

## Four new stygobitic cirolanids (Crustacea: Isopoda) from the Caribbean - with remarks on intergeneric limits in some cirolanids

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### Abstract

Four new stygobitic and troglomorphic cirolanids are described from various parts of the Caribbean. *Cirolana* (*C.*) *troglexuma* n. sp. is described from a cave on one of the Exuma Cays, Bahamas; two subgenera are recognized in g. *Cirolana*: sg. *Cirolana* including *troglexuma* as only presently known stygobitic species, and sg. *Anopsilana* equally well represented by subterranean and by epigeal species. *Haptolana bowmani* n. sp. and *H. belizana* n. sp. inhabit caves of Yucatan and Belize, respectively; interestingly, they are both abundantly different from the Cuban species of this stygobitic genus, showing more similarity with the species from Somalia and W. Australia. *Jamaicalana pleoscissa* n. g. n. sp. was discovered in a cave from Jamaica; the new genus has affinities with *Anopsilana* and *Bahalana*, but a combination of characters - some of them highly original - renders definition of a new genus necessary. *Bahalana mayana* BOWMAN should be removed from that genus, whereas *Dodecalana yagerae* Carpenter is an interesting species of *Bahalana*.

**Key-words:** Isopoda, cave fauna, Caribbean, taxonomy.

### Résumé

Quatre cirolanides stygobies et troglomorphes sont décrits de diverses parties des Caraïbes. *Cirolana* (*C.*) *troglexuma* n. sp. est décrite d'une grotte de l'une des Exuma Cays, Bahamas; on reconnaît deux sous-genres dans le genre *Cirolana*: sg. *Cirolana* dans lequel *troglexuma* prend place comme seule espèce stygobie décrite, et sg. *Anopsilana* également bien représenté par des espèces épigées et souterraines. *Haptolana bowmani* n. sp. et *H. belizana* n. sp. peuplent des grottes du Yucatan et, respectivement, de Belize; situation intéressante, les deux diffèrent nettement de l'espèce cubaine de ce genre stygobie, montrant plus de similarité avec les espèces de Somalie et d'Australie occidentale. *Jamaicalana pleoscissa* n. g. n. sp. a été découverte dans une grotte de la Jamaïque; le nouveau genre présente des affinités avec *Anopsilana* et *Bahalana*, mais la combinaison de plusieurs caractères - dont certains hautement originaux - rend nécessaire la définition d'un nouveau genre. *Bahalana mayana* BOWMAN n'appartient pas à ce genre, tandis que *Dodecalana yagerae* Carpenter est une intéressante espèce de *Bahalana*.

**Mots-clés:** Isopoda, faune cavernicole, Caraïbes, taxonomie.

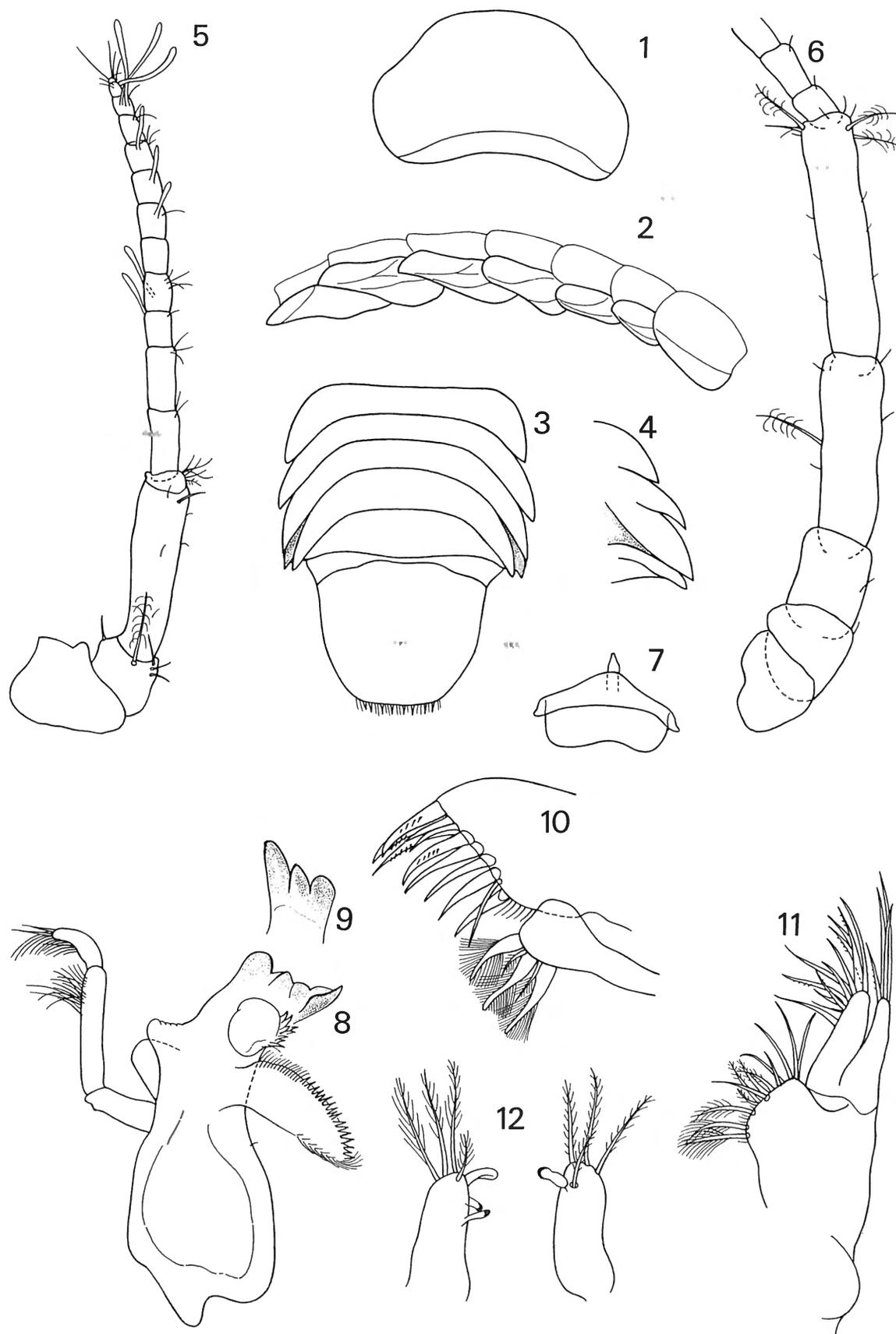
### Introduction

Many exciting discoveries of stygobitic animals have been made in the Caribbean in various groundwater zones and habitats. Not less than 24 species of stygobitic cirolanids are presently recorded from the Caribbean (including Mexico) - a remarkably high number (see especially BOTOSANEANU, BRUCE & NOTENBOOM, 1986). To these we shall add four more, in three genera, one new. All specimens examined have been deposited in the N.M.N.H., Washington, U.S.A.; all dissected appendages were placed in small vials with alcohol.

Several preliminary remarks are necessary. A source of difficulty in describing some of the new taxa was the fact that limits between some described genera in Cirolanidae are vague. We have done our best to find acceptable solutions to this problem. Comparisons are sometimes difficult because of the different style of descriptions and illustration in various publications. The limited number of specimens available allowed only few observations on intraspecific variability.

All new species described in this paper are troglomorphic: completely depigmented, anophthalmous, devoid of coarse cuticular ornamentation; all are unable to roll into a ball; no females with oostegites were found; this information will not be repeated in the descriptions. Moreover, in the descriptions, some details (like exact number of setae or spines on some mouth parts) were sometimes omitted when clearly illustrated and considered as not being very significant. Concerning the illustration: many plumose setae (for instance, on mandibular palp, maxilliped, as well as the plumose marginal setae on pleopods, uropods and telson) were not illustrated as such in order to avoid complication of the drawings; and even in the descriptions, this was generally not mentioned.

Finally, besides the four new taxa here described, the material examined includes also specimens of *Creaseriella anops* (CREASER) from several Mexican localities: Mayan Blue Cenote, Tulum, Quintana Roo (4 VII. 1993 and 12 XII. 1996); Cenote 27 Steps, Akumal, Quintana Roo (13 XII. 1996); Chac Mol Cenote, Paamul, Quintana Roo (17 XII. 1996); Noc Ac Cenote (also known as Cenote Kambul), Noc Ac, Yucatan (7 XII. 1993 and 19 XII. 1996); Grutas de Tzab Nah, Tecoh, Yucatan (20 XII. 1996). Moreover, one ovigerous ♀ of *Arubolana aruboides*



Figs. 1-12. - *Cirolana (C.) troglexuma*, female. - 1. Cephalon. - 2. Pereion, lateral. - 3. Pleon and pleotelson. - 4. Left pleonal epimera, ventral. - 5. A. I - 6. A. II peduncle and first flagellar articles. - 7. Lamina frontalis and clypeo-labrum. - 8. Left Mdb. - 9. Acies of right Mdb. - 10. Distal parts of left Mx. I - 11. Left Mx. II - 12. Endite of left and right Mxp.

(Bowman & Iliffe) was caught from the water column in Bitumen Cave, Hamilton Parish, Bermuda (new locality for this species, described from two other caves in Bermuda).

### Descriptions of new taxa

#### *Cirolana (C.) troglexuma* n. sp. (Figs. 1-24)

#### MATERIAL EXAMINED

Exuma Cays, Great Guana Cay: Oven Rock Cave. Female holotype collected on 22 V. 1995; two ♀ paratypes collected on 22 V. 1995 and 13 IX. 1996; all by TH. M. ILIFFE.

#### DESCRIPTION OF FEMALE

Length of holotype ca 8.6 mm; of paratypes 8.3 and 7.5 mm.

Cephalon roughly semicircular, lateral margins depressed in their anterior half, also posterior margin depressed; no rostrum - even no rostral point - is present, but a minute vertical carina not at all apparent dorsally. Epimera of even the last three pereionites (lateral view) with only moderately acute tips. First four pleonal epimeres with sharply pointed tips, epimeres III particularly strong, only very tips of epimeres V concealed under IV.

A. I reaching middle of pereionite I; peduncle with three distinct articles, article 3 not much longer than 1 + 2, and with well individualized distal zone; flagellum with 12 articles, several with single aesthetascs, those (2 and resp. 1) on the two preapical articles much longer than remaining ones. A. II reaching anterior end of pereionite V; peduncle art. 5 slightly shorter than art. 1-3 together; flagellum with 22 articles.

Lamina frontalis is a thin blade perpendicular on clypeolabrum, separating roots of A. II but not of A. I; in dorsal view very narrow, distally pointed. Clypeus with lateral ends freely - but only slightly - hanging. Mandibulae: acies strongly differing in right and left one, most important difference being the presence in the right mdb. of a strong middle tooth replaced in the left mdb. by two more attenuate, rendering the acies wider; molar process with abundant setulae on both ends of the row of sharp points. Mx. I: endite with three very robust, strongly plumose setae, and between them two small plumose setae; lateral lobe with 10 spines, one seta, and a few setulae. Mx. II: internal lobe with 13 setae - 7 of them plumose, the most internal strongly; middle lobe with 13, external lobe with 4 setae. Mxp. endite with 4 plumose setae and a tendency towards more than one coupling hook (2 or 3).

Pereiopods: none haptorial (none with very strong propodus - although that of P. I is wider than the others; dactyli all remarkably short); all spinose (P. I with very few spines, these progressively more numerous), all spines

with auxiliary bristle, spines not arranged "in V" (although merus of P. III has a double row of spines); pereiopods progressively longer (P. VI and VII twice as long as P. I) and more slender.

Pleopod coxopodites wide, no endopodite fleshy or thickened, only enp. V devoid of distal row of setae (and of setulae along internal margin), enp. I narrow and distinctly emarginate externally; exopodites III-V completely bipartite, limits between the two parts faint (III) or very faint (IV-V).

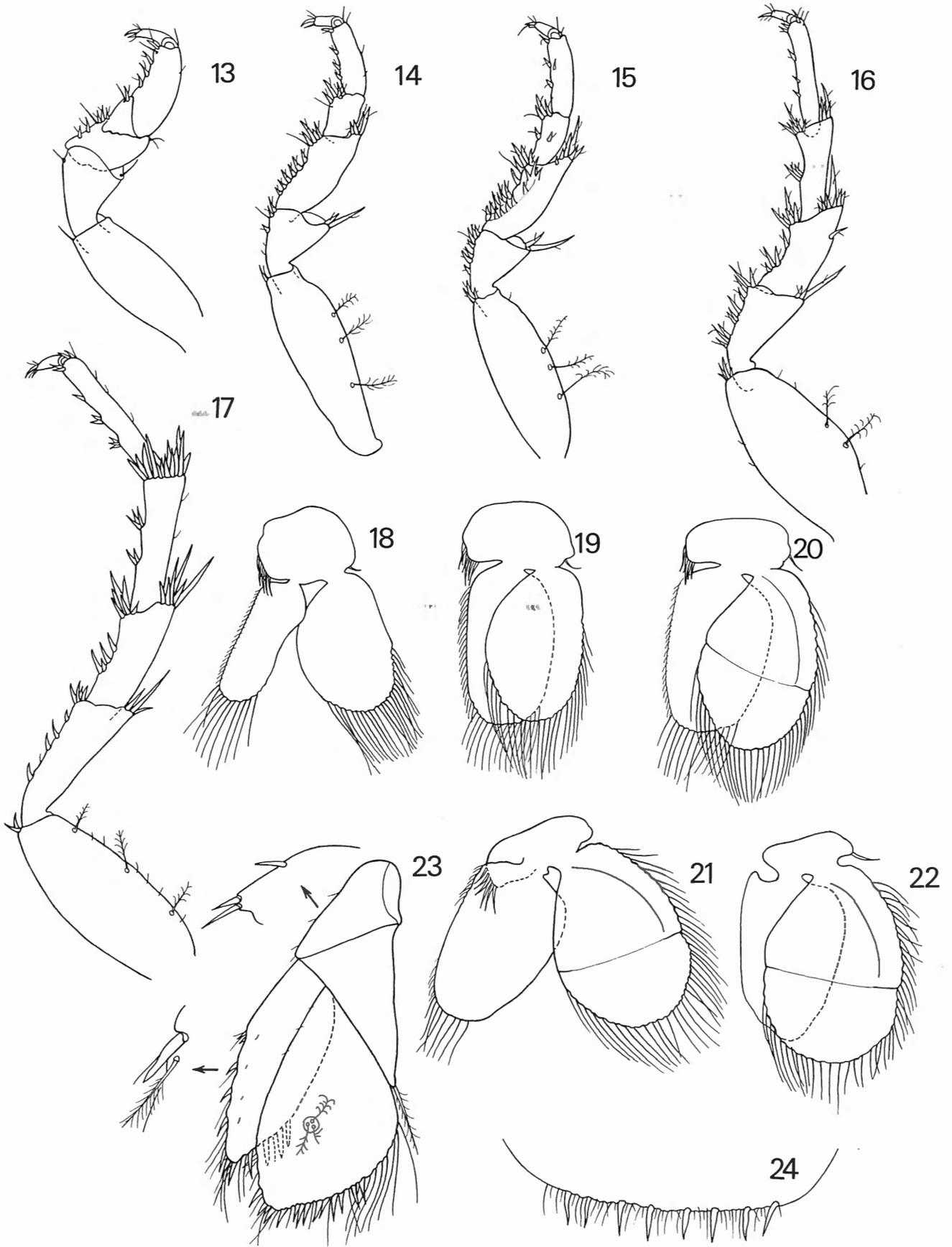
Uropods only very slightly reaching beyond telson; coxopodite externally with one spine in middle besides the two of its distal corner, and with not very long disto-internal projection with only one strong plumose seta apically; endo- and exopodite with apices not excised nor pointed or distinctly truncate; endopodite broadly foliaceous, longer than the narrowly foliaceous exopodite, sensory patch with 3 short setae; setation of both enp.- and exp. rather poor, setae generally short - excepting the most proximal ones on enp.; spines on enp. only along distal margin; most spines of exp. with annex bristle and accompanied at short distance by a short seta.

Telson trapezoidal (but lateral margins slightly convex) distally characteristically widely truncate, there with 8 (holotype) or 6-7 (paratypes) short spines, and between them equally short plumose setae and minute setulae.

#### AFFINITIES

Many characteristics of this species clearly point to genus *Anopsilana* PAULIAN & DELAMARE-DEBOUTTEVILLE, 1956, although it clearly does not match any of the species described in this genus. *Anopsilana* presently includes, besides a number of non-troglo-morphic marine or estuarine and mangal inhabiting species, 7 troglomorphic and stygobitic species, 4 of them from the Caribbean (lists in BRUSCA, WETZER & FRANCE, 1995; and in BRUCE, 1992, where *Anopsilana* is considered, as in other publications, as representing "a polyphyletic assemblage of species"). We should have with little hesitation described the new species as belonging to *Anopsilana*, were it not for an important discordant element. BRUCE (1981; see also, i.a., BOWMAN & FRANZ, 1982, BRUCE, 1992, BRUSCA, WETZER & FRANCE, 1995) has separated *Anopsilana* from *Cirolana* based only on one "stronger" character: absence in *Anopsilana* and presence in *Cirolana* of setation on the endopodites of pleopods III and IV (Dr. N.L. BRUCE - in litt. - considers absence of setation in *Anopsilana* as being "an evident homoplasy"). The presently described species having rather well developed setation on these endopodites, it should belong - as the only known troglomorphic/stygobitic species - to the predominantly marine *Cirolana* LEACH. We may add that another character points rather at *Cirolana*: absence of a rostrum; whereas the frontal lamina of the n. sp. has a shape probably never described in the two genera.

It is probable that MONOD (1976) was right when considering *Anopsilana* as a synonym of *Cirolana*. For the time



Figs. 13-24. - *Cirolana (C.) troglexuma*, female. - 13-17. Left pereopods I-IV and VII. - 18-22. Left pleopods I-V, ventral. - 23. Left uropod, dorsal. - 24. Distal margin of pleotelson.

being, a practical solution of the problem, which possibly will prove to be artificial, seems to be recognition of two subgenera: *Cirolana* (*Cirolana*) including all marine, non-stygobitic, species plus *C. troglexuma* n. sp., and *Cirolana* (*Anopsilana*) equally well represented by troglomorphic and non-troglomorphic species.

#### HABITAT AND ASSOCIATED FAUNA

One of the more notable inland, anchialine caves in the Exumas is Oven Rock Cave, located on Great Guana Cay. The cave entrance is situated in a hillside about 1 km from the southern tip of the island. A large dry chamber descends over breakdown from the entrance to a tidal anchialine lake. The first underwater chamber of the cave is well decorated with large stalactites and stalagmites at depths to 5 m. A second chamber has a small air bell in the ceiling at one end but dips to 10 m depths at the far extreme, where a submerged passage extends to 24 m depths. Surface salinity in the entrance pool was 35 g/l. In addition to the isopod *Cirolana troglexuma*, other anchialine fauna inhabiting Oven Rock Cave include remipedes, amphipods, copepods, halocyprid ostracods, thermosbaenaceans and polychaetes. 22 V. 1995, 2 specimens (♀ holotype and paratype) collected with suction bottle from the water column in 0-22 m depths. 13 IX. 1996, 1 specimen (♀ paratype) collected with suction bottle in 0-18 water depths; leg. TH. ILIFFE.

#### *Haptolana bowmani* n. sp.

(Figs 25-52)

#### MATERIAL EXAMINED

Mexico, Yucatan: Grutas de Tzab-Nah (Dzab Nah), 2 km S of Tecoh on road to Telchaquillo. ♂ holotype collected on 27 VI. 1991; ♀ allotype collected on 24 VI. 1992; both by TH. M. ILIFFE. Moreover, several immature specimens of *Haptolana*, probably belonging to the species here described, but not designated as types, are from three cenotes in Yucatan (all: leg. TH. M. ILIFFE): Noc Ac Cenote (1 specimen with 6 pereopods, 7 VII. 1993), Cenote Mucuyché (2 specimens with 6 pereopods, 9 VII. 1993), Cenote Yuncu (1 specimen with 5 pereopods, 10 VII. 1993).

#### DESCRIPTION (MAINLY BASED ON FEMALE ALLOTYPE)

Length of ♂ holotype: ca 7.5 mm; of ♀ allotype: ca 9.5 mm. Body rather slender. Cephalon (with its rostrum) having the shape of a helmet, wider than long, lateral margins convex but posteriorly suddenly oblique towards median line and slightly depressed (also posterior margin depressed); rostrum narrowly triangular. Pleonite I not concealed under pereonite VII. Epimera of pereonites IV-VII (lateral view) pointed. Epimera of pleonites I-IV

sharply pointed, those of III and IV particularly slender and long, tips of pleonite V well concealed behind pleonite IV and antero-lateral angles of telson.

A. I reaching middle of pereonite II; first two articles of peduncle coalescent, article 3 with its well individualized distal zone only slightly longer than the fused 1 and 2; flagellum with 15 articles, single or - rarely - paired aesthetascs on the 8 articles preceding the last one. The very long A. II reaches the posterior limit of the pereon; peduncle article 5 as long as articles 3 + 4; flagellum with 48 articles (female allotype) and 34 articles (male holotype), first one short.

Lamina frontalis with rather broad stem and globular end; dorsally visible, completely separating bases of A. I. Clypeus narrow, its still narrower lateral ends leaning on the sides of the labrum which is almost not emarginated posteriorly. Mandibulae: masticatory part only very slightly dissimilar in right and left mdb.; molar process with row of ca 15 slender points, and devoid of setulae. Mx. I: lateral lobe with 10 spines (only 2 shortly ciliate) and 1 seta; endite with 3 plumose setae, most internal one much stronger than the remaining two. Mx. II: external lobe with 3 setae, middle lobe with 8, internal lobe with 10. Mxp. endite with only one coupling hook in both ♂ and ♀, whereas there are 3 plumose setae in the ♀, and 4 in the ♂.

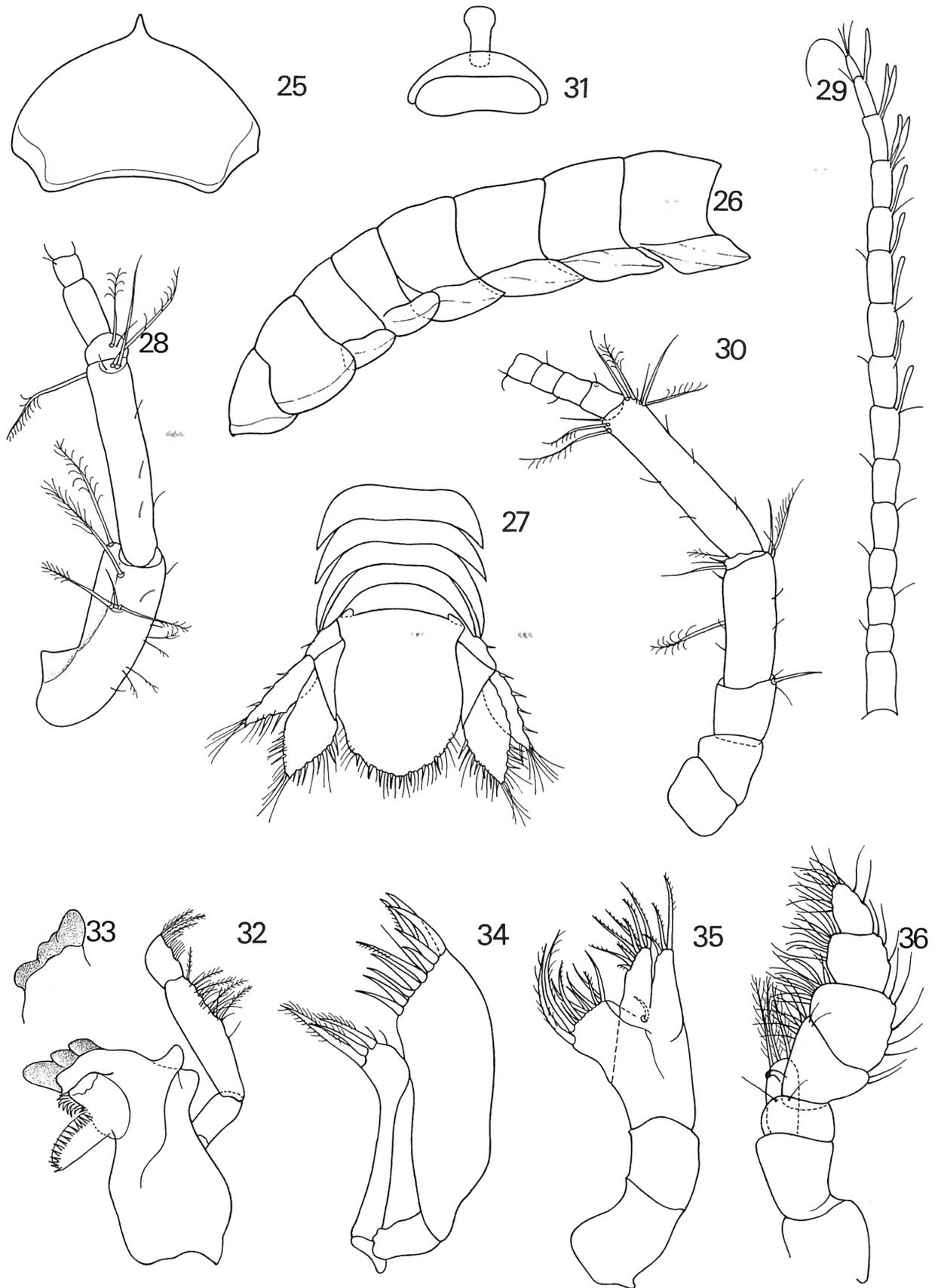
The pereopods are quite typical for genus *Haptolana*: all clearly haptorial, all with robust propodus, slender, elongate, probably swinging dactylus, all (except I) very spinose, spines on propodi (and also on carpi and meri) arranged in "V;" on propodus of P. I two tufts of subapically inserted setae arranged "in V;" all spines with antepical annex bristle (quite a few on carpus and merus of the last pereopods have also small rows of cilia); P. VI and VII distinctly longer than I-V.

Penes: a pair of adjacent, small, blunt papillae.

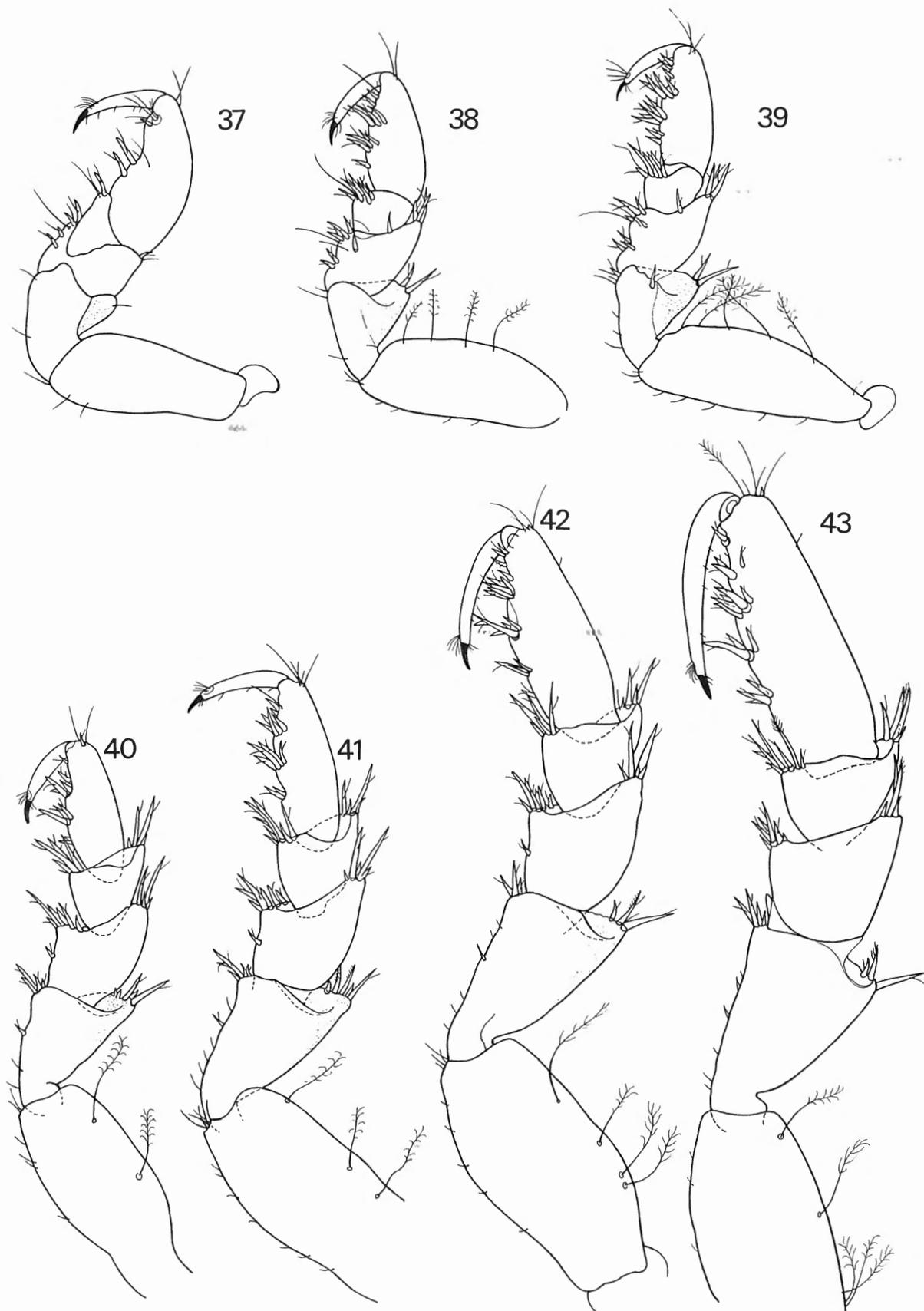
All pleopods with small (i.e., not widened) coxopodites; only endopodites I-II setose, all enp. smaller than exopodites; all exp. moderately setose, exp. I with rather long seta on external margin near base, rows of setulae along external margin of exp. II-V, exp. III-V distinctly bipartite. Appendix masculina rooted at distal end of basal 1/4 of endopodite; slender, not reaching end of enp., distally very slightly curved, obtusely ending.

Uropods slightly reaching beyond telson; coxopodite externally with one spine in middle - besides the two of its distal corner, with rather short internal projection with a few subapical setae; exp. distinctly shorter than enp.; apices of exp. and enp. truncate, a spine in internal angle, external angle slightly salient; enp. moderately broad, with two sensory patches (with 2 and resp. 3 setae), about 6 spines along external margin, about 4 along internal one, and rather long setae; exp. triangular, with only 3-4 spines along each side, and setae only between those on external margin.

The telson has the shape of a shield, being longer than wide; its proximal angles are characteristically developed; the lateral margins, slightly convex, converge towards a strongly convex, crenulate apex on which 8 (♀ allotype) or 6 spines (♂ holotype) are implanted; between these



Figs. 25-36. - *Haptolana bowmani*, female. - 25. Cephalon. - 26. Pereion and cephalon, latero-dorsal. - 27. Pleon, pleotelson, and uropods. - 28. A. I peduncle and first flagellar articles. - 29. A. I flagellum. - 30. A. II peduncle and first flagellar articles. - 31. Lamina frontalis and clypeo-labrum. - 32. Right Mdb. - 33. Acies of left Mdb. - 34. Left Mx. I. - 35. Left Mx. II. - 36. Left Mxp.



Figs. 37- 43. - *Haptolana bowmani*, female, left pereopods I-VII

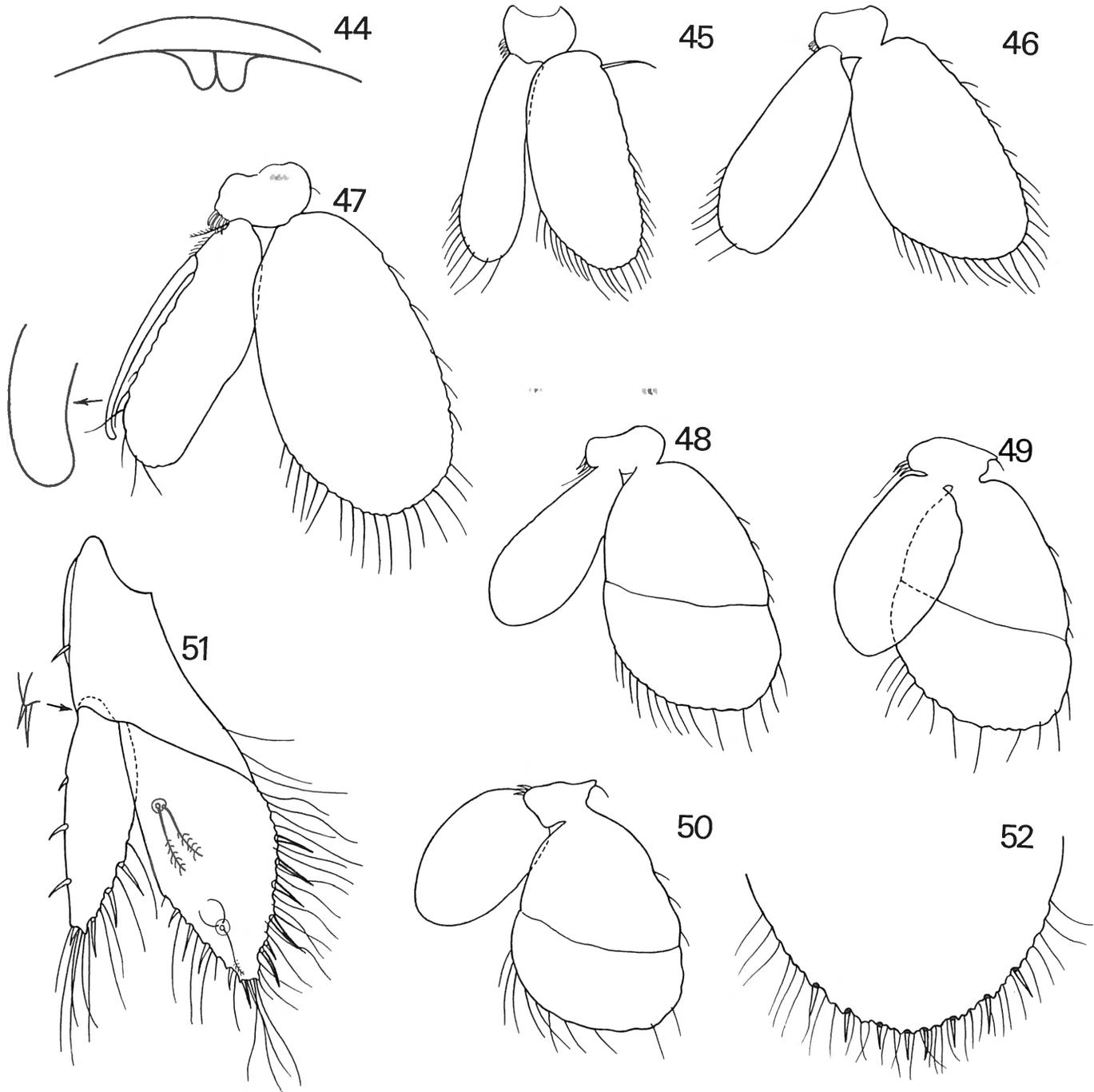
spines there are longer setae and these are also present more proximally along telson's margins.

#### DERIVATIO NOMINIS

This new species is named in memory of Thomas BOWMAN (Oct. 1918 - Aug. 1995) who recognized it as a new representative of *Haptolana*.

#### AFFINITIES

In *Haptolana* BOWMAN, 1966, only 3 species were described to the present, all characterized especially by what could be an interesting synapomorphy: all 7 pereiopods strongly haptorial. The species are *H. trichostoma* BOWMAN, 1966, from Cuba; *H. somala* MESSANA & CHELAZZI, 1984, from Somalia; and *H. pholeta* BRUCE & HUMPHREYS, 1993, from Western



Figs. 44-52. - *Haptolana bowmani*. - 44. Penes of male holotype. - 45-46 and 48-50. Left pleopods I-V of female allotype, ventral. - 47. Left pleopod II of male holotype, with strongly magnified apex of appendix masculina. - 51. Left uropod, dorsal (female). - 52. Distal margin of pleotelson (female).

Australia. It could be expected that *H. bowmani* n. sp. will prove to resemble more the Cuban *trichostoma*, but the reality is completely different: in most respects the Mexican species strongly differs from *trichostoma*, and there is more similarity with *somala* and especially with *pholeta*: body slender; lamina frontalis not pentagonal but anteriorly globose; telson elongated, not subtruncate, posterior margin with few spines; uropod endopodite with margins converging to a narrow apex. On the other side, numerous characteristics of the ♂ and ♀ allow easy recognition of the new species.

#### HABITAT AND ASSOCIATED FAUNA

Grutas de Tzab (or Dzab) Nah is located about 60 km inland from the coast of the Gulf of Mexico. It is situated 2 km south of the village of Tecoh on the road to Telchaquillo. The 1.8 m high by 3 m wide entrance is in a gently sloping sink, 100 m east of the road. To the left, walking passage in the cave leads to a bridge across a 7 m deep chasm with a lake at the bottom. Across the bridge and to the right, the main passage of the cave continues past several deep fissure pools and through two crawl ways to a 30 m diameter freshwater lake. Two artificial well shafts enter this large chamber at opposite ends of the lake. Underwater, the sandy bottom of the lake slopes down to a 20 m wide submerged cave entrance at 15 m depth. This underwater passage of solutional origin continues for 130 m to 33 m depth where it abruptly ends. While the water in this section of the cave is exceptionally clear, other pools in the cave are murky and have a thick scum at the surface. This pollution apparently arises from liquid wastes from a heniquen processing plant located above the cave. Aquatic fauna reported from the cave by REDDELL (1977) included mysids (*Antromysis cenotensis*), amphipods (*Mayaweckelia cenoticola*), atyid shrimp (*Typhlatya mitchelli* and *T. pearsei*), palaemonid shrimp (*Creaseria morleyi*), blind eels (*Ophisternon infernale*) and brotulids (*Typhliasina pearsei*). Numerous copepods reported from this cave include *Macrocyclops albidus*, *Thermocyclops inversus*, *Mesocyclops yutsil*, *Mesocyclops longisetus*, *Mesocyclops reidae* and *Mesocyclops chaci* (FIERS *et al.*, 1996; SUAREZ-MORALES *et al.*, 1996). In addition, podocopid ostracods, cirolanid isopods (*Creaseriella anops*) and thermosbaenaceans were also collected from the lake; for instance, numerous specimens of *C. anops* were collected by the second author on 20 XII. 1996. 27 VII. 1991, 1 specimen (♂ holotype) collected from an old wooden board in 50 cm water depth along the left side of the last lake. 24 VI. 1992, 1 specimen (♀ allotype) collected in 50 cm water depth along the left side of the last lake; leg. TH. ILIFFE

#### *Haptolana belizana* n. sp.

(Figs 53 - 81)

#### MATERIAL EXAMINED

Belize: Inland Blue Hole, Caves Branch. ♂ holotype collected on 24 II. 1989 by TH. M. ILIFFE and S. SARBU.

#### DESCRIPTION OF MALE

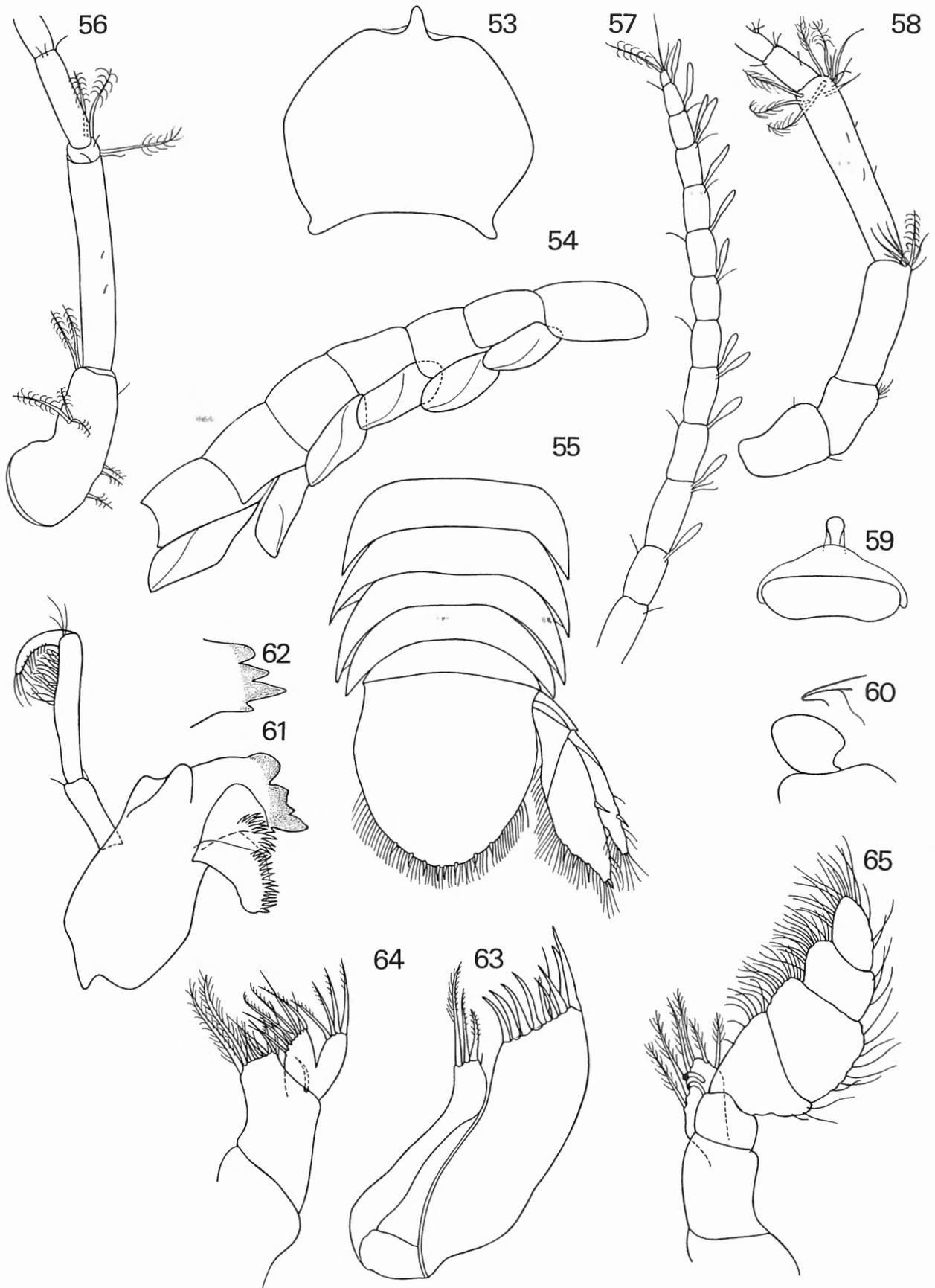
Length of the specimen: 12 mm. Rather characteristic body shape. Cephalon roughly an irregular hexagon, posterior angles salient, posterior border rather deeply depressed; rostrum rather narrowly triangular, not reaching lamina frontalis in lateral view. Only epimeres of pereionites V-VII ending in a point. Pleonite I not concealed under pereionite VII; in dorsal view pleonal epimeres I-IV ending in long, sharp points; those of pleonite V not concealed behind pleonite IV but almost reaching its epimeres.

A. I reaching middle of pereionite II, art. 1 and 2 of peduncle coalescent; art. 3 with its strongly individualized distal zone about 1/3 longer than the coalescent articles; flagellum with 14 articles, single - rarely paired - aesthetascs on the 11 articles preceding the apical one.

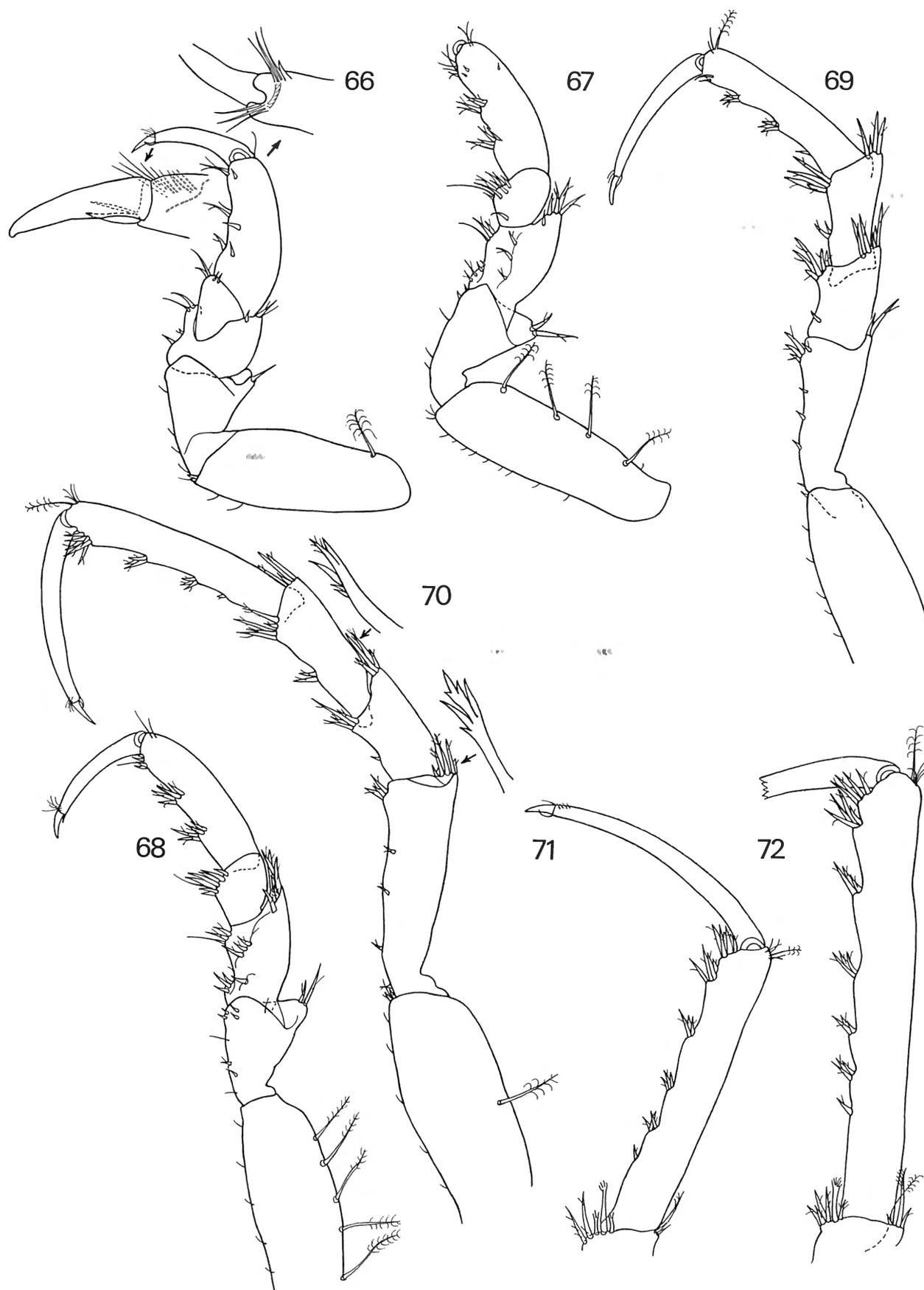
A. II very long, reaching limit pereion/pleon; peduncle only with 4 articles, the two basal ones being coalescent; last peduncular article as long as the two preceding it; flagellum with 39 articles, first one relatively long.

Lamina frontalis well visible dorsally; in ventral view like a stem ending in a globe; laterally looking like an oval blade with proximal emargination; clypeus well developed in its middle, but lateral arms very narrow, descending along the sides of the labrum which is only slightly depressed proximally. Mandibulae: masticatory part rather dissimilar in the two mdb., left acies being longer because of the presence of two teeth in the middle (replaced by one, conical, in the right acies); a minute additional tooth at the lower end of the acies of both mdb. seems to be characteristic; strongly developed molar process with row of ca 15 slender points and devoid of setulae. Mx. I lateral lobe with 9 spines (one or two shortly ciliate) + 1 seta; endite with 3 plumose setae, internalmost one strongest. Mx. II external lobe with 4 setae, middle lobe with 9. Mxp. endite bilaterally bearing 2 coupling hooks, and not less than 6 plumose setae (forming two groups of 4+2 or 3+3). Pereiopods<sup>1</sup> quite typical for the genus, all clearly haptorial, gradually considerably increasing in size; propodus moderately robust in P. I-III, almost parallel sided and gradually considerably increasing in length in IV-VII; very strongly elongated and certainly swinging dactyli (dactylus + unguis generally only slightly shorter than propodus); unguis in P. I-VII not pectinate, with very slender additional unguis ("secondary spine": BRUSCA, WETZER & FRANCE, 1995: 4) adpressed to the main one; P. II-VII very spinose, spines of propodi (but also of carpi and meri) arranged "in V"

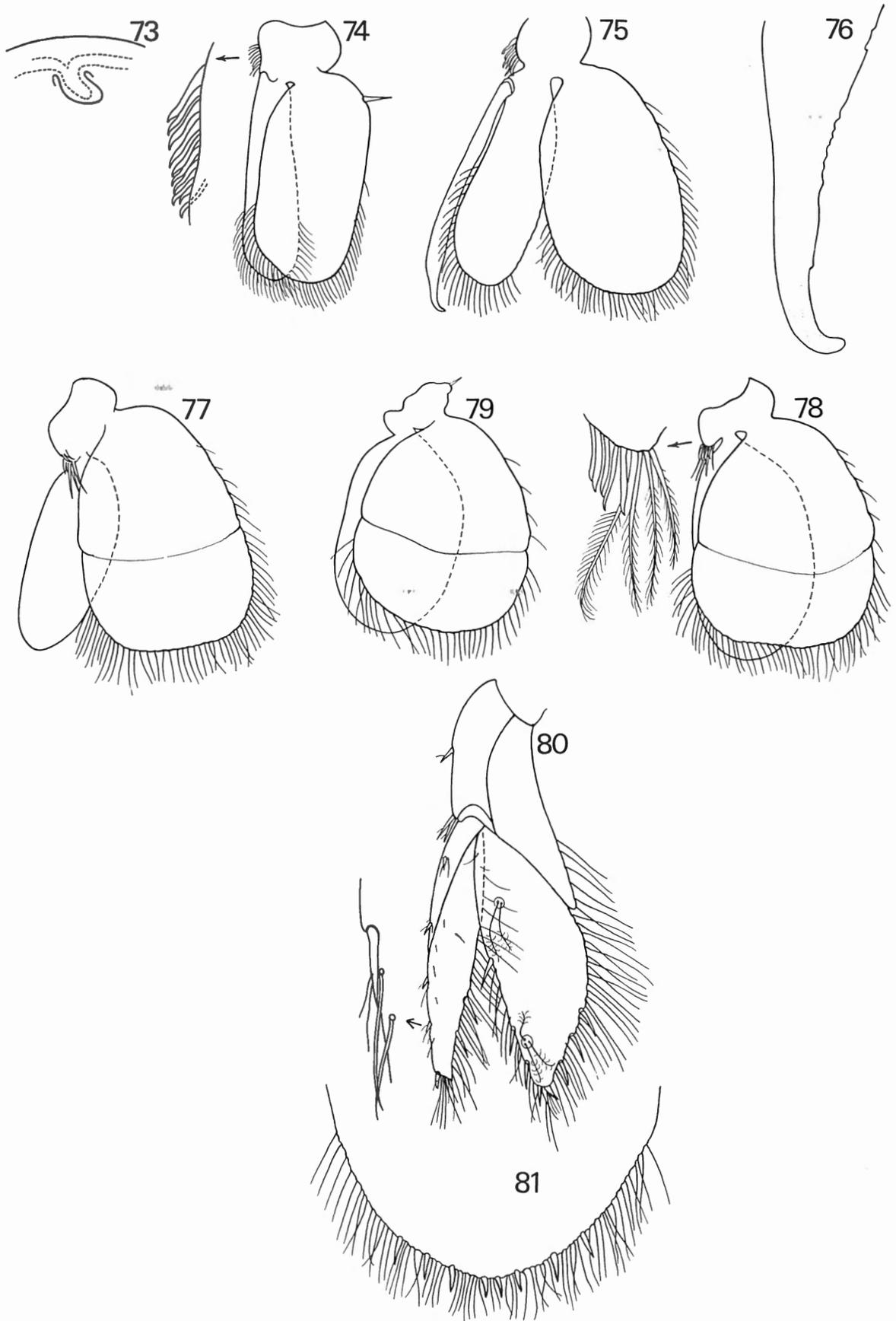
<sup>1</sup> In P. II dactylus + unguis bilaterally missing; in P. VII bilaterally broken or missing. All figures of pereiopods: same scale!



Figs. 53-65. - *Haptolana belizana*, male. - 53. Cephalon. - 54. Pereion, lateral. - 55. Pleon, pleotelson, and right uropod. - 56. Left A. I peduncle and first flagellar articles. - 57. Last 12 articles of left A. I flagellum. - 58. A. II peduncle and first flagellar articles. - 59. Lamina frontalis and clypeo-labrum. - 60. Almost lateral view of lamina frontalis (left) and rostrum (right). - 61. Left Mdb. - 62. Acies of right Mdb. - 63. Left Mx. I. - 64. Left Mx. II. - 65. Left Mxp.



Figs. 66-72. – *Haptolana belizana*, male, complete or more or less incomplete left pereopods I- VII (in fig. 66, the two arrows point to the strongly magnified unguis + accessory unguis + dactylian organ, and to the apex of propodus in median view).



Figs. 73-81. - *Haptolana belizana*, male. - 73. The unique penial papilla. - 74-79. Left pleopods I-V, ventral (fig. 76: strongly magnified distal parts of appendix masculina). - 80. Left uropod, dorsal. - 81. Distal margin of pleotelson.

(P. I distinctly less spinose, but here two distal tufts of setae on the propodus are arranged "in V").

There is an unique penial papilla, relatively short, not showing any tendency to bipartition.

Pleopods. Coxopodites small, not widened, on internal margin with remarkably rich armament of coupling hooks (Pl. I) or coupling hooks and plumose setae (Pl. II-IV); exopodites large, distally with numerous not very long plumose setae, that of Pl. I also with a rather long seta on external margin near base, those of Pl. II-V also with row of setulae along basal part of external margin, those of Pl. III-V apparently completely bipartite - but for Pl. III and IV the bipartition line is extremely faint; endopodites I-II hyaline, rather abundantly setose, III-V opaque, glabrous. Appendix masculina sub-basally rooted, longer than endopodite II, moderately slender, slightly broader just before its apical part which becomes suddenly much narrower, curving towards the blunt tip; external margin irregularly notched just basal from the narrowed zone.

Uropods. Coxopodite with one spine in middle of external margin, besides the pair of the distal angle, internal angle only moderately protruding, this projection distally with several setae. Exopodite very slightly shorter than endopodite, both with truncate apices; enp. very moderately broad, 2 sensory patches with 2 and respectively 3 plumose setae, margins (especially internal one) with numerous longer setae and 3 spines, two spines at apex, shorter setae and 3 spines along external margin; exp. remarkably slender, abundantly setose but with only very few spines along internal margin, external margin without long setae but with row of short spines with annex bristle and accompanied by one or two short setae.

Telson with the shape of a shield almost as wide as long, without strongly salient basal angles, convex lateral margins converging towards the obtuse, slightly crenulated distal margin on which 8 short spines are implanted; between these spines and largely exceeding their row on both sides, abundant rather long plumose setae.

#### AFFINITIES

The remarks about affinities of *H. bowmani* n. sp. are perfectly valid also for *H. belizana* n. sp. Although clearly related, these two species differ in numerous respects, and *H. belizana* will be easily distinguished from *H. bowmani*, i.a., by: larger size; larger head; A. II peduncle with only 4 articles; mxp. endite with more setae; pereopods with extremely long dactyli and (especially IV-VII) with propodi of completely different shape; pleopods with richer setation and richer armature of coupling hooks etc. of the coxopodites; unique penis; uropods with exp. narrower and longer, and both exp. and enp. more setose; wider telson.

#### HABITAT AND ASSOCIATED FAUNA

The Inland Blue Hole, located on the edge of the Hummingbird Highway about 40 km inland and 19 km

southeast of Belmopan, is a karst window to an underground freshwater river system (Day, 1992). This impressive karst feature consists of a 50 m diameter, 17 m deep collapse depression. On the southeastern side of the sinkhole, water wells up from a large underwater entrance at six m depth, flows 45 m across the bottom, before disappearing under a ledge on the far side. Upstream, a large underwater passage at 6 m depths connects after 70 m to the stream in St. Herman's Cave. Downstream, the underwater passage reaches depths to 25 m and was explored for 400 m without an end being found. Tree limbs and other organic debris are scattered about the gravel bottom of the underwater cave. Clear, warmer water, isolated in ceiling domes, contained troglitic isopods and shrimp. In deeper waters with significant flow, eyed shrimp and fishes were present. Discharge of water through the Blue Hole varies seasonally from less than one cubic meter per second in the dry season to up to 15 m<sup>3</sup>/sec. in the rainy season (DAY, 1992). Stream temperature was 23.5°C on 24 February 1989. Other animals collected from this cave included shrimp (*Typhlatya* sp.) and copepods. 24 II. 1989: 1 ♂ specimen was collected with a suction bottle from domes in the cave ceiling reaching at 3 m water depth; leg. TH. M. ILIFFE and S. SARBU.

#### *Jamaicalana pleoscissa* n. g. n. sp. (Figs. 82 - 108)

#### MATERIAL EXAMINED

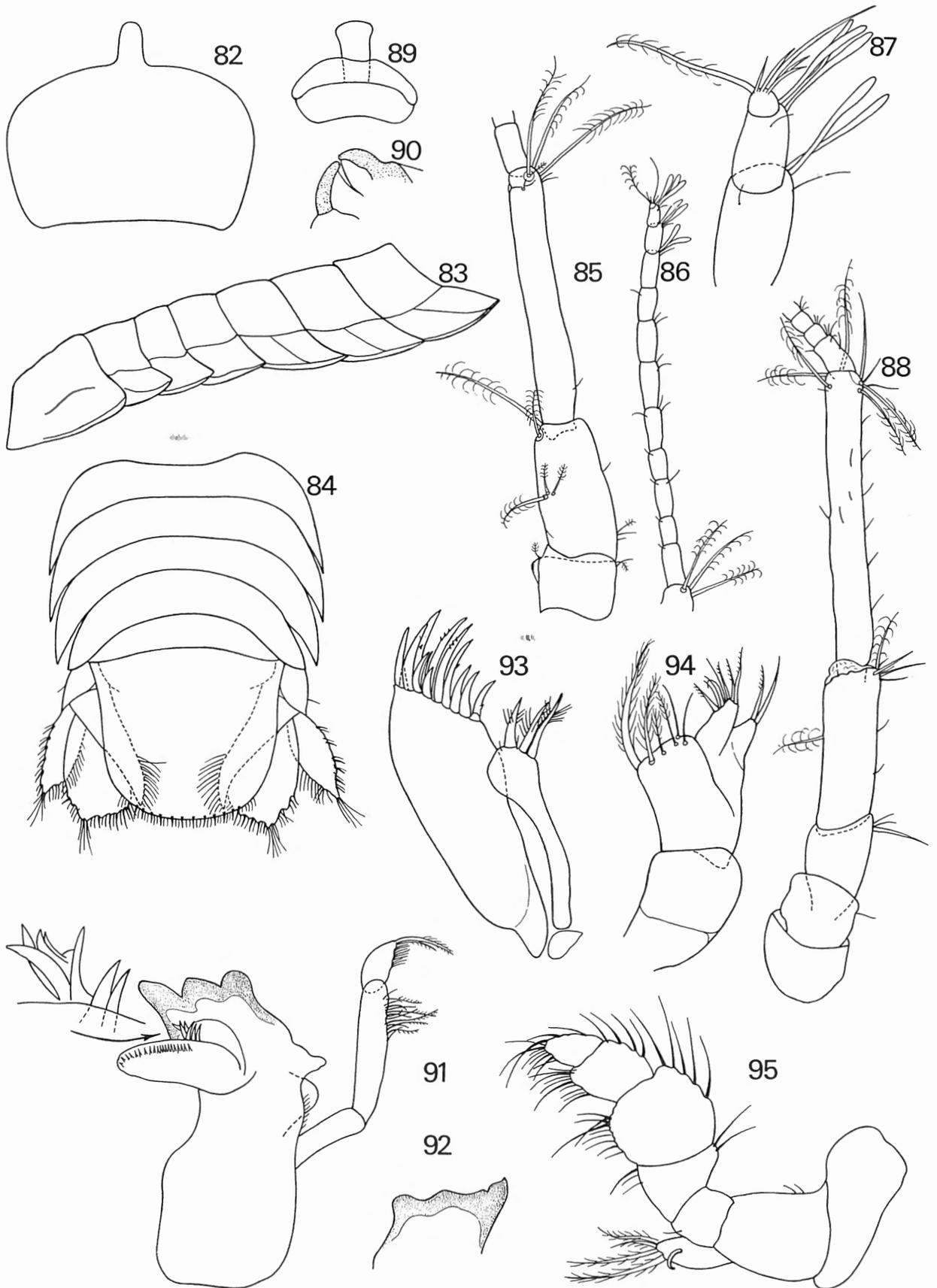
Jamaica, Westmoreland Parish: Revival Water Pump cave. ♀ holotype and (much smaller) ♀ paratype. Collected on 27 VI. 1990 by TH. M. ILIFFE and S. SARBU.

#### DESCRIPTION OF FEMALE

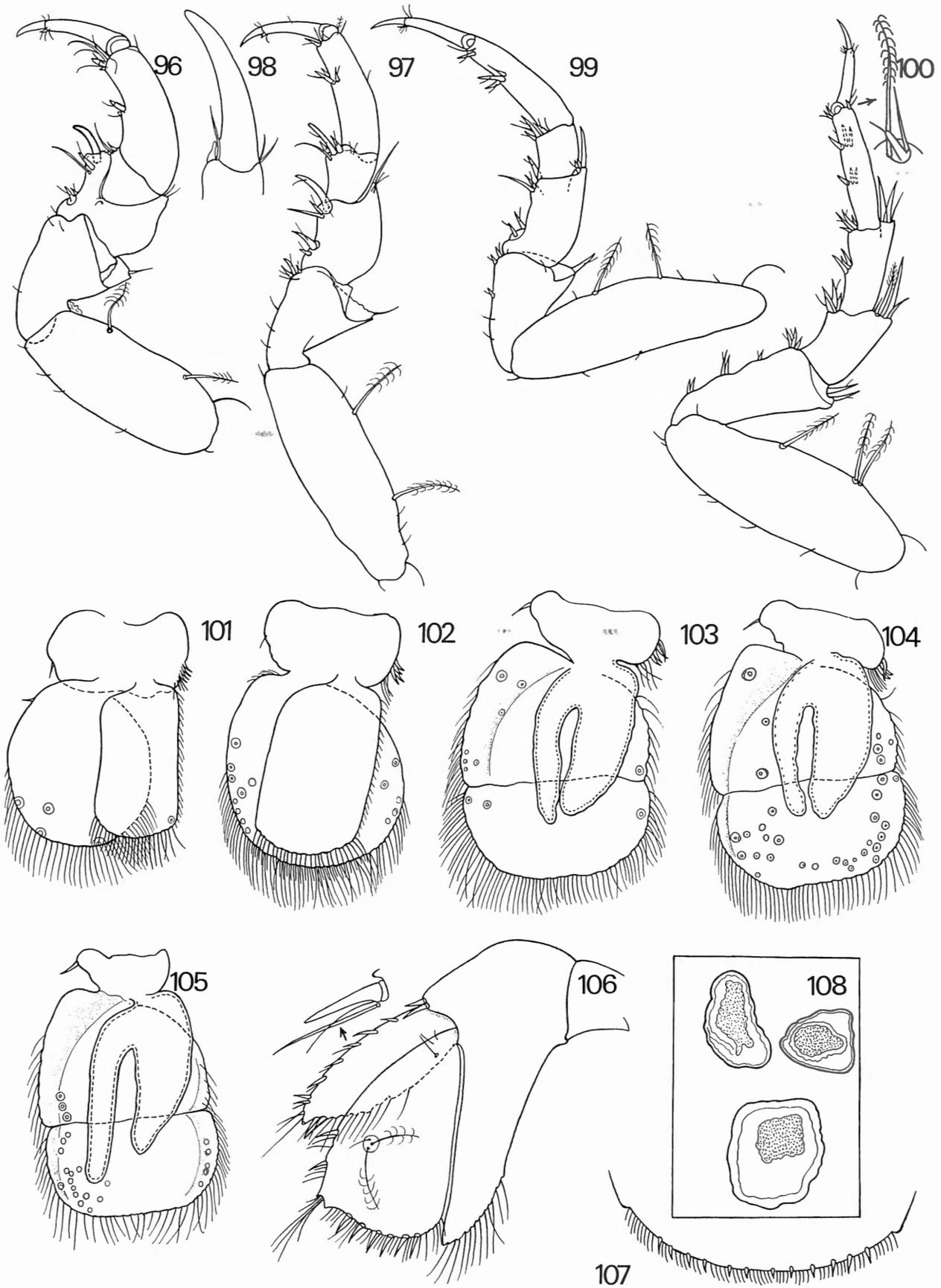
Length of holotype: 10 mm; of paratype: 3.6 mm; although considerably smaller than the holotype, the paratype is in all respects similar to it, having 7 well developed pereopods and even the highly characteristically split pleopod endopodites, no appendix masculina being present. Similar cases - whose biological significance is unknown - were mentioned by CARPENTER (1994) for *Bahalana geracei* CARPENTER and for "*Bahalana*" *mayana* BOWMAN. Cephalon roughly transversely rectangular but anteriorly slightly convex and lateral margins slightly converging posteriad. Rostrum strongly developed, with parallel margins, slightly curved ventrad, apex blunt.

Pereional sternites II-VII in lateral view all ending in sharp points. Pleonite I not - or only slightly - concealed under pereionite VII; pleonites I-III laterally very sharply ending (but tips not very long), IV with less sharp tips, tips of V concealed under pleonite IV.

A. I peduncle : art. 1 less than half as long as art. 2; art. 3 with its rather well individualized distal zone about



Figs. 82-95. - *Jamaicalana pleoscissa*, female. - 82. Cephalon. - 83. Pereion, lateral. - 84. Pleon, pleotelson, and uropods. - 85. A. I peduncle and first flagellar articles. - 86. A. I flagellum. - 87. More strongly magnified apical articles of A. I flagellum. - 88. A. II peduncle and first flagellar articles. - 89. Lamina frontalis and clypeo-labrum. - 90. Almost lateral view of lamina frontalis (left) and rostrum (right). - 91. Right Mdb. with more strongly magnified spines of spine row. - 92. Acies of left Mdb. - 93. Right Mx. I. - 94. Left Mx. II. - 95. Left Mxp.



Figs. 96-108. - *Jamaicalana pleoscissa*, female. - 96-97 and 99-100. Left pereopods I-II and, respectively, III-IV. - 98. More strongly magnified unguis and accessory unguis of P. II. - 101-105. Left pleopods I-V, dorsal. - 106. Left uropod, dorsal. - 107. Distal margin of pleotelson. - 108. Mineral concretions in (or on) some internal organs.

1.4 as long as art. 1+2; flagellum with 12 articles, last one minute, only art. 9 and 10 with 2 aesthetascs, and art. 11 with 3. A. II peduncle with short art. 1-3, art. 5 almost two times as long as art. 4 and almost as long as 2-4 together; flagellum with 24 articles (1<sup>st</sup> one longest, 2<sup>nd</sup> and 3<sup>rd</sup> shortest of all).

Lamina frontalis strongly developed, with parallel sides, apically even more widened; rather well seen dorsally, rather strongly curved dorsad, its apex almost meeting that of the rostrum, but not fused with it. Clypeus rather narrow, anteriorly slightly depressed in middle, lateral angles obtuse and practically not protruding beyond labrum (i.e., not freely hanging). Acies of right mdb. with 3 strong teeth, in left one middle tooth more attenuate, internal one more pointed; molar process with row of ca 20 small, fine points, and devoid of setulae. Mx. I lateral lobe with 12 spines, some sparsely ciliate; endite with 3 not very dissimilar plumose setae.

Mx. II with relatively poor setation: on internal lobe only 2 strong and 4 fine setae, on middle lobe 8, on external lobe only 2 setae. On mxp. endite one coupling hook and 4 plumose setae.

Pereiopod I robust, merus internally with particularly strong relief and armament, in its apico-internal angle with an extremely strong, curved spine; triangular carpus with poor armament; propodus moderately robust; dactylus rather long. P. II and III roughly resembling each other, of an intermediate type between I and IV-VII: in P. II merus with salient apico-external angle, in apico-internal angle a very strong, slightly curved spine, trapezoidal carpus also with very strong spine in apico-internal angle; in P. III there are no more exceedingly strong spines; propodus of P. II-III gradually less robust than in P. I, but dactylus similar. P. IV-VII strongly resembling each other, longer and more slender than I-III, gradually longer especially because of the elongation of ischium, fairly spinose and with some tendency of the spines on the slender propodi to be arranged "in V", dactyli slender, only moderately elongated. In all pereiopods well developed, not pectinate unguis with accessory unguis ("secondary spine") strong and freely projecting.

All pleopods with very wide coxopodites. Exopodites I-II round, III-V very large and more squarish, completely bipartite; all abundantly setose, setae rather long. Endopodites I and II almost quadrangular (external border of I very slightly emarginate), almost as long as the exopodites, distal margin setose, row of simple setulae along internal margins; enp. III-V fleshy, much shorter than exp., glabrous, very deeply split longitudinally, median "lobe" broader than lateral "lobe".

Uropods slightly reaching beyond telson. Coxopodite with enormously developed internal projection running along internal margin of the enp., almost reaching its apex and with rather many setae inserted along the crenulated distal part of its free margin. Endopodite very broad, roughly triangular (base of the triangle represented by the distal margin), apex bifid, only 2 spines on external margin, 6 spines intermingled with short setae along the distal one, and one sensory patch with 3 setae. Exopodite much

shorter, foliaceous, apex obliquely truncate; row of ca 7 spines mostly with annex bristle and accompanying short seta, along external margin; only one spine but several setae along internal margin.

Telson of regular shape, very broad (wider at base than maximum length), distal margin very slightly convex, with 12 very small spines between which equally short plumose setae are inserted (such setae also on both sides of the spine row; zone with spines and setae laterally delimited by minute emarginations).

#### ADDITIONAL OBSERVATIONS

Examination of the abundant gut content has allowed observation of very numerous remains of aquatic crustaceans (isopods, amphipods . . . ); even entire ostracods were found (*Pseudocypretta* sp., *Cypridopsis* sp. aff. *vidua*; D.L. DANIELOPOL det.). It is clear that *Jamaicalana pleoscissa* is a voracious carnivore feeding on living prey.

During dissection, from inside the body numerous small irregular concretions escaped, externally hyaline and with opaque "nucleus". Supposedly these are - despite their irregular, non-crystalline shape - of the same nature as the "crystals" described by CARPENTER (1981, 1994) from *Bahalana geracei* and *Dodecalana yagerae*.

#### DERIVATIO NOMINIS

The specific name alludes to the unique shape of the pleopod endopodites III-V: *scissus -a-um* (Lat.) = tore up.

#### AFFINITIES AND DIAGNOSIS OF THE NEW GENUS

Finding an acceptable generic placement for this new species was problematic.

There is, in some characteristics, similarity with one or another of the (reputedly polyphyletic, morphologically heterogeneous) *Anopsilana* PAULIAN & DELAMARE-DEBOUTTEVILLE, the apparently most consistent being found in the general structure of the pereiopods (although *Anopsilana* species are heterogeneous in this respect, and in the Jamaican species P. I and II are more robust and with some peculiar spines, and dactylus and propodus of all pereiopods are more elongated and slender), and in the uropod structure - and sometimes also armature; there is also similarity in the pleopods I-II and in the exopodites of III-V. Nevertheless, a series of other characteristics prevent inclusion of the Jamaican species in *Anopsilana*. Here is a selection of those apparently more significant: very strong rostrum; peduncle of A. I with art. 3, and peduncle of A. II with art. 5 much longer; mx. II with only 2 setae on external lobe; for several details of the pereiopods: *vide supra*; longitudinally deeply split endopodites of Pl. III-V; pleonite I not concealed under pereonite VII; enormously developed disto-internal projection of the uropod coxopodite.

Next comparisons should be made with *Bahalana* CARPENTER, but two remarks will precede them. First: *B. mayana* BOWMAN, 1987, should be removed from that genus, an opinion shared (*in litt.*) by Dr. N.L. BRUCE and Dr. J.H. CARPENTER; at present, we shall not attempt to find a better generic placement for this species<sup>2</sup>. Second: *Dodecalana yagerae* CARPENTER, 1994, is a species of *Bahalana*, this being also the opinion (*in litt.*) of Dr. N.L. BRUCE; we synonymize here *Dodecalana* with *Bahalana*; *B. yagerae* is a species remarkable especially by the absence, in mature specimens, of pereopods VII - maybe a fine example of neoteny. This means that presently three described species belong to *Bahalana*: *B. geracei* CARPENTER, 1981 (San Salvador, Bahamas), *B. cardiopus* NOTENBOOM, 1981 (Mayaguana, Bahamas), and *B. yagerae* (CARPENTER, 1994) (Grand Bahama and adjacent Sweeting's Cay).

There is some similarity in the Jamaican species with one or another species of *Bahalana*. Two interesting points of contact are the existence in *B. geracei* and in the species here described (but also in "*Bahalana*" *mayana*!) of dwarf specimens otherwise fully developed; and the existence in *B. geracei*, *B. yagerae*, and the Jamaican species, of mineral concretions in (or on) some internal organs. There is similarity with one or another *Bahalana* - but never with all three - in: A. I peduncle with art. 3 longest, molar process of mdb. devoid of setulae, art. 2 of mdb. palpus without long subapical seta, endite of mxp. with only one coupling hook, general shape of exp. and enp. of Pl. I-II and of exp. of Pl. III-V, general shape of telson. But a series of significant differences from *all* species of *Bahalana* render inclusion in this genus impossible: lamina frontalis strongly developed, wide, even wider apically; clypeus not freely hanging on the sides of labrum (but it is possibly similar in *B. geracei*); epimeres of pleonite V concealed behind pleonite IV; telson with row of spines on posterior margin; pereopods strongly differing: difference between P. I-III and IV-VII much less conspicuous, P. I-III devoid of conspicuous extensions of various articles; enp. of Pl. III-V glabrous, fleshy, longitudinally split almost to the base; uropod coxopodite with massive extension of disto-internal angle, almost reaching apex of enp.

We dislike unnecessarily creating new genera, but including this new species in one of those already described would clearly do violence to the existing evidence. We thus propose

#### *Jamaicalana* n. g.

TYPE SPECIES (here designated):

*Jamaicalana pleoscissa* n. sp.

#### DIAGNOSIS

Troglophobic cirolanid unable to roll into a ball, of large size but also with fully developed dwarf specimens;

cephalon roughly transversely rectangular, rostrum strong; pereonial epimera II-VII all ending in sharp points, pleonite I not concealed under pereonite VII, pleonite V well developed but with tips concealed behind pleonite IV; A. I peduncle with 3 articles, art. 3 longer than 1+2, flagellum with very few aesthetascs; A. II peduncle with long article 5; lamina frontalis long and broad, clypeus narrow, its lateral ends not freely hanging, tips of lamina frontalis and rostrum almost in contact; molar process of mdb. devoid of setulae; mx. II with reduced number of setae on the three lobes; endite of mxp. with only one coupling hook and 4 plumose setae; P. I, II-III, and IV-VII, forming three distinct groups, only I really robust and with strong armament of spines on merus, similarly strong spines also on merus and carpus of P. II, propodi never particularly strongly developed, dactyli of P. I-VII slender and moderately elongated (haptorial function of at least P. I-III demonstrated by the gut content showing that the species is feeding on living prey); *Pleopods* with strongly widened coxopodites, large and very setose exp. (exp. III-V bipartite), enp. I-II quadrangular and setose, enp. III-V fleshy, glabrous, longitudinally almost completely split in two "lobes"; uropods with disto-internal enormously developed projection, large and roughly triangular enp. and shorter, foliaceous exp.; telson very broad with distal row of (12) short spines and between them equally short setae.

#### HABITAT AND ASSOCIATED FAUNA

Revival Water Pump Cave, Westmoreland Parish, Jamaica, consists of an 8-10 m deep vertical pit situated between bedrock and breakdown walls at the edge of a 200 m diameter sinkhole. The cave is located on the opposite side of the sinkhole from the road leading north from the small town of Revival. A large, noisy pump inside the cave draws water from a still, groundwater pool in an area of total darkness. This pool is 6 m long by 1.5 m wide and 0.5 m deep. Water in the pool was clear, while the bottom consisted of gravel and small rocks. The cave is located approximately 1 km inland from the Caribbean coast. Amphipods, ostracods, gastropods, and copepods were also collected from the cave pool. 27 VI. 1990. 2 specimens were collected with a plankton net from the gravel bottom and root masses in 30 cm water depth; leg. TH. M. ILIFFE and S. Sarbu.

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<sup>2</sup> According to Dr. N.L. BRUCE (*i.l.*, 21 April 1997) this species is "... a straight forward eyeless *Metacirolana* having all the characters of that genus".

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Dr. N.L. BRUCE (Copenhagen) has knowledgeably answered several questions of the first author, especially regarding generic limits in Cirolanidae. He has also made a number of useful comments on the manuscript of this paper, sent to him by the authors. The first author also exchanged ideas with Dr. J.H. CARPENTER (Highland Heights, Kentucky).

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