



First record of *Pilumnopus convexus* (Maccagno, 1936) (Crustacea, Decapoda, Pilumnidae) from the Indian coast

Swapnil Gosavi, Jigneshkumar N. Trivedi, Dhruva J. Trivedi, Kauresh D. Vachhrajani

Marine Biodiversity and Ecology Laboratory, Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara-390002, Gujarat, India.

Corresponding author: Kauresh D. Vachhrajani, kauresh@gmail.com

Abstract

Pilumnopus convexus (Maccagno, 1936) (Pilumnidae) is recorded for the first time across the Indian coast. The species has so far been reported from coastal waters of the Red Sea, Pakistan and Persian Gulf. *P. convexus* can be easily distinguished from closely related species in having transversely hexagonal carapace, acute anterolateral teeth and tip of the male left gonopod curved to form a hook like structure. Possible explanations to the new record are discussed.

Key words

Geographic distribution extension; rubble shore; first record; Arabian Sea.

Academic editor: Temim Deli | Received 1 February 2017 | Accepted 13 July 2017 | Published 11 September 2017

Citation: Gosavi S, Trivedi JN, Trivedi DJ, Vachhrajani KD (2017) First record of *Pilumnopus convexus* (Maccagno, 1936) (Crustacea, Decapoda, Pilumnidae) from the Indian coast. Check List 13 (5): 429–433. <https://doi.org/10.15560/13.5.429>

Introduction

Brachyuran crab species of the family Pilumnidae Samouelle, 1819 are inhabitants of rocky and muddy shores of tropical and subtropical seas (Davie 1989, Ghani & Davie 2000; Kaullysing et al. 2015; Trivedi et al. 2015). The family is currently composed of 5 subfamilies (Calmaniinae Števíć, 1991, Eumedoninae Dana, 1852, Pilumninae Samouelle, 1819, Rhizopinae Stimpson, 1858, Xenophthalmodinae Števíć, 2005), 69 genera and 394 species (Davie et al. 2015). DAVIE (1989) revised the taxonomy of 2 genera, *Pilumnopus* A. Milne Edwards, 1863 and *Heteropanope* Stimpson, 1858, and proposed the new genus *Benthopanope* Davie, 1989 to accommodate 5 species previously described under these genera. *Pilumnopus* differs from *Heteropanope* in having the carapace more convex and narrower and rounded in front, and with 8 sternites visible laterally on

the male abdomen (Davie 1989). Currently, *Pilumnopus* contains 10 well-recognised species (Davie 1989, Ng et al. 2008, Ghory et al. 2013), but *Pilumnopus convexus* (Maccagno, 1936) is taxonomically problematic. This species was originally described from Ethiopia based on 2 female specimens (Maccagno 1936), but later Davie (1989) redescribed *P. convexus* based on a female lectotype collected from Ethiopia and illustrated the carapace and cheliped of this specimen. More recently, Ghory et al. (2013) discussed the taxonomy of *P. convexus* and *P. salomonensis* Ward, 1942 and assigned *P. salomonensis* as junior synonym of *P. convexus*. *Pilumnopus convexus* is recorded to date from the coast of Ethiopia (Maccagno 1936), South Africa (Barnard 1955), Red Sea (Apel 2001); Iran (Naderloo and Türkay 2012, Naderloo et al. 2013); Saudi Arabia and Bahrain (Apel 2001), UAE (Cooper 1997, Apel 2001), and Pakistan (Ghani and Davie 2000, Ghory et al. 2013). The present study records *P. convexus*

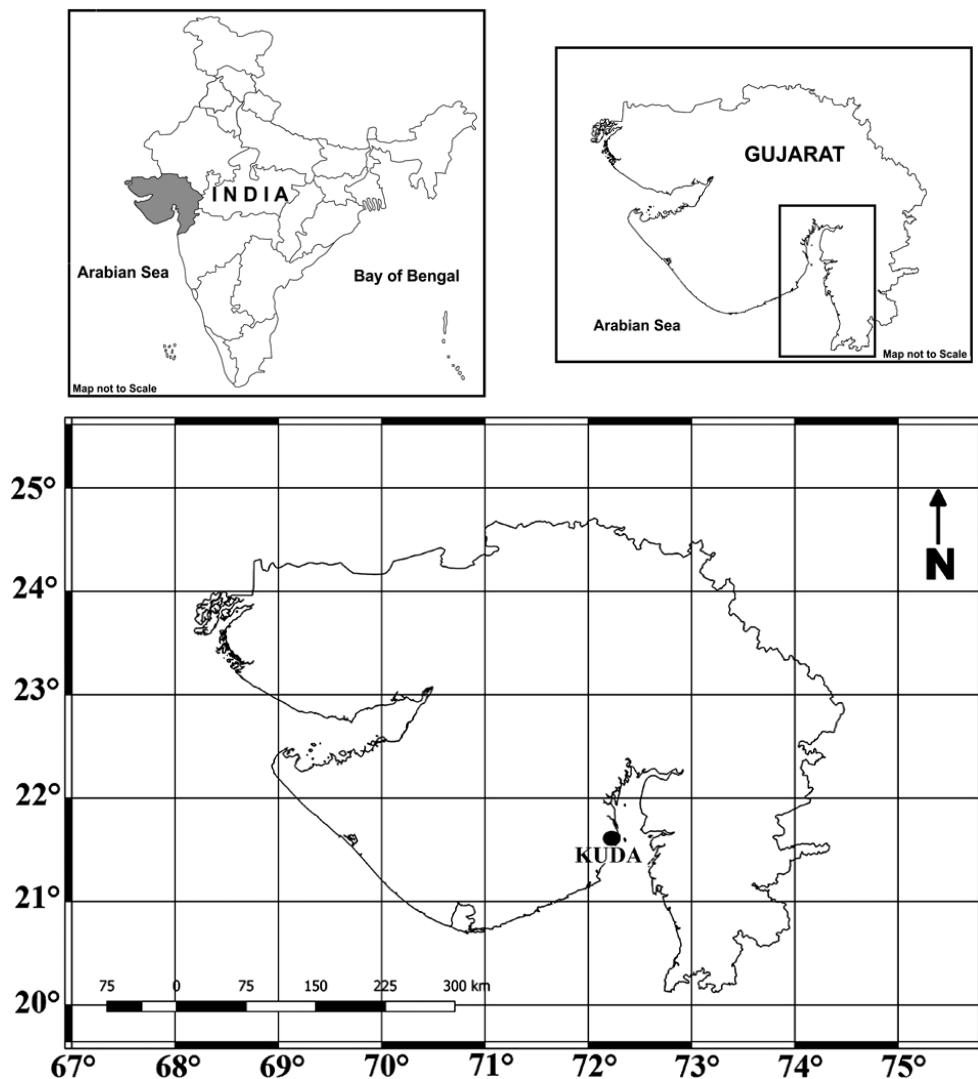


Figure 1. Map showing the location of the new record of *Pilumnopus convexus* (Maccagno, 1936) at Kuda (21°37'33" N, 072°18'17" E), Gujarat, India.

for the first time in Indian waters and suggests a possible explanation for its occurrence there.

Methods

One male and 2 females of *P. convexus* were collected from the coast at Kuda village (21°37'33" N, 072°18'17" E) (Fig. 1), which is located in Gulf of Khambhat (Bhavnagar District, Gujarat state, India). Specimens were collected by hand picking from a rocky rubble intertidal shore during low tide. Photographs were taken from freshly caught specimens in the laboratory using a Canon 1000D camera with a 18–55 mm lens. Crabs were preserved in 70% alcohol and deposited in the Zoology Museum, Department of Zoology, Faculty of Science, the Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India with accession number (ZL-AR-CR-100). Terminology used for morphological descriptions follows Ghory et al. (2013): carapace length (CL), measured along the vertical median line of the carapace; carapace width (CW), measured horizontally at the widest point of the carapace; and male first gonopod and male second

gonopod (G1 and G2, respectively). Morphometric characters were measured in millimetres using digital caliper to the nearest 0.01 mm.

Results

Order Decapoda Latreille, 1802
 Infraorder Brachyura Latreille, 1802
 Family Pilumnidae Samouelle, 1819
 Subfamily Pilumninae Samouelle, 1819
 Genus *Pilumnopus* A. Milne-Edwards, 1867

Pilumnopus convexus (Maccagno, 1936) (Figs. 2–7)

Heteropanope convexa Maccagno 1936: 176.

Pilumnopus salomonensis Ward 1942: 96—Davie 1989: 143, Ng et al. 2008: 141.

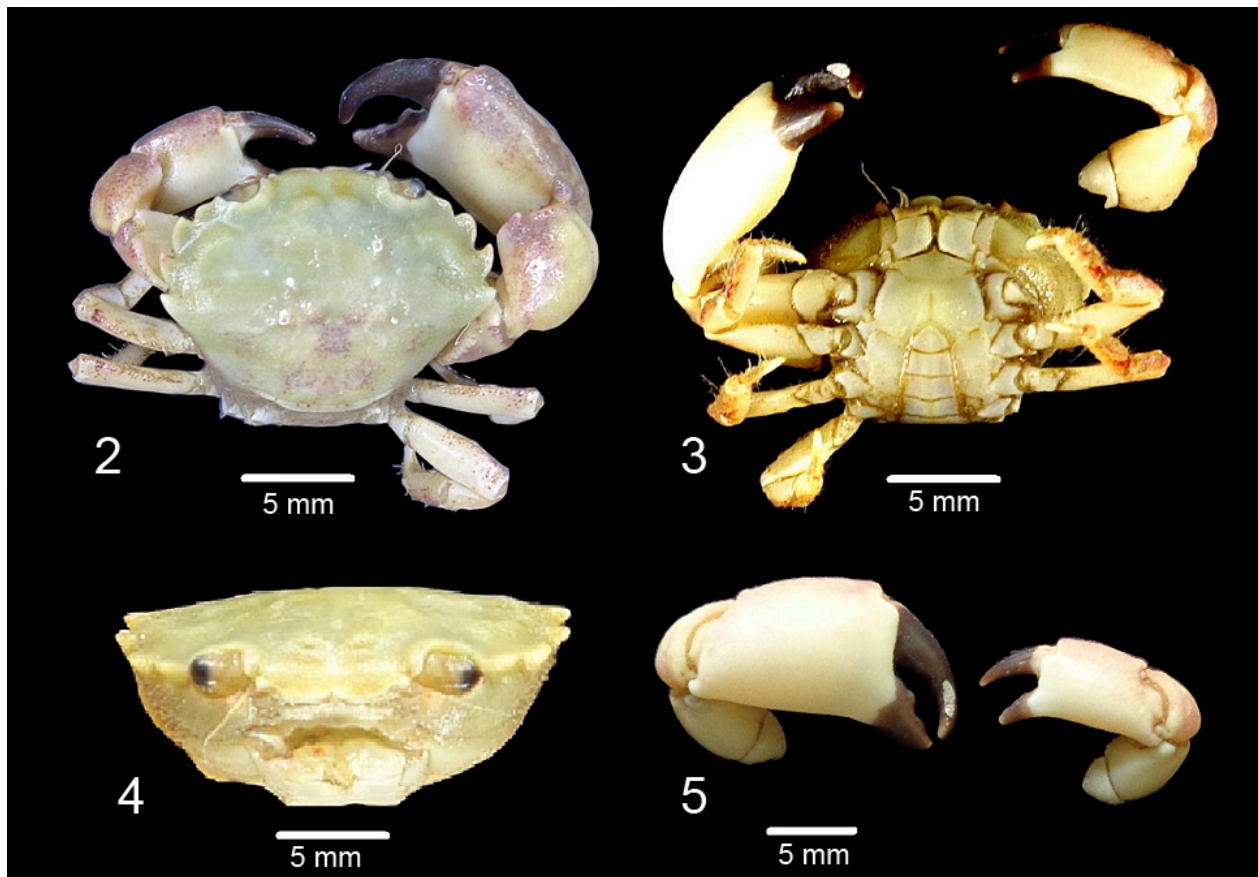
Pilumnopus vauquelini Stephensen 1946: 141.

Pilumnopus indica Barnard 1955: 30.

Pilumnopus convexa Davie 1989: 142.

Pilumnopus convexus—Cooper 1997: 171, Ng et al. 2008: 141, Ghory et al. 2013: 303.

Material examined. ZL-AR-CR-100, 1 male (CW 15.38 mm, CL 11.36 mm), 2 females (CW 11.91 mm, CL



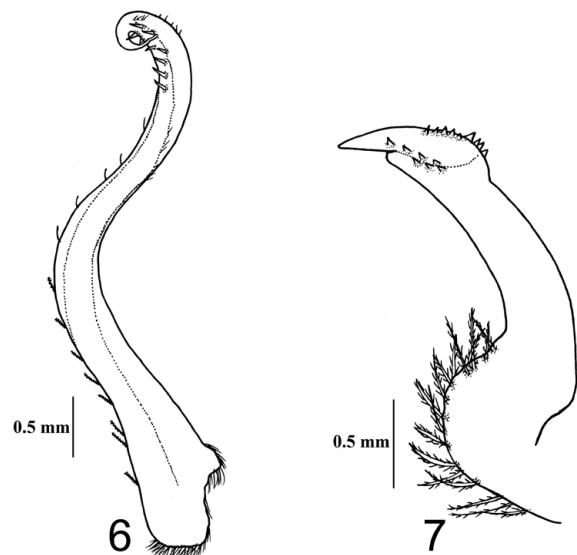
Figures 2–5. *Pilumnopus convexus* (Maccagno, 1936), male (CW: 15.38mm, CL: 11.36mm) (ZL-AR-CR-100), Gujarat, India. **2.** Dorsal view. **3.** Ventral view. **4.** Frontal view. **5.** Chelipeds outer view.

8.47 mm; CW 12.85 mm, CL 8.60 mm), Kuda (21°37'33" N, 072°18'17" E), muddy rubble shore, 12 October 2016, collector Jignesh Trivedi.

Diagnosis (modified from Ghory et al. 2013). Carapace hexagonal (Fig. 2), broader than long, frontal margin (Fig. 4) bilobed forming an external angle; margin of lobe slightly convex; inner supraorbital tooth with an outer frontal angle, forming a V-shaped notch in which antenna fits; supraorbital margin with 2 fissures, dorsal surface with rows of small rounded granules on frontal, gastric, branchial and cardiac regions, scattered plumose setae of different sizes on branchial region, 3 teeth on anterolateral margin after external orbital angle; first anterolateral tooth blunt, second and third teeth sharp but not pointed.

Chelipeds subequal (Fig. 5), right larger; larger chela smooth; smaller chela finely granulated; carpus with 1 lobe distally, fingers shorter than palm, cutting edges of fingers slightly toothed. Ambulatory legs reasonably shorter than larger cheliped; unarmed coxa, merus, carpus and propodus; covered with long and short dispersed setae; dactylus slightly curved with slightly tapering tip.

First and second thoracic sternites (Fig. 3) completely fused; second and third sternites separated by almost straight groove; sternite 8 not visible in ventral view, laterally beside the abdomen. Abdomen with 7 segments including telson, covered with fine setae; telson triangular with curved apex. G1 (Fig. 6) sinuous, slender; distal



Figures 6, 7. *Pilumnopus convexus* (Maccagno, 1936), male (CW: 15.38mm, CL: 11.36mm) (ZL-AR-CR-100), Gujarat, India. **6.** G1 dorsal view (left). **7.** G2 dorsal view (left).

part markedly recurved, hook like, tip elongated, with numerous subdistal spines. G2 (Fig. 7) short, sigmoid, armed with distal spines.

Colouration in life. Male: Carapace olive with reddish brown spots on urogastric, cardiac and intestinal regions. Chelipeds olive, dorsal surface of palm and carpus reddish, inner surface white, fingers black. Ambulatory legs

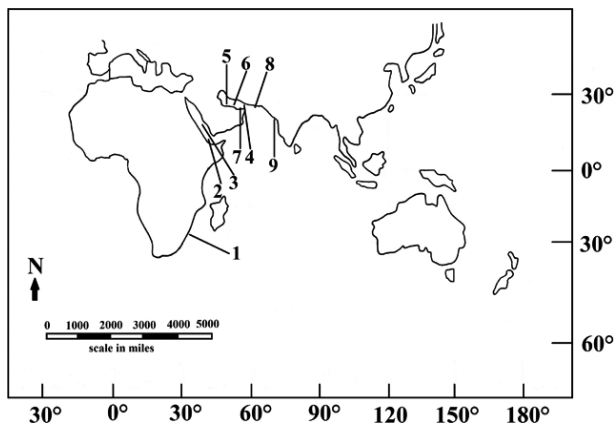


Figure 8. Map showing distribution range of *Pilumnopus convexus* (Maccagno, 1936): (1) Durban Bay, South Africa (Barnard 1955), (2) unknown locality, Ethiopia (Maccagno 1936), (3) unknown locality, Red Sea (Apel 2001), (4) Qeshm Island, Persian Gulf, Iran (Naderloo and Türkay 2012, Naderloo et al. 2013), (5) unknown locality, Saudi Arabia (Apel 2001), (6) unknown locality, Bahrain (Apel 2001), (7) Abu Dhabi, UAE (Cooper 1997, Apel 2001), (8) Somar Goth, Pakistan (Ghani and Davie 2000, Ghory et al. 2013), (9) Kuda, Gujarat state, India (present study).

brown with red spots. Female: Carapace cream with reddish brown patch from mesogastric region to intestinal region. Cheliped outer surface reddish brown, inner surface white, fingers brown. Ambulatory legs brown with red spots.

Habitat. The species occurs on rocky rubble shore line.

Distribution. The distribution range of *P. convexus* is shown in Fig. 8.

Discussion

Morphological examination of the newly examined specimens of *P. convexus* corresponds with previous descriptions of the same species by Barnard (1955), Davie (1989), and Ghory et al. (2013). Indeed, the newly collected crabs have hexagonal carapace, bilobed frontal margin, structure of anterolateral teeth, armature of chelipeds and ambulatory legs. However, the newly collected specimens differ from the previous descriptions of *P. convexus* (Barnard 1955, Davie 1989, Ghory et al. 2013) by the placement of sternite 8 and the morphology of G1. Sternite 8 is not visible in the ventral view of the new specimens, while it is clearly visible in specimens examined by Davie (1989) and Ghory et al. (2013). The G1 of the male specimen examined in the present study has an elongated tip compared to specimens described and figured by Barnard (1955) and Ghory et al. (2013). Such noticeable variations could be related to the difference in the size of specimens (Ghory et al. 2013).

Pilumnopus convexus was initially described from the coastal areas of Ethiopia (Maccagno 1936) and subsequently recorded from South Africa (Barnard 1955), Red sea (Apel 2001); Iran (Naderloo and Türkay, 2012, Naderloo et al. 2013); Saudi Arabia and Bahrain (Apel 2001),

UAE (Cooper 1997, Apel 2001), and Pakistan (Ghani and Davie 2000, Ghory et al. 2013) and now from Kuda village of Gujarat state, India which is more than 1000 km from the site mentioned by Ghory et al. 2013. The present study expands the geographic distribution of *P. convexus* in the Arabian Sea and Indian Ocean. Recently, many brachyuran crab species (i.e., *Atergatis ocyroe* (Herbst, 1901) (Tirmizi and Ghani 1996); *Cryptopodia angulata* H. Milne Edwards & Lucas, 1841 (Tirmizi and Kazmi 1983); *Dentoxanthus iranicus* Stephensen, 1945 (Tirmizi and Serène 1971, Tirmizi and Kazmi 1982); *Macrophthalmus (Mareotis) laevis* A. Milne-Edwards, 1867 (Tirmizi and Ghani 1988); *Opusia indica* (Alcock, 1900) (Alcock 1900, Ng et al. 2009)), which are common along the Pakistan coast, have been recorded for the first time from northwestern coastal India (Trivedi and Vachhrajani 2013, Trivedi et al. 2014, Ng et al. 2015, Trivedi and Vachhrajani 2016, Trivedi et al. 2017).

Two explanations can be provided for the geographic distribution of these brachyuran crab species, including *P. convexus*, in northwestern Indian waters. Firstly, the coastal area of Pakistan and Gujarat state, India have a similar marine habitat including rocky and muddy shores, mangroves, and estuaries (Trivedi and Vachhrajani 2012, Trivedi et al. 2012, Shukla et al. 2013). Secondly, the circular movement of surface current of northern Arabian Sea could mediate the transport of larvae of these brachyurans from Pakistani waters to coastal northwestern India (Shetye 1994).

Acknowledgements

SG and DJT thank the Earth System Sciences Organization (ESSO), Department of Earth Sciences, Government of India, New Delhi for the fellowship award under the research project “Studies on brachyuran crabs of Saurashtra coast” (Sanction No.: MoES/16/06/2013-RDEAS of 11-11-2014). The authors thank Dr Bhavik Patel for preparation of map, as well as the academic editor and anonymous reviewers for their valuable comments on the manuscript.

Authors’ Contributions

JNT collected the specimens; SSG, JNT, DJT examined and identified the specimens; DJT prepared the drawings; SSG, JNT and KDV prepared, reviewed and finalized the manuscript. All authors read and approved the manuscript.

References

- Alcock A (1900) Materials for a carcinological fauna of India. No. 6. The Brachyura Catometopa or Grapsoidae. Journal of Asiatic Society of Bengal 69: 279–486.
- Apel M (2001) Taxonomie und Zoogeographie der Brachyura, Paguridea und Porcellanidae (Crustacea: Decapoda) des Persisch-Arabischen Golfes. PhD thesis, Frankfurt am Main, Germany, Johann Wolfgang Goethe-Universität. 268 pp.
- Barnard KH (1955) Additions to fauna-list of South African Crustacea

- and Pycnogonida. *Annals of south African Museum* 43 (1): 1–107.
- Cooper RT (1997) Mangal-associated Brachyura (Ocypodidae, Grapsidae, Portunidae, Majidae, Xanthidae and Leucosiidae) from the north-eastern coastal Islands of Abu Dhabi, United Arab Emirates. *Crustaceana* 70 (2): 155–179. <https://doi.org/10.1163/156854097X00807>
- Davie PJF, Guinot D, Ng PKL (2015) Systematics and classification of Brachyura. In: Castro P, Davie PJF, Guinot D, Schram FR, Vaupel Klien JC von (Eds) *Treatise on Zoology: Anatomy, Taxonomy, Biology. The Crustacea. Volume 9C–II. Decapoda: Brachyura* (Part 2). E.J. Brill, Leiden, 1049–1130.
- Davie PJF (1989) A re-appraisal of *Heteropanope* Stimpson, and *Pilumnopus* A. Milne Edwards (Crustacea: Decapoda: Pilumnidae) with descriptions of new species and new genera. *Memoirs of Queensland Museum* 27 (2): 129–156.
- Ghani N, Davie PJF (2000) New record of a xanthid, *Pilumnopus convexus* (Maccagno 1936) with a note on its ecology. *Pakistan Journal of Marine Biology* 6 (2): 121–124.
- Ghory F, Ng PKL, Kazmi QB (2013) On the identities of *Pilumnopus convexus* Maccagno, 1936, and *P. salomonensis* Ward, 1942, from the Indian Ocean, with a note on *P. riui* Takeda, 2001 (Decapoda, Brachyura, Pilumnidae). *Crustaceana* 86 (3): 301–312. <https://doi.org/10.1163/15685403-00003180>
- Kaullysing D, Padate VP, Rivonker CV (2015) New records of *Epixanthus frontalis* and *Heteropanope glabra* (Decapoda: Brachyura: Oziidae, Pilumnidae) for Goa, India, with identification keys of their respective genera. *Indian Journal of Geo-Marine Sciences* 44 (8): 1191–1199.
- Maccagno T (1936) Spedizione del Barone Raimondo Franchetti in Doncalia (1928–29). Crostacei di Assab. Decapodi, Stomatopodi, Anfipodi. *Annali del Museo Civico di Storia Naturale di Genova* 59: 171–186.
- Naderloo R, Türkay M (2012) Decapod crustaceans of littoral and shallow sublittoral habitats along the eastern (Iranian) coast of the Persian Gulf: faunistic, biodiversity and zoogeography. *Zootaxa* 3374:1–67.
- Naderloo R, Türkay M, Sari A (2013) Intertidal habitats and decapod (Crustacea) diversity of Qeshm Island, a biodiversity hotspot within the Persian Gulf. *Marine Biodiversity* 43: 445–462. <https://doi.org/10.1007/s12526-013-0174-3>
- Ng PKL, Guinot D, Davie PJF (2008) *Systema Brachyurorum: Part I. An annotated checklist of extant brachyuran crabs of the world*. *Raffles Bulletin of Zoology* 17 (Supplement): 1–286.
- Ng PKL, Rahayu DL, Naser MD (2009) The Camptandriidae of Iraq, with description of a new genus and notes on *Leptochryseus* Al-Khayat & Jones, 1996 (Crustacea: Decapoda: Brachyura). *Zootaxa* 2312: 1–26.
- Ng PKL, Trivedi JN, Vachhrajani KD (2015) *Dentoxanthus iranicus* Stephensen, 1946 (Crustacea: Brachyura: Galenidae) a new record from Gujarat, India, with systematic notes. *Marine Biodiversity Records. Marine Biological Association of the United Kingdom* 8: e132. <https://doi.org/10.1017/S1755267215001098>
- Shetye SR, Gouveia AD, Shenoi SSC (1994) Circulation and water masses of the Arabian Sea. *Proceedings of the Indian Academy of Sciences. Earth and Planetary Sciences* 103 (2): 107–123. <https://doi.org/10.1007/BF02839532>
- Shukla ML, Patel BK, Trivedi JN, Vachhrajani KD (2013) Brachyuran crabs diversity of Mahi and Dhadhar estuaries, Gujarat, India. *Research Journal of Marine Sciences* 1 (2): 8–11.
- Stephensen K (1946) The Brachyura of the Iranian Gulf with an appendix: the male pleopoda of the Brachyura. *Danish Scientific Investigations in Iran* 4: 57–237.
- Tirmizi NM, Ghani N (1988) The rediscovery of *Macrophthalmus* (*Macrophthalmus*) *laevis* A. Milne-Edwards, 1867, in the Arabian Sea (Decapoda Brachyura). *Crustaceana* 55 (3): 253–256. <https://doi.org/10.1163/156854088X00348>
- Tirmizi NM, Ghani N (1996) Marine fauna of Pakistan. (Xanthidae, Goneplacidae, Pinnotheridae, Ocypodidae, Grapsinae). *Crustacea: Brachyura: Brachyrahyncha. Centre of Excellence in Marine Biology, University of Karachi* 1 (5): 1–188.
- Tirmizi NM, Kazmi QB (1982) Range extension of *Harrovia elegans* De Man, 1887, with note on the male of *Dentoxanthus iranicus* Stephensen, 1945, from the northern Arabian Sea. (Decapoda, Brachyura, Eumedininae). *Crustaceana* 43: 308–313. <https://doi.org/10.1163/156854082X00254>
- Tirmizi NM, Kazmi QB (1983) Carcinological studies in Pakistan with remarks on species common to the Red Sea and the Mediterranean. *Bulletin of the Institute of Oceanography and Fisheries* 9: 347–380.
- Tirmizi NM, Serène R (1971) The rediscovery of two species of crabs (Decapoda, Brachyura) with observations on three others from Pakistan. *Crustaceana* 21: 21–32.
- Trivedi JN, Vachhrajani KD (2016) On identity of *Atergatis ocyroe* (Herbst, 1801) (Crustacea: Brachyura: Xanthidae) in Indian waters. *International Journal of Fauna and Biological Studies* 3 (2): 62–64.
- Trivedi JN, Soni GM, Arya S, Vachhrajani KD (2014). First record of *Macrophthalmus laevis* A. Milne Edwards, 1867 (Decapoda: Brachyura: Macrophthalmidae) from India. *Journal of Marine Biological Association of India*. 56 (2): 85–87. <https://doi.org/10.6024/jmbai.2014.56.2.01789-13>
- Trivedi JN, Vachhrajani KD (2012) Distribution and diversity of brachyuran crabs along the coastal region of Junagadh district, Gujarat. *Proceedings of the Biodiversity and Conservation of Coastal and Marine Ecosystems of India* 1: 8–14.
- Trivedi JN, Vachhrajani KD (2013) First record of *Cryptopodia angulata* H. Milne Edwards & Lucas, 1841 from Saurashtra coast, Gujarat, India (Decapoda: Brachyura: Parthenopidae). *Check List* 9 (4): 897–898. <https://doi.org/10.15560/9.4.897>
- Trivedi JN, Trivedi DJ, Vachhrajani KD (2017) Range extension of brachyuran crabs of the family Camptandriidae Stimpson, 1858 (Crustacea: Decapoda: Brachyura) in Indian waters. *Check List* 13 (3): 2145. <https://doi.org/10.15560/13.3.2145>
- Trivedi JN, Soni GM, Vachhrajani KD (2015) First record of brachyuran crab *Heteropanope glabra* Stimpson, 1858 (Crustacea, Decapoda, Pilumnidae) from India. *Marine Biodiversity Records* 8: e112. <https://doi.org/10.1017/S1755267215000883>
- Trivedi JN, Gadhavi MK, Vachhrajani KD (2012) Diversity and habitat preference of brachyuran crabs in Gulf of Kutch, Gujarat, India. *Arthropods* 1 (1):13–23.
- Ward M (1942) Notes on the Crustacea of the Desjardins Museum, Mauritius Institute, with descriptions of new genera and species. *Mauritius Institute Bulletin* 2 (2): 49–108.