



# Shrimps of the family Pandalidae (Caridea) from Indian waters, with new distributional record of *Plesionika adensameri* (Balss, 1914)

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## Abstract

Twenty four species of Pandalid shrimps reported from the Indian waters, of which six genera (*Chlorotocella*, *Chlorotocus*, *Chlorocurtis*, *Dorodotes*, *Heterocarpoides* and *Stylopandalus*) are represented by single species each. The genera, *Plesionika* and *Heterocarpus* are represented by eleven and seven species respectively. *Plesionika adensameri* (Balss, 1914) a deep-sea shrimp hitherto unreported from Indian waters is recorded from west coast of India. Information on some biological aspects of few Pandalid shrimps from Indian waters is also reported in the present paper.

**Keywords:** *Pandalidae*, *Plesionika adensameri*, Indian EEZ, Deep-sea shrimp.

## Introduction

Pandalid shrimps play an important role in the marine ecosystem as they constitute a major part of the diets of mesopelagic and deep-sea fishes. They also form a major share of the world shrimp market (Bergstrom, 2000). The Family Pandalidae (Caridea) is a diverse group with more than 189 species in 23 genera (De Grave *et al.*, 2009). Pandalid shrimps are characterised by the presence of microscopically small or sometimes absent chelae on first pair of pereopods and the subdivided carpus of the second pereopod.

Though Pandalid shrimps are the most diverse group in deep-sea shrimp resources, very few studies on this group are available from Indian EEZ. Of the twenty four species of Pandalid shrimps reported from Indian EEZ, only four species have fishery importance and they are the largest contributor to deep-sea shrimp fishery of India (Nandakumar and Manissery 2006). The studies and records of many species of deep-sea shrimps from Indian waters dates back to early 20th century mainly from the surveys of the RIMS *Investigator* (Wood-Mason and Alcock, 1891; Alcock and Anderson, 1894, 1899; Alcock, 1901; Kemp, 1925). Abundance and availability of deep-sea shrimp resources along the Indian coast have also been reported by John and Kurian (1959), Kurian (1965), George (1966), Silas (1969), Mohamed and Suseelan (1973), Thomas (1979), Oommen (1980), Suseelan *et al.* (1989), Ninan *et al.* (1992) and Kurup *et al.* (2008) based on exploratory surveys. Studies on diversity and biological aspects of deep-sea and pandalid shrimps from Indian waters are limited to the works of Suseelan and Mohamed (1968), Suseelan (1974), Lalitha (1980), Dineshbabu *et al.* (2001), Nandakumar *et al.* (2001), Thirumilu and Rajan (2003), Radhika (2004), Radhika and Kurup (2005) and Anrose (2009). Targeted deep-sea shrimp fishing started in the early 1990s in the Indian EEZ. Considering the tropical importance of sustainability in deep-sea fisheries, the present study collects information on

Table: 1 The Check list of Pandalid shrimps from Indian EEZ, AS=Arabian Sea, BB=Bay of Bengal, AN=Andaman Sea

Species	Source	Area of occurrence	Study location (Sagar Sampada)	
			Lat.	Long.
<i>Chlorotocella gracilis</i> Balss, 1914	Kemp (1925), Cruise No.252	AN	13°13 N	93°17 E
<i>Chlorotocus crassicornis</i> (Costa, 1871)	Alcock (1901)	AN		
<i>Chlorocurtis jactans</i> (Nobili, 1904)	Kemp (1925)	AN		
<i>Dorodotes reflexus</i> Bate, 1888	Alcock (1901)	BB		
<i>Heterocarpoides levicarina</i> (Bate, 1888)	Lalitha (1980)	BB		
<i>Heterocarpus dorsalis</i> Bate, 1888	Alcock (1901), Radhika (2004), Cruise No.252	AS, BB & AN	12°48 N	93°07 E
<i>Heterocarpus gibbosus</i> Bate, 1888	Alcock (1901), Commercial trawlers Cruise No.252, 247 & 281	AS, BB & AN	20°32 N 13°09. N 12°48 N	88°28 E 93°11 E 93°07 E
<i>Heterocarpus laevigatus</i> Bate, 1888	Alcock (1901)	AS		
<i>Heterocarpus longirostris</i> MacGilchrist, 1905	Alcock & MacGilchrist (1905)	AN		
<i>Heterocarpus sibogae</i> De Man, 1917	Suseelan (1990)	AS		
<i>Heterocarpus tricarlinatus</i> Alcock and Anderson, 1894	Alcock (1901)	AS		
<i>Heterocarpus woodmasoni</i> Alcock, 1901	Alcock (1901), Commercial trawlers, Cruise No.252, 247	AN & AS	17°06 N 12°52 N	83°25 E 93°04 E
<i>Plesionika adensameri</i> (Balss, 1914)	Commercial trawlers	AS & BB		
<i>Plesionika alcocki</i> (Anderson, 1896)	Alcock (1901), Radhika (2004) Commercial trawlers, Cruise No.252	AN, BB & AS	13°14 N	93°09 E
<i>Plesionika bifurca</i> Alcock and Anderson, 1894	Alcock (1901)	AS, BB & AN		
<i>Plesionika ensis</i> (Milne-Edwards, 1881)	Alcock (1901), Commercial trawlers, Cruise 247	AS, BB & AN	17°06 N	83°25 E
<i>Plesionika longicauda</i> (Rathbun, 1901)	Lalitha (1980) Commercial trawlers	BB		
<i>Plesionika martia</i> (Milne-Edwards, 1883)	Alcock (1901), Commercial trawlers Cruise No.252 & 281	AS, BB & AN	10°57 N 13°01 N	80°21 E 93°07 E
<i>Plesionika ocellus</i> (Bate, 1888)	Alcock (1901)	AS & BB		
<i>Plesionika sindoi</i> (Rathbun, 1906)	Suseelan (1996), Anrose (2009)	AN & AS		
<i>Plesionika spinipes</i> Bate, 1888	Alcock (1901), Commercial trawlers, Cruise No. 247	AS, AN & BB	10°57 N 20°32 N	80°21 E 88°28 E
<i>Plesionika unidens</i> Bate, 1888	Alcock (1901)	AN		
<i>Plesionika williamsi</i> Forest, 1963	Suseelan (1990), Commercial trawlers Cruise No.281	AS	13°01 N	93°07 E
<i>Stylopandalus richardi</i> (Coutiere, 1905)	Kemp (1925)	BB		

pandalid shrimp resources of India with special emphasis on *Plesionika adensameri* which is a new record in the Indian EEZ. There had been much taxonomic confusion with regard to genus *Parapandalus* Borradaile, 1899. In this work we follow Chace (1985) in treating the genus *Parapandalus* Borradaile, 1899 as a synonym of *Plesionika* Bate, 1888.

## Material and methods

Pandalid shrimp samples collected during deep-sea trawling operation onboard FORV *Sagar Sampada* during various cruises

(Cruise No. 247, Bay of Bengal, July-August, 2006, Cruise No. 252, Andaman Sea, January-February, 2007, and Cruise No. 281, Arabian Sea, October, 2010). Trawling operations were carried out using HSDT CV and EXPO model gear at depths varying from 200 -1200 m. Samples were also collected from landings of commercial deep-sea shrimp trawlers during September 2008 and March 2011 period from different fisheries harbours/ fish landing centres along the Indian coast. The measurements used are total length (TL) measured from the tip of rostrum to tip of telson and carapace length (CL)

from the orbital margin to the posterior dorsal edge of the carapace.

## Results and discussion

### Occurrence of *Plesionika adensameri* (Balss, 1914) in Indian EEZ

**Material examined:** Three samples were collected from commercial deep-sea shrimp trawlers landed at Cochin Fisheries Harbour, Kerala (India), Arabian Sea in 2009. 1 male (TL 9.8 cm, CL 1.9 cm), 2 female (TL 8.2-10.3 cm; CL 1.6-2.2 cm). The material has been deposited in the National Marine Biodiversity Museum at Central Marine Fisheries Research Institute (CMFRI), Cochin. (Accession number: ED. 2.4.3.3)

**Distribution:** Red sea (Depth: 732-1308 m) Gulf of Aden (Depth: 457-549 m), Maldives (Depth: 494 m) and India (Depth: 200-300 m, present study.)

**Diagnosis:** Eye broadly subpyriform and ocellus longitudinally oval. Rostrum double curved with dorsal teeth distributed over entire length; antennal spine well developed and reaching distal margin of basicerite; pterygostomian tooth distinct, smaller than antennal spine; stylocerite sharp, overreaching dorsal margin of first antennular segment. Second maxilliped with small rectangular dactylar segment, bearing many bristle like setae; third maxilliped long and slender, reaching beyond scaphocerite. Scaphocerite long and slender, 4.5 times as longer than maximal width. Basal segment of antennular peduncle with small ventromesial tooth. First pereopod reaching with chela and half of carpus beyond scaphocerite; second pereopods reaching distal margin of first pereopod; third, fourth, and fifth pereopods similar, very long and slender. Second thoracic sternite unarmed; sixth thoracic sternites with prominent median elevation; seventh thoracic sternite broader than sixth, with prominent median elevation, larger than that of sixth. Abdomen without

Table 2. Biological characteristics and depth range of Pandalid shrimps from India EEZ.

Species	Depth range (m)	Total Length (Male) in mm	Total Length (Female) in mm	Fecundity	Sex ratio (M:F)	Percentage of berried	Size of smallest berried (mm)
<i>Chlorotocella gracilis</i>	695-700						
<i>Chlorotocus crassicornis</i>	300-340						
<i>Chlorocurtis jactans</i>							
<i>Dorodotes reflexus</i>	2300-2900						
<i>Heterocarpoides levicarina</i>	10-30	54-68	54-68				
<i>Heterocarpus dorsalis</i>	540-1300						
<i>H. gibbosus</i>	280-500	71-140	69-140	17605	01.2 :01	67.4	96
<i>H. laevigatus</i>	780-1100	44-50					
<i>H. longirostris</i>	1200-1750						
<i>H. sibogae</i>	310-400		114-120				
<i>H. tricarinatus</i>	1500-1600						
<i>H. woodmasoni</i>	280-500	70-130	75-132	8870	01.4 :01	76.2	90
<i>Plesionika adensameri</i>	200-300						
<i>P. alcocki</i>	350-1100	26-35					
<i>P. bifurca</i>	315-1020						
<i>P. ensis</i>	250-400	56-118	61-120	2625		69.8	83
<i>P. longicauda</i>	10-50	24-41	24-41				
<i>P. martia</i>	180-400	65-119	72-121	2833	01:01.0	81.4	80
<i>P. sindoi</i>	220-380	68-120	68-120				
<i>P. ocellus</i>	300-315						
<i>P. spinipes</i>	180-350	63-115	75-125	4657	01:01.3	79.6	81
<i>P. unidens</i>	310-545						
<i>P. williamsi</i>	320-360		115-145				
<i>Stylopandalus richardi</i>	700-750						

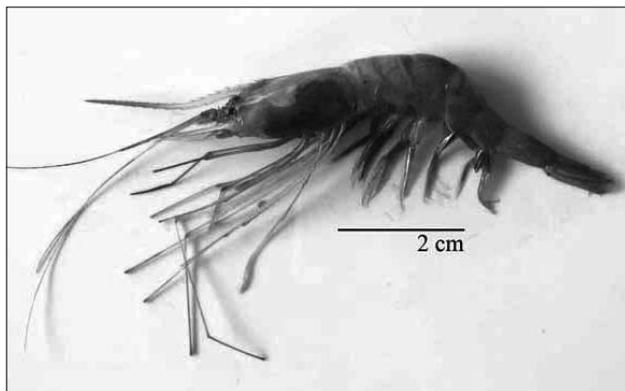


Fig.1. *Plesionika adensameri* (Balss, 1914), female, collected from Cochin, Arabian Sea

posteromesial tooth or median dorsal carina on third somite. Sixth abdominal somite less than twice as long as high. Exopod of third pleopod less than 2/3 as long as carapace. Telson as long as sixth somite, ending in distinct acute distal protruding tip. Uropods as long as telson, slender, exopod with movable distolateral spine.

**Remarks:** Fransen (2006) suggested that report of *P. adensameri* from Gulf of Aden and Maldives need confirmation, since this species is a possible endemic of deep Red Sea waters. The present record from the Indian waters confirmed the occurrence of this species from southern Arabian Sea. The present specimens collected from west coast of India agree well with the description provided by Fransen (2006) from Red Sea and description provided by Chace (1985).

### *Pandalid species in Indian waters: Check list, distribution, and biological characters.*

The shrimp family Pandalidae has wide distribution all over the world (Scigliano *et al.*, 2007) and twenty four species belonging to six genera are reported in Indian EEZ. Species such as *Plesionika ocellus*, *P. bifurca*, *P. unidens*, *Chlorotocus crassicornis*, *Dorodotes reflexus* and *H. tricarinatus* from Indian waters were described as long as hundred years back and there are no further reports of these species (Table.1&2). *Heterocarpus ensifer* described based on collections of the RIMS Investigator from Andaman Sea by Alcock (1901) was later re-identified as *H. sibogae* De Man, 1917 by Suseelan (1990). The species like *Parapandalus zurstrasseni* reported from Bay of Bengal and *Heterocarpus alphonsi*, *Chlorocurtis miser*, *Chlorotocus gracilipes* var. *andamanensis* from Andaman Sea are considered to be synonyms of *Stylopandalus richardi*, *Heterocarpus dorsalis*, *Chlorocurtis jactans* and *Chlorotocus crassicornis* respectively. Most of the pandalid shrimps, except two species (*Heterocarpoides levicarina* and *Plesionika longicauda*) reported from Indian waters are

deep-sea inhabitants usually distributed in the 200-3000 m depth range. *Heterocarpus gibbosus* is the largest among the pandalid shrimps of this area and marketability of this species is also high.

Among the twenty four species reported from Indian waters, only four species (*Heterocarpus gibbosus*, *H. woodmasonii*, *P. spinipes* and *P. martia*) have fishery importance while others are very rare in the commercial deep-sea shrimp landing. Studies on these four species indicated low fecundity which is a general pattern found in deep-sea fish species and shrimps (Omori, 1971; Vivekanandan, 2006). Hump-back nylon shrimp, *H. gibbosus* showed highest level of fecundity (17,605 eggs) and *P. ensis* the lowest (2,625 eggs). Among the species, dominance of males in the species *H. gibbosus* and *H. woodmasoni* and females in the *P. spinipes* and *P. martia* landed were observed. Dominance of females has been similarly reported in many *Plesionika* species (Possenti *et al.*, 2007; Vafidis *et al.*, 2008). The percentage of berried shrimps in the commercial landings was very high and observed throughout the year and highest percentage was noted in *P. martia* (81.4%) and *P. spinipes* (79.6%). The presence of ovigerous females throughout the year has been observed in many deep-sea pandalid shrimps (Company and Sarda, 1997; Maiorano *et al.*, 2002; Ahamed and Ohtomi, 2011). As stated by Radhakrishnan *et al.*, (2007) deep sea pandalid shrimps have greater life spans, lower growth rate and fecundity than coastal shrimps.

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### References

- Ahamed, F and J. Ohtomi. 2011. Reproductive biology of the Pandalid shrimp *Plesionika izumiae* (Decapoda: Caridea). *J. Crust. Biol.*, 31(3):441-449.
- Alcock, A. 1901. A descriptive catalogue of Indian deep-sea Crustacea, Decapoda, Macrura and Anomala in the Indian Museum., Baptist Mission Press, Calcutta, India, 286 pp.
- Alcock, A and A.R. Anderson. 1894. Natural history notes from H.M. Indian Marine Survey Ship "Investigator". Series II, No. 14. An account of a recent collection of deep-sea Crustacea from the Bay of Bengal and Laccadive Sea. *J. Asiat. Soc. Bengal*, 63: 141-185.
- Alcock, A and A.R. Anderson. 1899. Natural History Notes from H.M. Royal Indian Marine Survey Ship "Investigator," series III, No.22: An Account of the Deep-Sea Crustacea, dredged during the Surveying Season of

- 1897-98. *Ann. Mag. Nat. Hist.*, 3: 278-292.
- Alcock, A. and A.C. MacGilchrist 1905. Crustacea, Part XI. In *Illustrations of the Zoology of the Royal Indian Marine Survey Ship Investigator*, Indian Museum, Calcutta, 77 pp
- Anrose, A. 2009. Studies on some deep-sea shrimps around peninsular India. Ph.D Thesis. University of Madras. Chennai. 240 pp.
- Bergstrom, B. I. 2000. The biology of *Pandalus*. *Advances in Marine Biology*, 38:54-245.
- Chace, F.A., Jr. 1985. The Caridean Shrimps (Crustacea: Decapoda) of the Albatross Philippine Expedition, 1907-1910, Part 3: Families Thalassocarididae and Pandalidae. *Smith. Contr. Zool.*, 143 pp.
- Company, J.B. and F. Sarda. 1997. Reproductive patterns and population characteristics in five deep-water Pandalid shrimps in the Western Mediterranean along a depth gradient (150-1100 m). *Mar. Ecol. Prog. Ser.*, 148: 49-58.
- De Grave, S., N. D. Pentcheff, S. T. Ah Yong, T.-Y. Chan, K. A. Crandall, P. C. Dworschak, D. L. Felder, R. M. Feldmann, C. H. J. M. Fransen, L. Y. D. Goulding, R. Lemaitre, M. E. Y. Low, J. W. Martin, P. K. L. Ng, C. E. Schweitzer, S. H. Tan, D. Tshudy and R. Wetzer. 2009. A classification of living and fossil genera of decapod crustaceans. *Raffles Bull. Zool.*, Suppl. No. 21: 1-109
- Dineshbabu, A.P., B. Sreedhara and Y. Muniyappa. 2001. New crustacean resources in the trawl fishery off Mangalore coast. *Mar. Fish. Infor. Serv., T & E Ser.*, No.170:3-5.
- Fransen, C.H.J.M. 2006. Pandalidae (Crustacea: Decapoda) of the SONNE, VALDIVIA and METEOR Expeditions 1977-1987 to the Red Sea and the Gulf of Aden.
- George, M. J. 1966. On a collection of the penaeid prawns from the offshore waters off the south-west coast of India. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, Part 1: 337-346.
- John, C.C. and C.V. Kurian. 1959. A preliminary note on the occurrence of deep-water prawn and spiny lobster off the Kerala Coast. *Bull. Cent. Res. Inst. Trivandrum, Ser.*, 7(1): 155-162.
- Kemp, S. 1925. Notes on Crustacea Decapoda in the Indian Museum, XVII: On various Caridea. *Rec. Indian Mus.*, 27(4): 249-344.
- Kurian, C.V. 1965. Deep water prawns and lobsters off the Kerala coast. *Fish. Tech.*, 2(1):51-53.
- Kurup, B.M., Radhika Rajasree and S. Venu. 2008. Distribution of deep-sea prawns off Kerala. *J. Mar. Biol. Ass. India.*, 50 (2):122-126.
- Lalitha Devi, S. 1980. Notes on three caridean prawns from Kakinada. *J. Mar. Biol. Ass. India.*, 22 (1&2):169-173.
- Maiorano, P., D'Onghia, G., Capezzuto, F. and Sion, L. 2002. Life history traits of *Plesionika martia* (Decapoda: Caridea) from the eastern-central Mediterranean Sea. *Mar. Biol.*, 141: 527-539.
- Mohamed, K.H and C. Suseelan. 1973. Deep-sea prawn resources off the South-West Coast of India. *Proc. Symp. Living Resources of the Seas around India*, CMFRI., India, pp. 614-633.
- Nandakumar, G and M.K. Maniserry. 2006. Crustacean Fisheries in India. In: S.Ayyappan, (Eds.) *Handbook of Fisheries and Aquaculture*. Indian Council of Agricultural Research, New Delhi, p. 106-115.
- Nandakumar, G., K.N.Rajan, and K. Chellappan, 2001 Is the deep-sea prawn fishery of Kerala sustainable?. *Mar. Fish. Infor. Serv., T & E Ser.*, 170: 5-9.
- Ninan, T.V., V. Sivaji and N. Jagannadh. 1992. Observations on demersal resources survey between latitude 7° N 11° N along the south-west coast, Wadge bank and Gulf of Mannar during 1988-90. *Bull. Fish. Surv. India.*, No.24:14-25.
- Omori, M. 1971. Taxonomy and some notes on the biology of a new caridean shrimp, *Plesionika izumiae* (Decapoda, Pandalidae). *Crustaceana*, 20(3): 241-256.
- Oommen, P. V. 1980. Results of the exploratory fishery of Quilon Bank and Gulf of Mannar. *IFP Bulletin* No. 4, 53 pp.
- Possenti, E., P. Sartor, S. De Ranieri. 2007. Reproductive biology of females of *Plesionika edwardsii* (Brandt, 1851) (Crustacea, Decapoda, Pandalidae) in the northern Tyrrhenian Sea (Western Mediterranean). *Atti. Soc. tosc. Sci. nat., Mem., Serie B*, 114:91-98.
- Radhika, R. 2004. Systematics, Fishery, Resource Characteristics and Bionomics of Deep Sea Prawns Off Kerala. Ph.D Thesis, Cochin University of Science and Technology, Cochin, 358 pp.
- Radhika, R. and B. M. Kurup. 2005. Fishery and biology of deep-sea prawns landed at the fishing harbours of Kerala. *Fish. Tech.*, 42(2): 141-148.
- Radhakrishnan, E.V, M.K. Maniserry and G. Nandakumar. 2007. Status of research on crustacean fisheries. In: *Status and Perspectives in Marine Fisheries Research in India*. Central Marine Fisheries Research Institute, Kochi. 135: 172.
- Scigliano, C, P. Vidoris and A. Kallianiotis. 2007. Depth distribution of Pandalids genus in the North Aegean sea. *Rapp. Comm. int. Mer. Medit.*, 38:597.
- Silas, E. G. 1969. Exploratory fishing by R. V. *Varuna*. *Bull. Cent. Mar. Fish. Res. Inst.*, No. 12, 86pp.
- Suseelan, C and K.H. Mohamed. 1968. On the occurrence of *Plesionika ensis* (Pandalidae, Crustacea) in the Arabian Sea, with notes on its biology and fishery potentialities. *J. Mar. Biol. Ass. India.*, 10(1):88-94.
- Suseelan, C. 1974. Observations on the deep-sea prawn fishery off the south-west coast of India with special reference to pandalids. *J. Mar. Biol. Ass. India.*, 16 (2): 491-511.
- Suseelan, C., M. S. Muthu, K. N. Rajan, G. Nandakumar, M. Kathirvel, N. Neelakanta Pillai, N. Surendranatha Kurup and K. Chellappan. 1989. Results of an exclusive survey for the deep-sea crustaceans off southwest coast of India. *Proc. First Workshop Sci. Res. FORV Sagar Sampada*, Cochin, India, p.347-359.
- Suseelan, C. 1990. Occurrence of *Heterocarpus sibogae* De Man and *Plesionika williamsi* Forest (Crustacea, Decapoda, Pandalidae) in the Arabian Sea. *Indian J. Fish.*, 37 (4): 321-326.
- Suseelan, C. 1996. Crustacean biodiversity, conservation and management In: *Marine Biodiversity: Conservation and management*. Menon, N G and Pillai, C S G, (Eds.) CMFRI, Cochin, p. 41-65.
- Thomas, M. M. 1979. On a collection of deep-sea decapod crustaceans from the Gulf of Mannar. *J. Mar. Biol. Ass. India*, 21(1 and 2): 41-44.
- Thirumilu, P and S.Rajan. 2003. Commercial exploitation of deep-sea fishes and crustaceans along Tamilnadu and Pondicherry coast. *Mar. Fish. Infor. Serv., T & E Ser.*, 178. 6-8.
- Vafidis, D, P.K. Leontarakis, T. Dailianis, and A.Kallianiotis. 2008. Population characteristics of four deep-water Pandalid shrimps (Decapoda: Caridea) in the northern Aegean Sea (NE Mediterranean) *J. Nat. Hist.*, 42: 31, 2079-2093.
- Vivekanandan, E. 2006. Oceanic and Deep-sea fisheries of India. *Handbook of Fisheries and Aquaculture*. Ayyappan, S.(Ed.). Indian Council of Agricultural Research, New Delhi, p. 93-105.
- Wood-Mason, J. and A. Alcock. 1891. Natural history notes from H.M. Indian Marine Survey Steamer "Investigator", Commander R.F. Hoskyn, R.N., commanding. Series II, No. 1. On the results of deep-sea dredging during the season 1890-1891. *The Ann. Mag. Nat. Hist.*, ser. 6 (8): 268-386.