

ON SOME CRUSTACEAN ASSOCIATES OF ECHINODERMATA
FROM THE BAY OF BENGAL

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(With 4 Text-figures and 1 Plate)

Associations in marine environment are common. It is particularly so with echinoderms, for the arms and pinnules of crinoids, the ambulacral grooves and spinous armature of asteroids and ophiuroids, the thick forest of spines and pedicellariae of echinoids and the cloaca of holothurians serve as attractive habitats for a variety of symbionts ranging from Protozoa to Pisces. The associates and their adaptations to the special biotope and relationships with their hosts and other members of the community, have been dealt with in detail by many, especially Hyman (1955), Dales (1957, 1966), Hopkins (1957), Davenport (1966) Fischelson (1973) and Bruce (1976). There are several reports on the crustacean associates of Indian Echinodermata, notably those of Kemp (1922), Chopra (1931), Jones and Sankarankutty (1960), Jones and Mahadevan (1965), Reddiah (1966, 1968), Rao and Sowbhagyavathi (1972) Ganapati and Sastry (1972) and Daniel and Krishnan (1978). During the recent survey to Andaman and Nicobar Islands, led by Shri G. Ramakrishna (Superintending Zoologist), two species of shrimps associated with sea-urchins were collected by the author, a preliminary report of which has already been made (Sastry, 1977). An examination of the unnamed National Zoological Collections, revealed some more decapod crustacean associates of echinoids and crinoids which are being reported here. The following is the list of crustacean associates dealt with in the present communication.

<i>Crustacean associate</i>	<i>Echinoderm host</i>	<i>Locality</i>
Alpheidae		
1. <i>Athanas dorsalis</i> (Stimpson)	<i>Stomopneustes variolaris</i> (Lamarck) (Echinoidea : Stomopneustidae)	Camorta (Nicobars)

<i>Crustacean associate</i>	<i>Echinoderm host</i>	<i>Locality</i>
2. <i>A. indicus</i> (Coutiere)	<i>Echinometra mathaei</i> (Blainville) (Echinoidea : Echinometridae)	Camorta (Nicobars) ; Chidiatapu, Port Blair and Neill (S. Andamans)
3. <i>Synalpheus stimpsoni</i> (de Man)	Crinoidea	Havelock and Peel (S. Andamans)
Palaemonidae : Pontiinae		
4. <i>Periclimenes (Harpilius)</i> <i>spiniferus</i> de Man	Crinoidea	Mergui Archipelago
Parthenopidae		
5. <i>Echinoecus pentagonus</i> (Milne-Edwards)	<i>Echinothrix diadema</i> (Linnaeus) (Echinoidea : Diadematidae)	Car Nicobar (Nicobars)

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Family ALPHEIDAE

1. *Athanas dorsalis* (Stimpson)

(Text-fig. 1)

1861. *Arete dorsalis* Stimpson, *Proc. Acad. Nat. Sci. Philad.*, 12 : 32.

1960. *Athanas dorsalis* : Banner and Banner, *Pacific Sci.*, 14 : 151.

1962. *Athanas dorsalis* : Sankarankutty, *J. mar. biol. Ass. India*, 4 : 167.

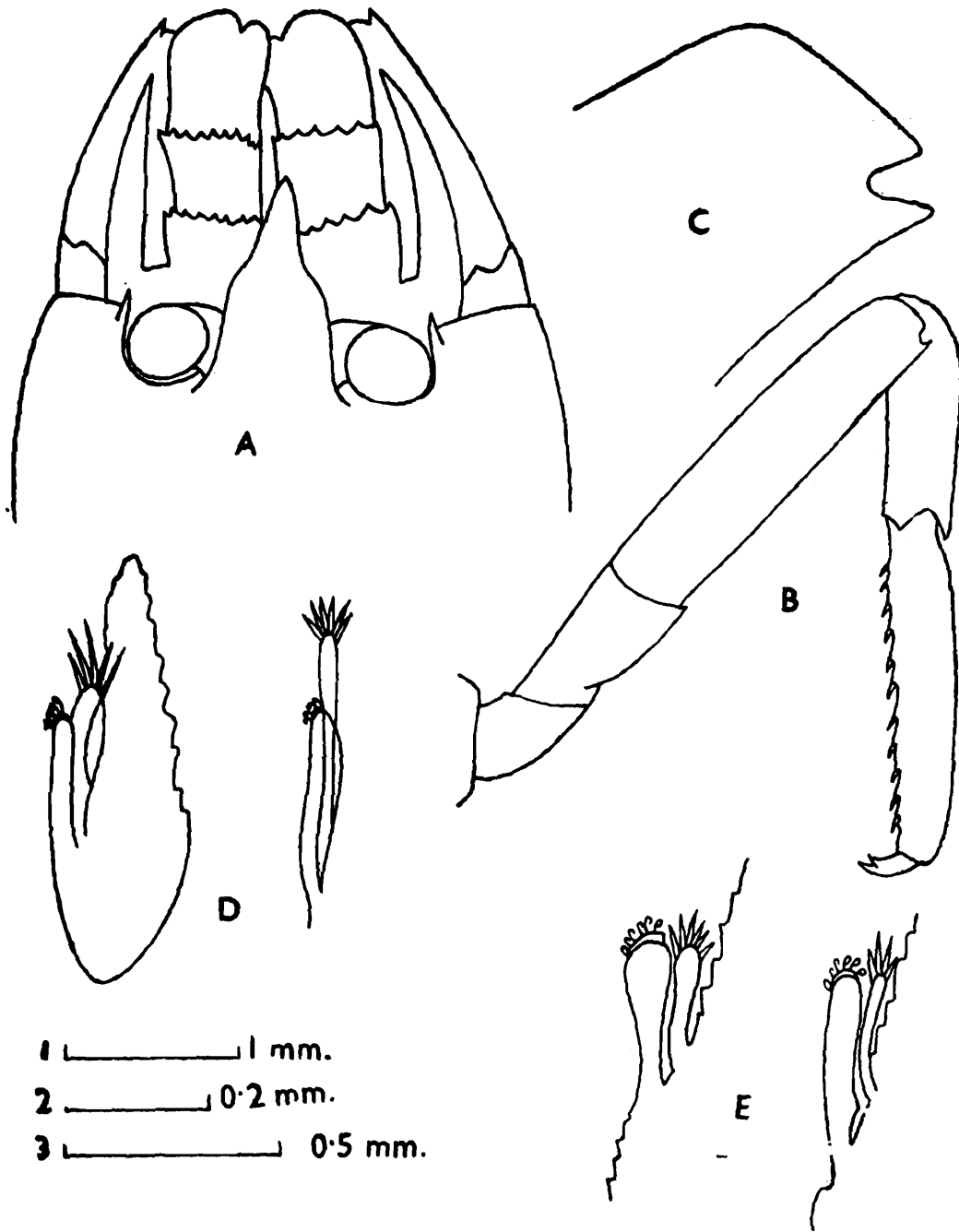
1972. *Athanas indicus* : Ganapati and Sastry, *Proc. Indian natn. Sci. Acad.*, 38 B : 367.

[Non : *Athanas indicus* (Coutiere, 1903)]

Material : 4 ♂♂ and 4 ♀♀ *Loc* : Camorta, Nicobar Is. *Coll* : G. Ramakrishna and Party. D/1. ii. 1976.

Remarks : The shrimps were dark pink in colour appearing almost black when alive. Body robust, with heavy chelae. Rostrum lanceolate with margins parallel near the base and converging distally to a blunt tip, reaching a little beyond the middle of the second antennular article. Carpus of the second legs four segmented. Merus of third legs with a notch on the outer distal margin and dactylus biunguiculate.

All the four females are carrying eggs on the abdomen and have the *appendix masculina* on the second pleopods, as long as the *appendix interna*. In males the *appendix masculina* is longer than the *appendix interna* and bears longer spines (Text-figs. 1 D, E).



Text-fig. 1.—*Athanas dorsalis* (Stimpson) A. Anterior region, dorsal view. B. Third pereiopod. C. Distal region of merus of third pereiopod. D. Second pleopods of males. E. Second pleopods of females. Figs. A, B-scale 1. Fig. C-scale 2. Figs. D, E-scale 3.

On a comparison with the present material, it appears that the shrimps associated with *Stomopneustes variolaris* on the Visakhapatnam Coast (Ganapati and Sastry, 1972) are also *A. dorsalis*. The present material also was collected from the same sea-urchin and in a similar habitat.

Distribution : Indo-west Pacific. From peninsular India it was reported in the Gulf of Mannar (Sankarankutty, 1962) and along the Visakhapatnam Coast (Ganapati and Sastry, 1972).

The species is recorded here for the first time from the Andaman and Nicobar Islands.

2. *Athanas indicus* (Coutiere)

(Text-fig. 2)

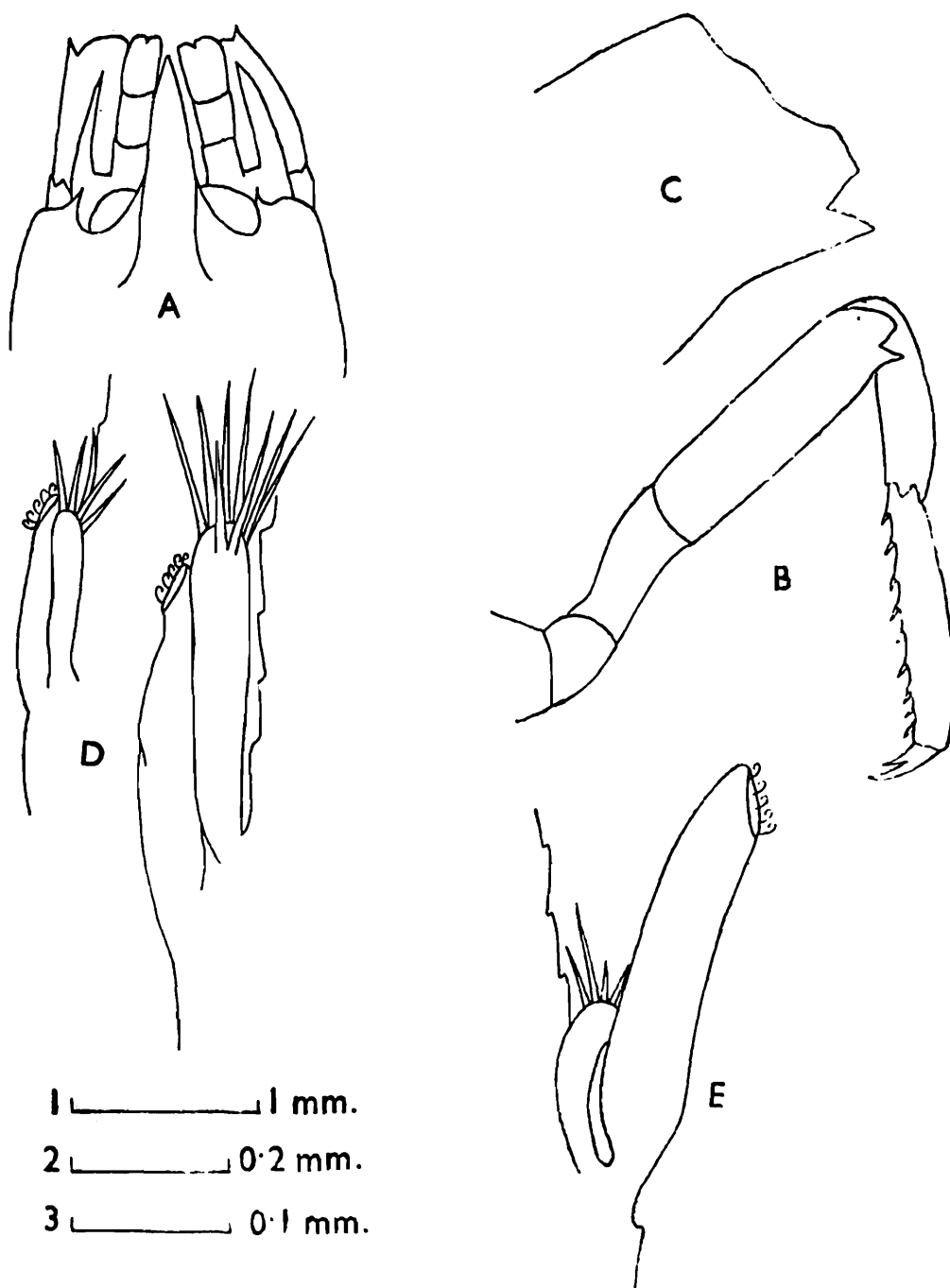
1903. *Arete dorsalis* var. *indicus* Coutiere, *Bull. Soc. Philon. Paris*, IX, 5 : 85.

1905. *Arete indicus* : Coutiere, *Fauna and Geogr. Mald. Laccad. Archip.*, 2 : 863.

1960. *Athanas indicus* : Banner and Panner, *Pacific Sci.*, 14 : 149.

1968. *Athanas indicus* : Miya and Miyake, *Publ. Amakusa mar. biol. Lab.*, 1 : 151.

[Non : *Athanas indicus* : Ganapati and Sastry, 1972]



Text-fig. 2.—*Athanas indicus* (Coutiere) A. Anterior region, dorsal view. B. Third pereiopod. C. Distal region of merus of third pereiopod. D. Second pleopods of males. E. Second pleopod of a female.

Figs. A, B-scale. 1. Fig. C.-scale 2. Figs. D, E-scale 3.

Material : 1 ♂ Loc : Chidiatapu, S. Andaman Is. Coll : G. Ramakrishna and Party. D/16. i. 1976. 4 ♂ ♂ 4 ♀ ♀ Loc : Camorta, Nicobar Is. Coll : G. Ramakrishna and Party. D/24. i. 1976. 1 ♂ 1 ♀ Loc : Camorta, Nicobar Is. Coll : G. Ramakrishna and Party. D/30. i. 1976. 1 ♂ 3 ♀ ♀ Loc. Camorta, Nicobar Is. Coll : G. Ramakrishna and Party. D/1. ii. 1976. 1 ♂ 1 ♀ Loc : Neill I., S. Andaman Is. Coll : B. P. Haldar and Party. D/6. v. 1978. 2 ♂ ♂ 2 ♀ ♀ Loc : Port Blair, S. Andaman Is. Coll : B. P. Haldar and Party. D/22. v. 1978.

Remarks : The specimens were reddish brown with one median and two lateral yellowish longitudinal stripes on the dorsal side. Body smooth and slender. Rostrum triangular, tip pointed, reaching from the middle of the second article to the tip of the antennular peduncle. Carpus of second legs four segmented. Outer inferior distal margin of merus of third legs produced into a tooth-like projection and dactylus biunguiculate.

All the eleven females are carrying eggs on the abdomen and eight of them have a diminutive *appendix masculina* of about one third the length of *appendix interna* on the second pleopods. In nine males the *appendix masculina* is a little shorter than the *appendix interna* while in the tenth it slightly exceeds the *appendix interna*. (Text-figs. 2 D, E).

The shrimps were collected from *Echinometra mathaei* inhabiting the bores made by the urchin in hard clay mounds and corals.

Distribution : Indo-west Pacific.

The species is recorded here for the first time from Indian coast.

3. *Synalpheus stimpsonii* (de Man)

(Text-fig. 3)

1888. *Alpheus stimpsonii* de Man, *Arch. Naturgesch.*, 53 : 513.

1966. *Synalpheus stimpsonii* : Banner and Banner, *Siam Soc. Monogr.*, 3 : 46

1968. *Synalpheus stimpsonii* : Banner and Banner, *Micronesica*, 4 : 274.

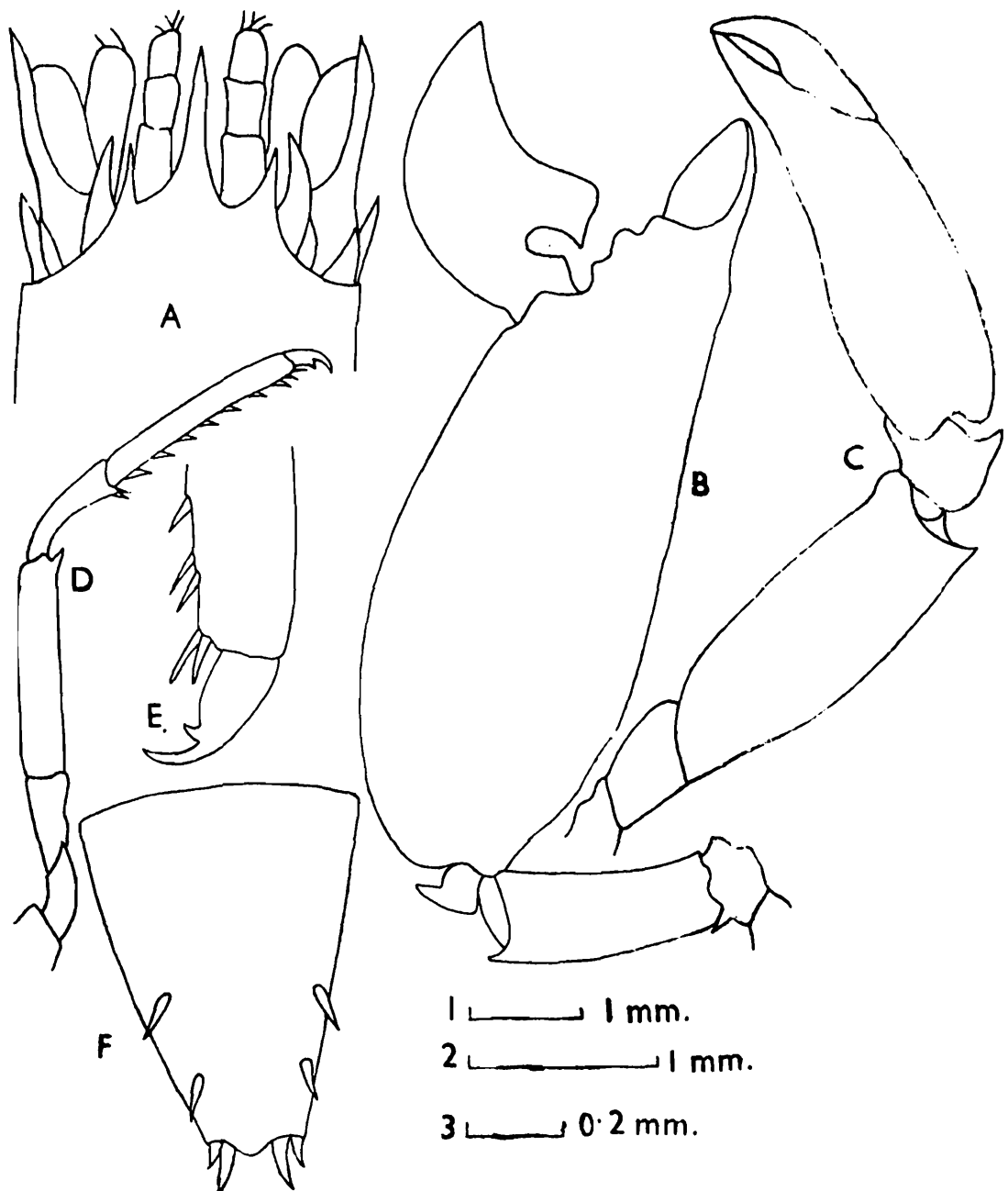
1973. *Synalpheus stimpsonii* : George *et al*, *Rec. Zool. Surv. India*, 67 : 292.

1975. *Synalpheus stimpsonii* : Banner and Banner, *Rec. Austr. Mus.*, 29 : 292.

Material : 1 ♂ Loc : Peel, S. Andaman Is. Coll : Dr. G. C. Rao. D/7. iv. 1974. 1 ♀ Loc : Havelock, S. Andaman Is. Coll : Dr. G. C. Rao. D/8. iv. 1974.

Remarks : In the specimen from Peel Island, the rostrum reaches to about two thirds of the second article of the antennular peduncle and the propodus of the third pereopod bears 16 spines. In the one from Havelock Island the rostrum reaches beyond the middle of the

third article of the antennular peduncle and the propodus of the third pereiopod bears only 10 spines. Though Banner and Banner (1966) characterised *S. stimpsonii* as having more than 10 spines (figure shows 16 spines), they however found later (1968, 1975) the number to vary from 6-10 in their Australian specimens. They also observed the rostrum to reach from distal quarter of the first to beyond the end of the second antennular article.



Text-fig. 3.—*Synalpheus stimpsonii* (de Man) A. Anterior region, dorsal view. B. Large cheliped. C. Small cheliped. D. Third pereiopod. E. Dactylus of third pereiopod. F. Telson. Figs. A, B, D-scale 1. Figs. C, F-scale 2. Fig. E-scale 3.

The shrimps were associated with crinoids and are black in colour as the preserved crinoids.

Distribution : Bay of Bengal and from Singapore and Japan to Marshall Island Gilbert Is. and Australia. George *et al* (1973) reported this species from Gulf of Mannar, India. The species is recorded here for the first time from Andaman Is,

Family PALAEMONIDAE

Subfamily PONTONIINAE

4. *Periclimenes (Harpilius) spiniferus* de Man

(Text-fig. 4)

1902. *Periclimenes petithouarsii* var. *spinifera* de Man, *Abh. Senckemb naturf. Ges.*, 25 : 824.

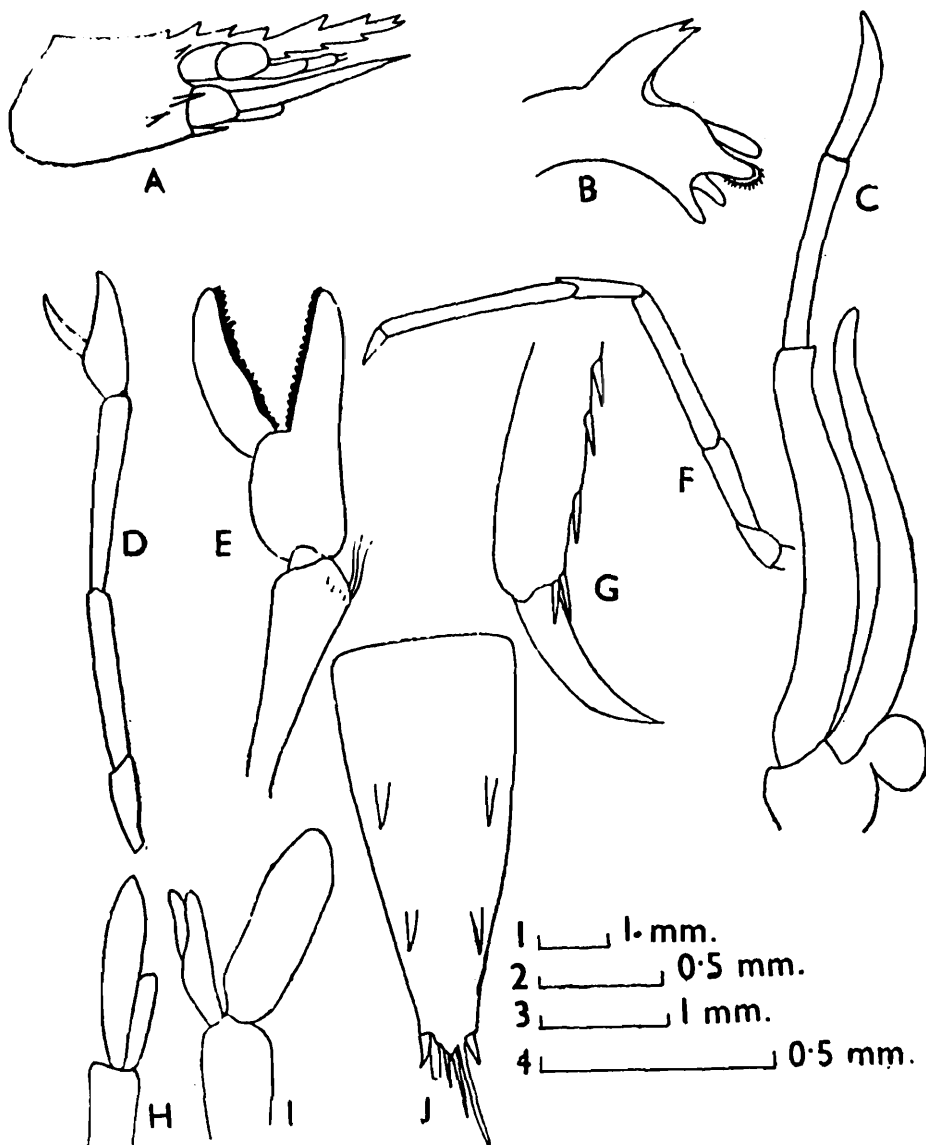
1917. *Periclimenes (Falciger) spiniferus* : Borradaile, *Trans. Linn. Soc. Lond. Zool.*, (ser. 2) 17 : 369.

1922. *Periclimenes (Ancylocaris) spiniferus* : Kemp, *Rec. Indian Mus.*, 24 : 195.

1927. *Periclimenes spiniferus* : Gravely, *Bull. Madras Govt. Mus.*, I (1) : 137.

1952. *Periclimenes (Harpilius) spiniferus* : Holthuis, *Siboga Exped. Monogr.*, 39a 10 : 76.

Material : 1 ♀ Mergui Archipelago. D/Jan. 1937.

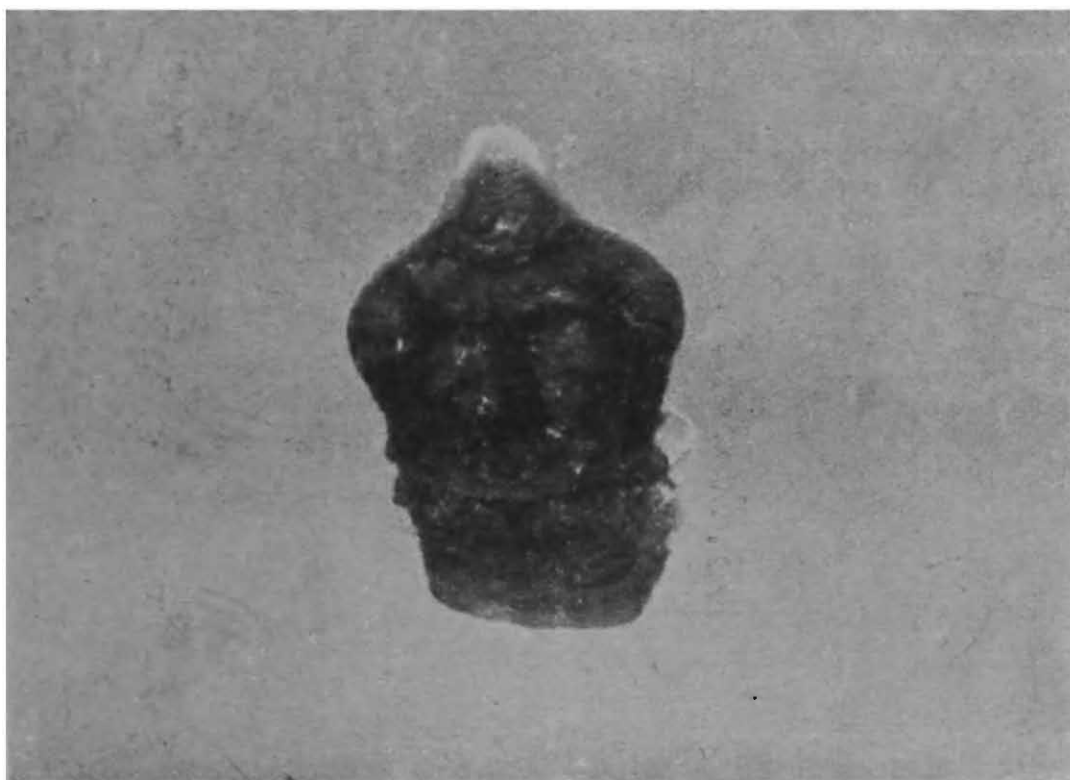


Text-fig. 4.—*Periclimenes (Harpilius) spiniferus* de Man A. Anterior region, lateral view. B. Mandible. C. Third maxilliped. D. First pereiopod. E. Chela of first pereiopod. F. Third pereiopod. G. Dactylus of third pereiopod. H. First pleopod. I. Second pleopod. J. Telson. Fig A-scale 1, Figs. B, C, E, H, I, J-scale 2. Figs. D, F-scale 3. Fig. G-scale 4.

Remarks : Carapace 5.5 mm long (to the tip of the rostrum). The rostrum bears seven teeth on the upper side, the first one small and

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PLATE I



Echinoecus pentagonus (Milne-Edwards). Dorsal view.

placed behind the orbit and three on the lower side. The carapace bears strong supra corneal, antennal and hepatic spines. The fingers of first chelae have fine teeth arranged like a comb. Unfortunately both the second chelae are lost in the present specimen. However, in all other characters, the specimen agrees with the figures of *P. spiniferus* given by Borradaile (1917) and the specimens of the same species in the Indian Museum, reported by Kemp (1922). Moreover, it differs from the other species of the subgenus with denticulated first chelae, in having the supra orbital spine.

This species was usually reported from corals. The present specimen is from a crinoid.

Distribution : Indo-west Pacific from Madagascar to S. Pacific Is.

The species is here recorded for the first time from Mergui Archipelago.

Family PARTHENOPIDAE

5. *Echinoecus pentagonus* (Milne-Edwards)

(Plate I)

1879. *Eumedon pentagonus* Milne-Edwards, 104.

1905. *Eumedon convictor* Bouvier and Seurat, *C. R. Acad. Sci. Paris*, 140 ; 629.

1965. *Echinoecus pentagonus* : Sakai, *The Crabs of Sagami Bay* : 102.

Material : 1 Loc : Malacca Beach, Car Nicobar Is. Coll : Dr. K. K. Tiwari. D/27. iii. 1959.

Remarks : Carapace sharply pentagonal with the anterolateral margins produced into a rostrum. Upper surface pink with two parallel white stripes in the posterior half of the carapace and the rostrum with a white margin.

The specimen is a female carrying eggs. It was found in the rectum of the sea-urchin *Echinothrix diadema* (Linnaeus). Due to the presence of the crab, the apical system of the sea-urchin was distorted.

Distribution : Indo-west Pacific.

The species is recorded here for the first time from Indian coast.

DISCUSSION

The study of animal associates is important because of their adaptations to the special biotope and their relationship with the host and other members of the community. Though the echinoderm hosts are provided with varied defensive mechanisms such as mucous secretions, spines, pedicellariae, cuverian tubules etc. the symbionts seem to have adapted themselves to the protective devices of the

echinoderms and made them a congenial habitat. In most cases the symbiont gets its protection and food associated with the host. They also make their presence inconspicuous by means of concealing colouration. Thus the colourations of *Athanas dorsalis*, *A. indicus*, and *Echinoecus pentagonus* closely approach those of their respective hosts. The stripes of *A. indicus* and *E. pentagonus* distort the outline of the body. The colouration of *Synalpheus stimpsonii* is not known in the present material. The pontoniid species is in general transparent while alive, and thus suits to any back ground.

Ganapati and Sastry (1972) observed that *A. dorsalis* actively searches for its host when dislodged from the latter and finds its host by photoreception. It is protected from enemies because of concealing colouration and from environmental stresses of temperature, desiccation etc. because of its occurrence among the tube feet, on the oral side. It is observed at Camorta Island that *A. indicus* also behaves in a similar way. Thus both the species appear to be obligate commensals on the Indian coast.

It was earlier reported that *A. dorsalis* may not occur in male female pairs (Ganapati and Sastry, 1972). However, further observations on this species at Visakhapatnam and Camorta and on *A. indicus* at Andaman and Nicobar Islands revealed that both the species do occur in heterosexual pairs and occasionally along with 1 or 2 juveniles. Though these two species have so far been reported from different sea-urchins (Banner and Banner, 1960 ; Miya & Miyake, 1968 ; Sankaran Kutty, 1962), the present material indicates a definite host-specificity when occurring sympatrically. Thus all the specimens from *Stomopneustes variolaris* are *A. dorsalis* while the ones from *Echinometra mathaei* are *A. indicus*, though the two sea-urchins are from the same locality and habitat at Camorta Island.

From the reports of Miyake (1939) and Sakai (1956) it appears that the males and females of the parthenopid crab *Echinoecus pentagonus* swim freely in the vicinity of various sea urchins and only the females after mating enter the rectum of their hosts. The recent studies of Castro (1971) on the association of this crab with the sea-urchin *Echinothrix calamaris* in Hawaii, showed that the males and juvenile females live on the oral side of the host and meet their energy requirements by ingesting epithelial tissue and the tube feet from the peristomial region while the adult females live in the rectum and subsist on the abundant aggregations of coelomocytes and faecal pellets of the host. Due to complete metabolic dependency of the crab on its host, Castro (1971), based on the scheme of Cheng (1967), categorized the association as parasitism.

The information on *Synalpheus stimpsonii* is meagre and at present its relationship is not known. However, it can be presumed that it receives protection and food associated with the host as has been shown for many other commensals of crinoids by Potts (1915) and Fischelson (1973). *Periclimenes (Harpilius) spiniferus* is in general an associate of corals. Its occurrence on the crinoid may be merely accidental.

Finally, it should be admitted that "the distinction being not always clear, the terms are of use as stepping stones in helping us to understand the real relationships in any particular association" (Dales, 1957) and that "definitions will not neatly pigeonhole all cases" (Hopkins, 1957).

SUMMARY

The present communication deals with five species of crustacean associates of Crinoidea and Echinoidea in the Bay of Bengal. The alpheid shrimps *Athanas dorsalis* (Stimpson) and *A. indicus* (Coutiere) inhabit the oral and ambital regions of the sea-urchins *Stomopneustes variolaris* (Lamarck) and *Echinometra mathaei* (Blainville), respectively, while *Synalpheus stimpsonii* (de Man) (Alpheidae) and *Periclimenes (Harpilius) spiniferus* de Man (Pontoniinae) are from crinoids. The female of the parthenopid crab *Echinoecus pentagonus* (Milne-Edwards) is from the rectum of the sea-urchin *Echinothrix diadema* (Linnaeus). The probable relationships with their respective hosts are briefly classified.

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