

Phaennocalanus unispinosus (Copepoda, Calanoida, Phaennidae): new genus, and new species from the bathypelagic Arctic Basin

Elena L. Markhaseva

SARSIA



Markhaseva EL. 2002. *Phaennocalanus unispinosus* (Copepoda, Calanoida, Phaennidae): new genus, and new species from the bathypelagic Arctic Basin. *Sarsia* 87:312–318.

Phaennocalanus unispinosus gen. et sp. nov. is based on a female specimen collected at bathypelagic depths in the Arctic Ocean. The new genus is placed in the Phaennidae on account of the number and kind of sensory setae on the maxilla terminal part: the distal basal lobe plus exopod of maxilla bear one worm-like plus seven brush-like sensory setae. There are five setae on the maxilla praecoxal endite and five setae on the praecoxal lobes of syncoxa of the maxilliped. However, it differs from all other phaennid genera in the maxilliped with two setae sclerotized on the distal praecoxal lobe instead of one brush-like seta and one sclerotized seta which is typical of phaennids, and in leg 5 with a single terminal spine and a lack of surface spinulation on this appendage.

E. L. Markhaseva, Zoological Institute, Russian Academy of Sciences, Universitetskaya nab. 1, St. Petersburg 199034, Russia.
E-mail: copepoda@zin.ru

Keywords: Calanoid copepod; Calanoida; Phaennocalanus gen. nov.; taxonomy; Arctic Ocean; deep sea.

INTRODUCTION

The calanoid copepod family Phaennidae contains the genera: *Brachycalanus* Farran, 1905; *Cephalophanes* Sars, 1907; *Cornucalanus* Wolfenden, 1905; *Onchocalanus* Sars, 1905; *Phaenna* Claus, 1863; and *Xanthocalanus* Giesbrecht, 1892. *Talacalanus* Wolfenden, 1911 was redefined by Campaner (1978), but this genus is very close if not identical to *Xanthocalanus* (Park 1983; Tanaka & Omori 1992). The majority of phaennid species were collected in deep waters of the world's oceans in pelagic or near bottom localities. *Phaennocalanus* gen. nov. described here is the seventh genus of the family and the third phaennid genus in addition to *Xanthocalanus* and *Onchocalanus* recorded from bathyal of the Arctic Ocean.

MATERIAL AND METHODS

A single female was collected during the RV *Polarstern* ARK XI/1 cruise (1995) between 3200 and 1000 m in the Eastern Nansen Basin of the Arctic Ocean (80°00'N 134°56'E) with an opening closing net ("multinet", MN1); mouth opening 0.25 m², 150 µm mesh. For this study the specimen was dissected under the microscope. All figures were prepared using a *camera lucida*.

The following abbreviations are used in the descriptions: A1, antennule; A2, antenna; Enp, endopod; Exp, exopod; Gn, gnathobase; Gns, genital somite; Md, mandible; Mdp, mandibular palp; Mx1, maxillule; Mx1

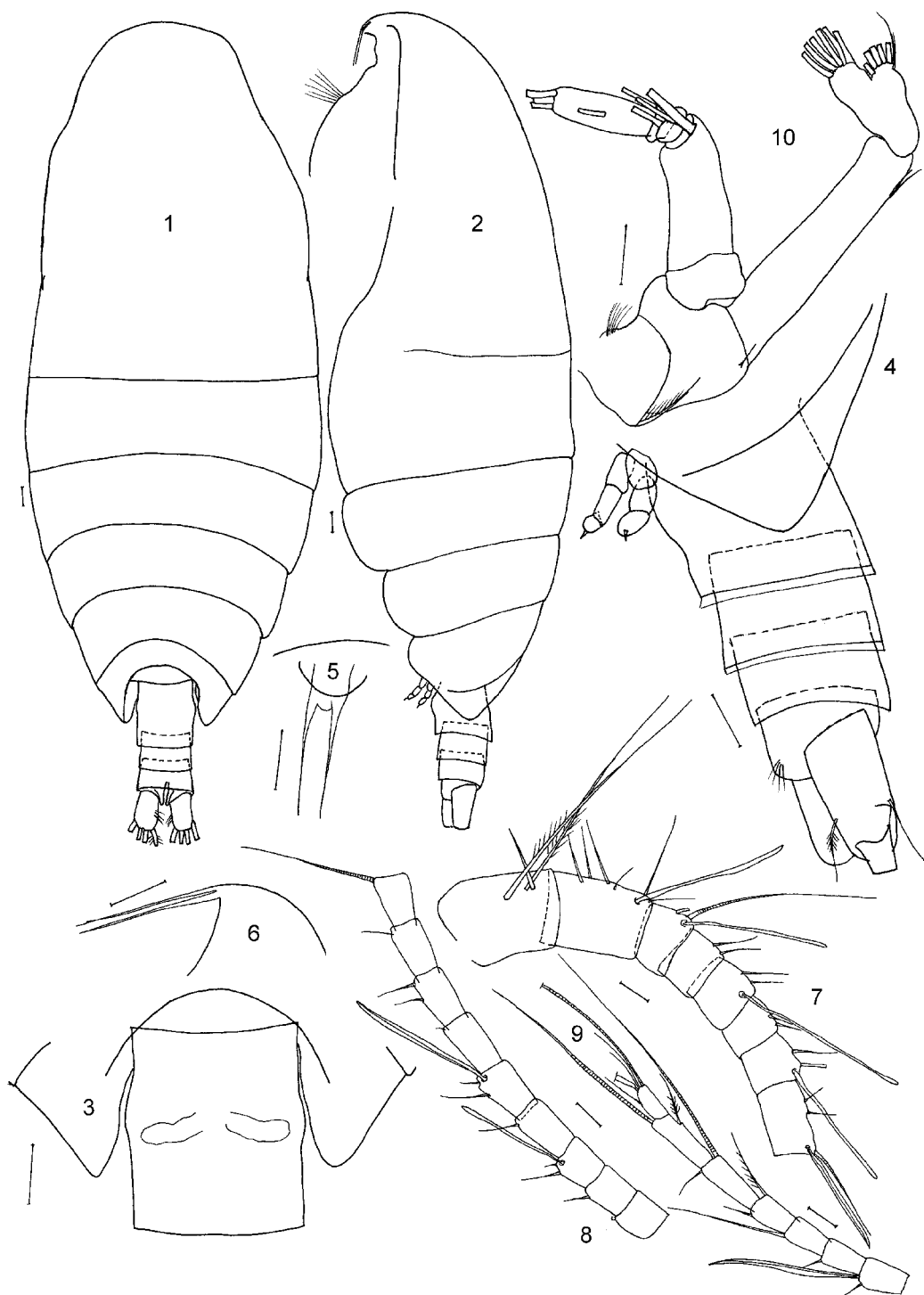
Li1, praecoxal arthrite; Mx1 Li2, coxal endite; Mx1 Li3–4, basal endites (proximal and distal); Mx1 Le1, coxal epipodite; Mx2, maxilla; Mx2 Li1–2, praecoxal endites; Mx2 Li3–4, coxal endites (proximal and distal); Mx2 Li5, basal endite; Mxp, maxilliped, P1–P5, swimming legs 1–5; Pd1–5, pedigerous somites 1–5. Ramal segments of Mx2 are considered exopodal (Ferrari 1995) and the tip of Mx2 is considered a complex of exopodal segments plus the sixth enditic lobe on the basis (Ferrari & Markhaseva 1996); Mxp syncoxa with three praecoxal lobes and one coxal lobe (Ferrari & Ambler 1992; Martínez Arbizu 1997; Ferrari & Markhaseva 2000a, b).

TAXONOMY

Genus *Phaennocalanus* gen. nov.

Diagnosis: Phaennid calanoid copepod; rostrum with two thin, long filaments. Mx1 Li2 with five setae; Mx1 Exp with 10 setae. Mx2 Li1 with five setae; Li4–Li5 with one of setae spine-like; terminal part of Mx2 comprises distal basal lobe plus exopod with one worm-like and seven brush-like sensory setae, the latter are: two thick brushes plus five thin brushes. Mxp syncoxa with five praecoxal setae in total, all are sclerotized. P5 three-segmented lacking surface spinulation, with one terminal spine.

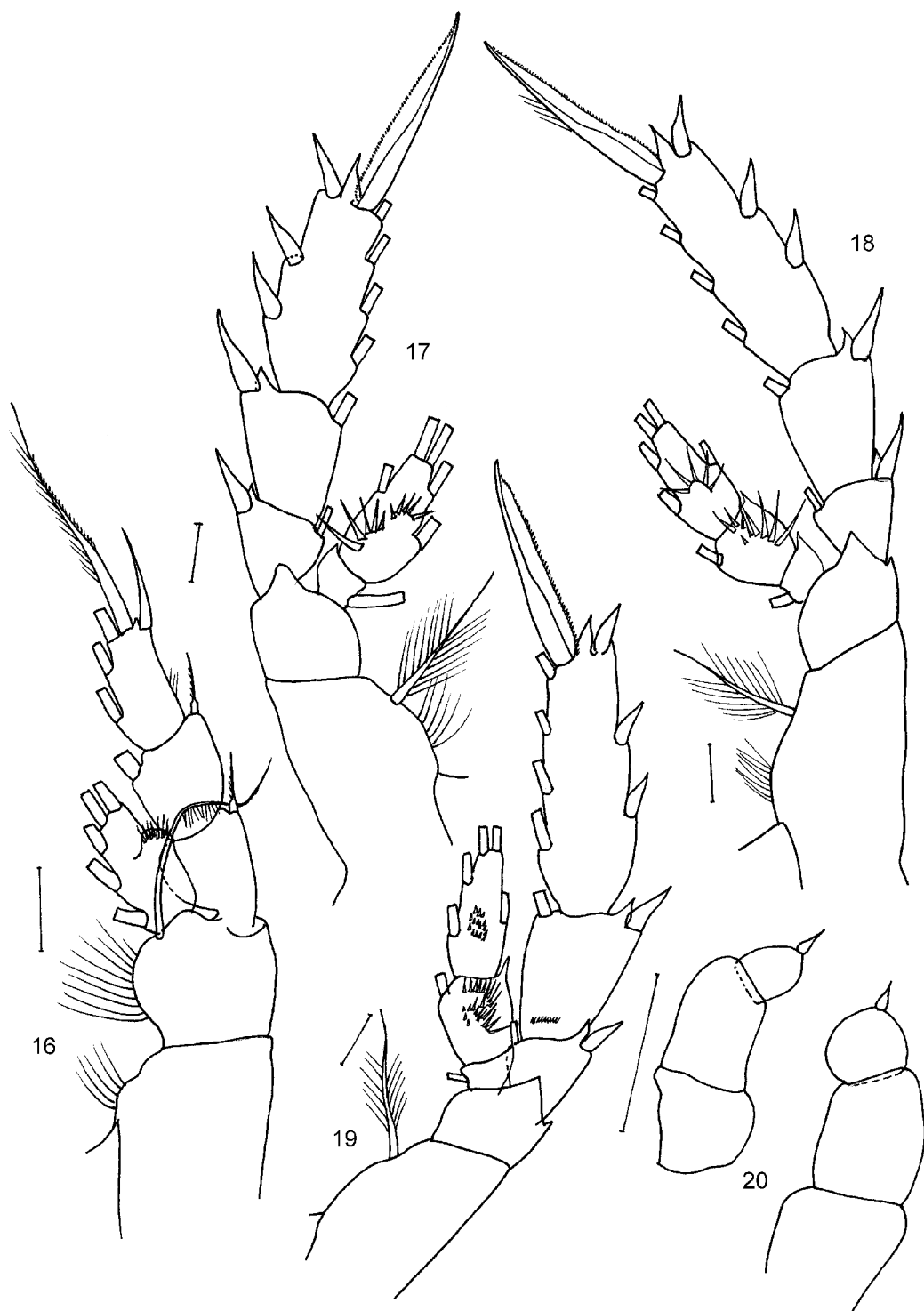




Figs 1–10. *Phaennocalanus unispinosus* gen. et sp. nov., female. 1. Dorsal view. 2. Left lateral view. 3. Pd5 and Ur (dorsal view). 4. Pd5 and Ur (left lateral view). 5. Rostrum (ventral view). 6. Rostrum (left lateral view). 7. A1, articulated segments 1–8. 8. A1, articulated segments 9–17. 9. A1, articulated segments 18–24. 10. A2. See text for abbreviations. Scale bar = 0.1 mm.



Figs 11–15. *Phaennocalanus unispinosus* gen. et sp. nov., female. 11. Mdp. 12. Gn. 13. Mx1. 14. Mx2. 15. Mxp. See text for abbreviations. Scale bar = 0.1 mm.



Figs 16–20. *Phaennocalanus unispinosus* gen. et sp. nov., female. 16. P1. 17. P2. 18. P3. 19. P4. 20. P5. See text for abbreviations. Scale bar = 0.1 mm.



Type species: *Phaennocalanus unispinosus* sp. nov., by monotypy.

Phaennocalanus unispinosus sp. nov.

Material: One female collected in the Arctic Ocean's Eastern Nansen Basin at station 36-045 during the RV *Polarstern* ARK XI/1 cruise, in a vertical haul 3200–1000 m, 18 August 1995, by K. N. Kosobokova.

Holotype: Adult female, total length 4.15 mm, deposited at the Zoological Institute of the Russian Academy of Sciences (St. Petersburg), catalogue no. N 90719.

Description: Female. Total length 4.15 mm. Prosome/ urosome length ratio 4.5:1. Cephalon and Pd1, and Pd4–Pd5 (Figs 1, 2) nearly completely separate, incomplete ventrolaterally. Prosome posterior corners prolonged into triangular lobes (Figs 1–4) exceeding the mid-length of genital somite. Gns symmetrical viewed dorsally. Rostrum with two long, thin filaments (Figs 5, 6). A1 of 24 articulated segments (Figs 7–9), reaching the posterior end of prosome; eighth, 13th and 18th articulated segments with knife-like aesthetascs similar to those in *Brachycalanus*, aesthetascs on the second, third, fourth, seventh and 11th segments not knife-like. A2 Exp (Fig. 10) of six articulated segments, slightly shorter than Enp; second to fifth articulated segments with one seta each, terminal segment with one seta in the mid-length and three terminal setae; Enp1 with two setae; Enp2 with 13 (six plus seven) setae. Md (Figs 11, 12) basis with three setae; Enp1 with two setae; Enp2 with nine setae. Mx1 (Fig. 13) Li1 with nine terminal setae, four posterior setae and one anterior seta; Li2 with five setae; Li3 with four setae, Li4 with five setae, Enp with segments nearly completely fused, with 10 setae, Exp with 10 setae, Le1 with seven long plus two short setae. Mx2 (Fig. 14) with five setae on Li1; Li2–Li4 with three setae each and Li5 with four setae; terminal part of Mx2 comprises distal basal lobe plus Exp bearing one worm-like and seven brush-like sensory setae; brushes are different in structure: two are thick with well-developed brushes and five are thin with weakly developed brushes. Mxp (Fig. 15) syncoxa with all setae sclerotized on praecoxal lobes: one, two and two setae from proximal to distal and three setae on coxal lobe. Mxp basis with three setae proximally and two setae distally; Enp of five articulated segments with four, four, three, four and four setae. Segmentation and setation of P1–P4 (Figs 16–19) are typical of phaennids. P1 Exp1–2 lateral spines narrow abruptly at proximal one third length. P5 (Fig. 20) three-segmented, lacking any surface spinulation, with only one small terminal spine on segment 3.

Male unknown.

Etymology: The generic name *Phaennocalanus* is formed by combining the family name (Phaennidae) with “calanus”, the suffix of many copepod genera. Species name “*unispinosus*” reflects the presence of the single spine on P5 segment 3.

DISCUSSION

Calanoid copepods belonging to the families Phaennidae, Diaixidae, Parkiidae, Scolecitrichidae and Tharybidae of the superfamily Clausocalanoidea possess sensory setae on the Mx2 and Mxp. Phaennids are characterized by the presence of one worm-like and seven brush-like sensory setae on the Mx2 terminal part (Bradford 1973). In rare cases, e.g. in some *Brachycalanus* species and in *Xanthocalanus pavlovskii* Brodsky, 1955 (Campaner 1978; Ferrari & Markhaseva 2000a) there are nine sensory setae in total in different numbers of kinds. In the remaining above-mentioned families there are at least three worm-like plus five or six brush-like sensory setae.

The new genus is placed in the Phaennidae based on the following combination of characters typical of phaennids: Mx2 distal basal lobe plus exopod with one worm-like and seven brush-like sensory setae; Mxp syncoxa with five setae: one, two and two setae from proximal to distal on the praecoxal lobes (Ferrari & Markhaseva 2000b); Mx2 Li1 with five setae, Mx1 Exp with 10 setae.

Phaennocalanus differs from other phaennid genera in the following combination of derived characters: A1 eighth, 13th and 18th articulated segments with knife-like aesthetascs; Mx2 brush-like setae of *Phaennocalanus* are of nearly the same length, but not identical in structure: there are two thick brushes and five brushes are thin with small heads; P1 Exp1–2 lateral spines narrow abruptly at its proximal one third length; P5 is three-segmented with one terminal spine, segments lacking surface spinulation. Plesiomorphic character states separating the new genus from the other phaennids are the following combination: Mx1 Li2 with five setae and Mxp syncoxa with two sclerotized setae on the distal praecoxal lobe (this is the third group of setae on syncoxa from proximal to distal).

The knife-like aesthetascs of *Phaennocalanus* are similar to those of *Brachycalanus*. Aesthetascs of such shape were proposed as a synapomorphy for species of *Brachycalanus* (Ferrari & Markhaseva 2000a). This is no longer the case and the only shared derived character state for species of *Brachycalanus* is epicuticular



extensions of female Gns and following two urosomal somites.

Phaennocalanus P5 shares a single terminal spine on P5 with *Cornucalanus chelifer* (Thompson, 1903). In the remaining phaennid genera, the terminal P5 segment is supplied with two to four spines (except for *Phaenna* in which the P5 is lacking).

Phaennocalanus has more similarities with *Xanthocalanus* than with any other phaennid genus. *Phaennocalanus unispinosus* shares five setae on the Mx1 Li2 with some *Xanthocalanus* species (*X. greeni* Farran, 1905; *X. penicillatus* Tanaka, 1960; *X. spinodenticulatus* Markhaseva, 1998), the usual state for phaennids is two to four setae, or one seta as in *Phaenna*.

Mx2 brush-like setae of *Phaennocalanus* are of nearly the same length, but not identical in structure: there are two thick brushes with big heads and five thin brushes with small heads. *Phaennocalanus unispinosus* shares the presence of two thick brush-like setae with some species of *Xanthocalanus*, e.g. *X. spinodenticulatus* Markhaseva, 1998. However, the thick brush-like setae in the latter species are of different length. Usually *Xanthocalanus* species have brush-like setae identical in structure, or only one brush-like seta is thicker, or, if all seven brush-like setae are of nearly the same thickness, two of them are much shorter. In the remaining phaennid genera, all seven brushes are usually identical in structure.

Five setae on the Mxp praecoxal lobes of the syncoxa of *Phaennocalanus unispinosus* are typical of phaennids. However, both setae in the distal group are

sclerotized contrary to the typical condition of the other phaennid genera which usually have: one sclerotized and one brush-like seta. Two sclerotized setae of the distal group are shared with some species of *Xanthocalanus* e.g. *X. fallax* Sars, 1921, *X. muticus*, Sars, 1905 and *X. greeni* Farran, 1905. The setation patterns for the Mxp syncoxa of the above-mentioned *Xanthocalanus* species for comparison with *Phaennocalanus unispinosus* are taken from Sars (1902, plates 31, 32; 1924–1925, plates 36, 37). The data on maxilliped syncoxal setation for the majority of *Xanthocalanus* species are incomplete because of brief descriptions and poor illustrations. Details for numbers and kinds of Mxp syncoxal setae are available for about one quarter of the total number of species in the genus and in these cases setation is typical of phaennids: one sclerotized and one brush-like seta on the distal praecoxal lobe.

Phaennocalanus differs from all *Xanthocalanus* species in the presence of knife-like aesthetascs on A1 segments, a structure of brush-like sensory setae at the Mx2 terminal part, and P5 lacking surface spinulation with a single terminal spine.

Further revision of *Xanthocalanus* is required to clarify the degree of similarity of these two genera.

ACKNOWLEDGEMENTS

The work of E. L. Markhaseva was supported by the Russian Foundation for Basic Research, RFFI grant 99-04-49663. The author thanks Dr K. N. Kosobokova for the specimen of this new genus.

REFERENCES

- Bradford JM. 1973. Revision of family and some generic definitions in the Phaennidae and Scolecithricidae (Copepoda, Calanoida). *New Zealand Journal of Marine and Freshwater Research* 7:133–152.
- Campaner AF. 1978. On some new planktobenthic Aetideidae and Phaennidae (Copepoda, Calanoida) from the Brazilian continental shelf. II. Phaennidae. *Ciencia e Cultura* 30:966–982.
- Ferrari FD. 1995. Six copepodid stages of *Ridgewayia klausruetzleri*, a new species of copepod crustacean (Ridgewayiidae, Calanoida) from the barrier reef in Belize, with comments on appendage development. *Proceedings of the Biological Society of Washington* 108:180–200.
- Ferrari FD, Ambler JW. 1992. Nauplii and copepodids of the cyclopoid copepod *Dioithona oculata* (Oithonidae) from a mangrove cay in Belize. *Proceedings of the Biological Society of Washington* 105:275–298.
- Ferrari FD, Markhaseva EL. 1996. *Parkius karenwishnerae*, a new genus and species of calanoid copepod (Parkiidae, new family) from benthopelagic waters of the eastern tropical Pacific. *Proceedings of the Biological Society of Washington* 109:264–285.
- Ferrari FD, Markhaseva EL. 2000a. *Brachycalanus flemingeri* and *B. brodskyi*, two new copepods (Crustacea: Calanoida: Phaennidae) from benthopelagic waters of the tropical Pacific. *Proceedings of the Biological Society of Washington* 113:1064–1078.
- Ferrari FD, Markhaseva EL. 2000b. *Grievella shanki*, a new genus and species of scolecithricid calanoid copepod (Crustacea) from a hydrothermal vent along the southern East Pacific Rise. *Proceedings of the Biological Society of Washington* 113:1079–1088.
- Martínez Arbizu P. 1997. A new genus of cyclopoid copepods (Crustacea), with a redescription of *Smirnovipina barentsiana* comb. nov. (Smirnov, 1931). *Sarsia* 82: 313–323.
- Park TS. 1983. Calanoid copepods of the family Phaennidae from Antarctic and Subantarctic waters. Biology of the Antarctic Seas, 14. *Antarctic Res. Ser.* 39:317–368.



- Sars GO. 1902. *An account of the Crustacea of Norway. 4. Copepoda. Parts 3–12*. Bergen Museum: Bergen. p 29–144, plates 17–96.
- Sars GO. 1924–1925. Copepodes particulièrement bathypelagiques provenant des campagnes scientifiques du Prince Albert 1-er de Monaco. Result. Camp. Sci. Prince Albert 1-er. 69. 1924 (atlas), 1925 (text). 408 p.
- Tanaka O, Omori M. 1992. Additional report on the Calanoid Copepods from the Izu Region. Part. 6. Phaennidae. *Publications of the Seto Marine Biological Laboratory* 35:253–271.

Accepted 28 June 2001 – Printed 7 November 2002
Editorial responsibility: Tore Høisæter