

epiphragms while with the supply of water the number increased to 17, and with the supply of water and food the snails secreted as much as 30 epiphragms and the process, if continued would be much more.

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OBSERVATIONS ON THE SWARMING, BREEDING HABITS AND
SOME LARVAL STAGES OF THE DEEP SEA PORTUNID CRAB
CHARYBDIS (GONIOHELLENUS) EDWARDSI LEENE AND
BUITENDIJK 1949 IN THE NORTHERN ARABIAN SEA IN
JANUARY-FEBRUARY 1974 AND OFF THE MADRAS
COAST DURING JANUARY TO MARCH
1976 TO 1979.

By

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(With 1 Plate, 10 Text-figures and 1 Map)

INTRODUCTION

Swimming crabs of the family Portunidae as a rule are bottom dwelling animals. The pelagic occurrence of some species of Portunids of the genera *Polybius* and *Charybdis* is attributed as a periodic phenomenon ; the swarms appearing rather suddenly and disappearing equally abruptly, connected with the reproductive cycle, which in turn is associated with the temporary presence of food in the upper layers of the sea.

A perusal of the literature reveals that authentic records of the swarming habit of the swimming crabs of the family Portunidae have been reported only for *Polybius henslowi* Leach and *Charybdis (Goniohellenus) edwardsi* Leene and Buitendijk (Clark, 1909, p. 287 ; Balss, 1955, pp. 1318-1319 ; Della Croce, 1961, pp. 5-13 ; Della Croce & Holthuis, 1964-65, p. 33 for *P. henslowi* and Della Croce & Holthuis, 1964-65, p. 33-37 ; Silas, 1969, pp. 1-86 and Prasad, R. R. & Nair, P. V. R., 1973, p. 1 for *C. (G) edwardsi*).

The abundant occurrence of this species in dense concentrations along the shelf edge in the Arabian Sea between Mangalore and Trivandrum and its possible utilisation for the manufacture of crab meal, if not as food, has been reported by Silas, 1969. This species as a possible resource for further exploitation has also been remarked by Prasad and Nair, 1973.

This ubiquitous crab (Plate IV) was observed to swarm at the sea surface after sun set (16. 05 hrs. to 20. 05 hrs.) i) at two deep sea

oceanic stations 03/03 Lat. 23° 29' N ; Long. 60° 17' E and 09/15 Lat. 20° 30' N ; Long. 61° 55' E established in January and February 1974 during the Oceanographic Expedition on INS Darshak in the Northern Arabian Sea and ii) in the inshore surface waters of the Madras coast, periodically appearing suddenly and disappearing equally abruptly during the cruises of the R. V "Chota Investigator" during January to March 1976 to 1979 either in the early morning before sunrise or after sun set. The distribution and abundance of this species based on previous records and from the present observations are presented in Text-fig. 1. Although this swarming crab has been observed to swim solitarily or float passively at the sea surface of the south-west coast of India and the Laccadive sea (Silas, 1969), its abundant occurrence in swarms in deep sea oceanic regions in the central part of the Northern Arabian Sea, where the total depth was ranging from 1800 to 3240 metres is remarkable. Further, its occurrence in the inshore surface waters of Madras coast during the cruises of the R. V. "Chota Investigator" sporadically, from January to March in 1976, 1977, 1978 and 1979 is first recorded from Bay of Bengal and suggests that the distribution of this species has been extended to the Bay of Bengal, gradually establishing itself in this area also. Furthermore, very little published information is available on the breeding and mating habits of this species. Therefore, details on observations on the swarming, breeding and mating habits, and distribution of this species are presented in this paper. In addition, the first stage zoea, megalopa and first instar stages of a species of *Charybdis*, which is provisionally assigned to this species, since these stages occurred in appreciable numbers in the plankton-neuston collections at the stations where the adults of *Charybdis (Goniohellenus) edwardsi* were observed in dense swarms, are also briefly described.

DESCRIPTION OF THE SALIENT FEATURES OF THE SPECIES

Family PORTUNIDAE Rafinesque, 1815

Genus **Charybdis** De Hann, 1833

Goniosoma A. Milne-Edwards, 1860-61

Charybdis (Goniohellenus) edwardsi Leene & Buitendijk, 1949

Goniosoma truncatum A. Milne Edwards, 1860-61, p. 380, pl. 34, fig. 4.

Charybdis (Goniohellenus) edwardsi, Leene and Buitendijk, 1949, p. 296, figs. 3, 4C ; Della Croce and Holthuis, 1964-65. p. 119, one figure not *Portunus truncatus* Fabricius, 1798, p. 365.

One of the conspicuous and most characteristic features of this species is the smooth and highly polished hexagonal carapace with

by the present authors during January to March, 1974 and the occurrence of swarms of berried females in the Madras inshore waters during January to March, forces one to surmise that the breeding season extends most probably from about November to March during each year, since mating in some of these crabs were observed by us, in specimens maintained in the field and laboratory aquaria, during the months of January to March in the Madras coast.

Mating habits :

In the male, the first and second pair of abdominal appendages act as genital organs. The first pair is a tube like organ, while the second is a jointed rod. The two are usually separate, but the second is capable of being inserted into the first. The female is in a soft state during copulation, since it has just moulted. Before copulation, the male hold the female with the second pair of walking legs. The female at this stage is upright, with its back against the abdomen of the male, and is quite passive. It is not attracted towards any food, but the cleaning operation of the gills by moving the third pair of maxillipeds to and fro, takes place. The male, on the contrary, is very active and drives away any intruder with its chelipeds. If, however, the intruder persists in advancing, the male, catching the female in its legs, swims away. The pair may thus lie in the same position for two or three days.

Sometimes it happens that the female is "hard" (i. e. not recently moulted) when the male catches her. In that case, the male still holds the female which struggles hard, not to get away from the male, but to get rid of its moult.

When copulation begins, the male turns the female so that the latter is now inverted, with its abdomen opposed to that of the male. The male then inserts the second pair of appendages inside the first, and both together acting as a penis are thrust into the female openings. The first pair is capable of very little motion in this position, but the second pair of appendages can move freely up and down inside the first, very much like a piston of a pump and forces the sperm into the female. The copulation may last for three or four hours, after which the crabs separate.

The abdomen of the male during copulation is shut against the sternum, only the penis protruding, and the abdomen of the female is opened only just sufficiently for the penis to move freely. If the crabs are disturbed during copulation, the act ceases and the crabs readily separate.



Fig. 1. Showing dorsal view of adult female of *Charybdis (Goniohellenus) edwardsi* Teene & Buitendijk, 1949.

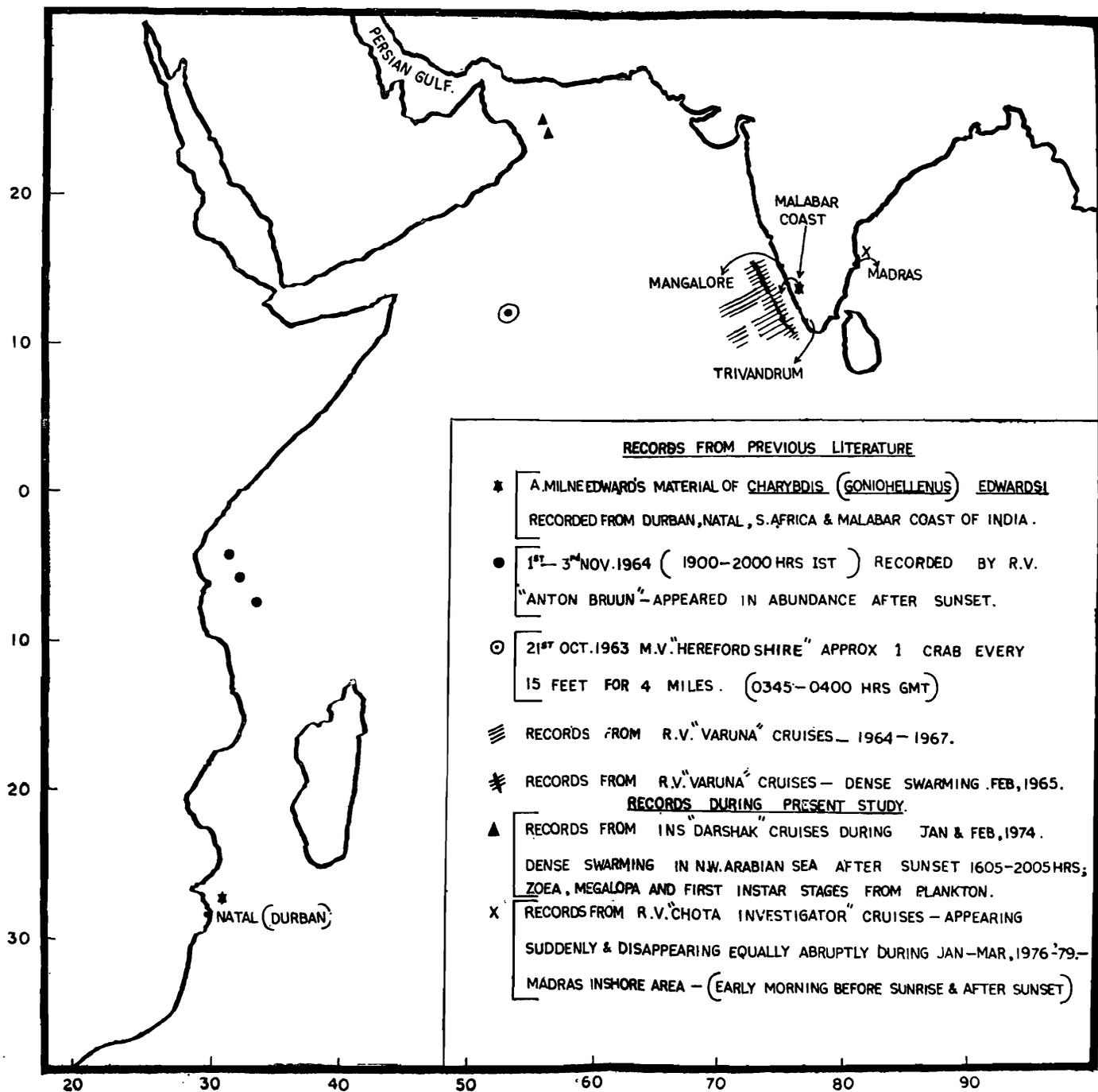
transverse granular ridges on it. The small and sharp frontal teeth, large and truncate antero lateral teeth, distinguish this species (Plate IV).

This species which was not represented so far in the collections of the Zoological Survey of India, Calcutta is now being added to the National Zoological Collections.

OBSERVATIONS ON SWARMING AND BREEDING HABITS

During the oceanographic expedition on I.N.S. "Darshak" in Northern Arabian Sea dense swarms of this species were observed over a wide area in the North Western part of Arabian Sea near to Persian Gulf between Lat. 23°29'N ; Long. 61°55'E and Lat. 20°30'N ; Long. 60°55'E after sun-set during January-February 1974. At some regions in this area, they appeared in abundance, two crabs occurring every five feet approximately, as the ship was cruising along its set course, establishing predetermined stations (*vide* Daniel & Jothinayagam, 1977). Similar swarms of this species were observed during the regular cruises of the R. V. "Chota Investigator" either in the early morning before sun-rise or after sun-set, during January to March in 1976, 1977, 1978 and 1979, in the inshore area of Madras coast. These swarms were observed to appear suddenly and disappearing equally abruptly after few days during this period. However, a few female crabs collected from this region were infested by the pedunculate cirripede, *Conchoderma virgatum* (Spengler) bearing large sized eggs suggesting that this pelagic cirripede and its host might have spent at least 80 to 90 days in the pelagic domain of the sea, since *C. virgatum* (Spengler) (*vide* Daniel, 1955, John Roskell, 1969 and Newman, W. A. ; Zullo, V. A. and T. H. Withers, 1969) is a pelagic species which cannot stand the pressure of deep water. Therefore, it is inferred that this crab which occurs in dense swarms in the surface waters for mating, descends to slightly lower depths of 5 to 10 metres only, and does not become a deep sea benthic form, for at least 3 to 4 months. A detailed examination of the adult female crabs obtained in the North Western Arabian sea revealed that while some crabs harboured the same species of Cirripede, i. e. *C. virgatum*, in some other large sized crabs there were only the bases of the peduncles of this cirripede, suggesting that these cirripedes were probably killed during the descent of the adult crab after spending a few months of its life span in the surface waters for breeding purposes.

The occurrence of berried crabs during January and February in the North Western Arabian Sea and the occurrence of the Zoea, megalopa and first instar stages of a species of *Charybdis* (assigned to this species



Records of the swarming crab *Charybdis (Goniohellenus) edwardsi* in the Arabian sea and Bay of Bengal

Larval stages :

As mentioned in the introduction, the first stage Zoea, Megalopa and first instar stage of a species of *Charybdis* occurred in appreciable numbers in the plankton and neuston collections at the stations where the adults of *Charybdis (Goniohellenus) edwardsi* were observed in dense swarms both in the North West Arabian Sea and inshore waters of Madras coast. These larval stages are, therefore, provisionally assigned to this species. This however, must be confirmed by obtaining berried females of this species and rearing their larval stages in the laboratory aquaria tanks. The following larval forms are briefly described.

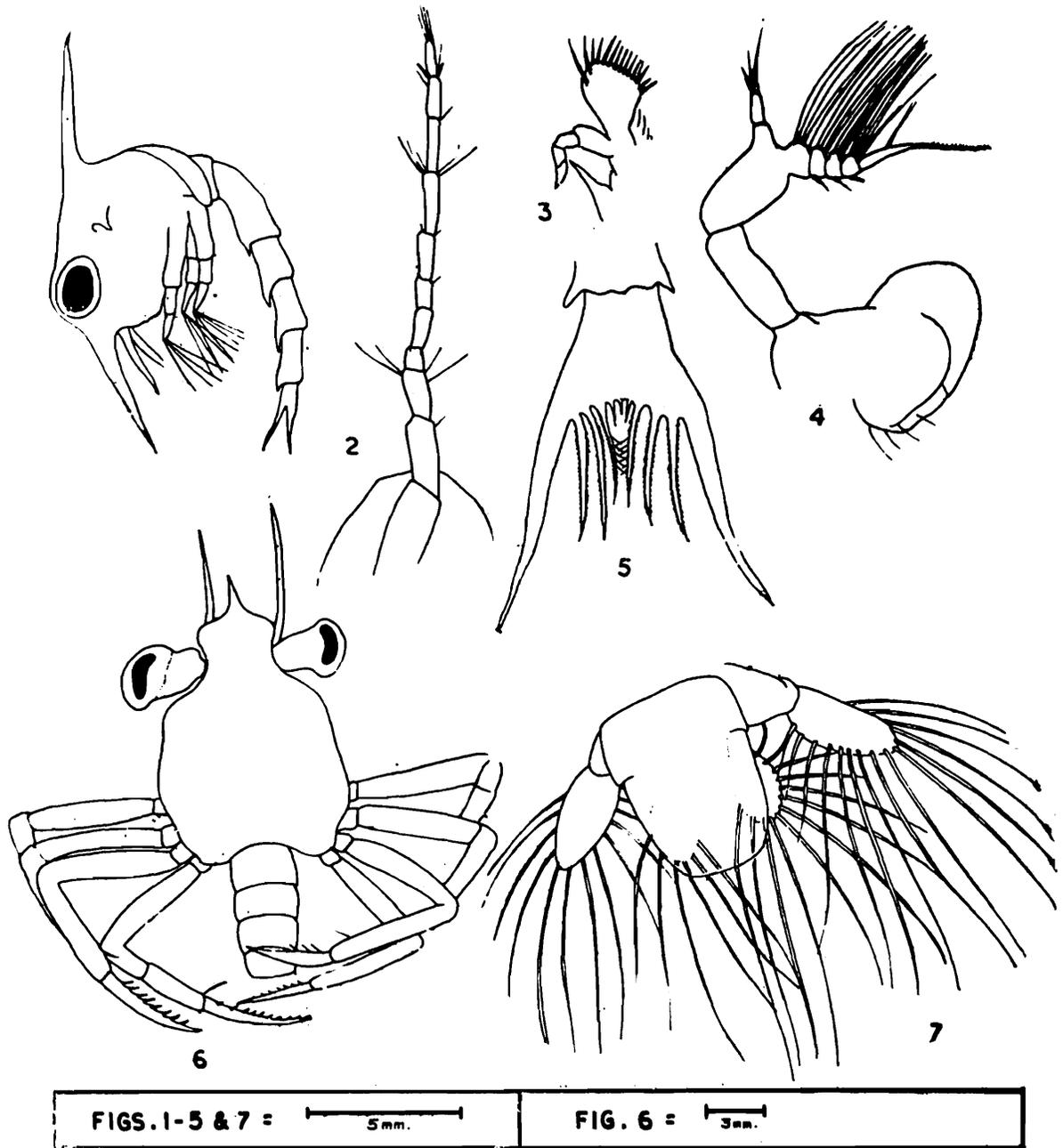
First stage Zoea (Text-figs. 1-5)

The carapace is rounded (Text-fig. 1). The dorsal spine is straight with slightly curved tip and is equal in size with the straight rostrum. The antennule (Text-fig. 3) is a short unjointed pigmented process with a single aestheta. The antenna (Text-fig. 3) consists of a well developed spine from process which is nearly as long as the rostrum and a small exopodite bearing a setae. The first maxillipede (Text-fig. 4) has the usual stout basipodite, an exopodite of two segments with four setae at the tip, and a five-jointed endopodite with four setae at the tip. In the second maxillipede, the endopodite consists of three joints. The thoracic appendages (Text-fig. 2) are ten jointed. The abdomen consists of five segments and a telson. The second and third segments have the usual lateral hooks, while the third, fourth and fifth segments have a pair of long downwardly directed spines from the postero-lateral border. The forks of the telson are curiously inbent posteriorly in a regular curve, and bear two spines. There are seven hairs on the inner border of the innermost pair of setae in the fork of the telson (Text-fig. 5), followed by a few spinules. The outer surface of these setae and both the borders of outer setae are spinulate.

Megalopa stage (Text-fig. 6).

The carapace is elongate a rostrum is present and consists of a single long spine. The sides are angular. A pair of ventral cornua (prolongations of the external plate of the last thoracic segment) is present.

The chelipeds and pleopods are fully developed. The last joint of the last pair of legs is flattened and bears along its inner border five coarse setae with curved tips and three straight setae. The other legs almost resemble those of the crab. The abdomen consists of six segments and a telson. The first segment is comparatively shorter than the rest and bears no pleopods. The postero-lateral borders of the fifth pleon segments are developed into long spines. The pleopods on the last abdominal segment (Text-fig. 7) have 12 setae each.



Text-figs. 1-7. *Charybdis (Goniohellenus) edwardsi*

1. First Zoea — Side view.
2. First Thoracic appendage.
3. Antennule and Antenna of Zoea.
4. First maxillipede of Zoea.
5. Telson of Zoea.
6. Megalopa stage.
7. Last abdominal segment with pleopods.

First instar stage.

The first post larval instar resemble the adult crab. The carapace has widened, and the six serrulate spines on the antero-lateral borders have developed. The last of these is much longer than the rest. The rostral spine of the megalopa has disappeared and the front is a simple transverse curve. The branchio-cardiac groove and the grooves from the last spines on the antero-lateral borders are present. The last pair of leg is adapted into swimming paddles. The abdomen is permanently flexed. Its colour varies from dirty white to a very faint grey, the eyes being yellowish pink and the cornea black.

Records and Distribution.

The previous records and swarming of this species from literature and its present records and swarming based on the present study is represented in Text-fig. 1. It is noteworthy that this species is recorded for the first time from the Bay of Bengal and the Madras coast suggesting that *Charybdis (Goniohellenus) edwardsi* has extended its range of distribution to the Bay of Bengal also.

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