

TWO NEW RECORDS OF *HALOPTILUS* (COPEPODA: CALANOIDA) FROM THE INDIAN OCEAN

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A study of the systematics and zoogeography of the genus *Haloptilus* (Copepoda: Calanoidea) of the International Indian Ocean Expedition (IIOE) samples revealed the presence of *H. paralongicirrus* Park and *H. bullicepts* Farran, Stage IV female which are new to the Indian Ocean. Their diagnostic characters and distribution pattern are described.

INTRODUCTION

The present account deals with the description and distribution of two species of the genus *Haloptilus* viz., *H. paralongicirrus* Park female and *H. bullicepts* Farran stage IV female which are new to the Indian Ocean. Male of *H. paralongicirrus* is unknown. The only previous record of this species is by Park (1970) based on 28 specimens of *H. paralongicirrus* from the Caribbean Sea. Examination of 442 standard samples from the IIOE collections revealed the presence of *H. paralongicirrus* in large numbers. Farran (1926) recorded *H. bullicepts* stage IV female specimens from Bay of Biscay. Subsequently the species was found in collections taken from the tropical western Pacific by Wilson (1950) and from the Atlantic Ocean by Bjornberg (1965).

MATERIAL AND METHODS

The study is based on 1341 specimens of *H. paralongicirrus* and 6 specimens of stage IV females of *H. bullicepts* from the standard samples (IOBC, 1969) collected with the Indian Ocean Standard Net (Currie, 1963) during the International Indian Ocean Expedition (1960-1965). For the distribution studies, representative samples from each 5° square were selected and the whole area was tentatively divided into four regions viz., Arabian Sea, Bay of Bengal, southeast Indian Ocean and southwest Indian Ocean. The data were subjected to statistical analysis using student 't' test (Fisher and Yates, 1967).

Numbers per standard haul was computed and according to the numerical abundance different ranges were selected and locations of the stations plotted in Fig. 3.

SYSTEMATIC ACCOUNT

H. paralongicirrus Park 1970

H. paralongicirrus Park, 1970: 537, Figs. 343-355.

Description of Female: Length 2.31 m - 2.7 mm. General body shape, antennule and antennae similar to those of *H. longicornis* (Claus). Cutting edge of mandible with two teeth, anterior tooth bifurcated and with a small spine on the

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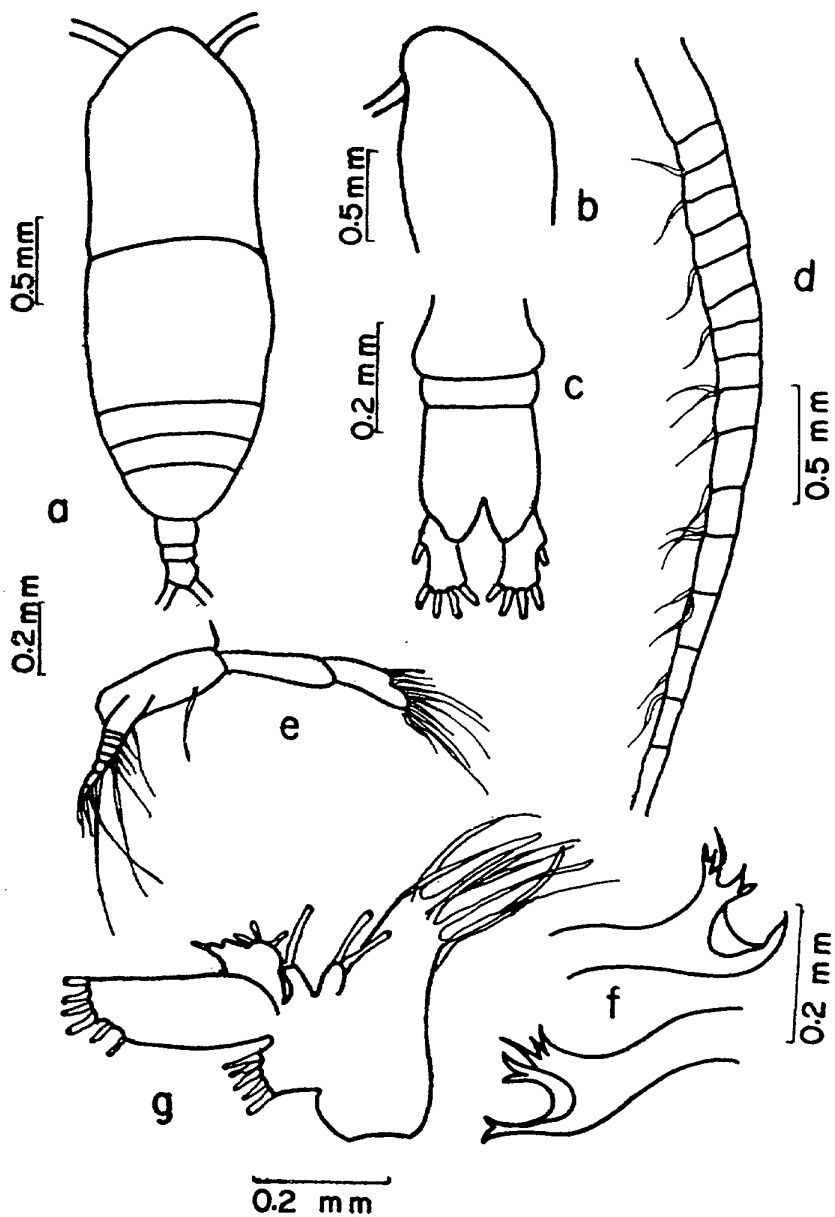


Fig. 1. *H. bulliceps*. Female stage IV.
a — body dorsal view; b — head side view; c — urosome; d — antennule;
e — antenna; f — mandible; g — maxillule

inner margin. Endopod and basis of maxillule with five setae. Maxilla without spine on 5th or 6th lobe. Coxa of 5th leg with a inner seta and basis with one long external seta. Genital segment very broad and spermathecae widely located.

H. bulliceps Farran 1926

Stage IV Female (Fig. 1 and 2)

H. bulliceps Farran, 1926: 286, Pls. 9, 10.

H. bulliceps Wilson, 1950:235

H. bulliceps Bjornberg, 1965:223.

Description: Length 3.3 - 3.69 mm. Head slightly inflated (Fig 1, a). Body short. Urosome (Fig. 1, c) segmented. Antennules (Fig. 1, d) in none of the specimens were entire. Endopod of antennae with 2 and exopod with 7 segments (Fig. 1, e). Cutting edge of mandibles asymmetrical (Fig. 1, f). Anterior tooth of left and right mandibles with 5 thick spines each, but the posterior tooth of the right mandible with a bifurcated tip and that of left mandible with a single pointed tip. First inner lobe of maxillule with 8 setae, second with 2 and third

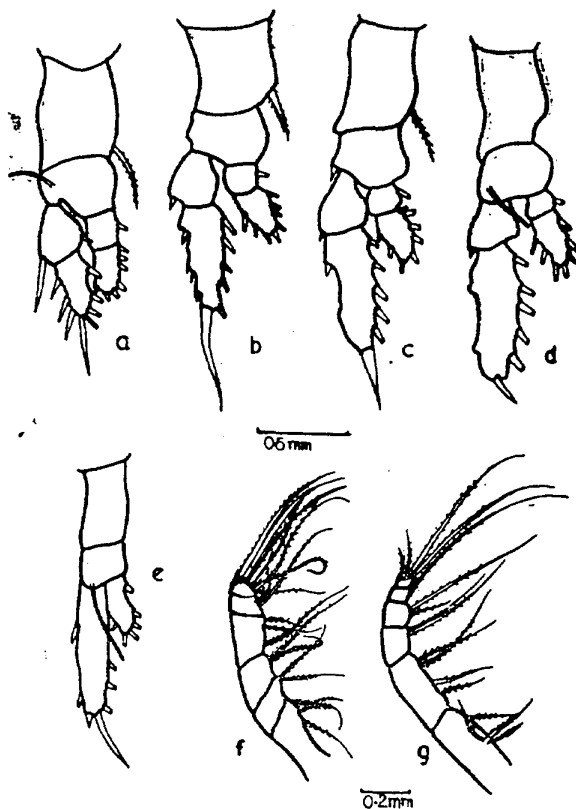


Fig. 2. *H. bulliceps*. Female stage IV.
a-e — swimming legs 1-5; f — maxilla; g — maxilliped

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with 1 setae. Second basis with 3 and endopod with 1 setae. Outer lobe with 5 and exopod with 6 setae (Fig. 1, g). Maxilla (Fig. 2, f) consists of 6 lobes, each provided with 3, 2, 2, 3, 2 and 7 setae respectively. Spines absent on 5th and 6th lobes. Maxilliped (Fig. 2, g) long and furnished with plumose setae.

Swimming legs symmetrical and biramous. Legs 1-4 more or less similar in morphology. First and fifth legs (Fig. 2a and e) smaller than the other three pairs. Setation of the legs as shown in figures (Fig. 2a — e).

DISTRIBUTION

Fig. 3 illustrates the stations from where the specimens were taken. *H. paralongicirrus* was present in 38% of the total samples examined and this species constituted 4.19% of the genus *Haloptilus*. The average number is 3/standard haul. Maximum number (26/standard haul) was observed in a day sample collected from a station located at 04°22'S and 67°24'E during

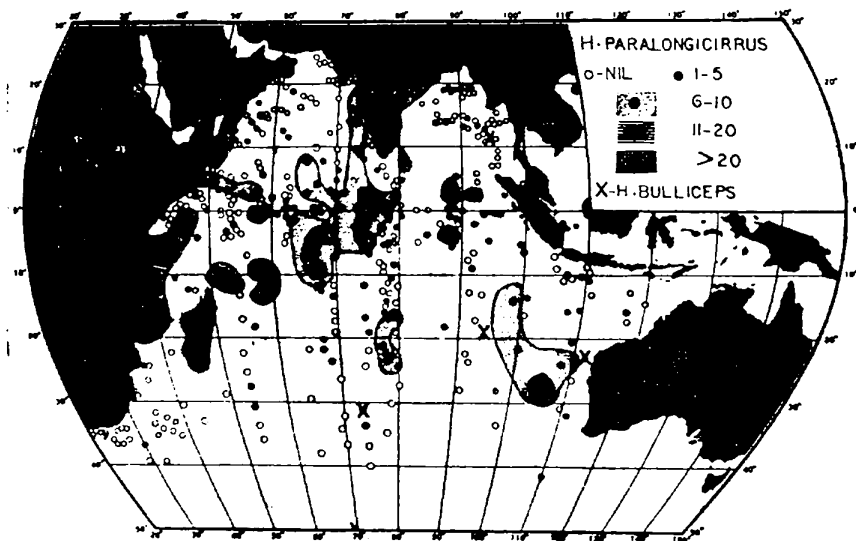


Fig. 3. Distribution map for *H. paralongicirrus* and *H. bulliceps*

SW monsoon. High values were noticed at the mouth of Gulf of Oman, around 105°E and 27°S, south of Equator 04°00'S and 10°00'S and 67°24'E — 67°30'E. Moderate values were observed in the Equatorial belt between 10°N and 10°S, in the Gulf of Aden and in Mozambique coasts. It is sparsely represented in the northern and southern parts of the Ocean. Out of 442 samples *H. bulliceps* was found only in 4 stations from three localities *viz.*, Bay of Bengal, eastern Indian Ocean and southern Indian Ocean. Hydrographic conditions of the stations from where the specimens were collected show that *H. paralongicirrus* can tolerate a temperature from 11.85° to 30.42°C, salinity from 32.03 to 36.44 ‰ and dissolved oxygen from 0.44 to 6.22 ml/l. *H. bulliceps* was found to occur at a range of temperature between 11.54 and 29.30°C, salinity 32.71 and 35.87 ‰ and dissolved oxygen 0.58 and 6.22 ml/l.

Results of the statistical analysis of the data for *H. paralongicirrus* are shown in Tables 1 and 2. From Table 1 it can be seen that southwest Indian Ocean showed a significant difference between day and night collections at 5% level during SW monsoon. Number of specimens in night collections were more when compared to day collections. Table 2 gives a comparison of regions irrespective of seasonal and diurnal variations. Significant result is noticed between Arabian Sea and southwest Indian Ocean and Arabian Sea and Bay of Bengal ($p < 0.01$, $p < 0.05$). Arabian Sea has more number of specimens than southwest Indian Ocean and Bay of Bengal. Comparison of SW monsoon and NE monsoon irrespective of diurnal and regional variations showed no significant results.

TABLE 1. COMPARISON OF DAY AND NIGHT COLLECTIONS IN DIFFERENT REGIONS FOR THE SW AND NE MONSOONS

Regions	Night mean	Day mean	S	t	df
SW monsoon					
Arabian sea	0.8500	0.8380	0.4281	0.0956	47
SE Indian Ocean	—	—	—	—	—
SW Indian Ocean	0.8333	0.2719	0.5185	8.2971*	16
Bay of Bengal	0.6330	0.6618	0.3416	0.1912	19
NE monsoon					
Arabian Sea	0.8469	0.8197	0.2877	0.3192	44
SE Indian Ocean	—	—	—	—	—
SW Indian Ocean	0.7265	0.7059	0.2486	0.1705	15
Bay of Bengal	—	—	—	—	—

*Significant at 5% level.

TABLE 2. COMPARISON BETWEEN REGIONS IRRESPECTIVE OF SEASONS AND TIME OF COLLECTION

Regions	1st mean (\bar{x}_1)	IIInd mean (\bar{x}_2)	Combined S.D. (s)	t	df
Arabian Sea & SE Indian Ocean	0.8386	0.7819	0.3324	0.4892	102
Arabian Sea & SW Indian Ocean	0.8386	0.6323	0.3534	2.9598**	128
Arabian Sea & Bay of Bengal	0.8386	0.6707	0.3354	2.2658*	119
SW Indian Ocean & SW Indian Ocean	0.7819	0.6323	0.3902	1.0267	42
SE Indian Ocean & Bay of Bengal	0.7819	0.6707	0.3391	0.8488	33
SW Indian Ocean & Bay of Bengal	0.6323	0.6707	0.3796	0.3914	59

* Significant at 5% level. ** Significant at 1% level.

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DISCUSSION

In the original description from the Caribbean Sea Park (1970) recorded three closely related species of *Haloptilus* viz., *H. longicornis* (Claus), *H. paralongicirrus* Park and *H. longicirrus* Brodsky. They were separable mainly by body size, shape of the forehead and location of the spermathecae. The smallest was identified as *H. longicirrus* (1.94-2.16 mm), the largest was *H. longicirrus* (2.96-3.32 mm) and the intermediate was *H. paralongicirrus* (2.32-2.64 mm). *H. longicirrus* was found in the upper 200 m. The second one below 500 m and the third one in between. Park remarked that the anatomical details of appendages of *H. paralongicirrus* are indistinguishable from that of *H. longicirrus*, but they can be clearly distinguished by the differences in body size. Although Park doubts whether these differences involve specific characters or simply ecophenotypic variations caused by the differences in vertical distribution, Matthews (1972) has shown that these species form recognizable population units. In the present collections, only *H. paralongicirrus* and *H. longicornis* were observed and they constitute separate population units. *H. paralongicirrus* is reported here for the first time from the Indian Ocean. Park recorded this species from the Northern Atlantic at 11°03'N lat. and 89°55'W long. His collections were from 100-1850 m depth with closing net and maximum number of specimens (11/haul) was found in one station from 450-155 m. This illustrates that *H. paralongicirrus* is a mesopelagic form. Present collections were from 200-0 m. In Indian Ocean high values of the species were obtained where upwelling is evident. The presence of this species on either side of the Equator from 45°E to 80°E meridian may be associated with the upwelling off Somali coast and monsoon current carrying the Somali population eastward along the Equator.

In the original description of *H. bulliceps* Farran does not mention whether the specimens are males or females and no indication of male characters, like geniculation of antennule, asymmetry of fifth leg etc. are given. Hence there is a possibility of it being stage IV female.

The present specimens are characterized by the absence of geniculated antennule and in having small symmetrical 5th leg which are evidently female characters. This species is reported for the first time from the Indian Ocean.

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