



***Baetis venkataramani* sp. nov., a new species of the genus *Baetis* Leach, 1815 (Ephemeroptera: Baetidae) from Tamil Nadu, India**

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Abstract

As part of the ongoing research in the southern Western Ghats, a new species of *Baetis* Leach is described based on the nymphs collected in the Tamil Nadu, Southern India. *Baetis venkataramani* sp. nov. does not belong to any of the *Baetis* species groups proposed so far. The most closely related species to *B. venkataramani* sp. nov. is *B. collinus* Müller-Liebenau & Hubbard. However, the new species is distinguished from *B. collinus* by the presence of tergalis I, posterior-tergal spines absent on the tergites I–VIII and present on the tergum IX and by the size of the labial palp segment III. The main differences between *B. venkataramani* sp. nov. and other oriental species of *Baetis* are also discussed.

Key words: *Baetis collinus*, mayflies, new species, Western Ghats

Introduction

The family Baetidae in India comprises of about 12 genera: *Acentrella* Bengtsson, 1912; *Baetis* Leach, 1815; *Baetiella* Ueno, 1931; *Centroptella* Braasch & Soldán, 1980; *Cloeon* Leach, 1815; *Indobaetis* Müller-Liebenau & Morihara, 1982; *Indocloeon* Müller-Liebenau, 1982; *Labiobaetis* Novikova & Kluge, 1987; *Nigrobaetis* Kazlauskas (in Novikova & Kluge), 1987; *Procloeon* Bengtsson, 1915; *Symbiocloeon* Müller-Liebenau (in Müller-Liebenau & Heard), 1979 & *Tenuibaetis* Kang & Yang (in Kang, Chang & Yang), 1994 (Sivaramakrishnan *et al.* 2009; Kubendran *et al.* 2015; Kluge 2022). The genus *Baetis* is distinguished from the closely related *Tenuibaetis* by the absence of a patch of notched scales on the paraproct and the absence of robust setae with a median ridge on anterior surface of the femur. In Southern India, several researchers have mentioned species such as *Baetis acceptus* Müller-Liebenau & Hubbard, 1985; *Baetis conservatus* Müller-Liebenau & Hubbard, 1985; *Baetis fluitans* Gillies, 1949 in their ecological articles (Sivaramakrishnan & Venkataraman 1990; Selvakumar *et al.* 2014; Kubendran *et al.* 2017a, b), but the reliability of these species records remain dubious. Therefore, no reliable specific record of this genus was known from South India. In this contribution, we described a new species of *Baetis* based on the nymphs collected in the Tamil Nadu part of Western Ghats.

Material and methods

The nymphs of the new species were collected by hand picking from the Puliyuthu Falls, Theni District, Tamil Nadu. The collected samples were preserved in 80% ethanol and the morphological characters of the new species were studied using a LABOMED Luzeo 6Z stereo zoom microscope and a LABOMED Lx400 microscope, and photos were taken with the help of an AR 6 Pro digital camera, subsequently editing of photographs was done by

Adobe Photoshop 7.0. Permanent slides were made with Canada balsam. Type specimens are now housed in the American College Museum (AMC), Madurai, Tamil Nadu, India.

Results

Systematic account

Baetis venkataramani Sivaruban, Srinivasan, Barathy & Isack sp. nov.

(Figs. 1–20)

Material examined. Holotype (on slide): ♀ mature nymph (AMC ZN 247), South India, Tamil Nadu, Theni district, Bodimettu, Puliyyuthu Falls, 10°03'16"N, 77°27'29"E; 1230 m; 13.x.2021, Pandiarajan Srinivasan & Rajasekaran Isack. **Paratypes** (in alcohol): 3 nymphs (AMC ZN 248), same data as holotype.



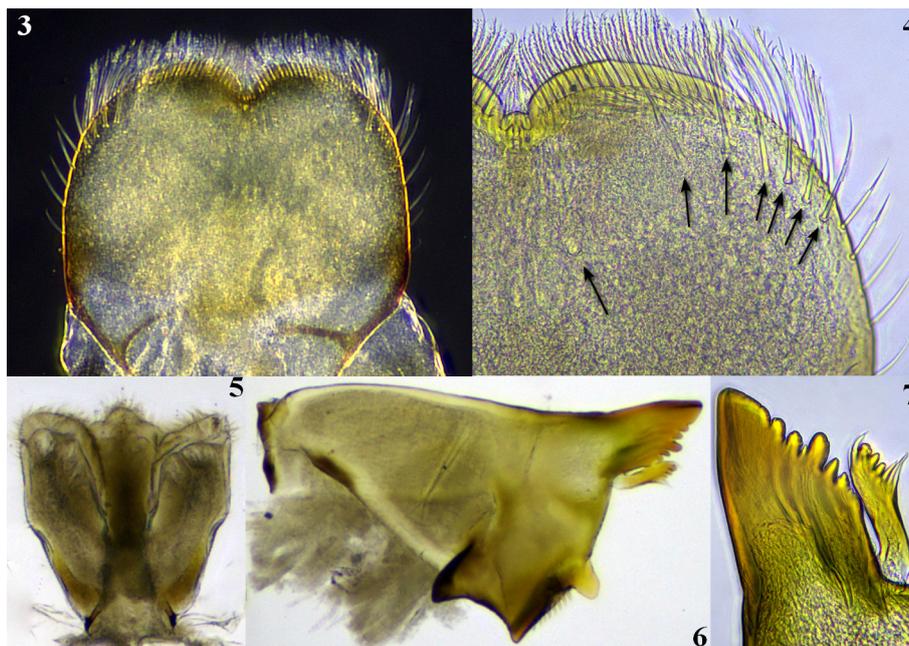
FIGURES 1–2. *Baetis venkataramani* sp. nov. 1, habitus, dorsal view; 2, habitus, ventral view.

Descriptions.

Mature nymph. Length: Body 4.3–4.5 mm; paracercus 2.1–2.2 mm, cerci 2.4–2.6 mm. Colouration (Fig. 1): Head and thorax uniformly light brownish dorsally with dark scutellum. Legs generally light brownish, femur medially with well developed, dark brown spot (Fig. 2); claw proximally light brownish and distally dark brownish. Abdominal tergum uniformly light brownish along with two paramedial spots, posterior margin of tergal segments I to VIII washed with longitudinal dark brownish band. Abdominal sternites I to IX uniformly creamy with a pair of sub-lateral markings. Cerci light brownish.

Head: Scape and pedicel subcylindrical. Each segment of the antenna with fine, simple setae on the apex. Labrum (Fig. 3): Sub-rectangular, length 0.75× maximum width; medial emargination with notched margin; dorsal surface with scattered fine, simple setae all over surface; 1 + 6 simple setae, distolaterally decreasing in size (Fig. 4) forming submarginal arc; ventral surface with 9–10 short, spine-like setae laterally. Hypopharynx (Fig. 5): Lingua slightly longer than superlingua; medial tuft of fine, simple setae poorly developed. Left mandible (Fig. 6): Incisors fused; both outer and inner incisor with 3 large denticles and a minute denticle in between; first denticle blade-like; prosthema robust and comb-shaped with small denticles apically (Fig. 7); medial margin between prosthema and molar region straight; molar apex without setae. Right mandible (Fig. 8): Incisors fused; outer and inner incisor with 3 + 4 denticles and 2 minute denticles on the inner margin of innermost denticle; first denticle blade-like; prosthema toothbrush-like, distally and distolaterally denticulate (Fig. 9); medial margin between prosthema and molar region

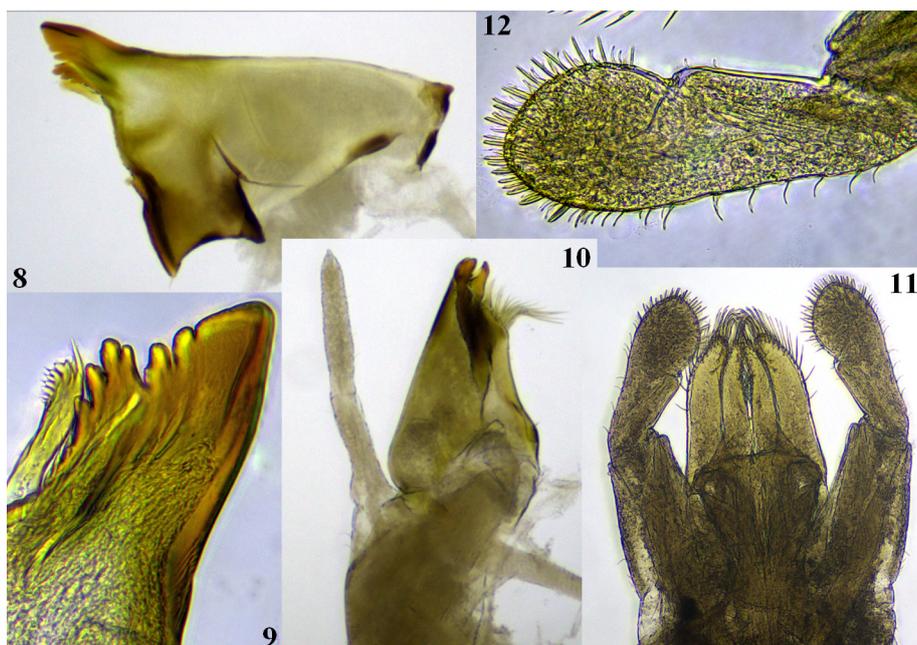
slightly convex; molar apex with a tuft of fine setae. Maxilla (Fig. 10): Galea-lacinia with a simple seta under the crown; medially with a small, bifid seta and five to six long, simple setae. Maxillary palp sub-equal to the length of galea-lacinia; two segmented, segment II 1.2× length of the segment I; fine, small, simple setae scattered over the surface of maxillary palp; segment II bluntly pointed at apex. Labium (Fig. 11): Glossa subequal in length to paraglossa; inner margin of glossa with 8–9 curved, spine-like setae; apex with three long, stout setae; outer margin with 3–4 long, spine-like setae. Paraglossa with two rows of long, simple setae on the apex, ventromedial surface with a minute, curved, hair-like seta, dorsal surface with a row of 3 long, curved, simple setae near the inner margin. Labial palp three segmented; segment I subequal in the length of segments II and III combined. Segment I with small micropores dorsally and fine, simple setae ventrally; segment II with very small, distomedial protuberance; outer margin with fine, hair-like setae; dorsal surface with four long, spine-like setae medially; segment III oval shaped; apex rounded; length 1.2× width (Fig. 12); ventrally covered with numerous spine-like setae along with hair-like setae.



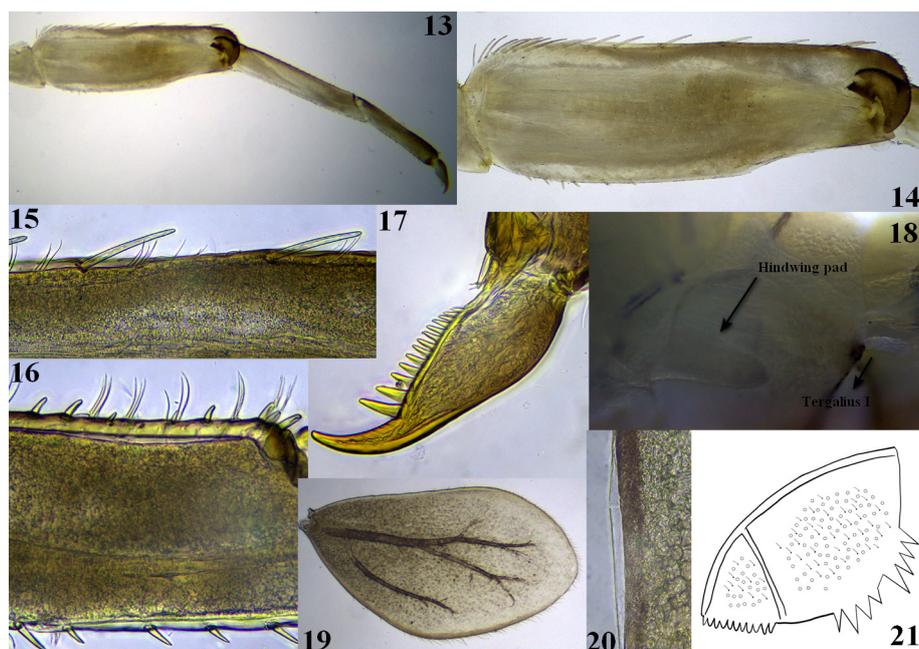
FIGURES 3–7. *Baetis venkataramani* sp. nov. 3, labrum; 4, submarginal arc of setae in labrum; 5, hypopharynx; 6, left mandible; 7, left prosthema and incisor.

Thorax: Hind wing pads well developed (Fig. 18). Foreleg (Fig. 13): ratio of length of femur / tibia / tarsus / claw 1.4:1.0:0.6:0.3. Femur (Fig. 14). Length ca. 3.2 × maximum width; outer margin with a row of ca. 18 long, spatulate setae (Fig. 15); length of setae 0.23× maximum width of femur; femora with rounded apex with numerous small, stout, clavate setae along with hair-like setae and a pair of spatulate setae; inner margin with irregular row of stout, lanceolate, apically blunt setae; femoral patch well developed. Tibia. Outer margin with a row of short, spine-like setae along with hair-like setae (Fig. 16); inner margin with a row of spine-like setae different in size; patellotibial suture present on 2/3 of tibia. Tarsus. Outer margin with a row of short, spine-like setae along with hair-like setae; inner margin with row of spine-like setae, increasing in size distally. Claw with a row of 13 denticles, increasing in size distally and four stripes apically; subapical setae absent (Fig. 17).

Abdomen: Tergum. Surface with irregular rows of U-shaped scale bases and scattered micropores, and with fine, simple setae. Postero-tergal spines absent on segments I–VIII (Fig. 20); present on tergum IX & X, triangular, sharply pointed, longer than wide. Tergalii (Fig. 19). Present on segments I–VII; margin with small denticles and intercalating fine, simple setae (Fig. 19); tracheae well developed and extending from the main trunk to outer margin; tergalium I very minute (Fig. 18), as long as the length of 1/4th of abdominal segment II; tergalium IV as long as the length of abdominal segments V and 1/3rd VI combined; tergalium VII as long as the length of abdominal segment VIII and 1/3rd IX combined. Paraproct (Fig. 21): Distally not expanded, with ca. 8 long, triangular, sharply pointed marginal spines; surface scattered with micropores and long, fine setae; cercotractor with few medium, stout, marginal spines.



FIGURES 8–12. *Baetis venkataramani* sp. nov. 8, right mandible; 9, right prostheca and incisor; 10, maxilla; 11, labium; 12, labial palp segments II & III.



FIGURES 13–21. *Baetis venkataramani* sp. nov. 13, foreleg; 14, forefemur; 15, outer marginal setae in forefemur; 16, setation in foretibia; 17, foreclaw; 18, hindwing pad and tergalium I; 19, tergalium IV; 20, posterior margin of tergum IV; 21, paraproct.

Imago. Unknown.

Distribution. Tamil Nadu (Western Ghats).

Diagnosis. Nymphal diagnostic characters of *Baetis venkataramani* sp. nov. are as follows: (i) dorsal surface of the labrum with 1 + 6 pairs of simple setae, distolaterally decreasing in size (Fig. 4); (ii) maxillary palp segment II 1.2× length of the segment I (Fig. 10); (iii) labial palp segment III length 1.2× width (Fig. 12); (iv) maxillary palp segment II bluntly pointed at the apex (Fig. 10); (v) outer margin of forefemur with a row of ca. 18 long, spatulate setae (Fig. 14); (vi) claw with a row of 13 denticles (Fig. 17); (vii) postero-tergal spines absent on tergal segments I–VIII (Fig. 20), present on tergal segments IX & X; (viii) tergalii present on segments I–VII, tergalium I reduced and (ix) paraproct with ca. 8 long, triangular, sharply pointed marginal spines (Fig. 21).

Etymology. This new species is named in honor of Dr. K. Venkataraman for his remarkable contribution to the Indian Ephemeroptera.

Discussion

Baetis venkataramani **sp. nov.** is similar to the Sri Lankan species *Baetis collinus* Müller-Liebenau & Hubbard, 1985 by the absence of postero-tergal spines on the tergite IV, shape of mandibular incisors, maxillary palp segment II with a pointed tip at the apex, and by the tergal coloration. However, it can be distinguished by i) the presence of tergalium I, whereas, in *B. collinus*, it is absent (Müller-Liebenau & Hubbard 1985); ii) labial palp segment III length 1.2× width, whereas, in *B. collinus*, labial palp segment III length 1.4× width (Müller-Liebenau & Hubbard 1985: fig. 4b); iii) postero-tergal spines present on the tergal segments IX & X, whereas, in *B. collinus*, it was absent in all the tergal segments (Müller-Liebenau & Hubbard 1985). It is further distinguished from other Sri Lankan species (*Baetis acceptus* Müller-Liebenau & Hubbard, 1985 and *Baetis conservatus* Müller-Liebenau & Hubbard, 1985) by the presence of seven pairs of tergalia, while, both the above species, only have six pairs of tergalia (Müller-Liebenau & Hubbard 1985). Further, it is distinguished from the Malaysian species *B. ideii* Müller-Liebenau, 1984, the Taiwanese species *B. tatuensis* Müller-Liebenau, 1985 and *B. taiwanensis* Müller-Liebenau, 1985 and the Chinese species, *B. rutilocylindratus* Wang, Qin, Chen & Zhou, 2011 and *B. maculosus* Tong, Dudgeon & Shi, 2014 by the shape of labial palp segment III and the maxillary palp segment II with bluntly pointed tip at the apex (Müller-Liebenau 1984, 1985; Wang *et al.* 2011; Tong *et al.* 2014). In the Western Ghats, at least one species (*B. fluitans*) was nominally placed under the genus *Baetis*. However, they are known only from the adults and the generic assignment of this species also remains doubtful, as the identification of the adult stages based on the old type material is generally very difficult in the family Baetidae. Therefore, we did not take this species into account in our study and await further clarification of its status in the future by using integrative taxonomic methods.

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