Indian Journal of Geo Marine Sciences
Vol. 54 (01), January 2025, pp. 40-45
DOI: 10.56042/ijms.v54i01.20695

Short Communication

Rediscovery of a deep-water paguroid crab *Xylocheles miersi* (Alcock & Anderson, 1899) (Decapoda: Anomura) from the Andaman Sea, India

S Tiwari*, V P Padate, V S Anoop, W Sebastian & S S Cubelio

Centre for Marine Living Resources & Ecology, Ministry of Earth Sciences, Government of India, Atal Bhavan, LNG Terminus Road, Puthuvype, Kochi, Kerala – 682 508, India

*[E-mail: shivamecci00@gmail.com]

Received December 30, 2024; revised 31 January 2025

This paper reports the rediscovery of a rare deep-water pylochelid hermit crab, *Xylocheles miersi* (Alcock and Anderson, 1899), from the Indian Exclusive Economic Zone based on a specimen collected off Narcondam Island, the Andaman Sea, using a High-Speed Demersal Trawl at a depth of 300 m. This is the second record of this species from the type locality. Detailed photographs of the morphological characters of the present specimen and its DNA barcodes of the partial mitochondrial COI and 16S rRNA genes are provided herein.

[**Keywords**: DNA barcoding, Northern Indian Ocean, Pylochelidae, Taxonomy, Xylicolous]

Introduction

Hermit crabs of the anomuran family Pylochelidae Spence Bate, 1888 (represented by 48 species belonging to 10 genera and three subfamilies), are unique among the paguroid crabs in having a calcified, symmetrical segmented pleon[1]. Moreover, they differ from the other paguroid crabs by the nature of their refuge, *i.e.* cavities of decayed wood, stones, scaphopod shells, or living sponges[1]. Forest's monograph[2] on the pylochelids of the MUSORSTOM expedition is the most seminal taxonomic study of this family, wherein he designated *Xylocheles* Forest, 1987 as a subgenus of *Pylocheles* A. Milne-Edwards, 1880, and included two species, namely *Pylocheles* (*Xylocheles*) *macrops* Forest, 1987 and *P.* (*X.*) *miersi* (Alcock and Anderson, 1899). Subsequently, McLaughlin & Lemaitre (2009)[3] elevated *Xylocheles* to the generic level owing to the presence of a distal cluster of tubercles on the dorsomesial face of the carpus of the cheliped, and an undivided posterior lobe of telson.

A review of Indian literature on the family Pylochelidae[4] revealed the reporting of two species *Pylocheles scorpio* Alcock, 1894 (= *Parapylocheles scorpio* (Alcock, 1894)) and *Pylocheles miersi* Alcock and Anderson, 1899 (= *Xylocheles miersi* (Alcock and Anderson, 1899)), both from the deep-waters of the Andaman Sea. A recent faunal expedition (FORV Sagar Sampada cruise 411) conducted in the Andaman Sea by the Centre for Marine Living Resources and Ecology, Kochi, India, yielded a small collection of deep-water anomurans, including chirostyloid (*Gastroptychus valdiviae* Balss, 1913) and galatheoid squat lobsters (*Garymunida prolixa* Alcock, 1894, *Gonionida andamanica* Alcock, 1894), and a single specimen of the wood cavity-inhabiting hermit crab *Xylocheles miersi* (Alcock and Anderson, 1899). This paper reports the second record of *X. miersi* from the Indian Exclusive Economic Zone.

Material and Methods

The sample was collected during a deep-sea expedition (FORVSS cruise 411; Andaman Sea, November 2024) using a High Speed Demersal Trawl net (Fig. 1). The specimen was photographed onboard with a Fujifilm GFX 100s mirrorless camera equipped with a 120 mm macro lens. Morphological characters were photographed with a Leica M80 stereo-zoom microscope equipped with a Leica MC170 HD microscope camera and Leica Application Suite imaging software. Measurements of the carapace and the appendages were done with the scaling tool provided in the Leica Application Suite imaging software. The map depicted in the study was plotted using ODV mapping software[5].

Terminology used in the morphological description follows McLaughlin[6]. Specimen size is indicated by shield length measured from the midpoint of the anterior margin of the carapace to the posterior margin of the cervical groove. Length of ocular peduncle was measured on the lateral surface from the distal corneal margin to the proximal margin of the ultimate peduncular segment. Corneal diameter was measured across the dorsal surface of the cornea.

Material examined during this study is deposited in the reference voucher collection in the Referral Centre of the Centre for Marine Living Resources and

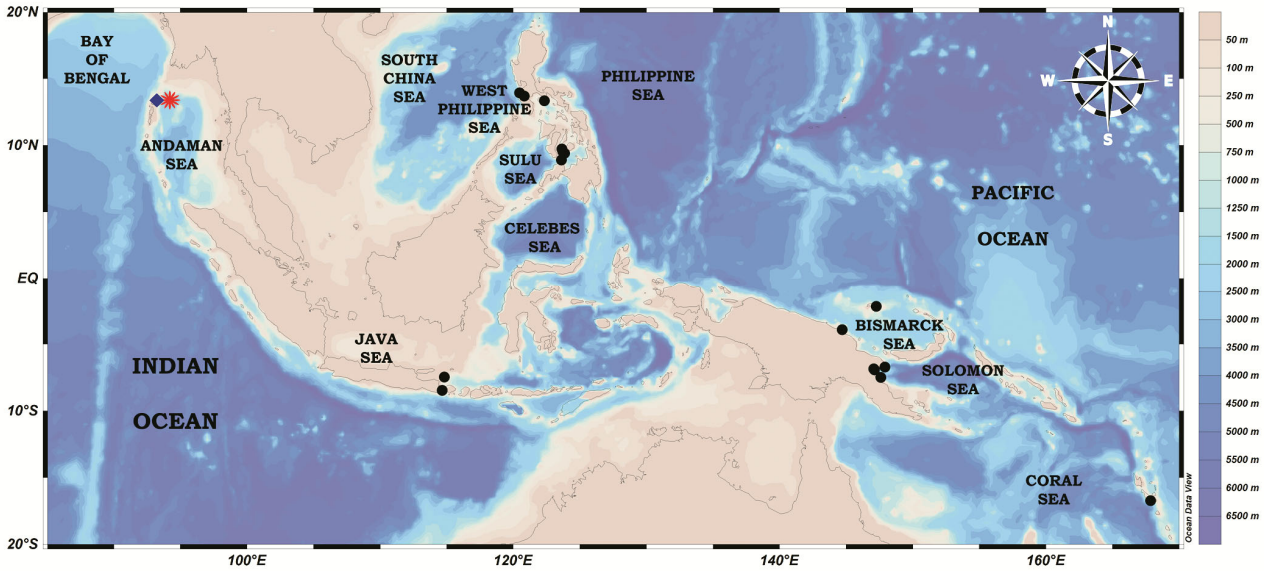

Fig. 1 — Map indicating the known geographical distribution of *Xylocheles miersi* (Alcock and Anderson, 1899). ✸ - present study, ◆ - lectotype, ● - other locations

Ecology, Kochi, India (CMLRE), which is a designated national repository for deep-sea fauna, and the regional node of Ocean Biodiversity Information System (OBIS) for the Indian Ocean. The occurrence data associated with this specimen will be available at the OBIS portal (https://obis.org/). Abbreviations used are: FORVSS - Fishery Oceanographic Research Vessel Sagar Sampada; HSDT (CV) - High Speed Demersal Trawl – II (Crustacean Version); IO/SS/ANO - Indian Ocean/Sagar Sampada/Anomura; Mxp3 - third maxilliped; P2, P3, P4 and P5 - second to fifth pereopods, respectively; and stn - station.

Genomic DNA was extracted from the pleopod tissue preserved in absolute ethanol with the help of the NucleoSpin tissue kit (Macherey-Nagel) as per the manufacturer's instructions. The partial mitochondrial cytochrome oxidase subunit I (COI) and 16S rRNA gene sequences were amplified. For COI, CrustDF1 (5′-GGTCWACAAAYCATAAAGAYATTGG-3′) and CrustDR1 (5′-TAAACYTCAGGRTGACCR AARAAYCA-3′)[7] primers were used with PCR temperatures; 94 °C for 1 min, five cycle of 94 °C for 30 s, 45 °C for 90 s, and 72 °C for 1 min, followed by 35 cycle of 94 °C for 30 s, 53 °C for 90 s, 72 °C for 1 min, and final step of 72 °C for 5 min. For 16S, 16sar-L (5′-CGCCTGTTTATCAAAAACAT-3′) and 16sbr-H (5′-CCGGTCTGAACTCAGATCACGT-3′)[8] were used with PCR temperatures: 94 °C for 5 min, 35 cycles of 94 °C for 30 s, 58 °C for 10 s, 72 °C for 30 s, and a final step of 72 °C for 5 min. All the PCR mixes were prepared using Emerald Amp® GT PCR Master Mix (Takara). The PCR products were visualised on 1.5 % agarose gels. All samples were sequenced using a SeqStudio Flex capillary sequencer (Applied Biosystems™) following the instructions of the manufacturer. The sequences were manually checked for any ambiguities and were submitted to NCBI.

Results

Infraorder: Anomura MacLeay, 1838[ref. 9]
Superfamily: Paguroidea Latreille, 1802[ref. 10]
Family: Pylochelidae Spence Bate, 1888[ref. 11]
Subfamily: Pylochelinae Spence Bate, 1888[ref. 11]
Genus: *Xylocheles* Forest, 1987
Xylocheles Forest, 1987: 57.

Type species: *Pylocheles* (*Xylocheles*) *macrops* (Forest, 1987)

Xylocheles miersi (Alcock & Anderson, 1899)

(Figs. 2 – 3)

Pylocheles Agassizii: Alcock, 1898[ref. 12]: 141. [not *Pylocheles agassizi* A. Milne-Edwards, 1880]

Pylocheles Miersi Alcock & Anderson, 1899a[ref. 13]: 14; Alcock & Anderson, 1899b[ref. 14]: pl. 43, fig. 4, 4(a), 4(b); Alcock, 1899[ref. 15]: 111.

Pylocheles miersii: Alcock, 1901[ref. 16]: 212; Alcock, 1905[ref. 17]: 16, pl. 1, fig. 2, 2(a), 2(b).

Pylocheles (*Xylocheles*) *miersii*: Forest, 1987[ref. 2]: 57, fig. 14(a-d).

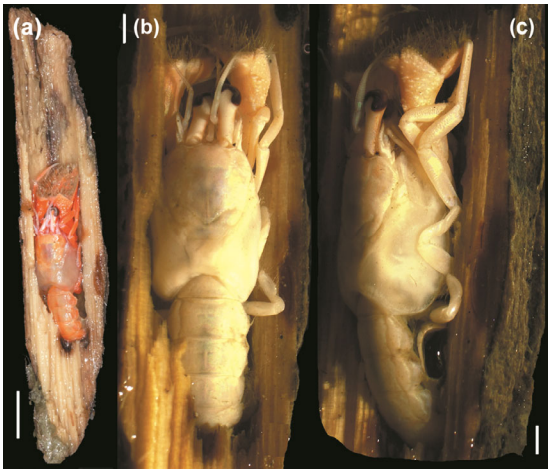

Fig. 2 — *Xylocheles miersi* (Alcock and Anderson, 1899): Female (IO/SS/ANO/00194; shield length 3.5 mm), Andaman Sea (inside cavity of wood piece): a) Dorsal habitus, fresh condition; b) Dorsal habitus, preserved condition; and c) Lateral habitus, preserved condition. Scale bars: 5.0 mm

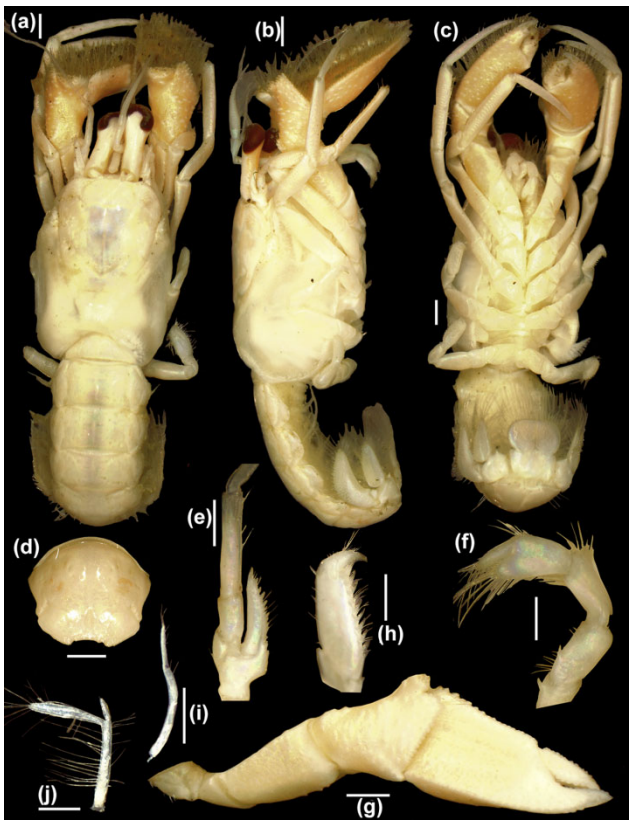

Fig. 3 — *Xylocheles miersi* (Alcock and Anderson, 1899): Female (IO/SS/ANO/00194; shield length 3.5 mm), Andaman Sea: a) Habitus, dorsal view; b) Habitus, lateral view; c) Habitus, ventral view; d) Abdominal tergite 6, dorsal view; e) Left antenna, lateral view; f) Left Mxp3, lateral view; g) Right P1, dorsolateral view; h) Right P4 dactylus, lateral view; i) Left pleopod 1, dorsal view; and j) Left pleopod 2, doral view. Scale bars: a, b, c, d, g = 1.0 mm; e, f, h, i, j = 0.5 mm

Xylocheles miersi: McLaughlin & Lemaitre, 2009[ref. 3]: 180, fig. 5(A, B); McLaughlin *et al*., 2010[ref. 18]: 41 (checklist).

Material examined

One female (IO/SS/ANO/00194; shield length 3.5 mm), Andaman Sea, off Narcondam Island, India, FORVSS stn. 41117, 13° 23' 27.72" N, 94° 12' 41.34" E, 300 m depth, HSDT (CV) net, coll. Shivam Tiwari, 26 November 2024.

Abbreviated description

Shield almost as long as wide, 1.80 times longer than posterior carapace; rostrum absent. Ocular peduncles 0.75 times shield length; corneal diameter 0.48 times peduncular length. Antennal peduncles not reaching distal corneal margin, antennal acicle reaching half the length of ocular peduncle, lateral margin bearing row of 10 spinules. Maxilliped 3 ischium with ventrodistal spine, merus with 1 midventral spine on ventral margin.

Chelipeds with chela rectangular in general dorsal outline; dactyli bearing dorsomesial row of small tubercles, ventromesial margin with row of flattened, tuberculate spines; palm dorsal surface weakly convex, sparsely setose, dorsomesial and dorsolateral margins each bearing row of small tubercles; carpus dorsodistal margin densely setose, slightly overhanging proximal margin of chela, bearing row of small spines or tubercles; dorsal and lateral surfaces of distal facet tuberculate. Pereopods 2 and 3 overreaching tip of cheliped; dactyli each bearing row of 15 – 20 tiny corneous spinules on ventral margins**;** carpi bearing a dorsodistal spinule, additional row of minute spinules on dorsal margin of only pereopod 2; pereopod 4 subchelate, propodal rasp bearing 1 row of corneous scales. Pleomere 6 tergite subcircular, with deep lateral incisions and shallow median sulcus; terminal margin with median area excavated and denticulate. Uropodal protopod with posteriorly directed spine. Telson with posterior lobe wider than anterior lobe, weakly divided into 2 ovate lobes by median longitudinal groove; terminal margins rounded. Pleopod 1 slender, bisegmented; pleopod 2 unequally biramous, exopod longer than endopod.

Colouration in fresh condition

Shield and pleon brownish-orange; posterior carapace light brown. Ocular peduncles white, mesial and lateral sides of corneal bases orange; corneas black. Chelipeds bright orange with white striae, fingers whitish. Pereopods 2 and 3 light orange;

dactyli white on distal halves; propodi each with distal white band.

Genetic data

COI GenBank accession number: PV699509 (644 bp). 16s rRNA GenBank accession number: PV668634 (429 bp).

Distribution

Andaman Sea (India)[3,19], Indonesia[2], Philippines[2,3], Papua New Guinea (Table 1) and Vanuatu[3]; bathymetric range: 100 – 888 m[(refs. 2,3)]. The present specimen was obtained from the Andaman Sea off Narcondam Island at a depth of 300 m.

Remarks

The morphology of the present specimen agrees with those of the original description by Alcock & Anderson[13] and subsequent reports from the western Pacific regions of *X. miersi*[2,3], although this report provides additional illustrations of the species from the Indian waters (Andaman Sea off Narcondam Island). *Xylocheles miersi* is distinguished from its only congener *X. macrops* Forest, 1987, from the Western Pacific by the ocular peduncles being shorter, with a prominently dilated cornea (*vs*. long, with slightly dilated cornea in *X. macrops*), and the terminal margin of the sixth pleomere with an irregularly concave median portion (*vs*. with conspicuously produced median portion in *X. macrops*)[3].

The COI (cytochrome oxidase I) gene sequence generated during this study is the first for the family Pylochelidae. Additionally, the 16S rRNA sequence generated during this study is the second sequence for the family, except for that of *Trizocheles spinosus* (Henderson, 1888)[20].

Table 1 — Occurrence records of *Xylocheles miersi* (Alcock and Anderson, 1899) known from published literature

Region	Latitude	Longitude	Depth (meters)	Reference
Andaman Sea, India	13.4° N	94.2° E	300	Present study
Andaman Sea, India	13.39° N	93.21° E	338	Lectotype (McLaughlin & Lemaitre, 2009)
Philippines	13.92° N	120.47° E	326 – 330	Forest, 1987
Philippines	13.92° N	120.51° E	318 – 320	Forest, 1987; McLaughlin & Lemaitre, 2009
Philippines	9.68° N	123.66° E	400	Forest, 1987
Philippines	13.68° N	120.78° E	365	Forest, 1987
Indonesia	8.5° S	114.63° E	450	Forest, 1987
Indonesia	7.48° S	114.82° E	240	Forest, 1987
Philippines	13.38° N	122.33° E	760 – 820	McLaughlin & Lemaitre, 2009
Philippines	9.52° N	123.69° E	100	McLaughlin & Lemaitre, 2009
Philippines	9.41° N	123.83° E	712 – 888	McLaughlin & Lemaitre, 2009
Philippines	9.46° N	123.82° E	273 – 302	McLaughlin & Lemaitre, 2009
Philippines	8.87° N	123.62° E	569 – 597	McLaughlin & Lemaitre, 2009
Philippines	9.48° N	123.69° E	400 – 436	McLaughlin & Lemaitre, 2009
Vanuatu	16.75° S	167.86° E	350 – 358	McLaughlin & Lemaitre, 2009
Papua New Guinea	6.95° S	147.13° E	240 – 269	MNHN, Paris (France) : Collection: Crustaceans (IU): MNHN-IU-2011-6012; MNHN-IU-2011-6017
Papua New Guinea	6.73° S	147.83° E	403 – 418	MNHN, Paris (France): Collection: Crustaceans (IU): MNHN-IU-2011-3479
Papua New Guinea	3.95° S	144.68° E	198 – 219	MNHN, Paris (France): Collection: Crustaceans (IU): MNHN-IU-2011-2700
Papua New Guinea	6.90° S	147.08° E	395 – 406	MNHN, Paris (France): Collection: Crustaceans (IU): MNHN-IU-2011-3415
Papua New Guinea	6.75° S	147.81° E	460 – 485	MNHN, Paris (France): Collection: Crustaceans (IU): MNHN-IU-2011-6029
Papua New Guinea	7.49° S	147.55° E	280 – 302	MNHN, Paris (France): Collection: Crustaceans (IU): MNHN-IU-2011-6006
Papua New Guinea	7.48° S	147.51° E	279 – 290	MNHN, Paris (France): Collection: Crustaceans (IU): MNHN-IU-2011-6037
Papua New Guinea	2.17° S	147.28° E	300	MNHN, Paris (France): Collection: Crustaceans (IU): MNHN-IU-2011-6030

MNHN – Muséum national d'Histoire naturelle

Acknowledgements

The authors are grateful to the Secretary, Ministry of Earth Sciences, New Delhi and the Director, Centre for Marine Living Resources and Ecology, Kochi. We are thankful to the Ministry of Earth Sciences, Government of India, for their crucial funding support. We thank the Captain, Chief Engineer, Fishing Master, and crew members of FORV Sagar Sampada Cruise no. 411 for their support during the sample collection. This is CMLRE contribution number 222.

Conflict of Interest

Authors do not have any conflict of interest in publishing this manuscript.

Ethical Statement

The organisms under the study are not under the scheduled list/protection categories, thus ethical clearance is not applicable.

Author Contributions

ST: Conceptualisation, formal analysis, methodology, writing – original draft. VPP: Conceptualisation, formal analysis, methodology, writing – review & editing. VSA: DNA extraction and PCR. WS: DNA sequencing. SSC: Project administration, manuscript review and editing.

References

1 Poore G C & Ahyong S T, *Marine Decapod Crustacea: A Guide to Families and Genera of the World*, (CSIRO Publishing, United States), 2023, pp. 928. https://doi.org/10.1071/9781486311798

2 Forest J, Les Pylochelidae ou "Pagures symétriques" (Crustacea Coenobitoidea), In: *Résultats des Campagnes MUSORSTUM, Vol. 3*, *Mém Mus Natl Hist Nat sér. A, Zool*, edited by Crosnier A, 137 (1987) 1–254.

3 McLaughlin P A & Lemaitre R, A new classification for the Pylochelidae (Decapoda: Anomura: Paguroidea) and descriptions of new taxa, *Raffles Bull Zool*, Suppl. No. 20 (2009) 159–231.

4 Patel K, Padate V P, Osawa M, Tiwari S, Vachhrajani K, *et al.*, An annotated checklist of anomuran species (Crustacea: Decapoda) of India, *Zootaxa*, 5157 (1) (2022) 1–100. https://doi.org/10.11646/zootaxa.5157.1.1

5 Schlitzer R, *Ocean data view 5.3.0. Bremerhaven*, (Alfred Wegener Institute for Polar and Marine Research). Available online at: https://odv.awi.de/; (Accessed on January 2025).

6 McLaughlin P A, Illustrated keys to families and genera of the superfamily Paguroidea (Crustacea: Decapoda: Anomura), with diagnoses of genera of Paguridae, *Mem Mus Victoria*, 60 (1) (2003) 111–144. http://dx.doi.org/10.24199/j.mmv.2003.60.16

7 Radulovici A E, Sainte-Marie B & Dufresne F, DNA barcoding of marine crustaceans from the Estuary and Gulf of St Lawrence: a regional-scale approach, *Mol Ecol Resour*, 9 (2009) 181–187. https://doi.org/10.1111/j.1755-0998.2009.02643.x

8 Palumbi S R, Martin A, Romano S, McMillan W O, Stice L, *et al.*, *The Simple Fool's Guide to PCR, Version 2*, (University of Hawaii Zoology Department, Honolulu), 1991, pp. 45.

9 MacLeay W S, Illustrations of the Annulosa of South Africa. On the brachyurous decapod Crustacea. Brought from the Cape by Dr. Smith, In: *Illustrations of the Zoology of South Africa; consisting chiefly of Figures and Descriptions of the Objects of Natural History Collected during an Expedition into the Interior of South Africa, in the Years 1834, 1835, and 1836; fitted out by "The Cape of Good Hope Association for Exploring Central Africa"*, edited by A Smith, (Published under the Authority of the Lords Commissioners of Her Majesty's Treasury, London), 1838, pp. 53–71. https://doi.org/10.5962/bhl.title.10416

10 Latreille P A, *Histoire Naturelle, Générale et Particulière des Crustacés et des Insectes. Ouvrage Faisant suite à l'Histoire Naturelle Générale et Particulière, Composée par LeClerc de Buffon, et Rédigée par C.S. Sonnini, Membre de Plusieurs Sociétés Savantes*, Vol 3, (Dufart, Paris), 1802, pp. 467. https://doi.org/10.5962/bhl.title.15764

11 Spence Bate C, Report on the Crustacea Macrura collected by the Challenger during the years 1873–76, *Report on the Scientific Results of the Voyage of H.M.S. Challenger During the Years 1873–76, Zoology*, 24 (52) (1888) i–xc, 1–942, pls. 1–150. https://doi.org/10.5962/bhl.title.6513

12 Alcock A, Natural history notes from H.M. Indian Marine Survey Ship Investigator, Commander T.H. Heming, R.N., commanding. Series II No. 25. A note on the deep-sea fishes with descriptions of some new genera and species including another probably viviparous ophidioid, *Ann Mag Nat Hist Zool Bot Geol*, 2 (1898) 136–155. https://doi.org/10.1080/00222939808678029

13 Alcock A & Anderson A R S, Natural history notes from H.M. Royal Indian Marine Survey Ship 'Investigator,' Commander T.H. Heming, R.N., commanding.—Series III., No. 2. An account of the deep-sea Crustacea dredged during the surveying-season of 1897–98, *Ann Mag Nat Hist ser 7*, 3 (1899a) 1–27. https://doi.org/10.1080/00222939908678071

14 Alcock A & Anderson A R S, *Illustrations of the Zoology of the Royal Indian Marine Surveying Ship "Investigator", under the command of Commander T.H. Heming, R.N.. Crustacea. Part IX. Published under the Authority of Captain W.S. Goodridge, R.N., Director of the Royal Indian Marine*, (Office of the Superintendent of Government Printing, Calcutta), 1899b, pls. XXXVI–XLV.

15 Alcock A, Natural history notes from the Royal Indian marine survey ship 'Investigator,' Commander T. H. Heming, R.N., commanding.—Series III. No. 3. On some notable new and rare species of Crustacea, *J Asiat Soc Bengal*, 68 (1899) 111–119, pl I.

16 Alcock A, *A descriptive catalogue of the Indian deep-sea Crustacea Decapoda Macrura and Anomala, in the Indian Museum. Being a revised account of the deep-sea species collected by the Royal Indian Marine Survey Ship Investigator*, (Office of the Superintendent of Government Printing, Calcutta), 1901, pp. 286.

17 Alcock A, *Catalogue of the Indian decapod Crustacea in the collection of the Indian Museum. Part II. Anomura. Fasciculus I. Pagurides*, (Office of the Superintendent of Government Printing, Calcutta), 1905, pp. 193, pls. I–XVI. https://doi.org/10.1080/00222930709487239

18 McLaughlin P A, Komai T, Lemaitre R & Rahayu D L, Annotated checklist of anomuran decapod crustaceans of the world (exclusive of the Kiwaoidea and families Chirostylidae and Galatheidae of the Galatheoidea) Part I–Lithodoidea, Lomisoidea and Paguroidea, *Raffles Bull Zool*, 23 (2010) 5–107.

19 Alcock A, Natural history notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R.F. Hoskyn, R.N., late commanding.—Series II., No. 1. On the result of deep-sea dredging during the season 1890–1891 (concluded), *Ann Mag Nat Hist, ser 6*, 13 (1894) 225–245, 321–334, 400–411. https://doi.org/10.1080/00222939408677694

20 Henderson J R, Report on the Anomura collected by H.M.S. Challenger during the years 1873–76, Report on the Scientific Results of the Voyage of H.M.S. Challenger During the Years 1873–76, *Zoology*, 27 (part 69) (1888) i–xi, 1–221, pls. 1–21. https://doi.org/10.5962/bhl.title.6513