Some Crustacea Copepoda from Venezuela

B. H. Dussart
Station Biologique de l'Université de Paris VI, F 24620 Les Eyzies, France

Keywords: tropical zooplankton, Crustacea, Copepoda, Venezuela, biogeography, ecology

Abstract

The study of 38 samples of aquatic fauna from Venezuela increased the number of known species here from 28 to 66. Fifteen new species for science are described. A list of Copepoda known from the other regions of South America is presented. From this list, it can be said that only 50% of the inland water Copepoda living actually in Venezuela are known.

In spite of the diversity of aquatic environments in Venezuela, their crustacean fauna is not well known. Only the lake of Valencia has been regularly prospected (Pearse, 1921; Kiefer, 1954, 1956; de Infante *et al,* 1979). The Orinoco delta and the surroundings of Lake Maracaibo were studied by Gessner (Kiefer, 1956) and Deevey (Bowman, 1973). Zoppi & Michelangeli were interested in the Caracas region and state of Guarico (region of Calabozo). In the Caribbean sea, waters of some isles were prospected (Kiefer, 1933; Bowman, 1979; Dussart, 1982a).

This region is biogeographically interesting because it is at the cross-section of the Caribbean, Andes, Amazonia and Guyana Massifs. Thus, I was pleased to have the opportunity to collect samples there, some of which have been rarely prospected in Venezuela.

Stations studied (Fig. 1)

a. Collection B. Dussart

1. Lake of Valencia (littoral, South), 12.10.1981
   Mesocyclops meridianus (Kiefer, 1926)
   Thermocyclops decipiens (Kiefer, 1929)
2. Lake of Valencia (other station in the surroundings), 12.10.1981
   Microcyclops anceps (Richard, 1897)
   Thermocyclops decipiens
3. Lake of Valencia (littoral, South, with *Typha* sp.) 12.10.1981
   Microcyclops anceps
   Mesocyclops meridianus
   Thermocyclops decipiens
4. Small pool near and in communication with lake of Valencia, 12.10.1981, numerous larvae of Culicids
   Mesocyclops anceps
   Mesocyclops meridianus
5. Lake of Valencia (littoral, South, with *Eichhornia*), 12.10.1981
   Notodiaptomus deeveyorus nov. nom.
   Microcyclops anceps
6. Rio near Magdalena (Carabobo), among periphyton (biotecton), 12.10.1981
   Mesocyclops aspericornis (Daday, 1906)
7. Zuata reservoir near Cagua (Aragua), 12.10.1981
   Prionodiaptomus colombiensis (Thiébaud, 1912)
   Microcyclops anceps
   Mesocyclops meridianus

Hydrobiologia 113, 25–67 (1984).

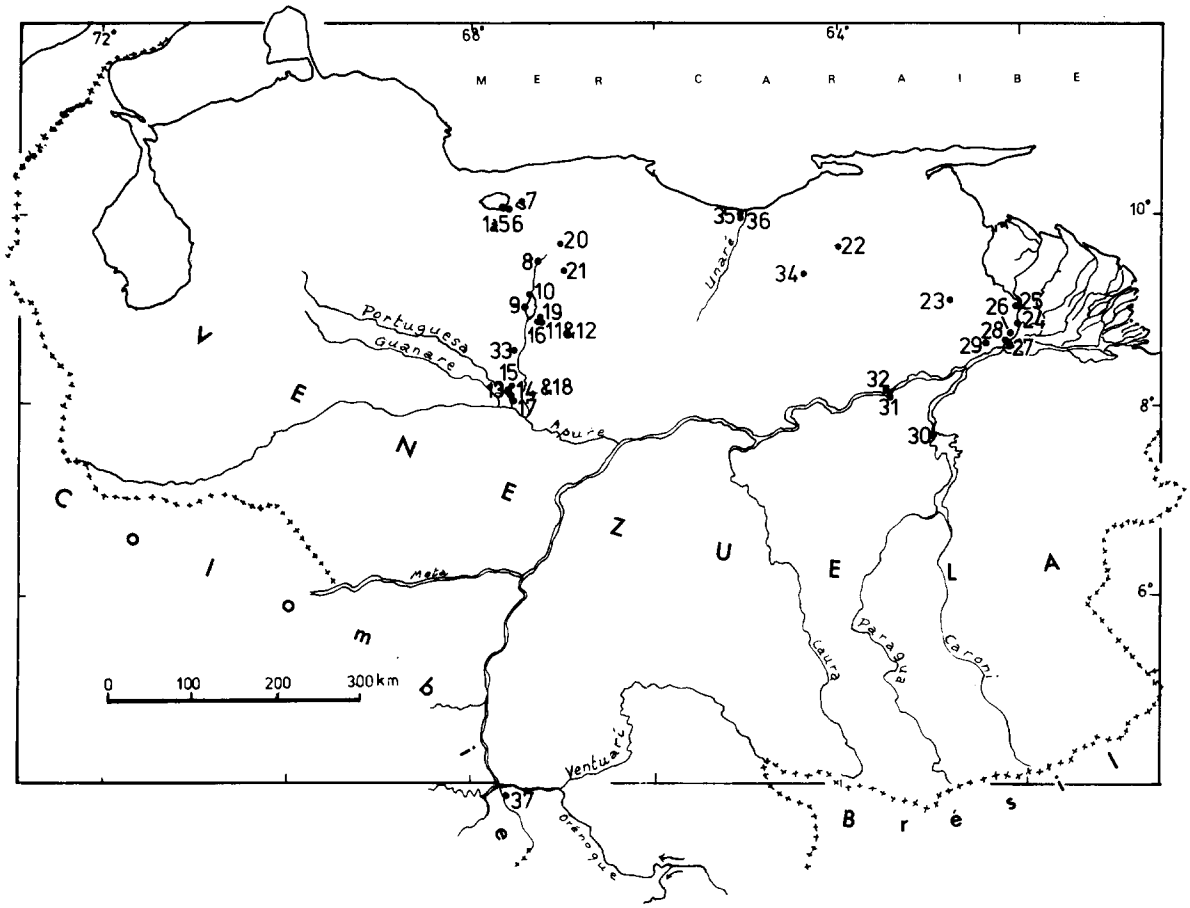

Fig. 1. Situation of sampling stations

Thermocyclops decipiens

8. Swamp near Dos Caminos (near Ortiz) (Guarico), 15.10.1981
   Acanthocyclops sp. ? juv.
   Mesocyclops longisetus (Thiébaud, 1914)
   Mesocyclops meridianus
9. Guarico reservoir near Calabozo (Guarico) at front of the pump plant, 15.10.1981
   Notodiaptomus cearensis (Wright, 1936)
   Mesocyclops meridianus
   Thermocyclops decipiens
10. Guarico reservoir 'up stream', 15.10.1981
    Microcyclops anceps
    Mesocyclops meridianus
11. Peat bog with Morichal, farm near Calabozo, 16.10.1981
    Macrocyclops sp. juv.
    Ectocyclops herbsti nov. nom.
    Microcyclops varicans (Sars, 1863)
12. *Drinking tank at the farm near Calabozo, 16.10.1981*
    Metacyclops tredecimus (Lowndes, 1934)
    Mesocyclops longisetus
13. Caño Falcon, Rio Portuguesa near San Fernando de Apure (Guarico), 16.10.1981
    Notodiaptomus cearensis
    Macrocyclops albidus principalis Herbst, 1963
    Microcyclops anceps
    Thermocyclops decipiens
    Paramphiascella aquaedulcis nov. spec.
    Canthocamptus cf. *microstaphylinus* Wolf, 1905
    Attheyella orinocoensis nov. spec.
    Elaphoïdella bidens (Schmeil, 1894)
14. Rio Portuguesa at Camaguan (Guarico), 16.10.1981
    Notodiaptomus sp. juv.
    Macrocyclops albidus albidus (Jurine, 1820)

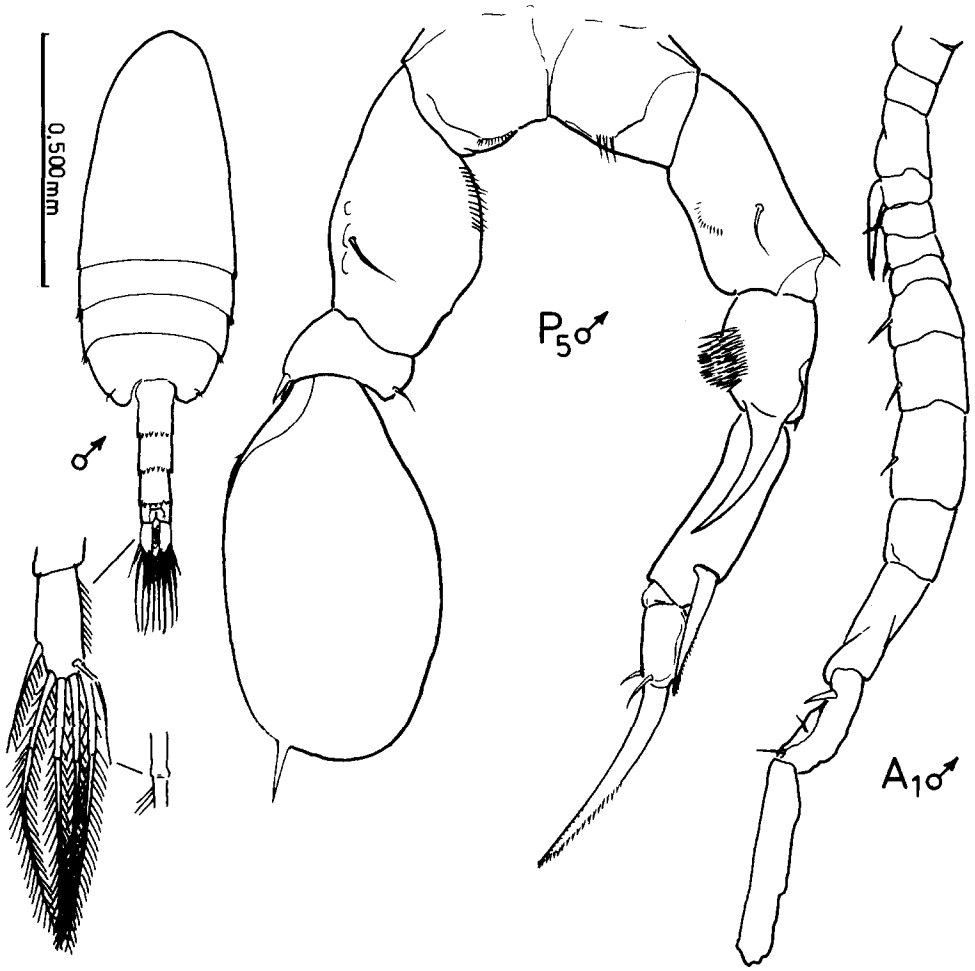

Fig. 2. Pseudodiaptomus gracilis, (orig.)

Microcyclops anceps
Thermocyclops decipiens

15. 'Estero'[1] de Camaguan (Guarico), near the road n° 2, 16.10.1981
Prionodiaptomus colombiensis
Notodiaptomus sp.
Microcyclops varicans
Mesocyclops meridianus
Thermocyclops minutus (Lowndes, 1934)

16. Limnocrene spring at El Carmen (Hato Becerra) near Calabozo, 16.10.1981
Ectocyclops cf. *bromelicola* juv.
Elaphoïdella bispina nov. spec.
Forficatocaris forficata crenensis nov. ssp.

17. Rio Portuguesa at Camaguan, 'gas oil' station (dock), 16.10.1981
Mesocyclops ellipticus Kiefer, 1936

18. Pool with *Azolla* and leaves, under trees near Camaguan, 16.10.1981
Microcyclops diversus (Kiefer, 1935)
Microcyclops finitimus nov. spec.
Neutrocyclops brevifurca (Lowndes, 1934)
Mesocyclops meridianus
Thermocyclops decipiens
Thermocyclops minutus

19. Pond (natural) 'los Patos' near the field biological station of Calabozo, 16.10.1981
Notodiaptomus cearensis
Microcyclops finitimus
Mesocyclops meridianus, juv.

20. Man-made lake at Camatagua (Aragua), 17.10.1981

[1] Local name for the back waters left after floods of the rivers in the plains (llanos) and return in their bed. An 'estero' is also partially filled with rain waters.

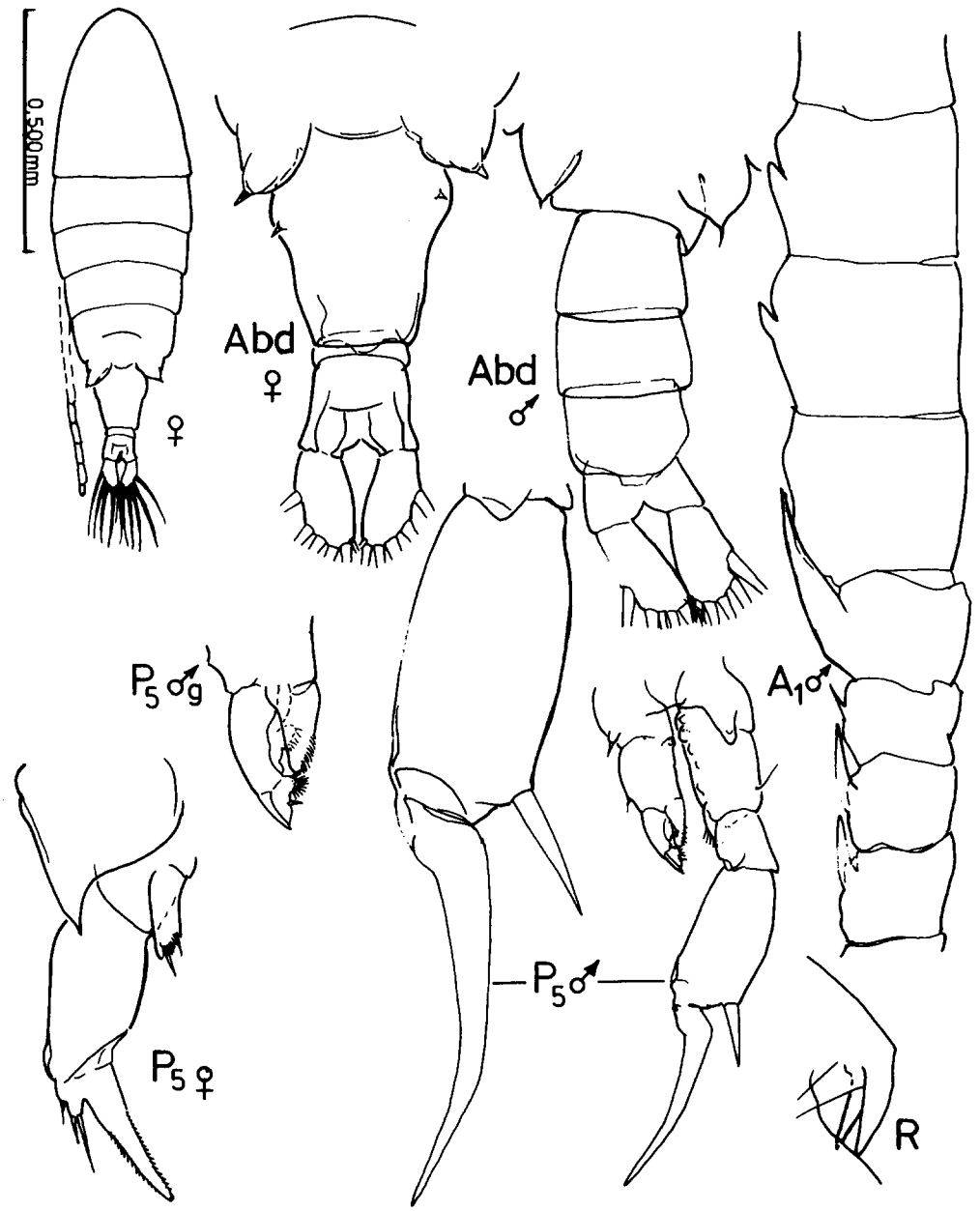

Fig. 3. Notodiaptomus henseni (= *N. venezolanus*) (Paratypes of this 'species') (orig.)

Notodiaptomus cearensis
Macrocyclops albidus albidus
Thermocyclops decipiens

21. Pond (natural) near El Sombrero (Guarico), with important littoral zone of macrophytes, 17.10.1981
Notodiaptomus cearensis
Mesocyclops meridianus
Thermocyclops decipiens
Thermocyclops minutus

22. Pond between Barcelona and Maturin, near Urica (road n° 13) (Anzoategui), 23.10.1981
Notodiaptomus cearensis
Ectocyclops herbsti
Microcyclops finitimus
Microcyclops dubitabilis (Kiefer, 1934)

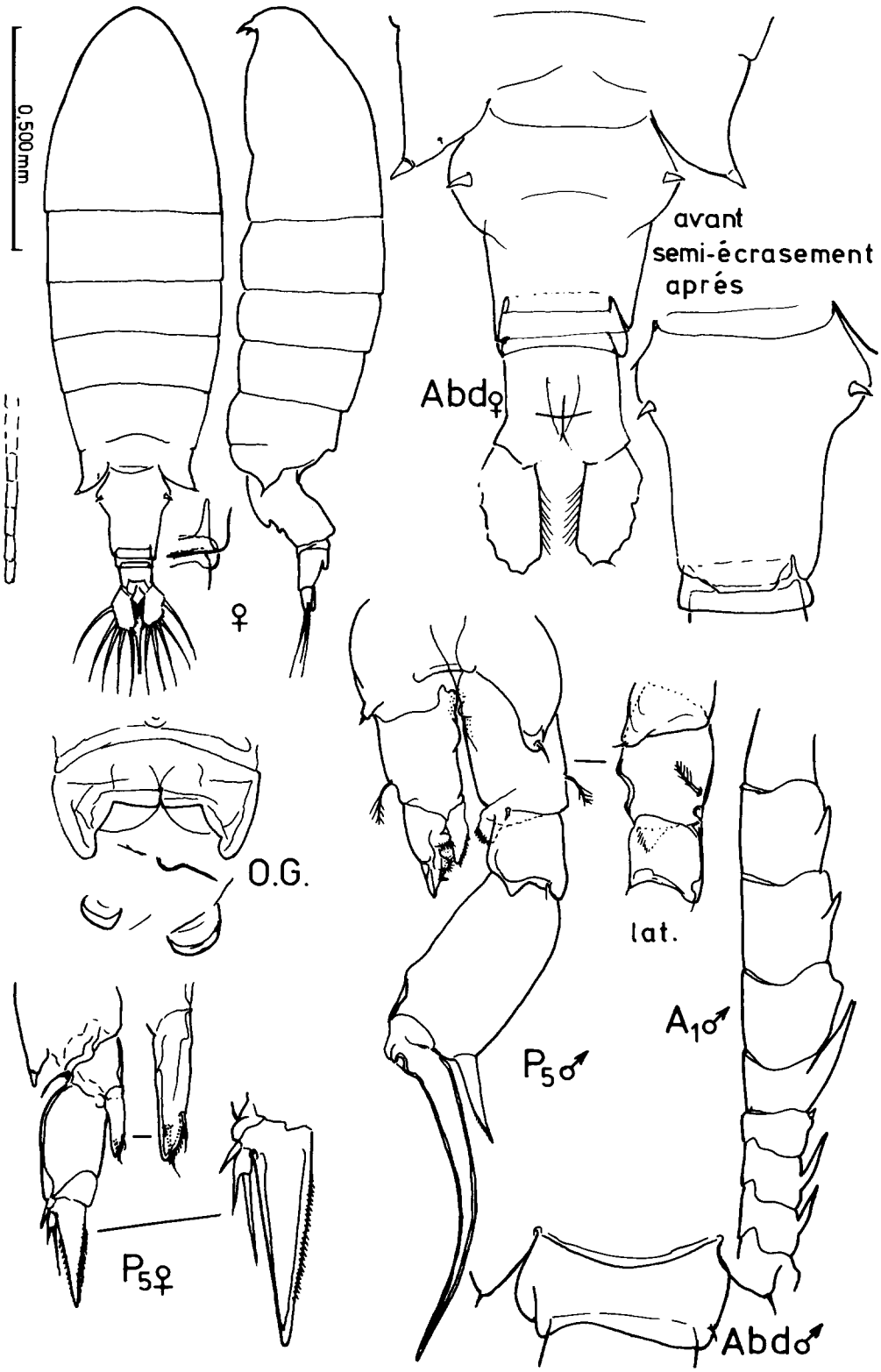

Fig. 4. Notodiaptomus deeveyorus nov. nom. (orig.)

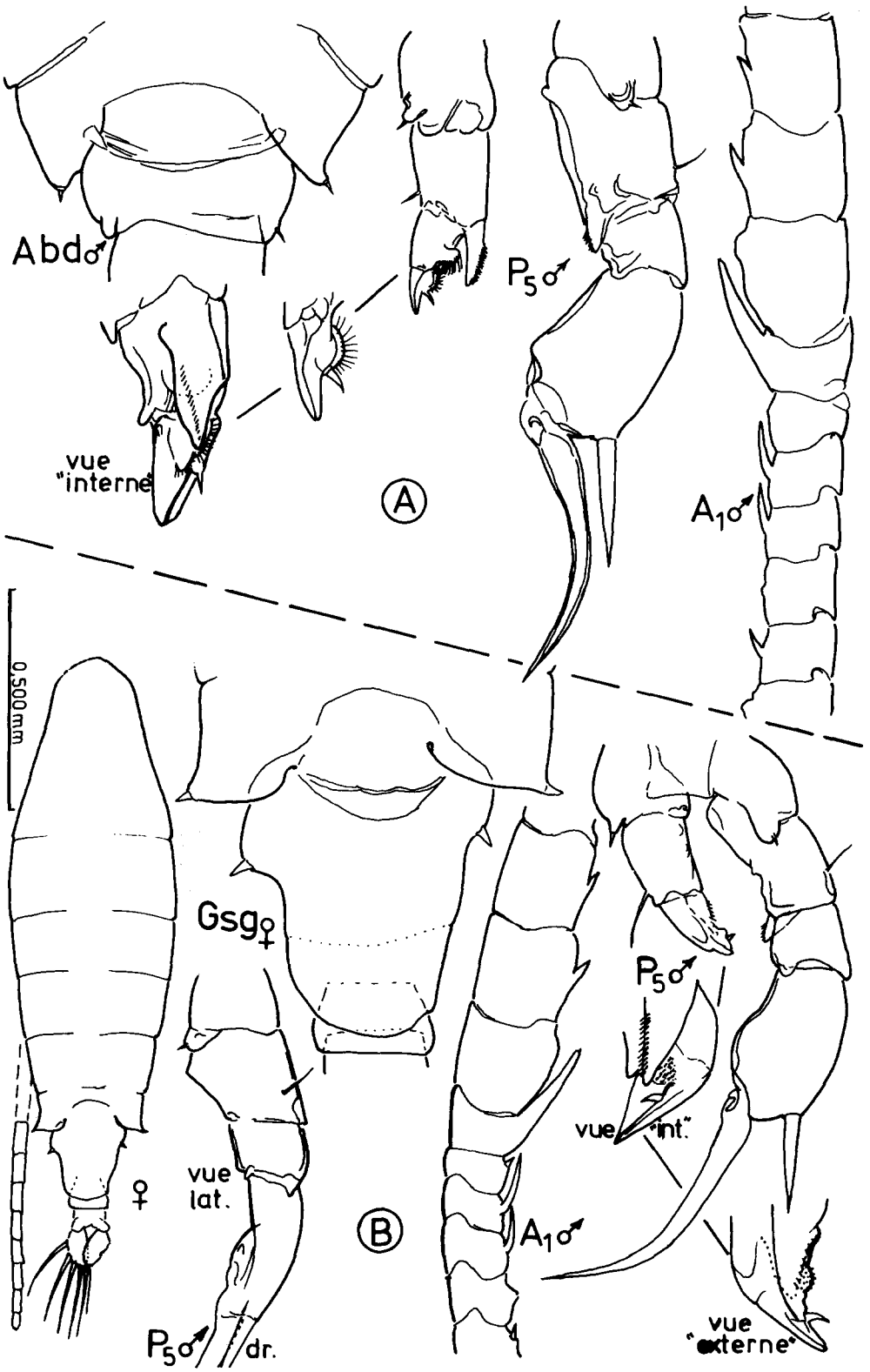

Fig. 5. A. *Notodiaptomus amazonicus;* B. *Notodiaptomus nordestinus* (orig.)

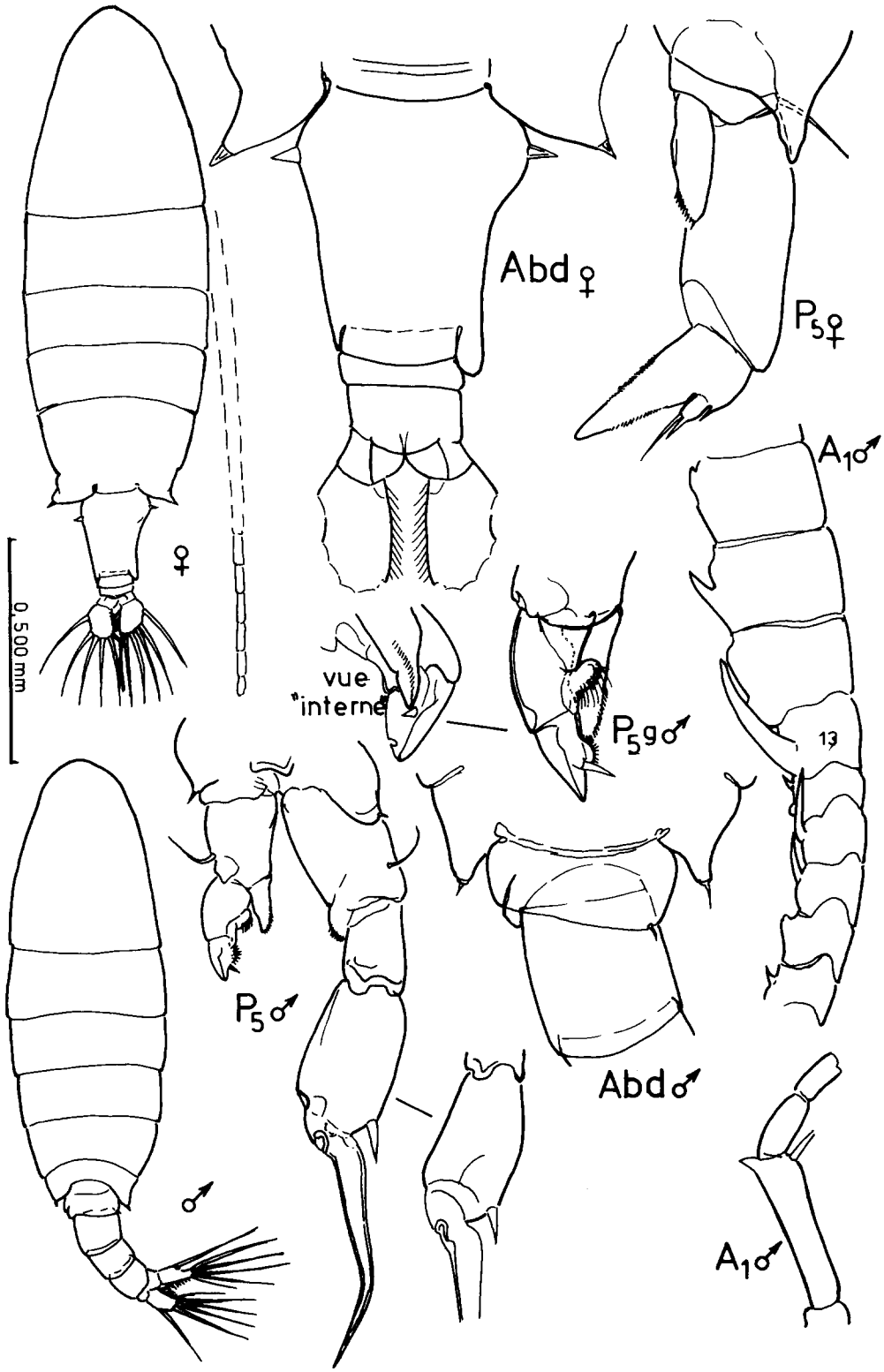

Fig. 6. Notodiaptomus cearensis (orig.)

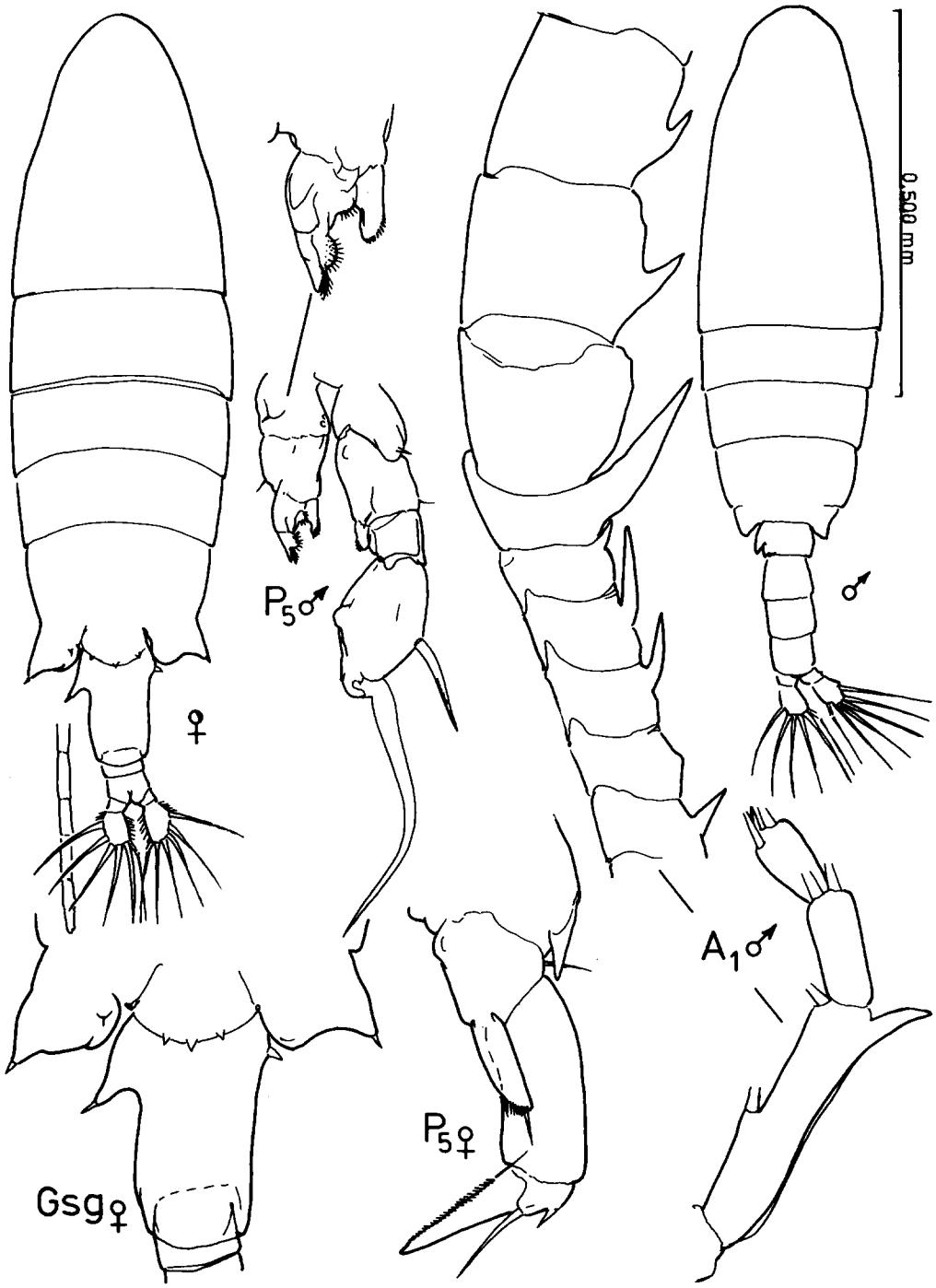

Fig. 7. Notodiaptomus kieferi (orig.)

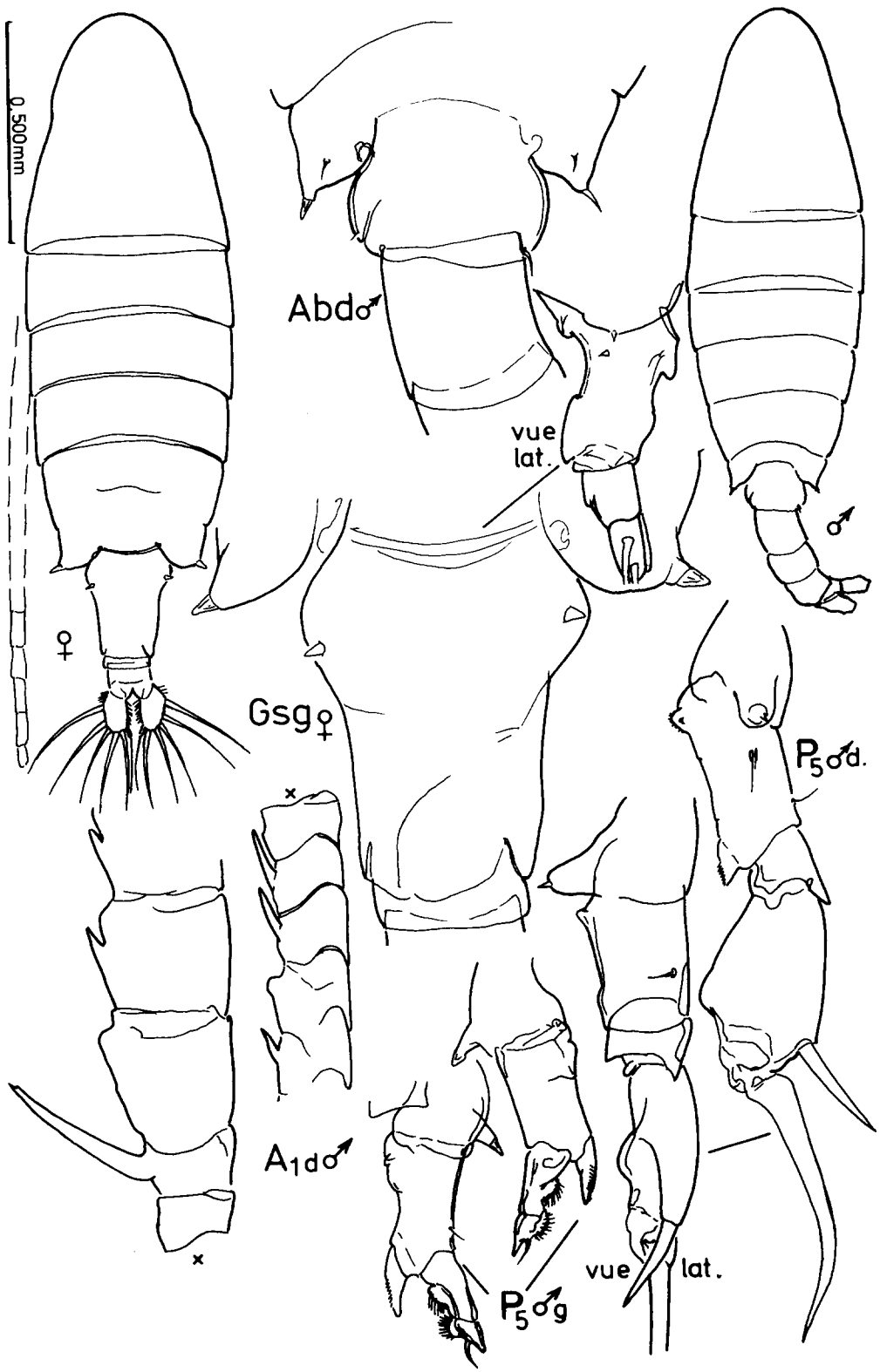

Fig. 8. Notodiaptomus dilatatus nov. sp.

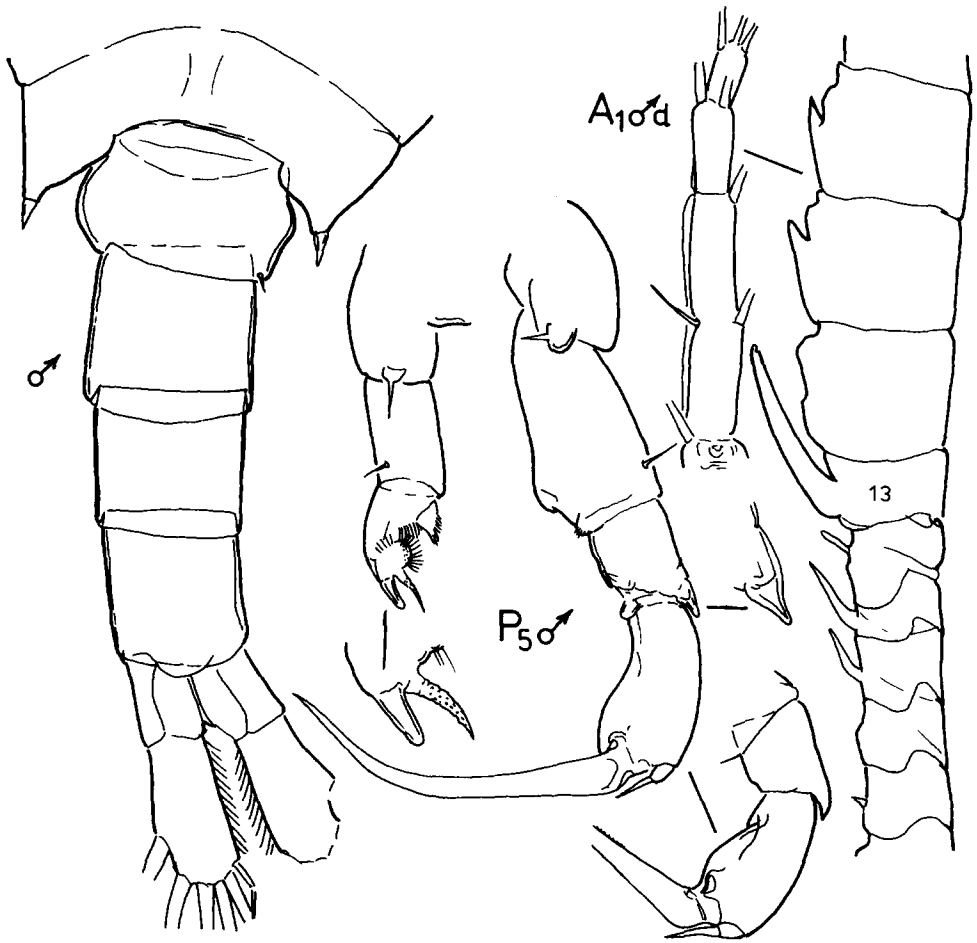

Fig. 9. Notodiaptomus coniferoides (orig.)

23. Rio Morichal near Barrancas (Monagas), 23.10.1981
    Microcyclops sp. juv.
24. Caño Guara near Tucupita (Orinoco Delta), 23.10.1981, 17h30
    Notodiaptomus henseni (Dahl, 1894)
    Notodiaptomus coronatus (Sars, 1901)
    Rhacodiaptomus calatus (Brandorff, 1973)
    'Diaptomus' negrensis (Andrade & Brandorff, 1975)
    Oithona sp.
    Macrocyclops albidus albidus
    Mesocyclops meridianus
25. Caño Manamo near Tucupita, 24.10.1981, 8h
    Notodiaptomus deeveyorus
    Notodiaptomus cearensis
    Notodiaptomus henseni
    Ectocyclops herbsti
    Mesocyclops meridianus
26. 'lagoon' with *Trapa* between Coporito and Barrancas, 24.10.1981, 8h40
    Rhacodiaptomus calatus
    Microcyclops finitimus
27. Rio Orinoco at Barrancas (from a run aground ferry), 24.10.1981, 9h30
    Notodiaptomus deeveyorus
    Notodiaptomus amazonicus (Wright, 1935)
    Notodiaptomus cearensis
    Notodiaptomus coniferoides (Wright, 1927)
    Rhacodiaptomus calatus
    'Diaptomus' negrensis
    Dactylodiaptomus pearsei (Wright, 1927)
    Oithona amazonica (Burckhardt, 1913)
    Macrocyclops albidus juv.
    Paracyclops pilosus nov. spec.
    Microcyclops anceps
    Mesocyclops ellipticus

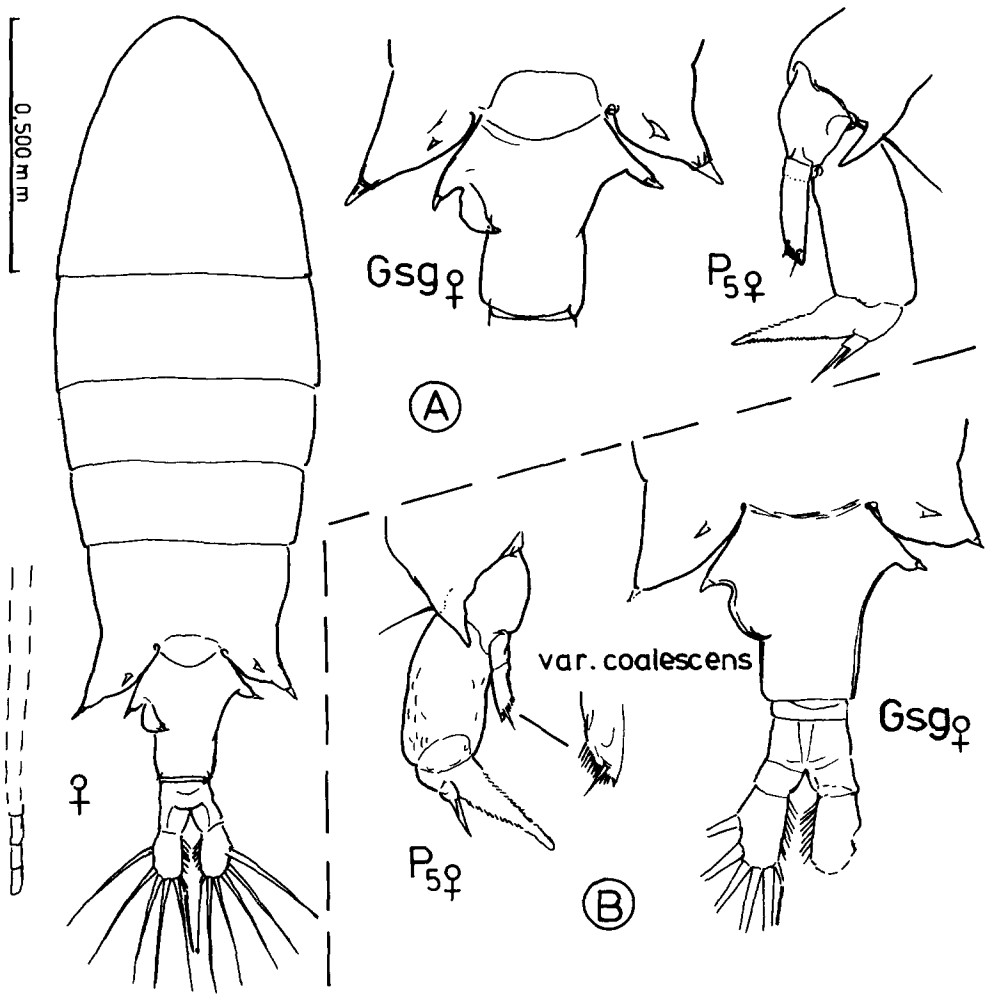

Fig. 10. A. *Rhacodiaptomus calatus;* B. *Rhacodiaptomus calatus coalescens* nov. sspec. (orig.)

28. Caño (pond) lateral and near Orinoco at Barrancas (south from the town), 24.10.1981, 10h
    Pseudodiaptomus gracilis (Dahl, 1894)
    Notodiaptomus deeveyorus
    Notodiaptomus coniferoides
    Rhacodiaptomus calatus
    'Diaptomus' negrensis
    Oithona amazonica
    Macrocyclops sp., juv.
    Ectocyclops compactus (Sars, 1909)
    Microcyclops finitimus
    Thermocyclops minutus
    Attheyella (Chappuisiella) orinocoensis nov. spec.
29. Rio Guarguapo with Morichal near Barrancas, 24.10.1981, 11h30
    Microcyclops finitimus
    Metacyclops curtispinosus nov. spec.
30. Guri, man-made lake near the dam on Caroni River, 24.10.1981, 16h
    Notodiaptomus deeveyorus
    Notodiaptomus cearensis
    Notodiaptomus kieferi Brandorff, 1972
    Mesocyclops sp. juv.
    Thermocyclops minutus
31. Rio Orinoco, right side, at Ciudad Bolivar, 25.10.1981
    Notodiaptomus deeveyorus
    Notodiaptomus amazonicus
    Notodiaptomus dilatatus nov. spec.
    Notodiaptomus kieferi
    Rhacodiaptomus calatus
    Dactylodiaptomus pearsei

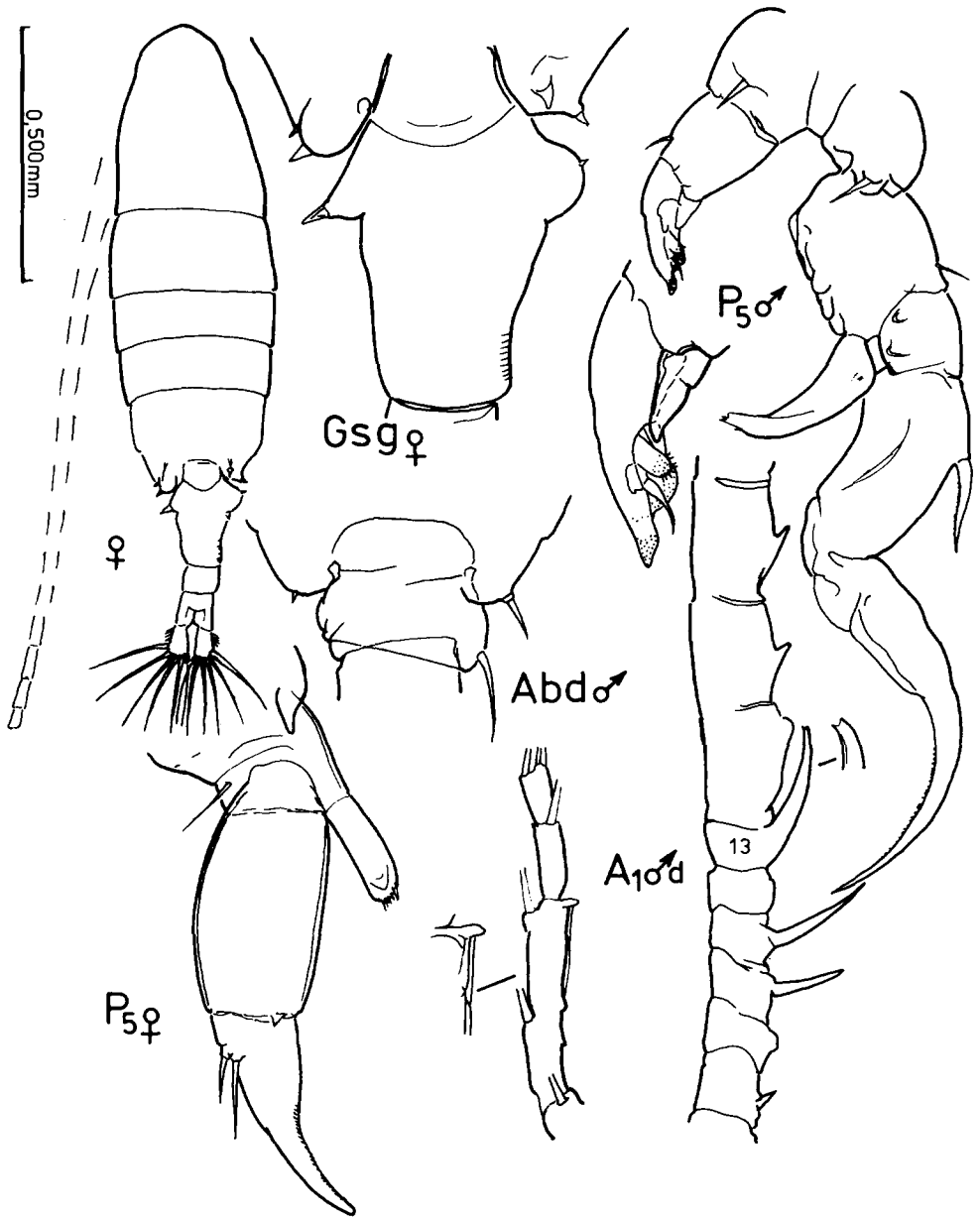

Fig. 11. 'Diaptomus' negrensis (orig.)

'Diaptomus' negrensis
Oithona amazonica
Macrocyclops albidus
Paracyclops pilosus nov. spec.
Microcyclops anceps
Metacyclops subaequalis nov. spec.
Allocyclops neotropicalis nov. spec.
Mesocyclops meridianus
Mesocyclops ellipticus
Themocyclops decipiens

32. Rio Orinoco, left side at Soledad, 25.10.1981, 10h
Notodiaptomus cearensis
'Diaptomus' negrensis
Paracyclops pilosus
Mesocyclops meridianus
Thermocyclops decipiens
33. Shady pool, km 245, road n° 2, between Camaguan and Calabozo, 16.10.1982
Prionodiaptomus colombiensis

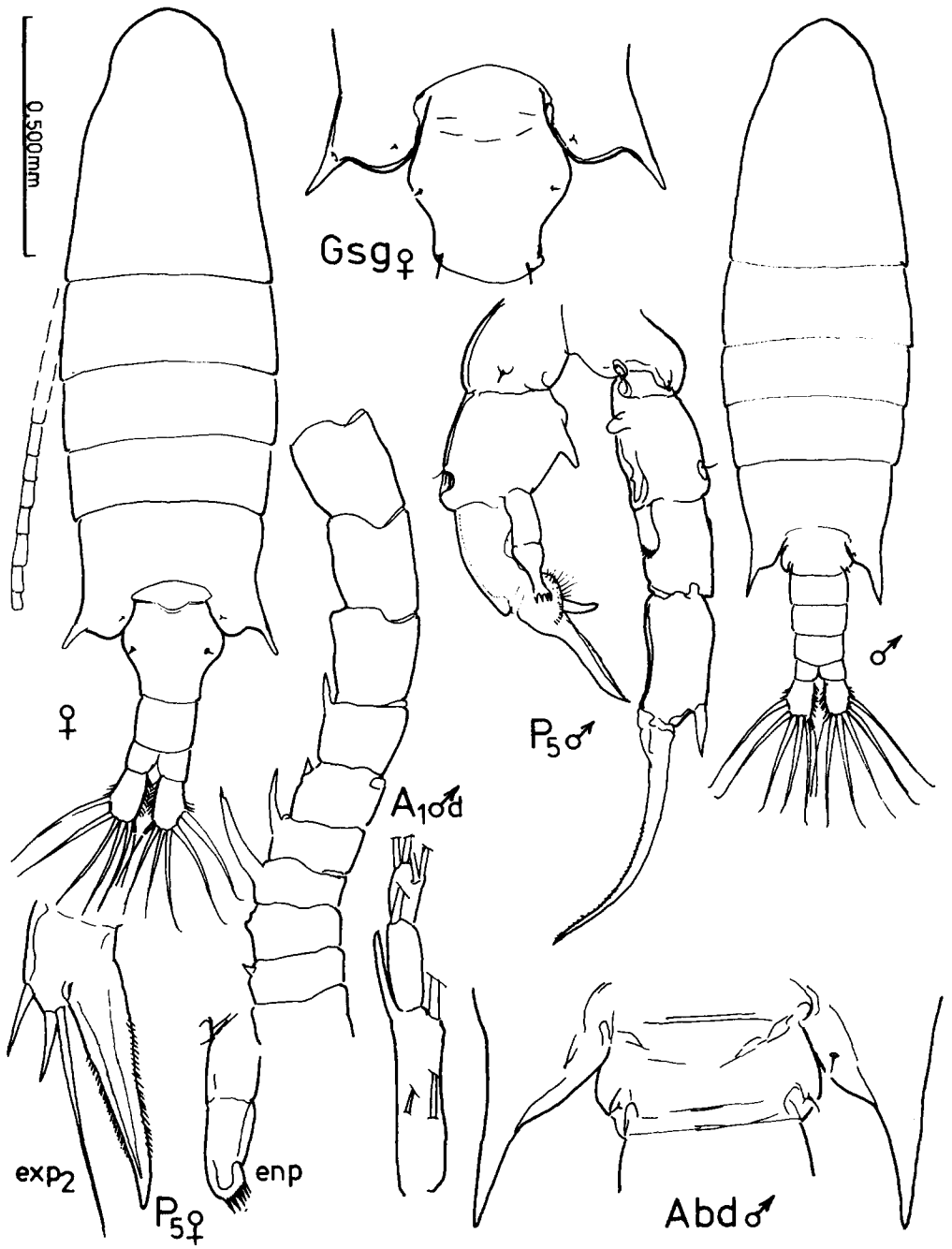

Fig. 12. Dactylodiaptomus pearsei (orig.)

34. 'Estero' between Cantaura and Anaco (cross of Buena Vista), 25.10.1981
Microcyclops cf. *varicans*
Mesocyclops meridianus
Mesocyclops ellipticus
b. Collection G. Pereira

35. Charca 1, near Unaré river at Clarines, 13.4.1981
Prionodiaptomus colombiensis
Microcyclops anceps var. *minor* nov. var.

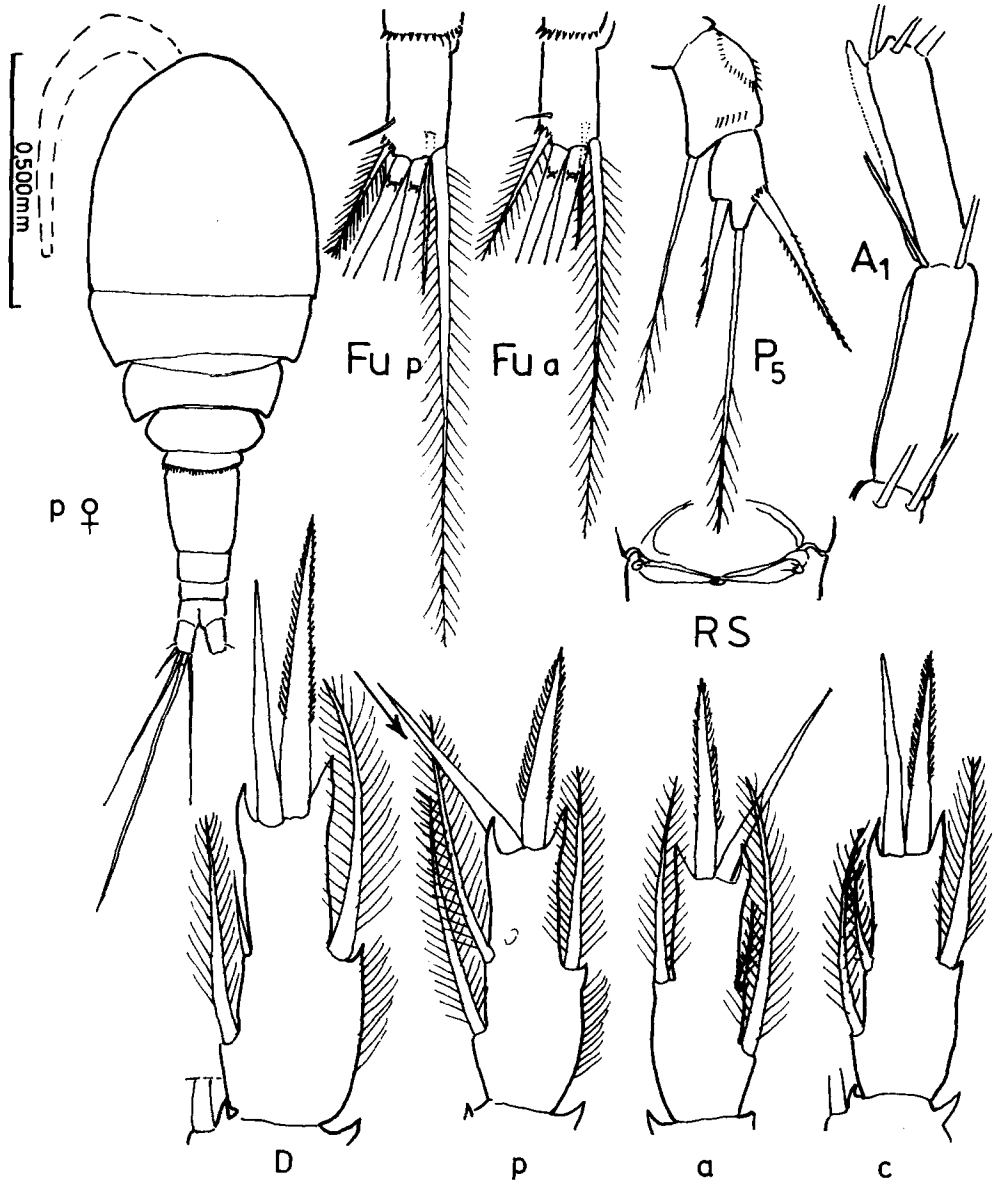

Fig. 13. Macrocyclops albidus. D = individual of Dordogne (France); a = individual of Rio Portuguesa; c = individual of Camaguan; p = individual of Caño Falcon (rio Portuguesa) *(M. a. principalis)* (orig.)

Mesocyclops aspericornis
Thermocyclops decipiens

36. Charca 2, near Unaré River, at Clarines, 13.4.1981
Notodiaptomus cearensis
Thermocyclops decipiens

c. Collection E. Zoppi de Roa

37. Rio Atabapo, 1, 24.2.1974
Notodiaptomus deeveyorus
Notodiaptomus coniferoides
Notodiaptomus kieferi
Notodiaptomus dilatatus nov. spec.
Rhacodiaptomus calatus coalescens nov. spec.
Mesocyclops meridianus

38. Laguna Mucubaji (Andes), 5.10.1980 (altitude 3 600 m)
Eucyclops pseudoensifer nov. spec.
Metacyclops leptopus mucubajiensis Kiefer, 1956

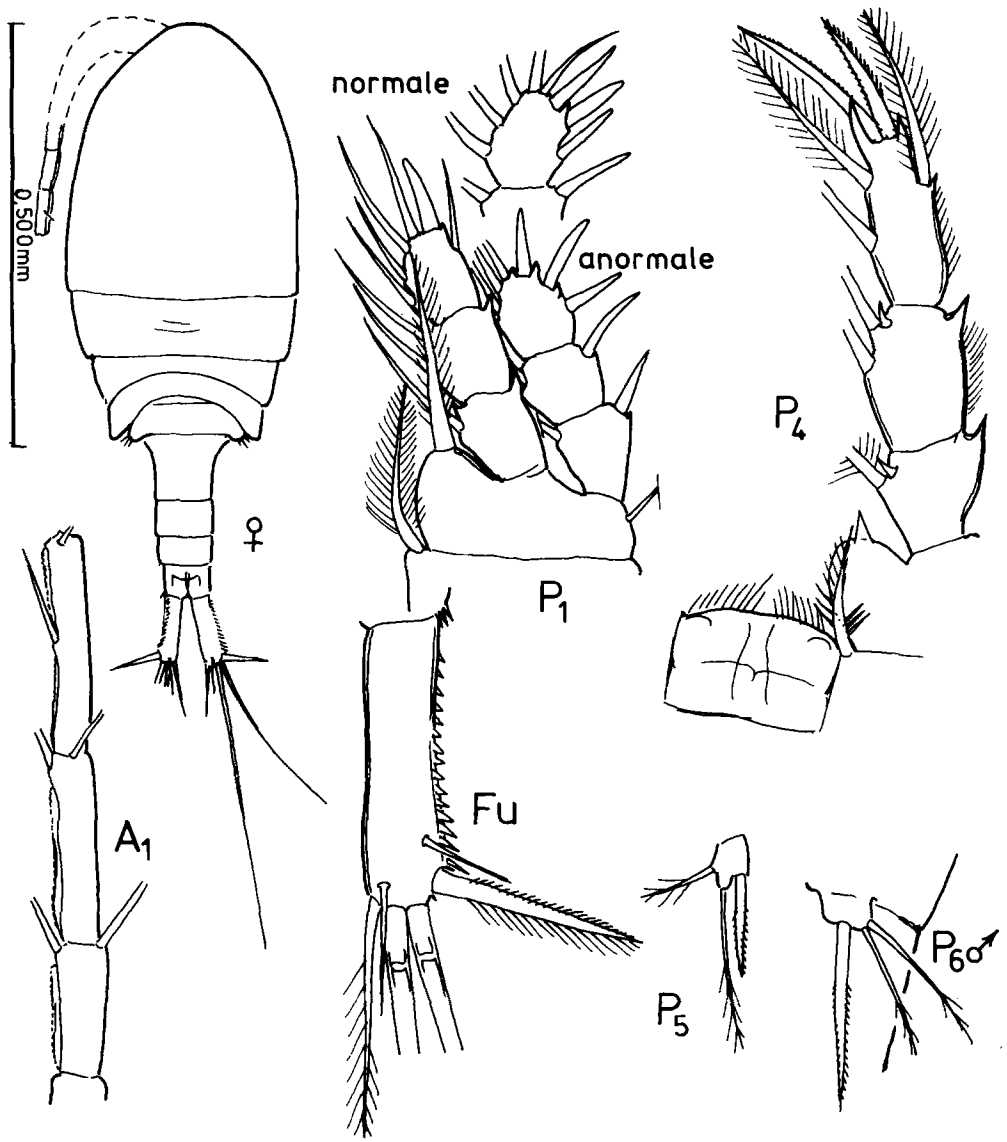

Fig. 14. Eucyclops pseudoensifer nov. sp. (orig.)

List of species observed

Order CALANOIDA
- Family Pseudodiaptomidae
  - *Pseudodiaptomus gracilis* (Dahl, 1894)
- Family Diaptomidae
  - *Prionodiaptomus colombiensis* (Thiébaud, 1912)
  - *Notodiaptomus henseni (= venezolanus)* (Dahl, 1894)
  - *N. deeveyorus* nov. nom.
  - *N. amazonicus* (Wright, 1935)
  - *N. coniferoides* (Wright, 1927)
  - *N. cearensis* (Wright, 1936)
  - *N. coronatus* (Sars, 1901)
  - *N. kieferi* Brandorff, 1972
  - *N. dilatatus* nov. spec.
  - *Rhacodiaptomus calatus* Brandorff, 1973
  - *R. calatus coalescens* nov. sspec.
  - *'Diaptomus' negrensis* Andrade et Brandorff, 1975
  - *Dactylodiaptomus pearsei* (Wright, 1927)

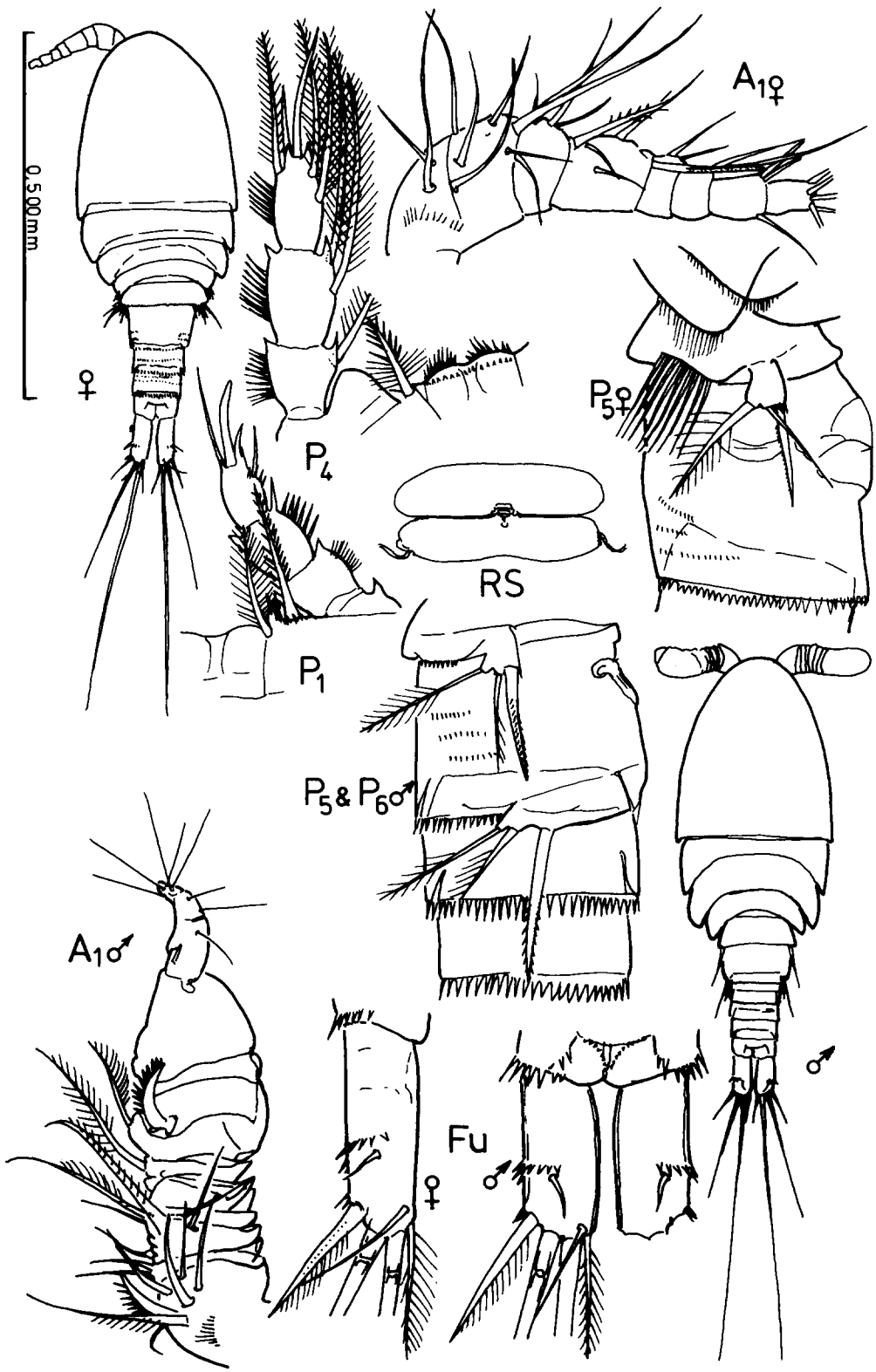

Fig. 15. Paracyclops pilosus nov. sp. (orig.)

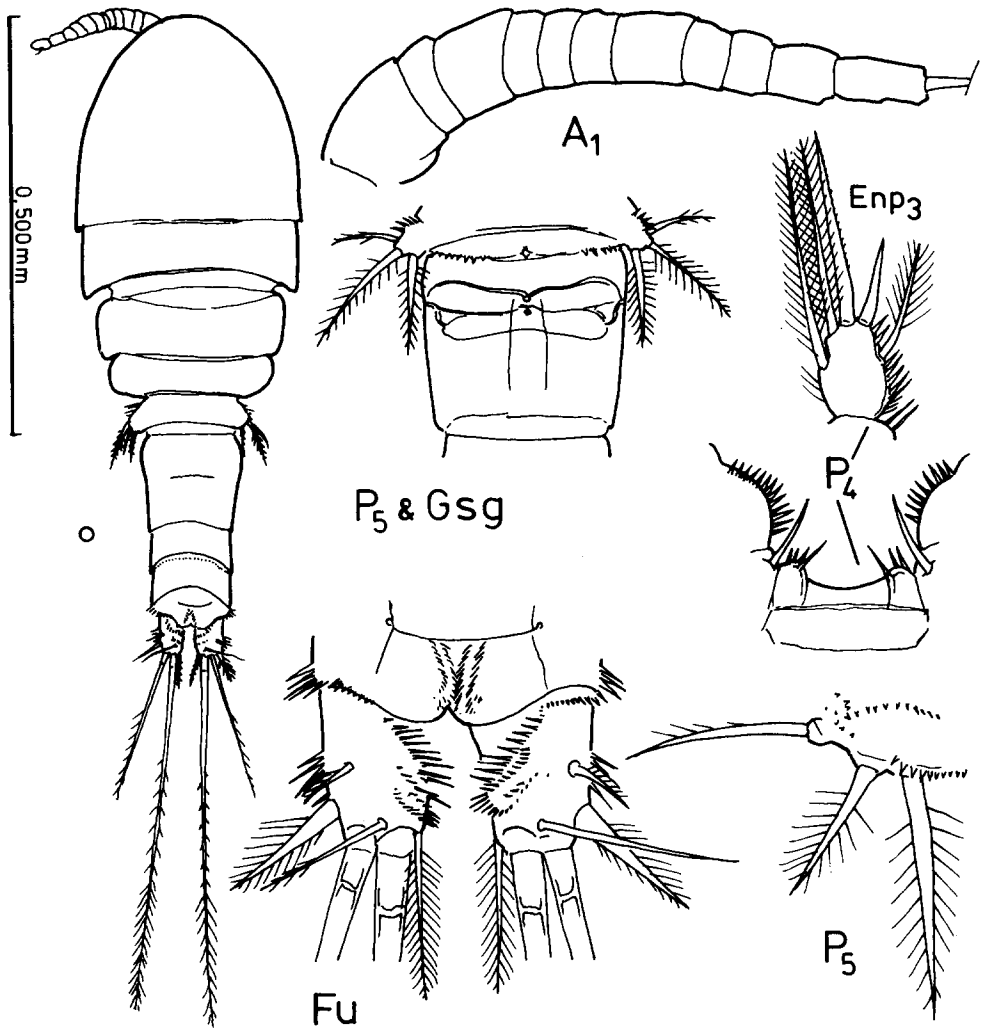

Fig. 16. Ectocyclops herbsti nov. sp. (orig.)

Order CYCLOPOIDA
- Family Oithonidae
  - *Oithona* sp.
  - *Oithona amazonica* Burckhardt, 1913
- Family Cyclopidae
  - *Macrocyclops albidus* (Jurine, 1820)
  - *Macrocyclops albidus principalis* Herbst, 1963
  - *Eucyclops pseudoensifer* nov. spec.
  - *Ectocyclops compactus* (Sars, 1909)
  - *E. herbsti* nov. nom.
  - *E.* cf. *bromelicola* Kiefer, 1935
  - *Paracyclops pilosus* nov. spec.
  - *Microcyclops anceps* (Richard, 1887)
  - *M. anceps* var. *minor* nov. var.
  - *M. diversus* (Kiefer, 1935)
  - *M. dubitabilis* (Kiefer, 1934).
  - *M. finitimus* nov. spec.
  - *M. varicans* (Sars, 1863)
  - *Metacyclops tredecimus* (Lowndes, 1934)
  - *Metacyclops curtispinosus* nov. spec.
  - *M. subaequalis* nov. spec.
  - *M. leptopus mucubajiensis* Kiefer, 1956
  - *Neutrocyclops brevifurca* (Lowndes, 1934)
  - *Allocyclops neotropicalis* nov. spec.
  - *Mesocyclops aspericornis* (Daday, 1906)
  - *M. meridianus* (Kiefer, 1926)
  - *M. longisetus* (Thiébaud, 1914)
  - *M. ellipticus* Kiefer, 1936
  - *Thermocyclops decipiens* (Kiefer, 1929)
  - *T. minutus* (Lowndes, 1934)

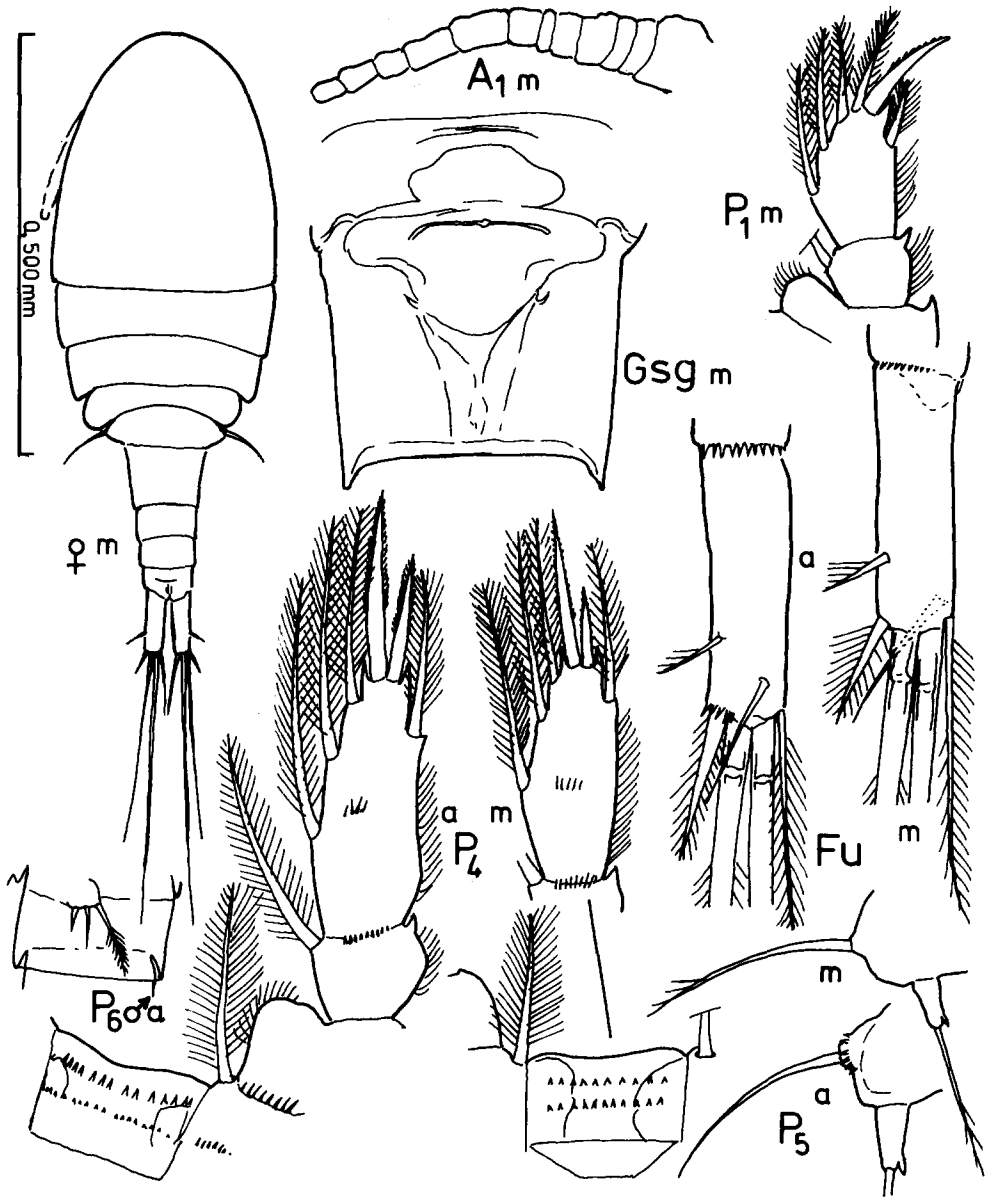

Fig. 17. Microcyclops anceps. a = *M. anceps* m = var. *minor* nov. var. (orig.)

Order HARPACTICOIDA
- Family Diosaccidae
  - *Paramphiascella aquaedulcis* nov. spec.
- Family Canthocamptidae
  - *Canthocamptus* cf. *microstaphylinus* Wolf, 1905
  - *Attheyella (Chappuisiella) orinocoensis* nov. spec.
  - *Elaphoïdella bidens* (Schmeil, 1894)
  - *Elaphoïdella bispina* nov. spec.
- Family Parastenocaridae
  - *Forficatocaris forficata crenensis* nov. ssp.

Notes on some species[2]

[2] Types of some species and subspecies are placed in the author's collection, Station Biologique de l'Université Pierre et Marie Curie, at F.-24620 Les Eyzies and will be stocked thereafter in the collection of Museum National d'Histoire Naturelle in Paris.

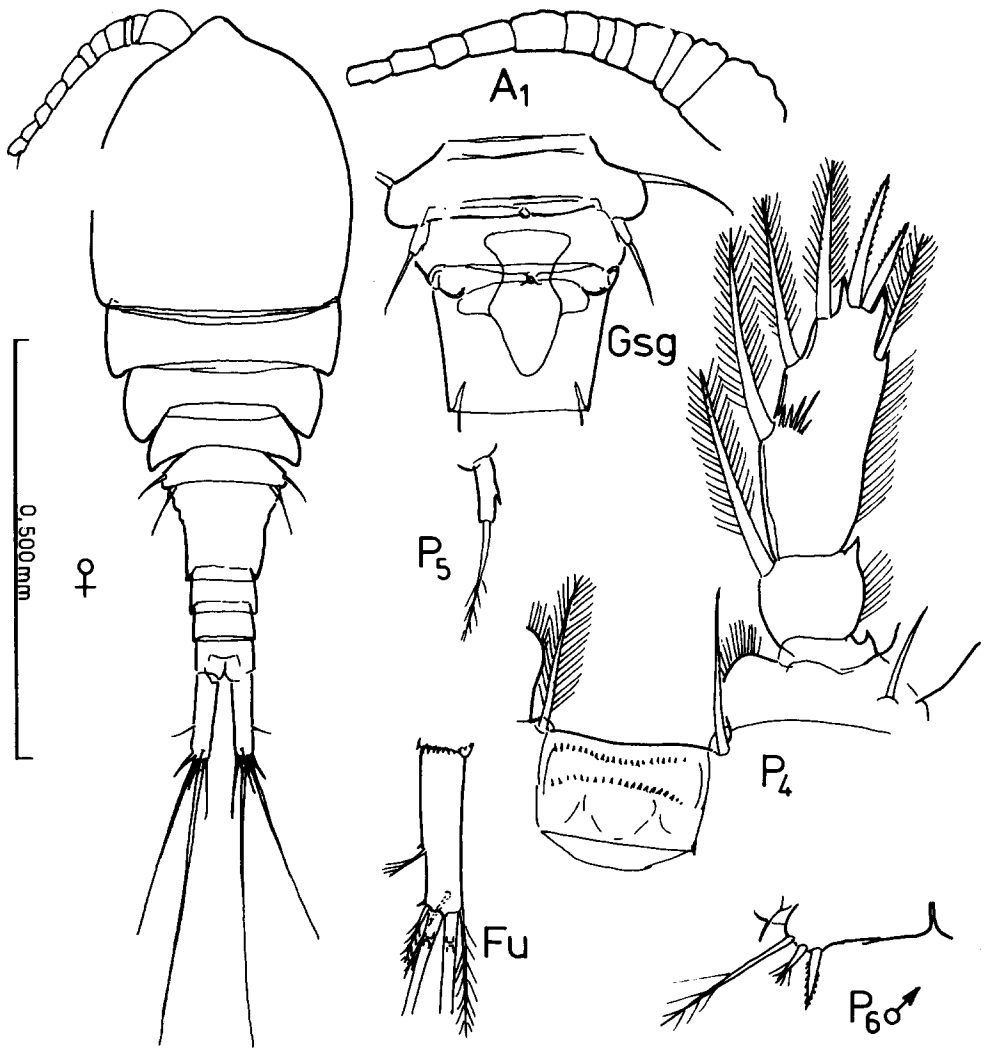

Fig. 18. Microcyclops diversus (orig.)

Pseudodiaptomus gracilis (Fig. 2)

Until now, no *Pseudodiaptomus* was found in Venezuela. Thus, the presence of *P. gracilis* near Tucupita is not noteworthy. This species is common in freshwaters such as the lower Amazone, rio Tocantin and lake Arary. Wright (1936) believed that it was endemic to the Amazonian region.

Only several males of the species were found; they were small and easy to recognize.

Notodiaptomus henseni (Fig. 3)

Contrary to what Wright stated (1935a), the 'description' of Dahl (1894) of *N. henseni* is precise enough, although reduced to some drawings and measurements. Wright's drawings, on the other hand, are insufficient.

The configuration of the right P5 of male is difficult to present in only one drawing because the knobs on exopodite 2 are only obvious in an oblique view.

The internal sides of basopodites right and left are granular as is the knob near the proximal inner angle of basopodite of right P5.

N. henseni presents no other noticeable peculiarity at the right antennule of male. Of the spiniform processes of the joints 8, 10, 11, 13, 15 and 16, those

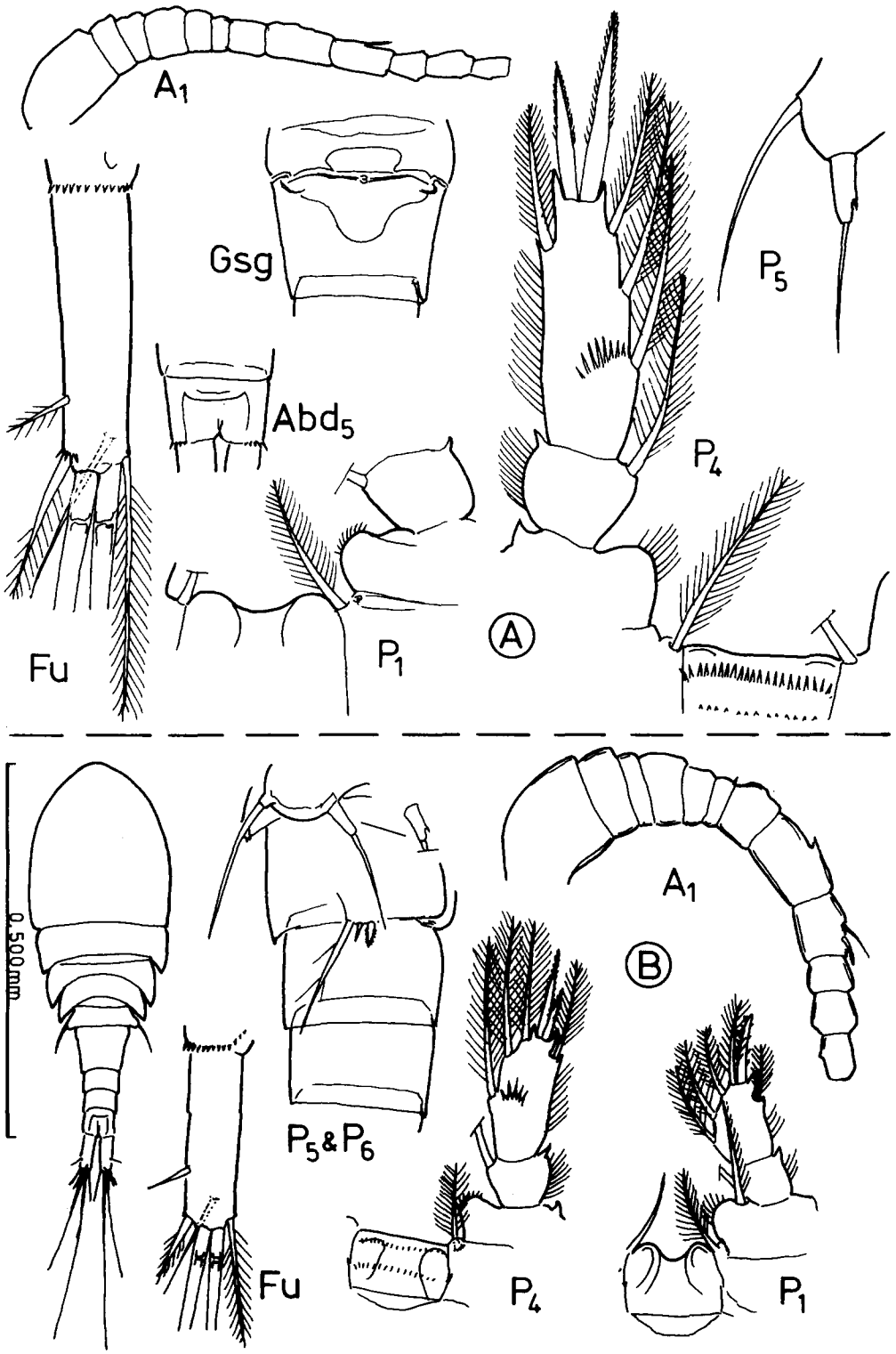

Fig. 19. A. *Microcyclops finitimus* nov. sp.; B. *Microcyclops cf. varicans* (orig.)

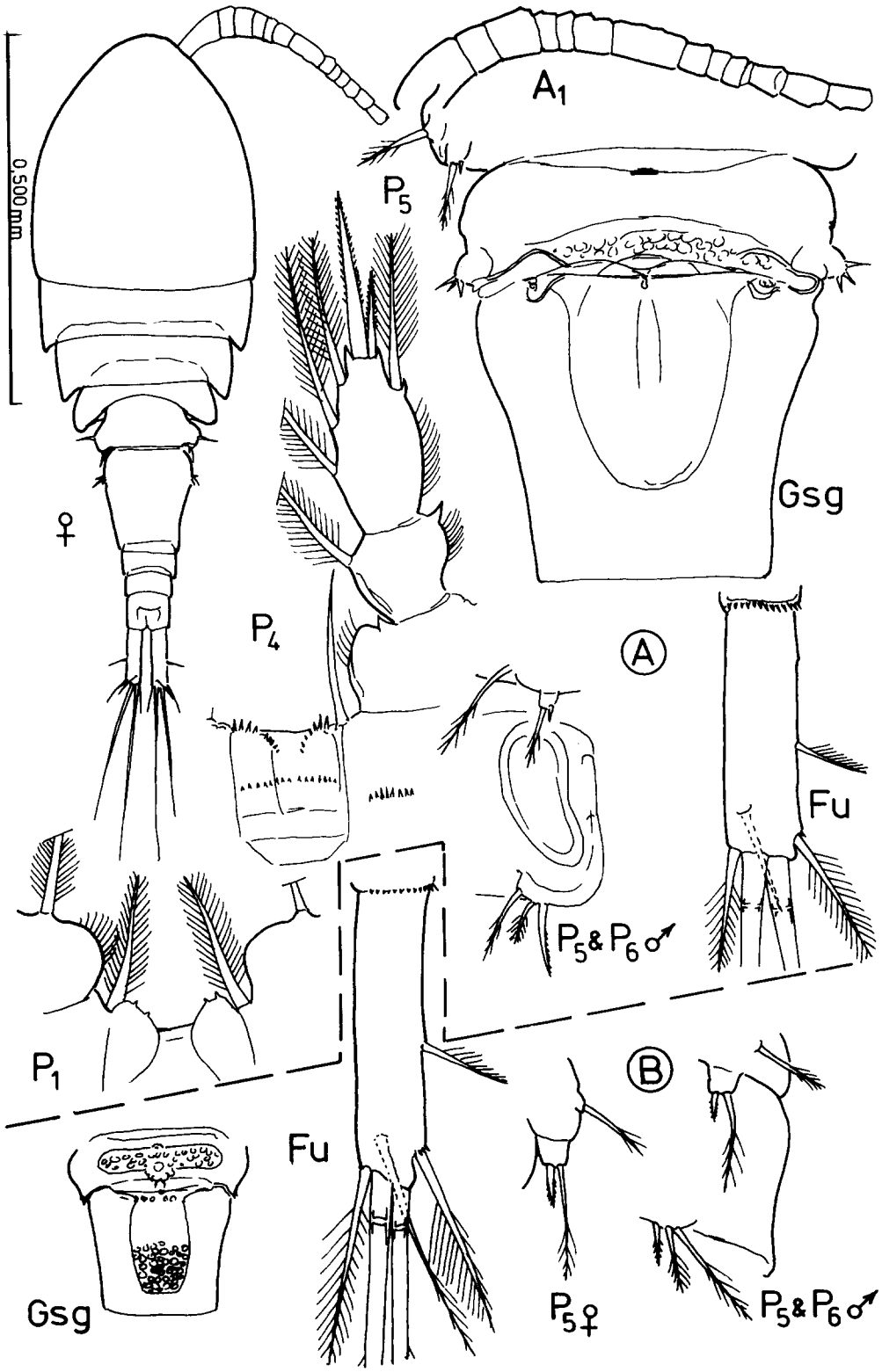

Fig. 20. A. *Metacyclops tredecimus;* B. *Metacyclops leptopus mucubajiensis* (orig.)

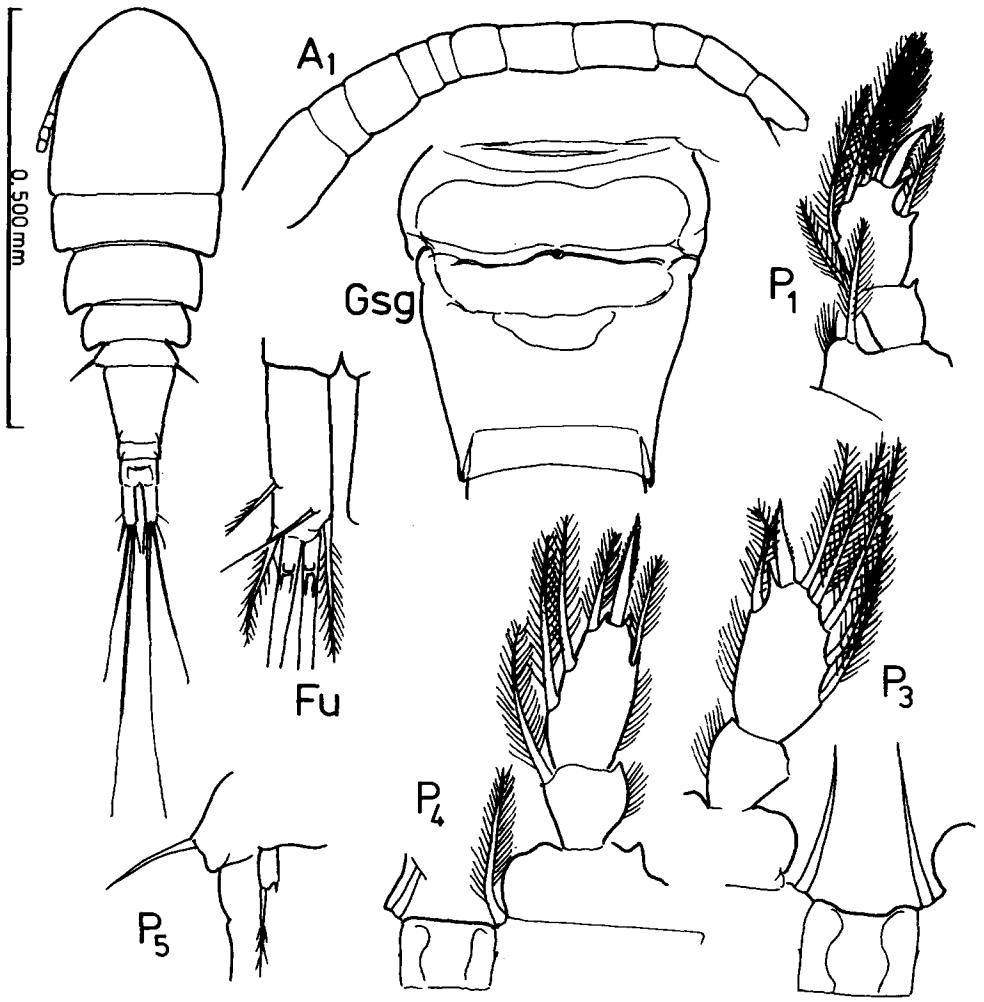

Fig. 21. Metacyclops curtispinosus nov. sp.

of 8, 15 and 16 are the smallest.

With the granulation of the internal side of basopodite of left P5, *N. henseni* makes transition with the genus *Argyrodiaptomus.* However, the species of this genus have an exopodite different at left and right P5.

I have studied paratypes of *N. venezolanus*[3] and I did not find any noticeable difference between this *N. venezolanus* and the *D. henseni* of Dahl. In comparing the illustrations of the first of these species by Kiefer (1954), I have come to the conclusion that these two species are synonymous.

[3] I thank T. Bowman from the Smithsonian Institution who kindly offered me this possibility.

Notodiaptomus deeveyorus nov. nom. (Fig. 4)

Bowman (1973) described a subspecies of *N. venezolanus* and named it *N. venezolanus deeveyorum.* He did not refer to the work of Dahl (1894) on *N. henseni.*

The differences between this last species and the subspecies *deeveyorum* are such that it is possible and necessary to elevate the subspecies to species. I suggest the name *N. deeveyorus.* Bowman (1973) was already of this opinion when he wrote: 'this decision could be altered when the now largely unknown diaptomid fauna of Northern Venezuela becomes adequately studied'.

N. deeveyorus is very close to that of *N. nordestinus* Wright, 1935. By comparison with some speci-

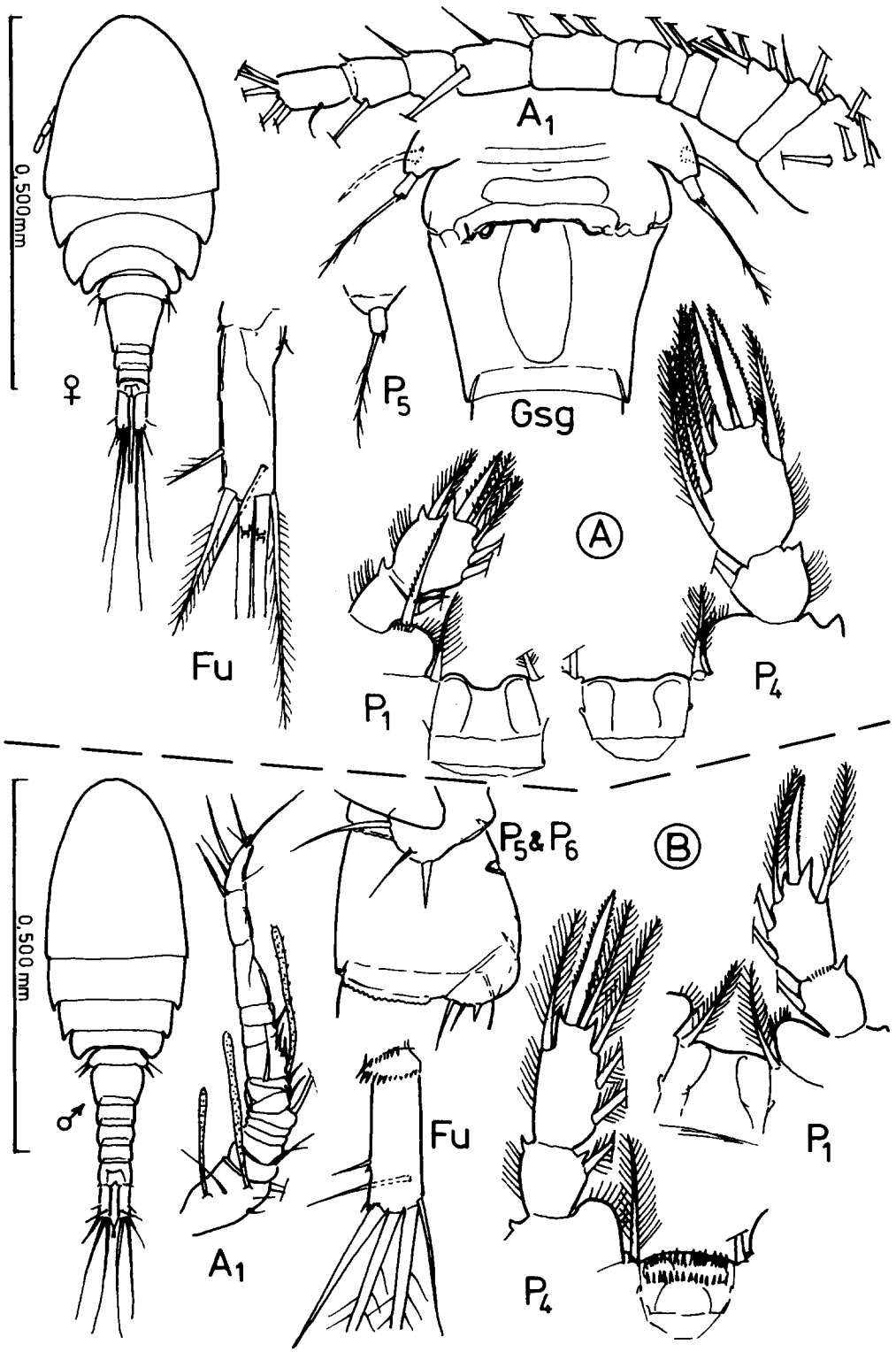

Fig. 22. A. *Metacyclops subaequalis* nov. sp.; B. *Allocyclops neotropicalis* nov. sp. (Mâle)

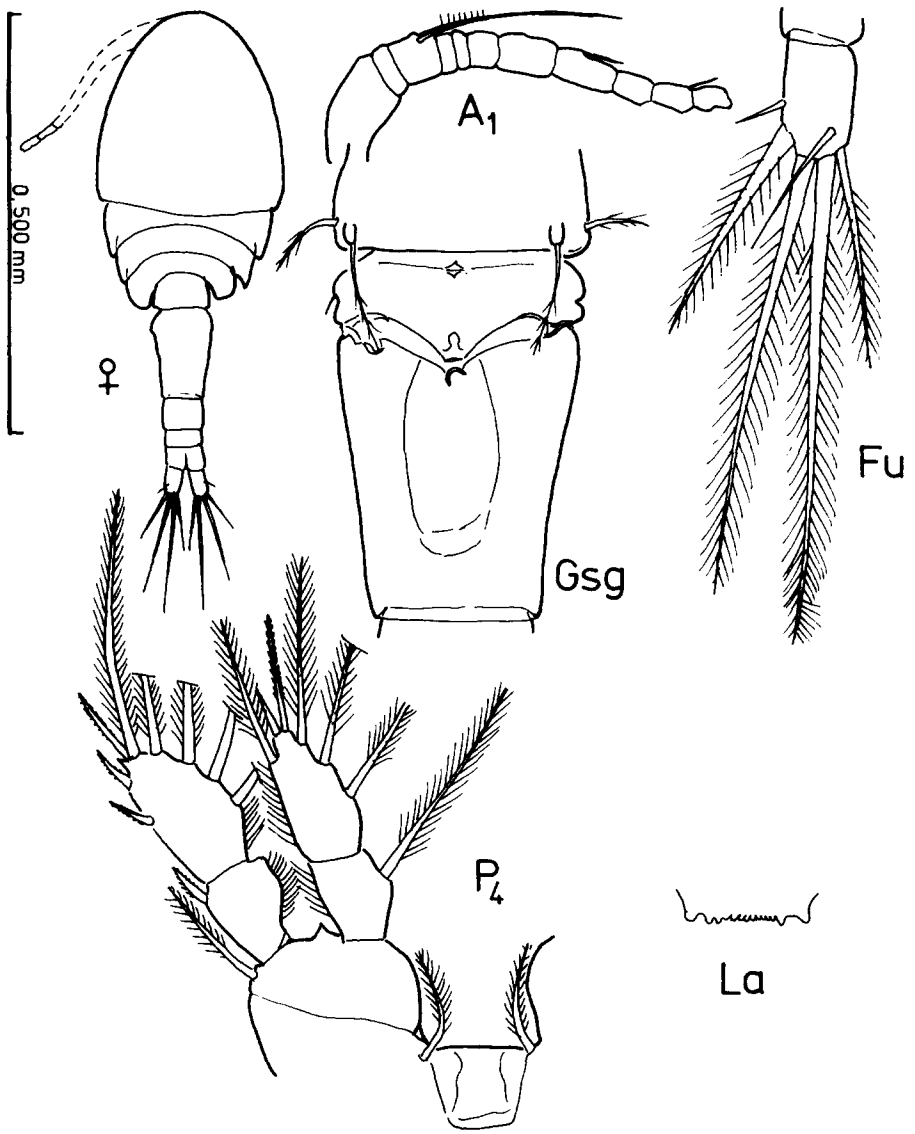

Fig. 23. Neutrocyclops brevifurca (orig.)

mens collected by S. Wright in Brazil and named *N. nordestinus,* I recognized some analogies between females and differences between males: the basopodite of left P5 of *N. deeveyorus* male has a 'ponctuated' hyaline lamella; that of right P5, at the proximal inner corner is a ponctuated knob; the exopodite 2 of right P5 is twice as long as it is wide. At the right antennule, the thirteenth joint has a spiniform process which is particularly strong.

Thus, *N. nordestinus* and *N. deeveyorus* are species which must be distinguished in spite of their resemblance and the succinct description of the first by Wright (1935). Kiefer's illustration (1936) of *N. nordestinus* shows a different species related to *N. deeveyorus* but surely not this, nor *N. nordestinus.*

Notodiaptomus amazonicus (Fig. 5)

This species, difficult to separate from some other *Notodiaptomus* existing in the Orinoco-Amazone region, is easy to characterize by the right P5 of the male: the last joint is strong and the lateral spine (aculeus) is long and almost half the terminal claw which is regularly curved, relatively short and

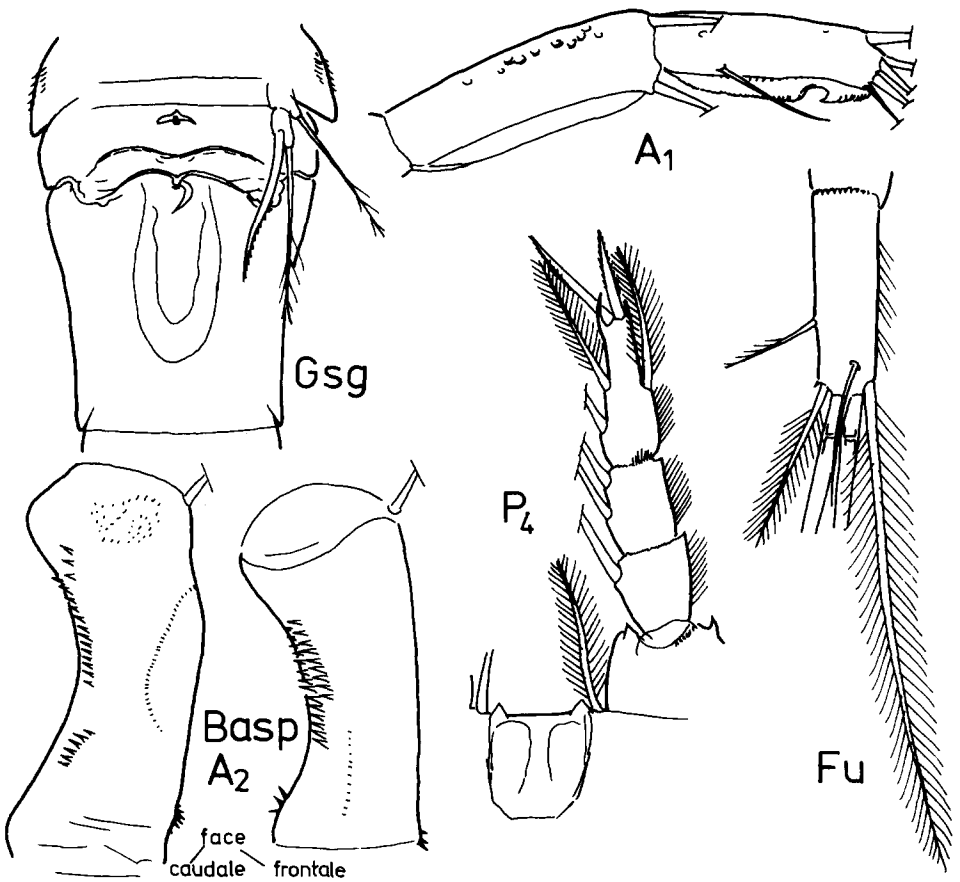

Fig. 24. Mesocyclops aspericornis (orig.)

significantly sclerified.

The length of the male corresponds to that of *N. deeveyorus* but the eight joint of its right A1 has a spiniform process relatively long and strong and that of the sixteenth joint is reduced.

Notodiaptomus cearensis (Fig. 6)

Wright (1936) already noted some variations in *N. cearensis* particularly in the 20th joint of antennule which may have a distal 'spur'.

I also noted some differences in the joints 10 and 11 which have spiniform processes subparalleles or not and in the joint 13 where the corresponding process may be more or less curved towards the antennule. The processes sometimes show with the joint an angle of 30 to 45 °.

N. cearensis also has a lamella on the posterior face of exopodite 2 of the right P5 male, lamella not described by Wright (1936) or Bowman (1973).

Notodiaptomus kieferi (Fig. 7)

This species is characterized as follows.

Male: Abdomen with the four first segments subequal, the second, the longest; Fu dissymetric, smooth. A1 with a spur at the antepenultimate joint not long enough to reach the middle of the next joint; the joint 8 has a well-developed spiniform process and also at the joints 10, 11, 15 and 16; at the joint 13, it is strong and reaches the end of joint 14.

The right P5 has a coxopodite with a well-developed lobe and an exopodite 1 characteristic of the genus. Exopodite 2 presents a lateral internal development which is similar in *N. falcifer*. The lateral spine (aculeus) is long, slender and fixed at the middle of the segment. The terminal claw is very long and slender.

The left P5 has a short bristle near the top, weakly feathered and going beyond the last finger-like

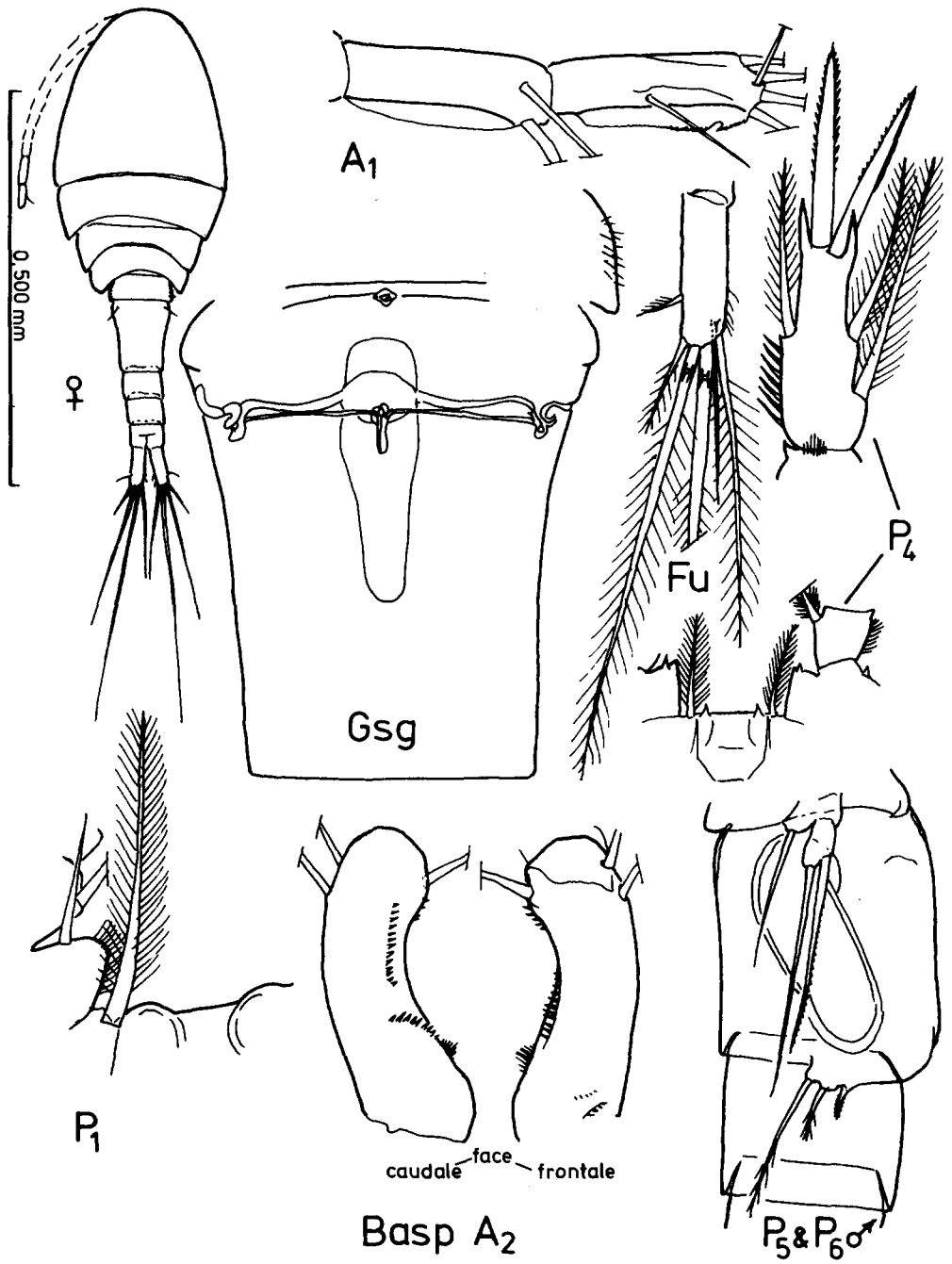

Fig. 25. Mesocyclops ellipticus (orig.)

process.

Length: 0.90 mm (0.83 to 1.03)

Female: 4th and 5th thoracic segments fused. Wings bilobates and slightly dissymetric, each armed by a strong enough spine. Abdomen with 4 distinct segments. Genital segment long and assymetric with the left side proximally expanded in a fingerlike process orientated posteriorly and armed by a spine; the corresponding spine at right side is still more proximal.

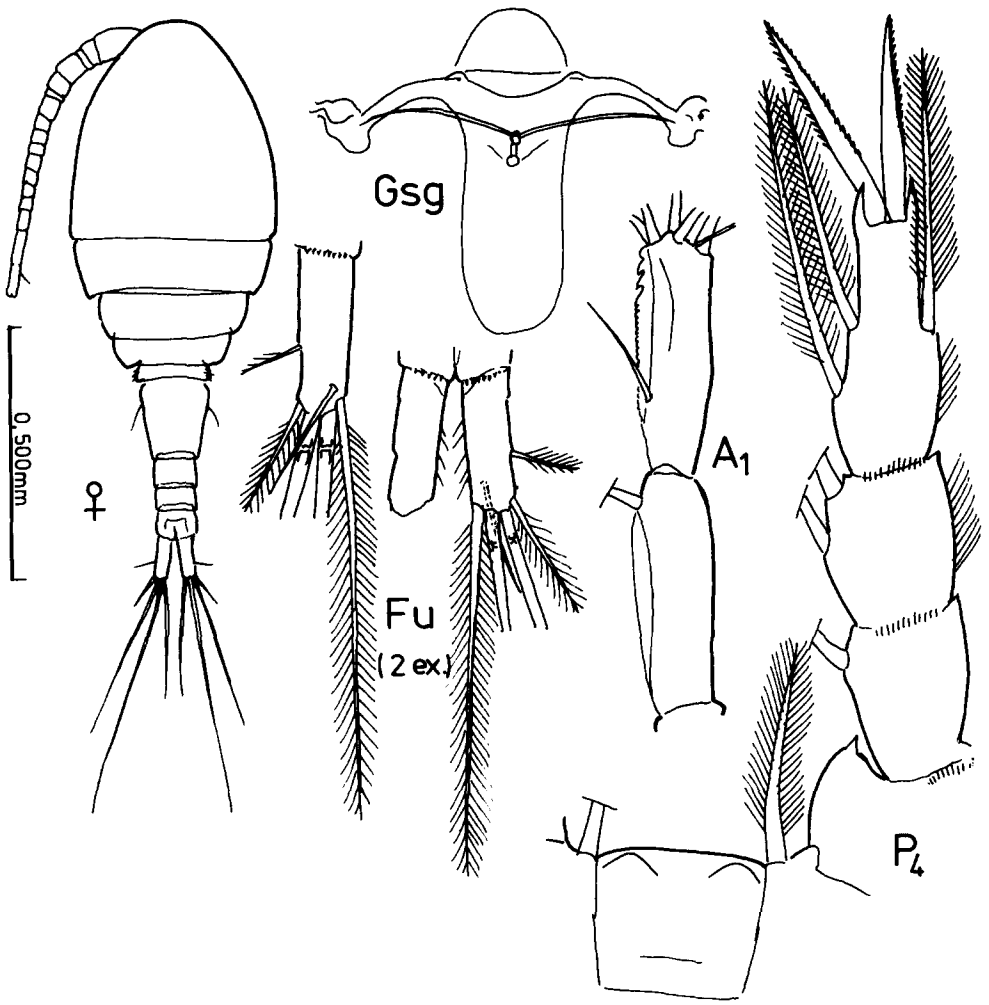

Fig. 26. Mesocyclops meridianus (orig.)

Antennules very long, even exceeding the furcal setae. The coxopodite of P5 has a lobe with a strong spiniform process. The exopodite 3 of this P5 is well distinguishable; its endopodite is unisegmented and has at the tip a long spine, a brush and a subterminal spine less conspicuous.

Length: 1.08 mm (until at least 1.10).

This small species, very characteristic, presents some analogy with *Dactylodiaptomus pearsei* for the female (excepted the size) and with *N. falcifer* for the male.

I found it in the Caroni River – man-made lake of Guri – and it might be found in Guyana Massive. Elsewhere, it was described from Amazonia (Brandorff, 1973) near Manaus.

Notodiaptomus dilatatus nov. sp. (Fig. 8)

Holotype: a male taken in Orinoco River at Ciudad Bolivar (coll. B. Dussart, 25.10.1981, prep. B. Dussart).

Allotype: a female taken at the same station (prep. B. Dussart).

Similar to *N. amazonicus* this species is characterized by several features.

Description. Male: 5th thoracic segment distinct from the fourth and terminating in acutely produced corners pointing posteriorly, with spines, the left one hyaline and stout, the right fine and slender. Moreover, two small spines are placed on dorsal face of these wings.

First abdominal segment with a slender spine

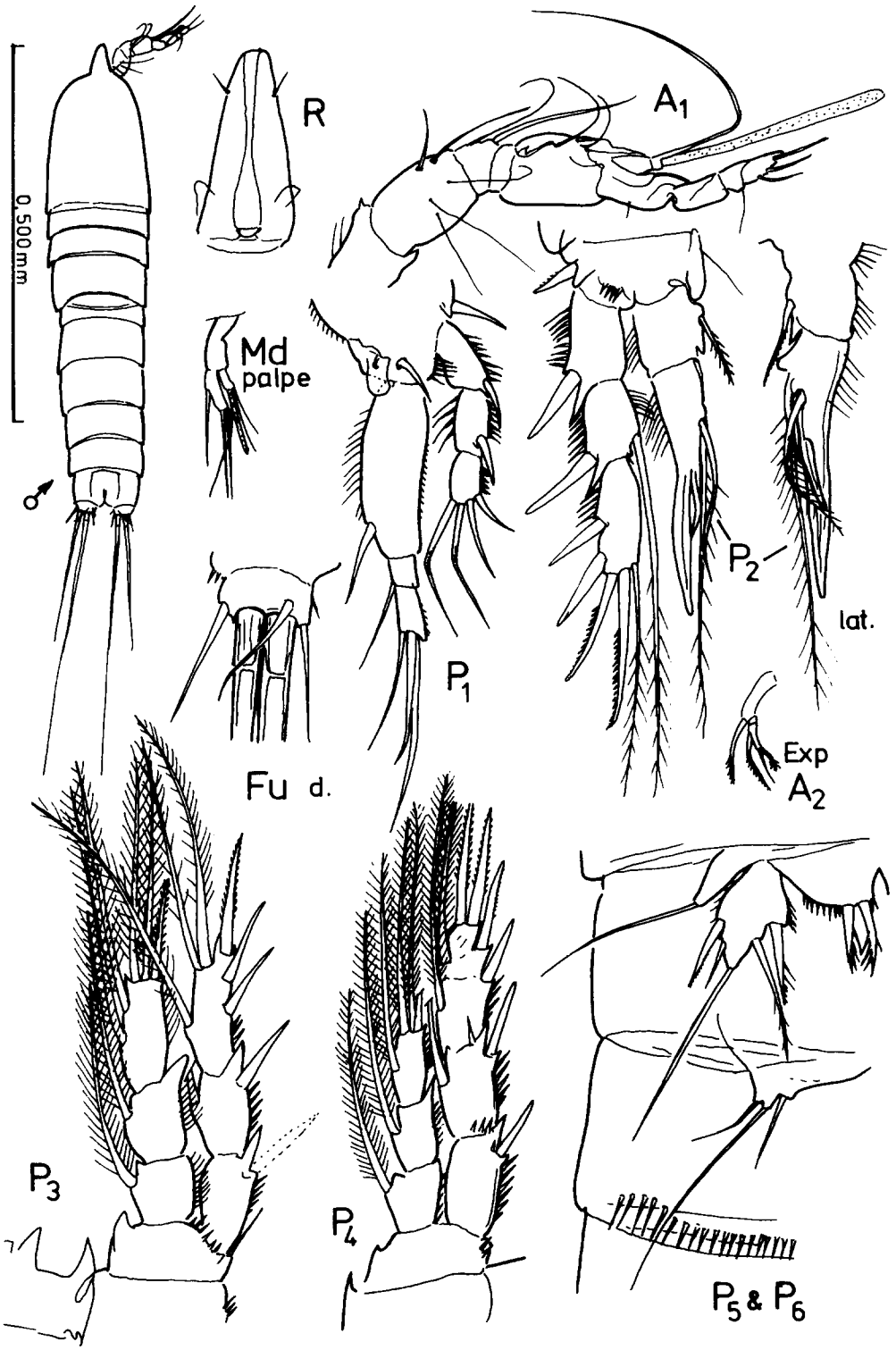

Fig. 27. Paramphiascella aquaedulcis, male, nov. sp.

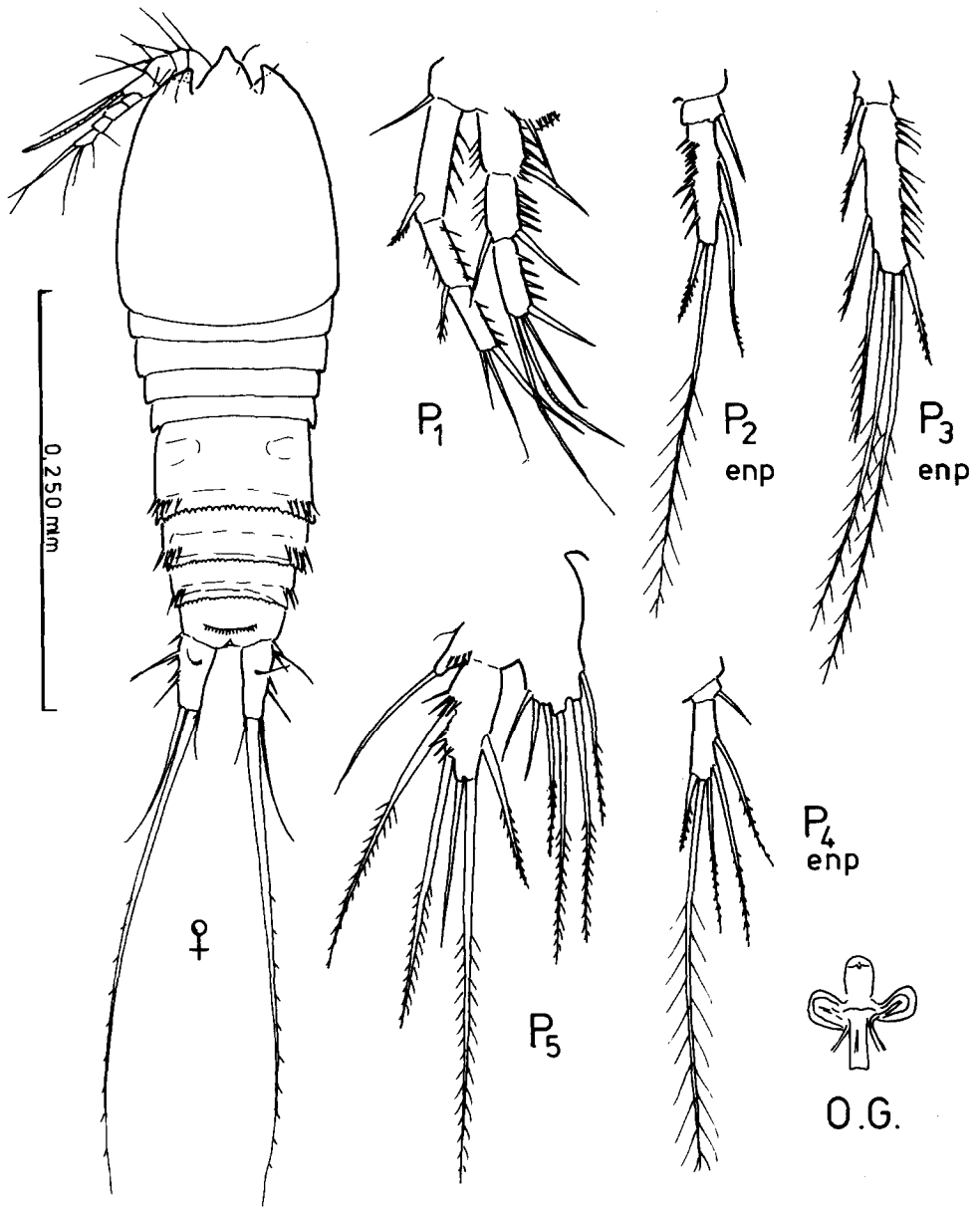

Fig. 28. Attheyella (Chappuisiella) orinocoensis nov. sp.

posteriorly on each side, the right one long and curved. Right antennule with a spiniform process at the 13th joint particularly long and the spine of 8th joint is relatively long. The antepenultimate joint has no hook but a conspicuous hyaline lamella.

The right P5 has a basopodite with a verrucose knob at proximal inner corner; its posterior face is expanded in its first third; its exopodite 1 is similar to that in *N. amazonicus*. Exopodite 2 is expanded interiorly and forms a knob well visible laterally; lateral spine of exopodite 2 relatively long and almost straight; terminal claw strong, short and curved.

The left P5 is special by the proximal inner corner of basopodite slightly expanded and bringing a small button. The spine of coxopodite is conical and attached to a tronconical expansion of the joint.

At the end of the leg, the subterminal internal setae is long, curved and smooth.

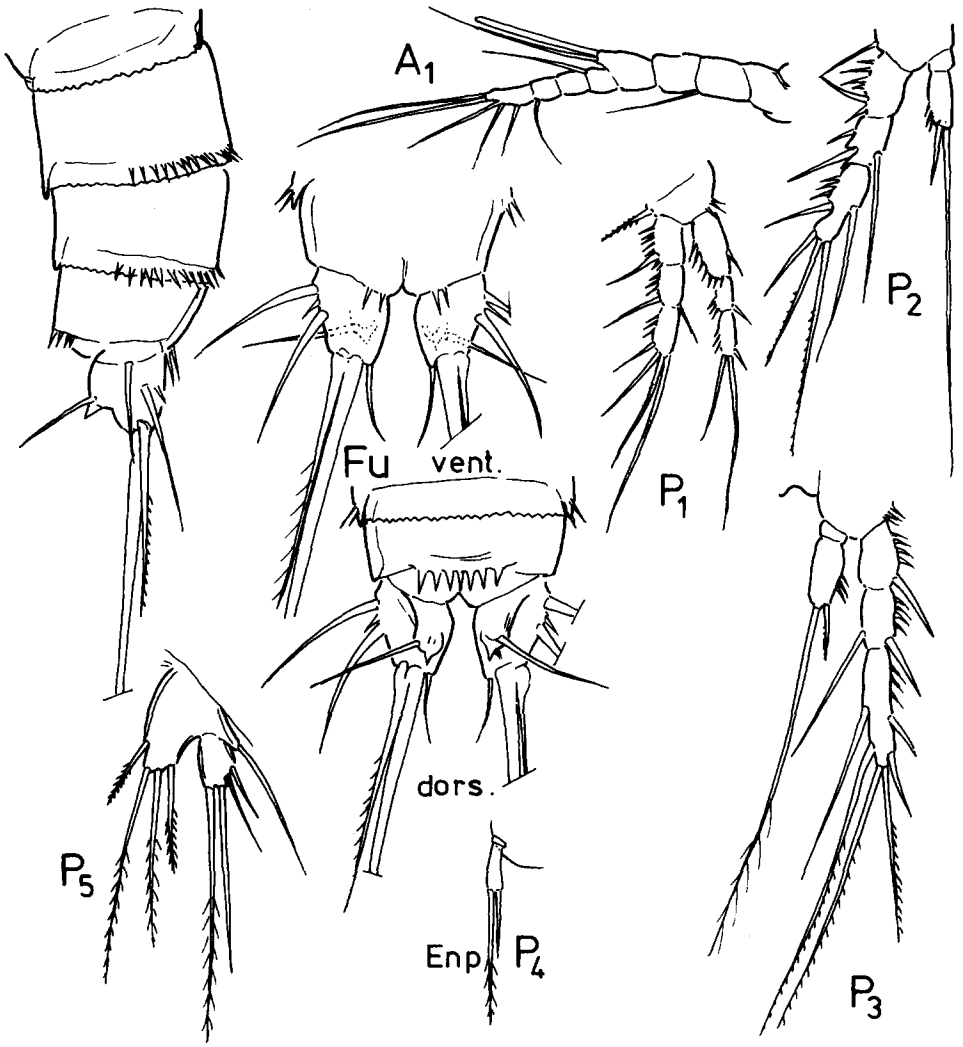

Fig. 29. Elaphoïdella bispina nov. sp.

Length: about 1.5 mm.

Female: Only slightly larger as the male. Wings of Th5 dissymetric, orientated outwards, each terminating with a strong and short spine. Genital segment relatively wide, expanded anteriorly (more at left) and deepened as a saddle dorsally. Posterior corners overlapping the next segment, particularly at right. Second abdominal segment short. Fu ciliated externally and internally. P5 with endopodite relatively elongated, exceeding the 3 quarters of exopodite 1. Spines of exopodites 2 and 3 strong.

Found in Orinoco River, this species might be found along the river in the calm zones.

Notodiaptomus coniferoides (Fig. 9)

Largely distributed in South America, this species was simultaneously described by Wright (1927) and Pesta (1928) who gave it the name *Diaptomus lobifer*. Brehm (1957, 1958) observed it in Argentina. Noone noted the particularity of this species having a spine verrucose at the end of left P5 of male, near the finger-like terminal process. At the right P5, the external angle of exopodite 1 is very sharp and hyaline; the exopodite 3 is conspicuous. The 13th joint of right antennule of male has a spiniform process elongated and curved once or twice; the antepenultimate joint has a hyaline lamel-

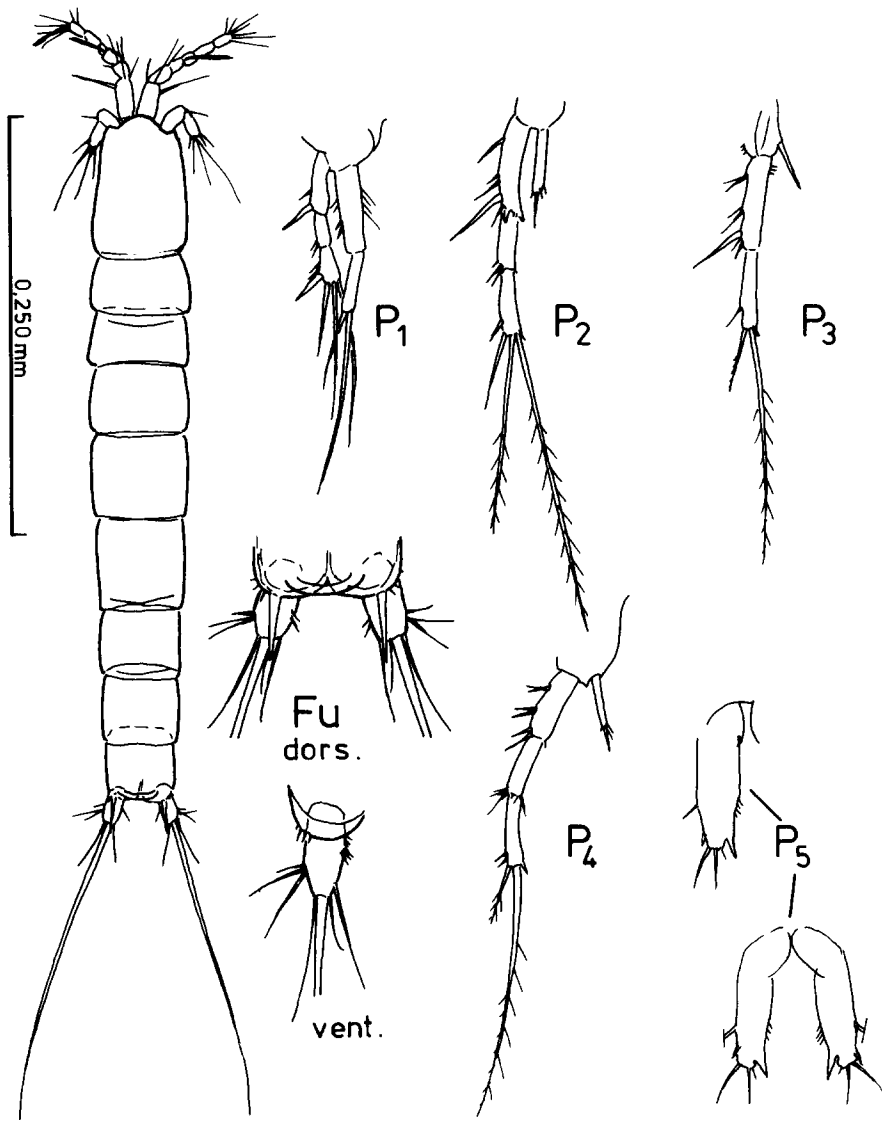

Fig. 30. Forficatocaris forficata crenensis nov. subspec.

la, narrow but conspicuous.

This species was found in the whole Orinoco basin.

Rhacodiaptomus calatus (Fig. 10)

Only females were found. These females had two features: some presented the left expansion of the genital segment as an acute semicircular tongue curved towards the back as in the type described by Brandorff (1973). Others had this tongue fused with this back. P5 were decorated with wrinkles on exopodite 1. This variety was relatively small: up to 0.70 mm only. I suggest calling it *R. calatus coalescens* because of the solder of the semicircular lobe with the genital segment.

'Diaptomus' negrensis (Fig. 11)

Andrade & Brandorff (1975) describe this species found in lateral lakes to Rio Negro near Manaus (Brazil) and compare it to *'Diaptomus' alter* Herbst, 1960. This last species is in fact the *D. proximus* described by Kiefer (1936). Herbst (1960) compares

'D.' alter to *Prionodiaptomus colombiensis* described by Thiébaud (1914) and named *D. marshi* by Juday (1914).

It is difficult to put all these species in only one genus close to *Arctodiaptomus* as Light (1939) tried to do.

Because we do not know this group sufficiently well in South America, I agree with the author's decision to put them in a 'supergenus' *'Diaptomus'* which will be with time revised and divided into several new genera.

I noted in *'D.' negrensis* the lateral right furcal seta which is twice as wide at the base as the others.

Dactylodiaptomus pearsei (Fig. 12)

After the discovery of this species by Wright (1927), it seems that it was difficult to find new specimens, males or females.

In the samples collected in the Orinoco basin, I found males corresponding to those described by Wright. But the females linked, if they had defined affinities with the males present, had no common characteristics with those described by Wright. In these conditions, I do not know what kind of females must be referred to the described males.

I consider the females found here as the good ones. Their description is:

Body torpedo-like. 5th thoracic segment not defined from the preceding one and with lateral corners expanded in sharp wings orientated towards the tail. Only the left wing has a sort of spine at the end. Moreover every internal lobe has a tiny posterior spinule. The genital segment is nearly symmetric, expanded in the middle and armed on each side with a small spine. Second abdominal segment well-developed, as long as wide. Fu ciliated on each side. Furcal setae curved at the end. Antennules short, extending only until the posterior edge of thorax. P5 elongated: endopodite as the two-third of exopoditel, more or less two-segmented, with a shew brush of spinules near the tip. Exopodite 3 with a seta longer as exopodite 2.

Only when it is possible to observe several (monospecific) populations of *'D.' pearsei* will we be sure that these females correspond to the males observed and described by Wright. Recently Brandorff (1982) arrived at the same conclusions.

Macrocyclops albidus (Fig. 13)

This cosmopolitan species exists in Venezuela under two subspecies, the nominal one, *Macrocyclops albidus albidus* and the subspecies *M. albidus principalis.*

I noted in the nominal form a variability in the second seta of endopodite 3 of P4. Sometimes it is a small one, unciliated as in European form and sometimes a 'normally developed seta', although not so long as the first internal lateral seta. I never found the form *oligolasius* so frequent in Africa.

Eucyclops pseudoensifer n. sp. (Fig. 14)

In laguna Mucubaji, some specimens of *Eucyclops* were present with some *Metacyclops leptopus mucubajiensis,* a form described by Kiefer (1956) from the same station.

These *Eucyclops* were almost similar to *E. ensifer* from Chili, described by Kiefer (1936). However, they were different by some characters.

Holotype: a female from Laguna Mucubaji. 5.10.1980. Coll. E. Zoppi de Roa (prep. B. Dussart).

Allotype: a male from the same station.

Female: P4 with endopodite 3 relatively long, more than twice as long as wide; inner apical spine relatively short, only a little longer as the joint. Setae 'normal'. P5 with inner spine 'normal'.

Length: about 0.77 mm.

Male: a little smaller (0.76 mm), the male has a P6 formed with a strong and long spine (55 μm) and two setae of the same length. Fu without longitudinal spines (serra) but with some transversal spines near the marginal external seta.

This species and *E. ensifer* are similar in their precoxal lamella and their coxopodite of P4. I therefore suggest naming this population of laguna Mucubaji *E. pseudoensifer.* This species is to be related to *E. leptacanthus* described by Kiefer (1956) and to *E. bondi* from Haïti (Kiefer, 1934).

I noted moreover an anomaly in exopodite 3 of P1 of *E. pseudoensifer:* in one specimen (Paratype) the internal edge was armed with 3 instead of 5 setae (Fig. 14).

Paracyclops pilosus n. sp. (Fig. 15)

Kiefer (1957) described *P. andinus* with the peculiarity of having an antennule with 8 joints, Fu

2.4 times as long as wide, a P5 with median seta as long as the inner one, a P4 with endopodite 3 about 1.65 as long as wide and armed with 2 spines, the inner twice to 2.5 as long as the outer.

In Orinoco River lives another *Paracyclops,* related to *P. andinus.*

Holotype: a female found in Orinoco River at Barrancas. 24 Oct. 1981 (coll. B. Dussart) (prep. B. Dussart).

Allotype: a male from the same station, same date (prep. B. Dussart).

Female: Fu long, 2.9 times as long as wide. Inner terminal seta as long as the outer. Dorsal seta of the same length, smooth. Thoracic segments 3, 4 and 5 with hairs at the edge. Abdomen with cuticule finely striated and so the Fu ventrally. P1 with precoxal lamella smooth. That of P4 with spinules. Spine formula of swimming legs: 3.4.4.3.

Antennule with 8 joints, the two first partially confluent. Receptaculum seminis symetric, genital opening particular.

Length: ca. 0.595 mm.

Male: of the same size, the geniculate antennules are compact. P6 with inner spine 1.5 times as long as the second abdominal segment. The medial seta is much shorter and the external seta is of the same length of that corresponding of P5.

This species was found in the littoral zone of flowing waters of Orinoco at Barrancas and at Ciudad Bolivar.

Ectocyclops herbsti nov. nom. (Fig. 16)

Herbst (1959) has described an *Ectocyclops* under the name *E. hirsutus* which has some characteristics different from those of the species described by Kiefer (1930) from animals collected in Madagascar (see Dussart, 1982).

The essential characteristics of this species are:

Antennule with 11 joints as in *E. phaleratus.* Fu short, 1.2 to 1.8 times as long as wide only; P5 with setae (and spine) as 100, 65 and 74, the internal very ciliated. P6 constituted by three appendages more or less of the same size.

The armature of furcal rami is very particular and different from *E. hirsutus:* the proximal row of spinules is formed with long ones. The dorsal furcal seta is long, the inner apical seta is longer than the outer ones, this last strong and very ciliated.

This species was first found in a peat bog with *Sphagnum* in East Brazil, at Cananea near São Paulo and was thus considered a synonym to *E. hirsutus,* but I also found it in a swamp near Calabozo supplied by a 'black water' stream and in a 'Morichal' environment and I consider *E. hirsutus* as a different species.

I suggest naming it *Ectocyclops herbsti* nov. nom. in remembrance of the first describer. It is related to *E. bromelicola* found in Brazil by F. Kiefer (1935).

Microcyclops anceps var. *minor* (Fig. 17)

The different descriptions of *M. anceps* in South America show that furcal setae and also endopodite P4 are very variable in size.

Near Unaré, I found individuals with terminal inner seta long, about 2.5 times the outer, relatively stout. Endopodite 2 P4 is a little more twice as long as wide and has two terminal spines, the inner twice the outer and 0.75 times the joint.

The length of observed animals was about 0.73 mm only. It is why I propose to name this population (at least) variety *minor,* to differenciate it from the 'normal' ones which measure 0.8 to 0.9 mm in general.

Moreover, the seta of Th5 has no spinules near its base on the segment.

Microcyclops diversus (Fig. 18)

Very near to *M. varicans,* this species is differentiated particularly by a group of microcharacters. In Venezuela, the animals were small relatively (0.88 mm) in comparison with those studied by Kiefer (1935) from Uruguay. Moreover, their furcal rami were longer (4.5 times as long as wide) but for the other characteristics, the animals were similar to the type (particularly the receptaculum seminis and the P4).

Microcyclops finitimus nov. sp. (Fig. 19A)

In *Microcyclops* in general, the basopodite of P1 has a spine at inner corner. However, Lindberg (1957) recalls that *M. anceps* and *M. crassipes* are exceptions to this rule.

In a pool near Camaguan, I found a female closely resembling *M. anceps* but with a P5, the lateral

spine of which is fixed at the beginning of the second half of the joint and not at its tip. So, this P5 is quite close to that of *M. diversus*. The furcal rami are longer as those of *M. anceps*, the inner dorsal setae also longer (compared with the outer).

A1 with 12 joints and endopodite of P4 a little more elongated as in *M. anceps*.

Because of the relationship of this species with *M. anceps* I suggest calling it *M. finitimus*.

Holotype: one female from a pool in the shade of trees near Camaguan along the road. 16.10.1981 (coll. B. Dussart) (prep. B. Dussart).

The main measurements of the individuals studied are:

Length (without furcal setae): 0.89 mm
Ratio L:l Fu = 4.10
T_i:T_e = 1.7
Ratio L:l Enp2P4 = 2.6
Inner spine of Enp2P4:L Enp2P4 = 0.75

Microcyclops cf. *varicans* (Fig. 19B)

In an 'Estero' near the Buena Vista Cross, I found a curious individual of *M. varicans*, a male, except for the antennule which was constituted as in a female. The P6 was similar to that of *M. diversus* and the endopodite of P4 was like in *M. longiramus*.

Because I was observing only one individual of this curious species, I named it cf. *varicans* waiting for more samples to indicate what it is.

Metacyclops tredecimus (Fig. 20A)

The description of Lowndes (1934) is sufficient. However, I noted in the populations of Venezuela that the antennules are shorter and do not reach the Th2. Moreover, the precoxal lamella are armed differently in P1 and P4.

Male was unknown. I give some drawings, particularly of P6. Lindberg (1961) considers *M. tredecimus* as a good species. I agree. It was discovered in Paraguay and I found it in a trough of a farm near Calabozo (in the Llanos).

Metacyclops leptopus mucubajiensis (Fig. 20B)

Found for the first time by Kiefer (1956) in the same station, the individuals observed were quite similar to those of the type. Kiefer *(loc. cit.)* put it close to *M. leptopus venezolanus*, which seems to me a *M. mendocinus*. The findings of Lindberg (1961), the suggestions of Löffler (1963) and my observations (Dussart, 1979) show the necessity to describe again what could be called two good species: *M. mendocinus* and *M. leptopus*. In any case, the fact that the first of these species was found in a pelagic zone disproves the assertion of Löffler (1963).

Metacyclops curtispinosus nov. sp. (Fig. 21)

This small species could be named *M. subdolus*, particularly as it is characterized by furcal setae (Lindberg, 1961).

Holotype: one female found in the rio Guarguapo near Barrancas; 24.10.81. (coll. B. Dussart) (prep. D. Dussart).

Female: Antennules short, with 11 joints; they do not attain the posterior border of cephalothorax. Swimming legs tri-segmented; spine formula of exopodites: 3.4.4.3.

P1 with a long spine slender at the inner edge of the basopodite. P4 with endopodite 2 less than twice as long as wide. Terminal seta short (0.8 times the length of the joint).

Furcal rami with a lateral outer seta at 1/3 of the border. The dorsal seta is almost as long as the outer and this last, shorter as the inner.

The P5 has the particularity of having only one joint with a terminal seta relatively long and a spinule at the outer angle.

Length: 0.6 mm.

The environment of this species is special enough to suggest that it would be interesting to collect more fauna in the water, aquatic plants, sand banks, etc. which constitute this 'milieu' protected by Morichal.

Metacyclops subaequalis nov. sp. (Fig. 22A)

In Orinoco River, lives one of the 13 species of *Metacyclops* known in South America (cf. addendum).

It is small and its swimming legs have spines in spatula.

Holotype: a female observed at Ciudad Bolivar in Orinoco river, 25.10.81 (coll. B. Dussart) (prep. B. Dussart).

Length: 0.56 mm.

Body suboval, like an *Eucyclops cf. serrulatus,* but smaller. Th5 with the spine fixed subdorsally (representing the first joint of P5). Abdomen with posterior edge of segments smooth. Fu 3 times as long as wide, with an outer lateral spine fixed at the end of the three quarters of the segment. The apical medial setae are long and feathered but heteronomous. The inner seta is 1.5 times the outer. The dorsal seta is a bit shorter than the outer and is not as long as the furcal rami.

Antennule with 11 joints. P1 with a long spine inserted at the inner corner of basopodite; apical spine of endopodite stout and almost straight. P4 with endopodite 2 short, armed with two terminal spines almost equal (whence the name of the species); precoxal lamella with symetric knobs smooth and small.

Male: unknown.

This species is related to *M. brauni* Herbst (1962) but P4 is different as are the length and the number of joints of antennules.

Allocyclops neotropicalis nov. sp. (Fig. 22B)

Until now, the genus *Allocyclops* was only known in Africa and Europe. If they are subterranean species in Europe, in Africa they live in temporary waters more or less phreatic.

It was surprising to find an *Allocyclops* in Orinoco River in the littoral vegetation.

Holotype: one male from Orinoco river, 25.10.-1981 at Ciudad Bolivar (coll. B. Dussart) (prep. B. Dussart).

Description: Anterior part of the body ovoïdal; Th4 wrapping, with round corners. First abdominal segment well-developed, a little more wide than long. All abdominal segments with a posterior border serrate. Anal operculum simply convex. Furcal rami with spinules at the base all around; lateral seta inserted at the end of the second third of the segment. Apical outer seta stout at the base, with spinules inserted at the junction with the furcal rami. Apical inner seta as long as the furcal rami and slightly shorter than the outer. Dorsal seta relatively short.

Antennule geniculate with three important aesthetascs, two at the first joint and one at the ninth. P1 with rami two-jointed and with endopodite armed with an outer seta, a stout apical spine, slightly curved and three setae; coxal setae well developed. P4 with precoxal lamella cambered and decorated with two rows of spinules; endopodite 2 1.7 times longer than wide, with three inner setae, one subapical seta, a spine aside of almost the same length and an outer seta. P5 formed by a spine, a seta and the normal lateral and long seta which is a vestige of the first joint. P6 constituted by a short stout spine and two setae.

Length: 0.59 mm.

Because of the lack of possibility to describe the female, I consider as provisional the taxonomic place of this male and therefore suggest naming it *neotropicalis,* to remember the neotropical region where it was found.

Neutrocyclops brevifurca (Fig. 23)

This curious species, well described by Lowndes (1934) and Kiefer (1956) presents apical furcal setae feathered helicoïdally at the end. It is recognizable by several characters, particularly the relative length of the furcal setae and furcal rami. The antennule has 11 joints, not 10.

Biogeographically, it is a South American species common in Venezuela and present at least from Brazil to Colombia.

Mesocyclops aspericornis (Fig. 24)

This species was recently redescribed by Kiefer (1981). It was known in Asia and from the Pacific isles (Mariannes, Marshall, Hawaï, Tahiti) and its presence in Africa is controverted. Its presence in South America increases its extension in the intertropical regions of biosphere. The same may be true of *M. thermocyclopoïdes* which is actually chiefly known from East and Far East.

Mesocyclops ellipticus (Fig. 25)

This species is easy to recognize by its receptaculum seminis, which is similar to that of *M. tenuisaccus* or *M. annulatus.*

Found in Brazil (Bom Conselho) for the first time, it was observed in Venezuela by Kiefer (1956). Herbst (1962) found it in Amazonia.

However, comparison of the various descriptions shows significant differences and this could be explained by the existence of two or several species

called *M. ellipticus*. Only a study of an adequate number of samples would permit a conclusive identification. The individuals observed in Rio Portuguesa and in Orinoco were already different from those collected in the Estero de Buena Vista. Unfortunately, I did not obtain a sufficient number of individuals from this last station to describe this 'species' sufficiently.

Mesocyclops meridianus (Fig. 26)

After a very short description of *M. meridianus* from Paraguay (Kiefer, 1926), Kiefer (1933) described a *M. brasilianus* from the Amazon region near Manaus.

By comparing drawings, it seems that *M. meridianus* from Paraguay is very similar to *M. ellipticus* found in Pernambouc (east Brazil). Likewise, very few differences distinguish *M. meridianus* and the Brazilian *M. brasilianus*. One of these species is frequent in Venezuela and there, some '*M. meridianus*' have a receptaculum seminis very close to that of *M. brasilianus*. Moreover, the furcal rami may have some internal hairs. Kiefer (in litt.) does not possess more types of these 'species' but he thinks that their variability is sufficient to explain the confusion between these last two species. Harding (1955) and Löffler (1963) also consider *M. brasilianus* and *M. meridianus* as synonyms. I agree. In both species, size, position of egg-sacs, and number of eggs per sac (20–25) are similar.

The P6 of the male has a particularly long medial seta, half the external one. The inner spine is always stout and short. The Kiefer's (1956) illustrations are an extreme case. Further studies will determine the precise number and characteristics of species present in South America under the collective name: *M. meridianus*.

Paramphiascella aquaedulcis nov. sp. (Fig. 27)

Quite new was the finding between Camaguan and San Fernando de Apure, in freshwaters, of a representative of the family Diosaccidae, genus *Paramphiascella*.

The station is characterized by the presence of rio Portuguesa seasonally flooding the plain along the road where only a male was collected.

Holotype: a male collected in Rio Portuguesa (Caño Falcon) near Camaguan, 16.10.1981 (coll. B. Dussart) (prep. B. Dussart).

Body almost cylindrical. Rostrum projecting. Last abdominal segment rather elongated. Furcal rami very short. Two furcal setae well-developed; inner and outer setae subequal. Antennule geniculate with a long aesthetasc exceeding the last joint. Antenna with last joint armed with three appendages. Mandibule with a palpe well-developed. P1 with endopodite 1 longer than the exopodite and with a subrectangular expansion. P2 with the last joint of endopodite modified and armed with two unequal spiniform processes. P3 and P4 with exopodite and endopodite three-jointed. Setae-spinal formula (without the outer marginal spines of exopodites):

	Exopodite	*Endopodite*
P1	0 · 0 · 1 2 1	1 · 1 · 1 2 0
P2	0 · 1 · 0 2 3	1 transf.
P3	0 · 1 · 1 2 3	1 · 1 · 2 2 1
P4	0 · 1 · 2 2 2	1 · 1 · 1 2 1

Exopodite P5 armed with 5 setae, two of which are spiniform; basoendopodite with 2 spines (more or less feathered) and several outer spinules. P6 constituted by 3 setaes more or less spiniform, the middle one the longest.

Length: 0.63 mm

Female: unknown.

Since this species was found only one time, in one place and only in one individual, it is not yet possible to compare it with other populations coming from similar environments. I suggest provisionally naming it *Paramphiascella aquae dulcis* nov. sp. considering that it is very close to *P. xiphophora* Lang, 1965.

Canthocamptus cf. *microstaphylinus*

Between the water plants growing in Caño Falcon, I obtained another Harpacticoida easy to recognize by its form and the armature of its last abdominal segment and also by the P4 and P5. The nearest known species is *Canthocamptus microstaphylinus*.

However, the individual was damaged; the difficulty in observing all details and the fact that it is the first time that such a species is found in South America leaves doubt about its determination. New samplings are needed to confirm this observation.

Attheyella (Chappuisiella) orinocoensis nov. sp. (Fig. 28)

Holotype: a female from Barrancas in a caño near Orinoco river, 24.10.1981 (coll. B. Dussart) (prep. B. Dussart)

This species is related to *A. (Ch.) fuhrmanni* and *A. (Ch.) camposi.* But it has a sharp rostrum, the furcal rami are elongated, hairless at the inner edge, the genital aperture has a different armature and the endopodite of P2 has only one terminal seta (instead of two).

The female is small (about 0.41 mm). The last abdominal segment has only three lateral spines at posterior edge. The other abdominal segments have this edge denticulated and are armed with, the genital segment 5 long spines laterally, the two other some ventral and lateral spines, these last the shortest.

The formula of setae and spines of the four first swimming legs is:

	Exopodite	*Endopodite*
P1	0 · 1 · 121	1 · 1 · 120
P2	0 · 1 · 123	1 · 211
P3	0 · 1 · 223	1 · 321
P4	0 · 1 · 233	1 · 221

P1 and P5 are similar to the corresponding legs in *A. fuhrmanni.*

Male: unknown.

Elaphoïdella bispina nov. sp. (Fig. 29)

In a water trickle between stones and gravels on a path near a farm at Calabozo, I collected in a few minutes three species of Copepods: an *Ectocyclops* too young to be denominated with certainty, a Parastenocarid (see further) and an *Elaphoïdella* related to *E. surinamensis* (Delachaux, 1924).

Holotype: a female from this station in Venezuela, 16.10.1981 (B. Dussart coll. and prep.);

Description: Posterior to the genital segment, the two other abdominal segments have ventral spinules and a dorsal serrate edge. The anal operculum is armed with 7 stout spines. The furcal rami are subconical and present a ridge terminated by a strong hook. P1 biramous with exopodite and endopodite 3-segmented. Endopodite P2 to P4 2 segmented and with 2 very unequal setae. P5 with 4 setae at basoendopodite and at exopodite. Length of this female: 0.42 mm.

I do not know of any other *Elaphoïdella* with similar characteristics, especially such simple endopodites.

Male: unknown, but it could be easy to collect it by regularly sampling this 'spring'.

Forficatocaris forficata crenensis nov. subsp. (Fig. 30)

In samples collected in the littoral region of Amazon river near Santarem, Noodt (1963) described a *Parastenocaris* (sensu lato) which belonged to a new group. Jakobi (1969) designated this group as *Forficatocaris* nov. gen.

In the spring described above, I found a female of such a species but with some small differences.

These differences are:

Size relatively larger: 0.43 mm (instead of 0.35 mm for the type). Anal segment with apical spines slender, straight. No other ornementation at this segment; anal operculum smooth. Antennules with 6 joints. P5 slightly different from the denominate type, especially by some hairs on the inner side.

I did not find any male and as I find these above differences significant, I suggest designating it as a new subspecies *crenensis* of *F. forficata.*

Considering the distance between these two findings (Santarem and Calabozo), it is probable that new samplings in the phreatic environment of Orinoco and the Amazona river will be rich in other surprises.

Summary

Venezuela, with 912 050 km², has a special biogeographical interest:

- In the South, it is part of Amazon basin thanks to the Casiquiare which connects the Orinoco and Rio Negro.
- In the East and already from the Caroni River, it is a part of the Guyan Massif, old and long isolated from the rest of South America.
- In the West, it is related to the Andes and part of Central America and all mountains of the Cordillera in the South.
- In the North, it is the route of colonization of the Caribbean isles and the contact point between marine, brackish and freshwater environment.

Finally, the center of the country has a uniqueness of its own, with the Orinoco Basin and where marine species may have the opportunity to live in freshwater and to be adapted to this new environment.

So, it is 'normal' to find in Venezuela a diversified although insufficiently known fauna. 368 species are actually described in freshwaters in South America (cf. addendum) and 66 (18%) in Venezuela; 19 other species may be present. On these 66 species, 47 were found during this survey. It would be desirable to study the upper region of Orinoco, and Atabapo, Ventuari and Caura rivers.

Some synonymies were detected:

'Notodiaptomus venezolanus' is a synonym of *N. henseni* described by Dahl (1894). *'D.' alter* Herbst (1960) is in fact *'D.' proximus* Kiefer, 1936.

I also described what I consider to be the true female of *Dactylodiaptomus pearsei.* It is always difficult to decide whether males and females are of the same species in plurispecific communities.

Moreover, it is rare to find so many species of Copepods in the same sample (here up to 16!).

Finally, South American Copepoda are often known only partially and the drawings of some authors are sketchy. If you except those of Mrázek (1901) and Sars (1901), only the male or female is described. Sometimes, however, the drawings are sufficiently precise to clarify the taxonomical position of a species. For instance, *Ectocyclops* described by Herbst (1960) is not *E. hirsutus* but a new species I found again.

Biogeographically, the study of samples collected in 1981 is very interesting because it extends the distribution of some Brazilian species: *N. coronatus, R. calatus, D. pearsei* for example or *M. tredecimus* known only in Paraguay and so on. Moreover, the genus *Allocyclops* is new for South America whereas *Pseudodiaptomus* and *Paramphiascella* are new for Venezuela.

Ecologically too, this collection is informative. For the first time, a member of the Pseudodiaptomidae has been collected in Venezuela. Several marine or brackish water species were found in freshwater: two species of *Oithona* are living in Orinoco waters as far as Ciudad Bolivar. A harpacticoid of the marine genus *Paramphiascella* is also living in freshwater.

Thus, this region, rich in primitive forms, can be considered as a center of expansion of many freshwater species which could start the conquest of salt waters.

The complex Amazona-Orinoco shows faunistic homogeneity. Only a more in-depth knowledge of the fauna of Guyana would enable a better understanding of the South American fauna distribution and allow conclusions on their ecological requirements and their role in the ecosystems.

Resumen

El estudio de 38 muestras de fauna acuatica recogidas y/o examinadas por el autor en Venezuela permitió reencontrar casi todas las especies determinadas por Kiefer (1956), Chappuis (1956), Infante *et al* (1979), Montiel y Zoppi (1979).

Las especies identificadas pasan de 28 a 66, cuyas 15 son nuevas para la ciencia y descritas.

Si se compara con las listas de Copepodos conocidos en las regiones vicinas de America del Sur, es posible concluir que Venezuela aun tiene otras tantas especies que descubrir, particularmente Calanoidos y Harpacticoidos. La descripción y ilustración de varias especies son completadas.

Acknowledgements

I thank Pedro Roa, Director of the Tropical Zoology Institute of the Central University of Caracas for his help and use of the facilities, and Dr Evelyn Zoppi de Roa who helped me in the field and in the laboratory.

Addendum

Copepods actually known in inland waters of South America and their relative (x) or probable (?) distribution

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
Order CALANOIDA	
Acartiidae	
Acartia tonsa	x x
Centropagidae	
Parabroteas sarsi	x
Boeckella longicornis	x

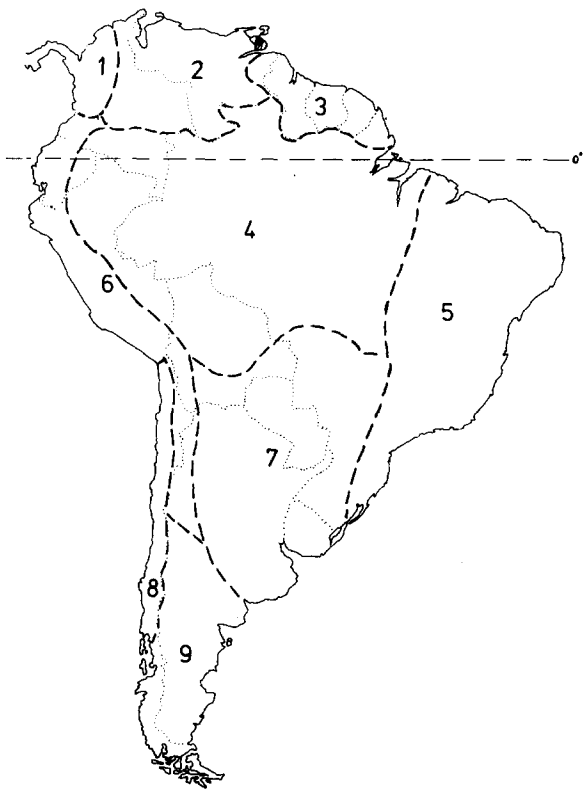

Fig. 31. Biogeographic zones in South America. Regions: 1 – magdalenian; 2 – orinoco-venezuelian; 3 – Guyanas; 4 – amazonian; 5 – east brazilian; 6 – andine; 7 – paranean; 8 – chilian; 9 – patagonian.

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
B. bergi	x
B. b. conesae	x
B. b. cornuta	x
B. b. serrifera	x
B. gracilipes	x x
B. michaelseni	x
B. gracilis	x x
B. occidentalis	x
B. pooponensis	x x
B. meteoris	x
B. m. dentifera	x
B. schwabei	x
B. birabeni (= rahmi?)	x
B. titicacae	x
B. bilobata	x
B. kinzeli	x
Pseudoboeckella braziliensis	x
P. brevicaudata	x

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
P. poppei	x
P. dubia	x
P. entzei	x
P. longicauda	x
P. silvestrii	x
P. vallentini	x
P. erubescens	x
P. gibbosa	x
P. thomseni	x
P. calcaris	x
P. palustris	x
P. peruviensis	x
Pseudodiaptomidae	
Pseudodiaptomus acutus	x x
P. a. leptopus	x
P. richardi	x x x
P. r. inaequalis	x
P. gracilis	x x x
P. marshi	x
P. wrighti	x
Diaptomidae	
Prionodiaptomus colombiensis	x x
Argyrodiaptomus granulosus	x
A. bergi	x x ?
A. furcatus	x x
A. f. macrochaetus	x
A. aculeatus (= furcatus?)	x x
A. (spiniger) incerta sedis (cf. *Notod.*)	x
A. denticulatus	x x
A. azevedoi	? x x
A. argentinus	x
A. neglectus	x
Calodiaptomus merrillae	? x x
C. perelegans	? x
Notodiaptomus gibber	x x
N. deitersi	x x
N. henseni (= venezolanus)	x x x
N. conifer	x ? x x
N. coronatus	x x x
N. anisitsi (= inflexus?)	x x
N. incompositus	x x x
N. lobifer	x
N. coniferoides	x x x
N. santaremensis	? x
N. transitans	x
N. inflatus	? x
N. carteri	x
N. amazonicus	x x x x x
N. a. occidentalis	x
N. iheringi	x
N. nordestinus	x x
N. cearensis	x x

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
N. (corderoi) (?)	x
N. isabelae	x
N. dahli	? x x
N. jatobensis	x x
N. maracaibensis	x
N. deeveyorus	x ? ?
N. (anceps) (?)	x
N. (bidigitatus) (?)	x
N. kieferi	x x
N. orellanai	x
N. dilatatus	x
Rhacodiaptomus calamensis	? x
R. flexipes	? x
R. insolitus	x x
R. retroflexus	? x
R. calatus	x x
R. c. coalescens	x
Tumeodiaptomus vivianae	x
T. diabolicus	x
Dactylodiaptomus pearsei	x x
Odontodiaptomus thomseni	x
O. michaelseni	? x
O. paulistanus	? x
Idiodiaptomus gracilipes	x
Aspinus acicularis	? x
'Diaptomus' proximus	x
D. carinifera	x
D. echinatus	x
D. falcifer	x
D. inexpectatus	x
D. linus	? x
D. meridionalis	x
D. mildredae	x
D. negrensis	x x
D. ohlei	x
D. santafesinus	x
D. silvaticus	? x
D. s. infrequens	x
Order CYCLOPOIDA	
Oithonidae	
Oithona plumifera	x x x
O. p. atlantica	? x x
O. similis	? x
O. vivida	?
O. brevicornis	? ?
O. hebes	x
O. amazonica	x
O. a. continentalis	x
O. ovalis	x
O. gessneri	x

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
O. attenuata	x ?
O. simplex	x
O. sp.	x
O. neotropica	x
Dioithona minuta	x x x
Cyclopinidae	
Cyclopinopsis brasiliensis	x
Procyclopina polyarthra	x
Cyclopidae	
(Halicyclopinae)	
Halicyclops crassicornis	x
H. venezuelaensis	x
Neocyclops medius	x
(Eucyclopinae)	
Macrocyclops albidus	x x x x
M. a. principalis	x x
?M. fuscus	x
M. ater	x
Eucyclops serrulatus	x x x x x x x x
E. s. chilensis	x
E. delachauxi	x
E. silvestrii	x x
E. neumani	x x x x x
E. n. titicacae	x
E. prionophorus	x
E. ensifer	x x x x
E. neotropicus	x
E. leptacanthus	x
E. alticola	x
E. de = macedoi	x
E. solitarius	x
E. breviramatus	x
E. siolii	x
E. pseudoensifer	x
Paracyclops fimbriatus	x x x x x
P. f. chiltoni	x x
P. finitimus	x x x
P. poppei?	x
P. andinus	x x x
P. pilosus	x
Ectocyclops rubescens	x x
E. compactus	x
E. phaleratus	? ? ? ? ?
E. bromelicola	x x
E. strenskei	x x
E. herbsti	x x
E. hirsutus	x
Tropocyclops prasinus	x x x
T. p. peruviana	x
T. p. meridionalis	x x x

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
T. schubarti	x
T. s. dispar	x
(Cyclopinae)	
Megacyclops viridis	x x x
Acanthocyclops robustus	x x
A. vernalis	?
A. v. michaelseni	x x x
A. v. skottsbergi	x x
Diacyclops uruguayensis	x
Microcyclops varicans	x x x x x
M. v. subaequalis	x x
M. anceps	x x x x x x x
M. a. minor	x
M. a. pauxensis	x
M. furcatus	x
M. dubitabilis	x
M. diversus	x x
M. alius	x x
M. paludicola	x
M. finitimus	x
M. elongatus	x
Metacyclops gracilis	x
M. mendocinus	x x x x
M. m. venezolanus	x
M. leptopus	x
M. l. mucubajiensis	x
M. laticornis	x
M. tredecimus	x x
M. grandis	x
M. hartmanni	?
M. brauni	x
M. curtispinosus	x
M. subaequalis	x
M. distans	x
Neutrocyclops brevifurca	x x
Allocyclops neotropicalis	x
Mesocyclops cf. *leuckarti*	? ?
M. edax	? x
M. annulatus	x x x x x
M. a. diversus	x
M. aspericornis	x
M. longisetus	x x x x x
M. l. araucanus	x
M. meridianus (= brasilianus)	x x x
M. minutus	x x
M. ellipticus	x x
M. nicaraguensis	x
Apocyclops procerus	x x
Thermocyclops tenuis	x x
T. brehmi	x
T. decipiens	x
T. minutus	x x x
T. inversus	x

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
Muscocyclops operculatus	x x
Menzeliella staheli	x
Order HARPACTICOIDA	
Phyllognathopodidae	
Allophyllognathopus brasiliensis	x
Phyllognathopus viguieri	x x
Tachidiidae	
Euterpina acutifrons	x x
Harpacticidae	
Harpacticus dubitabilis	x
Tigriopus angulatus	x
Thalestridae	
Parathalestris ganio	x
Diosaccidae	
Paramphiascella aquae dulcis	x
Schizopera vicina	x
Ameiridae	
Stygonitocrella montana	x
Canthocamptidae	
Canthocamptus staphylinus	x
C. microstaphylinus	x
Attheyella (? Atth.) brasiliensis	x
A. farelloensis	x
A. santaremensis	x
A. septemarticulata	x
Attheyella (Chappuisiella) crenulata	x x
A. fuhrmanni	x x x x
A. huaronensis	x
A. guyanensis	x
A. oculta	x
A. subdola	x
A. palustris	x
A. pichilafquensis	x
A. quillehuensis	x
A. levigata	x
A. bullata	x
A. camposi	x
A. chilensis	x
A. laciniata	x
A. vivianii	x
A. orinocoensis	x
A. koepkei	x
A. brasiliana	x
A. salviniae	x
Attheyella (?Canthosella) bromelicola	x

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
A. goeldii	x
A. montana	x
Attheyella (Delachauxiella) lanata	x x
A. trigonura	x
A. aculeata	x
A. horvathi	x
A. dadayi	x
A. hannae	x
A. incae	x
A. schindleri	x
A. biarticulata	x
A. ciliata	x
A. nuda	x
A. ornata	x
A. serrata	x
A. wieseri	x
A. freyi	x
A. arequipensis	?
A. clavigera	x
A. ensifer	x
A. ferox	x
A. inconstans	x
A. i. egena	x
A. insignis	x
A. lanceolata	x
A. maxima	x
A. peruana	x
Attheyella (? Elaph.) sphagnobiotica	x
Attheyella (? Neocamptus) cordillierica	x
Attheyella (? Neocamptus) nebulosa	x
'Attheyella' gessneri	x
Maraenobiotus fontinalis	x
M. fontinaloides	x
Moraria neotropica	x
M. kummeroworum	x
Löfflerella chilensis	x
L. rouchi	x
L. trisaetosa	x
Epactophanes richardi	x
Elaphoïdella bidens	x
E. laciniata	x
E. surinamensis	x
E. pectinata	x
E. humboldi	x
E. paraplesia	x
E. siolii	x
E. bispina	x
E. armata	x
E. grandidieri	x
E. schubarti	x
Pseudocamptus peruanus	?
Antarctobiotus koenigi	x
A. rapoporti	x

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
A. bahamondei	x
Spelaeocamptus neotropicus	x
Parastenocaridae	
Parastenocaris[4] *brasilibathynellae*	x
P. hurdi	x
P. chelifer	x
P. clandestina	x
P. digitata	x
P. icoaraci	x
P. jakobi	x
P. paraensis	x
P. p. bulbifera	x
P. amazonicus	x
P. arequipensis	x
P. hexacantha	x x
P. panamericana	x
P. staheli	x x x
P. surinamensis	x x x
P. paraguayensis	x
P. p. phylloides	x
P. remanei	x
P. santaremensis	x
P. sioli	x
P. tapajoensis	x
P. jujuyensis	x
P. argentina	x
P. sierrae	x
P. cordobaensis	x
P. ciliata	x
P. rhizophora	x
P. hecate	x
P. persephone	x
P. pluto	x
P. oncophora	x
P. sanctiludovici	x
P. membranacea	x
P. dactyloides	x
P. drepanoephora	x
P. bolbodes	x
P. columbiensis	x
P. divae	x
P. kubitskii	x
P. röttgeri	x
P. tagae	x
P. ignotus[5]	x
Forficatocaris amazonensis	x
F. tetracantha	x

[4] Jakobi, in 1972, proposed divisions of the genus. Except for *Forficatocaris*, a more complete knowledge of this group seems necessary before creation of new genera.

Addendum continued.

	Regions (see Fig. 31) 1 2 3 4 5 6 7 8 9
F. forficata	x
F. f. crenensis	x
F. guarani	x
F. noodti	x
F. claudii	x
F. lilianae	x
F. evelinae	x
F. jakobii	x
F. affinis[5]	x
Cletodidae	
Cletocamptus deitersi	x x
C. d. ecuadorianus	x
C. bicolor	x

Total: 16 families, 61 genera, 368 species or subspecies.

References

Andrade, A. R. & G.-O. Brandorff, 1975. Uma nova espécie de Diaptomidae (Crustacea, Copepoda) *'Diaptomus' negrensis* das aguas pretas perto de Manaus. Acta Amazonica 5 (1): 97–103.

Bowman, T. E., 1973. Two freshwater copepods from Barrancas, Venezuela: *Notodiaptomus cearensis* (Wright) and *N. venezolanus deeveyorum*, new subspecies (Calanoida: Diaptomidae). Proc. biol. Soc. Wash. 86: 193–202.

Brandorff, G.-O., 1973. Neue freilebende Calanoide Copepoden (Crustacea) aus dem Amazonasgebiet. Amazoniana 4 (2): 205–218.

Brehm, V., 1957. Sobre los copepodos hallados por el Profesor Biraben en la Argentina. 4a comun. Neotropica 3 (11): 53–64.

Brehm, V., 1958. Bemerkungen zu einigen Kopepoden Südamerikas. Sitz. Ber. Akad. Wiss. Wien 1, 167, 3 (4): 139–171.

Dahl, F., 1894. Die Copepodenfauna des unteren Amazonas. Ber. Naturf. Ges. Freiburg b. 8: 10–23.

de Infante, A., W. Riehl & J. F. Saunders, 1979. Los Copépodos del Lago de Valencia, Venezuela. Acta Cient. Venezolana 30: 224–233.

Delachaux, Th., 1924. Zur Kenntnis der Copepodenfauna von Surinam. Zool. Anz. 59, 1,2: 1–16.

Dussart, B., 1979. Algunos Copépodos de America del Sur. Publ. Oc. 30. Mus. nac. Hist. nat., Santiago de Chile, 13 pp.

Dussart, B. H., 1981. Sobre algunos Copépodos de America del Sur, 2. Comun. cient. CECOAL, Argentina, 12: 6 pp.

Dussart, B. H., 1982. Copépodes des Antilles françaises. Rev. Hydrobiol trop. 5, 4: 313–324.

Dussart, B. H., 1982. Faune de Madagascar, 58. Crustacés Copépodes des eaux intérieurs. ORSTOM/CNRS, Paris, 146 pp.

Dussart, B. H., 1983. Sobre algunos Copépodos de America del Sur, 3 (sous presse).

Harding, J. P., 1955. The Percy Sladen expedition to lake Titicaca in 1937 – Crustacea, Copepoda. Trans. linn. Soc. Lond. 1 (3): 216–247.

Herbst, H. V., 1960. Copepoden (Crustacea, Entomostraka) aus Nicaragua und Südperu. Gewäss. Abwäss. 27: 27–54.

Jakobi, H., 1972. Trends (Enp P4 ♂) innerhalb der Parastenocarididen (Copepoda Harpacticoidea). Crustaceana 22 (2): 127–146.

Kiefer, F., 1926. Beiträge zur Copepodenkunde (IV). Zool. Anz. 69, 1,2: 21–26.

Kiefer, F., 1933. Süsswassercopepoden aus Brasilien. Zool. Anz. 105, 1,2: 38–43.

Kiefer, F., 1935. Neue Süsswassercyclopiden (Crustacea, Copepoda) aus Uruguay. Zool. Anz. 109, 7,8: 181–188.

Kiefer, F., 1936. Über die Systematik der südamerikanischen Diaptomiden (Crustacea, Copepoda). Zool. Anz. 116, 7,8: 194–200.

Kiefer, F., 1956. Freilebende Ruderfusskrebse (Crustacea, Copepoda), 1. Calanoida und Cyclopoida. Ergebn. deutsch. limnol. Venezuela-Exped. 1952 1: 233–268.

Kiefer, F., 1957. Freilebende Ruderfusskrebse (Crustacea, Copepoda) des Titicacasees. Veröff. Zool. Staatssamml. München 4: 125–150.

Kiefer, F., 1981. Beitrag zur Kenntnis von Morphologie, Taxonomie und geographischer Verbreitung von *Mesocyclops leuckarti* auctorum. Arch. Hydrobiol., Suppl. 62 (1); 148–190.

Lang, K., 1965. Copepoda Harpacticoidea from the Californian Pacific Coast. K. Svenska vetensk. Handl. 10 (2): 560 pp.

Light, S. F., 1939. On american subgenera of *Diaptomus* (Copepoda, Calanoida). Trans. am. microsc. Soc. 58 (4): 473–484.

Lindberg, K., 1961. Remarques sur le genre *Metacyclops* (Kiefer, 1927) et description d'un *Metacyclops* nouveau du Portugal. K. fysiogr. Sällsk. Lund För. 31, 14: 133–145.

Löffler, H., 1963. Zur Ostracoden- und Copepodenfauna Ekuadors. Arch. Hydrobiol. 59 (2): 196–234.

Löffler, H., 1981. Copepoda. In S. H. Hurlbert, G. Rodriguez & N. D. Dos Santos, Aquatic Biota of Tropical South America, 1. Arthropoda: 14–19.

Lowndes, A. G., 1934. Results of expedition to Brazil and Paraguay in 1926–27. Copepoda. I. Linn. Soc. Lond. Zool. 39: 83–131.

Noodt, W., 1963. Subterrane Crustaceen der zentralen Neotropis. Zur Frage mariner Relikte des Rio Paraguay-Parana-Amazonas-Systems. Zool. Anz. 171: 114–147.

Noodt, W., 1965. Crustacea subterranea aus Argentinien. Beitr. neotrop. Fauna: 84–129.

Pearse, A. S., 1921. Crustacea from Lake Valencia, Venezuela. Proc. U.S. nac. Mus. 59: 459–462.

Pesta, O., 1928. Ein Beitrag zur Kenntnis der Copepodenfauna von Argentinien. Zool. Anz. 73, 3,4: 67–80.

Wright, S., 1927. A revision of the south american species of *Diaptomus*. Trans am. microsc. Soc. 46, 2: 73–121.

Wright, S., 1935. Three new species of *Diaptomus* from Northeast Brazil. Ann. Acad. brasil. Cienc. 7: 213–233.

Wright, S., 1936. Preliminary report on six species of *Diaptomus* from Brazil. Ann. Acad. brasil. Cienc. 8 (2): 79–85.

[5] Species in course of description (Dussart, 1983).