *Typhlatya utilaensis* were collected during an expedition to Utila in Bay Islands of Honduras in 1996. Utila is a 20 km^2 island consisting of about 80% mangrove swamps with limestone ridges sloping from the west. While the other Bay Islands are mostly volcanic, Utila is primarily composed of karstic limestone. George Gaberel's Cave, Utila, Bay Islands, Honduras, 5 May 1996. This cave consists of a small sinkhole in a cow pasture. A shallow, 1.5 m long by 0.5 m wide pool at the bottom of the sinkhole extends under a ledge and is floored by rocks and soil. Surface salinity was 1‰. Shrimps, along with copepods, amphipods, and thermosbaenaceans, were collected with a plankton net from 0–20 cm depths. The shrimps had yellow internal organs and red chromatophores at the base of the antennae and on the telson and uropods.

Material of the new species treated herein is deposited in the Colección Nacional de Crustáceos, Instituto de Biología, Universidad Nacional Autónoma de México (CNCR). The abbreviations used are: cl = carapace length, tl = total length, my = million years, mya = million years ago.

Results

Typhlatya Creaser, 1936

Diagnosis.—Body generally without coloration, occasionally light yellow to pink. Carapace smooth, without spines; anterior margin without antennal spine. Rostrum unarmed, never reaching beyond distal article of antennular peduncle. Eyes with or without pigmentation, lacking facets. Mandibles without palp. Third maxilliped with arthrobranch. First and second pereiopods with distal portion of carpus excavated, chelae similar in shape. First to fourth pereiopods with epipodites. All pereiopods with exopods, that of last pair may be reduced or absent.

Distribution.—In anchialine and freshwater caves and cenotes around the Caribbean; in anchialine caves in Bermuda, the Bahamas, Galapagos Islands, and Ascension Island; and in freshwater caves in Spain and Hercegovina.

Type Species.—*Typhlatya pearsei* Creaser, 1936.

Typhlatya dzilamensis, new species
Figs. 2, 3

Holotype.—♂, cl 6.5 mm, tl 19.2 mm; 3 April 2002; Cenote Buya Uno, Dzilam de Bravo, Yucatan, Mexico; collected by T. M. Iliffe; CNCR 21795.

Allotype.—♀, cl 7.6 mm, tl 21.6 mm; 31 March 2002; Cenote Cervera, Dzilam de Bravo, Yucatan, Mexico; collected by T. M. Iliffe; CNCR 21796.

Paratypes.—♂, cl 7.0 mm, tl 19.4 mm; 3 April 2002; Cenote Dzilamway, Dzilam de Bravo, Yucatan, Mexico, collected by T. M. Iliffe; CNCR 21797. 4 ♀♀, cl 5.6, 6.6, 8, 8.2 mm, tl 16.5, 19.2, 24.2, 23.7 mm; same date, locality and collector as allotype; CNCR 21796.

Description of Holotype.—Rostrum unarmed, anteriorly oriented, reaching distal margin of eyes, triangular in dorsal view (Figs. 2A, G). Carapace smooth, devoid of spines; in lateral view, dorsal and ventral margins slightly arched; anterior margin, from antennal angle to pterygostomian angle, straight; antennal and pterygostomian angles simple, not produced; posterior margin laterally expanded, overlapping with first abdominal somite (Fig. 2A). Eyes reduced, not pigmented.

Abdomen smooth. Anterior margin of pleura of first somite under posterior portion of carapace. Second somite with pleura broadly rounded, anterior and posterior margins asymmetrical. Pleura of somites 3–4 with posterolateral margin rounded. Fifth somite with posterolateral margin of pleura acute. Sixth somite the longest, 1.4 times length of fifth, middle portion of posterior margin produced. Telson slightly shorter than uropods; elongated, anterior width 2.8 times posterior width; with 2 pairs of articulated, dorsal spines on posterior third. Posterior margin of telson slightly arched, central portion slightly concave; with 3 pairs of spines: external pair the smallest; second pair the largest, 3 times as long as external pair; internal pair 2 times as long as external pair; 2 pairs of setae on middle portion of margin, external pair longer than internal one (Fig. 2F).

Antennular peduncle shorter than antennal scale (Fig. 2G). Stylocerite well developed, blade-like, ending in sharp tip anteriorly, reaching distal margin of basal segment. Second antennular segment twice as wide as long, segments of internal flagellum shorter. Antenna with scaphocerite twice as long as broad, anterolateral margin with small spine, not reaching distal margin.

Mandibles asymmetrical, molar processes with minute striations, dense line of setae between molar and incisor processes. Incisor process of left mandible with 10 teeth, right mandible with 7 teeth (Figs. 2B, C).

First maxilla with distal lacinia approximately rectangular, mesial margin lined with short setae; proximal lacinia broadly rounded, mesial margin with setae increasing in size distally; palp shorter than distal lacinia, with 2 subdistal large setae (Fig. 2H).

Second maxilla with scaphognathite bordered with plumose setae, increasing in size distally and mesially, distal lobe broader than proximal one; palp small, finger-like, unsegmented, devoid of setae; distal endite approximately rectangular, bordered with thick, dense setae along gnathal margin, submarginal row of setae except on distal corner; proximal endite rounded, with thick, dense setae on gnathal margin (Fig. 3A).

First maxilliped with exopod formed by rounded portion bordered with long, plumose setae, corresponding to caridean lobe, and elongated mesial projection, corresponding to flagellar lobule (Fig. 2D). Palp small, narrow proximally, wider distally, devoid of setae. Distal endite with marginal and submarginal rows of thick, dense setae; proximal endite rounded, bearing long plumose setae mesially.

Second maxilliped subpediform, endopod 5-segmented, gnathal border of distal article with dense, uniform setae; exopod about twice as long as endopod (Fig. 2E).

Third maxilliped pediform, reaching beyond distal margin of scaphocerite with half of distal segment. Endopod 3-segmented; distal segment longest, proximal three-fourths with thick short setae along mesial margin, distal fourth with 5 strong spines. Exopod slender, not reaching distal margin of second segment of endopod, distal portion bearing long plumose setae (Fig. 3G).

First pair of pereiopods with exopod reaching proximal third of propodus, distal portion with long plumose setae; carpus hollowed distally, 2.5 times as long as maximum width, longer than propodus, shorter than ischium and merus combined; chela 2.7 times as long as wide, with dense tuft of setae (Fig 3B).

Second pair of pereiopods longer, more slender than first pair; exopod reaching distal margin of merus, tip with plumose setae; carpus hollowed distally, 4.1 times as long as maximum width, longer than propodus, 0.7 times length of ischium and merus combined; chela 3.2 times as long as wide, with dense tuft of setae (Fig. 3C).

Third pair of pereiopods slender; ischium and merus fused, slightly arched, not straight, with 4 strong spines along ventral margin; exopod 0.6 times length of ischium and merus combined, tip with plumose setae; carpus approximately one-third length of ischium and merus combined; propodus 0.6 times length of ischium an merus combined, with 7 small spines along ventral margin; dactyl with 7 spines on flexor margin (Fig. 3D).

Fourth pair of pereiopods similar to third pair, differing in having dactyl with 8 spines (Fig. 3E).

Fifth pair of pereiopods slender, ischium and merus fused, slightly arched, not straight, bearing 3 spines on distal third of ventral margin; exopod approximately half length of ischium and merus combined, tip with plumose setae; carpus about one-third length of ischium and merus combined; propodus with scattered setae, 0.7 times length of ischium and merus combined; dactyl ending in sharp tip, with line of dense short setae on flexor margin (Fig. 3F).

Epipodites present from third maxilliped to fourth pereiopod, reduced to small blunt hump on fifth pereiopod.

First pair of pleopods in both sexes with endopod reduced, devoid of setae, without appendix interna (Fig. 3H); pairs 2–5 with appendix interna slender, approximately one-third length of endopod. Second pair in males with appendix masculina thicker, 0.8 times length of appendix interna, with rounded distal end bearing 12 setae (Fig. 3I).

Uropods with both rami of about the same length, reaching beyond tip of telson. Endopod oval-shaped, bordered with long setae except for proximal portions of margin. Exopod with straight external margin ending in movable spine, bordered with long setae from posterolateral spine to mesial margin; diaeresis complete, strongly marked laterally, becoming less distinct mesially (Fig. 2F).

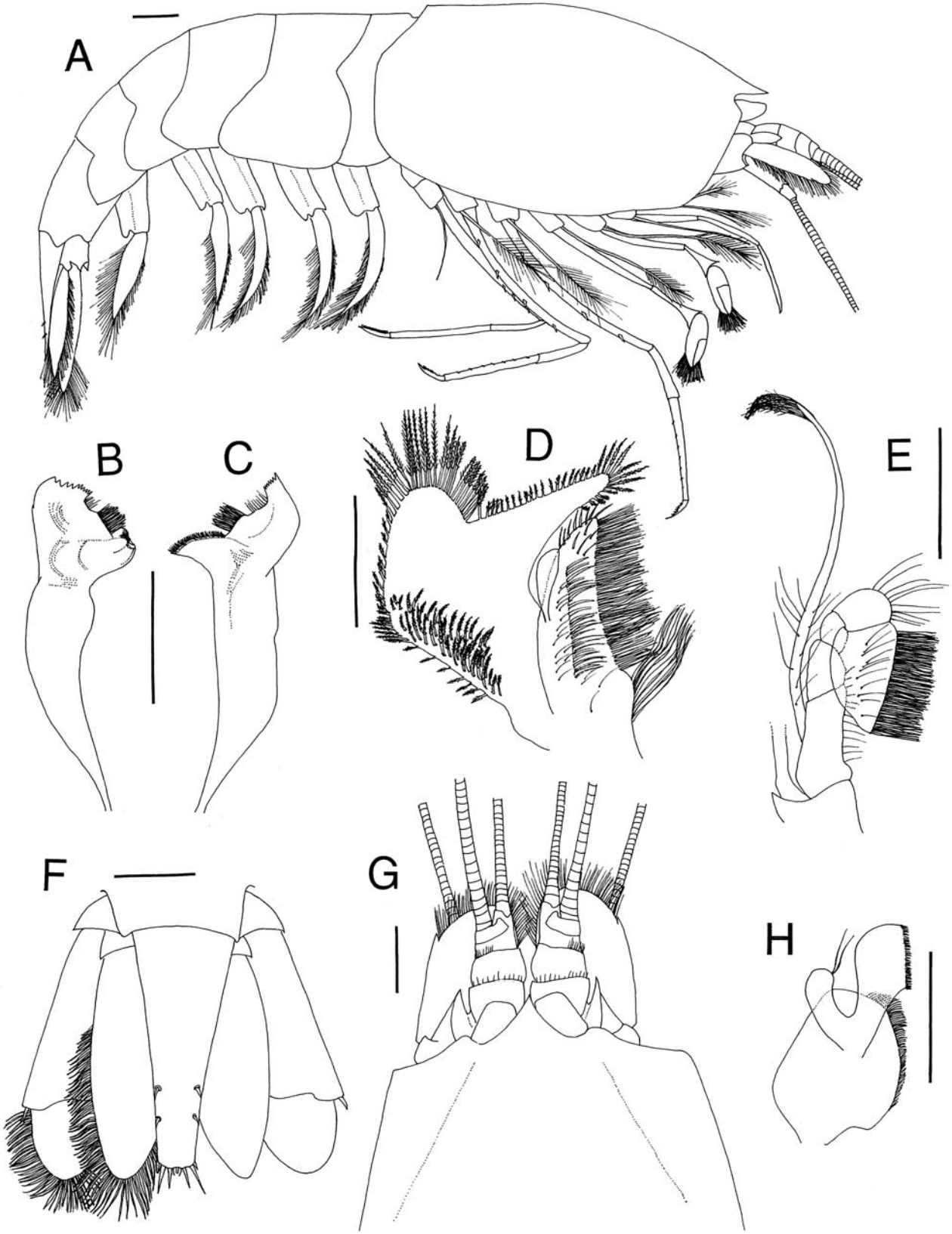

Fig. 2. *Typhlatya dzilamensis*, new species, male holotype: A, body, lateral view; B, left mandible; C, right mandible; D, first maxilliped; E, second maxilliped; F, dorsal view of telson and uropods, setae of right uropod omitted; G, dorsal view of anterior portion of carapace; H, first maxilla. Scale bars represent 1 mm.

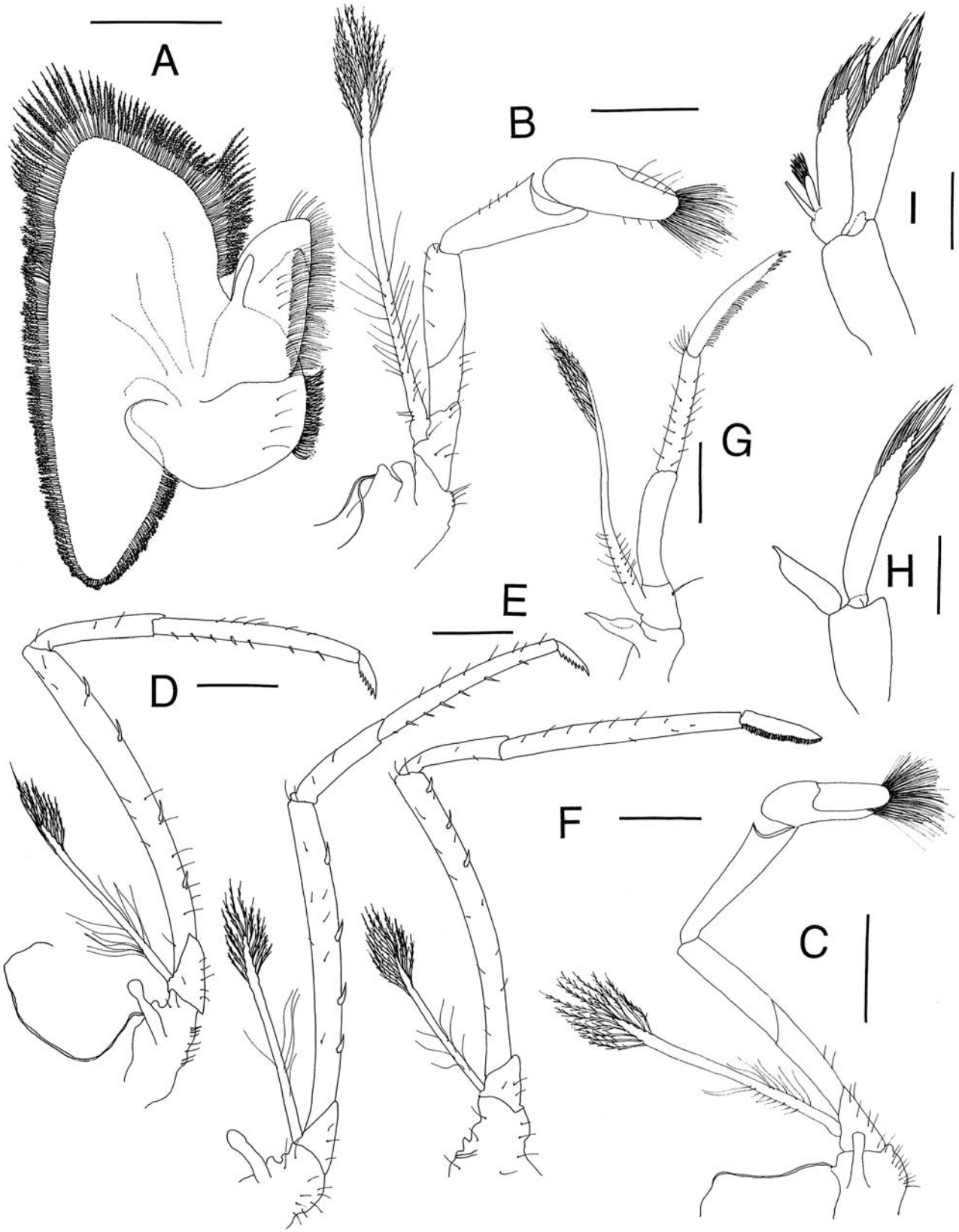

Fig. 3. *Typhlatya dzilamensis*, new species, male holotype: A, second maxilla; B, first pereiopod; C, second pereiopod; D, third pereiopod; E, fourth pereiopod; F, fifth pereiopod; G, third maxilliped; H, first pleopod; I, second pleopod. Scale bars represent 1 mm.

Etymology.—The specific epithet is derived from "Dzilam de Bravo," the name of the town where the type locality is found in northern Yucatan, Mexico.

Remarks.—*Typhlatya dzilamensis* is the fourth species to be described from the Yucatan Peninsula in Mexico. The type locality, near the town of Dzilam de Bravo, is located in the central portion of the northern coast of the peninsula. Interestingly, while the ranges of *T. mitchelli* and *T. pearsei* overlap considerably over the north central portion of the peninsula, *T. dzilamensis* appears to be in an area where no other *Typhlatya* species are present, with the nearest locality for *T. pearsei* 40 km to the west in the town of Telchac Puerto (Hobbs and Hobbs, 1976).

Morphologically, *T. dzilamensis* is more similar to *T. mitchelli* than to the other two Mexican species. However, the two species can be easily distinguished because in *T. mitchelli* the rostrum is directed upwards, is short, and is acuminate in dorsal view, whereas in the new species it is directed frontwards, it reaches the distal margin of the eyes, and is triangular in dorsal view; in *T. mitchelli* the carpi of pereiopods 1–2 are longer and thinner; and in *T. dzilamensis* there are three pairs of spines and two pairs of setae on the distal margin of the telson versus two pairs of spines and two pairs of spiniform setae in *T. mitchelli*. Other differences include in the new species: a short sixth abdominal segment, an antennal scale that is slightly longer than the antennular peduncle, a second maxilla with a scaphognathite composed of two rounded lobes, and a first maxilliped with a rounded caridean lobe and a more slender flagellar lobule. In contrast, *T. mitchelli* has: a sixth abdominal segment as long as the fourth and fifth segments combined, an antennal scale that reaches beyond the distal margin of the antennular peduncle with one third of its length, a second maxilla with a scaphognathite composed of a distal rectangular lobe and an elongated proximal lobe, and a first maxilliped in which the caridean lobe and the flagellar lobule form a continuous straight margin.

Typhlatya kakuki, new species
Figs. 4, 5

Holotype.—♂, cl 5.1 mm, tl 16.5 mm; 14 January 1999; Shrimp Hole, Salinas Point, Acklins Island, Bahamas; collected by T. M. Iliffe; CNCR 21791.

Allotype.—♀, cl 5.2 mm, tl 17.3 mm; same date, locality, and collector as holotype; CNCR 21792.

Paratypes.—2 ♂♂, cl 3.7, 5.4 mm, tl 11.1, 16.5 mm; same date, locality, and collector as holotype; CNCR 21793.

Other Material Examined.—♂, cl 19 mm, tl 6.4 mm; 4 ♀♀, cl 10.7, 17.4, 18, 18.6 mm, tl 3.8, 5.9, 6, 6.2 mm; same date and collector as holotype; Liza Bay Cave, Salinas Point, Acklins Island, Bahamas; CNCR 21794.

Description of Holotype.—Rostrum unarmed, oriented frontwards, not reaching distal margin of eyes, acuminate in dorsal view (Figs. 4A, G). Carapace smooth, devoid of spines; in lateral view, dorsal margin arched, ventral margin almost straight; orbit deeply excavated; anterior margin, from antennal angle to pterygostomian angle, straight; antennal angle slightly produced, pterygostomian angle simple; posterior margin broadly rounded laterally, overlapping first abdominal somite (Fig. 4A). Depth of carapace similar to that of abdomen. Eyes reduced, with 2 clusters of pigmented granules each (Figs. 4A, G).

Abdomen smooth. Anterodorsal portion of pleura of first somite covered by posterior portion of carapace. Second somite with pleura broadly rounded, anterior and posterior margins asymmetrical. Posteroventral angles of pleura of somites 3–5 becoming more acute posteriorly; notch on middle portion of posterior margin of pleura of somites 4–5. Sixth somite the longest, almost 1.5 times length of fifth, middle portion of posterior margin produced. Telson shorter than uropods, anterior width 2.5 times posterior width; with 2 pairs of movable, dorsal spines on posterior third. Posterior margin of telson rounded, with 4 pairs of spines: external pair the shortest; second pair the largest, three times as long as external pair; third and fourth pairs progressively decreasing in size (Fig. 4F).

Antennular peduncle 0.7 times length of antennal scale (Fig. 4G). Stylocerite well developed, blade-like, ending in sharp tip anteriorly, reaching beyond articulation of first and second antennular segments. Second antennular segment 1.2 times as wide as long, segments of internal flagellum shorter. Antenna with scaphocerite twice as long as broad, lateral margin slightly arched, with small spine, not reaching distal margin.

Mandibles asymmetrical, molar processes with minute striations, dense line of setae between molar and incisor processes. Left mandible with incisor process with 4 rounded teeth, molar process with concave mesial surface. Right mandible with 4 sharp teeth, molar process with convex mesial surface (Figs. 4B, C).

First maxilla with distal lacinia approximately rectangular, mesial margin lined with short setae; proximal lacinia broadly rounded, mesial margin with setae increasing in size proximally; palp shorter than distal lacinia, with 4 setae on mesial margin (Fig. 4H).

Second maxilla with scaphognathite bordered with plumose setae, increasing in size distally, distal lobe broader than proximal one; palp small, finger-like, unsegmented, devoid of setae; distal endite approximately rectangular, twice as long as palp, bordered with thick, dense setae along gnathal margin, scattered submarginal setae; proximal endite rounded with thick, long setae along gnathal margin (Fig. 5A).

First maxilliped with exopod approximately trapezoidal, with long plumose setae along lateral and distal borders, line of submarginal setae next to lateral margin; flagellar lobule reduced, triangular, with scattered setae (Fig. 4D). Palp small, narrow proximally, becoming wider distally, bearing setae along distal margin. Distal endite as long as exopod, with marginal and submarginal rows of thick setae of uniform size; proximal endite bearing 12 long plumose setae.

Second maxilliped subpediform, endopod 5-segmented, gnathal border of distal article with dense, uniform setae; exopod less than twice the length of endopod; podobranch well developed (Fig. 4H).

Third maxilliped pediform, reaching slightly beyond distal margin of scaphocerite. Endopod 3-segmented, basal segment thickest, shortest, slightly arched distally; middle segment straight, with scattered seta; distal segment longest, with dense field of setae on ventral margin, ending in

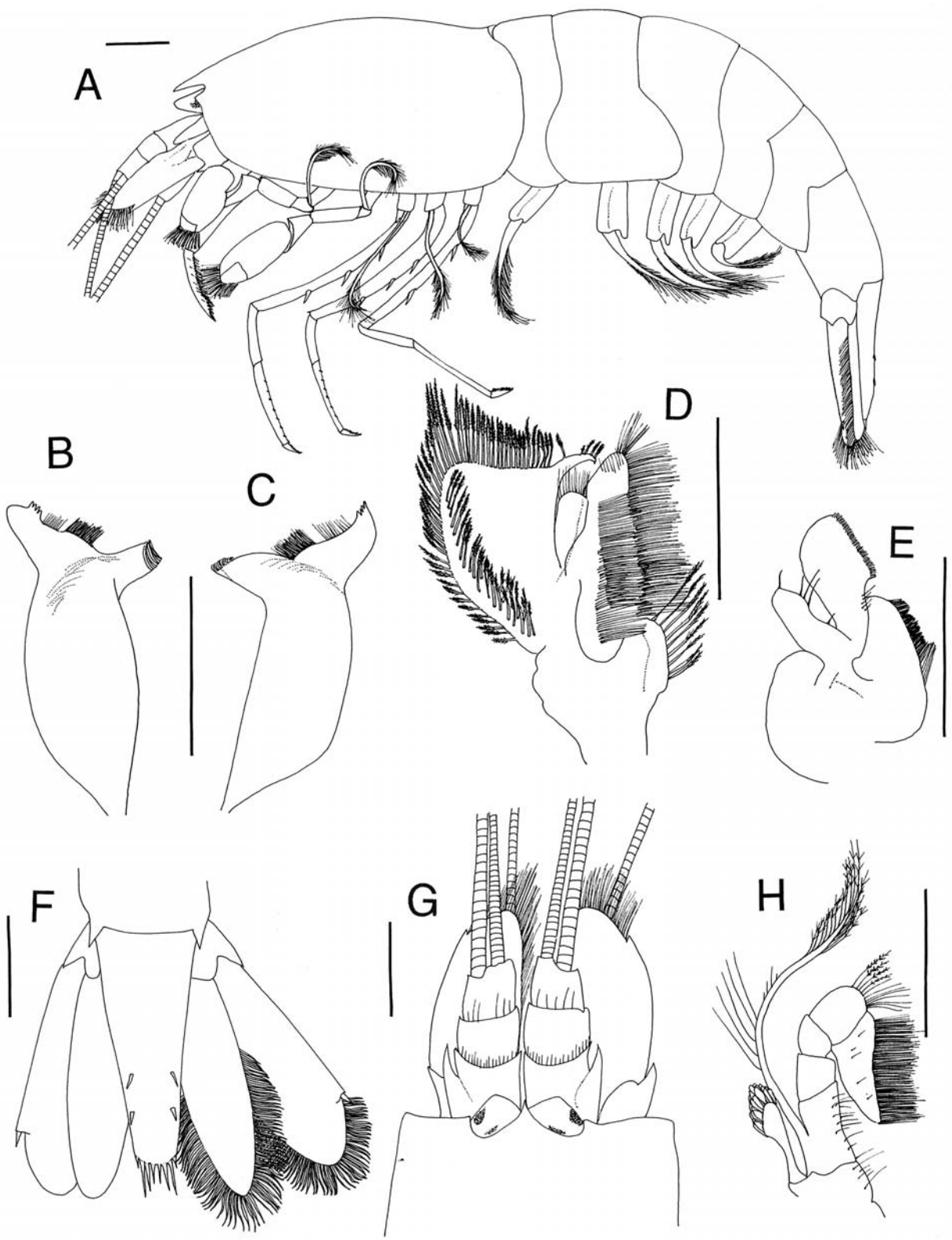

Fig. 4. *Typhlatya kakuki*, new species, male holotype: A, body, lateral view; B, left mandible; C, right mandible; D, first maxilliped; E, first maxilla; F, dorsal view of telson and uropods, setae of left uropod omitted; G, dorsal view of anterior portion of carapace; H, second maxilliped. Scale bars represent 1 mm.

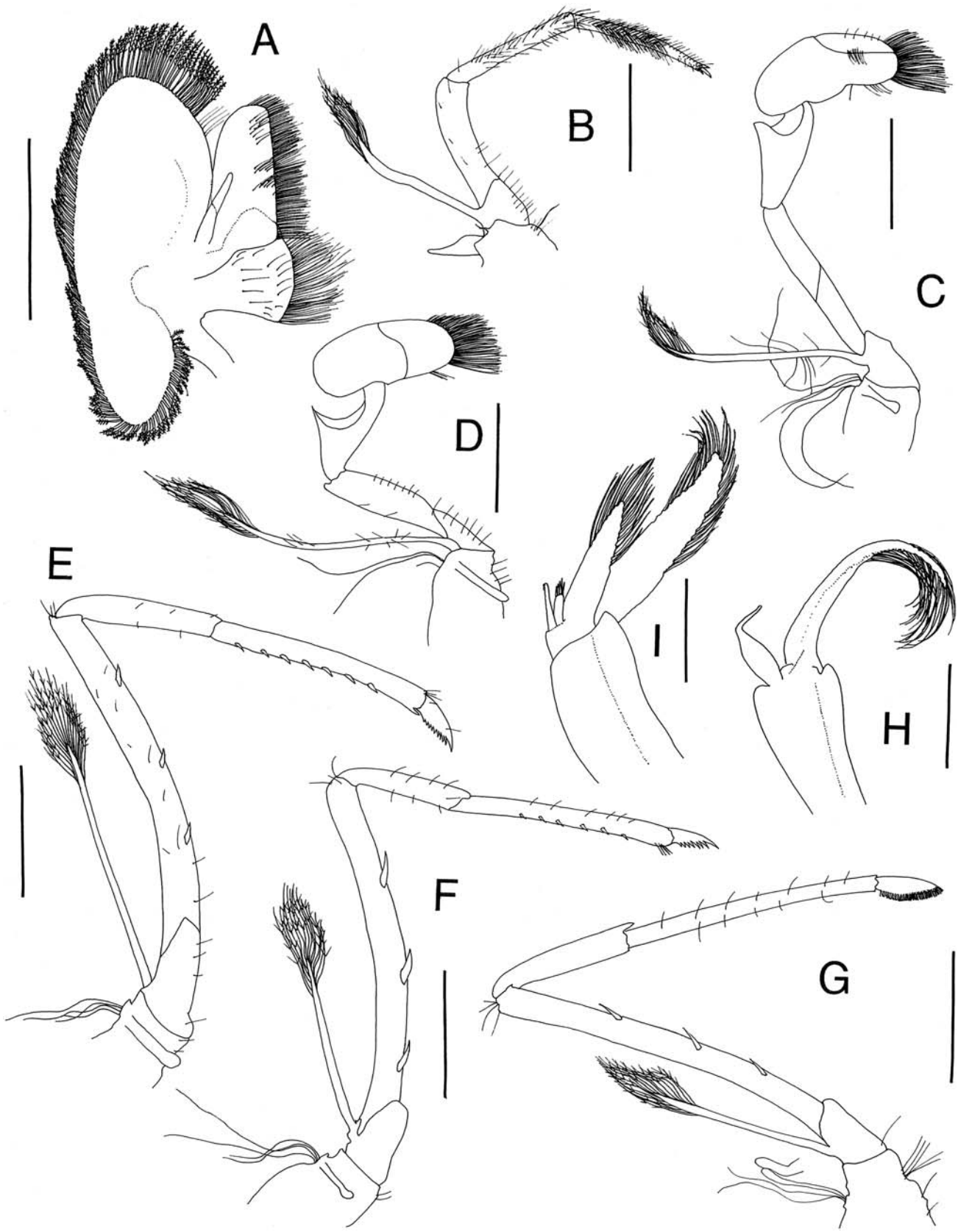

Fig. 5. *Typhlatya kakuki*, new species, male holotype: A, second maxilla; B, third maxilliped; C, second pereiopod; D, first pereiopod; E, third pereiopod; F, fourth pereiopod; G, fifth pereiopod; H, first pleopod; I, second pleopod. Scale bars represent 1 mm.

corneous tip, with 2 accessory spines (Fig. 5B). Exopod slender, not reaching distal margin of basal segment, distal portion bearing long plumose setae.

First pair of pereiopods stout, exopod reaching proximal portion of propodus, distal portion with long plumose setae; carpus hollowed, short, almost twice as long as wide, shorter than propodus; chela 2.2 times as long as wide, with dense tuft of setae (Fig. 5D).

Second pair of pereiopods longer, more slender than first pair; exopod reaching proximal portion of carpus, tip with plumose setae; carpus hollowed distally, short, twice as long as wide, 0.7 times length of propodus; chela 2.2 times as long as wide, with dense tuft of setae (Fig. 5C).

Third pair of pereiopods slender, ischium and merus fused, slightly arched, not straight, with 3 strong spines along ventral margin; exopod 0.7 times length of ischium and merus combined, tip with plumose setae; carpus 0.4 times length of ischium and merus combined; propodus 0.6 times length of ischium and merus combined, with 7 small spines along ventral margin; dactyl with 10 spines on flexor margin (Fig. 5E).

Fourth pair of pereiopods similar to third pair, differing in exopod being 0.5 times length of ischium and merus combined, spines on ischium and merus stronger, propodus with 6 spines, dactyl with 8 spines on flexor margin (Fig. 5F).

Fifth pair of pereiopods slender, ischium and merus fused, slightly arched, not straight, bearing 3 spines evenly spaced; exopod approximately half length of ischium and merus combined, tip with plumose setae; carpus 0.4 times length of ischium and merus combined; propodus with scattered setae, 0.7 times length of ischium and merus combined; dactyl ending in sharp tip, with line of dense short setae on flexor margin (Fig. 5G).

Epipodites present from third maxilliped to fourth pereiopod, absent from fifth pereiopod.

First pair of pleopods in both sexes with endopod reduced, without appendix interna (Fig. 5H); pairs 2–5 with appendix interna slender, approximately one-third length of endopod. Second pair in males with appendix masculina thicker, 0.7 times length of appendix interna, with rounded distal end bearing 4 setae (Fig. 5I).

Uropods with both rami of about same length, reaching beyond tip of telson. Endopod oval-shaped, bordered with long setae except for proximal portions of margin. Exopod with straight external margin, ending in movable spine, bordered with long setae from posterolateral spine to mesial margin; diaeresis absent (Fig. 4F).

Etymology.—This species is named for Brian Kakuk, diver, discoverer, and explorer of many underwater caves in the Bahamas.

Remarks.—*Typhlatya kakuki* is the first species of the genus to be described from the Bahamas proper, although *T. garciai* has been reported from the Caicos Islands, which are geographically and geologically a continuation of the Bahamian archipelago (Buden and Felder, 1977). Considering the numerous underwater caves, marine and anchialine, found in the Bahamas archipielago (Juberthie and Iliffe, 1994; Palmer, 1997), it is likely that more new populations or species of *Typhlatya* will be found.

Geographically, *T. kakuki* could be related to the five known Cuban species, because the island of Cuba is the closest large land mass to Acklins Island that possesses species of *Typhlatya* (Fig. 1). However, morphologically, the new species cannot be clearly related to any of them. *Typhlatya consobrina*, *T. elenae*, and *T. taina* have unpigmented eyes, and the ischium and merus of pereiopods 3–5 are not fused. *Typhlatya garciai* has pigmented eyes and an articulated ischium and merus of pereiopods 3–5. *Typhlatya garciadebrasi* has very long carpi of pereiopods 1–2 and a long sixth abdominal segment (Chace, 1942; Juarrero, 1994; Juarrero and Ortiz, 2000).

Typhlatya utilaensis, new species
Figs. 6, 7

Holotype.—♂, cl 3.1 mm, tl 10.1 mm; 5 May 1996; George Gaberel's Cave, Utila, Bay Islands, Honduras; collected by T. M. Iliffe; CNCR 21798.

Allotype.—♀, cl 4.1 mm, tl 13.1 mm; same date, locality, and collector as holotype; CNCR 21799.

Paratypes.—♂, cl 3.4 mm, tl 10.6 mm; 2 ♀♀, cl 3.3, 4 mm, tl 11.5, 12.6 mm; same date, locality, and collector as holotype; CNCR 21800.

Description of Holotype.—Rostrum unarmed, oriented downwards, not reaching distal margin of eyes, acuminate in dorsal view (Figs. 6A, G). Carapace smooth, devoid of spines; in lateral view, dorsal margin with lower anterior portion, rest of margin, from orbit to posterior portion, broadly rounded; antennal and pterygostomian angles rounded (Fig. 6A). Eyes reduced, with one cluster of pigmented granules; bilobed, mesial lobe longer (Figs. 6A, G).

Abdomen smooth. Anterior portion of pleura of first somite covered by posterior portion of carapace. Second somite with pleura broadly rounded, posterior margin evidently convex, more pronounced than anterior one. Posteroventral angles of pleura of somites 3–5 rounded; notch on middle portion of posterior margin of pleura of somite 5. Sixth somite longest, 1.6 times length of fifth, middle portion of posterior margin produced. Telson shorter than uropods, approximately rectangular, anterior width 1.4 times posterior width; with 2 pairs of movable, dorsal spines, anterior pair next to lateral margin on anterior third of telson, posterior pair submarginal on middle third of telson (Fig. 6F). Posterior margin of telson convex, with 4 pairs of spines: external pair shortest; second pair largest, 3 times as long as external pair; third pair two-thirds length of second pair, inner pair half length of second pair (Fig. 6F).

Antennular peduncle of about same length as antennal scale (Fig. 6G). Stylocerite well developed, blade-like, ending in sharp tip anteriorly, not reaching distal margin of basal antennular segment. Second antennular segment approximately as wide as long, segments on internal flagellum shorter. Antenna with scaphocerite twice as long as broad, lateral margin straigth, with small spine, not reaching distal margin.

Mandibles asymmetrical, molar processes with minute striations, dense line of setae between molar and incisor processes. Left mandible with 5 sharp teeth on incisor process, molar process concave (Figs. 6B, C).

First maxilla with elongated distal lacinia, mesial margin finely serrated, with minute teeth; proximal lacinia broadly

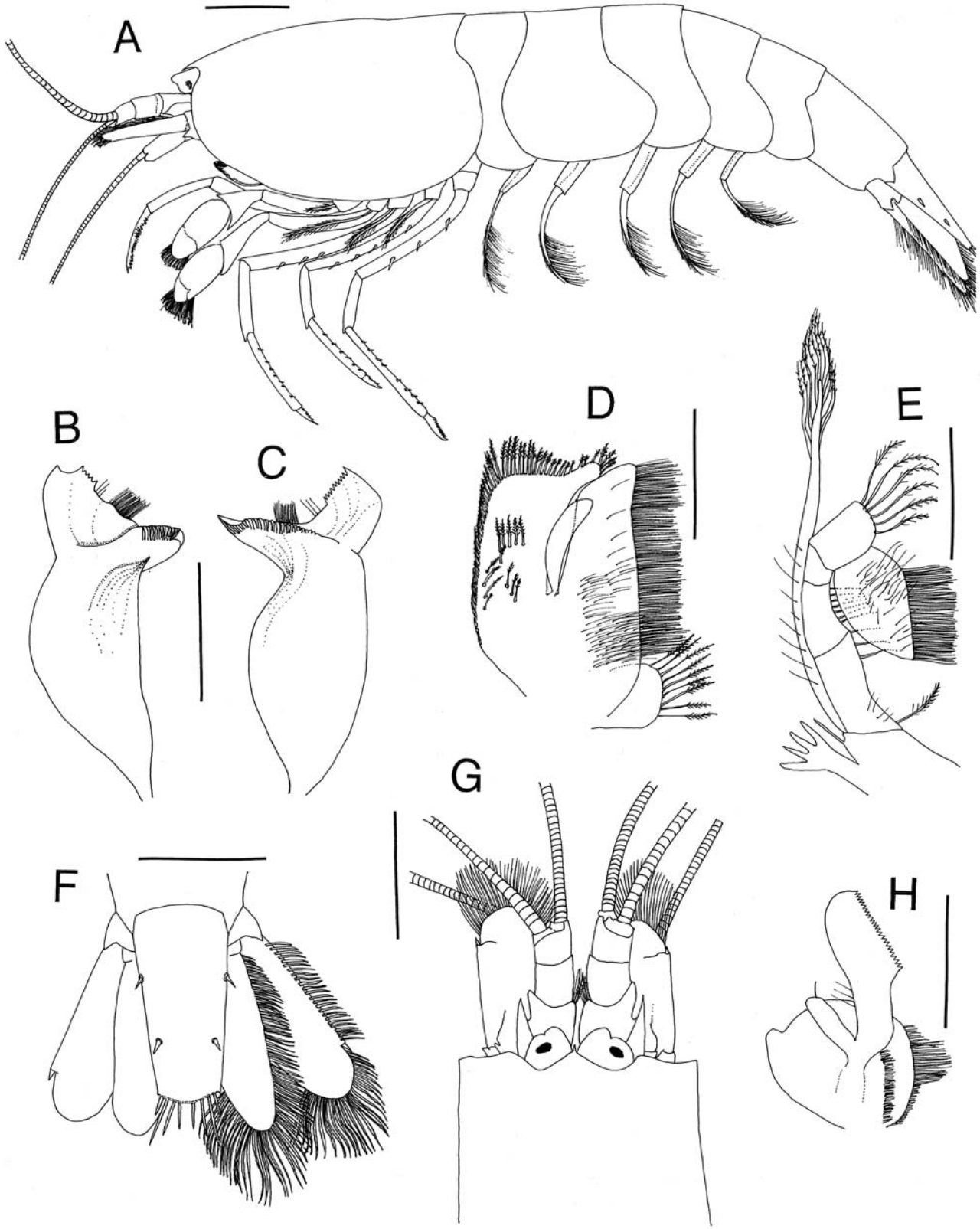

Fig. 6. *Typhlatya utilaensis*, new species, male holotype: A, body, lateral view; B, left mandible; C, right mandible; D, first maxilliped; E, second maxilliped; F, dorsal view of telson and uropods; G, dorsal view of anterior portion of carapace; H, first maxilla. Scale bars represent 1 mm.

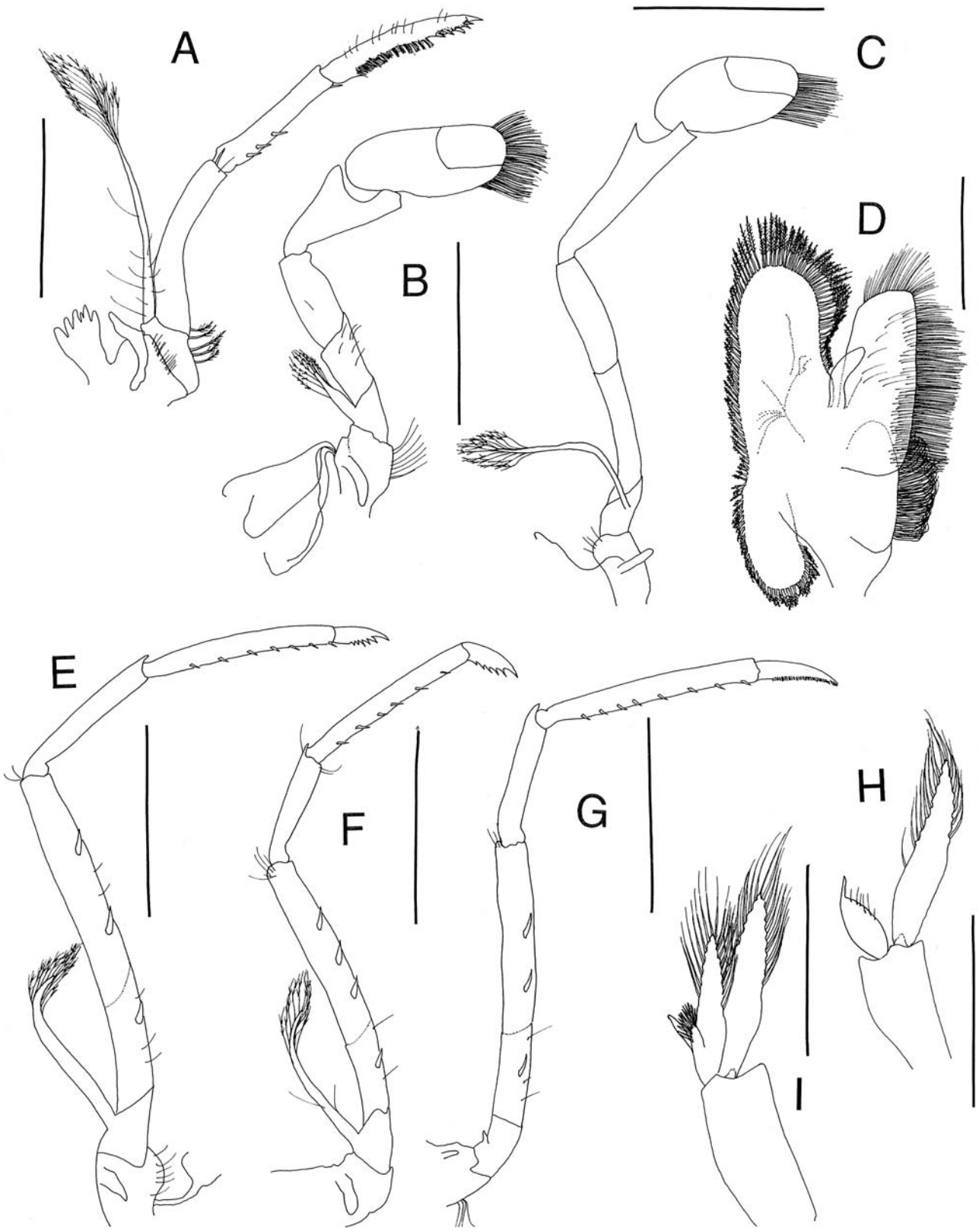

Fig. 7. *Typhlatya utilaensis*, new species, male holotype: A, third maxilliped; B, first pereiopod; C, second pereiopod; D, second maxilla; E, third pereiopod; F, fourth pereiopod; G, fifth pereiopod; H, first pleopod; I, second pleopod. Scale bars represent 1 mm.

rounded, mesial margin with setae increasing in size medially, submarginal row of short setae; palp simple, with 1 distal seta (Fig. 6H).

Second maxilla with scaphognathite bordered with plumose setae, increasing in size distally, distal lobe broader than proximal one, both rounded; palp small, finger-like, unsegmented, devoid of setae; distal endite rectangular, bordered with thick, dense setae along gnathal margin, scattered submarginal setae, organized in row on proximal half; proximal endite oval-shaped, with thick, long setae along gnathal margin (Fig. 7D).

First maxilliped with exopod approximately rectangular, with long plumose setae along lateral and distal borders, few scattered setae on surface of exopod; flagellar lobule reduced, as rounded projection (Fig. 6D). Palp somewhat elongated, devoid of setae. Distal endite almost as long as whole maxilliped, gnathal border with thick seta of uniform size, scattered submarginal setae, becoming denser proximally; proximal endite rounded, with 8 long plumose setae (Fig. 6D).

Second maxilliped subpediform, endopod 5-segmented, gnathal border of distal article with dense, uniform setae; exopod less than twice length of endopod; podobranch well developed (Fig. 6E).

Third maxilliped pediform, reaching beyond distal margin of scaphocerite. Endopod 3-segmented, basal segment thickest, longest, slightly arched; middle segment straight, shortest, with 3 spines on proximal portion of ventral margin; distal segment with short, dense setae on ventral margin, ending in row of 6 sharp spines including corneous tip (Fig. 7A). Exopod slender, reaching middle portion of second segment, tip with plumose setae; arthrobranch well developed.

First pair of pereiopods stout, exopod short, not reaching distal margin of ischium, tip with plumose setae; carpus hollowed, short, twice as long as wide, shorter than propodus; chela 2.2 times as long as wide, with dense tuft of setae (Fig. 7B).

Second pair of pereiopods longer, more slender than first pair; exopod reaching proximal half of merus, tip with plumose setae; carpus longest segment, hollowed distally, 3.6 times as long as wide; chela 2 times as long as wide, with dense tuft of setae (Fig 7C).

Third pair of pereiopods slender, ischiomeral articulation visible, ischium and merus combined slightly arched, ischium with 1 strong spine, merus with 2 strong spines along ventral margin; carpus 0.4 times length of ischium and merus combined; propodus 0.5 times length of ischium and merus combined, with 7 small spines along ventral margin; dactyl with 6 spines on flexor margin (Fig. 7E). Exopod about half length of ischium and merus combined.

Fourth pair of pereiopods similar to third pair, differing in merus with 3 strong spines along ventral margin, propodus 0.7 times length of ischium and merus combined, with 6 small spines along ventral margin (Fig. 7F). Exopod reaching more than half length of ischium and merus combined.

Fifth pair of pereiopods slender, ischiomeral articulation visible, ischium with 1 strong spine, merus with 2 strong spines along ventral margin; carpus 0.4 times length of ischium and merus combined; propodus 0.8 times length of ischium and merus combined, with 8 small spines along ventral margin; dactyl ending in sharp tip, with line of dense short setae on flexor margin (Fig. 7G). Exopod reduced to small knob.

Epipodites present from third maxilliped to fourth pereiopod, present in fifth pereiopod as minute knob.

First pair of pleopods in both sexes with endopod reduced, without appendix interna (Fig. 7H); pairs 2–5 with appendix interna slender, approximately one-third length of endopod. Second pair in males with appendix masculina thicker, 0.6 times length of appendix interna, bearing 18 setae, apex rounded (Fig. 7I).

Uropods with both rami of about same length, longer than telson. Endopod oval-shaped, bordered with long setae. Exopod with straight external margin, with row of submarginal setae, ending in movable spine, diaeresis absent (Fig. 6F).

Etymology.—The specific name is derived from "Utila," the name of the island where the type locality is located in Honduras.

Remarks.—*Typhlatya utilaensis* is the first species described from Central America, exhibiting a strong morphological similarity with *T. monae* from Mona Island, Puerto Rico. The two species share: short exopods in pereiopods 1–4, a very reduced exopod in pereiopod 5, and all pereiopods with ischium and merus not fused. However, they can be distinguished through the following characters present in the new species: eyes bilobed, external ramus of uropod with submarginal setae along external lateral margin, carapace with rounded margin from orbit to posterior margin, and telson twice as long as wide.

Utila and Mona Islands are both very young, the former being mostly from the Holocene (McBirney and Bass, 1969) and the latter from the late Miocene–early Pliocene (Frank *et al*., 1998). Their recent origin may explain the presence in both species of several presumably plesiomorphic characters such as eyes pigmented and ischium and merus of pereiopods not fused (Sanz and Platvoet, 1995).

Discussion

The diversification process of *Typhlatya* has been discussed at length by Sanz and Platvoet (1995), who established the major pathways that the ancestral stock could have followed to originate the present-day fauna. They have proposed also a time frame to place the evolution of *Typhlatya* in relation to the evolution of the continents, suggesting that the ancestral stock range reached its maximum in the late Cretaceous, during the Turonian Age (91–88.5 mya).

In contrast to this old origin proposed for the genus, several species inhabit islands or land masses that have a much recent origin or time of emergence. Assuming that the species of *Typhlatya* occur in anchialine or coastal freshwater caves down to 30 m, then the time of emergence of the landmass where they occur could be used as an age estimate of the species. Five of the 12 species distributed in the Caribbean (*T. campecheae*, *T. mitchelli*, *T. pearsei*, *T. dzilamensis*, *T. utilaensis*), plus three more inhabiting oceanic islands (*T. iliffei*, *T. rogersi*, *T. galapagensis*), occur

in land masses that have formed or been emergent since the Miocene–Pliocene transition 5–6 mya (McBirney and Bass, 1969; van Andel *et al*., 1973; Chavez and Brusca, 1991; Graham, 2003). The five Cuban species could have originated when most of the island became emergent in the middle Miocene (19–12 mya; Graham, 2003); while *T. monae* occurs in Mona Island, which is relatively young (5 my), and Hispaniola and Barbuda, which are much older (15 my and 45 my, respectively; Frank *et al*., 1998; Graham, 2003).

Two important considerations derive from these data and should be kept in mind if the hypothesis of Sanz and Platvoet (1995) is to be supported. First, there is a very large gap from the proposed origin of the genus to the time when most of the Caribbean islands developed. This period could go from 90 to 45 my, during which we should suppose the existence of a shallow-water coastal ancestor occupying an ample range in the Caribbean and in the equatorial seas around South America. Further, while some populations could have differentiated into new *Typhlatya* species 45 mya (*T. monae*), others could be as young as 10,000 yr (*T. utilaensis*), an unlikely scenario assuming one common ancestral stock. Second, the Sanz and Platvoet (1995) model is constrained by the preferential use of vicariance events to explain present day distributions. In the Caribbean, most islands have related but independent histories with varying periods of emergence and submergence. As discussed by Iturralde-Vinent and MacPhee (1999) and Graham (2003), dispersal probably has played a more important role in the shaping of modern distributions through the Caribbean than vicariance.

Regarding the number of species of *Typhlatya*, it is anticipated that more new species will be found as exploration of areas such as Central America and the northern portion of the Bahamas archipelago proceeds. The anchialine habitat is a common feature along tropical karstic and volcanic coastlines, which are particularly abundant around the Caribbean basin (Carr and Stoiber, 1990; Boss, 1996; Bourrouilh-Le Jan, 1998).

Key to the Species of the Genus *Typhlatya*, Modified from Sanz and Platvoet (1995)

1. Eyes pigmented 2
– Eyes without pigment 7
2. Ischium and merus of all pereiopods not fused 3
– Ischium and merus in at least one pair of pereiopods fused 5
3. Exopod of fifth pereiopod reaching well beyond ischiomeral articulation . . . . . *T. garciai*
– Exopod of fifth pereiopod reduced, not reaching ischiomeral articulation 4
4. Eyes bilobed, external ramus of uropod with submarginal setae along external lateral margin . . . . . *T. utilaensis*
– Eyes not bilobed, external ramus of uropod without submarginal setae along external lateral margin . . . . . *T. monae*
5. Ischium and merus of all pereiopods fused . . . . . *T. iliffei*
– Ischium and merus of some pereiopods not fused 6
6. Ischium and merus of first and second pereiopods fused, articulated in third to fifth pereiopods . . . . . *T. rogersi*
– Ischium and merus of third to fifth pereiopods fused, articulated in first and second pereiopods . . . . . *T. kakuki*
7. Rostrum extending beyond distal margins of eyes 8
– Rostrum not reaching or barely reaching distal margins of eyes . 12
8. Rostrum reaching first antennular segment 9
– Rostrum reaching second antennular segment 10
9. Ischium and merus of all pereiopods not fused . . . . . *T. campecheae*
– Ischium and merus of first and second pereiopods fused, articulated in third to fifth pereiopods . . . . . *T. consobrina*
10. Exopod of fifth pereiopod not reduced, reaching ischiomeral articulation . . . . . *T. elenae*
– Exopod of fifth pereiopod reduced, shorter than total length of basipodite 11
11. Exopods of first through fourth pereiopods setose . . . . . *T. pearsei*
– Exopods of first through fourth pereiopods not setose . . . *T. pretneri*
12. Sixth abdominal somite four times as long as fifth . . . . . *T. garciadebrasi*
– Sixth abdominal somite less than four times as long as fifth 13
13. Ratio of carpus/propodus of second pereiopod more than 2.5 . . . . . *T. mitchelli*
– Ratio of carpus/propodus of second pereiopod less than 2.5 14
14. Ischium and merus of third to fifth pereiopods fused 15
– Ischium and merus of all pereiopods not fused 16
15. Pleura of second abdominal somite with bilobed ventral margin . . . . . *T. galapagensis*
– Pleura of second abdominal somite with ventral margin not bilobed . . . . . *T. dzilamensis*
16. Telson with one pair of lateral spines . . . . . *T. miravetensis*
– Telson with two pairs of lateral spines . . . . . *T. taina*

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