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First record of the nominotypical subgenus *Acentrella* Bengtsson, 1912 (Ephemeroptera: Baetidae) from India with description of a new species

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ABSTRACT

A new species *Acentrella* (*A.*) *isacki* sp. n. is described based on the larvae collected from the Neeru stream of Jammu and Kashmir, India. It is the first record of the nominotypical subgenus *Acentrella* Bengtsson, 1912 from India. The new species does not belong to any Palearctic subgenus group proposed by Kluge and Novikova (2011). It is distinguished from closely related *Acentrella* (*A.*) *lata* (Müller-Liebenau, 1985) by the apico-internal projection on the labial palp segment II, sub-marginal arc of setae in labrum, and by the presence of spines on the inner margin of paraproct.

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Acentrellini; *A. isacki* sp. n.; Himalayas; Jammu and Kashmir; new species

Introduction

The genus *Acentrella* Bengtsson, 1912 was established based on the type species *Acentrella lapponica* Bengtsson, 1912. The genus was treated as a subgenus to the genus *Baetis* Leach, 1815 by several authors (Edmunds and Traver 1954; Novikova and Kluge 1987). However, Waltz and McCafferty (1987) and subsequently Sroka and Arnekleiv (2010) considered them as separate genera. The genus *Acentrella* includes five subgenera: *Acentrella* s. str. Kluge and Novikova, 2011; *Tanzaniops* Kluge and Novikova, 2011; *Jubabaetis* Kluge and Novikova, 2011; *Liebebiella* Kluge and Novikova, 2011; *Platybaetis* Kluge and Novikova, 2011. Probably the genera *Acerobiella* Gattolliat, 2012, *Asiobaetodes* Gattolliat, 2012 and *Gratia* Thomas, 1992 also belong to the genus *Acentrella* (Tungpairojwong, Phlai-Ngam, and Jacobus 2022). The nominotypical subgenus *Acentrella* is distinguished from other subgenera of *Acentrella* by: in larvae, (1) tarsus of each leg lacks ventral subapical seta, (2) flat denticles forming a row on the mola of left mandible, longer than 1/2 of the distal molar projection and begin close to

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it, and (3) paraglossal muscle on the mentum is oblique and ventrally overlapping the glossal muscle (Kluge 2022). The nominal species in *Acentrella* s. str. (*Acentrella*/fg2 according to rank-free classification in Kluge and Novikova (2011) are *Acentrella almohades* Alba-Tercedor and El-Alami, 1999; *A. chantauensis* Kluge, 1981; *A. charadra* Sroka and Arnekliev, 2010; *A. diptera* Kluge and Novikova, 2011; *A. fenestrata* (Kazlauskas, 1963); *A. feropagus* Alba-Tercedor and McCafferty, 2000; *A. fimbriata* Tungpairojwong, Phlai-Ngam, and Jacobus, 2022; *A. gnom* Kluge, 1983; *A. inexpectata* (Tshernova, 1928); *A. insignificans* (McDunnough, 1926); *A. joosti* (Zimmermann and Braasch, 1979); *A. lapponica* Bengtsson, 1912; *A. lata* (Müller-Liebenau, 1985); *A. nadineae* McCafferty, Waltz, and Webb, 2009; *A. scabriventris* Kluge and Novikova, 2011; *A. sibirica* (Kazlauskas, 1963); *A. sinaica* Bogoescu, 1931; *A. turbida* (McDunnough, 1924). *Acentrella glareosa* Sroka and Arnekleiv, 2010 was synonymised with *A. sibirica* (Kazlauskas, 1963) by Kluge and Novikova (2011). In the Indian subcontinent, so far only two species of *Acentrella* were recorded viz., *Acentrella* (*Liebebiella*) *vera* (Müller-Liebenau, 1982) from South India and *Acentrella* (*Platybaetis*) *selvai* Kubendran, Vasanth, and Subramanian, 2021 in Kubendran et al. (2021) from eastern Himalayas. *Platybaetis arunachalae* Selva Kumar, Sundar, and Sivaramakrishnan, 2012, described from South India, was synonymised with *Acentrella* (*Liebebiella*) *vera* by Kluge, Sivaramakrishnan, Selva Kumar, and Kubendran (2013). In this contribution, we describe a new species of the nominotypical subgenus *Acentrella* viz., *A.* (*A.*) *isacki* sp. n. from the northwestern Himalayas. It is the first record of this subgenus from the country.

Material and methods

The larvae of the new species were collected from Neeru stream in the Bhaderwah region of Jammu and Kashmir. The collected specimens were preserved in 80% ethanol. The morphological characters were studied using LABOMED Luzeo 6Z stereo zoom microscope and LABOMED Lx400 microscope. The images were taken with an AR 6 Pro digital camera and edited with Adobe Photoshop 7.0. Type specimens have been deposited in The American College Museum (AMC), Madurai, Tamil Nadu, India.

Results

Acentrella (A.) isacki sp. n.

(Figures 1–27)

Type locality

India, Jammu and Kashmir, Doda District, Neeru Stream, 32°57.08′N, 75°43.15′E.

Type material

Holotype. ♂ larva, 'North India, Jammu and Kashmir, Doda district, Bhaderwah, Neeru stream, 32°57.08′N, 75°43.15′E, ca.1800 m, 10.10.2020, leg. Asha Sohil' (AMC/ZN/243).

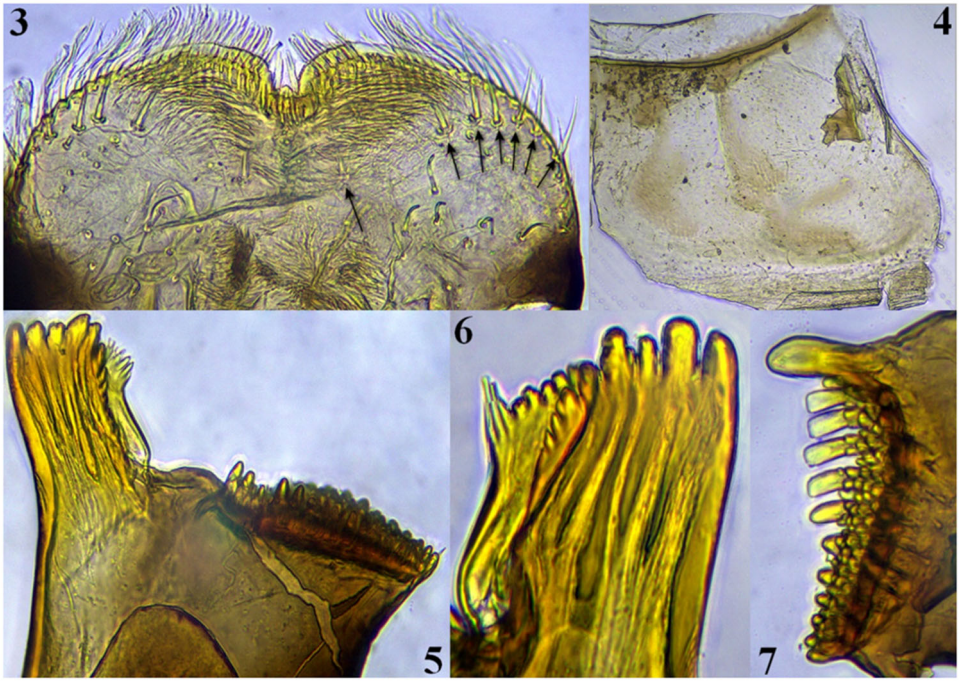
Figures 1–2. *Acentrella* (*A.*) *isacki* sp. n.: (1) male habitus, dorsal view; (2) male habitus, ventral view.

Paratypes. 3 larvae, with same label data as holotype (AMC/ZN/244).

Description of mature larva

Measurements. Body length: 3.3–3.5 mm; cerci length: 3.1–3.2 mm; antenna length: 0.8 mm; paracercus reduced to a single segment.

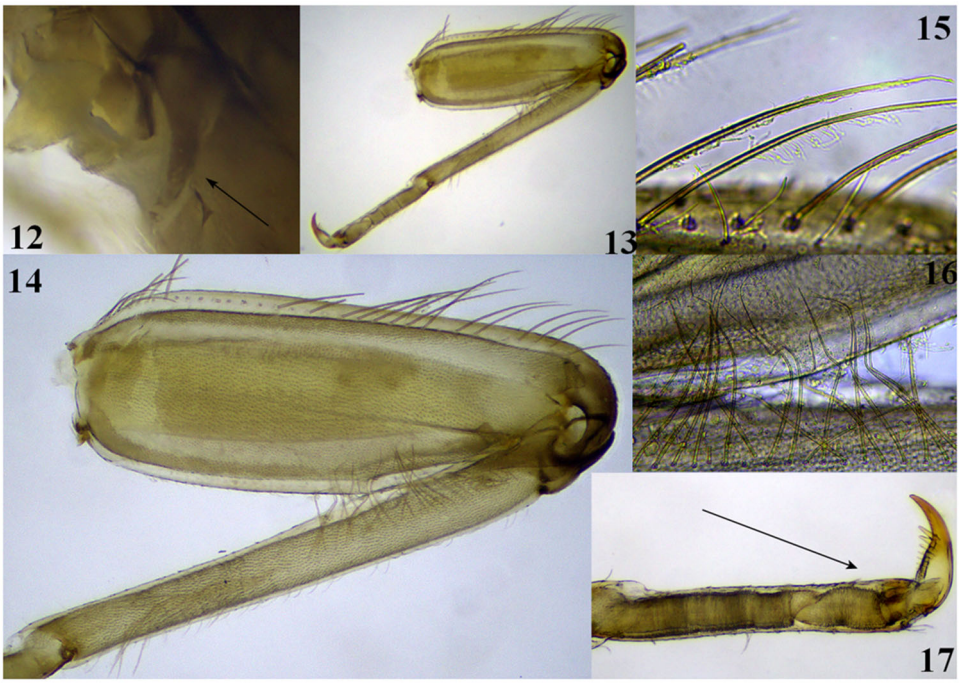
***Colouration* (Figure 1).** Head and thorax dorsally dark brownish; pronotum with dark sigilla on a lighter background (Figure 4); abdomen dorsally light brownish in tergum I; dark brownish in terga II–VIII; whitish in tergum IX and darker in tergum X; all tergite surface with a well-developed medioposterior sigilla (Figure 20) (poorly expressed on tergum X); head and thorax ventrally light brownish and abdomen ventrally pale (Figure 2); cerci pale brownish.



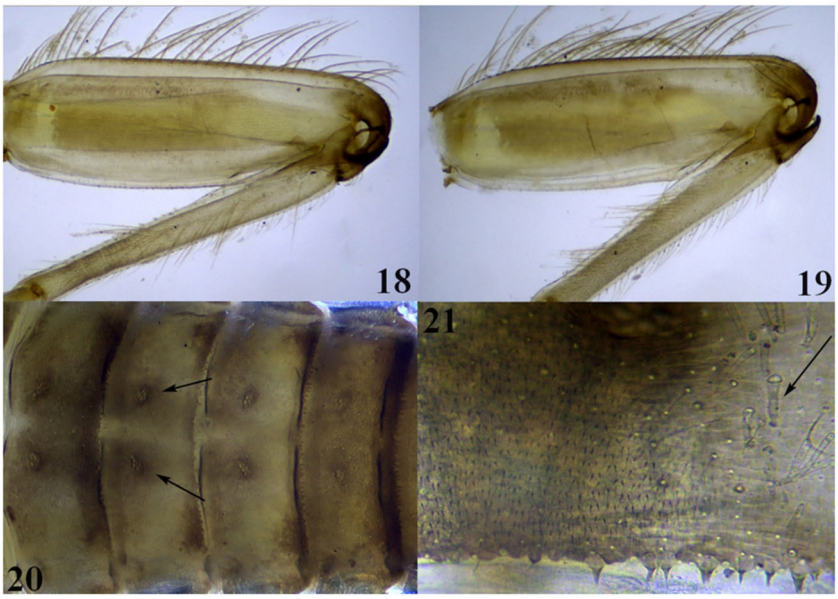
Figures 3–7. *Acentrella* (*A.*) *isacki* sp. n.: (3) labrum, sub-marginal setae; (4) right half of pronotum; (5) closer view of right mandible; (6) left mandibular prostheca; (7) left mandibular mola.

Figures 8–11. *Acentrella* (*A.*) *isacki* sp. n.: (8) maxilla; (9) setation of maxilla; (10) labium; (11) labial palp segments II and III (arrow indicates muscle).

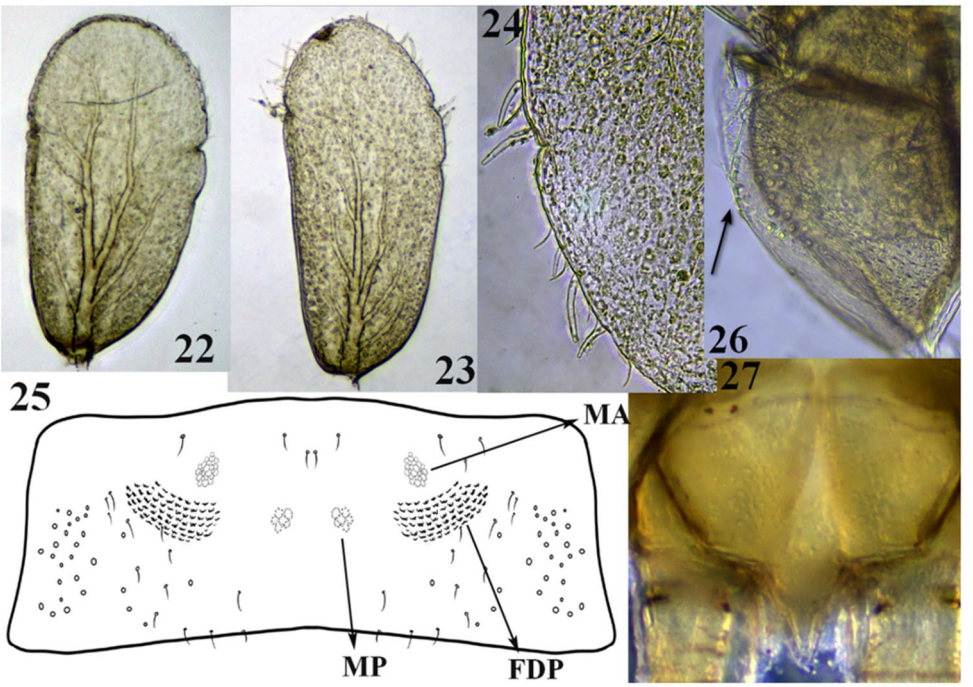
Head. Head surface entirely covered with short hair-like setae. Labrum (Figure 3): approximately 1.8 × wider than long; medial emargination with notched margin, dorsal surface with sparse, curved, simple setae; submarginal arc with a pair of 1 + 5–6



Figures 12–17. *Acentrella* (*A.*) *isacki* sp. n.: (12) hindwing pad; (13) foreleg; (14) forefemur; (15) forefemoral setae; (16) foretibial setae; (17) foretarsus and foreclaw (arrow indicates absence of long ventral subapical seta).



Figures 18–21. *Acentrella* (*A.*) *isacki* sp. n.: (18) midfemur and midtibia; (19) hindfemur and hindtibia; (20) tergum III–VI (arrows indicate medioposterior sigillum); (21) posterior margin of tergum IV denticulation (arrow indicate tube-shaped bristles).



Figures 22–27. *Acentrella* (*A.*) *isacki* sp. n.: (22) tergalius I; (23) tergalius IV; (24) marginal setation in tergalii; (25) sternum V (FDP – field of dentate protuberances; MA – medioanterior sigillum; MP – medioposterior sigillum); (26) closer view of paraproct (arrow indicates spine); (27) paracercus.

long, simple setae (Figure 3); ventral surface with four short, spine-like setae on each side near lateral margin. Hypopharynx: covered with scattered fine, simple setae. Right mandible: Incisors with 6 large, blunt denticles and 3 small denticles on the inner margin; prostheca extended apically, with numerous sharp teeth; molar apex with a small, thin seta (Figure 5). Left mandible: incisors with 6 large, blunt denticles and 4 small denticles on the inner margin; prostheca comb-like and denticulate apically (Figure 6); flat denticles forming row on mola longer than 1/2 of distal molar projection (Figure 7). Maxilla (Figure 8): galea-lacinia with two simple setae under crown; medially with a small, bifid seta dorsally and four long, simple setae ventrally (Figure 9). Maxillary palp two-segmented, segment I 1.3 times longer than segment II; segment II with a pointed tip. Labium (Figure 10): paraglossae ca. 2 times wider than glossae, paraglossae apically with 3 irregular rows of long, curved, monopectinate setae. Labial palp three-segmented; segment I 1.4× lengths of segments II and III combined. Segment I with small micropores dorsally and fine, simple setae ventrally; segment II with slightly produced apico-internal projection on the distal margin, with muscles (Figure 11); outer margin with small fine, simple setae and inner margin almost bare; dorsal surface with 3 long, apically pointed, simple setae; segment III rounded with scattered short, spine-like setae.

Thorax. Hindwing pads vestigial (Figure 12). Foreleg (Figure 13): ratio of length of femur/tibia/tarsus/claw 0.9:1.0:0.4:0.2. Femur (Figure 14). Length ca. 2.8 × maximum

width; outer margin with a row of long setae with ciliate bristles (Figure 15), setae length ca. 0.6 × width of the femur; inner margin with small spine-like setae along with hair-like setae; dorsal surface with numerous, scattered hair-like setae; femoral villopore present, formed by simple, setae. Tibia with two rows of ciliate bristles (Figure 16), bristles of dorsal row ca. 2.4 times longer than the width of tibia; bristles of ventral row ca. 0.4 times longer than the width of tibia; patello-tibial suture present on proximal half of tibia. Tarsus with a regular row of ciliate bristles (ca. 0.7 times as long as tarsal width) on outer margin. Claw with a row of ca. 10 long, apically blunt denticles, increasing in size distally; subapical setae absent (Figure 17). Tibiae and tarsi of mid and hindlegs similar to the ornamentation of foreleg, bristles of dorsal row of tibia ca. 2.1 times (in midtibia) and ca. 2.2 times (in hindtibia) as long as tibia width. Bristles of ventral row of tibia ca. 0.9 times (in midtibia) and ca. 1.2 times (in hindtibia) as long as tibia width (Figures 18 and 19). Bristles on outer margin of tarsus ca. 1.3 times (in midtarsi) and ca. 1.5 times (in hindtarsi) as long as tarsal width.

Abdomen. Tergum surface scattered with fine, simple setae in mid region and in lateral and sublateral region, long tube-shaped bristles present (Figure 21); width of tergum I 2.7 times the width of tergum X; tergum II width/length: 3.75–4. Posterior margin of tergum medially with rounded denticles, laterally with apically pointed, triangular denticles (Figure 21). Tergalii (plate-like gills) present on segments I–VII, elliptical with well-developed tracheation (Figures 22 and 23), dorsal surface scattered with numerous pores, margin smooth with fine, short simple setae and tube-shaped bristles (Figure 24). Tergalius IV length/tergum length: 2.1–2.2; tergalius IV width/tergum length: 0.7–0.8; tergalius VII much smaller than other tergalii and as long as length of abdominal segment VIII. Sternal surface with paired sternal fields of dentate protuberances transverse, broad, located closer to medioanterior sigilla and far from medioposterior sigilla (Figure 25). Paraproct with numerous pores equipped with simple setae and with ca. 5 small, stout spines near inner proximal margin (Figure 26). Paracercus reduced to one segment (Figure 27) and cerci with well-developed swimming setae on inner side.

Imago

Unknown.

Diagnosis

Larval diagnostic characters of *Acentrella* (*A.*) *isacki* sp. n. are as follows: (1) submarginal arc of labrum with a pair of 1 + 5–6 long, simple setae (Figure 3); (2) maxillary palp segment II with a pointed tip at apex (Figure 8); (3) labial palp segment II with a slightly produced apico-internal projection on the distal margin (Figure 11); (4) hindwing pads vestigial and it does not develop into an imaginal hindwing (Figure 12); (5) legs with two dense rows of ciliate bristles along tibia (Figures 16, 18, and 19); (6) tergalius VII much smaller than other tergalii; (7) paraproct with ca. 5 small, stout spines along the inner margin (Figure 26) and (8) paracercus reduced to one segment (Figure 27).

Etymology

The new species is named after Mr Isack Rajasekaran (PG and Research Department of Zoology, The American College, Madurai) for his remarkable contribution to the study of Indian mayflies. The species name is a noun in the genitive case.

Distribution

Neeru stream (Doda, Jammu and Kashmir), India.

Discussion

The larva of *Acentrella isacki* sp. n. belongs to the genus *Acentrella* based on the following combination of characters: (i) 2nd segment of labial palp without any large inner-apical projection and muscles in the 2nd segment retained, (ii) 3rd segment of labial palp widened and rounded, (iii) body typical of *Acentrella*-type i.e., short, with ventral side usually flattened, thorax enlarged, leg bases widely separated, and abdomen diminished, (iv) tibia on the outer-dorsal side with a regular longitudinal row of setae, and (v) paracercus reduced (Kluge and Novikova 2011). It belongs to the *Acentrella* s. str. or *Acentrella*/fg2 rank-free classification based on the following combination of characters: (i) larval tarsus lacks ventral subapical seta, (ii) flat denticles forming a row on the mola of left mandible, longer than 1/2 of the distal molar projection and begin close to it, and (iii) paraglossal muscle on the mentum oblique and ventrally overlapping the glossal muscle (Kluge and Novikova 2011). The new species is easily confused with the subgenus *Liebebiella* by the presence of two long rows of ciliate bristles on tibia, as it is mostly present in the subgenus *Liebebiella* but the species *A.* (*A*). *sibirica* has two regular rows of bristles in the hindtibia (Kluge and Novikova 2011, Figure 89). This shows that the species, which have this additional row, do not form a holophylum, but are dispersed within the genus *Acentrella* (Kluge and Novikova 2011). The new species can be easily distinguished from another Indian species *Acentrella* (*Liebebiella*) *vera* by (i) larval tarsus lacks ventral subapical seta (whereas, in *A.* (*L.*) *vera*, larval tarsus with large ventral subapical seta (Tungpairojwong et al. 2022, Figure 15E)); (ii) flat denticles forming a row on the mola of left mandible, longer than 1/2 of the distal molar projection and begin close to it (whereas, in *A.* (*L.*) *vera*, flat projections forming a row on mola of left mandible, very small and petiolate (Selva Kumar, Sundar, and Sivaramakrishnan 2012, Figure 7)); (iii) paracercus reduced to one segment (whereas, in *A.* (*L.*) *vera*, paracercus consists of ca. 11–12 segments (Tungpairojwong et al. 2022, Figure 17F)).

It does not belong to any group of the nominotypical subgenus *Acentrella*, proposed by Kluge and Novikova (2011). It is distinguished from the group *lapponica* which includes species: *Acentrella lapponica*, *A. feropagus*, *A. sinaica*, *A. charadra*, *A. chantauensis*, *A. joosti*, *A. almohades*, and *A. insignificans*, by the absence of functional hindwing pads. It is further distinguished from group *fenestrata* which includes *A. fenestrata*, by the presence of well-developed swimming setae on the inner side of cerci. The new species is also distinguished from group *inexpectata* which includes *A. inexpectata* and *A. gnom*, by the absence of multisegmented paracercus and pronotum with dark sigilla on a lighter background. It also distinguished from group *sibirica*

which comprise of *A. sibirica*, *A. diptera,* and *A. scabriventris*, by the presence of well-developed muscles on the segment II of labial palp. The most closely related species to *Acentrella* (*A.*) *isacki* sp. n. is *Acentrella* (*A.*) *lata*, however, the new species can be distinguished from it by (i) labial palp segment II with a slightly produced apico-internal projection on the distal margin (whereas, in *A.* (*A.*) *lata*, segment II of labial palp without any apico-median projection (Müller-Liebenau 1985, Figure 4b)); (ii) submarginal arc of labrum with a pair of 1 + 6 long, simple setae (whereas, in *A.* (*A.*) *lata*, the submarginal of labrum only with a pair of 1 + 4 simple setae (Müller-Liebenau 1985, Figure 4g)); (iii) paraproct with ca. 5 small, stout spines along the inner margin (but in *A.* (*A.*) *lata*, no spines present on the inner margin of paraproct (Müller-Liebenau 1985, Figure 4a)); (iv) tibia of all legs possess two dense rows of long ciliate bristles (whereas, in *A.* (*A.*) *lata*, tibia of all three legs possess only one row of long bristles (Müller-Liebenau 1985, Figure 4i)).

Acentrella (*A.*) *isacki* sp. n. obviously occupies a rather isolated position within the nominotypical subgenus. Moreover, shape of the maxillary palp of *Acentrella* (*A.*) *isacki* sp. n. is different from those of all other known *Acentrella* species, except *A.* (*A.*) *fimbriata*. However, the new species differs from *A.* (*A.*) *fimbriata* by (i) tergalii without any long, simple setae apically (whereas, in *A.* (*A.*) *fimbriata*, tergalii II–VII with long, fine, simple setae apically (Tungpairojwong et al. 2022, Figure 5F)); (ii) paracercus reduced to one segment (whereas, in *A.* (*A.*) *fimbriata*, paracercus consists of ca. 5–7 segments (Tungpairojwong et al. 2022, Figure 5H)); (iii) paraproct with ca. 5 small, stout spines along the inner margin (but in *A.* (*A.*) *fimbriata*, ca. 10 small spines are present on the inner margin of paraproct (Tungpairojwong et al. 2022, Figure 5G)).

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Disclosure statement

There is no potential conflict of interest between the author(s).

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