

New records of decapod crustaceans from the Arabian Sea, southwest coast of India

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Short communication

Abstract

Deep-sea lobster *Polycheles typhlops* Heller, 1862 and two squat lobsters *Munidopsis scobina* Alcock, 1894 and *Paramunida bineeshi* Macpherson, Chan, Kumar and Rodriguez-Flores, 2020 belonging to the family Polychelidae, Munidopsidae and Munididae respectively forms the new records from the Arabian sea along the southwest coast of India. Samples were obtained from the commercial bottom trawlers at a depth of 200–300 m operated off Sakthikulangara fishing harbour (8°56'60.78" N / 76°32'34.27" E) from the Arabian Sea, Kerala, India, from January to December 2020. DNA barcoding and phylogenetic analysis with mitochondrial gene sequencing were used to explore the genetic distances within the genera *Polycheles*, *Munidopsis* and *Paramunida* revealing high interspecies genetic divergence.

Keywords: Deep-sea lobster, phylogeny, taxonomy, Southwestern India

Introduction

Squat lobsters belong to the Superfamily Galatheoidea under order Decapoda and infra order Anomura. New species of squat lobsters were reported from Indian waters (Thirumilu, 2011; Vaitheeswaran and Venkataramani, 2012; Vaitheeswaran, 2014, 2015, 2017; Komai *et al.*, 2019; Macpherson *et al.*, 2020). The present study reports the occurrence of two squat lobsters and a deep-sea lobster *viz.*, *Munidopsis scobina* Alcock, 1894, *Paramunida bineeshi* Macpherson, Chan, Kumar and Rodriguez-Flores, 2020, *Polycheles typhlops* Heller, 1862 belonging to the genus *Munidopsis* Whiteaves, 1874, *Paramunida* Baba, 1988 and *Polycheles* Heller, 1862, respectively from the Arabian Sea, southwest coast of India.

The galatheid lobster of the genus *Munidopsis* Whiteaves, 1874 is distributed worldwide in all deep-sea habitats and forms one of the most diverse genera (Baba, 2005). Species of the genus *Munidopsis* are found in a variety of habitats, from shallow to deep water throughout the Atlantic, Indian and Pacific Oceans (Ambler, 1980; Baba, 2005; Macpherson and Segonzac, 2005; Macpherson, 2007). They are mostly found living on the continental slope, usually deeper than 500 m, and on the abyssal plain > 2000 m (Chace, 1942; Miyake and Baba, 1970; Pequegnat, 1970, 1971; Baba, 2005). The genus *Paramunida* Baba, 1988 which includes the galatheid squat lobsters commonly found living on the continental shelf and slope between 200 and 500 m, recorded across the Indian and Pacific Oceans (Baba *et al.*, 2008; Macpherson *et al.*, 2010) currently representing 46 species in the genus. They have been reported from the Philippines, Indonesia, New Caledonian (Macpherson, 1993), the western Pacific (Macpherson and Baba, 2009), and north-western Australia (Mccallum *et al.*, 2016).

Deep-sea lobster *Polycheles typhlops* Heller, 1862 under the family Polychelidae are often referred to as deep-sea blind lobsters having strongly reduced eyes. The family consists of 6 genera, but only two genera (*Polycheles* and *Stereomastis*) were reported in India, none having commercial importance. Genus *Polycheles* are distinguished from others by the presence of a V-shaped or slit-like dorsal orbital notch. *Polycheles typhlops* is a mesobathyal species, distributed throughout the Indo-Pacific and along both sides of the Atlantic region (Ahyong and Chan, 2004) at extreme depths, from 450 to 2000 m.

The current report gives detailed information on the occurrence of these three species of deep-sea lobsters from the Arabian Sea, southwestern India with detailed morphological descriptions illustrated with quality photographs.

Material and methods

The specimens were collected from Saktikulangara fishing harbor (8°56'60.78" N/ 76°32'34.27" E) off Kollam, Kerala along the Arabian Sea from the southwest coast of India from January to December 2020 by bottom trawlers with cod-end mesh size in 250-300 m depth. Samples were preserved in 95% ethanol, and the voucher specimen was deposited at Central Marine Fisheries Research Institute (CMFRI), Kochi, India. The carapace length (CL) measurement refers to the dorsal distance between the posterior margins of the orbit to the posterior margin of the carapace. Total genomic DNA was extracted from the pleopods using the DNeasy® Blood and Tissue Kit. The 16S and COI sequences of the mitochondrial region were amplified using universal primers (Palumbi, 1996; Folmer *et al.*, 1994) and PCR-purified products were sequenced by the dideoxy chain termination method (Sanger *et al.*, 1977) using ABI Prism 3770 automated sequencer from Scigenom, India. The phylogenetic tree for the mitochondrial genes 16S and COI was built by the statistical method of maximum likelihood with 1000 bootstrap replicates (Felsenstein, 1993) using MEGA7 software.

Results and discussion

Systematic status

Order : Decapoda Latreille, 1802
 Suborder : Pleocyemata Burkenroad, 1963
 Infraorder : Polychelida Scholtz & Richter, 1995
 Family : Polychelidae Wood-Mason, 1874
 Genus : *Polycheles* Heller, 1862
 Species : *Polycheles typhlops* Heller, 1862 Fig. 1

Material examined

A specimen submitted to Marine Biodiversity Museum at CMFRI (ID: ED.7.2.1.1); Female (Carapace length (CL): 4.1 cm; Carapace width (CW): 3.0 cm; Total length (TL):10.1cm; Weight (W): 11.518 g, India: Kerala, Kollam, Saktikulangara, Arabian Sea, 300 m, Jan 2020 (Fig. 1).

Diagnosis of specimen from off Kerala

The specimen identified shows similar morphological characteristics to the Type specimen (Heller, 1862; Wood-mason, 1874; A. Milne Edwards, 1880; Riggio, 1885; Alcock, 1894; Bouvier, 1905; Kemp & Sewell, 1912; Balss, 1914)

except in the colour pattern where the body is bright orange in colour with whitish abdominal terga. The female specimen is identified with the presence of a chela in the dactyl of P5 (Fig. 1).

Remarks

In India, the family Polychelidae is represented by two species *Polycheles phosphorus* (Alcock, 1894) and *Stereomastis phosphorus* (Alcock, 1894) from the Bay of Bengal. The present study reports a single female specimen of *Polycheles typhlops* Heller, 1862 from Saktikulangara along the southern region of the Arabian Sea.

The gene sequence obtained from the present specimen was deposited in GenBank (Accession Number: MZ569117, MZ569118) and showed a sequence length of 273 bp for the Cytochrome c Oxidase I (COI) gene. The present specimen sequences were compared with the NCBI sequences of the genus *Polycheles* obtained from the GenBank. The level of intraspecies genetic divergence within the Indian material was 0% with COI, while

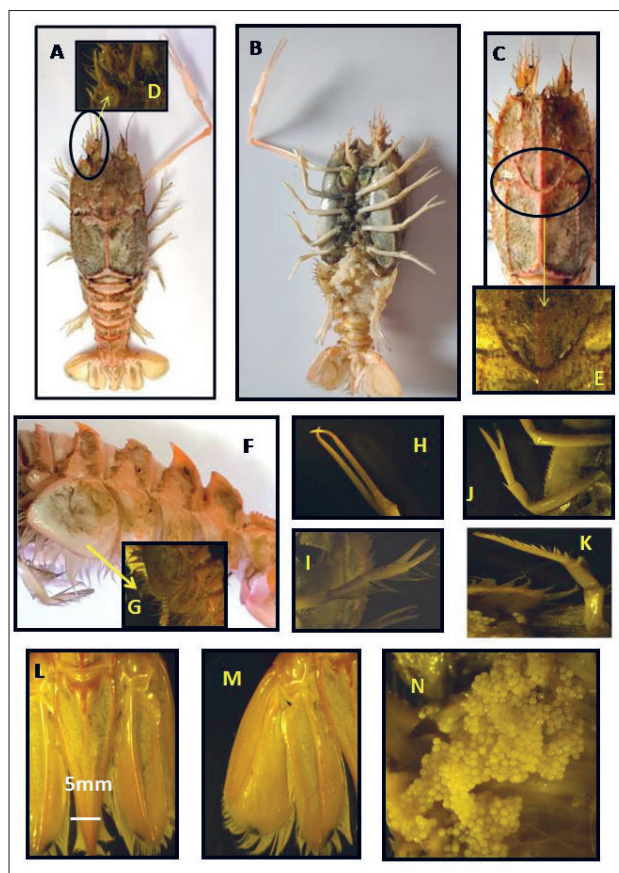


Fig. 1. *Polycheles typhlops* Heller, 1862; A: Female dorsal view; B: Female ventral view; C: Carapace; D: Basal antennular region; E: Spinular carapace; F: Abdominal pleura; G: 2nd abdominal pleura; H: Claw of 1st pereopod; I: Claw of 2nd & 3rd pereopod; J: Claw of 4th pereopod; K: Claw of 5th pereopod; L: Telson; M: Uropod-exopod & exopod; N: Egg

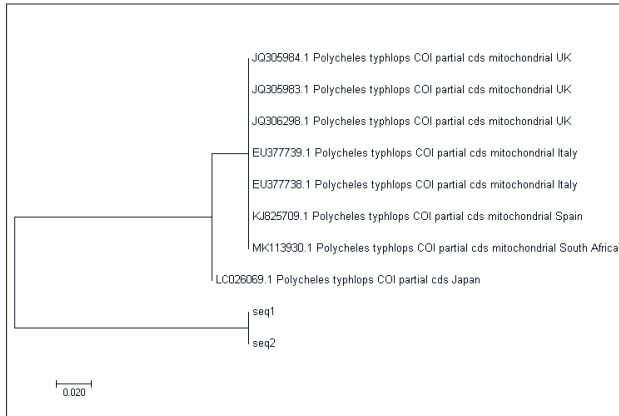


Fig. 2. Phylogenetic tree of the genera *P. typhlops* using Maximum Likelihood with 1000 bootstrap under the best fitting model GTR+G+I inferred from DNA sequences of COI mitochondrial gene.

interspecies genetic divergence varied from 24.1% (Japanese specimen) to 26.4% (UK, Italy & South Africa) between the present specimen and eight accessions of *Polycheles* sequences collected from NCBI as depicted in Fig. 2. COI sequence divergences of less than 3% are generally considered to be intraspecific in decapod crustaceans (Darling, 2011; Vergamini *et al.*, 2011; Yang *et al.*, 2016).

Systematics

Suborder	: Pleocyemata Burkenroad, 1963
Infraorder	: Anomura MacLeay, 1838
Superfamily	: Galatheaidea Samouelle, 1819
Family	: Munidopsidae Ortmann, 1898
Genus	: <i>Munidopsis</i> Whiteaves, 1874

Munidopsis scobina Alcock, 1894 Fig. 3

Munidopsis scobina Alcock, 1894: 330; 1901:254. — Alcock & Anderson 1894, p. 13: fig. 1.—Tirmizi 1966, p. 222: fig. 35; *Munidopsis scobina indica* Rao 1974, pl. 1; *Munidopsis scobina* Baba 1988, p.163: fig. 64 A–F; Baba 2005, p. 295; Thirumilu 2011, p. 21, fig. 1, 2; Vaitheeswaran 2017, p. 408: fig. 2–6.

Material examined

Sakthikulangara (off Kollam 8°56'60.78"N; 76°32'34.27"E) fish landing centre, 4 male specimens (TL: 42–47 mm; CL: 15–19 mm, CW: 14–18 mm, Weight: 1.63–2.87 gm), 1 berried female (TL: 47 mm; CL: 16 mm, CW: 16 mm, Weight: 2.28 gm, Fecundity: 78), 200–300 m depth during December 2020 (Fig 3).

Diagnosis of specimen from off Kerala

The specimen on hand (Fig. 4) agrees closely with the

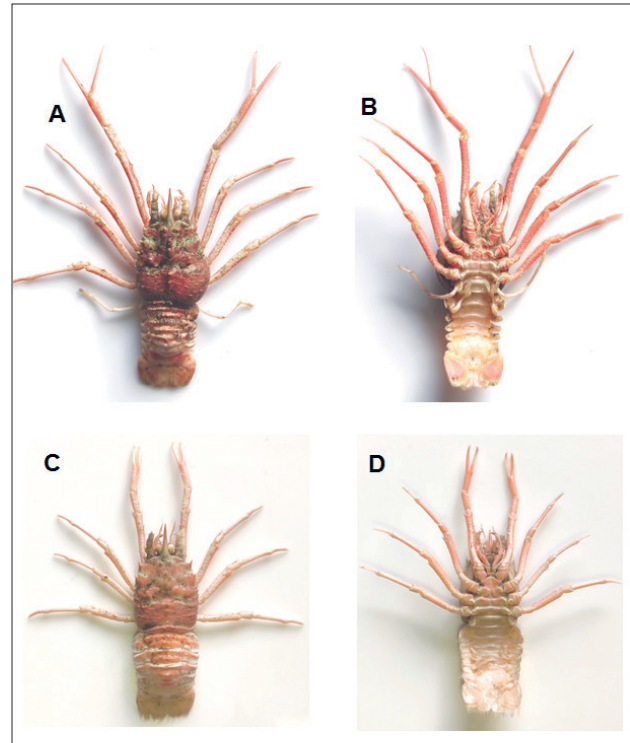


Fig. 3. *Munidopsis scobina* Alcock, 1894; A: Male dorsal view; B: Male ventral view; C: Female dorsal view; D: Female ventral view

morphological descriptions of the Type specimen. Body orange in colour with white horizontal bands on carapace and edges of abdominal segments. Telson is light orange in colour.

Distribution

Munidopsis scobina Alcock, 1894 is widely distributed in the Indo-Pacific from the Andaman Sea, Bay of Bengal, the Moluccas off the west coast of Halmahera and the South Arabian coast, between 353–1046 m, Indonesia, Banda Sea, between 528–582 m, Kei Islands, 443–468 m. In India, the previous records were from the Bay of Bengal at 265–458 m in 1894, from the Andaman Sea at 439 m in 1894, the northern end of the Bay of Bengal at 353–748 m in 1901, from the Chennai coast at 200–400 m in 2011, off Kollam at 180–400 m in 1974 and from Thoothukudi coast, Gulf of Mannar at 305–310 m in 2017.

Remarks

The morphological characteristics of the specimens examined are in agreement with the original description provided by Alcock (1901), Tirmizi (1966) and Baba (1988). The important feature that easily identifies the species is the arrangement of dorsal spines on the carapace and the presence of telson plates. The characteristics of the eye agree with the description of specimens from Thoothukudi, Gulf of Mannar.

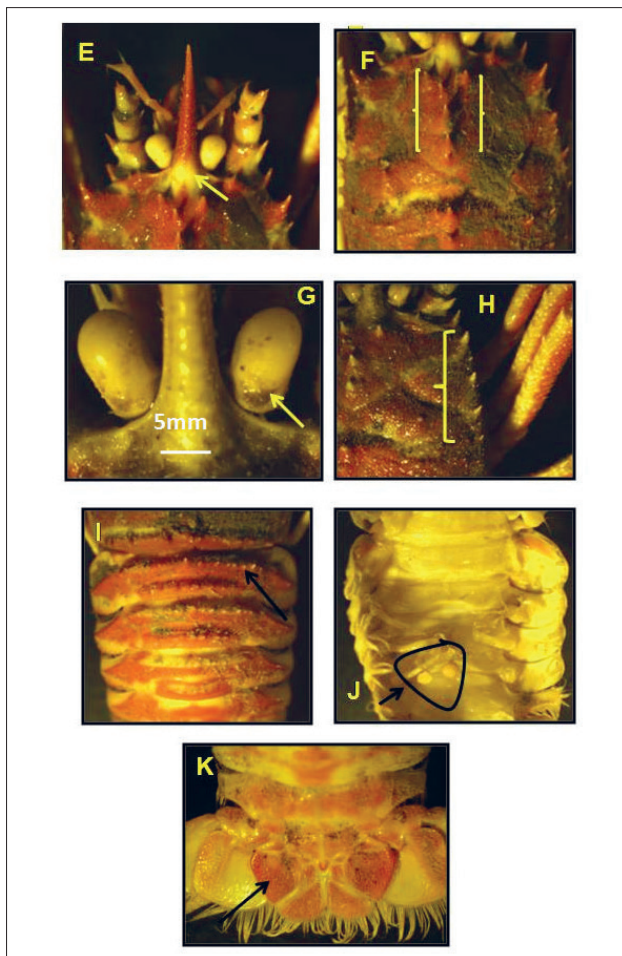


Fig. 4. *Munidopsis scobina* Alcock, 1894; E : Upcurved rostrum; F: Carapace dorsal spines- 2 epigastrics, 1 mesogastric, 1 metagastric, 1 cardiac; G: Eye-small and movable; H: Carapace-6 lateral spines; I: Abdominal spines; J: Berried female; K: Telson with 12 plates

Systematics

Family : Munididae Ahyong, Baba, Macpherson & Poore, 2010
 Genus : *Paramunida* Baba, 1988

Paramunida bineeshi Macpherson, Chan, Kumar & Rodriguez-Flores, 2020 (Fig. 5)

Material examined

Sakthikulangara (off Kollam 8°56'60.78"N; 76°32'34.27"E) fish landing centre, Female specimen (Carapace length (CL): 1.3 cm; Carapace width (CW): 1.1cm; Abdominal length (AL): 1.1 cm; Abdominal width (AW): 1.0 cm; Total length (TL): 3 cm; Weight (W): 0.878g), 250–300 m depth during January 2020 (Fig. 5).

Diagnosis of specimen from off Kerala

The specimen on hand (Fig. 6) agrees closely with the

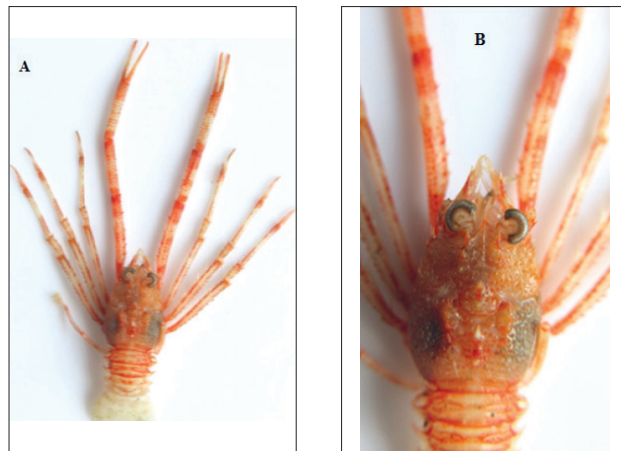


Fig. 5. *Paramunida bineeshi* Macpherson, Chan, Kumar & Rodriguez-Flores, 2020; A: Female dorsal view; B: Carapace

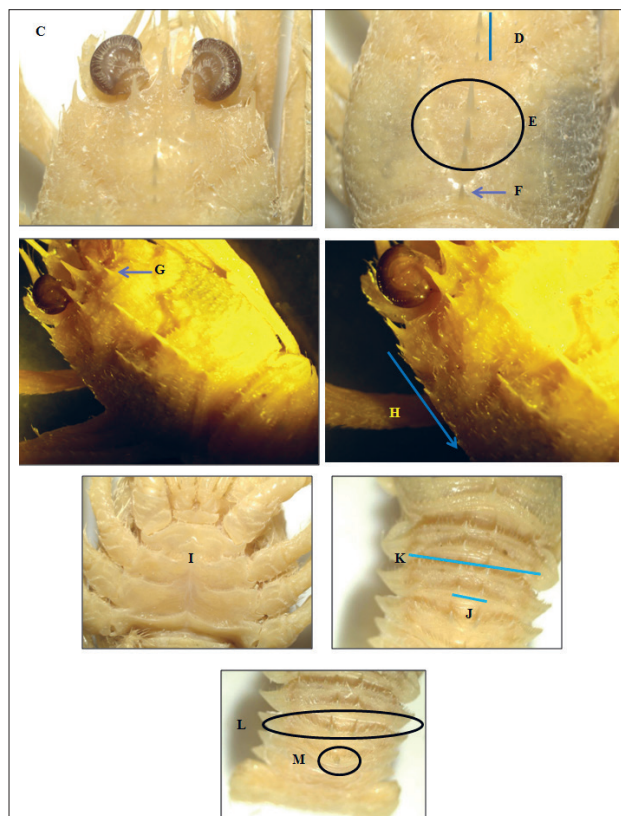


Fig. 6. *Paramunida bineeshi* (Macpherson, Chan, Kumar & Rodriguez-Flores, 2020); C: Eyes; D: Mesogastric spines; E : Cardiac spines; F: Posterior transverse ridge with well-developed median spine; G: Epigastric tooth behind rostral spine; H: Lateral margin with small spines; I: Thoracic sternum; K: Tergite 3 with 4 median spines; J: Tergite 3 with posterior ridge with 2 median spines; L: tergum 4 with 4-6 median spines on the anterior ridge; M: Tergum 4 with single median spine on the posterior ridge.

morphological descriptions of the Type specimen. *Paramunida bineeshi* appears to have a combination of red and white colour, particularly in the carapace, abdomen, and appendages, while the telson appears white.

Distribution

Paramunida bineeshi was reported only from the Type locality in the Andaman Sea—Depth: 320 m. The present study reports the species from the Arabian Sea.

Remarks

Paramunida bineeshi Macpherson, Chan, Kumar and Rodriguez-Flores, 2020 is observed to have very close similarity to *P. mozambica* and *P. marionis* from the southwestern Indian Ocean, while molecular analysis revealed less interspecies distance with the earlier. The present study reports a single female specimen of *P. bineeshi* from the southwest coast of India.

Mitochondrial gene sequencing

The acquired gene sequences of *Paramunida bineeshi* (Accession Number: OK483681, OK483682) and *Munidopsis scobina* (Accession Number: MW709458, MW709459) were deposited in GenBank showed a sequence length of 480 bp for 16S ribosomal RNA. The NCBI sequences of the genus *Paramunida* and *Munidopsis* retrieved from the GenBank were compared with the sequences of present specimens. The level of intraspecies genetic divergence within the specimens of

Paramunida bineeshi with the holotype from Indian waters was 0%, while interspecies genetic divergence varied from 1.6% (*P. mozambica*) to 9.1% (*P. proxima*) between the Indian specimens and 20 species (21 sequences) of *Paramunida* as shown in the phylogenetic tree. Similarly, in *M. scobina* the level of intraspecies genetic divergence within the Indian material was 0%, while interspecies genetic divergence varied from 1.7% (*M. cylindrophthalma*) to 13.2% (*M. dispar*) between the present specimen and five species (eight sequences) of *Munidopsis*. A sequence of deep-sea shrimp, *Aristeus alcocki* was used as an outgroup for constructing the phylogenetic tree (Fig. 7).

Conclusion

In this study, we report the new records of three crustacean species consisting of one deep-sea lobster, *Polycheles typhlops* Heller, 1862 belonging to the family Polychelidae and two squat lobsters *Munidopsis scobina* Alcock, 1894 and *Paramunida bineeshi* Macpherson, Chan, Kumar and Rodriguez-Flores, 2020 belonging to the family, Munidopsidae and Munididae from the Arabian sea.

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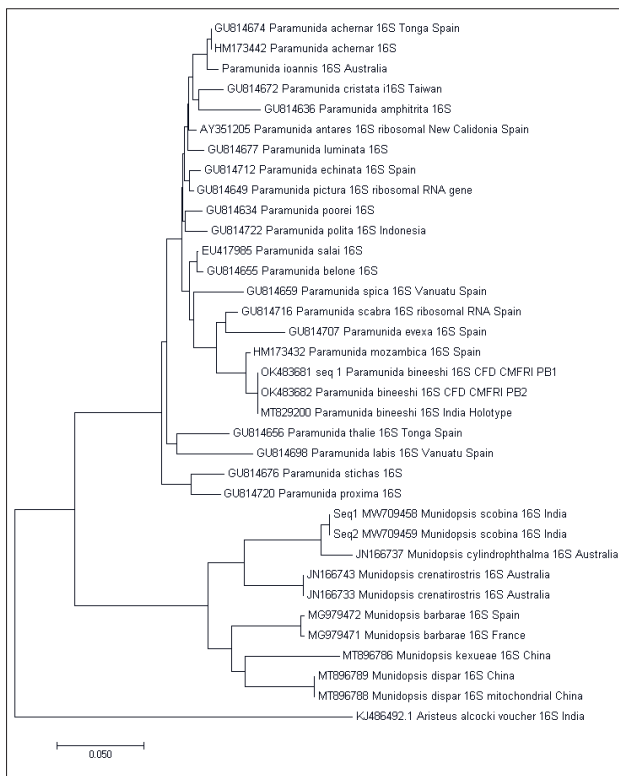


Fig. 7. Phylogenetic tree of the genera *Paramunida* and *Munidopsis* using Maximum Likelihood with 1000 bootstrap under the best fitting model GTR+G+I inferred from DNA sequences of 16S mitochondrial gene.

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