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ONCAEIDAE (COPEPODA: POECILOSTOMATOIDA) IN THE INDIAN OCEAN WITH COMMENTS ON THE SPECIES OF *LUBBOCKIA* AND *CONAEA*

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ABSTRACT

Conaea, *Lubbockia* and *Oncaea* are three genera of the family Oncaeidae encountered in the International Indian Ocean Expedition (IIOE) collections. *Conaea*, represented by a single species *Conaea rapax* was observed at 13 stations. The two species of *Lubbockia*, *L. aculeata* and *L. squillimana* were widespread in the Indian Ocean; the former was present at 43 stations and the latter in 53 stations. The mean temperature of the positive stations ranged from 14 to 24°C. *Conaea rapax* and *L. aculeata* showed affinity to lower temperature and the highest density observed was at 14 to 16°C, whereas *L. squillimana* was abundant at stations with higher mean temperature. Maximum density for the genus *Oncaea* was observed in the northern and equatorial Indian Ocean. *Oncaea* populations diminished towards the subtropical and southern latitudes.

Key-words: Copepoda, *Oncaea*, *Lubbockia*, *Conaea* IIOE.

INTRODUCTION

Studies on poecilostomatoid, cyclopoid and harpacticoid copepods are less among the numerous literature published on pelagic copepods. The taxonomy and distribution of calanoid copepods of the IIOE have been extensively studied from the Indian Ocean (Saraswathy, 1986). But accounts on other pelagic copepods are restricted. A general account of the harpacticoids in IIOE collections was given by Haridas and Rao (1981). Saraswathy (1982) described the siphonostomes from IIOE. The three planktonic families that comprise the order Poecilostomatoida (Kabata, 1979 and Bowman and Abele, 1982) are Corycaeidae, Sapphirinidae and Oncaeidae, of which the first two groups were studied in some detail from the Indian Ocean (Meenakshikunjamma, 1974 and Rajaram & Krishnaswamy, 1980). Oncaeidae is the most abundant poecilostomatoid copepod and the only work based on IIOE was by Moulton (1973) who analysed the variation within *Oncaea conifera*. Studies of Oncaeidae from several expeditions in the Pacific, Atlantic and Antarctic waters has been published in recent years. Heron and Damkaer (1969) described *Pseudolubbockia* and *Lubbockia* species from the Gulf of Alaska. Heron & Damkaer (1978) dealt with the *Lubbockia* species of Northeast Pacific. Heron (1977) described many new species of *Oncaea*, *Conaea* and *Epicalymma* from the waters

of the Antarctic. Boxshall (1977) and Malt (1982) studied the Oncaeidae from the Atlantic Ocean. This paper gives a general information on the distribution of the family Oncaeidae in the Indian Ocean. Species composition in two genera, namely *Lubbockia* and *Conaea* is also discussed.

MATERIAL AND METHODS

The family Oncaeidae was subsorted from 340 standard samples of the IIOE and members of *Conaea* and *Lubbockia* were identified. General information on the collection and processing of IIOE samples was given by Hansen (1966). Distribution of the family Oncaeidae is discussed based on the numerical data obtained during subsorting and a brief description of the species along with distribution maps is also presented.

RESULTS AND DISCUSSION

Heron and Damkaer (1978) established five genera in the family Oncaeidae, namely *Oncaea, Lubbockia, Pseudolubbockia, Conaea* and *Epicalymma.* Only members of the first three genera were encountered in the IIOE collections. The genus *Lubbockia* is represented by *L. aculeata* and *L. squillimana* and genus *Conaea* by one species, namely *Conaea rapax.*

Genus: *Lubbockia* Claus, 1863.

Members of the genus *Lubbockia* are quite distinct from *Oncaea* in having an elongate prosome and slender urosome.

Lubbockia aculeata Giesbrecht, 1891.

Lubbockia aculeata Giesbrecht, 1891: 477, 1892: p.606-611, pl.48, figs.3, 9, 11, 13, 16, 20.

Lubbockia aculeata Heron and Damkaer, 1978: p.15-18, figs.10-11.

Female: (Fig.1a - Length: 2.1 to 2.3 mm) prosome and appendages with thick exoskeleton. Rostrum pointed postero-ventrally. Antennule 7 segmented antenna with elongate third segment. Maxilliped (Fig.1b) with large dentiform process on first segment; second segment with a number of dentiform processes. Terminal claw with a seta at the distal end bearing spinules towards the latter half. Urosome 5 segmented, leg 5 with 2 setae, the inner one reaching up to the posterior border of genital segment.

Male: (Length 1.6-1.8 mm) Urosome 6 segmented. Antennule with 7 segments, the terminal seta on last segment nearly as long as the body.

Lubbockia squillimana Claus, 1863

Lubbockia squillimana Giesbrecht, 1892: p.606-611, pl.4; fig.6, pl.48; figs.1, 2, 4-8, 17-19, 21.

Lubbockia marukawai Mori, 1937: p.122, 123; pl.67, figs.10-13.

Lubbockia squillimana Heron and Damkaer, 1978, p.18-19, fig.12.

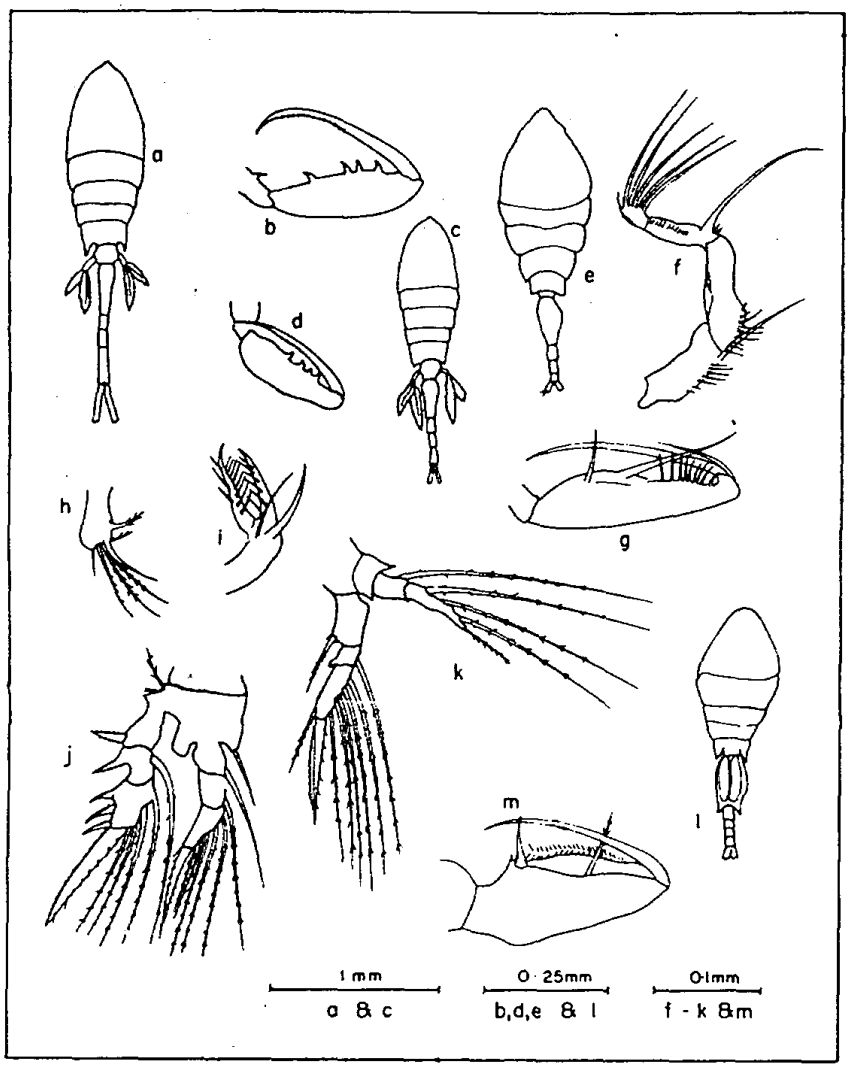

Fig.1.a. *Lubbockia aculeata* - female; b. Maxilliped; c. *Lubbockia squillimana;* d. Maxilliped; e. *Conaea rapax* - female; f. Antenna; g. Maxilliped; h. Maxilla - 1; i. Maxilla - 2; j. Leg - 1; k. Leg - 4; l. Male; m. Maxilliped.

Female: (Fig.1c, length 1.45-1.8 mm) General characters as that of *L. aculeata.* Dentiform process absent on first segment of the maxilliped (Fig.1d). Inner seta on leg 5 reaching beyond the posterior border of the genital segment.

Male: (Length 1.3 to 1.6 mm) Similar to male of *L. aculeata* stage V specimens were also obtained. Mori (1937) described stage V as *L. marukawai.* Stage V specimens can be differentiated by the undeveloped genital segment and the shorter urosome segments.

Genus: *Conaea*

Conaea, although resembling *Oncaea*, differs from it in having the antennule with different ornamentation, genital segment with a single seta and caudal ramus with expansion on dorsal surface.

Conaea rapax Giesbrecht, 1891.

Conaea rapax Giesbrecht, 1892, pp.82, 605, p.48, figs.50-59.

Conaea gracilis Wilson, 1950, p.191, pl.5, figs.36-46.

Conaea rapax Heron, 1977, p.86-90, figs.30, 31 & 32.

Female: (Fig.1e, Length 0.85-1.00 mm) Body cyclopoid in shape, slender and elongate. Urosome 5 segmented. Genital segment ovoid with a slight constriction posteriorly. External genital apertures located at mid region dorsally bearing one setule, posterior border of anal segment fringed with minute spinules. A dorsal expansion present on dorsal surface of caudal ramus surrounding base of dorsal seta. The row of setules on second segment of antenna and the hook tipped spines on the third segment are very conspicuous (Fig.1f). Maxilliped (Fig.1g) 4 segmented, second segment with two spines on inner surface; the distal elongate and armed with a row of small denticles and long spinules; anterior surface with a row of long setules. Third segment small and unarmed. Terminal segment as a long claw with row of setules on concave surface. Maxilla I and II as figured (Fig.1h & i), swimming legs 1 and 4 as shown in figures Fig.1, j & k.

Male: (Fig.1l, length 0.8-0.9 mm) urosome 6 segmented maxilliped 3 segmented and differs from that of females, (Fig.1m) with second segment bearing longitudinal cleft with two setae, the posterior expansion with several rows of setules. Legs 1 to 5 as in female; leg 6 seen as postero-lateral flap on ventral surface of genital segment. Posterior corners of genital segment with recurved tip, protruding in dorsal view.

Distribution of Oncaeidae: In the tropical pelagic zone only *Oncaea*, *Lubbockia* and *Conaea* have been encountered. *Pseudolubbockia* of *Epicalymma* were reported from the abyssal waters of the Gulf of Alaska (Heron and Damkaer, 1969) mostly from deep water collections. Genus *Oncaea* includes many species which resemble one another and within which many forms and varieties were recognised (Sewell, 1947). Moulton (1973) described morphological variation in the *Oncaea conifera* group in the Indian Ocean. Genus *Oncaea* was represented in 337 stations (Fig.2). *Oncaea* is the most abundant poecilostomatoid, hence the diurnal and seasonal difference in distribution was studied. The average number of *Oncaea* specimens during night (1127/std. sample) was nearly double to that of day (664/std. sample). Similarly the average value for northeast monsoon (1093/std. haul) was greater compared to the average (841/std. haul) for south-west monsoon. When the density for the different localities of the Indian Ocean was compared, the equatorial region showed maximum density. The Arabian Sea was found richer when compared to the Bay of Bengal. From the distribution map it is obvious that the distribution of *Oncaea* differs from that of total copepod distribution (Kasturirangan, Saraswathy

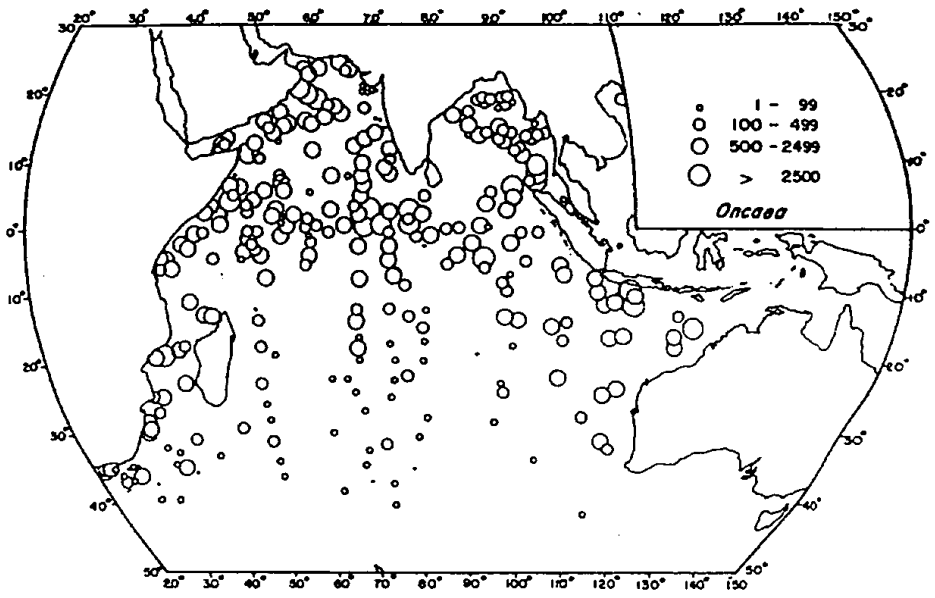

Fig.2. Distribution of genus *Oncaea* in the Indian Ocean.

and Gopalakrishnan, 1973). Maximum density of copepods coincided with areas of highest biomass. But for *Oncaea* the maximum densities were observed in mid oceanic regions. *Oncaea* is regarded mainly as carnivorous and sometimes as parasitic. In the coastal upwelling areas usually herbivorous copepods are predominant. *Oncaea* being predatory might not be directly related with areas of maximum productivity.

The distribution of *Lubbockia aculeata* and *L. squillimana* is shown in Fig.3. Both species are widespread in the Indian Ocean. *L. aculeatus* was encountered at 43 stations, *L. squillimana* at 53 and *Conaea* at 11 stations. *L. aculeata* was recorded mostly from the equatorial and southern Indian Ocean. Representation in the northern Indian Ocean was limited to a few stations in the Arabian Sea. *L. Squillimana* on the other hand was well represented both in the Arabian Sea and Bay of Bengal. *Conaea rapax* (Fig.4) was encountered at 9 stations from the central and southern Indian Ocean. The mean temperature (200-0 m) at the stations from which *Lubbockia* and *Conaea* were observed was examined and found to vary between 14 and 24°C. When the average number of each species was plotted against each degree celcius from 14 to 24°C, a linear relation was observed (Fig.5). *L. squillimana* was abundant in the higher temperature range of 21 to 24°C and *L. aculeata* in 14 to 16°C. Highest density for *Conaea rapax* was also noticed in lower temperatures. It is to be inferred that *L. aculeata* and *Conaea rapax* prefer cold waters and might be well represented in the deep waters of the tropical Indian Ocean.

Reports of *L. aculeata* from the Indian Ocean are summarised by Sewell (1947) and that of *L. squillimana* by Krishnaswamy (1953). De Decker

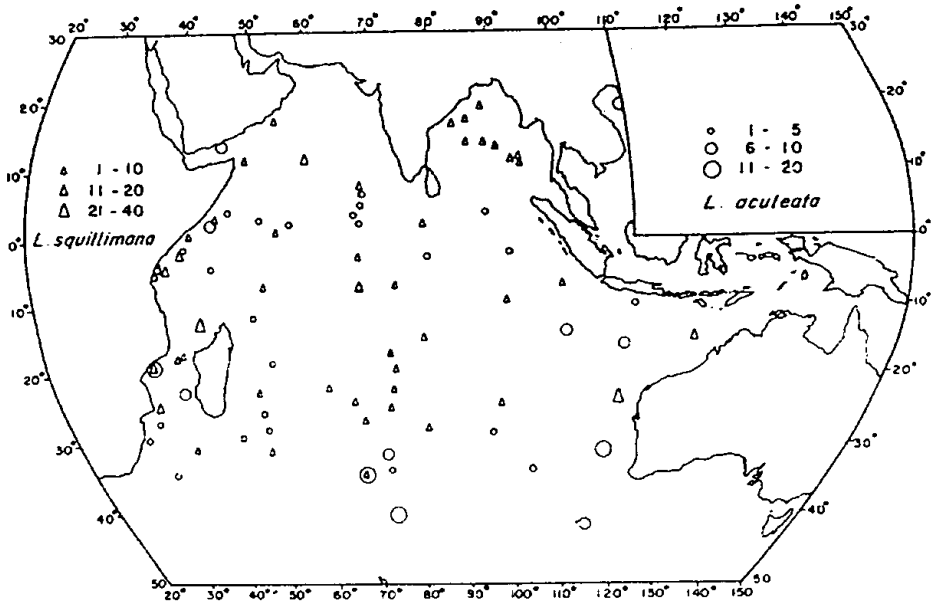

Fig.3. Distribution of *Lubbockia aculeata* and *Lubbockia squillimana* in the Indian Ocean.

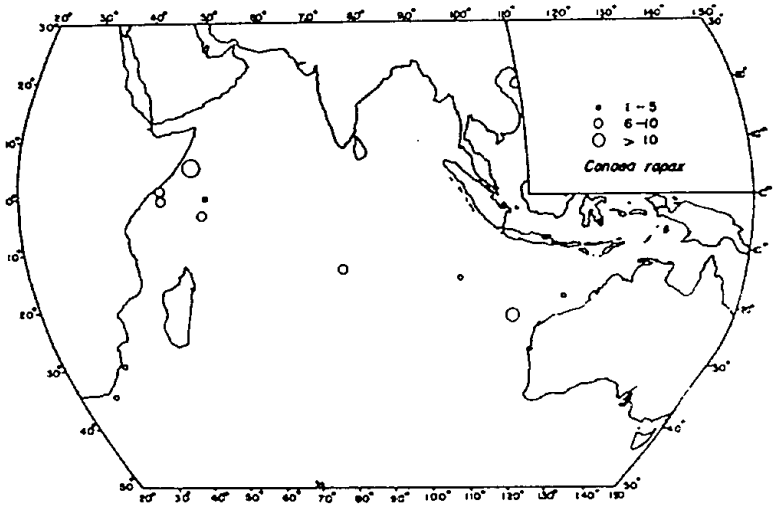

Fig.4. Distribution of *Conaea rapax* in the Indian Ocean.

and Mombeck (1964) reported both species from South African waters. Heron and Damkaer (1978) listed the two *Lubbockia* species with a definite tropical distribution. The present study also showed that the two species are distributed in the tropical waters. But the distribution of *L. squillimana* is well extended to the northern Indian Ocean, especially in the Bay of Bengal.

L. aculeata may be abundant in the cooler deeper layers. Affinity to lower temperature is indicated in Fig.5.

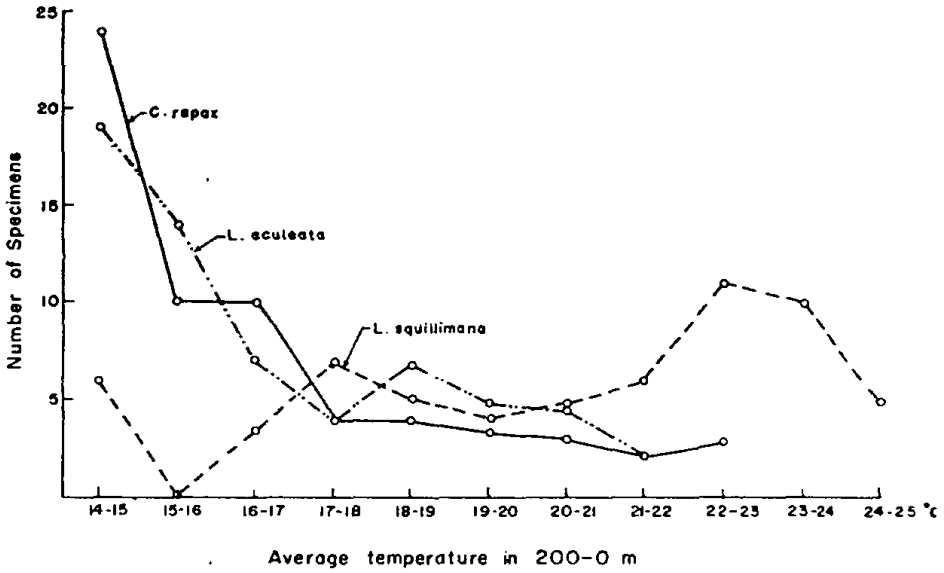

Fig.5. Density of *Lubbockia* and *Conaea* plotted against the average temperature in 200-0 m.

The only record of *C. rapax* from the Indian Ocean was by De Decker and Mombeck (1964) who reported this species in the South African waters from surface as well as deeper hauls. The analysis of IIOE Oncaeidae showed that the distribution of *C. rapax* is extended to equatorial and southern parts of the Indian Ocean, though found at few stations. In general *Lubbockia* and *Conaea* species are sparsely distributed in the epipelagic realm. The study of Siphonostomes (Saraswathy, 1982) in the Indian Ocean also showed a very scattered distribution. A similar study on *Urocorycaeus* also showed sparse representation of the species in northern Arabian Sea and southern subtropical gyre (Meenakshikunjamma, 1974). Most of the newly described species of the family Oncaeidae were obtained from very deep hauls taken from the Atlantic and Pacific. In general, it can be inferred that in the family Oncaeidae, members of genus *Oncaea* are very abundant in the pelagic biotope, while the other genera are either sparsely distributed or are totally absent. The possibility of encountering additional species of *Lubbockia* and *Conaea* as well as members of the other two genera, namely *Pseudolubbockia* and *Epicalymma*, which are at present not represented, cannot be ruled out. Any comments on the distribution of this highly complex family would be more concrete after a thorough investigation of the species composition from benthic environments.

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