

MONOCULUS

Copepod Newsletter



Nr. 28

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MONOCULUS

Copepod Newsletter

Number 28

November 1994

Edited by: Hans-U. Dahms and H. Kurt Schminke, Fachbereich 7 (Biologie), Universität Oldenburg, Postfach 2503, D-26111 Oldenburg, Germany. Gerd Schriever, Forschungsinstitut Hohenwestedt, Kieler Str. 51, D-24594 Hohenwestedt, Germany.

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This issue has been typed by: Angelika Sievers, Fachbereich 7 (Biologie), Universität Oldenburg.

Cover (as well as cartoons by M. Pottek, Oldenburg):

Pectenophilus ornatus, new genus, new species. Microanatomy of female sectioned in median plane (after NAGASAWA et al. 1988 - Journal of Crustacean Biology 8: 31-42).

Deadline for the next issue of MONOCULUS: 1st April 1995.

ERRATUM

As has been discovered by Z. Kabata, there was a wrong author adjoint in MONOCULUS 27 to the following paper:

PIASECKI, W. - 1993: Symposium on: Sea lice and other parasitic Copepoda. Wiadomosci Parazytologiczne 39(2): 205-207

EDITORIAL

Are copepods important?

Copepod research is, of course, a justifiable scientific enterprise by itself. But when it comes to fund-raising one will be asked about the significance of copepod taxa in an ecological context, their economic importance, or their use for other scientific disciplines.

It is likely that copepods are the most numerous metazoan animals. They are inhabiting different aquatic realms and are performing a variety of life styles. Being that ubiquitous they are affecting mankind either directly (e.g. as human parasite vectors) or more indirectly by their economic importance. The latter is not restricted to their nutritional role as many are the early diet for many organisms which will become human sea-food items. Copepods are substantial primary and secondary consumers in aquatic food chains. And they can be used as biological agents (e.g. in mosquito control as pointed out by C.H. Fernando, MONOCULUS 27) and for environmental monitoring purposes, both in the field and in the laboratory. There may be also negative effects of copepods from an economical point of view: parasitic copepods afflicting fisheries and aquaculture. Copepod grazing will use up algal primary production in the transfer to a higher trophic level, which is not yet exploited directly by humans. On the other hand, copepods make organic material available to higher trophic levels in a larger pelletable size, saving foraging energy for their predators.

Most important, it seems that copepods can be used as ideal model organisms for any general biological approach. Their very ubiquity makes them readily available. High density and diversity reduces sampling size and processing and storage effort for *in situ* studies. Concepts of e.g. community ecology could be tested using copepod communities as model systems. Owing to their small body size, comparatively short generation times, and high growth rates, space and time requirements for experiments with them are modest.

The small size of copepods makes it possible to use experimental populations of millions of individuals, which excludes any unwanted influence of inter-individual variability. Many copepods can easily be maintained and even be reared over multiple generations. Cultures may provide evidence on e.g. life history traits, embryonic morphology, growth, colour-pattern, physiology, life habits, behaviour, autecology, and the ontogenetic changes of these parameters.

Candidate members of WAC are reminded of sending a short article about e.g. themselves, their research interests and running projects to the editor of MONOCULUS.

This issue of MONOCULUS came about due to the efforts of several colleagues. The editorial staff thanks the following members for their contributions:

H. Juhl, Bob Kabata, Janet Reid, Carlos da Rocha, Peter Rumm, Chang-tai Shih, Chad Walter.



Mr. McSilliped and Miss O'Frioid invite you to the
SIXTH INTERNATIONAL CONFERENCE ON COPEPODA
in Oldenburg 1996

The Sixth International Conference on Copepoda will be held in
Oldenburg (Germany) in the week from 29th July to 2nd August
1996.

It will be organized by Arbeitsgruppe Zoomorphologie,
Universität Oldenburg, and Alfred-Wegener-Institut für Polar- und
Meeresforschung, Bremerhaven under the auspices of the World
Association of Copepodologists (WAC).

If you are interested in attending and wish to receive the
second circular and registration forms, please fill in the form
on the attached sheet and return it to:

Sixth International Conference on Copepoda
Dr. Horst Kurt Schminke
Universität Oldenburg
D-26111 Oldenburg, Germany
Fax: +49-441-798-3250
Telephone: +49-441-798-3374
e-mail: SCHMINKE@HRZ1.PCNET.UNI-OLDENBURG.DE

The official language will be English. All posters, presentations and submitted papers must be in English. Oral presentations will be limited to 15 minutes including questions. Poster sessions will be given special emphasis.

The following special symposia are being considered for special sessions:

- Copepods as parasites of fishes (convenor: J.-s. Ho)
- Role of copepods in freshwater ecosystems (convenor: G. Fryer)
- Reproductive biology of copepods (convenor: F. Ferrari)
- Life cycles of copepods (convenor: S.-i. Uye)

Forms for registration, reserving accommodations, and participation in post-conference workshops, as well as details of transportation will be included in the second circular.

OLDENBURG - where the "Sixth International Conference on Copepoda" will take place in 1996

Oldenburg is situated in the middle of the countryside, on the "Green Coastal Road" running up to the North Sea coast.

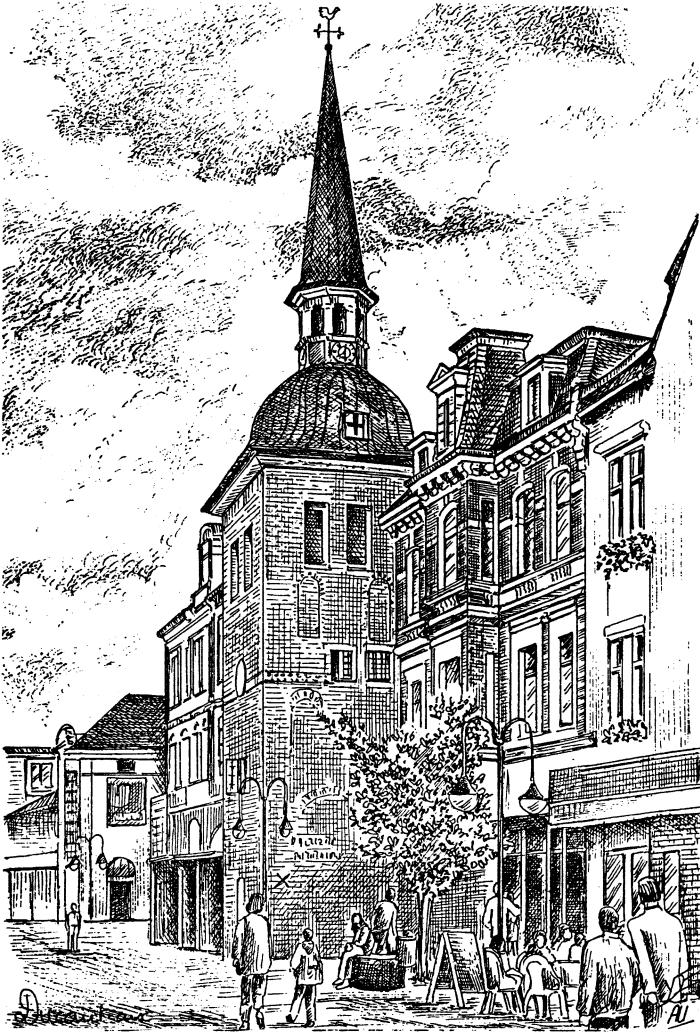
Many ways lead to the young university city. With its 150,000 inhabitants it is both the cultural centre and the capital of the governmental district of the Weser-Ems region.

Being linked to the "Intercity" and "Interregio" railway network of the federal railway system, Oldenburg can be reached by train several times a day. The city centre is situated only a few minutes from the railway station. Those who come to Oldenburg by car can reach the city most quickly via the motorways A28 and A29. The motorway ringroad around the city leads you directly to the town centre and to special places marked "Park + Ride", from which busses will take you to the centre every ten minutes on workdays. Of course, you can also go to Oldenburg by airplane: Bremen airport is accessible by car in no more than 30 minutes. (The nearby airport of Hatten is available for private aircrafts.)

Oldenburg is a city of many faces, each of which has a typical attraction for visitors from near and far. Have a look around and see for yourself.

Red and yellow are the colours on the city's coat of arms, but perhaps green should also be there. Parks and gardens are dotted about the city inviting visitors and townspeople alike to enjoy the many leisure and sporting activities available, whether on Shank's pony or in the saddle of a bicycle or horse, balanced on a surfboard, on the tennis court or in the cockpit of a small aircraft. Oldenburg has the widest range of facilities either within the city itself or nearby.

Nature lovers in particular can enjoy the beauties of three typical coastal regions: sandy geest, lush marshland and sombre moorlands offer wide-ranging views and turn excursions in the tangy sea air into an experience to remember. And even when the weather does not look too promising, there is still Oldenburg itself to discover.



The charm of this old residence of the counts and dukes of Oldenburg is just as strong today as it ever was. History comes alive as you walk through the old streets and alleys of the centre with its five hundred-year-old tradition.

In the beginning there was a river, strictly speaking a ford. In the eighth century an old trade route from Bremen to Jever led

across the River Hunte marking the approximate location of the city today. The ford promised revenues, especially tolls and contributions for convey protection. Enough reason for some nobles - the future Earls of Oldenburg - to settle down at this place. In 1108 "Aldenburg" was first documentarily mentioned and gave the name to the arising village nearby.

The village developed to the county's centre of commerce and administration and gained the freedom of the city on the 6th of January in 1345 - therefore the 650th anniversary of the city of Oldenburg will be celebrated in 1995.

The city centre has now, of course, been completely modernised. Experts consider the pedestrian precinct to be one of the most attractive of the whole of Germany and the town planners have also managed to combine the old and the new in delightful harmony. After all, "buildings for people" has long been a motto of Oldenburg's city fathers. Oldenburg city centre is designed for shoppers, but that's not all. Park fountains, lawns and quiet corners make it an enclave for people looking for relaxation or for those who appreciate the advantage of having museums and other nationally reputed culture institutions, such as the Castle and the State Theatre close to the centre of the city. And not only indoors, but also in the open and free of charge - another typical feature of Oldenburg. Visitors can also follow the Oldenburg motto "Go by bike" and discover its beauties on 250 km of cycle paths.

From spring right through the winter there is always something going on outside - yet another reason for the city being a focal point for half a million people in the surrounding region. There are hundreds of bistros and pubs, elegant restaurants and fashionable cafés to cater for all tastes, from a glass of draught beer at the corner to restaurants with an exquisite international cuisine.

(For further information please contact the local tourist information office, Wallstrasse 14, 26122 Oldenburg, phone (Germany) 441/235-2235.)

WAC - TREASURER'S REPORT 1991/1992

1. The financial situation

	01.01.-31.12.1992	01.01.-31.12.1993
Balance forward	17.101,91 DM	15.918,21 DM
Deposits	1.317,00 DM	10.524,89 DM
Interests	1.265,50 DM	340,52 DM
Total	2.582,50 DM	10.865,41 DM
Expenses		
Transfer to Conference	2.977,00 DM	5.083,20 DM
Support of MONOCULUS 91/92	668,20 DM	1.668,40 DM
Account dues	121,00 DM	143,13 DM
Total	3.766,20 DM	6.894,73 DM
Balance	15.918,21 DM	19.888,89 DM

Remarks: The total financial situation of WAC looks always better than it actually is. Several members have used the Baltimore Conference to pay their dues in advance. You can see this from the development of the deposits since 1990. This was as follows: 1990: 6.048,33 DM (year of Conference); 1991: 2.796,28 DM and 265,99 US \$; 1992: 1.265,50 DM and 958,52 US \$ and 1993: 10.524,89 DM (including the transfer from the American \$ account to the German account). Many thanks again to all who have made generous donations to the WAC. All this helps the Association to support those members whose dues have been waived and to give grants to some colleagues to attend the next conference in Oldenburg/Germany. In the next MONOCULUS Thomas Glatzel and Ruth Boettger-Schnack will give a report on how Gerd is doing his job as treasurer.

!!!!!!!!!!!!!!!!!!!!!! THIS IS YOUR LAST MONOCULUS !!!!!!!!!!!!!!!!!!!!!!!

The following WAC-members and candidate members have not paid their dues since 1990 and will be ELIMINATED from the MONOCULUS mailing list - this is your last MONOCULUS - if you do not send your dues to Gerd:

Bron, Brown, Burns, Chisholm, Chow-Fraser, Conover, Diel-Christiansen, Fernandez de Puellas, Hairston Jr., Hamond, Hiromi, Hisae, Iwasaki, Jonasdottir, Maas, Matsuo, McAlice, Miller, W. Oldewage, Orsi, Peterson, Rainville, Rio Mispireta, Sevigny, Sieg, Suarez-Morales, Tafe, Williamson, Yoosuk.

HELP-HELP-HELP

Someone has sent a cheque for 17 DM dues to Kurt Schminke. Unfortunately, Kurt has endorsed the cheque without putting down the name. Please write to Gerd.

Gerd Schriever, Hohenwestedt, Germany

ANNOUNCEMENTS

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EMILIA STELLA

1909-1994

On March 10, 1994, Prof. Emilia Stella of the University "La Sapienza di Roma" passed away at the age of 84.

She was born on April 4, 1909, and worked on the plankton of lakes and temporary waters, particularly on calanoids.

Her department made the following announcement:

Il Dipartimento di Biologia Animale e dell'Uomo dell'Università "La Sapienza" di Roma, annuncia con profondo cordoglio la scomparsa, avvenuta in Roma il 10 marzo 1994, della

Prof. EMILIA STELLA

ricordandone l'opera appassionata in favore della ricerca idrobiologica, l'impegno didattico e la signorilità dell'animo.

Second European Crustacean Conference

A Second European Crustacean Conference is planned to be held in Belgium in 1995 (or 1996). Those interested can contact Dr. André Péqueux, Laboratoire de Physiologie Animale, Institut Van Beneden, Université de Liège, Quai Van Beneden 22, B-4020 Liège, Belgium.

Il Congresso de Ecologia do Brasil

(December 5-9, 1994)

Universidade Estadual de Londrina
Centro de Ciências Biológicas
Departamento de Biologia Animal e Vegetal
Campus Universitario. Caixa Postal 6001
CEP 86051-970 Londrina - Paraná BRASIL
Tel: (043) 3212000 (ext. 4247)

New Journal

The Brazilian Society for Carcinology is launching a new journal "*Nauplius*" dealing with all aspects of crustacean systematics and biology. Anyone requiring further information on the journal may contact the editor, Dr. Monica Montu, Plankton Laboratory, Dept. of Oceanography, Foundation University of Rio Grande, Caixa Postal 474, 96201-900 Rio Grande RS, Brazil.

**Carbon Fluxes and Dynamic Processes in the Southern Ocean:
Present and Past**

Institut Universitaire Européen de la Mer
Université de Bretagne Occidentale
Brest (France)

28-31 August 1995

an International Symposium organized in association with
Southern Ocean JGOFS

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Back issues of MONOCULUS

I am trying to clean my book shelves and I am about to throw away back issues of MONOCULUS. The number of each issue of the MONOCULUS (Nrs. 4-26) varies from a few to over fifty. Would you announce in the next issue of MONOCULUS that these back issues will be given away free as long as they are still available.

Chang-tai Shih
Natn. Mus. Nat. Sci
Zool Division, Stn. D,
P.O.Box 3434
Ottawa, Ontario
Canada U1A 6P4

Annual lists of new copepod taxa (1985-1994)

Since 1985, I have been compiling annual lists of new copepod taxa. The lists consist of the name, type depository, type locality, and reference of each new taxon. A computer printout of the list from 1985-1990 will be available on request. The list is too long to be included in MONOCULUS (25 to 44 pages per list).

The list comprises two paragraphs: a. new taxa; b. publications. In the *New Taxa*, each new species includes information on the types and locality of the holotype. In the *Publications*, the new taxa in each publication is listed after the full citation of the publication.

Based on my experience in compiling these lists, I would like to recommend to fellow copepodologists who publish new taxa that the following information should be included in their manuscripts:

1. Designation of types.
2. Depository of types. The types, at least the holotype and allotype should be deposited in an institution which will take properly care of the specimens on a permanent basis.
3. Information on type locality and other collecting data.

Copepodologists who are publishing taxonomic work for the first time should check with Ride, W.D.L. et al. (eds.), 1985, International code of zoological nomenclature (3rd ed.) adopted by the XX General Assembly of the International Union of Biological Sciences, International Trust for Zoological Nomenclature, London, especially on fixation and depository of types. Holotypes and other types of equally taxonomical importance should not be kept at a private collection.

Chang-tai Shih, Ottawa, Canada

SAMPLE:

Annual lists of new copepod taxa (1985-1994)

I. New Taxa of the Copepoda: 1985

CALANOIDA

ACARTIIDAE

Acartia (Acanthacartia) bacorehuisensis Zamora-Sánchez et Gomez-Aguirre

Holotype: f. Paratypes: 16 m, 17 f. All in the collection of la Universidad Autónoma Metropolitana. (In the publication, the description of female is under the heading of *Holotipo hembra*. However, at the end of the description it stated: "Holotipo m y Paratipos 17 f y 16 m,...")

Type locality: Gulf of California: Mexico: Laguna de Agiabampo Sonora: Estero de Bacorehuis, 26°20'N 109°05'W.

Acartiella nicolae Dussart

Holotype: m. Allotype: f. Paratypes: 5 m, 5 f. All in the author's collection which will be deposited in Museum d'Histoire naturelle de Paris.

Type locality: Pacific: Borneo: estuary of Mahakam: 117°20'E, 0°30'S.

II. Publications of Copepoda New Taxa: 1985

Alvarez, M.P.J. A new species of a misophrioid copepod from the near-bottom waters off Brazil. *Journal of Natural History* 19: 953-959.

Archimisophria squamosa sp.nov.

Alvarez, M.P.J. A new arietellid copepod (Crustacea): *Pilarella longicornis*, gen.n. sp.n., from the Brazilian continental shelf. *Revista Brasileira de Zoologia* 3: 189-195.

Pilarella longicornis gen. et sp.nov.

Alvarez, M.P.J. Revision of the genus *Neoscolecithrix* (Copepoda, Calanoida) and description of *N. caetanoi*, sp.n., collected off Brazil. *Revista Brasileira de Zoologia* 3: 197-207.

Neoscolecithrix caetanoi sp.nov.

Andronov, V.N. Benthic Copepoda in the area of Cape Blanc (Islamic Republic of Mauritania). 1. The family Platycopiidae. *Zoologicheskii Zhurnal* 64: 1735-1739.

Platycopia robusta sp.nov.

Apostolov, A. Etude sur quelques copépodes harpacticoides du genre *Elaphoidella* Chappuis, 1929 de Bulgarie avec une revision du genre. *Acta Musei Macedonici Scientiarum Naturalium* 17: 133-163.

Elaphoidella bisetosa sp.nov.

Elaphoidellopsis gen.nov.

Stygoelaphoidella gen.nov.

Neoelaphoidella gen.nov.

Bayly, I.A.E. A new species of *Boeckella* (Copepoda: Calanoida) from western Australia, and comments on two other congeners.

Records of West Australian Museum 12: 79-84.

Boeckella shieli sp.nov.

We appreciate this compilation of "Annual lists of new copepod taxa" very much and it will undoubtedly be of help for many Copepodologists.

Therefore, we are asking interested people to send a request to the editor of MONOCULUS. According to this response the "Annual lists of new copepod taxa" will be printed and distributed.



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MODEL DESCRIPTION

Cyclopoida

MODEL DESCRIPTION

Family CYCLOPIDAE

Metacyclops oraemaris (Figs. 1-4)

Holotype. MZUSP 11449.

Type locality. Itamambuca (23°24'S, 44°59'W), Ubatuba, State of São Paulo, Brazil.

Paratypes. MZUSP 11450, 39 specimens from Itamambuca, in moss growing on crystalline rock moistened by freshwater trickling down on highway BR 101 (1 June 1991; coll. C.E.F. da Rocha).

Other material. MZUSP 11451-11452, 2 specimens in moss about 1 m above groundlevel at entrance of Gruta que Chora (23°30'S, 45°8'W), Ubatuba, a small grotto which may sometimes be reached by the sea during high tide (28 February 1991; coll. C.E.F. da Rocha); 2 specimens from moss growing along road to Forte Defensor Perpétuo, Parati (23°15'S, 44°42'W), State of Rio de Janeiro (31 May 1991; coll. C.E.F. da Rocha).

Etymology. The specific name (from the Latin 'orae', edge; 'maris', from the sea) refers to the find of the species very near the sea's edge at Gruta que Chora.

Female. Length of holotype, excluding caudal setae 460 µm. Length of 8 paratypes ranging from 440 to 500 µm. Prosome: urosome ratio about 1.8:1. Body surface without patterns of cuticle striae. Posterior borders of all prosomites and first urosomite smooth (Fig. 1A). Genital double somite (Fig. 1B) about 1.25 times broader than long, broadest at anterior third and tapering posteriorly except for pronounced straightening at posterior third. Distal border of genital double somite and of two subsequent urosomites with hyaline membrane irregularly serrated (Fig. 1B,C). Seminal receptacle as shown in Fig. 1B. Anal pseudoperculum (Fig. 1C) with rounded hump on each corner; pseudoperculum of one female from Parati with row of tiny hyaline spinules along distal border.

Caudal rami (Fig. 1C,D) 2.3-2.5 times longer than wide, with lateral row of 3-4 spinules at anterior third. Lateral seta inserted at beginning of posterior third and preceded by a row of 5 spinules. Outermost apical seta 1.4-1.5 times length of innermost apical seta. Dorsal seta as long as or slightly longer than outermost apical seta. Inner middle apical seta longer than urosome and twice longer than outer one; both middle apical setae ornamented by setules sparsely placed on anterior third which become closer together and gradually longer and thinner towards tip. Pore signature pattern of urosome as shown by Fig. 1B-D.

Antennule (Fig. 2A) 11-segmented and armed as follows: 8 + row of spinules ventrally, 4,6,2,1 + spine, 2,3,2 + aesthetasc, 2,2 + aesthetasc, 7 + aesthetasc. Apical aesthetasc fused at base with adjacent seta.

Antenna (Fig. 2B) with coxa unarmed. Seta representing exopod absent. Basis with 2 setae around inner distal angle, and with row of 5 or 6 spinules on posterior surface. Endopod segment 1 with inner seta. Endopod segment 2 with 8 setae, of which 7 on posterior surface and only 1 on anterior surface of inner side; seta on inner distal angle thicker than other setae. Endopod segment 3 with 7 apical setae.

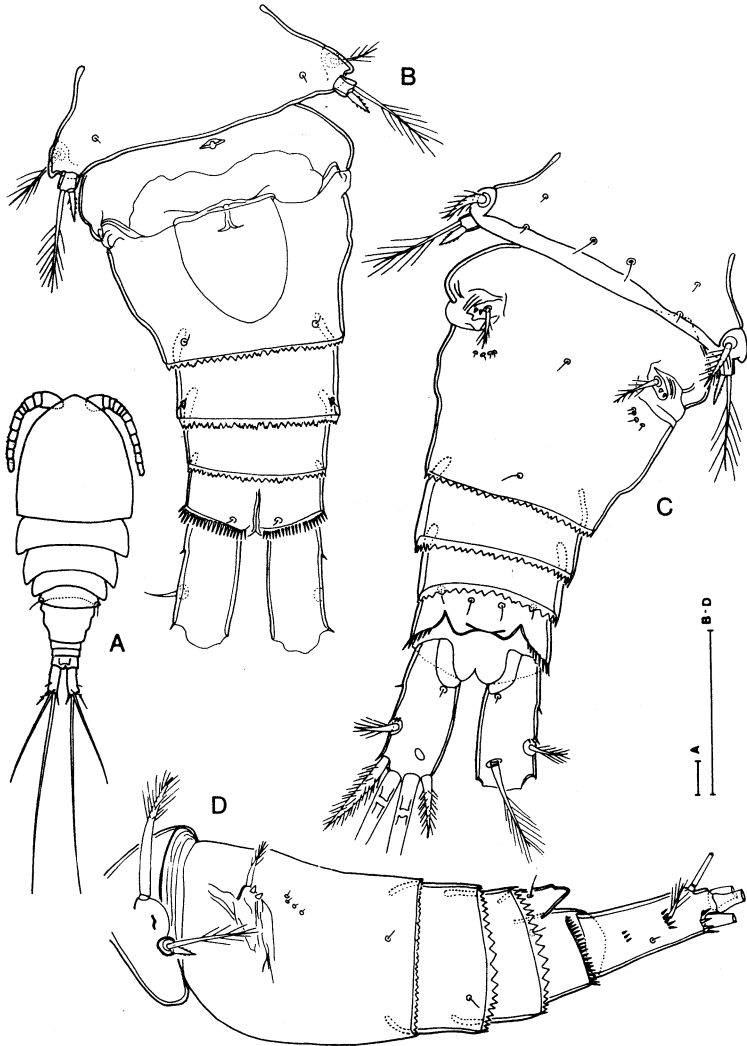


Fig. 1. *Metacyclops oraemaris* sp.n., female. - A. Habitus, dorsal. - B. Urosome showing seminal receptacle, ventral. - C. Urosome, dorsal. - D. Urosome, lateral. Scale bars: 50 μ m.

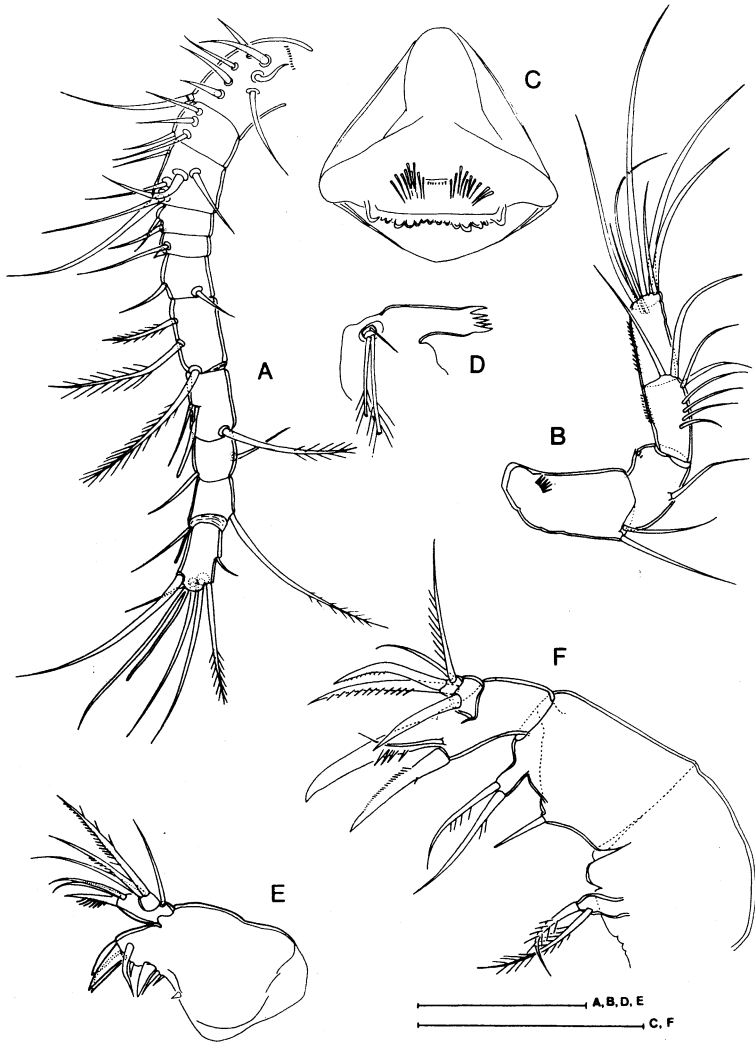


Fig. 2. *Metacyclops oraemaris* sp.n., female. - A. Antennule, ventral. - B. Antenna, posterior. - C. Labrum. - D. Mandible. - E. Maxillule. - F. Maxilla, posterior. Scale bars: 50 μ m.

Labrum (Fig. 2C) with strong teeth on posterior margin and 2 groups of setules separated from each other by row of tiny denticles.

Mandible (Fig. 2D) with reduced palp bearing 2 long plumose setae and short naked seta.

Maxillule (Fig. 2E) comprised by well-developed praecoxa and 2-segmented palp. Praecoxal arthrite armature consisting of 9 spines and setae. Proximal segment of palp derived from basis, armed with 3 inner setae and outer remnant seta of exopod. Distal segment of palp representing endopod, armed with 3 setae.

Maxilla (Fig. 2F) 5-segmented, comprised of praecoxa, coxa, basis and 2-segmented endopod. Praecoxa fused to coxa on posterior surface. Basis drawn out into claw with 4 inner teeth. Seta formula: 2,3,2,2,3.

Maxilliped (Fig. 3A) of 4 segments, comprising syncoxa, basis and 2-segmented endopod. Seta formula 3,2,1,3.

Legs 1-4 (Fig. 3B-D) armed as follows (Roman numerals indicating spines, Arabic numerals representing setae):

	Coxa	Basis	Exopod		Endopod	
			1	2	1	2
Leg 1	0-1	1-I	I-1	III,2,3	0-1	1,I+1,3
Leg 2	0-1	1-0	I-1	III,I+1,4	0-1	1,I+1,4
Leg 3	0-1	1-0	I-1	III,I+1,4	0-1	1,I+1,4
Leg 4	0-1	1-0	I-0	II,I+1,4	0-1	1,II,3

Basis of leg 1 with spinulose inner spine almost reaching insertion of proximal inner seta of endopod segment 2.

Legs 2 and 3 differing in size only.

Leg 4 coxa with row of spinules on distal border and curved row of spinules proximally on outer corner of caudal surface; second endopodal segment 1.6-1.8 times longer than broad, with inner apical spine slightly shorter than segment (0.9:1) and 1.7 times longer than outer apical spine.

Intercoxal sclerites of legs 1-4 smooth on both surfaces and with pair of humps at posterior corners.

Free segment of leg 5 (Fig. 1B) as long as wide. Spine serrate and longer than segment. Seta plumose and 3 times longer than spine. Dorsal remnant seta of basal segment (Fig. 1D) stout, plumose, and turned dorsally and posteriorly. Area of somite between free segment of leg 5 and dorsal seta (Fig. 1D) with thickening of cuticle.

Male. Body length ranging from 375 to 430 μm (N = 10). Pore signature pattern of urosome (Fig. 4A-C) differing from that of female by absence of group of 4 pores posterior to leg 6.

Antennule of 16 segments and armed as in Fig. 4D,E. Armature of segments 14 and 15 not seen clearly.

Free segment of leg 5 (Fig. 4B) with seta 2.5 times longer than spine.

Leg 6 (Fig. 4C) with spine as long as middle seta and about half length of outer seta.

Male similar to female in all other respects.

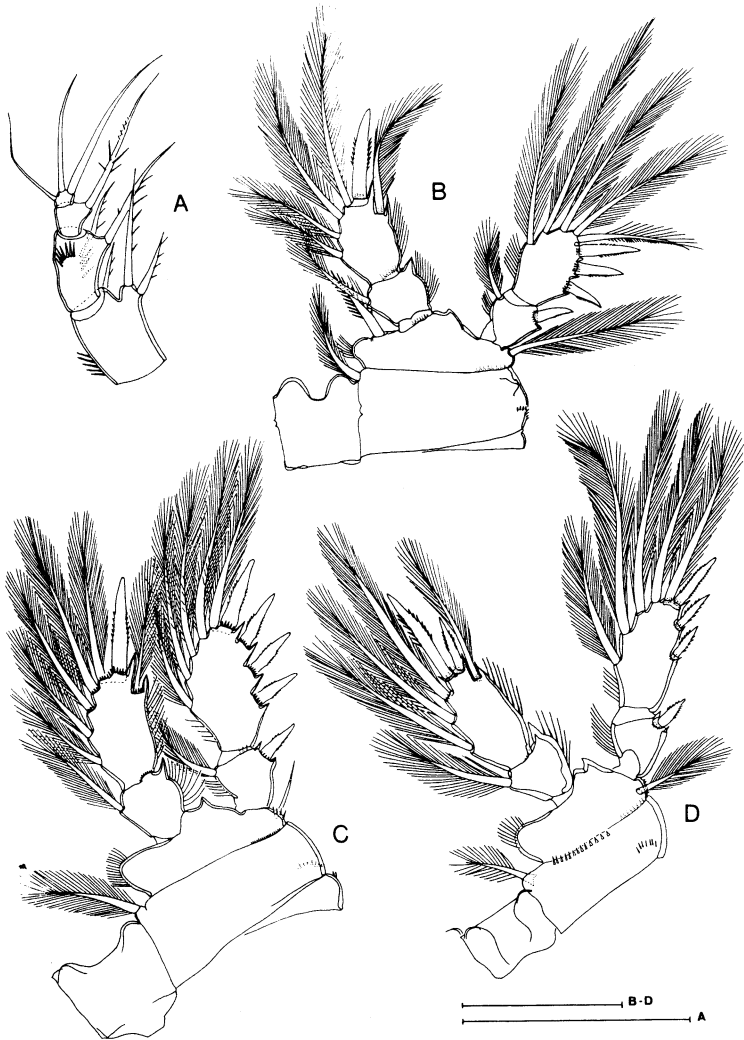


Fig. 3. *Metacyclops oraemaris* sp.n., female. - A. Maxilliped, posterior. - B. Leg 1, posterior. - C. Leg 2, anterior. - D. Leg 4, posterior. Scale bars: 50 μ m.

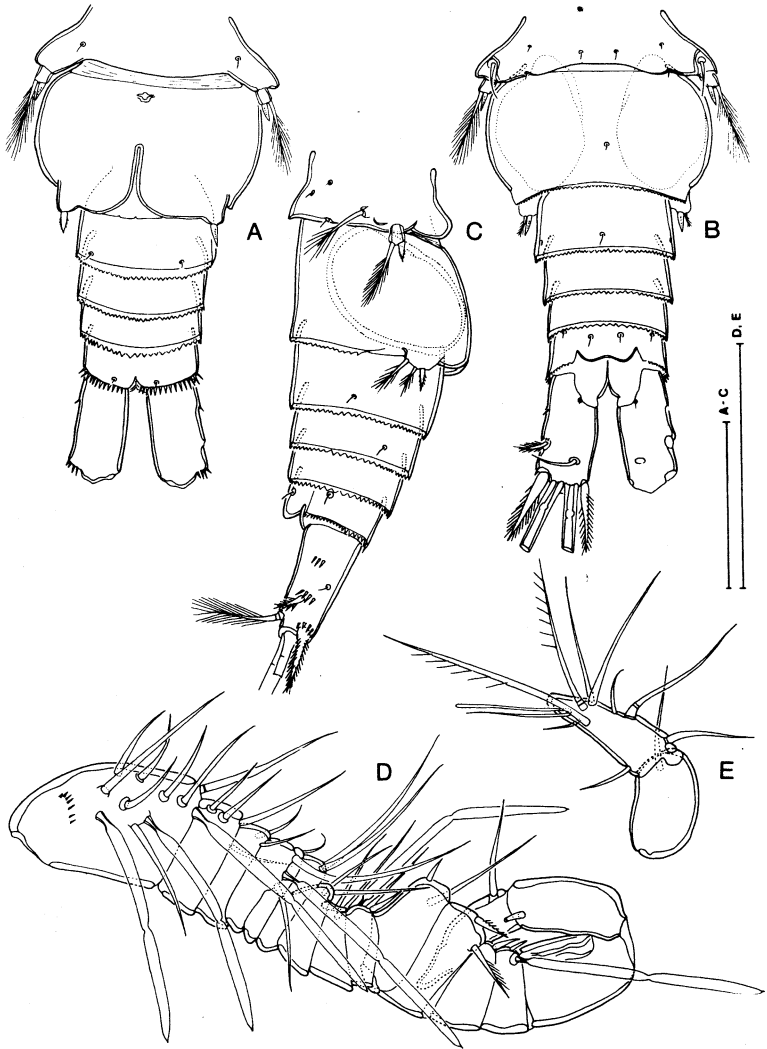


Fig. 4. *Metacyclops oraemaris* sp.n., male. - A. Urosome, ventral. - B. Urosome, dorsal. - C. Urosome, lateral. - D. Antennule. - E. Last two segments of antennule. Scale bars: 50 μ m.

Remarks. The new species closely resembles *M. paludicola* described by Herbst (1959). They share the same structure of the genital double somite, leg 4 endopod 2, and intercoxal sclerite of the leg 4; the same proportions of the caudal rami; and a similar number of segments of the antennule. Also, both species inhabit the moss in the coastal area of the State of São Paulo. The type locality of the new species is about 250 km north of the type locality of *M. paludicola*. However, differences between them are great enough to warrant them in different species.

The afore-described specimens were initially thought to represent *M. campestris* Reid, 1987 because of the absence of the outer seta on the basis of the antenna, the number of spinules on the anterior third of the outer surface of the caudal ramus, and also the general structure of legs 4 and 5. In order to clear doubts about the identity of these two species, part of the type material of *M. campestris* was re-examined.

C.E.F. da Rocha
São Paulo, Brazil



LITERATURE

(Sources marked by an asterisk * are donated to the MONOCULUS library)

1992

- *BAN, S. - 1992: Seasonal distribution, abundance and viability of diapause eggs of *Eurytemora affinis* (Copepoda: Calanoida) in the sediment of Lake Ohnuma, Hokkaido. Bulletin of Plankton Society of Japan 39 (1): 41-48
- *BAN, S. - 1992: Effects of photoperiod, temperature, and population density on induction of diapause egg production in *Eurytemora affinis* (Copepoda: Calanoida) in Lake Ohnuma, Hokkaido, Japan. Journal of Crustacean Biology 12 (3): 361-367
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CANDIDATE MEMBERS

BRANDORFF, G.-O. Dr.
Wulfsdorfer-Weg 64
D-22926 AHRENSBURG
Germany

KLEPPEL, G.S. Dr.
Nova University
Oceanographic Center
8000 North Ocean Drive
DANIA, FL 33004
USA

LEE, Chu Dr.
National Fisheries Research
& Development Agency
Shirang-ri, Kijang-up
Yongsan-gun
KYOUNGSANGNAM-DO 629-900
Korea

McKENNY, T. Dr.
National Fisheries Service
28 Tarzwell Drive
NARRANGENSETT, RI 02882-1199
USA

PIEPER, R.E. Dr.
Fish Harbor Marine Lab
University of Southern California
820 S. Seaside Avenue
TERMINAL ISLAND, CA 90731
USA
e-mail: r.pieper@omnet.com

SMURNOV, A.V. Dr. and
IVANENKO, V.N.
Department of Zoology
Biology Faculty
Moscow State University
MOSCOW, 119899
Russia
e-mail Dr. Smurnov:
avsFb7@omnet.npimsu.msk.su
e-mail Mr. Ivanenko:
ivanenkony@bio.msu.su

SUH, H.-L. Dr.
Department of Oceanography
Chonnan University
KWANGJU, 500-757
Korea

CHANGE OF ADDRESS

BROWNELL, Ch.L. Dr.
10621 Keel Avenue
GARDEN GROVE, CA 92643
USA

GAVIRIA, S. Dr.
Biozentrum
Althanstrasse 14
A-1090 WIEN
Austria

HIROTA, R. Dr.
Higashiko-Umatate
Misumi-machi
Uto-gun
KUMAMOTO 869-32
Japan

IWASAKI, N. Dr.
Usa Marine Biological Inst.
Kochi University
Usa-cho, Tosa
KOCHI 781-11
Japan

KURBJEWIT, F. Dr.
Ernst-Moritz-Arndt Universität
Geographisches Institut
Koordinierungsbüro Boddenforschung
Friedrich-Ludwig-Jahn-Str. 16
D-17489 GREIFSWALD
Germany

MORAN, J.
Department of Biological Sciences
Simon Fraser University
BURNABY, British Columbia
Canada V5A 1S6
FAX (604)291-3496
e-mail: JMORAN@SFU.CA

MOREIRA, G. Dr.
Instituto de Biociencias
Dept. de Fisiologia Geral
Universidade de Sao Paulo
Caixa Postal 05499 SAO PAULO SP
Brazil

SCHIZAS, N.V.
Department of Biology and
Baruch Inst. for Marine Biology
and Coastal Research
COLUMBIA, SC 29208
USA
e-mail: t420031@UNIVSCVM.CSD.
SCAROLINA.EDU

CHANGE OF e-MAIL ADDRESS

HO, J.-s. (Vice President of WAC): JSHO@CSULB.EDU

LIST OF e-MAIL ADDRESSES

Rafael Arocena University of Uruguay LIMNO@FCIEN.EDU.UY
Annemarie Avenant-Oldewage Rand Afrikaans University WHO@RAU3.RAU.AC.ZA
Ulf Bamstedt University of Bergen ULF.BAAMSTEDT@IFM.UIB.NO
Pamela I. Blades-Eckelbarger University of Maine MAINE.CMS ATT.P.ECKELBARGER
(omnet)
Walter A. Boeger UFPR WBOEGER@BRUFPR.BITNET
Ruth Böttger-Schnack Universität Kiel DSCHNACK@MEERESKUNDE.UNI-KIEL.D400.DE
James E. Bron University of Stirling JEB1@UK.AC.STR.FORTH
Carolyn W. Burns University of Otago ZOOLOGY@OTAGO.AC.NZ
Patricia Chow-Fraser McMaster University CHOWFRAS@SSCVAX.CIS.MCMASTER.CA
Bruce C. Coull University of South Carolina N090012@UNIVSCVM
Hans-U. Dahms Universität Oldenburg HUDAHMS@HRZ1.PCNET.UNI-OLDENBURG.DE

Hans G. Dam University of Connecticut HGDAM@UCONNVM.UCONN.EDU
 Danielle Defaye Museum National d'Histoire Naturelle CRUSTACE@FRMNH11.BITNET
 Stanley Dodson University of Wisconsin DODSONS@WISC.MACC.EDU
 Lisa A. Drake Old Dominion University DRAKE@CS.ODU.EDU
 Robert Feller University of South Carolina N080005@UNIVSCVM
 Frank Ferrari Smithsonian Institution FERRARIF@SIMSC.SI.EDU
 John W. Fleegeer Louisiana State University ZOFLEE@LSUVM.BITNET
 Grant A. Gardner Memorial University of Newfoundland GGARDNER@KEAN.USC.MUN.CA
 Nelson G. Hairston, Jr. Cornell University NGH@CORNELLA.CIT.CORNELL.EDU
 Ju-shey Ho California State University JSHO@CSULB.EDU
 Monica Susana Hoffmeyer Instituto Argentino de Oceanografia BMHOFFME@ARCRIBA
 Wim Kimmerer Biosystem Analysis Inc. onmet W.KIMMERER
 Klaus Kohlhage Universität Oldenburg KOHLHAGE@HRZ1.PCNET.UNI-OLDENBURG.DE
 Peter Koomen Rijksmuseum van Natuurlijke Historie SBU2PK@RILSFB.LEIDENUNIV.NL
 Darcy J. Lonsdale SUNY Stony Brook DLONSDAL@SBCMAIL.BITNET
 Guilherme Ribeiro Lotufo Louisiana State University ZOFLEE@LSUVM.BITNET
 Andrey Marchenkov Academy of Science ZISP.PM@PCSTI.SPB.SU
 Nancy H. Marcus Florida State University bitnet N.MARCUS@FSU
 Victor H. Marin Universidad de Chile VMARIN@UCHDCIU.X.SECCI.UCHILE.CL
 John R. McConaugha Old Dominion University JRML00F@NAECO.LUDWICK.ODU.EDU
 Silvina A. Menu-Marque Universidad de Buenos Aires INIDEP@BIOUBA.EDU.AR
 Jens Christian Nejstgaard University of Bergen JENS.NEJSTGAARD@IFM.UIB.NO
 Thomas Noji Institute of Marine Research TOM-NOJI@SEAGATE.IMR.NO
 Maria Fredrika Norrbin University of Tromsø FNORRBIN@CLIFF.WHOR.EDU
 Judith M. O'Neil University of Queensland BTDENNISON@UQVAX.CC.UQ.OZ.AU
 Mark D. Ohman Scripps Institution of Oceanography MOHMAN@UCSD.EDU
 Willie H. Oldewage Rand Afrikaans University WHO@RAU3.RAU.AC.ZA
 Gustav-A. Paffenhöfer Skidaway Institute of Oceanography onmet G.Paffenhofer
 Margaret A. Palmer University of Maryland 209194@UMDD
 Wojciech Piasecki University of New Brunswick PIASECKI@UNB.CA
 Ricardo Pinto-Coelho Universidade Federal de Minas PCOELHO@BRUFMG.BITNET
 (notify via fax 031-441-1412)
 Janet W. Reid Smithsonian Institution MNHIV035@SIVM.SI.EDU (c/o Chad Walter)
 Nikolaos V. Schizas University of South Carolina T420031@UNIVSCVM.CSD.
 SCAROLINA.EDU
 Horst Kurt Schminke Universität Oldenburg SCHMINKE@HRZ1.PCNET.UNI-OLDENBURG.DE
 Charles A. Simenstad University of Washington CSIMENSTAD@LTERNET.WASHINGTON.EDU
 Terry W. Snell Georgia Institute Technology TS41@PRISM.GATECH.EDU
 J. Rudi Strickler Center for Great Lakes Studies JRS@CONVEX.CSD.UWM.EDU
 T. Chad Walter Smithsonian Institution MNHIV035.SIVM.SI.EDU
 John B.J. Wells Victoria University of Wellington SCIFAC@MATAI.VUM.AC.NZ
 Elke Willen Universität Oldenburg WILLEN@HRZ1.PCNET.UNI-OLDENBURG.DE
 Karen F. Wishner University of Rhode Island KWISHER@GSOSUNI.GSO.URI.EDU
 Jeanette Yen SUNY Stony Brook JYEN@CCMAIL.SUNYSB.EDU

Compiled by Chad Walters, Smithsonian Institution, Washington D.C., U.S.A.



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