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Original Article

Description of a new species of soil-dwelling termites (Blattodea: Termitidae: Mirocapritermitinae) from the Indian subcontinent

Rituparna Sengupta [1,2] | Balmohan Baraik [1] | Keloth Rajmohana [1] | Rupam Debnath [1,2] | K.P. Dinesh [3] | Ipe Chinnu [4]

1 Zoological Survey of India, M-Block, New Alipore, Kolkata, West Bengal 700053, India; bbaraik.zsi@gmail.com
2 Department of Zoology, University of Calcutta, Kolkata, West Bengal 700019, India; rituparnasengupta1234@gmail.com; rupam.zoology@gmail.com
3 Zoological Survey of India, Western Regional Centre, Pune, Maharashtra 411044, India; kpdinesh.zsi2@gmail.com
4 Department of Zoology, Church Missionary Society College, Kerala 686001, India. Email: chinnurupen@gmail.com

Corresponding author: Keloth Rajmohana | ✉ mohana.skumar@gmail.com

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ABSTRACT. The present study reports a new species, *Pseudocapritermes novus* Rituparna, Baraik & Rajmohana **sp. nov.** from West Bengal, India. Species description followed an integrative taxonomic approach by including a mitochondrial 16S rRNA genetic sequence with comprehensive morphological characteristics of the soldier caste. Additionally, the first mt 16S rRNA gene sequence for the recently identified *Pseudocapritermes kunjepu* Mathew, 2020, is presented in the study. Digital photos of the new species are also included, along with an identification key to the soldier castes of all species of the genus reported from the Indian sub-continent. Association of *Pericapritermes semarangi* (Holmgren, 1913) with the new species is also recorded in the study.

KEYWORDS: Inquiline, mitochondrial 16S rRNA, molecular phylogeny, *Pericapritermes, Pseudocapritermes*

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INTRODUCTION

India, with its vast ecological diversity, is home to a rich assemblage of termites, encompassing 323 described species (Amina & Rajmohana 2025; Baraik et al. 2025) across various feeding and nesting types. These include representatives from both lower and higher termites, adapted to a wide range of environments from dense rainforests to dry deciduous forests and arid zones. West Bengal, located in eastern India, comprises a mosaic of ecological zones; the termite fauna of this state remains comparatively less explored. Prior studies have reported only 26 genera and 74 species of termites in total from the region, with 17 genera and 55 species belonging to the family Termitidae (Krishna et al. 2013; Baraik et al. 2025; Sengupta et al. 2025; Basak et al. 2026).

The Termitidae family, referred to as "higher termites", is the largest and most diverse termite family with 238 genera, 2072 living species, and 8 subfamilies (Krishna et al. 2013). In fact, they make up almost 70% of all termite species that are known to exist in India and around the world (Krishna et al. 2013; Rajmohana et al. 2019). Within this family, the soil and soil-wood interface feeding members belong to the subfamily *Mirocapritermitinae* Kemner, 1934. In fact, owing to their soil-humus feeding habit, species of the genus *Pseudocapritermes* are regarded as ecological indicators of soil quality and fertility and therefore, of considerable ecological significance (Amina & Rajmohana 2016).

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Subfamily *Mirocapritermitinae* Kemner, 1934 comprises the '*Pericapritermes*' Group with the characteristic snapping mandible, earlier assigned under subfamily Termitinae Latreille, 1802. The subfamily Mirocapritermitinae Kemner, 1934 is distinguished from the earlier subfamily Termitinae Latreille, 1802 by the absence of Malpighian nodules in the worker gut and the absence of a frontal projection on the soldier head (except in the genus *Mirocapritermes*) (Hellemans et al. 2024). It is further characterized by the presence of a second marginal tooth on the right mandible and a concave posterior margin. Out of 14 genera, currently assigned under subfamily Mirocapritermitinae Kemner, the genus *Pseudocapritermes* Kemner 1934 is characterized by monomorphic soldiers with sub-rectangular heads and asymmetrical mandibles- the left mandible is twisted and ends in a beak-like tip, and the right is blade-like with a pointed tip (Chhotani 1997; Hellemans et al. 2024). They exhibit a unique flipping behaviour with a loud click sound, possibly serving as a defence or alarm mechanism (Krishna et al. 2013).

The present study describes a new species of *Pseudocapritermes* Kemner, based on detailed morphological characters and supported by molecular data through mitochondrial (mt) 16S rRNA gene sequencing. Additionally, the recently described *Pseudocapritermes kunjepu* Mathew, 2020, is sequenced for its mt 16S rRNA gene for the first time in this study. In fact, the inclusion of molecular data in taxonomic descriptions has been increasingly recommended by researchers to resolve complex species delimitations (Schyra et al. 2019; Korb et al. 2019; Kalleshwaraswamy 2023). A key to the species of the soldier caste of genus *Pseudocapritermes* Kemner from the Indian subcontinent is also appended. High-resolution digital images illustrate the diagnostic characters of the newly described species.

MATERIAL AND METHODS

The specimens examined in the present study were collected in the year 2018 during a faunal exploration survey of Chapramari Wildlife Sanctuary, Jalpaiguri district, in Northern Bengal by the Zoological Survey of India. The termites were preserved in 100% ethanol. All specimens studied have been deposited in the collections of the Zoological Survey of India, Kolkata. The specimens were identified using a Leica® EZ4 microscope with a magnification range between 8–35×. Morphological characters and indices used for identification and species description followed Chhotani (1997) and Roonwal and Chhotani (1989). Termite classification follows Hellemans et al. (2024). A Leica® 205-A stereomicroscope with DFC 500 camera was used for taking images. Images were processed with extended focus software, LAS Version 3.8.

Genomic DNA was extracted from the amputated legs of six soldier termite specimens belonging to the proposed new species, as well as from a voucher specimen of *Pseudocapritermes kunjepu* Mathew 2020, using the DNeasy Blood and Tissue Kit (QIAGEN, Inc.) following the manufacturer's protocol. Amplification of the mitochondrial 16S rRNA gene was carried out using the forward primer 16Sar (5'-CGCCTGTTTATCAAAAACAT-3') and reverse primer 16Sbr (5'-CCGGTCTGAACTCAGATCACGT-3') as described by Palumbi (1996). PCRs were performed in a total reaction volume of 25 µL, containing 12.5 µL of 2× Hot Start Master Mix (Promega), 10 µM of each forward and reverse primer, 30–40 ng of template DNA, and nuclease-free water added to make up the final volume (Debnath et al. 2024). The thermal cycling profile included an initial denaturation at 98°C for 1 min; followed by 40 cycles of denaturation at 98°C for 5 sec, annealing at 48°C for 40 sec, and extension at 72°C for 15 sec; with a final extension step at 72°C for 2 min and a hold at 4°C. Successful amplification was confirmed via agarose gel electrophoresis. Positive PCR products were purified and sequenced bidirectionally using an ABI 377 sequencer (Applied Biosystems). Chromatograms were manually inspected for quality, and finalized sequences were submitted to the National Center for Biotechnology Information (NCBI) GenBank. A BLAST (Basic Local Alignment Search Tool) search was performed on 6 June 2025 to assess sequence similarity against publicly available records in NCBI.

For the phylogenetic analysis of *Pseudocapritermes* Kemner, the available mt 16S rRNA sequence was retrieved from GenBank on 6th June 2025 and aligned with the newly generated sequences from this study using MEGA X (Kumar et al. 2018) (Table 2). Pairwise genetic distances were calculated using the Kimura 2-Parameter (K2P) model in MEGA X. Bayesian phylogenetic analysis was performed in

MrBayes v3.2 (Ronquist & Huelsenbeck 2003) using two independent Markov Chain Monte Carlo (MCMC) runs, each with four chains, run for 500,000 generations with trees sampled every 1,000 generations and a burn-in of 25%. Maximum Likelihood (ML) analysis was performed using IQ-TREE v2.3.6 (Minh et al. 2020). The TN+F model was selected as the best-fit model based on the Bayesian Information Criterion (BIC), and branch support was assessed with 1,000 ultrafast bootstrap replicates. *Nasutitermes indicola* (Holmgren & Holmgren, 1917) was used as the out-group, following Hellemans et al. (2024).

RESULTS

Class Insecta Linnaeus, 1758

Order Blattodea Wattenwyl Brunner Von, 1882

Family Termitidae Latreille, 1802

Subfamily Mirocapritermitinae Kemner, 1934

Genus *Pseudocapritermes* Kemner, 1934

Type species. *Pseudocapritermes silvaticus* Kemner, 1934

Pseudocapritermes novus Rituparna, Baraik & Rajmohana sp. nov.

https://zoobank.org/urn:lsid:zoobank.org:act:63CFC84F-67B2-49D2-A259-8C873C921D3B

[Fig. 1A–G, Table 1]

Material examined. **Holotype**: Soldier (ZSI/ 5371/H11), India: West Bengal: Jalpaiguri: Chapramari Wildlife Sanctuary (26°53'58"N, 88°50'28"E, 217.2 m asl), 31-X-2018, Coll. B. Baraik, extracted from: Soil under Sal log. **Paratypes**: 2 Soldiers (ZSI/ 5371/H11), with the same data as the holotype.

Etymology. The specific epithet '*novus*' in Latin means 'new'.

Diagnosis. **Soldier** (Fig. 1A). Head capsule yellow**,** anteriorly darker and posteriorly paler**;** fontanelle gland and antennae pale yellow; labrum translucent with yellowish white tinge; thorax and legs yellowish white; abdomen whitish yellow; head sparsely hairy; body moderately hairy with several short and long hairs. In the key to genus *Pseudocapritermes* from the Indian sub-region by Ipe et al. (2020), the proposed new species is keyed to couplet no. 4, close to *Pseudocapritermes bhutanensis* Roonwal & Chhotani, 1977. In fact, the head length and width of *P. bhutanensis* overlap with the range of the proposed new species, and the sides of the head are slightly convex for both. But these two species differ in the following characters: the left mandible is weakly bent with a prominently incurved beak in the case of *P. bhutanensis,* while the same is strongly bent with a weakly incurved beak in the case of *P. novus* **sp. nov**. The swollen portion below the beak of the left mandible has a sub-straight inner margin in *P. bhutanensis,* but it is more rounded in *P. novus* **sp. nov**. In fact, the postmentum of *P. bhutanensis* is shorter and wider (length: 0.83 mm; maximum width: 0.43 mm) than *P. novus* **sp. nov.** (length: 1.00–1.20 mm; maximum width: 0.30–0.35 mm). Moreover, the dorsal spurs of the fore tibia of *P. bhutanensis* are weak, while they are strong and prominent in the case of *P. novus* **sp. nov**. On the other hand, *P. tikadari* Roonwal & Chhotani, 1962 keyed in the same couplet and closely related within the genus from India, differs from the proposed new species in having a narrower head and a wider postmentum (head width: 1.17–1.36 mm; maximum postmentum width: 0.37–0.40 mm) compared to *P. novus* (head width: 1.40–1.45 mm; maximum postmentum width: 0.30–0.35 mm).

Description. — **Soldier** (Fig. 1). Head capsule sub-rectangular, sides sub-parallel in dorsal view (Fig. 1D); frons distinctly inclined in front at an angle. Frontal projection weak; epicranial suture distinct, extended little more than half of head length to base of mandibles from posterior margin; fontanelle small, circular, situated at base of frontal projection/inclination; antennae 14 segmented, segment 2 shorter than 3, 2 shortest (Fig. 1G); labrum asymmetrical, anterolateral corners extended into long processes with pointed tip; anterior margin slightly incurved (Fig. 1F); mandibles shorter than head length to base of mandibles, left mandible twisted and strongly incurved in basal half, tip broadly pointed

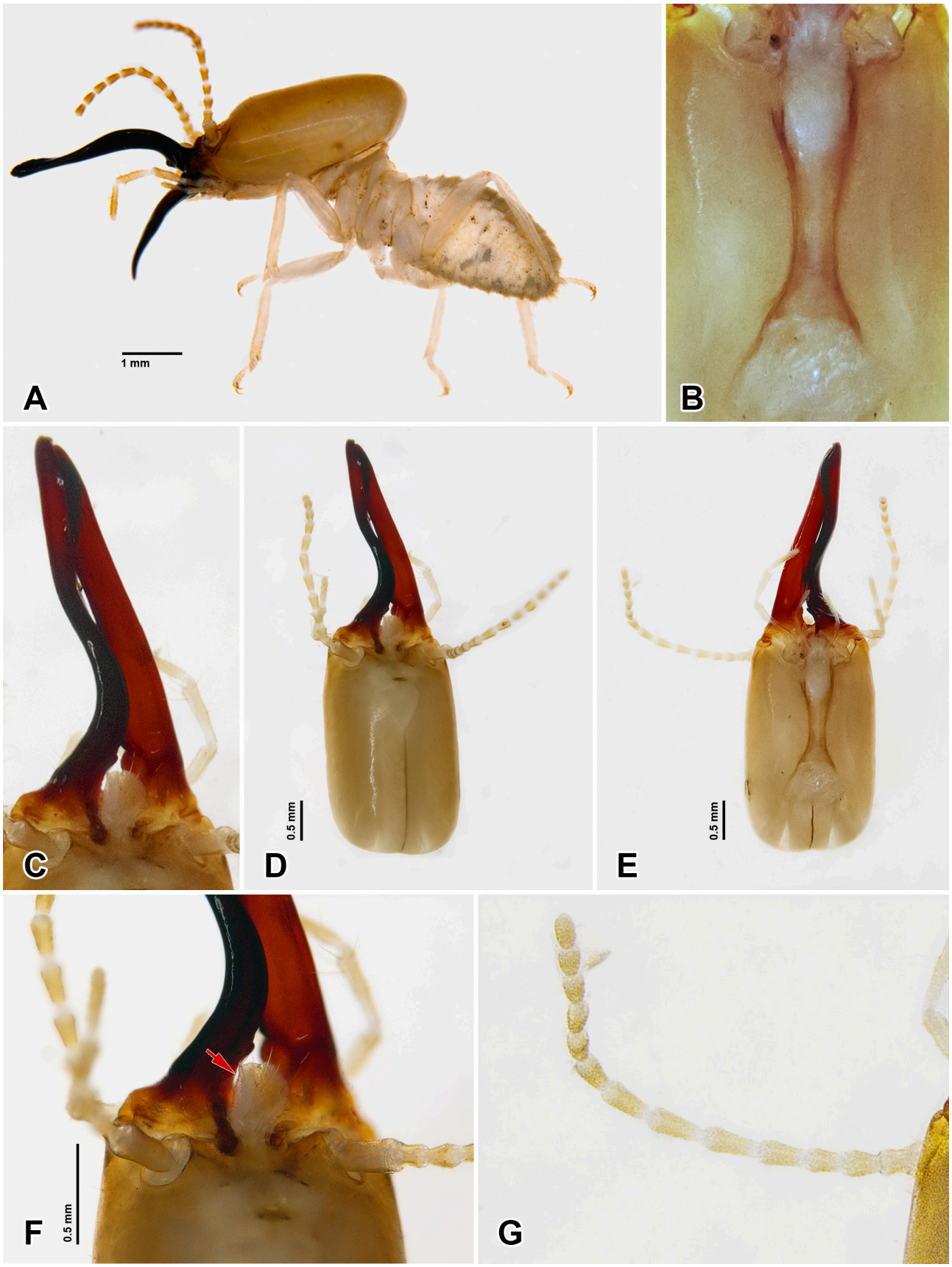

Figure 1. *Pseudocapritermes novus* Rituparna, Baraik & Rajmohana **sp. nov.**, Soldier: **A.** General habitus, lateral view; **B.** Postmentum; **C.** Mandibles; **D.** Head capsule, dorsal view; **E.** Head capsule, ventral view; **F.** Labrum marked with an arrow (the extended process of the anterolateral corner of the labrum is broken on the right side); **G.** Antennae.

Table 1. Measurements for the different attributes of soldier castes (in mm).

Attributes	*P. novus* Rituparna, Baraik & Rajmohana **sp. nov.** (Holotype)	*P. novus* Rituparna, Baraik & Rajmohana **sp. nov.** (Paratypes)
Head length	2.30	2.20–2.30
Head width	1.40	1.40–1.45
Head thickness (less)	1.10	1.00–1.10
Left mandible length	2.10	2.00–2.10
Right mandible length	2.25	1.70–2.25
Left mandibular tooth distance	1.80	1.80–1.85
Postmentum length	1.00	1.00–1.20
Postmentum width	0.35	0.30–0.35
Postmentum waist	0.20	0.20
Pronotum length	0.35	0.25–0.35
Pronotum width	0.80	0.75–0.80
Hind tibia length	1.35	1.25–1.35
Mandible length/Head length index	0.91	0.88–0.91
Head width/Head length index	0.60	0.60–0.63

Table 2. The mt 16S rRNA sequences used for the phylogenetic analysis of the species of *Pseudocapritermes*.

Sl. no.	Species	Country	Accession no.
1	*P. novus* Rituparna, Baraik & Rajmohana **sp. n.**	India	PV915725
2	*P. kunjepu* Mathew, 2020	India	PZ022838
3	*P. sinensis* Ping & Xu, 1986	China	KX129976
4	*Nasutitermes indicola* (Holmgren & Holmgren, 1917)	India	KU574660

into a short bent beak slightly incurved, inner margin of left mandible below beak strongly swollen, right mandible blade like, apical part processed into long incurved blunt tip, inner margin of mandible sub-straight (Fig. 1C); In ventral view (Fig. 1E), postmentum elongated, club-shaped (Fig. 1B), waist little below line connecting maximum width and posterior margin; pronotum saddle-shaped, anterior and posterior margin weakly emarginated; apical tibial spur 3:2:2; tarsi 4 jointed.

Worker. Not collected in the present study.

Remarks. The specimens were collected in mixed condition with the specimens of *Pericapritermes semarangi* (Holmgren, 1913) from the same habitat. In Table 1, measurements of the holotype are at the upper or lower end of the paratype ranges, which is a case of typical variability, also observed for other species of termites (Ipe et al. 2020; Amina & Rajmohana 2025).

DISCUSSION

Pseudocapritermes Kemner (Type III soil-feeders) is a relatively species-poor genus, currently represented by 19 species worldwide, and is characterized by limited dispersal ability, with distribution largely confined to the Oriental region (Krishna et al. 2013). In fact, that is why each biogeographical region has its own indigenous soil feeding clades (Jones & Eggleton 2011). However, earlier studies could record only four species of this genus from India (Krishna et al. 2013; Ipe et al. 2020). Except for *P. tikadari* Roonwal & Chhotani, 1962, which shares its distribution with Bhutan, all three species are endemic to the country. The current study has augmented the record of the genus from India to five species altogether. The association of the new species with another species of the same subfamily, *Pericapritermes semarangi* (Holmgren, 1913), may indicate a potential inquiline habit of the species (Mathews 1977). Though no interaction between the two species could be observed. In fact, in India, a maximum of four species of inquiline termites were recorded to be associated at a time, belonging to different families (Verma 1986; Sengupta et al. 2019).

The NCBI BLAST search revealed that the mt 16S rRNA sequence of *P. novus* **sp. nov.** (GenBank accession no. PV915725) shared 90.8% similarity with an unidentified specimen of termitinae (GenBank accession no. KJ934410) from Malaysia. The genetic distance between species for mt 16S rRNA ranged

from 5.3% (*P. novus* **sp. nov.** and *P. kunjepu*) to 11.1% (*P. novus* **sp. nov.** and *P. sinensis*) (Table 3). Both Bayesian inference (BI) and ML phylogenies revealed similar topology. The proposed new species is sister to *P. kunjepu* with strong BI probability and bootstrap support (Fig. 2). However, *P. novus* **sp. nov.** can be readily distinguished from *P. kunjepu* using the diagnostic characters outlined in the taxonomic key provided below. The limited availability of nucleotide sequences for *Pseudocapritermes* species in public databases highlights the need for additional voucher-based molecular studies. Expanding sequence data across reliably identified specimens will enable a more comprehensive understanding of genetic divergence and phylogenetic relationships within the genus.

Key to the species of soldier caste of genus *Pseudocapritermes* from the Indian subcontinent

[modified from Ipe et al. 2020]

1 Left mandible strongly twisted and length much shorter than head. **2**

– Left mandible weakly twisted and length slightly shorter than or subequal to head. **3**

2 Smaller head capsule; (head-length to base of mandibles 1.11–1.32, max. width of head 0.76–0.84 mm), head mandibular index 0.73–0.83. ..... ***Pseudocapritermes kunjepu* Mathew, 2020**

– Larger head capsule; (head-length to base of mandibles 1.40–1.80, max. width of head 0.90–1.03 mm, head mandibular index 0.75–0.79. ..... ***Pseudocapritermes fletcheri* (Holmgren & Holmgren, 1917)**

3 Head capsule long and slender. Mandibles shorter, left mandible incurved in basal half. **4**

– Head capsule smaller and wider. Mandibles longer, left mandible moderately incurved in basal half. .... ***Pseudocapritermes karticki* Bose, 1997**

4 Head sides slightly convex, left mandible weakly bent with a prominently incurved beak. .... ***Pseudocapritermes bhutanensis* Roonwal & Chhhotani, 1977**

– Head sides subparallel, left mandible twisted with a weakly incurved beak. **5**

5 Head narrower, width 1.17–1.36 mm, head mandibular index 0.82–0.87. .... ***Pseudocapritermes tikadari* Roonwal & Chhhotani, 1962**

– Head wider, width 1.40–1.45 mm; width/length 0.60–0.63; left mandible-length/head-length 0.88–0.91. .....***Pseudocapritermes novus* Rituparna, Baraik & Rajmohana sp. nov.**

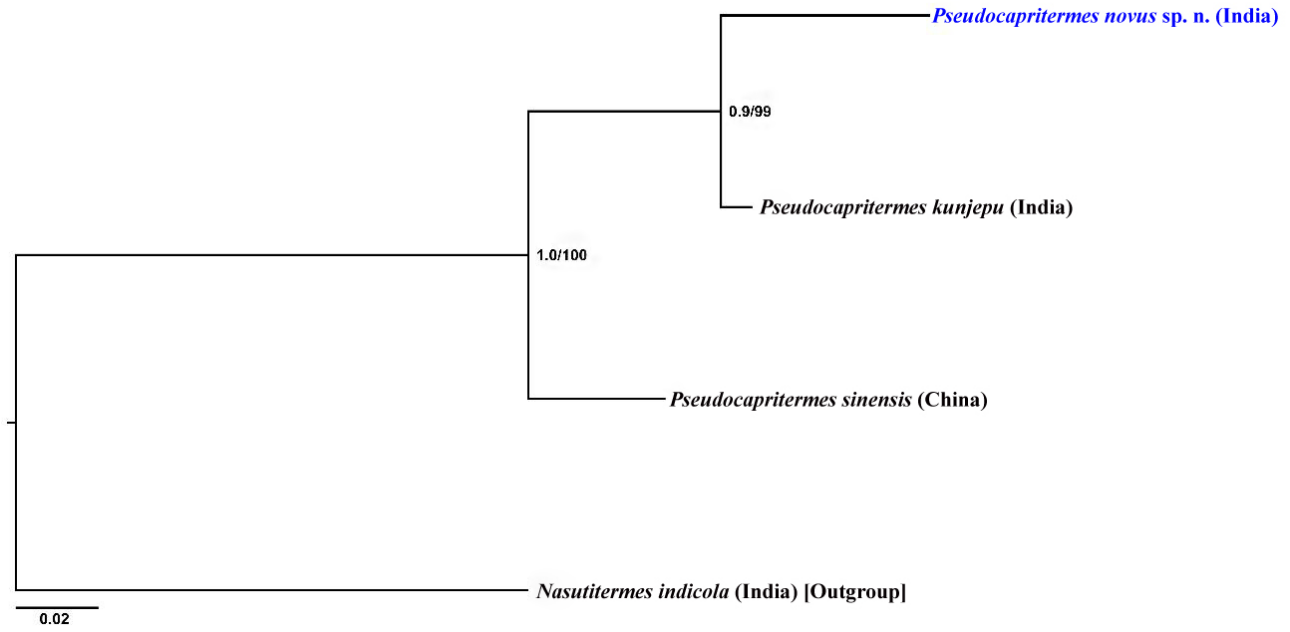

Figure 2. Molecular phylogenetic tree for the species of *Pseudocapritermes* Kemner based on the mt 16S rRNA. Node values represent BI with posterior probability/ bootstrap support.

Table 3. Pairwise K2P genetic distance based on the mt 16S rRNA partial gene.

Species	*P. novus* **sp. n.**	*P. kunjepu*	*P. sinensis*
P. novus Rituparna, Baraik & Rajmohana **sp. n.**	0.0		
P. kunjepu Mathew, 2020	5.3	0.0	
P. sinensis Ping & Xu, 1986	11.1	7.3	0.0

This study recommends additional faunistic studies to uncover the hidden biodiversity of India, particularly in the region of West Bengal, which has varied physiographic and climatic conditions. The effort of integrative taxonomy in the study will unveil any taxonomic complexity within the taxa. Among the five extant species of *Pseudocapritermes,* the Indian subcontinent, only two species are represented on the tree (Fig. 2); a larger data set with multigene studies is recommended.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: R. Sengupta: Investigation, methodology, formal analysis, visuzlization, software, writing original draft, writing, review and editing; B. Baraik: Investigation, methodology, writing original draft, writing, review and editing; K. Rajmohana: Supervision, project administration, investigation, validation, writing original draft, writing, review and editing; R. Debnath: Software, visualization, investigation, methodology, writing original draft, writing, review and editing; K.P. Dinesh: Methodology, investigation, writing original draft, writing, review and editing; I. Chinnu: Methodology, writing, review, and editing. All authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the Zoological Survey of India, Kolkata, and are available from the curator upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

GENERATIVE AI STATEMENT

No AI tools were used in the preparation of the manuscript.

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توصیف یک گونه جدید از موریانه‌های خاک‌زی (Blattodea: Termitidae: Mirocapritermitinae) از شبه قارهٔ هند

ریتوپارنا سنگوپتا [۱،۲]، بالموهان بارایک [۱]، کلوث راج‌مُحنی [۱]، روپام دبنات [۱،۲]، ک.پ. دینش [۳]، ایپه چینو [۴]

۱ موسسه مطالعات جانورشناسی هند، نیو الیپور، کلکته، بنگال غربی، هند.
۲ گروه جانورشناسی، دانشگاه کلکته، کلکته، بنگال غربی، هند
۳ موسسه مطالعات جانورشناسی هند، مرکز منطقه‌ای غربی، پونه، مهاراشترا، هند
۴ گروه جانورشناسی، کالج جامعه مبلغان کلیسا، کرالا، هند

نویسندهٔ مسئول: کلوث راجموهنا | mohana.skumar@gmail.com

ویراستار علمی
زهره میرزایی

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چکیـده: این مطالعه، گزارش یک گونه موریانهٔ جدید به نام *Pseudocapritermes novus* Rituparna, Baraik & Rajmohana **sp. nov.** از بنگال غربی، هند است. توصیف گونه با رویکردی تلفیقی انجام شده است که شامل توالی ژنوم میتوکندریایی 16S rRNA همراه با ویژگی‌های ریخت‌شناسی جامع از طبقهٔ سرباز می‌باشد. علاوه بر این، اولین توالی ژن mt 16S rRNA برای *Pseudocapritermes kunjepu* Mathew, 2020 که اخیراً شناسایی شده، نیز در این مطالعه ارایه شد. تصاویر دیجیتال از گونه جدید همراه با یک کلید شناسایی برای طبقات سرباز تمام گونه‌های گزارش شده این جنس در شبه قارهٔ هند ارایه شد. ارتباط موریانهٔ *Pericapritermes semarangi* (Holmgren, 1913) با گونه جدید نیز در این مطالعه ثبت شد.

واژگـان کلیدی: مهمان، آرای ریبوزومی میتوکندریایی، فیلوژنی مولکولی، *Pericapritermes*، *Pseudocapritermes*