

# A new species of *Choroterpes* Eaton, 1881 (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) from Western Himalaya, India

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## Abstract

As part of an ongoing exploration of the mayflies of hill streams/rivers of Western Himalaya, we describe a new species, *Choroterpes* (*Choroterpes*) *girigangaensis* Kubendran and Vasanth **sp. nov.** It can be differentiated from all other known species of the genus by the following combination of characters: (i) femur with a dark brown macula middle and apex; (ii) anteromedian emargination of the labrum with five broad unequal denticles; (iii) hind tibiae with a row of the dense medium, long, feathered setae; (iv) upper and lower lamellae of gills II–VII broad, alike with 3 apical processes; and (v) tarsal claw apically hooked with a row of 13–14 denticles. Brief ecology of habitat information and larval key to the known Indian species of *Choroterpes* (*Choroterpes*) is also provided.

**Keywords:** *Choroterpes*, India, Mayfly, New Species, Western Himalaya

## Introduction

The genus *Choroterpes* Eaton, 1881 has 6 subgenera viz., *Choroterpes* s.str. distributed in all biogeographical regions except Australia and the Neotropics, *Neochoroterpes* restricted to the New World, *Euthralus* restricted to the Ethiopian region and Oriental region (Old world), *Cryptopenella*, *Dilatognathus* and *Monochoroterpes* in the Oriental region (Bauernfeind and Soldan, 2012; Flowers, 2009; Kluge, 2012; Selvakumar *et al.*, 2017). Presently, twenty-one species are described under the subgenus *Choroterpes* from Ethiopia, Oriental, Palaearctic, Nearctic and Neotropical Regions (Kluge, 2012; Selvakumar *et al.*, 2017). In the Oriental Region, five species are described viz., *Ch. (C.) proba* Ulmer 1939 from Sumatra, *Ch. (C.) hainanensis* (You and Gui, 1995) from China, *Ch. (C.) petersi* Tong and Dudgeon, 2003 from Hong Kong, *Ch. (C.) mercatorius* Kluge, 2012 from Sulawesi and *Ch. (C.) kaegies* Selvakumar, Subramanian and Chandra, 2017

from India. Recently, two more species are described viz., *Choroterpes* (*C.*) *andamanensis* Vasanth, Subramanian and Selvakumar, 2021 from Andaman and Nicobar Islands and *Choroterpes* (*Choroterpes*) *kumaradhara* Muthukatturaja and Balasubramanian, 2022 from Karnataka both are larval stage only. In this paper, we described a new species of the subgenus *Choroterpes* s.str. is based on larval material collected from the Sirmour district, expeditions of the Zoological Survey of India, Solan.

## Material and Methods

Larval materials were collected from the Giri Ganga River, Giripul (Sirmour) in the north Western Himalaya of India. The larvae were mainly collected by kick-net sampling and stored in 95% Ethanol. Permanent mounts of specimens were made in Hoyer's medium to enable detailed microscopic observations and photographs

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were taken using an Olympus digital camera on a Z14-16 Olympus microscope and live ProgRes speed XT core 3. Holotype and part of the paratypes of the new species are deposited in the Faunal Repository of Himalayan Ecosystem, High Altitude Regional Centre, Zoological Survey of India, Solan, Himachal Pradesh, India.

## Taxonomy

**Material examined:** Holotype: Mature larva, INDIA, Himachal Pradesh, Sirmour, Giri Ganga River, Giripul 31. 11872 N, 77. 53689 E, 1600 m, 09.vi.2018, Coll. T. Kubendran (Reg. No. HARC/I-6181). Paratypes: 4 larvae, same data as holotype (Reg. No. HARC/I-6182). Type specimens are deposited in the ZSI, Solan, Himachal Pradesh.

### *Choroterpes (Choroterpes) girigangaensis*

Kubendran and Vasanth **sp. nov.**

(Figures 1–22)

**Length:** body, 5.0–5.2 mm; antennae, 3.0–3.5 mm; cerci, 5.5–5.7 mm; terminal filament, 5.8–6.2 mm. General coloration dark brownish yellow (Figures 1–2).

**Head:** Head prognathous. Dark brown washed with yellow. Upper portion of the male compound eye is reddish black, lower portion is black. Antenna whitish yellow. Labrum (Figures 3–5) dark brown, anteromedian emargination with broad five unequal denticles; laterally rounded with dense hair-like setae. Hypopharynx (Figure 6) lingua well developed; lateral process with anterior margin cleft, superlingua ‘V’ shaped marking medially. Mandibles (Figures 7–8) translucent, dark brown, incisors and molars reddish, inner incisor slightly longer than outer one; prosthema long and branched; outer margin curved with scattered long setae. Maxilla (Figure 9) palp 3 segmented; segment II subequal in the length of segment I, segment III approximately  $\frac{3}{4}$  length of segment II. Labium (Figure 10) glossa with plate-like thick setae on the ventral surface and dense row of fewer setae on the dorsal surface; paraglossa with denser setae but thinner setae on the dorsal surface; segment I of labial palp with thick long setae on outer margins, segment II with hair-like setae on outer margin, the apical segment with thick and fine setae and small tufts; segment I length, subequal to segment II length, segment III approximately  $\frac{3}{4}$  length of segment II.

**Thorax:** Yellowish brown, irregularly washed with dark brown; pronotum dark yellowish brown with diffuse black markings laterally. Meso and metathorax light

brown tinged with dark brown or black laterally. Legs (Figures 11–13) pale yellowish brown; each femur with a brown macula on middle and distal region; fore femur proximally ca. 3–4 feathered setae on dorsal surface, mid and hind femur moderately developed; each femur with thick and thin setae on outer margin; tibiae with fine and thick setae on inner margin, and very sparse and thin setae on inner margin, and very sparse and thin setae on outer margin, but hind tibiae mixed with thick and few feathered setae on surface; tarsi of all legs with several thin setae on inner margin and sparse setae on outer margins (Figures 15–16). Tarsal claw apically hooked with a row of 13–14 denticles (Figure 14).

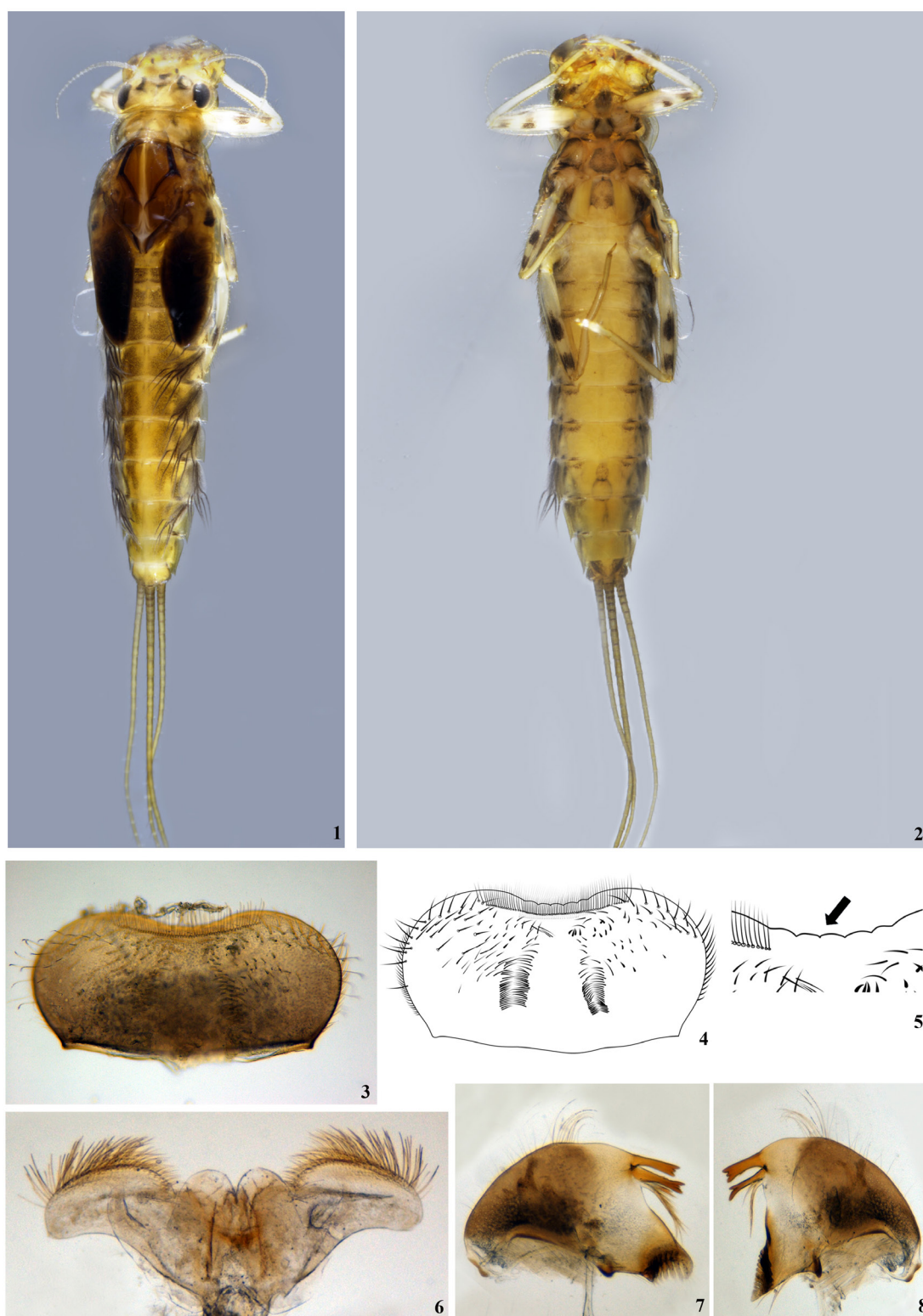
**Abdomen:** Terga I–IV light yellowish brown with diffuse black markings; terga V–IX dark brown with light yellow; terga X yellowish; I–IX with posterior marginal spines; posterolateral margins of abdominal terga I–V blunt denticles and VI–IX with pointed denticles, size of denticles progressively larger posteriorly (Figure 1). Gills present on segments I–VII; gill I single, slender, lanceolate and hair like setae present on the inner and outer margin of half of the gill (Figure 17); gills II–VII broad, alike with 3 apical processes (Figures 18–21). Sterna I–X yellowish, sternum VII with one spot on middle (Figure 2). Sternum IX of male with a deep apical cleft, sternum IX of female with apex entire and without emargination (Figure 22). Caudal filaments yellowish brown; with a whorl of setae on alternate segments; setae shorter than the length of the corresponding segment. Hind wings present.

**Adult:** Unknown.

**Distribution:** Giri Ganga River, Himachal Pradesh (Figure 23).

**Etymology:** This species is named after the type locality of Giri Ganga River, Sirmour district, Himachal Pradesh, India.

**Diagnosis:** *Choroterpes (C.) girigangaensis* Kubendran and Vasanth **sp. nov.** can be differentiated from all other known Oriental species of the subgenus by the following combination of characters: (i) femur with a dark brown macula middle and apex (Figures 11–13); (ii) anteromedian emargination of the labrum with five broad unequal denticles (Figures 3–5); (iii) hind tibiae with a row of the dense medium, long, feathered setae (Figure 15); (iv) upper and lower lamellae of gills II–VII broad, alike with 3 apical processes (Figures 18–21); and (v) tarsal claw apically hooked with a row of 13–14 denticles (Figure 14).



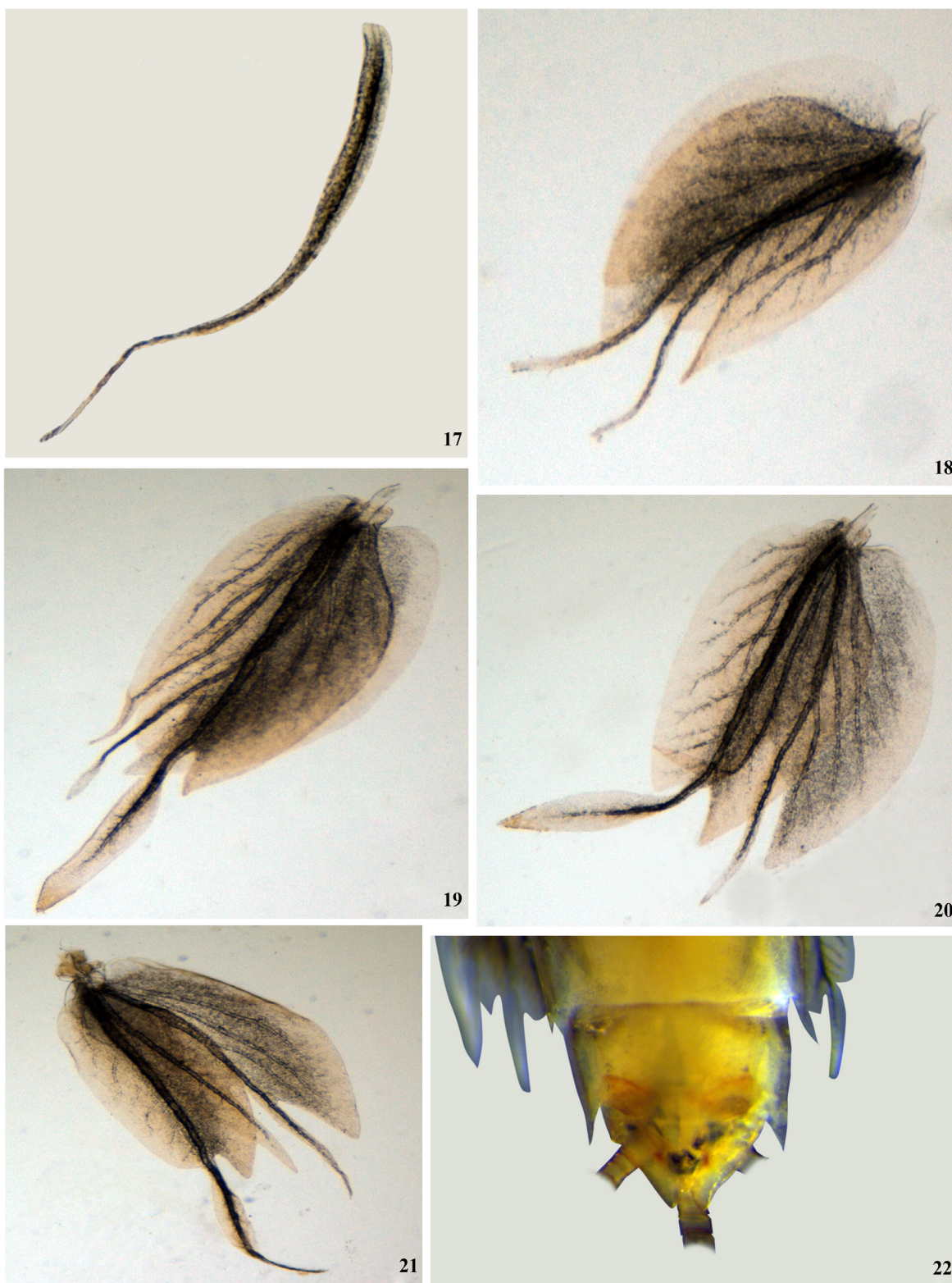
**Figures 1-8.** Larvae of *Choroperpes (Choroterpes) girigangaensis* sp. nov. 1. Dorsal view; 2. Ventral view; 3. Labrum; 4. Labrum emargination; 5. Labrum emargination with unequal denticles 6. Hypopharynx; 7. Left mandible; 8. Right mandible.





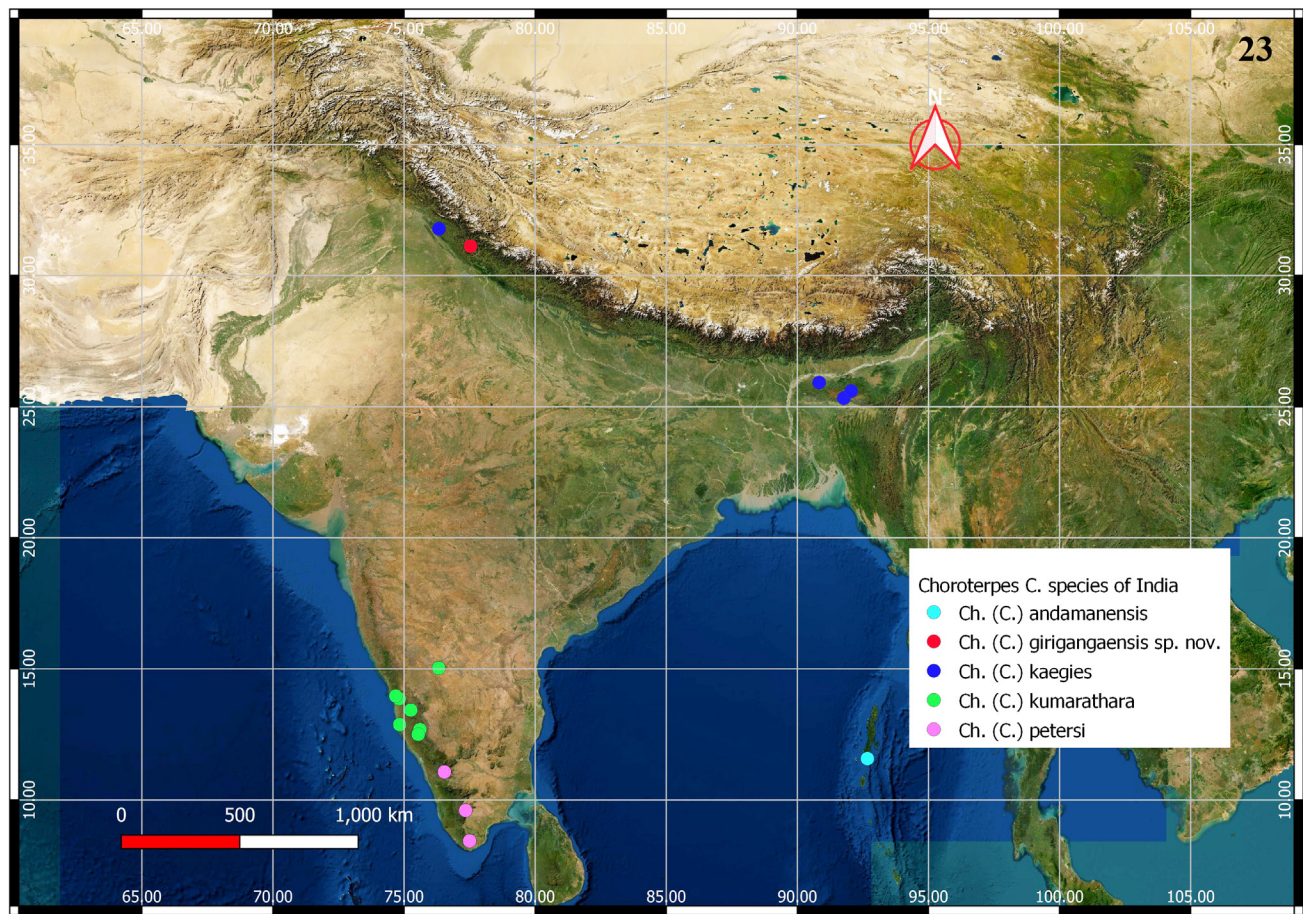
**Figures 9-16.** Larvae of *Choroterpes* (*Choroterpes*) *girigangaensis* sp. nov. 9. Maxilla; 10. Labium; 11. Foreleg; 12. Midleg; 13. Hindleg; 14. Hind tibia; 15. Hind tarsi. 16. Claw.





**Figures 17-22.** Larvae of *Choroperpes* (*Choroerpes*) *girigangaensis* sp. nov. 17. Gill I; 18. Gill II; 19. Gill V; 20. Gill VI; 21. Gill VII; 22. Ventral view of segment VIII–X.





**Figure 23.** Distribution of *Choroterpes* (*Choroterpes*) species of India.

**Table 1.** Comparison of larval characters of the subgenus *Choroterpes* s. str. from India

Species Characters	<i>Ch. (C.) girigangaensis</i> sp. nov.	<i>Ch. (C.) andamanensis</i>	<i>Ch. (C.) kaegies</i>	<i>Ch. (C.) kumarathara</i>	<i>Ch. (C.) petersi</i>
<b>Colouration</b>	dark brownish yellow	yellowish brown	light yellowish brown with diffuse black markings.	grey with yellowish brown	yellowish brown with diffuse black
<b>Labrum anterior emargination</b>	broad five unequal denticles	shallow, broad with five blunt denticles	broad without denticles	two times longer than wide; deeply cleft (U-shaped) with few denticle like protuberances	dorsally with 3 transversal rows; deeply cleft with U shaped ventrally
<b>Mandibles</b>	outer margin curved with scattered long setae	outer margins with scattered setae	outer margins with scattered setae	outer margin with a row of thin, long 9–12 setae	outer margins with scattered setae

<b>Hypopharynx</b>	lingua well developed; lateral process with anterior margin cleft, superlingua 'V' shaped marking medially	lingua with well-developed lateral process, with cleft anterior margin	lingua with well-developed lateral process, anterior margin cleft	lingua deeply cleft; lateral margin of superlingua angularly curved; anterior margin with rows of thin setae	lingua with well-developed lateral process, anterior margin cleft
<b>Claw</b>	13–14 denticles	8–9 denticles	4–5 denticles	10–12 denticles	11–12 denticles
<b>Gill I</b>	gill I single, slender, lanceolate and hair like setae present on inner and outer margin of half of the gill	gill I slender	gill I single, slender, lanceolate	gill I single lamellate, basal half broader and tapered to apex	gills I bilamellate, slender, dorsal and ventral portions are with fine hairs
<b>Gills II–VII</b>	gills II–VII broad, alike with 3 apical processes	gills II–VII with dorsal lamella larger than ventral	gills II–VII alike, well-tracheated, dorsal and ventral lamellae broad	gills II–VII median projection of dorsal lamella plate-like and ventral lamella smaller than dorsal lamella and trifurcated	gills II–VII median projection of dorsal lamella plate-like and ventral lamella smaller than dorsal lamella and trifurcated
<b>Femur with maculae</b>	each femur with a brown macula on middle and distal region	each femur with a brown macula on middle and distal region	each femur with a dark brown spot at middle and near apex	yellowish-brown with grey bands; surfaces covered with long hair-like setae	brownish yellow with greyish bands
<b>Hind tibia</b>	mixed with thick and few feathered setae on surface	thick and few feathered setae on surface	mixed with more denser thick and few feathered setae on surface	inner and outer margin of tibia with rows of spatulate setae and stout spines	rows of spatulate, feathered setae and stout spines
<b>Abdominal segment</b>	terga I–V blunt denticles and VI–IX with pointed denticles, size of denticles progressively larger posteriorly	terga I–X pale yellowish brown with diffuse black markings	terga I–X light yellow-brown with diffuse black markings	terga I–X grey to pale yellow; terga II–IX with a macula on either side of mesal margin; posterolateral spines present on segments II–IX progressively longer posteriorly	terga I–III yellowish brown; IV–VII yellowish brown with black markings; VIII–X black
<b>Caudal filaments</b>	yellowish; whorl of setae on alternate segments; setae shorter than length of corresponding segment	pale yellow-brown; with a whorl of setae on alternate segments; setae shorter than length of corresponding segment	pale yellow-brown; with a whorl of setae on alternate segments; setae shorter than length of corresponding segment.	pale yellow-brown; with a whorl of setae on alternate segments; setae shorter than length of corresponding segment.	brownish yellow with a whorl of setae on alternate segments
<b>Hind wings</b>	present	present	present	present	present

## Biological Notes

Larvae of this species were collected in a medium sized River (wide 4-4.5 m and 50 cm depth), medium water current (0.8 m/sec.) on the eastern part of Western Himalaya at an altitude of 1600m. The river's surrounding hills are covered with dense vegetation of pine trees (India, Himachal Pradesh State). The river bottom was covered with boulders, cobbles and sand. The water temperature ranged between 16-18°C (seasonal variations) and the pH was between 6.8 and 7.2. The larva was collected from under stones together with *Baetis* sp., and Hydropsychidae (Trichoptera).

## Discussion

In the Oriental region, six species were described viz., *Ch. (C.) proba* Ulmar, 1939, *Ch. (C.) hainanensis* You and Gui, 1995, *Ch. (C.) petersi* Tong and Dudgeon, 2003, *Ch. (C.) mercatorius* Kluge 2012, *Ch. (C.) kaegies* Selvakumar *et al.*, 2017 and *Ch. (C.) andamanensis* under the subgenus *Choroterpes*. Among this *Ch. (C.) hainanensis* You and Gui, 1995 described based on adult from China. Hence, the larval characters of Oriental species of the subgenus *Choroterpes* s.str. are compared with *Choroterpes (C.) girigangaensis* sp. nov. In India, only four species are recorded from the subgenus *Choroterpes* s.str. viz., *Choroterpes (C.) petersi* Tong and Dudgeon, 2003 from southern Western Ghats by Selvakumar *et al.*, (2015) which was originally described from Hong Kong, *Choroterpes (C.) kaegies* Selvakumar, Subramanian and Chandra, 2017 described from Himachal Pradesh and Meghalaya by Selvakumar *et al.*, (2017), *Choroterpes (C.) andamanensis* Vasanth, Subramanian and Selvakumar, 2021 described from Andaman Island by Vasanth *et al.*, 2021 and recently Muthukatturaja and Balasubramanian described *Choroterpes (C.) kumaradhara* from Karnataka. The present study a new species, *Choroterpes (C.) girigangaensis* sp. nov. is described from Himachal Pradesh. The distribution of *Choroterpes (C.) petersi* Tong and Dudgeon, 2003 appears to be disjunct in its geographical range. *Choroterpes (C.) kaegies* Selvakumar, Subramanian and Chandra, 2017 widely distributed in North and North-East India. *Choroterpes (C.) girigangaensis* sp. nov. is only known from Himachal

Pradesh and Jammu and Kashmir. However, detailed field surveys are required to explore the distribution of this genus in the Indian biogeographic regions.

## Larval Key to the known Species of Subgenus *Choroterpes* in India

1. Gill 1 single; upper and lower lamellae of gills 2-7 with 3 apical processes, median process relatively slender and longer than laterals ..... 2
- Gill 1 double; upper and lower lamellae of gills 2-7 with 3 apical processes, median process relatively larger and longer than laterals ..... *Choroterpes (C.) petersi*
2. Gill 1 basally broad and distally lanceolate ..... *Choroterpes (C.) kumaradhara*
- Gill 1 not as above ..... 3
3. Upper and lower lamellae of gills 2-7 broad ..... 4
- Upper and lower lamellae of gills 2-7 not broad ..... *Choroterpes (C.) andamanensis*
4. Claw apically hooked with a row of 13-14 denticles; anteromedian emargination of labrum with denticles ..... *Choroterpes (C.) girigangaensis* sp. nov.
- Claw apically hooked with a row of 4-5 denticles, anteromedian emargination of labrum without denticles ..... *Choroterpes (C.) kaegies*

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