Proc. Indian natn. Sci. Acad. **B50** No 2 pp 133–138 (1984)

Thermocyclops oblongatus (Sars) (Crustacea: Copepoda): A New Cyclopid for the Fauna of India, and Zoogeography of the Species

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(Received 29 August 1983)

Thermocyclops oblongatus (Sars), cyclopid copepod hitherto not recorded in India, was found during preliminary survey of the stygofauna occurring in phreatic subterranean waters of that country. A detailed description of the species, together with remarks on its phenology, ecology and zoogeography, is given. From a biogeographical point of view the discovery of *Thermocyclops oblongatus* in India considerably enlarges its distribution eastward and helps to better define the geonemy of the species. Some information is also given about other cyclopid copepods occurring in the same localities of *Th. oblongatus* in India.

Key Words: *Thermocyclops oblongatus*, **Zoogeography, Cyclopids, Copepods**

Introduction

During a survey of stygofauna occurring in phreatic underground waters (wells) of India, carried out in December 1982 and January 1983 by the Zoological Institute of the University of L'Aquila (Italy), large samples of cyclopoid copepods were obtained. Among this material, besides some widely distributed species, such as *Eucyclops serrulatus* (Fischer), *Mesocyclops aspericornis* (Daday) and *Tropocyclops prasinus* (Fischer), already known for India, numerous specimens of the species *Thermocyclops oblongatus* (Sars), previously not recorded in this country, were collected from fresh-water wells in the neighbourhood of New Delhi, viz. in the villages of Basant, Lado Sarai, Munirka, Rangpuri and Ber Sarai.

The above discovery is noteworthy and of remarkable systematic and biogeographical interest since, up to this time, this species was reported only from European and African areas, mostly in underground biotopes. The present record shows that *Thermocyclops oblongatus* could be more widely distributed, and enables us to better define both its doubtful systematic status and ecology.

In the present paper new localities from India, together with the morphological,

ecological and zoogeographical data of the species, as well as some phenetic variations regarding the populations examined have been pointed out. Moreover, a list and some information about other cyclopid copepods, living in the same biocoenoses, in which *Th. oblongatus* was collected, are reported.

Thermocyclops oblongatus (G. O. Sars 1927)
(Figures 1–10)

Mesocyclops oblongatus G.O. Sars 1927, p. 114
Mesocyclops (*Thermocyclops*) *infrequens* Kiefer 1929, p. 315
Thermocyclops stephanidesi Kiefer 1938, pp. 96–98
Thermocyclops oblongatus Kiefer 1978, pp. 214–215
Thermocyclops oblongatus Pesce & Maggi 1981, pp. 172–173

Material

12♀♀, 4♂♂, fresh-water well in the village of Basant (New Delhi) (depth of the well: 6.5m; water level: 5.5m; temperature: 11.1°C; *p*H: 7; bottom sediment: sandstone with organic detritus); December 23, 1982; coll. Agrusti & Pace; 3♀♀, 2♂♂, freshwater well in the village of Lado Sarai (New Delhi) (depth of the well: 10.5 m; water level: 3.2 m; temperature: 14.9°C; *p*H: 6.9; bottom sediment: sand-stone with organic detritus); December 26, 1982; coll. Agrusti, Pace and Singhal; 10♀♀, 6♂♂, freshwater well in the village of Munirka (New Delhi), near the Temple (depth of the well: 16.0 m; water level: 8.2 m; temperatre: 10.9°C; *p*H: 6.9; bottom sediment: sandstone); December 28, 1982; coll. Agrusti & Pace; 3♂♂, 1♀, freshwater well in the village of Rangpuri (depth of the well: 16.8 m; water level: 4.5m; temperature: 12.5°C; *p*H: 6.8; bottom sediment: sandstone with many vegetable detritus); January 2,1983; coll. Agrusti & Pace; 20♀♀, 12♂♂, fresh-water wells in the village of Ber Sarai (depth of the well: 21.5 m; water level: 1.8 m; temperature: 8.9°C; *p*H: 7; bottom sediment sandstone and clay, with organic detritus); January 4, 1983; coll. Agrusti & Pace.

Material deposited at the zoological Institute of the University of L'Aquila, Italy (Author's collections). Three ♀♀ and one ♂, completely dissected and mounted on coverlips in Faure's medium, deposited in National Zoological Collections of the Zoological Survey of India, Calcutta.

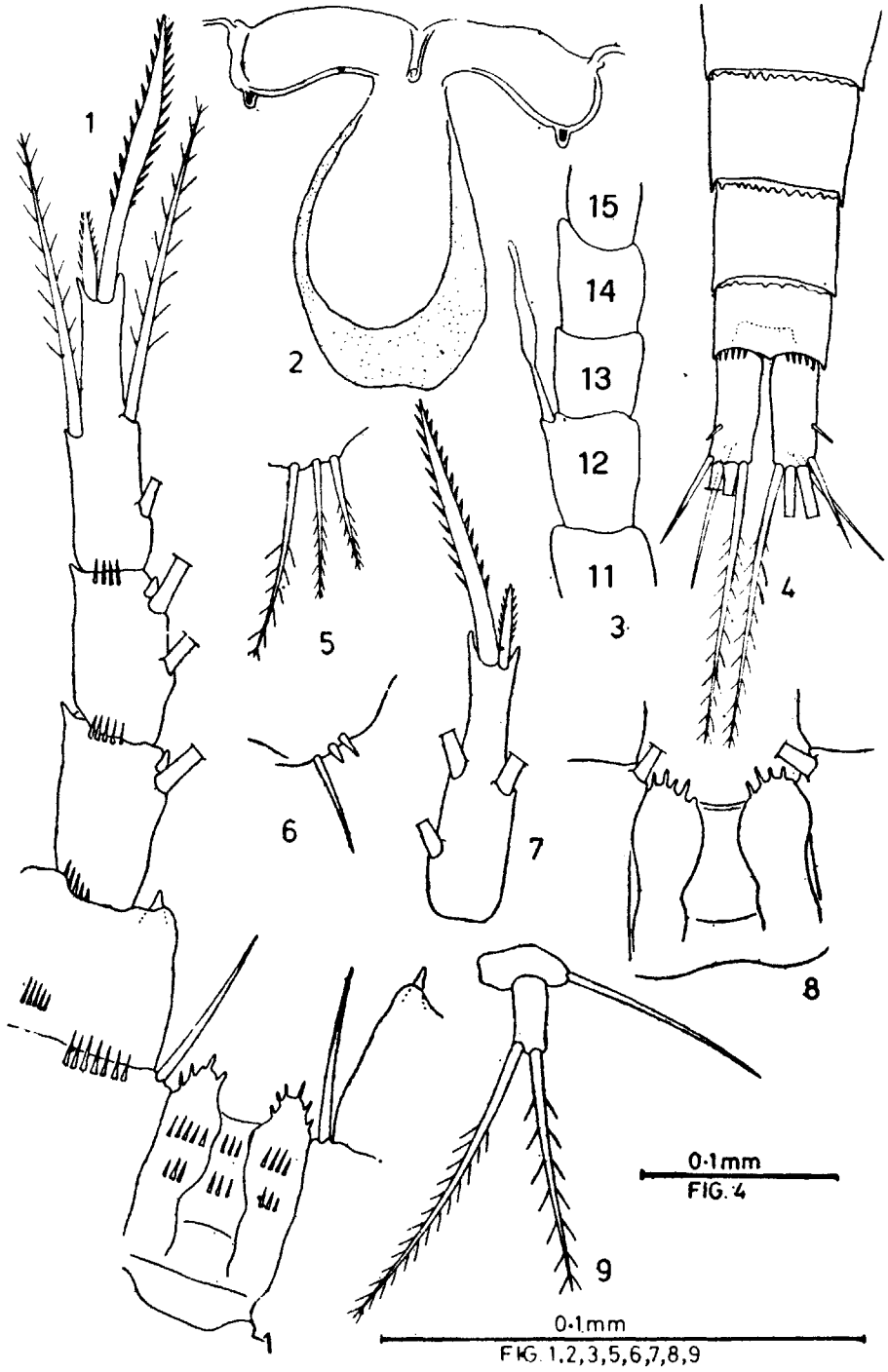
Description

Female: Body unpigmented, eyeless, and fusiform; body length, excluding antennae, antennulae and furcal setae, 0.75 to 0.79 mm. Egg-sacks, each with 3–4 eggs in mature females. Thoracic segments without spines or chitinous lamella; abdominal segments longer than broad and with a posterior, denticulate chitinous lamella, the last one armed with a row of small spinules at the base of each furcal ramus. Genital segment slightly longer than large; genital field as in (figure 2). Anal operculum slightly convex and quite naked.

Antennula 17-segmented, aesthetasc on segment 12 reaching about the tip of segment 14.

Coxal plate of leg 1 with rounded and denticulate protruding lobes; coxal plates of legs 2 and 3 with rounded, not much protruding spiniform lobes; coxal plate of leg 4 with protruding lobes, each armed with some spiniform elements on the distal margin, and 2 rows of spinules on the median ventral part. Distal segment of the endopod of leg 4, elongated (L/1 = 3.70—3.79; in other descriptions, the same segment is slightly shorter); inner apical spine stout and much longer (3.1 to 3.3 times) than the outer, and slightly longer than the segment.

Leg 5, basiendopod enlarged, with 1 seta on the outer corner; exopod elongated (L/1 = 2.1—2.4), with 2 long, plumose setae, the outer slightly shorter than the inner one. Leg 6 consisting of a chitinous lamella bearing 1 seta and 2 short spines.



Figures 1–9 *Thermocyclops oblongatus* (Sars): **1**, Endopod of leg 4 and coxal plate (♀); **2**, Genital field; **3**, Antennula, detail of segment 12; **4**, Abdomen and furcal rami, ventral view; **5**, Leg 6 (♂); **6**, Leg 6 (♀); **7**, Distal segment of the endopod of leg 4 (♂); **8**, Coxal plate of leg 1; **9**, Leg 5 (♀)

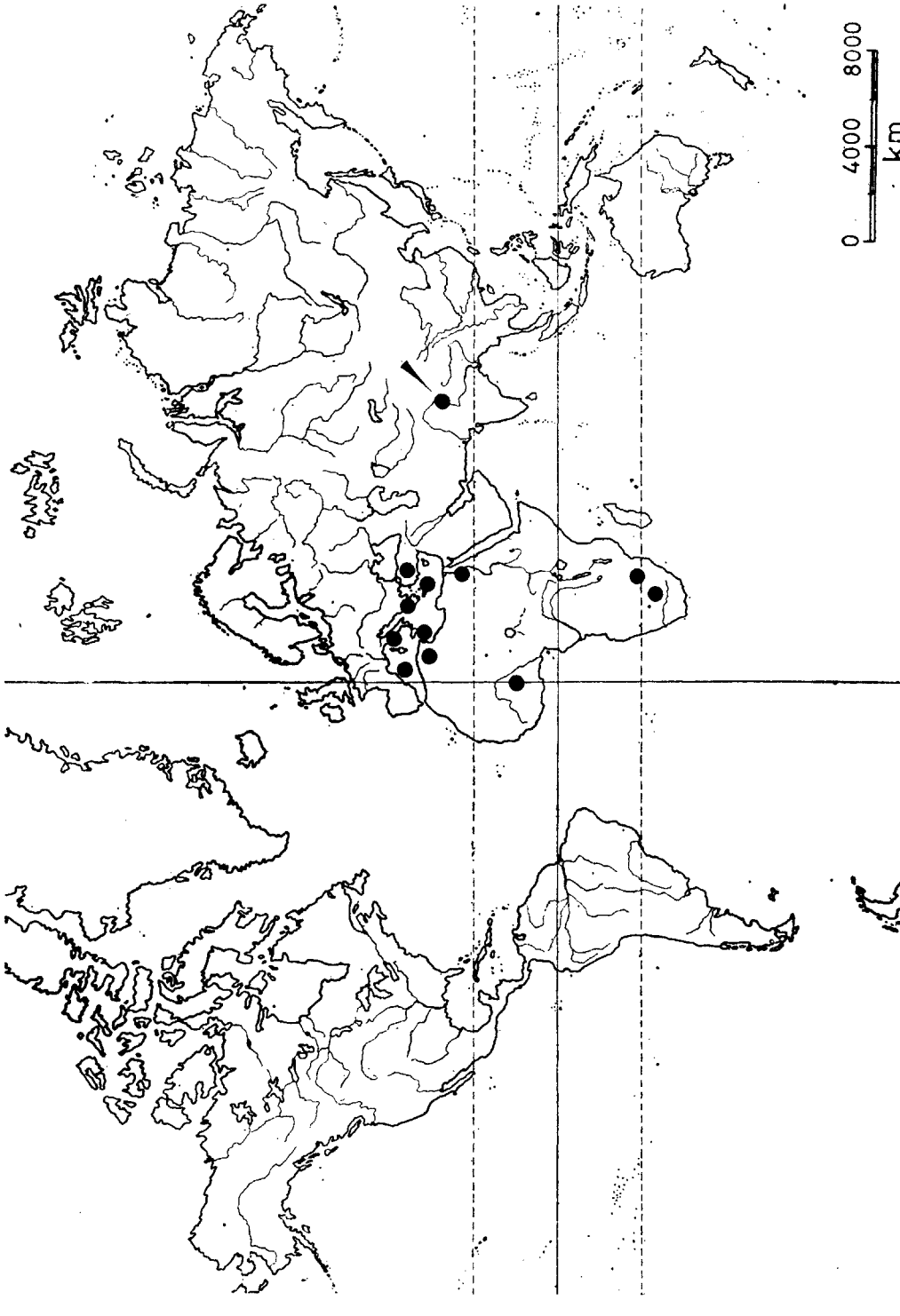


Figure 10 *Thermocyclops oblongatus* (Sars) Geonemy

Furcal rami subparallel, 2.7 to 3.0 times longer than large; innner apical seta 2.7 to 2.9 times longer than the outer one; dorsal seta longer than the outer apical seta and longer than each furcal ramus.

Male: Body length, excluding antennulae, antennae and furcal setae, 0.65 to 0.72 mm. Aestetasc on segments 1, 4 and 9 of the antennula slender and short. Leg 6 armed with 3 setae otherwise similar to females.

Remarks: *Thermocyclops oblongatus* was described by Sars (1927), as *Mesocyclops oblongatus*, to accomodate material from south-Africa. Kiefer (1929) reported this species, as *Mesocyclops* (*Thermocyclops*) *infrequens*, from Africa too (Egypt), and later the same Author (1938) recorded the species from Greece (Island of Corfu as *Thermocyclops stephanidesi*). Successively, other Authors (Cottarelli & Maiolini 1973, Pesce & Fabrizi 1979, Pesce & Maggi 1981, Pesce et al. 1978, Gorbault & Lescher-Moutoué 1979) reported the same species, as *Thermocyclops stephanidesi*, from numerous underground mediterranean localities (Italy, Spain, Greece, Algery, Turkey). Harding and Smith (1967) and Kiefer (1978) definitively stated that both the species *Thermocyclops infrequens* and *Thermocyclops stephanidesi* are to be considered as synonyms with *Thermocyclops oblongatus*, and we share this opinion.

From an ecological point of view, on account of its regular presence in the interstitial and phreatic biotopes, *Th. oblognatus* could be considered as a stygobiont (or eustygophil) member of the subterranean biocoenoses; this hypothesis is supported by the presence in the examined biocoenoses from India, as well as in those from other mediterranean localities of numerous ovigerous females, nauplii, copepodites and coupling males and females. On the other hand, the geonemy of *Th. oblongatus* is discontinuous and still doubtful, the species being reported from remote, well separated localities such as north and south-Africa, Italy, Turkey, Greece, Spain and now in India.

Eucyclops serrulatus (Fischer 1851)

Material: 12♀♀ (2 ovigerous), 3♂♂ and some copepodites IV, V; fresh-water wells in the village of Ber Sarai (collecting data as above).

Mesocyclops aspericornis (Daday 1906)

Cyclops aspericornis Daday 1906, p. 181
Mesocyclops leuckarti partim, Kiefer 1938, p. 61
Mesocyclops iranicus Lindberg 1936, p. 254
Mesocyclops aspericornis Kiefer 1981, p. 172

Material: numerous ♀♀, ♂♂ and juveniles; freshwater wells in the villages of Basant, Lado Sarai and Rangpuri (collecting data as above).

According to Kiefer's (1981) recent revision of the species-group of *Mesocyclops leuckarti* s.l., the material from India is referable to the complex of *M. leuckarti* s. restr.; within this group it is easily identifiable with the species *M. aspericornis*, due to the presence of hair-like elements on the inner margin of the furcal rami, the morphology of the genital field and the length of the furcal rami.

From an ecological point of view, *M. aspericornis* is to be considered as an occasional (stygoxen) element of the underground biocoenoses.

Till now, *M. aspericornis* is known from Sumatra, Java, Singapore, Hawai, Philippines, southern China, besides from India.

Tropocyclops prasinus (Fischer 1860)

Material: numerous ♀♀, ♂♂ and copepodites II, IV and V; fresh-water well in the village of Ber Sarai (collecting data as above).

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