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### A taxonomic revision of the Patagonian species of the *Dasyhelea mutabilis* species group with a phylogenetic analysis of New World species (Diptera: Ceratopogonidae)

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## A taxonomic revision of the Patagonian species of the *Dasyhelea mutabilis* species group with a phylogenetic analysis of New World species (Diptera: Ceratopogonidae)

Florentina Díaz<sup>a</sup>, Gustavo R. Spinelli<sup>a\*</sup>, Mariano Donato<sup>b</sup> and María M. Ronderos<sup>c</sup>

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We provide a taxonomic revision of the *Dasyhelea mutabilis* species group inhabiting Patagonia, including diagnoses and identification key for both sexes of all species, descriptions and illustrations of seven new and three previously described species, and a discussion of phylogenetic relationships for each species. In addition, a cladistic analysis of the Neotropical and Nearctic species of the *mutabilis* group was performed using TNT version 1.1. It suggests that this group is not monophyletic, and this and other results are discussed within a phylogenetic framework.

<http://zoobank.org/urn:lsid:zoobank.org:pub:39D6AE31-36D1-4CBF-8C43-40050801ECAD>

**Keywords:** *Dasyhelea mutabilis* group; cladistics; new species; Patagonia

### Introduction

Biting midges of the genus *Dasyhelea* Kieffer are common, widespread, and except for Antarctica, are found in all regions of the world in a wide variety of habitats (Wirth and Linley 1990). Taxonomically, the recognition of subgenera and/or species groups is still incipient and generally has been applied sporadically only to various regional fauna (Díaz et al. 2009). In the New World, Waugh and Wirth (1976) provided diagnoses of the *cincta*, *grisea*, *leptobranchia* and *mutabilis* groups in the Nearctic region; Wirth and Waugh (1976) described five new species from north-eastern Brazil in the *borgmeieri* group that they named, with characters identical to those of the *mutabilis* group (Díaz et al. 2010); Grogan and Wieners (2006) proposed the *brevicornis* group for one Nearctic and one Neotropical species; Díaz et al. (2009) reviewed the *cincta* group from Patagonia; and Díaz et al. (2010) proposed the *patagonica* group for seven species that inhabit southern South America.

Borkent (2014) listed 66 species of *Dasyhelea* in the Neotropics. Nineteen species are known to occur in Patagonia, three of which belong to the *mutabilis* group: *Dasyhelea andensis*, *Dasyhelea lacustris* and *Dasyhelea monticola*, all collected by F. W. Edwards during 1926–27 and subsequently described by Ingram and Macfie (1931).

A cladistic analysis of the species of the *mutabilis* group inhabiting the Neotropical and Nearctic regions was performed to assess the phylogenetic

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relationships within this complex. We also provide a taxonomic revision of the Patagonian species of the group based on the material collected during numerous collecting trips to Argentinean and Chilean Patagonia during the past 30 years, including descriptions and illustrations of seven new and three previously described species, and a key to adult males and females.

## Material and methods

Adults were collected with entomological nets, CDC light and Malaise traps, and pupae were collected with pipettes from water along stream margins. The studied specimens were slide-mounted in Canada balsam using the methods of Wirth and Marston (1968), while the pupal exuviae of paratypes of *Dasyhelea pseudolacustris* and *Dasyhelea serrana* Díaz and Spinelli sp. nov. and their emerged adults were handled using the techniques described by Borkent and Spinelli (2007).

Pupae were prepared for examination with scanning electron microscopy by the techniques of Ronderos et al. (2000, 2008). Illustrations were prepared with the aid of a camera lucida. Photographs were taken with a Micrometrics SE Premium digital camera attached to a Nikon Eclipse E200 compound microscope.

Terms for structures of adults follow those in the *Manual of Central American Diptera* (Brown et al. 2009), whereas terminology of pupae are those in Borkent (2012), with the addition of the following abbreviations for two measurements: DAL, dorsal apotome length, and DAW, dorsal apotome width. We also propose the W/L ratio for the aedeagus, which is obtained by dividing the internal width of the aedeagal basal arch by the total aedeagus length, and the L/W wing ratio, which is obtained by dividing the wing length by the wing width.

During this investigation we studied the types of *Dasyhelea andensis* Ingram and Macfie, *D. lacustris* Ingram and Macfie and *D. monticola* Ingram and Macfie, deposited in the Natural History Museum, London (BMNH), and the specimens from the Canadian National Collection of Insects (CNCI), collected in 1984–85 by J. Antony Downes in northern Argentinean and Chilean Patagonia. For specimens from the CNCI, collector nomenclature is included after the locality (e.g. JAD 1651/3).

The holotypes and allotypes of the new species are deposited in the collection of the Division Entomología, Museo de La Plata, Argentina (MLPA), and paratypes are in the BMNH, in the US National Museum of Natural History, Washington, D. C., USA (USNM) and in the CNCI, as noted.

## Cladistic analysis

The phylogenetic relationships of the *mutabilis* group were assessed with a cladistic analysis applying maximum parsimony as optimality criteria. The Neotropical and Nearctic species included in this analysis were *D. ancora* (Coquillett), *D. andensis* Ingram and Macfie, *D. atlantis* Wirth and Williams, *D. bajensis* Wirth, *D. bermudae* Wirth and Williams, *D. borgmeieri* Wirth and Waugh, *D. cacaoi* Wirth and Waugh, *D. guadeloupensis* Delécolle and Rieb, *D. lacustris* Ingram and Macfie, *D. monticola* Ingram and Macfie, *D. mutabilis* (Coquillett), *D. sinclairi* Borkent, *D. sonorensis* Wirth, *D. soriai* Wirth and Waugh, *D. spiniforma* Waugh and Wirth, *D. suarezi* Spinelli and Ronderos, *D. williamsi* Wirth and Waugh, *D. winderi* Wirth and

Waugh and the following seven new species described herein: *D. carlae* Díaz and Spinelli, *D. ingrami* Díaz and Spinelli, *D. macfieei* Díaz and Spinelli, *D. pseudolacustris* Díaz and Spinelli, *D. serrana* Díaz and Spinelli, *D. tehuelche* Díaz and Spinelli and *D. yamana* Díaz and Spinelli.

This analysis included 11 continuous and 24 discrete characters. These characters and character states are self-explanatory and are listed in Appendix 1. Characters 2, 7 and 9 were herein considered for the first time for *Dasyhelea*. Continuous characters were standardized and expressed as ranges as suggested by Donato (2011). Character standardization was calculated following Sokal (1961). As a consequence of standardization, some characters (those below the mean) acquire negative values and therefore cannot be analysed. To prevent this problem, the standardized matrix was transformed through the addition of a constant value of 3 to ensure positive values for all characters. Discrete characters were coded as non-additive and quantitative characters were analysed as additive given that TNT allows treating these kinds of characters. The data matrix is presented in Table 1.

The data matrix was analysed with TNT version 1.1 (Goloboff et al. 2008). All tree searches were performed using 1000 random addition sequences plus tree bisection and reconnection and saving 10 trees per replicate, followed by tree bisection and reconnection branch swapping over the trees obtained (Figure 1).

To calculate character support measurements, two methods were applied. Absolute and relative Bremer support values were calculated, saving up to six steps on suboptimal trees obtained with branch swapping.

To root and polarize the trees, the species *D. cincta* (Coquillett), *D. necrophila* Spinelli and Rodriguez and *D. patagonica* Ingram and Macfie were included as outgroups.

## Results

### *Dasyhelea mutabilis* group

A group of species characterized by their small size and dark or pale brown coloration. Male with parameres and gonocoxal apodemes usually forming an asymmetrical structure, and aedeagus with posterolateral arms single or divided, and usually with posteromedian projection. Female with antennal flagellum short, frontal sclerite elongate, ovoid without lateral processes, scutum usually with contrasting pigmented pattern, subgenital plate circular with broad lumen, one well developed spermatheca. Pupal general coloration yellowish to pale brown, respiratory organ annulated with 6–45 apical and 5–9 lateral pores, and segment 9 with terminal process triangular, divergent and with tip pointed. Larva unknown.

## Taxonomy

Patagonian species included:

- *Dasyhelea andensis* Ingram and Macfie.
- *Dasyhelea carlae* Díaz and Spinelli sp. nov.
- *Dasyhelea ingrami* Díaz and Spinelli sp. nov.

Table 1. Data matrix of 25 species of *Dasyphleia* Kieffer *mutabilis* group plus three outgroups and 35 characters.

	0	1	2	3	4	5	6
<i>cincta</i>	3.714–5.555	2.108–2.951	8.833–10.200	4.096–5.034	1.891–3.562	1.238–2.919	0.467–1.744
<i>Patagonica</i>	2.683–3.567	2.542–3.661	8.482–9.380	3.534–4.284	1.951–3.562	1.574–3.255	1.651–3.146
<i>necrophila</i>	2.093–3.051	2.265–2.951	8.638–10.200	3.909–4.659	4.099–5.173	3.423–4.432	3.423–4.432
<i>andensis</i>	2.535–3.272	3.469–4.673	7.701–9.380	1.659–2.784	2.428–3.144	2.527–4.544	2.118–2.897
<i>cariae</i> sp.nov	1.578–3.198	2.867–3.950	7.702–10.003	1.846–2.409	2.965–5.352	2.919–3.871	2.430–4.143
<i>ingrami</i> sp.nov	3.714–5.924	3.950–4.673	7.194–9.028	2.221–3.534	0.876–3.204	1.406–2.919	1.370–2.087
<i>lacustris</i>	1.872–2.756	2.746–3.950	7.740–9.890	2.034–2.784	2.368–3.323	2.302–3.087	2.243–2.616
<i>macleiei</i> sp.nov	2.388–2.609	2.987–3.709	7.975	2.034–2.409	2.846–3.741	2.302–4.208	2.461–2.492
<i>monticola</i>	2.388–3.788	2.505–3.469	7.701–9.223	0.159–2.784	1.115–3.741	1.070–3.031	1.713–2.430
<i>pseudolacustris</i> sp.nov	2.020–3.051	2.662–3.770	8.014–9.184	1.846–2.409	3.084–3.800	2.695–4.152	2.430–3.239
<i>rehueche</i> sp.nov	2.904–3.051	2.024–2.987	8.600–8.716	1.846–2.409	2.965–3.025	2.078–2.246	2.180–2.211
<i>yamana</i> sp.nov	2.314–3.125	3.661–4.432	7.860–9.070	2.221–2.971	2.368–3.144	2.919–4.040	2.430–2.710
<i>serrana</i> sp.nov	2.020–2.830	3.770–4.673	8.600–9.145	1.846–2.596	2.726–3.800	3.367–4.544	2.523–2.710
<i>encora</i>	1.946–2.756	1.458	?	?	?	?	2.430
<i>atlantis</i>	3.198–3.935	2.662	7.820–8.404	3.534–4.096	?	?	2.990–3.582
<i>bajensis</i>	3.788	3.168	8.250-	3.346	?	?	3.364
<i>bermudeae</i>	2.093	?	?	?	?	?	?
<i>guadeloupensis</i>	2.977	2.746	10.510	3.346	2.189	4.376	2.243
<i>mutabilis</i>	2.535–4.009	2.746	8.365–8.677	2.409–3.346	?	?	3.053–3.676
<i>sinclairi</i>	2.462–3.346	?	?	?	?	?	?
<i>suarezi</i>	2.167–2.388	2.867–3.469	8.794	1.471	2.189–2.368	2.639–2.919	2.897–3.364
<i>borgmeieri</i>	2.388–3.125	1.663	8.170–8.833	2.221–2.596	?	?	2.834–3.613
<i>williamsi</i>	1.725–3.051	1.663	7.430–7.740	3.534–3.909	?	?	3.364–4.922
<i>sorai</i>	2.388–3.272	1.061	7.820–8.248	2.971–3.721	?	?	3.987–4.984
<i>cacaoi</i>	1.209–1.946	1.302	8.053–8.210	3.909–4.847	?	?	3.987–5.233
<i>winderi</i>	2.241–3.051	0.820	8.521–8.560	3.346–3.909	?	?	3.333–4.922
<i>sonorensis</i>	3.935	4.372	8.482	3.534	?	?	3.676
<i>spiniforma</i>	1.578–2.093	2.602	8.092–9.613	3.534–4.096	?	?	3.084–3.987

	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
<i>cincta</i>	2.503–4.113	2.008–2.303	?	3.023–3.495	0	0	0	0	0	0	0	0	0	0	0
<i>Patagonica</i>	2.637–4.381	3.185–6.128	?	3.850–4.204	1	0	0	1	0	0	0	0	0	3	0
<i>necrophila</i>	0.893–2.905	2.303–4.657	?	4.677–6.567	0	1	1	0	0	0	0	0	0	1	1
<i>andensis</i>	1.966–3.308	2.008–3.480	3.949–4.230	2.668–3.968	1	1	0	0	0	0	0	1	1	2	0
<i>cariae</i> sp.nov	2.100–3.173	2.303–3.774	4.404–4.644	1.014–1.841	1	1	0	0	0	1	1	1	4	2	0
<i>ingrami</i> sp.nov	2.368–4.381	2.303–3.774	?	2.668–3.968	1	1	0	1	0	0	0	0	0	2	0
<i>lacustris</i>	1.429–3.576	2.303–3.480	4.177–4.404	1.959–3.259	1	1	0	0	0	0	0	1	2	2	0
<i>macefiei</i> sp.nov	2.234–3.710	2.303–3.185	4.551–4.965	2.077–3.259	1	0	0	0	0	0	0	1	4	2	0
<i>monticola</i>	0.893–2.771	2.008–3.774	2.399–2.533	2.432–3.259	1	1	1	0	1	0	0	0	2	2	0
<i>Pseudolacustris</i> sp.nov	2.234–3.173	2.008–3.480	3.401–3.869	3.023–4.086	1	0	0	0	0	0	0	2	1	2	0
<i>rehuelche</i> sp.nov	2.234–2.771	1.714–3.185	3.508–3.629	2.077–2.195	0	1	0	0	0	0	0	1	3	2	0
<i>yamana</i> sp.nov	1.966–3.308	2.891–4.068	3.508–3.909	2.668–3.259	1	0	2	1	0	0	0	1	1	2	0
<i>serrana</i> sp.nov	3.039–3.710	2.008–3.480	3.508–3.949	2.432–3.023	1	1	0	0	0	0	0	1	1	2	0
<i>ancora</i>	4.381	?	?	2.195	1	1	0	1	0	0	0	0	5	2	0
<i>atlantis</i>	2.368	?	2.466	3.023	1	0	0	0	0	0	0	1	2	2	0
<i>bajensis</i>	3.978	?	2.693	2.432	1	1	2	1	1	0	0	0	4	2	0
<i>bermudae</i>	3.978	?	2.840	2.786	1	1	?	1	0	0	0	1	3	2	0
<i>guadeloupensis</i>	3.039	?	2.198	3.259	1	1	0	1	1	0	0	0	0	2	0
<i>mutabilis</i>	4.381	?	2.653	2.432	1	1	0	1	1	0	0	0	1	2	0
<i>sinclairi</i>	?	?	2.091	2.432	1	0	1	?	?	0	0	0	5	2	0
<i>suarezi</i>	3.442–3.978	2.891	2.399–2.466	2.314–2.550	1	1	1	1	1	0	0	0	2	2	0
<i>borgmeieri</i>	3.576	?	?	3.141	1	0	0	1	1	0	0	0	0	2	0
<i>williamsi</i>	2.100	?	?	4.795	1	0	2	1	1	0	0	0	0	2	0
<i>soritai</i>	3.978	?	2.706	3.495	1	0	3	1	0	0	0	1	1	2	0
<i>cacaoi</i>	2.368	?	?	2.786	1	1	0	1	1	0	0	0	0	2	0
<i>winderi</i>	3.978	?	2.733	3.377	1	1	1	1	0	1	0	0	5	2	0
<i>Sonorensis</i>	4.515	?	2.733	3.023	1	1	0	1	1	0	0	0	4	2	0
<i>spiniforma</i>	1.161	?	2.639	1.014	1	0	4	1	1	0	0	0	1	2	0

(Continued)

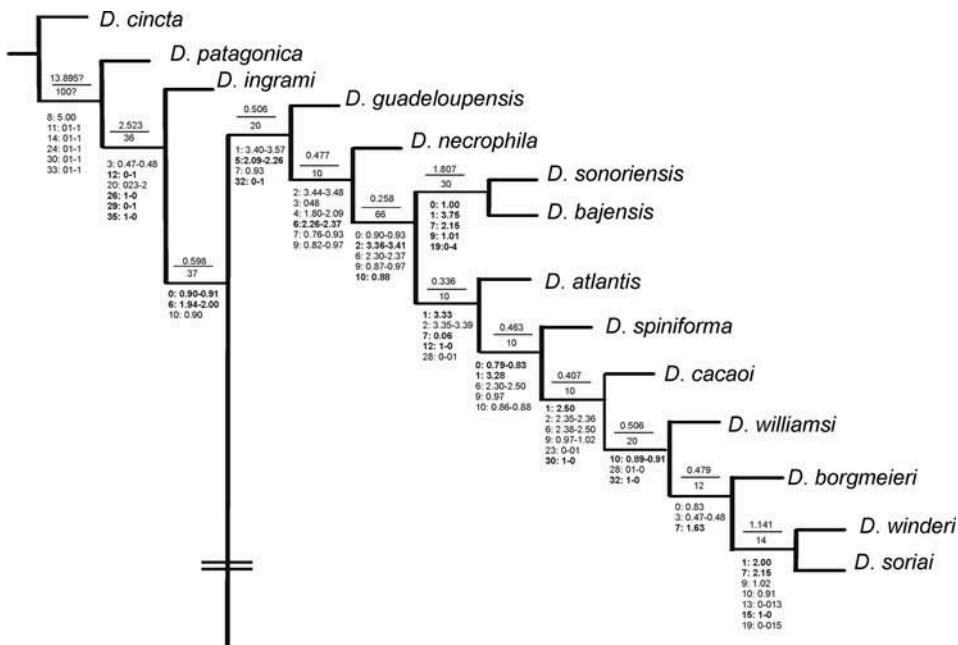
Table 1. (Continued).

	22	23	24	25	26	27	28	29	30	31	32	33	34
<i>cincta</i>	0	0	0	1	1	0	0	0	0	0	0	0	1
<i>Patagonica</i>	0	0	1	0	[1, 2]	0	2	0	1	0	0	1	1
<i>necrophila</i>	0	0	1	1	2	0	0	1	1	0	0	1	0
<i>andensis</i>	0	0	1	1	0	0	1	0	0	0	0	1	1
<i>cariae</i> sp.nov	0	0	1	1	0	1	2	1	0	1	0	1	1
<i>ingrami</i> sp.nov	0	0	1	1	0	0	0	1	1	0	0	1	1
<i>lacustris</i>	0	0	1	1	0	0	1	0	1	0	0	0	1
<i>macfieei</i> sp.nov	0	0	1	1	0	1	0	1	0	0	0	0	1
<i>monticola</i>	0	1	1	1	0	0	0	1	1	0	1	1	1
<i>pseudolacustris</i> sp.nov	0	0	1	1	0	0	1	0	0	0	0	0	1
<i>rehueche</i> sp.nov	0	0	1	1	0	0	1	1	0	0	0	0	1
<i>yamana</i> sp.nov	0	0	1	1	0	0	1	1	0	1	0	1	1
<i>sierrana</i> sp.nov	1	0	1	1	0	1	1	1	0	0	0	1	1
<i>ancora</i>	1	?	1	1	0	?	?	1	0	?	?	1	1
<i>atlantis</i>	0	?	1	1	0	?	?	1	1	0	?	1	1
<i>bajensis</i>	0	0	1	1	0	0	2	1	1	?	1	1	1
<i>bermudae</i>	0	?	1	1	0	?	?	1	?	0	?	1	1
<i>guadeloupensis</i>	0	0	1	1	0	0	0	1	0	0	0	1	1
<i>mutabilis</i>	1	?	1	1	0	0	1	1	0	?	0	1	1
<i>sinclairi</i>	0	?	1	1	0	?	?	1	1	?	0	1	1
<i>squarezi</i>	1	1	1	1	0	0	0	1	1	?	0	1	1
<i>bormeieri</i>	1	1	1	1	0	0	0	1	0	?	0	1	1
<i>williamsi</i>	0	?	1	1	0	0	0	1	0	?	0	1	1
<i>soritai</i>	0	?	1	1	0	0	0	1	0	?	0	1	1
<i>cacaoi</i>	0	?	1	1	0	0	1	1	0	?	1	1	1
<i>winderi</i>	0	0	1	1	0	0	1	0	1	?	0	1	1
<i>sonorensis</i>	0	0	1	1	0	0	1	0	1	1	?	1	1
<i>spiniforma</i>	0	0	1	1	0	0	1	1	1	1	?	1	1

- *Dasyhelea lacustris* Ingram and Macfie.
- *Dasyhelea macfiei* Díaz and Spinelli sp. nov.
- *Dasyhelea monticola* Ingram and Macfie.
- *Dasyhelea pseudolacustris* Díaz and Spinelli sp. nov.
- *Dasyhelea serrana* Díaz and Spinelli sp. nov.
- *Dasyhelea tehuelche* Díaz and Spinelli sp. nov.
- *Dasyhelea yamana* Díaz and Spinelli sp. nov.

**Key to the Patagonian species in the *Dasyhelea mutabilis* group**

- |    |  |    |
|----|--|----|
| 1. | Males .....  | 2  |
|    | Females .....  | 11 |
| 2. | Paramere J-shaped ( <a href="#">Figure 7E</a> ); aedeagus with posterolateral arms straight, parallel, tapering to pointed tips, each with outer mesal, triangular process ( <a href="#">Figure 7C</a> ) ..... <i>D. monticola</i> Ingram and Macfie |    |
|    | Paramere and aedeagus not as above .....   | 3  |
| 3. | Paramere bifid ( <a href="#">Figure. 17E</a> ) ..... <i>D. yamana</i> Díaz and Spinelli sp. nov.   |    |
|    | Paramere simple .....  | 4  |
| 4. | Sternite 9 without posteromedian projection ( <a href="#">Figure 16D</a> ); aedeagus with triangular posteromedian projection and bifid, recurved tip ( <a href="#">Figure 16C</a> ) ..... <i>D. tehuelche</i> Díaz and Spinelli sp. nov.            |    |
|    | Sternite 9 with posteromedian projection; tip of posteromedian projection of aedeagus not recurved .....   | 5  |
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Figure 1. Cladogram obtained from the analysis of standardized ranges data set under equal weights ( $L = 138.8$ ;  $CI = 0.47$ ;  $RI = 0.55$ ). Below nodes the characters and its optimized character states are shown, synapomorphies in bold. Continuous characters were transformed from the standardization to raw data for a better understanding. Above node: Absolute Bremer support.

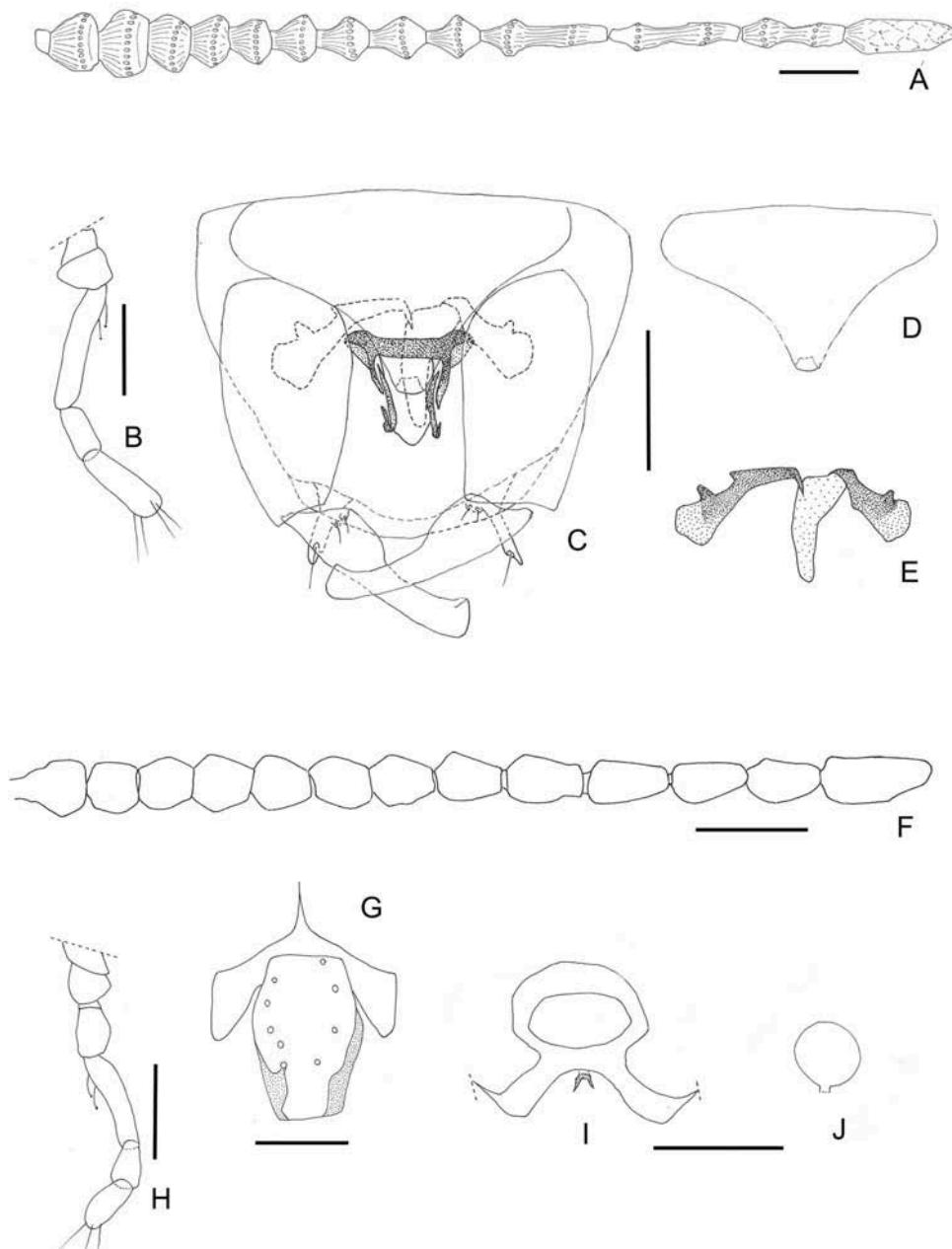


Figure 2. *Dasyhelea andensis* Ingram and Macfie: (A–E) male, (F–J) female. (A, F) Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

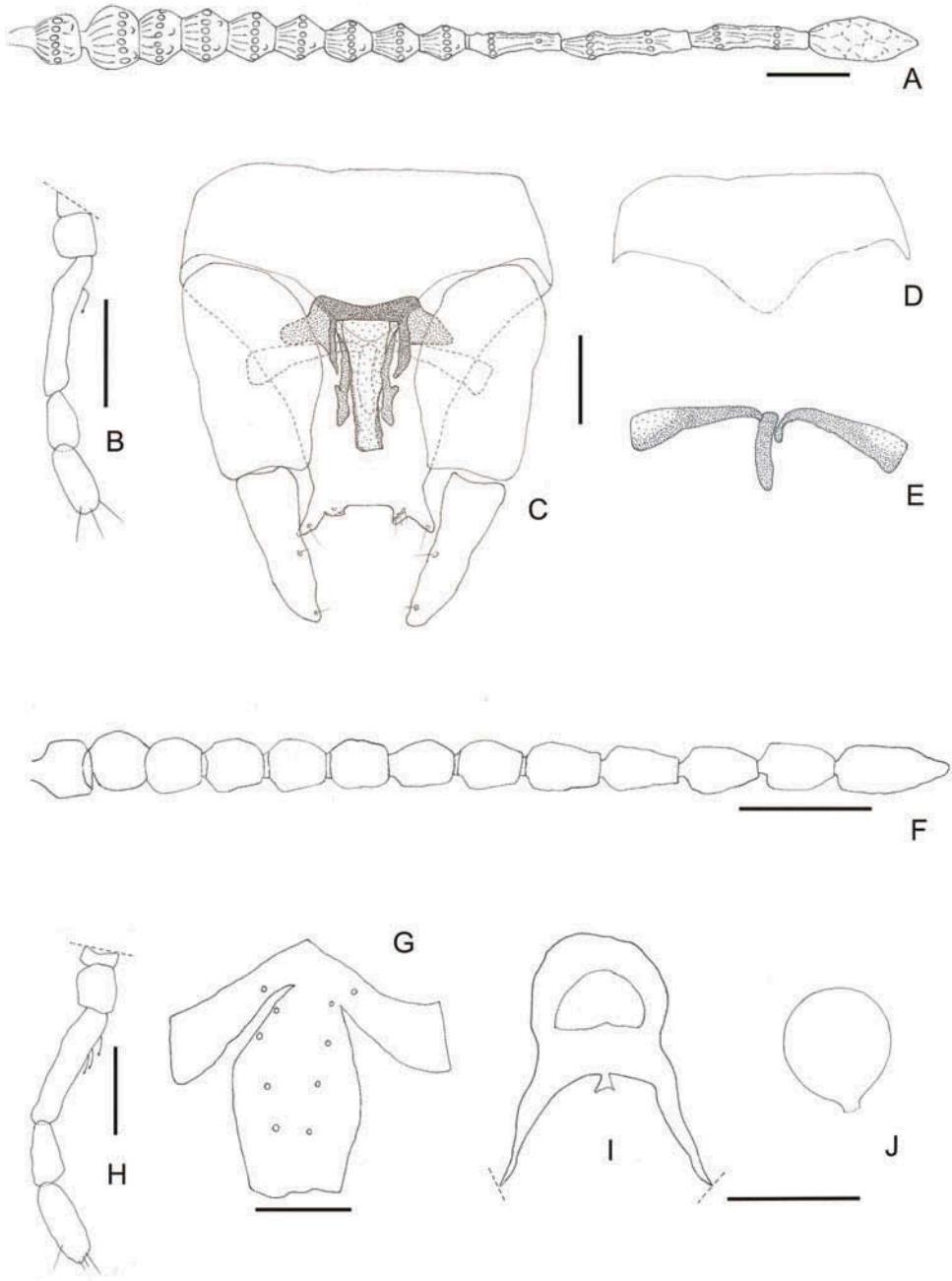


Figure 3. *Dasyhelea carlae* Díaz and Spinelli sp. nov.: (A–E) male, (F–J) female. (A, F), Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

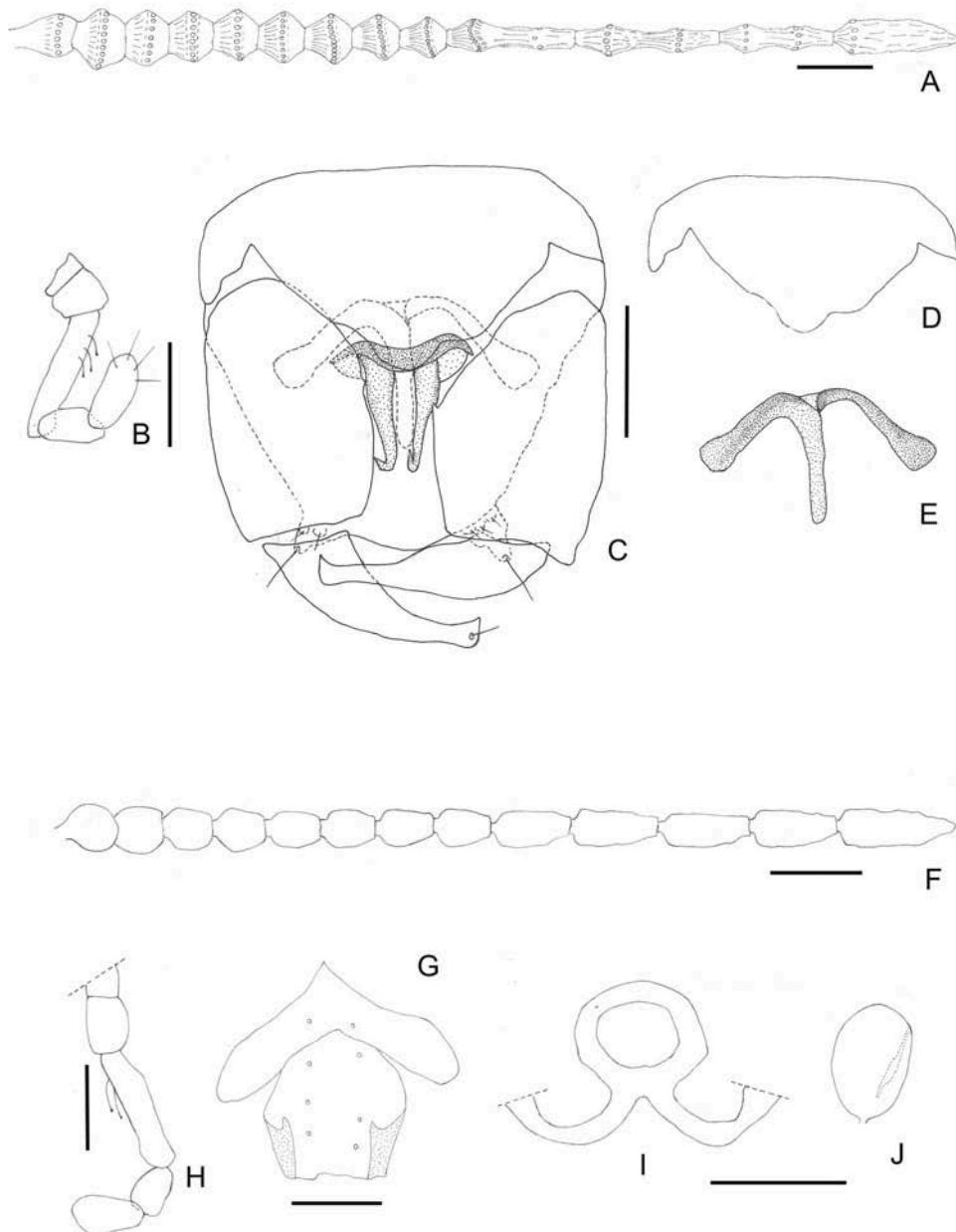


Figure 4. *Dasyhelea ingrami* Díaz and Spinelli sp. nov.: (A–E) male, (F–J) female. (A, F), Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

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Scutellum pale brown; clypeus with 6–7 pairs of setae (Figure 5G); PR 3.40–4.00; subgenital plate with short pointed posteromedian projection, posterolateral arms slender (Fig. 5I) ..... *D. lacustris* Ingram and Macfie

***Dasyhelea andensis* Ingram and Macfie  
(Figures 2, 18A,B, 20)**

*Dasyhelea andensis* Ingram and Macfie, 1931: 180 (male, Argentina); Wirth, 1974: 16 (in catalogue of south USA species); Spinelli and Wirth, 1993: 29 (in list; Argentina); Borkent and Wirth, 1997: 51 (in World catalogue); Spinelli, 1998: 325 (in list; Argentina); Borkent and Spinelli, 2000: 24 (in New World catalogue south of USA); Borkent and Spinelli, 2007: 59 (in Neotropical catalogue); Borkent, 2014: 60 (in online World catalogue).

*Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arms of aedeagus divided, posteromedian projection of aedeagus stout, tapering slightly at apex to triangular, simple tip, and W/L ratio 1.67–1.87. Female with subgenital plate rounded with broad, rounded lumen, the posteromedian projection bifurcate and posterolateral arms stout, apices recurved; scutum and legs dark brown and tarsi progressively infuscated.

*Redescription of male.* Similar to female with usual sexual differences. Antennal flagellum as in Figure 2A. Palpus (Figure 2B) brown; segment 3 bearing scattered sensilla on mesobasal surface; PR 4.20–5.00 (4.46,  $n = 9$ ). Scutellum with 7–8 large, 2–3 thinner setae. Wing (Figure 18B) length 0.75–1.20 (0.94,  $n = 10$ ) mm, width 0.24–0.33 (0.28,  $n = 10$ ) mm; CR 0.40–0.45 (0.42,  $n = 10$ ). Genitalia (Figure 2C): tergite 9 rounded distally, reaching level of apex of gonocoxites, apicolateral process slender, with subapical seta; cercus very short with 2–3 setae; sternite 9 (Figure 2D) 0.6 length of greatest width, posteromedian projection reaching half of total length of aedeagus, apex folded, heavily sclerotized. Gonocoxite stout, 1.9 × longer than greatest width, with short anteromedian process directed anteromesad; gonostylus 0.9 length of gonocoxite, base wide, tapering abruptly distally, apex slightly broader, tip pointed, slightly hooked. Paramere and gonocoxal apodemes (Figure 2E) forming an asymmetrical structure; gonocoxal apodemes conspicuous, with stout subbasal tooth; right apodeme slightly contacting paramere, left broadly fused with paramere, latter stout, simple with blunt rounded tip reaching subapical portion of aedeagus. Aedeagus 0.9

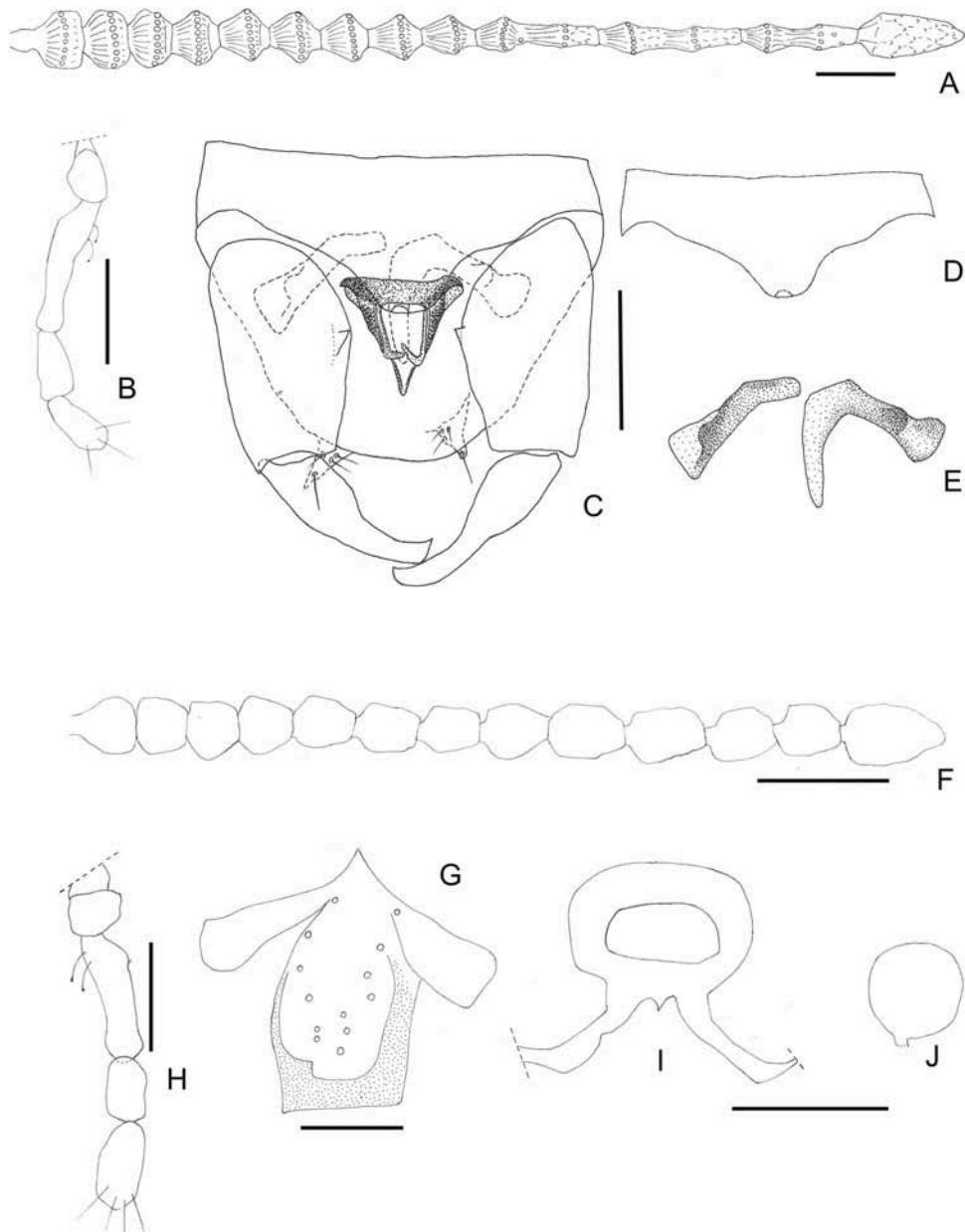


Figure 5. *Dasyhelea lacustris* Ingram and Macfie: (A–E) male, (F–J) female. (A, F) Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

length of greatest width, W/L ratio 1.67–1.87 (1.79,  $n = 10$ ); anterior margin nearly straight, basal arms short, slightly recurved, directed anterolaterad; posterolateral arms divided, inner portion slender, tips recurved anterad; posteromedian projection stout, tapering slightly distally to triangular, simple tip.

*Description of female.* Head dark brown. Eyes contiguous for distance of width of 1–2 ommatidia. Antennal flagellum (Figure 2F) dark brown; AR 0.86–0.96 (0.92,  $n = 10$ ). Clypeus (Figure 2G) with 4–5 pairs of setae. Palpus (Figure 2H) pale brown; segment 3 with 2–3 subbasal capitate sensilla; PR 4.00–5.00 (4.42,  $n = 10$ ).

Thorax. Scutum dark brown; scutellum with 6–7 large, 3–4 thinner setae. Femora, tibiae dark brown, tarsi progressively infuscated; apex of hind tibia with 6 spines; foreleg TR 1.81–1.93 (1.86,  $n = 10$ ), midleg TR 1.93–2.20 (2.06,  $n = 10$ ), hind leg TR 1.90–2.12 (2.02,  $n = 10$ ). Wing (Figure 18A) length 0.72–0.96 (0.85,  $n = 10$ ), width 0.33–0.45 (0.37,  $n = 10$ ) mm; CR 0.38–0.44 (0.41,  $n = 10$ ); membrane hyaline, densely covered with macrotrichia; radial cells obliterated; cubital fork at level of midlength of second radial cell. Haltere dark brown, knob base whitish.

Abdomen. Dark brown. Subgenital plate (Figure 2I) circular, with broad, ovoid lumen; posteromedian projection bifurcate; posterolateral arms stout, curved. Spermatheca (Figure 2J) spherical, diameter 36  $\mu\text{m}$ , neck very short, straight, measuring 6  $\mu\text{m}$ .

#### *Distribution* (Figure 20)

Argentina (La Pampa, Neuquén, Río Negro, Chubut, Santa Cruz, Tierra del Fuego), Chile (Arauco, Malleco, Cautín, Llanquihue, Aisen).

#### *Type material*

Holotype male, Argentina, Río Negro prov., lago Gutiérrez, 3–14 November 1926, F. and M. Edwards (examined, BMNH).

#### *Other specimens examined*

Argentina, La Pampa prov., General Acha, 22 November 1984, J. A. Downes, sweep net, 1 female (JAD 1646/1) (CNCI). Neuquén prov., 16 km south of San Martín de los Andes, 27 November 1984, G. Spinelli, 2 males (MLPA); same data except 4 February 1986, G. Spinelli, 3 females (MLPA); río Malleo y salida a Primeros Pinos, 7 February 1986, G. Spinelli, 2 males (MLPA); Parque Nacional Lanín, Hua-Hum, 11 February 1989, G. Spinelli, 1 female, sweep net (MLPA); lago Aluminé, 22 December 1996/3 January 1997, G. Spinelli, 2 males, 1 female, Malaise trap (MLPA); Paimún, arroyo Rucaleufú, 18 February 1994, G. Spinelli, 1 male, 2 females (MLPA); El Cholar, 1225 m, 24 February 2001, G. Spinelli, 1 male (MLPA). Río Negro prov., Parque Nacional Nahuel Huapi, arroyo Blanco y ruta a Tronador, 31 January 1986, G. Spinelli, 2 males, 5 females, sweep net (MLPA); Parque Nacional Nahuel Huapi, río Manso, 1 February 1986, G. Spinelli, 2 males, 4 females, sweep net (MLPA); río Manso superior, 41°14'8.1" S, 71°42'27.3" W, 845 m, 11/30 December 2006, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); same data except 7 February/2 March 2007, 2 males, 1 female (MLPA); Parque Nacional

Nahuel Huapi, río Manso Medio, La Cantera, 41°21'16" S, 71°42'27.3" W, 764 m, 11/30 December 2006, Garré-Montes de Oca, 1 male, 4 females (MLPA); Malaise trap; same date except 15 January/7 February 2007, 1 male (MLPA), 1 male, 1 female (BMNH), 1 male, 1 female (USNM), 1 male, 1 female (CNCI); extremo sur lago Mascardi, 31 January 1986, G. Spinelli, 4 males, 2 females (MLPA); Parque Nacional Nahuel Huapi, ruta Cascada de Los Alerces, 24 January 1988, G. Spinelli, 4 males, 2 females (MLPA); 6.5 km east of Cascada de Los Alerces, 14 February 1989, G. Spinelli, 1 male, 1 female, sweep net (MLPA); Parque Nacional Nahuel Huapi, Puerto Blest, 9 December 1992, G. Spinelli, 1 female, sweep net (MLPA); Parque Nacional Nahuel Huapi, lago Villarino, 5 December 1992, G. Spinelli, 3 females (MLPA); meseta de Somuncurá, estancia El Rincón, 27 February 1995, G. Spinelli, 1 male, 5 females, sweep net (MLPA); same data except 26/30 December 1995, G. Spinelli, 1 male, Malaise trap (MLPA); same data except December 1995, 2 males, Malaise trap (MLPA); meseta de Somuncurá, Chipauquill, 27 February 1995, G. Spinelli, 1 male, sweep net (MLPA); ruta Nac. 40 y río Chenqueniyen, 1 December 1999, G. Spinelli, 2 males, sweep net (MLPA); Laguna Puesto de Chapa, 5 December 2006, G. Spinelli, 3 males, sweep net (MLPA); Paraje Chasico, vertiente, 41°08'28" S, 67°35'43.9" W, 961 m, 6 December 2006, G. Spinelli, 1 male, sweep net (MLPA); Comi-Co, arroyo Comi-Co, 31 January 1999, P. Marino, 1 female, sweep net (MLPA); Rincón de Comi-Co, 41°08'35.1" S, 67°27'34.6" W, 1000 m, 7 December 2006, G. Spinelli, 1 male, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, laguna Los Juncos, 41°03'37.9" S, 71°00'34.3" W, 906 m, 12 December 2006, Garré-Montes de Oca, 2 males, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, arroyo Nireco (Complejo Chall-huaco) 41°11'51.9" S, 71°19'40.5" W, 962 m, 20 December 2006/23 January 2007, Garré-Montes de Oca, 1 male, 2 females, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, arroyo Llum, 41°16'13.3" S, 71°30'56.7" W, 857 m, 4–25 January 2007, Garré-Montes de Oca, 1 male, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, arroyo Leon, 40°43'48" S, 71°08'04" W, 764 m, 12 December 2007/3 January 2008, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, arroyo Neuquenco, 40°28'48.3" S, 71°36'44.1" W, 809 m, 23 January/4 February 2008, Garré-Montes de Oca, 3 males, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, río Minero, 40°41'23.5" S, 71°17'33.2" W, 832 m, 7–20 February 2008, Garré-Montes de Oca, 3 males, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, río Pichitraful, 40°42'46" S, 71°47'23" W, 789 m, 14 December 2007/3 January 2008, 2 males, Garré-Montes de Oca, Malaise trap (MLPA); same data except 4–23 February 2008, 11 males, 1 female (MLPA). Chubut prov., 35 km east of Esquel, 720 m, 18 November 1966, Schlinger-Irwin, 1 male (MLPA); Esquel, laguna Z, 19 January 1988, G. Spinelli, 2 females, sweep net (MLPA); lago Fontana, 12 December 1995, G. Spinelli, 2 males, 4 females, sweep net (MLPA); meseta de Sierra Cuadrada, estancia Don Eduardo, 1 December 1996, G. Spinelli, 2 males, 1 female, at light (MLPA); same data except 1–2 December 1996, 5 males, 3 females, Malaise trap (MLPA); Volcán Piedra Parada, Monte Sarmiento, 42°34'8.57" S, 70°04'34.4" W, 580 m, 26 February 2009, G. Spinelli, 1 male, sweep net (MLPA). Santa Cruz prov., lago del Desierto, 9 December 1996, G. Spinelli, 2 females, sweep net (MLPA). Tierra del Fuego prov., estancia Harberton, January–February 2006, M. L. Pagnosin, 4 males, 6 females, at light (MLPA).

Chile, Arauco prov., Pata de Gallina, 7 December 2003, G. Spinelli, 1 female, sweep net (MLPA). Malleco prov., Parque Nacional Nahuelbuta, 26 December 1984, J. A. Downes, 2 males, sweep net (JAD 1682/2) (CNCI), same data except, 27 December 1984, J. A. Dow nes, 2 males, 2 females (JAD 1683/1) (CNCI). Cautin prov., Fundo San Martín, 16 December 1984, J. A. Downes, 1 male (JAD 1670/1), 1 female (JAD 1670/2), sweep net (CNCI). Llanquihue prov., Puerto Mont, 1 January 1985, J. A. Downes, 1 male, 1 female, sweep net (JAD 1688/3) (CNCI); same date except, 1 male (JAD 1688/4); Parque Nacional Vicente Perez Rosales, Casa Pangue, 41°02'55" S, 71°52'31.2" W, 366 m, 18 February 2008, M. Donato, 2 males, sweep net (MLPA); río Peulla, 41°02'55" S, 71°52'31.2" W, 366 m, 18 February 2008, M. Donato, 1 male, Malaise trap (MLPA); Aisen prov., 8 km west Chile Chico, 540 m, 22 November 1966, Schlinger-Irwin, 1 female (MLPA).

### *Phylogenetic relationships*

*Dasyhelea andensis* with *D. carlae*, *D. lacustris* and *D. macfieei* form a polytomy supported by the synapomorphy 'W/L ratio' [character 9]. Despite the fact that *D. andensis* did not possess an autapomorphy; it is clearly differentiated from the other Patagonian species in this clade by the combination of characters presented in the diagnosis.

### *Remarks*

We provide the first description and illustrations of the female of *D. andensis*.

***Dasyhelea carlae* Díaz and Spinelli sp. nov.  
(Figures 3, 18C,D, 21)**

### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arm of aedeagus divided, bearing a mesolateral, short, blunt protuberance directed anterolaterally. Female with subgenital plate semicircular with straight posterolateral arms; legs brown, femora darkest and femorotibial joints dark.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum as in Figure 3A. Palpus (Figure 3B) pale brown; segment 3 bearing scattered sensilla on mesobasal surface; PR 4.20–5.25 (4.81,  $n = 10$ ). Scutellum with 7–8 large, 2–3 thinner setae. Wing (Figure 18D) length 0.78–0.96 (0.86,  $n = 9$ ) mm, width 0.27–0.36 (0.29,  $n = 9$ ) mm; CR 0.39–0.43 (0.41,  $n = 9$ ). Genitalia (Figure 3C): tergite 9 tapering abruptly distally, produced beyond apex of gonocoxites, posterior margin straight, apicolateral process stout with one elongate subbasipal seta; cercus with 4–5 setae, base broad; sternite 9 (Figure 3D) 0.35 length of greatest width, posteromedian projection triangular. Gonocoxite stout, 1.85 × longer than greatest width; gonostylus 0.70 length of gonocoxite, stout, nearly straight with blunt rounded tip. Paramere and gonocoxal apodemes (Figure 3E) forming an asymmetrical structure; left gonocoxal apodeme recurved distad, both apodemes fused with base of

paramere; paramere moderately short, nearly straight, with blunt rounded tip. Aedeagus 0.93 length of greatest width, W/L ratio 1.72–2.18 (2.04,  $n = 10$ ); anterior margin nearly straight, basal arms stout, subtriangular; posterolateral arms divided, inner portion with mesolateral, short, blunt, anterolaterally directed protuberance; posteromedian projection rectangular, elongate, with truncate tip, produced beyond inner posterolateral arm.

*Description of female.* Head dark brown. Eyes contiguous by width of 3–4 ommatidia. Antennal flagellum (Figure 3F) pale brown; AR 0.73–0.99 (0.83,  $n = 7$ ). Clypeus (Figure 3G) with five pairs of setae. Palpus (Figure 3H) pale; segment 3 with 2–3 subbasomesal capitate sensilla; PR 3.60–4.60 (4.02,  $n = 9$ ).

Thorax. Scutum dark brown; scutellum paler with 7–8 large, 3–4 thinner setae. Legs brown, femora slightly darker, femorotibial joints darkish, tarsomeres 1–3 whitish, tarsomeres 4–5 slightly infuscated; apex of hind tibia with 7 spines; foreleg TR 1.90–2.30 (1.97,  $n = 9$ ), midleg TR 2.00–2.17 (2.07,  $n = 9$ ), hind leg TR 2.00–2.55 (2.14,  $n = 9$ ). Wing (Figure 18C) length 0.78–0.96 (0.88,  $n = 8$ ) mm, width 0.33–0.42 (0.38,  $n = 9$ ) mm; CR 0.39–0.42 (0.40,  $n = 9$ ); membrane hyaline, covered with macrotrichia; radial cells obliterated; cubital fork at same level of anterior portion of second radial cell. Haltere pale brown.

Abdomen. Dark brown. Subgenital plate (Figure 3I) semicircular, anterior margin of lumen deeply concave, posterior margin of lumen truncate, posteromedian projection semi-triangular; posterolateral arms slender, straight. Spermatheca (Figure 3J) spherical, heavily sclerotized, diameter 60  $\mu\text{m}$ , neck short, straight, hyaline, measuring 12  $\mu\text{m}$ .

#### *Distribution* (Figure 21)

Argentina (Neuquén, Río Negro, Chubut, Santa Cruz).

#### *Type material*

Holotype male, Argentina, Chubut prov., 16 km southeast Paso del Sapo, 27/28 February 2001, G. Spinelli, sweep net (MLPA); allotype female, Argentina, Santa Cruz prov., río Pinturas, 6 December 2002, G. Spinelli, sweep net (MLPA). Paratypes, 22 males, 16 females, as follows: same data as holotype 3 males, 1 female (MLPA); same data as allotype 3 males, 2 females (MLPA). Neuquén prov., 40 km SO Zapala, laguna del Burro, 16 December 1996, G. Spinelli, 1 female, sweep net (MLPA). Río Negro prov., Parque Nacional Nahuel Huapi, arroyo León, 40°43'48" S, 71°08'04" W, 764 m, 12 December 2007/3 January 2008, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, río Minero, 40°41'23.5" S, 71°17'33.2" W, 832 m, 7/20 February 2008, Garré-Montes de Oca, 1 male, Malaise trap (MLPA). Chubut prov., 16 km southeast Paso del Sapo, 28 February 2001, G. Spinelli, 2 males, 2 females (MLPA); Los Altares, 20 February 1989, G. Spinelli, 3 males, 3 females (MLPA); Colonia Sarmiento, Camping La Isla, brazo del río Senguer, 45°33'6.65" S, 69°03'45.5" W, 300 m, 23/24 February 2009, G. Spinelli, 1 male, Malaise trap (MLPA). Santa Cruz prov., río Pinturas, 5 December 1996, G. Spinelli, 6 males, 3 females (MLPA), 1 male, 1 female (BMNH), 1 male, 1 female (USNM), 1 male, 1 female (CNCI), sweep net.

### *Etymology*

This species is named after our colleague Dr Carla G. Cazorla, entomologist of the Museo de La Plata, in recognition of her valuable contributions to the taxonomy of Neotropical Ceratopogonidae.

### *Phylogenetic relationships*

The phylogenetic relationships of this species are discussed in the description of the *D. andensis*.

### *Dasyhelea ingrami* Díaz and Spinelli sp. nov. ([Figures 4, 18E,F, 21](#))

### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arms of aedeagus single, tapering distally to anteroventrally recurved tip; paramere and gonocoxal apodemes forming an asymmetrical structure, paramere stout with blunt rounded tip. Female subgenital plate circular with posterolateral arms gently recurved over 90° and spermatheca ovoid with very short, narrow straight neck.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum as in [Figure 4A](#). Palpus ([Figure 4B](#)) pale; segment 3 slender, with scattered mesal capitate sensilla; PR 5.00–6.00 (5.73,  $n = 10$ ). Scutellum with 7–8 large, 3–4 thinner setae. Wing ([Figure 18F](#)) length 1.02–1.26 (1.17,  $n = 8$ ) mm, width 0.33–0.42 (0.37,  $n = 8$ ) mm; CR 0.41–0.45 (0.43,  $n = 8$ ). Genitalia ([Figure 4C](#)): tergite 9 rounded distally, reaching level of apex of gonocoxites, apicolateral process stout, triangular, broadly divergent with apical seta; cercus small with 2–3 very small setae; sternite 9 ([Figure 4D](#)) 0.5 length of greatest width, posteromedian projection rounded. Gonocoxite stout, 1.6 × longer than greatest width, with anteromedian process heavily sclerotized; gonostylus 0.9 length of gonocoxite, wide basally, tapering abruptly at mid-length, apex broader, hook-like, tip pointed. Paramere and gonocoxal apodemes ([Figure 4E](#)) forming a slightly asymmetrical structure; gonocoxal apodemes stout, slightly curved, left apodeme slightly contacting paramere, right apodeme broadly fused with paramere; paramere moderately slender with blunt rounded tip reaching subapical portion of aedeagus. Aedeagus 0.9 length of greatest width; anterior margin slightly curved, heavily sclerotized; basal arms short, recurved, directed laterad; posterolateral arms single, lightly sclerotized, wide basally, tapering slightly distally to anteroventrally recurved tips; without posteromedian projection.

*Description of female.* Head dark brown. Eyes contiguous for the distance of width of 3 ommatidia. Antennal flagellum ([Figure 4F](#)) pale brown; AR 1.06–1.32 (1.12,  $n = 10$ ). Clypeus ([Figure 4G](#)) with 4 pairs of setae. Palpus ([Figure 4H](#)) pale; segment 3 slender with 2–3 subbasal capitate sensilla; PR 4.20–5.00 (4.63,  $n = 10$ ).

Thorax. Scutum dark brown; scutellum paler with 7–8 large, 3–4 thinner setae. Legs pale brown; apex of hind tibia with 7 spines; foreleg TR 1.55–1.96 (1.69,  $n = 10$ ),

midleg TR 1.73–2.08 (1.82,  $n = 10$ ), hind leg TR 1.66–1.89 (1.76,  $n = 10$ ). Wing (**Figure 18E**) length 0.99–1.23 (1.07,  $n = 10$ ) mm, width 0.42–0.51 (0.47,  $n = 10$ ) mm; CR 0.41–0.47 (0.43,  $n = 10$ ); membrane slightly infuscated, densely covered with macrotrichia; radial cells obliterated or reduced to slender suture; cubital fork at level of anterior portion of second radial cell. Haltere pale brown, knob base whitish.

Abdomen. Pale brown. Subgenital plate (**Figure 4I**) circular, with broad round lumen; posteromedian projection absent; posterolateral arms slender, gently recurved over 90°. Spermatheca ovoid (**Figure 4J**), heavily sclerotized, measuring 60 × 48 µm, neck short, narrow, straight, measuring 12 µ.

### *Distribution* (**Figure 21**)

Argentina (Río Negro, Chubut).

### *Type material*

Holotype male, allotype female, Argentina, Chubut prov., 60 km east Tecka, 20 February 1989, G. Spinelli, sweep net (MLPA). Paratypes, 9 males, 15 females, as follows: same data as holotype 1 female (MLPA). Río Negro prov., meseta de Somuncurá, 18 km south Pailemán, 10 December 2005, G. Spinelli, 1 male (MLPA); Rincón de Comi-Co, 41°08'35.1" S, 67°27'34.6" W, 1000 m, 7 December 2006, G. Spinelli, 3 females, Malaise trap (MLPA). Chubut prov., Comodoro Rivadavia, 12 January 1992, J. Muzón, 1 male (MLPA); meseta de Sierra Cuadrada, estancia Don Eduardo, 1 December 1996, G. Spinelli, 1 male, 4 females (MLPA), 1 male (BMNH), 1 male (USNM), 1 male (CNCI), at light; Telsen, arroyo Telsen, 42°28'35.2" S, 66°52'18.0" W, 24 February 2007, G. Cheli, 3 males, 4 females (MLPA), 1 female (BMNH), 1 female (USNM), 1 female (CNCI), at light.

### *Etymology*

This species is named after the late British entomologist Alexander Ingram, in recognition of his pioneer work with Ceratopogonidae of Patagonia that was co-authored by John William Scott Macfie.

### *Phylogenetic relationships*

*Dasyhelea ingrami* is the basal species of the clade containing the other species of the *mutabilis* group and *D. necrophila*.

### *Dasyhelea lacustris* Ingram and Macfie, 1931 (**Figures 5, 18G,H, 20**)

*Dasyhelea lacustris* Ingram and Macfie, 1931: 190 (female, Argentina); Wirth, 1974: 17 (in catalogue of south USA species); Spinelli and Wirth, 1993: 29 (in list; Argentina); Borkent and Wirth, 1997: 55 (in World catalogue); Spinelli, 1998: 325 (in list; Argentina); Borkent and Spinelli, 2000: 25 (in New World catalogue south of

the USA); Borkent and Spinelli, 2007: 60 (in Neotropical catalogue); Borkent, 2014: 66 (in online World catalogue).

### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arm of aedeagus divided, posteromedian projection of aedeagus triangular with simple pointed tip; sternite 9 0.3 × longer than greatest width; PR 5.00–5.50. Female with subgenital plate semicircular with semicircular lumen, posteromedian projection short, triangular and posterolateral arms slender, slightly recurved distally; scutum brown and scutellum pale brown.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum as in Figure 5A. Palpus (Figure 5B) pale brown; segment 3 very slender, bearing scattered sensilla on mesal surface; PR 5.00–5.50 (5.34,  $n = 10$ ). Scutellum with 7–8 large, 2–3 thinner setae. Wing (Figure 18H) length 0.87–1.11 (0.97,  $n = 10$ ) mm, width 0.27–0.36 (0.31,  $n = 10$ ) mm; CR 0.40–0.44 (0.41,  $n = 10$ ). Genitalia (Figure 5C): tergite 9 rounded distally, reaching level of apex of gonocoxites, apicolateral process slender, broadly divergent with subapical seta; cercus very small, appressed to base apicolateral process, with 2–3 setae; sternite 9 (Figure 5D) 0.3 length of greatest width, posteromedian projection rounded, reaching half of aedeagus length, apex folded, heavily sclerotized. Gonocoxite stout, 1.9 × longer than greatest width, with short anteromedial process; gonostylus 0.8 length of gonocoxite, proximal half moderately broad, abruptly tapered at mid-length, apex slightly hooked, tip pointed. Paramere and gonocoxal apodemes forming an asymmetrical structure (Figure 5E); gonocoxal apodemes stout, nearly straight, with short subbasal tooth; right apodeme broadly fused with parameres, left apodeme separate; parameres moderately short, reaching mesal portion of aedeagus, apex blunt pointed. Aedeagus 0.4 length of greatest width; W/L ratio 1.83–2.00 (1.90,  $n = 10$ ), anterior margin straight, basal arms short, directed laterad; posterolateral arms divided, inner portion slender with anteroventrally recurved tips; posteromedian projection triangular, tip simple, pointed.

*Redescription of female.* Head dark brown. Eyes contiguous for the distance of width of 5 ommatidia. Antennal flagellum (Figure 5F) dark brown; AR 0.77–0.88 (0.84,  $n = 10$ ). Clypeus (Figure 5G) with 6–7 pairs of setae. Palpus (Figure 5H) pale brown; segment 3 with 1–2 subbasomesal capitate sensilla; PR 3.40–4.00 (3.81,  $n = 10$ ).

Thorax. Scutum dark brown; scutellum pale brown with 6–7 large, 3–4 thinner setae. Legs dark brown, tarsomeres 1–3 whitish, 4–5 slightly infuscated; apex of hind tibia with 6–7 spines; foreleg TR 1.75–1.96 (1.84,  $n = 10$ ), midleg TR 1.89–2.03 (1.97,  $n = 10$ ), hind leg TR 1.94–2.06 (2.00,  $n = 10$ ). Wing (Figure 18G) length 0.75–0.87 (0.80,  $n = 10$ ) mm, width 0.33–0.39 (0.34,  $n = 10$ ) mm; CR 0.40–0.44 (0.42,  $n = 10$ ); membrane hyaline, densely covered with macrotrichia; radial cells obliterated; cubital fork at level of anterior portion of second radial cell. Haltere dark brown.

Abdomen. Dark brown. Subgenital plate (Figure 5I) ovoid, with broad, semicircular lumen, posteromedian projection short, triangular; posterolateral arms slender, curved. Spermatheca (Figure 5J) spherical, heavily sclerotized, diameter 36 µm, neck short, straight, measuring 12 µm.

### Distribution (Figure 20)

Argentina (La Pampa, Neuquen, Río Negro, Chubut, Santa Cruz, Tierra de Fuego), Chile (Concepción, Malleco, Cautín, Valdivia, Llanquihue, Coihaique).

### Type material

Holotype female, Argentina, Río Negro prov., lago Gutiérrez, 3–14 November 1926, F. and M. Edwards (examined, BMNH).

### Other specimens examined

Argentina, La Pampa prov., General Acha, 22 November 1984, J. A. Downes, 1 female, sweep net (JAD 1646/1) (CNCI). Neuquen prov., San Martín de los Andes, 27 November 1984, J. A. Downes, 1 female, sweep net (JAD 1654/1) (CNCI); 16 km south San Martín de los Andes, 27 November 1984, G. Spinelli, 1 female (MLPA); same data except 4 February 1986, G. Spinelli, 1 female (MLPA); lago Espejo, 27 November 1984, G. Spinelli, 2 females (MLPA); Parque Nacional Nahuel Huapi, lago Espejo, 40°38'49.3" S, 71°42'12.7" W, 903 m, 4/23 February 2008, Garré-Montes de Oca, 1 male, Malaise trap (MLPA); río Mallo y salida a Primeros Pinos, 7 February 1986, G. Spinelli, 3 males, 4 females (MLPA); 40 km SO Zapala, laguna del Burro, 16 December 1986, G. Spinelli, 1 male, 1 female, sweep net (MLPA); 20 km west lago Aluminé, 14 February 1994, G. Spinelli, 1 female (MLPA); Lago Aluminé, 22 December 1996/3 January 1997, G. Spinelli, 1 male, 1 female (MLPA), 1 male, 1 female (BMNH), Malaise trap; same data except 4 December 1997, G. Spinelli, 2 females, Malaise trap (MLPA); same data except 19 January/2 February 1997, G. Spinelli, 2 males, 4 females (MLPA), 1 male, 1 female (USNM), 1 male, 1 female (CNCI), Malaise trap; arroyo camino a las Termas del Queñi, 7 February 1999, P. Marino, 2 males, 1 female, sweep net (MLPA); laguna Epulaufquen, 22 February 2001, G. Spinelli, 2 females, sweep net (MLPA); El Cholar, 1225 m, 24 February 2001, G. Spinelli, 3 males, 5 females, sweep net (MLPA); Quillén, 30 November 2001, G. Spinelli 8 females (MLPA); Parque Nacional Nahuel Huapi, río Minero, 40°41'23.5" S, 71°17'33.2" W, 832 m, 7/20 February 2008, Garré-Montes de Oca, 2 males, Malaise trap (MLPA); same data except 20 February/6 March 2008, 4 females (MLPA). Río Negro prov., Parque Nacional Nahuel Huapi, arroyo Blanco y ruta a Tronador, 31 January 1986, G. Spinelli, 1 male, 2 females (MLPA); extremo S lago Mascardi, 31 January 1986, G. Spinelli, 2 males, 4 females (MLPA); Bariloche, arroyo Chall-Huaco, 26 January 1988, G. Spinelli, 2 females (MLPA); meseta de Somuncurá, estancia El Rincón, 27 February 1995, G. Spinelli, 4 females, sweep net (MLPA); same data except November 1995, G. Spinelli, 1 male, 1 female, Malaise trap (MLPA); same data except 26/30 December 1995, G. Spinelli, 1 female, (MLPA); same data except 28/29 January 1999, P. Marino, 1 female, sweep net (MLPA); ruta Nac. 40 y río Chenqueniyen, 1 December 1995, G. Spinelli, 2 females, sweep net (MLPA); lago Steffen, 1 December 1999, P. Marino, 3 males, 3 females, sweep net (MLPA); Parque Nacional Nahuel Huapi, río Manso, 1 February 1986, G. Spinelli, 7 males, 2 females (MLPA); Parque Nacional Nahuel Huapi, río Manso superior, 41°14'8.1" S, 71°42'27.3" W, 845 m, 7 February/2 March 2007, Garré-Montes de

Oca, 1 male, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, río Manso Medio, La Cantera, 41°21'16" S, 71°42'27.3" W, 764 m, 11/30 December 2006, Garré-Montes de Oca, 2 males, Malaise trap (MLPA); same date except 15 January/7 February 2007, 2 males (MLPA); Parque Nacional Nahuel Huapi, Laguna Los Juncos, 41°03'37.9" S, 71°00'34.3" W, 906 m, 12 December 2006, Garré-Montes de Oca, 1 female, sweep net (MLPA); Parque Nacional Nahuel Huapi, Laguna Schmool, 41°11'36.7" S, 71°29'51.2" W, 1925 m, 24 January 2007 Garré-Montes de Oca, 1 female, sweep net (MLPA); Parque Nacional Nahuel Huapi, arroyo Nireco, 41°11'51" S, 71°19'40.5" W, 962 m, 23 January/13 February 2007, Garré-Montes de Oca, 3 males, 7 females, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, río Pichitraful, 40°42'46" S, 71°47'23" W, 789 m, 23 February 2008, Garré-Montes de Oca, 1 male, 1 female, Malaise trap (MLPA); same data except 14 December 2007/3 January 2008, 1 female (MLPA); Parque Nacional Nahuel Huapi, Laguna Mercedes, 40°52'43.4" S, 71°34'41" W, 899 m, 14 December 2007/3 January 2008, Garré-Montes de Oca, 2 females, Malaise trap (MLPA); same data except 3/21 January 2008, 5 females (MLPA); same data except 21 January/4 February 2008, 1 male (MLPA); Parque Nacional Nahuel Huapi, Lago Hess, 41°22'00" S, 71°44'31" W, 767 m, 23 December 2008/19 January 2009, Garré-Montes de Oca, 3 females, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, Lago Fonck, 41°20'09.5" S, 71°45'17.4" W, 771 m, 26 February/19 March 2009, Garré-Montes de Oca, 1 female, Malaise trap (MLPA). Chubut prov., Esquel, laguna Z, 19 January 1988, G. Spinelli, 1 male, 1 female (MLPA); lago Fontana, 12 December 1995, G. Spinelli, 1 male, 1 female, sweep net (MLPA); meseta de Sierra Cuadrada, estancia Don Eduardo, 1 December 1996, G. Spinelli, 3 males, 2 females, at light (MLPA); same date except 1/2 December 1996, G. Spinelli, 5 males, 4 females, Malaise trap (MLPA); arroyo Las Bayas, 1 December 1999, G. Spinelli, 3 females, sweep net (MLPA). Santa Cruz prov., lago del Desierto, 19 January 1995, I. Garda, 1 male, sweep net (MLPA); ruta Prov. 41, (Ranchito), 46°54'34.9" S, 71°51'54.4" W, 1060 m, 19 February 2009, G. Spinelli, 1 male, sweep net (MLPA). Tierra del Fuego prov., Parque Nacional Tierra del Fuego, Lapataia, 8 January 1994. G. Spinelli, 1 female (MLPA).

Chile, Concepción prov., Rafael, 8 December 2003, G. Spinelli, 1 male, 1 female, sweep net (MLPA). Malleco prov., Cord de las Raices, 40 km west Curacautin, 1650 m, 5 February 1979, Davis-Akerbergs, 1 male (MLPA); Parque Nacional Nahuelbuta, 27 December 1984, J. A. Downes, 2 males, 2 females, sweep net (JAD 1683/1) (CNCI). Cautín prov., Fundo San Martín, 15 December 1984, J. A. Downes, 2 females, sweep net (JAD 1669/1) (CNCI); same data except 16 December 1984, 1 female (JAD 1670/1) (CNCI). Valdivia prov., Panguipulli, 26 November 1992, G. Spinelli, 1 male, 2 females (MLPA). Llanquihue prov., Puerto Montt, 1 January 1985, J. A. Downes, 1 female, sweep net (JAD 1688/4) (CNCI); same date except 1 female (JAD 1688/5) (CNCI); Parque Nacional Vicente Pérez Rosales, Casa Pangue, 41°02'55" S, 71°52'31.2" W, 366 m, 18 February 2008. M. Donato, 5 females, sweep net (MLPA); río Peulla, 41°02'55" S, 71°52'31.2" W, 366 m, 18 February 2008. M. Donato, 2 males, 2 females, Malaise trap (MLPA). Coihaique prov., Coihaique, 5 February 1985, J. A. Downes, 1 female, sweep net (JAD 1718/2) (CNCI).

### *Phylogenetic relationships*

The phylogenetic relationships of this species are discussed in the description of the *D. andensis*.

### *Remarks*

We provide the first description and illustrations of the male of *D. lacustris*.

### ***Dasyhelea macfieei* Díaz and Spinelli sp. nov. (Figures 6, 18I,J, 22)**

### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arm of aedeagus divided and posteromedian projection rectangular with truncate tip; paramere and gonocoxal apodemes forming a symmetrical structure, paramere short with blunt pointed tip; and W/L ratio 2.11–2.29. Female with subgenital plate ovoid; legs including tarsi pale brown and hind tibial comb with 8 spines.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum as in Figure 6A. Palpus (Figure 6B) pale; segment 3 bearing scattered capitate sensilla on basomesal surface; PR 4.00–5.00 (4.55,  $n = 10$ ). Scutellum with 6–7 large 2–3 thinner setae. Wing (Figure 18J) length 0.75–0.84 (0.80,  $n = 10$ ) mm, width 0.24–0.30 (0.27,  $n = 10$ ) mm; CR 0.40–0.44 (0.42,  $n = 10$ ); haltere pale brown. Genitalia (Figure 6C): tergite 9 rounded distally, extending just below apex of gonocoxites, apicolateral process slender, straight, with apical seta; cercus small with 2 setae; sternite 9 (Figure 6D) 0.4 length of greatest width, posteromedian projection rounded. Gonocoxite stout, 1.7 X longer than greatest width; gonostylus 0.8 length of gonocoxite, base wide, nearly straight, apex slightly hooked, tip pointed. Paramere and gonocoxal apodemes (Figure 6E) forming a symmetrical structure; gonocoxal apodemes stout, slightly curved, both fused to base of paramere; paramere short, slender with blunt pointed tip. Aedeagus 1.2 × longer than greatest width, W/L ratio 2.11–2.42 (2.29,  $n = 10$ ); anterior margin slightly curved, heavily sclerotized; basal arms stout, posteriorly directed; posterolateral arms divided, heavily sclerotized, inner portion elongate, slender with slightly recurved tip; posteromedian projection wide, rectangular with truncate tip.

*Description of female.* Head dark brown. Eyes contiguous for a distance of the width of 3–4 ommatidia. Antennal flagellum (Figure 6F) pale; AR 0.84. Clypeus (Figure 6G) with 7 pairs of setae. Palpus (Figure 6H) pale; segment 3 with 1–2 subbasal capitate sensilla; PR 4.20 ( $n = 2$ ).

Thorax. Scutum dark brown; scutellum paler with 5–6 large, 2–3 thinner setae. Legs pale brown; apex of hind tibia with 8 spines; foreleg TR 1.92–2.03 (1.97,  $n = 2$ ), midleg TR 2.23, hind leg TR 2.02 ( $n = 2$ ). Wing (Figure 18I) length 0.90 ( $n = 2$ ) mm, width 0.42 ( $n = 2$ ) mm; CR 0.40 ( $n = 2$ ); membrane slightly

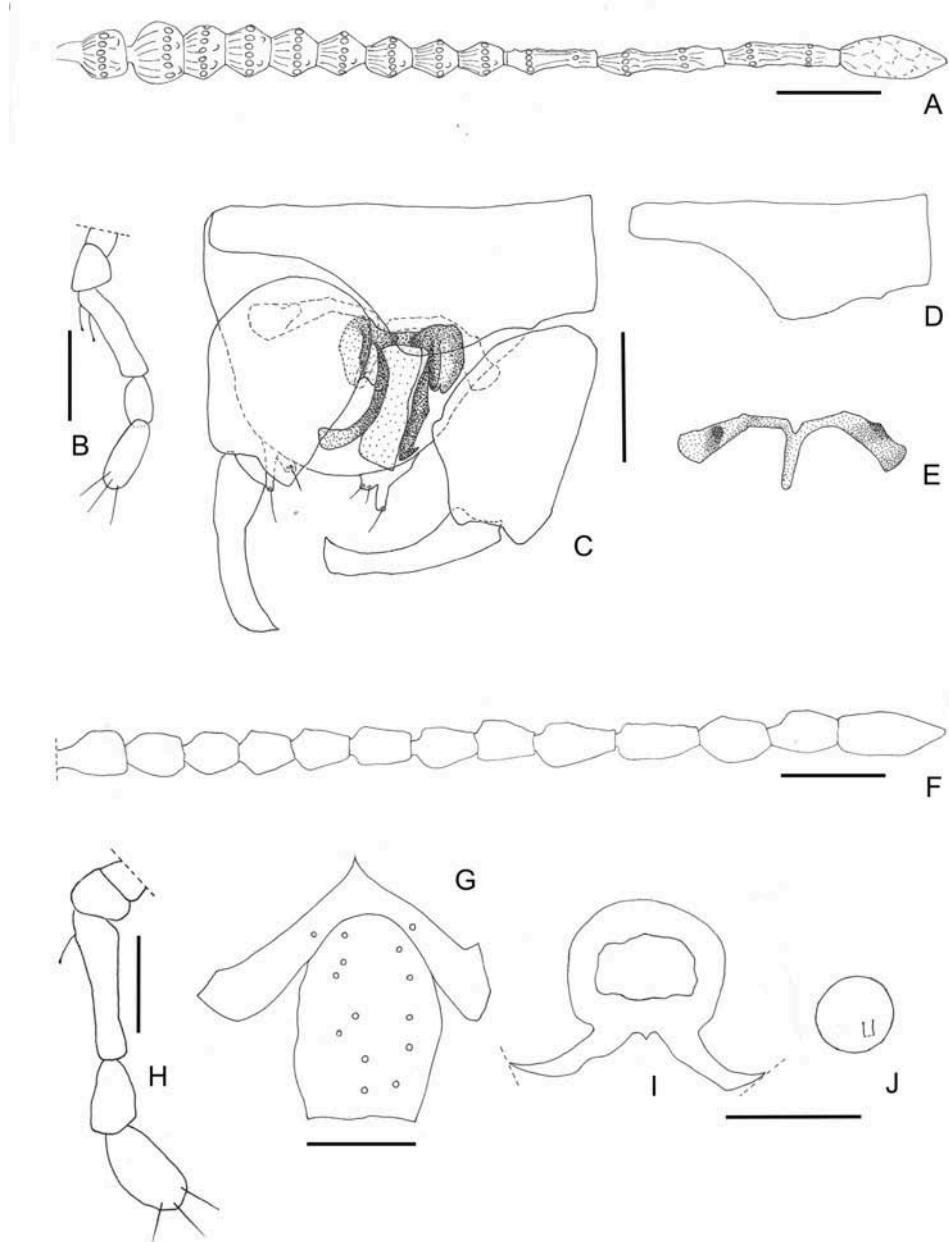


Figure 6. *Dasyhelea macfieei* Díaz and *Spinelli* sp. nov.: (A–E) male, (F–J) female. (A, F) Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

infuscated, densely covered with macrotrichia; radial cells obliterated; cubital fork at level of anterior portion of second radial cell. Haltere missing in the two available specimens.

Abdomen. Pale brown. Subgenital plate (Figure 6I) semicircular with broad lumen, posterior margin nearly straight, posteromedian projection short, triangular; posterolateral arms short, apices slightly recurved. Spermatheca (Figure 6J) spherical, heavily sclerotized, diameter 36 µm, neck short, straight, measuring 12 µm.

#### *Distribution* (Figure 22)

Argentina (Salta, San Luis, Río Negro, Chubut)

#### *Type material*

Holotype male, allotype female, Argentina, Chubut Prov., meseta de Sierra Cuadrada, estancia Don Eduardo, 1/2 December 1996, G. Spinelli, Malaise trap (MLPA).

Paratypes, 20 males, 1 female, as follows: same data as holotype, 1 male, 1 female (MLPA). Salta prov., ciudad de Salta, 28 February 2005, G. Spinelli, 2 males, at light (MLPA). San Luis prov., ruta Prov. 5, bajo de Veliz, 32°18'43.2" S, 65°24'43.3" W, 583 m, 16 November 2007, G. Spinelli, 1 male, sweep net (MLPA). Río Negro prov., Chipauquil (Pueblo), 40°57'41.1" S, 66°38'20.8" W, 481 m, 3 December 2006, G. Spinelli, 7 males (MLPA), 1 male (BMNH), 1 male (USNM), 1 male, (CNCI), sweep net; same data except (Puesto Policial), 4 December 2006, 4 males (MLPA); meseta de Somuncurá, estancia El Rincón, 40°59'24.1" S, 66°40'35.7" W, 620 m, 4 December 2006, M. Donato, 2 males, sweep net (MLPA).

#### *Etymology*

This species is named after the late British entomologist John William Scott Macfie, in recognition of his pioneer work dealing with the Ceratopogonidae from Patagonia, that he co-authored with Alexander Ingram.

#### *Phylogenetic relationships*

The phylogenetic relationships of this species are discussed in the description of the *D. andensis*.

#### ***Dasyhelea monticola* Ingram and Macfie, 1931** (Figures 7, 19A-B, 21)

*Dasyhelea monticola* Ingram and Macfie, 1931: 188 (male, female, Chile); Wirth, 1974: 17 (in catalogue of south USA species); Borkent and Wirth, 1997: 56 (in World catalogue); Borkent and Spinelli, 2000: 25 (in New World catalogue south of the USA); Borkent and Spinelli, 2007: 60 (in Neotropical catalogue); Borkent, 2017: 67 (in online World catalogue).

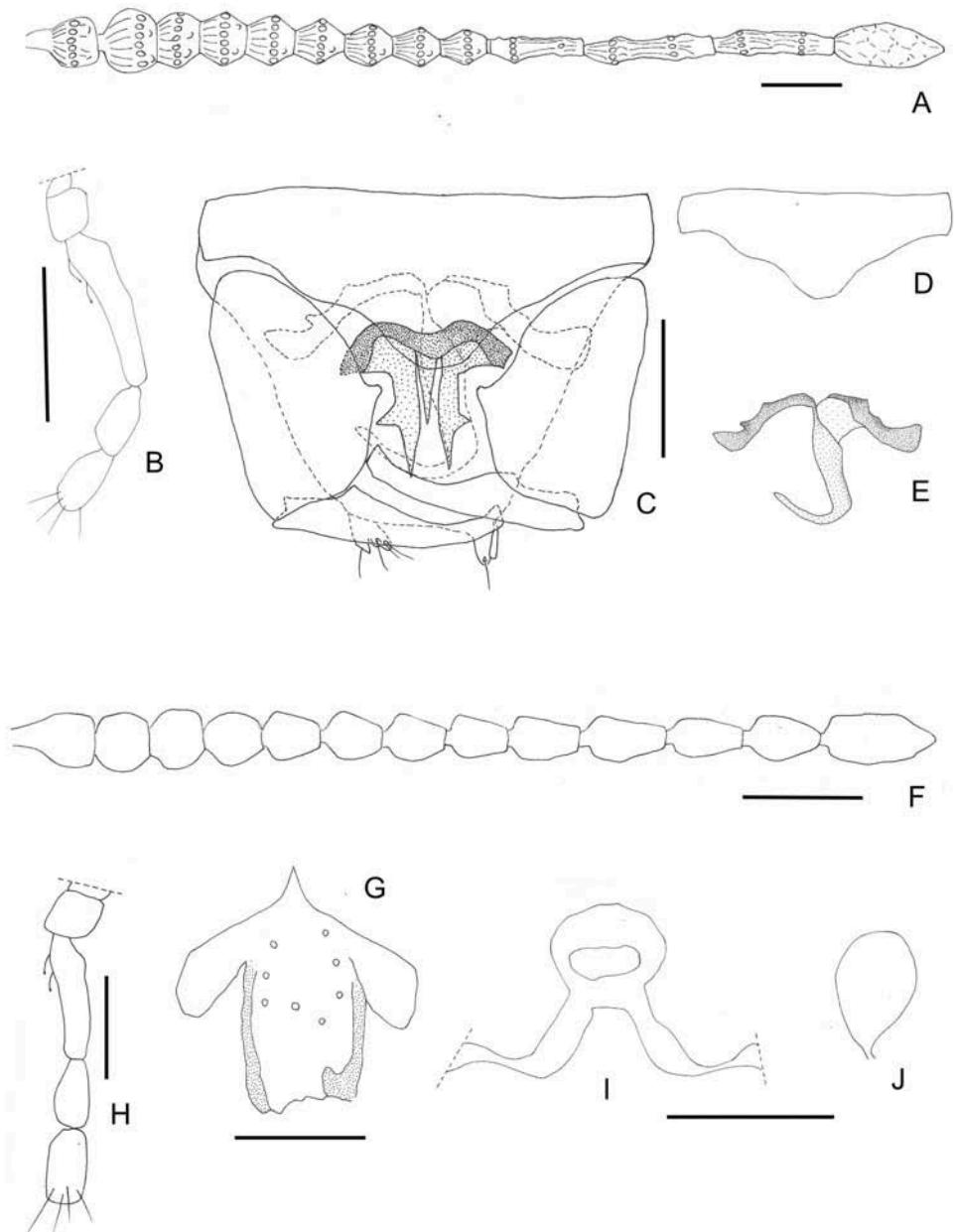


Figure 7. *Dasyhelea monticola* Ingram and Macfie: (A–E) male, (F–J) female. (A, F) Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

### Diagnosis

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male paramere J-shaped. Female subgenital plate circular; cubital fork of wing distad to level of end of costa; spermatheca ovoid with oblique neck.

*Redescription of male.* Similar to female with usual sexual differences. Antennal flagellum as in Figure 7A. Palpus (Figure 7B) brown; segment 3 bearing scattered sensilla on basomesal surface; PR 3.57–4.66 (4.14,  $n = 10$ ). Scutellum with 7–8 large, 1–2 thinner setae. Wing (Figure 19B) length 0.69–1.14 (0.94,  $n = 10$ ) mm, width 0.24–0.36 (0.31,  $n = 10$ ) mm; CR 0.38–0.44 (0.41,  $n = 10$ ). Genitalia (Figure 7C): tergite 9 rounded distally, reaching level of apex of gonocoxites, apicolateral process moderately short, stout, with conspicuous apical seta; cercus very small with 2–3 small setae; sternite 9 (Figure 7D) 0.5 length of greatest width, posteromedian projection rounded, reaching one-third of aedeagus length. Gonocoxite stout, 1.8  $\times$  longer than greatest width, with short, blunt anteromedian process; gonostylus 0.9 length of gonocoxite, base moderately broad, slightly curved, tapering slightly distally, apex barely hooked, tip pointed. Paramere and gonocoxal apodemes (Figure 7E) forming an asymmetrical structure; gonocoxal apodemes stout, right apodeme barely fused with paramere, left broadly fused with paramere; paramere greatly elongate, J-shaped. Aedeagus 0.9 length of greatest width, W/L ratio 0.50–0.60 (0.53,  $n = 7$ ); anterior margin concave; basal arms heavily sclerotized, stout, recurved 60°, posteriorly directed; posterolateral arms stout, straight, parallel, tapering to slender, sharply pointed tips, each with mesal, subapical, outer triangular process; posteromedian projection short, slender, triangular, tapering distally, with simple, pointed tip.

*Redescription of female.* Head dark brown. Eyes contiguous for distance of the width of 3 ommatidia. Antennal flagellum (Figure 7F) pale; AR 0.85–1.03 (0.91,  $n = 10$ ). Clypeus (Figure 7G) with 4 pairs of setae. Palpus (Figure 7H) pale brown; segment 3 with 2–3 subbasomesal capitate sensilla; PR. 3.20–4.00 (3.60,  $n = 10$ ).

Thorax. Scutum dark brown, scutellum pale brown with 6–7 large, 2–3 thinner setae; apex of hind tibia with 4–6 spines; foreleg TR 1.59–2.03 (1.70,  $n = 10$ ), midleg TR 1.67–2.02 (1.82,  $n = 10$ ), hind leg TR 1.77–2.00 (1.87,  $n = 10$ ). Wing (Figure 19A) length 0.75–0.96 (0.85,  $n = 10$ ) mm, width 0.30–0.42 (0.37,  $n = 10$ ) mm; CR 0.30–0.44 (0.39,  $n = 10$ ); membrane slightly infuscated, densely covered with macrotrichia; radial cells obliterated; cubital fork slightly distad to level of apex of costa. Haltere dark brown, knob base whitish.

Abdomen. Pale brown. Subgenital plate (Figure 7I) circular with narrow lumen, without posteromedian projection; posterolateral arms moderately broad, distal portions slender, recurved nearly 90°. Spermatheca (Figure 7J) ovoid heavily sclerotized, 60  $\times$  36  $\mu\text{m}$ , neck oblique, short, measuring 12  $\mu\text{m}$ .

### Distribution (Figure 21)

Argentina (Neuquén, Río Negro, Chubut, Santa Cruz, Tierra del Fuego), Chile (Malleco, Osorno).

### Type material

Holotype male, allotype female, Chile, Llanquihue prov., Casa Pangue, 4/10 December 1926, F. and M. Edwards (BMNH examined).

### Other specimens examined

Argentina, Neuquen prov., Parque Nacional Lanin, lago Ruca-Choroy, 14 January 1994, G. Spinelli, 2 females (MLPA); 20 km south Moquehue, 14 February 1994, G. Spinelli, 1 female (MLPA); lago Aluminé, 22 December 1996/3 January 1997, G. Spinelli, 1 female (MLPA); lago Huechulaufquen, 28 February 1998, G. Spinelli, 1 female (MLPA); arroyo camino a las Termas del Queñi, 7 February 1999, P. Marino, 2 females, sweep net (MLPA); Villa la Angostura, 11/15 January 2004, G. Spinelli, 1 male, at light (MLPA). Río Negro prov., Parque Nacional Nahuel Huapi, Puerto Blest, 9 December 1992, G. Spinelli, 2 males, 6 females (MLPA); Rincón de Comi-Co, 41°08'35.1" S, 67°27'34.6" W, 1000 m, 7 December 2006, G. Spinelli, 1 male, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, Mallin la Cortadera, 41°05'13" S, 71°48'26" W, 769 m, 11/30 December 2006; Garré-Montes de Oca, 1 female, Malaise trap (MLPA); same data except 14 December 2006/8 January 2007, 3 males, 1 female (MLPA); same data except 8 January/3 February 2007, 8 males, 5 females (MLPA) 1 male, 1 female (BMNH), 1 male, 1 female, (USNM), 1 male, 1 female, (CNCI); Parque Nacional Nahuel Huapi, Mallin los Patos, 41°15'48.6" S, 71°17'50.3" W, 1020 m, 20 December 2006/3 January 2007, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, Mallin La Heladera, 41°05'13" S, 71°48'26" W, 769 m, 14 December 2006/8 January 2007, Garré-Montes de Oca, 2 males, Malaise trap (MLPA); same data except 8 January/3 February 2007, 1 male, 3 females (MLPA); Parque Nacional Nahuel Huapi, arroyo Vantitter, 41°11'53.8" S, 71°29'47.3" W, 1748 m, 24 January 2007, Garré-Montes de Oca, 1 male, sweep net (MLPA); Parque Nacional Nahuel Huapi, Laguna Schmoll, 41°11'36.7" S, 71°29'51.2" W, 1925 m, 24 January 2007, Garré-Montes de Oca, 2 females, sweep net (MLPA); Parque Nacional Nahuel Huapi, cerro Catedral, laguna Toncek, 41°11'52.2" S, 71°29'31.2" W, 1770 m, 20 February 2007, Cazorla-Donato, 1 male, 1 female, sweep net (MLPA); Parque Nacional Nahuel Huapi, Manso Superior, 41°14'8.1" S, 71°46'58.5" W, 845 m, 7 February/2 March 2007, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, arroyo Llum, 41°16'13.3" S, 71°30'56.7" W, 857 m, 4/25 January 2007, Garré-Montes de Oca, 1 male, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, arroyo Blanco (Villa Traful), 40°39'03.4" S, 71°24'45.8" W, 822 m, 12 December 2007/7 March 2008, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); same data except 21 January/7 February 2008, 1 female, (MLPA); Parque Nacional Nahuel Huapi, arroyo Neuquenco, 40°28'48.3" S, 71°36'44.1" W, 809 m, 9/23 January 2008, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); same data except 23 January/4 February 2008, 1 male, 2 females (MLPA); Parque Nacional Nahuel Huapi, laguna Mercedes, 40°52'43.4" S, 71°34'41" W, 899 m, 3 January/21 February 2008, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, río Pichitraful, 40°42'46" S, 71°47'23" W, 789 m, 4/23 February 2008, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); Parque Nacional Nahuel Huapi, Lago Espejo, 40°38'49.3" S, 71°42'12.7" W, 903 m, 23

February/5 March 2008, Garré-Montes de Oca, 1 female, Malaise trap (MLPA). Chubut prov., lago Fontana, 12 December 1995, G. Spinelli, 2 males, sweep net (MLPA); cerro Galera, 2/4 December 2002, G. Spinelli, 2 males, Malaise trap (MLPA); Puerto Patriada, 500 m Epuyén, 2/8 December 2008 P. Pessacq, 2 males, Malaise trap (MLPA); same data except 3/29 January 2009, 1 male (MLPA). Santa Cruz prov., lago del Desierto, 19 January 1995, G. Spinelli, 2 females, sweep net (MLPA); same data except 9 December 1996, 2 females (MLPA). Tierra del Fuego prov., Parque Nacional Tierra del Fuego, laguna Negra (turbera),  $54^{\circ}50'42.1''$  S,  $68^{\circ}35'17.9''$  W, 15 m, 1/4 December 2008, Donato-Spinelli, 2 males, Malaise trap (MLPA); same data except 4/7 December 2008, 4 males, 3 females (MLPA).

Chile, Malleco prov., Parque Nacional Conguillio, 22 December 1984, J. A. Downes, 1 female, sweep net (JAD 1677/1) (CNCI); Parque Nacional Nahuelbuta, 26 December 1984, J. A. Downes, 1 male, sweep net (JAD 1682/2) (CNCI). Osorno prov., Pucatrihue, 1 December 1992, G. Spinelli, 1 male (MLPA); Parque Nacional Vicente Pérez Rosales, Casa Pangue,  $41^{\circ}02'55''$  S,  $71^{\circ}52'31.2''$  W, 366 m, 18 February 2008, M. Donato, 2 females, sweep net (MLPA).

#### *Phylogenetic relationships*

*Dasyhelea monticola* is the sister species of *D. suarezi* Spinelli and Ronderos. The clade (*D. monticola*, *D. suarezi*) is supported by the characters “parameres” [character 13 (1)]; “shape of posteromedian projection of aedeagus” [character 19 (2)] and “cubital fork (female)” [character 23 (1)].

#### ***Dasyhelea pseudolacustris* Díaz and Spinelli sp. nov. (Figures 8–11, 19C,D, 22)**

*Dasyhelea lacustris*: Spinelli and Ronderos, 1987: 13 (male, pupa; Argentina), misidentification except holotype of *D. lacustris*.

#### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arms of aedeagus divided with apex of inner portion recurved ventrolaterad at  $90^{\circ}$ . Female with subgenital plate semicircular with broad, deep lumen, posteromedian projection very small and posterolateral arms slender, gently curved; clypeus with 3 pairs of setae; femora and tibiae dark brown, tarsi whitish and hind tibial comb with 8 spines.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum as in Figure 8A. Palpus (Figure 8B) pale; segment 3 bearing scattered sensilla on basomesal surface; PR 4.20–5.50 (4.77,  $n = 10$ ). Scutellum with 6–7 large, 2–3 thinner setae. Wing (Figure 19D) length 0.72–0.96 (0.85,  $n = 10$ ) mm, width 0.27–0.30 (0.29,  $n = 10$ ) mm, CR 0.40–0.44 (0.41,  $n = 10$ ). Genitalia (Figure 8C): tergite 9 rounded distally, reaching level of apex of gonocoxites, apicolateral process slender on distal half with single subapical seta; cercus moderately short with 2–3 small setae; sternite 9 (Figure 8D) 0.5 length of greatest width, posteromedian projection elongate,

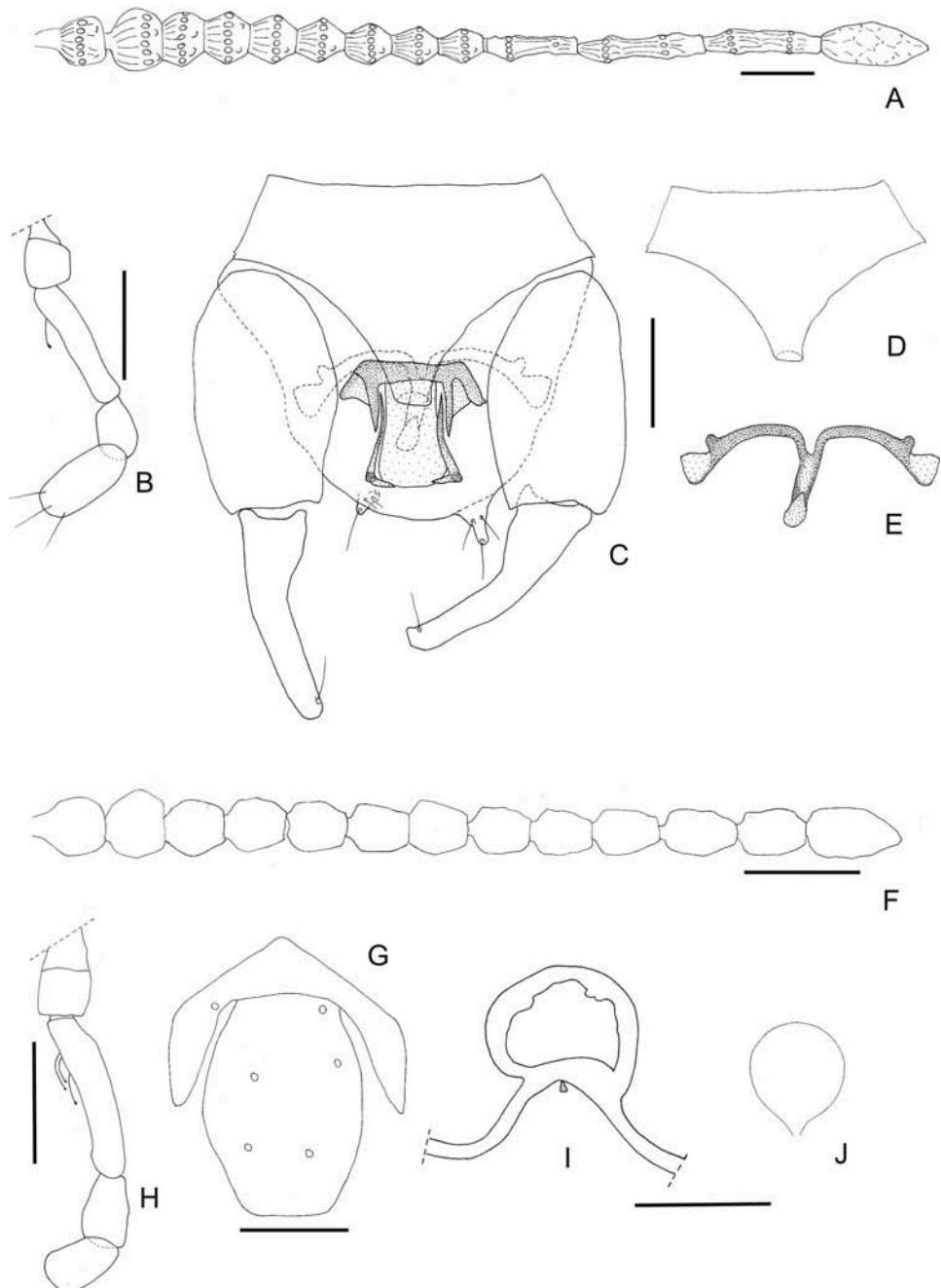


Figure 8. *Dasyhelea pseudolacustris* Díaz and Spinelli sp. nov.: (A–E) male, (F–J) female. (A, F) Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

moderately narrow, reaching one-third of aedeagus length, apex rounded, folded. Gonocoxite stout,  $1.7 \times$  longer than greatest width; gonostylus 0.9 length of gonocoxite, proximal one-third moderately broad, distal two-thirds abruptly tapered, apex slightly hooked, tip broad, rounded. Paramere and gonocoxal apodemes (Figure 8E) forming a symmetrical structure; gonocoxal apodemes slender with small, subbasal, anteriorly directed tooth, both apodemes fused with paramere by a slender stalk, paramere slender, tip rounded, folded. Aedeagus 0.8 length of greatest width, W/L ratio 1.25–1.60 (1.41,  $n = 10$ ); anterior margin straight, heavily sclerotized; basal arms stout, recurved 60°, directed posteriorly; posterolateral arms divided, inner portion elongate, apex recurved ventrolaterad at 90°, posteromedian projection stout, apex very broad with rounded tip.

*Description of female.* Head dark brown. Eyes contiguous for distance of the width of 3 ommatidia. Antennal flagellum (Figure 8F) pale; AR 0.79–0.90 (0.86,  $n = 10$ ). Clypeus (Figure 8G) with 3 pairs of setae. Palpus (Figure 8H) pale; segment 3 with 2–3 subbasal capitate sensilla; PR 3.33–4.25 (3.78,  $n = 10$ ).

Thorax. Scutum dark brown; scutellum paler with 6–7 large, 2–3 thinner setae. Legs dark brown except tarsi whitish; apex of hind tibia with 8 spines; foreleg TR 1.82–2.04 (1.95,  $n = 10$ ), midleg TR 1.96–2.22 (2.01,  $n = 10$ ), hind leg TR 2.00–2.26 (2.12,  $n = 10$ ). Wing (Figure 19C) length 0.69–0.87 (0.82,  $n = 10$ ) mm, width 0.30–0.39 (0.36,  $n = 10$ ) mm; CR 0.39–0.44 (0.41,  $n = 10$ ); membrane hyaline, densely covered with macrotrichia; radial cells obliterated; cubital fork at same level of median portion of second radial cell. Haltere pale brown.

Abdomen. Pale brown. Subgenital plate (Figure 8I) semicircular with extensive lumen, posterior margin truncate, posteromedian projection very small; posterolateral arms slender, gently curved distally. Spermatheca (Figure 8J) spherical, heavily sclerotized, diameter 60 µm, neck short, straight, heavily sclerotized, measuring 12 µm.

*Description of female pupa.* Total length 1.89–2.25 (1.97,  $n = 6$ ) mm. General coloration of exuviae pale brown. Dorsal apotome (Figure 10B) 3 × broader than long, apex broadly rounded, surface covered with stout rounded tubercles, except smooth anterolateral areas weakly wrinkled; anterior margin slightly concave, posterior margin rounded with stout, rounded tubercle, bearing 6–7 strong spicules; dorsal apotome sensilla medium-sized, thin, located on rounded well-developed tubercle (Figure 10B); DAL 0.07–0.08 (0.08,  $n = 4$ ) mm; DAW 0.18–0.19 (0.18,  $n = 4$ ) mm DAW/DAL 2.14–2.66 (2.30,  $n = 4$ ). Cephalothorax (Figure 10A) surface smooth, length 0.72–0.81 (0.77,  $n = 6$ ) mm, width 0.51–0.60 (0.55,  $n = 6$ ) mm. Cephalothoracic sensilla as follows (Figure 10D): three dorsolateral cephalic sclerite sensilla, two short, thin, hyaline setae, one campaniform sensillum; two anterolateral sensilla, one thin, medium-sized seta, one campaniform sensillum; two medium-sized anteromedial sensilla; three dorsals present (Figure 11A), D-1-T, D-5-T short setae, D-3-T campaniform sensillum, supralar campaniform sensillum (SA-2-T) (Figure 11A). Respiratory organ (Figure 10A) slightly curved,  $6.66 \times$  longer than broad, posterior half annulated, with 42–45 apical and 6–8 lateral pores; RO length 0.19–0.25 (0.23,  $n = 6$ ) mm, RO width 0.02–0.04 (0.03,  $n = 6$ ) mm; pedicel (P) slightly darker, smooth, short, stout, pedicel length 0.02 ( $n = 6$ ) mm, P/RO 0.09–0.12 (0.10,  $n = 6$ ). Two short, hyaline clypeal/labral sensilla (Figure 11B); two ocular sensilla,

O-1-H medium-sized, thin seta, O-2-H campaniform sensillum (Figure 11B). Abdominal segments covered with small spinules. First abdominal segment (Figure 11C) with sensilla as follows: one D-2-I peg; D-4-I, D-7-I posterior campaniform sensilla; 3 lateral sensilla: L-1-I, L-3-I short setae; L-2-I medium-sized seta. Second abdominal segment similar to first, except three posterior sensilla, 2 campaniform sensilla, one thin, short, hyaline seta. Segment 4 with sensillar pattern (Figure 11D) as follows: D-2-IV peg; D-4-IV, D-7-IV pores, D-8-IV medium-sized, thin, hyaline seta, all located on flattened tubercles; L-1-IV medium-sized, thin, hyaline seta located on triangular tubercle; L-2-IV, L-3-IV, L-4-IV stout, short setae all located on flattened tubercles; V-5-IV medium-sized, thin, hyaline seta; V-6-IV short, stout seta, both on flattened tubercles. Segment 9 (Figure 10G) 0.88 × longer than greatest width, anterior margin of ventral surface with pair of lateral areas with few scattered strong spinules; length 0.16–0.19 (0.17,  $n = 5$ ) mm, width 0.17–0.20 (0.19,  $n = 5$ ) mm. Terminal process triangular (Figure 10G), divergent, tip pointed, base wide with two setae, one medium-sized, hyaline seta located on small tubercle, other short, stout seta on rounded tubercle; length 0.04–0.06 (0.05,  $n = 5$ ) mm.

*Description of male pupa* (Figure 9A). Similar to female with sexual differences: Total length 1.86–2.01 (1.93,  $n = 4$ ) mm. Exuviae pale brown. Dorsal apotome (Figures 9B, 10C) with DAL 0.08–0.10 (0.09,  $n = 4$ ) mm; DAW 0.19–0.21 (0.20,  $n = 4$ ) mm; DAW/DAL 2.00–2.42 (2.13,  $n = 4$ ). Dorsals and supraalar as in Figure 10E. Respiratory organ (Figures 9A–D) length 0.21–0.23 (0.22,  $n = 4$ ) mm, width 0.02–0.04 (0.03,  $n = 4$ ) mm; pedicel length 0.04 ( $n = 4$ ) mm, P/RO 0.15–0.17 (0.16,  $n = 4$ ). Cephalothorax length 0.75–0.76 (0.76,  $n = 4$ ) mm, width 0.51–0.57 (0.54,  $n = 4$ ) mm. Clypeal/labral sensilla and ocular sensilla as in Figure 10F. Segment 4 with sensillar pattern as in Figure 9E,F. Segment 9 (Figure 9A, G) length 0.180–0.192 (0.189,  $n = 4$ ) mm, width 0.18–0.22 (0.20,  $n = 4$ ) mm; terminal process (Figure 9G) length 0.04–0.06 (0.05,  $n = 4$ ) mm.

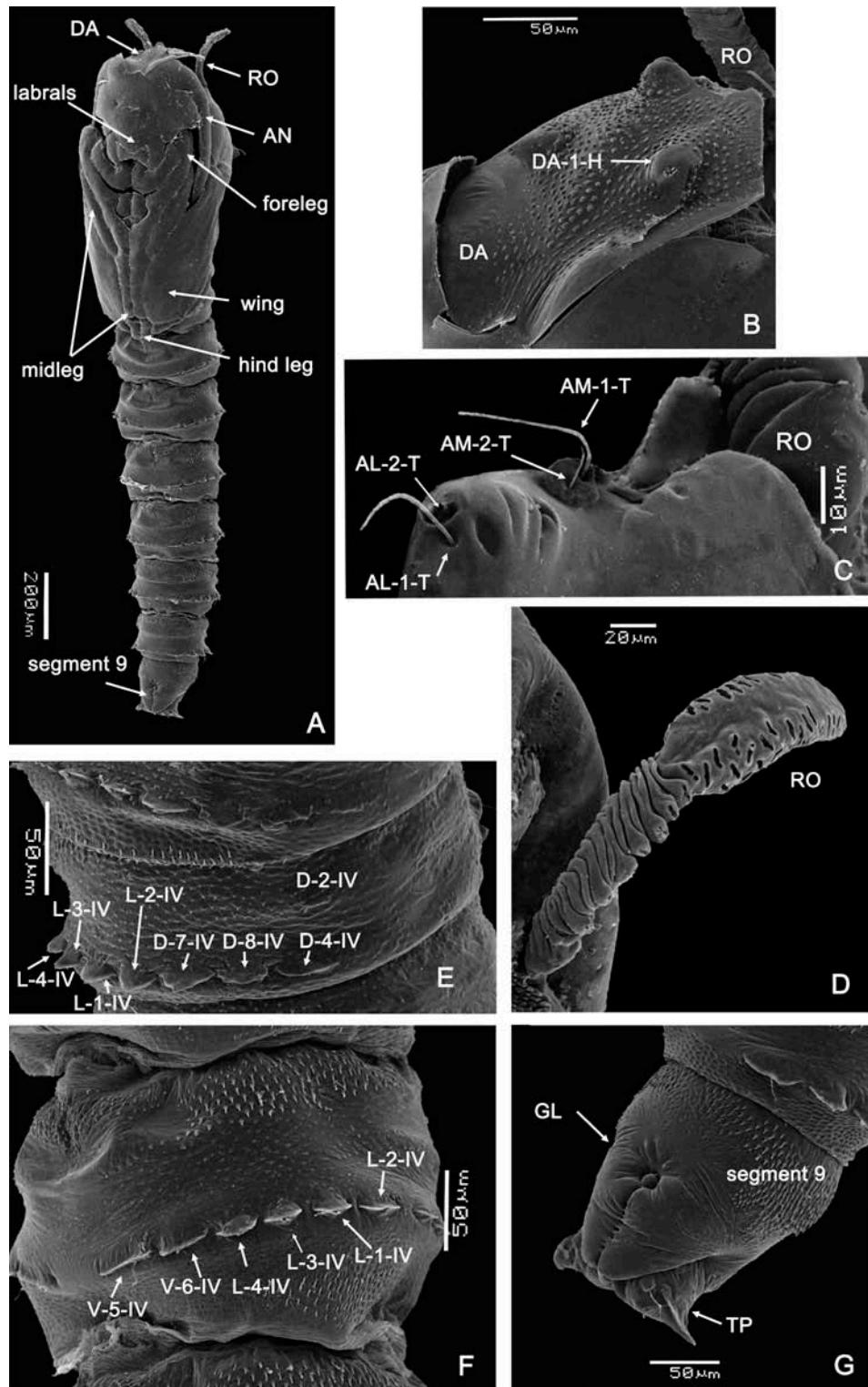
### Distribution (Figure 22)

Argentina (Salta, Catamarca, Mendoza, La Pampa, Neuquen, Río Negro, Chubut, Santa Cruz).

### Type material

Holotype male (with pupal exuviae), allotype female (with pupal exuviae), Argentina, Neuquen prov., lago Ramos Mexia, 2 December 1993, F. Kaisin (MLPA).

Paratypes, 36 males, 45 females, as follows: same data as holotype 1 female. Salta prov., Angastaco, río Calchaquí, 23 November 1982, A. L. Estevez, 1 male, 1 female (MLPA); ruta Nac. 51, 35 km southeast San Antonio de los Cobres, 20 March 2005, G. Spinelli, 1 male, sweep net (MLPA); San Antonio de los Cobres, 3/7 November 2006, N. Furlan, 1 male, 1 female, at ligh (MLPA); same data except 13/20 November 2006, 1 female (MLPA). Catamarca prov., escuela La Aguadita, salar del Hombre Muerto, 19 March 2005, G. Spinelli, 1 male, 1 female, sweep net (MLPA). Mendoza prov., ciudad Mendoza, Zoológico, May 1997, S. Roig, 2 males (MLPA); 53 km west Bardas Blancas, 20 February 2001, 1850 m, G. Spinelli, 1 male, 2 females, sweep net (MLPA). La Pampa prov., Casa de Piedra,



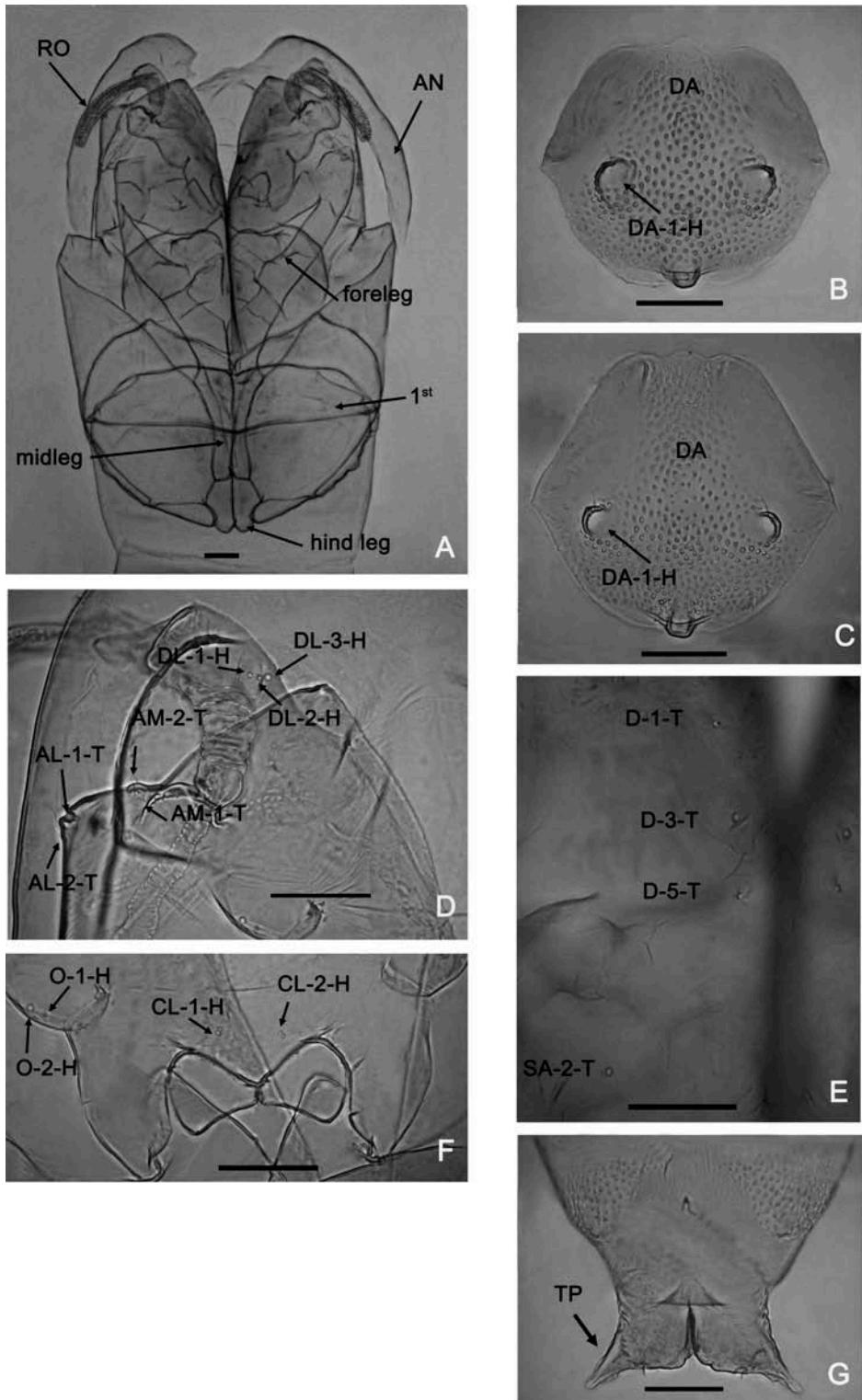
Dique, 38°09'46.8" S, 67°09'08,1" W, 276 m, 18 November 2009, Díaz-Lozano, 1 male, 1 female (with pupal exuviae) (MLPA), 1 male, 1 female (with pupal exuviae) (BMNH), 1 female (with pupal exuviae) (USNM), 1 male, 1 female (with pupal exuviae) (CNCI). Neuquen prov., 40 km SO laguna del Burro, 16 December 1996, G. Spinelli, 2 males, 4 females, sweep net (MLPA); río Malleo y salida Primeros Pinos, 7 February 1986, G. Spinelli, 1 male, sweep net (MLPA). Río Negro prov., Parque Nacional Nahuel Huapi, río Manso, 1 February 1998, G. Spinelli, 1 female, sweep net (MLPA); Parque Nacional Nahuel Huapi, río Manso, 41°14'08.1" S, 71°46'58.5" W, 845 m, 7 February/2 March 2007, Garré-Montes de Oca, 1 female, Malaise trap (MLPA); General Conesa, December 1993, G. Spinelli, 4 males, 1 female, sweep net (MLPA); meseta de Somuncurá, estancia El Rincón, 27 November 1995, G. Spinelli, 1 male, 2 females, sweep net (MLPA); same data except December 1995, 1 female, Malaise trap (MLPA); same data except 28/29 January 1999, P. Marino, 1 female, sweep net (MLPA); same data except 40°59'24.1" S, 66°40'35.7" W, 620 m, 4 December 2006, M. Donato, 2 males, 6 females, sweep net (MLPA); ruta Prov. 33 aprox. 13 km Clemente Onelli, 4 February 1998, P. Marino, 2 males, sweep net (MLPA); meseta de Somuncurá, Comi-Co, arroyo Comi-Co, 31 January 2001, P. Marino, 3 males, 2 females, sweep net (MLPA); meseta de Somuncurá, 18 km south, Pailemán, 10 December 2005, G. Spinelli, 1 male, sweep net (MLPA); Chipauquil (Pueblo), 40°57'41.1" S, 66°38'20.8" W, 481 m, 3 December 2006, G. Spinelli, 2 males, sweep net (MLPA); same data except (Puesto Policial), 4 December 2006, 3 females (MLPA); 5 km northwest Paraje Chasicó, 7 December 2006, G. Spinelli, 2 males, sweep net (MLPA). Chubut prov., 45 km southwest Paso del Sapo, 27 February 2001, G. Spinelli, 4 females, (MLPA); 16 km southwest Paso del Sapo, 28 February 2001, G. Spinelli, 2 females, (MLPA); Paso del Sapo, 27/28 February 2001, G. Spinelli, 2 males, 3 females, Malaise trap (MLPA); meseta de Sierra Cuadrada, estancia Don Eduardo, 1 December 1996, G. Spinelli, 1 male, at light (MLPA); same data except 1/2 December 1996, G. Spinelli, 1 female, Malaise trap (MLPA); arroyo s/n, ruta Nac. 40, 44°49'07.9" S, 70°07'4.43" W, 520 m, 26 February 2009, G. Spinelli, 2 males, 3 females (MLPA), 1 male (USNM); ruta Prov. 12., 42°38'57.4" S, 70°19'08.5" W, 420 m, 26 February 2009, G. Spinelli, 3 males, 2 females (MLPA). Santa Cruz prov., ruta Prov. 12., aprox. 15 km south Pico Truncado, 46°52'7.81" S, 68°05'23.5" W, 150 m, 23 February 2009, G. Spinelli, 2 females (MLPA).

#### *Material examined by scanning electron microscopy*

La Pampa prov., Casa de Piedra, Dique, 38°09'46.8" S, 67°09'08,1" W, 276 m, 18 November 2009, Díaz-Lozano, 1 pupa male.

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Figure 9. *Dasyhelea pseudolacustris* Díaz and Spinelli sp. nov.: male pupa. (A) Entire pupa. (B) Dorsal apotome. (C) Cephalothoracic sensilla. (D) Respiratory organ. (E) Chaetotaxy of segment 4, dorsal view. (F) Chaetotaxy of segment 4, ventral view. (G) segment 9. Antenna (AN); anterolateral sensilla (AL-1-T, AL-2-T); anteromedial sensilla (AM-1-T, AM-2-T); dorsal apotome (DA); dorsal apotomal sensilla (DA-1-H); dorsal sensilla of segment 4 (D-2-IV, D-4-IV, , D-7-IV, D-8-IV); genital lobe (GL); lateral sensilla of segment 4 (L-1-IV, L-2-IV, L-3-IV, L-4-IV); respiratory organ (RO); terminal process (TP); ventral sensilla of segment 4 (V-5-IV, V-6-IV).



### *Etymology*

The specific epithet is in reference to the fact that the specimen here designated as the holotype male of *D.pseudolacustris* was misidentified by Spinelli and Ronderos (1987) as *Dasyhelea lacustris*.

### *Phylogenetic relationships*

*Dasyhelea pseudolacustris* is the sister species of the polytomy formed by *D. andensis*, *D. carlae*, *D. lacustris* and *D.macfiei*. The clade (*Dasyhelea pseudolacustris* (*D. andensis*, *D. carlae*, *D. lacustris* and *D.macfiei*)) is supported by the characters “shape of posterolateral arms of female subgenital plate” [character28 (0)].

### *Remarks*

The pupa of *D. pseudolacustris* is very similar to *D. serrana*. The latter species differs by the exuviae yellowish, dorsal apotome sensilla stout and rounded tubercle of dorsal apotome without strong spicules, respiratory organ with 6–7 apical and 5–6 lateral pores, sensilla of segment 4 shorter than those of *D.pseudolacustris* and ventral surface of segment 9 with anterior band of spinules.

### *Dasyhelea serrana* Díaz and Spinelli sp. nov. (Figures 12–15, 19E,F, 21)

### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with scutellum with 6 large and 1–2 thinner setae; tergite 9 rounded distally, produced beyond apex of gonocoxites; posteromedian projection of aedeagus stout, tip truncate and W/L ratio 1.33–1.65. Female scutum with contrasting pigmented pattern.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum (Figure 12A) brown. Palpus (Figure 12B) pale; segment 3 bearing scattered sensilla on basomesal surface; PR 4.75–5.25 (4.86,  $n = 9$ ). Scutellum with 6 large, 1–2 thinner setae. Wing (Figure 19F) length 0.72–0.87 (0.78,  $n = 10$ ) mm, width 0.24–0.30 (0.26,  $n = 10$ ) mm; CR 0.41–0.44 (0.42,  $n = 10$ ). Genitalia (Figure 12C): tergite 9 rounded distally, produced beyond apex of gonocoxites, apicolateral process stout,

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Figure 10. *Dasyhelea pseudolacustris* Díaz and Spinelli sp. nov.: (A, B, D, G) female pupa, (C, E, F) male pupa. (A) Cephalothorax, dorsal view. (B, C) Dorsal apotome. (D) Cephalothoracic chaetotaxy, dorsal view. (E) Dorsal and supraalar sensilla. (F) Clypeal/labral sensilla. (G) Segment 9 of female. Scale bars: 0.05 mm. Antenna (AN); anterolateral sensilla (AL-1-T, AL-2-T); anteromedial sensilla (AM-1-T, AM-2-T); clypeal/labral sensilla (CL-1-H, CL-2-H); dorsal apotome (DA); dorsal apotomal sensilla (DA-1-H); dorsolateral cephalic sclerite sensilla (DL-1-H, DL-2-H, DL-3-H); dorsals sensilla (D-1-T, D-3-T, D-5-T); ocular sensilla (O-1-H, O-2-H, O-3-H); respiratory organ (RO); supraalar (SA-2-T); terminal process (TP).

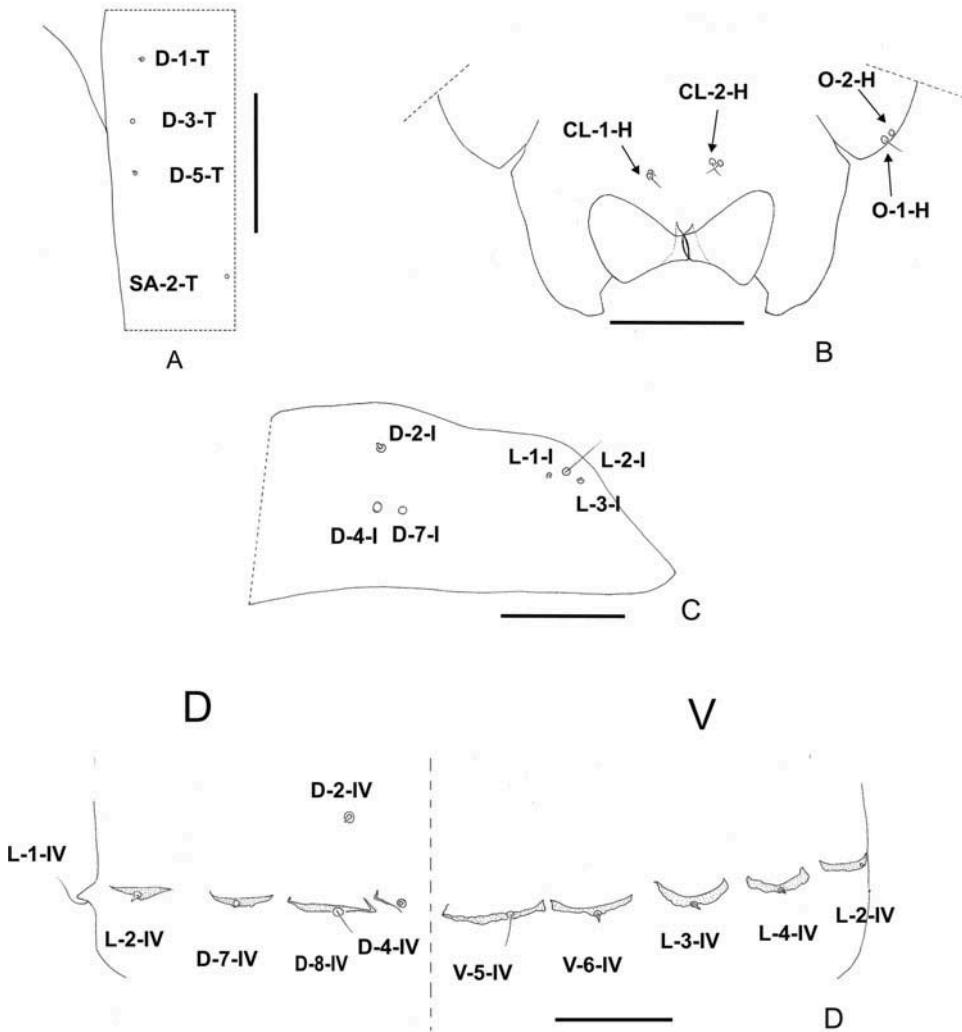


Figure 11. *Dasyhelea pseudolacustris* Díaz and Spinelli sp. nov.: female pupa. (A) Dorsal and supraalar sensilla. (B) Clypeal/labral and ocular sensilla. (C) Chaetotaxy of tergite 1 of abdomen. (D) Chaetotaxy of segment 4 of abdomen. Scale bars: 0.05 mm. Clypeal/labral sensilla (CL-1-H, CL-2-H); dorsal sensilla (D-1-T, D-3-T, D-5-T); dorsal sensilla of first abdominal segment (D-2-I, D-4-I, D-7-I); lateral sensilla of first abdominal segment (L-1-I, L-2-I, L-3-I); dorsal sensilla of segment 4 (D-2-IV, D-4-IV, D-7-IV, D-8-IV); lateral sensilla of segment 4 (L-1-IV, L-2-IV, L-3-IV, L-4-IV); ocular sensilla (O-1-H, O-2-H, O-3-H); supraalar (SA-2-T); ventral sensilla of segment 4 (V-5-IV, V-6-IV).

moderately short with apical elongate seta; cercus with 3 setae; sternite 9 (Figure 12D) 0.50 length of greatest width, posteromedian projection reaching half of aedeagus length, apex rounded, folded. Gonocoxite stout, 1.7 × longer than greatest width; gonostylus 0.8 length of gonocoxite, moderately broad basally, tapering slightly at one-third of length, slightly curved, apex slightly hooked. Paramere and gonocoxal apodemes forming an asymmetrical structure (Figure 12E); gonocoxal

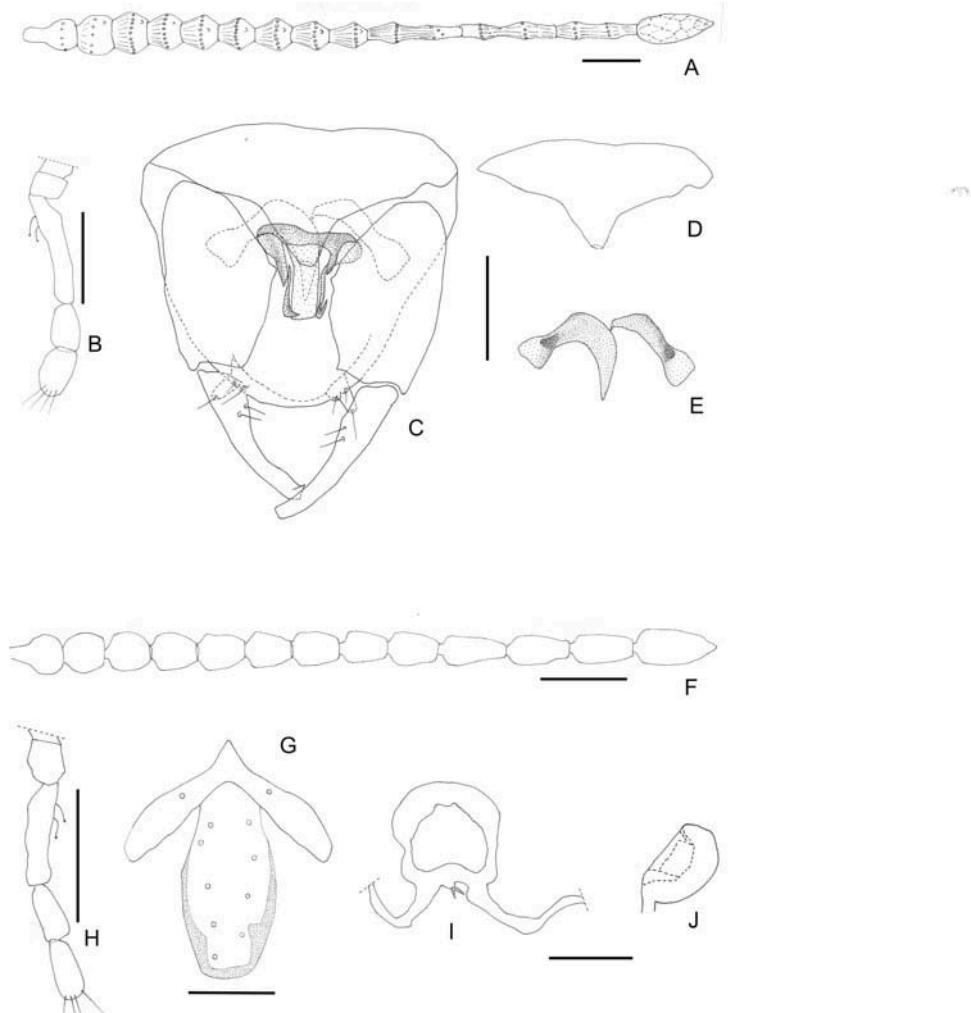


Figure 12. *Dasyhelea serrana* Díaz and Spinelli sp. nov.: (A–E) male, (F–J) female. (A, F), Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

apodemes with small subbasal tooth, left apodeme barely fused with paramere, right broadly fused with paramere, paramere moderately short, tapering distally to slender pointed tip. Aedeagus 0.86 length of greatest width, W/L ratio 1.33–1.65 (1.47,  $n = 9$ ); anterior margin nearly straight, heavily sclerotized; basal arms stout, slightly recurved, directed posteriorly; posterolateral arms divided, inner portion elongate, recurved anterad 90° or more; posteromedian projection stout, tip truncate.

*Description of female.* Head dark brown. Eyes contiguous for distance of the width of 4 ommatidia. Antennal flagellum (Figure 12F) pale; AR 0.79–0.90 (0.86,  $n = 10$ ).

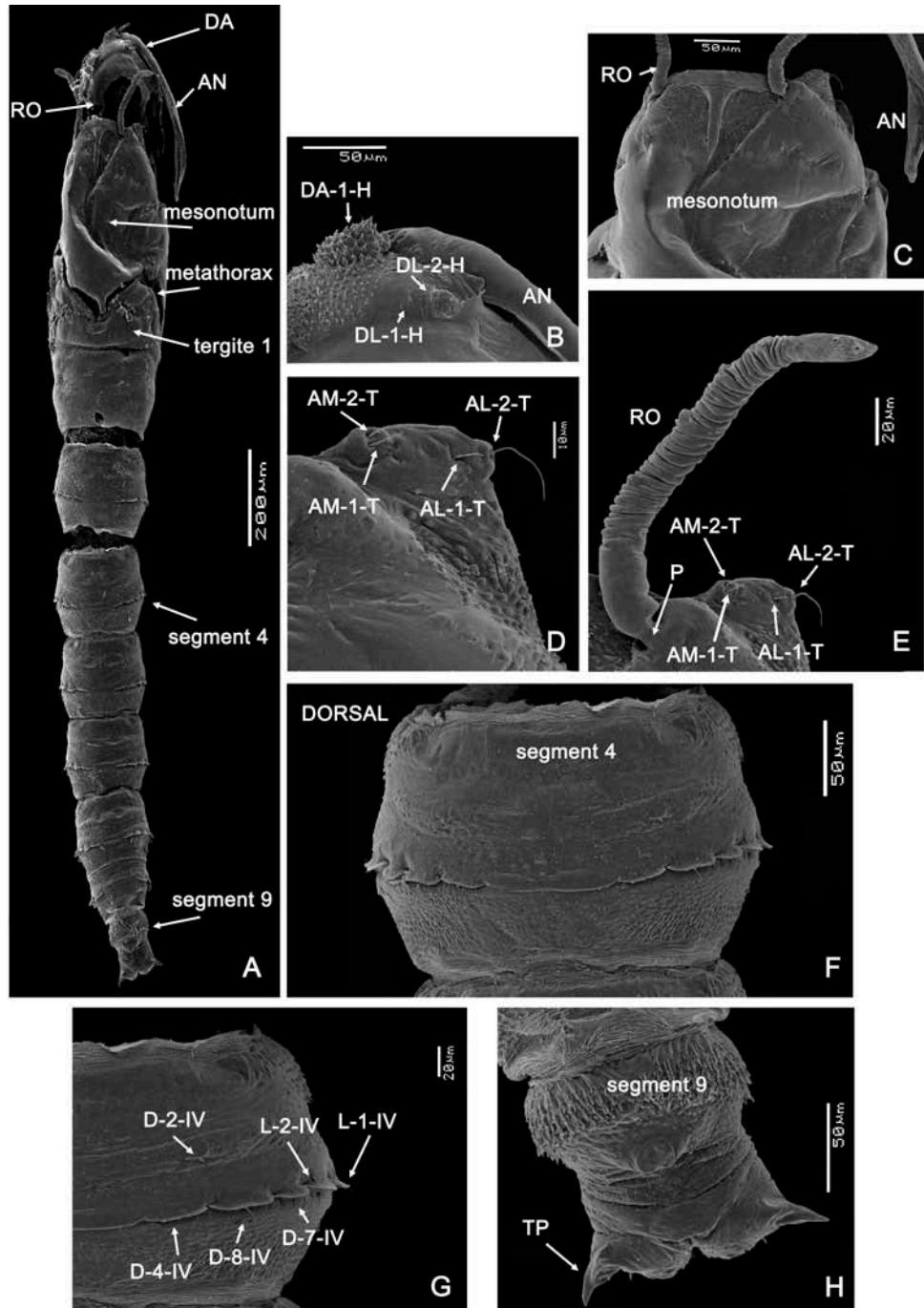


Figure 13. *Dasyhelea serrana* Díaz and Spinelli sp. nov.: female pupa. (A) Entire pupa. (B) Dorsal apotome. (C) Cephalothorax, dorsal view. (D) Cephalothoracic chaetotaxy, dorsal view. (E) Respiratory organ. (F) Segment 4. (G) Chaetotaxy of segment 4 of abdomen. (H) Segment 9. Antenna (AN); anterolateral sensilla (AL-1-T, AL-2-T); anteromedial sensilla

Clypeus (Figure 12G) elongate with 6 pairs of setae. Palpus (Figure 12H) pale; segment 3 with 1–2 subbasal capitate sensilla; PR 4.25–5.00 (4.60,  $n = 10$ ).

**Thorax.** Scutum dark brown, with contrasting pigmented pattern as in Figure 14G; scutellum pale brown with 6–7 large, 2–3 thinner setae. Legs with coxae, trochanters, femora pale brown, tibiae yellowish, tarsomeres 1–4 whitish, tarsomeres 5 infuscated; apex of hind tibia with 7 spines; foreleg TR 1.86–2.04 (1.94,  $n = 10$ ), midleg TR 2.08–2.26 (2.17,  $n = 10$ ), hind leg TR 1.96–2.19 (2.08  $n = 10$ ). Wing (Figure 19E) length 0.66–0.78 (0.71,  $n = 10$ ) mm, width 0.27–0.33 (0.30,  $n = 10$ ) mm; CR 0.39–0.43 (0.41,  $n = 10$ ); membrane hyaline, densely covered with macrotrichia; second radial cell with visible narrow lumen; cubital fork at level of anterior portion of second radial cell. Haltere brown, knob base whitish.

**Abdomen.** Pale brown. Subgenital plate (Figure 12I) semicircular anteriorly, lateral margins parallel, with broad lumen, posteromedian projection small, bifurcate; posterolateral arms slender, distal one-third to one-half recurved 60–90°. Spermatheca (Figure 12J) spherical, heavily sclerotized, diameter 36 µm, neck short, straight, measuring 12 µm.

**Description of female pupa** (Figure 13A). Total length 1.92–2.04 (1.99,  $n = 3$ ) mm. General coloration of exuviae yellowish. Dorsal apotome (Figures 13B, 14A) 2.04 × broader than long, apex broadly rounded, surface covered with strong spicules, each side of posterior surface with a pair of raised lateral areas with wrinkles; anterior margin straight; posterior margin with stout, rounded tubercle; dorsal apotome sensilla short, stout, located on well-developed tubercle with strong spicules (Figures 13B, 14A); DAL 0.072–0.084 (0.078,  $n = 4$ ) mm; DAW 0.016–0.017 (0.016  $n = 4$ ) mm; DAW/DAL 1.86–2.17 (2.05,  $n = 4$ ). Cephalothorax (Figure 13A) surface smooth, length 0.78–0.84 (0.82,  $n = 4$ ) mm, width 0.48–0.51 (0.49,  $n = 4$ ) mm. Cephalothoracic sensilla as follows: three dorsolateral cephalic sclerite sensilla, two short, thin setae (Figures 13B, 14C), one campaniform sensilla; two anterolateral sensilla (Figures 13D,E, 14C), one long and thin, and the other one medium-sized seta; two medium-sized antermomedial sensilla (Figures 13D,E, 14C); three dorsals present (Figures 14D, 15A) D-1-T, D-5-T short setae, D-3-T campaniform sensillum, supraalar campaniform sensillum (SA-2-T) (Figures 14D, 15A). Respiratory organ (Figures 13A, C, E, 14C) nearly straight, 9.00 × longer than broad, annulated, apex and base smooth, 6–7 apical and 5–6 lateral pores; RO length 0.20–0.23 (0.22,  $n = 5$ ) mm, RO width 0.02 ( $n = 5$ ) mm; pedicel (P) (Figure 13E) slightly pale brown, smooth, short, stout, pedicel length 0.01–0.02 (0.02,  $n = 5$ ) mm, P/RO 0.05–0.10 (0.08,  $n = 5$ ). Two short clypeal/labral sensilla (Figure 15B); two ocular sensilla (Figure 15B), O-1-H medium-sized, thin sensillum, O-2-H campaniform sensillum. Abdominal segments covered with very small spinules. First abdominal segment (Figures 13A, 15C) with sensilla as follows: one D-2-I peg; D-4-I, D-7-I posterior campaniform

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(AM-1-T, AM-2-T); dorsal apotome (DA); dorsal apotomal sensilla (DA-1-H); dorsolateral cephalic sclerite sensilla (DL-1-H, DL-2-H, DL-3-H); dorsal sensilla of segment 4 (D-2-IV, D-4-IV, D-7-IV, D-8-IV); lateral sensilla of segment 4 (L-1-IV, L-2-IV); respiratory organ (RO); terminal process (TP).

sensilla; 3 lateral sensilla: L-1-I, L-3-I short setae, L-2-I medium-sized seta. Second abdominal segment similar to first, except three posterior sensilla, 2 campaniform sensilla, one thin, short hyaline seta. Segment 4 with sensillar pattern: (Figures 13A, F-G, 15D) as follows: D-2-IV peg; D-4-IV, D-7-IV pores, D-8-IV short, thin seta; L-1-IV medium-sized, thin seta, located on triangular tubercle, L-2-IV, L-3-IV, L-4-IV short, stout setae, all located on flattened tubercle; 2 ventral sensilla, V-5-IV medium-sized, thin seta; V-6-IV short, stout seta, both located on flattened tubercles. Segment 9 (Figures 13A, H)  $0.92 \times$  longer than width, ventral surface with spinules on anterior band; length 0.13–0.16 (0.14,  $n = 4$ ) mm, width 0.12–0.14 (0.13,  $n = 4$ ) mm. Terminal process triangular (Figure 13H), divergent, tip pointed, base wide with two setae, one medium-sized, hyaline seta located on small tubercle, other short, stout seta on rounded tubercle, length 0.04–0.05 (0.04,  $n = 4$ ) mm

*Description of male pupa.* Similar to female with sexual differences: Total length 2.16 ( $n = 2$ ) mm. Exuviae pale brown. Dorsal apotome (Figure 14B) with DAL 0.08–0.10 (0.09,  $n = 3$ ) mm; DAW 0.18–0.19 (0.18,  $n = 3$ ) mm, DAW/DAL 1.87–2.14 (2.00,  $n = 3$ ). Clypeal/labral sensilla and ocular sensilla as in Figure 14E. Respiratory organ: RO length 0.19–0.21 (0.20,  $n = 3$ ) mm, RO width 0.02 ( $n = 3$ ) mm; pedicel length 0.01–0.02 (0.02,  $n = 3$ ) mm, P/RO 0.05–0.12 (0.10,  $n = 3$ ). Cephalothorax length 0.84–0.93 (0.90,  $n = 3$ ) mm, width 0.54–0.57 (0.56,  $n = 3$ ) mm. Segment 9 (Figure 14F) length 0.16–0.18 (0.17  $n = 3$ ) mm, width 0.16–0.18 (0.17  $n = 3$ ) mm; terminal process (Figure 14F) length 0.04–0.05 (0.04,  $n = 3$ ) mm.

#### Distribution (Figure 21)

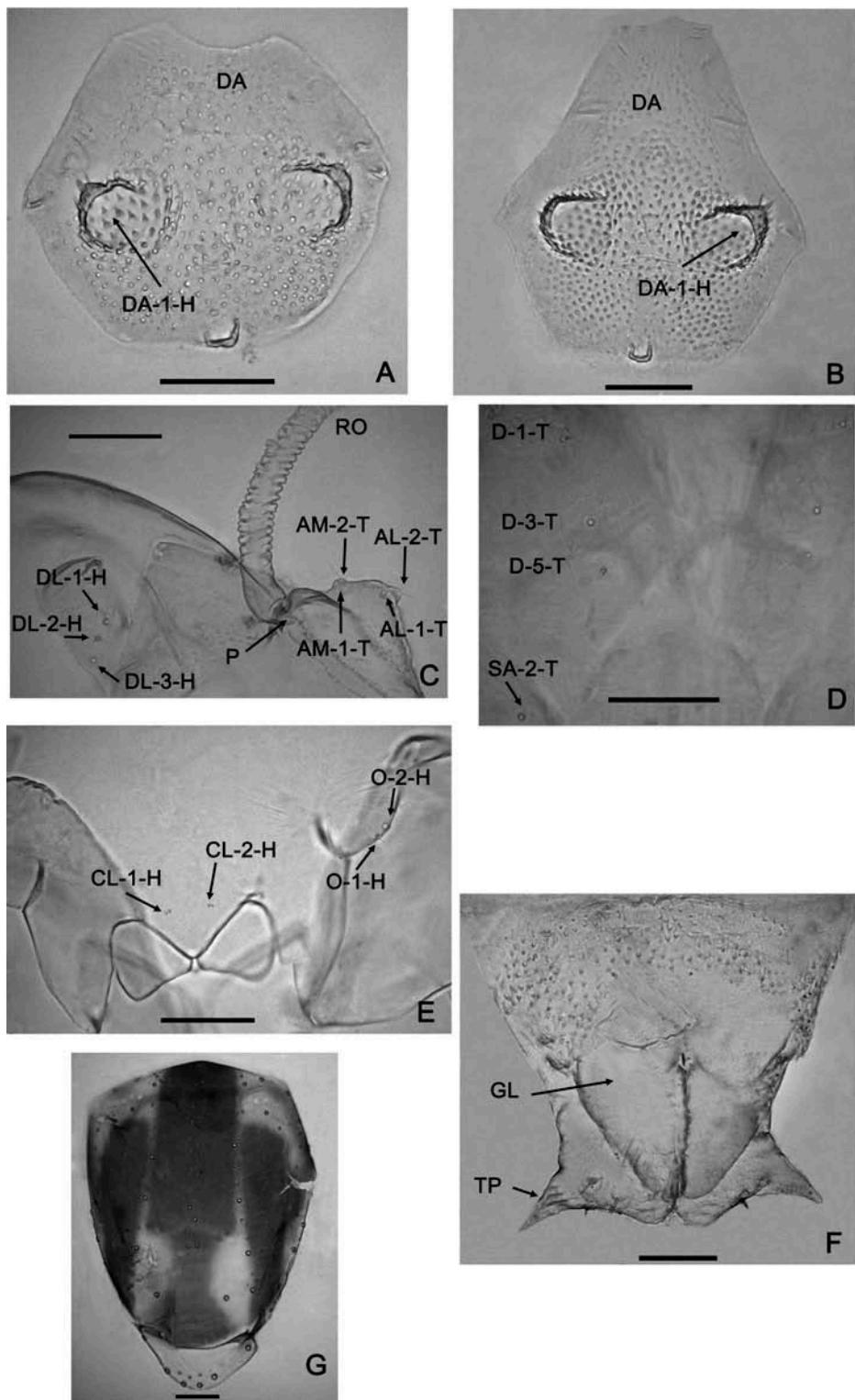
Argentina (Buenos Aires, Río Negro).

#### Type material

Holotype male, allotype female, Argentina, Buenos Aires prov., Sierra de la Ventana, arroyo Napostá Grande, 38°08'44.2" S, 62°05'32.7" W, 300 m, 7 February 2007, F. Díaz, reared in laboratory (MLPA). Paratypes, 10 males, 17 females, as follows: same data holotype, 3 males, 2 females (MLPA), 1 male, 1 female (BNMH), 1 female (USNM), 1 male, 1 female (CNCI); same data except 19 December 2006, Cazorla-Marino, 1 female, sweep net (MLPA); same data except 7 December 2007, Cazorla-Marino, 2 females, sweep net (MLPA); Saldungaray, arroyo Rivera; 38°13'53.4" S, 61°48'01.3" W, 228 m, 8 February 2007, Marino-Cazorla, 1 male, 3 females (MLPA),

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Figure 14. *Dasyhelea serrana* Díaz and Spinelli sp.nov.: (A, C, D), female pupa, (B, E, F) male pupa, (G), adult female. (A, B) Dorsal apotome. (C) Cephalothoracic chaetotaxy, dorsal view. (D) Dorsal and supraalar sensilla. (E) Clypeal/labral sensilla. (F) Segment 9. (G) Thorax. Scale bars: 0.05 mm. Anterolateral sensilla (AL-1-T, AL-2-T); anteromedial sensilla (AM-1-T, AM-2-T); clypeal/labral sensilla (CL-1-H, CL-2-H); dorsal apotome (DA); dorsal apotomal sensilla (DA-1-H); dorsolateral cephalic sclerite sensilla (DL-1-H, DL-2-H, DL-3-H); dorsals sensilla (D-1-T, D-3-T, D-5-T); genital lobe (GL); ocular sensilla (O-1-H, O-2-H, O-3-H); pedicel (P); respiratory organ (RO); supraalar (SA-2-T); terminal process (TP).



1 male, sweep net (USNM). Río Negro prov., Chipauquil (Pueblo), 40°57'41.1" S, 66°38'20.8" W, 481 m, 3 December 2006, G. Spinelli, 1 male, sweep net (MLPA); same data except Puesto Policial, 4 December 2006, 3 males, 4 females (MLPA); estancia El Rincón, 40°59'24.1" S, 66°40'35.7" W, 620 m, 4 December 2006, M. Donato, 2 males, 2 females, sweep net (MLPA).

#### *Material examined by SEM.*

Same data as holotype 2 pupae (MLPA).

#### *Etymology*

The specific epithet “*serrana*” is a reference to the type-locality, in the Ventania hills system in the southwestern portion of Buenos Aires province, Argentina.

#### *Phylogenetic relationships*

*Dasyhelea serrana* is closely related to the clade (*D.pseudolacustris* (*D.andensis*, *D.carlae*, *D.lacustris*, *D.macfieii*)). This clade is supported by the synapomorphy: “posteromedian projection of female subgenital plate” [character 27 (1)].

#### *Remarks*

The pupa is similar to that of *D.pseudolacustris*. Characters to distinguish pupae of both species may be found in the discussion under the description of the *D.pseudolacustris*.

### ***Dasyhelea tehuelche* Díaz and Spinelli sp. nov. (Figures 16, 19G,H, 20)**

#### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arms of aedeagus divided and posteromedian projection triangular with bifid, ventrally recurved tip. Female with subgenital plate semicircular with broad lumen, posteromedian projection absent; legs with coxae, trochanters and femora dark brown, tibiae pale brown and tarsomeres 1–4 whitish; PR 2.80–3.60.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum as in Figure 16A. Palpus (Figure 16B) pale brown; segment 3 bearing scattered sensilla on mesobasal surface; PR 3.75 ( $n = 3$ ). Scutellum with 5–6 large setae, one thinner seta. Wing (Figure 19H) length 0.66–0.75 (0.70,  $n = 3$ ) mm, width 0.21–0.27 (0.24,  $n = 3$ ) mm; CR 0.39–0.44 (0.42,  $n = 3$ ). Genitalia (Figure 16C): tergite 9 rounded distally, extending just below level of apex of gonocoxites, apicolateral process stout, distal portion moderately elongate with large apical seta; cercus small with 3–4 thin setae; sternite 9 (Figure 16D) 0.3 length of greatest width, posteromedian projection absent, posterior margin truncate. Gonocoxite stout, 2 × longer than greatest width; gonostylus 0.8 length of gonocoxite, proximal

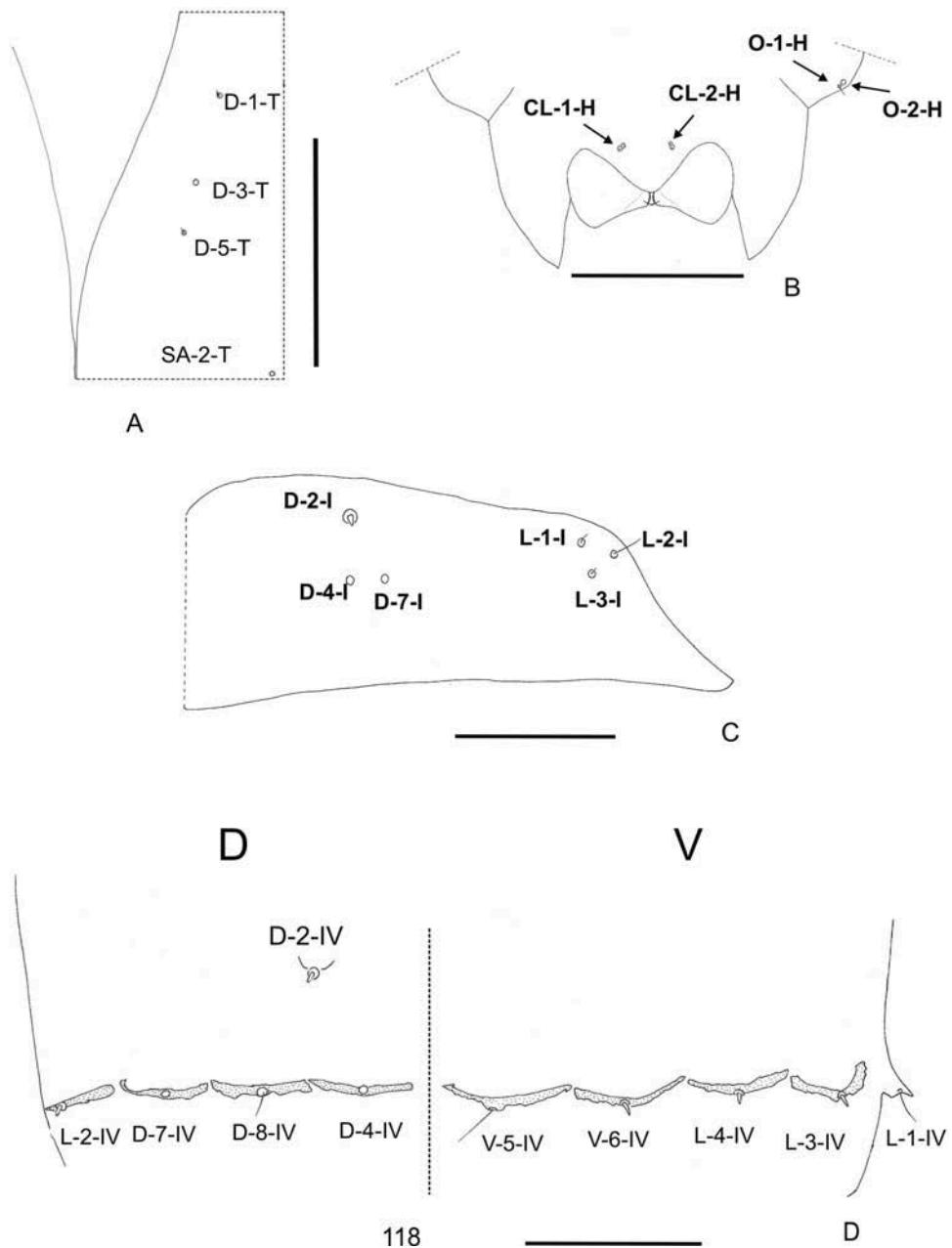


Figure 15. *Dasyhelea serrana* Díaz and Spinelli sp. nov.: female pupa. (A) Dorsal and supraalar sensilla. (B) Clypeal/labral sensilla. (C) Chaetotaxy of tergite 1 of abdomen. (D) Chaetotaxy of segment 4 of abdomen. Scale bars: 0.05 mm. Clypeal/labral sensilla (CL-1-H, CL-2-H); dorsals sensilla (D-1-T, D-3-T, D-5-T); dorsal sensilla of first abdominal segment (D-2-I, , D-4-I, D-7-I); lateral sensilla of first abdominal segment (L-1-I, L-2-I, L-3-I); dorsal sensilla of segment 4 (D-2-IV, D-4-IV, D-7-IV, D-8-IV); lateral sensilla of segment 4 (L-1-IV, L-2-IV, L-3-IV, L-4-IV); ocular sensilla (O-1-H, O-2-H, O-3-H); supraalar (SA-2-T); ventral sensilla of segment 4 (V-5-IV, V-6-IV).

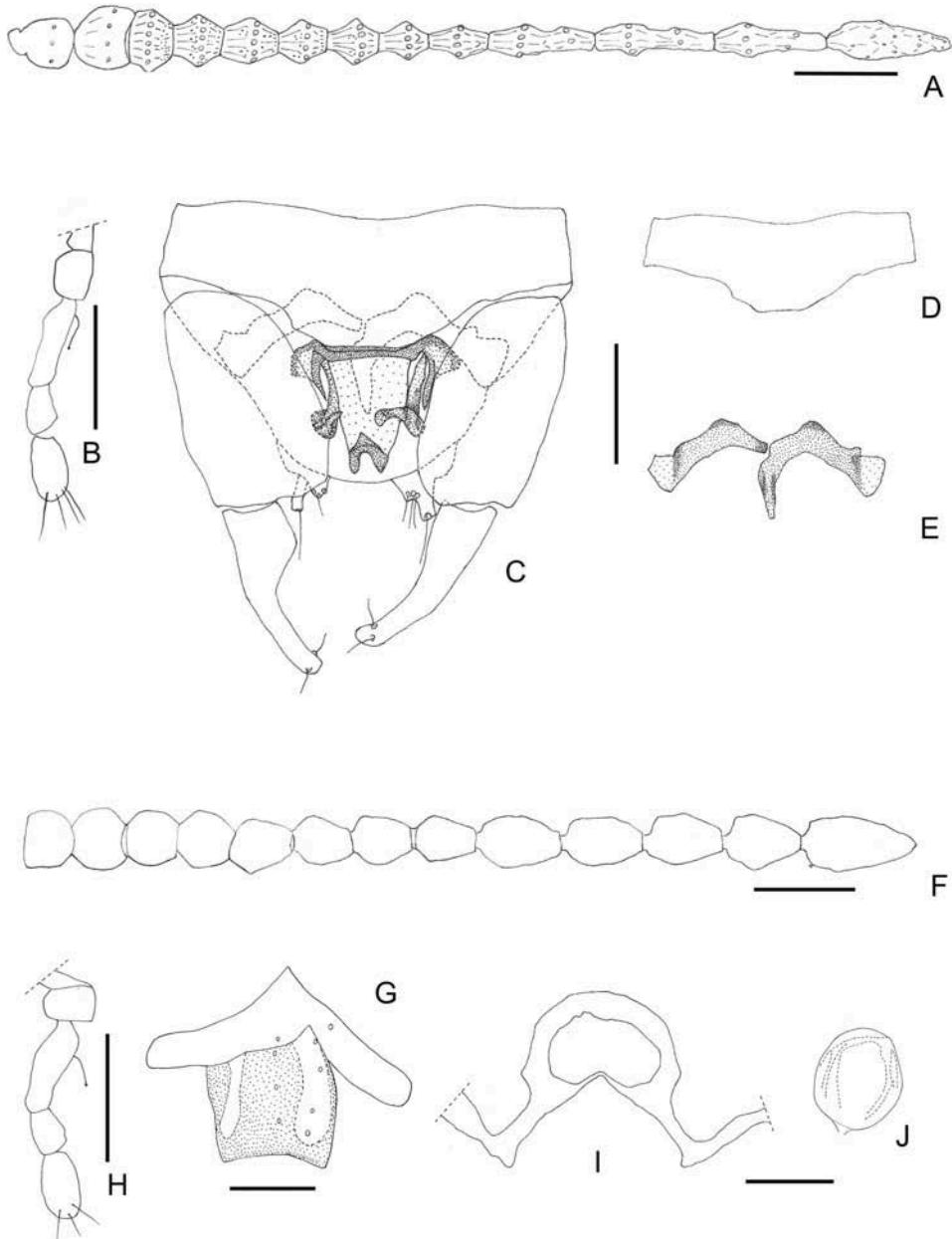


Figure 16. *Dasyhelea tehuelche* Díaz and *Spinelli* sp. nov.: (A–E) male, (F–J) female. (A, F) Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

one-third moderately broad, tapering slightly distally to blunt rounded tip. Paramere and gonocoxal apodemes (Figure 16E) forming an asymmetrical structure; gonocoxal apodemes stout with broad, short, subbasal tooth; right apodeme broadly fused with left apodeme barely contacting paramere; paramere moderately short, bent at base, reaching one-half of aedeagus length, apex slender, tip pointed. Aedeagus 0.8 length of greatest width; W/L ratio 1.33–1.42 (1.39,  $n = 3$ ); anterior margin straight, heavily sclerotized; basal arms stout, slightly recurved, directed posteriorly; posterolateral arms divided, inner portion moderately long, apical one-third recurved anteroventrally; posteromedian projection triangular with bifid, ventrally recurved tip.

*Description of female.* Head dark brown. Eyes contiguous for distance of width of 2 ommatidia. Antennal flagellum (Figure 16F) pale; AR 0.91–0.93 (0.92,  $n = 2$ ). Clypeus (Figure 16G) with 4 pairs of setae. Palpus (Figure 16H) pale brown; segment 3 with 1–2 subbasomesal capitate sensilla; PR 2.80–3.60 (3.20,  $n = 2$ ).

Thorax. Scutum dark brown; scutellum pale brown with 6 large, 1–2 thinner setae. Legs with coxae, trochanters, femora dark brown, tibiae pale brown, tarsomeres 1–4 whitish, tarsomeres 5 infuscated; apex of hind tibia with 6 spines; foreleg TR 1.90–1.91 (1.90,  $n = 2$ ), midleg TR 1.85–1.88 (1.86,  $n = 2$ ), hind leg TR 1.92–1.93 (1.92,  $n = 2$ ). Wing (Figure 19G) length 0.63–0.69 (0.66,  $n = 2$ ) mm, width 0.27–0.30 (0.28,  $n = 2$ ) mm; CR 0.39–0.42 (0.40,  $n = 2$ ); membrane slightly infuscated, densely covered with macrotrichia; second radial with narrow lumen; cubital fork at level of anterior portion of second radial cell. Haltere pale brown, knob base whitish.

Abdomen. Pale brown. Subgenital plate (Figure 16I) semicircular, with large broad lumen, without posteromedian projection; posterolateral arms slender, deeply angulate, recurved 90°. Spermatheca (Figure 16J) spherical heavily sclerotized, diameter 60 µm, neck short, straight, slightly tapered, measuring 12 µm.

#### Distribution (Figure 20)

Argentina (Río Negro, Santa Cruz), Chile (Malleco).

#### Type material

Holotype male, allotype female, Argentina, Santa Cruz prov., lago del Desierto, 9 December 1996, G. Spinelli, sweep net (MLPA). Paratypes, 2 males, 1 female, as follows: same data as holotype 1 male (MLPA). Río Negro prov., Parque Nacional Nahuel Huapi, La Cantera, 41°21'16" S, 71°42'27.3" W, 764 m, 11/30 December 2007, Garré-Montes de Oca, 1 female, Malaise trap (MLPA). Chile, Malleco prov., Parque Nacional Nahuelbuta, 26 December 1984, J. A. Downes, 1 male, sweep net (JAD 1682/2) (CNCL).

#### Etymology

The species is named after the Tehuelche Indians, early inhabitants of Santa Cruz province, Argentina.

### *Phylogenetic relationships*

*Dasyhelea tehuelche* is closely related to the clade (*Dasyhelea yamana* (*D. serrana* (*D. pseudolacustris* (*D. andensis*, *D. carlae*, *D. lacustris*, *D. macfiei*)))), This clade is supported by the synapomorphy: “W/L ratio” [character 9].

### *Dasyhelea yamana* Díaz and Spinelli sp. nov. (Figures 17, 19I-J, 20)

#### *Diagnosis*

Only species of *Dasyhelea* in Patagonia with the following combination of characters: male with posterolateral arms of aedeagus divided and apex of paramere bifid, each prong very slender with sharply pointed tip. Female with subgenital plate semicircular with broad reniform lumen, posteromedian projection absent; spermatheca spherical, heavily sclerotized with short, straight, tapered hyaline neck; legs pale brown except tarsomeres 1–4 whitish and tarsomeres 5 infuscated; PR 4.00–4.80.

*Description of male.* Similar to female with usual sexual differences. Antennal flagellum (Figure 17A) brown. Palpus (Figure 17B) pale brown; segment 3 bearing scattered sensilla on basomesal surface; PR 4.00–4.14 (4.07,  $n = 2$ ). Scutellum with 7–8 large, 5–6 thinner setae. Wing (Figure 19J) length 1.14–1.23 (1.18,  $n = 2$ ) mm, width 0.36–0.39 (0.37,  $n = 2$ ) mm; CR 0.42–0.46 (0.44,  $n = 2$ ). Genitalia (Figure 17C): tergite 9 rounded distally, reaching level of apex of gonocoxites, apicolateral processes stout, greatly divergent with large apical seta; cercus very short with 3 small setae; sternite 9 (Figure 17D) 0.56 length of greatest width, posteromedian projection moderately long, reaching one-half of aedeagus length, apex rounded, folded. Gonocoxite stout,  $2.1 \times$  longer than greatest width with small mesobasal tubercle; gonostylus 0.9 length of gonocoxite, slightly curved, very broad proximally, tapering gradually distally near mid-length, apex slightly broader, tip barely hooked, pointed. Paramere and gonocoxal apodemes (Figure 17E) forming a symmetrical structure; gonocoxal apodemes stout, with blunt subbasal tooth, both fused with paramere; paramere slender, tapering slightly distally, apex bifid, each prong with sharply pointed tip. Aedeagus 0.9 length of greatest width, W/L ratio 1.33–1.63 (1.48,  $n = 2$ ); anterior margin straight, heavily sclerotized; basal arms short, stout, slightly recurved, directed posteriorly; posterolateral arms divided, inner portion elongate, apical portion slender, recurved anteroventrally; posteromedian projection stout, extending considerably beyond apices of posterolateral arms with rounded tip.

*Description of female.* Head dark brown. Eyes contiguous for distance of the width of 4 ommatidia. Antennal flagellum (Figure 17F) pale; AR 0.83–0.94 (0.89,  $n = 6$ ). Clypeus (Figure 17G) with 4 pairs of setae. Palpus (Figure 17H) pale brown; segment 3 with 2–3 subbasomesal capitate sensilla; PR 4.00–4.80 (4.39,  $n = 6$ ).

Thorax. Scutum dark brown; scutellum pale with 8–9 large, 6–8 thinner setae. Legs pale brown, tarsomeres 1–4 whitish, tarsomeres 5 infuscated; apex of hind tibia with 6–8 spines; foreleg TR 1.80–1.93 (1.86,  $n = 6$ ), midleg TR 2.00–2.20 (2.10,

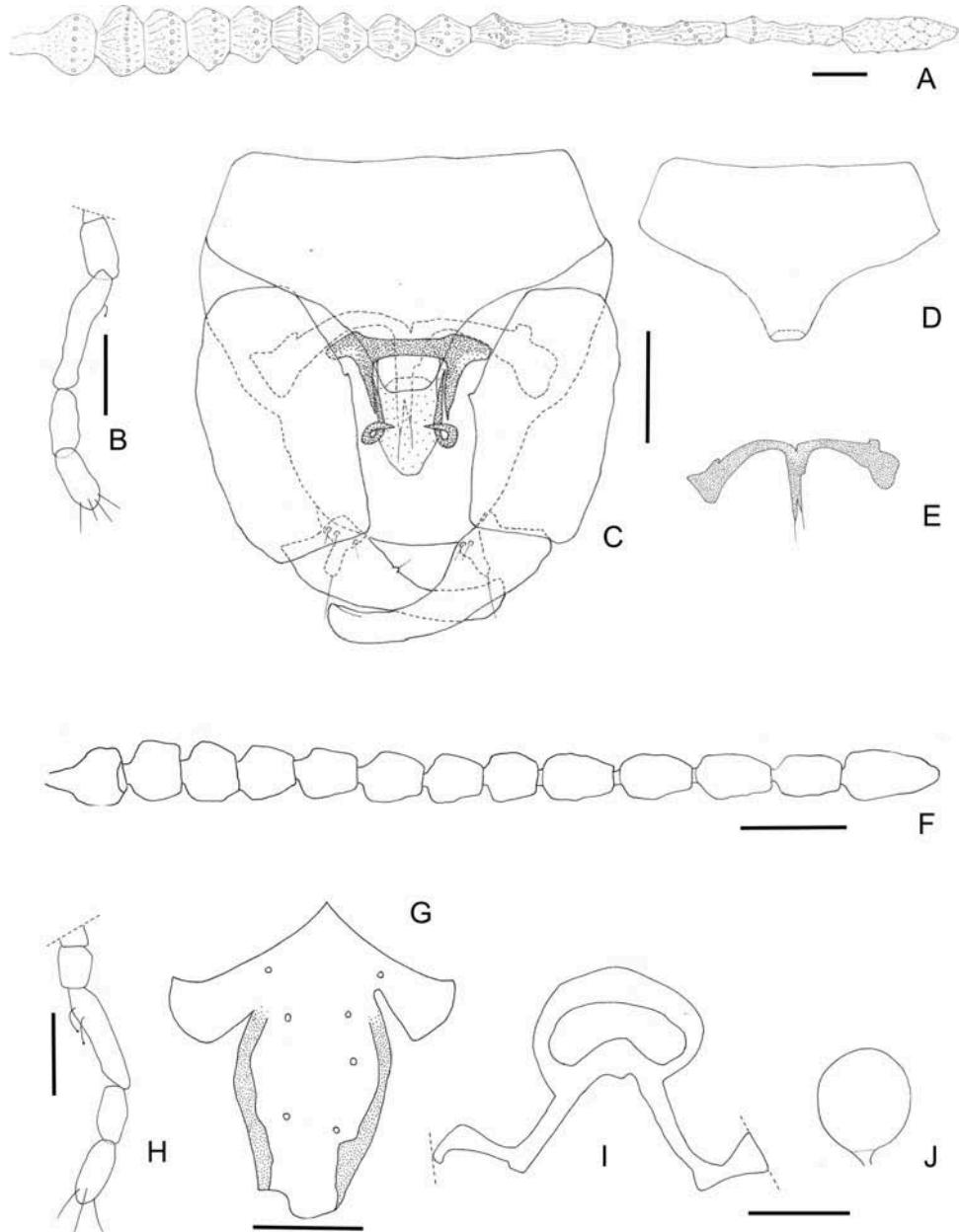


Figure 17. *Dasyhelea yamana* Díaz and *Spinelli* sp. nov.: (A–E) male, (F–J) female. (A, F) Flagellomeres. (B, H) Palpus. (C) Genitalia, ventral view. (D) Sternite 9. (E) Paramere and gonocoxal apodemes. (G) Clypeus. (I) Subgenital plate, ventral view. (J) Spermatheca. Scale bars: 0.05 mm.

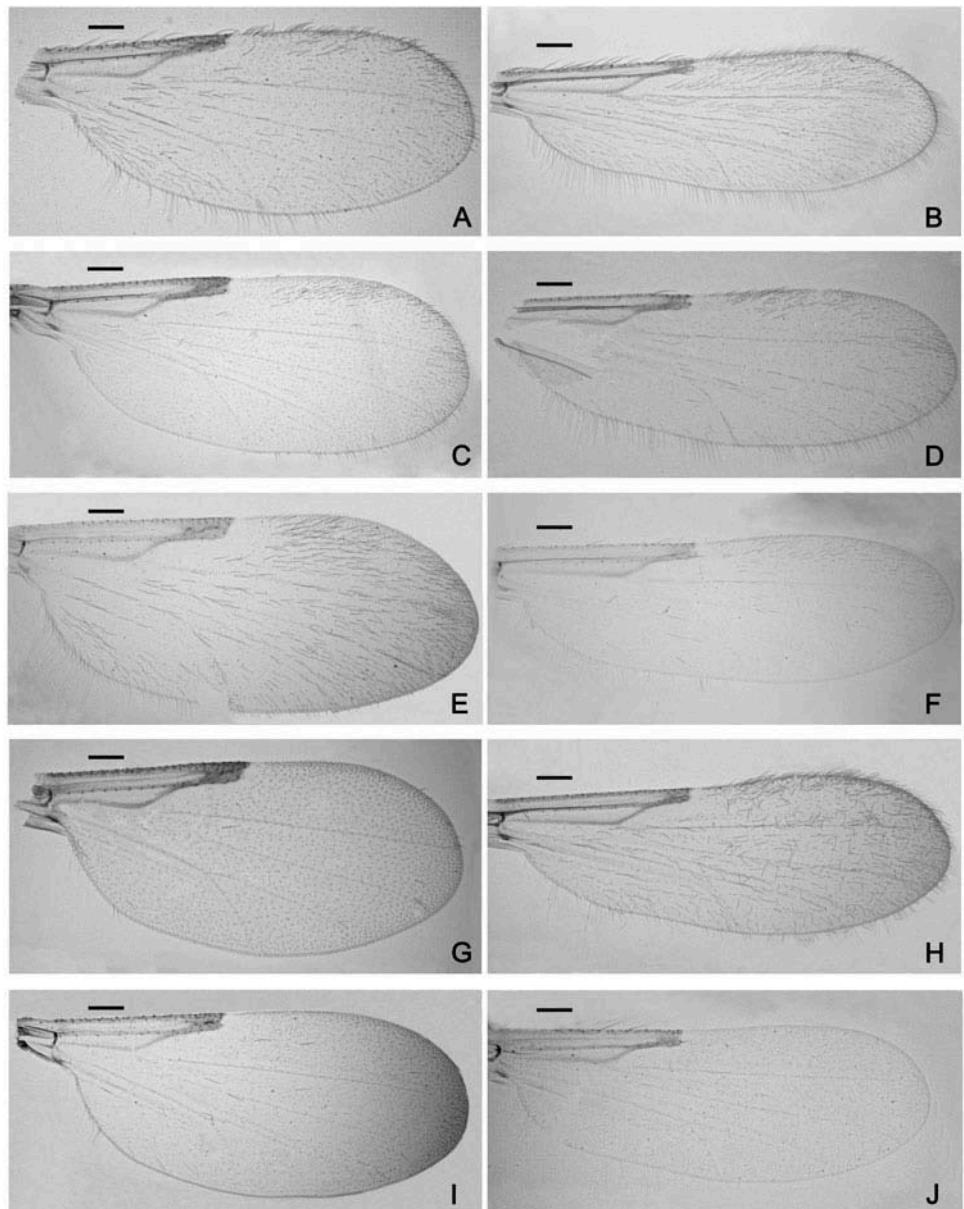


Figure 18. Photographs of wings. (A, B) *Dasyhelea andensis* Ingram and Macfie: (A) female, (B) male. (C, D) *Dasyhelea carlae* Díaz and Spinelli sp. nov.: (C) female, (D) male. (E, F) *Dasyhelea ingrami* Díaz and Spinelli sp.nov.: (E) female, (F) male. (G, H) *Dasyhelea lacustris* Ingram and Macfie: (G) female, (H) male. (I, J) *Dasyhelea macfiei* Díaz and Spinelli sp. nov.: (I) female, (J) male. Scale bars: 0.05 mm.

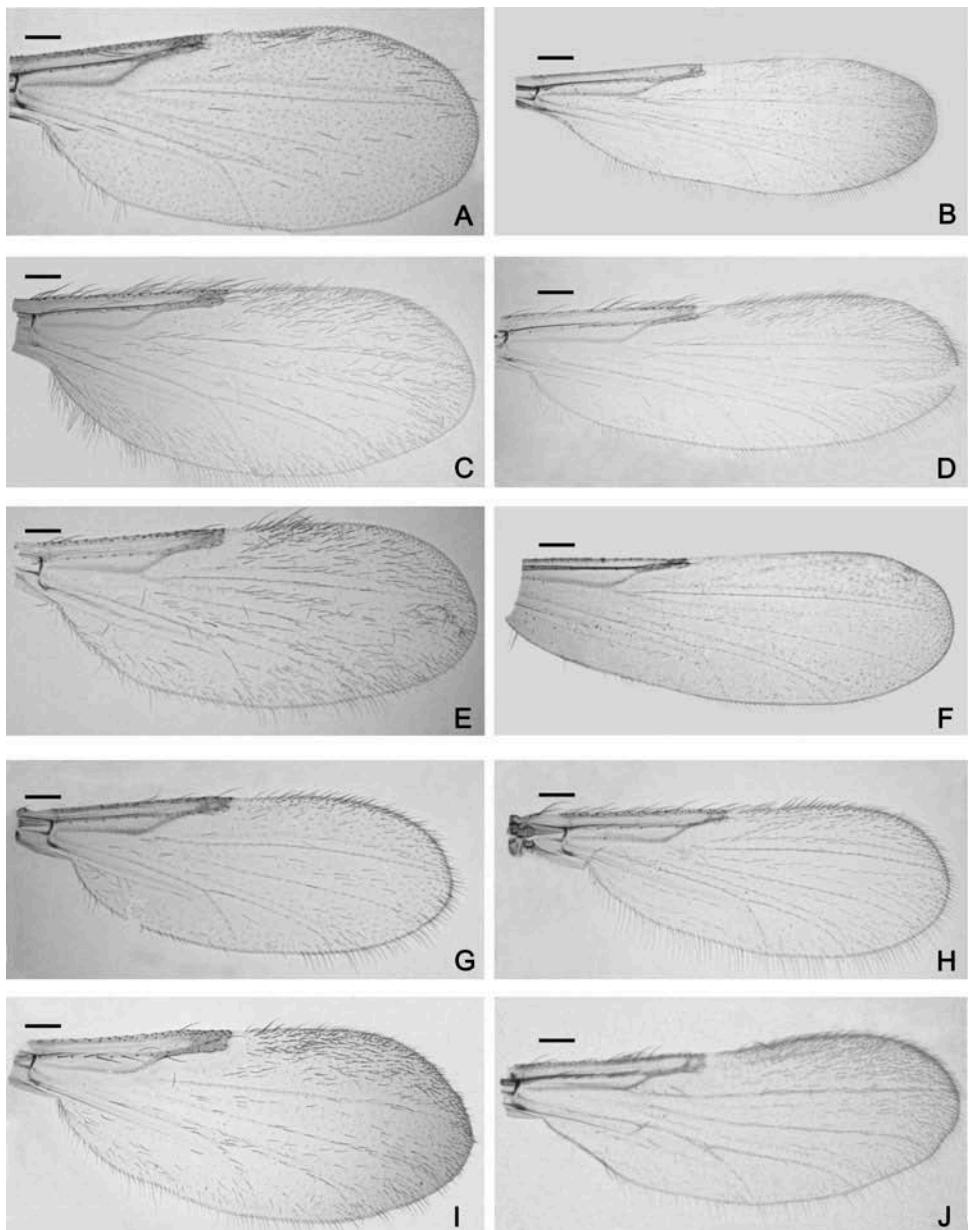


Figure 19. Photographs of wings. (A, B) *Dasyhelea monticola* Ingram and Macfie: (A) female, (B) male. (C, D) *Dasyhelea pseudolacustris* Díaz and Spinelli sp. nov.: (C) female, (D) male. (E, F) *Dasyhelea serrana* Díaz and Spinelli sp. nov.: (E) female, (F) male. (G, H) *Dasyhelea tehuelche* Díaz and Spinelli sp. nov.: (G) female, (H) male. (I, J) *Dasyhelea yamana* Díaz and Spinelli sp. nov.: (I) female, (J) male. Scale bars: 0.05 mm.

$n = 6$ ), hind leg TR 2.00–2.09 (2.04  $n = 6$ ). Wing (Figure 19I) length 0.93–1.08 (1.02,  $n = 6$ ) mm, width 0.42–0.51 (0.45,  $n = 6$ ) mm; CR 0.41–0.45 (0.42,  $n = 6$ ); membrane hyaline, densely covered with macrotrichia; second radial cell with very narrow lumen; cubital fork at level of anterior portion of second radial cell. Haltere pale brown.

Abdomen. Pale brown. Subgenital plate (Figure 17I) semicircular, with broad, reniform lumen, posteromedian projection absent; posterolateral arms slender, distal one-third deeply angulate, recurved 90°. Spermatheca (Figure 17J) spherical, heavily sclerotized, diameter 48  $\mu\text{m}$ , neck short, straight, slightly tapered, hyaline, measuring 12  $\mu\text{m}$ .

#### Distribution (Fig. 20)

Argentina, known only from the type-locality in Tierra del Fuego province, Argentina.

#### Type material

Holotype male, allotype female, Argentina, Tierra del Fuego prov., estancia Harberton, January/February 2006, M. L. Pagnosin (MLPA). Paratypes, 1 male, 5 females, as follows: same data as holotype 1 male, 2 females (MLPA), 1 female (BMNH), 1 female (USNM), 1 female (CNCI).

#### Etymology

The species is named after the Yamana Indians, early inhabitants of the seashores of Tierra del Fuego.

#### Phylogenetic relationships

*Dasyhelea yamana* is closely related to the clade (*D. serrana* (*D. pseudolacustris* (*D. andensis*, *D. carlae*, *D. lacustris*, *D. macfieii*))). This clade is supported by the synapomorphies: “palpal ratio” [character 1] and shape of posteromedian projection of aedeagus [character 19 (1)].

#### Cladistic analysis

The cladistic analysis using maximum parsimony of the *mutabilis* group yielded one tree ( $L = 138.8$ ;  $CI = 0.47$ ;  $RI = 0.55$ ) (Figure 1). The analysis suggests that the *mutabilis* group as defined by Wirth (1952) and Waugh and Wirth (1976) is not monophyletic due to *D. necrophila*, a species in the *grisea* group, that is embedded within the *mutabilis* clade. *Dasyhelea ingrami* is the most basal species. Two main clades were recognized, one formed by (*D. guadeloupensis* (*D. necrophila* ((*D. sonorensis*, *D. bajensis*) (*D. atlantis* (*D. spiniforma* (*D. cacaoi* (*D. williamsi* (*D. borgmeieri* (*D. winderi*, *D. soriai*)))))))), and the other by (*D. sinclairi* (*D. suarezi*, *D. monticola*) ((*D. mutabilis*, *D. ancora*) (*D. bermudae* (*D. tehuelche* (*D. yamana* (*D. serrana* (*D. pseudolacustris* (*D. andensis*, *D. carlae*, *D. lacustris*, *D. macfieii*

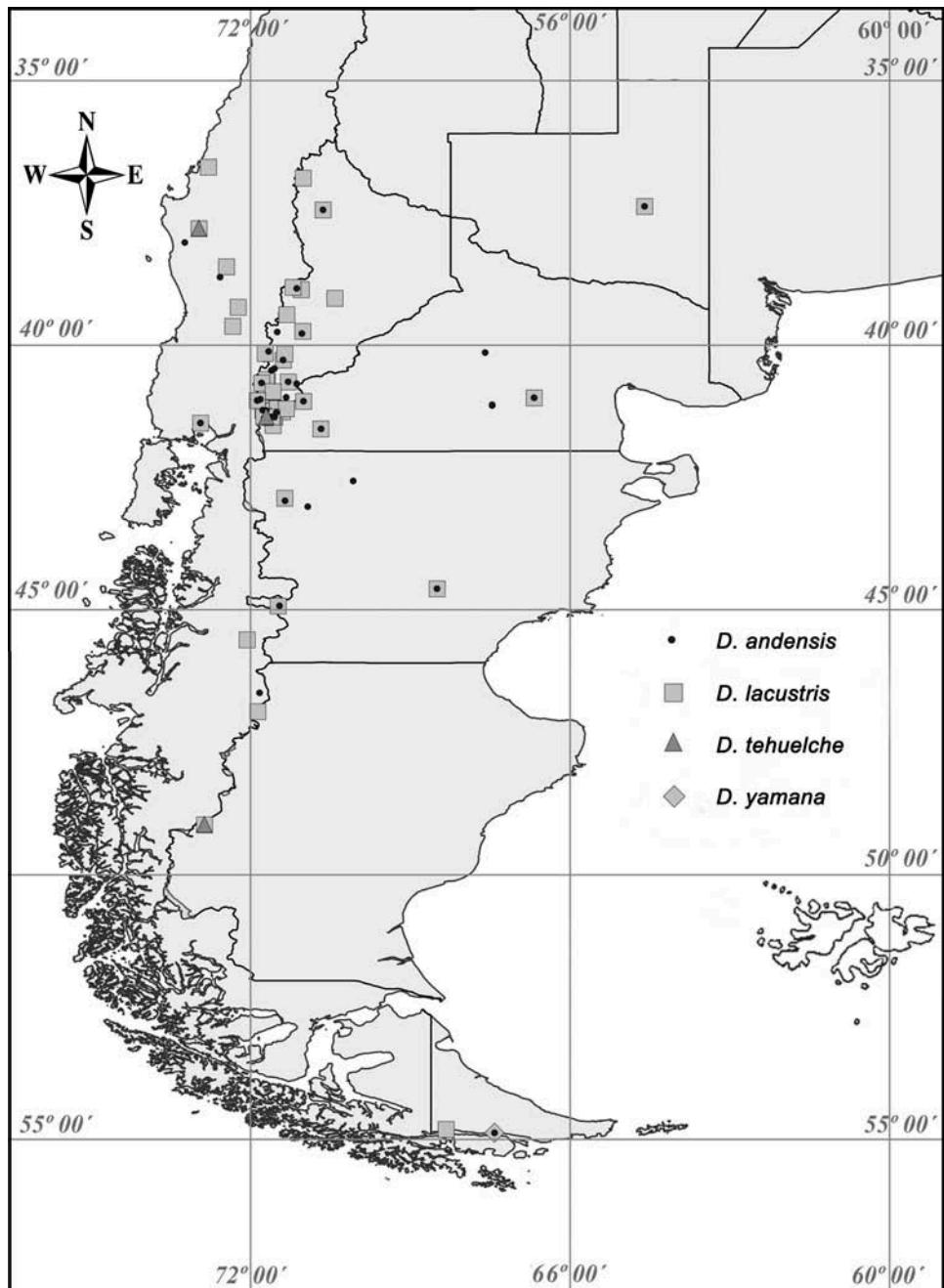


Figure 20. Distribution map of *Dasyhelea andensis*, *Dasyhelea lacustris*, *Dasyhelea tehuelche* and *Dasyhelea yamana*.

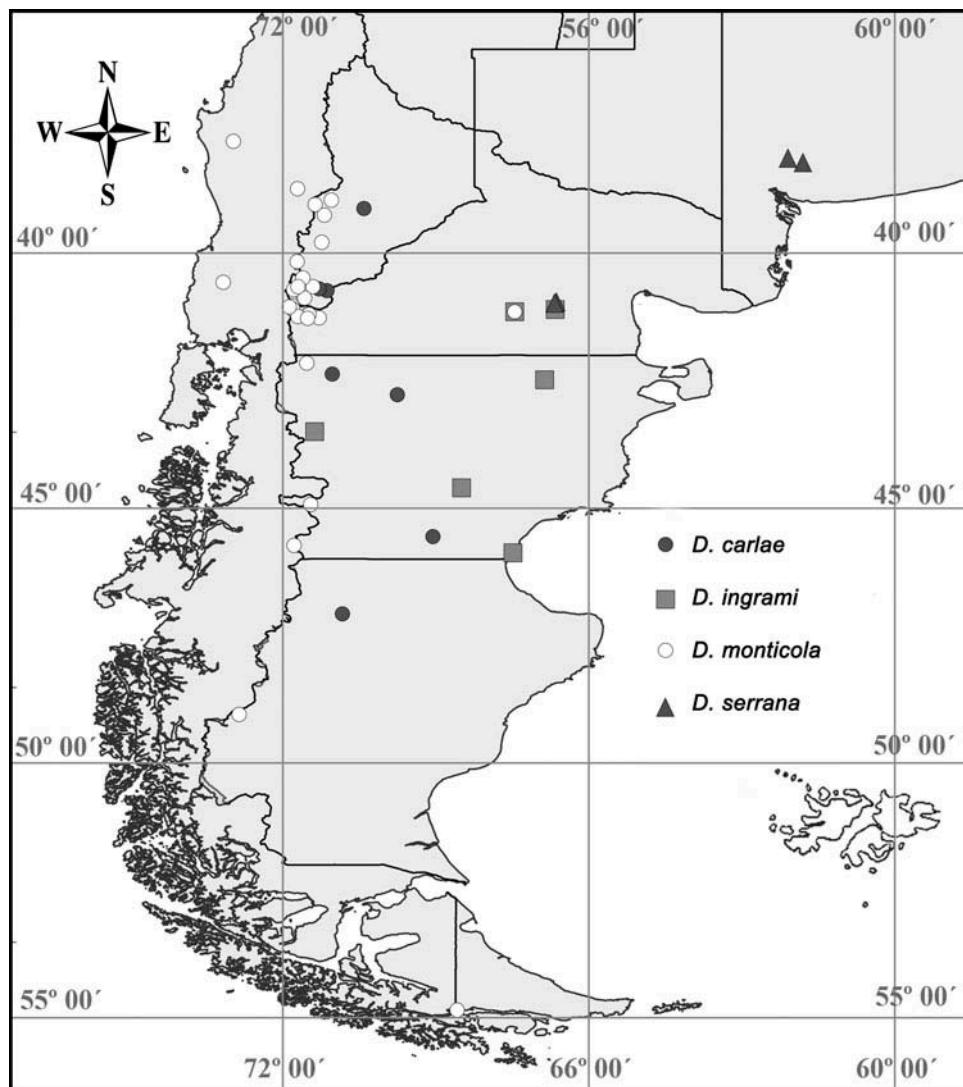


Figure 21. Distribution map of *Dasyhelea carlae*, *Dasyhelea ingrami*, *Dasyhelea monticola* and *Dasyhelea serrana*.

## Discussion

In his revision of the Ceratopogonidae of California, Wirth (1952), proposed for *Dasyhelea* the *cincta*, *grisea*, *mutabilis* and *traversae* species groups. For the Palaearctic *Dasyhelea*, Remm (1962) recognized the subgenera *Dasyhelea* s. str. Remm, *Dicryptoscena* Enderlein, *Pseudoculicoides* Malloch and *Prokempia* Kieffer. Waugh and Wirth (1976) recognized four species groups for the Nearctic species, two of which with identical characteristics of two subgenera defined by Remm (1962): the *grisea* group with *Dasyhelea* s. str. and the *mutabilis* group with *Pseudoculicoides*,

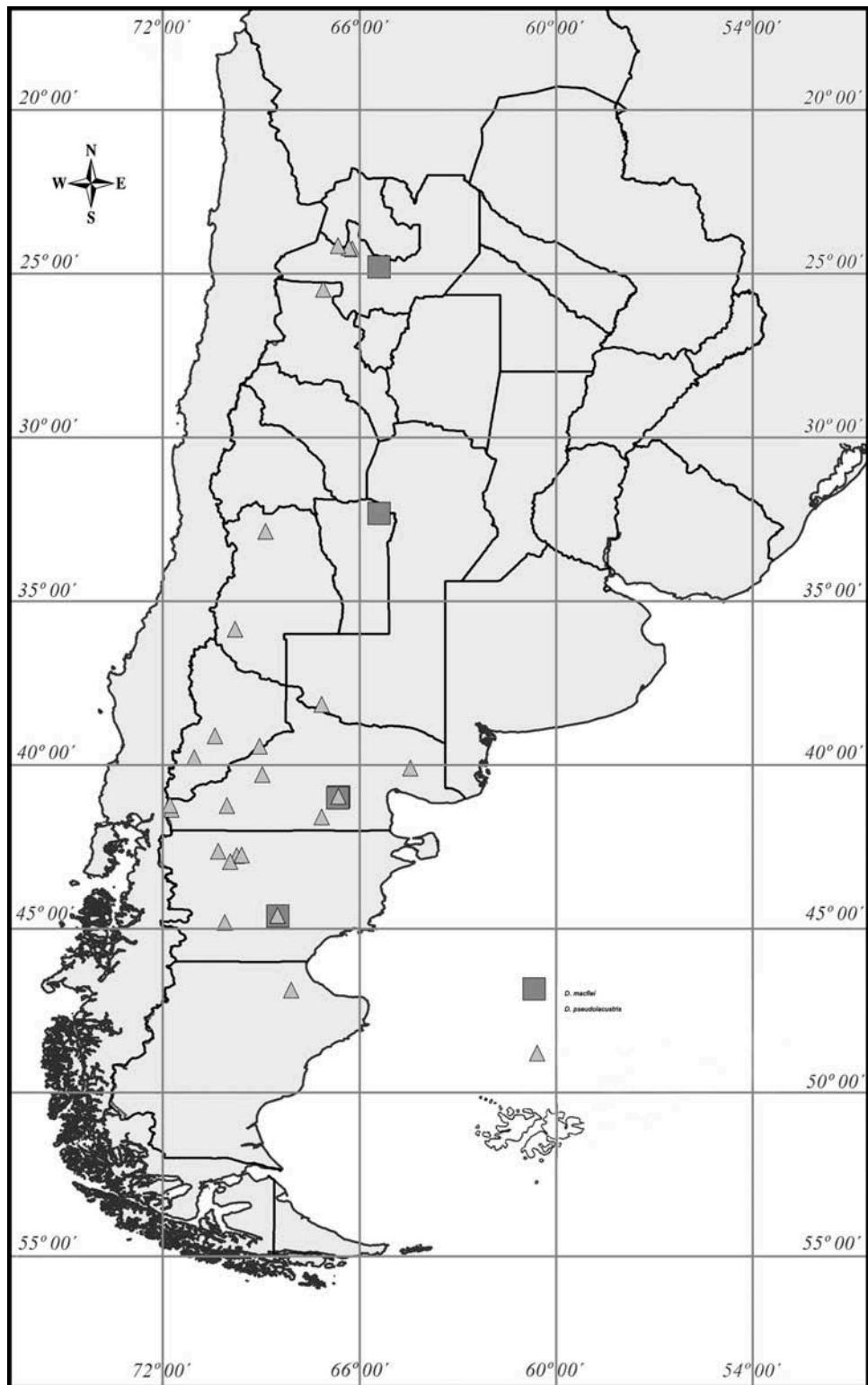


Figure 22. Distribution map of *Dasyhelea macfieei* and *Dasyhelea pseudolacustris*.

whereas the *cincta* and *leptobranchia* groups do not readily fit into any of these subgenera.

The cladistic analysis herein presented does not support the previous hypothesis with regard to the *grisea* and *mutabilis* groups *sensu* Wirth (1952) and Waugh and Wirth (1976), due to *D. necrophila*, a member of the *grisea* group, being embedded with other species of the *mutabilis* group. This relationship is supported by the characters “presence of one spermatheca”, “asymmetrical parameres” and “rounded subgenital plate”. The character “presence of one spermatheca” is a symplesiomorphy since it is shared by species of other groups of *Dasyhelea* (e.g. *mutabilis*, *grisea*, *leptobranchia* and *brevicosta* groups). The character “asymmetrical parameres” heavily supports the inclusion of *D. necrophila* inside the *mutabilis* group because it is present in all species of the *grisea* group and in many species of the *mutabilis* group. The character “rounded subgenital plate” is a true synapomorphy of the *mutabilis* group because in this cladogram it reverses to “triangular subgenital plate” in *D. necrophila*. This situation could represent a methodological artefact because the above-mentioned reversion of the character “subgenital plate” from “rounded” to “triangular” does not contradict the synapomorphy of the character “asymmetrical parameres”. Moreover, the outgroup species *D. necrophila* is the only representative of the *grisea* group in this analysis, and the most important characters of this group are expressed as autopomorphies. For these reasons the eventual monophyly of the *mutabilis* group could be verified if more species of the *grisea* group are considered in a larger analysis.

Finally, it is worth pointing out that this is the first attempt at a phylogenetic analysis of the species in the *mutabilis* group. Based on these results, it is clear that further analyses are needed in order to properly resolve the relationships between the different species groups proposed by previous authors (Wirth 1952; Waugh and Wirth 1976; Grogan and Wieners 2006; Díaz et al. 2010) for the Nearctic and Neotropical species of *Dasyhelea*, including their monophyly.

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## Appendix 1

List of characters as character states and coding used in the cladistic analysis of the *mutabilis* species group of *Dasyhelea* Kieffer. Quantitative characters were treated as standardized.

### Quantitative characters

- 0- Antennal ratio
- 1- Palpal ratio
- 2- Length/width wing ratio: obtained dividing the wing length by the wing width.
- 3- Costal ratio
- 4- Foreleg hind leg TR
- 5- Midleg TR
- 6- Hind leg TR
- 7- Ratio of lengths of flagellomeres 12/13
- 8- Number of large scutellar setae
- 9- W/L ratio: obtained dividing the internal width of the aedeagal basal arch by the total aedeagus length.
- 10- Gonostylus length/gonocoxite length

### Qualitative characters

- 11- Posteromedian projection of sternite 9 of male: absent (0); present (1)
- 12- Parameres and gonocoxal apodemes: forming a structure: symmetrical (0); asymmetrical (1)
- 13- Parameres: simple (0); J-shaped (1); bifid (2); rectangular (3); absent (4)
- 14- Hyaline envelope of aedeagus: present (0); absent (1)
- 15- Posterolateral arms of aedeagus single with recurved tips: absent (0); present (1)
- 16- Posterolateral arms of aedeagus single with pointed tips: absent (0); present (1)
- 17- Posterolateral arms of aedeagus divided with mesolateral projection: absent (0); present (1)
- 18- Posterolateral arms of aedeagus divided with recurved tips: absent (0); recurved anterad (1); recurved lateral in angle of 90° (2)
- 19- Shape of posteromedian projection of aedeagus: type 1 (without projection) (0); type 2 (stout with rounded tip) (1); type 3 (triangular with simple tip) (2); type 4 (triangular with recurved tip) (3); type 5 (rectangular with truncate tip) (4); type 6 (slender with rounded tip) (5)
- 20- Frontal sclerite- Frontal sclerite: elongate with broad ribbon-like lateral border (0); broad elliptical with long, slender ventral projection (1); elongate ovoid without lateral processes (2), elongate rhomboidal without lateral processes (3)
- 21- Coloration of femora and tibiae: unicoloured (0); banded (1)
- 22- Scutum pattern of female: absent (0); present (1)
- 23- Cubital fork of female wing: anterior to apex of costa (0); beyond apex of costa (1)
- 24- Dark streaks on abdominal terga: present (0); absent (1)
- 25- Margin of gonopore heavily sclerotized: present (1); absent (0)
- 26- Shape of female subgenital plate: circular (0); rectangular (1); triangular (2)

- 27- Posteromedian projection of female subgenital plate: absent (0); present (1)
- 28- Shape of posterolateral arms of female subgenital plate: curved (0); angulate (1); straight (2)
- 29- Number of well-developed spermatheca: two (0); one (1)
- 30- Spermatheca(e) shape(s): spherical (0); ovoid (1)
- 31- Sclerotization of spermatheca/e neck: sclerotized (0); hyaline (1)
- 32- Shape of spermatheca(e) neck(s): straight (0); oblique (1)
- 33- Hyaline punctations of spermatheca(e): present (0); absent (1)
- 34- Female flagellomeres reticulations: present (0); absent (1)