



ISSN 2347-2677

IJFBS 2019; 6(5): 53-61

Received: 24-07-2019

Accepted: 28-08-2019

Quddusi B Kazmi

Marine Reference Collection &
Resource Centre and
University of Karachi, Karachi,
Pakistan

Farhana S Ghory

Marine Reference Collection &
Resource Centre and
University of Karachi, Karachi,
Pakistan

Afzal Kazmi

Department of Zoology,
University of Karachi, Karachi,
Pakistan

Rediscovery of adult and zoeal stage of *Procletes levicarina* (Bate, 1888) (Caridea, Pandalidae) and an account of other caridean species from RRS Charles and a discovery in cruise in gulf of Oman

Quddusi B Kazmi, Farhana S Ghory and Afzal Kazmi

Abstract

A small but interesting collection of caridean shrimps was handed over to the first author for identification. The collection was made in Omani waters by the "RRS Charles Discoveryin" expedition. There are all together 8 species in 6 genera: *Thalassocaris* of Thalassocarididae, *Procletes* and *Plesionika* of Pandalidae, *Leptochela* of Pasiphaeidae, *Anchistitoides* of Anchistoididae. An account of the material is given in the present paper. One species of the genus *Anchistitoides* might be new science.

Keywords: Rediscovery of adult and zoeal stage of *Procletes levicarina*, thalassocarididae, pandalidae

Introduction

The Southampton Oceanography Centre (SOC), UK obtained decapod samples from deep and shallow water in upper mid water to >800 m off the coast of Oman during 1977 cruise on board "RRS Charles Discoveryin". The Gulf of Oman extends between 22° N and 26° N and 56° E and 60° E. In its northwestern part, it is connected to the Persian Gulf by the Strait of Hormuz; in its southeastern part, it opens on the Indian Ocean and the Arabian Sea. The samples included penaeoid, sergestoids and carideans. Dr. Pat Hargreaves mentions of other carideans in his letter (7th October, 1977) but from relatively shallow water hauls at depth of 200m there are 5 different caridean shrimps families in small numbers handed over to late N. M. Tirmizi who gave to the first author for identification. There are all together 7 genera: *Thalassocaris* of Thalassocarididae, *Procletes* and *Plesionika* of Pandalidae, *Leptochela* of Pasiphaeidae, *Anchistitoides* of Anchistoididae. All specimens are adults except the post larvae and juveniles of the Pandalidae.

Kemp (1925)^[22], Calman (1939)^[7], Hogarth (1989)^[18], Holthuis (1986) and Dehghani *et al.* (2016)^[11] have published on caridean shrimps of Oman. Kazmi and Kazmi (2008) reported all the above mentioned taxa (abstract only). In the present paper *Procletes levicarina* is dealt in detail, and an account of the other species is also included. Two genera *Anchistitoides*, and *Plesionika* might be representing species new to science.

Pandalidae Haworth, 1825

Procletes levicarina (Bate, 1888)

(Figs. 1- 4)

Dorodotes levicarina Bate, 1888: 680, pl. 112: fig. 5; Henderson, 1893^[20]: 436; Balss, 1915^[2]: 20 *Procletes biangulatus* Bate, 1888:680 *Heterocarpus (Heterocarpoides) levicarina* De Man, 1917 : 284, 1920 : 178, pl. 15 : fig. 44; Kemp, 1925^[22] : 275; Liu, 1963:231

Procletes levicarina Holthuis, 1993^[19]: 278; Liu and Zhong, 1994: 560; Miyake, 1998: 187 (list); Li and Komai, 2003^[26]: 271; Li, 2004: 823; Li, 2006: 361; Kim *et al.* 2011^[23]: 399; Grave and Ashelby, 2011^[16]: 2; Samuel *et al.* 2016^[31]: 8985

Heterocarpoides levicarina Calman 1939^[7]: 207; Lalitha, 1980:169; Chace, 1985^[8]: 16, fig. 11, 12; [?] Wang, 1987:49;

? *Heterocarpus (Heterocarpoides)* [sic] *glabrus* Zarenkov, 1971: 193, fig. 4 *Heterocarpus (Procletes) levicarina* Menon, 1972^[28]: 382.

Corresponding Author:

Quddusi B Kazmi

Marine Reference Collection &
Resource Centre and
University of Karachi, Karachi,
Pakistan

Material examined: 1 ♀ R/V “RRS Charles Discoveryin” cruise 1977, St. 54009 # 2, 48-0 m, cl. 8mm; 1 ♂, “RRS Charles Discoveryin”, St. 54009 # 2; cl. 9mm; 2 juveniles (some long appendages missing, RRS Charles Discoveryin, St. 54009 # 1, cl. 4 - 4.9mm).

Diagnosis of adult: On the lateral surface of the carapace two longitudinal carinae are present. The rostrum (Fig. 1A, A') is longer than carapace length somewhat upward distally. The antennal and branchiostegal spines are present. The dorsal margin of rostrum is armed with 10 teeth, including 4 teeth on carapace posterior to level of orbital margin, dorsal series of teeth not extending posteriorly to mid length of carapace, ventral margin is armed with 4 teeth; third to fifth somites each armed with strong posteromedian tooth; pleura of fourth to sixth somites ends in a small tooth posteroventrally; the telson (Fig. 1B, B') is armed with 4 pairs of dorsolateral spines, the posterior most pair is superimposed above bases of lateral pair of posterior spines, the posterior length acutely triangular, with pair of long stout, the lateral spines and median pair of contiguous spines are concealed beneath triangular margin but distal ends are visible.

The antennular peduncle falls short of half of antennal scale; the stylocerite (Fig. 1C) is acute, overreaches basal peduncular segment. The spine of the scaphocerite reaches beyond the apex of the antennal scale that forms a rounded angle (Fig. 1D). The second pair of pereopods is subequal and similar, its carpus is composed of 6 or 7 articles. The fourth pair is more slender than the third pair. The fifth pair is more slender than the fourth pair.

Range: Red Sea to Indonesia, South China Sea, Korea, Yellow Sea, Philippines, Australia, Bay of Bengal, India 10-30m, the Gulf of Oman, Persian Gulf, 31-274m.

Remarks: The genus *Procletes* includes only one species *Procletes levcarina* that was originally described by Bate, 1888 as *Dorodotes levcarina*. Calman (1939) [7] described *Heterocarpus levcarina* as *Heterocarpoides levcarina* first time from the Gulf of Oman. The present report is the subsequent record of the species from the Gulf of Oman.

General variability has been observed in the adults of *P. levcarina* (see Chace, 1985; Li and Komai, 2003) [8, 26]. When the larvae in the material at hand were compared with the original description given by Bate (1888), it was seen that body size and armature matches with that illustrated by Bate (1888 pl. xxvii 4-4c). The RRS Charles Discoveryin adult female from Oman it is small as compared to those earlier recorded from the area by Calman (1939: 204) [7] and other areas, for example 12-16mm. in Korean waters (Kim *et al*, 2011) [23]. Calman's material of this species included vigorous females but they were smaller than those of Bate's (1888) and Henderson's (1893) [20] specimens. The rostrum is shorter in Omani female when compared to that figured in de Man (1920). Omani female differs from the Philippine material (Chace, 1985) [8] in having longer median pair of telson spines, from Omanis material of Calman it differs in having a pointed telson instead of truncated.

The two larvae were studied with the help of Menon description of 1972 [28]. The stages allotted to larvae by Menon (1972) [28] are followed. The adult and larval

characters are compared and illustrated. The larvae have some of the long appendages broken and missing. There are a number of characters of both the carapace and abdomen that place the present specimens in the zoeal stage. According to Menon (1972) [28] there are 13 zoeal stages estimated but the size range given by the same author may place the specimens in the megalopal stage which are in total 3 as compared to zoeal stages. The carapace is not broad in the megalopal stage. Its length is about twice its breadth. There is a posterior dorsal papilla in the present stage completely disappearing in the adult. The rostrum is more than twice the carapace length, in the adult same ratio exists.

The rostral teeth are minute both in megalopa and adult, four are on the carapace in adult. The supraorbital and antennal spines are developed. Two spines are present on the ventral margin behind the pterygostomial spine. The supra orbital spine disappears in the adult and the infraorbital tooth develops in the adult, only the pterygostomial spine is present in adult at the ventral part. No carina on carapace are present in adult.

The carpus of second leg of adult is subdivided “the carpal articulations of the second pereopods are relatively indistinct” as given by Grave and Ashelby (2011) [16] and that of larvae undivided. Li and Komai (2003) [26] also mention of one juvenile from the South China Sea in their account of pandalids from the South China Sea but without any discussion.

Ladeira *et al* (2014) had some reservations on the validity of Menon's identification of his material.

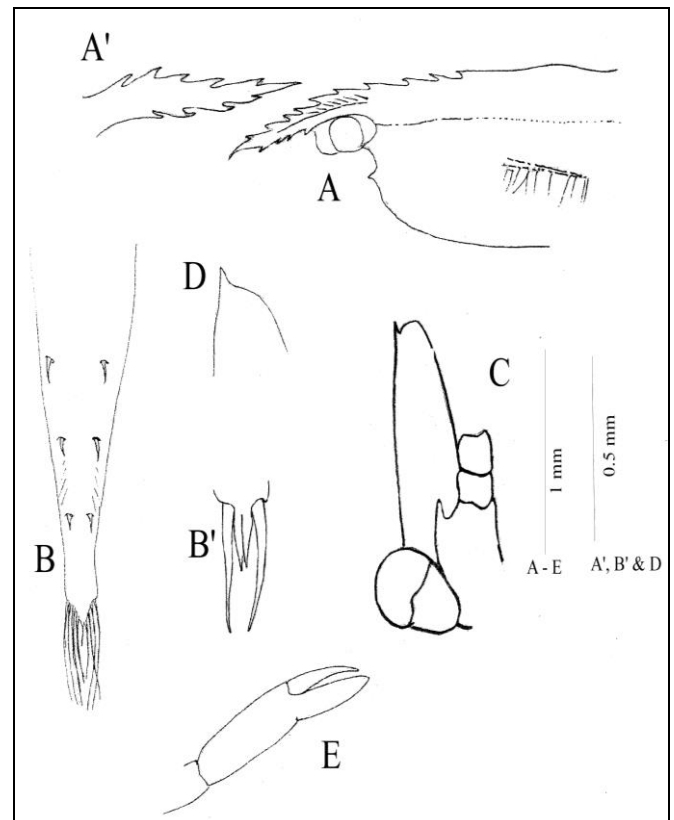


Fig 1: *Procletes levcarina* (Bate, 1888) ♂. A, lateral surface of the carapace; A', rostrum enlarge; B, telson; B', posterior margin of telson; D, apex of the antennal scale; E, II pereopod.

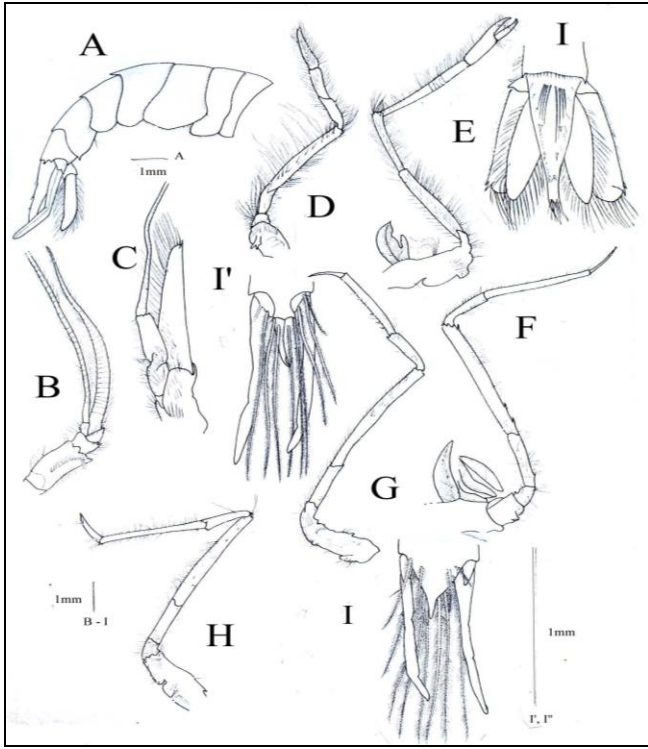


Fig 2: *Proclestes levcarina*. (CL. 9mm). A, abdomen and telson, lateral view; B, antennules; C, antenna; D, third maxilliped; E – H, pereopods I – IV; I, posterior margin of telson, dorsal view; I', same, ventral view.

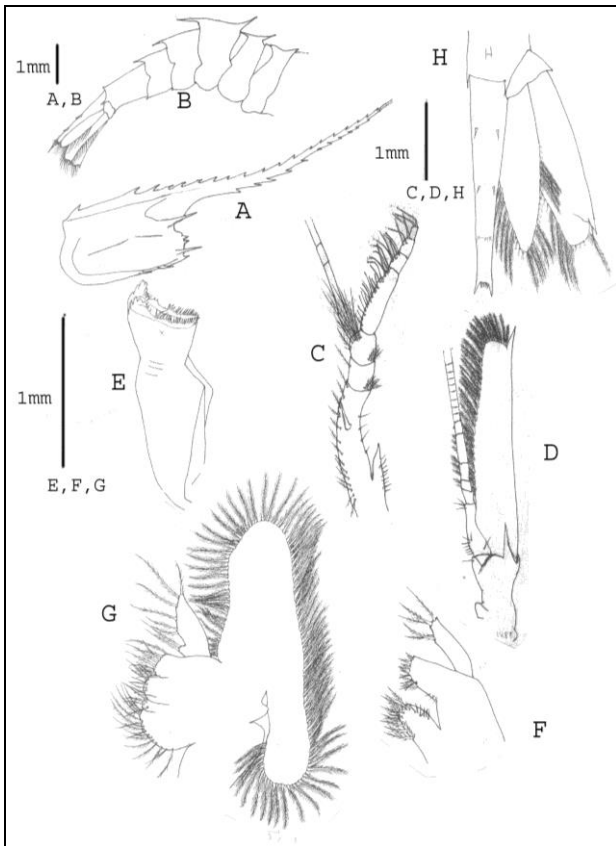


Fig 3: *Proclestes levcarina* (Bate, 1888). (Cl. 4mm) A, carapace and rostrum, lateral view; B, abdomen and telson, lateral view; C, antennule; D, antenna; E, mandible; F, maxillule; G, maxilla; H, telson and right uropod, dorsal view.

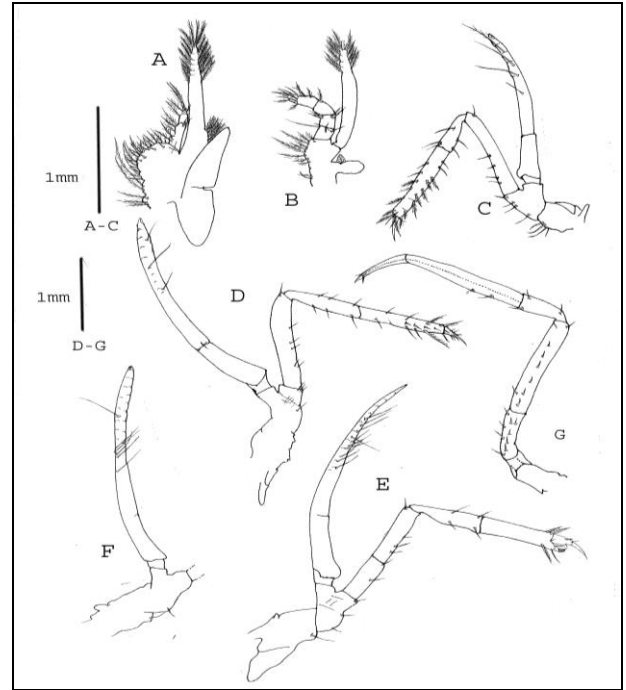


Fig 4: *Proclestes levcarina* (Bate, 1888). A- C, first to third maxillipeds; D & E, first and second legs; F, third leg (exopod); G, fifth leg (endopod).

Pandalid sp. juvenile
(Figs. 5 - 6)

Material examined: 4 ♀ (1 ov.) RRS Charles Discovery in st. 54004 # 3 50-100 m. ♀ cl+r = 22-24 mm, cl. 7. 9mm - 9mm

Description: The specimen has a long up-curving rostrum. The rostrum has 14 spines above, the first four of which on the carapace are in front of the orbit and in rapidly ascending height, and form a group separated from the others by a short space. The others on the rostrum are in an almost equidistant series except the subapical and apical spines. Ventrally on the rostrum are 18 closely spaced and fixed spines progressively more separated distally, none with barbed tips (Fig. 5A). The integument of the carapace appears to be minutely pubescent. The antennal spine is very strong. The pterygostomial spine is smaller than antennal spine.

The abdomen has no dorsal spines on any of the tergites. Third somite is strongly arched. The pleura (Fig. 5B) of the fourth and fifth segments are produced posteriorly, the third and fourth pleura are minutely serrated ventrally. The sixth segment is twice the length of the fifth and has a spine ventrolaterally at the posterior end.

The telson (Fig. 5H) is 1.5 times longer than the sixth segment and bears four pairs of moveable spinules, separated from each other, including pair adjacent to lateral pair of posterior spines. The apex is acuminate, with 2 lateral pairs of spines, outer lateral six times longer than inner pair. The uropods are as long as telson. The outer edges of the outer branches of the uropods end in a sharp projection in the axil of which is a large moveable spine.

The eyes are large. The larger of the flagella of the antennule is flattened. The stylocerite is sharp-pointed and slightly shorter in length to the first segment of the antennular peduncle (Fig. 5F). The antennal scale is 4.5 times as

wide. The distal spine of the outer edge of the scaphocerite of the antenna is surpassing level of distal margin of the lamella (Fig. 5G). The mandibular palp is composed of 3 segments; the distal segment is rounded (Fig. 5C). The endopod of the maxillula is incompletely bifid, each part is spiny and with many setae (Fig. 5D). The scaphognathite of the maxilla is triangular (Fig. 5E). The pereopods are without any epipods; the second pair is unequal, left is with 103 segments, right has 22 segments; third pair has a row of spines on merus and carpus.

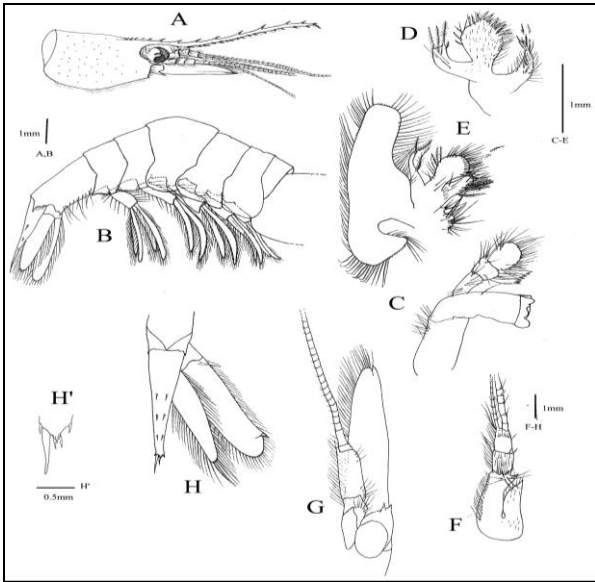


Fig 5: Pandalid sp. juvenile. A, carapace, lateral view; B, abdomen with telson, lateral view; C, mandible; D, maxillule; E, maxilla; F, antennule; G, antenna; H, telson and uropod; H', posterior margin of telson.

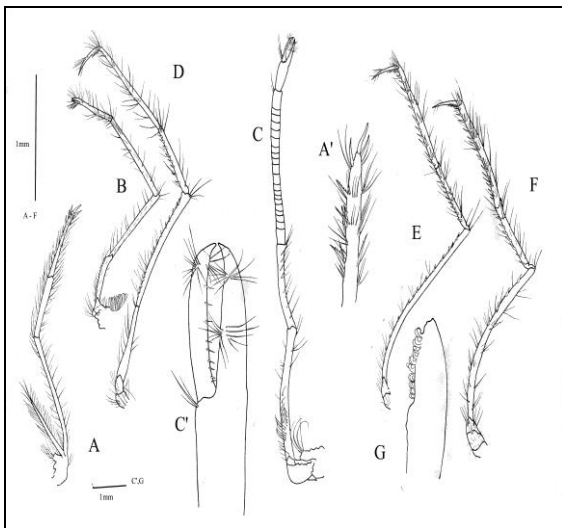


Fig 6: Pandalid sp. juvenile. A, third maxilliped; A', same, distal segments; B, first leg; C, second leg, C', same chela enlarged; D-F, third to fifth legs; G, appendix masculina.

Remarks: The present four female specimens could not be keyed out using the invaluable keys to the species of *Plesionika* provided by Chace (1985) [8] and Hanamura and Takeda (1987) [17], they seem to be juvenile specimens very close to both *Plesionika persica* (Kemp, 1925) [22] at 477 – 136 m. and *P. binoculus* (Bate, 1888).

***Plesionika persica* (Kemp, 1925) [22]**

(Fig. 7)

Parapandalus persicus Kemp, 1925 [22]: 273, fig. 8.

Parapandalus filipes Calman, 1939 [7]: 202, fig. 2.

Plesionika filipes-Chace 1985 [8]: 46.

Plesionika persica-Chace, 1985 [8]: 46; Tiefenbacher 1992:

120; Fransen 2006 [12]: 73, fig. 21; De Grave & Fransen 2011

[15]: 450; Chan *et al.*, 2018 [10]:538

Material examined: 4 specimens RRS Charles Discoveryin, st 54004 # 2 cl. 7. 9- 9mm.

Description: The rostrum is slightly shorter than the carapace, curving downwards at basal region, slightly recurved upwards and nearly straight after passing antennular peduncle; the rostral crest is low and bears 7 dorsal teeth including 2 teeth posterior to orbital margin restricted to proximal half of rostrum; the ventral margin is armed with 5 fine teeth (Fig. 7A); the antennal and pterygostomial spines are present and distinct, similar sized. The stylocerite tapers anteriorly and not markedly folded upwards laterally, extends to about middle of the second segment of antennular peduncle (Fig. 7B). The scaphocerite is slender, the distolateral tooth just exceeds the distal margin of lamina, basicerite spine is moderately long and just exceeds proximal end of lateral margin of scaphocerite (Fig. 7C). The third maxilliped and pereopods all lack the epipods (Figs. 7D - G). The propodus of the first pereopod is several times as long as carpus. The pair of second pereopod is subequal, bearing 15 carpal articles (Fig. 7E). The third pereopods is very long, while the fourth and fifth pereopods are even thread like, their tips are broken (Figs. 7F & G). There is no spine on the third abdominal tergite; fourth pleuron is posteroventrally rounded, while fifth pleuron has the posteroventral angle is somewhat pointed. The telson is as long as sixth somite and bears 3 pairs of dorsolateral spines excluding the pair adjacent to posterior margin of the telson (Fig. 7H).

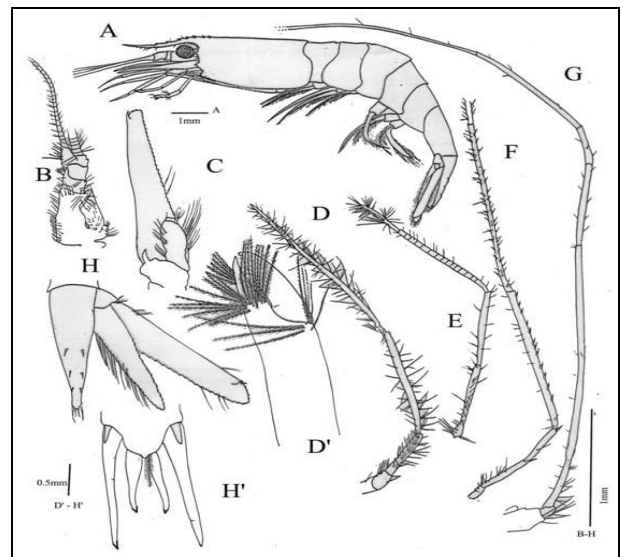


Fig 7: *Plesionika persica* (Kemp, 1925) [22]. Cl. 8. 2mm. A, entire, lateral view; B, antennule; C, antenna; D, third maxilliped; D', first pereopod, chela, magnified; E - G, second - fourth pereopods; H, telson and uropod; H', posterior margin of telson.

Range: Arabian Sea, Red Sea and India

Remarks: *Plesionika* Bate, 1888 is the most species diverse

genus in the family Pandalidae and has wide geographic distribution all over the world, with 93 described species (Chan, 2016) [9]. Up to the present, the occurrence of 45 species of the genus has been reported from Asian waters (Ahamed *et al.*, 2017) [1]. Earlier Calman (1939) [7] reported *P. minor* Calman, 1939 [7] and *P. persica* (Kemp, 1925) [22] from the Gulf of Oman and lately Fransen (2006) [12] reported 8 species: *P. adensameri* (Balss, 1914), *P. alcocki* (Anderson, 1896), *P. bifurca* Alcock and Anderson, 1894, *P. minor* Calman, 1939 [7], *P. narval* (Fabricius, 1787), *P. persica* (Kemp, 1925) [22], *P. quasigrandis* Chace, 1985 [8], and *P. reflexa* (Chace 1985) [8] from other gulf of Aden the Arabian sea.

Thalassocarididae Bate, 1888

The caridean shrimp family Thalassocarididae is rather species poor, comprised of four species in two genera; one genus *Thalassocaris* is found in the present collection.

Generic characters of *Thalassocaris*: Rostrum with dorsal and ventral teeth; carapace with supra-orbital spine and two spines on anterior margin, ventral to orbit. Abdominal pleura pointed, except on anterior somites in some mature females; prominent median backwardly-directed spine on posterior margin of third somite, none on other somites. Tip of telson not bifurcate. Outer margin of stylocerite crenate; antennal scale pointed, outer margin with spines; mandible with three-segmented palp; scaphognathite with rounded posterior lobe; first leg with propodus and dactylus fused, pointed; second legs symmetrical, with undivided carpus and stout chela; dactylus of third leg with more spines in male than in female. Exopods on maxillipeds; epipods on maxillipeds and legs 1-3; arthrobranchs on third maxilliped and legs 1-4. Two pairs of luminous organs: at base of maxilla and just behind fifth leg on each side. Endopod of first pleopod inflated and bilobed in male, reduced in female; second pleopod of male with appendix masculina; pleopods 2-5 with appendix interna. Exopod of uropod with faint diaeresis, outer margin setose and ending in two spines. (After Menon and Williamson, 1971).

Remarks: The presence of a posteromedian tooth on the telson, mentioned as a diagnostic character by Menon and Williamson (1971:31), needs to be defined more exactly if it is to be used effectively to separate *T. lucida* from *T. obscura*.

Thalassocaris crinita (Dana, 1852)

(Fig. 8)

Regulus crinitus Dana, 1852a:27; 1852b:599; 1855, pi. 39: fig. 6a-h.

Thalassocaris crinita.—Menon and Williamson, 1971:33, figs, lb, 3, 5b, 6c, d, 10a, b, 1 lj-r, 13; Chace, --:7

Material examined: 3 ♀ RRS Charles Discovery in st. 54009#1 cl. 2. 6mm

Description: The rostrum long, and the rostral formula. 8/3. The pereopods with massive chelae of 2nd pair far overreaches the rostrum.

Range: South of Japan and in the eastern Arabian Sea

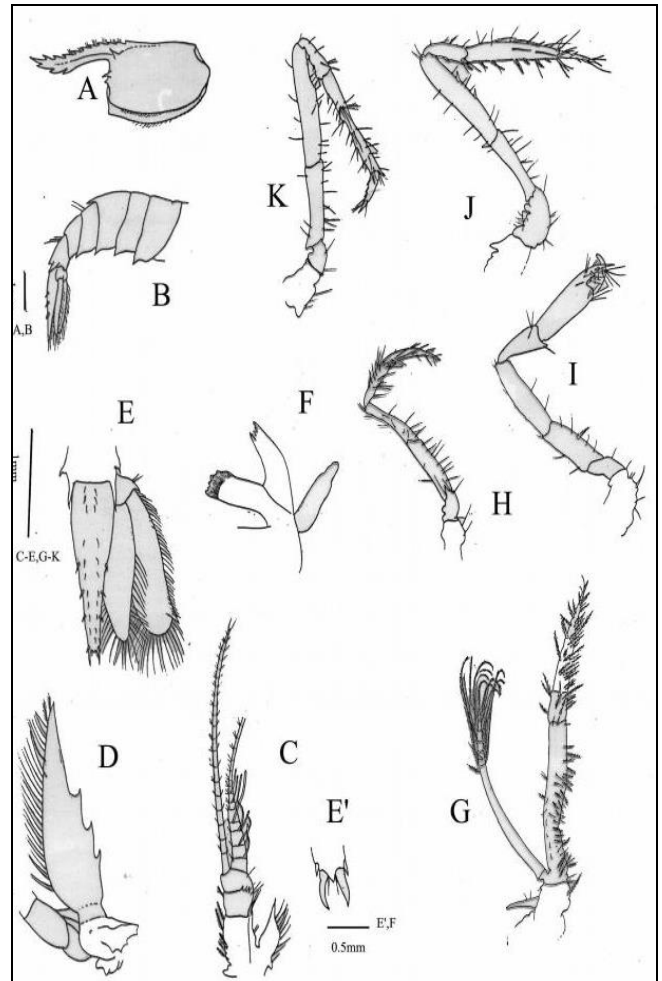


Fig 8: *Thalassocaris crinita* (Dana, 1852). A, carapace, lateral view; B, abdomen with telson, lateral view; C, antennule; D, antenna; E, telson and uropod; E', posterior margin of telson; F, mandible; G, third maxilliped; H – K, first to fourth legs.

Thalassocaris lucida (Dana, 1852)

(Fig. 9)

Regulus lucidus Dana, 1852a:27; 1852b:598; 1855, pi. 39: fig. 5a-g

Thalassocaris lucida.—Menon and Williamson, 1971:29, figs, la, 2, 5a, b, 10c, d, lls. t, 13. Chace, 1985 [8]: 9; De Grave and Fransen, 2011 [15]: 195-589 figs 1-59.

Material examined: RRS Charles Discovery in, st. 54009#1, 1 ♀, cl. 2. 6 mm.

Description: The rostrum is basally broadened into rather wide supraorbital eaves with subparallel margins. The telson is more than 4 times as long as wide. The second pair of pereopods possesses no massive chelae, not attaining level of distal end of antennal scale.

Range: South Africa, eastern Indian Ocean, Japan, Marianas, and the Fiji Islands;

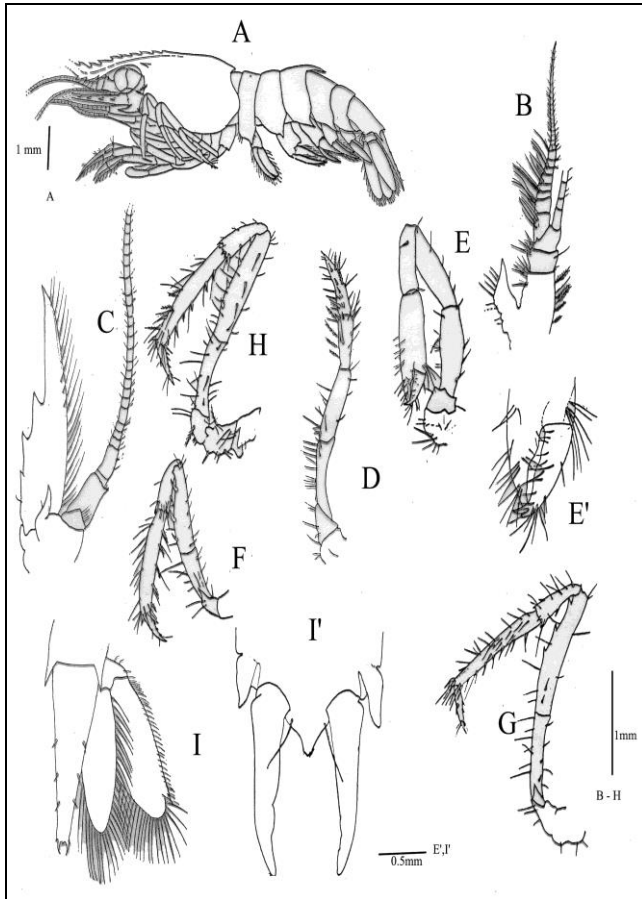


Fig 8: *Thalassocaris lucida*. A, entire, lateral view; B, antennule; C, antenna; D, first leg; E, second leg, E', same, chela, magnified; F – H, third to fifth legs; I, telson and uropod; I', posterior margin of telson, magnified.

***Thalassocaris obscura* Menon and Williamson, 1971 (Fig. 9)**

Thalassocaris obscura Menon and Williamson, 1971:36, figs, 1c, 4, 5c, 6e, 7-9; Chace, 1985 [8]: 9

Material examined: 1 ♀RRS Charles Discoveryin, st. 54009+2 cl 3mm.

Description: The rostrum tapers from base, not forms wide supraorbital eaves. The telson is nearly 4 times as long as wide. The second pair of pereopods has chelae of moderate size, not massive, not greatly overreaches the rostrum.

Range: Red Sea and Indian Ocean to west.

Remarks: The three females are tentatively identified as *Thalassocaris lucida* (Dana, 1852) *Thalassocaris obscura* Menon and Williamson, 1971 and *Thalassocarcis crinita* (Dana, 1852). *Thalassocaris obscura* Menon and Williamson, 1971, *Thalassocarcis lucida* and *Thalassocarcis crinita* are very closely allied species and have been a source of confusion in the past as well. *Thalassocaris obscura* was previously confused with *Thalassocaris crinita* by Borradaile (1915, 1917) [4, 6] and with *Thalassocaris lucida* by Kemp (1925) [22] (see Menon and Williamson, 1971). *Thalassocaris lucida* described by George and George (1964) [13] is now *Thalassocaris obscura*. *Thalassocaris crinita* is a shallow-water species and *Thalassocaris lucida* and *Thalassocaris obscura* are open ocean species.

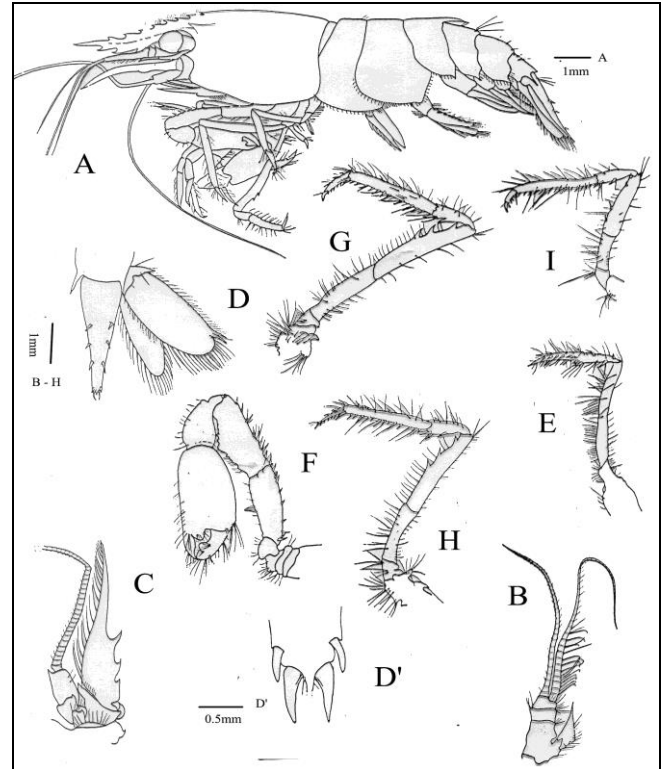


Fig 9: *Thalassocaris obscura* Menon and Williamson, 1971. A, entire, lateral view; B, antennule; C, antenna; D, telson and uropod; D', posterior margin of telson, magnified; E, first leg; F, second leg; G – I, third to fifth legs.

Anchistioididae Borradaile, 1915 [4]

***Anchistitoides* sp.**

(Figs. 10-11)

Material examined: RRS Charles Discoveryin St. 15400 # 2, 2 ♀cl. 3. 2-4. 9mm.

Description: The body is smooth rostrum is straight and somewhat tilted down lateral view, extending slightly beyond the end of the antennal scale; the upper border is rather convex and armed with seven teeth which lie equidistantly, and the first is situated at the proximal one-fifth point of the rostrum; there are three teeth on the lower border with a shallow concavity, and they are shorter and less erected than those of the upper. The carapace is somewhat swollen and longer than the rostrum; the anterolateral margin of the carapace is blunt; one obscure ridge runs backwards just behind the eye, the eye is rather small, the eyestalk is longer than the cornea (Fig. 10A). The first segment of the antennular peduncle is somewhat broad. The stylocerite is rather broad and directed outwards, the tip of which is sharply pointed, extending to the middle of the first segment; the anterolateral margin of the second segment is round, not forming a spine nor lobe (Fig. 10B); the antennal scale is somewhat elongated and as long as the rostrum, becoming narrower towards the tip; the anterolateral tooth is large and directed outwards; the end of the lamella forms an acute triangle (Fig. 10C). The movable finger of the first pereopod is not as broad as the immovable one and shorter than the palm; the cutting edge of the immovable finger is slightly convex, instead of being concave in that of the movable one (Fig. 10D & D'). The second pereopods is missing. The third pereopod is slender and the dactylus is curved ventrally, the tip of which is a sharp claw armed with a very small

protuberance on the posterior margin; a pair of the spinules is placed at the distal end of the posterior border of the propodus, and one spine is situated in the distal third point of the same border (Fig. 10E), but both fourth and fifth pereiopods lack the pair of the spinules; the propodus of the third pereiopod is longer than the carpus; the fourth and fifth pereiopods resemble the third in shape. The telson (Fig. 10H) is stout; there are two pairs of dorsal spinules; the end of the telson (Fig. 10H') is furnished with two pairs of the terminal spines, the inner of which is slender than the outer; two pairs of setae are placed between the two pairs. The uropod is shorter than the telson.

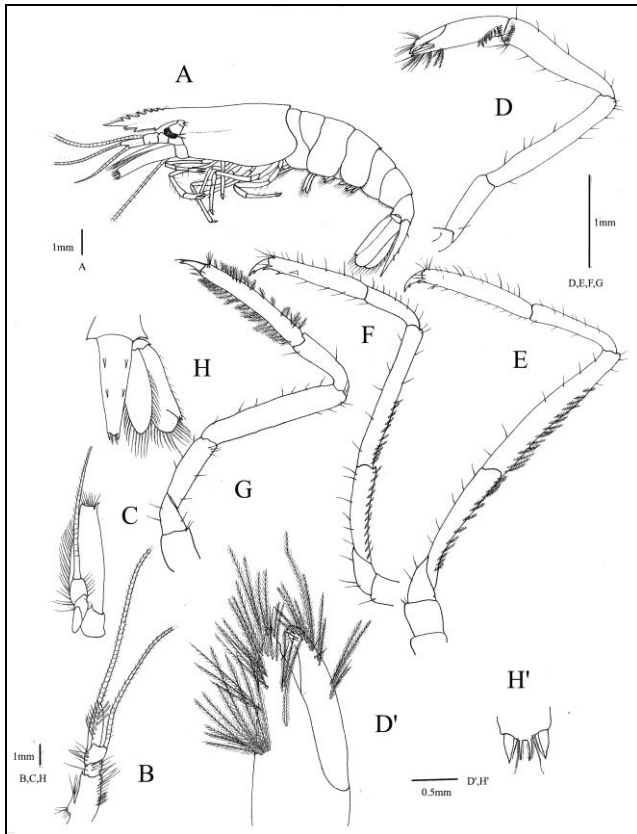


Fig 10: *Anchistitoides* sp. A, entire, lateral view; B, antennule; C, antenna; D, first pereiopod; D', same, chela, magnified; E - G, third - fifth pereiopods; H, telson and uropod; H', posterior margin of telson.

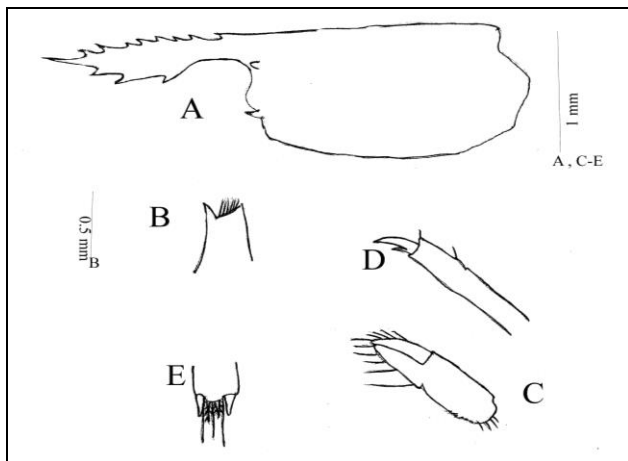


Fig 11: *Anchistitoides* sp. A, carapace, lateral view; B, distal end of antennal scale; C, chela, first pereiopod; D, claw, third pereiopod; E, telson, distal end.

Remarks: This is the sole genus of the family. Because of uncertainty about the variability in three nominal species (see WoRMS) of *Anchistitoides*, only Gordon (1935) [14] attempted to compile a key. There is a possibility that specimens from the Gulf of Oman represent an undescribed species. The rostral formula and sharp post orbital tooth resemble those of *Anchistitoides australiensis* described by Chace and Bruce (1993) now = *Anchistitoides willeyi* (Borradaile, 1900), the antennal scale is like that of *Anchistitoides compressus* Paulson, 1875.

Pasiphaeidae Dana, 1852

***Leptocheila* sp.
(Fig. 12)**

Material examined: 4 specimens: RRS Charles Discoveryin, St. 54009 # 1, ♀, CL. 4mm, ♂ CL. 5mm.

Description: The rostrum (Fig. 12 A) is distinctly upturned, the dorsal margin is concave in all the specimens, not reaching up to the distal end of basal segment of the antennular peduncle. The median carina of the carapace on the rostrum and base of the carapace. The orbital margin (Fig. 12A') is not entire, microscopically serrated, the ventral portion is armed with a mesially directed tooth, and the suborbital angle is truncated. The third and fourth abdominal somites end posteriorly as angular projection on the ventral margin. The fifth somite is without dorsal prominences and without posterodorsal tooth but there is a spinule at the posterolateral margin on the ventral side (Fig. 12A). The sixth somite has the ventrolateral spine distinct and curved but the posterodorsal lobe bears a small spine.

The telson (Fig. 12, B) not including the posterior spines is about 1.3 times as long as the 6th somite, armed with two pairs of dorsolateral spines in addition to the anterior mesial pair; the posterior margin (Fig. 11 B') is without a pair of minute spines between the bases of mesial pair of usual 5 pairs of prominent spines.

The stylocerite on the antennular peduncle (Fig. 12C) does not reach the distolateral margin of the basal segment. The second segment is distinctly shorter than the distal segment. The antennal scale (Fig. 12D) is narrow, the lateral margin is concave, the distal tooth is continued with mesial margin of the blade. The distal segment of the peduncle is nearly as wide as scale not reaching middle length of the scale, the basal segment has a strong tooth.

The first pereiopod (Fig. 12 E) over reaches the antennal scale, the length of fingers; the fingers are 1.5 to 2.0 times as long as the palm; the dactylus (Fig. 12E') is armed with 22 spines on opposable margin. The second pereiopod (Fig. 12F) over reaches the antennal scale by half of the fingers; the fingers are longer than the palm; the dactylus is armed with 15 spines on the opposable margin. The endopod of first pleopod of male is rectangular with rounded corners. The appendix musculina (Fig. 12G) bears 7 long secondarily armed spines over reaching the appendix interna (Fig. 12G') not including spines.

Remarks: *Leptocheila* Stimpson, 1860, belongs to one of the systematically controversial families in Caridea is predominantly pelagic and typical from shallow waters occurring in swarms. From the Gulf of Oman previously *Leptocheila robusta* Stimpson has been reported by Calman

(1939) [7]. The present material from the Gulf of Oman, differs from *L. robusta* not having rounded abdominal pleura, instead the pleura 3rd to 5th are armed with small tooth like those found in the juveniles of *L. irrobusta* (but the other character of juveniles – the minute pair of mesial spines between and orbital margin serrated.

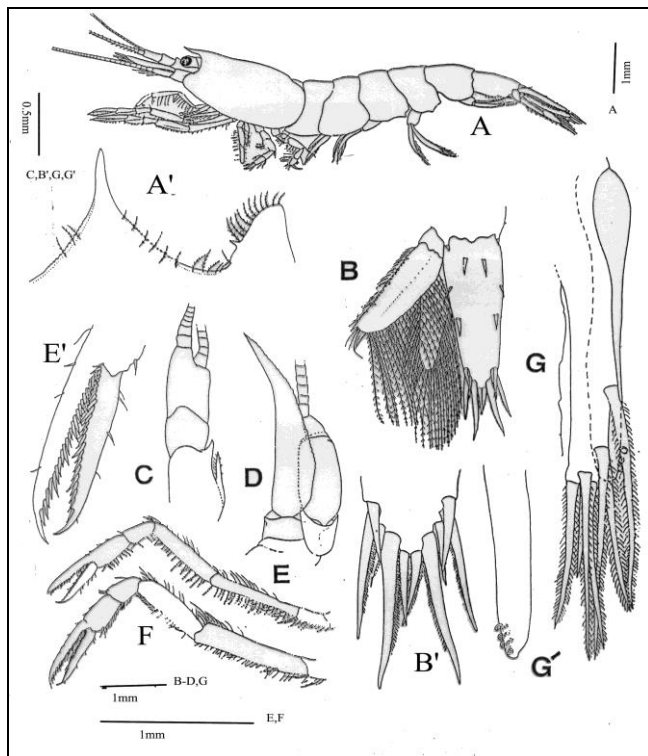


Fig 12: *Leptochela* sp. A, entire, lateral view; A', rostrum and orbital margin; B, telson and uropod; B', posterior margin of telson; C, antennule; D, antenna; E, first pereiopod; E', same, chela, magnified; F, second pereiopod; G, appendix masculina and appendix interna; G', appendix masculina.

Conclusion

The small number of specimens of all the species in the material is due to them being probably coastal species rather than from the deep open sea. Even if they are collected from deep waters scientists say that "Shallow-water shrimp can tolerate deep-sea conditions" (Oliphant *et al.* 2011) [30]. The composition of species in these groups is different at different depths. Almost all of them are females in the present material, this may indicate a migration of females to shallower waters or certain phenomenon in the life cycle of carideans like the pandalids change their sex at a certain time during their life. One example is *Pandalus borealis*, in which species the male animals function as male for 2–5 years before changing sex, and spend the remainder of their life cycle as females.

Acknowledgements

The first author acknowledges Dr. Pat Hargreaves (SOC, UK) for sending the RRS Charles Discoveryin material and late Professor Dr. L. B. Holthuis for confirming the species *Procletes levicarina* and reading the first draft of MS.

References

1. Ahamed F, Cardoso IA, Ahmed ZF, Hossain Md Y, Ohtomi J. An overview of the genus *Plesionika* Bate, 1888 (Decapoda, Caridea, Pandalidae) in Asian waters.

Zootaxa. 2017; 4221(5):575-593.

2. Balss H. Die Decapoden des Roten Meeres. I. Macruren. Denkschr. Akad. Wiss. Wien. 1915; 91:1-38.
3. Bate CS. Report on the Crustacea Macrura collected by H. M. S. Challenger during the year 1873- 1876. Rep. Voy. Challenger (Zool.) 1888; 24: xc+942.
4. Borradaile LA. Notes on Carides. Ann. Mag. nat. Hist. 1915; 15(8):202-213.
5. Borradaile LA. Crustacea. Part I. - Decapoda. Nat. Hist. Rep. Br. Antarct. Terra Nova Exped. 1916; 3(2): 75-110.
6. Borradaile LA. On Carides from the western Indian Ocean. The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr. J. Stanley Gardiner. Trans. Linn. Soc. Lond. (Zool.) 1917; 17(2):397-412.
7. Calman WT. Crustacea: Caridea, in the John Murray Expedition, 1933-1934, Scientific Reports. 1939; 6(4):183-224, figs. 1-8.
8. Chace FA Jr. The caridean shrimps (Crustacea: Decapoda) of the Albatross Philippine Expedition, 1907-1910, part 3: Families. Thalassocarididae and Pandalidae. Smithsonian Contr. Zool. 1985; 411:1-143.
9. Chan TY. New records of the rare pandalid shrimp *Plesionika exigua* (Rathbun, 1906) (Crustacea: Decapoda: Caridea) in the western Pacific. Zootaxa 2016; 4205(1):97-100
10. Chan TY, Chakraborty RD, Purushothaman P, Kuberan G, Yang CH. On *Plesionika persica* (Kemp, 1925) and *P. reflexa* Chace, 1985 (Crustacea: Decapoda: Pandalidae) from India. Zootaxa. 2018; 4382(3):583-591.
11. Dehghani A, Sari A, Naderloo R. Annotated checklist of the snapping shrimps of the genus *Alpheus* Fabricius, 1798 (Crustacea: Decapoda: Alpheidae) from the Persian Gulf and Gulf of Oman, Iran. Zootaxa. 2016; 4:45-44
12. Fransen Chjm. Pandalidae (Crustacea: Decapoda) of the Sonne, Valdivia and Meteor Expeditions 1977–1987 to the Red Sea and the Gulf of Aden Marine Biodiversity 2006; 36(1):51-82.
13. George MJ, George KC. On the occurrence of the caridean prawn *Thalassocaris lucida* (Dana) in the stomach of *Neothunnus macropterus* (Temminck and Schlegel) from the Arabian Sea. Journal of the Marine Biological Association of India. 1964; 6(1):171-172.
14. Gordon I. On new and imperfectly known species of Crustacea Macrura. – The Journ. Linn. Soc. Zoology. 1935; 39:307-351.
15. De Grave S, Fransen CHJM. *Carideorum catalogus*: the recent species of the dendrobranchiate, stenopodidean, procarididean and caridean shrimps (Crustacea: Decapoda). Zool. Med. Leiden. 2011; 85(9):30. ix: 195-589 figs 1-59.
16. Grave S De, Ashelby C. Notes on some shrimp species (Decapoda: Caridea) from Qatar, with an annotated checklist of marine caridean species known from the Persian Gulf. Marine Biodiversity Records, 2011, 4.
17. Hanamura Y, Takeda M. Family Pandalidae (Crustacea, Decapoda, Caridea) Collected by the RV "SOELA" from the Northwest Australian Shelf. - Bulletin of the national Science Museum, Tokyo, 1987; (A)13(3):103-121, Figs. 1–5.
18. Hogarth PJ. The Marine Crustacea of Dhofar, Southern Oman. Journal of Oman Studies. 1989; 10:99-124.
19. Holthuis LB. The recent genera of the Caridean and

- Stenopodidean shrimps (Crustacea, Decapoda) with an appendix on the order Amphionidacea [Led. C. H. J. M. Fransen & C. Van Achaterberg] Nat. Nature Mus. III with index, 1993, 328.
20. Henderson JR. A contribution to Indian carcinology Trans. Linn. Soc. Lond. Zool. 1893; 5(2):325-458.
 21. Kazmi QB, Kazmi MA. Discovery of adult and juveniles of *Procletes levicarina* (bate, 1888) (Caridea: Pandalidae) from Omanese waters (Abstract) Zoological Congress, 2008.
 22. Kemp S. On various Caridea. Notes on Crustacea Decapoda in Indian Museum XVII. Rec. Indian Mus. 1925; 27:249-343, figs. 1-24.
 23. Kim JN, Choi JH, Oh TY, Ch KH, Lee DW. A New Record of Pandalid Shrimp *Procletes levicarina* (Crustacea: Decapoda: Caridea) from Korean Waters. Fish Aquat Sci. 2011; 14(4):399-401.
 24. Landeira JM, Chan TY, Aguilar-Soto N, Jiang GC, Yang CH. Description of the decapodid stage of *Plesionika narval* (Fabricius, 1787) (Decapoda: Caridea: Pandalidae) identified by DNA barcoding. Journ. Crust. Biol. , 2014; 34:377-387.
 25. Li X. Report on four pandalids shrimps for the Yellow sea (Decapoda: Caridea). Crustaceana. 2007; 80(6):699-705.
 26. Li X, Komai T. Pandaloids shrimps from the northern South China Sea, with description of a new species of *Plesionika* (Crustacea: Decapoda: Caridea). The Raff. Bull. Zoo. 2003; 51(2):257-275.
 27. Man de. The Decapoda of the Siboga Expedition. Part IV. Families Pasiphaeidae, Styrodactylidae, Hoplophoridae, Nematocarinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Glyphocrangonidae and Crangonidae. Siboga-Expedition. 1920; 39a3:1-318.
 28. Menon G. Decapoda Crustacea from the IIOE: The larval development of *Heterocarpus* (Caridea). Journal of Zoology London. 1972; 167(3):371-397.
 29. Menon G, Williamson D. Decapod Crustacea from the International Indian Ocean Expedition The species of *Thalassocaris* (Caridea) and their larvae. Jour. Zool. 2009; 165(1):27-51.
 30. Oliphant A, Thatje S, Brown A, Morini M, Ravaux J, Shillito B. Pressure tolerance of the shallow-water caridean shrimp *Palaemonetes varians* across its thermal tolerance window. J Exp. Biol. 2011; 241:1109-1117.
 31. Samuel VKD, Ch R Sreeraj, Krishnan P, Parthiban Ch, Sekar V, Chamundeeswari K *et al.* Journal of Threatened Taxa. 2016; 8(7):8977-8988.