DEEP WATER CALANOID COPEPODS FROM THE MEDITERRANEAN SEA. FAMILY SPINOCALANIDAE (1)

by

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Résumé

Copépodes Calanoïdes abyssaux de la Méditerranée.
Famille des Spinocalanidae.

Six espèces de Copépodes Calanoïdes, qu'on peut rapporter à la famille des Spinocalanidae, ont été précédemment décrites en Méditerranée. Dans des récoltes faites à Rhodes et à Gibraltar, deux espèces connues (*Spinocalanus parabyssalis* et *Mimocalanus cultrifer*) ainsi qu'une espèce nouvelle ont été trouvées. Cette nouvelle espèce est décrite et une clé présentée pour l'identification des neuf espèces connues des Spinocalanidae méditerranéens.

Introduction

Copepods of the family Spinocalanidae are numerically important constituents of bathypelagic plankton. In the case of the deep-living genera *Spinocalanus* and *Mimocalanus,* one is tempted to infer that their absence from the relatively warm surface waters (upper 200 m) is related to unfavorable temperatures in the epipelagial. None of the species in these two genera reported by Grice and Hulsemann (1965) in samples obtained between the surface and 5000 m in the Northeastern Atlantic (30-61°N) occurred in depths less than 200 m. In Antarctic waters where epipelagial temperatures are colder than they are in lower latitudes, it may be expected that the upper limits of occurrence of bathypelagic species may be considerably nearer the surface. However, examination of depth of capture records for species of *Spinocalanus* and *Mimocalanus* reported by Vervoort (1957) shows that these species occurred only in his deeper collections, that is in depths similar to those in which they occur in lower latitudes (Grice and Hulsemann, *op cit*).

To investigate the occurrence of bathypelagic copepods in areas where temperatures and other hydrographic conditions are markedly dissimilar from what they are in the open ocean, we have previously examined (Grice, unpublished) a series of 25 closing net zooplankton collections obtained in the Red Sea from the surface to approximately

(1) Contribution No. 2554 from Woods Hole Oceanographic Institution. Study was supported by National Science Foundation Grant GB 8612 and GA 1298.

2150 m. The Red Sea is a narrow basin that is separated from the Mediterranean Sea by the Isthmus of Suez and from the Indian Ocean by a sill with a depth of approximately 125 m. Between approximately 200 m and the bottom the water temperature is practically isothermal (22°C) and isohaline 40.5 p. 1000). Oxygen concentrations in these depths vary between 2 and 3 ml/l (Neumann and McGill, 1962).

No species of Spinocalanidae were found in the samples and no species referable to the four genera in this family have previously been reported from the Red Sea. Moreover, the samples contained no species of Copepoda which we (Grice and Hulsemann, 1965, 1967) have hitherto found exclusively in deep waters.

In order to investigate further the occurrence of bathypelagic copepods in a similarly restricted but hydrographically different basin, we sampled the deep zooplankton in the Mediterranean Sea during R/V Atlantis II Cruise 49 in May and June 1969. The basin of the Mediterranean Sea is separated from the Atlantic by a sill with a depth of approximately 320 m. In the depths sampled temperatures vary between 13° and 15°C and salinities between 38 and 39 p. 1000. The concentrations of dissolved oxygen is approximately 4.4 ml/l (Sverdrup et al., 1942).

Unlike the Red Sea samples, the Mediterranean samples did contain species which we consider bathypelagic and one family (Spinocalanidae) is here treated. The family contains approximately 40 species of copepods distributed in four genera : *Spinocalanus* Giesbrecht, 1888, *Mimocalanus* Farran, 1908, *Monacilla* Sars, 1905, and *Teneriforma* Grice and Hulsemann, 1967. Over two thirds of the species are referrable to the first named genus.

Methods

The zooplankton samples were obtained by a Brown-McGowan opening-closing net (McGowan and Brown, 1966) equipped with No. 6 net (aperture .236 mm). A depth telemetering pinger was attached

Table 1. Station data for zooplankton.

Station	Date 1969	Position		Sampling Interval (meters)	Species*
		Latitude	Longitude		
1	May 11	34°48.6' N	28°18.7' E	750- 800	3, 4
2	May 11	34°27.5' N	28°04' E	1050-1200	1, 2, 3
3	May 13	34°00' N	25°52.5' E	1100-1400	2, 3, 4
5	May 15	33°57' N	22°27' E	1250-1350	2, 3, 4, 5
8	May 18	33°21' N	19°33.7' E	1150-1250	2, 3, 4, 6
10	May 20	36°01' N	17°16.0' E	1000-1150	2, 3, 4, 6
14	May 31	40°08.5' N	6°50' E	2025-2200	4, 6
17	June 3	38°23.5' N	3°20' E	1190-1250	2, 3, 4, 5
18	June 4	38°03.5' N	1°53.2' E	2000-2050	4, 6
21	June 7	36°24.5' N	1°42' W	1100-1400	2, 3, 4, 6
22	June 8	36°15' N	4°07.5' W	850-1000	2, 3, 4, 6

* Species : 1. *Spinocalanus abyssalis;* 2. *S. magnus* ; 3. *S. parabyssalis ;* 4. *S. neospinosus ;* 5. *Mimocalanus cultrifer ;* 6. *Monacilla typica.*

to the cable below the net and thus the depth of each collection could be monitored. Zooplankton was collected at 22 stations between Rhodes, Greece, and the Straits of Gibraltar in depths between 700 and 2200 m. Samples from 11 of these stations were examined (Table 1).

MEDITERRANEAN RECORDS OF SPINOCALANIDAE

Two species of *Spinocalanus* have been described from specimens obtained in the Mediterranean Sea: *S. caudatus* Sars, 1920 from a single female collected near the Island of Mallorca, and *S. heterocaudatus* Rose, 1937, apparently from a single female collected in the Bay of

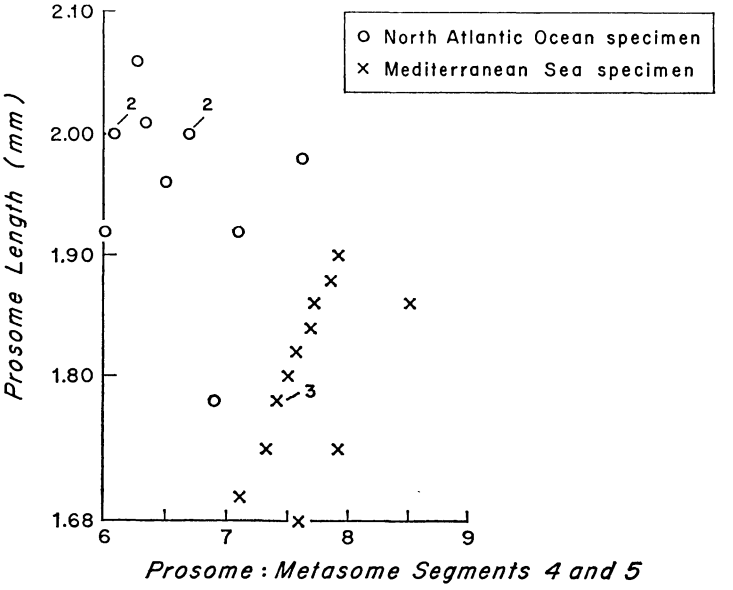

FIG. 1

Protuberance of fifth metasomal segment of North Atlantic and Mediterranean Sea specimens of *Spinocalanus magnus*.

Algiers. The following other species of *Spinocalanus* have been reported from the Mediterranean Sea: *Spinocalanus magnus* Wolfenden, 1904, *S. abyssalis* Giesbrecht, 1888 (= *S. brevicaudatus*, Brodsky, 1950), *S. abyssalis* var. *pygmaeus* Farran, 1926. The last named was raised to species rank by Brodsky (1950) and should be designated *S. abyssalis* Giesbrecht, 1888. In addition to these *Monacilla typica* Sars (1905) has also been previously found in the Mediterranean.

In our present collections, we have observed the following species of Spinocalanidae: *Spinocalanus abyssalis* Giesbrecht, 1888, *S. magnus* Wolfenden, 1904, *S. parabyssalis* Park, 1970, *Mimocalanus cultrifer* Farran, 1908, *Monacilla typica* Sars, 1905, and an undescribed species of *Spinocalanus, S. neospinosus* n. sp.

There are indications that the Mediterranean population of *S. magnus* may be different from the Atlantic population. In size Mediterranean specimens are significantly smaller than North Atlantic specimens ("t" test, 24 specimens, p=.05). Mediterranean specimens differ also from Atlantic ones in having a less protuberant fifth thoracic segment (Fig. 1). In other features the populations from the two areas are very similar.

Rose (1937) stated that *S. heterocaudatus,* a species closely resembling *S. magnus,* differs from *S. magnus* chiefly in having 5 setae on the endopod of the first pair of swimming feet and in having a more protuberant fifth thoracic segment. The first pair of swimming feet of 10 specimens of *S. magnus* from the North Atlantic and 14 specimens from the Mediterranean had 5 setea on the endopod. Both Farran's (1905) and Sar's (1924) figures of the first feet, which Rose examined, are possibly in error. There probably should be 5 rather than 4 setae on the endopod. Rose's figure of *S. heterocaudatus* shows that the fifth thoracic segment is more elongate than in *S. magnus.* In the former species the protuberant portion reaches to the second urosomal segment while in the latter species it reaches about to the midpoint of the genital segment.

Whether *S. heterocaudatus* is an abnormal specimen of *S. magnus* must await examination of additional specimens. The male described as the male of *S. heterocaudatus* by Rose (1942) is referrable to neither that species nor the genus *Spinocalanus* as Vervoort (1946) has already pointed out.

Spinocanalus neospinosus n. sp.
(Fig. 2)

Occurrence: Bongo Stations 1, 2, 3, 5, 8, 10, 14, 17, 18, 21, 22.

Size. Adult female, 48 specimens, total length range 1.20-1.50 mm, mean size 1.38 mm. Standard deviation ± .08 mm.

Type. Female holotype deposited in U.S. National Museum, Washington, D.C.

Diagnosis. Posterolateral corner of cephalothorax broadly rounded. Integumental spinules present on left sides of metasomal segments one through four and right sides of metasomal segments one through three. Spinules more dense anteriorly on both sides and more numerous on left side. Antennule reaches to end of furca. Maxillule with 6 setae on first inner lobe, 3 setae on second inner lobe, 5 setae on second basal segment, 16 setae on endopod and 11 setae on exopod. Maxilla

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FIG. 2

Spinocalanus neospinosus n. sp., female.

A, laterial view; B, maxilla; C, maxilliped, coxa and basis; D, maxilliped, terminal segment; E, first foot; F, second foot; G, third foot, distal two segments of exopod missing; H, fourth foot, distal two segments of exopod missing; I, fourth foot, endopod omitted.

Monacilla typica, female.

J, lateral view; K, maxilliped.

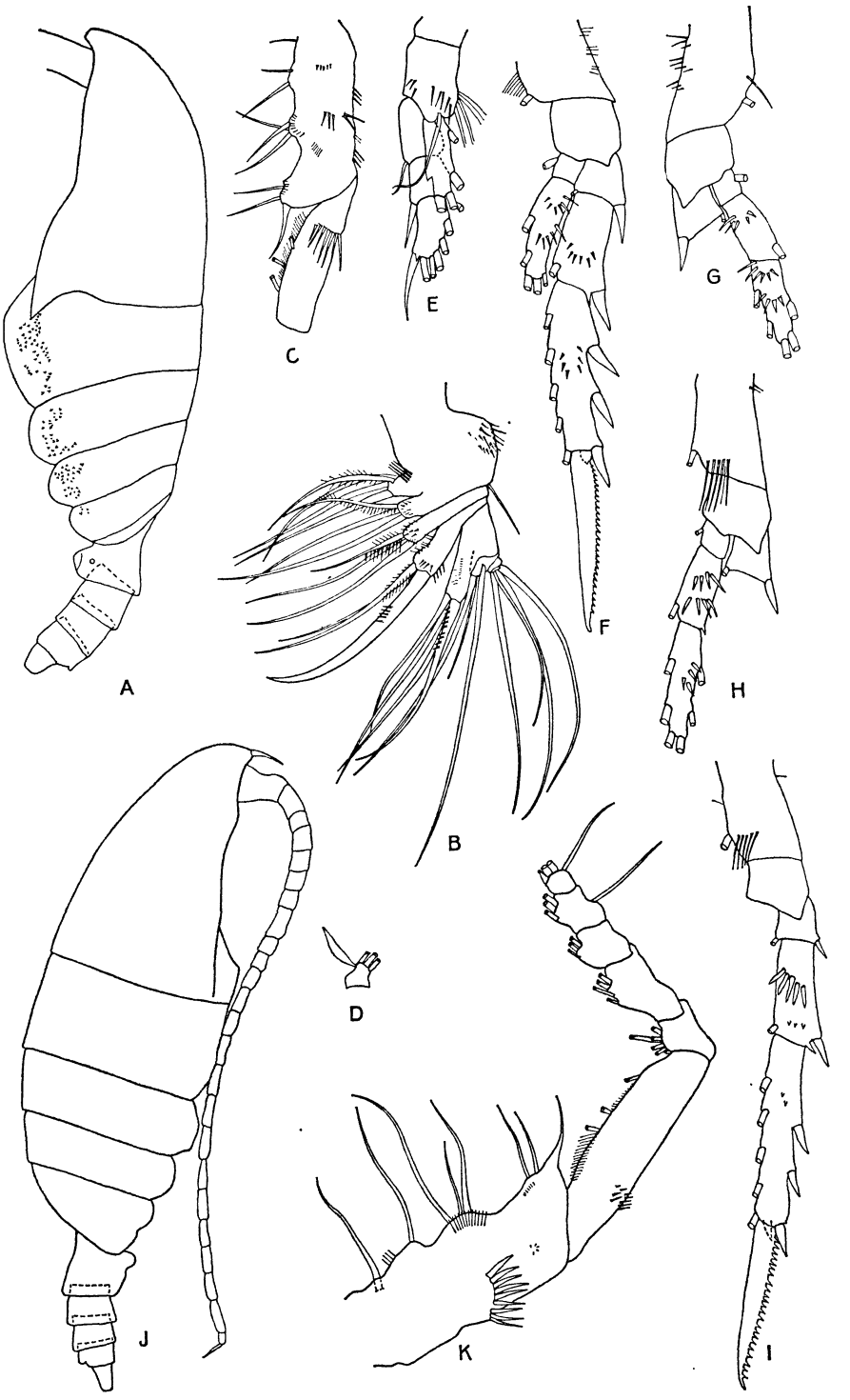

FIG. 2

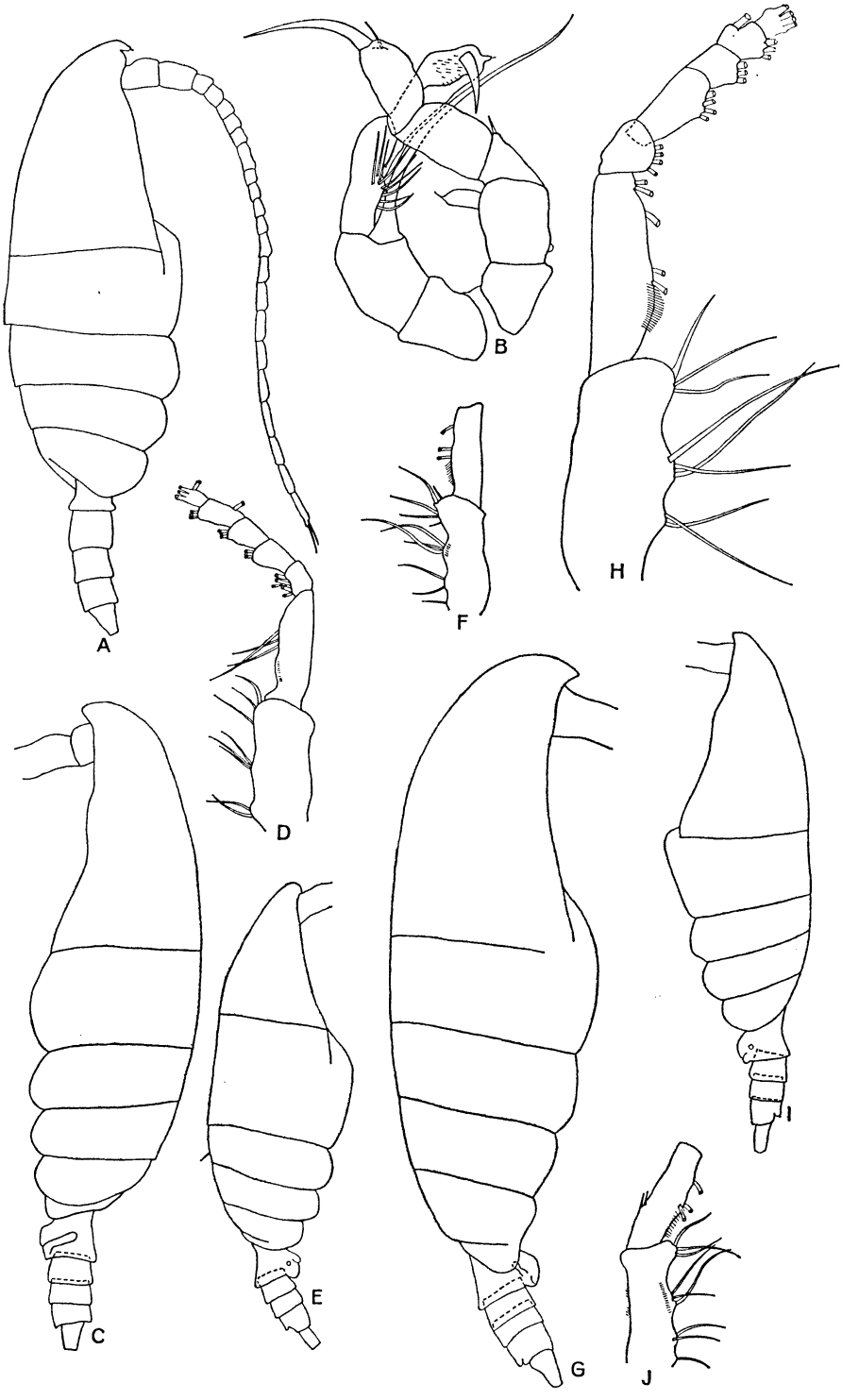

FIG. 3

without spinules on base of fifth lobe. Basis and coxa of maxilliped with comb of spines, spines on basis about one half the length of spines of coxa. Other appendages similar to those of *S. oligospinosus* Park, 1970. Male unknown.

Remarks. This species is very similar to *S. oligospinosus* but the two may be distinguished by the distribution of spinules on the metasome and spines on the coxa of the maxilliped. In *S. neospinosus* spinules are present on the right sides of the first three metasomal segments and on the left sides of the first four metasomal segments. In *S. oligospinosus* only the first two metasomal segments bear lateral spinules. Although variable in size the spines on the coxa of the maxilliped of *S. neospinosus* may be as large as one fourth the length of the spines on the basis. In *S. oligospinosus* the spines on the coxa are very small, sometimes nearly invisible.

Key to the Species of the Spinocalanidae from the Mediterranean Sea
(females unless noted otherwise)

1.	Rostrum present	*Monacilla typica* ♀, ♂ (Fig. 2 J, K; Fig. 3 A, B)
	Rostrum absent	2
2.	Second endopodal segment of maxilliped less than twice the length of first segment, posterior surfaces of second, third and fourth feet without spines	*Mimocalanus cultrifer* (Fig. 3 C, D)
2.	Second endopodal segment of maxilliped more than twice the length of first segment, posterior surfaces of second, third and fourth feet with spines (genus *Spinocalanus*)	3
3.	Basis of maxilliped without comb of spines	4
3.	Basis of maxilliped with comb of spines	5

FIG. 3

Monacilla typica, male.
A, lateral view; B, fifth pair of feet.

Mimocalanus cultrifer, female.
C, lateral view; D, maxilliped.

Spinocalanus abyssalis, female.
E, lateral view; F, maxilliped, coxa and basis.

Spinocalanus magnus, female.
G, lateral view; H, maxilliped.

Spinocalanus parabyssalis, female.
I, lateral view; J, maxilliped, coxa and basis.

4. Posterolateral corner of fifth thoracic segment broadly rounded, animals less than 1.5 mm in total length	*S. parabyssalis* (Fig. 3 E, F)
4. Posterolateral corner of fifth thoracic segment protuberant, animals greater than 2.0 mm	*S. magnus* or *S. heterocaudatus*, see text (Fig. 3 G, H)
5. Integumental spines present on sides of second and third metasomal segments..	*S. neospinosus* (Fig. 2 A-I)
5. Integumental spines not present on sides of second and third metasomal segments	6
6. Total length of animals 1.0-1.3 mm	*S. abyssalis* (Fig. 3, I, J)
6. Total length of animals 1.4-1.6 mm	7
7. Urosome approximately 1/4 as long as prosome	*S. brevicaudatus**
7. Urosome 1/3 to 1/2 as long as prosome	*S. caudatus**

(*) Not found in present samples.

Zusammenfassung

Calanoide Tiefsee-Copepoden des Mittelmeeres
Familie : Spinocalanidae

Bisher wurden sechs Arten von calanoiden Copepoden der Familie Spinocalanidae im Mittelmeer festgestellt. Zwei weitere Arten (*Spinocalanus parabyssalis* und *Mimocalanus cultrifer*) und eine neue Art wurden im tiefen Wasser zwischen Rhodos und Gibraltar gefunden. Die neue Art wird beschrieben und ein Schlüssel für die neun Arten der Spinocalanidae des Mittelmeeres aufgestellt.

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