

The freshwater cyclopoid copepods of Nigeria, with an illustrated key to all species

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INTRODUCTION

Dracunculiasis is caused by the guineaworm, *Dracunculus medinensis* L., and is endemic in parts of Africa and Asia. The vectors of guineaworm are cyclopoid copepods that inhabit stagnant ponds and the disease is especially prevalent in rural areas among people who obtain their drinking water from such ponds. The vectors are commonly referred to as 'Cyclops' but *D. medinensis* exhibits a high level of host specificity and only a few species act as vectors in nature. *Mesocyclops leuckarti* (Claus) is widely reported as the common intermediate host in India (Sarkar, 1982) and Africa (Onabamiro, 1950; Muller, 1970). Other reported hosts include species of the genera *Mesocyclops* Sars (Sarkar, 1982), *Thermocyclops* Kiefer (Onabamiro, 1952a) and *Metacyclops* Kiefer (Steib, 1985). The correct identification of the copepod intermediate hosts is important in mapping the geographical distribution and spread of the disease, and is vital in the development of eradication programs which aim to combat the disease by control of the vectors.

Recent progress in copepod systematics has refined the level of taxonomic resolution of these freshwater copepods and it is now known that *Mesocyclops leuckarti* does not occur in either Africa or India (Kiefer, 1981; Van de Velde, 1984). There is, therefore, an obvious need to record these taxonomic changes, to review earlier records, and to update the nomenclature of the host wherever possible. The purpose of the present paper is to review all records of freshwater cyclopoid copepods from Nigeria, including those that act as vectors of guineaworm, and to give their current names.

THE FRESHWATER CYCLOPOID COPEPODS OF NIGERIA

A. Valid species

Family Cyclopidae

Subfamily Halicyclopinae

1. *Halicyclops korodiensis* Onabamiro, 1952: (Figs. 1–3)

This species was described from a brackish pool near the Lagoon at Ikorodu, 16 miles from Lagos, South West Nigeria (Onabamiro, 1952a). It was redescribed by Gabriel et al. (1987) from material collected in the estuary of the Warri River, Nigeria. It has since been recorded from the estuary of the river Bonny near Port Harcourt (unpublished data).

MATERIAL EXAMINED. 4♀♀ syntypes collected from brackish pool near the lagoon at Ikorodu, near Lagos, Nigeria by Onabamiro, BM(NH) Reg.No. 1952.11.28.7–8. Additional material, 3♀♀, 5♂♂ and 3 copepodids collected from estuary of River Bonny near Port Harcourt by Mrs E. Etta, BM(NH) Reg. No. 1985.108.

2. *Halicyclops pondoensis* Wooldridge, 1977: (Figs. 4–6)

This species was described from the plankton in the Msikaba and Mbotyi estuaries on the Pondoland coast, Transkei (Wooldridge, 1977). It has since been recorded in the

estuary of the Bonny river near Port Harcourt (unpublished data).

MATERIAL EXAMINED. 6♀ ♀, 1♂ and 9 copepodids collected from estuary of River Bonny near Port Harcourt by Mrs E. Etta, BM(NH) Reg. Nos. 1985.258–273.

Subfamily Eucyclopinae

3. *Macrocylops albidus oligolasius* Kiefer, 1928: (Fig. 7)

This species was first recorded from Nigeria by Onabamiro (1952a) under the name *Macrocylops oligolasius*. Green (1962) reported this subspecies from the river Sokoto.

MATERIAL EXAMINED. 1♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.6.

4. *Eucyclops serrulatus* (Fischer, 1851): (Figs. 18, 25)

This species was recorded from South West Nigeria by Onabamiro (1952a) under the name *Eucyclops agilis* (Koch). Green (1962) reported it from the river Sokoto. The material recorded as *E. productus* Kiefer by Onabamiro (1952b) is indistinguishable from *E. serrulatus* collected in the same area.

MATERIAL EXAMINED. 5♀ ♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.11. Numerous specimens collected from Mkpani village, Cross River State, Nigeria by Braide. 1♀ from South West Nigeria, reported as *E. productus* by Onabamiro (1952b), BM(NH) Reg. No. 1957.2.15.10.

5. *Eucyclops macruroides* (Lilljeborg, 1901): (Fig. 20)

This species was recorded from South West Nigeria by Onabamiro (1952a).

MATERIAL EXAMINED. Nigerian specimens of this species were not available: 2♀ ♀ collected by J. P. Harding in Wise Een Tarn, Westmorland, England, BM(NH) Reg. No. 1964.4.2.6.

6. *Eucyclops agiloides* (Sars, 1909): (Figs. 22, 23–4)

This species has a wide distribution in Africa and was recorded from Nigeria by Onabamiro (1952b).

MATERIAL EXAMINED 10♀ ♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.9.

7. *Afrocylops gibsoni* (Brady, 1904): (Figs. 19, 26b–28)

This species was recorded as *Eucyclops (Afrocylops) gibsoni* by Onabamiro (1951) from South West Nigeria and as *A. gibsoni* in 1952. It was reported from the Sokoto river by Green (1962) and from Oyo State by Sridhar & Kale (1985). The *Cyclops longistylis* reported from northern Nigeria by Brady (1910) were regarded by Lindberg (1950) as probably belonging to *Afrocylops gibsoni*.

MATERIAL EXAMINED. 2♀ ♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.8.

8. *Afrocylops curticornis* (Kiefer, 1932): (Fig. 26a)

This species was recorded from South West Nigeria by Onabamiro (1952a).

MATERIAL EXAMINED. None.

9. *Afrocylops doryphorus* (Kiefer, 1935): (Figs. 31–32)

This species was recorded from South West Nigeria by Onabamiro (1952b).

MATERIAL EXAMINED. 1♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.7.

10. *Afrocylops ikennus* Onabamiro, 1957: (Figs. 29–30)

This species was described from material taken at Ikenne in South West Nigeria (Onabamiro, 1957).

MATERIAL EXAMINED. Paratype ♀ collected on 24 May 1951 by Onabamiro (1957) at Ikenne, Ijebu-Remo, Nigeria, BM(NH) Reg. No. 1957.2.15.5.

11. *Tropocyclops prasinus* (Fischer, 1860): (Fig. 17)

This species was recorded by Sridhar & Kale (1985) from Oyo State. The *Cyclops virescens* reported from Nigeria by Brady (1910) is treated as a synonym of *T. prasinus* by Dussart & Defaye (1985).

MATERIAL EXAMINED. Nigerian specimens of this species were not available: 2♀ ♀ collected in Egypt, BM(NH) Reg. Nos. 1939.3.15.31–33 and several ♀ ♀ collected in Kirkudbright, Scotland, BM(NH) Reg. Nos. 1911.11.8.41160–41179.

12. *Tropocyclops prasinus shagamiensis* Onabamiro, 1957

This subspecies was described from material collected in stagnant side pools formed by the Ibu river at Shagamu, and in similar habitats at Ilaro and Ijebu in South West Nigeria (Onabamiro, 1957).

MATERIAL EXAMINED. Paratype ♀ collected on 10 April 1951 from stagnant side pools formed by Ibu River at Shagamu, Nigeria, BM(NH) Reg. No. 1957.2.15.4.

13. *Tropocyclops confinis* (Kiefer, 1930): (Figs. 14, 21)

This species was recorded from South West Nigeria by Onabamiro (1951, 1952a). Lindberg (1951) recorded *T. confinis* from the Okolom area of Nigeria. The *Cyclops virescens* reported from Nigeria by Brady (1910) were regarded as probably identical with *Tropocyclops confinis* by Lindberg (1950, and in Onabamiro, 1952a), although Dussart & Defaye (1985) treat *C. virescens* as a synonym of *Tropocyclops prasinus*.

MATERIAL EXAMINED 1♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.12. Numerous specimens collected from Mkpani village, Cross River State, Nigeria by Braide.

14. *Tropocyclops confinis awiensis* Onabamiro 1957

This subspecies was described from material collected from large pools in the shrinking bed of the river Omi-Awa, 30 miles south of Ibadan (Onabamiro, 1957).

MATERIAL EXAMINED. Paratype ♀ collected from River Omi-Awa, Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.3.

15. *Tropocyclops onabamiroi* Lindberg, 1950: (Fig. 15)

This species was described on material collected by Onabamiro from South West Nigeria (Lindberg, 1950). It was also reported from Oyo State by Sridhar & Kale (1985).

MATERIAL EXAMINED. 1♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.13.

16. *Tropocyclops mellanbyi* Onabamiro, 1952: (Fig. 16)

This species was described as widespread within Nigeria by Onabamiro (1952a) who recorded it from Ibadan, Kajola, and Sagamu (Ijebu province). It was suggested as a possible synonym of *Tropocyclops prasinus prasinus* by Lindberg (1955) and treated as incertae sedis by Dussart & Defaye (1985).

MATERIAL EXAMINED. Paratype ♀♀ collected on 7 March 1950 by Onabamiro (1952a) from reservoir near Ibadan, Nigeria, BM(NH) Reg. No. 1952.11.28.3–4.

17. *Paracyclops affinis* (Sars, 1863): (Figs. 8–9)

This species is widely distributed in Africa and was reported from Nigeria by Onabamiro (1952b).

MATERIAL EXAMINED. Numerous specimens collected from Mkpani village, Cross River State, Nigeria by Braide; 1♀ collected by R. Gurney from Calthorpe, England, BM(NH) Reg. No. 1950.9.20.193.

18. *Ectocyclops phaleratus* (Koch, 1838): (Figs. 10–11)

This species was recorded from South West Nigeria as *Platycyclops phaleratus* by Onabamiro in 1951 and as *Ectocyclops phaleratus* in 1952. A specimen of *E. phaleratus* sensu lato was reported from the river Sokoto by Green (1962).

MATERIAL EXAMINED. 1♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.14.

19. *Ectocyclops phaleratus ilariensis* Onabamiro, 1952: (Fig. 13)

This subspecies was described as a new species, *E. ilariensis*, on material collected near Ilaro in South West Nigeria by Onabamiro (1952a). It was treated as a subspecies by Dussart & Defaye (1985).

MATERIAL EXAMINED. Paratype ♀♀ collected by Onabamiro (1952a) on 18 October 1950 at Ilaro, Nigeria, BM(NH) Reg. Nos. 1952.11.28.5–6.

20. *Ectocyclops compactus* (Sars, 1909): (Fig. 12)

This species was reported from the river Sokoto by Green (1962).

MATERIAL EXAMINED. Nigerian specimens of this species were not available: 1♀ collected by C. K. Richards & R. J. Owen in Lake Young, East Africa, BM(NH) Reg. No. 1941.5.16.101.

Subfamily Cyclopinae**21. *Metacyclops pseudoanceps*** (Green, 1962): (Fig. 33–34)

This species was described as a new species of *Microcyclops* by Green (1962) from material collected in the Sokoto river.

It was regarded as belonging to the genus *Metacyclops* by Dussart & Defaye (1985).

MATERIAL EXAMINED. 2♀♀ syntypes donated by Prof. J. Green, collected in the Sokoto river, BM(NH) Reg. Nos. 1989.964–965.

22. *Metacyclops minutus* (Claus, 1863): (Fig. 35)

This species was recorded from Nigeria by Onabamiro (1952b) under the name *Microcyclops minutus*.

MATERIAL EXAMINED. 1♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.17.

23. *Microcyclops varicans* (Sars, 1863): (Fig. 36)

This species was recorded from South West Nigeria by Onabamiro (1952a), from the river Sokoto by Green (1962) and from Ijere, in Oyo State by Sridhar & Kale (1985). It was recorded from northern Nigeria by Gurney (1933) as *Cyclops (Microcyclops) varicans*.

MATERIAL EXAMINED. 1♀ (damaged with caudal rami missing) collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.17, and 1♀ as *M. varicans subaequalis* from same region, BM(NH) Reg. No. 1957.2.15.16.

24. *Microcyclops jenkiniae* Lowndes, 1933: (Figs. 37–39)

This species was reported from South West Nigeria by Onabamiro (1951, 1952a) as *Cryptocyclops jenkiniae*.

MATERIAL EXAMINED. 1♂ collected by Dr E. I. Braide at Okpuru Udebe, Anambra, Nigeria.

25. *Cryptocyclops bicolor* (Sars, 1863): (Fig. 40)

Brady (1910) first recorded this species from Nigeria, as *Cyclops bicolor*. His species was regarded as probably identical to *Cryptocyclops linjanticus* (Kiefer) by Lindberg (in Onabamiro, 1952a). Dussart & Defaye (1985) list this species as occurring in Nigeria, based on Brady's record. Its presence in Nigeria requires confirmation.

MATERIAL EXAMINED. Nigerian specimens of this species were not available: 1♀ collected from Lake Naivasha, Kenya, BM(NH) Reg. No. 1933.9.25.20.

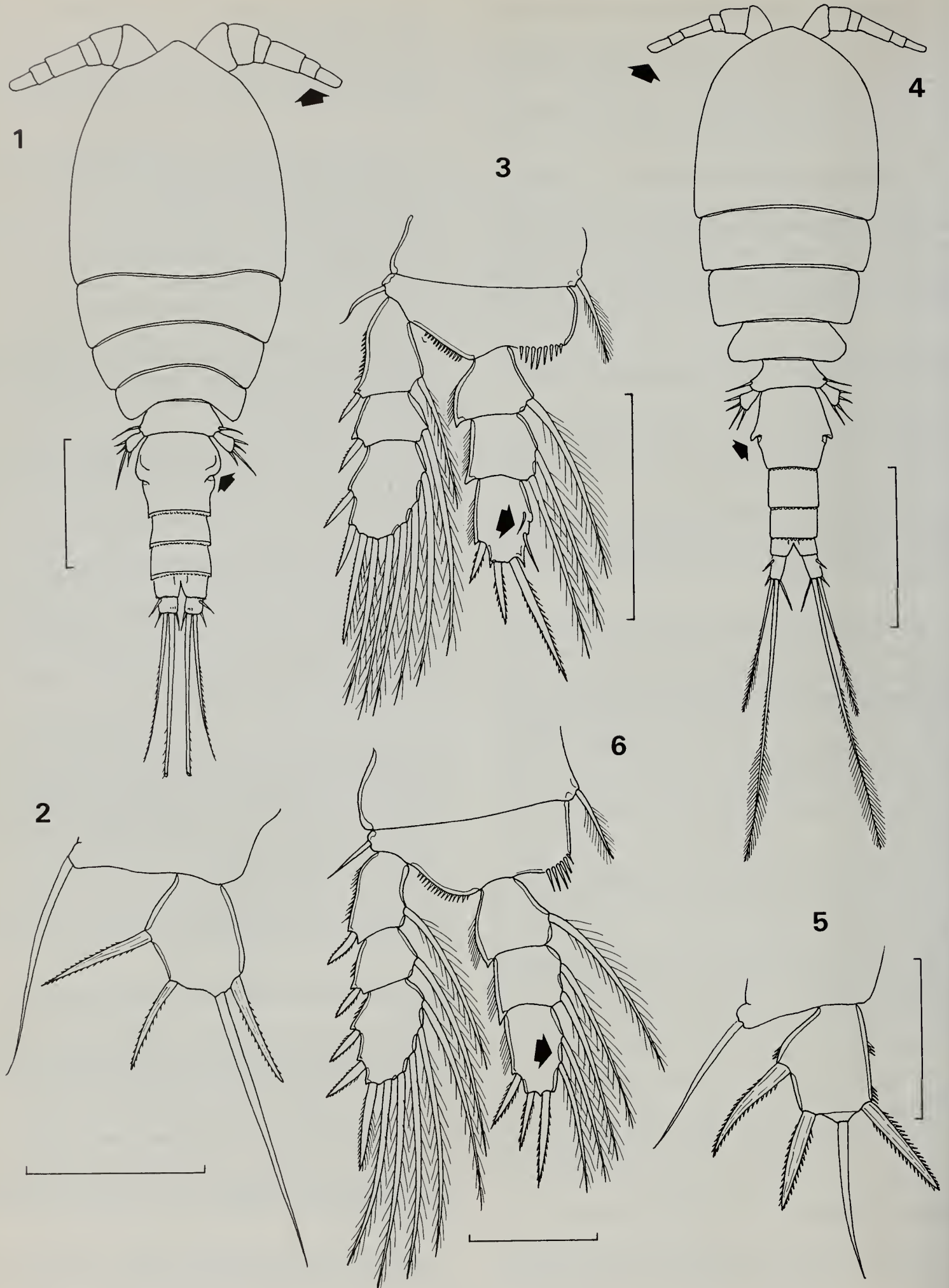
26. *Cryptocyclops linjanticus* (Kiefer, 1928): (Figs. 41–42)

This species was recorded in South West Nigeria as *Microcyclops linjanticus* by Onabamiro (1951, 1952a). It was reported from Ijere, Oyo State by Sridhar & Kale (1985).

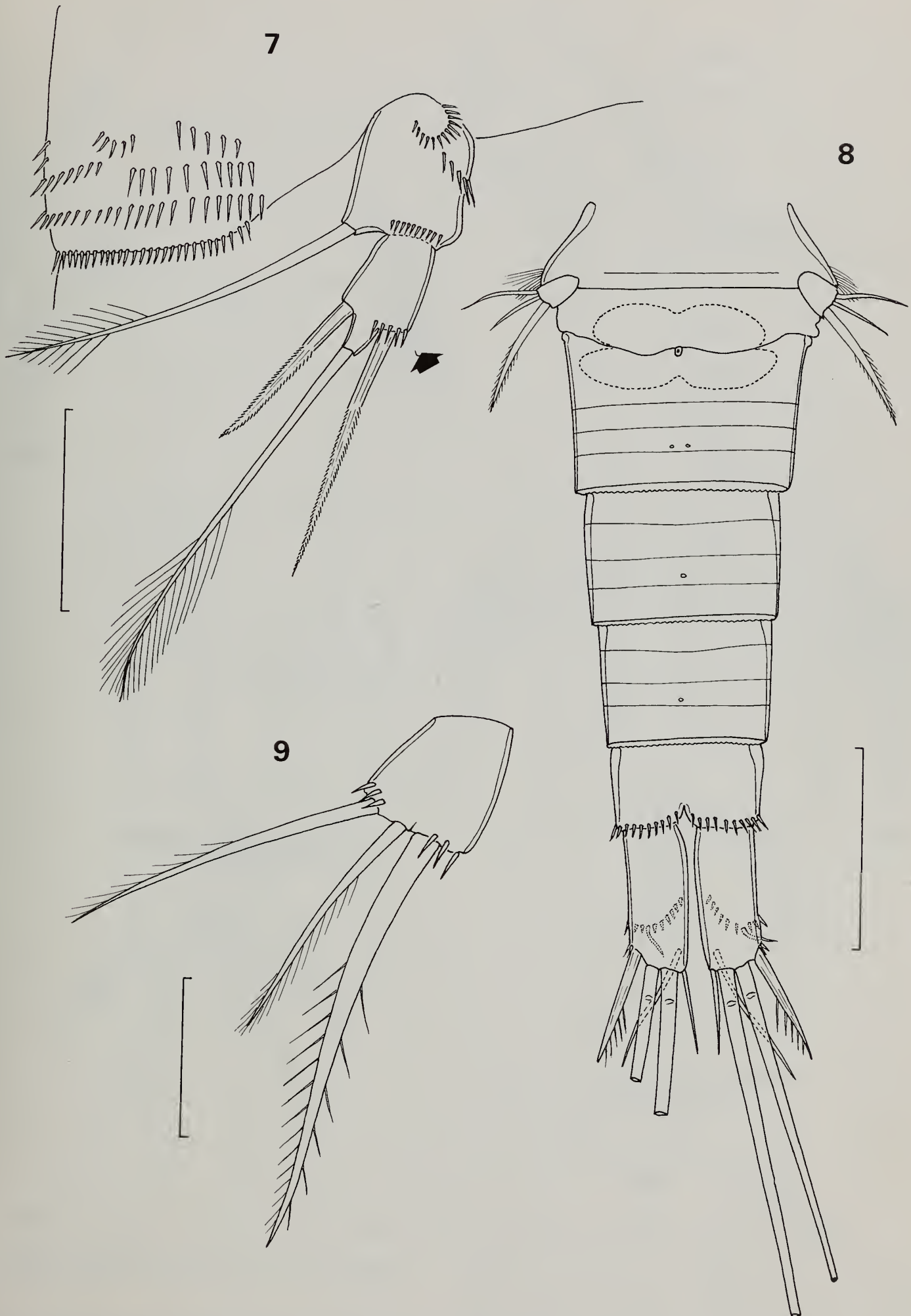
MATERIAL EXAMINED. 2♀♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. Nos. 1950.8.5.5 and 1957.2.15.15. The *M. linjanticus* collected by Onabamiro and stored as BM(NH) Reg. No. 1950.8.5.6. is a fifth copepodid of *Mesocyclops*; 2♀♀ collected by Dr E. I. Braide from Benue, Nigeria.

27. *Mesocyclops aspericornis* (Daday, 1906): (Figs. 43, 59)

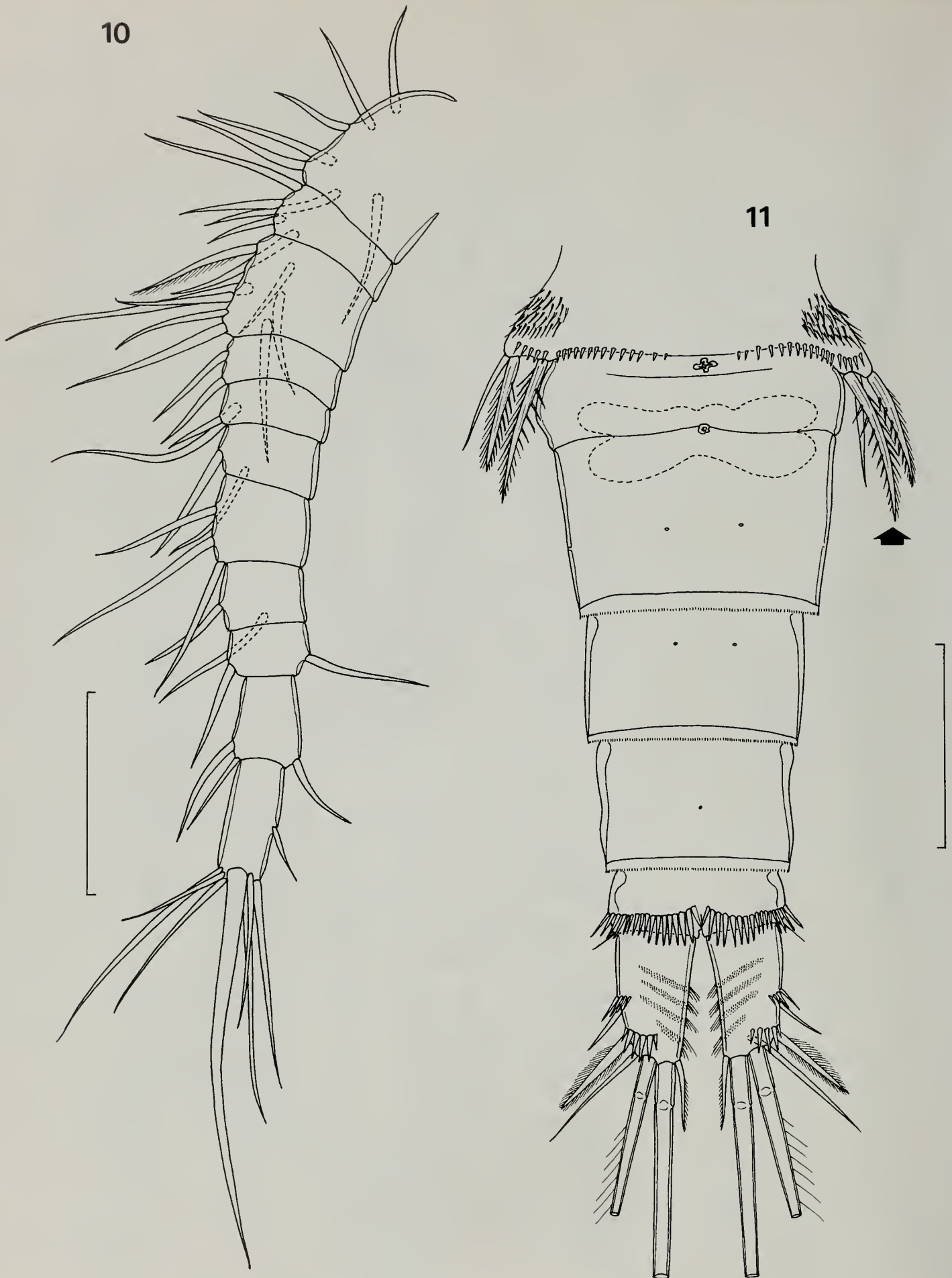
This species is the only *Mesocyclops* species found in Africa that also has a wide distribution in the Oriental region (Van



Figs 1-6 *Halicyclops korodiensis*: 1, syntype female; 2, fifth leg; 3, leg 4. *Halicyclops pondoensis*: 4, female; 5, fifth leg; 6, leg 4. Scale bars 1 = 100 μ m, 2 and 5 = 30 μ m, 3 and 6 = 50 μ m, 4 = 250 μ m.



Figs 7-9 *Macrocyclus albidus*: 7, fifth leg. *Paracyclops affinis*: 8, female urosome; 9, fifth leg. Scale bars 7 = 50 μ m, 8 = 100 μ m, 9 = 25 μ m.

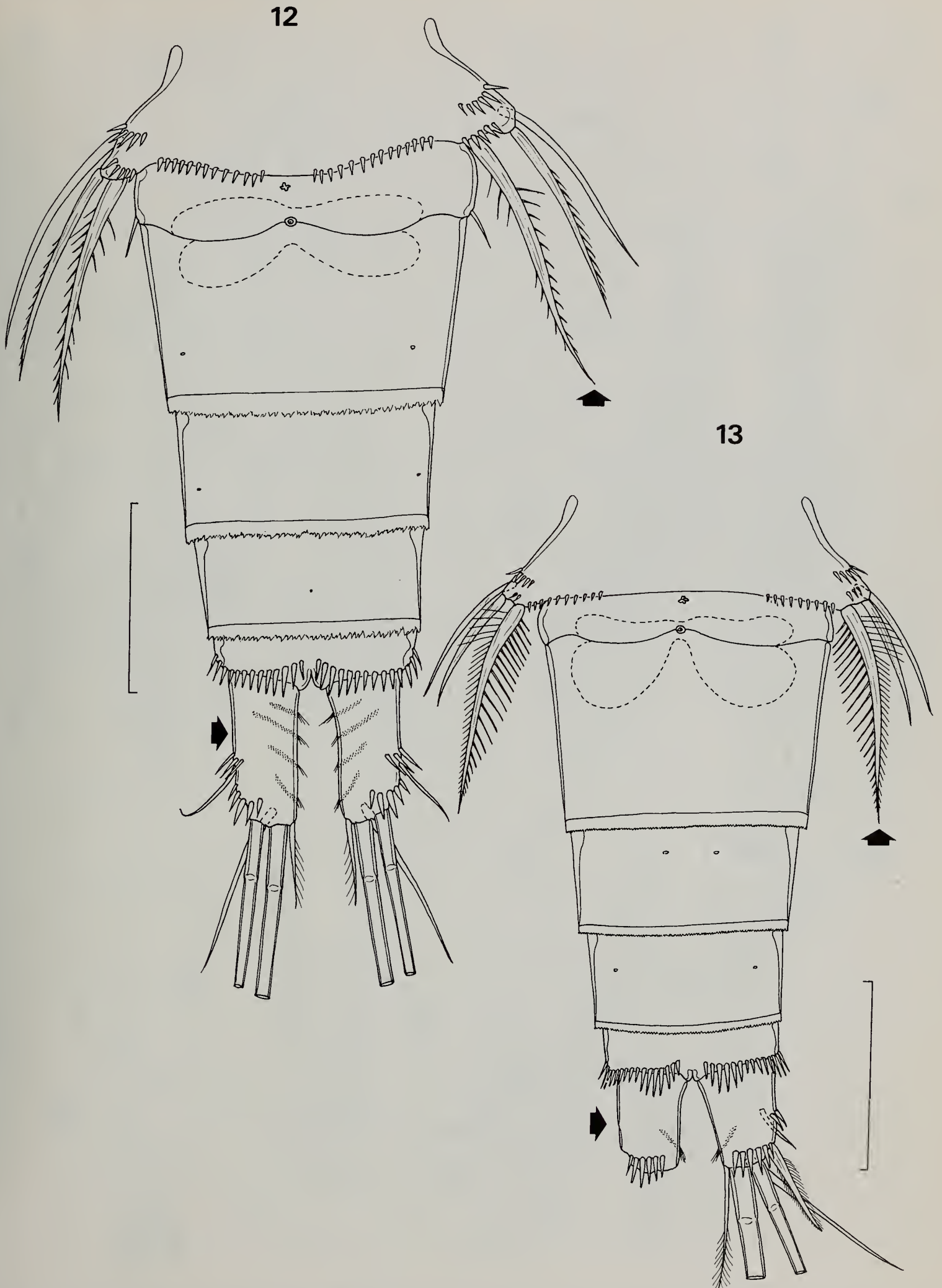


Figs 10–11 *Ectocyclops phaleratus*: 10, female antennule; 11, female urosome. Scale bars 10 = 50 μ m, 11 = 100 μ m.

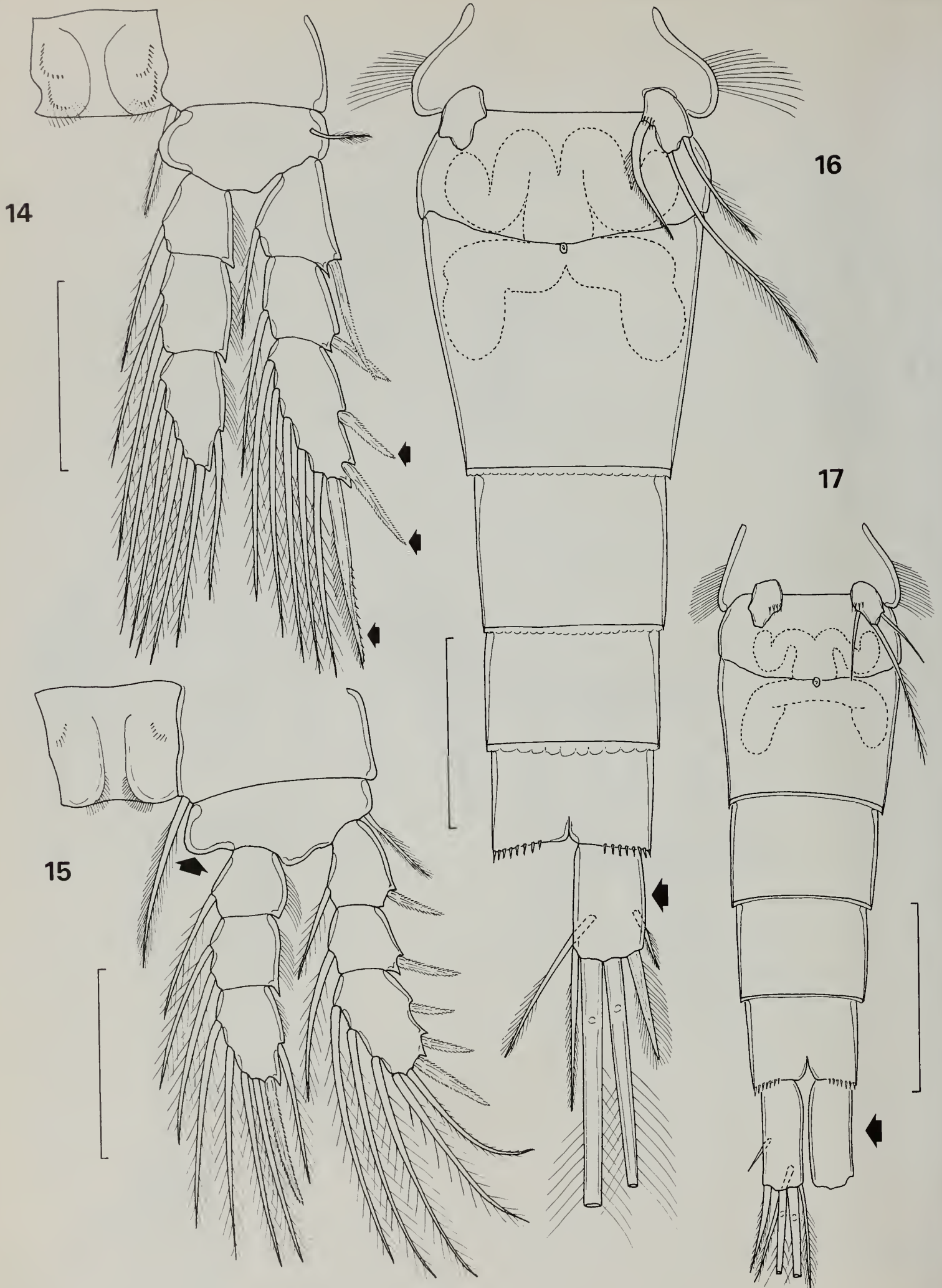
de Velde, 1984). It was identified in material from Okolom, Nigeria by Van de Velde (1984). This material had previously been reported as *Mesocyclops leuckarti* by Lindberg (1951). Jeje (1988) reported *M. aspericornis* from a range of habitats

at Ibadan, Benin city, Ilorin, Moniya and Margia, and from the river Bonney and Nike lake.

MATERIAL EXAMINED. Numerous specimens collected from

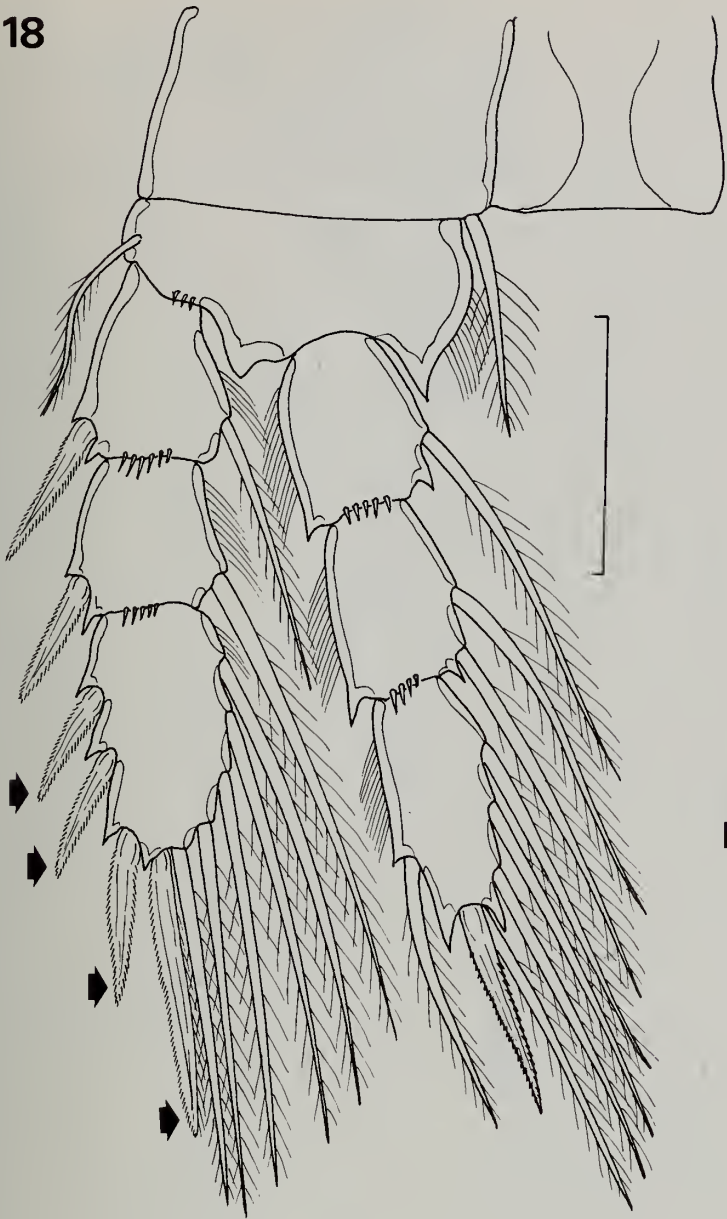


Figs 12–13 *Ectocyclops compactus*: 12, female urosome. *Ectocyclops phaleratus ilariensis*: 13, female urosome. Scale bars = 100µm.

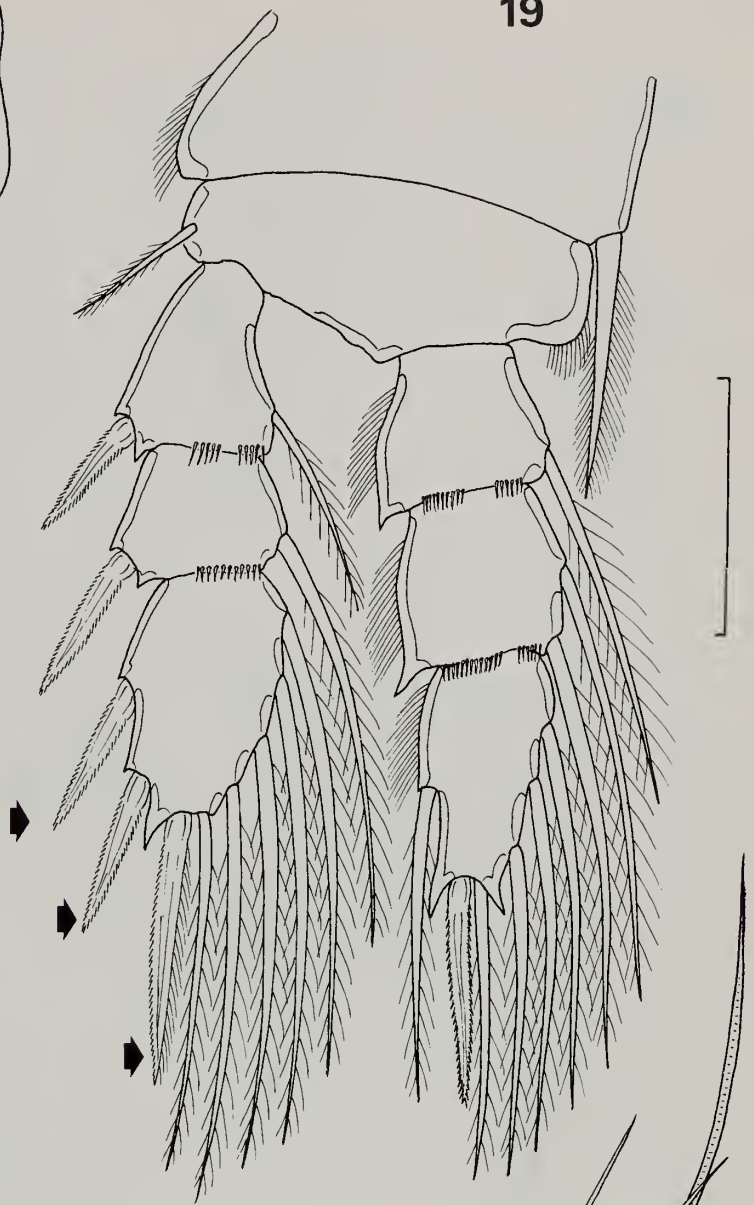


Figs 14–17 *Tropocyclops confinis*: 14, leg 3. *Tropocyclops onabamiroi*: 15, leg 1. *Tropocyclops mellanbyi*: 16, female urosome. *Tropocyclops prasinus*: 17, female urosome. Scale bars 14–16 = 50 μ m, 17 = 100 μ m.

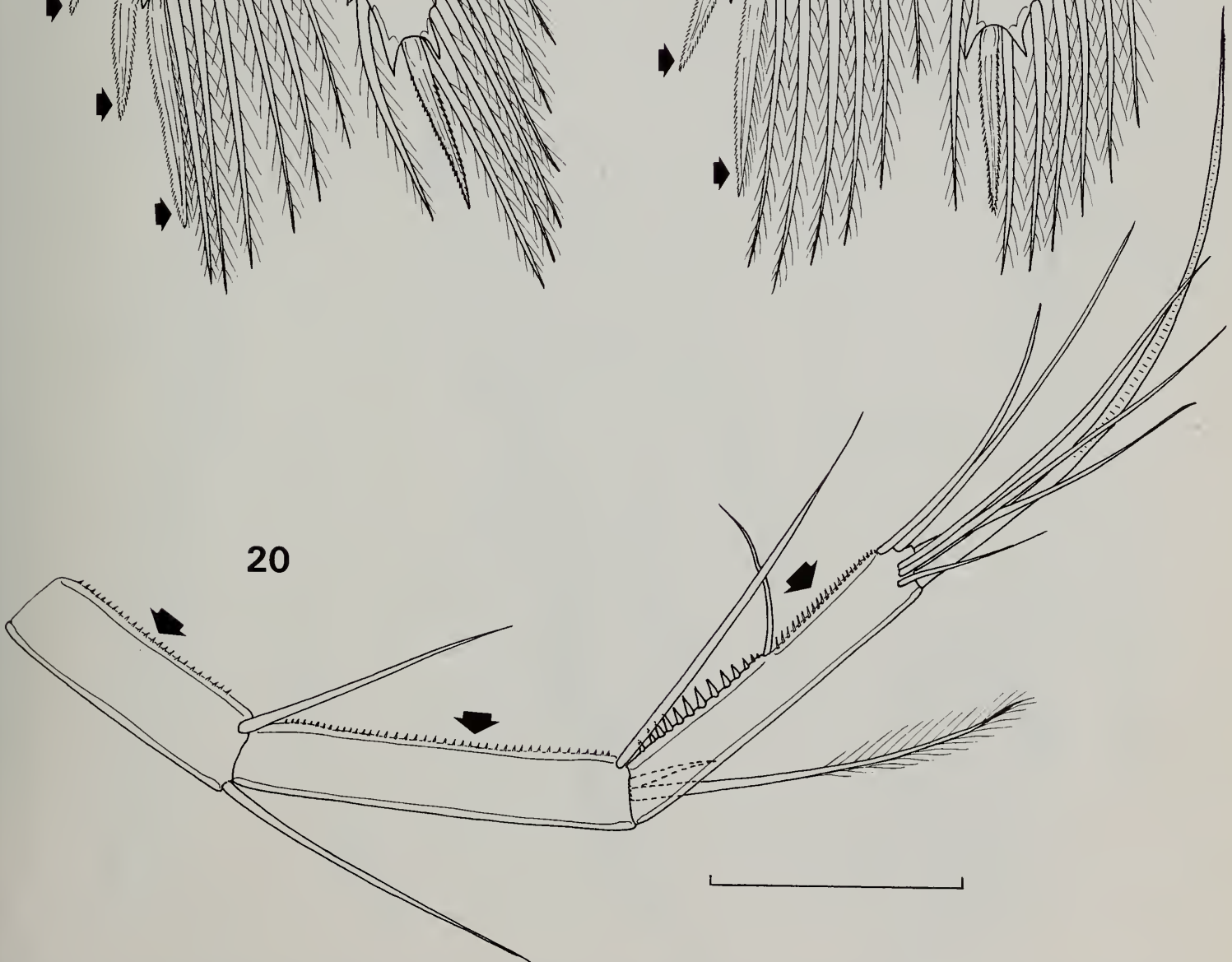
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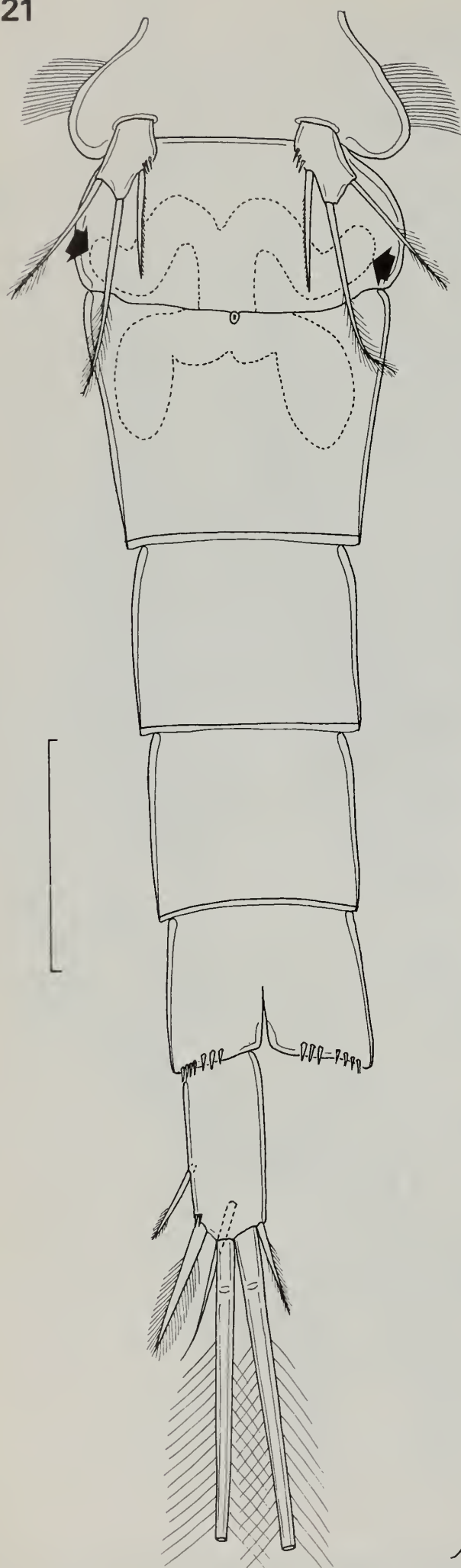


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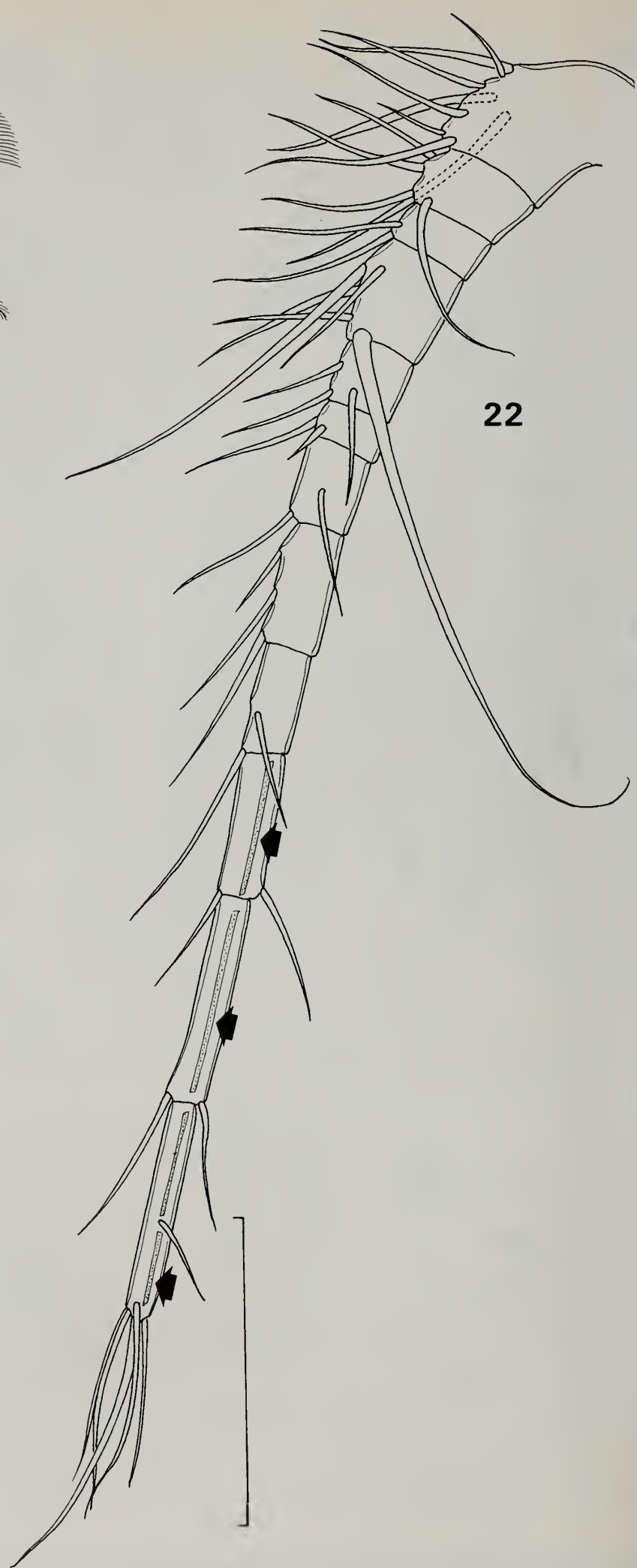


Figs 18-20 *Eucyclops serrulatus*: 18, leg 3; *Afrocylops gibsoni*: 19, leg 3. *Eucyclops macruroides*: 20, distal 3 segments of female antennule. Scale bars = 50µm.

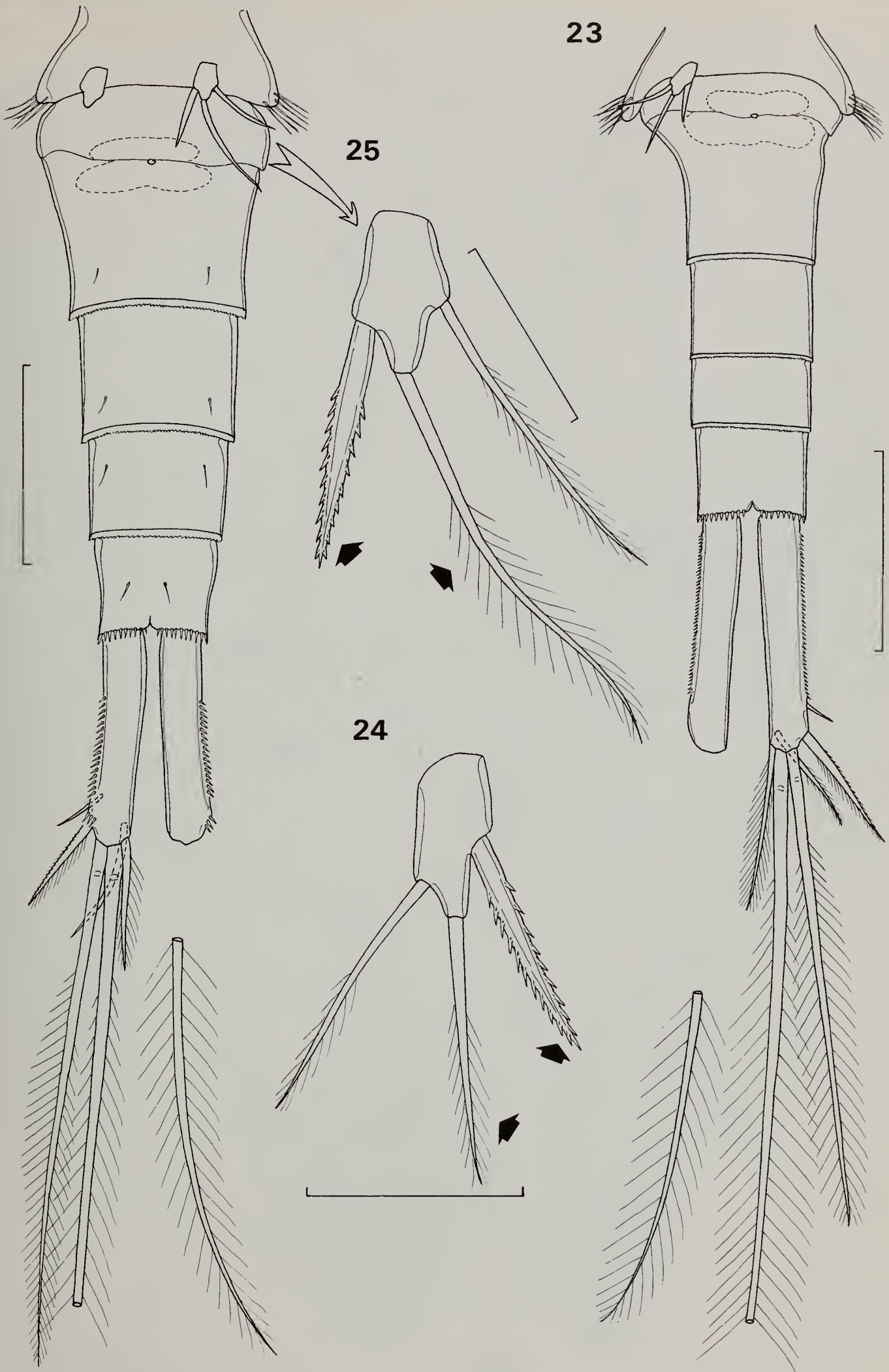
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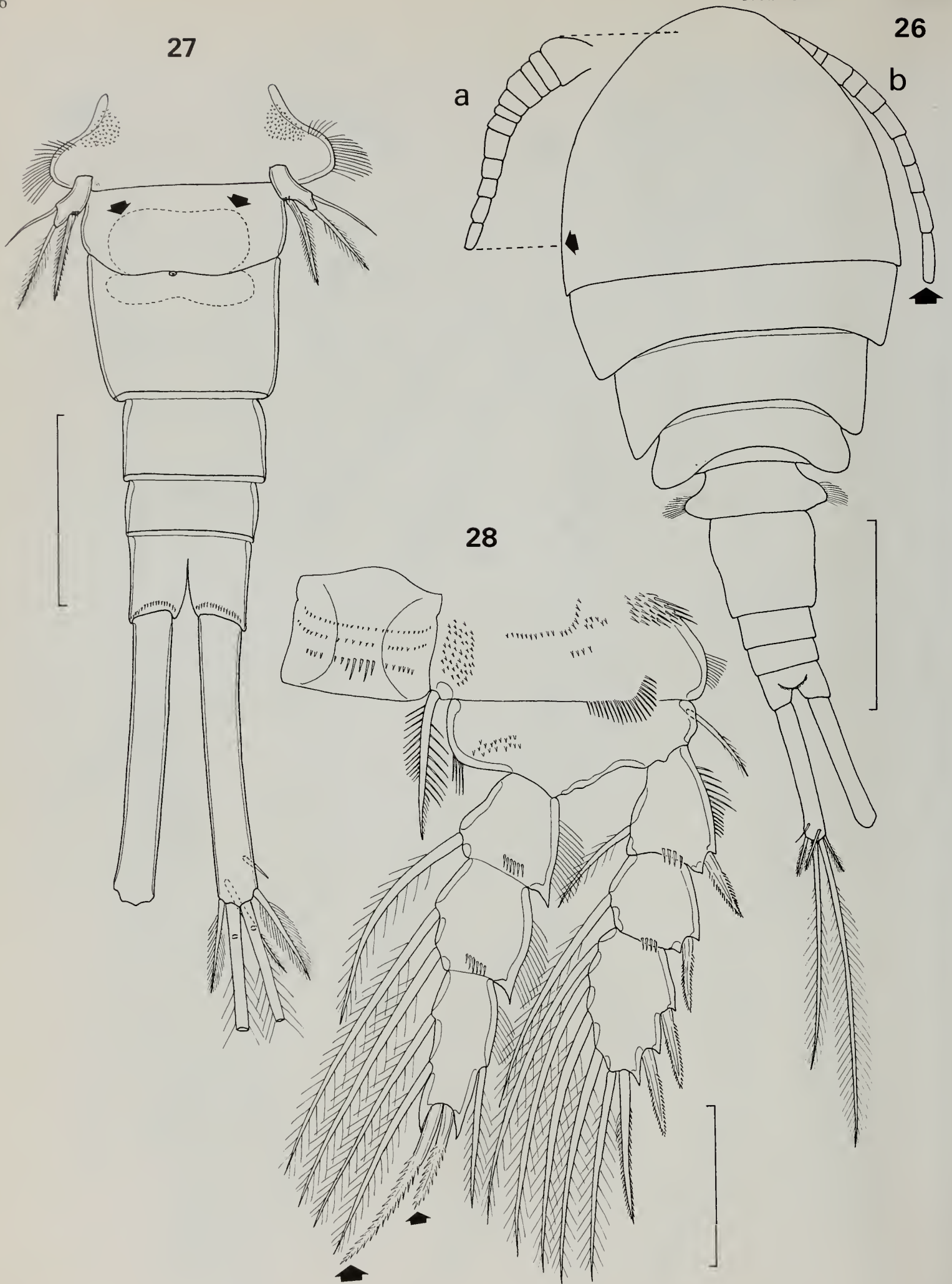
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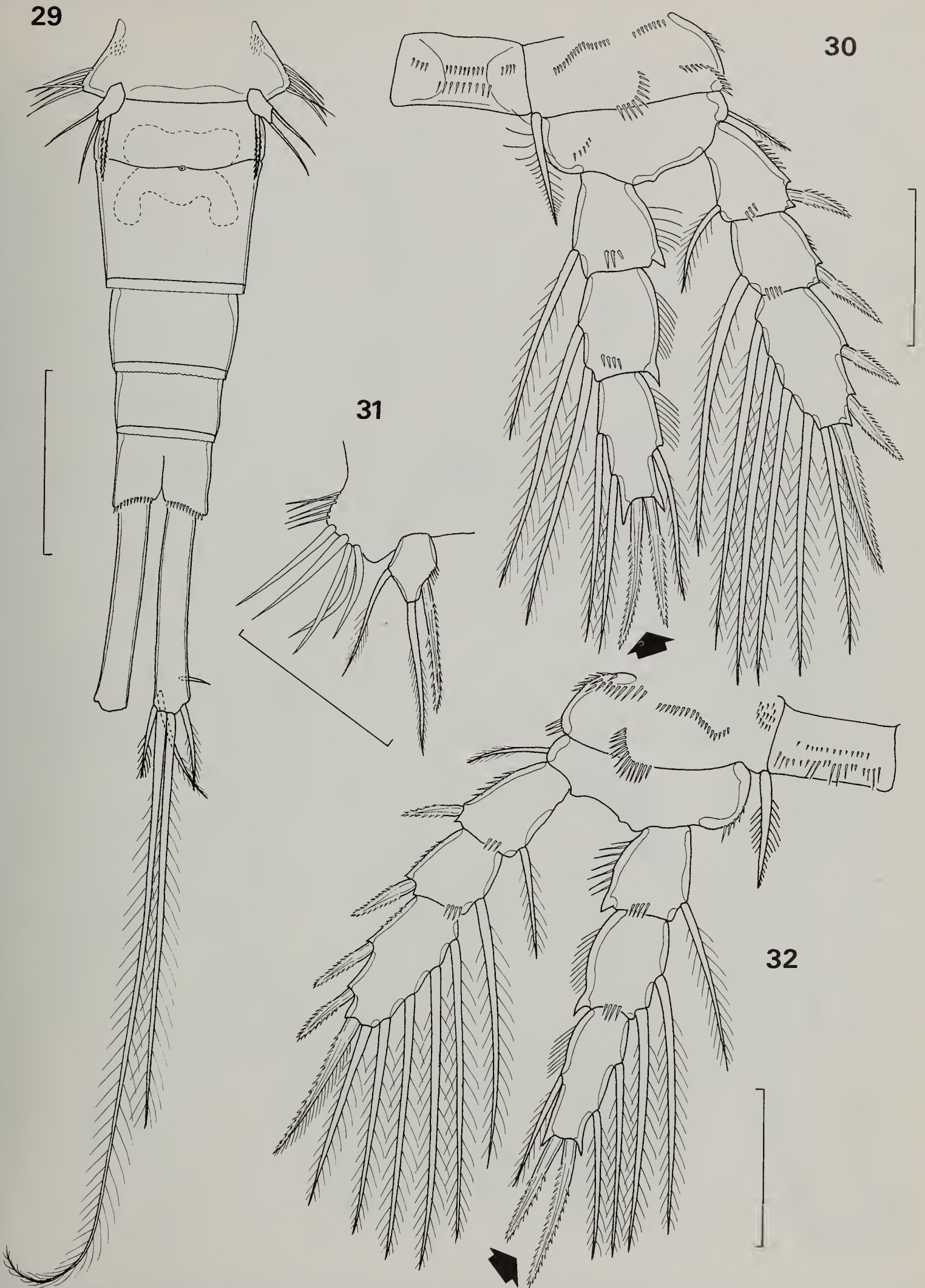
Figs 21–22 *Tropocyclops confinis*: 21, female urosome. *Eucyclops agiloides*: 22, female antennule. Scale bars 21 = 50µm, 22 = 100µm.



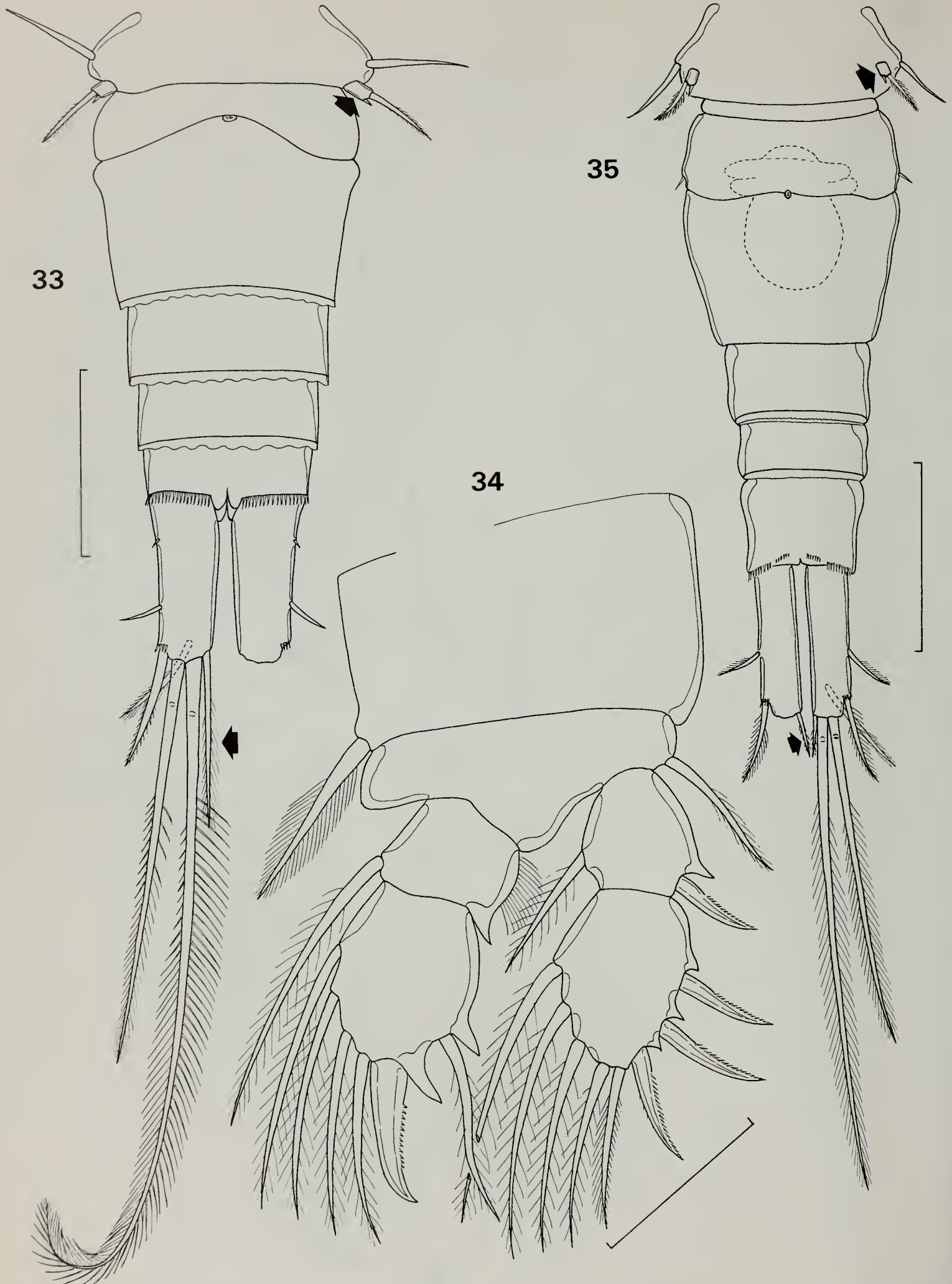
Figs 23–25 *Eucyclops agiloides*: 23, female urosome; 24, fifth leg. *Eucyclops serrulatus*: 25, female urosome, with detail of fifth leg. Scale bars 23 and 25 = 100 μ m, 24 = 25 μ m.



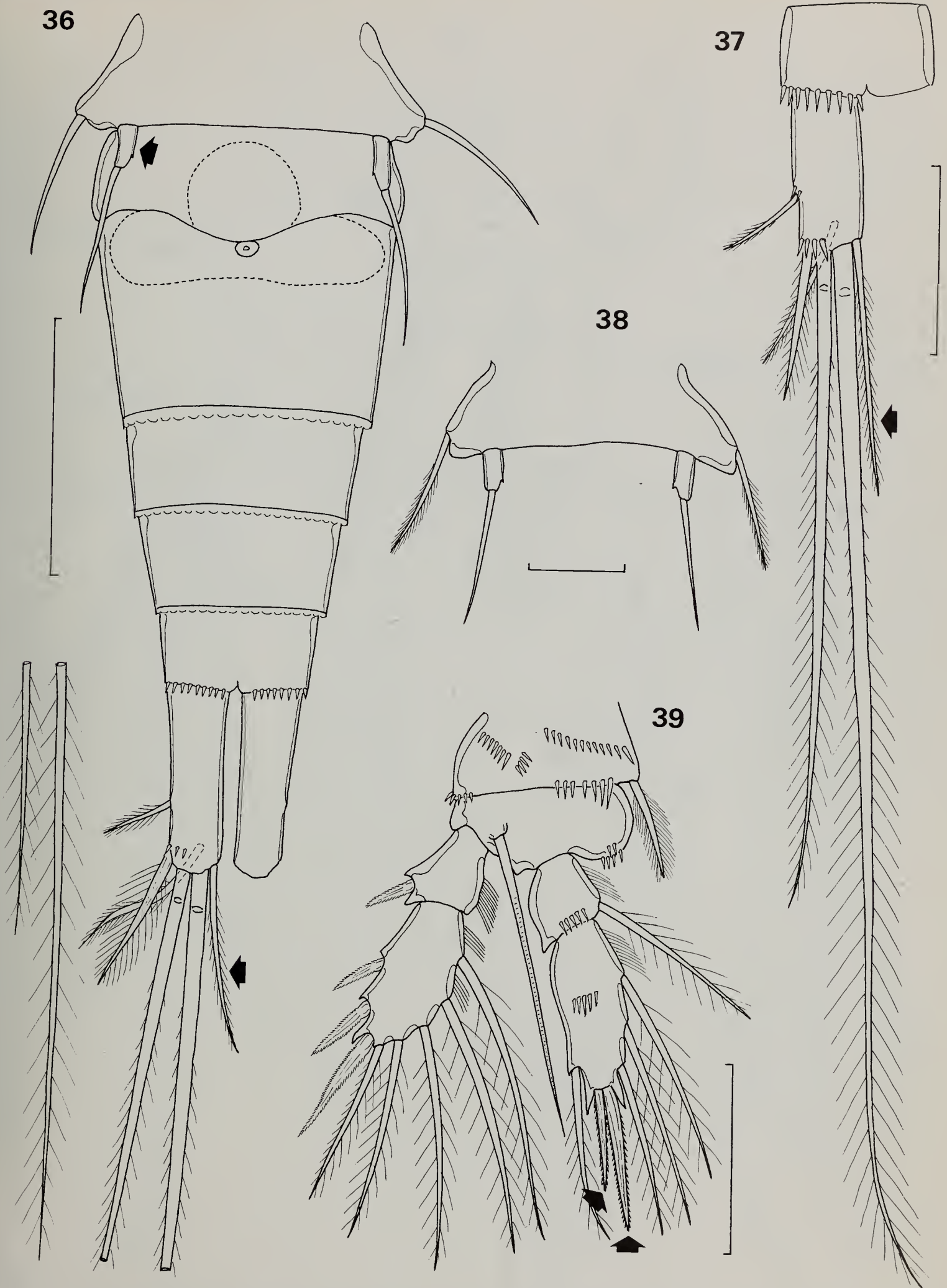
Figs 26–28 *Afrocyclops curticornis*: 26a, antennule redrawn from Kiefer (1933) to show length relative to cephalothorax. *Afrocyclops gibsoni*: 26b, female; 27, female urosome; 28, leg 4. Scale bars 26 = 200µm, 27 = 100µm, 28 = 50µm.



Figs 29-32 *Afrocyclops ikennus*: 29, female urosome; 30, leg 4. *Afrocyclops doryphorus*: 31, fifth leg; 32, leg 4. Scale bars 29 = 100µm, 30-32 = 50µm.

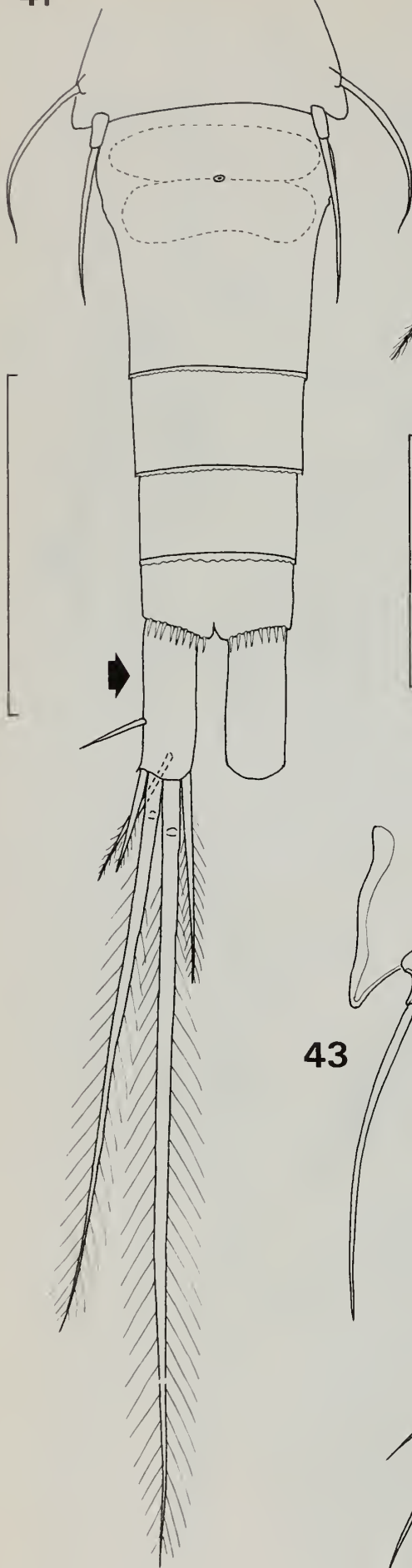


Figs 33–35 *Metacyclops pseudoanceps*: 33, syntype female urosome; 34, leg 1. *Metacyclops minutus*: 35, female urosome. Scale bars 33 and 35 = 100 μ m, 34 = 50 μ m.

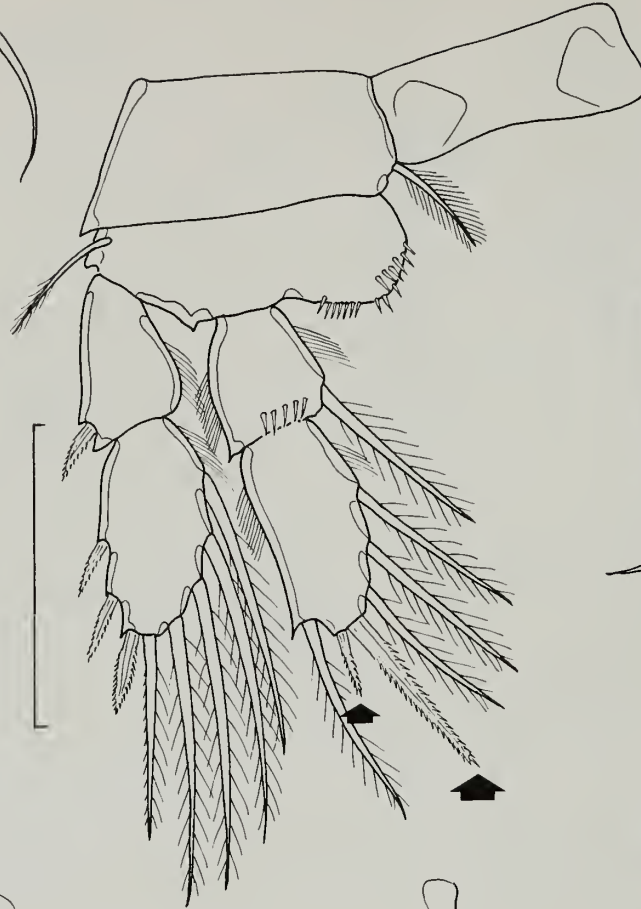


Figs 36-39 *Microcyclops varicans subaequalis*: 36, female urosome. *Microcyclops jenkiniae*: 37, male anal somite and caudal ramus; 38, fifth legs; 39, leg 4. Scale bars 36 = 100µm, 37 and 39 = 50µm, 38 = 25µm.

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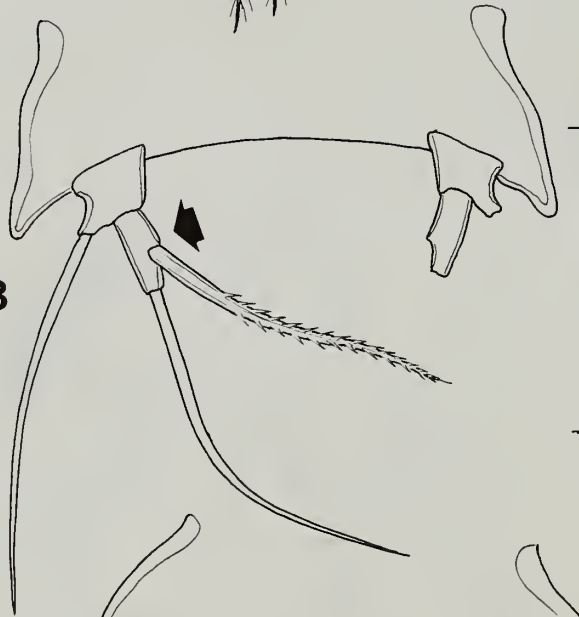
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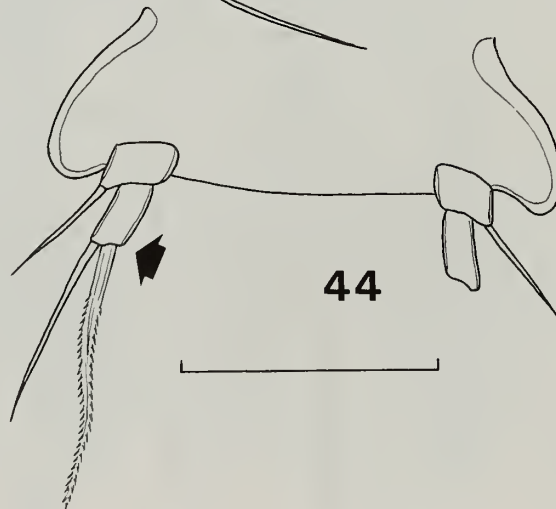
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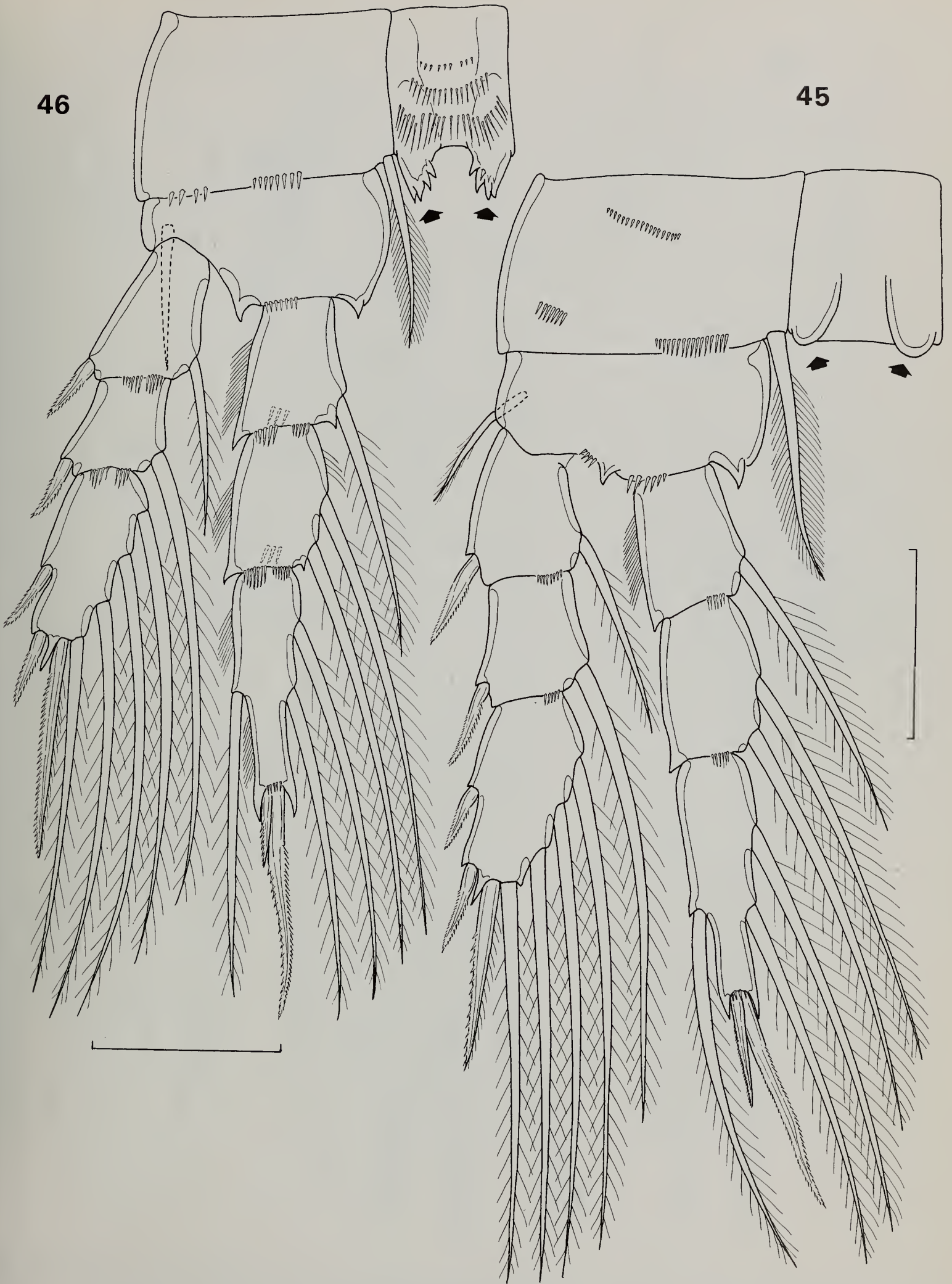
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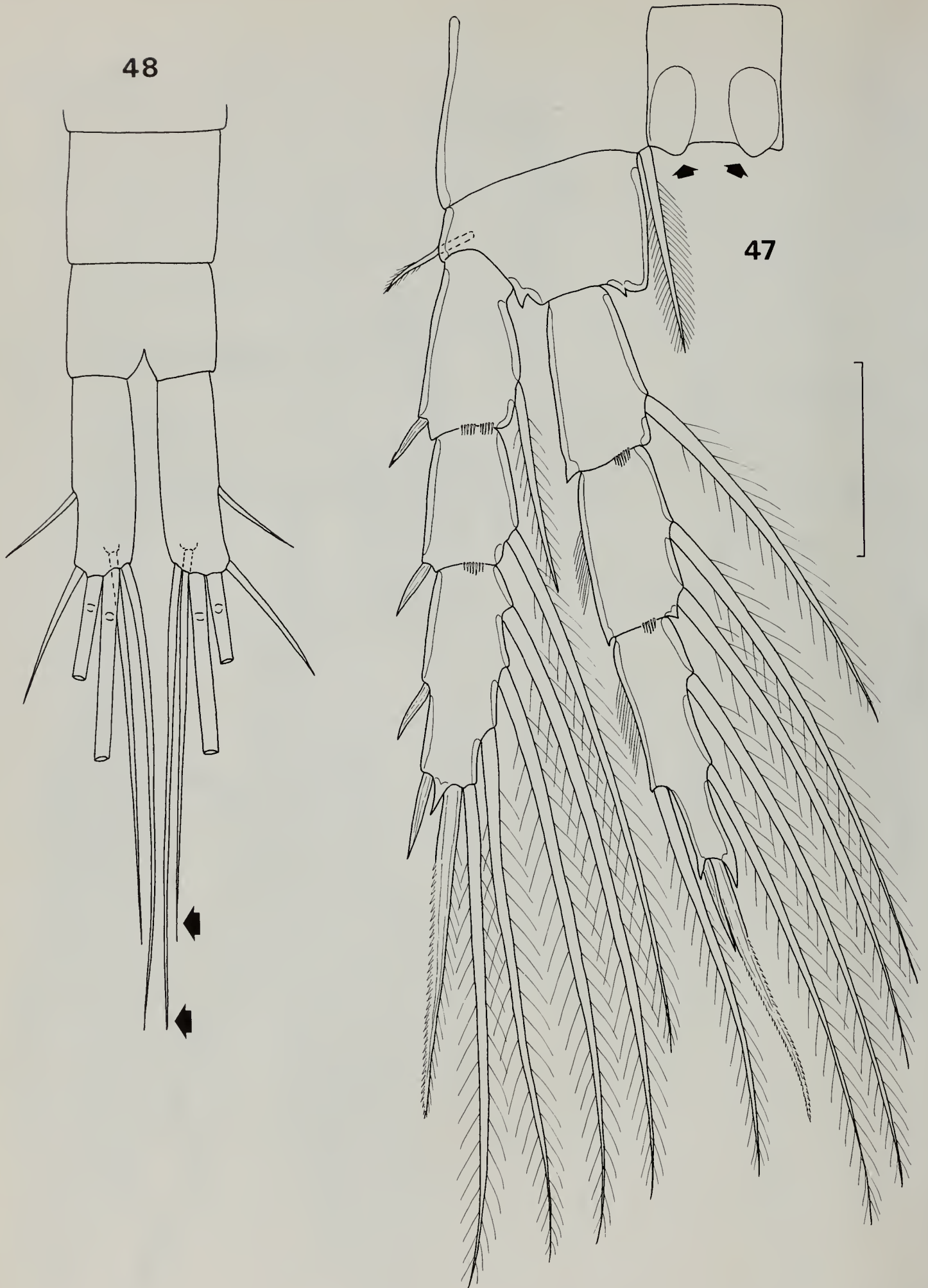
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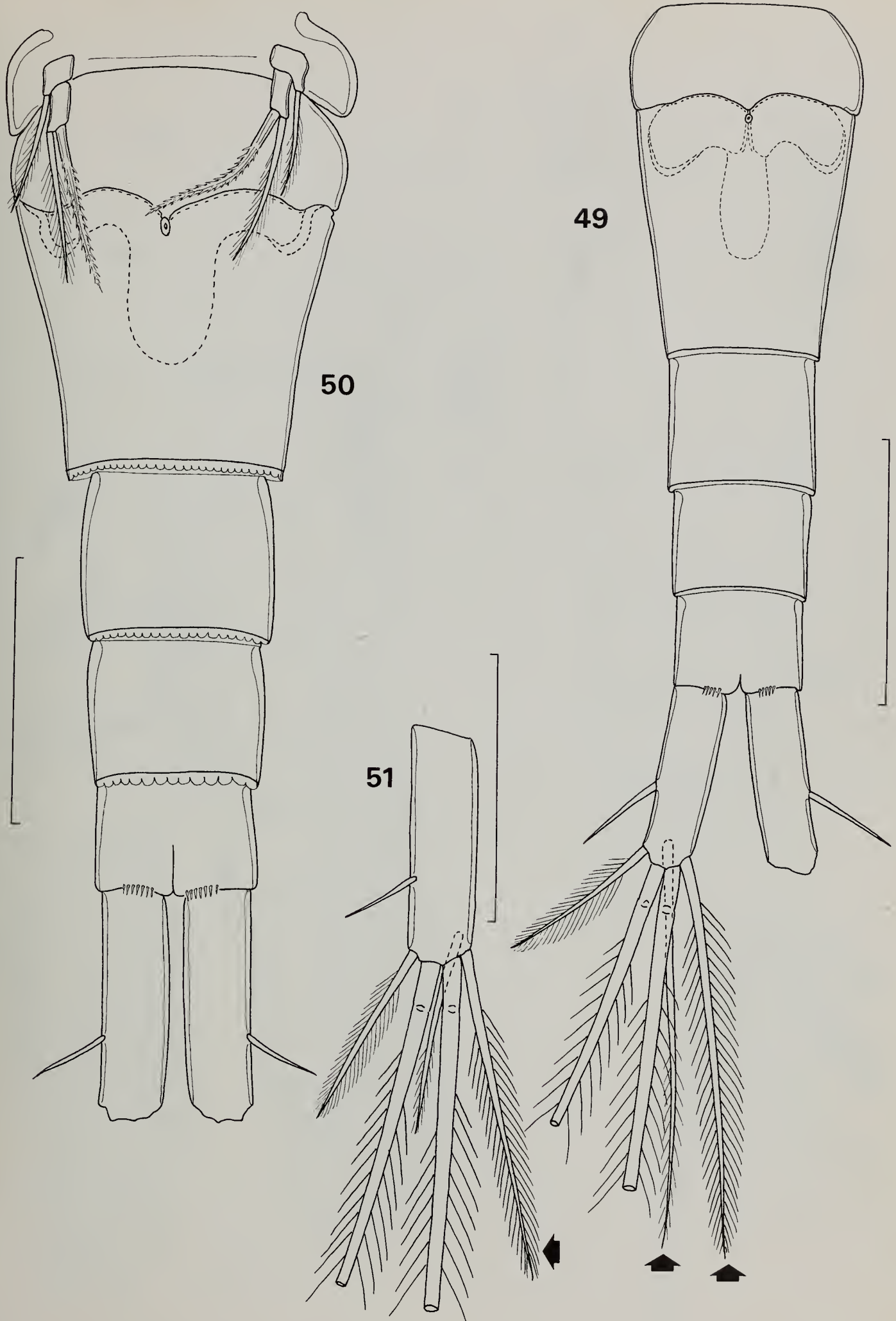
Figs 40–44 *Cryptocyclops bicolor*: 40, anal somite and caudal ramus. *Cryptocyclops linjanticus*: 41, female urosome; 42, leg 4. *Mesocyclops aspericornis*: 43, fifth legs. *Thermocyclops oblongatus*: 44, fifth legs. Scale bars 40, 42–44 = 50µm, 41 = 100µm.



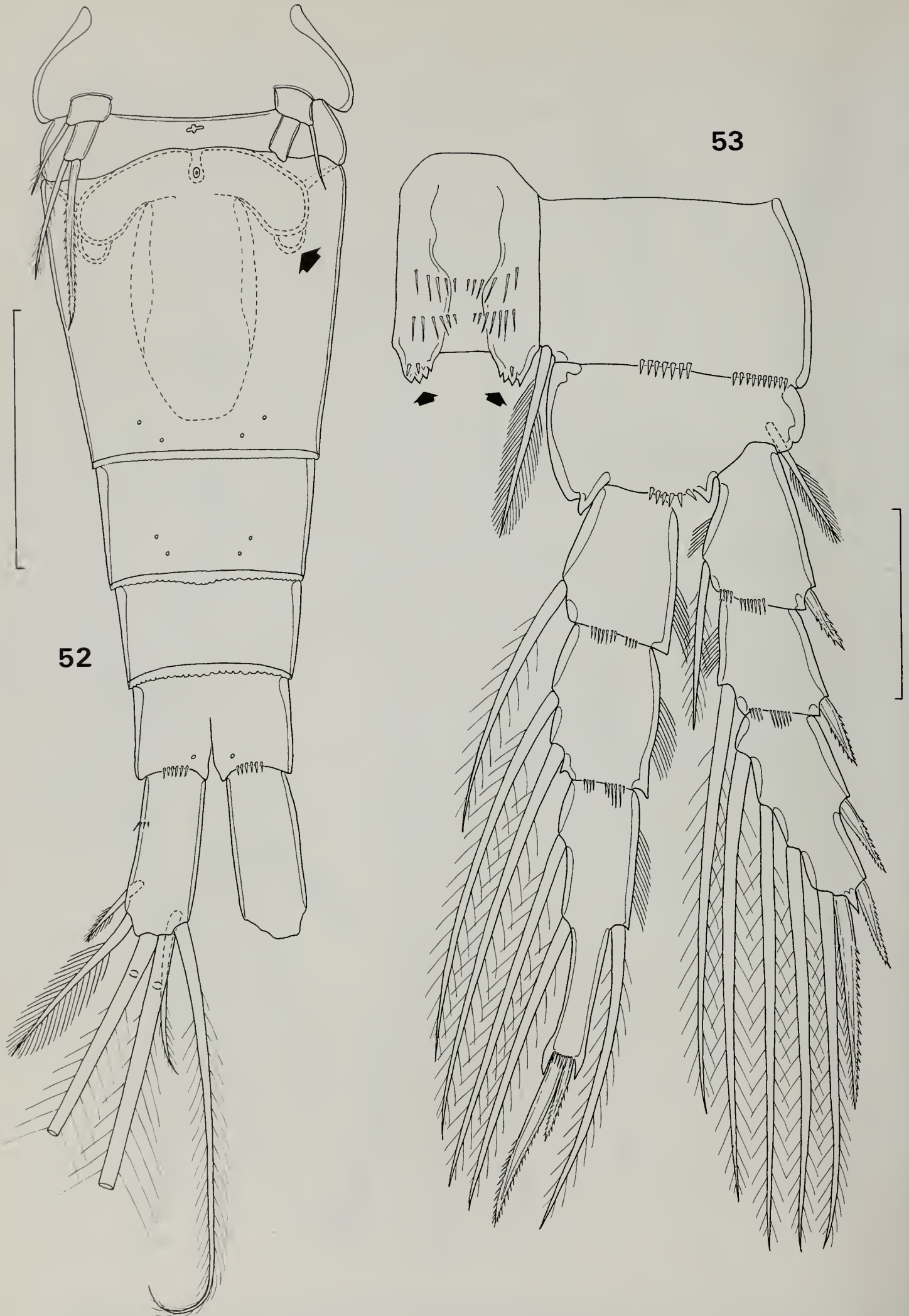
Figs 45–46 *Thermocyclops inopinus*: 45, leg 4. *Thermocyclops neglectus*: 46, leg 4. Scale bars = 50µm.



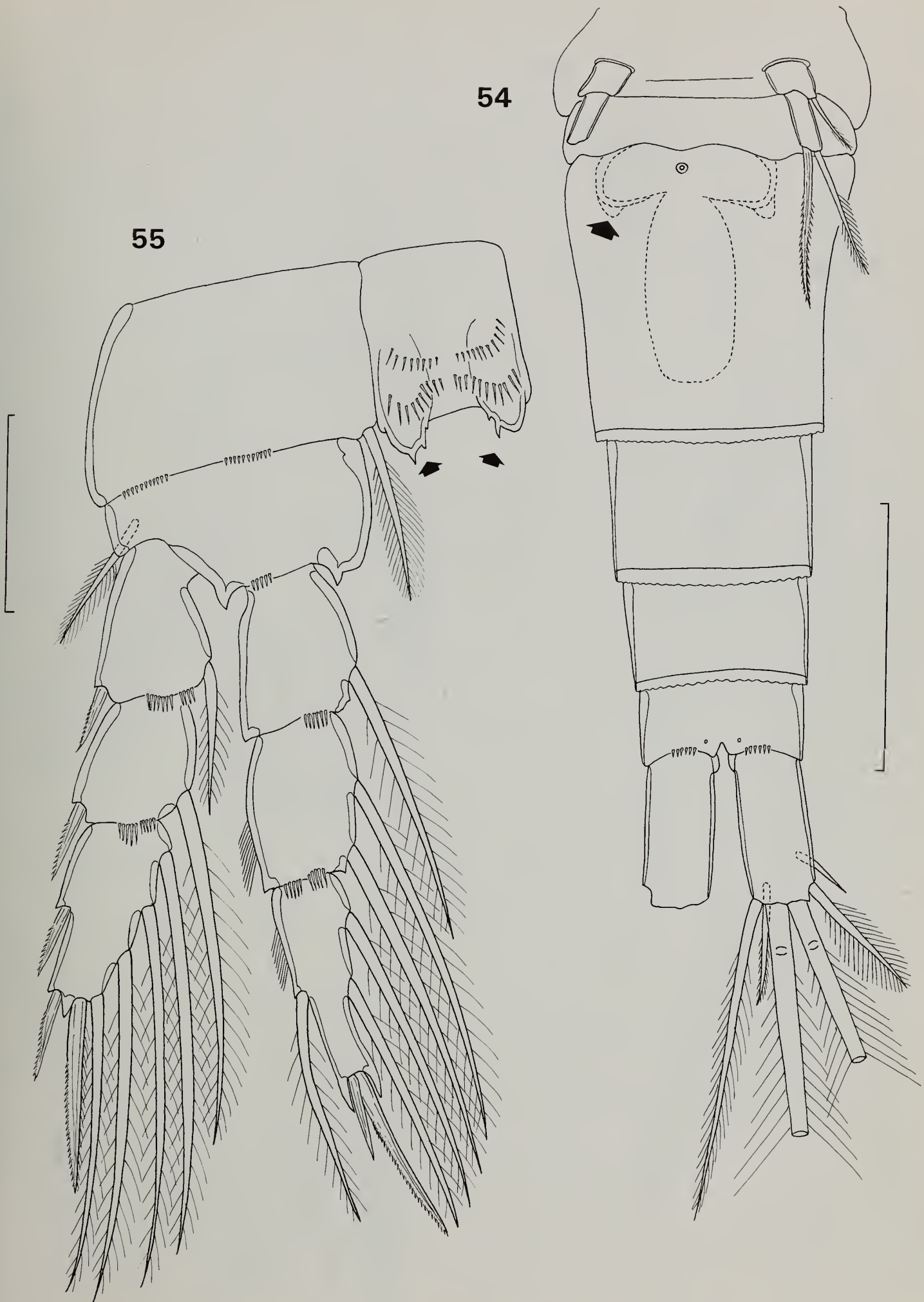
Figs 47–48 *Thermocyclops iwoyensis*: 47, leg 4. *Thermocyclops incisus*: 48, posterior part of urosome and caudal rami, redrawn from Kiefer (1933). Scale bar = 50 μ m.



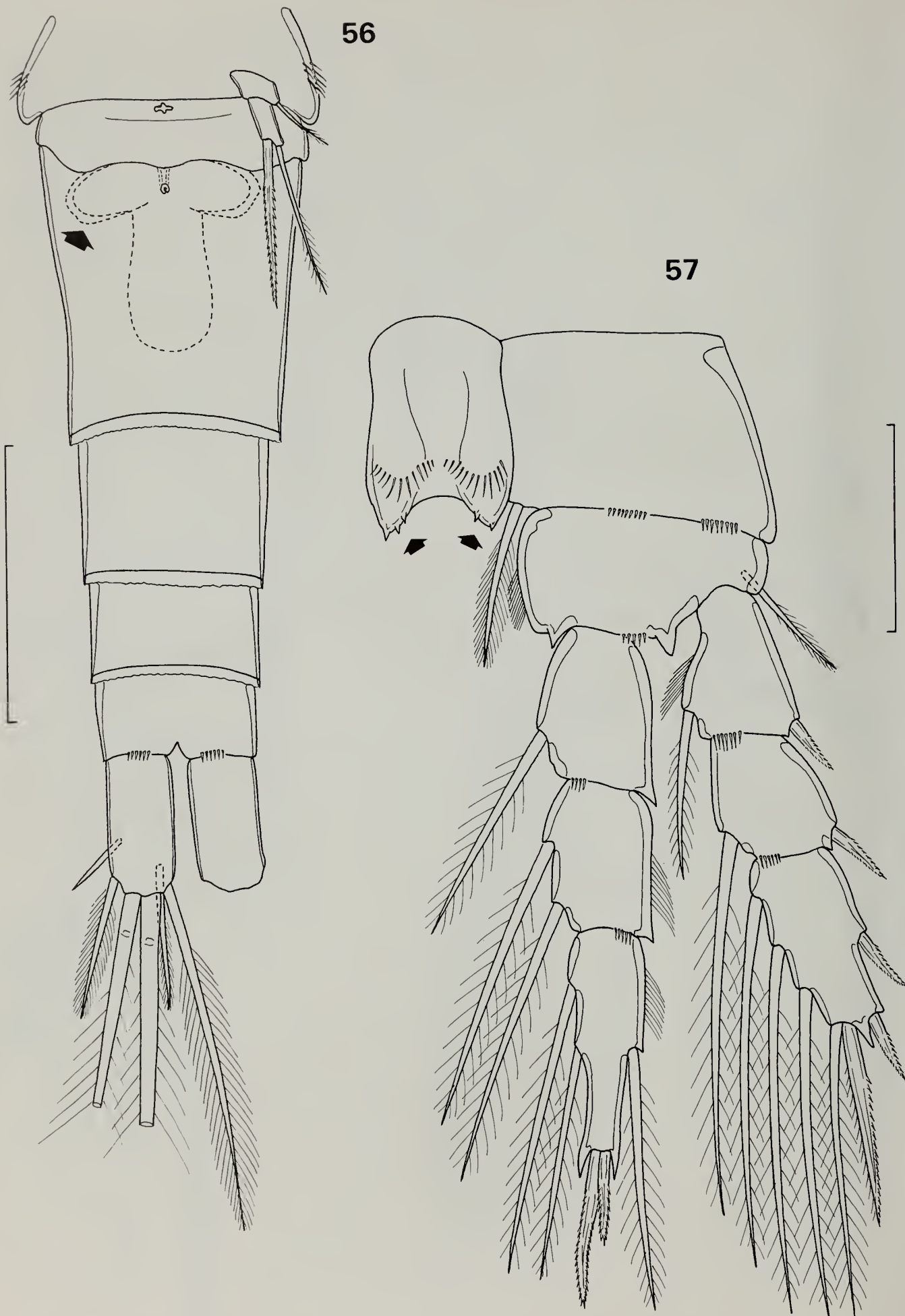
Figs 49-51 *Thermocyclops iwoyensis*: 49, female urosome. *Thermocyclops inopinus*: 50, female urosome; 51, caudal ramus. Scale bars = 100µm.



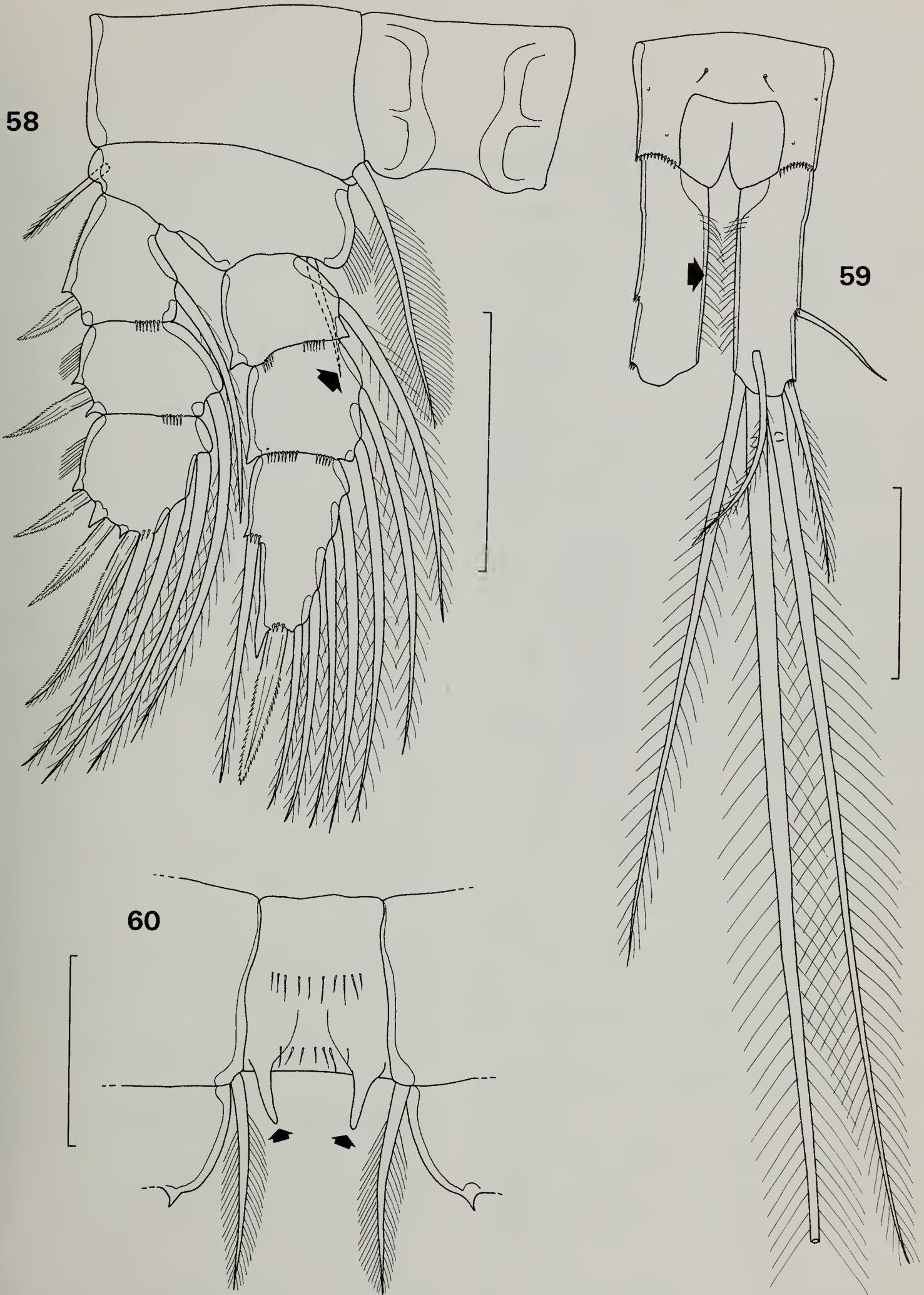
Figs 52-53 *Thermocyclops oblongatus*: 52, female urosome; 53, leg 4. Scale bars 52 = 100µm, 53 = 50µm.



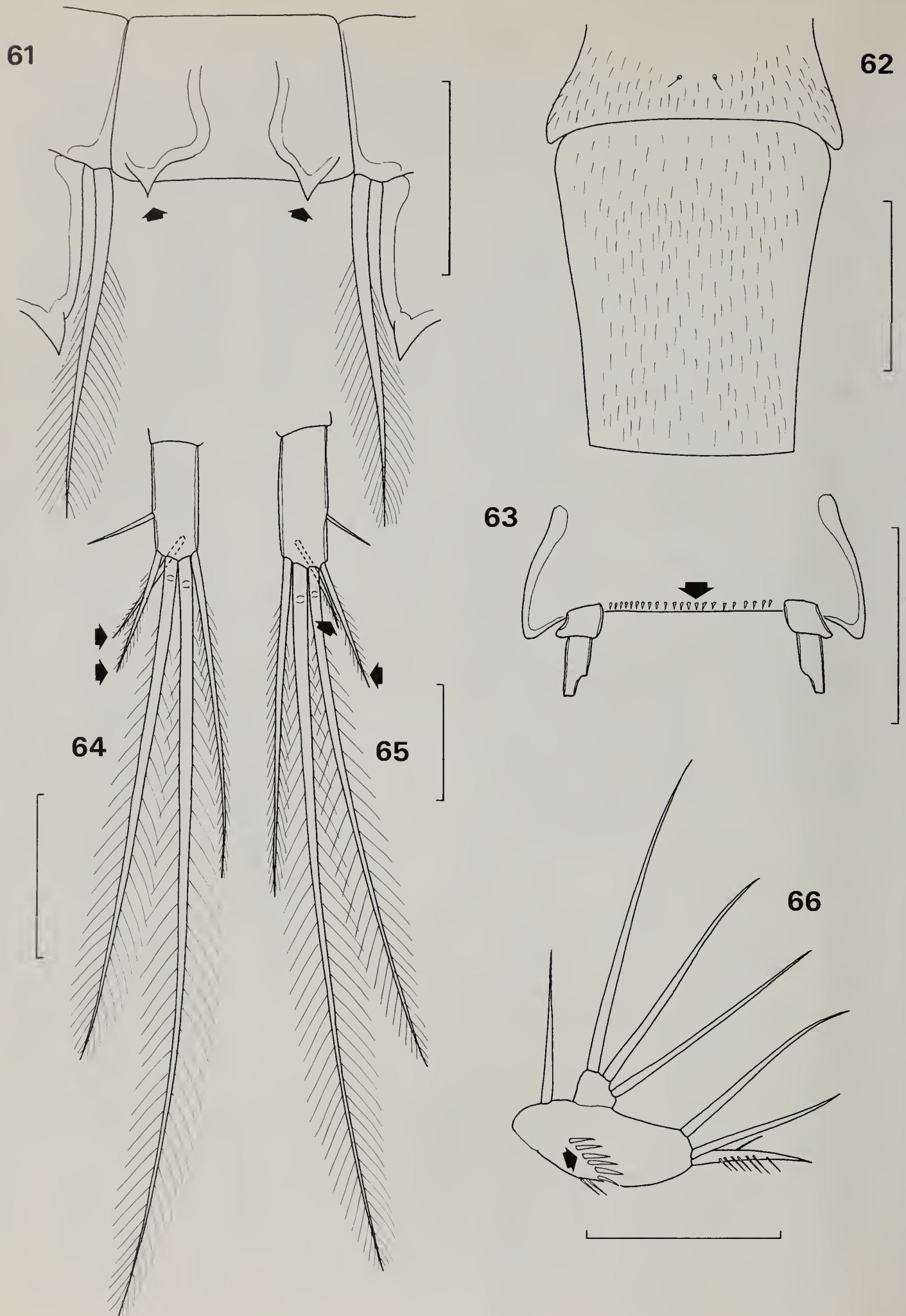
Figs 54-55 *Thermocyclops crassus*: 54, female urosome; 55, leg 4. Scale bars 54 = 100µm, 55 = 50µm.



Figs 56–57 *Thermocyclops decipiens*: 56, female urosome; 57, leg 4. Scale bars 56 = 100 μ m, 57 = 50 μ m.



Figs 58–60 *Mesocyclops rarus*: 58, leg 1. *Mesocyclops aspericornis*: 59, anal somite and caudal rami. *Mesocyclops salinus*: 60, syntype female, intercoxal plate of leg 4. Scale bars 58 = 100µm, 59–60 = 50µm.



Figs 61–66 *Mesocyclops aequatorialis similis*: 61, intercoxal plate of leg 4; 65, caudal ramus. *Mesocyclops major*: 62, anterior part of urosome; 63, fifth pedigerous somite, ventral. *Mesocyclops ogunnus*: 64, syntype female, caudal ramus; 66, maxillary palp redrawn from van de Velde (1984). Scale bars 61 and 66 = 50 μ m, 62–65 = 100 μ m.

Mkpani village, Cross River State, Nigeria by Braide, and 3 ♀♀ collected from Obuasi, Ghana by Graham, BM(NH) 1909.12.11.14.23.

28. *Mesocyclops major* Sars, 1927: (Fig. 62–63)

M. major was described from South Africa and was not found again until Van de Velde (1984) revised the African *Mesocyclops* and discovered that *M. major* is widespread South of the Sahara in all climatic belts from hyper-arid to equatorial. It was reported from Nigeria for the first time by Sridhar & Kale (1985) who collected it at Ijere, Oyo State.

MATERIAL EXAMINED. 2 ♀♀ collected from Mkpani village, Cross River State, Nigeria by Braide.

29. *Mesocyclops salinus* Onabamiro, 1957: (Fig. 60).

This species was described from brackish water at Korodu beach, near the sea at Lagos by Onabamiro (1957). It was not reported after its original description until Van de Velde (1984) recognised it as a widely distributed species in Africa south of the Sahara. Jeje (1988) reported *M. salinus* from several localities south of the river Niger and its major tributary, the river Benue.

MATERIAL EXAMINED. 4 ♀♀ syntypes collected from Korodu Beach, near Lagos, Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.1.

30. *Mesocyclops aequatorialis similis* Van de Velde, 1984: (Fig. 61, 65)

There are two subspecies of *M. aequatorialis* found in Africa (Van de Velde, 1984) and although many of the old records of *M. leuckarti* are attributable to this species it is usually not possible to refer to a particular subspecies. *M. aequatorialis aequatorialis* (Kiefer, 1929) is restricted to Lakes Kivu and Tanganyika whereas *M. aequatorialis similis* is widely distributed in Africa south of the Sahara (Van de Velde, 1984). On the basis of known distributions Green's (1962) record of *Mesocyclops leuckarti aequatorialis* is probably referable to *M. aequatorialis similis*. Jeje (1988) reported *M. aequatorialis similis* present on small numbers in the Nun river at Ikolo, the river Yenagoa and a pool at Yartafki.

MATERIAL EXAMINED. 1 ♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.20. Numerous specimens collected from Mkpani village, Cross River State, Nigeria by Braide.

31. *Mesocyclops ogunnus* Onabamiro, 1957: (Fig. 64, 66)

This species was described from material collected in stagnant pools formed as the river Ogun dried out, at Abeokuta in Nigeria (Onabamiro, 1957). It tolerates brackish and saline waters and is widely distributed in Africa south of the Sahara (Van de Velde, 1984). *M. ogunnus* was reported from various habitats at Ibadan, Benin city, Patani, Aviara, Doro and Nsukka by Jeje (1988).

MATERIAL EXAMINED. 2 ♀♀ syntypes collected from stagnant pools in the river Ogun at Abeokuta, Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.2.

32. *Mesocyclops rarus* Kiefer, 1981: (Fig. 58)

This species was reported from Nigeria for the first time by Jeje (1988) who found it at a single locality, a pond in Nsukka campus botanical gardens.

MATERIAL EXAMINED. Nigerian specimens of this species were not available; 10 ♀♀, 2 ♂♂ collected from pond on Muheza Estate, Tanzania by Judith Pell on 20th September 1987, BM(NH) Reg. Nos. 1990.651–660.

33. *Mesocyclops dussarti* Van de Velde, 1984

This species was recorded from Nigeria by Jeje (1988). It occurred in a temporary pool at Port Harcourt, in fish ponds at Moniya, in the river Asaba, and in a lake at Kainji.

MATERIAL EXAMINED. None.

34. *Thermocyclops crassus* (Fischer, 1853): (Figs. 54–55)

This species was first recorded from Nigeria by Lindberg (1950), as *Thermocyclops hyalinus* (Rehberg). It was subsequently re-recorded from South West Nigeria by Onabamiro (1952a) under the same name. *T. crassus* was reported from several localities throughout Nigeria by Jeje (1988).

MATERIAL EXAMINED. Numerous specimens collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.23, by Egborge from the Oshun River, Nigeria, BM(NH) Reg. No. 1969.10.4.5, and by Braide from Mkpani village, Cross River State, Nigeria.

35. *Thermocyclops neglectus* (Sars, 1909): (Fig. 46)

This species was reported from Okolom by Lindberg (1951) and from South West Nigeria by Onabamiro (1952a). Jeje (1988) recorded *T. neglectus* from Opi lake, a temporary pool at Oheorhe, and fish ponds at Moniya.

MATERIAL EXAMINED. 3 ♀♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.22 and 10 ♀♀ collected by Tetteh from Ghana, BM(NH) Reg. No. 1974.760–770 (as *T. hyalinus*).

36. *Thermocyclops inopinus* (Kiefer, 1926): (Figs. 45, 50–51)

This species was first recorded from Nigeria by Lindberg (1951) who found both sexes at Okolom.

MATERIAL EXAMINED. 1 ♀ collected from South West Nigeria by Onabamiro, BM(NH) Reg. No. 1957.2.15.25.

37. *Thermocyclops oblongatus nigerianus* Kiefer, 1932: (Figs. 44, 52–53)

This species was described, as *Mesocyclops* (*Thermocyclops*) *nigerianus*, on material collected in Upper Volta (Kiefer, 1932). It is widely distributed throughout Nigeria. It was reported as *Thermocyclops nigerianus*, from South West Nigeria by Onabamiro (1951, 1952a, 1952b), from Anambra State by Nwosu et al. (1982), from Plateau State by Onwuliri & Obi (pers. comm.), from Kwara State by Abolarin (1979) and Edungbola & Watts (1984), from Ogun State by Ogunba & Kale (1985), and from Oyo State by Edungbola (1984) and Ogunba & Kale (1985).

MATERIAL EXAMINED. Numerous specimens collected by Onabamiro (as *T.nigerianus*) from South West Nigeria, BM(NH) Reg. No. 1957.2.15.21 and from Mkpani village, Cross River State, Nigeria by Braide.

38. *Thermocyclops decipiens* Kiefer, 1929: (Figs. 56–57)

This species was reported from the Sokoto river by Green (1962) and from a reservoir near Ibadan by Imevbore (1965). It was recorded from Oyo State by Sridhar & Kale (1985) as *Thermocyclops neglectus decipiens*. Jeje (1988) found *T.decipiens* to be the commonest Nigerian species of *Thermocyclops* and reported it from a wide range of habitat types and localities.

MATERIAL EXAMINED. 1♀ collected by Onabamiro in South West Nigeria, BM(NH) Reg. No. 1957.2.15.24 and numerous ♀♀ collected from Mkpani village, Cross River State, Nigeria by Braide.

39. *Thermocyclops incisus* Kiefer, 1932: (Fig. 48)

This species was reported from the Sokoto river by Green (1962).

MATERIAL EXAMINED. None.

40. *Thermocyclops iwoyensis* Onabamiro, 1952: (Fig. 47, 49)

This species was described on material collected at Iwoye, South West Nigeria by Onabamiro (1952a). It has not been recorded since.

MATERIAL EXAMINED. 2♀♀ paratypes collected on 13 September 1950 by Onabamiro at Iwoye village, Nigeria, BM(NH) Reg. Nos. 1952.11.28.1–2. Numerous additional specimens collected from Mkpani village, Cross River State, Nigeria by Braide.

B. Invalid species

1. *Cyclops brevipes* Brady 1910

This species was treated as incertae sedis by Dussart & Dcfaye (1985). It was identified as juveniles of *Cyclops* sensu lato by Lindberg (1950).

2. *Diacyclops gauthieri* Green, 1962

This species was established by Green (1962) as *Cyclops (Diacyclops) gauthieri* and was recorded from the Sokoto river in Nigeria. Green (1962) does not figure the urosome of his material, stating that it was described by Gauthier (1951) from Senegal but was not named. Gauthier's figures (1951: plate XXXI, figures A–D) are clearly of a fifth male copepodid stage of a *Mesocyclops*. The appendages figured by Green (1962) also closely resemble those of a male fifth copepodid of *Mesocyclops*. *Diacyclops gauthieri* is herein regarded as an indeterminate species of *Mesocyclops*, based on male fifth copepodids.

3. *Mesocyclops leuckarti* (Claus, 1857)

The confusion regarding the identification and geographical distribution of *M.leuckarti* has only recently been revealed.

Van de Velde (1984) revised the African species of *Mesocyclops* and demonstrated that *M.leuckarti* does not occur in Africa. Similarly, Kiefer (1981) analysed many other records of this species and showed that it extends through Europe into the western part of Northern Asia. All other records of *M.leuckarti* are incorrect. The taxonomic confusion is very significant for studies of the transmission of *Dracunculus* since *M.leuckarti* is by far the commonest name given in the literature as the vector both in Africa and Asia. It has been recorded many times from Nigeria (Brady, 1910, as *Cyclops nigeriae*; Lindberg, 1950, 1951; Onabamiro, 1951, 1952a, 1952b; Nwosu et al., 1982; Ogunba & Kale, 1985). Without access to the specimens upon which these reports are based it is not possible to reidentify the copepods involved. Some of the *M.leuckarti* records contain sufficient description to allow identification, for example Green (1962), and these are treated in the list of valid species given above.

4. *Eucyclops productus* Kiefer, 1936

This species is known only from Kashmir (Kiefer, 1936; Lindberg, 1939). It was recorded, without description, from Nigeria by Onabamiro (1952b). Upon re-examination, Onabamiro's material of *E.productus* (BM(NH) Reg. No. 1957.2.15.10) was found to be indistinguishable from the *Eucyclops serrulatus* collected by him in the same region of Nigeria.

C. Taxonomic remarks

Seven species of *Thermocyclops* are recorded from Nigeria. Some of these species are extremely difficult to identify. The characters used by Jeje (1988) to distinguish between *T.neglectus*, *T.crassus* and *T.decipiens* were found to be unreliable in the present study. *Thermocyclops* is one of the genera that serves as a natural host for *Dracunculus* and the African species of this genus are in urgent need of revision, as Van de Velde (1984) has revised the African species of *Mesocyclops*.

In this study a total of 40 species and subspecies of freshwater cyclopoid copepods is recognised from Nigeria. Material of most of these taxa has been examined and figured during the present study. Our primary objective was to provide a well illustrated and easy to use key for Guineaworm researchers. Obvious characters were used in the key whenever possible on the assumption that high resolution compound microscopes would not be readily available to Nigerian field workers. All major characters have been figured and the majority of the figures are original and based upon Nigerian material. Considerable emphasis was placed on the use of Nigerian material in an attempt to avoid identification problems caused by geographical variation. The key is specifically constructed for use with Nigerian material and should be used with caution elsewhere in Africa.

Key to Nigerian freshwater cyclopoid copepods

(adult females only)

1. Female antennule 6-segmented (Fig. 1); distal segment of fifth leg with 4 setae or spines (Figs 2, 5) 2
- Female antennule with 10 or more segments (Fig. 10); distal segment of fifth leg with at most 3 setae or spines (Figs. 7, 9) 3
2. Lateral margins of genital double segment rounded (Fig.

28. Projecting lateral fields on intercoxal plate of leg 4 forming large toothed process (Fig. 46) *Thermocyclops neglectus*
Projecting lateral fields on intercoxal plate of leg 4 armed with small spinules (Figs. 55, 57) 29
29. Lateral wings of seminal receptacles with small, posteriorly produced lobes (Fig. 54) *Thermocyclops crassus*
Lateral wings of seminal receptacles without posteriorly produced lobes (Fig. 56) *Thermocyclops decipiens*
30. Inner spine on basis of leg 1 present (Fig. 58) *Mesocyclops rarus*
Inner spine on basis of leg 1 absent 31
31. Inner margin of caudal rami with row of setules (Fig. 59) *Mesocyclops aspericornis*
Inner margin of caudal ramus devoid of setules 32
32. Intercoxal plate of leg 4 with finger-like processes laterally (Fig. 60) *Mesocyclops salinus*
Intercoxal plate of leg 4 with lateral processes rounded, or short and pointed (Fig. 61) 33
33. Dorsal surface of genital double segment completely covered with short setules (Fig. 62) 34
Dorsal surface of genital segment devoid of setules 35
34. Ventral margin of fifth pedigerous somite with row of spinules between fifth legs (Fig. 63); intercoxal plate of leg 4 with setules on caudal surface *Mesocyclops major*
No row of spinules on somite between fifth legs; intercoxal plate of leg 4 without setules *Mesocyclops dussarti*
35. Maxillulary palp with row of spinules (Fig. 66); dorsal seta on caudal rami about equal to outer apical seta (Fig. 64) *Mesocyclops ogunnus*
Maxillulary palp without row of spinules; dorsal seta on caudal rami shorter (about 2/3rds) than outer apical seta (Fig. 65) *Mesocyclops aequatorialis*

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