

Amsterdam Expeditions to the West Indian Islands, Report 45*

CYCLOPIDS (CRUSTACEA, COPEPODA) FROM WEST INDIAN GROUNDWATER HABITATS

by

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ABSTRACT

A collection of groundwater cyclopoid copepods from the West Indian islands has been studied. Twenty species or subspecies are identified, and taxonomic and zoogeographic remarks on some rare or poorly known taxa are made. Seven new taxa, viz. *Neocyclops stocki* n. sp., *Metacyclops (Metacyclops) botosaneanui* n. sp., *Metacyclops (Metacyclops) diana* n. sp., *Metacyclops (Apocyclops) stocki* n. sp., *Mesocyclops intermedius* n. sp., *Mesocyclops aequatorialis americanus* n. ssp., and *Thermocyclops tenuis longifurcatus* n. ssp. are described.

In general, the cyclopoid fauna of the West Indian islands is much more closely related to the South and Central American fauna than to the fauna of North America. On the other hand, some species in the present collection, such as *Halicyclops antiguaensis* Herbst, *Neocyclops stocki* n. sp., *Metacyclops (Metacyclops) botosaneanui* n. sp., *Metacyclops (Metacyclops) diana* n. sp., *Metacyclops (Apocyclops) stocki* n. sp., *Mesocyclops intermedius* n. sp., and *Microcyclops dubitabilis* Kiefer are, up to now, endemic to the Caribbean area.

Other species, such as *Macrocyclus albidus* (Jurine), *Eucyclops serrulatus* (Fischer) and *Microcyclops varicans* (G.O. Sars) are cosmopolitan.

According to data from the present study, the most common and widely distributed species in the groundwaters of the West Indian Islands seem to be *Macrocyclus albidus* (Jurine), *Metacyclops panamensis* (Marsh), *Mesocyclops aspericornis* (Daday), and *Thermocyclops decipiens* (Kiefer).

RÉSUMÉ

Etude d'une collection de Copépodes Cyclopidés hypogés des îles des Indes Occidentales. Vingt espèces ou sous-espèces sont déterminées, des remarques sont faites sur la taxonomie et sur la distribution de plusieurs taxa rares ou médiocrement connus. Sept taxa nouveaux sont décrits:

Metacyclops stocki n. sp., *Metacyclops (Metacyclops) botosaneanui* n. sp., *Metacyclops (Metacyclops) diana* n. sp., *Metacyclops (Apocyclops) stocki* n. sp., *Mesocyclops intermedius* n. sp., *Mesocyclops aequatorialis americanus* n. ssp. et *Thermocyclops tenuis longifurcatus* n. ssp.

Généralement parlant, la faune de Cyclopidés des îles des Indes Occidentales est nettement plus apparentée à celles d'Amérique du Sud et Centrale qu'à la faune d'Amérique du Nord. D'autre part, les espèces suivantes de la collection étudiée sont à considérer, pour l'instant, comme endémiques pour la zone des Caraïbes: *Halicyclops antiguaensis* Herbst, *Neocyclops stocki* n. sp., *Metacyclops (Metacyclops) botosaneanui* n. sp., *Metacyclops (Metacyclops) diana* n. sp., *Metacyclops (Apocyclops) stocki* n. sp., *Mesocyclops intermedius* n. sp. et *Microcyclops dubitabilis* Kiefer.

D'autres espèces, telles que *Macrocyclus albidus* (Jurine), *Eucyclops serrulatus* (Fischer) et *Microcyclops varicans* (G. O. Sars) sont des éléments cosmopolites.

Les espèces suivantes de la collection étudiée semblent être les plus communes et largement distribuées dans les îles des Caraïbes: *Macrocyclus albidus* (Jurine), *Metacyclops panamensis* (Marsh), *Mesocyclops aspericornis* (Daday) et *Thermocyclops decipiens* (Kiefer).

INTRODUCTION

The groundwater cyclopoid fauna of the West Indian area, particularly that from the underground waters of the Lesser Antilles, has not been well investigated so far.

During the Amsterdam Expeditions to the West Indian Islands, between 1974 and 1980, a large amount of cyclopoid copepods was obtained from caves, springs, wells and interstices of macroporous substrates of numerous islands, both of the Greater and of the Lesser Antilles, viz. Haiti, Jamaica, Puerto Rico, Curaçao, Bonaire, Aruba, Barbuda, St. Croix, Martinique, Eleuthera, Mayaguana, San Salvador

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Island, Inagua, the Caymans, the Turks & Caicos Islands, and Crooked Island.

A great part of the above material was entrusted to me for study through the kindness of Prof. Dr. J. H. Stock, to whom I wish to express my sincere thankfulness.

A list of all the identified species and subspecies is given in table I. Brief descriptions and taxonomic, ecologic and zoogeographic remarks on some rare or poorly known species, as well as the descriptions of *Neocyclops stocki* n. sp., *Metacyclops (Metacyclops) botosaneanui* n. sp., *Metacyclops (Metacyclops) diana* n. sp., *Metacyclops (Apocyclops) stocki* n. sp., *Mesocyclops intermedius* n. sp., *Mesocyclops aequatorialis americanus* n. ssp. and *Thermocyclops tenuis longifurcatus* n. ssp. are provided. Widely distributed or cosmopolitan species, as well as species that were already known from the same area, are not discussed in detail.

The material is preserved in the collections of the Zoölogisch Museum, Amsterdam, The Netherlands (ZMA) and in the author's collec-

tions at the "Dipartimento di Scienze Ambientali", University of L'Aquila, Italy (GPC).

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- 1974 — Curaçao, Martinique: J. H. Stock, B. Stock.
- 1975 — Bonaire, St. Croix: J. H. Stock.
- 1976 — Bonaire: J. H. Stock.
- 1979 — Cayman Islands, Turks & Caicos Islands, Bahamas: J. H. Stock, E. S. W. Weinberg.
- 1979 — Haiti: L. Botosaneanu, J. Notenboom.
- 1979 — Jamaica: L. Botosaneanu, J. Notenboom, J. H. Stock, E. S. W. Weinberg.
- 1980 — Aruba, Bonaire: L. Botosaneanu, J. Notenboom.
- 1980 — Puerto Rico: E. S. W. Weinberg, F. Zijlstra.

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TABLE I

List of species collected by the Amsterdam Expeditions to the West Indian islands, and their distribution in the West Indies.

<i>Halicyclops antiquaensis</i> Herbst, 1983 (Bonaire, Antigua)
<i>Neocyclops stocki</i> n. sp. (Bonaire)
<i>Neocyclops affinis</i> Dussart, 1974 (San Salvador)
<i>Eucyclops serrulatus</i> (Fischer, 1851) (widely distributed)
<i>Paracyclops fimbriatus chiltoni</i> (Thomson, 1883) (widely distributed)
<i>Macrocyclus albidus</i> (Jurine, 1828) (widely distributed)
<i>Metacyclops (Metacyclops) botosaneanui</i> n. sp. (Bonaire)
<i>Metacyclops (Metacyclops) diana</i> n. sp. (Haiti)
<i>Metacyclops (Metacyclops) mendocinus</i> Wierzejski, 1902 (Puerto Rico, Haiti, Cuba)
<i>Metacyclops (Apocyclops) panamensis</i> (Marsh, 1913) (widely distributed)
<i>Metacyclops (Apocyclops) stocki</i> n. sp. (Barbuda, Bonaire)
<i>Microcyclus varicans rubellus</i> (Lilljeborg, 1901) (widely distributed)
<i>Microcyclus dubitabilis</i> Kiefer, 1934 (Curaçao, Bonaire, Martinique, Guadeloupe, Dominican Republic, Haiti)
<i>Microcyclus ceibaensis</i> (Marsh, 1919) (Bonaire, Haiti, Cuba)
<i>Mesocyclops aspericornis</i> (Daday, 1906) (widely distributed)
<i>Mesocyclops intermedius</i> n. sp. (Bonaire)
<i>Mesocyclops ellipticus</i> Kiefer, 1936 (Haiti, Jamaica, Cayman, Cuba)
<i>Mesocyclops aequatorialis americanus</i> n. ssp. (Crooked Island, Inagua)
<i>Thermocyclops tenuis longifurcatus</i> n. ssp. (Bonaire)
<i>Thermocyclops decipiens</i> (Kiefer, 1929) (Aruba, Curaçao, Bonaire, Martinique, Guadeloupe, Marie Galante, U.S. Virgin Islands, Haiti).

DESCRIPTIVE PART

Subfamily HALICYCLOPINAE Kiefer

***Halicyclops antiguaensis* Herbst, 1983**
(Figs. 1-5)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-31, NETHERLANDS ANTILLES, Bonaire: pool in a small cave very close to Boca Onima (12°15'35"N 68°18'37"W), chlorinity 4402 mg/l, temp. not recorded, 28 May 1980. Five ♀♀, completely dissected and mounted in Faure's medium (ZMA).

Description. — Total length, excluding antennulae and caudal setae, 0.58 to 0.62 mm (mean of five specimens 0.60 mm). Metasome longer than urosome. Abdominal segments faintly denticulate along the posterior margin (dorsal view), and with a row of ventral spines on the same margin; genital segment slightly larger than long, with lateral sides slightly produced; anal segment deeply cleft, with a row of stout spines at the base of each furcal ramus.

Furcal rami short (length/width ratio 1.39 to 1.41); all furcal setae usually found in the genus present, except the innermost distal one, which is very reduced and spine-like.

Antennula 6-segmented.

Spine formula of the third exopodal segment of the swimming legs 1 to 4: 3 4 4 3.

Leg 5 rounded and armed with 3 short spines (shorter than the segment) and 1 long, slender seta.

Remarks. — The specimens from Bonaire differ from the original description by Herbst (1983) based on material from Antigua, particularly with regard to the less marked protrusions on the lateral sides of the middle of the genital segment, and to the very reduced innermost distal furcal setae. However, owing to the morphology and the armature of leg 5, as well as to the construction and armature of all the swimming legs, it is easily identifiable as *H. antiguaensis*.

Up to now, *H. antiguaensis* is known only from groundwaters (wells) of the Caribbean area, viz. from Antigua (Herbst, 1983) and Bonaire (present data).

***Neocyclops stocki* n. sp.**
(Figs. 6-10)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-39, NETHERLANDS ANTILLES, Bonaire: large natural well close to the Spelonk cave (12°13'23"N 68°13'17"W) on Estate Bolivia, a few metres from the shore, chlorinity 14060 mg/l, temp. 28° C, 29 May 1980. One holotype (♀), completely dissected and mounted in Faure's medium, three ♀♀ in Faure, four ♀♀ in alcohol (all paratypes).

Sta. 80-43, same island: Pos di Molino, Estate Bacuna (12°07'29"N 68°12'65"W), a 6 m deep well, with 10 to 20 cm of water, chlorinity 2464 mg/l, temp. not recorded, 30 May 1980. One ♀ (paratype), in Faure.

Sta. 80-47, same island: Playa Cocolishi, Washington National Park (12°18'32"N 68°22'00"W), interstitia of coarse sand on a protected beach, method Karaman-Chappuis, chlorinity 23862 mg/l, temp. 29.5° C, 31 May 1980. Eleven ♀♀ (paratypes), in Faure.

Holotype and six paratypes in ZMA, remaining paratypes in the author's collection (GPC).

Description. — A large *Neocyclops*; body length, excluding antennulae and caudal setae, ranging from 0.61 to 0.69 mm. Both thoracic and abdominal segments dorsally and ventrally naked; genital segment about as long as wide, receptaculum seminis as in fig. 7.

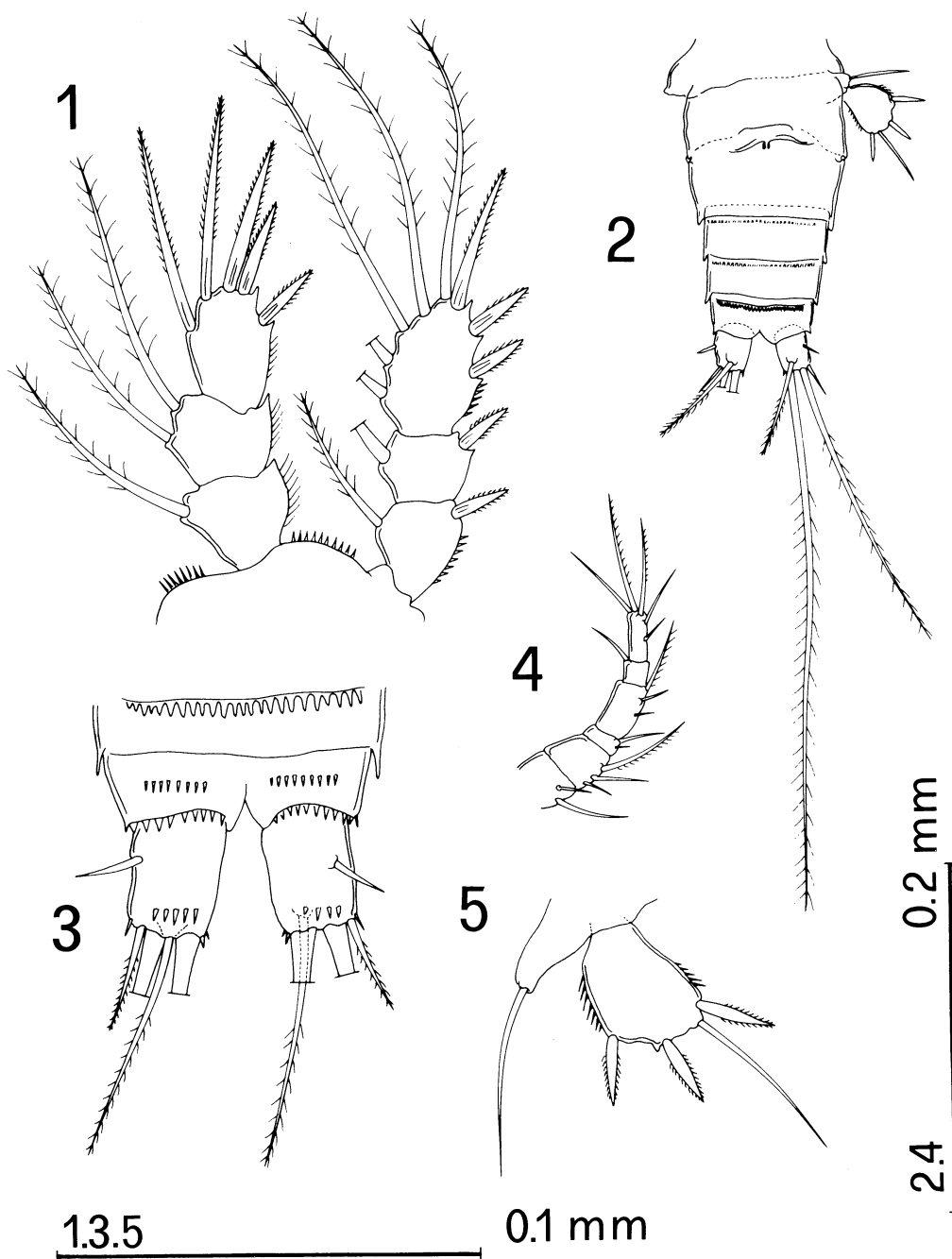
Furcal rami short (length/width ratio 2.2 to 2.4), parallel and well divaricated; innermost distal seta long, more than twice the length of the outermost one; dorsal seta very elongate, longer than the innermost one, and more than twice as long as the ramus.

Antennula 12-segmented, reaching to about 2/3 of the cephalothorax; segments 8-12 elongated. Antenna 4-segmented. Mandibular palp reduced, without visible setae; other mouthparts without particular characteristics.

Swimming legs without particular characteristics. Leg 5 composed of 3 segments, the distal one elongated (length/width ratio 3.9 to 4.1) and armed with 3 subequal spines and one long, apical seta.

Male unknown.

Affinities and distribution. — Following Pleša's (1981) key to the species of the genus *Neocyclops* (= *Eurycyclops* = *Pareuryte*), *N. stocki* n. sp. is closely related both to *N. medius* Herbst, 1955 and *N. remanei mediterraneus*

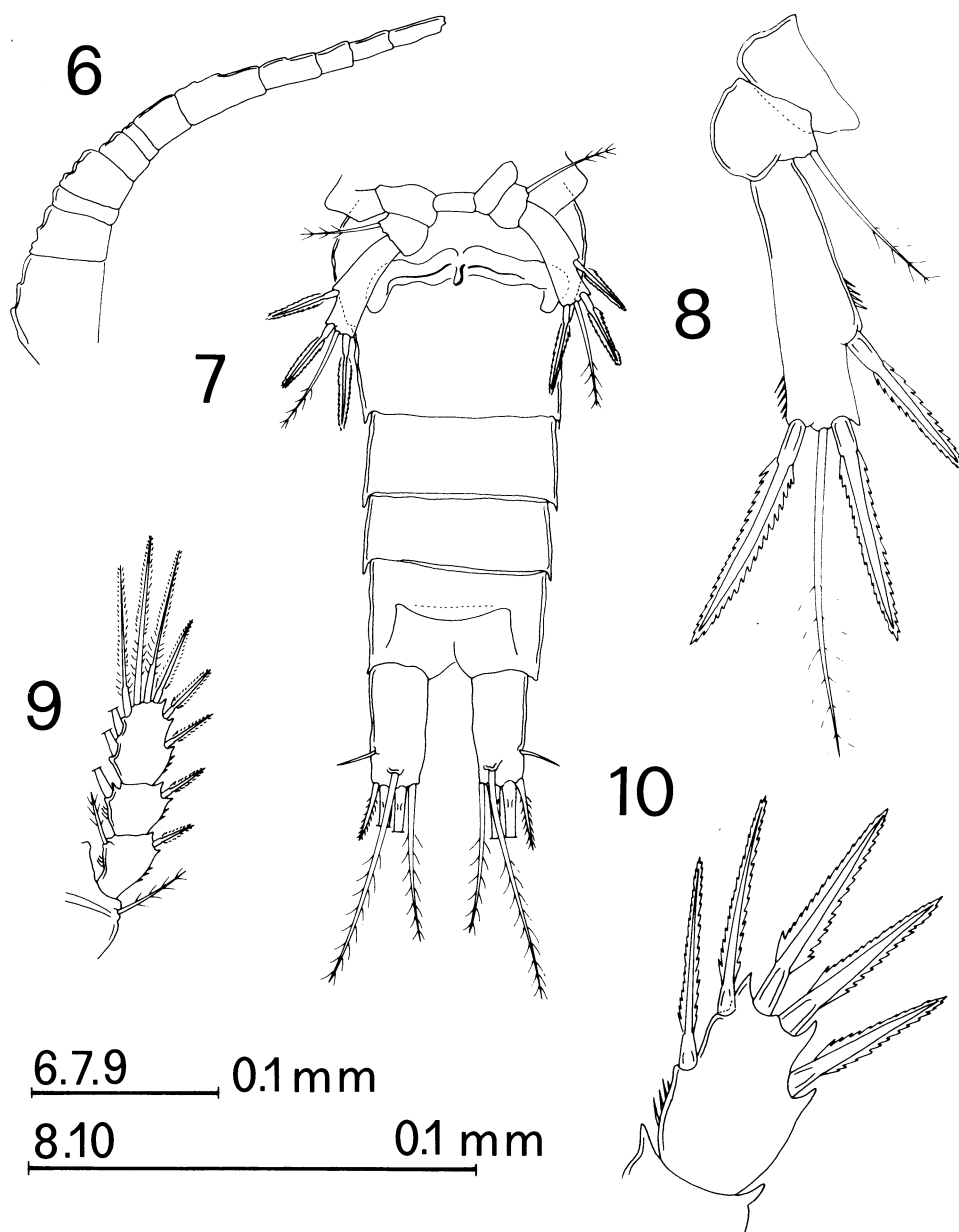


Figs. 1-5, *Halicyclops antigenaensis* Herbst, 1983, from Bonaire (♀, sta. 80-31): 1, leg 4; 2, abdomen and caudal rami, dorsal view; 3, caudal rami, ventral view; 4, antennula; 5, leg 5.

(Kiefer, 1960). *N. stocki* n. sp. is distinguished as follows: from the former in having a different construction of the antennula, short and well separated furcal rami and a different length ratio of the distal segment of leg 5; from the lat-

ter the new species differs mainly by the shorter caudal rami and their armature, and by the length ratio of the distal segment of leg 5.

At present *N. stocki* n. sp. is to be considered endemic to the island of Bonaire.



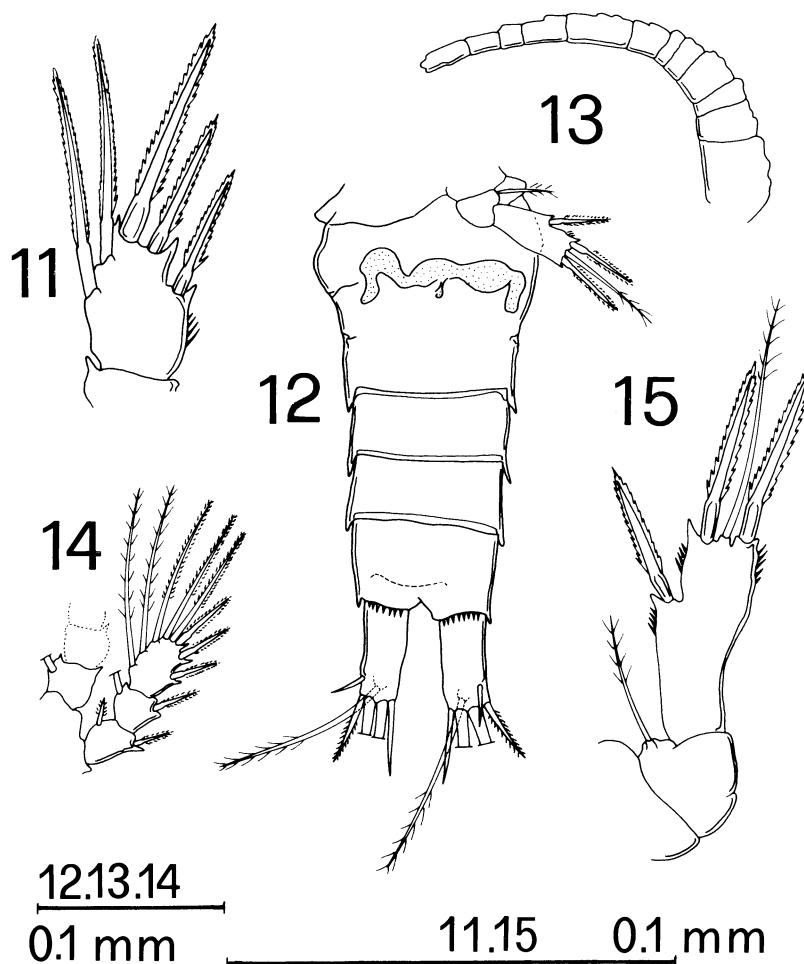
Figs. 6-10, *Neocyclops stocki* n. sp., from Bonaire (holotype, sta. 80-39): 6, antennula; 7, abdomen, caudal rami (dorsal view) and legs 5; 8, leg 5; 9, exopodite of leg 4; 10, distal segment of endopodite of leg 4.

***Neocyclops affinis* Dussart, 1974**
(Figs. 11-15)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 79-188, BAHAMAS, San Salvador Island: well at Riding Rock Point, N. of Teacher's Quarters (24°04'17"N 74°31'53"W), chlorinity 39 mg/l, temp. 25.3°C, 24 Nov. 1979. One ♀, dissected and mounted in Faure's medium. Associated fauna: Oligochaeta, Nematoda, Ostracoda, Acari, Zoea larvae.

Description. — Body length, excluding antennulae and furcal setae, 0.53 mm. Rostrum triangular. Genital segment slightly longer than large and anteriorly enlarged. Abdominal segment naked posteriorly.

Furcal rami short, 2.1 times longer than wide; innermost and outermost distal setae subequal in length; dorsal seta very long, more



Figs. 11-15, *Neocyclops affinis* Dussart, 1974, from San Salvador Island (♀, sta. 79-188): 11, distal segment of endopodite of leg 4; 12, abdomen, furcal rami (ventral view) and leg 5; 13, antennula; 14, exopodite of leg 4; 15, leg 5.

than twice the length of the outermost seta; outer lateral seta implanted about at 3/4 of the length of the caudal ramus.

Antennula 12-segmented. Antenna without exopodite, 4-segmented. Mandibular palp absent.

Maxilliped with 3 basal spines. Leg 5 elongated. Other characteristics as in the original description of the species.

Remarks. — The Bahamian specimen differs from the description by Dussart (1974) in the following characteristics: genital segment less enlarged anteriorly, slightly longer caudal rami, innermost and outermost distal furcal

setae subequal in length (the innermost slightly shorter than the outermost in the original description) and a more elongated dorsal furcal seta.

Up to now *N. affinis* is known, besides the present record (Bahamas), from the type-locality in Ethiopia, along the Red Sea coast, Madagascar and Ghana.

The discovery of this species from San Salvador brings the total number of species of the genus *Neocyclops* from the Caribbean area to 4, the others being: *N. improvisus* Pleša and *N. remanei mediterraneus* (Kiefer) both from Cuba, and *N. stocki mihi* from groundwaters of Bonaire (present data).

Subfamily EUCYCLOPINAE Kiefer

Eucyclops serrulatus (Fischer, 1851)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-02, NETHERLANDS ANTILLES, Aruba: Lago Colony Cave, second well (Fifth Avenue no. 339) (12°25'33"N 69°52'40"W), very clean, bottom mud and sand, chlorinity 3514 mg/l, temp. 32.5° C, 21 May 1980. Three ♀♀, one ♂ (alcohol) and four ♀♀ (dissected and mounted in Faure's medium); alcohol material in GPC, slides in ZMA.

Paracyclops fimbriatus chiltoni (Thomson, 1883)

Cyclops chiltoni Thomson, 1883: 97.

Paracyclops fimbriatus f. *imminuta* Kiefer, 1928: 50.

Paracyclops finitimus Kiefer, 1928: 51.

Paracyclops fimbriatus f. *bromeliarum* Herbst, 1959: 58.

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 79-45, JAMAICA, Clarendon Parish: Milk Spring no. 2 (near Wilco factory, Springfield) (17°51'46"N 77°20'36"W), deep well (water table at 25 m, water depth 33 m), chlorinity 134 mg/l, temp. 25.8° C, 24 Oct. 1979. Three ♀♀ mounted in polyvinyl lactophenol (stained with chlorazol black) (ZMA).

Sta. 79-40, same island, same parish: Cottage of Public Works Department, just E. of Dawkins Pen (17°49'40"N 77°13'28"W), shallow well (water table at 2.50 m, water depth 0.30 m), with windpump, leaves, chlorinity 8048 mg/l, temp. 26.8° C, 24 Oct. 1979. Two ♀♀, one ♂, mounted as above (ZMA).

Sta. 79-570, HAITI, dépt. de l'Est: Cave Ti-Louis, in the karstified plateau of Cap Rouge (estimated position 18°16'21"N 72°27'22"W), pool in cave, alt. 595 m, chlorinity not determined, temp. 20.0-20.5° C, guano, 17 Nov. 1979. Two ♀♀, mounted as above (ZMA).

Remarks. — *Paracyclops fimbriatus chiltoni* is widely distributed in northern, central and southern America, both in surface freshwaters and groundwaters.

According to Dussart (1969), Lindberg (1958) and Pleša (1981), this species shows a great variability, that could include, as synonyms, *P. fimbriatus* f. *imminuta* Kiefer and *P. finitimus* Kiefer. Monchenko (1974) proposed the synonymy between *P. fimbriatus* f. *bromeliarum* Herbst and *P. fimbriatus chiltoni*.

Macrocyclus albidus (Jurine, 1828)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-47, NETHERLANDS ANTILLES,

Bonaire: Playa Cocolishi, Washington National Park (12°18'32"N 68°22'00"W), interstitia of protected beach, coarse sand, method Karaman-Chappuis, chlorinity 23862 mg/l, temp. 29.5° C, 31 May 1979. One ♀, in Faure (ZMA).

Sta. 80-118, PUERTO RICO, doline near Cueva Espiral (18°20'40"N 66°49'25"W), fed by the underground river, Río Camuy, fast-running, completely dark, chlorinity and temp. not determined, 6 July 1980. One ♀, in Faure (GPC).

Sta. 79-506, HAITI, dépt. du Sud: Laval (18°15'10"N 73°47'51"W), old "colonial" well, water table at 4 m, water depth 17 m, chlorinity 35.4 mg/l, temp. 26.0° C, 31 Oct. 1979. One ♀, in Faure (GPC).

Sta. 79-509, HAITI, dépt. du Sud: Puits Chaillé, about 1000 m S. of sugar factory Dessalines of Cayes (18°14'40"N 73°46'53"W), open well, water table at 3.5 m, water depth 6.5 m, chlorinity 19.8 mg/l, temp. 27.8° C, 1 Nov. 1979. One ♀, in Faure (GPC).

Sta. 79-560, HAITI, dépt. de l'Est: well of Jacques Siméon at Marigot (18°13'51"N 72°18'52"W), in the extreme east of the village, open well, water table at 4 m, water depth 1 m, chlorinity 31 mg/l, temp. 25.0° C, clean, 16 Nov. 1979. One ♀, one ♂, in Faure (GPC).

Sta. 79-639, HAITI, dépt. de la Grande Anse, Berguer well at Jérémie, rue Paul Emile Jeanmichel, about 100 m from the sea (18°38'32"N 74°07'05"W), open, water table at 4 m, water depth 0.8 m, chlorinity 131 mg/l, temp. 26.2° C, 1 Dec. 1979. Two ♀♀, in Faure (GPC).

Sta. 79-640, HAITI, dépt. de la Grande Anse: Bac well, Jérémie, near Hôtel Versailles, about 150 m from the sea (18°38'06"N 74°06'48"W), covered, very clean, water table at 3 m, water depth 2 m, pumped, chlorinity 445 mg/l, temp. 27.5° C, 1 Dec. 1979. Two ♀♀, 1 ♂, in Faure (ZMA).

Sta. 79-653, HAITI, dépt. de la Grande Anse, River Voldroque at Marché Léon (18°32'20"N 74°07'05"W), interstitia of alluvia, pebbles, method Karaman-Chappuis, chlorinity less than 10 mg/l, temp. 24.2° C, 4 Dec. 1979. One ♀, in Faure (GPC).

Sta. 79-659, HAITI, dépt. de la Grande Anse: Sources de Tessier (valley of the river La Grande Anse, between Beaucalin and Ravine Blanche) (18°35'55"N 74°10'46"W), spring with moderate water supply, pebbles on sand, chlorinity and temp. not determined, 5 Dec. 1979. Three ♀♀ and 1 ♂, in Faure (GPC).

Sta. 79-660, HAITI, dépt. de la Grande Anse: spring about 200 m from previous station, flowing into a basin, gravel on bottom, marine, temp. 24.0° C, 5 Dec. 1979. Three ♀♀, in Faure (GPC).

Sta. 79-52, JAMAICA, parish of St. Mary: Roaring River, W. of Annotto (18°14'42"N 76°49'07"W), interstitia in gravel of a small brooklet, alt. 15-30 m, chlorinity and temp. not determined, 26 Oct. 1979. Three ♀♀, in alcohol (GPC).

Sta. 79-53, JAMAICA, parish of St. Mary: Robins Bay near Green Castle (Annotto Bay), interstitia of marine beach (18°18'19"N 76°48'13"W), limestone rock, coral

debris, 0.3 m above wave-line, chlorinity 23016 mg/l, temp. 26.0° C, 26 Oct. 1979. One ♂, in alcohol (GPC).

Sta. 79-58, CAYMAN ISLANDS, Grand Cayman: Water Ground (19°22'32"N 81°24'02"W), open well in swampy grassland (water table at 0.5 m, water depth 0.6 m), chlorinity 56 mg/l, temp. 28.5° C, filamentous algae, 27 Oct. 1979. One ♀, in Faure (GPC).

Sta. 79-65, CAYMAN ISLANDS, Grand Cayman: Bodden's well (Boddentown) (19°16'08"N 81°15'20"W), open well on kind of natural cleft in coral rock, water table at 3 m, water depth 1.5 m, chlorinity 209 mg/l, temp. 27.5° C, 27 Oct. 1979. One ♀, in Faure (GPC).

Sta. 79-74, CAYMAN ISLANDS, Cayman Brac: Spot Bay (19°45'17"N 79°44'35"W), well marked "Nov. 7, 1957", open, with electrical pump, chlorinity 31 mg/l, temp. 26.3° C, 28 Oct. 1979. One ♀, in Faure (GPC).

Sta. 79-78, CAYMAN ISLANDS, Cayman Brac: Stake Bay, Western Nurses Residence (Old Clinic Yard) (19°42'37"N 79°50'04"W), pumped well, water table at 0.1 m, water depth 0.3-0.5 m, chlorinity 22 mg/l, temp. not recorded, 28 Oct. 1979. One ♀ (GPC).

Sta. 79-80, CAYMAN ISLANDS, Cayman Brac: Cotton Tree Bay (19°42'10"N 79°51'34"W), square well cut in rock, covered, pumped, water table at 1 m, water depth 0.5 m, chlorinity 893 mg/l, temp. 28.0° C, 28 Oct. 1979. One ♀ (GPC).

Sta. 79-81, CAYMAN ISLANDS, Cayman Brac: Knob Hill (19°41'20"N 79°51'39"W), covered well, W. of the road, pumped, water table at 1.5 m, water depth 1 m, chlorinity 84 mg/l, temp. 28.6° C, 28 Oct. 1979. Two ♀ ♀, in Faure (GPC).

Sta. 79-149, TURKS & CAICOS ISLANDS, Providenciales, Pasture Well, East (21°47'11"N 72°15'43"W), open well, polluted, water table at 0.75 m, water depth 0.25 m, chlorinity 2816 mg/l, temp. 25.0° C, 16 Nov. 1979. Two ♀ ♀, in Faure (GPC).

Sta. 79-121, BAHAMAS, Mayaguana: Abraham Bay (22°22'14"N 72°57'52"W), Mr. Brooks' well, open, cut in rock, water table at 2.5 m, water depth 0.3 m, chlorinity 1122 mg/l, temp. 25.6° C, 11 Nov. 1979. One ♀, in Faure (GPC).

Sta. 79-124, BAHAMAS, Mayaguana: Abraham Bay, Public School Well (22°22'09"N 72°57'50"W), open well, water table at 3 m, water depth 0.2 m, chlorinity 144 mg/l, temp. 25.5° C, 11 Nov. 1979. Two ♀ ♀, in Faure (GPC).

Sta. 79-209, BAHAMAS, Crooked Island: True Blue Settlement (22°43'48"N 74°03'55"W), open, pumped well, chlorinity 284 mg/l, temp. 25.6° C, 28 Nov. 1979. One ♀, in Faure (GPC).

Sta. 79-210, BAHAMAS, Crooked Island: True Blue East (22°43'45"N 74°03'21"W), open well, water table at 2.5 m, water depth 0.3 m, chlorinity 214 mg/l, temp. 26.3° C, 28 Nov. 1979. One ♂, in Faure (GPC).

Sta. 79-184, BAHAMAS, San Salvador Island: Hannah Bay at Club Short Stop (24°06'40"N 74°27'08"W), square well, water table at 1 m, water depth 0.3 m, chlorinity 90 mg/l, temp. 25.5° C, 23 Nov. 1979. One ♀,

mounted in polyvinyl lactophenol and stained with chlorazol black (ZMA).

Sta. 79-185, BAHAMAS, San Salvador Island: Graham's Harbour, Public Dock well (24°07'20"N 74°27'27"W), open, water table at 2.5 m, water depth 0.2 m, chlorinity 108 mg/l, temp. 23.6° C, 23 Nov. 1979. Three ♀ ♀, mounted in polyvinyl lactophenol/chlorazol black (ZMA).

Sta. 79-188, BAHAMAS, San Salvador Island: well N. of Teacher's Quarters (village Riding Rock Point) (24°04'17"N 74°31'53"W), closed, clean well, water table at 2 m, water depth 1.5 m, chlorinity 39 mg/l, temp. 25.3° C, 24 Nov. 1979. One ♀, mounted in polyvinyl lactophenol/chlorazol black (ZMA).

Sta. 79-98, BAHAMAS, Eleuthera: John Millars village, well S. of the road (24°41'07"N 76°12'08"W), open well with leaves and green algae, near a big pool, chlorinity 106 mg/l, temp. 25.8° C, 8 Nov. 1979. Two ♀ ♀, mounted in polyvinyl lactophenol/chlorazol black (ZMA).

Sta. 79-101, BAHAMAS, Eleuthera: Foxhill, well W. of the road (24°43'12"N 76°13'06"W), open, water table at 1 m, water depth 0.2 m, chlorinity 232 mg/l, temp. 25.1° C, 8 Nov. 1979. One ♂, mounted in polyvinyl lactophenol/chlorazol black (ZMA).

Sta. 79-120, BAHAMAS, Eleuthera: Savannah Sound (south-east), large concrete well in meadow, dirty (estimated position: 25°04'44"N 76°07'40"W), chlorinity 304 mg/l, temp. not recorded, 9 Nov. 1979. One ♂, in alcohol (GPC).

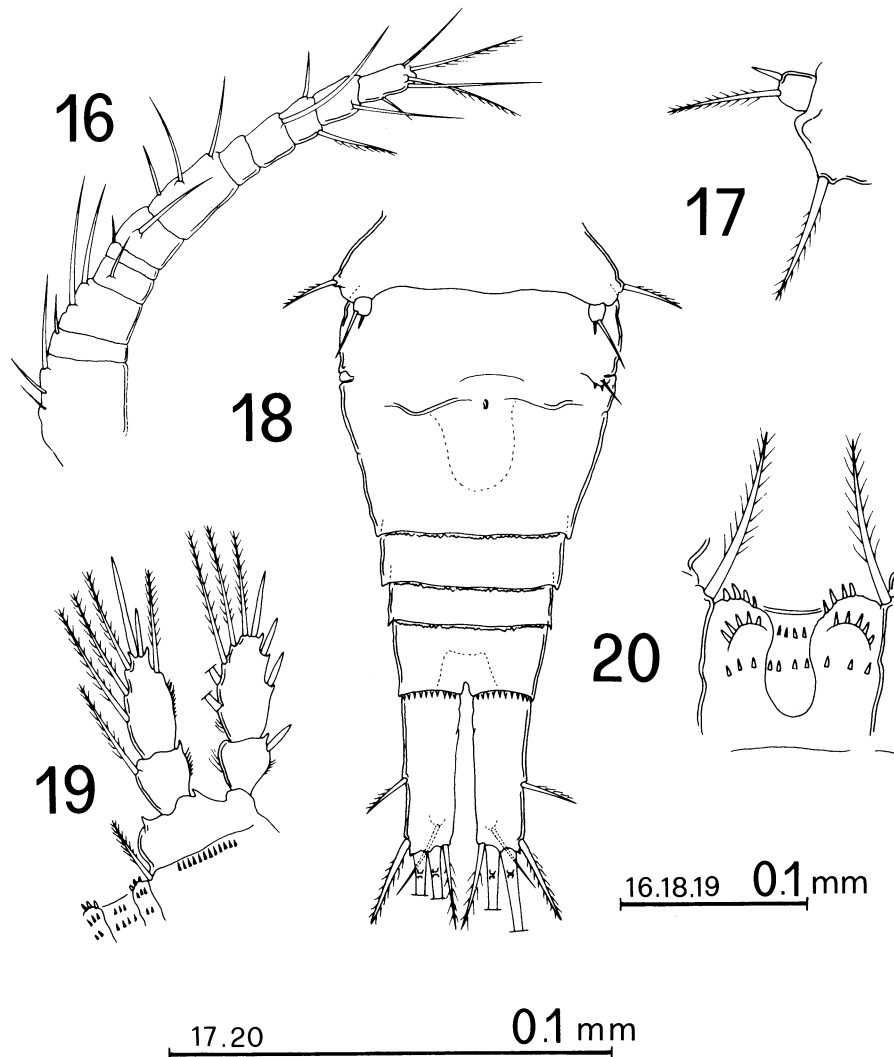
Remarks. — This large species is well characterized by the membrane on the last segment of the antennulae, the shortness of the caudal rami and the morphology of the receptaculum seminis.

The presence of *M. albidus* in the groundwaters of the Antilles has little biogeographic significance since it is found world-wide, both in surface and underground waters.

Subfamily CYCLOPINAE Kiefer

Metacyclops (Metacyclops) botosaneanui n. sp. (Figs. 16-20)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-29, NETHERLANDS ANTILLES, Bonaire: Kralendijk, two wells in the garden of the (former) house of Drs. T. van 't Hof, not far from the coast (12°09'11"N 68°16'28"W), closed, water table at 1.5 m, water depth 0.5 m, root fragments, rather polluted, chlorinity 1096 mg/l, temp. 30.0° C, 27 May 1980. One holotype (♀), completely dissected and mounted in Faure's medium, and 3 paratypes (♀ ♀), mounted in the same way; holotype in ZMA, paratypes in GPC.



Figs. 16-20, *Metacyclops (Metacyclops) botosaneanui* n. sp., from Bonaire (holotype, sta. 80-29): 16, antennula; 17, leg 5; 18, abdomen, furcal rami (ventral view) and legs 5; 19, leg 4; 20, connecting plate of leg 4.

Description. — A medium-sized and not slender *Metacyclops*; body length, excluding antennulae and caudal setae, ranging from 0.81 to 0.83 mm. Genital segment about as long as large, and without lateral protrusions; genital field as in fig. 18. Abdominal segments faintly denticulate along the posterior, dorsal margin; anal segment with a row of small spinules at the base of each furcal ramus; anal operculum without particular characteristics.

Furcal rami parallel and about 3 times longer than wide; innermost distal seta about as long as the outermost; dorsal seta short.

Antennula 12-segmented, not reaching the posterior margin of the cephalothorax.

Swimming legs with both endopodite and exopodite 2-segmented. Connecting plate of leg 4 with 2 spinulose protrusions and 2 rows of stout spinules; distal segment of the endopodite about twice as long as wide, and armed with 2 spines of different length, the inner more than twice as long as the outer one.

Leg 5: basal segment assimilated with the 5th thoracic segment and reduced to a short seta, laterally implanted; distal segment sub-quadrangular and armed with 1 seta and 1

spine, both distally implanted. Leg 6 consisting of 1 seta and 2 small spines.

Male unknown.

Affinities and distribution. — Following Lindberg's (1961) key to the species of the genus *Metacyclops*, *M. (M.) botosaneanui* n. sp. is a member of the "*gracilis*" group, due to the segmentation of the antennula and the armature of the distal segment of the endopodite of leg 4. Within this group the new species is morphologically allied to *M. grandis* Kiefer (Uruguay) in having denticulate protrusions on the coxal plate of leg 4; from this species, as well as from the other species in the same group, *M. (M.) botosaneanui* n. sp. differs by the shape of the genital segment, the length of the furcal rami, the length ratio between innermost and outermost furcal setae, the armature of the terminal segment of the endopodite of leg 4 and the armature of the coxal plate of the same leg.

At present, *M. (M.) botosaneanui* n. sp. is known only from its type-locality, and is to be considered endemic to the island of Bonaire.

Metacyclops (Metacyclops) diana* n. sp. *
(Figs. 21-26)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 79-533, HAÏTI, dépt. de l'Ouest: Groureau well, at Groureau, hamlet of Cazeau, Croix-des-Missions (18°34'53"N 72°16'16"W), well dug in sediments, chlorinity 43 mg/l, temp. 27.3° C, 10 Nov. 1979. One holotype (♀), dissected and mounted in Faure's medium, 3 paratypes (♀ ♀), mounted in the same way; holotype in ZMA, paratypes in GPC.

Description. — A small and stocky *Metacyclops*; body length, excluding antennulae and furcal setae, ranging from 0.55 to 0.66 mm. Genital segment barrel-shaped, slightly larger than long and without marked protrusions along the lateral margins. Genital field as in figs. 22-23. Both thoracic and abdominal segments naked along the posterior margin; anal segment with a row of small spinules at the base of each furcal ramus; anal operculum not well defined.

** Named after miss Dr. Diana P. Galassi, presently attached to our department, who greatly helped me in the present study.

Furcal rami short (length/width ratio 1.95 to 2.05); innermost distal seta about twice as long as the outermost; dorsal seta very long, about as long as the innermost seta, and twice as long as each furcal ramus.

Antennula 11-segmented, slightly shorter than the cephalothorax. Antennae and mouthparts without particular characteristics.

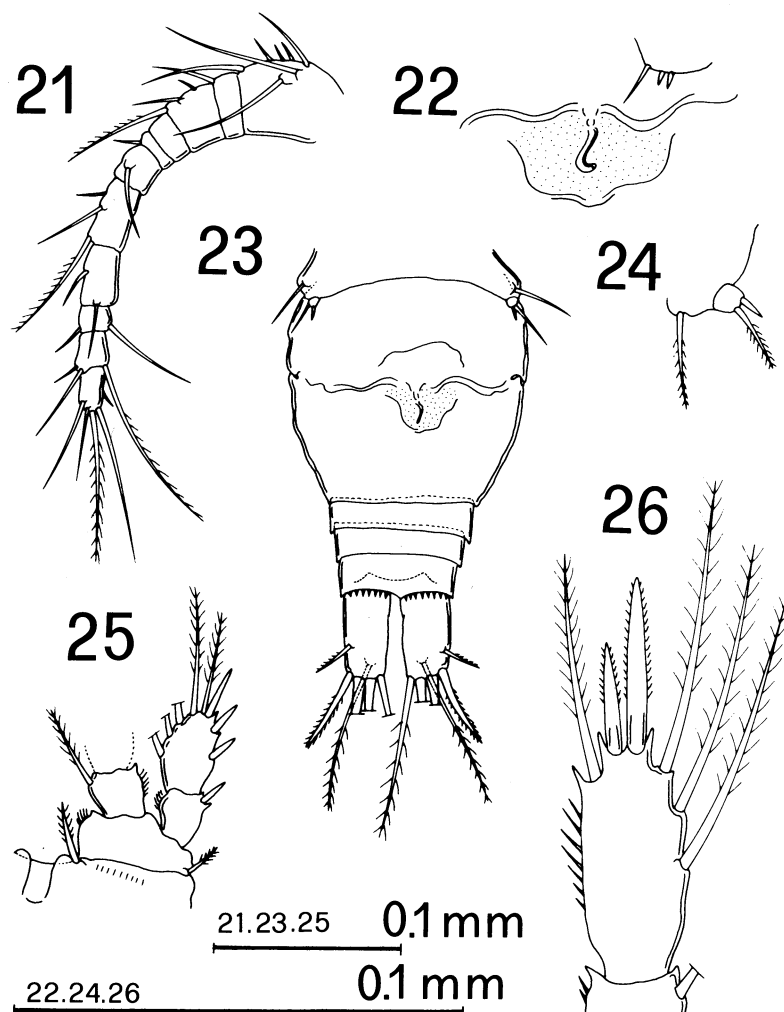
Swimming legs with both endopodite and exopodite 2-segmented; basipodite 2 of leg 1 with elongate seta; distal segment of the endopodite of leg 4 elongate (length/width ratio 2.39 to 2.46) and armed with two stout distal spines, the innermost about 1.6 times longer than the outermost; all setae overreaching the tip of the inner spine; precoxal plate of leg 4 with small, rounded unarmed protrusions.

Leg 5: basal segment assimilated with the thorax and reduced to a short, plumose seta, laterally implanted; distal segment about as long as wide, armed with 1 short spine and 1 seta, both apically implanted. Leg 6 consisting of 2 small spines and 1 short seta.

Male unknown.

Affinities and distribution. — *M. (M.) diana* n. sp. belongs to the "*gracilis*" group of *Metacyclops* according to Lindberg (1961), its closest relative being *M. brauni* Herbst from Amazonia and *M. rudis* Pleša from Cuba. With the former, the new species shares the construction and armature of the furcal rami, as well as the shape and armature of leg 5; with the latter it shares the stout body, the segmentation of the antennula, the length of the caudal rami, and the morphology and armature of the endopodite of leg 4.

From the above species, *M. (M.) diana* n. sp. differs as follows: from *M. brauni* in having a short genital segment (versus longer than wide), an 11-segmented antennula (versus 12-segmented), a protruding, naked coxal plate of leg 4 (versus no protrusions), and a very elongated dorsal furcal seta (versus a very short seta); from *M. rudis* it differs mainly in having a wider genital segment (versus quite longer than wide), longer dorsal furcal setae, a different morphology of the distal segment of leg 5, and a different receptaculum seminis.



Figs. 21-26, *Metacyclops (Metacyclops) diana* n. sp., from Haiti (holotype, sta. 79-533): 21, antennula; 22, genital field; 23, abdomen, furcal rami (ventral view) and legs 5; 24, leg 5; 25, exopodite of leg 4; 26, distal segment of the endopodite of leg 4.

Up to now, *M. (M.) diana* n. sp. is known only from its type-locality, viz. a freshwater well at Groureau, Haiti.

Metacyclops (Metacyclops) mendocinus
Wierzejski, 1902 (Figs. 32-34)

Cyclops mendocinus; Kiefer, 1936: 310.

Metacyclops mendocinus; Herbst, 1960: 35.

Microcyclops mendocinus; Smith & Fernando, 1978: 2020.

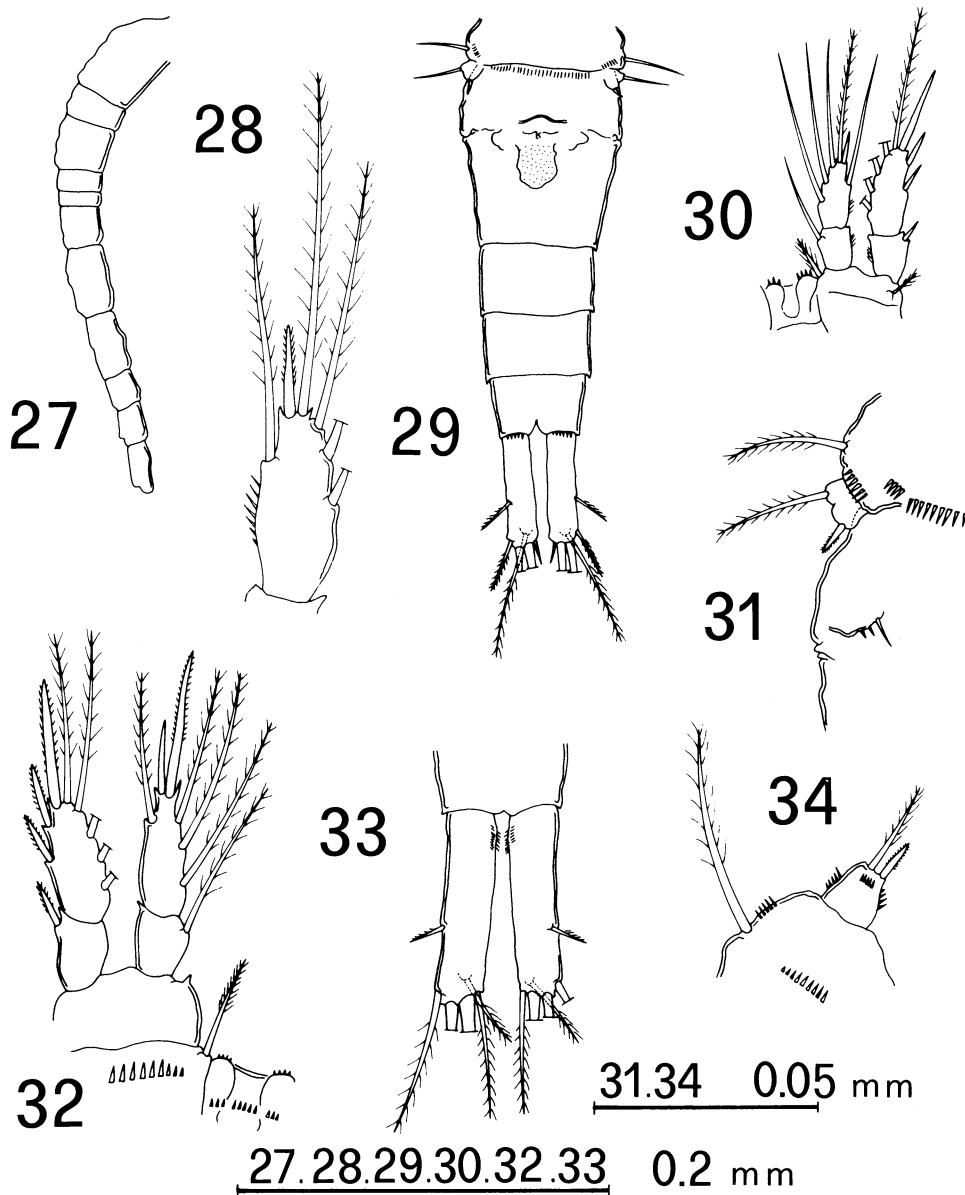
Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-115, PUERTO RICO: Río Camuy Caves, Cueva Espiral (18°20'40"N 66°49'25"W), cave pool at the bottom of a 50 m deep doline, pool shallow,

bottom mud, chlorinity and temp. not determined, 6 July 1980. Four ♀♀, one ♂, completely dissected and mounted in Faure's medium (ZMA).

Description. — A slender *Metacyclops*, body length, excluding antennulae and furcal setae, 0.80 to 0.95 mm (females) and 0.68 mm (male).

Furcal rami about 4 times longer than wide; innermost seta slightly shorter than the outermost; dorsal seta short.

Spine formula of swimming legs: 3 4 4 3. Distal segment of the endopodite of leg 4 armed with 2 spines of different length, the inner about twice the length of the outer one.



Figs. 27-31, *Metacyclops* (*Apocyclops*) *panamensis* (Marsh, 1913) (♀, from Bonaire, sta. 80-31); 32-34, *Metacyclops* (*Metacyclops*) *mendocinus* Wierzejski, 1902, from Puerto Rico (♀, sta. 80-115): 27, antennula; 28, distal segment of endopodite of leg 4; 29, abdomen, furcal rami (ventral view) and legs 5; 30, leg 4; 31, leg 5; 32, leg 4; 33, furcal rami (ventral view); 34, leg 4.

Leg 5 consisting of a single segment, armed with 1 stout spine and 1 short seta.

Distribution. — *M. (M.) mendocinus* shows a wide distribution, both in surface and

underground fresh waters, of Central and South America (Lowndes, 1934; Lindberg, 1961; Herbst, 1960) as well as of the West Indian islands Haiti (Kiefer, 1934, 1936), Cuba (Smith & Fernando, 1978), and Puerto Rico (present data).

Metacyclops (Apocyclops) panamensis
(Marsh, 1913) (Figs. 27-31)

Cyclops panamensis Marsh, 1913: 16.

Cyclops (Metacyclops) panamensis; Kiefer, 1936: 299.

Microcyclops panamensis; Comita, 1951: 371.

Apocyclops panamensis; Kiefer, 1967: 300.

Microcyclops panamensis; Smith & Fernando, 1978: 2020.

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-31, NETHERLANDS ANTILLES, Bonaire: small cave near Boca Onima (12°15'35"N 68°18'37"W), pool in cave, rocks, chlorinity 4402 mg/l, temp. not determined, 28 May 1980. Six ♀♀, four ♂♂, in Faure (ZMA).

Sta. 79-43, JAMAICA, Clarendon Parish: Jackson Bay Cave (17°43'55"N 77°13'43"W), flooded cave passages, water depth 0-0.6 m, stagnant, semi-dark to dark, mud, stones, chlorinity 2928 mg/l, temp. not determined, 24 Oct. 1979. Three ♀♀, completely dissected and mounted in Faure's medium (ZMA).

Sta. 79-83, CAYMAN ISLANDS, Grand Cayman: John Bodden's Bay (W. of Savannah) (19°16'21"N 81°15'20"W), intersticia of sublittoral sands (water depth 0.3 m), marine, behind a barrier reef, temp. 30.3° C, 29 Oct. 1979. One ♀, in Faure (ZMA).

Dr. P. Wagenaar Hummelinck's West Indian Expeditions, sta. 669, BARBUDA: Pyecrust Well, Highlands, cavern water about 10 m below the surface of limestone plateau, bottom soft mud, few pieces of wood, thin coating of algae, chlorinity 1700 mg/l, temp. 27° C, 6 July 1955. Three ♀♀, four ♂♂, in Faure (ZMA).

Description. — A slender and medium-sized *Metacyclops*; body length, excluding antennulae and furcal setae, 0.68 to 0.73 mm (females) (average of 14 specimens 0.70 mm), 0.63 to 0.69 mm (males) (average of 9 specimens 0.66 mm). Genital segment longer than large, slightly enlarged posteriorly.

Antennula 11-segmented, reaching about half the length of the 2nd cephalothorax segment.

Caudal rami 4.0 to 4.5 times longer than wide; innermost terminal seta very short; dorsal seta slightly longer than furcal ramus.

Leg 4: coxal plate with two spinose protrusions; distal segment of endopodite about 2.5 times longer than wide, and armed with 1 apical spine and 1 long seta; other setae on the same segment very elongated. Proximal segment of the exopodite of leg 4 with a distinct inner seta, as in the original description and illustrations of the species by Marsh (1913);

however, in describing material of the same species from Cuba, Smith & Fernando (1978: 2021) reported "basal segment of exopod of fourth leg with or without a small, inner seta".

Leg 5 consisting of 1 distinct, broad article, armed with 1 inner short spine and 1 outer seta.

Remarks. — According to Pleša (1981), the genus *Metacyclops* s.l. could be subdivided in three subgenera, viz. *Metacyclops* s. str., *Apocyclops* Lindberg and *Psammophilocyclops* Fryer. The specimens from West Indian islands, owing to the segmentation of the antennula and in particular the construction and armature of leg 5, are to be placed in the subgenus *Apocyclops*.

M. (A.) panamensis is a brackish-water species, widely distributed both in surface and in underground waters, in northern, southern and central America, numerous West Indian islands included (Marsh, 1913, 1919; Kiefer, 1936; Yeatman, 1959; Comita, 1951; Smith & Fernando, 1978; Collado et al., 1984).

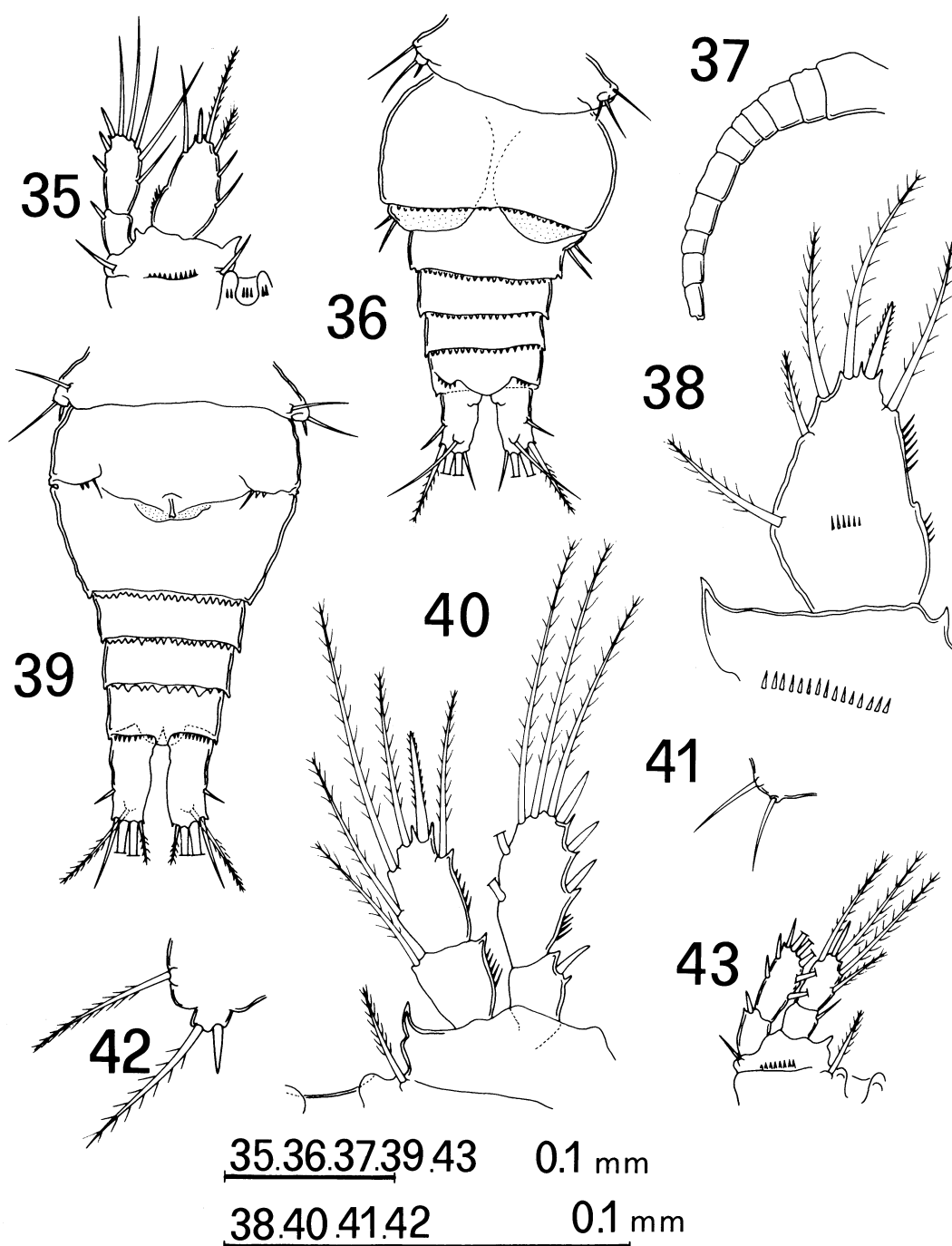
This very common species has not previously been reported from the islands of Jamaica, Barbuda and Grand Cayman.

Metacyclops (Apocyclops) stocki n. sp.
(Figs. 35-43)

Material. — Dr. P. Wagenaar Hummelinck's West Indian Expeditions, sta. 673, BARBUDA, Two-feet Bay water hole, 50 m from shore, temporary, in limestone terrace, muddy, without vegetation, chlorinity 1020 mg/l, temp. not recorded, 10 July 1955. One ♀ (holotype), completely dissected and mounted in Faure's medium, and 6 ♀♀ and 4 ♂♂ (paratypes), in Faure. Holotype in ZMA, paratypes in GPC.

Amsterdam Expeditions to the West Indian Islands, sta. 80-29, NETHERLANDS ANTILLES, Bonaire: Kralendijk, two wells in the garden of the (former) house of Drs. T. van 't Hof, close to the sea (12°09'11"N 68°16'28"W), covered, many sediments and roots, dirty, chlorinity 1096 mg/l, temp. 30.0° C, 27 May 1980. One ♀, one ♂ (paratypes, in GPC).

Description. — Female: A small and stocky *Metacyclops*; body length ranging from 0.58 to 0.61 mm, excluding antennulae and furcal setae. Genital segment barrel-shaped and wider than long, without marked protrusions on the lateral margins. Posterior border of the ab-



Figs. 35-43, *Metacyclops (Apocyclops) stocki* n. sp. (paratypes, from Barbuda, sta. Hummelinck 673): 35, leg 4 (♀); 36, abdomen, furcal rami (dorsal view), leg 5 and leg 6 (♂); 37, antennula; 38, endopodite of leg 4 (♀); 39, abdomen, furcal rami, legs 5 and 6 (ventral view) (♀); 40, leg 4 (♂); 41, leg 6 (♂); 42, leg 5 (♀); 43, leg 4 (♂).

dominal segments weakly denticulate dorsally; the same border armed with a row of stout chitinous denticulations on the ventral side; last abdominal segment (anal segment) with a row of fine spinules at the base of each furcal ramus. Anal operculum rounded, with a row of small spinules on each lateral margin.

Furcal rami longer than wide (length/width ratio 2.4 to 2.6) and about twice as long as the anal segment; apical outer seta much longer than the inner one; dorsal seta slightly longer than each furcal ramus.

Antennula 11-segmented, shorter than the cephalic segments. Second antenna and mouthparts without particular characteristics.

Endopodite and exopodite of swimming legs 1-3 2-segmented; leg 4 with a 2-segmented exopodite and a 1-segmented, large endopodite, armed with 1 short apical spine, 1 outer and 4 inner setae of different length. Spine formula of legs 1-4: 3 4 4 3.

Leg 5 consisting of 2 articles, the distal one wider than long, and armed with 1 spine and 1 seta. Leg 6 consisting of a chitinous protrusion bearing 2 small spines and 1 slender seta.

Male: Noticeably smaller than female, but similar in shape. Body length, excluding antennulae and furcal setae, 0.48 to 0.51 mm. Abdomen with a broad genital segment.

Sixth legs consisting of 1 seta and 1 setiform spine at posterior lateral corners of the genital segment; leg 4 with both exopodite and endopodite 2-segmented; endopodite armed as in female but with strongly elongated setae. Other characteristics as in female.

Affinities. — *M. (A.) stocki* n. sp. is remarkable since it occupies an intermediate position between the subgenera *Metacyclops* s. str. (viz. *M. planus* Gurney) and *Apocyclops* (viz. *A. dengizicus* Lepeschkin); with the former, the new species shares the construction of the male leg 6 and the 1-segmented endopodite of leg 4 in the female; with the latter it shares the segmentation of the antennula, the construction of the female leg 5, the length of the setae and spines on the female endopodite of leg 4 and, above

all, the peculiar spiniform protrusion on the basipodite of leg 4, both in female and male.

From the above species, as well as from all the other species, *M. (A.) stocki* n. sp. differs in numerous characteristics, such as the size and the morphology of the genital segment, the construction and the armature of the furcal rami, the short spine on the distal segment of the endopodite of leg 4 and, above all, the fused segments of the endopodite of female leg 4, which could be considered (as in *M. planus*) a disposition to reach sexual maturity before completing the ontogenetic development (neoteny).

***Microcyclops varicans rubellus* (Lilljeborg, 1901)**

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-25, NETHERLANDS ANTILLES, Bonaire: Pos Nobo, on the boarder of Lima Estate (12°07'59"N 68°15'43"W), natural well, large, water table at 4 m, water depth 0.4 m, chlorinity 1576 mg/l, temp. 31.0° C, 27 May 1980. Two ♀♀, in Faure (ZMA).

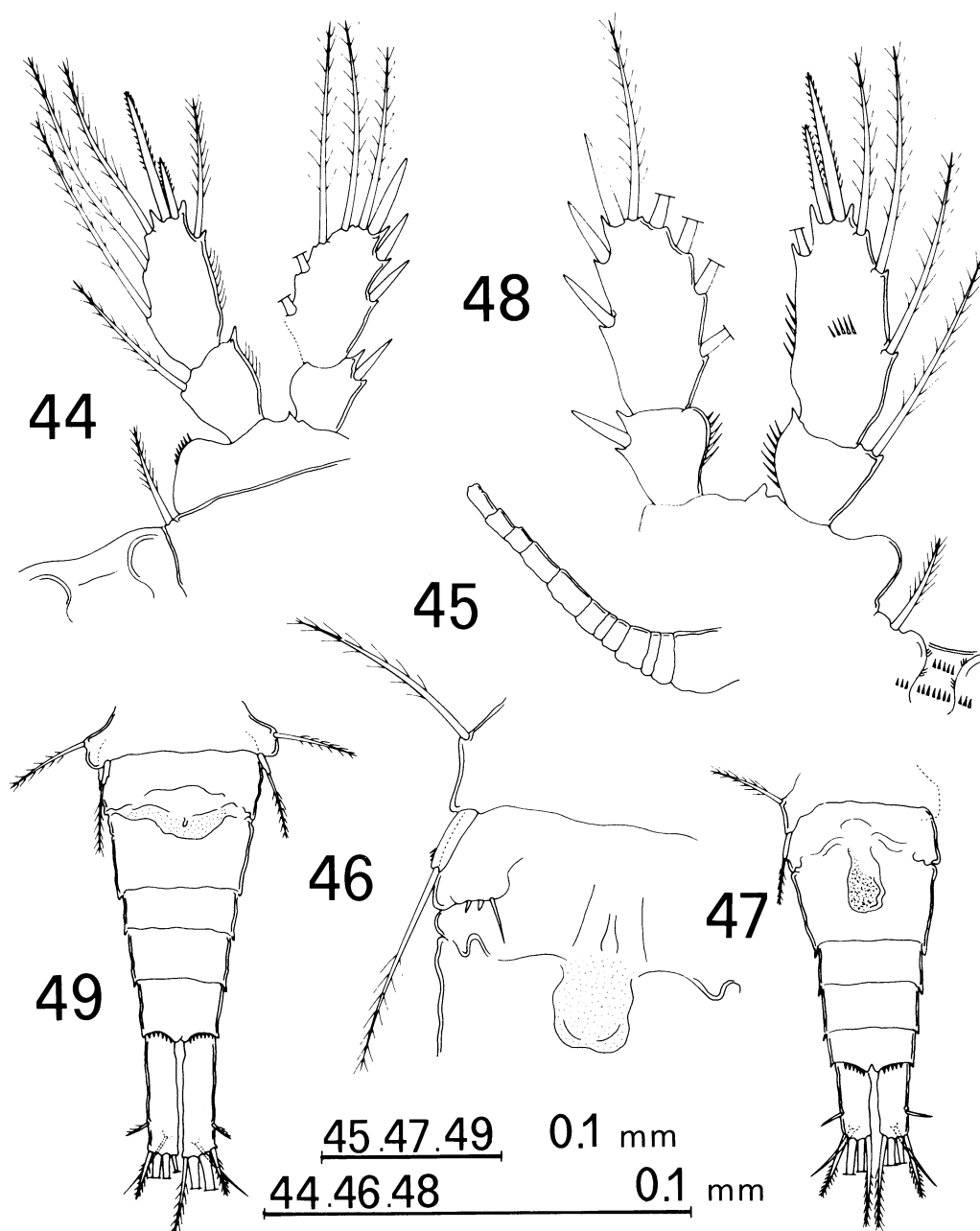
Sta. 80-116, PUERTO RICO: small pool, Cueva Espiral (Río Camuy cave system) (18°20'40"N 66°49'25"W), stones, leaves, chlorinity and temp. not determined, 6 July 1980. Three ♀♀, in Faure.

Dr. P. Wagenaar Hummelinck's West Indian Expeditions, sta. 669, BARBUDA: Pyecrust Well, Highlands, cavern water about 10 m below surface of limestone terrace, bottom soft mud, pieces of wood, thin coating of algae, chlorinity 1700 mg/l, temp. 27° C, 6 July 1955. Two ♀♀, completely dissected and mounted in Faure (ZMA).

Remarks. — *M. varicans rubellus* is a cosmopolitan and ubiquitous cyclopoid, from both epigeal and underground fresh and brackish waters of Central America and the Caribbean region, viz. Honduras, Panama, Haiti, Cuba (Kiefer, 1936; Smith & Fernando, 1978; Pleşa, 1981), Barbuda, Bonaire and Puerto Rico (present data).

***Microcyclops dubitabilis* Kiefer, 1934** (Figs. 44-47)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-28, NETHERLANDS ANTILLES, Bonaire: two wells at Wanaga (12°07'45"N 68°13'29"W),



Figs. 44-47, *Microcyclops dubitabilis* Kiefer, 1934, from Bonaire (♀, sta. 80-28); 48-49, *Microcyclops ceibaensis* (Marsh, 1919), from Bonaire (♀, sta. 76-32): 44, leg 4; 45, antennula; 46, genital field and legs 5 and 6; 47, abdomen, furcal rami and leg 5 (ventral view); 48, leg 4; 49, abdomen, furcal rami and legs 5 (ventral view).

water table at 1.8-2.0 m, water depth 0.4-0.8 m, chlorinity 2508 mg/l, temp. 30.3° C, 27 May 1980. One ♂, mounted in Faure's medium (GPC).

Sta. 79-509, HAÏTI, dépt. du Sud: Puits Chaillé, about 1000 m S. of sugar factory Dessalines at Cayes (18°14'40"N 73°46'53"W), open well, water table at 3.5 m, water depth 6.5 m, chlorinity 20 mg/l, temp. 27.8°

C, 1 Nov. 1979. Four ♀♀, 1 copepodite IV, mounted in Faure's medium (ZMA).

Description. — A small and slender *Microcyclops*; body length, excluding antennulae and furcal setae, 0.53 to 0.61 mm. Thoracic and abdominal segments without particular

characteristics. Genital segment slightly longer than wide.

Caudal rami short, about 2.5 times longer than wide; innermost terminal seta about 1.5 times longer than the corresponding outer one; dorsal seta about as long as furcal ramus.

Antennula 12-segmented. Antenna and mouthparts without particular characteristics.

Leg 4, coxal plate without prominent lobes; last segment of the endopodite 2.1-2.2 times longer than wide, inner terminal spine slightly shorter than the segment and more than twice longer than the outer one. Leg 5 consisting of one distinct segment, armed with only one seta.

Remarks. — The specimens from Haiti closely resemble *M. dubitabilis* Kiefer from the same island; those from Bonaire, on the contrary, reveal some small differences as compared to the original description by Kiefer, viz. shorter innermost distal furcal setae and stouter spines on the distal segment of the endopodite of leg 4.

M. dubitabilis is known, both from surface and underground fresh waters, from Haiti (Kiefer, 1934, 1936; Collado et al., 1984; present data), Nicaragua (Herbst, 1960), Guadeloupe, Martinique (Dussart, 1982), Curaçao and Dominican Republic (Collado et al., 1984) and Bonaire (present data).

Microcyclops ceibaensis (Marsh, 1919)
(Figs. 48-49)

Cyclops ceibaensis Marsh 1919: 547.

Microcyclops diversus Kiefer, 1935: 185.

Microcyclops ceibaensis Smith & Fernando, 1978: 2020.

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 76-32, NETHERLANDS ANTILLES, Bonaire: well on Estate Washikemba (12°10'24"N 68°13'08"W), water level at 3.5 m, water depth 1.5 m, chlorinity and temp. not determined, 15 June 1976. One ♀, completely dissected and mounted in Faure's medium (ZMA).

Description. — A small and slender *Microcyclops*; body length, excluding antennulae and furcal setae, 0.61 mm. Genital segment about as long as wide.

Antennula short, 12-segmented.

Furcal rami about 4 times longer than wide; innermost terminal seta 1.6 times longer than

the outer one; dorsal seta about as long as the innermost.

Swimming legs, both endopodite and exopodite 2-segmented; spine formula: 3 4 4 3. Distal segment of the endopodite of leg 4 elongated (length/width ratio 2.39), and armed with 2 apical spines of different length, the outer about 1.55 times longer than the inner one; coxal plate of leg 4 with small protrusions and 2 rows of spinules.

Remarks. — *M. ceibaensis* has been previously recorded from South and Central America (Marsh, 1919; Kiefer, 1935), Haiti (Kiefer, 1936) and Cuba (Smith & Fernando, 1978); this is the first record of its occurrence in the Lesser Antilles (Bonaire).

Genus **Mesocyclops** Kiefer, 1927

The genus *Mesocyclops* shows a worldwide distribution, being most prolific in the tropical and subtropical regions, with a great number of taxa in Africa, Europe, and the western part of northern Asia.

This genus has received much critical systematic attention by numerous authors in the past years, but up to 1981 its taxonomic status has been in a very fluid state.

Recently Kiefer (1981), and later Van de Velde (1984), accurately reviewed the *Mesocyclops* species from the Old World and from Africa, respectively, pointing out some new diagnostic characteristics at specific level, viz. the presence or absence of a spine on the basipodite of leg 1, the armature of the connecting lamella of leg 4, the peculiar form of the frontal part of the receptaculum seminis and the structure of its porous area, and the spinule pattern on the basipodite of the antenna.

Following the above reviews, four species are identified among the present material from West Indian islands, viz. *M. aspericornis* (Day), *M. intermedius* n. sp., *M. ellipticus* Kiefer and *M. aequatorialis americanus* n. spp.

The present records enlarge to 7 the number of species of the genus in groundwaters of the West Indies, the others being: *M. longisetus* (Thiebaud) from Haiti and Cuba (Kiefer,

1936; Smith & Fernando, 1978) and Guadeloupe (Dussart, 1982); *M. meridianus* (Kiefer) from Aruba, Bonaire and Curaçao (Kiefer, 1933) and *M. edax* (Forbes) from Cuba (Pleša, 1981). Certain West Indian records of *Mesocyclops leuckarti* refer in reality to *Thermocyclops thermocyclopoides* (see Kiefer, 1981).

The most widely distributed species in the groundwaters of the West Indian islands appears to be *M. aspericornis*, which occurs in numerous wells, karst holes or clefts, and hyporheic habitats of Aruba, Curaçao, Bonaire, Martinique, U.S. Virgin Islands, Puerto Rico, Haiti, Jamaica, Grand Cayman, the Turks & Caicos Islands, and Inagua.

Mesocyclops aspericornis (Daday, 1906) (Figs. 50-59)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-15, NETHERLANDS ANTILLES, Aruba: well at Daimari, in coconut plantation, ca. 150 m from the sea (12°31'59"N 69°56'31"W), strong smell of H₂S, water table at 2 m, water depth 0.2 m, chlorinity 2768 mg/l, temp. 28.9° C, 23 May 1980. Four ♀♀, 1 ♂, in Faure (ZMA).

Sta. 74-26, NETHERLANDS ANTILLES, Curaçao: Estate Flip, on north side of road Santa Cruz-Barber, near house no. 10 (12°18'05"N 69°05'53"W), chlorinity 475 mg/l, temp. not recorded, 24 Jan. 1974. Two ♀♀, in Faure (ZMA).

Sta. 74-57, NETHERLANDS ANTILLES, Curaçao: Westpunt, Pos di Boca Djegu, just W. of dam in gully (12°22'59"N 69°08'03"W), open well, water table at 1.5 m, water depth 3.5 m, chlorinity 155 mg/l, temp. 28.0° C, 5 Apr. 1974. Three ♀♀, in Faure (GPC).

Sta. 74-67, NETHERLANDS ANTILLES, Curaçao: Estate Leliëberg, Domeinput, in plot 260 (12°17'55"N 69°05'43"W), covered well, water table at 10 m, water depth 5 m, chlorinity 155 mg/l, temp. 28.8° C, 11 Apr. 1974. One ♂, in Faure (GPC).

Sta. 76-32, NETHERLANDS ANTILLES, Bonaire: well on Estate Washikemba (12°10'24"N 68°13'08"W), water table at 3.5 m, water depth 1.5 m, chlorinity and temp. not determined, 15 June 1976. One ♂, in alcohol.

Sta. 74-127, MARTINIQUE: just S.E. of Manoir de Beauregard (village of Ste. Anne), well in ruined sugar mill, coordinates not recorded, open well, depth 2 m, chlorinity not determined, temp. 24.5° C, 15 Feb. 1974. One ♂, in alcohol (GPC).

Sta. 75-36, U.S. VIRGIN ISLANDS, St. Croix: Longford Estate, well W. of chimney (17°43'02"N 64°41'47"W), large well, depth 10 m, chlorinity and temp. not determined, 21 Nov. 1975. One ♂, in Faure (ZMA).

Sta. 80-103, PUERTO RICO: Pozo de la Bruja, Papayo (about 50 m N. of road 324) (17°58'52"N 67°01'39"W), well, covered, water table at 1 m, water depth 5 m, chlorinity and temp. not recorded, 9 Mar. 1980. One ♀, in Faure (ZMA).

Sta. 80-105, PUERTO RICO: Pozo Manantial, about 3 km N.E. of Balua Sucid (about 1 km N. of road 303) (17°59'23"N 67°09'02"W), covered well in basin, chlorinity and temp. not recorded, 9 Mar. 1980. One ♀, in Faure (ZMA).

Sta. 79-502, HAITI, Dépt. du Sud: interstitia of bank of river l'Islet, just before Cayes (18°13'32"N 73°41'28"W), gravel, sand, plant debris, method Karaman-Chappuis, chlorinity and temp. not determined, 31 Oct. 1979. One ♀, completely dissected and mounted in Faure (ZMA).

Sta. 79-504, HAITI, Dépt. du Sud: well near Forgas, on the road to Cayes (18°15'23"N 73°44'10"W), water table at 3 m, water depth 1.5 m, chlorinity 14 mg/l, temp. 27.0° C, 31 Oct. 1979. One ♀, in Faure (ZMA).

Sta. 79-530, HAITI, Dépt. de l'Ouest: Beaugé, artesian well constructed in 1976 in cultivated field (18°33'35"N 72°07'42"W), depth 39 m, chlorinity 14 mg/l, temp. 24.0° C (at 3 m), 10 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-547, HAITI, Dépt. de l'Est: Massac (between Cayes-Jacmel and Ti Mouillage) (18°13'58"N 72°22'50"W), well of Mrs. André Pascal, 40-50 m from the coast, water table at 3 m, water depth 0.5 m, chlorinity 38 mg/l, temp. 27.0° C, 13 Nov. 1979. Three ♀♀, in Faure (ZMA).

Sta. 79-578, HAITI, Dépt. de l'Ouest: near Trou Caiman (18°38'58"N 72°06'58"W), well of Mrs. Tissé Coriolan, dug in sandy bottom, water table at 5.1 m, water depth 0.9 m, chlorinity 422 mg/l, temp. 27.2° C, 21 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-580, HAITI, Dépt. de l'Ouest: Debas (18°38'51"N 72°06'34"W), well Eliassin Aldoni, in sand, partly covered, water table at 6 m, water depth 1.8 m, chlorinity 2330 mg/l, temp. 28.0° C, 21 Nov. 1979. Four ♀♀, one ♂, in Faure (ZMA).

Sta. 79-581, HAITI, Dépt. de l'Ouest: Debas (coordinates as in previous station), well of Sevilis Eliassin, in sand, water table at 4.6 m, water depth 1.4 m, chlorinity 5865 mg/l, temp. 27.8° C, 21 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-586, HAITI, Dépt. de l'Ouest: village l'Etang (18°38'38"N 72°03'48"W), well of Mrs. Celhomme, much sediment, water table at 2.1 m, water depth 5 m, chlorinity 83 mg/l, temp. 27.8° C, 21 Nov. 1979. Four ♀♀, in Faure (ZMA).

Sta. 79-588, HAITI, Dépt. de l'Ouest: well of the Rectory of Thomazeau (18°39'01"N 72°05'47"W), dug in alluvia, water table at 6 m, water depth 1 m, chlorinity 593 mg/l, temp. 27.3° C, 21 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-590, HAITI, Dépt. de l'Artibonite: Saint Marc (south) (19°05'29"N 72°42'04"W), well Altidor Mezidor, about 200-300 m from the shore, on the new

highroad to Port-au-Prince, covered, in sand, water table at 6.7 m, water depth 0.5 m, chlorinity 16 mg/l, temp. 26.5° C, 22 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-591, HAITI, Dépt. de l'Artibonite: well of Frans Mezidor, near previous station, water table at 7.3 m, water depth 1.7 m, chlorinity 45 mg/l, temp. 26.8° C, 22 Nov. 1979. Five ♀♀, in alcohol (GPC).

Sta. 79-592, HAITI, Dépt. de l'Artibonite: well Tubérissé Surpris, near previous station, covered, water table at 5 m, water depth 2.5 m, chlorinity 24 mg/l, temp. 26.8° C, 22 Nov. 1979. Four ♀♀, one ♂, in Faure (GPC).

Sta. 79-593, HAITI, Dépt. de l'Artibonite: well Mrs. Sinaï Francis, near previous station, covered, dug in sand, bottom clay, water table at 5.2 m, water depth 1.8 m, chlorinity 24 mg/l, temp. 25.8° C, 22 Nov. 1979. Three ♀♀, in Faure (GPC).

Sta. 79-594, HAITI, Dépt. de l'Artibonite: Saint Marc, well Ludovic Desinor, on the old National Road along the sea (19°06'12"N 72°42'11"W), 20 m from the shore, water table at 3 m, water depth 0.15 m, chlorinity 15 mg/l, temp. not recorded, 22 Nov. 1979. Four ♀♀, in Faure (ZMA).

Sta. 79-601, HAITI, Dépt. de l'Artibonite: Dessalines, well of Gaby Gabriel, Rue Jacques Ier (coordinates as in previous station), dug in sand and gravel, covered, water table at 8 m, water depth 3 m, chlorinity 143 mg/l, temp. 28.1° C, 23 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-602, HAITI, Dépt. de l'Artibonite: Dessalines, well of Darius Belhomme, Rue Simonet (19°15'36"N 72°31'01"W), dug in sand and gravel, partly covered, water table at 6.2 m, water depth 2 m, chlorinity 105 mg/l, temp. 28.1° C, 23 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-617, HAITI, Dépt. de l'Ouest: well near the market of Arcahaie (18°46'08"N 72°30'44"W), ca. 100 m from the sea, open, murky, water table at 0.5 m, water depth 0.9 m, chlorinity 145 mg/l, temp. 26.3° C, 24 Nov. 1979. Three ♀♀, in Faure (ZMA).

Sta. 79-618, HAITI, Dépt. de l'Ouest: Arcahaie, well of Luc Pierre, Rue Abbé Andelin (18°46'08"N 72°30'44"W), ca. 200 m from the sea, open, rather clean, water table at 1.5 m, water depth 2 m, chlorinity 101 mg/l, temp. 28.0° C, 24 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-620, HAITI, Dépt. de l'Ouest: Arcahaie (quarter Cortade), well of Boss Raoul Bélizaire (ca. 18°46'N 72°31'W), open, dug in sand, clean, water table at 3.2 m, water depth 4 m, chlorinity 17 mg/l, temp. 26.9° C, 24 Nov. 1979. Two ♂♂, in Faure (GPC).

Sta. 79-684, HAITI, dépt. du Nord: Limbé, well of Mrs. Antoine Dugrène (19°42'14"N 72°23'55"W), water table at 1.8 m, water depth 1 m, chlorinity 17 mg/l, temp. 25.1° C, 10 Dec. 1979. Three ♀♀, in Faure (ZMA).

Sta. 79-685, HAITI, Dépt. du Nord: Limbé, well of Jean Terilys, ca. 100 m from the catholic church (19°42'14"N 72°23'55"W), water table at 2.2 m, water depth 0.8 m, chlorinity 27 mg/l, temp. 25.5° C, 10 Dec. 1979. One ♀, in Faure (ZMA).

Sta. 79-687, HAITI, Dépt. du Nord: Limbé, section Canal, well of André Constant (19°42'14"N 72°23'55"W), rather clean, water table at 2 m, water depth 1.1 m, chlorinity 26 mg/l, temp. 26.0° C, 10 Dec. 1979. Two ♂♂, in Faure (GPC).

Sta. 79-44, JAMAICA, Clarendon Parish: Sedge Pond (17°51'02"N 77°18'50"W), well, covered, water table at 6 m, water depth 4 m, chlorinity 826 mg/l, temp. 27.0° C, 24 Oct. 1979. One ♀, one ♂, in alcohol (GPC).

Sta. 79-58, CAYMAN ISLANDS, Grand Cayman: Water Ground (19°22'32"N 81°24'02"W), well in swampy grassland, open, filamentous algae, water table at 0.5 m, water depth 0.6 m, chlorinity 56 mg/l, temp. 28.5° C, 27 Oct. 1979. One ♀, in Faure (ZMA).

Sta. 79-147, TURKS & CAICOS ISLANDS, South Caicos: Cockburn Harbour, The Fountain (21°29'57"N 71°32'05"W), open karst hole with tidal influence, water table at 0.5 m, water depth 0.4 m, chlorinity 159 mg/l, temp. 26.0° C, 15 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-148, TURKS & CAICOS ISLANDS, South Caicos: Cockburn Harbour, karst cleft close to The Fountain (21°30'00"N 71°32'08"W), in limestone terrace, water table at 2.5 m, water depth 2.5 m, chlorinity 1748 mg/l, temp. 29.1° C, 15 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-153, TURKS & CAICOS ISLANDS, Providenciales: Five Cays Settlement, West Well (21°45'39"N 72°16'03"W), open, water table at 0.5 m, water depth 0.2 m, chlorinity 568 mg/l, temp. 26.1° C, 16 Nov. 1979. Two ♀♀, in Faure (ZMA).

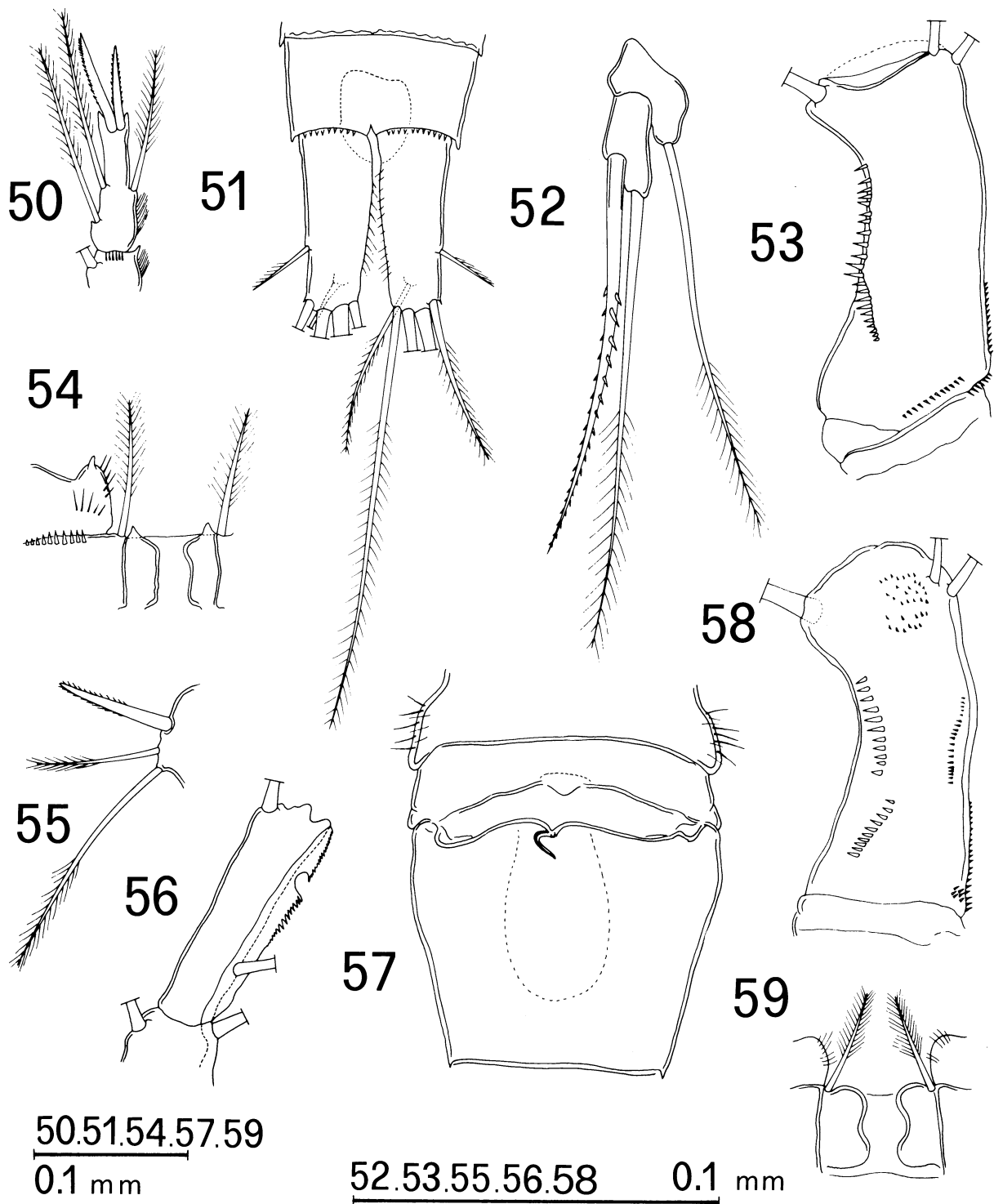
Sta. 79-154, TURKS & CAICOS ISLANDS, Providenciales: Blue Hill Settlement, Government well near school (21°47'58"N 72°16'17"W), open, water table at 3.5 m, water depth 0.2 m, chlorinity 2858 mg/l, temp. 26.4° C, 16 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-164, BAHAMAS, Inagua: Birma Road wells (21°00'21"N 73°41'32"W), open wells, water table at 0.3 m, water depth 0.2 m, chlorinity 62 mg/l, temp. 26.6° C, 18 Nov. 1979. One ♀, in alcohol (GPC).

Description. — Female: Body length, excluding antennulae and furcal setae, from 0.95 to 1.05 mm. Last thoracic segment with groups of setules on the outer, posterior corners. Genital segment slightly longer than wide; receptaculum seminis, lateral arms not much curved backwards, anterior part with a median, small incision; copulatory pore-canal curved.

Furcal rami 3.40 to 3.48 times longer than wide, with hair-like setules on inner margins; dorsal seta about as long as the outermost distal seta.

Antennula reaching about the distal margin of the 2nd thoracic segment; hyaline membrane with a deep notch and minutely denticulate.



Figs. 50-59, *Mesocyclops aspericornis* (Daday, 1906), from Haiti (sta. 79-580): 50, distal segment of endopodite of leg 4; 51, furcal rami (ventral view); 52, leg 5; 53, basipodite of A_2 , frontal side; 54, connecting lamella of leg 4; 55, leg 6 (σ); 56, distal segment of A_1 ; 57, genital segment and genital field; 58, basipodite of A_2 , caudal side; 59, connecting lamella of leg 1.

Caudal side of basipodite of antenna with two continuous rows of spinules on the medial side, and a group of minute spinules near the basis of the apical setae; frontal side of antenna with a row of 12-24 spinules.

Leg 4: endopodite 2.65 to 2.92 times longer than wide; inner apical spine slightly exceeding the external one in length; connecting lamella with 2 well developed prominences; inner part of basipodite distally and proximally with a group of setules. Spine-like seta on distal segment of leg 5 slightly shorter than the other seta on this segment. Leg 6 composed of 2 spines and 1 seta.

Male: Total length, excluding antennulae and furcal setae, about 0.80 mm. Furcal rami 3.30 to 3.35 times longer than wide; inner margin without hair-like elements.

Leg 6 consisting of 1 spine and 2 setae of different length. Other characteristics as in the female.

Remarks. — Up to now, the first and the only record of *M. aspericornis* from West Indian islands, as well as for the New World, was that of Dussart (1982) who reported this species from epigeal fresh waters of the island of Guadeloupe. The present study shows that *M. aspericornis* is widely distributed also in the groundwaters of the islands, and it suggests that it is to be considered a cosmopolitan species that can occur in epigeal and underground waters of both the Old and the New World (Africa, India, Taiwan, Java, Sumatra, Philippines, Marian and Marshall Islands, Hawaii, and in many islands of the West Indies).

***Mesocyclops intermedius* n. sp.**
(Figs. 60-62)

Material. — Amsterdam Expeditions to the West Indian Islands, all from the NETHERLANDS ANTILLES, Bonaire:

Sta. 80-51, Klein Bonaire, small "pos" (= well), feeding the Pos Blauw Duif (12°09'40"N 68°17'40"W), a simple natural hole in limestone, stones on bottom, chlorinity 1576 mg/l, temp. not recorded, 1 June 1980. One holotype (♀), 2 paratypes (♀♀), completely dissected and mounted in Faure's medium (ZMA).

Sta. 80-27, Pos di Wanapa, well on natural cavern (12°07'47"N 68°14'23"W), stones, filamentous algae, chlorinity 1722 mg/l, temp. 30.5° C, 27 May 1980. Two ♀♀, in Faure (ZMA).

Sta. 80-32, Rincón, Pedra Bonaire, hand pump (12°15'42"N 68°18'07"W), chlorinity 1064 mg/l, temp. not recorded, 28 May 1980. Three ♀♀, one ♂ (GPC).

Sta. 80-35, Dos Pos, about 3 km from Rincón (12°14'32"N 68°21'16"W), pumped well, covered, in limestone, chlorinity 502 mg/l, temp. not recorded, 28 May 1980. One ♀, in Faure.

Sta. 80-37, Pos di Dentuna, Estate Bolivia (12°11'47"N 68°13'52"W), well with wind pump, depth 10 m, black sediment on bottom, chlorinity 2808 mg/l, temp. not recorded, 29 May 1980. Three ♀♀, in alcohol (GPC).

Sta. 80-39, Large natural well near Spelonk Cave, on Estate Bolivia (12°13'23"N 68°13'17"W), cavern water, shaded, clear, stones, chlorinity 14060 mg/l, temp. 28.0° C, 29 May 1980. One ♀, in alcohol (GPC).

Sta. 80-41, Cueva Antoine, Estate Bacuna (12°07'34"N 68°13'09"W), cavern water, muddy, with algae, chlorinity 2644 mg/l, temp. not recorded, 30 May 1980. Two ♀♀, in alcohol (GPC).

Sta. 80-42, Pos di Soldatchi, Estate Bacuna (12°07'37"N 68°12'26"W), cavern water, many algae, mud, decaying wood, chlorinity 4012 mg/l, temp. not recorded, 30 May 1980. One ♀, in alcohol (GPC).

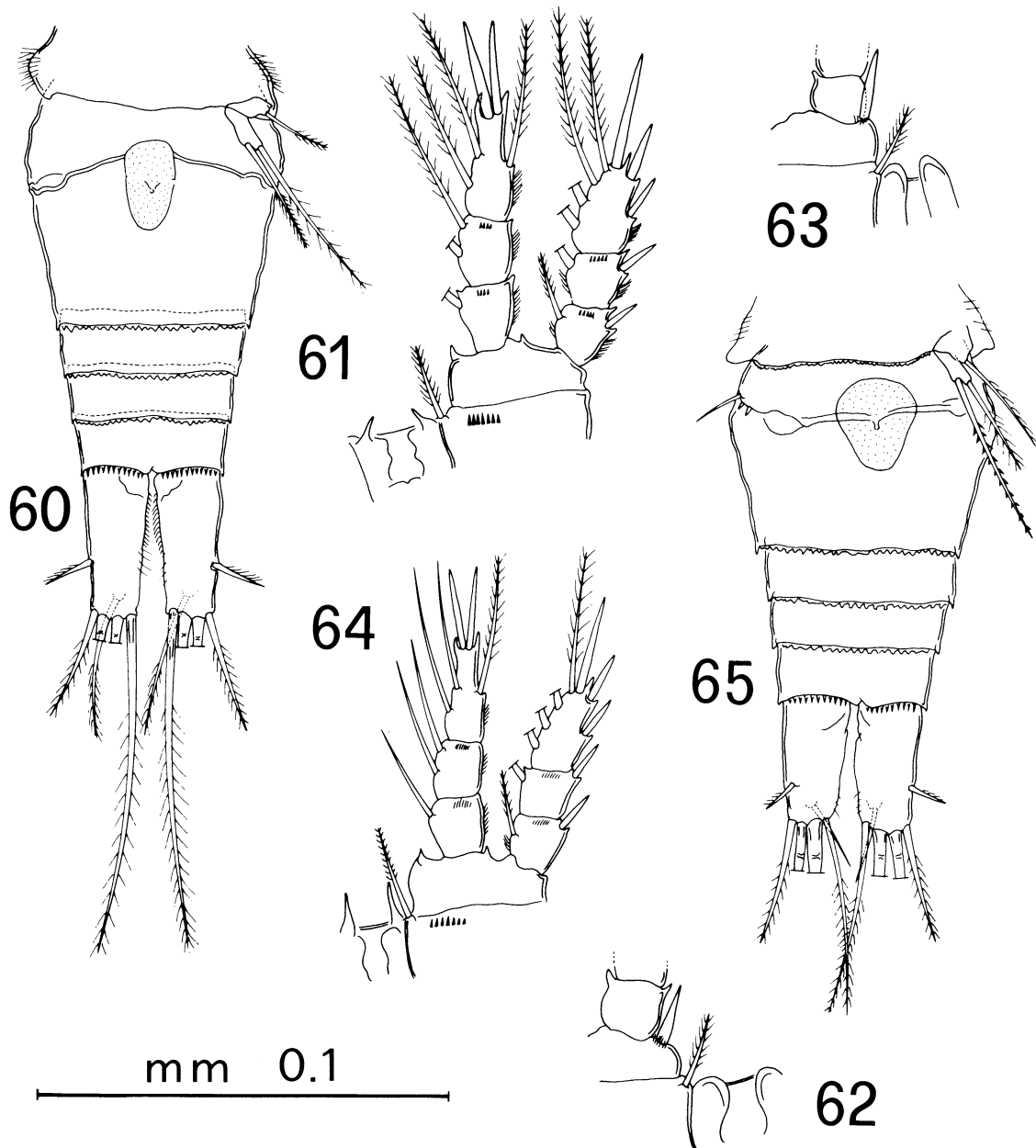
Sta. 80-47, Playa Cocolishi, in the Washington National Park (12°18'32"N 68°22'00"W), interstitia of coarse beach sand, method Karaman-Chappuis, chlorinity 23862 mg/l, temp. 29.5° C, 31 May 1980. One ♀, in alcohol (GPC).

Description. — A small *Mesocyclops*: total body length, excluding antennulae and furcal setae, 0.52 to 0.61 mm. Last thoracic segment with setules along each side. Genital segment slightly longer than wide; receptaculum seminis as in fig. 60. Other abdominal segments faintly denticulate along the posterior margin.

Furcal rami about 3 times longer than wide; inner margin with hair-like setules; innermost distal seta about 3 times longer than the corresponding outer one; dorsal seta short, about as long as the furcal ramus and the outermost distal seta.

Antennulae reaching about the third thoracic segment; hyaline membrane on 17th segment with one deep notch.

Leg 1 with a stout spine on inner distal margin of basipodite. Leg 4: endopodite 3, 2.5 to 2.6 times longer than wide, and armed with 2 apical spines, subequal in length; prom-



Figs. 60-62, *Mesocyclops intermedius* n. sp., from Bonaire (♀, sta. 80-27); 63-65, *Mesocyclops ellipticus* Kiefer, 1936, from Haiti (♀, sta. 79-509): 60, abdomen, genital field, caudal rami and leg 5 (ventral side); 61, leg 4; 62, basipodite of leg 1; 63, basipodite of leg 1; 64, leg 4; 65, abdomen, genital field, caudal rami and leg 5 (ventral side).

inences on distal margin of connecting lamella well developed.

Leg 5: spiniform seta of distal segment shorter than the other seta implanted on the same segment; seta on basal segment short. Leg 6 of the male consisting of one spine and two setae of different length.

Remarks. — *M. intermedius* n. sp. shows a mixture of morphological characteristics of the species *M. longisetus* (Thiebaud) and *M. meridianus* (Kiefer). With the former the new species shares the length and armature of the furcal rami, the construction and armature of legs 4 and 5, and the length of the setae on leg 6 of the

male; with the latter it shares the peculiar morphology of the receptaculum seminis and the length and armature of the furcal rami.

From the above species, as well as from other species, *M. intermedius* n. sp. differs by its remarkably small size, the length ratio between the innermost and outermost distal furcal setae, the morphology of the hyaline membrane on the first antenna, and by the marked prominences on the distal margin of the connecting lamella of leg 4.

Ecology and distribution. — Up to now, *M. intermedius* n. sp. is known only from phreatic waters of the island of Bonaire. Type-locality: Pos on Klein Bonaire, sta. 80-51.

Mesocyclops ellipticus Kiefer, 1936 (Figs. 63-65)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 79-509, HAITI, Dépt. du Sud: Puits Chaillé, about 1000 m from the sugar factory Dessalines of Cayes (18°14'40"N 73°46'53"W), open well, water level at 3.5 m, water depth 6.5 m, chlorinity 20 mg/l, temp. 27.8° C, 1 Nov. 1979. Two ♀♀, completely dissected and mounted in Faure's medium (ZMA).

Sta. 79-606, HAITI, Dépt. de l'Artibonite: Verretes, quarter Daudad, well of Irène Nelson (19°05'46"N 72°29'45"W), open, in sand, water table at 1.8 m, water depth 2 m, chlorinity 65 mg/l, temp. 25.0° C, 23 Nov. 1979. Four ♀♀, in Faure (ZMA).

Sta. 79-608, HAITI, Dépt. de l'Artibonite: Verretes, quarter Moreau des Iles, well of Nicolas Louis (19°05'55"N 72°29'45"W) in sand, water table at 1 m, water depth 0.7 m, chlorinity 190 mg/l, temp. 26.0° C, 23 Nov. 1979. Four ♀♀, one ♂, in Faure (ZMA).

Sta. 79-610, HAITI, Dépt. de l'Artibonite: Gonaïves, well of Agricultural Department Office, about 250 m from the sea, coordinates not recorded, water level at 1 m, water depth 1.1 m, chlorinity 79 mg/l, temp. 27.5° C, 24 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-611, HAITI, Dépt. de l'Artibonite: Gonaïves, well of Mrs. Luc Désir, on the National Road from Gonaïves to Cap-Haïtien, about 1.5 km from the sea, coordinates not recorded, primitive well in black, fine sediments, water table at 0.5 m, water depth 1 m, chlorinity 410 mg/l, temp. 26.5° C, 24 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-639, HAITI, Dépt. de la Grande Anse: Jérémie, Berguer well, Rue Paul Emile Jeanmichel, about 100 m from the sea (18°38'32"N 74°07'05"W), open, clean, water table at 4 m, water depth 0.8 m, chlorinity 131 mg/l, temp. 26.2° C, 1 Dec. 1979. Three ♀♀, in Faure (ZMA).

Sta. 79-686, HAITI, Dépt. du Nord: Limbé, well of Vincent Noël, near catholic church (19°42'14"N 72°23'55"W), water table at 2.2 m, water depth 0.8 m, chlorinity 27 mg/l, temp. 25.5° C, 10 Dec. 1979. One ♂, in Faure (GPC).

Sta. 79-688, HAITI, Dépt. du Nord: Limbé, section Moulin, well Mézardié (19°42'14"N 72°23'55"W), very dirty, water level at 4 m, water depth 0.4 m, chlorinity 12 mg/l, temp. 25.4° C, 10 Dec. 1979. Two ♀♀, one ♂, in Faure (GPC).

Sta. 79-689, HAITI, Dépt. du Nord: well of Rectory of Limbé (19°42'14"N 72°23'55"W), covered, pumped, bottom sandy, clean, water table at 2.3 m, water depth 1.2 m, chlorinity 14 mg/l, temp. 26.5° C, 11 Dec. 1979. One ♀, in Faure (GPC).

Sta. 79-52, JAMAICA, parish of St. Mary: interstitia in gravel and loam on the bank of Roaring River (W. of Annotto) (18°14'42"N 76°49'07"W), method Karaman-Chappuis, chlorinity and temp. not determined, 26 Oct. 1979. One ♂, in Faure (GPC).

Sta. 79-78, CAYMAN ISLANDS, Cayman Brac: Stake Bay, Western Nurses' Residence (Old Clinic yard) (19°42'37"N 79°50'04"W), well, pumped, clean, roots, water table at 0.1 m, water depth 0.3-0.5 m, chlorinity 22 mg/l, temp. not recorded, 28 Oct. 1979. One ♀, one ♂, in alcohol (GPC).

Sta. 79-80, CAYMAN ISLANDS, Cayman Brac: Banko Village, well along the road (19°42'10"N 79°51'34"W), covered, pumped, water table at 1 m, water depth 0.5 m, chlorinity 893 mg/l, temp. 28.0° C, 28 Oct. 1979. One ♀, in alcohol (GPC).

Sta. 79-81, CAYMAN ISLANDS, Cayman Brac: Knob Hill (19°42'04"N 79°51'39"W), well on natural cleft, W. of road, pumped, water table at 1.5 m, water depth 1 m, chlorinity 84 mg/l, temp. 28.6° C, 28 Oct. 1979. One ♀, in alcohol (GPC).

Remarks. — Our material quite closely agrees with the original diagnosis of *M. ellipticus* by Kiefer (1936), as well as with the subsequent descriptions and illustrations by Herbst (1962), Yeatman (1977), and Smith & Fernando (1978), being easily identifiable by the ovoid shape of the receptaculum seminis and the prominent, sharp and recurving protuberances on the connecting lamella of the fourth legs. Some small differences were observed in the spine on the distal segment of leg 5, which is more elongated as compared to the previous descriptions, in the longer innermost furcal setae, and in the slightly shorter furcal rami.

M. ellipticus shows a wide distribution, both in epigeal fresh waters and in groundwaters, of central and southern America, as well as in

groundwaters of the West Indian islands. Kiefer (1936, 1956) reported this species from Brazil and Venezuela; Herbst (1962) reported it from the Amazon region; Yeatman (1977) recorded for the first time its occurrence in cave waters of Mexico, and Smith & Fernando (1978) reported *M. ellipticus* from Cuba.

Mesocyclops aequatorialis americanus n. ssp.
(Figs. 66-71)

Material. — Amsterdam Expeditions to the West Indian Islands, all from the BAHAMAS:

Sta. 79-192, Crooked Island: Moss Town, well on S. side of road (22°48'27"N 74°15'25"W), open, water table at 3.5 m, water depth 0.2 m, chlorinity 310 mg/l, temp. 25.6° C, 27 Nov. 1979. One ♀ (holotype), two ♀♀ (paratypes), completely dissected and mounted in Faure's medium (ZMA).

Sta. 79-193, Crooked Island: Moss Town, public village well (22°48'19"N 74°15'27"W), covered, water table at 7 m, water depth 0.5 m, chlorinity 152 mg/l, temp. 25.3° C, 27 Nov. 1979. Three ♀♀, in Faure (ZMA).

Sta. 79-194, Crooked Island: Cripple Hill (22°47'55"N 74°14'35"W), well, open, water table at 6 m, water depth 0.3 m, chlorinity 234 mg/l, temp. 24.9° C, 27 Nov. 1979. Six ♀♀, in Faure (ZMA).

Sta. 79-195, Crooked Island: Fair Field (22°47'14"N 74°13'39"W), well, open, water table at 3.5 m, water depth 0.25 m, chlorinity 418 mg/l, temp. 24.2° C, 27 Nov. 1979. Two ♀♀, in alcohol (GPC).

Sta. 79-196, Crooked Island: Timber Hill (22°46'21"N 74°12'15"W), well, covered, water table at 3 m, water depth 0.2 m, chlorinity 492 mg/l, temp. 25.6° C, 27 Nov. 1979. One ♀, in alcohol (GPC).

Sta. 79-164, Inagua: Birma Road well (21°00'21"N 73°41'32"W), water table at 0.3 m, water depth 0.2 m, chlorinity 62 mg/l, temp. 26.6° C, 18 Nov. 1979. One ♀, in alcohol (GPC).

Description. — A medium-sized *Mesocyclops*; total body length 0.65 to 0.70 mm. Last thoracic segment without setules on the lateral sides. Genital segment about as long as wide; receptaculum seminis as in the nominate subspecies. Abdominal segments without particular characteristics.

Furcal rami about 3 times longer than wide, without hair-like elements on the inner margins; dorsal seta about as long as the outermost one.

Basipodite of antenna as in fig. 66. Antennula and mouthparts as in *M. aequatorialis aequatorialis*.

Connecting lamella of leg 4 with marked prominences.

Leg 5: spiniform seta on distal segment about as long as the setae on the same and on the basal segment.

Male unknown.

Remarks. — *M. aequatorialis americanus* n. ssp. has to be ascribed to *M. aequatorialis* s.l. due to the peculiar shape of the receptaculum seminis, in particular the morphology of its pore-canal, the absence of a spine on the inner distal margin of the basipodite of leg 1 and the absence of hair-like setules on the inner margin of the furcal rami.

From the nominate species, as well as from *M. aequatorialis similis* Van de Velde, 1984, it differs in the absence of setules on the last thoracic segment, in the length ratio between the setae on the distal segment of leg 5, and in the more marked prominences on the connecting lamella of leg 4.

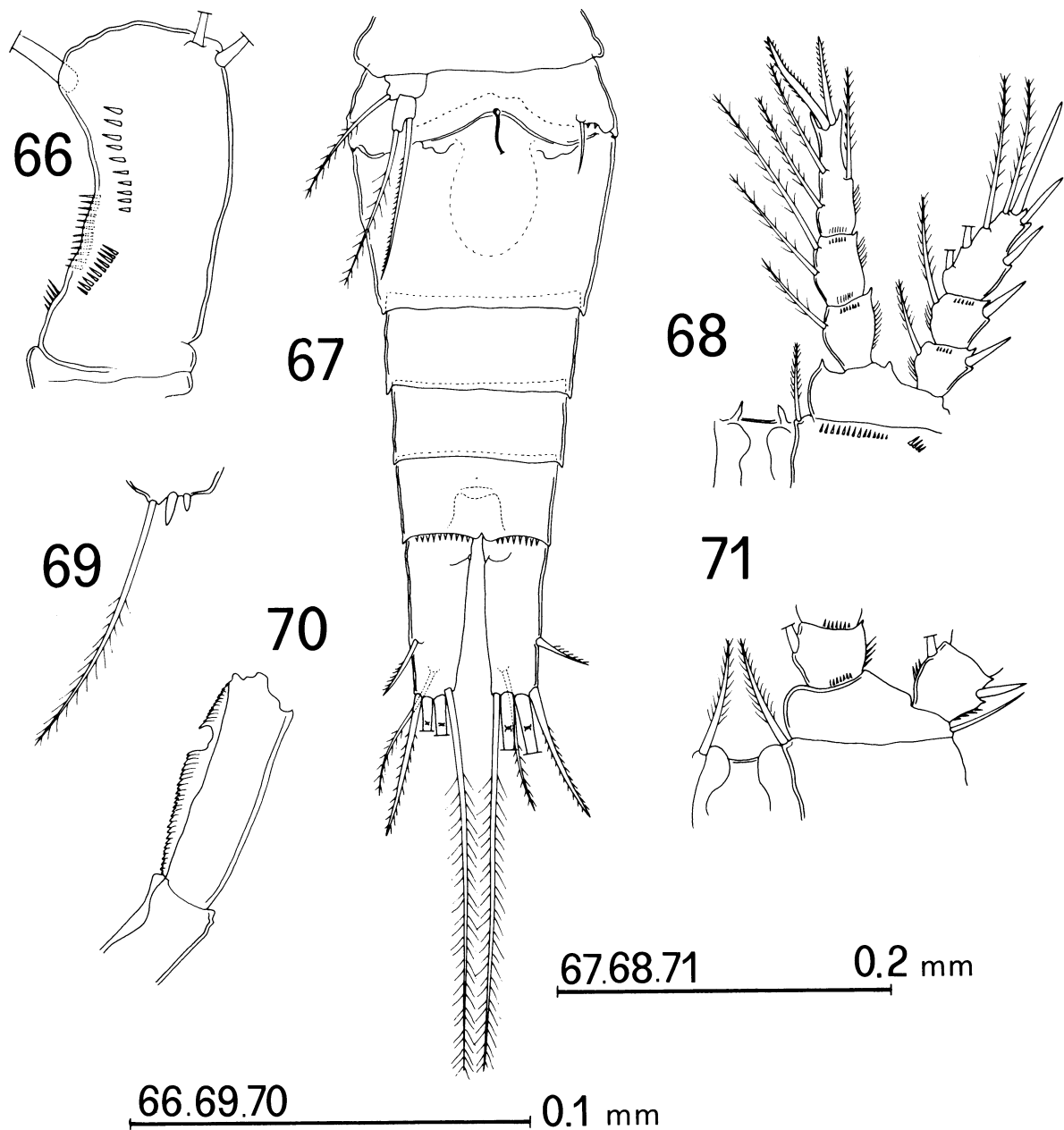
M. aequatorialis s.l. shows a wide distribution both in the New (*M. aequatorialis americanus* n. ssp.: Bahamas) and in the Old World (*M. aequatorialis aequatorialis* (Kiefer): East African Lake district, Lake Tchad, and Tenerife; *M. aequatorialis similis*: African continent, south of the Sahara).

KEY TO THE SUBSPECIES OF *M. aequatorialis* (KIEFER)

1. Basipodite of antenna with a group of spinules at the basis of the exopodal seta; dorsal furcal seta shorter than the outermost furcal seta
..... *M. aequatorialis similis* Van de Velde
- Basipodite of antenna without spinules at the basis of the exopodal seta; dorsal furcal seta longer or as long as the outermost furcal seta 2
2. Last thoracic segment with setules on lateral and ventrolateral sides ... *M. aequatorialis aequatorialis* (Kiefer)
- Last thoracic segment without setules on lateral and ventrolateral sides... *M. aequatorialis americanus* n. ssp.

Thermocyclops tenuis longifurcatus n. ssp.
(Figs. 72-77)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-40, NETHERLANDS ANTILLES,



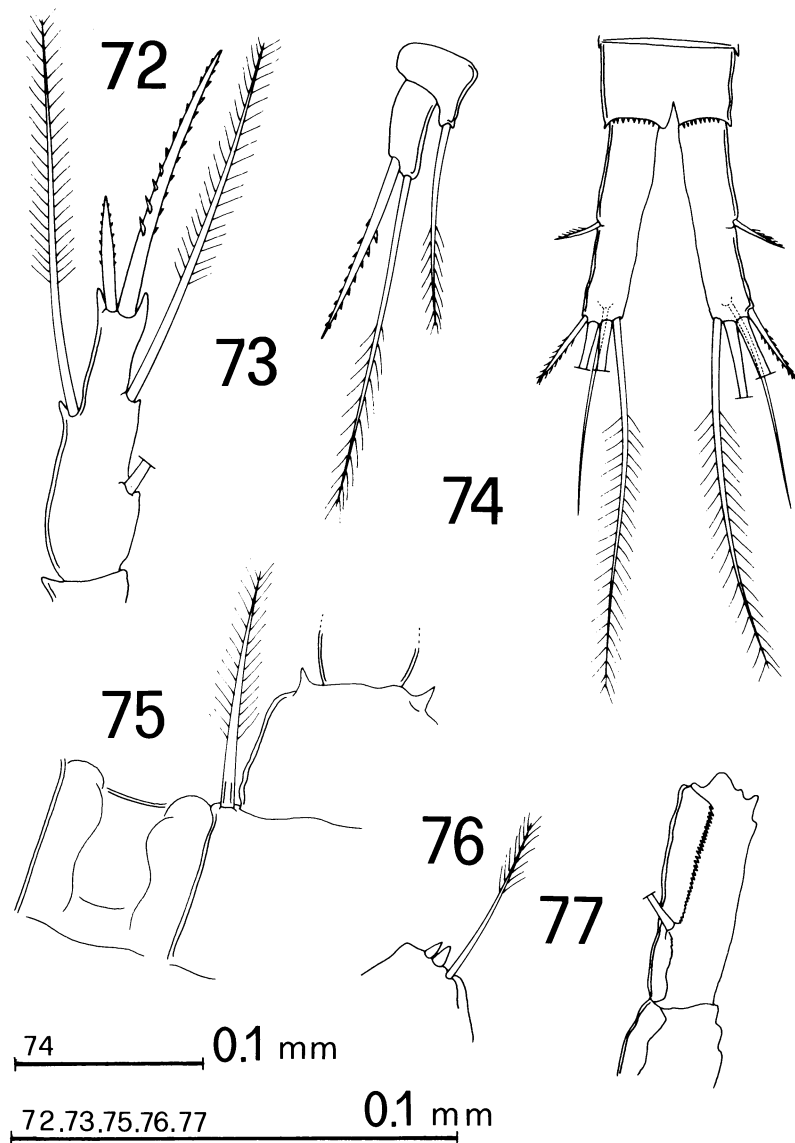
Figs. 66-71, *Mesocyclops aequatorialis americanus* n. ssp., from Crooked Island (holotype, sta. 79-192): 66, basipodite of A₂, caudal side; 67, abdomen, furcal rami, legs 5 and 6 (ventral view); 68, leg 4; 69, leg 6; 70, distal segment of A₁; 71, basipodite of leg 1.

Bonaire: Pos di Bolivia Abajo (12°13'25"N 68°15'28"W), a narrow well with strong smell of H₂S, water table at 5 m, water depth 1 m, chlorinity 3744 mg/l, temp. not recorded, 29 May 1980. One ♀ (holotype) and one ♀ (paratype), both completely dissected and mounted in Faure's medium (ZMA).

Sta. 75-10, NETHERLANDS ANTILLES, Bonaire: Pos

Carnè, Estate Rooi Lamunchi (12°08'34"N 68°11'45"W), open well, green unicellular algae, chlorinity not determined, temp. 29.2° C, 17 Nov. 1975. One ♀ (paratype), in Faure (GPC).

Description. — Body length, excluding antennulae and furcal setae, 0.85 to 0.88 mm.



Figs. 72-77, *Thermocyclops tenuis longifurcatus* n. ssp., from Bonaire (holotype, sta. 80-40): 72, distal segment of endopodite of leg 4; 73, leg 5; 74, furcal rami, ventral view; 75, connecting lamella of leg 4; 76, leg 6; 77, distal segment of A_1 .

Caudal rami elongated and divaricated (length/width ratio 5.0 to 5.1); lateral seta implanted near middle of outer margin of each furcal ramus; innermost distal seta very elongated, about 5 times longer than the outermost one; dorsal seta about as long as furcal ramus.

Hyaline membrane on 16th and 17th segments of antennula, broad and minutely serrated.

Distal endopodal segment of leg 4 about 3 times longer than wide, and armed with 2 distal spines, the inner about as long as the segment and 2.2-2.3 times longer than the outer one; connecting lamella with small, not much protruding prominences.

Leg 5 with seta on the distal segment much longer than the inner spine.

Male unknown.

Remarks. — *T. tenuis longifurcatus* n. ssp. basically resembles the original description and illustrations of *T. tenuis* by Marsh, 1909, as well as the subsequent ones by Coker (1943) and Smith & Fernando (1978). The most characteristic features of the new subspecies are the more elongated caudal rami (length/width ratio about 5; versus less than 4 in *T. tenuis*), the different length ratio between innermost and outermost distal furcal setae and the different pattern of the connecting plate of leg 4.

As regards its distribution, *T. tenuis longifurcatus* n. ssp. is up to now peculiar to the groundwaters of the island of Bonaire; on the contrary, *T. tenuis* s. str. shows a wide distribution in North and South America (Coker, 1943; Smith & Fernando, 1978).

Thermocyclops decipiens (Kiefer, 1929) (Figs. 78-84)

Material. — Amsterdam Expeditions to the West Indian Islands, sta. 80-10, NETHERLANDS ANTILLES, Aruba: Pos Chiquito, not far from San Nicholas (12°27'56"N 69°57'24"W), well in limestone, bottom sand and stones, water table at 1.5 m, water depth 0.3 m, chlorinity 2772 mg/l, temp. 31.5° C, 22 May 1980. One ♀, in Faure (ZMA).

Sta. 74-67, NETHERLANDS ANTILLES, Curaçao: well ("Domeinput") on Estate Leliëberg, plot Leliëberg 260 (12°17'55"N 69°05'43"W), covered, bottom sand, water table at 10 m, water depth 5 m, chlorinity 155 mg/l, temp. 28.8° C, 11 Apr. 1974. Four ♀♀, in Faure (ZMA).

Sta. 76-32, NETHERLANDS ANTILLES, Bonaire: well on Estate Washikemba (12°10'24"N 68°13'08"W), partly covered, water table at 3.5 m, water depth 1.5 m, chlorinity and temperature not recorded, 15 June 1976. Four ♀♀, in Faure (ZMA).

Sta. 80-36, NETHERLANDS ANTILLES, Bonaire: Pos di Saliña Chikita, near Estate Pourier (12°14'50"N 68°21'35"W), large, shallow well with rich swamp vegetation, smell of H₂S, chlorinity 632 mg/l, temp. not recorded, 28 May 1980. One ♀, in Faure (ZMA).

Sta. 75-36, U.S. VIRGIN ISLANDS, St. Croix: Longford Estate, W. of chimney (17°43'02"N 64°41'47"W), large well, depth 10 m, chlorinity and temp. not recorded, 21 Nov. 1975. Three ♀♀, in Faure (ZMA).

Sta. 79-506, HAITI, Dépt. du Sud: Laval (18°15'10"N 73°47'51"W), one of old colonial wells on the road Cayes-Camp Perrin, open, water table at 4 m, water depth 17 m, chlorinity 35 mg/l, temp. 26.0° C, 31 Oct. 1979. One ♀, one ♂ (ZMA).

Sta. 79-580, HAITI, Dépt. de l'Ouest: Debas, well Eliassin Aldoni (18°38'51"N 72°06'34"W), partly

covered, water table at 6 m, water depth 1.8 m, chlorinity 2330 mg/l, temp. 28.0° C, 21 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-592, HAITI, Dépt. de l'Artibonite: Saint Marc (south), well Tubérissé Surpris on the new National Road to Port au Prince (19°05'29"N 72°42'04"W), 250-300 m from the sea, dug in sand, in a house, water table at 5 m, water depth 2.5 m, chlorinity 24 mg/l, temp. 26.8° C, 22 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-593, HAITI, Dépt. de l'Artibonite: Saint Marc (south), well of Mrs. Sinai Francis (near previous station), water table at 5.2 m, water depth 1.8 m, chlorinity 24 mg/l, temp. 25.8° C, 22 Nov. 1979. Two ♀♀, in Faure (ZMA).

Sta. 79-597, HAITI, Dépt. de l'Artibonite: Saint Marc, well called "Portail des Guêpes", on the road to Gonaïves (19°07'23"N 72°41'44"W), about 100 m from the sea, water table at 2.5 m, water depth 0.5 m, chlorinity 231 mg/l, temp. 27.4° C, 22 Nov. 1979. One ♀, in Faure (ZMA).

Sta. 79-601, HAITI, Dépt. de l'Artibonite: Dessalines, well Gaby Gabriel, Rue Jacques Ier (19°15'36"N 72°31'01"W), dug in sand, covered, water table at 8 m, water depth 3 m, chlorinity 143 mg/l, temp. 28.1° C, 23 Nov. 1979. One ♀, two ♂♂, in Faure (ZMA).

Sta. 79-602, HAITI, Dépt. de l'Artibonite: Dessalines, well of Darius Belhomme, Rue Simonet (19°15'36"N 72°31'01"W), in sand and gravel, partly covered, clean, water table at 6.2 m, water depth 2 m, chlorinity 105 mg/l, temp. 28.1° C, 23 Nov. 1979. Three ♀♀, in Faure (ZMA).

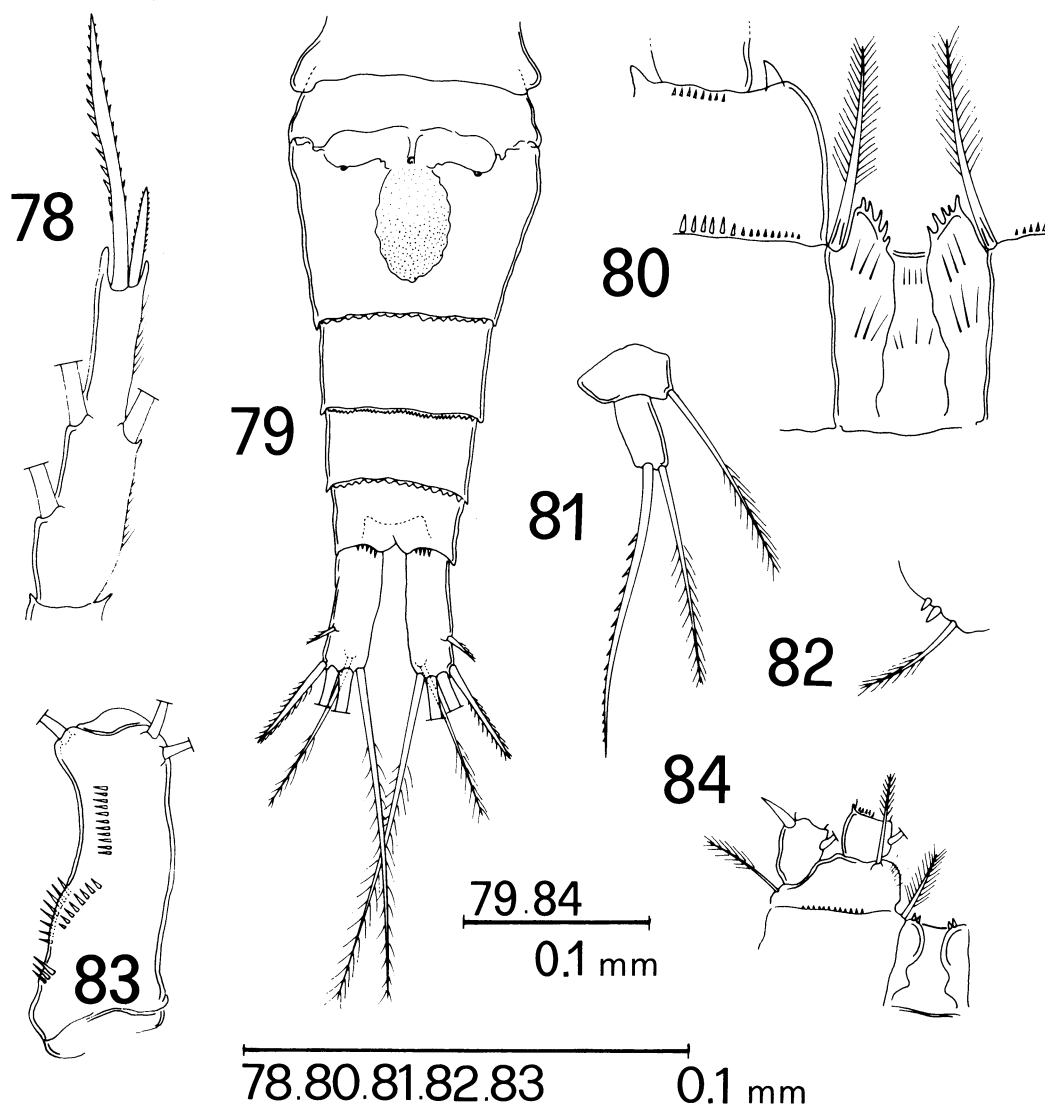
Sta. 79-603, HAITI, Dépt. de l'Artibonite: Dessalines, well of Saimval Luisin, corner Rue Christophe and Rue Jacques Ier (coordinates as previous station), very large well, in sand, partly covered, clean, chlorinity 189 mg/l, temp. not recorded, 23 Nov. 1979. Five ♀♀, in alcohol (GPC).

Sta. 79-605, HAITI, Dépt. de l'Artibonite: Dessalines, well Nord Albert, Rue Charlottin (19°15'36"N 72°31'15"W), covered, clean, in sand and gravel, at the foot of a calcareous mountain, water table at 3.5 m, water depth 6 m, chlorinity 73 mg/l, temp. 27.3° C, 23 Nov. 1979. Two ♀♀, in alcohol (GPC).

Sta. 79-609, HAITI, Dépt. de l'Artibonite: well of Royal Hôtel at Gonaïves (coordinates not recorded), inner court, about 250 m from the sea, water table at 0.4 m, water depth 2 m, chlorinity 79 mg/l, temp. 27.5° C, 24 Nov. 1979. One ♀, in alcohol (GPC).

Sta. 79-684, HAITI, Dépt. du Nord: Limbé, well of Mrs. Antoine Dugrène, on the National Road (19°42'14"N 72°23'55"W), water table at 1.8 m, water depth 1 m, chlorinity 17 mg/l, temp. 25.1° C, 10 Dec. 1979. Three ♀♀, in alcohol (GPC).

Sta. 79-685, HAITI, Dépt. du Nord: Limbé, well of Vincent Noël, near catholic church (19°42'14"N 72°23'55"W), water table at 2.2 m, water depth 0.8 m, chlorinity 27 mg/l, temp. 25.5° C, 10 Dec. 1979. One ♂, in alcohol (GPC).



Figs. 78-84, *Thermocyclops decipiens* (Kiefer, 1929), from Haiti (♀, sta. 79-602): 78, distal segment of endopodite of leg 4; 79, abdomen and furcal rami (ventral view); 80, connecting lamella of leg 4; 81, leg 5; 82, leg 6; 83, basipodite of A₂, caudal side; 84, basipodite and connecting lamella of leg 1.

Remarks. — Our material quite closely agrees with the original description of *T. decipiens* by Kiefer (1929) and with those of materials from South and Central America (Kiefer, 1956; De Infante et al., 1979). Some differences were noted as regards the very conspicuous pattern of the armature of the connecting lamella of leg 4, and the slightly more elongated caudal rami.

T. decipiens has been recorded previously in

numerous West Indian localities such as Guadeloupe, Marie Galante, Martinique, Aruba, Bonaire and Curaçao (Kiefer, 1936; Dussart, 1982) and from Costa Rica (Collado et al., 1984) and Venezuela (Kiefer, 1956; De Infante et al., 1979, as *T. crassus*).

As far as we know, it is recorded here for the first time from groundwaters of the island of Haiti.

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