



RESEARCH ARTICLE - TERMITES

A Redescription of *Pericapritermes ceylonicus* (Holmgren, 1911) (Blattodea, Isoptera, Termitidae) and First Record from India

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Abstract

Until now, the occurrence of *Pericapritermes ceylonicus* (Holmgren) was not confirmed in the Indian mainland. Here, we document the occurrence of this species from Karnataka state constituting its first report from India. The species was identified based on the soldier caste, and the worker characters were described for the first time, including the digestive tube and enteric valve armature. The enteric valve was characterized by the presence of gradually reducing triangular spines. The study provides the basis for further taxonomic characterization of *Pericapritermes* occurring in India using gut morphology of workers.

Introduction

The genus *Pericapritermes* Silvestri 1914 was erected from *Capritermes* Wasmann 1897 based on *Pericapritermes urgens* Silvestri. It is reported to occur in the Oriental, Ethiopian, Papuan and Palearctic regions (Bourguignon et al., 2008). Presently, the genus contains 40 species, of which five species occur on the Indian mainland (Krishna et al., 2013). *Pericapritermes ceylonicus* (Holmgren, 1911) was described based on samples collected from Peradeniya, Sri Lanka. However, the occurrence of this species has long been considered doubtful on the Indian mainland. Earlier records by Maiti (1983) from West Bengal and Bose (1984) from Southern India were re-identified as *P. assamensis* (Mathur & Thapa) and *P. topslipensis* Thakur, respectively (Chhotani, 1997), indicating absence of this species in India. As part of current studies conducted on the termites of Southern India, we

provide details of occurrences of *P. ceylonicus* in southern India based on the soldier caste including the worker gut morphology consisting of digestive tube and enteric valve armature.

Material and Methods

Samples were collected as part of surveys undertaken in Southern India during 2019–2020 from two colonies located underneath small boulders. The specimens were collected from two different locations of Karnataka (i) Nagamangala (Mandya district), 12°51'N 76°36'E, 900m (ii) Thalakaveri (Kodagu district) 12°23'N 75°29'E, 1248m. The specimens collected were preserved in 80% ethyl alcohol. The samples were deposited in the Department of Entomology, College of Agriculture, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences (KSNUAHS), Navile, Shivamogga, Karnataka, India. Measurements were



recorded under a stereo-zoom microscope (ZEISS Stemi508) at magnifications between 10–50X. Images of the specimens from UAHS were prepared using a Leica M205C microscope attached to a Leica DFC450 camera. Images of the American Museum of Natural History (AMNH) metatype soldier were prepared using a Nikon© SMZ18 stereo microscope, and multiple layers were stalked with a NIS-Elements© images software. Morphological terminologies and indices of soldiers follow Roonwal and Chhotani (1989) and Chhotani (1997) and workers follow Eggleton (2010). Mandibles of the workers were slide mounted in Canada balsam. Gut morphology of workers was studied by extracting the digestive system with tweezers and insect pins. The enteric valve, gizzard, and hindgut were separately dissected and slide-mounted using glycerine. Photographs of the gut anatomy were recorded with the help of camera lucida.

Indices used in the taxonomic description of soldiers were as follows, the respective numbers in Roonwal and Chhotani (1989) are indicated in parentheses:

1. Head index (1): Maximum head width/head length to the lateral base of mandible;
2. Fontanelle head index (9): Occipito-fontanelle distance/head length to the lateral base of mandibles;
3. Mandible head length index (13): Left mandible length/head length to the lateral base of mandibles;
4. Postmentum contraction index (19): Width at waist/maximum width.

Results and Discussion

Pericapritermes ceylonicus (Holmgren, 1911)

Capritermes ceylonicus Holmgren, 1911 in: Escherich's Termitenleben auf Ceylon: 204-205

Eutermes perparvus Holmgren, 1911 in: Escherich's Termitenleben auf Ceylon: 201

Capritermes distinctus Holmgren, 1913: 246 in: Kungliga Svenska Vetenskaps-Akademiens Handlingar 50(2): 1-276.

Pericapritermes perparvus (Holmgren, 1911) 1997 in: Fauna of India (Isoptera): 332-335

Materials examined

1. INDIA: Karnataka: Nagamangala, 12°51'N 76°36'E, 900m, 13.x.2019, Ranjith, M., ex. Underneath boulders (1 Soldier, 6 Workers) (UAHS), 2. INDIA: Karnataka: Kodagu, Thalakaveri, 12°23'N 75°29'E, 1248m, 12.x.2020. Ranjith, M., ex. Underneath boulders (2 Soldiers, 10 Workers) (UAHS); 3. Metatype: AMNH_IZC 00321215 SRI LANKA: Ceylon, Haputale or Ambalangoda, Coll. H.V. Buttell-Repeen (1 Soldier, 2 Workers) (AMNH, by photographs).

Redescription

Soldier (Table 1, Figs 1, 2)

Head capsule rectangular, pale yellow, anterior region dark yellow brown with scattered hairs, sides sub-straight and

twice as long as wide (head length to the base of mandible 2.00–2.18 mm; maximum head width 1.06–1.25 mm). The Y-shaped suture is prominent extending beyond anterior half. Antennae yellowish-brown, 14 antennal articles, fourth segment shorter, segment two and three subequal. Mandibles asymmetrical and shorter than head; left mandible greatly twisted and blackish (left mandible length 1.24–1.30 mm; left mandible index 0.60–0.64); right mandible blade-like and brownish with a notch at the base (length of right mandible 1.20–1.28 mm), the tip of right mandible gradually bending outward. Fontanelle is dot-like and situated in the anterior half of the head capsule (occipito-fontanelle distance 1.62–1.68 mm). Labrum short, sub-straight anteriorly with short lateral processes and few hairs. Pronotum weakly saddle-shaped (length 0.28–0.35 mm; width 0.65–0.91 mm). Postmentum shorter and club-shaped, length slightly higher than half of head length with a narrow waist lying medially. Legs and body pale yellowish; body densely hairy; legs with 3:2:2 apical tibial spurs; cerci short and two segmented.

Table 1. Measurements of soldiers of *Pericapritermes ceylonicus* (Holmgren, 1911)

Body parts	Measurements (mm)		
	Range ^a	Mean	Chhotani, 1997
Head length with mandibles	3.40–3.50	3.46	3.50–3.80
Head length to the lateral base of mandibles	2.00–2.12	2.07	2.09–2.18
Maximum head width	1.10–1.12	1.11	1.06–1.25
Maximum head height	0.98–1.00	0.99	
Occipito-fontanelle distance	1.62–1.68	1.65	
Head index	0.51–0.55	0.53	
Fontanelle head index	0.79–0.81	0.80	
Length of labrum	0.10–0.12	0.11	
Width of labrum	0.20–0.25	0.22	
Left mandible length	1.28–1.30	1.29	1.24
Right mandible length	1.20–1.28	1.24	
Mandible head length index	0.60–0.64	0.62	
Length of Postmentum	1.15–1.30	1.22	
Maximum width of Postmentum	0.38–0.45	0.43	
Width of postmentum at waist	0.20–0.22	0.21	
Postmentum contraction index	0.49–0.53	0.50	
Pronotum length	0.28–0.35	0.32	0.30
Pronotum width	0.65–0.75	0.69	0.72–0.91
Total body length	5.10–6.20	5.55	4.00–4.50

^aBased on material examined, range and mean are of three soldiers.

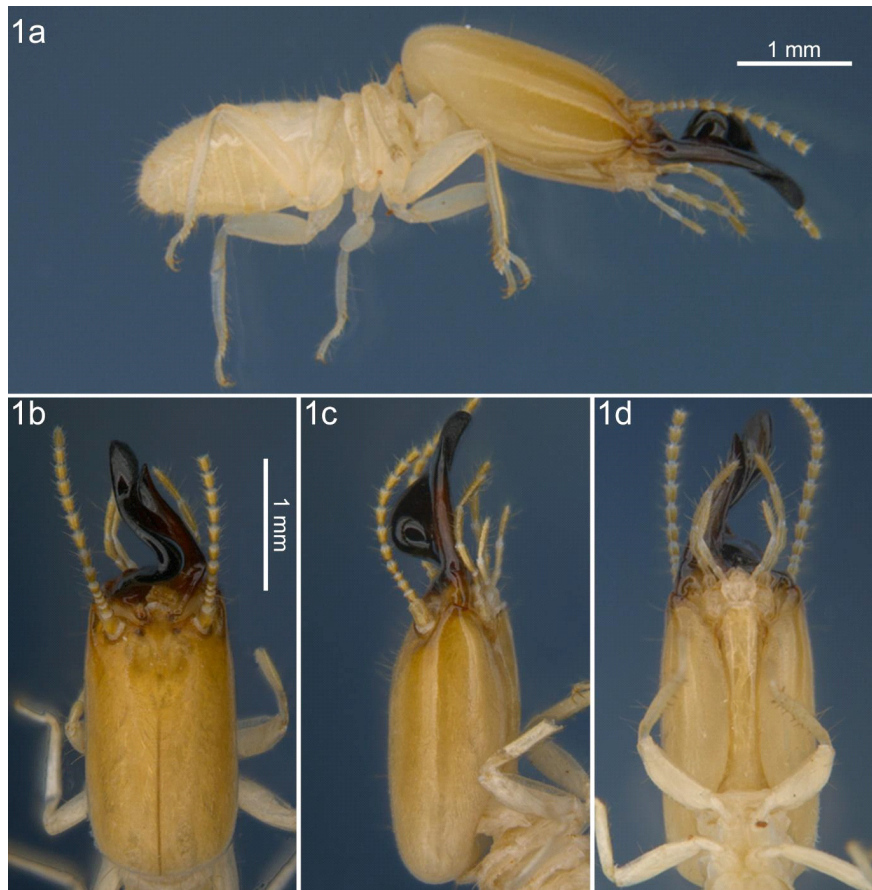


Fig 1. *Pericapritermes ceylonicus* (Holmgren) soldier (KSNUAHS): a) Lateral view of body; b) Dorsal view of head; c) Lateral view of head; d) Ventral view of head.

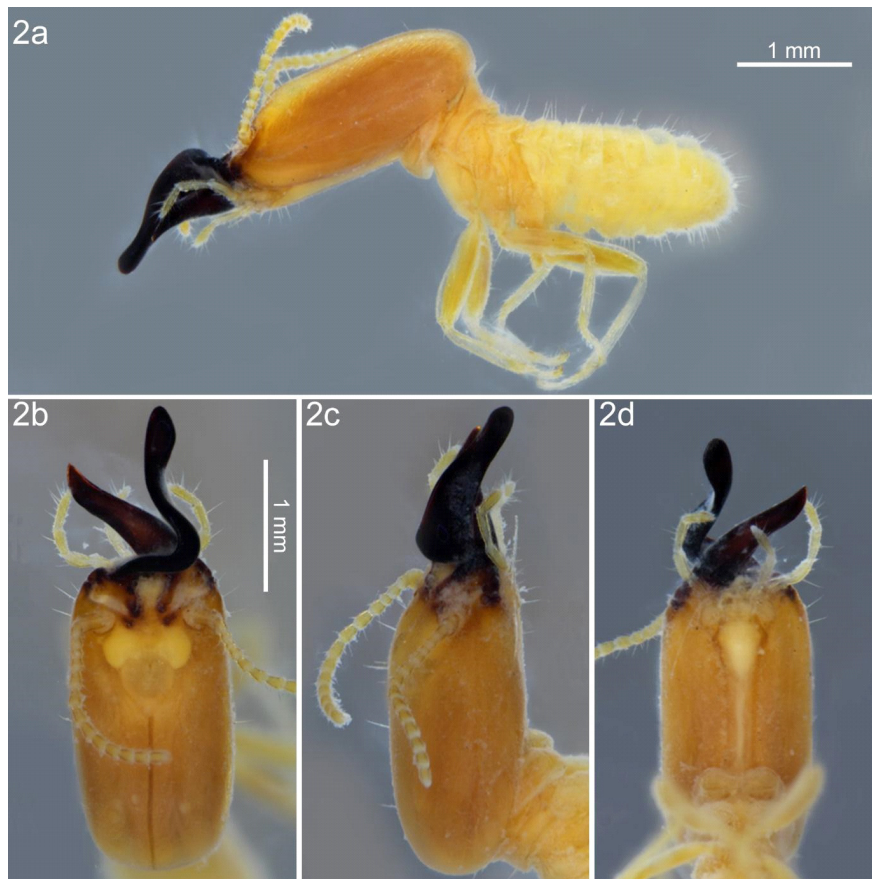


Fig 2. *Pericapritermes ceylonicus* (Holmgren) soldier (AMNH metatype): a) Lateral view of body; b) Lateral view of head; c) Ventral view of head; d) Dorsal view of head.

Worker (Table 2, Fig 3)

Head capsule and antennae pale cream; thorax and legs cream coloured; abdomen transparent with intestinal contents visible from the outside. Head sparsely hairy; abdomen and thorax densely hairy. Body elongate (total body length 3.80–4.30 mm). Head capsule broadly oval (head length to the base of mandible 0.62–0.72 mm; head length to the tip of labrum 1.07–1.15 mm; maximum head width 0.80–0.90 mm). Fontanelle is indistinct. Antennae with 14 articles, fourth segment shortest, second segment larger than third, third and fifth subequal. Labrum dome-shaped with anterior margin slightly invaginated. Mandibles (Fig 3c) with an apical and two marginal teeth. Apical tooth of the left mandible is longer followed by two short marginal, second marginal with a long posterior margin with a small notch before the second margin. Molar prominence not extending up to the level of the first margin but extending beyond the level of the second margin. Apical tooth of the right mandible is longer than marginal;

second marginal is longer than first but not separated by a long posterior margin, molar plate lack ridges. Pronotum saddle-shaped broader than long (pronotum length 0.25–0.30 mm; pronotum width 0.48–0.52 mm). Legs with apical tibial spur arranged in 3:2:2 manner. Forcoxae bearing three thick bristles pointing forward.

Table 2. Measurements of workers of *Pericapritermes ceylonicus* (Holmgren, 1911)

Body parts	Measurements (mm)	
	Range*	Chhotani, 1997
Head length to the base of mandible	0.62–0.72	
Head length to the tip of labrum	1.07–1.15	
Maximum head width	0.80–0.90	0.87–0.91
Pronotum length	0.25–0.30	
Pronotum width	0.48–0.52	0.49
Total body length	3.80–4.30	2.7–3.5

*Based on material examined (five workers)

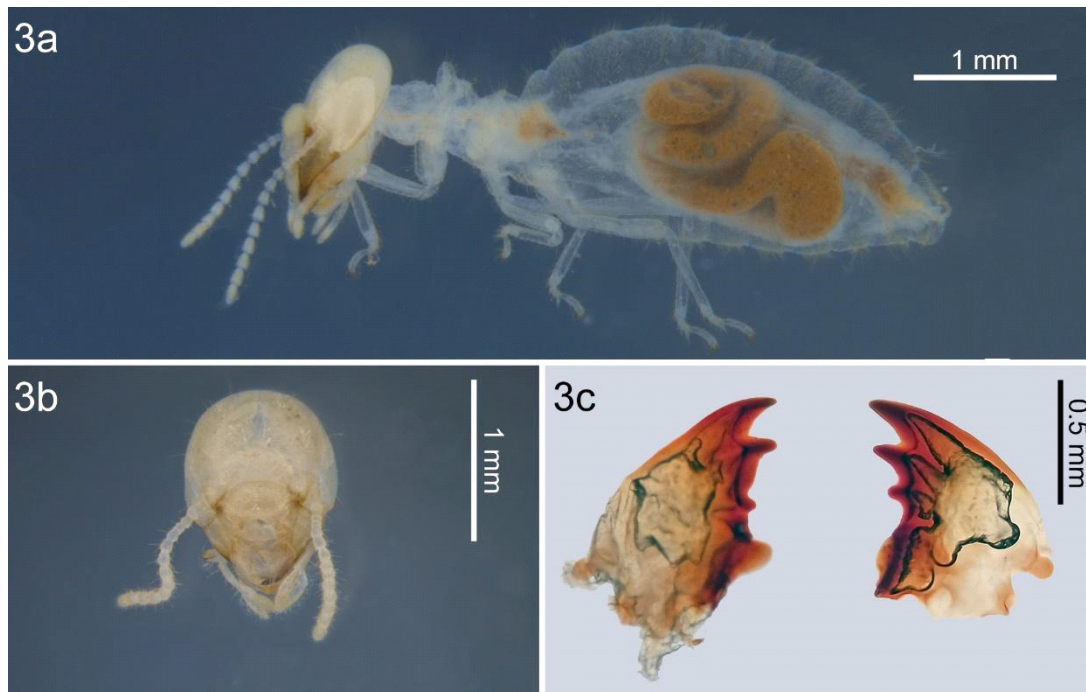


Fig 3. *Pericapritermes ceylonicus* (Holmgren) worker; a) Lateral view of body; b) Dorsal view of head; c) Left and right mandible.

Worker gut morphology (Figs 4, 5)

Crop slightly asymmetrical. Gizzard of the generalized type, with columnar and pulvillar belts subequal in length (Fig 5a); columns of first and second order covered with tiny pectinate scales, first-order pulvilli conspicuous, with aciculiform spines in rows, second-order pulvilli very reduced (Fig 5b). Stomodaeal valve inserted in apex of mesenteron. Mesenteric tongue dorsally oriented, with nearly half of the mesenteron length. Ileum (P1) tubular at the proximal portion, dilated and kidney-shaped at the distal portion (Fig 4b), inserted in P3 ventrally at right side of abdomen (Fig 4c).

Enteric-valve armature (P2) composed of six unequal cushions, ornamented with two longitudinal rows of spines, (Figs 5c and 5d). Paunch (P3) well developed and globose, (Fig 4c). Colon (P4) with a long U-turn (Figs 4c, 4d) and slightly displaced to the right side (Fig 4a).

Distribution in India: Karnataka (Coorg, Mandya) (Fig 6)

Remarks

Termites are ubiquitous in tropical region and range expansion is becoming common (Nagaraju et al., 2020). New species are also being described from time to time indicating

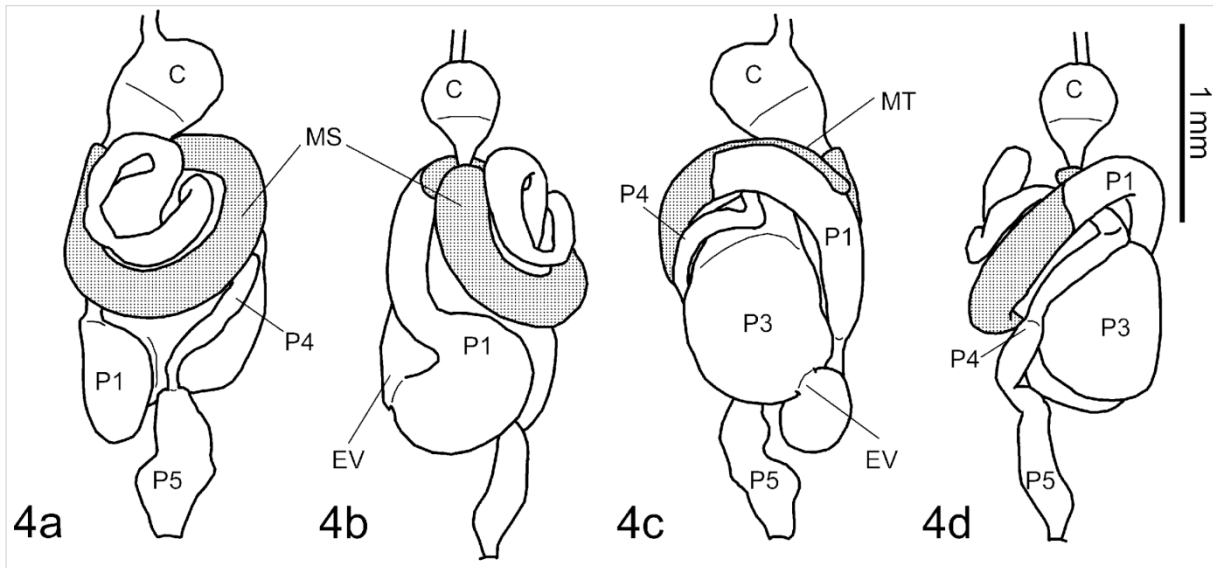


Fig 4. Digestive tube of *Pericapritermes ceylonicus* (Holmgren) worker: a) dorsal; b) left; c) ventral; and d) right views; C: Crop; MS: Mesenteric segment; MT: Mesenteric tongue; P1: First proctodeal segment (ileum); P3: Third proctodeal segment (paunch); P4: Fourth proctodeal segment (colon); P5: Fifth proctodeal segment (rectum).

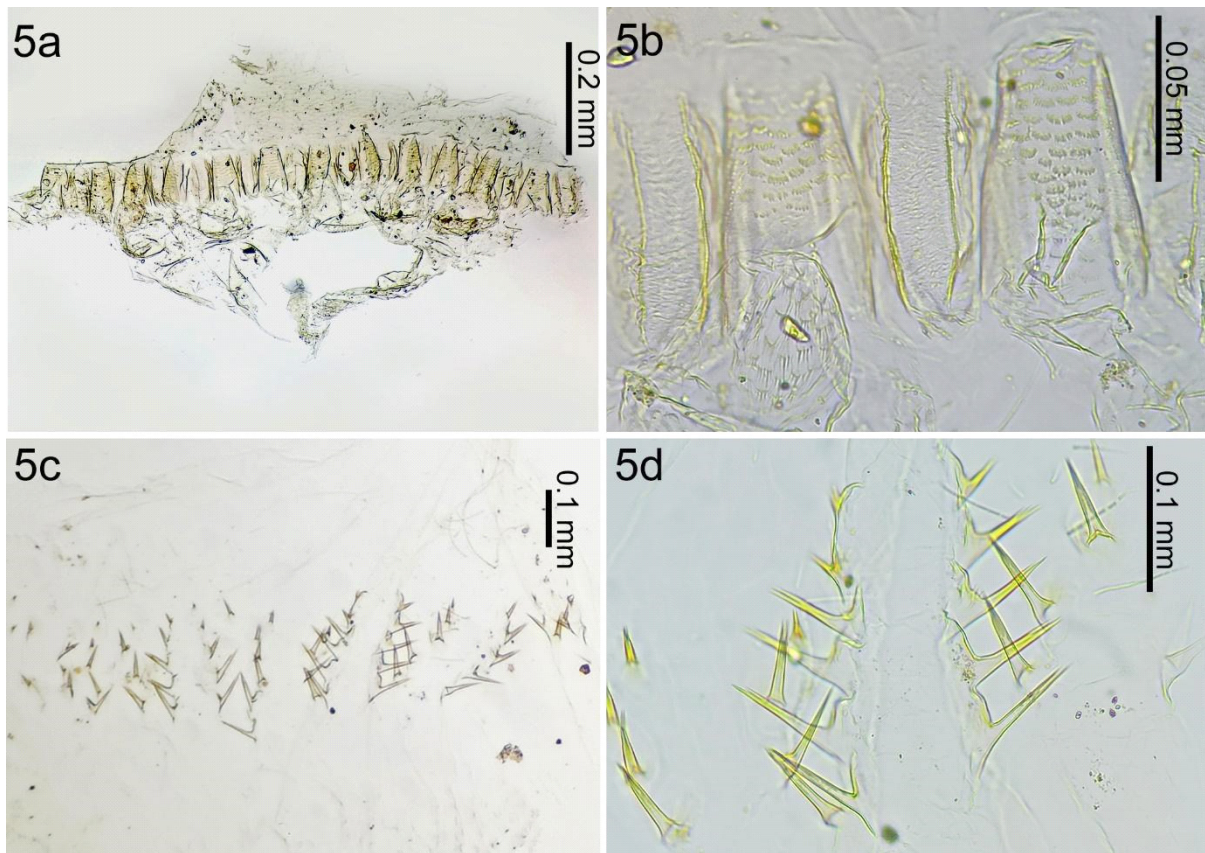


Fig 5. Worker enteric valve and gizzard of *Pericapritermes ceylonicus* (Holmgren); a) Gizzard armature pads; b) Detail of the gizzard armature; c) Enteric valve armature; d) Detail of the largest cushion.

their high diversity in tropics (Ranjith et al., 2022 a and b). Both soldier and worker castes of *Pericapritermes ceylonicus* are redescribed here, as the earlier descriptions were found to be inadequate for taxonomic purpose. The morphology and distribution of the soldier was compared with a metatype soldier from the AMNH (Figs 1, 2, 5). The occurrence of

P. ceylonicus in the Indian mainland was doubtful because all earlier records when re-identified were found to belong to other *Pericapritermes* species. For example, the earlier record of *P. ceylonicus* by Maiti (1983) from West Bengal was re-identified as *P. assamensis* (Mathur and Thapa) and the record by Bose (1984) from southern India was re-identified

as *P. topsilpensis* Thakur (Chhotani, 1997). *Pericapritermes ceylonicus* can be easily recognised from *P. assamensis* by its narrow head (head index 0.51–0.55) as *P. assamensis* have a much broader heads (maximum head width 1.19–1.27 mm; head index 0.56–0.58). The species can be easily distinguished from *P. topsilpensis* based on head length as *P. ceylonicus* has a smaller head (head length 2.00–2.18 mm), and *P. topsilpensis* is larger sized (head length 2.50–2.75 mm). In the recent past, there have been occurrence records documented of termites endemic to Sri Lanka also present on the Indian mainland. For example, *Hospitalitermes monoceros* (König) (Amina et al., 2013), *Dicuspitermes hutsoni* (Kemner) (Amina et al., 2020), two Sri Lankan endemic species, and *Ceylonitermellus* Emerson, 1960, a Sri Lankan endemic genus (Amina & Rajmohana, 2013; Ranjith et al., 2022 a) were

reported from Kerala. Hence, the presence of the Sri Lankan species, *P. ceylonicus* on Indian mainland should not be considered surprising. Our samples were collected from underneath boulders, which may indicate a soil feeding habit (type III) (Donovan, 2001) and indeed the guts were filled with soil particles. The enteric valve is well distinct from other *Pericapritermes* species described in the literature [*P. nigerianus* Silvestri, *P. magnificus* Silvestri, in Sands, 1998; *P. nitobei* (Shiraki), in Kanzaki and Ohmura, 2016; *P. parvus* Bourguignon and Roisin, *P. pilosus* Bourguignon and Roisin and, *P. schultzei* (Holmgren), in Bourguignon et al., 2008], by the acute spines organized in longitudinal rows (Figs 5c, 5d), all other *Pericapritermes* species have short spines spread over the pads, although the gut morphology of most *Pericapritermes* species still unknown.

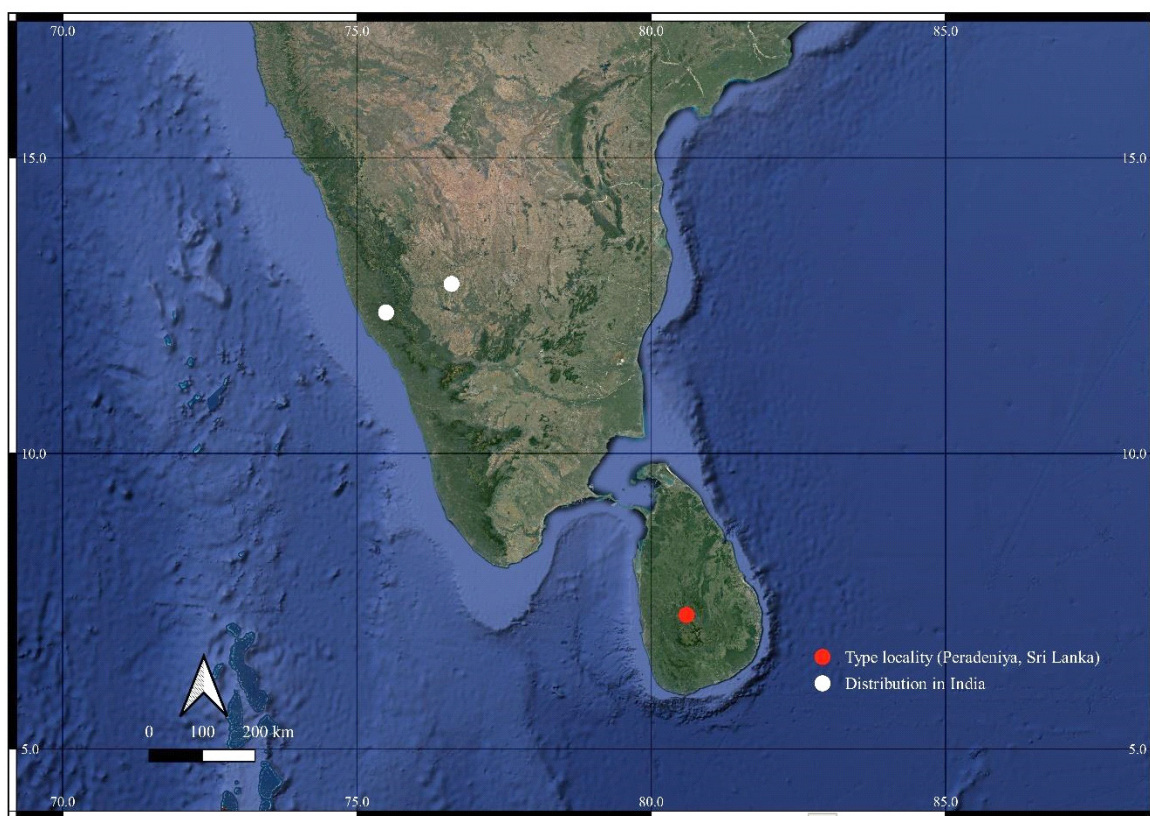


Fig 6. Registries of *Pericapritermes ceylonicus* (Holmgren).

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Author's Contribution

RM: methodology; formal analysis; investigation; writing-original and editing.

MMR: conceptualization; methodology; resources; writing and review draft

CMK: conceptualization; resources; writing and review draft; supervision

JLW: resources; review draft

RS: resources; review draft

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