

# Phylogeny and new species of the genus *Lipuometriocnemus* Sæther (Diptera: Chironomidae)

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Accepted on July 5, 2019.

Published online at [www.senckenberg.de/arthropod-systematics](http://www.senckenberg.de/arthropod-systematics) on September 17, 2019.

Published in print on September 27, 2019.

Editors in charge: Bradley Sinclair & Klaus-Dieter Klass.

**Abstract.** *Lipuometriocnemus* Sæther (Diptera: Chironomidae: Orthocladiinae) is composed of five species endemic to the American continent. Three new species from Argentina are described and illustrated as males and *Austrocladius barilochensis* (Edwards) is newly transferred to *Lipuometriocnemus*. A cladistic analysis of Orthocladiinae placed *Lipuometriocnemus* as sister group to *Metriocnemus* van der Wulp. A separate cladistic analysis of *Lipuometriocnemus* species was also conducted and the results are discussed. An identification key to the adult males of *Lipuometriocnemus* is provided.

**Key words.** *Lipuometriocnemus*, Chironomidae, Orthocladiinae, systematics, phylogeny, taxonomy.

## 1. Introduction

The family Chironomidae is a group of dipteran insects with a worldwide distribution, including Antarctica (ASHE et al. 1987). The Orthocladiinae is the most diverse subfamily and is considered as the most broadly adapted group ecologically, including species living in freshwater habitats as well as many terrestrial forms.

The genus *Lipuometriocnemus* (Orthocladiinae, Chironomidae) is endemic to the New World and was described from the British West Indies by SÆTHER (1981) based on *Lipuometriocnemus glabulus* from St. Vincent and St. Lucia, adding soon after *Lipuometriocnemus vixlobatus* from North Carolina and Georgia (U.S.A.) (SÆTHER 1982) and Yukon (Canada) (CRANSTON 1988). Later, ANDERSEN et al. (2016) described two new species from Brazil notably expanding *Lipuometriocnemus* distribution southwards in the Neotropics. More recently, OSPINA-TORRES et al. (2018) described a new species from the Andes of Colombia.

The similarities of *Lipuometriocnemus* with other genera within the Orthocladiinae were discussed by SÆTHER (1981), who stated that *Lipuometriocnemus* keyed to *Bryophaenocladus* Thienemann and also comes close to *Metriocnemus* van der Wulp in the key to male

Orthocladiinae (BRUNDIN 1956), pointing out the lack of anal point as the defining trait of *Lipuometriocnemus*. SÆTHER (1981) also stated that female characters place *Lipuometriocnemus* between *Chaetocladus* Kieffer and *Metriocnemus*. ANDERSEN et al. (2016) in agreement with SÆTHER (1981) mentioned the similarity among *Lipuometriocnemus* and *Bryophaenocladus*, also noting the absence of setae on the wing membrane as the main character setting *Lipuometriocnemus* apart from *Metriocnemus*. Notwithstanding earlier attempts to better understand the relationships among the taxa in the Orthocladiinae, a cladistic analysis of the group including the genus *Lipuometriocnemus* has been altogether lacking until present.

The study of recently collected material from several environments such as subantarctic forest, marginal rain forest and pampean mountain ranges, together with the detailed examination of the type material of *Spaniotoma* (*Orthocladus*) *barilochensis* Edwards has revealed some unplaced and hitherto undescribed taxa in *Lipuometriocnemus*.

Therefore, the objectives of our paper are as follows: 1) to present for the first time a phylogeny for the Or-

thocladiinae with special emphasis on the position of *Lipurometriocnemus* and an assessment of the relationships among the included species. 2) to describe three new species and propose a new combination and 3) to present a synopsis of *Lipurometriocnemus* and a key to the adult males of the genus.

## 2. Material and methods

**Material.** The specimens examined were preserved in ethanol. Microscope slides were prepared by clearing the specimens in 10% KOH; neutralize with glacial acetic acid; dehydrate in 80%, 96% and 100% ethanol and mounting in Canada balsam. Morphological terminology and measurement standards follow SÆTHER (1980); all measurements are in  $\mu\text{m}$  except when otherwise stated, the values are rounded off to the nearest 5  $\mu\text{m}$  unless otherwise stated; measurements are given as ranges followed by the measurements of the holotype in square brackets, followed by the number of specimens (n) measured in parentheses. The species *Lipurometriocnemus barilochensis* is the exception since the holotype, housed in the Natural History Museum (London, UK) (NHM), is pinned with the genitalia separated on celluloid. The type material of the new species is deposited in the collection of the Museo de La Plata, Argentina (MLP) and Instituto de Limnología “Dr. Raúl A. Ringuelet” (ILPLA).

**Cladistic analyses.** In order to assess the phylogenetic relationships of *Lipurometriocnemus* within the Orthocladiinae, a cladistic analysis was performed using the character set of MENDES et al. (2004) coded at genus level. The resulting data matrix included 159 characters and 42 taxa (El. Supplement Table S1). Multistate characters were treated as unordered. The data matrix was analysed with the program TNT, version 1.1 (GOLOBOFF et al. 2008b) applying implied weights as optimality criteria. In order to calculate the appropriate value for constant k (for details see GOLOBOFF et al. 2008a), a TNT script (propk.run) written by Salvador Arias (Instituto Miguel Lillo, Argentina) was used. The tree search strategy was 1000 random addition sequences plus TBR and saving 10 trees per replicate. Absolute and relative Bremer support values were calculated saving up to 6 steps longer suboptimal trees obtained with branch swapping.

The analysis of the phylogenetic relationships between the species of *Lipurometriocnemus* was performed applying implied weights as optimality criteria. The list of characters and character states is given in section 3.1., the data matrix in Table 1. Multistate characters were treated as unordered. The k value was calculated with the script propk.run and implicit enumeration as tree search strategy. Absolute and relative Bremer support values were calculated as was described before. Character evaluation was done mapping character states on most parsimonious trees using WinClada ver. 1.0 (NIXON 2002).

**Table 1.** Data matrix for interpretation of cladistic relationships of the species of *Lipurometriocnemus* Sæther: 19 characters scored as follows for 11 terminal taxa. Polymorphies: a=0&1; b=1&2.

Character	00000000	111111111
Taxon	123456789	0123456789
<i>M. fuscipes</i> (Meigen, 1818)	200200212	0100000012
<i>M. eurynotus</i> (Holmgren, 1883)	200200112	0100000110
<i>L. amazonicus</i> Andersen et al., 2016	101011000	0011110011
<i>L. barilochensis</i> comb.n.	011110100	0000111101
<i>L. biancae</i> Andersen et al., 2016	201100101	0100110111
<i>L. glabatus</i> Sæther, 1981	100200100	a001112001
<i>L. glabripalpus</i> sp.n.	100200101	0000111011
<i>L. mallincolis</i> sp.n.	011011101	1000110011
<i>L. rioplatensis</i> sp.n.	20a20a101	0101111111
<i>L. vixlobatus</i> Sæther, 1982	100200100	001111001b

## 3. Results and discussion

### 3.1. List of characters and character states

#### Head

- Ratio length of 3rd palpomere / length of 2nd palpomere: (0)  $< 2 \times$ , (1)  $2 - 3 \times$ , (2)  $> 3 \times$ . — The maximum lengths of both palpomeres have been used.
- Sensory pit with sensilla clavata on palpomere 2: (0) absent, (1) present.
- Sensory pit with sensilla clavata on palpomere 3: (0) absent, (1) present.

#### Thorax

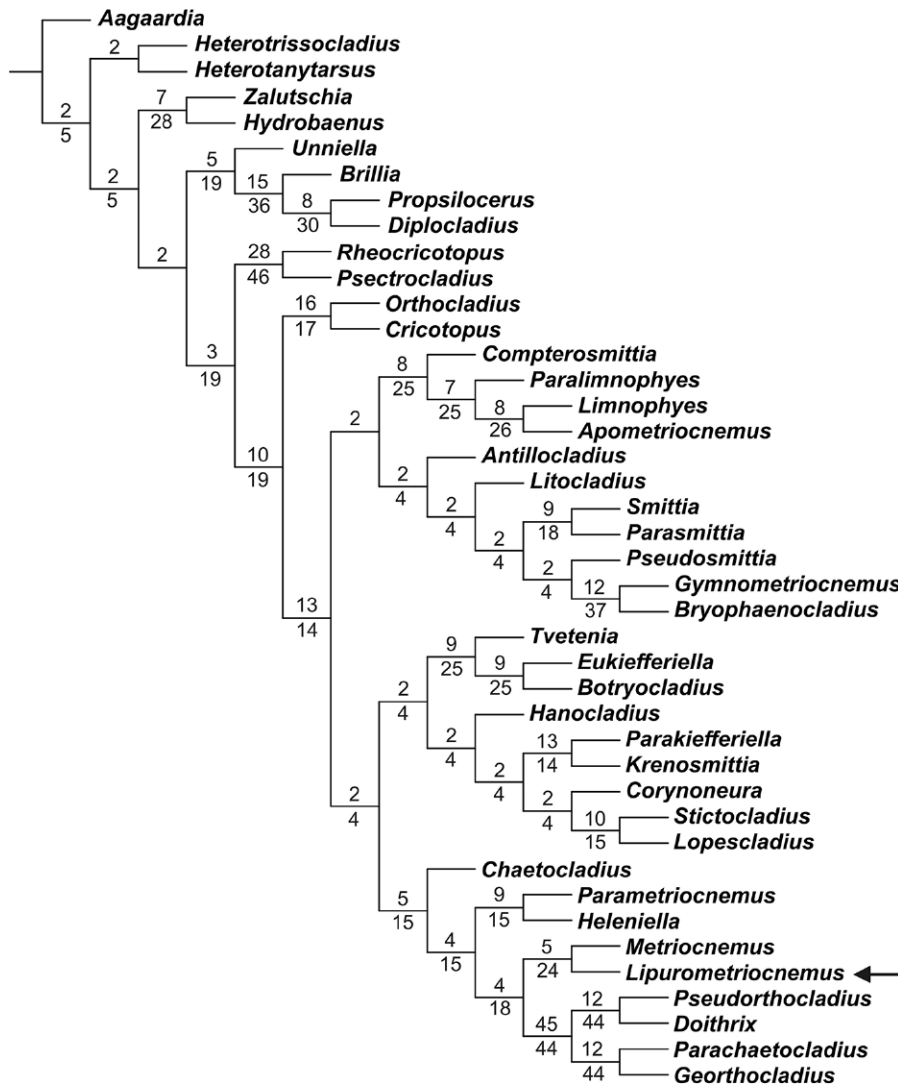
- Dorsocentral setae: (0) uniserial, (1) biserial, (2) multiserial.
- Dorsocentral setae: (0) starting near antepnotum, (1) starting at some distance from antepnotum (posterior to parapsidal suture).
- Supra-alar setae: (0) present, (1) absent.
- Scutellar setae: (0) uniserial, (1) biserial, (2) multiserial.

#### Wing

- Wing membrane: (0) bare, (1) setose.
- Anal lobe of wing: (0) distinctly to strongly projecting, (1) at most moderately projecting, (2) not projecting.
- Costal extension: (0) distinct,  $> 40 \mu\text{m}$  long, (1) absent or  $< 40 \mu\text{m}$  long.
- Ratio length of RM / length of the base of  $M_{1+2}$  vein: (0)  $> 2 \times$ , (1)  $< 2 \times$ .
- $R_1$  vein: (0) setose, (1) bare.
- $R_{4+5}$  vein: (0) setose, (1) bare.
- M vein: (0) setose, (1) bare.

#### Male genitalia

- Anal point: (0) present, (1) absent.



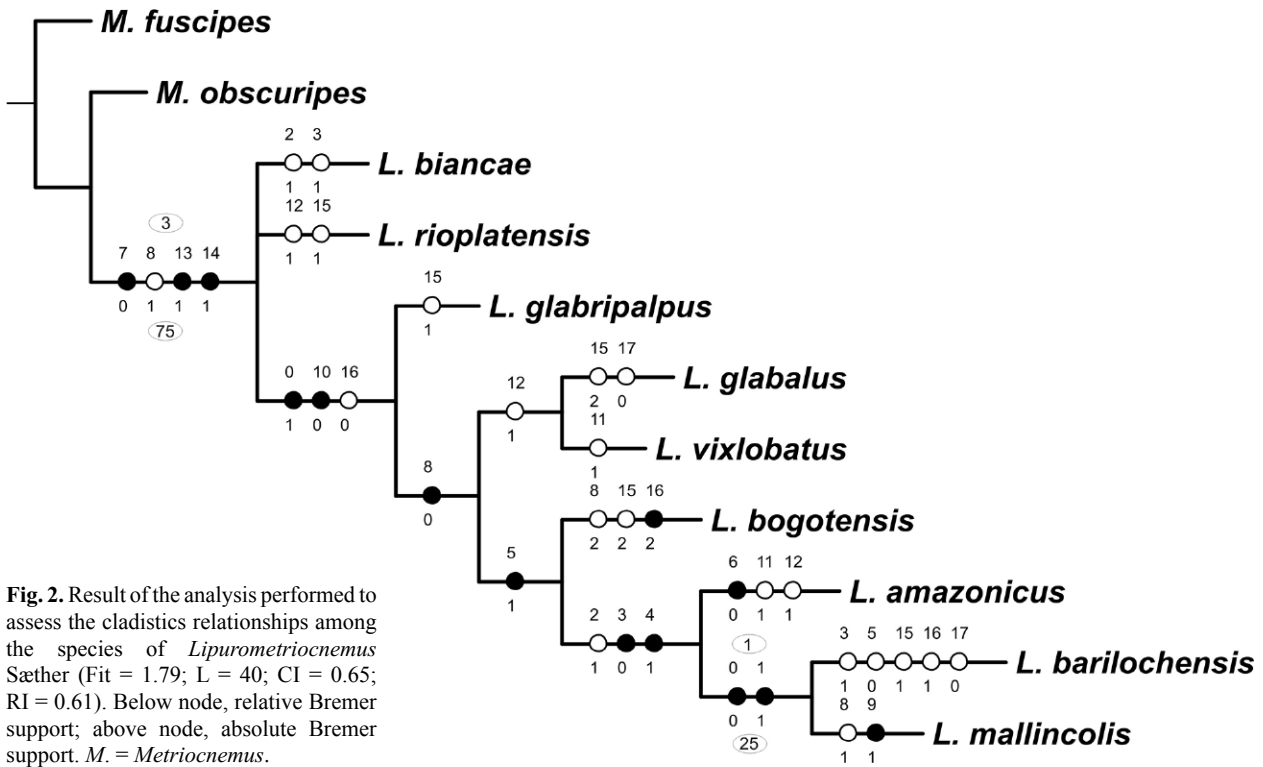
**Fig. 1.** Result of the cladistic analysis performed to assess the phylogenetic relationships of the genus *Lipurometrioctenus* Sæther within selected genera of Orthoclaadiinae (Fit = 99.37; L = 739; CI = 0.26; RI = 0.44). Below node, relative Bremer support; above node, absolute Bremer support.

- 16** Inferior volsella: **(0)** present and well developed, **(1)** present and low, **(2)** absent or present only as a projection of inner margin of gonocoxite.
- 17** Transverse sternapodeme: **(0)** nearly straight, **(1)** slightly arched, **(2)** strongly arched.
- 18** Crista dorsalis: **(0)** robust, preapical to apical, triangular to rounded, occasionally elongate; **(1)** weak, long and low to absent.
- 19** Virga: **(0)** present, consisting of cluster of spines or of single spine; **(1)** nail-shaped; **(2)** indicated or absent.

### 3.2. Cladistic analyses

The cladistic analysis performed to assess the phylogenetic relationships of *Lipurometrioctenus* among selected genera of Orthoclaadiinae using *Aagaardia* Sæther as outgroup (see MENDES et al. 2004), yielded one tree (Fit = 99.37; L = 739; CI = 0.26; RI = 0.44) (Fig. 1). The script returned a value of  $k = 6$  for the data set. The genus *Metrioctenus* was found to be the sister group of *Lipurometrioctenus*, supported by the synapomorphy “seminal capsules pale” (82: 1).

SÆTHER (1981) mentioned that *Lipurometrioctenus* keyed to *Bryophaenocladus* in the key to male Orthoclaadiinae (BRUNDIN 1956), differing from that genus by the lack of an anal point. This character was also used by ANDERSEN et al. (2016) to differentiate the two genera. The close relationship of *Lipurometrioctenus* and *Metrioctenus* were pointed out both by SÆTHER (1981) and ANDERSEN et al. (2016), the latter authors also mentioned the absence of setae in the wing membrane in *Lipurometrioctenus*. SÆTHER (1981) considered both genera quite similar in the female genitalia too, but could be distinguished by the presence of a more developed dorsomesal lobe, microtrichia in the seminal capsule, and the lack of bulbs before the common opening of the spermathecal ducts in *Lipurometrioctenus*. The cladistic analysis performed in this study is in agreement with SÆTHER (1981) concerning characters derived from female genitalia and the character wing membrane bare mentioned by ANDERSEN et al. (2016). Moreover, the results of the cladistic analysis showed additional characters to distinguish both genera. The presence of setae only on veins R, R<sub>1</sub> and R<sub>4+5</sub> differentiate *Lipurometrioctenus* from *Metrioctenus* that also has setae on M. Characters derived from



**Fig. 2.** Result of the analysis performed to assess the cladistics relationships among the species of *Lipurometrioconemus* Sæther (Fit = 1.79; L = 40; CI = 0.65; RI = 0.61). Below node, relative Bremer support; above node, absolute Bremer support. *M.* = *Metrioconemus*.

the male genitalia such as the absence of the anal point and the nail shaped virga present in *Lipurometrioconemus* also differ from *Metrioconemus* since the anal point is occasionally absent and the virga is of another type.

The analysis performed to assess the phylogenetic relationships between the species of *Lipurometrioconemus* under implied weights generated one tree (Fit = 1.79; L = 40; CI = 0.65; RI = 0.61) (Fig. 2). The script returned a k = 6. As the genus level analysis gave *Metrioconemus* van der Wulp as the sister group of *Lipurometrioconemus*, *M. fuscipes* (Meigen) and *M. eurynotus* (Holmgren) (representatives of the *fuscipes* and *eurynotus* species groups, respectively) were selected as outgroup to root the tree. The species *L. barilochensis* is the sister group of *L. mallincolis*, this relationship is supported by the true synapomorphies “ratio length palp 3 / length palp 2”, < 2 × (1: 0) and “sensory pit with sensilla clavata on palpomere 2” (2: 1). This clade is the sister group of *L. amazonicus* by sharing the apparent synapomorphy “dorsocentrals uniserial” (although reverted in *L. barilochensis* to the biserial condition) (4: 0) and the true synapomorphy “dorsocentrals starting some distance from antepnotum” (5: 1). The species *L. bogotensis* is the sister group of the clade *L. amazonicus* (*L. barilochensis* - *L. mallincolis*) supported by the apparent synapomorphy “supra-alars absent”.

Concerning character analysis, in this cladistic scheme the character “ratio length of third palpomere/ length of second palpomere” showed to be taxonomic informative, being a true synapomorphy and is placed at the basal node of the genus with the character state (0) “< 2 ×”. The multistate transformation series for this character is clear, state 0 being plesiomorphic, followed by state 1, and state 2 the most apomorphic.

## 4. Taxonomy

### 4.1. Key to species of *Lipurometrioconemus* Sæther

Modified from ANDERSEN et al. 2016.

- 1 Acrostichals absent [Colombia]  
***L. bogotensis* Ospina-Torres, Mey & Jaime-Murcia**
- 1' Acrostichals present ..... 2
- 2 R<sub>1</sub> and R<sub>4+5</sub> without setae ..... 3
- 2' R<sub>1</sub> with setae, R<sub>4+5</sub> with or without setae ..... 4
- 3 With 25–31 dorsocentrals, mostly bi- to triserial; AR = 1.60–1.75 [USA] ..... ***L. vixlobatus* Sæther**
- 3' With 9–19 dorsocentrals, mostly uniserial; AR = 1.23–1.45 [Brazil]  
..... ***L. amazonicus* Andersen, Pinho & Mendes**
- 4 Without inferior volsella; R<sub>1</sub> with 2 setae, R<sub>4+5</sub> without setae [British West Indies] ... ***L. glabralus* Sæther**
- 4' With distinct inferior volsella ..... 5
- 5 With low inferior volsella ..... 6
- 5' With distinct, rounded or sub-quadrangular inferior volsella ..... 8
- 6 R<sub>1</sub> with 4–7 setae, R<sub>4+5</sub> without setae [Argentina]  
..... ***L. rioplatensis* sp.n.**
- 6' R<sub>1</sub> with 8–9 setae, R<sub>4+5</sub> with setae ..... 7
- 7 R<sub>4+5</sub> with 9–10 setae; sensilla clavata on palpomeres 2 and 3 [Argentina]  
..... ***L. barilochensis* (Edwards) comb.n.**
- 7' R<sub>4+5</sub> with 2–3 setae. Sensilla clavata on palpomere 3 only, second palpomere short [Argentina]  
..... ***L. glabripalpus* sp.n.**

- 8 Second palpomere without sensilla chaetica. Thorax with dorsocentrals biserial;  $R_1$  with 11–18 setae,  $R_{4+5}$  with 8–27 setae [Brazil] ..... *L. biancae* Andersen, Pinho & Mendes
- 8' Second palpomere with sensilla chaetica. Thorax with dorsocentrals biserial;  $R_1$  with 8 setae,  $R_{4+5}$  with 3 setae. [Argentina] ..... *L. mallincolis* sp.n.

#### 4.2. *Lipuometriocnemus* Sæther

*Lipuometriocnemus* Sæther, 1981: 13 (type species: *Lipuometriocnemus glabalis* Sæther, 1981, by original designation); SÆTHER 1982: 477 (emended diagnosis); ANDERSEN et al. 1995: 38 (emended description); OSPINA-TORRES et al. 2018: 386 (emended diagnosis).

#### 4.3. Species of *Lipuometriocnemus*

##### 4.3.1. *Lipuometriocnemus barilochensis* (Edwards) comb.n.

Figs. 3A, 4A

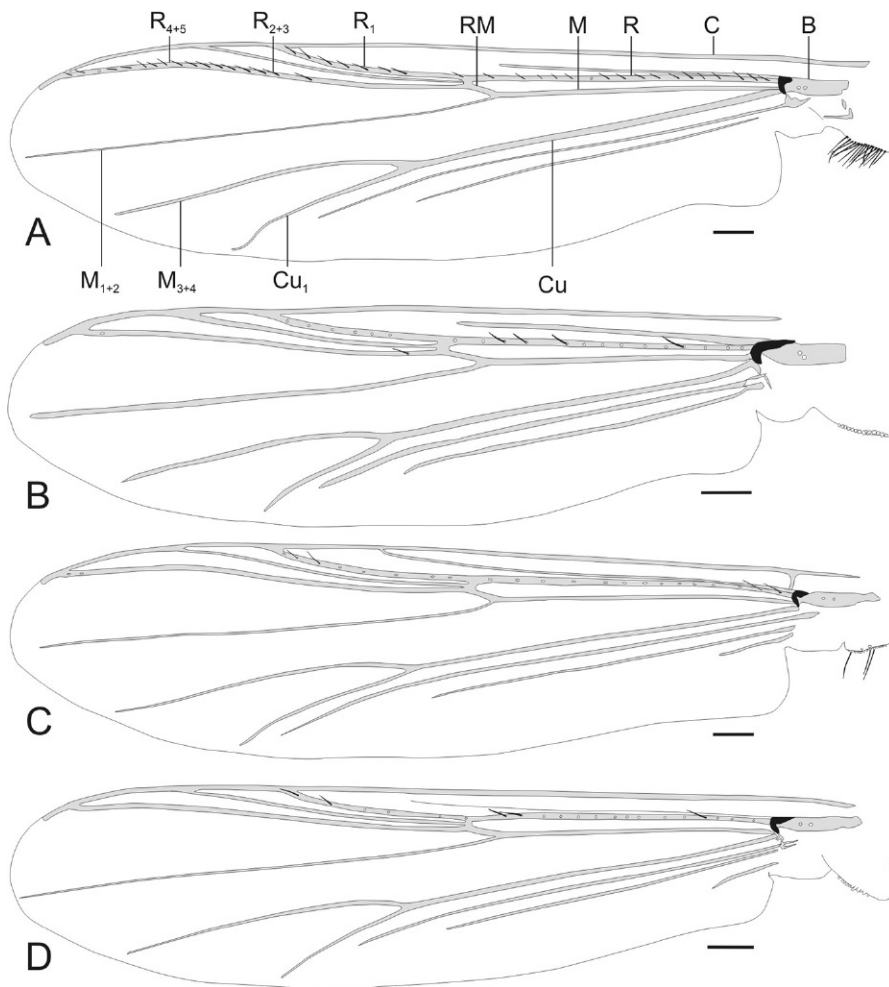
*Spaniotoma* (*Orthocladus*) *barilochensis* Edwards, 1931: 290.  
*Austrocladius barilochensis* (Edwards): ASHE & O'CONNOR, 2012: 127.

**Taxonomic history.** EDWARDS (1931) pioneered the study of Patagonian Chironomidae describing 70 species and placing them in Palaearctic genera and into newly described ones [i.e., *Rhinocladus*, *Stictocladus* (as subgenus)]. Many orthoclads described by EDWARDS (1931) were placed in the no longer recognized genus *Spaniotoma* Philippi and in several subgenera. The study of Edwards' types has led throughout the years to a major shift in the taxonomic position of his orthoclads (see El. Supplement Table S2). The first study of Edwards' species is that of FREEMAN (1961), who established the genus *Austrocladius* and included in it species from Australia, New Zealand and South America. The latter region corresponds to the Edwards' species *Spaniotoma* (*Orthocladus*) *hirtinervis*, *S. (O.) hamulata*, *S. (O.) heterogenea* and *S. (O.) obliqua*. Another species belonging to the subgenus *Orthocladus*, namely *S. (O.) barilochensis*, was considered by SPIES & REISS (1996) as an unplaced valid species in Orthocladiinae. They mentioned that an unpublished list of chironomid type material at The Natural History Museum (London) contains this species under *Austrocladius* and that it was not among the Edwards species transferred to that genus by FREEMAN (1961). ASHE & O'CONNOR (2012) mentioned that the original description of *S. (O.) barilochensis* is quite brief but states that it is a 'Black species resembling *S. obliqua* rather closely, but differing as indicated below'. On these arguments, the authors considered that most of the descriptive features given for *S. obliqua* apply to both species except for the specific differences given for *S. (O.) barilochensis* but these differences fit within the range of variation in the generic diagnosis of FREEMAN (1961: 647–648) and the latter author did not transfer *barilochensis* to *Austrocladius* probably by an accidental omission.

The examination of the types of *Spaniotoma* (*Orthocladus*) *barilochensis* and *A. obliquus* showed that they are very different. The latter species possess a strong bare anal point with rounded apex, the inferior volsella is well developed and divided in a dorsal and ventral lobe, and the third palpomere has an apical pit with 4–6 sensilla clavata and a subapical pit with 2–3 sensilla clavata. Besides, the combination of characters bare eye, acrostichals conspicuous beginning near antepnotum, wing membrane bare, squama with setae, sensilla chaetica and pulvilli absent, anal point absent, gonocoxite with a small nail-shaped virga and low inferior volsella places the former species in the genus *Lipuometriocnemus*. Therefore, the new combination *Lipuometriocnemus barilochensis* is established.

**Description. Measurements:** Male (n = 4, except when otherwise stated). Total length 3.2–3.7 mm. Wing length 1.94–2.08 mm. Total length / wing length 1.57–1.78. Wing length / length of profemur 2.31–2.49 (3). **Coloration** (preserved in alcohol): Head, thorax and abdomen brown, legs slightly lighter brown. **Head:** Temporal setae 9–13 including 3–7 inner verticals, 2–3 outer verticals and 3 postorbitals. Clypeus with 6–8 setae. Tentorium 202–260 (2) long; 34–50 (2) wide. Stipes 200–208 (2) long, 14 (2) wide. Antenna, AR 1.21–1.27 (3), ultimate flagellomere 529–544 (3) long. Palpomere lengths: 34–44, 82–108, 120–142, 112–142, 166–220 (2). Second palpomere with 3–5 and third palpomere with 5–8 sensilla clavata, both in apical half. **Thorax:** Antepnotum with 3–8 lateral setae. Acrostichals 8–13; dorsocentrals 14–22, mostly biserial; prealars 10–12; supra-alar 1. Scutellum with 16–20 setae, biserial. **Wing:** (Fig. 3A) VR 1.25–1.28. Costal extension 70–82 long. Brachiolum with 2–3 setae, R with 13–17 (3),  $R_1$  with 8–10 setae,  $R_{4+5}$  with 7–10 setae. Squama with 12–21 (3) seta. **Legs:** Spur of fore tibia 76–86 (3) long, spurs of mid tibia 53–62 (3) and 56–68 (3) long, spurs of hind tibia 52–60 (3) and 84–90 (3) long. Width at apex of fore tibia 52–58 (3), of mid tibia 48–56 (3), of hind tibia 58–76 (3). Comb with 12–14 (3) setae. Pseudospurs on  $ta_1$ – $ta_3$  absent. Lengths and proportions of legs as in Table 2. **Hypopygium:** (Fig. 4A) Tergite IX with 21–26 (3) setae. Laterosternite IX with 5–6 (3) setae. Transverse sternapodeme with weak oral projections, 116 (1) long. Phallapodeme 110 (1) long. Virga small, nail-shaped, 8–12 (3) long. Gonocoxite 246–274 (3) long; length from base of gonocoxite to apex of inferior volsella/length of gonocoxite 0.64–0.71 (3); inferior volsella ending 170–176 (3) from apex of gonocoxite. Gonostylus 120–130 (3) long; megaseta 14–16 (3) long. HR 1.97–2.11 (3). HV 2.57–3.08 (3). — Female and immatures. Unknown.

**Diagnosis.** The male imago can be separated from other members of the genus by having palpomere 2 very long, its length is more than half the length of palpomere 3; the presence of sensorial pit with sensilla clavata on palpomere 2; dorsocentrals biserial, starting some distance from antepnotum; anal lobe of wing strongly project-



**Fig. 3.** *Lipurometricnemus* wings. **A:** *L. barilochensis* (Edwards) comb.n.; **B:** *L. glabripalpus* sp.n.; **C:** *L. mallincolis* sp.n.; **D:** *L. rio-platensis* sp.n. — **Abbreviations:** B – Brachiolum; C – Costa; Cu – Cubital; Cu<sub>1</sub> – Cubital 1; M – Media; M<sub>1+2</sub> – Media<sub>1+2</sub>; M<sub>3+4</sub> – Media<sub>3+4</sub>; R – Radial; R<sub>1</sub> – Radial 1; R<sub>2+3</sub> – Radial 2+3; R<sub>3+4</sub> – Radial 3+4. — **Scale bars:** 100 µm.

ing; and inferior volsella low. See also the identification key.

**Distribution and ecology.** The type locality of this species is Bariloche, a city that is located in Nahuel Huapi National Park. The other specimens examined are also collected in the park and brings some clues about the habitat preferences of *L. barilochensis*. The Nahuel Huapi National Park preserves the Subantarctic forest and the ecotone with the Patagonian steppe. The specimens were collected in mallin Los Patos and its tributary stream. The word “mallin” means in Mapuche language marshy land and this kind of environment is distinctly differentiated from the surrounding areas by their highly organic-rich soil, in basins with high water content and with a characteristic flora. CRANSTON et al. (1989) have suggested that the immatures of this genus are semiaquatic or semiterrestrial and in this kind of environment is plausible to find them since other species belonging to genera with similar habitat preferences such as *Bryophaenocladus* Thienemann, *Pseudosmittia* Goetghebuer and *Metricnemus* were also collected.

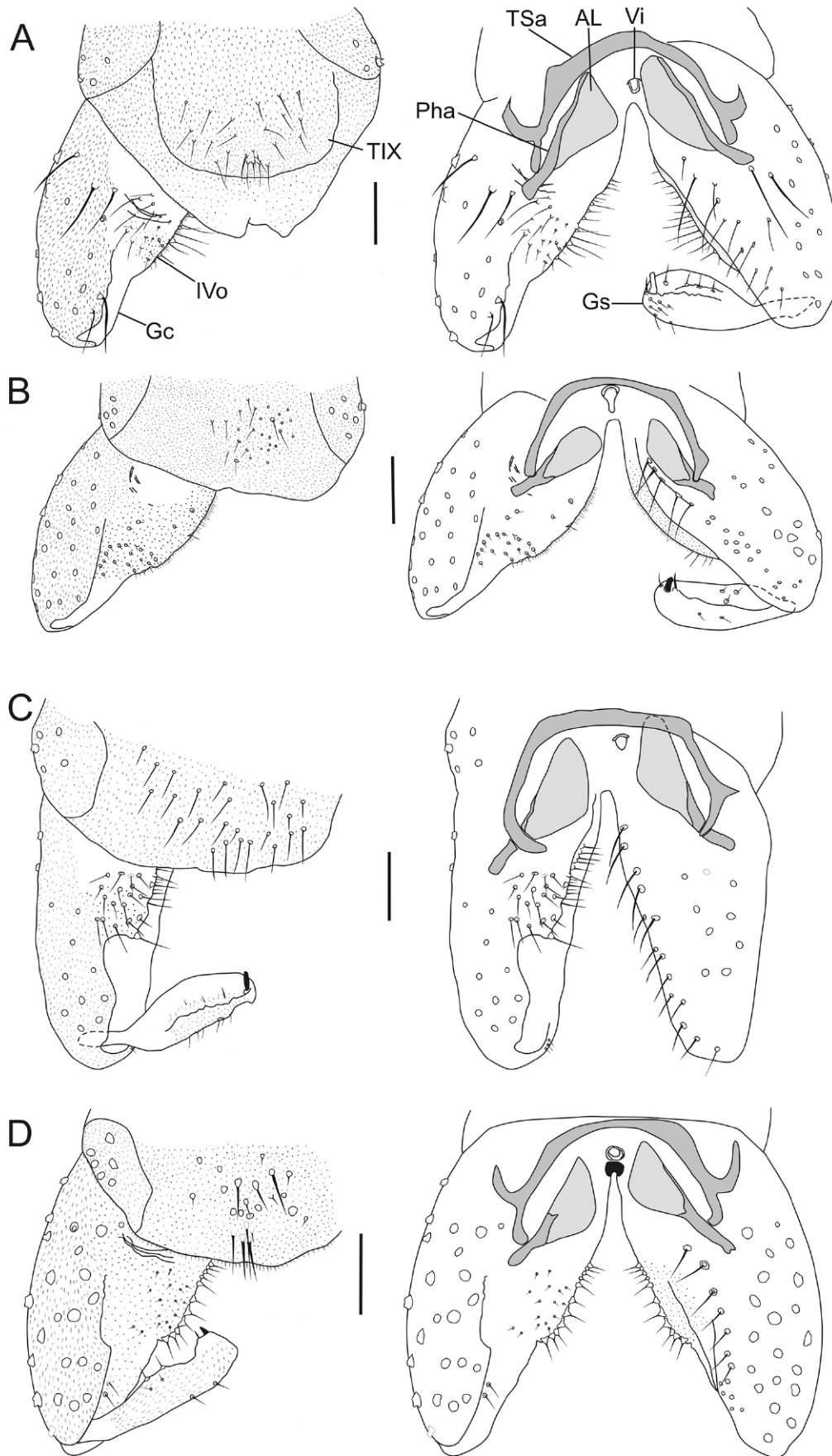
**Material examined. Type material:** Holotype ♂ (NHM), ‘Terr. Rio Negro, Bariloche, ARGENTINA’ | ‘25-28.x.1927, F. & M. Edwards’. — **Other material:** ARGENTINA: 2 ♂ (ILPLA), Rio Negro, P.N. Nahuel Huapi, Challhuaco, mallin Los Patos, 41°15′48.6″S 71°17′50.3″W, 1020 m asl, 10.xii/20.xii.2006, Malaise trap, A.

Garre & F. Montes de Oca; 1 ♂ (ILPLA), Río Negro, P.N. Nahuel Huapi, Challhuaco, mallin Los Patos, 41°15′48.6″S 71°17′50.3″W, 1020 m asl, 20.xii.2006- 3.i.2007, Malaise trap, A. Garre & F. Montes de Oca; 1 ♂ (ILPLA), Río Negro, P.N. Nahuel Huapi, Arroyo Verde, 41°15′41.9″S 71°17′49.2″W, 1510 m asl, 10.xii.2006, sweep net, A. Garre & F. Montes de Oca.

#### 4.3.2. *Lipurometricnemus glabripalpus* sp.n.

Figs. 3B, 4B

**Description. Measurements:** Male (n = 2, except when otherwise stated). Total length 2.88–3.16 [2.88] mm. Wing length 1.48–1.50 [1.48] mm. Total length / wing length 1.95–2.11 [1.95]. Wing length / length of profemur 2.18–2.21 [2.18]. **Coloration** (preserved in alcohol): Head, thorax and abdomen brown, legs slightly lighter brown. **Head:** Temporal setae 12 including 6–8 [6] inner verticals, 3 outer verticals and 3–4 [4] postorbitals. Clypeus with 15–16 [15] setae. Tentorium 176–234 [176] long; 32–34 [32] wide. Stipes 170 long, 10–22 [10] wide. Antenna, AR 1.41–1.50 [1.50], ultimate flagellomere 513–521 [521] long. Palpomere lengths: 32–38 [38]; 50–58 [58]; 124–158 [158]; 140–150 [150]; 170–174 [174]. Palpomeres without sensilla clavata. **Thorax:** Anteprepronotum with 5–8 [8] lateral setae. Acrostichals 11–15 [15]; dorsocentrals 40–42 [42], multiserial; prealar 15–16 [15]; supra-alar 1. Scutellum with 19–21



**Fig. 4.** *Lipurometriocnemus* male genitalia. On the left, dorsal aspect; on the right, hypopygium with anal point and tergite IX removed, dorsal aspect in left half, ventral aspect in right half. **A:** *L. barilochensis* (Edwards) comb.n.; **B:** *L. glabripalpus* sp.n.; **C:** *L. mallincolis* sp.n.; **D:** *L. rioplatensis* sp.n. — **Abbreviations:** Aedeagal lobe – AL; Inferior volsella – IVo; Gonocoxite – Gc; Gonostylus – Gs; Phallapodeme – Pha; Tergite IX – TIX; Transverse sternapodeme – TSa; Virga – Vi. — **Scale bars:** 50  $\mu$ m.

[19] setae, biserial. **Wing:** (Fig. 1B) VR 1.23–1.45 [1.23]. Costal extension 63–64 [63] long. Brachiolium with 2 setae, R with 13–16 [13], R<sub>1</sub> with 6–9 [6] setae, R<sub>4+5</sub> with 1–2 [2] setae. Squama with 14–16 [16] setae. **Legs:** Spur of fore tibia 74 long, spurs of mid tibia 30–32 [32] and 56 (1) long, spurs of hind tibia 26–28 [28] and 68–74 [68] long. Width at apex of fore tibia 42–50 [42]; of mid tibia 42–52 [42]; of hind tibia 50–60 [50]. Comb with 12–13 [13] setae. Pseudospurs on ta<sub>1</sub>–ta<sub>3</sub> absent. Lengths and proportions of legs as in Table 5. **Hypopygium:** (Fig. 4B) Tergite IX with 28–29 [29] setae. Laterosternite IX with 6–7 [6] setae. Transverse sternapodeme with weak oral projections, 96–110 [96] long. Phallapodeme 64–70 [64] long. Virga 18 (1) long. Gonocoxite 195–226 [195] long; length from base of gonocoxite to apex of inferior volsella/length of gonocoxite 0.65–0.72 [0.72]; inferior volsella ending 140–146 [140] from apex of gonocoxite. Gonostylus 98 long; megaseta 10–19 [10] long. HR 1.99–2.31 [1.99]. HV 2.94–3.22 [2.94]. — Female and immatures. Unknown.

**Diagnosis.** The male imago can be separated from other members of the genus by having palpomere 2 short, its length approximately half the length of palpomere 3; absence of sensilla clavata in palpomeres; dorsocentrals multiserial, starting close to anteprepronotum; anal lobe of wing moderately projecting; and inferior volsella low. See also the identification key.

**Derivatio nominis.** From Latin *glaber* (smooth, hairless) and *palpus* (palpomere), referring to the absence of sensilla clavata in the palpomeres.

**Distribution and ecology.** The new species occurs in the Ventania orogenic system, a mountain range surrounded by the grassy steppes of Buenos Aires province in Argentina. For more details concerning habitat characteristics, coexisting chironomid fauna and climate of this area see DONATO et al. (2012), SIRI & DONATO (2012) and MAUAD et al. (2013).

**Material examined. Type material:** Holotype ♂ (MLP), ARGENTINA, Sierra de la Ventana, A° Ventana, Buenos Aires | 38°02'53.1"S 62°07'41.5"W, 342 m asl, 26.xii.2015 | sweep net, M. Donato, A. Siri and F. Spaccesi. Paratype: 1 ♂ (ILPLA), ARGENTINA, Sierra de la Ventana, A° Napostá, Buenos Aires; 38°08'43.2"S 62°05'33.5"W, 566 m asl; 23.xi.2012, sweep net, M. Donato, A. Siri and F. Spaccesi.

#### 4.3.3. *Lipurometricnemus mallincolis* sp.n. Figs. 3C, 4C

**Description. Measurements:** Male (n = 1). Total length 3.52 mm. Wing length 2.14 mm. Total length / wing length 1.64. Wing length / length of profemur 2.33. **Coloration** (preserved in alcohol): Head, thorax and abdomen brown, legs slightly lighter brown. **Head:** Temporal setae 12 including 5 inner verticals, 2 outer verticals and 5 postorbitals. Clypeus with 10 setae. Tentorium 180 long; 40 wide. Stipes 160 long, 36 wide. Antenna, AR 1.42, ultimate flagellomere 592 long. Palpomere lengths: 38; 90; 142; 122; 232. Second palpomere with 5 and third palpomere

with 8 sensilla clavata, both in apical half. **Thorax:** Anteprepronotum with 4 lateral setae. Acrostichals 15; dorsocentrals 18, anteriorly uniserial, posteriorly biserial; prealars 13; supra-alar absent. Scutellum with 21 setae, biserial. **Wing:** (Fig. 3C) VR 1.26. Costal extension 36 long. Brachiolium with 2 setae, R with 14, R<sub>1</sub> with 8 setae, R<sub>4+5</sub> with 3 setae. Squama with 15 seta. **Legs:** Spur of fore tibia 80 long, spurs of mid tibia 56 long, spurs of hind tibia 52 and 80 long. Width at apex of fore tibia 52; of mid tibia 52; of hind tibia 64. Comb with 13 setae. Pseudospurs on ta<sub>1</sub>–ta<sub>3</sub> absent. Lengths and proportions of legs as in Table 4. **Hypopygium:** (Fig. 4C) Tergite IX with 25 setae. Laterosternite IX with 7 setae. Transverse sternapodeme with weak oral projections, 124 long. Phallapodeme 80 long. Virga small, nail-shaped, 8 long. Gonocoxite 262 long; length from base of gonocoxite to apex of inferior volsella/length of gonocoxite 0.36; inferior volsella ending 94 from apex of gonocoxite. Gonostylus 130 long; megaseta 14 long. HR 2.02. HV 2.71. — Female and immatures. Unknown.

**Diagnosis.** The male imago can be separated from other members of the genus by having palpomere 2 very long, its length more than half the length of palpomere 3 and sensorial pit with sensilla clavata on palpomere 2; dorsocentrals uniserial, starting some distance from anteprepronotum; anal lobe of wing moderately projecting; and inferior volsella well developed. See also the identification key.

**Derivatio nominis.** From Mapuche *mallin* (marshy land) and *incola* (resident, native), referring to the habitat where it was found.

**Distribution and ecology.** The new species was collected in mallin Los Patos together with *L. barilocheensis* and comments on the distribution and ecology of this species is also applicable to *L. mallincolis* sp.n.

**Material examined. Type material:** Holotype ♂ (MLP), ARGENTINA, P.N. Nahuel Huapi, Challhuaco, mallin Los Patos, Río Negro | 41°15'48.6"S 71°17'50.3"W, 1020 m asl, | 10.xii/20.xii.2006 | Malaise trap, A. Garre & F. Montes de Oca.

#### 4.3.4. *Lipurometricnemus rioplatensis* sp.n. Figs. 3D, 4D

**Description. Measurements:** Male (n = 6, except when otherwise stated). Total length 2.22–3.32 [3.14] mm. Wing length 1.48–1.68 [1.54] mm. Total length / wing length 1.35–2.13 [2.04]. Wing length / length of profemur 2.14–2.26 [2.20]. **Coloration** (preserved in alcohol): Head, thorax and abdomen brown, legs slightly lighter brown. **Head:** Temporal setae 12–15 [15] including 6–8 [6] inner verticals, 2–3 [3] outer verticals and 3–6 [6] postorbitals. Clypeus with 15–26 [20] setae. Tentorium 152–180 [152] long; 40–46 [42] (5) wide. Stipes 126–150 [126] (4) long, 6–10 [6] (4) wide. Antenna, AR 1.47–1.7 [1.63], ultimate flagellomere 552–615 [552] long. Palpomere lengths: 20–40 [36]; 44–60 [50]; 158–188 [158]; 132–190 [140]; 150–190 [164] (5). Third palpomere with 0–3 [3] sensilla clavata in apical



**Table 2.** Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Lipurometrioctenemus barilochensis* (Edwards) comb.n. ( $\sigma$ , n = 4). — **Abbreviations:** Leg (L); Femur (fe); Tibia (ti); Tarsomeres 1–5 ( $\text{ta}_{1-5}$ ); Leg Ratio (LR), ratio of metatarsus to tibia; «Beinverhältnisse» (BV), combined length of femur, tibia, and basitarsus divided by combined length of tarsomeres 2–5; «Schenkel-Schiene-Verhältnis» (SV), ratio of femur plus tibia to metatarsus.

	fe	ti	$\text{ta}_1$	$\text{ta}_2$	$\text{ta}_3$
L <sub>1</sub>	780–1020	940–1180	560–740	340–440	220–280
L <sub>2</sub>	800–1020	840–1100	400–480	220–300	160–200
L <sub>3</sub>	920–1160	1040–1400	540–720	300–580	220–340
	$\text{ta}_4$	$\text{ta}_5$	LR	BV	SV
L <sub>1</sub>	140–160	100–120	0.58–0.63	2.85–3.07	2.97–3.20
L <sub>2</sub>	100–120	80–120	0.43–0.48	3.51–3.67	4.10–4.50
L <sub>3</sub>	120–180	100–140	0.50–0.61	2.54–3.38	3.03–3.66

**Table 3.** Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Lipurometrioctenemus rioplatensis* sp.n. ( $\sigma$ , n = 6). Measurements of holotype in square brackets. — For abbreviations see Table 2.

	fe	ti	$\text{ta}_1$	$\text{ta}_2$	$\text{ta}_3$
L <sub>1</sub>	680–760 [700]	800–900 [880]	540–640 [580]	320–380 [340]	220–260 [240]
L <sub>2</sub>	660–760 [680]	740–840 [780]	360–580 [380]	200–240 [200]	140–180 [140]
L <sub>3</sub>	660–760 [700]	760–1080 [980]	500–580 [500]	280–320 [300]	220–240 [240]
	$\text{ta}_4$	$\text{ta}_5$	LR	BV	SV
L <sub>1</sub>	140–160 [140]	100–100 [100]	0.65–0.71 [0.66]	2.45–2.63 [2.63]	2.59–2.86 [2.72]
L <sub>2</sub>	100–120 [100]	80–80 [80]	0.48–0.78 [0.49]	3.03–3.54 [3.54]	2.45–4.11 [3.84]
L <sub>3</sub>	120–140 [120]	80–100 [100]	0.51–0.68 [0.51]	2.75–3.10 [2.87]	2.81–3.37 [3.36]

**Table 4.** Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Lipurometrioctenemus mallincolis* sp.n. ( $\sigma$ , n = 1). — For abbreviations see Table 2.

	fe	ti	$\text{ta}_1$	$\text{ta}_2$	$\text{ta}_3$
L <sub>1</sub>	920	1060	640	360	240
L <sub>2</sub>	940	980	420	260	160
L <sub>3</sub>	1040	1200	620	340	260
	$\text{ta}_4$	$\text{ta}_5$	LR	BV	SV
L <sub>1</sub>	160	100	0.60	3.05	3.09
L <sub>2</sub>	120	100	0.43	3.66	4.57
L <sub>3</sub>	140	100	0.52	3.40	3.61

**Table 5.** Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Lipurometrioctenemus glabripalpus* sp.n. ( $\sigma$ , n = 2, except when otherwise stated). Measurements of holotype in square brackets. — For abbreviations see Table 2.

	fe	ti	$\text{ta}_1$	$\text{ta}_2$	$\text{ta}_3$
L <sub>1</sub>	680	800	500 (1)	320 (1)	200 (1)
L <sub>2</sub>	660–680 [660]	760	340–360 [360]	200–220 [220]	160
L <sub>3</sub>	680–700 [680]	940–960 [940]	480–560 [480]	260	200–220 [220]
	$\text{ta}_4$	$\text{ta}_5$	LR	BV	SV
L <sub>1</sub>	140 (1)	80 (1)	0.63 (1)	2.68 (1)	2.96 (1)
L <sub>2</sub>	100	80	0.45–0.47 [0.47]	3.18–3.30 [3.18]	3.94–4.24 [4.24]
L <sub>3</sub>	120	80–100 [100]	0.51–0.58 [0.51]	3.00–3.36 [3.30]	2.96–3.38 [3.38]

half. **Thorax:** Antepnotum with 3–7 [5] lateral setae. Acrostichals 9–14 [12]; dorsocentrals 26–49 [29], mostly biserial; prealars 11–12 [11]; supra-alar 0–1 [1]. Scutellum with 13–20 [14] setae, biserial. **Wing:** (Fig. 3D) VR 0.72–0.79 [0.79]. Costal extension 46–52 [48] long. Brachiolum with 2 setae, R with 13–19 [13], R<sub>1</sub> with 4–7 [6] setae, R<sub>4+5</sub> with 0–1 [0] setae. Squama with 10–15 [15] seta. **Legs:** Spur of fore tibia 62–70 [70] (5) long, spurs of mid tibia 26–30 (5) and 30–34 (5) long, spurs of hind tibia 15–30 [28] (5) and 60–70 [70] (5) long. Width at apex of fore tibia 40–48 [40]; of mid tibia 40–46 [42];

of hind tibia 50–60 [50]. Comb with 10–13 [10] setae. Pseudospurs on  $\text{ta}_1$ – $\text{ta}_3$  absent. Lengths and proportions of legs as in Table 3. **Hypopygium:** (Fig. 4D) Tergite IX with 22–32 [29] setae. Laterosternite IX with 5–7 [7] setae. Transverse sternapodeme with weak oral projections, 88–108 [106] long. Phallapodeme 50–56 [50] long. Virga small, nail-shaped, 8–12 (3) long. Gonocoxite 206–236 [234] long; length from base of gonocoxite to apex of inferior volsella/length of gonocoxite 0.27–0.43 [0.39]; inferior volsella ending 56–92 [92] from apex of gonocoxite. Gonostylus 104–120 [118] long; megaseta

12–14 [14] long. HR 1.75–2.00 [1.98]. HV 2.13–2.77 [2.66]. — Female and immatures. Unknown.

**Diagnosis.** The male imago can be separated from other members of the genus by having palpomere 2 very short, its length less than one third of the length of palpomere 3; dorsocentrals multiserial, starting near antepnotum; anal lobe of wing moderately projecting; and inferior volsella low. See also the identification key.

**Derivatio nominis.** Named after the Rio de la Plata, as the localities where the type specimens were collected are located near the mouth of this river.

**Distribution and ecology.** This species was collected in two protected areas. The type locality is located in the Punta Lara Natural Reserve, which was created to preserve the Marginal Forest. This natural reserve represents the southern distribution of the Paranean rainforest present in north-eastern Argentina and southern Brazil, together with wetlands and riverine environments. The climate is temperate and wet, between the years 1909 and 2005 the mean annual temperature was 16.2°C with 22.8°C in January and 9.9°C in July (HURTADO et al. 2006). The mean annual precipitations from the same period was 1040 mm (HURTADO op. cit.).

The other locality area is the Costero del Sur Biosphere Reserve belonging to the UNESCO's Man and the Biosphere Programme, World Network of Biosphere Reserves (<http://www.unesco.org/mab/>). This natural reserve is located in the southern margin of the Rio de la Plata. It is situated in a humid and swampy region that comprises coastal areas, flooded and unflooded swamps, wetlands, pampean grasslands and dry forests.

**Material examined. Type material:** Holotype ♂ (MLP), ARGENTINA, Reserva natural Punta Lara, Buenos Aires, 34°48'00"S 58°01'50.6"W | 8.i.2008 | sweep net, M. Donato. — Paratypes: 3 ♂ (MLP), ARGENTINA, same data as holotype; 2 ♂ (MLP), Reserva de la Biosfera Parque Costero del Sur, Buenos Aires, Argentina, 35°16'52.2"S 57°13'16.5"W 27.v.2007, sweep net, M. Donato.

#### 4.3.6. *Lipuometriocnemus* nr. *vixlobatus* Sæther

The species *L. vixlobatus* was described from southeast USA and in the original description SÆTHER (1982) mentioned that virga is indicated. The geographic distribution was extended to the Yukon Territory in Canada by CRANSTON & OLIVER (1988). As the specimens examined from Peru fit the species diagnostic characters except for the presence of a small nail shaped virga, a potentially undescribed species close to *L. vixlobatus* is opted when more material is available.

**Material examined. Other material:** 2 ♂ (ILPLA), PERU, Kirigueti, Cuzco prov.[ince]; 11°38'13"S 73°07'07"W, 395 m asl, 24.ii.2004, J. Williams, at light.

## 5. Acknowledgements

This paper is supported by CONICET, Darwin Initiative project "Capacity Building for Biodiversity Studies in Freshwater Insects

(Ref. 15025) (Department for Environment, Food & Rural Affairs, UK) and Agencia Nacional de Promoción Científica (PICT-2008-1910). Authors wish to thank the Willi Hennig Society for the free availability of the TNT program, Anibal Areco and all of the park rangers of Parque Provincial E. Tornquist for help during the field work, OPDS for logistic support and for granting authorization to collect, and our friend Fernando Spaccesi for his invaluable help in the field collection. We also acknowledge Pluspetrol Peru Corporation S.A. and ERM Peru S.A. for the financial support of the fieldwork, which was carried out during the environmental impact assessment of block 56 and Prof. Jorge Williams, herpetologist of the Museo de La Plata, for his valuable help in collecting the *L. nr. vixlobatus* specimens.

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## Electronic Supplement Files

at <http://www.senckenberg.de/arthropod-systematics>

**File 1:** donato&siri-lipuometriocnemus-asp2019-electronicssupplement-1.xls — **Table S1.** Data matrix for interpretation of phylogenetic relationships of *Lipuometriocnemus* Sæther and relatives: 159 characters scored for 42 terminal taxa. — DOI: 10.26049/ASP77-2-2019-09/1

**File 2:** donato&siri-lipuometriocnemus-asp2019-electronicssupplement-2.doc — **Table S2.** List of orthoclad species described by EDWARDS (1931) which were subsequently placed in other genera, their current name and reference of authors for full taxonomic history. — DOI: 10.26049/ASP77-2-2019-09/2

## Zoobank Registrations

at <http://zoobank.org>

**Present article:** <http://www.zoobank.org/References/7388487F-ED6E-448B-9D5D-2DDCA5C16E2A>

***Lipuometriocnemus glabripalpus* Donato & Siri 2019:** <http://www.zoobank.org/NomenclaturalActs/A9A889FD-72B2-407B-8FA0-488579FC23E1>

***Lipuometriocnemus mallincolis* Donato & Siri 2019:** <http://www.zoobank.org/NomenclaturalActs/5efe8dee-e271-4eca-bb90-bca146b8c6fb>

***Lipuometriocnemus rioplatensis* Donato & Siri 2019:** <http://www.zoobank.org/NomenclaturalActs/d08617a8-5d8e-412e-9df7-a249fac04333>

