

First record and a new species description of *Dudgeodes* (Ephemeroptera: Teloganodidae) from South India

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Abstract: *Dudgeodes bharathidasani* sp. nov. is described from the Western Ghats of South India. The nymphs of this species were found in the seepage areas of a stream, and they were associated with the nets constructed by trichopteran larvae (Hydropsychidae: *Hydropsyche*).

Key words: *Dudgeodes*, new species, Teloganodidae, mayfly, South India

1. Introduction

The pannote mayflies of Teloganodidae are distributed throughout the Afrotropical and Oriental regions (McCafferty and Wang, 1997; Sartori et al., 2008). Currently, 26 species in 8 genera of Teloganodidae have been described globally (Sartori et al., 2008; Pereira-Da-Conceicao and Barber-James, 2013): 1 species in each of *Derlethina* Sartori (2008), *Lestagella* Demoulin (1970), *Lithogloea* Barnard (1932), and *Ephemerellina* Lestage (1924); 2 species of *Nadinetella* McCafferty & Wang (1998); 3 species of *Manohyphella* Allen (1973); 6 species of *Dudgeodes* Sartori (2008); and 10 species of *Teloganodes* Eaton (1882).

The genus *Dudgeodes* was first described by Sartori et al. (2008) and is known from the Oriental region. The genus *Dudgeodes* is separated from *Teloganodes* by the following characters: outer margin of forewing regularly convex, hindwing smaller with acute costal process, tarsus of male foreleg shorter, styliger plate not strongly convex in the adult stage, absence of gill VI, and last gill always incised in the nymphal stage (Sartori et al., 2008). Only 6 species of *Dudgeodes* are described (*D. celebensis* Sartori, 2008; *D. hutani* Sartori, 2008; *D. lugens* Navas, 1933; *D. pescadori* Sartori, 2008; *D. stephani* Sartori, 2008; and *D. ulmeri* Sartori, 2008), and no other species have been recorded from this genus until now. Here we describe a new species of *Dudgeodes* from South India, and a key to the nymphs of *Dudgeodes* species is given.

2. Materials and methods

2.1. Study area

The nymphs were collected from Kallar Stream in Kerala Province, India. Kallar Stream is in the Western Ghats of South India; this stream is situated 5 km away from Palode, nearer to Madathara village, Thiruvananthapuram, Kerala Province. The elevation of Kallar Stream is 300 m. This stream is related to 2 monsoons (the southwestern and northeastern monsoons). The water temperature ranges from 22 to 27 °C.

2.2. Sampling

Nymphs were collected manually from the nets constructed by trichopteran larvae (Hydropsychidae: *Hydropsyche*) within the seepage areas of the stream. Latitude, longitude, and elevation of location were taken by GPS (Garmin; 12 maps). Type materials are deposited in the Department of Environmental Biotechnology, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India.

3. Results and discussion

Description of *Dudgeodes bharathidasani* Anbalagan sp. nov. (Figures 1–4)

Materials examined. Holotype: 1 male nymph, India, Kerala Province, Thiruvananthapuram district, Palode, Kallar Stream, 90 m, 8°45'07"N, 77°01'39"E; 20/viii/2013 (DS110), S. Anbalagan. Paratypes (DS111: 4 male nymphs and 1 female nymph): same data as holotype. Type specimens are deposited in the Department of

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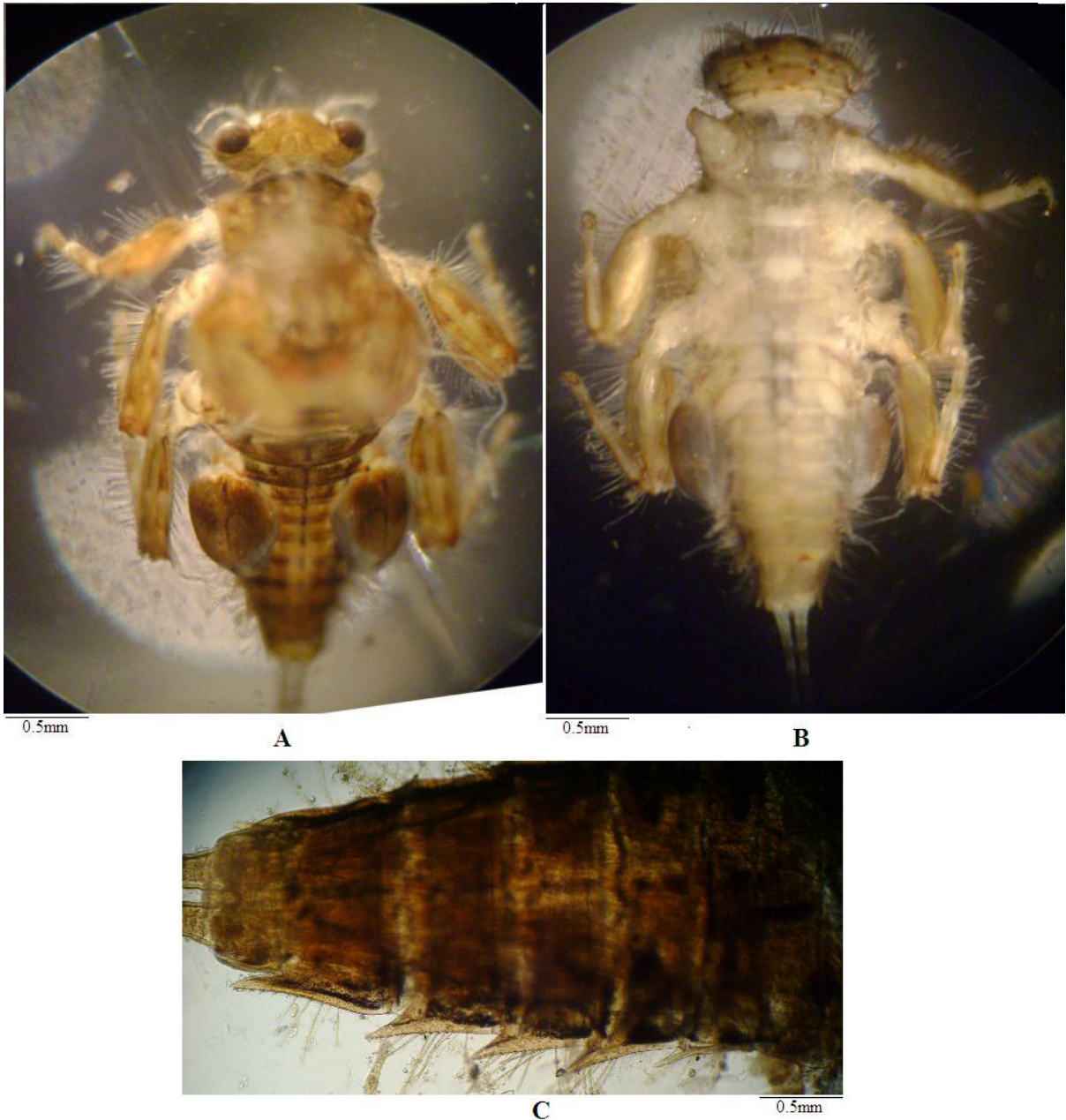


Figure 1. *Dudgeodes bharathidasani* sp. nov.: A) dorsal view; B) ventral view; C) dorsolateral view.

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Mature nymph:

Body length: 3.4–3.8 mm (excluding cerci) in female and male nymphs respectively; cerci length slightly longer than body length.

General coloration medium brown dorsally and yellowish-white ventrally; young specimens generally paler; legs light to medium brown, with femora bearing 4-stripe pattern (Figures 1A–1C).

Outer margin of head fringed with a row of short, basally forked setae from the front of eyes to labrum insertion. Antennae: 0.58 times shorter than head width, flagellum with 8 segments. Dorsal part of male eyes brownish-black. Labrum (Figure 2A) 2 times wider than long, with smooth anterior emargination; dorsal face covered medially by 2 rows of long feathered setae; dorsal setae with feather structure (Figure 2B); anterior margin with a row of small thin setae. Mandibles slender with 1 thin seta in middle of outer margin; right mandible



Figure 2. *Dudgeodes bharathidasani* sp. nov.: A) labrum, dorsal view; B) labrum, with details of dorsal setae; C) right mandible.

(Figure 2C) with outer incisor composed of 1 large tooth and 2 small teeth; inner incisor with 2 teeth; prostheca reduced, comprising a cluster of thin setae; 2 small rows of 5 long and thin setae below mola and some short setae above mola; left mandible (Figure 3A) with outer incisor with 1 slightly concave tooth; inner incisor with 2 teeth inserted transversely, 1 smaller and pointed, other large and rounded, prostheca small with a group of small setae; no setae below mola. Maxillae (Figure 3B) slender, with a well-developed carina, 2 indented dentisetae, and 3 long setae on inner apical part and a small row of 8–10 long, simple setae at crown; inner margin at base of lacinia, with 1 long feathered seta ventrally and 3 long simple setae dorsally; maxillary palp reduced to a single simple seta. Hypopharynx (Figure 3C) with superlinguae oval with a row of long simple setae at apex. Submentum moderately developed laterally; glossae and paraglossae partially fused; paraglossae larger than glossae; labial palp 3-segmented, articulation between segments 1 and 2 clearly visible, without constriction on inner margin; segment 3 ca. 2.7 times as long as wide (Figure 3D).

Prothorax with 4 rounded tubercles on dorsal face; mesothorax with none. Fore femur (Figure 4A) dilated, ca. 1.38 times longer than wide; outer margin covered by stout and long setae, meeting a transverse row of long and pointed setae across dorsal face; inner margin with a short row of long and thin setae proximally reaching distally to transverse row. Middle and hind femora similar, more slender, ca. 2.3 times longer than wide; dorsal and inner margins with a row of long and stout setae. Tibia with a row of long and stout setae on inner margin, and a row of long and thin setae on outer margin. Tarsal claw hooked, bearing 4–5 blunt teeth medially and 2 pointed teeth subapically; outer tooth well developed, inner tooth smaller; apex of claw with 2 rows of 3–4 thin setae laterally (Figure 4B).

Abdominal terga with a moderately developed median tubercle on segments I–IX except VI and VII more developed. No posterolateral projections on segments II–IV, slightly marked on segment V, and well marked on segments VI–IX. Gills as in Figures 4C–F; gill II with dorsal lamella operculate, oval and with entire margin;

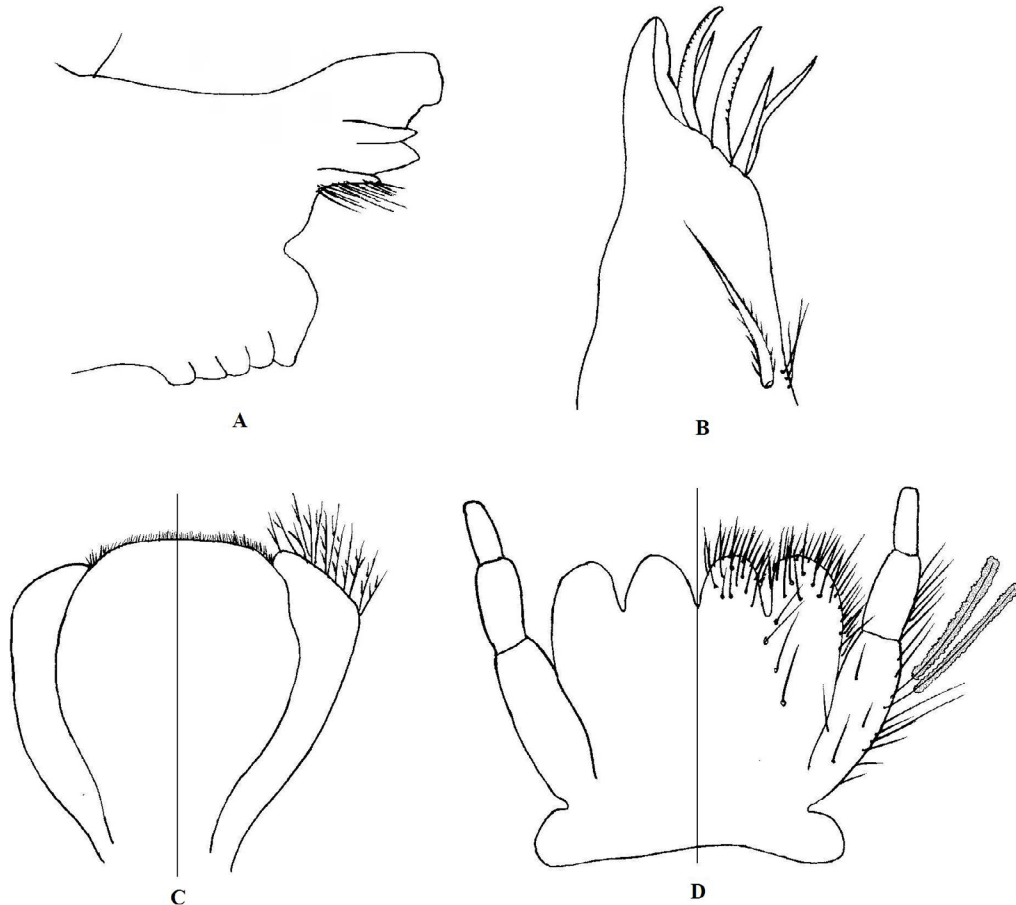


Figure 3. *Dudgeodes bharathidasani* sp. nov.: A) left mandible; B) maxilla (apicoventral part); C) hypopharynx; D) labium.

gills III–V with dorsal lamella incised medially; ventral lobe flabellate, well developed and purple on gills II–IV.

Cerci with a whorl of spines on each segment, spines considerably shorter than the length of corresponding segment, and brownish band present between 1 or 2 segments.

Etymology. Species is named after Bharathidasan University.

Ecology. This species was found in the seepage areas of the stream, associated with the nets constructed by caddisfly larvae (Hydropsychidae: *Hydropsyche*), possibly to feed on fine particulate organic matter available in the caddisfly nets.

Diagnosis. *D. bharathidasani* is most similar to *D. hutani*, from which it can be separated by the dorsal part of male eyes brownish black, labrum with feather structure of dorsal setae, left mandible with outer incisor with 1 slightly concave tooth. Maxilla inner margin at base of lacinia with 1 feathered long seta ventrally and 3 long simple setae dorsally, and more developed median tubercle on abdominal segments VI and VII.

Key to the nymphs of *Dudgeodes* species

1. Abdominal gills present on segments II–VI and gill VI with dorsal lamella not incised posteromedially; head capsule with long forked setae on lateral margin-----*Teloganodes*
 - Abdominal gills present on segments II–V and gill V with dorsal lamella incised posteromedially; head capsule with hair-like setae on lateral margin *Dudgeodes* 2
2. Dorsal part of male eyes yellow or yellowish brown 3
 - Dorsal part of male eyes blackish or brownish black 4
3. 3rd segment of labial palp more than 3 times longer than wide at base; hypopharynx with superlinguae broad and rhomboid *D. stephani*
 - 3rd segment of labial palp less than 3 times longer than wide at base; hypopharynx with superlinguae oval *D. ulmeri*
4. Tarsal claw with pointed subapical teeth 5
 - Tarsal claw without pointed subapical teeth 6

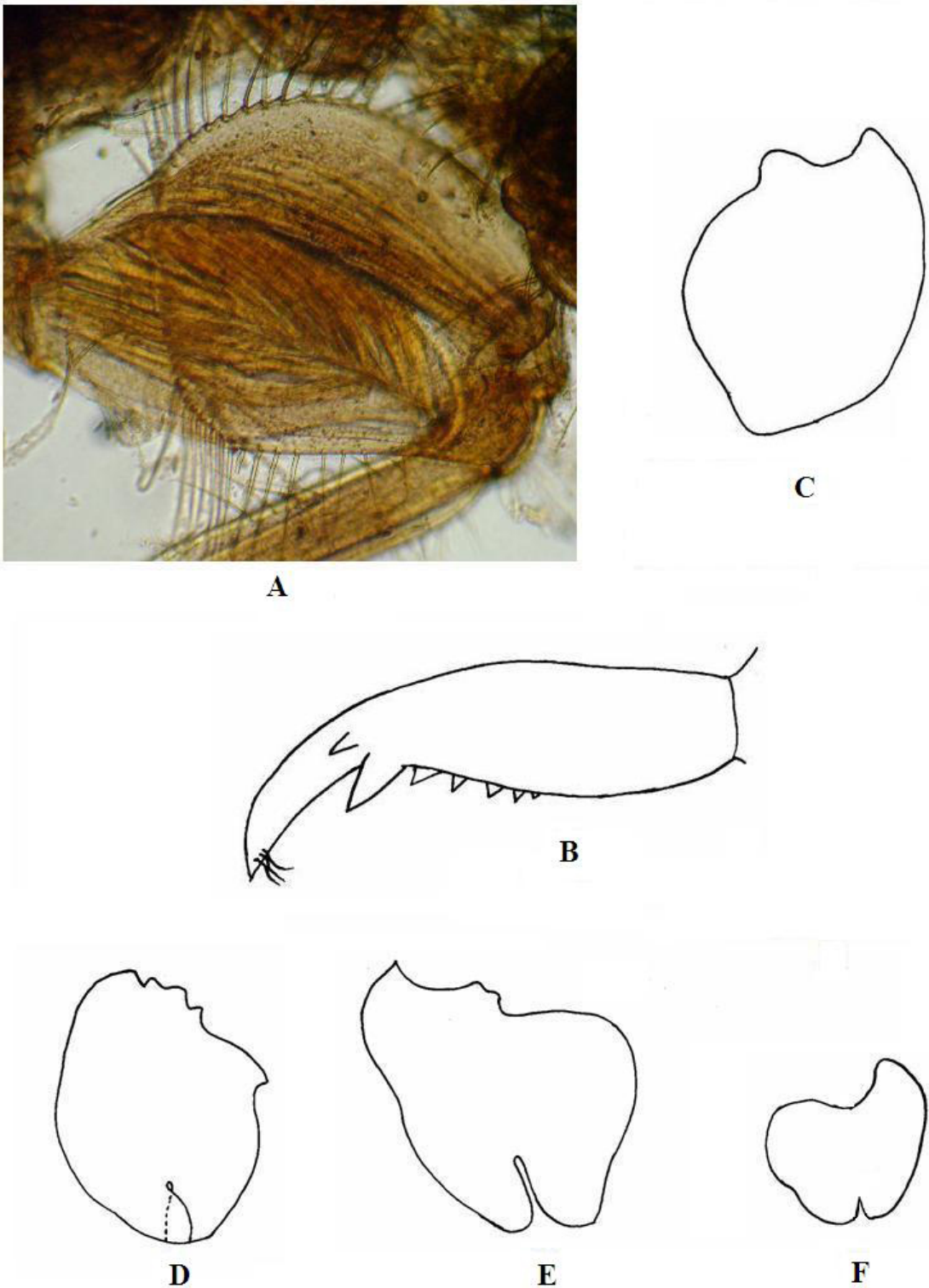


Figure 4. *Dudgeodes bharathidasani* sp. nov.: A) fore femur; B) tarsal claw; C) gill II; D) gill III; E) gill IV; F) gill V.

5. Antennae longer than head width, flagellum with 15–17 segments; the outer incisor with 3 teeth in left mandible *D. hutani*

- Antennae shorter than head width, flagellum with 8 segments; the outer incisor with 1 slightly concave tooth in left mandible *D. bharathidasani*

6. Prothorax with 2 rounded tubercles on dorsal surface; the inner margin of fore femora with a few stout setae in distal half; row of 4 setae below mola of right mandible *D. pescadori*
- Prothorax with 6 flat tubercles on dorsal surface; the inner margin of fore femora with numerous stout setae in distal half; row of 7–8 setae below mola of right mandible *D. celebensis*

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