

Fig. 21. *Mesocyclops ogunnus* Onabamiro Lake Tchad. A, A₁; B. Antennular segments 16 & 17, frontal side; C_b. Basipodite A₂, caudal side; D. Labrum; E. Mandible; F. Maxilla; G. Maxilliped; D-E: ventral side, F-H: caudal side.

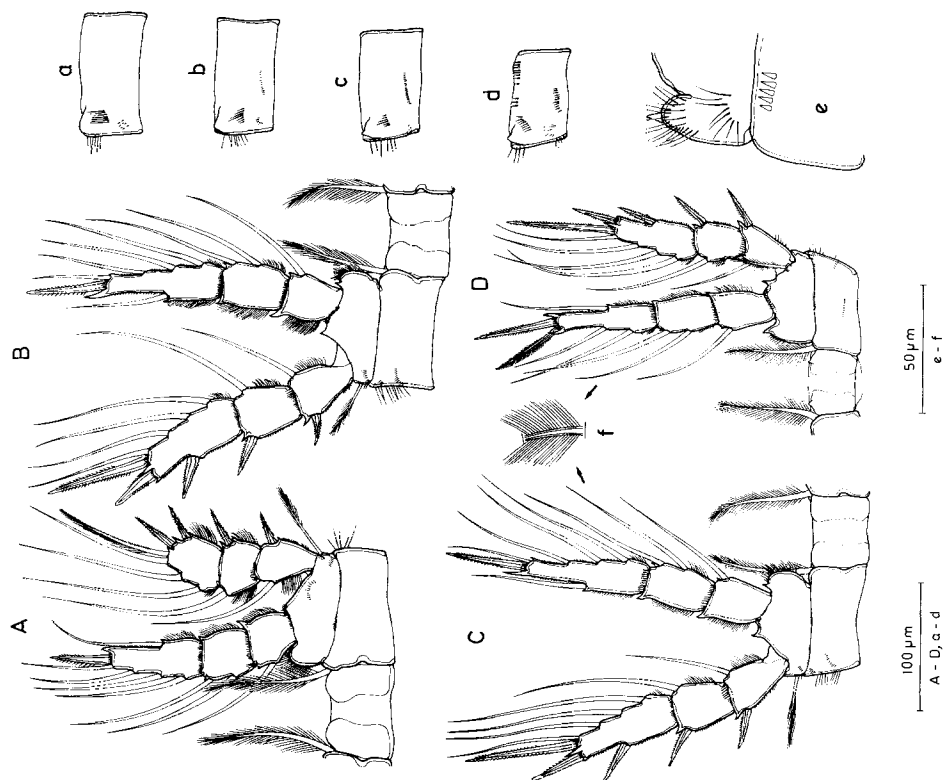


Fig. 22. *Mesocyclops ogunnus* Onabamiro Lake Tchad. A-D. Structure P-P₄, frontal side; a-d: coxopodite P-P₄, caudal side; e: inner portion coxo- and basipodite of P₄, caudal side; f: ornamentation setae of endo- and exopodites.

Further records are in South-East Africa: South Mozambique and Natal (river Pongolo). *M. ogunus* appears to be absent from the Western Rift. It is present in Lake Rudolf and in the Ethiopian highland and it has used the river Nile to extend northwards. It is found as far as Lake Kinneret (Israel). It also tolerates brackish and saline waters.

Mesocyclops aequatorialis aequatorialis (Kiefer, 1929)

1929 *Mesocyclops leuckarti aequatorialis* Kiefer [partim], Z. wiss. Zool., Vol. 133, p. 17.

1952 *Mesocyclops leuckarti aequatorialis*, Kiefer [partim], Explor. Parc Natn. Albert Mission H. Damas 1935/1936, Vol. 21, p. 99.

1956 *Mesocyclops leuckarti aequatorialis*, Kiefer, Revue Zool. Bot. afr., Vol. 54, p. 254, Figs 26–38.

1981 *Mesocyclops aequatorialis*, Kiefer [partim], Arch. Hydrobiol., Suppl. 62, Vol. 1, p. 168, Fig. 7.

Type locality: ? Lake Kivu (see remarks)

Type material: not indicated

Material examined (specifications see Table 1)

– Lake Kivu: Kanyungi, Kisenyi, Kawa, Buleke.

– Lake Tanganyika: Uvira.

Redescription of female

Since Kiefer (1929, 1981) indicated no type material, the following description is based on specimens from Lake Kivu (coll. Kiefer).

Mean total body length: 919 μm ($n = 5$).

Antennule. Reaches to middle of third thoracic segment. Spinule patterns on segments 1, 4–5 and 7–13 (Fig. 23D). Hyaline membrane with one deep notch (Fig. 23E).

Antenna. Structure of endopodite as in *M. leuckarti*.

Basipodite (Figs. 23A–B): in addition to the basic pattern an oblique row of minute spinules occurs on medial caudal side. A group of spinules can be present on caudal side near exopodite seta (Fig. 27A). This group of spinules may be present or absent, even in specimens from the same locality. Longitudinal row of, on average, seven spines on

caudal side; row proximal to this, on average with five minute spinules; longitudinal row on frontal side with, on average, fifteen spines.

Maxillule (Fig. 23C). Basis of maxillary palp without a group of spines.

Thoracopods P₁–P₄. Spine- and seta-formula as in *M. leuckarti*. Connecting lamella of P₁–P₄ not pilose.

P₁ (Figs. 23F–G). Spine on inner distal margin of basipodite absent.

P₄ (Figs. 23H–I). Enp₃ on the average 3.52 times as long as wide. Inner apical spine usually longer than outer one, at times equal to outer spine. Armature of external margin of outer spine as in Fig. 23I. Caudal side of connecting lamella not pilose; prominences weakly developed just reaching over distal margin of connecting lamella. Inner lateral part of caudal side of coxopodite naked (Fig. 23H). Inner part of caudal side of basipodite proximally with a row of setules, distally with a group of setules (Fig. 23H).

P₅ (Fig. 24A). Spinous seta (63 μm) considerably shorter than seta (131 μm) implanted on same segment. Seta (100 μm) of distal segment longer than spinous seta and, reaches as far as, or slightly exceeds distal margin of genital segment.

P₆ (Fig. 24C). Composed of two spines and one seta.

Last thoracic segment (Figs. 24A–B–D). Bears only ventro-laterally and laterally a few setules.

Receptaculum seminis. As in Fig. 24D; striking is the structure of the posterior margin of the proximal part which is strongly chitinized. Pore-canal straight, without any curvature.

Abdominal segments. Only last abdominal segment set with a few rows composed of minute spinules as in Figs. 24F–G. Dorsal and ventral distal margin of last abdominal segment fringed with a row of spines.

Furca (Figs. 24F–G). Furcal rami on the average 3.0 times as long as wide and, not pilose internally. With the light microscope no patterns of spinules can be seen on the ventrum and dorsum. Dorsal furcal seta distinctly longer than external seta. Implantation of lateral and external setae provided with spinules.

Description of male

Illustrations of abdomen and P₆ of a male from Lake Kivu are given by Kiefer (1981, p. 168: Fig.

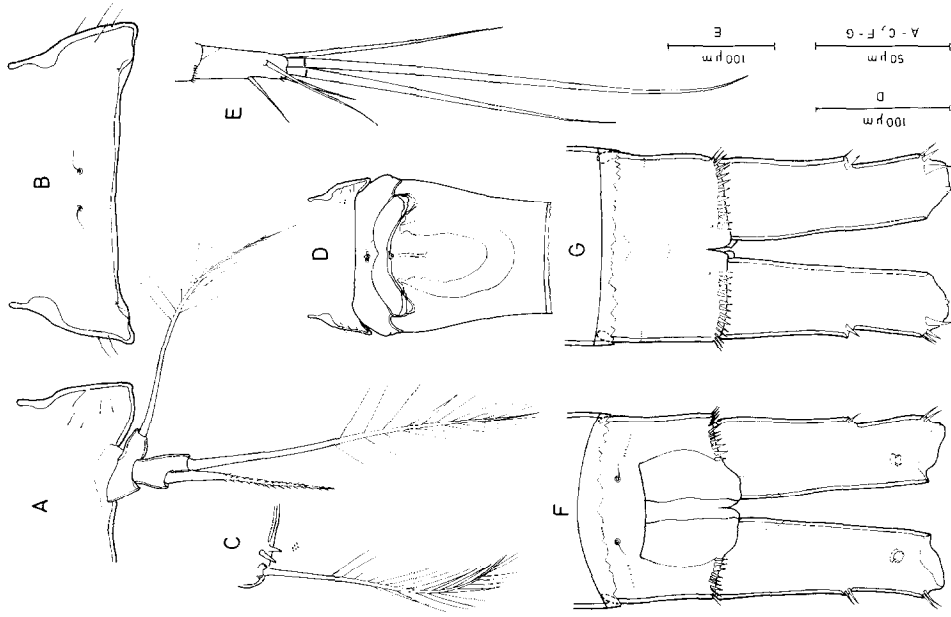


Fig. 24. *Mesocyclops aequatorialis aequatorialis* (Kiefer) Lake Kivu. A. P₅; B. Last thoracic segment, dorusum; C. P₆; D. Last thoracic segment and genital segment with receptaculum seminis; E. Furca; F. Last abdominal segment and furcal rami, dorsal view; G. Last abdominal segment and furcal rami, ventral view.

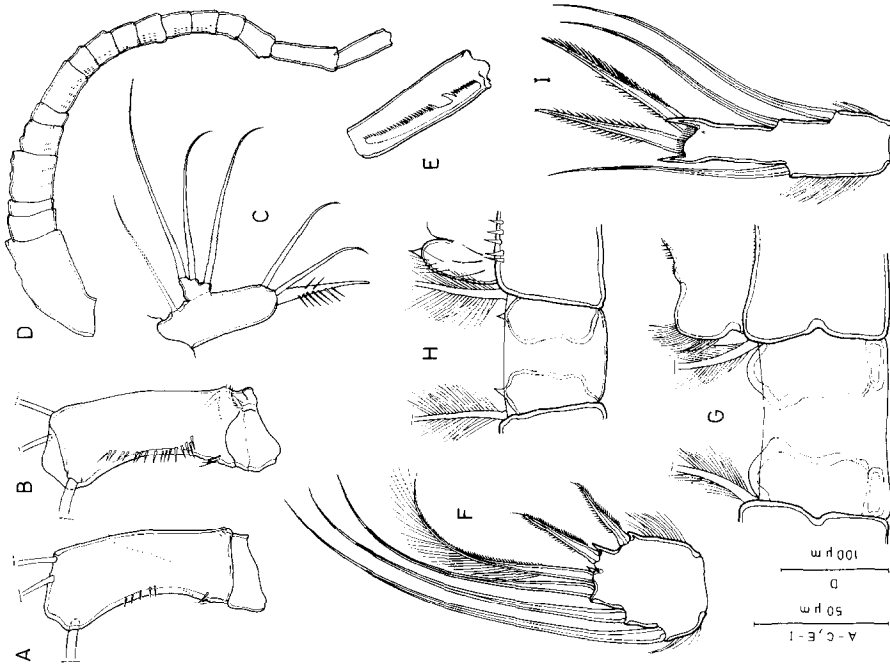



Fig. 23. *Mesocyclops aequatorialis aequatorialis* (Kiefer) Lake Kivu. A. Basipodite A₂, caudal side; B. Basipodite A₂, frontal side; C. Maxillary palp; D. A₁; E. Antennular segment 17; F. Exp₃P₄; G. Connecting lamella and inner portion of coxo- and basipodite of P₄; H. Connecting lamella and inner portion of coxo- and basipodite of P₄; I. Exp₃P₄.

10–11). The following description is based on specimens from Lake Tanganyika (Uvira).

Mean total body length: 679 μm ($n = 5$). Armature of antennule as in the other species. Spine pattern on basipodite of antenna as in female; the same variability, i.e. presence or absence of the group of spinules near exopodite seta, was found. Structure of P_1 - P_4 and P_5 as in female. P_6 composed of one spine (23 μm) and two setae (24 μm and 80 μm). Last thoracic segment in contrast to female with no setules ventro-laterally and laterally. Dorsal furcal seta as in female longer than external furcal seta.

Variability: females

Total body length between 835 μm and 966 μm . Furcal index: 2.92–3.38. No structural differences were found between the populations of Lake Kivu and Lake Tanganyika. Variability in spine pattern on basipodite of antenna only in one locus: spine group on caudal side at level of exopodite seta may be absent or present (Figs. 27A: , B). The usual variability, between restricted limits, was found in the number of spines per row: longitudinal row on caudal side 5–8 spines, row proximal to this last row 3–6 spines and longitudinal row on frontal side 13–17 spines.

Differential diagnosis

M. a. aequatorialis can be differentiated from *M. a. similis* subsp. n. by the spine pattern on the basipodite of the antenna, the structure of P_5 and by the length of the dorsal furcal seta which exceeds the external in length.

Distribution (Fig. 42)

M. a. aequatorialis is abundantly present in both the pelagial and the littoral of Lake Kivu and Lake Tanganyika. At present it is the only representative of *Mesocyclops* in Lake Kivu; in Lake Tanganyika in addition one record is known of *M. kieferi*.

Remarks

In 1929 Kiefer described *M. leuckarti aequatorialis* from specimens collected in Africa and Asia (without designating type specimens) and no doubt this material was a mixture of several taxa. In his work of 1981, the author redescribed the taxon using specimens from Lake Kivu as the material of 1929 was no longer usable for redescription (Kief-

ers, pers. commun.). *M. leuckarti aequatorialis* was raised to specific rank as from both biogeographical and morphological point of view '*aequatorialis*' could no longer be considered as a subspecies of *M. leuckarti*.

According to Kiefer (1981) *M. aequatorialis* is distributed in the East African Lake District, Lake Tchad and on Tenerife. A closer examination showed that *M. aequatorialis* is composed of two subspecies: *M. a. aequatorialis*, restricted to Lakes Kivu and Tanganyika and *M. a. similis* subsp. n., widely distributed on the African continent.

Mesocyclops aequatorialis similis subsp. n.

- 1952 *Mesocyclops leuckarti aequatorialis*, Kiefer [partim], Explor. Parc natn. Albert, Mission H. Damas 1935/1936, Vol. 21, p. 99.
 1978 *Mesocyclops leuckarti*, Van de Velde [partim], Biol. Jaarb., Vol. 46, p. 194.
 1981 *Mesocyclops* sp. 5, Dumont *et al.*, Hydrobiologia, Vol. 80, p. 165.
 1981 *Mesocyclops aequatorialis*, Kiefer [partim], Arch. Hydrobiol., Suppl. 62, p. 167.

Type locality: Kenya, Lake Naivasha (1 020 m a.s.), leg. K. Mavuti, Nairobi, 4-10-1979.

Type material

holotype: one ♀ without eggs, mounted on two slides as described above;
 allotype: one ♂, mounted on one slide;
 paratypes: four dissected females, each mounted on two slides; one tube containing undissected specimens preserved in a formaldehyde/glycerine mixture: 35 ♀ (with and without eggs), five ♂ and ten copepodids stage V.

Repository of type material

Holotype, allotype and six undissected specimens (4 ♀, 2 ♂) deposited in the Koninklijk Museum voor Midden-Afrika, Tervuren, Belgium. Five paratype females in the collection of Prof. Kiefer (Konstanz). Remaining paratypes in the collection of the Zoological Institute, University of Gent.

Etymology: the subspecies is named '*similis*' due to its close resemblance with *M. aequatorialis aequatorialis*.

Material examined (specifications see Table 1)

Kenya: Naivasha (type material); Senegal: Nieri Ko, Simenti, Ross Bethio; Mali: Niafunké, Horo, Télé, Mbuna, Tin Geicha, Tombouctou, Dyabali, Markala, Mopti, Sanga, Gossi, Aougoundou; Guinée-Bissau: Rio Geba; Ivory Coast: Gagouin; Upper-Volta: Loumbila; Algeria: Djanet, Beibei, Oued Adjerii; Zaire: Kolwezi, Jadotville, Wamba, Saké; Ruanda-Burundi: Astrida, Rugwero, Birira, Tsohoho; Ethiopia: Koka, Awassa, Black River, Hora, Bishoftu, Akaki, Debre Marcos, Langano, Zway, Abyata, Tana.

Description female (holotype)

Total body length of the holotype: 1 495 μm ; for other measurements see Table 7.

Antennule (Fig. 25A-B). As in *M.a. aequatorialis*.

Antenna. Structure of endopodite as in the nominate subspecies.

Basipodite (Figs. 25D-E). In addition to the basic pattern a row of minute spinules present on medial caudal side. At the level of exopodite seta a group of spines and, at the level of inner apical setae a patch of minute spinules present. Longitudinal row of

spines on caudal side with fourteen spines, row proximal to this with thirteen spines; longitudinal row on frontal side with 33 spines.

Mouthparts. As in the nominate subspecies.

Thoracopods P₁-P₄. The following differences are noted from *M.a. aequatorialis*. Segments more robustly built, prominences on distal margin of connecting lamella of P₄ slightly more prominent and L:W ratio of Enp₃P₄ 2.81 (Fig. 25I). Armature of inner apical spine of Enp₃P₄: external margin set with robustly built spinules whereas in *M.a. aequatorialis* the spinules are fine.

P₅ (Fig. 26C). Spinous seta on distal segment slightly shorter than seta implanted on the same segment and markedly longer than seta implanted on basal segment.

P₆ (Fig. 26D). Composed of two spines and one seta; this seta is markedly shorter than in the nominate subspecies.

Last thoracic segment (Figs. 26A-C). Laterally more densely setose than in *M.a. aequatorialis*.

Receptaculum seminis (Fig. 26B). As in nominate subspecies.

Abdominal segments (Figs. 26F-G). As in *M.a. aequatorialis*.

Table 7. Morphometry of *Mesocyclops aequatorialis similis* subsp.n. (Naivasha, Kenya). Measurements in μm .

		Holotype	Allotype	Paratypes (♀)			
Cephalothorax	L	541	354	533	525	491	516
	W	499	300	508	499	433	492
	L:W	1.08	1.18	1.05	1.05	1.13	1.05
Ceph. + Thorax	L	949	621	916	949	883	882
Genital segment	L	216	117	167	166	158	208
	W	167	113	208	233	212	154
	L:W	1.29	0.97	1.25	1.40	1.34	1.33
Abdomen	L	425	300	425	458	412	433
Furca	L	121	76	125	123	106	121
	W	38	25	44	40	37	38
	L:W	3.18	3.04	2.84	3.07	2.86	3.18
Total body length		1 495	997	1 511	1 530	1 401	1 436
Enp ₃ P ₄	L	104	70	104	108	91	91
	W	37	21	38	38	33	33
	L:W	2.81	3.33	2.74	2.84	2.76	2.79
Enp ₃ P ₄	sp _i	79	63	79	75	75	77
	sp _e	80	58	77	79	65	79
	sp _i :sp _e	0.98	1.09	1.03	0.94	1.15	0.97
	Furcal setae	S _i	292	183	308	283	266
	S _{mi}	566	400	566	575	533	516
	S _{me}	358	308	433	425	383	408
	S _e	121	79	120	121	108	133
	S _d	83	58	92	83	75	79

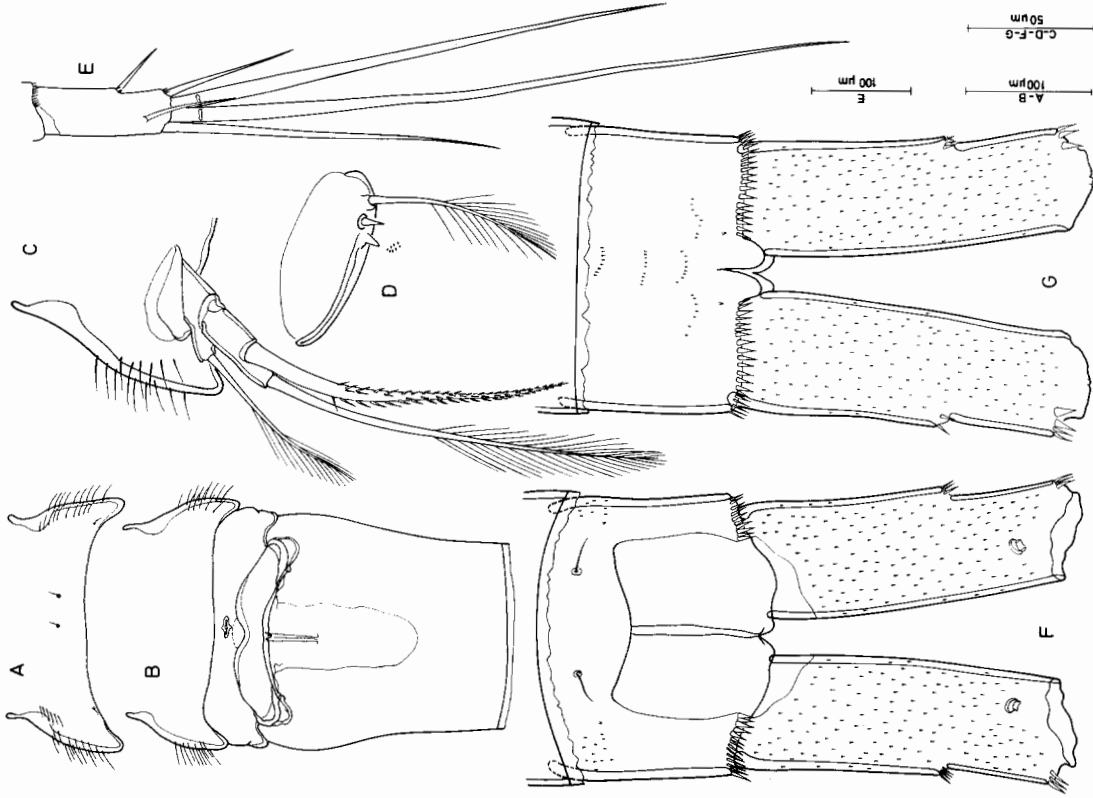


Fig. 26. *Mesocyclops aequatorialis similis* subsp. n. (holotype) Naivasha, Kenya. A. Last thoracic segment and genital segment with receptaculum seminis; B. P₅; C. P₆; D. Furca; E. Last abdominal segment and furcal rami, dorsal view; F. Last abdominal segment and furcal rami, ventral view; G. Last abdominal segment and furcal rami, ventral view.

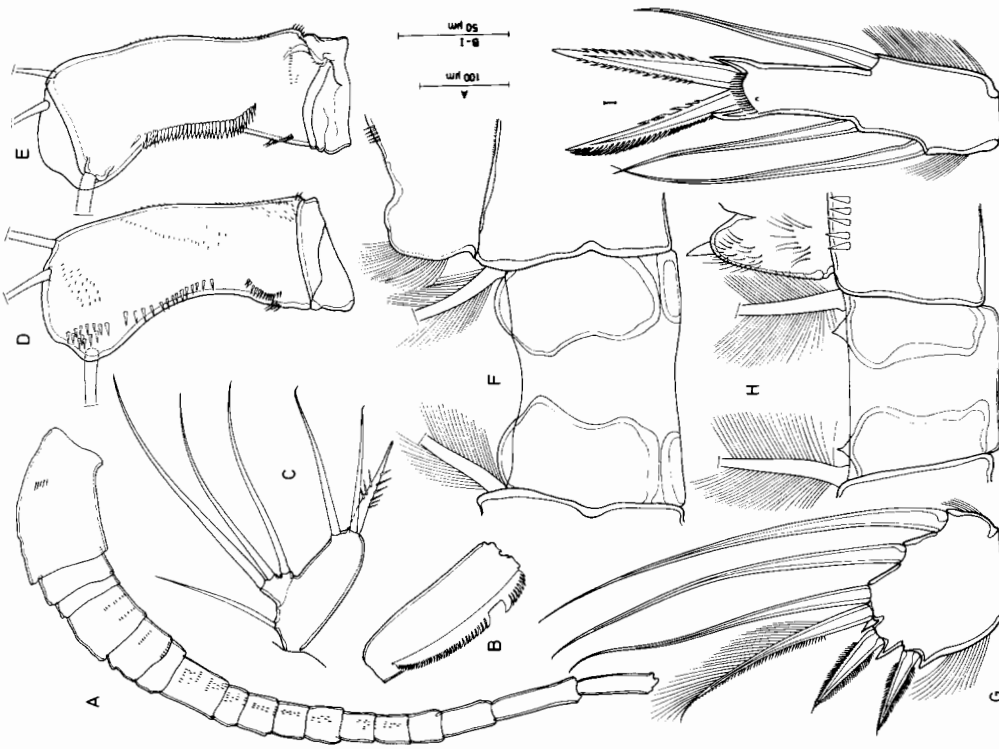


Fig. 25. *Mesocyclops aequatorialis similis* subsp. n. (holotype) Naivasha, Kenya. A. Antennular segment 17; B. Antennular segment 17; C. Maxillary palp; D. Basipodite A₂, caudal side; E. Basipodite A₂, frontal side; F. Connecting lamella and inner portion of coxo- and basipodite of P₁; G. ExpP₁; H. Connecting lamella and inner portion of coxo- and basipodite of P₄; I. EnpP₄.

Furca (Figs 26F-G). Differences from nominate subspecies in that: furcal rami more robustly built (L:W: 3.18), dorsum and ventrum with minute spinules; dorsal furcal seta shorter (83 μm) than external (121 μm).

Description of male (allotype)

Total body length: 997 μm , other measurements see Table 7. Armature of antennule as in nominate subspecies. Spine pattern on basipodite of antenna, structure of P₁-P₄, armature of last thoracic segment, structure of P₅ and furcal rami as in female. P₆ composed of one spine (33 μm) and two setae (respectively 30 μm and 47 μm); last seta considerably shorter than the seta of *M.a. aequatorialis*. Dorsal furcal seta, as in female, shorter than external.

Variability: females

Measurements were taken on fifteen specimens from various localities. Total body length between 1 201 μm and 1 547 μm . Furcal index between 2.65 and 3.21. Dorsal furcal seta always shorter than external.

L:W ratio of En₃P₄ 2.52–3.04. Inner apical spine longer or shorter than outer.

Spine pattern on basipodite of antenna constant; variability only in number of spines per row, between restricted limits: longitudinal row on caudal side with 9–14 spines, row proximal to this with 9–13 spines, longitudinal row on frontal side 23–34 spines.

Differential diagnosis

M. aequatorialis similis subsp.n. differs from the nominate subspecies in the spine pattern on the basipodite of the antenna, structure of P₅ and in the length of the dorsal furcal seta compared to the external.

Distribution (Fig. 42)

The range of *M.a. similis* is located south of the Sahara. In the Sahara pluvial relicts are found in the Tassili-n-Ajjer. It is abundant in the Sahel and Guinea zone in Western Africa and is widely distributed in the East African lake district where it occurs in lakes and swamps situated in the Eastern Rift Valley, the Western Rift Valley, and on the Ethiopian plateau. Further records are in Southern Zaire.

Remarks

Examination of populations from Lakes Victoria, Edward, and Mugesera (east of Lake Kivu) showed that these specimens did not completely agree with the above defined subspecies.

Individuals from Lake Victoria are robustly built (mean total body length: 1 145 μm ; n = 5) and characterized by a spine pattern on the basipodite of A₂ as in *M.a. similis* but the dorsal furcal seta exceeds the external in length and the spinous seta on the distal segment of P₅ almost is as long as the seta implanted on the basal segment (Figs. 27F-G-H).

Specimens from Lake Edward (mean total body length: 1 276 μm ; n = 5) are characterized by a spine pattern on the basipodite of A₂ similar to that of *M.a. aequatorialis*, the dorsal furcal seta exceeds the external in length and the spinous seta on the distal segment of P₅ equals in length the seta of the basal segment (Fig. 27C).

Lake Mugesera specimens showed the following characteristics: left antenna with the spine pattern on the basipodite of A₂ of *M.a. similis*, right antenna with the spine pattern of *M.a. aequatorialis*. Dorsal furcal seta considerably longer than external and spinous seta on the distal segment of P₅ equal in length to the seta of the basal segment (Figs. 27D-E).

We suggest that in a zone of contact between the two subspecies, hybrid populations occur, with character combinations of both subspecies. The populations described above are considered to be such hybrids of *M.a. aequatorialis* and *M.a. similis*.

Key to the subspecies of M. aequatorialis and hybrids

- Spine pattern on the basipodite of the antenna as in Figs. 23A-B or 27A-B, P₅: spinous seta of the distal segment distinctly shorter than the seta of the basal segment (Fig. 24A), dorsal furcal seta considerably longer than the external furcal seta (Fig. 24E) *M.a. aequatorialis* (Kieffer)
- Spine pattern on the basipodite of the antenna as in Figs. 25D-E, P₅: spinous seta of the distal segment distinctly longer than the seta of the basal segment (Fig. 26C), dorsal furcal seta shorter than the external furcal seta (Fig. 26E)
..... *M.a. similis* subsp.n.
- These characters not combined in that way (Figs. 27C-H) ... *M. aequatorialis*, hybrid populations

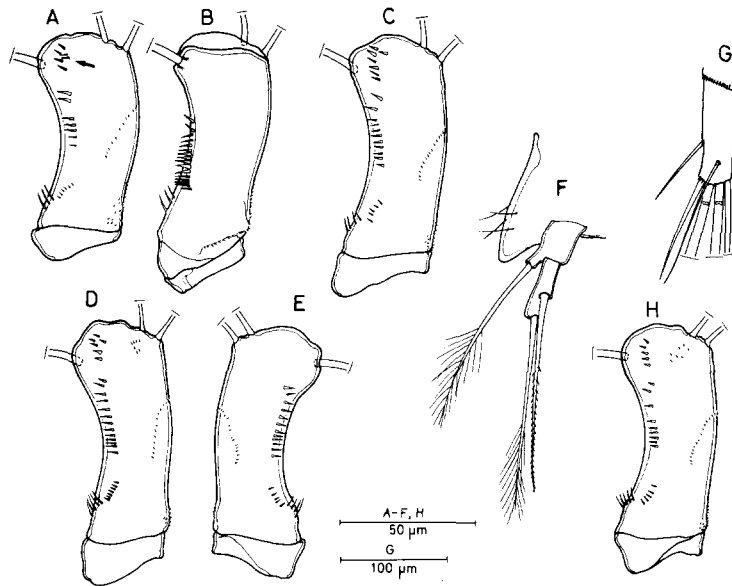


Fig. 27. *Mesocyclops aequatorialis aequatorialis* (Kiefer) Lake Tanganyika. A. Basipodite A², caudal side; B. Basipodite A², frontal side. *Mesocyclops aequatorialis*, hybrid populations. Specimen Lake Edward: C. Basipodite A², caudal side; Specimen Lake Mugesera: D. Left basipodite A², caudal side, E. Right basipodite A², caudal side; Specimen Lake Victoria: F. P⁵, G. Furca, H. Basipodite A₂, caudal side.

Mesocyclops aspericornis (Daday, 1906)

1906 *Cyclops aspericornis* Daday, Zool. Jb. Syst., Vol. 24, p. 18, Pl. 14: figs. 1-6.

1910 *Cyclops aspericornis*, Daday, Zoologica, Vol. 8, p. 60, Figs. 27-29.

1938 *Mesocyclops leuckarti*, Kiefer [partim], Bull. biogeogr. Soc. Japan, Vol. 8, p. 60, Figs. 27-29.

1951 *Mesocyclops leuckarti*, Lindberg, Bull. Soc. zool. Fr., Vol. 76, p. 10.

1974 *Mesocyclops leuckarti aequatorialis*, Dussart, Bull. I.F.A.N., A. Vol. 36, p. 114.

1981 *Mesocyclops aspericornis*, Kiefer, Arch. Hydrobiol., Suppl. 62, p. 172, Fig. 10.

Type locality: originally described from Sumatra, Singapore and Hawai.

Type material: collection von Daday, Zoologisches Museum, Budapest; not examined.

Material examined (specifications see Table 1)

Sumatra: Lake Toba (3 ♀); Nigeria: Okolom (1 ♀); Ethiopia: Awash (3 ♀, 1 ♂); Ghana: Obuasi (3 ♀);

Zaire (Kivu): Luvungi (1 ♀), Kalungwe (2 ♀), Lungwe (3 ♀); Sudan: Kaboushia (3 ♀), Chor Amat (1 ♀, 1 ♂); Niger: Mekrou (1 ♀).

Redescription of female

In 1929 Kiefer considered *M. aspericornis* as a synonym of *M. leuckarti aequatorialis*. In his recent work he revised his opinion and redescribed *M. aspericornis* based on Daday's type material from Sumatra.

Prof. Kiefer kindly let us examine specimens from Lake Toba and a comparison with African specimens showed that no morphological differences exist.

The following description is based on specimens from Obuasi, Ghana.

Total body length: 1 183 µm.

Antennule (Figs. 28A-B). Reaches to distal margin of second thoracic segment. Spinules on segments 1, 4-5 and 7-13. Hyaline membrane with one deep notch.

Antenna. Structure of endopodite as in in *M. leuckarti*.

Basipodite (Figs. 28D-E): in addition to the basic pattern a continuous row of minute spinules occurs

on medial caudal side, continuing with a few spinules on inner margin. A patch of minute spinules present near inner apical setae. On the caudal side, a group of minute spinules is implanted between longitudinal row of spines (13) and row of spines (10) proximal to that row (Fig. 28D: ↗). Longitudinal row on frontal side with 24 spines.

Maxillule. Basis of maxillary palp without a row of spines (Fig. 28C).

Thoracopods P₁-P₄. Spine- and seta-formula as in *M. leuckarti*. Connecting lamella of P₁-P₄ naked.

P₁. Inner distal margin of basipodite without a spine (Fig. 28F).

P₄. Enp₃ 2.50 times as long as wide. Inner apical spine exceeds external in length. External margin of inner apical spine smooth (Fig. 28I). Prominences of distal margin of connecting lamella well developed and as long as wide (Fig. 28H). Lateral inner part of caudal side of coxopodite without setules. Inner part of caudal side of basipodite distally with a group of setules and proximally with a row of setules (Fig. 28H).

P₅ (Fig. 29A). Spinous seta (95 μm) shorter than seta (125 μm) implanted on same segment; seta of basal segment 100 μm.

P₆. Of the usual structure, composed of two spines and one seta (Fig. 29D).

Last thoracic segment. Beset dorso-laterally with groups and rows of setules and spinous setules as in Fig. 29B; laterally and ventro-laterally with setules as in Figs. 29A-C.

Receptaculum seminis. As in Fig. 29C; lateral arms slightly curved backwards, anterior margin of proximal part bears a median incision. Copulatory-pore circular, pore-canal curved near the copulatory-pore.

Abdominal segments. Last segment with patterns of minute spinules dorsally and ventrally as in Figs. 29F-G. Dorsal and ventral distal margin of last abdominal segment fringed with a row of spines.

Furca. Furcal rami 3.45 times as long as wide with setules on inner margin (Figs. 29F-G). Minute spinules present on dorsum and ventrum of rami. Implantation of lateral and external furcal setae with spines. Dorsal furcal seta slightly shorter than external (Fig. 29E).

Description of male (specimen Awash)

Total body length: 762 μm. Armature of anten-

nule as in the preceding species. Spine pattern on basipodite of antenna and structure P₁-P₄ as in female. Last thoracic segment with setules on sides only. Furcal index 3.09; inner margin of rami without setules in contrast to female. P₆ composed of one spine and two setae.

Variability: females

Range in total length 1 183 μm and 1 313 μm. According to Kiefer (1981) the adult female reaches a length of 1.5 mm. Furcal index 3.37-3.45; 3-3.5 according to Kiefer (*op.cit.*). Dorsal furcal seta slightly shorter than external, but possibly sometimes longer.

Length: width ratio of Enp₃P₄ about 2.5. Inner apical spine of Enp₃P₄ shorter than outer apical spine, but possibly sometimes longer. Outer margin of inner apical spine smooth or bears a few spinules proximally. No variability in size of prominences on distal margin of connecting lamella of P₄, only shape of prominences differs (pointed or rounded at their apex).

Spine pattern on basipodite of antenna species-specific; variability only in number of spines per row; longitudinal row on caudal side 11-15 spines, proximal row 7-11 spines, longitudinal row on frontal side 20-25 (except in specimens from Kalungwe: 34 spines). In specimens from West Africa a row of spinules can be seen distal to the patch of spinules near the inner apical setae (Fig. 28D: ↗). This row is absent in specimens from East Africa and from Sumatra.

Differential diagnosis

M. aspericornis is easily distinguished from its congeners by the spine pattern on the basipodite of its antenna and by the shape of the receptaculum seminis. As regards the armature of the furcal rami, *M. aspericornis* (only females) and *M. tenuisaccus* are the only species in Africa that possess setules along the entire margin of the rami, but in the latter species the rami are extremely long.

Distribution (Fig. 45)

M. aspericornis is the only *Mesocyclops* species found in Africa that also has a wide distribution in the Oriental Region: India, Taiwan, Java, Sumatra, Philippines, Marian- and Marshall Islands and Hawai (vide Kiefer, 1981).

On the African continent it is distributed along a

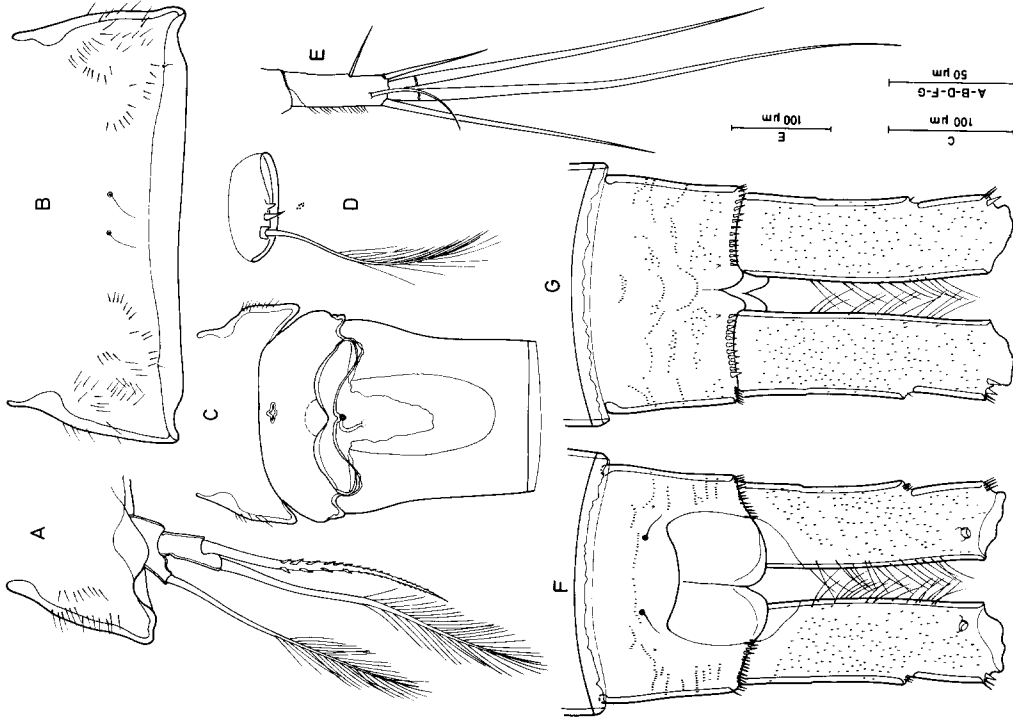


Fig. 29. *Mesocyclops aspericornis* (Daday) Obuasi, Ghana. A. P₅; B. Last thoracic segment, dorsum; C. Last thoracic segment and genital segment with receptaculum seminis; D. P₆; E. Furca; F. Last abdominal segment and furcal rami, dorsal view; G. Last abdominal segment and furcal rami, ventral view.

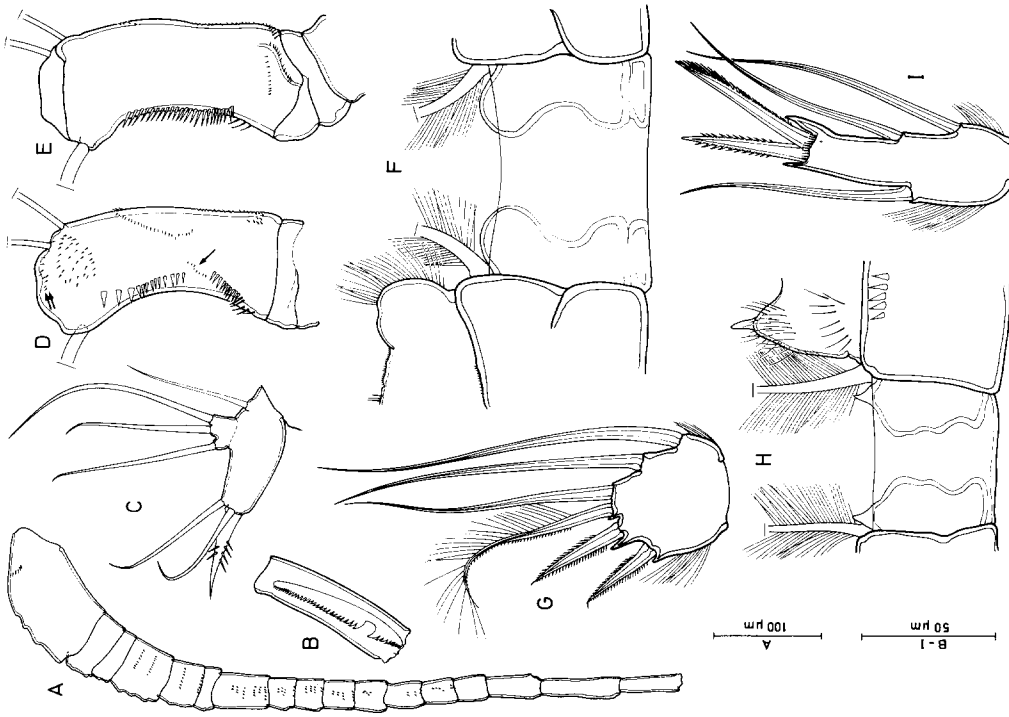


Fig. 28. *Mesocyclops aspericornis* (Daday) Obuasi, Ghana. A. A₁; B. Antennular segment 17; C. Maxillary palp; D. Basipodite A₂, caudal side; E. Basipodite A₂, frontal side; F. Connecting lamella and inner portion of coxo- and basipodite of P₁; G. Exp₃P₁; H. Connecting lamella and inner portion of coxo- and basipodite of P₄; I. Exp₃P₄.

west-east axis: West Africa (south of the Sahara), East African Lake District, Ethiopian highland, Nile-valley, and Red Sea hills. *M. aspericornis* is rather rare. In all localities, it was found in low numbers only.

Probably, the records of *M. iranicus* from Iran (Lindberg, 1936) and *M. leuckarti* (sic!) with pilose furcal rami from Afghanistan (Lindberg, 1948) refer to this species and this would fill up the present gap between the Afrotropical and Oriental regions.

Mesocyclops spinosus sp.n.

Type locality: Man (07°10'N-05°50'W), Ivory Coast: 2.5 km on the road Man-Danané, shallow pool in tropical rain forest at the foot of the Tonkoui mountain; leg. L. Samsoen, Gent, 1-8-1979.

Type material

holotype: one ovigerous female, dissected and mounted on two slides;

paratype material: nine females without eggs;

– five dissected females;

– one tube containing four undissected females, preserved in a formaldehyde/glycerine mixture.

Repository of type material

Holotype, two dissected and two undissected females, deposited in the Koninklijk Museum voor Midden-Afrika, Tervuren, Belgium.

Remaining paratype material in the collection of the Zoological Institute, University of Gent.

Etymology: the name '*spinosus*' point to the presence of spines on the genital segment, distal to P_6 .

Material examined: type material, as described above.

Description of female (holotype)

Total body length: 1408 μm . For other measurements see Table 8.

Antennule (Figs. 30A, E). Reaches middle of third thoracic segment. Spinules on segments 1, 4–5, 7–10 and 12–13. Hyaline membrane with one deep notch.

Antenna. Structure of endopodite as in *M. leuckarti*.

Basipodite (Figs. 30C-D). Spine pattern very similar to that of *M. kieferi* except that longitudinal row of spines on frontal side is composed of 30 spines (*M. kieferi*: 18–23 spines, *M. spinosus*: 26–30 spines).

Maxillule (Fig. 30B). Basis of maxillary palp not provided with a row of spines.

Thoracopods P_1 - P_4 . Spine- and seta-formula as in *M. leuckarti*. Connecting lamella of P_1 - P_4 naked.

P_1 . Spine absent on inner distal margin of basipodite (Fig. 30I).

P_4 . Enp_3 2.91 times as long as wide. Inner apical spine shorter than outer; armature of these spines as in Fig. 30F. Prominences on distal margin of connecting lamella well developed (Fig. 30G). Lateral inner part of coxopodite without setules; inner part of caudal side of basipodite distally with a group of setules and proximally with a row of setules (Fig. 30G).

P_5 (Fig. 31E). Spinous seta (129 μm) of distal segment shorter than seta (169 μm) implanted on same segment; seta of basal segment 131 μm long.

P_6 . Of the usual structure. Distally to implantation of P_6 , a group of spines more or less arranged in rows, occurs (Fig. 31B: ↗).

Last thoracic segment (Figs. 31C-D). Proximal part of dorso-lateral side with a curved row of spinous setules (Fig. 31C); and setules present along sides of segment.

Receptaculum seminis (Fig. 31D). Proximal part exhibits a narrow lengthened outlook; left and right part of posterior margin depart as one 'jointed' canal from copulatory-pore. Pore-canal curved proximally.

Abdominal segments. As described above, genital segment provided with a group of spines on its dorso-lateral side. Of the remaining abdominal segments only the last one ornamented with spinules as in Figs. 31F-G. Distal margin of last abdominal segment fringed with a row of spines.

Furca (Figs. 31A, F-G). Furcal rami 2.52 times as long as wide. Dorsum and ventrum of rami with spinules; in addition two groups of spines occur on distal part of dorsum. Inner margin furnished with a group of setules proximally. In contrast to external seta, lateral has no spines at its implantation. Length of setae as in Table 8.

Male: unknown.

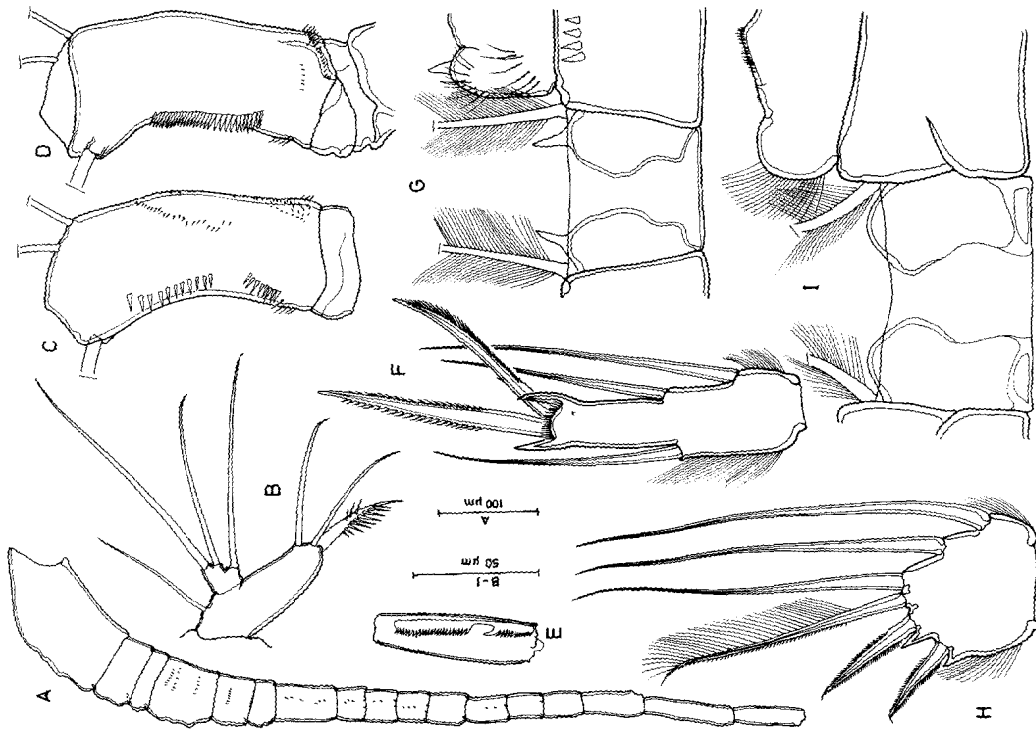


Fig. 30. *Mesocyclops spinosus* sp. n. (holotype) Man, Ivory Coast. A. A₁; B. Maxillary palp; C. Basipodite A₂, caudal side; D. Basipodite A₂, frontal side; E. Antennular segment 17; F. Enp3/P4; G. Connecting lamella and inner portion of coxo- and basipodite of P₄; H. Exp3/P₁; I. Connecting lamella and inner portion of coxo- and basipodite of P₁.

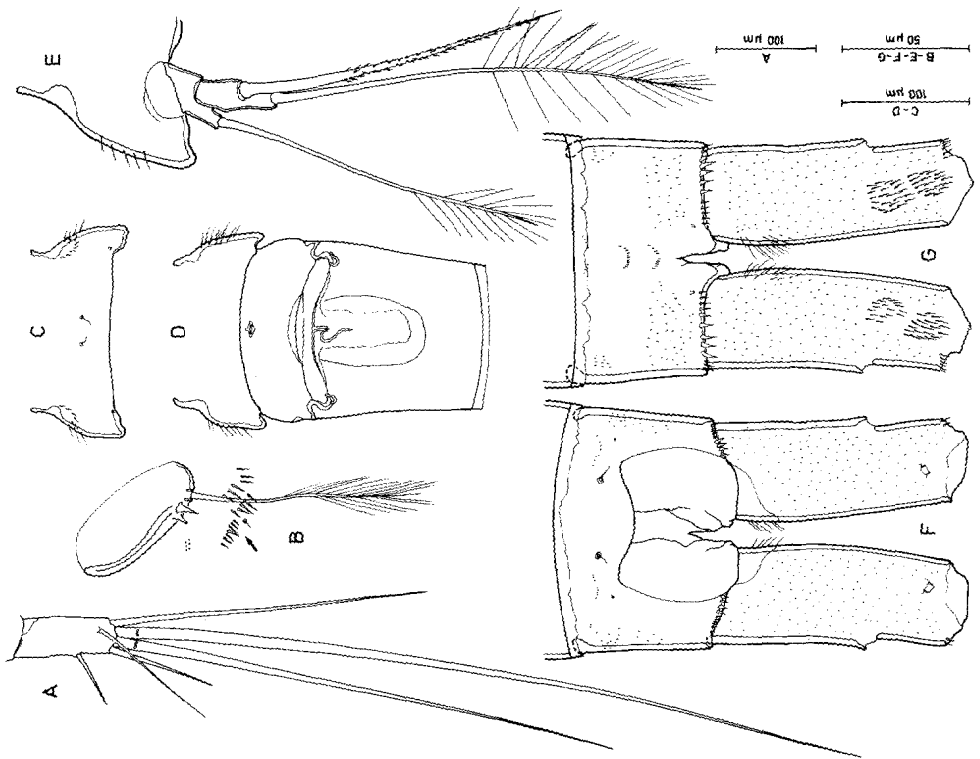


Fig. 31. *Mesocyclops spinosus* sp. n. (holotype) Man, Ivory Coast. A. Furca; B. P₆, note group of spines distally to implantation of P₆; C. Last thoracic segment, dorsum; D. Last thoracic segment and genital segment with receptaculum seminis; E. P₅; F. Last abdominal segment and furcal rami, dorsal view; G. Last abdominal segment and furcal rami, ventral view.

Table 8. Morphometry of *Mesocyclops spinosus* sp.n. (Man, Ivory Coast). Measurements in μm .

		Holotype	Paratypes (♀)		
Cephalothorax	L	541	500	500	558
	W	475	475	491	475
	L:W	1.14	1.05	1.02	1.17
Ceph. + Thorax	L	908	900	841	925
Genital segment	L	200	192	183	200
	W	150	142	142	142
	L:W	1.33	1.35	1.28	1.41
Abdomen	L	392	375	358	408
Furca	L	108	96	102	96
	W	42	33	35	38
	L:W	2.52	2.91	2.91	2.53
Total body length		1 408	1 371	1 301	1 429
Enp ₃ P ₄	L	99	92	103	96
	W	34	30	29	29
	L:W	2.91	3.06	3.55	3.31
Enp ₃ P ₄	sp _i	80	82	80	75
	sp _e	94	87	88	83
	sp _i :sp _e	0.85	0.94	0.99	0.90
Furcal setae	S _i	320	292	333	342
	S _{mi}	762	716	758	758
	S _{me}	511	483	450	483
	S _e	107	100	104	120
	S _d	135	86	121	129

Variability: females

Total length between 1 301 μm and 1 429 μm . Furcal index 2.52–2.91. Dorsal furcal seta shorter or longer than external.

Length:width ratio of Enp₃P₄ 2.91–3.55. In the examined specimens the inner apical spine does not exceed the outer in length. External margin of inner spine bears one to ten spinules, but it is possible that these spinules can be completely absent.

Spine pattern on basipodite of antenna constant; variability only in number of spines per row: longitudinal row on frontal side 26–30 spines, longitudinal row on caudal side 9–11, row proximal to this last row 9–11 spines.

Differential diagnosis

M. spinosus sp.n. is unique in possessing a group of spines on the genital segment. It also differs from its congeners by the structure of the receptaculum seminis and the armature of the furcal rami.

Distribution (Fig. 45)

At present *M. spinosus* sp.n. is known from its type locality only.

Mesocyclops salinus Onabamiro, 1957 [emend.]

1952 *Mesocyclops leuckarti aequatorialis*, Kiefer [partim], Explor. Parc natn. Albert, Mission H. Damas 1935/1936, Vol. 21, p. 99, Fig. 159.

1957 *Mesocyclops salina* Onabamiro, J. linn. Soc. London, Vol. 43, p. 123, Figs. 1–6.

1981 *Mesocyclops* sp. 2, Dumont *et al.*, Hydrobiologia, Vol. 80, p. 165.

1981 *Mesocyclops curvatus* Kiefer, Arch. Hydrobiol., Suppl. 62, p. 169, Fig. 8.

Type locality: Nigeria, Korudu beach near Lagos, brackish water. Collection made by S. D. Onabamiro on 24-2-1951.

Type material

Ibadan University College, index no. 5: 'Type', Female (stated in Onabamiro's paper). As already mentioned for *M. ogunnus*, no type material is available from this Institute.

British Museum (Natural History, London): one tube containing four undissected females (one ovigerous female), preserved in alcohol; labelled

syntypes, Korudu beach, Lagos, Nigeria, S. D. Onabamiro 1957, 2.15.1. These specimens are in a rather bad condition probably due to former dessication: all specimens are shrunken, parts of the furcal rami and several setae are broken off. The syntypical material has been manipulated as follows: all specimens were dissected and mounted each on one slide and, labelled according to the indications on the tube and marked respectively syntypes I-IV.

Material examined (specifications see Table 1)

Nigeria: type material, as described above; Guinea-Bissau: Rio Geba; Benin: Porto Novo; Zaire: Saké Banza, Kivu district: Karimurira, Luvungi, Lake Edward (Vitshumbi); Ruanda-Burundi: Tsohoho, Milay, Rugwero, Mugesera, Goshoba, Birira, Ruzizi (+ specimens resulting from breeding experiments); Mozambique: Dondo, Meconta, Xai-Xai, Mossuril; Mali: Gossi; Ethiopia: Lake Awassa, Black River.

Redescription of female

Onabamiro's description of *M. salinus* can be summarized as follows: furcal rami naked on their inner margin and rather short (2.5–2.8 times as long as wide); connecting lamella of P_4 with pointed prominences, Enp_3P_4 2.6 times as long as wide, terminal spines subequal; hyaline membrane of 17th antennular segment with three notches; receptaculum seminis resembling that of *M. longisetus* (Thiebaud).

The following redescription is based on the syntypes. Because of their poor condition additional information is given for specimens from lake Edward.

Total body length could not be measured accurately; length given by Onabamiro: 1.0 mm.

Antennule (Figs. 32E-F). Reaches to distal margin of second thoracic segment. Hyaline membrane with several notches.

Antenna. Endopodite as in *M. leuckarti*.

Basipodite (Figs. 32A-D). Spine pattern on basipodite of antenna very similar to that of *M. rarus* but differing in the number of spines in the group proximal to the exopodite seta (but see variability). Several spines are broken off, but remains of their implantation are still visible. Longitudinal row of spines on frontal side 12–16 spines; longitudinal row on caudal side of 9–12; spine row proximal to

this last row with 4–7 spines. Group of spines proximal to the exopodite seta with 4–6 spines.

Maxillule. Maxillary palp provided with a row of small spines (Fig. 32G).

Thoracopods P_1 - P_4 . Seta- and spine-formula as in *M. leuckarti*. Connecting lamella P_1 , P_2 and P_3 devoid of setules.

P_1 . Spine absent on inner distal margin of basipodite (Fig. 32I).

P_4 . Enp_3 in four syntypes respectively 2.44, 2.44, 2.70 and 2.54 times as long as wide. Inner apical spine exceeds outer in length. Armature of both spines illustrated in Fig. 32J. Caudal side of connecting lamella provided with two rows of setules; distal margin with strongly developed prominences (Fig. 32K). Caudal side of coxopodite devoid of setules on lateral inner part; distal internal part of caudal side of basipodite only proximally with a group of setules (Fig. 32K).

P_5 (Fig. 32L) and P_6 (Fig. 32M). Of the usual structure.

Last thoracic segment (Figs. 32L & 33A, E: specimen from Lake Edward). Naked.

Receptaculum seminis. The illustration of Onabamiro (*op.cit.*, p. 124, Fig. 2) is certainly inadequate. Due to shrinkage of the syntypes, structure of receptaculum seminis could not be reconstructed. Only in syntype III is the region of the copulatory pore visible (Fig. 33H). The following description is based on a specimen from Lake Edward. Left and right part of posterior margin of proximal part depart as a short 'jointed' canal from copulatory-pore. Lateral arms widen towards laterally, due to the strongly curved posterior margin (Fig. 33E). There is little resemblance to the receptaculum seminis of *M. longisetus* as stated by Onabamiro (*op.cit.*).

Abdominal segments. Last segment only ornamented with minute spinules dorsally and ventrally. Distal margin of last segment fringed dorsally with spines, ventrally with smaller spines (Figs. 32N-O).

Furca (Figs 32N-O). L:W ratio of rami in syntypes I-IV respectively 2.88, broken off, 2.78 and 2.89. Rami dorsally and ventrally with minute spinules. Most of furcal setae are broken off in syntypes. Onabamiro (*op. cit.*) states that dorsal seta is shorter than external. Lateral furcal seta lacks spines at its implantation, in contrast to external.

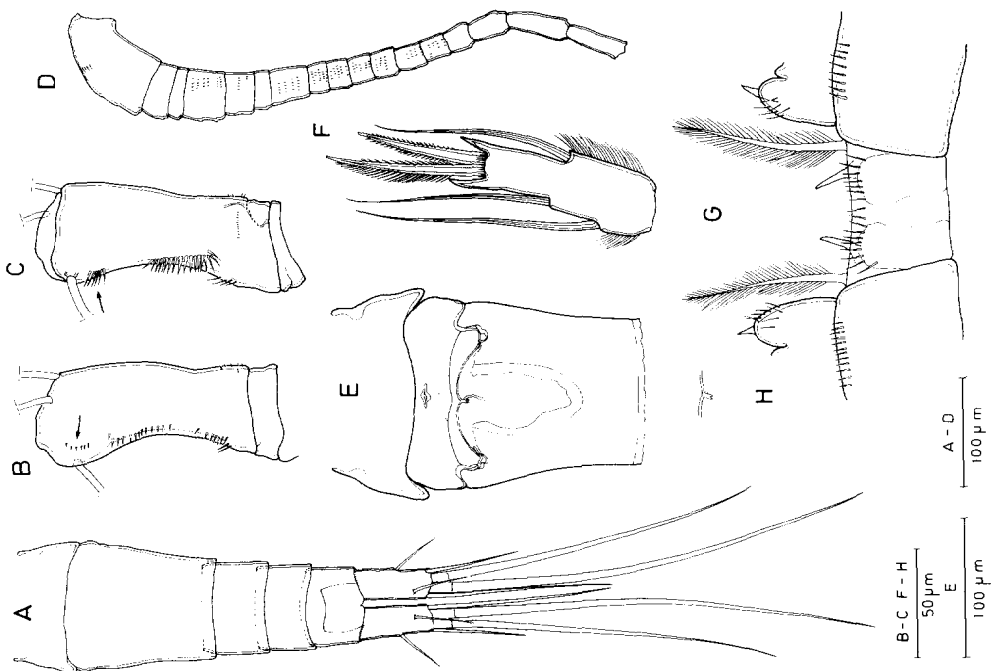


Fig. 33. *Mesocyclops salinus* Onabamiro Lake Edward. A. Last thoracic segment and abdomen; B. Basipodite A₂, caudal side; C. Basipodite A₂, frontal side; D. A₁; E. Last thoracic segment and genital segment with receptaculum seminis; F. Enp₃P₄; G. Connecting lamella and inner portion of coxo- and basipodite of P₄; H. Area copulatory-pore of syntype II.

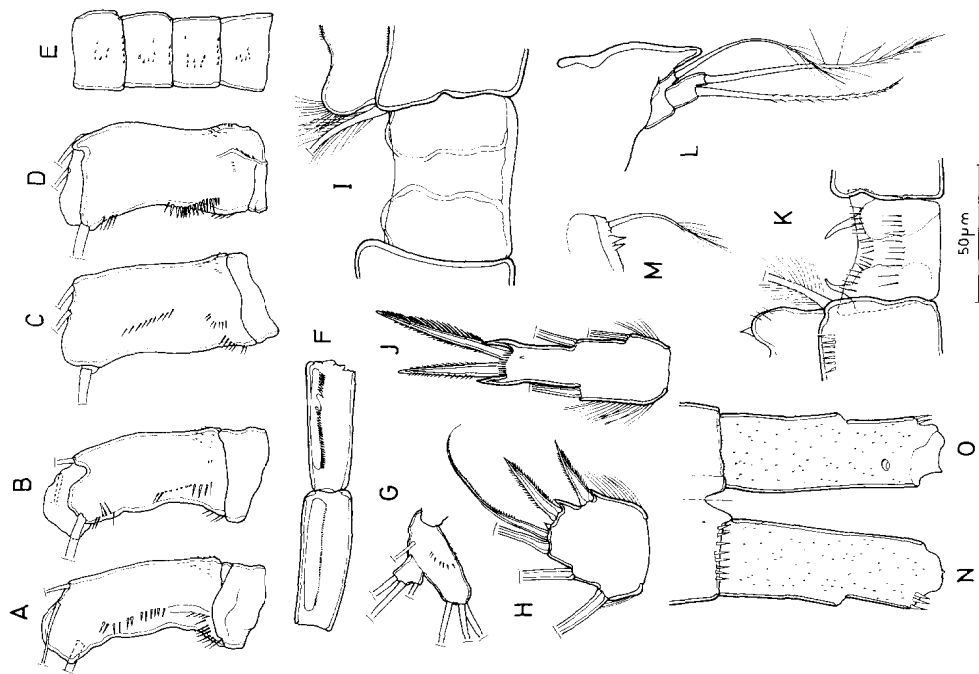


Fig. 32. *Mesocyclops salinus* Onabamiro (syntype I) Korudu, Nigeria. A. Basipodite A₂, caudal side; B. Basipodite A₂, frontal side; C-D. Idem, syntype II; E. Antennular segments 9-12; F. Antennular palp; G. Maxillular palp; H. Exp₃P₄; I. Connecting lamella and inner portion of coxo- and basipodite of P₄; J. Enp₃P₄; K. Connecting lamella and inner portion of coxo- and basipodite of P₄; L. P₅; M. P₆; N. Furcal ramus, ventral view; O. Furcal ramus, dorsal view.

Description of male

The male was hitherto unknown; the following description is based on specimens resulting from breeding experiments.

Mean total body length: 637 μm ($n = 10$). Armature of antennule as in preceding species. Spine pattern on basipodite of antenna, armature of maxillary palp, last thoracic segment, structure of P_1 - P_4 as in female. P_6 of the usual structure, composed of one spine and two setae. Furcal rami short, on the average 2.4 times as long as wide ($n = 10$); lateral and furcal setae provided with spines at their implantation.

Variability: females

Range, in total body length 952-1268 μm ($n = 10$). L:W ratio of furcal rami never exceeds 3 (2.28-2.89). In the examined specimens dorsal furcal seta always shorter than external.

L:W ratio of Enp_3P_4 2.44-2.90. Mostly inner apical spine longer than outer; in a few cases both spines equal in length. External margin of inner apical spine with spinules along its entire margin, or spinules only occur proximally. Prominences on distal margin of connecting lamella P_4 always strongly developed; their shape either straight (Fig. 33G) or slightly bent (Fig. 32K). Caudal side of connecting lamella always provided with setules, arranged in one (Fig. 33G) or two rows (Fig. 32K).

Spine pattern on basipodite of antenna shows variability in one locus: spine group on caudal side at level of exopodite seta either present or absent (compare Figs. 32A, C and Fig. 33B: \rightarrow). This variability also found in offspring from one pair of parents. When this spine group is absent, the pattern resembles that of *M. rarus*. Usually both species can be distinguished by the number of spines in the group located proximal to exopodite seta (Fig. 33C: \rightarrow). The number of spines in *M. salinus* (4-9 spines) is inferior to that of *M. rarus* (11-14 spines); but exceptions are found in a few specimens of *M. salinus* that possess eleven spines. Longitudinal row of spines on caudal side 9-15 spines, row of spines proximal to this row 4-8 spines; longitudinal row of spines on frontal side 12-19 spines.

Remarks on synonymy

M. salinus too has never been reported since its original description.

In 1981 Kiefer described *M. curvatus* from East

Africa of which the author put a few specimens at our disposal. A comparison was made with *M. salinus* and proved that *M. curvatus* is identical with *M. salinus*. Since Kiefer (*op. cit.*) did not study type material of *M. salinus*, specimens of *M. salinus*, designated by us as homeotypical, were sent to Prof. Kiefer who accepted the synonymy (see Kiefer, *op. cit.*, p. 190).

It should be noted that in Kiefer's figure 8:3 the connecting lamella is incorrectly drawn, i.e. without setules.

Differential diagnosis

With regard to the spine pattern on the basipodite of the antenna, *M. salinus* is related to the '*rarus-paludosus-tenuisaccus*' group, but it lacks the spine on the inner distal margin of the basipodite of P_1 .

Distribution (Fig. 43)

M. salinus only occurs south of the Sahara. It is abundant in the Western Rift, and in the Eastern Rift it is found in Lake Awassa and the Black River (near Lake Awassa). In West Africa it occurs south of the rivers Senegal and Niger; in South-East Africa it lives in the coastal region. As the name reveals, *M. salinus* tolerates brackish and saline waters.

Mesocyclops tenuisaccus (Sars, 1927)

1927 *Cyclops tenuisaccus* Sars, Ann. s. afr. Mus., Vol. 25, p. 108, Pl. X: Figs. 1-13.

1929 *Mesocyclops tenuisaccus*, Kiefer, Z. wiss. Zool., Vol. 133, p. 25.

Type locality: South Africa (Cape Province): Salt River near Cape Town. Collection made by Purcell (no date stated).

Type material

South African Museum (Cape Town): one tube no. A 12460, containing 32 specimens preserved in alcohol: eighteen ♀ (egg sacs detached, loose in fluid), ten ♂ and four copepodids; labelled in Sars' handwriting *Cyclops tenuisaccus* GOS, Salt River.

No type material in the Sars collection in the Zoologisk Museum (Oslo) (Christiansen, *in litt.*).