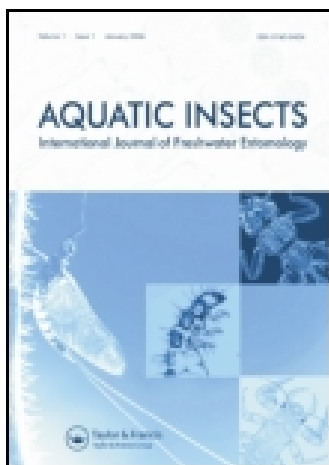


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**Notes about *Acentrella (Liebebiella) vera* (Müller-Liebenau, 1982)
(= *Pseudocloeon diffcilum* Müller-Liebenau, 1982
syn. n. = *Platybaetis arunachalae* Selvakumar, Sundar,
and Sivaramakrishnan, 2012 syn. n.) (Ephemeroptera: Baetidae)**

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Larvae described from southern India under the name *Platybaetis arunachalae*, are re-evaluated taxonomically. *Platybaetis arunachalae* Selvakumar, Sundar, and Sivaramakrishnan, 2012 and *Acentrella (Liebebiella) diffcila* (Müller-Liebenau, 1982), originally described from Sri Lanka, are synonymized with *Acentrella (Liebebiella) vera* (Müller-Liebenau, 1982), originally described from Malaysia. Taxonomic characters for the species identification are discussed, and a table of diagnostic characters for the subgenus *Liebebiella* is provided. Eggs of *A. (L.) vera* and *A. (L.) bispinosa* Kluge and Novikova, 2011 are figured for the first time; male genitalia of *A. (L.) orientale* (Müller-Liebenau, 1982) are figured for the first time. *Acentrella (L.) vera* is distributed over a wide area, including the south of Hindustan, Indochina, Malay Peninsula, Sri Lanka, Sumatra, Java, and Lombok.

Keywords: Ephemeroptera; *Acentrella (Liebebiella) vera*; systematics; new synonymy; Oriental Region

Introduction

Kluge and Novikova (2011) revised the taxon *Acentrella*/fg1 (which can be accepted either as the genus *Acentrella* Bengtsson, 1912 s. lat. or as the tribe Acentrellini Kluge and Novikova, 2011) and included there, besides others, the closely related taxa *Liebebiella* Waltz and McCafferty, 1987 and *Platybaetis* Müller-Liebenau, 1980. Selvakumar, Sundar, and Sivaramakrishnan (2012) reported larvae of Acentrellini from Hindustan for the first time. Being not familiar with the new publication by Kluge and Novikova (2011), they placed the Indian species in *Platybaetis* and described it as a new species *Platybaetis arunachalae* Kluge and Novikova, 2011. In the present work, the taxonomic position and status of *Platybaetis arunachalae* is re-evaluated based on the revision of Acentrellini. According to this study, it belongs to *Liebebiella*, but not to *Platybaetis*, being conspecific with *Acentrella (Liebebiella) vera* (Müller-Liebenau, 1982). Herein, we also synonymize *Pseudocloeon diffcilum* Müller-Liebenau, 1982 with it. These conclusions are confirmed by comparison of imagines reared from larvae

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collected in India near the type locality of *Platybaetis arunachalae* and imagines reared from larvae collected in Indonesia and Sri Lanka.

Material and methods

Material collected by N. Kluge and L. Sheyko is permanently deposited in the Zoological Institute of the Russian Academy of Sciences (Saint Petersburg, Russia); temporarily, this material is housed in the Department of Entomology of the Saint Petersburg State University. Material collected by C. Selvakumar and S. Sundar is deposited in the Zoological Survey of India, Kolkata.

In the list of material examined, the following arbitrary signs are used: **L** – larva; **S** – subimago; **I** – imago; **L-S-I♂** – male imago reared from larva, with larval and subimaginal exuviae; **L-S-I♀** – female imago reared from larva, with larval and subimaginal exuviae; **L-S♂** – male subimago reared from larva, with larval exuviae.

Morphological terms are given according to Kluge (2004, 2005).

Acentrella (Liebebiella) vera (Müller-Liebenau, 1982)

Pseudocloeon sp. 1: Ulmer 1939: 645 (larv. descr.).

Pseudocloeon kraepelini sensu Müller-Liebenau 1981: 199, non *Pseudocloeon kraepelini* Klapalek, 1905: 105; Kluge and Novikova 2011 (syn.).

Pseudocloeon verum Müller-Liebenau, 1982: 285 (larv. descr.).

Pseudocloeon diffilum Müller-Liebenau, 1982: 285 (larv. descr.) **syn. n.**

Liebebiella vera (Müller-Liebenau, 1982) sensu Waltz and McCafferty 1987: 557.

Liebebiella deigma Waltz and McCafferty, 1987: 558; Kluge and Novikova 2011 (syn.).

Acentrella (Liebebiella) vera (Müller-Liebenau, 1982) sensu Kluge and Novikova 2011: 37.

Platybaetis arunachalae Selvakumar, Sundar, and Sivaramakrishnan, 2012: 117 (larv. descr.) **syn. n.**

Material examined

India, Western Ghats: 1 L-S-I♂, 1 L-S-I♀, 1 L-S♂, 1 L-S♀, Karnataka State, Udipi District, Seethanadhi-hole and Modi-hole Rivers, 11–31.I.2013, leg. N. Kluge and L. Sheyko. 1 L-S-I♂, 10 larvae, Tamilnadu State, Tirunelveli District, Courtallam, Chittar River near Peraruvi (= Main Falls), 3–7.II.2013, leg. N. Kluge and L. Sheyko. 5 L♂, 6 L♀ (holotype and paratypes of *Platybaetis arunachalae*), Tamilnadu State, Tirunelveli District, Ramanadi Dam, Ramanadi River (above the dam), 15.VII.2009, leg. C. Selvakumar and S. Sundar. *Sri Lanka*: 3 L-S-I♂, 2 L-S-I♀, 1 L-S♂, 23 larvae, boundary of Uva and Central Provinces, tributary of Uma River near Randenigala Dam, 13–14.I.2011, leg. N. Kluge and L. Sheyko. *Indonesia*, Java: 3 L-S-I♂, many larvae, Bogor, Sadane River: 2.IX.2012, leg. N. Kluge. Other examined material from Java, Lombok, Malaysia, and Thailand is listed in Kluge and Novikova (2011).

Larva

Additions and corrections to the description. Larval characters of *Acentrella* (L.) *vera* have been described in detail by Kluge and Novikova (2011). Selvakumar et al. (2012) described larval holotype and paratypes of *Platybaetis arunachalae*. Herein, we provide additions and corrections to this description.

Inner margin of flagellomeres serrated. Maxillary palp two-segmented (Selvakumar et al. 2012: Figure 6). Labial palp three-segmented, segment 2 with weakly developed inner lobe; segment 3 rounded, weakly tapering apically (Selvakumar et al. 2012: Figure 9). Small vestiges of hind protoptera present. Femora with single dorsal row of multilaterally ciliate bristles (cilia relatively long and dense). Metatibia with two well-developed rows of bristles. Tarsus with greatly elongated distal bristle. Claw with 10 denticles, increasing in size towards apex, subapical setae absent (Selvakumar et al. 2012: Figure 15). Tergalii dark brown with strongly ramified tracheae (Selvakumar et al. 2012: Figure 11). Cerci subequal to body length, with swimming setae on inner side; paracercus reduced to 13–14 segments (Selvakumar et al. 2012: Figure 13).

Comparative notes. The larva of *Acentrella* (L.) *vera* differs from *A. (L.) siveci* Braasch, 1983 from Nepal by the shape of the labrum, which in *A. (L.) vera* is widest at the base (Müller-Liebenau 1982: Figure 1a) and in *A. (L.) siveci* is widest near the apex (Braasch 1983: Figure 43). Differences between larva of *A. (L.) vera* and other known species of *Liebebiella* are given in Table 1.

Winged stages (Figures 1a, b)

Additions to the description. The description of imago and subimago of *Acentrella* (L.) *vera* is given in Kluge and Novikova (2011) based on specimens from Indonesia. Structure and coloration of male adults reared from larvae in India and Sri Lanka are the same including the characteristic reddish maculae on the abdominal terga III and IV (Kluge and Novikova 2011: Figures 143 and 171) and the reddish distal half of the fore femur. The most characteristic feature of males is an unusual curvature of the gonovectes, which in the specimens from India (Figure 1b) and Sri Lanka is the same as in the specimens from Indonesia (Kluge and Novikova 2011: Figure 149); such shape of the gonovectes is markedly different from that of other Baetovectata.

Comparative notes. Male imago of *Acentrella* (L.) *vera* has an unusual shape of the gonovectes, which allows to distinguish it from other species known as male imagines – *A. feminalis* (Eaton, 1885) from Sri Lanka (Waltz and McCafferty 1985a: Figure 5); *A. (L.) orientale* (Müller-Liebenau, 1982) from Sri Lanka (Figure 1a); *A. (L.) bispinosa* Kluge and Novikova, 2011 and *A. (L.) cylindroculata* Kluge and Novikova, 2011 from Sulawesi (Kluge and Novikova 2011: Figures 161 and 162).

Egg

Description. Irregularly-oval; surface with large irregular folds and with fine longitudinal striation above them (Figures 2a–d).

Comparative notes. Eggs of *Acentrella* (L.) *vera* have a characteristic fine longitudinal striation, being the same in specimens from India (Figures 2a, b) and Lombok (Figures 2 c, d). Eggs of other species of *Liebebiella* hitherto had not been described; here we give figures of eggs of *A. (L.) bispinosa*, which differ from eggs of *A. (L.) vera* by the absence of longitudinal striation and presence of a very fine net-shaped relief (Figures 2e, f).

Discussion

Acentrella (*Liebebiella*) *vera* is the only species of Acentrellini reported from India. This species belongs to the plesiomorphon *Liebebiella* but not to *Platybaetis*, whose larvae are markedly different from *Liebebiella* in body shape, unusual structure of the prothorax,

Table 1. Diagnostic larval characters of known species of *Liebebiella*. (3–12) larval characters: (3) ‘+’ frons with dense setae; ‘–’ frons without dense setae; (4) ‘+’ mandibles blade-shaped; ‘–’ mandibles not blade-shaped; (5) coloration of pronotum: ‘P’ sigilla, if expressed, positive, i.e., dark on lighter background; ‘N’ sigilla, if expressed, negative, i.e., light on darker background; (6) ratio of tibial setae length to tibia width; (7) second row of setae on hind tibia: ‘+’ present; ‘–’ absent; (8) subapical setae on claw: ‘+’ two well-developed setae near tip; ‘–’ setae absent; (9) ratio of width of spread abdominal tergum II between tergalii bases to its length; (10) presence of dorsal spines or protuberances on each or some abdominal terga; (11) number of segments of paracercus; (12) swimming setae on inner side of cerci: ‘+’ present; ‘(–)’ absent, but vestiges of their bases are retained.

1	2	3	4	5	6	7	8	9	10	11	12
species * – examined	distribution	dense setae on frons	mandible blade shaped	larval pronotum	tibia: setae / width	2nd tibial setal row	setae on claw	abdom. tergum IIwidth/ length	spines on abdomen	segments of paracercus	swimming setae
<i>A. (L.) vera</i> (Müller-Liebenau, 1982)*	Oriental realm	+	–	P	1.5	+	–	4–4.5	–	several	+
<i>A. (L.) orientale</i> (Müller-Liebenau, 1982)*											
?= <i>A. (L.) ambigua</i> (Müller-Liebenau, 1982)	Sri Lanka	+	+	P	1.5	+	+	3.2	–	several	+
<i>A. (L.) klapaleki</i> (Müller-Liebenau, 1982)	Sri Lanka	?	?	P	?	+	+	?	–	several	+
<i>A. (L.) siveci</i> (Braasch, 1983)	Nepal	?	?	P	?	+	–	?	–	several	+
<i>A. (L.) proximum</i> (Müller-Liebenau, 1984)*	Borneo	–	–	–	1	+	–	4–4.5	–	several	+
<i>A. (L.) allinae</i> (Gatolliat, 2012)	Borneo	?	–	P	?	?	?	?	paired	several	+
<i>A. (L.) bispinosa</i> Kluge and Novikova, 2011*	Sulawesi	+	+	N	2	–	–	4.5	paired	1	(–)
<i>A. (L.) cylindroculata</i> Kluge and Novikova, 2011*	Sulawesi	+	+	N	2	–	–	5	–	1	(–)
<i>A. (L.) atoki</i> (Müller-Liebenau, 1982)	Philippines	?	+	P	2	–	+	5	–	1	?

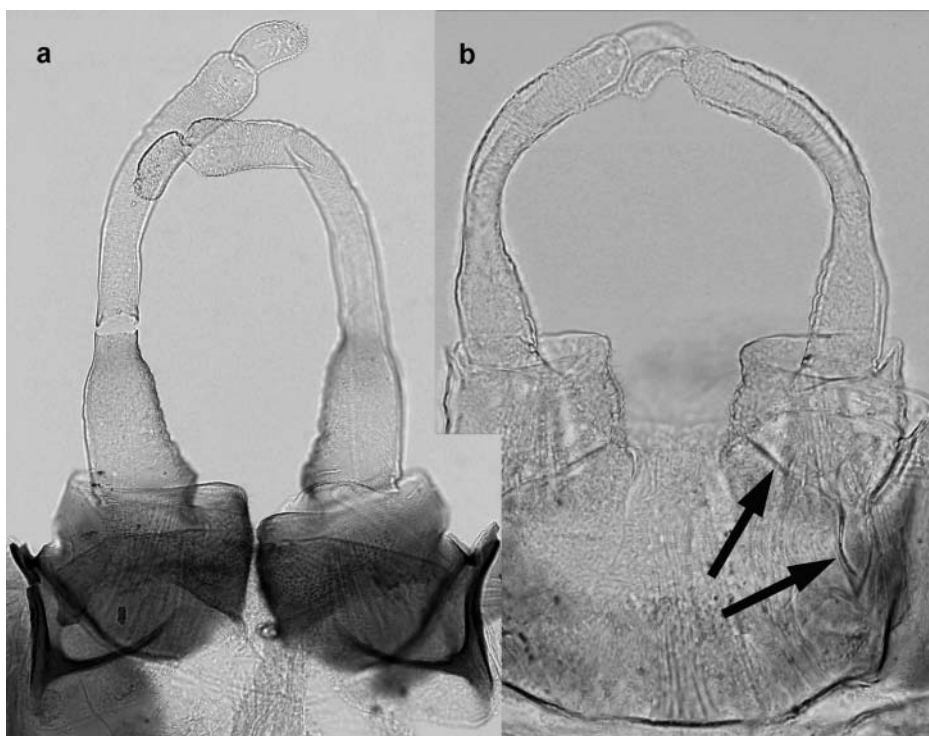


Figure 1. Genitalia of male imagines: (a) *Acentrella (Liebebiella) orientale* (Müller-Liebenau, 1982), collected in Sri Lanka, Uva Province, Badulla District, Lemastota Oya, 20.I.2011 by N. Kluge; (b) *Acentrella (Liebebiella) vera* (Müller-Liebenau, 1982), reared from larva in India, Courtallam, 7.II.2013. Arrows show right gonovectis.

modified mouthparts, and greatly enlarged tergalii (Kluge and Novikova 2011). Unlike them, larvae of *Liebebiella* have the same structure as larvae of *Acentrella* s. str., and differ from them only by the structure of the mola of the left mandible and presence of a long seta near apex of each tarsus (Kluge and Novikova 2011).

Originally, the species was described as *Pseudocloeon verum* Müller-Liebenau, 1982 and was attributed to the genus *Pseudocloeon* Klapalek, 1905, based on the lectotype designation of its type species, *P. kraepelini* Klapalek, 1905, made by Müller-Liebenau (1981). This lectotype designation has been found to be unavailable (Waltz and McCafferty 1985b), and the species *P. verum* is transferred to *Liebebiella* (Waltz and McCafferty 1987). *Liebebiella* was originally established in generic rank and can be treated as subgenus of *Acentrella* s. lat. (Kluge and Novikova 2011). *Acentrella* s. lat. (including *Liebebiella*) is not related to *Pseudocloeon* (Waltz and McCafferty 1985b); recently, the systematic position of *Pseudocloeon* was discussed by Kluge and Novikova (2014).

Based on larvae only, Müller-Liebenau (1982) described *Pseudocloeon verum* from Malaysia and *P. difficilum* from Sri Lanka as two different species. According to the original descriptions, these two species differ from each other by three characters: (1) '*P. difficilum* differs from *P. verum* in having smooth inner margins of the antennal segments, which is serrated in *P. verum*'; (2) 'submarginal bristles near the bases of the long, marginal bristles on the outer margins of the femora are not developed'; (3) 'the spines on the posterior margins of the terga are elongate and pointed in *P. verum* but shorter and

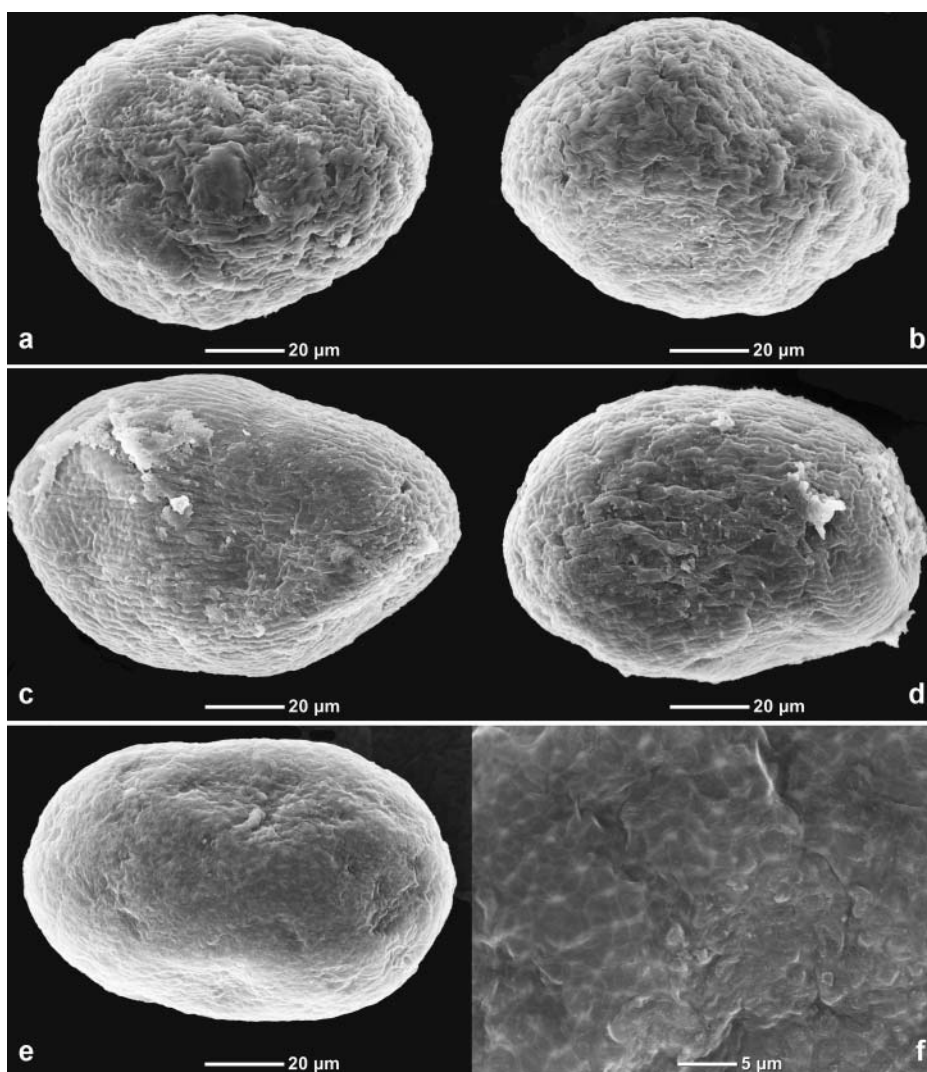


Figure 2. Eggs: (a) and (b) *Acentrella (Liebebiella) vera* (Müller-Liebenau, 1982), reared from larva in India, Modi-hole River; (c) and (d) the same species, reared from larva in Lombok, Senaru; (e) and (f) *Acentrella (Liebebiella) bispinosa* Kluge and Novikova, 2011, paratype, reared from larva in Sulawesi.

rather blunt in *P. diffcilum*'. Based on the first character, Müller-Liebenau (1982) placed *P. verum* and *P. diffcilum* in two different species groups, but this character varies individually (Kluge and Novikova 2011: 39). The second character was used also to separate these two species from '*Pseudocloeon* sp. 1' from Sumatra (later named *Liebebiella deigma* Waltz and McCafferty, 1987). Actually, shape, size, number, and arrangement of the stout submarginal bristles vary individually and can be different on different legs of the same individual. On femora of larvae collected in Bogor (Java), we found all variants: complete absence of stout submarginal bristles, a few small bristles in distal part of femur only, and numerous large bristles all along femur. As for the third character, the shape of these spines can differ on the same tergum from elongate and pointed to very wide and blunt (Müller-Liebenau 1982: Figure 10).



Figure 3. Known distribution of *Acentrella (Liebebiella) vera*.

Based on imagines reared from larvae, which were collected in extremely distant points, we can conclude, that *Acentrella (L.) vera* is distributed over a very wide area within the Oriental Realm (Figure 3). Its area includes the south of Hindustan (see ‘Material examined’), Sri Lanka Island (see ‘Material examined’ and Müller-Liebenau 1982, as *Pseudocloeon difficile*), Indochina (Kluge and Novikova 2011), the Malay Peninsula (Müller-Liebenau 1982, as *Pseudocloeon verum*; Kluge and Novikova 2011), Sumatra (Ulmer 1939, as *Pseudocloeon* sp. 1), Java (see ‘Material examined’; Kluge and Novikova 2011), and Lombok (Kluge and Novikova 2011). Larvae of *A. (L.) vera* inhabit very diverse running waters, from clean and cool (such as the Sindanggala waterfalls in Lombok) to strongly polluted and warm (such as the Sadane River in the Bogor Botanical Gardens). Probably, such ecological plasticity allows this species to have such a wide area of distribution.

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