



Additional record of the little known xylophagous endemic wood roach *Salganea rehni* Roth, 1979 (Blattodea, Blaberidae, Panesthiinae) from the Western Ghats, India with its DNA barcode

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ABSTRACT: The paper presents the record of the poorly known endemic species of wood roach from India after a gap of almost 40 years. In India, discernible work has been done on the DNA barcode of cockroaches including the genus *Salganea*. This work forms the first mitochondrial DNA barcode for the species *Salganea rehni* Roth, 1979. © 2022 Association for Advancement of Entomology

KEY WORDS: Rediscovery, India, Western Ghats

Cockroaches are phylogenetically closely related to termites. The diet of the termites is lignocellulosic while, cockroaches are omnivorous scavengers (Bell *et al.*, 2007). The blattid cockroaches have specialized gut microbiome to convert the lignocellulosic food material (Maekawa *et al.*, 2008, Schauer *et al.*, 2012). The genus *Salganea* was erected by Stål in 1877 under the subfamily Panesthiinae and the family Blaberidae (with the type species as *Panesthia morio* Burmeister, 1838). They live in the wood galleries tunneled in the rotten woods (Roth, 1979; Maekawa *et al.*, 2001) and are hence also considered as wood roaches. The lignocellulose digestion by these cockroaches helps in the turnover of organic matter in forest ecosystems (Roth, 1979). Some members from this genus live in biparental families having a male-female pair and the nymphs are fed by their parents (Maekawa *et al.*, 2005, 2006). Iteroparity and parental investments is believed to be the

reason for lack of eusociality in *Salganea* (Maekawa *et al.*, 2008). The genus *Salganea* reproduces ovoviviparously, producing young ones by means of eggs that hatch within the body of the parent. Generally, wood roaches are heavily bodied insects, male and female have a similar pronotum (Maekawa *et al.*, 2008).

Accepting the underlying taxonomic instability with regard to number of species considered in the genus, Beccaloni (2007) suggested 47 species (and six subspecies) and Maekawa *et al.* (2001) and Nalepa *et al.* (2008) considered 50 species worldwide including 10 species from India (Gupta and Chandra, 2019). In the recent studies Beccaloni (2014), reported 50 species across the globe under the genus *Salganea*, which are further categorized into five morphological species groups.

Roth (1979) in his taxonomic revision of the Panesthiinae of the world reported 42 species and

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four subspecies under *Salganea*. In the same revisionary work, he erected five species-groups, based on the anterior margin of the pronotum and male genitalia. The five species-groups considered by Roth (1979) include the *papua* species-group, the *foveolata* species-group, the *raggei* species group, the *morio* species-group, and the *nigrita* species-group. Roth (1979) did not place 11 species in the above-mentioned species-groups including *S. rehni*. The morphological species-group created by Roth (1979), were not fully supported by the molecular phylogenetic studies conducted by Maekawa *et al.* (2001).

Very recently, an annotated checklist of cockroaches of India has been published (Gupta and Chandra, 2019) which has 10 species of *Salganea* including five-endemic species to Tamil Nadu region of Southern India (*Salganea cavagnaroi* Roth, 1979; *Salganea erythronota* Bolívar, 1897; *Salganea indica* Princis, 1953; *Salganea kodaikanalensis* Roth, 1979 and *S. rehni* Roth, 1979) (Fig. 2). Interestingly, all the endemic species are known from Tamil Nadu (Table 1) but the voucher specimens were not collected since their discovery after 1979. Among

the 10 species known from India, *Salganea biglumis* (Saussure, 1895) is reported to have type locality in Sikkim, India with additional distribution records in Philippine Islands without any specific locality details (Roth, 1979). With this backdrop, the poorly known endemic species, *S. rehni* is reported here with the mitochondrial Cytochrome oxidase subunit I (mt COI) DNA barcode data from Agasthyamalai region of Upper Kodayar, south of the type locality, Annamalai region of Tamil Nadu, India (Fig. 2).

DNA barcoding and molecular studies in cockroaches / wood roaches in India are in a stage of infancy. India is known to have 181 species of cockroaches classified under 72 genera, 17 subfamilies and six families (Gupta and Chandra, 2019) of which 89 species are endemic to the country. Among the 181 species of cockroaches known from India, DNA barcode data (mt COI) is available for 33 species belonging to 23 genera in the GenBank.

In the present study, the *S. rehni* is identified by using morphological characters and for the first time an attempt was made to provide DNA barcode of

Table 1. *Salganea* species reported with their type localities (Roth, 1979)

No.	<i>Salganea</i> species	Type locality
1	<i>S. biglumis</i> (Saussure, 1895)	Sikkim, India
2	<i>S. cavagnaroi</i> Roth, 1979	Pykara, India
3	<i>S. erythronota</i> Bolívar, 1897	Madurai, India
4	<i>S. incerta</i> (Brunner, 1893)	Mooleyit, Burma
5	<i>S. indica</i> Princis, 1953	Anamalai Hills, India
6	<i>S. kodaikanalensis</i> Roth, 1979	Kodaikanal, Palni Hills, India
7	<i>S. morio</i> (Burmeister, 1838)	New Guinea
8	<i>S. passaloides</i> Walker, 1868	Ceylon, Sri Lanka
9	<i>S. raggei</i> Roth, 1979	Mt Angka, Thailand
10	<i>S. rehni</i> Roth, 1979	Attakati, Shola, India

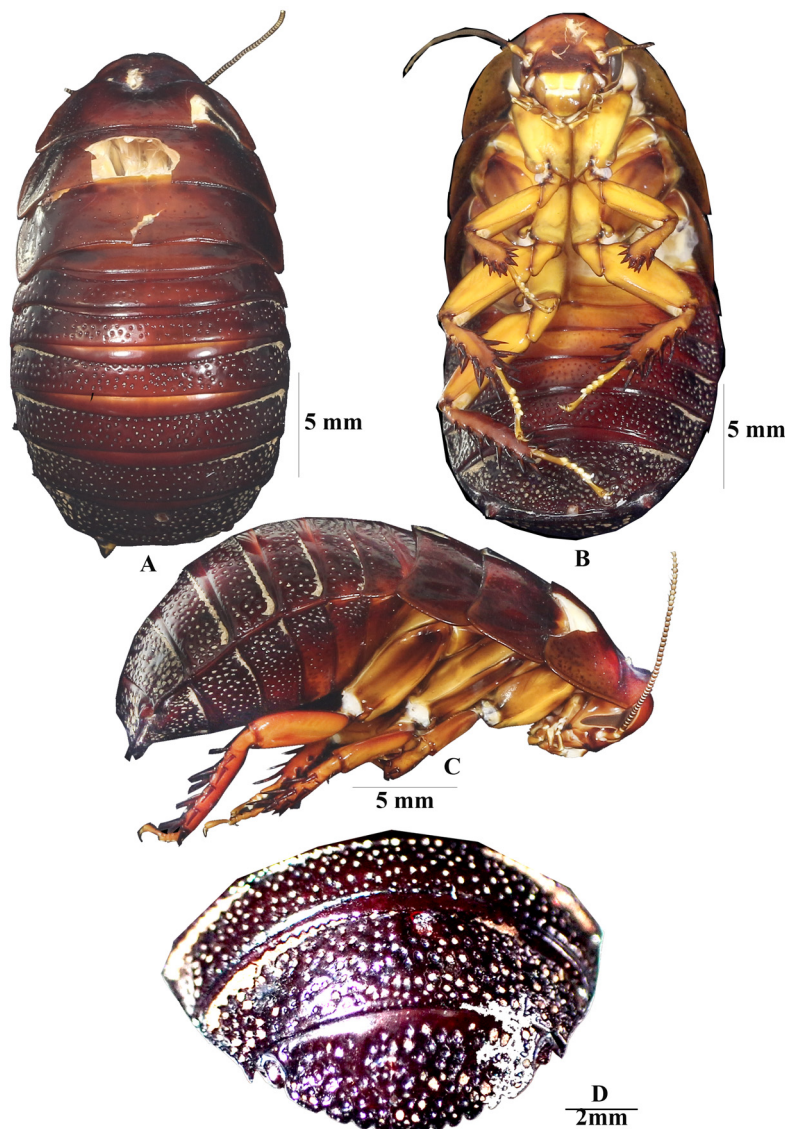


Fig. 1 *Salganea rehni*: Adult. A- Dorsal; B- Ventral; C- Lateral; D- Supra-anal plate

the voucher specimen collected in the recent field survey. Field sampling was done from decaying logs in the forest floors of Upper Kodayar (N 8.5377; E 77.3486; Altitude 1250 meters) (Fig. 2). The samples were preserved in ethyl alcohol for further studies. Among the two samples collected, the damaged sample was used for DNA studies and the specimen in good condition was used for both the DNA studies as well as taxonomic studies. Leica EZ4E stereomicroscope with photographic facility was used for examining the specimens and terminologies used follows Roth (1979). The identified specimen was deposited in the National

Zoological collections of Zoological Survey of India, Western Regional Centre, Pune (ZSI, WRC). The map of the collection locality was prepared using open, free access QGIS software (Fig. 2). Genomic DNA was extracted with DNeasy Blood and tissue kit (Qiagen). PCR amplification was done using LCO1490 and HCO2198 primers (Folmer *et al.*, 1994) in 25 μ L reaction volume including 12.5 μ L of 2X master mix (Promega), 10 μ M of each forward and reverse primer, 50 ng of template DNA and nuclease free water up to Q.S. Thermal cycle profile was as follows, one cycle of denaturation at 95°C for 2 min; 5 cycles of 94°C for 30 sec, 45°C

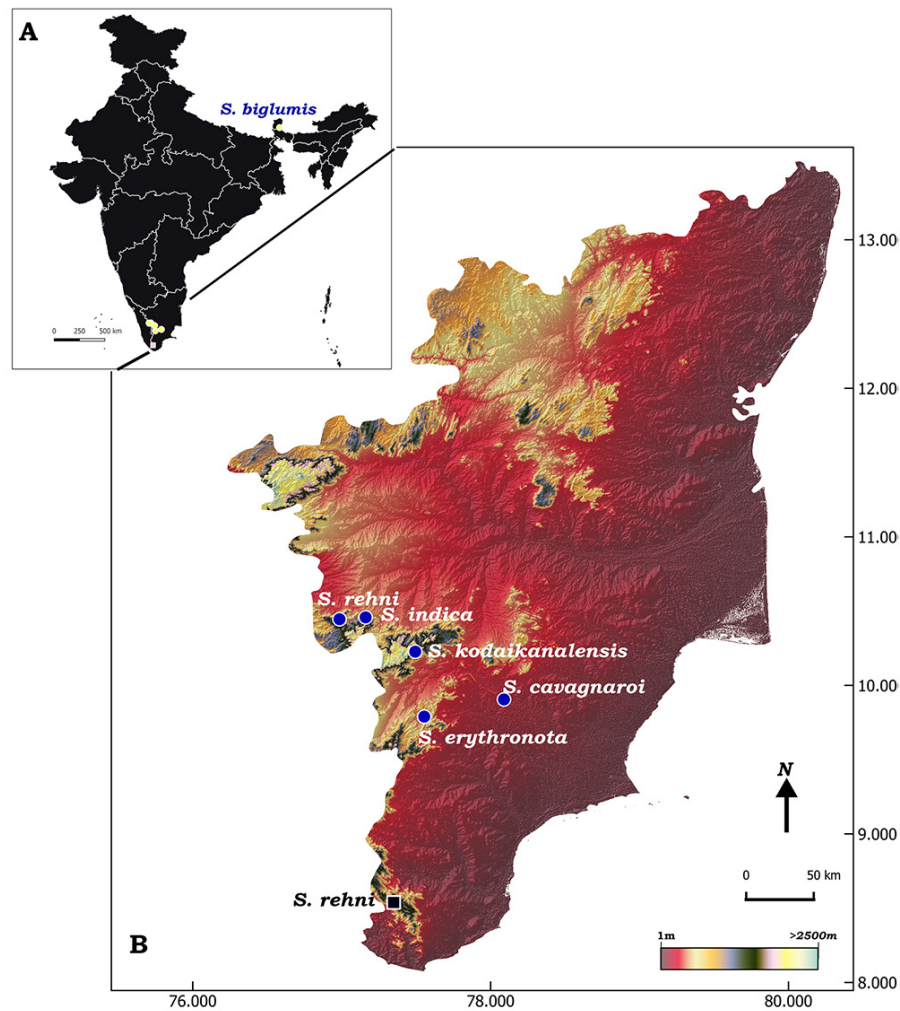


Fig. 2A - Type locality details for the species of *Salganea* described from India. **B** - Type locality of species described from Tamil Nadu (blue circle), and Upper Kodayar Tamil Nadu, the locality of *Salganea rehni* collected in present study (square)

for 1 min, 72°C for 1min; 30 cycles of 94°C for 30sec, 51°C for 1 min, 72°C for 1min followed by one cycle of final extension at 72°C for 5min (Hashemi-Aghdam *et al.*, 2017). Amplification band was confirmed by Gel electrophoresis stained with EtBr, followed by purification with Invitrogen's PureLink PCR Purification Kit. PCR product was sequenced by Sanger's method on ABI 377 (Applied Biosciences) sequencer. Morphologically the species could be identified as *S. rehni* Roth (1979) with an additional variation in the crenulation of supra-anal plate, shape of the teeth and a larger gap between the teeth (Fig. 1).

Taxonomic account

Order: Blattodea Brunner von Wattenwyl, 1882

Superfamily: Blaberoidea Saussure, 1864

Family: Blaberidae Saussure, 1864

Subfamily: Panesthiinae Kirby, 1904

Genus: *Salganea* Stål, 1877

1877. *Salganea* Stall, Ofvers. K. Sven. Vetenskapsakad. Foerh. 34, 33–58.

1903. *Mylacrina* Kirby, *Annals and Magazine of Natural History*, Series 7, 11, 404 - 415.

Type species. *Panesthia morio* Burmeister, 1838 Burmeister, 1838. Handbuch der Entomologie 2(2): 513.

Salganea rehni Roth, 1979

1979. *Salganea rehni* Roth, *Aust. J. Zool., Suppl. Ser.*, 1979, No. 69, 1-201.

Type locality. Inde meridionale, Attakatti, Shola am Iber Hill (= Tamil Nadu)

Material examined. ZSI-WRC Ent-12/82 24.viii.2019, 1 Female, Agasthyamalai Biosphere reserve, Upper Kodayar (N 8.537; N 77.348; altitude 1250 meters), Tamil Nadu, India, coll. K.P. Dinesh and Party.

Morphological description (Fig. 1A–D). Length-26mm. Body reddish brown, antennae brownish yellow, beaded and setose. Head sparsely punctate, vertex not foveolate, exposed. Pronotum convex, parabolic, anterior margin slightly indented, a pair of small reflexed tubercles behind the margin; anterior margin two-third depressed. Meso and metanotum sparsely punctulate. Tegmina and wings absent. Abdominal tergites hairless, T1-T7 punctate, T4-T7 densely punctate; Supra-anal plate (Fig. 1D) dense and coarsely punctate, rugulose, hind margin crenulate with 11-15 small subequal teeth which are broad at base and apically rounded. Abdominal sclerites punctate, denser on the lateral side, anterolateral corners of S7 with a small excavation lacking setae, lateral margin thickened under the cercus, hind margin rounded. Cercus with anterior margin curved, posterior apical angle broadly rounded. Anteroventral margin of front femur unarmed; distal spine absent; hind margin with a distal spine.

Original description of the species by Roth (1979) is based on female specimens and in the present study also only female specimens have been collected. As per the Paratype label the specimen was collected in 1921 from the Shambaganur region of Madurai parts of South India (with the register number BMNH (E) #876096; 130 km SW from type locality). Since the original description is from the Annamalai hill ranges and the current report of the species is from Agasthyamalai hills (around 190

km south of type locality), the species could be available in the hill ranges south of Palghat gap (Kerala and Tamil Nadu states).

The mt COI DNA barcode generated for *Salganea rehni* (Ent-12/82) is deposited in the GenBank (MW463933.1 and MW463934.1). Initial BLAST of the sequences MW463933.1 and MW463934.1 did not provide any 100 per cent match on NCBI. Since there is a dearth of DNA Barcode data for the cockroaches of Indian species, specifically for the genus *Salganea*, phylogenetic studies were not attempted. In the earlier studies Maekawa *et al.*, (2001) utilized mt COII gene for the study of 25 species of *Salganea* from the Southeast Asian region which is a partial range of distribution for the genus. Since the distribution range of the genus is wide spread, further studies are warranted from the South Asian region to understand the genetic pattern among the members.

Gupta and Chandra (2019) have included this species in their checklist but Prabakaran *et al.* (2019, 2020) did not include this endemic species in their document of Blattodea for the Tamil Nadu state, India. Most of the *Salganea* reports in India are based on the checklists without any voucher sample representation for any taxonomic or molecular studies. Present report of the little known xylophagous endemic wood roach, *Salganea rehni* from the Upper Kodayar is the first report of the species after its original description with a voucher specimen. Current mt DNA barcode forms the first mt DNA barcode for the species of *Salganea* as well as for the genus from India. The voucher specimen ZSI-WRC Ent-12/82 (Fig. 1) is expected to help the taxonomists in addressing the problems of Linnaean shortfall (Brown and Lomolino, 1998) and the mt DNA barcode generated is expected to support the understanding of Darwinian shortfall (Diniz-Filho *et al.*, 2013).

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