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Research paper

# *Acanthagrion peruvianum* Leonard, 1977 (Odonata Coenagrionidae) a junior subjective synonym of *A. floridense* Fraser, 1946 and description of its final stadium larva

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ABSTRACT

*Acanthagrion peruvianum* Leonard, 1977 is considered a junior subjective synonym of *A. floridense* Fraser, 1946 based on the analysis of type material. The species is diagnosed and SEM images are provided for male and female diagnostic characters. The larva of *A. floridense* is described based on specimens collected in Salta, Jujuy and Tucumán provinces (Argentina). A distribution map is given showing that this species is recorded for the first time for Misiones and San Luis provinces in Argentina, and for La Paz and Tarija departments in Bolivia.



## 1. Introduction

The Neotropical genus *Acanthagrion* was erected in 1876 by Baron Edmond Selys Longchamps to include nine species of Coenagrionidae. Currently it includes 44 small to medium sized coenagrionids which are distributed from Texas (USA) to Buenos Aires (Argentina) (Garrison et al., 2010;Machado,2012). Species generally have hyaline wings, CuP of HW reaching posterior margin of wing; flexure of male genital ligula short with lateral lobes on segment 3, when present, distal to flexure; male cerci decumbent forming an angle of 45° with posterior margin of S10, with dorso-basal tubercle; females without a well-defined mesepisternal carina between mesostigmal plates and medio-dorsal carina, generally with mesepisternal fossae on the dorsum of the pterothorax and vulvar spine on S8 (von Ellenrieder and Lozano, 2008; Garrison et al., 2010).

Between 1931 and 1934 J. W. Leonard worked on the first revision of the genus *Acanthagrion*, which included the description of 14 new species. His thesis was published posthumously with minor changes in 1977 (43 years later) by L. K. Gloyd. The posthumous publication of this thesis posed several taxonomic problems, mainly with respect to the status of the species described between 1934 and 1977. This is the case with *Acanthagrion floridense* Fraser, 1946 and *A. peruvianum* Leonard, 1977, whose synonymy has long been suspected by many authors (Gloyd, 1977; von Ellenrieder and Garrison, 2007a).

Knowledge of the final stadium larvae of the species of *Acanthagrion* is still scarce; the larvae of only 12 species have been described: *A. adustum* Williamson, *A. aepiolum* Tennessen, *A. apicale* Selys, *A. ascendens* Calvert, *A. fluviatile* De Marmels, *A. gracile* (Rambur), *A. hildegarda* Gloger, *A. indefensum* Williamson, *A. lancea* Selys, *A. quadratum* Selys, *A. vidua* Selys, and *A. viridescens* Leonard (Geijskes, 1941; Geijskes, 1943; De Marmels, 1990; De Marmels, 1992; De Marmels, 2007; Muzón et al., 2001; Westfall and May, 2006; Lozano et al., 2007; Novelo-Gutiérrez, 2009; Anjos-Santos et al., 2011; Gutiérrez et al., 2015).

Here we formally synonymize *A. peruvianum* with *A. floridense* based on the comparative analysis of type material and include a complete synonymy, updated distribution maps, and the description of the final stadium larva based on specimens collected in Argentina.

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## 2. Material and methods

Specimens were studied with the aid of a Leica MS5 stereomicroscope in the Laboratorio de Biodiversidad y Genética Ambiental (BioGeA) of the Universidad Nacional de Avellaneda (UNDAV). Illustrations were made with the aid of digital camera coupled to the stereomicroscope and an open-source design program (Inkscape version 0.91. at <www.inkscape.org>) and are not to scale. Specimens for SEM were cleaned in acetone, air dried and mounted on SEM stubs with carbon-conductive adhesive tabs, and then sputter coated with gold/palladium alloy and examined with a Jeol JSM 6360 LV scanning electron microscope in the Museo de La Plata, Buenos Aires, Argentina.

Measurements are given in mm. A list of examined material is provided in alphabetical order; country, department, state, province or any other political/administrative equivalent subdivision, locality (names of localities were transcribed from the label and are not translated to English), geographic coordinates and altitude, collector/s, date of collection, number of male and female specimens (when necessary number of pairs in copula/tandem are indicated in brackets), and deposition of material are indicated. When geographic coordinates were not included in the original label, they were culled from the Global Gazetteer website (<http://www.fallingrain.com/world/>) with the aid of Google Earth version 7.1.7.2606, and this is indicated in braces ({}). Information on type material examined Maps represent distribution records from collections and reliable literature records (name of locality, georeference, altitude and bibliographic reference are given), and were created electronically using QGIS version 2.16.3.

Acronyms for collections are as follows:

(BMNH) British Museum of Natural History, London, England.

(CSCA) California State Collection of Arthropods, Sacramento, California, USA;

(FML) *Fundación Miguel Lillo*, Tucumán, Argentina;

(IBN) *Instituto de Biodiversidad Neotropical*, Tucumán, Argentina

(MLP) *Museo de La Plata*, Buenos Aires, Argentina;

(UMMZ) University of Michigan Museum of Zoology, Ann Arbor, Michigan, USA;

(USNM) National Museum of Natural History, Smithsonian Institution, Washington D. C., USA.

## 3. Results

*Acanthagrion floridense* Fraser, 1946

*Acanthagrion gracile floridense* Fraser, 1946: 36–39, Figs. 8a, 10.2–10.3 (description, holotype male from Florida, Colombia, in BMNH; illustrations of terminalia in lateral view, genital ligula in lateral and ventral views); Kimmins, 1966: 192 (transcription of information in label of type material); Kimmins, 1970: 185 (mention in list of type material of BMNH); Gloyd, 1977: 147–148 (comments on similarities between *A. peruvianum* and *A. floridense*, suggestion of synonymy of *A. peruvianum*); von Ellenrieder and Garrison, 2007a: 11, Fig. 4a–4b (confirmation of presence of type material in BMNH, suggestion of synonymy of *A. peruvianum*; mention that holotype genital ligula is lost; illustration of holotype cerci lateral and medio-dorsal views).

*Acanthagrion gracilis*: Fraser, 1947: 431 (in part because record from Misiones, Argentina belongs to *A. gracile*; mention in checklist of Odonata of Argentina).

*Acanthagrion lancea*: Fraser, 1948: 49, 51–52, Figs. 1: 6, 2: 8–10 (misidentification based on differences in genital ligula with *A. gracile*; comparison with *A. apicale*, *A. ascendens* and *A. truncatum*; illustrations of genital ligula in lateral view; cerci in lateral and dorso-medial views, color patter of S1–3 in dorsal view; record from Argentina).

*Acanthagrion gracile gracile*: Fraser, 1948: 51 (in part, according to von Ellenrieder and Garrison, 2007b only the records from Tucuman belong to *A. floridense)*.

*Acanthagrion apicale floridense*: St. Quentin, 1960: 58 (in key, since he mentions Fraser 1946 this new combination is probably a mistake).

*Acanthagrion gracile*: Gloger, 1967: 47–48, 51, 56, Figs. 4–5 (in part, only the specimens from Yuto belong to *A. floridense*; description of color pattern and mention of wing characters; illustrations of cerci in lateral view, ligula genital in lateral view; records from Argentina); Muzón and von Ellenrieder, 1998: 23 (in checklist of Argentina; in part, only the records from Jujuy and Tucumán belong to *A. floridense*).

*Acanthagrion peruvianum* Leonard, 1977: 22, 24, 78, 94, 102, 113–119, 134, 159, 166, 170, 173; plate V Figs. 49 –50, plate XII Figs. 129, 133–134, plate XVI Fig. 159, plate XIX (description of male and female, holotype male from Colonia Perené, Peru, in UMMZ; key; illustrations of genital ligula of paratype lateral and ventral views, terminalia of holotype, lateral, dorsal and posterior views, thorax of female allotype dorsal view; map; records from Ecuador and Peru); Gloyd, 1977: 147–148; misspelled as *A. peruviana*, comments on the similarities between *A. peruvianum* and *A. floridense*, suggestion of synonymy with *A. floridense*; records from Ecuador and Peru); Jurzitza, 1980: 183 (mention as part of *viridescens* group); Muzón and von Ellenrieder, 1998: 23 (in checklist of Argentina; records from Argentina); Garrison et al., 2003: 36 (transcription of information in label of type material); Tennessen, 2004: 84 (record for Bolivia); Lencioni, 2006: 66, Fig. 16 A–F (mention of state of knowledge of this species, reproduction of illustrations of Leonard, 1977; records from Argentina, Brazil, Ecuador, and Peru); von Ellenrieder and Garrison, 2007b: 9–10, 34, 39, Table 1, Figs. 119, 124–125, 130–131, 133; Plate 10 (comments on misidentification of this species with *Acanthagrion gracile* in Fraser, 1948 and Muzón and von Ellenrieder, 1998; in key of Odonata from the Argentine Yungas; mention of habitat preferences; color picture of tandem; illustrations of head in dorsal view, genital ligula in lateral and ventral views, male terminalia in lateral and posterior views, female thorax in dorsal view); von Ellenrieder and Garrison, 2007c: 10, 49–50; Figs. 13 (comparison with other species of Acanthagrion present in the Yungas; diagnoses; distribution; records for the Yungas; picture of male and female ovipositing); von Ellenrieder and Lozano, 2008: 99–100, 102, 105–106, 108, 111, Table 1, Figs. 1b, 5i, 6h, 8a, 11 (species coded and included in cladistic analysis; illustrations of FW, genital ligula lateral and ventral views, female thorax in dorsal view, head in dorsal view; records from Argentina); von Ellenrieder and Muzón, 2008: 59 (mention in checklist of Argentina with provincial records); Hoffmann, 2009: 65, Table 6 (included in the list of Odonata of Peru); Rojas-R. and Sánchez, 2009: 17–18 (mention differences of specimens from Colombia with illustrations from Leonard, 1977); von Ellenrieder, 2009a: 41 (mention as one of the most common species of the Argentine Yungas); von Ellenrieder et al., 2009: 228–229 (mention in checklist of Uruguay); von Ellenrieder et al., 2009; von Ellenrieder and Garrison, 2009: 103, 105, Figs. 48, 85 (illustrations of head dorsal view, female thorax dorsal view); de Souza et al., 2010: 79, 81–83; Figs. 15, 30 (in key; reproduction of illustrations from Leonard, 1977 of female thorax dorsal view and male terminalia lateral view); Pérez Gutiérrez and Palacino Rodríguez, 2011: 212 (included in the checklist of Odonata from Colombia); von Ellenrieder and Garrison, 2011: 40 (record from Ecuador) — **new synonymy**.

*Acanthagrion floridense*: von Ellenrieder and Lozano, 2008: 99, 101, 111, Table 1, Fig. 11 (species coded and included in cladistic analysis); Hoffmann, 2009: 65, Table 6 (included in the list of Odonata of Peru); Garrison et al., 2010: 141, 171, 175, 181–185; Figs. 634, 953, 986, 1028, 1033, 1039, 1046, 1054–1055, 1066–1067 (mention within species list of the genus *Acanthagrion*; illustra-

tions of head dorsal view, wings, genital ligula lateral and ventral views, terminalia of male holotype lateral and dorso-medial view, female thorax, dorsal view; records from Argentina and Colombia); Pérez Gutiérrez and Palacino Rodríguez, 2011: 212 (included in the checklist of Odonata from Colombia); Tennessen, 2012: 96 (record for Ecuador); Lozano, 2013: 23, 35, Fig. 22 (in key, illustration of female thorax in dorsal view).

### 3.1. Synonymy

Taxonomic problems regarding these two species are due to Leonard's revisionary work (his PhD thesis) of the genus being published posthumously with minor changes addressed separately by Gloyd (1977). *Acanthagrion floridense* was described by Fraser after Leonard's description of *A. peruvianum* in his unpublished PhD thesis but before its formal publication by Gloyd. Type material of *Acanthagrion floridense* deposited in BMNH was examined by the first author and compared to pictures of the holotype of *A. peruvianum* sent by Mark O'Brien, the curator of the UMMZ (Fig. 1). Genital ligulae of both holotypes are lost, but drawings included in the original descriptions made comparison of these structures possible (Fig. 1). General morphology of male terminalia: (S10 and S9 equal or S10 slightly higher; cerci longer than 0.5 of the length of S10 with inner margin straight; in lateral view with a constriction in proximal third) and presence of long lateral lobes of segment 3 of genital ligula confirm that *A. peruvianum* is a junior synonym of *A. floridense*.

### 3.2. Larval description

Head: two times wider than long, with posterior margin slightly concave, posterior angle with several short spines (Fig. 2A); ventral border of eyes near maxillae with five spines. Antennae (Fig. 2B): with seven segments, third antennomere the longest; sixth and seventh the shortest (size in mm: 0.40, 0.50, 0.70, 0.50, 0.30, 0.25, 0.20). Labium: prementum – postmentum articulation reaching first coxae. Prementum (Fig. 2C, D): subtriangular, longer than wide; ventral surface with a pair of sub-median long hair-like setae at each side of midline, directed posteriorly (Fig. 2D) (best seen in exuviae; in young instars only seen in lateral view); dorsal surface with three premental setae on each side of midline, the inner ones the shortest (Fig. 2C); ligula prominent and convex, slightly crenulated with a row of minute spatulate setae (Fig. 2E); lateral margin of prementum with 11–14 spiniform setae (Fig. 2C); laterodistal margin with four strong spiniform setae (Fig. 2C). Postmentum: sub-quadrangular, in ventral view with scattered several spiniform setae. Labial palp (Fig. 3A) with four setae, outer margin with four strong spiniform setae; inner margin crenulated, outer half of distal margin with three small teeth, inner half with three teeth and a hook almost upright; movable hook slender and pointed and almost 0.5 times the length of external margin of palp. Maxillae (Fig. 3B): stipes with small short setae; inner lobe (galea + lacinia) with four strong teeth directed medially and nine setae near basal part; outer lobe (palp) with pointed sclerotized apex and two groups of setae, eight strong hair-like setae near apex and a group of nine spiniform setae near base. Mandibles (Fig. 3C–D) without molar crest, with a row of six piliform setae on outer surface near basal part. Mandibular formula: L 1 + 2 3 4 5 a b, R 1 + 2 3 4 5 y a.

Thorax: wing pads parallel, outer ones reaching half of S4, inner ones reaching 0.25 of S4. Legs (Fig. 4A): femora rectangular; inner margins of femora 1 with a row of spiniform setae; inner surface of tibia with one or two rows of setae, proximally these setae spiniform, distally trifid; tarsi with two rows of bipectinate spiniform setae on ventral surface.

Abdomen: cylindrical, narrowing posteriorly; dorsal and ventral surface of S1–4 nearly smooth with few scattered spiniform setae, terga and sterna of S5–10 covered with spiniform setae increasing in number posteriorly; with a row of lateral robust spiniform setae on S7–9; posterior margin of tergite 10 deeply emarginate and surrounded with strong spiniform setae. Male gonapophyses (Fig. 4B): slender and pyramidal reaching half of S10, sharply pointed and slightly diverging distally; with two rows of setae, an outer row of four or five spiniform setae, and an inner row of five or six long setae; with three or four lateral spiniform setae; male cercus as in Fig. 4C; with a small concavity on its inner surface (visible in posterior view). Female gonapohyses (Fig. 5A–B): slightly sub-parallel (not markedly diverging posteriorly) surpassing posterior margin of S10; lateral valvae sharply pointed and with two rows of setae, an outer row of six to eight spiniform setae, and an inner row of five or six slender setae; central valvae smooth, shorter than gonapophyses ending in posterior margin of S10. Female cerci: triangular and divergent in dorsal view.

Caudal lamellae lanceolate, apically acute (Fig. 5C). Lateral caudal lamellae: ratio length/width: 6.90–8.90; ventral margin with 35–40 spiniform setae; dorsal margin with 12–15 spiniform setae. Dorsal caudal lamellae: ratio length/width: 7.30–8.10; ventral margin with 5–40 spiniform setae; dorsal margin with 0–15 spiniform setae. Tracheation as in Fig. 5B.

Measurements (N = 5): Total length (without caudal lamellae): 10.33 [9.80–11.00]. Head: max. length: 1.21 [1.00–1.35]; max. width: 2.75 [2.50–2.95]. Prementum: max. length: 1.76 [1.70–1.85]; max. width: 1.49 [1.40–1.60]. Legs: femur 1: 1.37 [1.30–1.50]; femur 2: 1.79 [1.75–1.85]; femur 3: 2.29 [2.20–2.35]; tibia 1: 1.65 [1.50–1.85]; tibia 2: 1.98 [1.75–2.20]; tibia 3: 2.38 [2.20–2.50]. Inner wingpad: max. length: 3.77 [3.60–3.90]. Outer Wingpad: max. length: 3.61 [3.55–3.75]. Abdomen: total Length: 6.44 [6.10–7.00]; S9: length: 0.66 [0.60–0.75]; S10: length: 0.44 [0.40–0.50]. Male cercus: length: 0.22 [0.10–0.25]. Male gonapophyses: length: 0.70 [0.50–0.77]. Lateral caudal lamella: length: 5.59 [4.80–6.10]; max. width: 0.68 [0.65–0.70]. Dorsal caudal lamella: length: 5.45 [4.75–5.90]; width: 0.68 [0.65–0.70].

### 3.3. Material examined

**Type specimens examined** (between square brackets [] information transcribed from original publication is given):

Male Holotype: [*Acanthagrion gracile floridense*. S.E. Colombia: Florida, 7.iii.31. A single male, the *holotype*, which will be deposited in the British Museum (N.H.)]. Type currently deposited in BMNH. (Figs. 1A, C, E)

Male Holotype: [*Acanthagrion peruvianum*. Campamiento, Colonia del Perené, Peru, June 10, 1920, J. H. Williamson]. Female: [June 7, 1920, same locality and collector]. Types currently deposited in UMMZ. (Figs. 1B, D, F)

### 3.4. Specimens examined for larval description

**ARGENTINA: Salta**: Orán, Río Santa María, 23°15′52.30″S – 64°28′44.20″W, 426m, leg. Molineri, 27.vii.2013, 3 reared males (IBN). **Jujuy**: near Caimancito, Río Zora, 23°46′24.00″S – 64°36′41.00″W, 353m, leg. Molineri, 16.xi.2014, 1 reared male (IBN); Parque Nacional Calilegua, Río Sauzalito, 23°39′29.31″S – 64°34′39.01″W, 424m, leg. Molineri, xii.2013, 3 reared males (IBN). **Tucumán**: Famaillá, Río Famaillá (Balneario), 27°02′46.00″S – 65°23′53.00″W, 370m, leg. Molineri, 29.ix.2014, 2 reared females and 3 reared males (emerged in laboratory 19 October 2014) (IBN); near Monteagudo, Río Chico (bajo el puente), RN 157, 27°31′17.67″S – 65°16′00.62″W, 302m, leg. Molineri, Rodríguez and Hankel, 01.xii.2016, 7 females and 3 reared males (IBN); near Simoca, Río Balderrama (bajo el puente), RN 157, 27°10′45.08″S – 65°21′35.41″W, 330m, leg. Molineri, Rodríguez and Hankel, 01.xii.2016, 3 females and 1 reared male (IBN); Trancas, near camp-

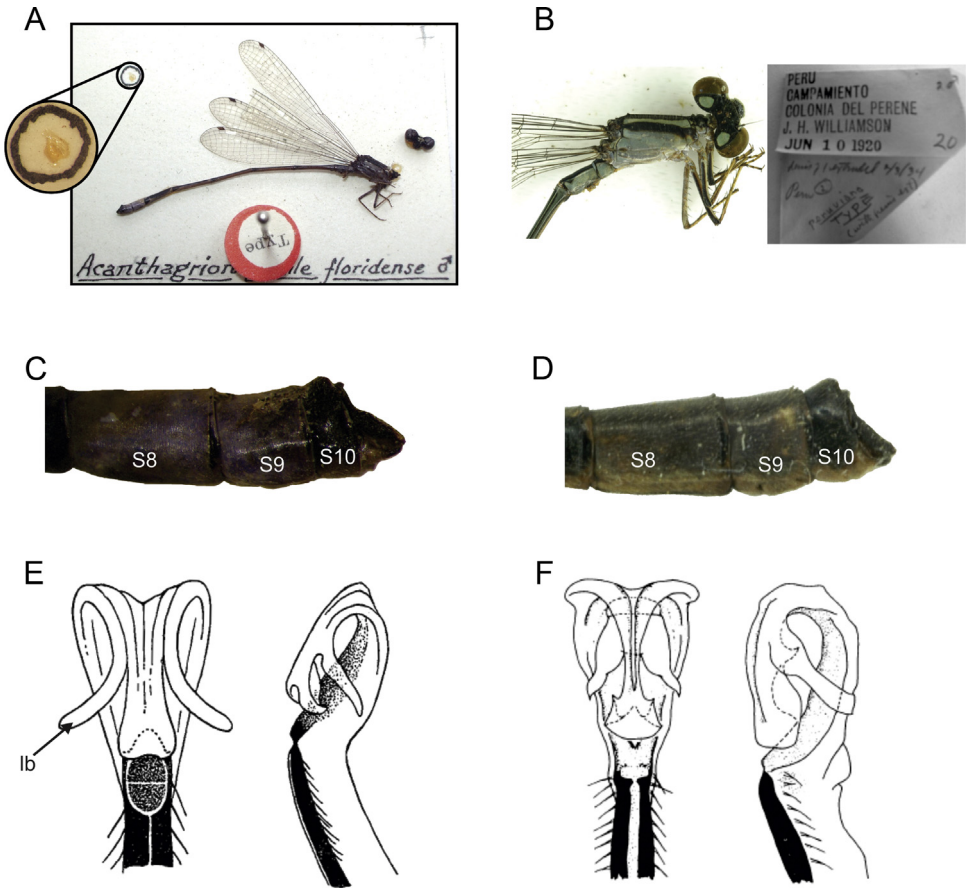


**Fig. 1.** *Acanthagrion floridense* and *A. peruvianum*, type material. (A) *A. floridense* holotype, general view. (B) *A. peruvianum* holotype, head thorax and label. (C) *A. floridense* holotype, male terminalia, lateral view. (D) *A. peruvianum* holotype, male terminalia, lateral view. (E) *A. floridense* holotype, genital ligula, ventral and lateral views (modified from Fraser, 1946). (F) *A. peruvianum* holotype, genital ligula, ventral and lateral views (modified from Leonard, 1977). lb: lateral lobes.

ing y balneario El Boyero, A° Pozo del Pescado, 26°13′53.64″S – 65°15′39.01″W, 760m, leg. Molineri and Rodríguez, 17.xii.2016, 1 reared female (IBN); Depto. Las Talitas, Sitio humedal SAT, 26°47′00.00″S – 65°09′48.00″W, 300m, leg. Nieto and Bardavid, 16.vii.2013, 1 reared female (IBN).

### 3.5. Other specimens examined

A total of 116 males and seven females were examined in order to provide a more thorough distribution map. Localities and georeferences are given in the following section together with reliable distribution records culled from literature.

### 3.6. Biology and distribution

*Acanthagrion floridense* has been found in shady streams, rivers, and ponds in forest areas from Ecuador and Peru to southwestern Brazil and central Argentina. Adults perch on leaves and twigs of waterside vegetation, and on grass blades along shores, close to water surface. Females oviposit inside stems of floating plants or masses of algae while in tandem with males, and may go completely underwater to lay eggs (von Ellenrieder and Garrison, 2007b; von Ellenrieder, 2009a, 2009b). Larvae were found mainly in the roots and other submerged parts of aquatic plants, together with larvae of *Acanthagrion lancea* Selys, 1876, *Oxyagrion ablutum* (Calvert, 1909) and *Enallagma novaehispaniae* Calvert, (1907).

The following represents a complete list of known localities shown in Fig. 6 for *A. floridense* (type material and reared specimens mentioned above are not included); when records were culled from literature only georeference, altitude and reference are given:

**ARGENTINA**: **Córdoba**: Mayu Sumaj, Río San Antonio, charcas de desborde 31°28′05.61″S – 64°32′23.11″W, 760m, leg. Muzón, 01-16.ii.2007, 4♂, MLP; Segunda Usina, 31°51′16.00″S – 64°22′22.00″W, 467m, leg. Ramos, i-2006, 2♂, MLP. **Jujuy**: Aguas Calientes, Caimancito, {23°44′17.87″S – 64°35′38.73″W, 381m}, leg. Bulla, 20.ix.1972, 1♂, MLP; same as before except for: 22.ix.1972, 14♂; Arroyo sin nombre sobre ruta provincial 6 camino a Palma Sola, 23°52′12.59″S – 64°22′44.50″W, 545m, leg. Muzón and von Ellenrieder, 17.i.1997, 1♂, MLP; Arroyo Zanjón Seco, sobre ruta nacional 34 a pocos km al N de Calilegua, 23°41′10.80″S – 64°34′14.00″W, 462m, leg. Muzón and von Ellenrieder, 17.i.1997, 1♂, MLP; Charca sobre ruta provincial 1, 20 km al E de ruta nacional 34, {23°47′43.65″S – 64°26′22.40″W, 447m}, leg. Muzón and von Ellenrieder, 17.i.1997, 4♂, MLP; Río Pantanoso, 23°31′17.04″S – 64°35′48.84″W, 590 m (von Ellenrieder and Lozano, 2008; Garrison et al., 2010); Río San Francisco, 23°42′47.88″S – 64°31′57.00″W, 365 m (record provided by von Ellenrieder); Río Zora, {23°44′44.00″S – 64°33′55.00″W, 351m}, leg. Bulla, 18.vii.1972, 1♂, MLP; same as before except for: 22.ix.1972, 2♂; Small pond along Hwy 1, 23°43′15.96″S – 64°31′15.96″W, 300 m (record provided by von Ellenrieder); Yuto, 23°30′36.00″S – 64°32′26.16″W, 1200 m (Gloger, 1967; Garrison et al., 2010). **Misiones**: Puerto Iguazú, {25°36′36.86″S – 54°33′46.00″W, 161m}, leg. Tomsic and Willink, 09.xi.1973, 1♂, MLP. **Salta**: Aguas Blancas, {22°44′10.00″S – 64°21′15.00″W, 419m}, leg. Bulla, 20.vii.1972, 15♂ 1♀, MLP; Anta, Dique Itiyuro, river above main dam, broad and muddy, 22°06′38.00″S – 63°44′54.00″W, 585m, leg. Garrison,

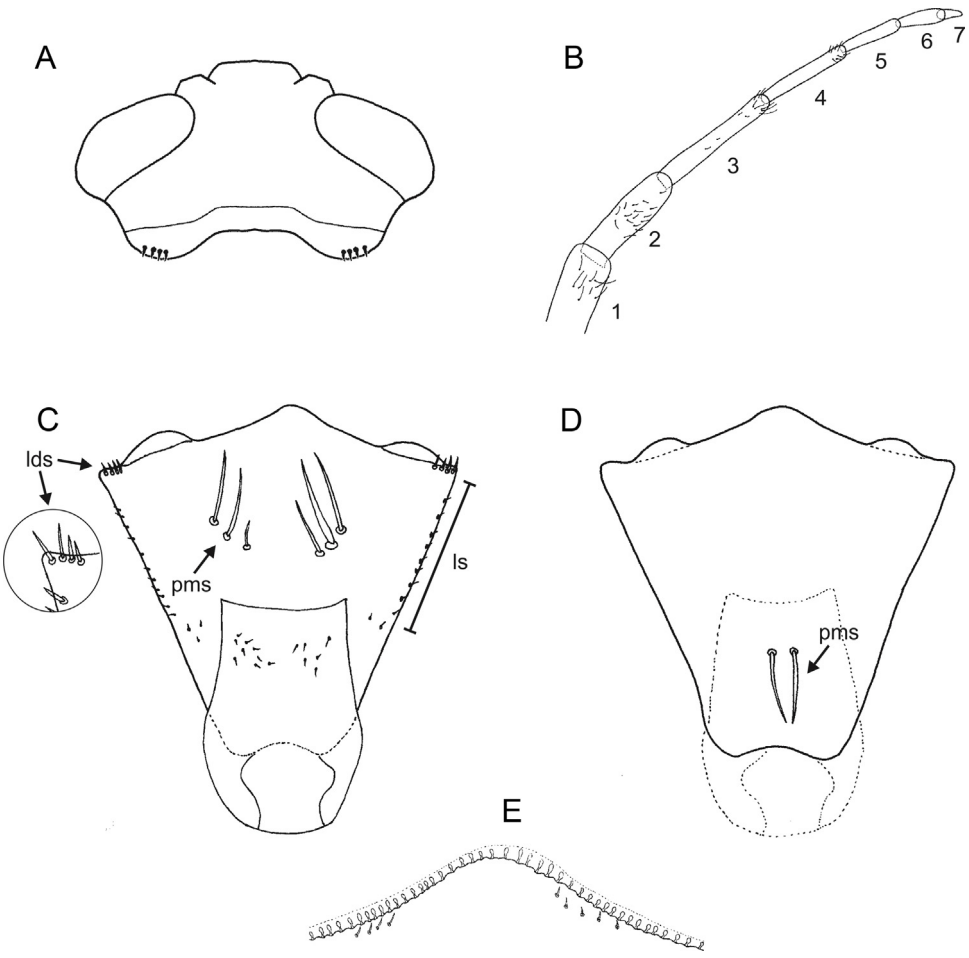


**Fig. 2.** *Acanthagrion floridense*, final stadium larva. (A) Head, dorsal view. (B) Antenna. (C) Prementum, dorsal view. (D) Prementum, ventral view. (E) Labial ligula, dorsal view. lds: laterodistal setae, ls: lateral setae, pms: premental setae.

28.x.2005, 1♀, CSCA; Apolinaro Saravia, shallow ponds with grass by provincial road 5, 24°26′16.00″S – 63°58′18.00″W, 360m, leg. von Ellenrieder, 01.xii.2007, 2♂, MLP; same as before except for: 1♂ 1♀ (in tandem), CSCA; Arroyo Agua Linda, 15 km N to Oran, 23°00′29.88″S – 64°21′59.04″W, 342 m (record provided by von Ellenrieder); Arroyo Castañares, 10 km de Salta, {24°42′02.00″S – 65°24′35.00″W, 1260m}, leg. Bulla, 17.iv.1973, 1♂, MLP; Arroyo del Medio, 17 km N to Oran, 22°58′32.88″S – 64°22′23.88″W, 349 m (record provided by von Ellenrieder); Arroyo Yacuy, {22°22′15.96″S – 63°46′21.00″W}, 792 m (von Ellenrieder and Lozano, 2008; Garrison et al., 2010); Barrio Los Lapachos, zanja, 24°47′00.00″S – 65°25′00.00″W, 1240m, leg. von Ellenrieder, 01.iv.1997, 1♂, MLP; Chicoana, Quebrada de Tilian, 25°07′50.88″S – 65°32′24.00″W, 130 m (record provided by von Ellenrieder); Dark water slough with PR 5, 24°29′53.00″S – 64°02′21.00″W, 385 m (record provided by von Ellenrieder); Dique El Tunal, 25°13′10.00″S – 64°29′12.00″W, 566 m (record provided by von Ellenrieder); Dique Itiyuro, Carapari river above main dam, 22°06′38.16″S – 63°44′53.88″W, 585 m (record provided by von Ellenrieder); Dique Itiyuro, small shaded stream afluent of Carapari river, 22°06′24.12″S – 63°43′22.08″W, 543 m (record provided by von Ellenrieder); Dique Itiyuro, spring below main dam, 22°06′05.04″S – 63°44′03.84″W, 552 m (record provided by von Ellenrieder); Laguna del Cielo, 26 km de Vespucio, {22°26′00.00″S, 63°58′00.00″W, 591m}, leg. Fidalgo, 30.xii.1969, 2♂, MLP; Laguna Los Lapachos, {24°46′25.84″S – 65°23′40.96″W, 1204m}, leg. von Ellenrieder, 01.iv.1997, 2♂, MLP; Las Lajitas, 24°44′24.00″S – 64°12′06.00″W, 499 m (record provided by von Ellenrieder); Pond at NR 81, 25°23′27.00″S – 64°38′17.00″W, 533 m (record provided by von Ellenrieder); Pond 1 km E of Embarcación, 23°12′18.00″S – 64°04′44.00″W, 392 m (record provided by von Ellenrieder); Pond at Nat Rt. 50, 16 km N to Orán, 23°00′30.00″S – 64°22′20.00″W, 351m, leg. Garrison and von Ellenrieder, 03.xi.2006, 1♂ 1♀ (in tandem), CSCA; Pond on Hwy 9 nr Embalse Campo Alegre, 24°33′38.88″S – 65°22′27.84″W, 1400 m (record provided by von Ellenrieder); Río Anta Muerta, 25 km al SE de Isla de Cañas, 23°07′00.00″S – 64°29′53.00″W, 496m, leg. Lozano and von Ellenrieder, 02.xii.2006, 3♂, MLP; same as before except for: 1♂ 1♀ (in copula), CSCA; Río Castellanos sobre ruta provincial 5, 25°06′40.00″S – 64°44′04.00″W, 715m, leg. von Ellenrieder, 09.iv.1998, 3♂, MLP; Rio del Valle Dorado, 24°42′12.00″S – 64°11′19.00″W, 467 m (record provided by von Ellenrieder); Río Pescado cerca de Orán, 22°53′00.00″S – 64°27′00.00″W, {491m}, leg. Porter, 26.v.1970, 1♀, FML; Río sin nombre 15 km al SE de Isla de Cañas, 22°55′32.00″S – 64°34′33.00″ W, 706m, leg. Lozano and von Ellenrieder, 02.xii.2006, 1♂, MLP; same as before except for: leg. von Ellenrieder, 22.v.2008, 1♀, CSCA; Río sin nombre 20 km al SE de Isla de Cañas, 22°57′30.00″S – 64°33′20.00″W, 661m, leg. von Ellenrieder, 17.v.2006, 1♂ 1♀ (in tandem), MLP; same as before except for: 09.ix.2006, 1♀; same as before except for: leg. Lozano and von Ellenrieder, 02.xii.2006, 10♂; Rio s/n 5 km SE Isla de Cañas, 22°56′04.92″S – 64°38′57.12″W, 761 m (record provided by von Ellenrieder); Ruta provincial 20 a Parque Nacional El Rey, 24°44′39.81″S – 64°36′42.10″W, 880m}, leg. von Ellenrieder, 09.iv.1998, 2♂, MLP; Sumalao, {24°57′56.00″S – 65°29′21″W, 1242m}, leg. Jurzitza, 31.i.1989, 1♂, MLP. **San Luis**: Bajo de Veliz, Arroyo Rincón del Carmen, 32°18′45.40″S – 65°24′42.10″W, 650m,

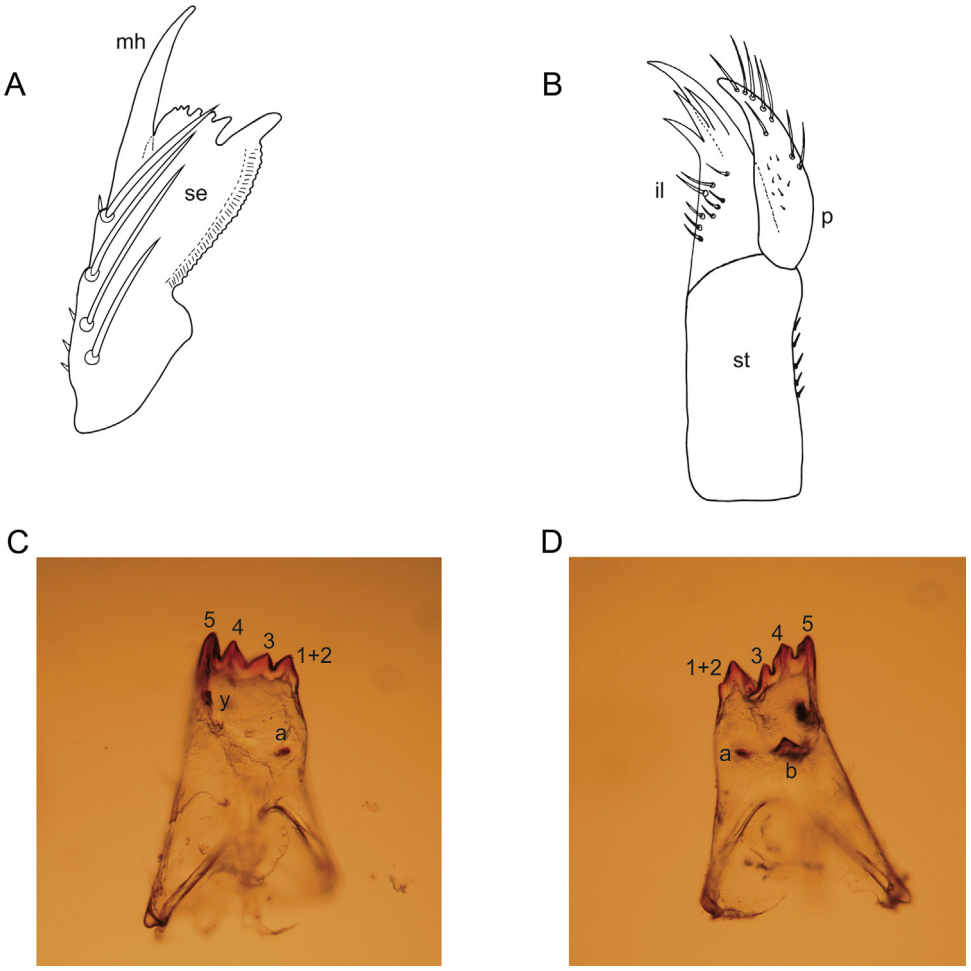


**Fig. 3.** *Acanthagrion floridense*, final stadium larva. (A) Labial palp. (B) Maxilla. (C) Right mandible. (D) Left mandible. il: inner lobe (galea + lascinia), mh: movable hook, p: palp, se: setae, st: stipes.

leg. Muzón, 16.xi.2007, 3♂, MLP. **Santiago del Estero**: Embalse Río Hondo, Termas de Río Hondo, 27°30′54.20″S – 64°53′26.5″W, {270m}, leg. Muzón and von Ellenrieder, 07.i.1997, 1♂, MLP. **Tucumán**: Arroyo El Tala, ruta nacional 34, {26°13′08.00″S – 64°30′44.00″W, 422m}, leg. Fidalgo, 24.i.1979, 2♀, FML; Concordia, {26°49′19.63”S – 65°17′00.24”W}, 465 m (Fraser, 1948); Horco Molle, Yerba Buena, 26°46′59.88″S – 65°21′00.00″W, 939 m (record provided by von Ellenrieder); Pozo junto a la ruta provincial 307, 27°01′27.00″S – 65°39′27.00″W, {1384m}, leg. Muzón and von Ellenrieder, 08.i.1997, 1♂, MLP; Río Nío, 40 km al NO de Tucumán, {26°26′00.00″S – 64°56′00.00″W, 902m}, leg. Bach, 05.xi.1065, 1♂, MLP; Río sin nombre, ruta nacional 9 km 895 cerca de Monteagudo, 5 km S de Río Chico, {27°29′50.00″S – 65°37′03.00″W, 373m}, leg. Muzón and von Ellenrieder, 07.i.1997, 2♂, MLP; Río Tapia sobre ruta nacional 9, 26°36′36.00″S – 65°15′54.00″W, {831m}, leg. Molineri, 28.xii.2000, 2♂, IBN; San Miguel de Tucumán, 26°46′59.88″S – 65°22′59.88″W, 435 m (record provided by von Ellenrieder); San Miguel de Tucumán, Instituto Miguel Lillo (fuente), {26°49′53.30″S – 65°13′18.60″W, 451m}, leg. Molineri, 30.iii.2000, 1♀, IBN; Villa Benjamin Araoz, {26°33′18.00”S – 64°47′49.00”W}, 564 m (Fraser, 1948); Yerba Buena, {26°49′00.01″S – 65°19′00.05″W, 516m}, leg. Molineri, 04.i.2005, 1♂, IBN.

**BOLIVIA**: **La Paz**: Caranavi, Río Coroico y charcas asociadas, 15°50′43.40″S – 67°32′46.00″W, 620m, leg. von Ellenrieder, 10.i.2000, 4♂, MLP; Mapiri, N de la Paz, {15°15′00.00″S – 68°10′00.00″W, 557m}, leg. unknown, 11–15.viii.1989, 1♂, MLP. **Tarija**: Provincia de Gran Chaco, Río Caraparí cerca de Caraparí, 21°55′46.20″S, 63°46′26.10″W, 810m, leg. Molineri and Manzo, 10.x.2004, 1♂, IBN. **BRAZIL**: **Rondônia**: Fazenda Rancho Grande 60 km S Ariquemes, 10°30′00.00″S, 63°42′00.00″W, {188m}, leg. Dunkle, 16–24.iii.1989, 1♂ 1♀ (in tandem), MLP; Fazenda Rancho Grande 62 km SW of Ariquemes, 10°50′00.00″S – 63°07′00.00″W, {187m}, leg. Garrison, 02-11.xi.1989, 1♂, MLP. **COLOMBIA**: **Meta**: Acacias, Vda. San José, Colegio Departamental Agropecuario, {03°59′06.00″N – 73°45′37.01″W}, 660 m (Rojas-R and Sánchez, 2009); Restrepo, Caño Seco, {04°12′42.43″N – 73°33′49.79″W, 484m}, leg. Flint Jr., 11.ii.1983, 1♂, MLP; Restrepo, Vda. El Palmar, Caño Caribe, {03°49′30.00″N – 76°31′30.00″W}, 1414 m (Rojas-R and Sánchez, 2009); San Juan de Arama, Finca, Caño Limón, {03°22′13.01″N – 73°44′30.01″W}, 400 m (Rojas-R and Sánchez, 2009); Villavicencio, Vda. Buena Vista, Fca. Juanambú, {04°08′06.22″N – 73°35′40.20″W}, 700 m (Rojas-R and Sánchez, 2009); Villavicencio, Vda. Cocuy, Río Negro, {04°09′00.00″N – 73°37′59.99″W}, 450 m (Rojas-R and Sánchez, 2009). **ECUADOR**: **Napo**: Cotos, {01°03′40.50″S – 77°45′07.02″W}, 453 m (Leonard, 1977); Pond along Río Sinde, ca. 5 km E of Puerto Napo bridge, 01°03′00.00″S – 77°44′32.00″W, 430 m (Tennessen, 2012); Río Anzu, {01°04′01.20″S – 77°48′00.00″W}, 493 m (Leonard, 1977); Río Ila, {01°06′00.00″S – 77°57′00.00″W}, 700 m (Leonard, 1977); Río Jatun Yacu, {01°04′01.20″S – 77°48′00.00″W}, 493 m (Leonard, 1977); Tena, {00°59′20.97″S – 77°48′55.03″ W, 507m}, leg. Flint Jr., 13.ix.1990, 2♂, USNM. **Orellana**: Tiputini Biodiversity Station, 00°38′00.00″S – 76°09′00.00″W, 220 m (von Ellenrieder et al., 2009 von Ellenrieder and Garrison, 2009) **Pastaza**: Puyo,

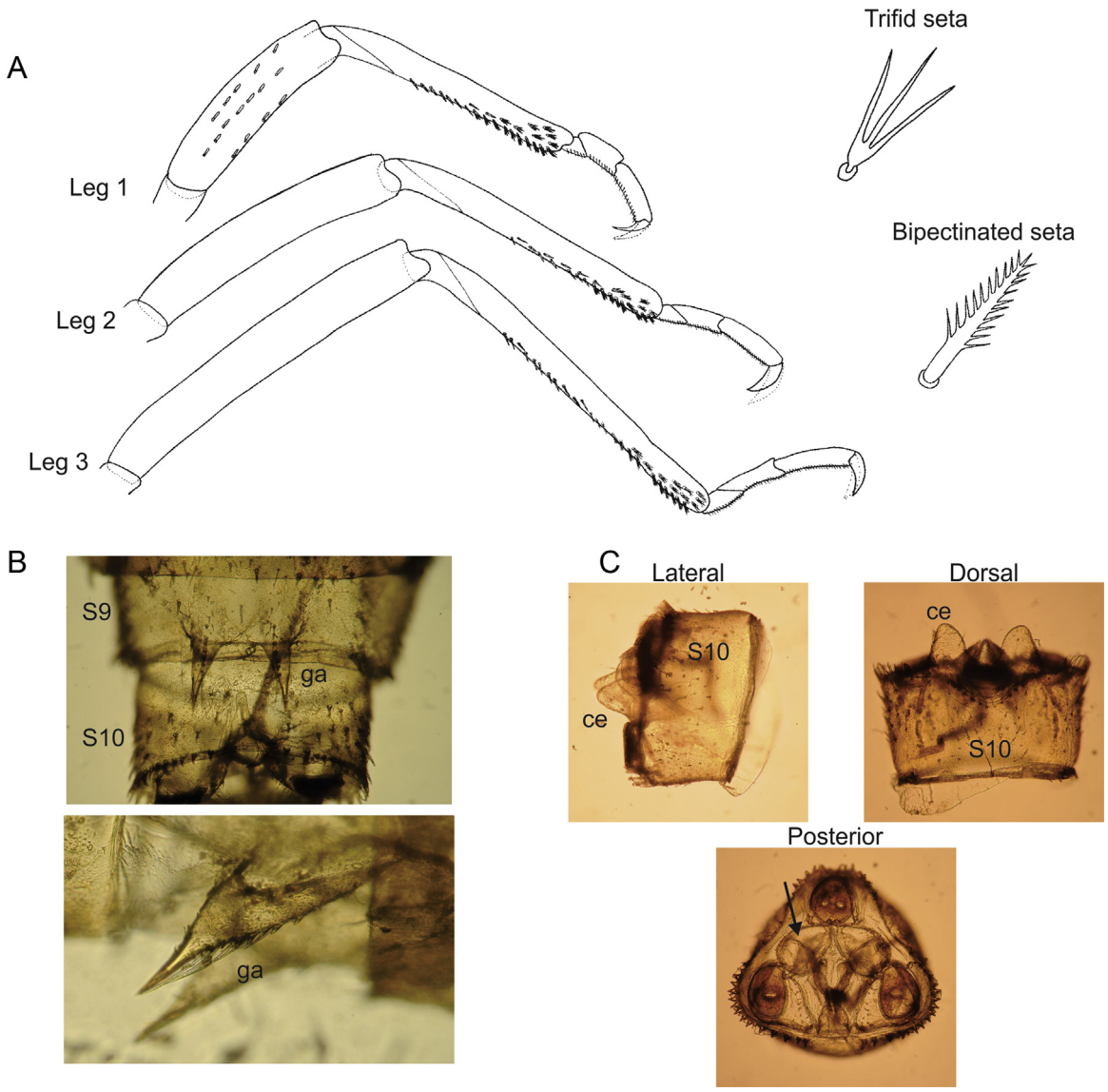


**Fig. 4.** *Acanthagrion floridense*, final stadium larva. (A) Legs with details of setae tibial and tarsal setae. (B) Male gonapophysis ventral and lateral views. (C) Male cerci, lateral, dorsal and posterior views, arrow indicating concavity of cerci. ga: gonapophyses.

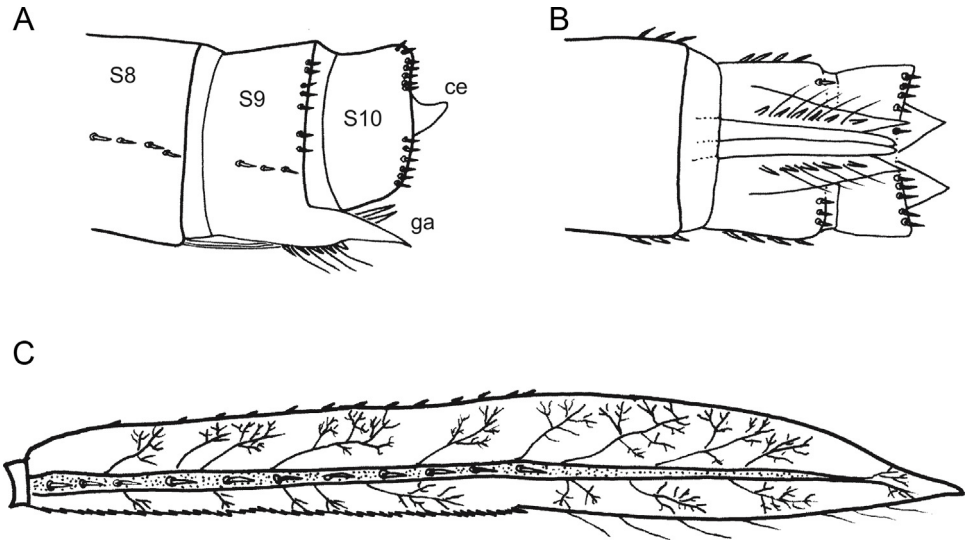


**Fig. 5.** *Acanthagrion floridense*, final stadium larva. (A) Female ovipositor, lateral view. (B) Female ovipositor, ventral view. (C) Lateral caudal lamellae, lateral view. ce: cerci, ga: gonapophyses.

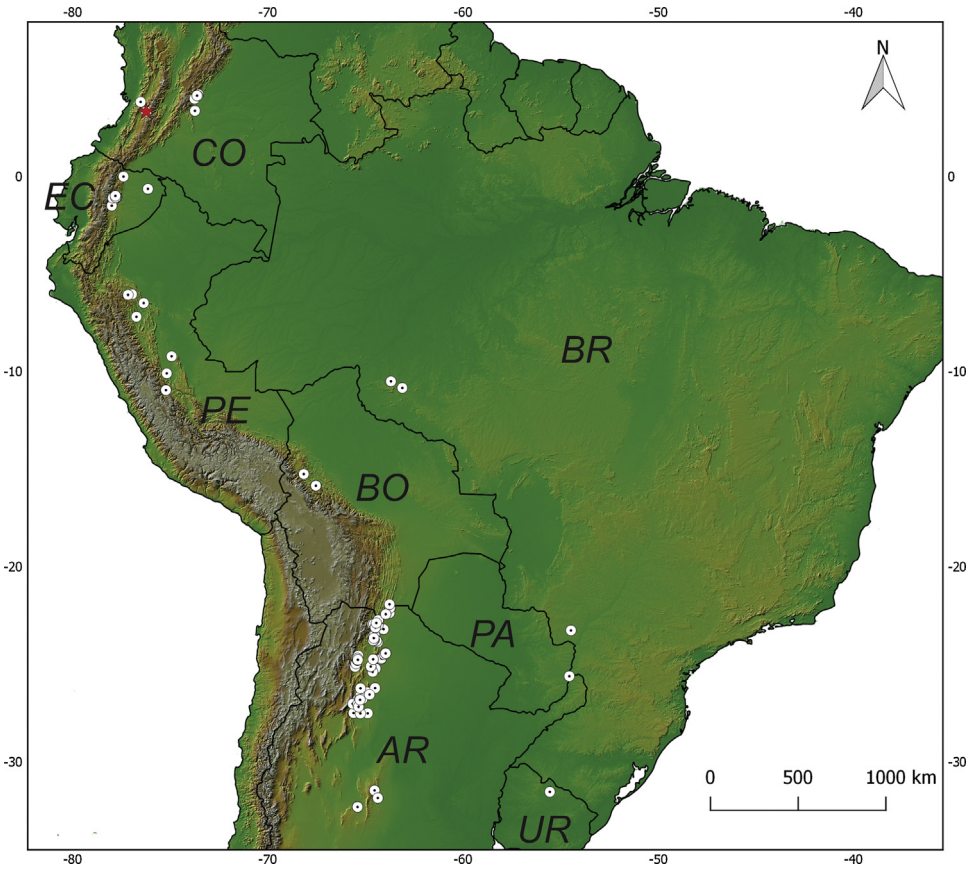


**Fig. 6.** *Acanthagrion floridense*, distribution map. Star indicating type locality. AR: Argentina, BO: Bolivia, BR: Brazil, CO: Colombia, EC: Ecuador, PA: Paraguay, PE: Peru, UR: Uruguay. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

{01°29′43.91″S – 78°00′09.08″W}, 1000m. **Sucumbios**: Swamp-forest pond near stream, Hwy. E45 ca. 52 km NE of Chaco, 00°00′04.00″S – 77°24′07.00″W, 685 m (Tennessen, 2012). **PERU**: **Huánuco**: Río Pachitea, {09°13′00.98″S – 74°56′14.75″W}, 224 m (Leonard, 1977). **Junín**: Campamiento (Colonia del Perene), {10°56′49.99″S – 75°13′34.00″W}, 666 m (Leonard, 1977). **Pasco**: Chuchuras, {10°05′23.71″S – 75°11′06.72″W}, 269 m (Leonard, 1977). **San Martín**: Moyobamba, {06°01′59.99″S – 76°58′00.01″W}, 837 m (Leonard, 1977); Río Seco, {07°11′10.54″S – 76°44′17.02″W}, 300 m (Leonard, 1977); Rioja, {06°03′53.93″S – 77°10′08.76″W}, 842 m (Leonard, 1977); Tarapoto, {06°28′59.99″S – 76°22′00.01″W}, 526 m (Leonard, 1977). **URUGUAY**: **Rivera**: Rivera, Santa Ernestina, cerca Mina de Corrales, Arroyo sin nombre sobre ruta 29, 31°32′23.80″S – 55°33′42.00″W, 146 m (von Ellenrieder et al., 2009).

*Acanthagrion floridense* is recorded for the first time from Misiones (previous records of *A. floridense* for Misiones refer to *A. gracile*) and San Luis provinces in Argentina, and for La Paz and Tarija departments in Bolivia.

## 4. Diagnosis

*Acanthagrion floridense* displays the typical color pattern within *Acanthagrion*, i.e. with dark black and pale light blue areas on head, thorax and abdomen (von Ellenrieder and Lozano, 2008; Lozano 2013). Male genital ligula (Figs. 1 E, F, 7A–C) has segment 3 narrow, lateral lobes long (reaching segment 2), approximately at 0.5 the length of segment 3 (unique within the genus); ental surface with a short transversal ridge between lateral lobes and a small swelling in distal half; distal margin convex without indentation, with its lateral margins slightly projected. Male terminalia (Figs. 1 C, D, 7 D–E) with a height of S10/S9 between 0.9 and 1.2; cerci long (more than 0.5 the length of S10) with inner margin of cerci straight; in lateral view with a constriction in proximal third; paraprocts with apophysis curved upwards from the base, not surpassing tip of cerci. Females with mesostigmal plates (Fig. 8A) without diagonal carina or hairs; interlaminar sinus triangular (width/length <1); mesepisternal fossae subcircular, contiguous to interlaminar sinus, not elevated, separated from each other by the middorsal carina (Fig. 8A). Vulvar spine present (Fig. 8B)

*Acanthagrion floridense* is placed within Leonard's *viridescens* group. In terms of the morphology of the cerci, this species group can be subdivided into species with cerci shorter than 2/3 of height of S10 (*A. cuyabae*, *A. lancea*, *A. truncatum*, *A. viridescens*), and species with cerci as long as or slightly longer than height of S10 (*A. gracile*, *A. floridense*, *A. peruanum*). *Acanthagiron floridense* can be easily distinguished from *A. gracile* and *A. peruanum* by the shape of the genital ligula: segment 3 with distal lobes visible in ventral view (absent in *A. peruanum*); lateral lobes of segment 3 reaching segment 2 (not reaching segment 2 in *A. gracile* and *A. peruanum*).

The females of *A. floridense* share with *A. gracile* and *A. peruanum* a long subtriangular sinus (as long as/or longer than 1.5 the width). *A. floridense* can be easily distinguished from *A. peruanum* because the mesepisternal fossae are confluent in *A. peruanum*. However, the females of *A. floridense* and *A. gracile* are almost indistinguishable; even though the interlaminar sinus is generally shorter in *A. floridense*, their ranges overlap, so in many cases reliable identification of females cannot be done unless taken in association with males.

Anjos-Santos et al. (2011) presented a table with characters to distinguish two groups of larvae in *Acanthagrion* based on the work of Novelo-Gutiérrez (2009). The larva of *A. floridense* has the same

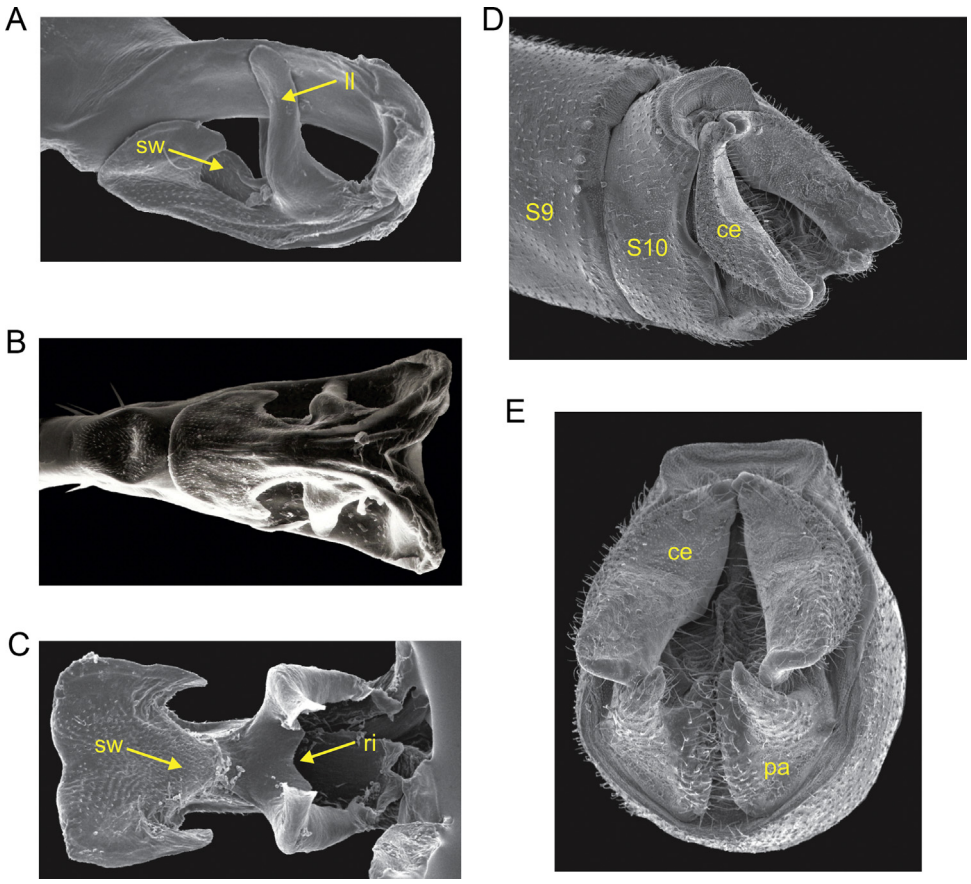


**Fig. 7.** *Acanthagrion floridense*, adult male. (A) Genital ligula, lateral view. (B) Genital ligula, ventral view. (C) Genital ligula, ental surface of segment 3. (D) Terminalia, posterolateral view. (E) Terminalia, posterior view. ce: cerci, ll: lateral lobe, pa: paraproct, ri: transversal ridge, sw: distal swelling.

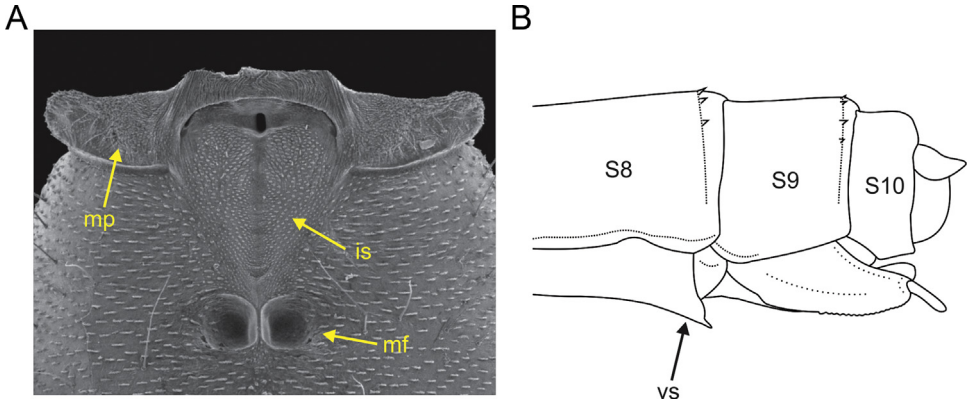


**Fig. 8.** *Acanthagrion floridense*, adult female. (A) Pterothorax, dorsal view. (B) Ovipositor, lateral view. is: interlaminar sinus, mf: mesepisternal fossae, mp: mesostigmal plate, vs: vulvar spine.

characters states as that of *A. lancea*, and thus it would pertain to "group II". We found only two characters to distinguish both species: 1) the incisors 3 and 4 are fused in *A. lancea* but separated in *A. floridense*; and 2) a lateral row of robust spiniform setae is present in S7–S9 in *A. floridense* (Fig. 5A) and in S2-S10 in *A. lancea*.

The following combination of characters may be used to distinguish last instar larvae of *A. floridense*: 1) cephalic lobes rounded; 2) 7 antennomeres present; 3) 4 labial palp setae; 3) 2 + 1 or 3 premental setae; 4) right mandible wit incisors 3 and 4 separated and distinguishable, mandibular formula: left 1 + 2 3 4 5 0 a b, right 1 + 2 3 4 5 y a; 5) wing pads reaching middle of S4; 6) lateral row of robust spiniform setae present on S7-S9; and 7) apex of caudal lamellae acute.

## Acknowledgements

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