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The cyclopid (Crustacea, Copepoda) fauna of the inland waters of Israel

2. Preliminary note on the genus Mesocyclops (Cyclopoida, Cyclopidae), with description of a new species

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Abstract

Four species of the genus *Mesocyclops* (Cyclopoida: Cyclopidae) are reported from Israel: *Mesocyclops kieferi* Van de Velde, 1984, *Mesocyclops aequatorialis similis* Van de Velde, 1984, *Mesocyclops ogunnus* Onabamiro, 1957 and *Mesocyclops arcanus* n.sp. The new species, close to *M. kieferi*, is described and some remarks are given for the other species.

Introduction

In Israel, *Mesocyclops leuckarti* (Claus, 1957) was the only species of the genus *Mesocyclops* (Cyclopidae, Cyclopinae) recorded until the works of Kiefer (1981) and Van de Velde (1984). Kiefer (1981) established that *M. leuckarti* was not a cosmopolitan species, and was only restricted to Europe and western Asia. Van de Velde (1984) gave a first revision of the genus in Africa, based on new criteria such as the ornamentation of the basipodite of the antenna. '*Mesocyclops leuckarti*' from Lake Kinneret was identified as *Mesocyclops ogunnus* by Van de Velde, 1984. The study of samples collected by Ortal and his collaborators, as part of the sampling programme of aquatic fauna developed in Israel by the Inland Water Ecological Service (IES) and the Zoology Department of the Hebrew University of Jerusalem, led to a first approach of the genus *Mesocyclops* in Israel. This paper deals with the four species present in Israel: *Mesocyclops kieferi* Van de Velde, 1984, *Mesocyclops aequatorialis similis* Van de Velde, 1984, *Mesocyclops ogunnus* Onamabiro, 1957 and *Mesocyclops arcanus* n.sp.

Material and methods

Specimens were dissected in lactic acid or glycerol and the dissected parts mounted in glycerol. All drawings were made using a camera lucida on a Wild M20 of Leitz Diaplan microscope. The abbreviations used are indicated in the text (except for P1–P6 = natatory legs 1 to 4, modified legs 5 and 6). The data and coordinates in brackets refer to the Inland Water Ecological Service catalogs, Jerusalem.

Mesocyclops arcanus n.sp.

Material examined:
Holotype: female dissected in lactic acid, and mounted in glycerol and sealed with Eukit (2 slides), deposited in the Muséum national d'Histoire Naturelle, Paris, MNHN-Cp1036.

Allotype: male dissected in lactic acid and mounted in glycerol and sealed with Eukit (4 slides), deposited in the Muséum national d'Histoire Naturelle, Paris, MNHN-Cp1037.

Type locality: Hula Valley, Nahal Enan, pond, 35°34′N – 33°03′E (Cyc 708, IES 4806, Cop 2301),

27.8.85, R. Ortal coll.

Paratypes: 7 females and 2 copepodites preserved in ethanol deposited in the Muséum national d'Histoire Naturelle, Paris, MNHN-Cp1038, 7 females deposited in The Hebrew University, Jerusalem.

Other material examined (non-type)

- some females from Kinneret Valley, Nahal Yarmouq-Naharayim Dam, spring-fed stream, 22.8.85 (Cyc 727, IES 4811, Cop 2322, 2040/2280), R. Ortal coll.
- a female from North lower Jordan Valley, Shifa, 26.8.85, river (Cyc 746, IES 4808, Cop 2341, 2034/2065), R. Ortal coll.

The area where these three samples were collected is a designated nature reserve.

Description of female (Figs 1–12)

Length excluding furcal setae: Holotype 0.96 mm (range: 0.83–0.97 mm, $n = 6$).

Antennule (Fig. 9) of 17 segments, reaching to the middle of the third thoracic somite. Armature as in Fig. 9. Hyaline lamella of the last segment with a weakly marked notch situated at the distal third of the segment (Fig. 10).

Segmentation of antenna as in all *Mesocyclops*. Ornamentation of the basipodite (Fig. 7), following Van de Velde's (1984) terminology, composed of: on caudal side, a longitudinal row of 10 spinules in the distal part of the segment, almost parallel to the axis of the segment, an oblique row of 6 spinules in the proximal half, which seems to be prolongated by a few spines directed towards the outer edge of the basipodite; an oblique row of minute spines, almost in the same axis as the oblique row, but directed towards the inner edge of the basipodite; frontal side with the usual longitudinal row of 19 spinules and a perpendicular line of minute spines at the base of the basipodite. In the paratypes and other specimens examined, the oblique row of 6 caudal spines is very difficult to observe. The number of spines per row varies by two or three spines extra or fewer.

Buccal appendages of the usual structure for the genus. Maxillulary palp without spinules at basis (Fig. 6). Mandible as figured (Fig. 5). Maxilla without spinules on the coxopodite; maxilliped as in Fig. 8.

P1 to P4 with spine formula of exopodites 2.3.3.3.

P1 (Fig. 11) without frontal spine at inner distal margin of basipodite. P3 similar to P2, but larger. Intercoxal plates without distal prominences on P1 to P3; on P4, two distal triangular prominences. P4 (Fig. 12): Enp3 2.63 times as long as wide (2.61–2.73, $m = 2.70$, $n = 6$). Inner apical spine slightly longer than outer (1.12, range 0.97–1.14, $n = 6$), and both always shorter than segment (inner spine 0.88 times as long as the segment, range 0.79–0.91). On caudal side of basipodite of P4, a small group of hairs at the distal internal part (arrow Fig. 12). P5: Apical seta and spinous seta of the second segment of same length, shorter than the genital somite (Fig. 3). P6 (Fig. 13) with two small internal spines and a short external seta.

Last thoracic somite with a few hairs on each lateral edge. Genital somite longer than wide, hardly tapering at caudal part. Seminal receptacle barely visible (Fig. 4), lateral arms of anterior part, short and thick, slightly curved at their ends. Posterior margin (Van de Velde's (1984) terminology) slightly V-shaped, from the copulatory pore. Pore canal apparently curved to the right, into a very thin comma, barely distinguishable. Last urosomite with a row of small spines on the distal margin , on the ventral face only.

Furcal rami (Fig. 2) not pilose on inner margin, 3.23 times (3.09–3.50, $n = 6$) as long as wide. No setule at base of lateral and external setae. Dorsal seta (Ds) shorter than external seta (Es) (Ds/Es = 0.87, range 0.80–1, $n = 4$). Internal terminal seta 2.33 longer than Es (2.11–2.69, $n = 5$). Lateral seta inserted just before the distal third of the external margin of the ramus (0.63 in holotype, range 0.61–0.67, $n = 6$).

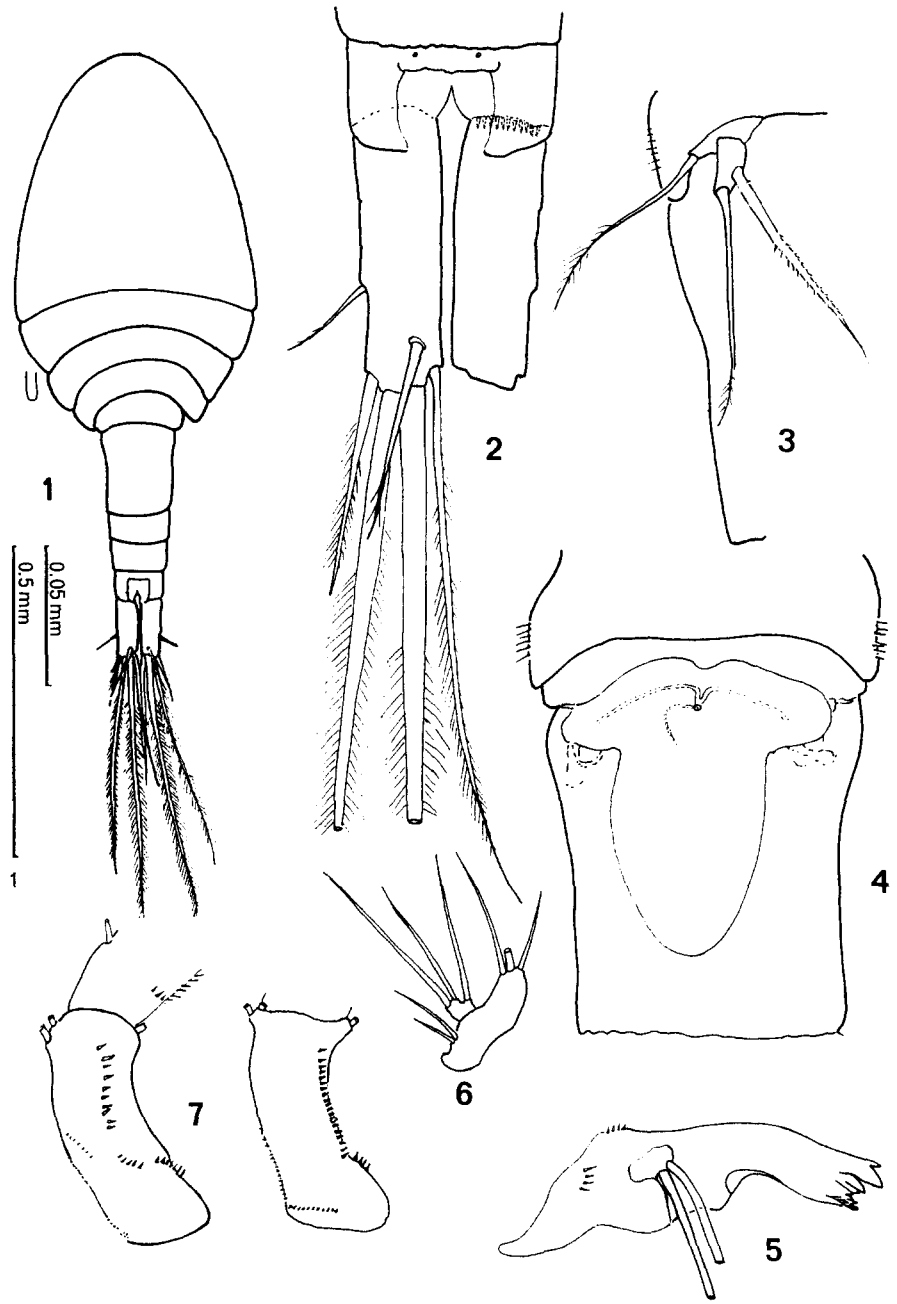
Description of male (Allotype)(Figs 14–18)

Length excluding furcal setae: 0.59 mm.

Antenna with basipodite ornamented as in female but with less spinules in each row.

Buccal appendages without particularity, maxillary palp without spinules.

P1 to P4 with spines and setae formula identical to female. Same morphology of the intercoxal plates of P2 to P4. P1 (Fig. 16) with rounded prominences on its intercoxal plate. Enp3P4 2.10 times longer than wide, with internal apical spine 1.07 times longer than outer (Fig. 17). P5 (Fig. 18) longer than in female, the terminal setae of the second segment reaching posterior margin of genital somite. P6 (Fig. 18) composed of two inner spines, the innermost the longest, and a setae which is almost as long as the next somite. Furcal rami (Fig. 15) not pilose at the inner edge, 3.2 times

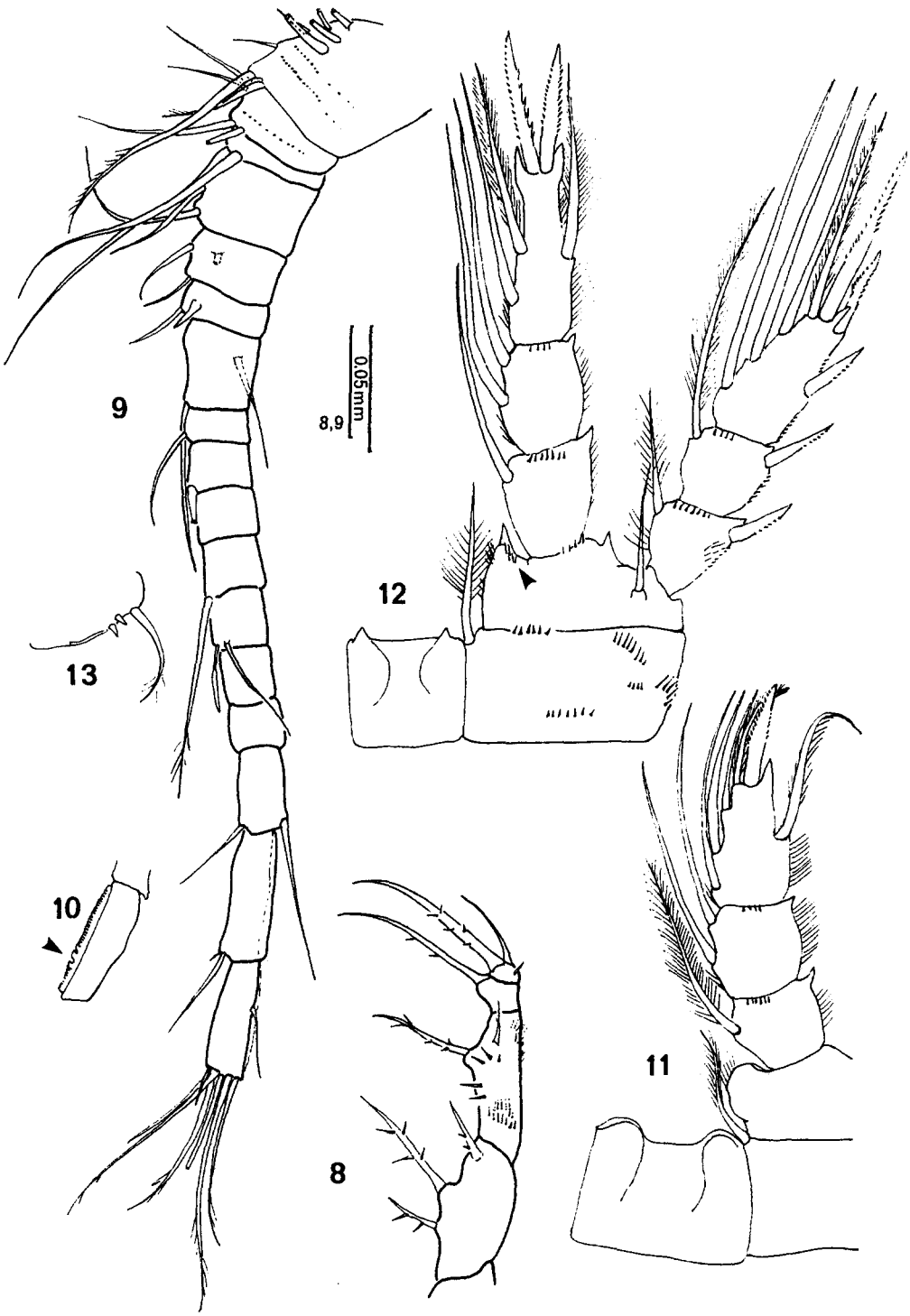


Figs 1–7. Mesocyclops arcanus n.sp. Female. 1. Habitus; 2. Furca, dorsal view, on the right side, the spinules on ventral side are drawn dotted; 3. P5; 4. Last thoracic and genital somite, ventral side, with view of the seminal receptacle; 5. Mandible; 6. Maxillulary palp; 7. Basipodite of antenna, left: caudal side, right: frontal side.

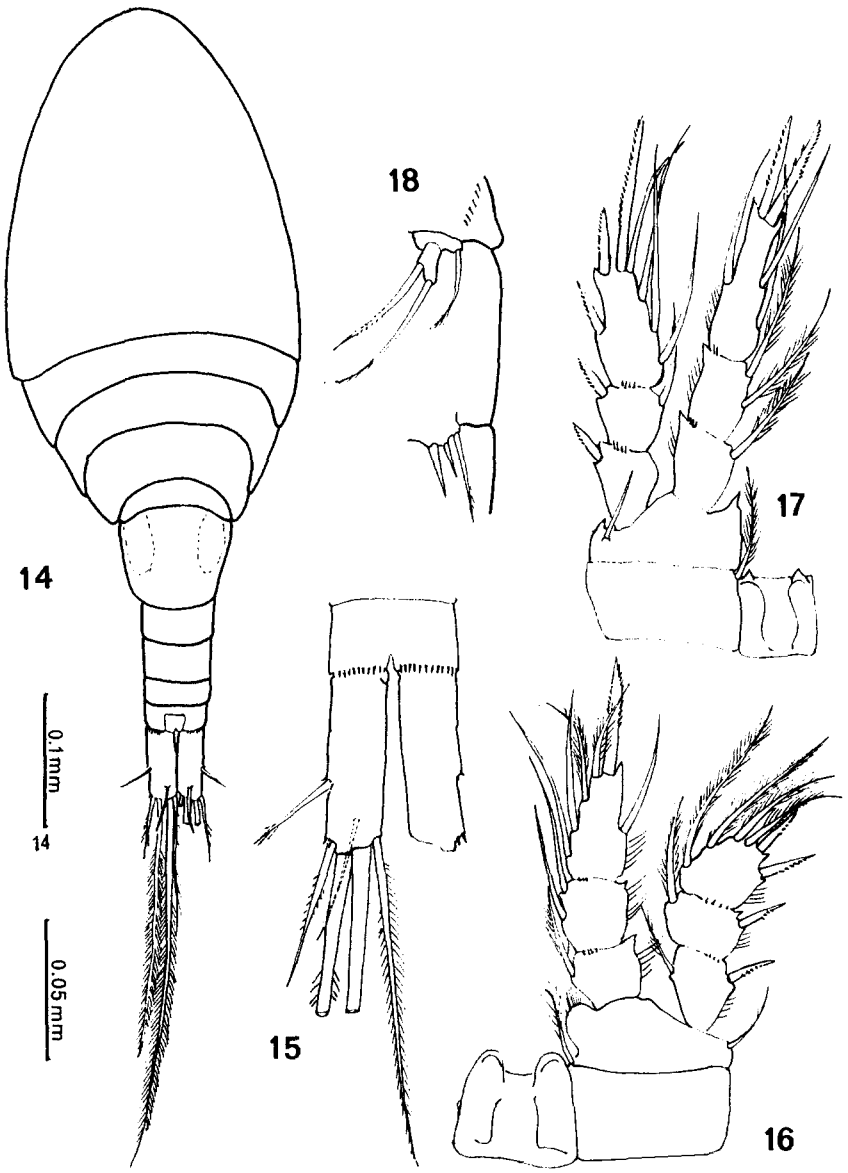
longer than wide with setules at insertion of lateral and external setae. Lateral seta inserted at 0.65 from the proximal edge of ramus. Dorsal seta shorter than external seta, latter 0.46 as long as internal seta.

The male differs from the female by the presence of setules at insertion of lateral and external furcal setae and by the last urosomite which has a row of small spines along the whole distal margin.

Differential diagnosis: the female of this small species is close to *M. kieferi* in the ornamentation of the basipodite of antenna; the maxillulary palp without setules; the features of the natatory legs: no spine



Figs 8–13. Mesocyclops arcanus n.sp. Female. 8. Maxilliped (dotted line, spines on the other side); 9. Antennule; 10. Hyaline lamella of the last segment of antennule; 11. P1; 12. P4; 13. P6.



Figs 14–18. *Mesocyclops arcanus* n.sp. Male. 14. Habitus, dorsal view; 15. Furca, ventral view; 16. P1; 17. P4; 18. P5 and P6.

on the inner distal margin of basipodite, shape and ornamentation of the intercoxal plates (identical to *M. kieferi*; P5 with seta and spine of second segment relatively short, not reaching distal edge of the genital somite. However, it differs by the following characters: smaller size; last thoracic somite with lateral hairs; spines only present ventrally on the distal margin of the last urosomite; shape of the hyaline lamella of female A1, without deep notch; absence of spinules at the implantation of the lateral and external furcal setae; presence of a small group of hairs at the internal part of the basipodite of P4 (caudal side). The shape of the seminal receptacle, althought very difficult to observe, appears to be quite different from that of *M. kieferi*: the lateral arms are not regularly curved and the posterior margin seems to be very close to the anterior one. Some characters are less clearly marked: the furcal index always is higher than 3, but lies within the

upper range of *M. kieferi*, as given by Van de Velde (1984). Also, the prominences on the distal edge of intercoxal plate of P4 appear generally less sharp in comparison to the paratypes of *M. kieferi* which have been examined from Mauritania and Yemen (material deposited in the collection of the Zoological Institute, University of Gent, Belgium).

This new species differs from *Mesocyclops ogunnus* in lacking the supplementary distal row of spines, on caudal side of the basipodite of antenna; a maxillulary palp with spines; the different shape of the seminal receptacle, with anterior margin differently curved; last urosomite with a continuous row of spines on its distal margin; and furcal rami with spines at the insertion of lateral and external furcal setae.

Etymology: from latin *arcanus* (= hidden), referring to the indistinct nature of the seminal receptacle.

Distribution: The species occurs at three different but close areas, Hulah Valley (Area 1B, see Fig. 1 in Defaye & Dussart, 1994), Kinneret Valley (7A) and Northern Jordan Valley (13A).

Mesocyclops kieferi Van de Velde, 1984

First reported from South Central Negev and Judean Desert, this species has also been identified in this study from samples collected in Dead Sea Valley (13B), En Ze'elim, 31.1.79 spring-fed pool (nature reserve)(IES 1430, 1826/0848). The females from this last locality presented the assymetrical ornamentation of the basipodite of antennae previously mentioned (Defaye & Dussart, 1994).

Mesocyclops ogunnus Onabamiro, 1957

As shown by Van de Velde (1984), this is the *Mesocyclops leuckarti* of Lake Kinneret cited in Richard (1893), Gurney (1913), Yashouv & Alhynis (1961), and Gophen's various papers from 1972 to 1981.

Mesocyclops aequatorialis similis Van de Velde, 1984

Three females were identified from Galilee coastal plain (4A), N. Na'aman, Enot Na'aman (IES 2471, 1611/2502, 1.9.81).

Length, excluding furcal setae: about 1.02 mm. The differential features observed are: hyaline lamella of the last segment of antennule with a deep notch (Fig. 21); absence of spine at the inner edge of the basipodite of P1 (Fig. 22); absence of spines on the maxillulary palp; intercoxal plates from P1 to P3 without developed prominences, with triangular expansions on P4 (Fig. 20); Enp3 P4 2.7 times as long as wide, outer terminal spine slightly longer than inner one and 0.9 times as long as the segment; furcal rami (Fig. 23) with setules at insertions of lateral and external furcal setae; form of the seminal receptacle (Fig. 19).

Compared to the description by Van de Velde (1984), the basipodite of antenna (Figs 24, 25) presents the same type of ornamentation although the two groups of minute spines well individualized in Van de Velde's drawings at the distal part on caudal side, are less evident in the Israelian specimens, in which the caudal distal minute spines appear to be distributed in four small groups. Some other differences have been observed: there are few hairs on the lateral edges of the last thoracic segment; P5 has a remarkably long spine which reaches the posterior edge of the segment, as long or even longer then the seta inserted on the same segment and much longer than the seta of the basal segment; the furcal index is 2.5 in the specimens from Israel, a little below the range of 2.65–3.04 given by Van de Velde (1984).

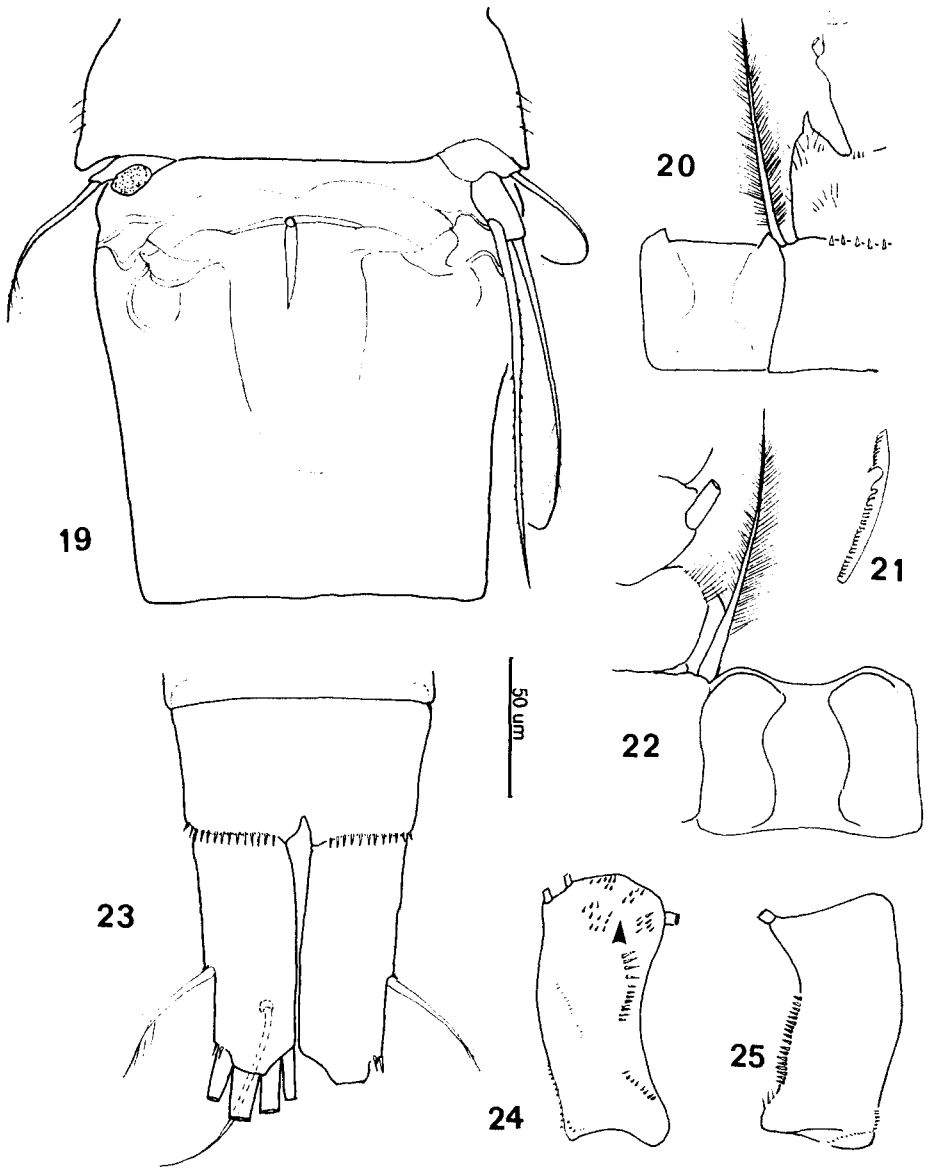
These variations can be considered as part of the variability range of the subspecies. To explain the great variability of this subspecies, Van de Velde (1984) suggested possible hybridizations between *M. aequatorialis aequatorialis* and *M. aequatorialis similis*. However, *M. aequatorialis aequatorialis* has not yet been reported from Israel.

The genus *Mesocyclops* seems well diversified in Israel, with four species found to date.

M. ogunnus was initially considered to be an African species, but its distribution is now known to extend outside Africa, to Lake Kinneret in the north. Moreover, it has been recorded from Bangladesh (Dussart & Fernando, 1988), Indonesia (Dussart & Sarnita, 1987) and recently from Thong Khan Kham, Vientiane, Laos (Reid & Kay, 1992).

M. kieferi presents an analogous situation: first considered an African species, it was subsequently reported outside Africa, from Dead Sea Valley and South Yemen (Van de Velde, 1984; Dumont, Maas & Martens, 1986). More eastward, it has been cited from Sri Lanka (south of Colombo) by Dussart & Fernando (1988).

This is the first report of *M. aequatorialis similis* in Israel. This subspecies is widely distributed in Africa, from the Guinea zone and Sahel to Eastern Africa, and



Figs 19–25. Mesocyclops aequatorialis similis. Female. 19. Last thoracic and genital somite with view of the seminal receptacle and P5 (at left, second segment of P5 not drawn); 20. Precoxal plate, P4; 21. Hyaline lamella of the last segment of antennule; 22. Precoxal plate, P1; 23. Furca, ventral view; 24. Basipodite of antenna, caudal side; 25. Basipodite of antenna, frontal side.

to Algeria in the North; its presence in Upper Central Galilea constitutes the northern limit of its distribution.

New information will be necessary on the presence of *M. arcanus* in and outside Israel to discuss the biogeographical characteristics of the genus *Mesocyclops* in Israel.

A simple key to the species of *Mesocyclops* of Israel is proposed (females only). However, identifications should be confirmed by a comparison with the detailed description of the species, particularly concerning the seminal receptacle. The first character to take into account when using the key is that all these species are devoid of a spine at the inner distal margin of the basipodite of P1.

1. – Basis of maxillulary palp ornamented with spines

M. ogunnus

– Basis of maxillulary palp without spines

2

2. – Basipodite of antenna with a row or group of spines on the distal part (arrowed in Fig. 24); terminal inner spine of P5 as long as the terminal setae and reaching the distal margin of the genital somite

M. aequatorialis similis

– Basipodite of antenna without a row or group of spines on the distal part

3

3. – Setules present at the insertion of lateral and external furcal setae; distal margin of last urosomite completely fringed of spines

M. kieferi

– Setules absent at the insertion of lateral and external furcal setae; distal margin of last urosomite with spines only of ventral side

M. arcanus n.sp.

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