

# The genus *Andinagrion*, with description of *A. garrisoni* sp. nov. and its larva from Argentina (Odonata: Coenagrionidae)

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## ABSTRACT

This study includes the description of a new species of the genus *Andinagrion*, *A. garrisoni* (holotype: Argentina, Río Caldera, Salta prov., 11 xi 2005, deposited at MLP), both from its adult and larval stages, a diagnosis of all known species, including a key to adults, synonymic lists, illustrations of diagnostic characters, and distribution maps.

## INTRODUCTION

The exclusively South American genus *Andinagrion* was established by Bulla (1973b) for the reception of *Oxyagrion saliceti* Ris, 1904 and *O. peterseni* Ris, 1908. Ris (1904) had mentioned that his new species *O. saliceti* was of doubtful placement, sharing the origin of CuA proximal to the anal cross vein with *Amphiagrion*, but differing from that genus and closely approaching *Oxyagrion* by the long, narrow and pointed quadrangle. He considered it as a somewhat 'aberrant' small *Oxyagrion*, and reiterated this view when describing *O. peterseni* (Ris 1908), mentioning that both species stood very close together.

Later, Bulla (1973b) separated these two species in his new genus *Andinagrion*, based on differences of the morphology of cerci and genital ligula in the male and thorax in the female, in addition to the differences in size, color and venation already mentioned by Ris (1904, 1908).

Bulla (1973b) observed variability in the male color pattern of *A. peterseni*, and considered it to be the result of geographic variation; he described a cline in the extension of the light blue areas of the abdomen, from more extended in the higher altitude areas of the northern distribution limit of the species, to more reduced in the southern populations at higher latitudes. We however found that there are two distinct species included in Bulla's (1973b) concept of *A. peterseni*, which differ not only in color pattern but also in morphology of cerci, genital ligula and female

mesostigmal plates. Here we describe both adults and final stadium larva of the second species, provide a key, synonymic list, diagnosis and updated distribution range for the three known species, and designate a lectotype for *A. peterseni*, the name bearing species of the genus. The larva of *A. saliceti* remains undescribed; that of *A. peterseni* was described by Bulla (1973a) based on specimens from Mendoza and Buenos Aires provinces, and we provide here some additional illustrations of diagnostic characters.

## MATERIAL AND METHODS

Diagnoses, synonymies and distribution ranges are provided for all species. All specimens listed were examined to establish variability of characters. All characters were illustrated with the aid of a camera lucida and drawings are to scale except where indicated. Photographs of male genitalia were taken with a Jeol JSM – T100 scanning electron microscope. Measurements are in mm. Wing terminology follows Riek & Kukalová-Peck (1984), mandibular formula for larvae Watson (1956), and biogeographic scheme Morrone (1999). Maps represent distribution records from collections and reliable literature records, and were created electronically from the Digital Chart of the World (1:1,000,000) using ArcView 9.1. Elevation data and longitude/latitude coordinates were culled from the Global Gazetteer website (<<http://www.fallingrain.com/world/>>).

Acronyms for collections are as follows:

ABM	Angelo B.M. Machado personal collection, Belo Horizonte, Brazil
BMNH	Natural History Museum, London, UK
DRP	Dennis R. Paulson personal collection, Seattle, USA
FL	Frederico A. Lencioni personal collection, São Paulo, Brazil
FML	Fundación Miguel Lillo, Tucumán, Argentina
FSCA	Florida State Collection of Arthropods, Gainesville, USA
IZA	Instituto de Zoología Agrícola, Maracay, Venezuela
KJT	Kenneth J. Tennessen personal collection, Wautoma, USA
MCZ	Museum of Comparative Zoology, Harvard, USA
MLP	Departamento Científico Entomología, Museo de La Plata, Argentina
MNRJ	Museo de Rio de Janeiro, Brazil
NE	N. von Ellenrieder personal collection, Salta, Argentina
RWG	Rosser W. Garrison personal collection, Sacramento, USA
SD	Sid Dunkle personal collection, Plano, USA
SMFD	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany
TWD	Thomas W. Donnelly personal collection, Binghamton, USA
UMMZ	University of Michigan, Museum of Zoology, M.I., USA
USNM	U.S. National Museum, Washington D.C., USA

Acronyms for collectors are as follows:

JM	Javier Muzón
NE	Natalia von Ellenrieder
RWG	Rosser W. Garrison

## *Andinagrion* Bulla, 1973

*Andinagrion* Bulla, 1973b: 511-522, figs 25-36, 49, 50, 52, 53, 55, 58-65, distribution map (description of genus); — Bulla (1973c: 222, 225-226, figs 12-15, key).

Type species: *Oxyagrion peterseni* Ris, 1908 (Bulla 1973b: 512 by original designation).

### Diagnosis

Small (Fw 14-18 mm), predominantly red and black coenagrionids, some light blue areas present on abdomen in two species (Figs 1e, 1g, 1h, 2a-e) with a round frons, hyaline wings, CuA arising proximal to anal crossing (Figs 3a, 3b), male cercus horizontal with a planar subquadrate (Figs 10c, 10f, 10i) or triangular (Figs 7c, 7d, 10a, 10b, 10d, 10e, 10g, 10h) disto-ventral branch, distal segment of genital ligula with two pairs of lateral lobes (Figs 7b, 8a-f) and an internal fold (Figs 8f, 9c), female mesostigmal plates lacking mesepisternal fossae (Figs 4d-f, 7a) and female S8 with a vulvar spine.

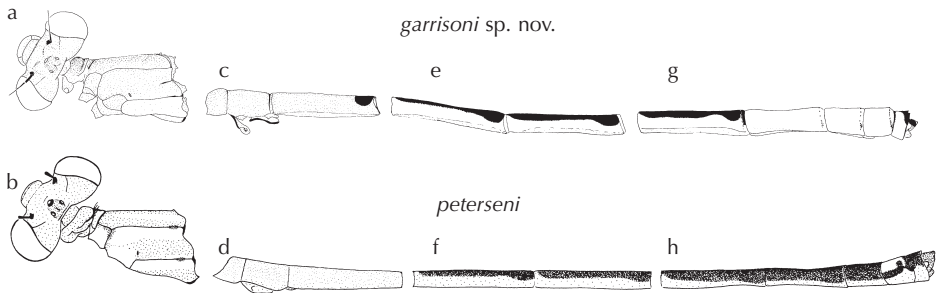


Figure 1: Male color pattern of two *Andinagrion* species — (a, b) head (dorsal view) and thorax (lateral view); (c-h) abdomen (lateral view) — (a, c, e, g) *A. garrisoni* sp. nov., male holotype; (b, d, f, h) *A. peterseni*, male lectotype.

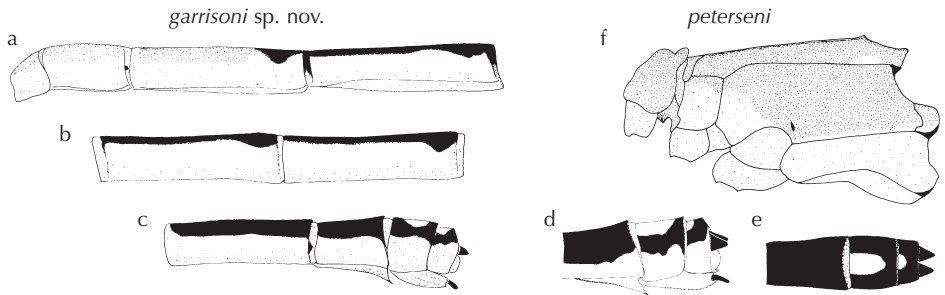


Figure 2: Female color pattern of two *Andinagrion* species — (a-d) abdomen (lateral view); (e) abdomen (dorsal view); (f) thorax (lateral view) — (a-c) *A. garrisoni* sp. nov., female allotype; (d-f) *A. peterseni*, female paralectotype.

KEY TO ADULTS OF *Andinagrion*

1. Color not including blue; ventral branch of male cercus subquadrate in postero-medial view (Fig. 10c); tips of basal and distal lateral lobes of male genital ligula distal segment rounded (Fig. 9d); postero-medial carina of female mesostigmal plate projected anteriorly reaching anterior margin (Fig. 4f); flatlands of Buenos Aires province in Argentina and Uruguay (Fig. 11) ..... *Andinagrion saliceti*

1'. Color including some light blue spots or areas on abdomen (Figs 1e, 1g, 1h, 2 a-e); ventral branch of male cercus subtriangular in posteromedial view (Figs 10a, 10b); at least one lateral lobe of male genital ligula distal segment with tip pointed (Figs 8a-f, 9a, 9b); postero-medial carina of female mesostigmal plate not projected anteriorly (Fig. 4d) or projected but extending only half way to anterior margin (Fig. 4e); Argentina along the Andes from Salta to Río Negro provinces, and to the E in Buenos Aires province (Fig. 11) ..... 2

2. Dorsum of male S7 light blue (Fig. 1g); sides of female S4-7 light blue (Figs 2a-c); male cercus as wide (A) as 1-1.3 of its length (B) in posteromedial view (Fig. 10a), with tip bluntly pointed (Figs 10a, 10j); distal lobe of male genital ligula distal segment with tip pointed (Figs. 9a, 9b), base of basal lobe wider than base of distal lobe (Figs 9a, 9b); dorsal surface of female mesostigmal plate almost flat with a slight longitudinal depression paralleling medial margin, and postero-medial carina transverse (Fig. 4d); anterior margin of female mesostigmal plate straight to slightly concave (Fig. 4d); E slope of Subandean mountain chains in Salta and Jujuy provinces (Fig. 11) ..... *Andinagrion garrisoni*

2'. Dorsum of male S7 black (Fig. 1h); sides of female S4-7 yellow; male cercus about as wide (A) as 0.83-0.9 of its length (B) in posteromedial view (Fig. 10b), with tip acutely pointed (Figs 7e, 10b, 10k); basal lateral lobe of male genital ligula distal segment with tip pointed, distal lobe with rounded tip (Fig. 8a, 8c, 8e); base of basal lobe narrower than base of distal lobe (Fig. 8a-f); dorsal surface of female mesostigmal plate with a marked longitudinal sulcus paralleling medial margin, and postero-medial carina projected anteriorly about half way to anterior margin along outer margin of sulcus (Figs 4e, 7a); anterior margin of female mesostigmal plate with a marked concavity (Figs 4e, 7a); SW of Salta to Río Negro province along the Andes, Somuncurá plateau in Río Negro province and Sierra de la Ventana hills in Buenos Aires province (Fig. 11) ..... *Andinagrion peterseni*

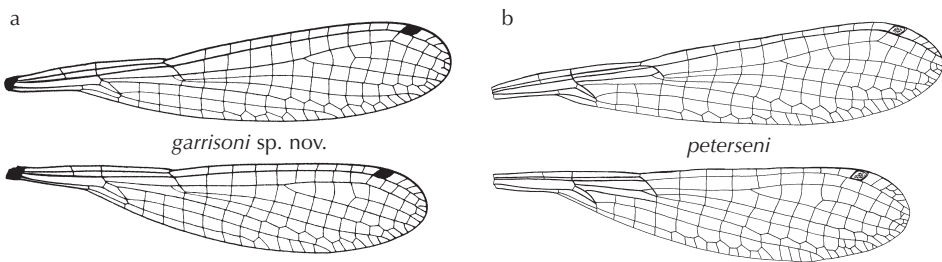


Figure 3: Wings of two *Andinagrion* species — (a) *A. garrisoni* sp. nov., male paratype from Jujuy, Angostura, right pair; (b) *A. peterseni*, lectotype male, left pair.

*Andinagrion garrisoni* sp. nov.

(Figs 1a, 1c, 1e, 1g, 2a-c, 3a, 4a, 4d, 5a-f, 6a-d, 6g, 6h,  
9a, 9b, 10a, 10d, 10g, 10j, 11, Plate VIIa)

*Andinagrion peterseni* nec Ris — Bulla (1973b: 513-515, figs. 51, 54, at least in part: records from Arroyo Castañares, Salta); — Rodrigues Capítulo (1992: 54, in part: mention from Jujuy); — Muzón (1995: 3, in part: mention from Jujuy); — Donnelly (1997: 7, records from Salta); — Muzón & von Ellenrieder (1998: 25, in part: mention from Jujuy).

**Type locality:** Argentina, Salta province, Río Caldera ca 5 km S to Campo Alegre Dam, side stream with macrophytes (24°35'41"S, 65°22'10"W; 1,419 m a.s.l.).

**Type status:** holotype ♂, allotype ♀.

**Type depository:** MLP.

## Etymology

We name this species *garrisoni* (Latinized genitive masculine noun) after our good friend and admired colleague Rosser W. Garrison, who has always lent us his generous help and support.

## Specimens examined

Total number of adult specimens examined: 81 ♂, 10 ♀. — **Holotype** ♂: 11 xi 2005, RG and NE leg. (MLP). **Allotype** ♀: same data as holotype (in copula). — **Paratypes** (76 ♂, 7 ♀): Argentina, Salta province: 3 ♂, 1 ♂♀ in tandem, same data as holotype (RWG); 1 ♂ same but (NE); 3 ♂ Sumalao, 30 i 1989, G. Jurzitza leg. (RWG); 1 ♂ Castellanos, stream and pond at Lesser (24°40'56"S, 65°28'40"W), 13 i 1997, T.W. Donnelly leg. (RWG); 10 ♂ same but NE and JM leg. (MLP); 2 ♂, 1 ♂♀ in tandem, same but 11 i 1998, NE leg. (MLP); 14 ♂, 1 ♂♀ in tandem, same but 23 iii 1999 (MLP); 2 ♂ same but (RWG); 8 ♂ same but 29 i 2000 (MLP); 4 ♂ same but 19 iv 2001 (MLP); 4 ♂ same but 10-12 xi 2005, NE and RG leg. (RWG); 1 ♂ same but (ABM); 1 ♂ same but (MNRJ); 1 ♂ same but 02 i 2006, NE leg. (KJT); 1 ♂ same (TWD); 1 ♂ same but 08 iii 2006, NE leg. (NE). — Jujuy province: 1 ♂ La Angostura, stream and pond (24°27'05"S, 65°22'40"W; 1,532 m) NE leg., 21 iv 2001 (FL); 1 ♂ same but (RWG); 1 ♂, 2 ♂♀ in copula, same but 08 xii 2005 (NE); 1 ♂ same but (BMNH); 1 ♂ same but (DRP); 1 ♂ same but (FSCA); 1 ♂ same but (IZA); 1 ♂ same but (MCZ); 1 ♂ same but (SD); 1 ♂ same but (SMFD); 1 ♂ same but (UMMZ); 1 ♂ same but (USNM); 1 ♂♀ in copula same but 08 i 2006 (FML), 1 ♂♀ in tandem, same but (RWG). — **Other specimens** (not included in type series due to bad preservation status): Argentina, Salta province: 1 ♀ Tacuil, Willink and Stange leg., 08 xii 1968 (FML). — Jujuy province: 3 ♂ Tilcara, laguna, A. Rodrigues Capítulo leg., 19 iv 1989 (MLP); 2 ♂ same but Tilcara, Rio Grande, bañado (salar), 20 iv 1989 (MLP); 1 ♀ Uquía (23°18'0"S, 65°20'60"W; 2,800 m) A. Willink leg., 21 iii 1967 (FML); 1 ♀ Laguna Yala (24°7'0"S, 65°22'60"W; 1,639 m) Birabén leg., 15 v 1985 (MLP). — **Exuviae:** 2 ♂ (from reared specimens): Argentina, Jujuy province, La Angostura, vegetated pond alongside river (24°27'05"S, 65°22'40"W; 1,532 m) NE leg., 08 i 2006 (NE).

Male holotype

**Head:** labium, mandibles, and distal half of labrum pale yellow; basal half of labrum, clypeus, and frons reddish brown. Frons rounded; top of head reddish brown; venter of head pale yellow. Antennae dark brown (Fig. 1a).

**Thorax:** prothorax largely reddish brown, with posterior lobe of pronotum rectangular with a slight medial concavity on distal margin. Mesepisternum dark reddish brown, slightly lighter along sides of medial carina; mesepimeron pale brown, metepisternum and metepimeron pale yellowish brown (Fig. 1a). Venter of thorax, coxae, and trochanters pale yellow. Femora brown, except for basal yellowish stripe; tibiae and tarsi yellow, distal half of pretarsi black. Black slender spines on femora and tibiae. Wings (as in Fig. 3a) hyaline; pterostigma covering one cell, reddish brown with a marginal yellow hairline; petiolation reaching midpoint between Ax 1 and 2; Px 9 in Fw, 8 in Hw; RP2 branching between Px 4-5 in Fw, between 3-4 in Hw; IRP2 arising at level of Px 7 in FW, of Px 6 in Hw.

**Abdomen:** venter pale yellow; S1 with an elongated black spot at basal  $\frac{2}{3}$  (Fig. 1c); S4-6 with a ventral mediolongitudinal black line (Fig. 1e). Dorsum and sides predominantly red on S1-3, and light blue on S4-10 (Fig. 1g). S3 with a black rounded spot at posterior  $\frac{1}{6}$ ; S4-6 with a black mediolongitudinal dorsal stripe as wide as  $\frac{1}{2}$  of segment width, then widening to full width at posterior  $\frac{1}{6}$ ; S7-9 almost entirely light blue, except for small black posterolateral spot on intersegmental membrane and posterolateral diffuse dark small spot on posterior  $\frac{1}{3}$  of S8-9; S10 with posterior  $\frac{1}{3}$  and anterior margin narrowly black. Cerci yellow with external surface and tip of ventral branch black; paraprocts yellow with pointed mediodorsal projection black. Apex of cercus less sclerotized than remainder of cercus and surrounded by numerous hairs (Figs 10a, 10d, 10g), with bluntly pointed tip (Figs 10a, 10j); in posteromedial view triangular and slightly wider than long – width (A)/length (B) 1.12 (Fig. 10a); in lateral view (Fig. 10d) about as wide as 0.8 its length. Genital ligula with two lateral lobes with basally directed tips; tip of distal lobe pointed, of basal lobe rounded (as in Figs 9a, 9b); base of distal lobe narrower than base of basal lobe (as in Figs 9a, 9b).

**Dimensions:** total length 28; abdomen length 22; Fw 16; Hw 15; costal side of Fw Pt 0.5.

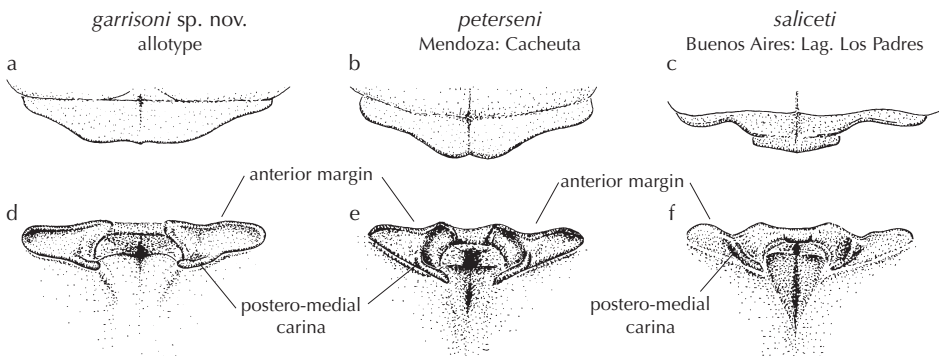


Figure 4: Female prothorax of all *Andinagrion* species, dorsal view — (a-c) posterior lobe; (d-f) mesostigmal plates.

## Female allotype

**Head:** as in holotype male but reddish brown areas replaced by olive brown; rear of head pale reddish brown.

**Thorax:** anterior and medial lobes of pronotum predominantly pale bluish brown; posterior lobe pale reddish brown, trapezoidal, and with a short triangular projection at medial portion (Fig. 4a). Mesostigmal plates (Fig. 4d) each about as wide as space between them, slightly narrowed at distal half, with dorsal surface almost flat, with a slight longitudinal depression paralleling medial margin; postero-medial carina transverse; anterior margin approximately straight to slightly concave. Medial half of mesepisternum olive brown; medial carina lighter; outer half pale reddish brown. Mesepimeron and metepisternum pale olive brown; mesepimeral-metepisternal suture and metepimeron yellow. Venter of thorax and legs yellow, except extreme tip of tarsi and distal half of pretarsal claws black. Wings as in holotype male, except yellowish brown Pt, and Fw Px 10, Hw Px 7 (right) - 8 (left).

**Abdomen:** color pattern as in male holotype, except for black mediolongitudinal line on venter of all segments (Fig. 2a-c); S7-8 black dorsally with light blue limited to a lateral stripe; S9-10 black dorsally with light blue color limited to a mediadorsal spot, which is rhomboidal on S8, and rounded on S9. Tip of vulvar spine and styli of S9 black; cerci conical and yellow except for dark brown mediodorsal surface.

**Dimensions:** total length 28.2; abdomen length 22.2; Fw 17.3; Hw 15.8; costal side of Fw Pt 0.5.

## Variation in paratypes

Dorsum of pterothorax in some males dark reddish brown (30%) or pale brown (5%); black spot on distal  $\frac{1}{6}$  of S3 diffuse (13%); S7-9 entirely light blue (11%) or with a small dark dorsolateral spot on each side (22%). Posterior lobe of pterothorax in some females with a medial V-shaped excision and no triangular projection as in Fig. 4b (20%), anterior margin of mesostigmal plates slightly concave (20%), and black spot on S3 extending along distal half of that segment (30%). All examined females have an 'andromorph' color pattern, but 'heteromorph' females do probably also exist. Genital ligula was examined under a binocular microscope in 30% of specimens; in 15% of them both basal and distal lateral lobes of distal segment were pointed. Px 9-11 in Fw, 7-9 in Hw in males, and Px 10-11 in Fw, 8-9 in Hw in females.

**Dimensions:** average and standard deviation; range in square brackets;  $n = 40\%$  of paratypes; males  $n = 35$ ; females  $n = 6$ ): total length males:  $27.4 \pm 1.01$  [25.0-29.0], females:  $28.6 \pm 0.9$  [27.2-29.5]; abdomen length males  $21.7 \pm 0.8$  [20.2-23.5], females  $22.7 \pm 0.6$  [22.0-23.4]; Fw males  $16.3 \pm 0.5$  [15.2-17.3], females  $17.8 \pm 0.3$  [17.6-18.3]; Hw males:  $15.2 \pm 0.5$  [14.0-16.3], females  $16.6 \pm 0.4$  [16.2-17.2]; costal side of Fw Pt males:  $0.45 \pm 0.04$  [0.4-0.5], females:  $0.48 \pm 0.03$  [0.45-0.5]; male cercus width in lateral view:  $0.38 \pm 0.02$  [0.32-0.42]; male cercus length in lateral view:  $0.43 \pm 0.03$  [0.37-0.50].

## Last stadium larva

**Head:** trapezoidal, ca 1.6-1.8 times as wide as long, with posterior margin slightly concave (Fig. 5a). Antenna 7-segmented, with third antennomere the longest (Fig. 5b). Prementum (Fig. 5d) 0.73-0.78 times as wide as long, with 3+1 (3 long setae plus 1 short medial one), 3 or 4 setae on each side, and with 7-8 lateral short setae; ligula entire and convex, finely crenulated along margin. Labial palp (Fig. 5c) with 5-6 setae along inner margin, and with 6 small distal teeth (3 large medial and 3 small outer ones), in addition to inner tooth. Articulation of pre- and postmentum midway between bases of coxae 1 and 2. Mandibles (Figs 6a-d) with following formula: L 1'1234 y a b, R 1'1234 y 0 b

**Thorax:** pronotum trapezoidal, with a transverse anterodorsal row of hairs on each side (Fig. 5a). Wing pads reaching mid-length of abdominal S4-5 (Fig. 5a). Legs pale except dark distal end of tibiae and tarsi. Femora and tibiae with a dorso-longitudinal row of hairs; tibiae with a ventrodistal patch of setae.

**Abdomen:** unpatterned (Fig. 5a). Male cerci conical in dorsal view (Fig. 6g), subquadrate in lateral view (Fig. 6h). Gonapophyses of male triangular with a medio-longitudinal row of small denticles (Fig. 5e). Caudal lamellae pale, with faint and scarcely branched traqueae (Fig. 5f); about as long as 0.6-0.8 times the abdomen length; marginal setae on ventral side of lateral caudal lamella extended along basal 0.44 or less.

**Dimensions:** range in square brackets;  $n = 2$ ; total length without appendages 10.1-10.5. Prementum length 2; prementum max. width 1.45-1.55. Femur I 1.2-1.4; II 1.7-2; III 2.3-2.6. Inner wing pads 3.15-3.4; external wing pads 2.85-3.3. Abdomen length without appendages 5.75-6.5; dorsal caudal lamella 3.9; lateral caudal lamellae 4.6.

## Diagnosis

This species is easily recognizable from *A. saliceti* by the light blue spots on abdomen, which is entirely red and black in *A. saliceti*; shape of ventral branch of male cercus: ca triangular in *A. garrisoni* (Fig. 10d) and subquadrate in *A. saliceti* (Fig. 10f); shape of lateral lobes of genital ligula: both with rounded tips in *A. saliceti*, in *A. garrisoni* only distal lobe pointed (Figs 9a, 9b), or both lobes pointed; and shape of mesostigmal plates: anterior margin straight to slightly concave, and postero-medial carina transverse in *A. garrisoni* (Fig. 4d), anterior margin strongly concave, and postero-medial carina projected to anterior margin in *A. saliceti* (Fig. 4f).

It closely resembles *A. peterseni*, from which it can be separated by dorsum of male S7 entirely light blue, versus black in *A. peterseni*; S8-10 predominantly light blue, with a few restricted black spots or areas (Fig. 1g), which in *A. peterseni* are predominantly black with light blue usually restricted to a mediodorsal spot on S9 and intersegmental membranes of S7-9 (Fig. 1h), occasionally extended along entire S9, and rarely also as a spot on S8; male cercus wider than long in postero-medial view: as long (B) as 1-1.3 of its width (A) (Fig. 10a), which is longer than wide in *A. peterseni*: as long (B) as 0.83-0.9 of its width (A) (Fig. 10b); with tip bluntly pointed (Figs 10a, 10j), versus acutely pointed in *A. peterseni* (Figs 7e, 10b, 10l); distal lobe of male genital ligula distal segment with tip pointed, and base of basal lobe wider than base of distal lobe (Figs 9a, 9b), both character states inverted in *A. peterseni* (Figs 7b, 8a-f).



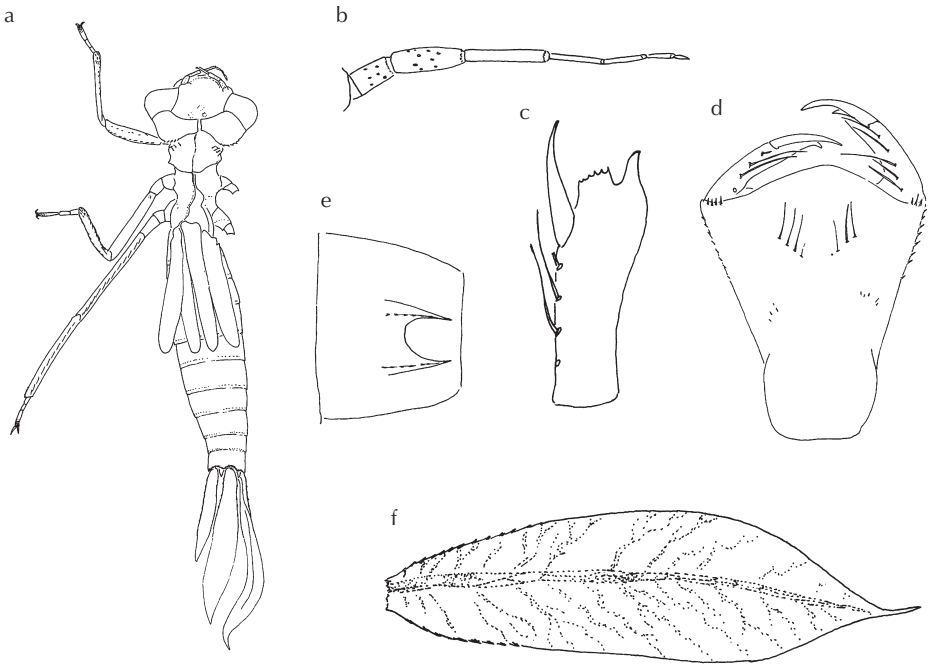


Figure 5: Final stadium larva of male *Andinagrion garrisoni* sp. nov., Jujuy, La Angostura — (a) general aspect (dorsal view); (b) left antenna (dorsal view); (c) left labial palp (dorsal view); (d) prementum (dorsal view); (e) gonapophyses (ventral view); (f) medial caudal lamellae (lateral view); not to scale.

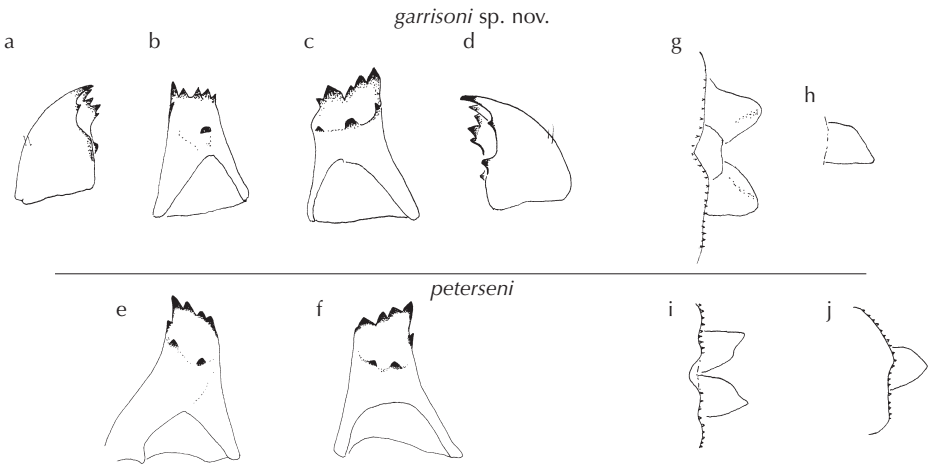


Figure 6: Final stadium larva of two *Andinagrion* species — (a-f) mandibles; (g-j) male cercus — (a, b, e) right mandible; (c, d, f) left mandible — (a, d, h, j) lateral view; (b, c, e, f) inner view; (g, i) dorsal view; not to scale.

Females differ by the mesostigmal plate dorsal surface almost flat with a slight longitudinal depression paralleling medial margin, and postero-medial carina transverse in *A. garrisoni* (Fig. 4d), with a marked longitudinal sulcus paralleling medial margin, and postero-medial carina projected anteriorly along outer margin of sulcus about half way to anterior margin in *A. peterseni* (Figs 4e, 7a); and anterior margin of mesostigmal plate straight to slightly concave in *A. garrisoni* (Fig. 4d), with a marked concavity in *A. peterseni* (Figs 4e, 7a); females of *A. garrisoni* have sides of S4-7 light blue (Fig. 2a-c), which in females of *A. peterseni* are yellow.

The larva of *A. garrisoni* can be distinguished from that of *A. peterseni* by the faint and scarcely branched tracheae (Fig. 5f) of caudal lamellae, versus a thick tracheation with some very dark areas in *A. peterseni*; extension of the marginal setae along the ventral side of lateral caudal lamella: basal 0.44 or less in *A. garrisoni*, basal 0.5 in *A. peterseni*; mandibular formula: presence of one molar on right mandible in *A. garrisoni* (Fig. 6b), two in *A. peterseni* (Fig. 6e); and shape of male cercus in lateral view: with approximately straight ventral margin in *A. garrisoni* (Fig. 6h), ventral margin smoothly convex in *A. peterseni* (Fig. 6j). Last stadium larva of *A. saliceti* is still unknown.

Distribution

25°25' - 23°18'S, 65°20' - 65°28'W, 1,030 - 2,800 m a.s.l. (Fig. 11). — Argentina: Salta and Jujuy provinces; distribution range is included in the Yungas biogeographic province of the Neotropical region, from montane forest (Angostura, Lesser, Caldera) to grasslands (Yala, Uquía, laguna de Tilcara).

Biology

Adults preferred environments were narrow stream and river inlets, and associated ponds and seepages with abundant aquatic vegetation. Males patrolled areas of the stream flying close to water's surface and perching horizontally on leaves of emergent aquatic vegetation. In tandem pairs the male remained in the horizontal position while holding the female. Pairs in copula were observed in grasses and bushes some meters away from the water.

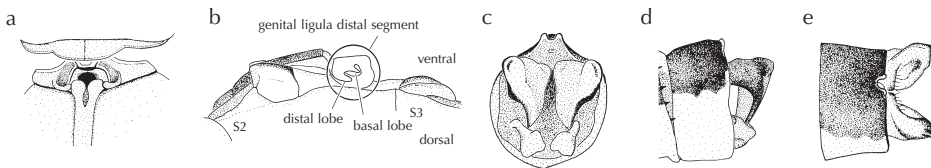


Figure 7: Morphological characters of *Andinagrion peterseni* — (a) posterior prothoracic lobe and mesostigmal plates of female paralectotype, dorsal view; (b) male lectotype S2-3 ventral portion, lateral view; (c-e) male lectotype S10: (c) posterior view, (d) lateral view, (e) dorsal view.

*Andinagrion peterseni* (Ris, 1908)

(Figs 1b, 1d, 1f, 1h, 2d-f, 3b, 4b, 4e, 6e, 6f, 6i, 6j, 7a-e, 8a-f, 9c, 10b, 10e, 10h, 10k, 11)

*Oxyagrion peterseni* Ris, 1908: 519-521, fig. 2 (description, illustration ♂ S10); — Ris (1913: 68, key); — Fraser (1947: 431, mention from Mendoza); — Bulla (1973a: 21-24, figs. 10-15, description of larva, from Buenos Aires and Mendoza provinces).

*Andinagrion peterseni* (Ris) — Bulla (1973b: 512-515, figs. 30-36, 52-53, 55, 57-65; in part, redescription, key, map); — Bulla (1973c: 222, 226, figs. 13-15); — Rodrigues Capítulo (1992: 54, figs. 99, 161, distribution in Argentina); — Muzón (1995: 2-3, distribution in Patagonia); — Muzón (1997: 127-133, distribution in Patagonia); — Muzón & von Ellenrieder (1998: 25, distribution in Argentina); — Muzón et al. (2005: 53; distribution in Somuncurá plateau).

**Type locality:** Argentina, Pedregal, Mendoza province.

**Type status:** ♂ lectotype (Ris no. 9915), 20 x 1906, Estación Pedregal, Joergensen leg. (SMFD), by present designation. Ris (1908) described this species based on a series of 67 males and 65 females from Pedregal without designating a holotype. Both male and female syntypes on loan from the Ris collection at SMFD were labeled as “*Oxyagrion peterseni*” by Ris and both had also a holograph red label “Lecto-[in ink by an unknown hand] / Paratypoid [printed]” affixed to the envelope. However, no lectotype designation has ever been published, and in order to clarify application of the name, and especially since this is the name bearing species of the genus, we designate the male specimen as lectotype, and provide its description, measurements and illustrations of diagnostic characters.

**Type depository:** SMFD.

## Specimens examined

Total number of specimens examined: 161 ♂, 120 ♀. — **Lectotype** ♂: Argentina, Mendoza province, Ris N° 9915, 20 x 1906. — **Paralectotype** ♀: same but 19 x 1906, Ris no. 9916. — **Other specimens:** Argentina, Mendoza province: 1 ♂, 1 ♀ Potrerillos (32°57'S, 69°10'W; 1,469 m) iv 2002, E. Schreiber leg. (MLP); 31 ♂, 7 ♀ Uspallata, Arroyo Uspallata (32°35'24"S, 69°21'09"W; 1,830 m) 28 ii 2005, JM and P. Pessacq leg. (MLP); 5 ♂, 1 ♂♀ in copula, same but 16 xii 2004; 2 ♂, 2 ♀ same but (NE); 4 ♂, 6 ♀ same but 04 iii 2005, JM leg. (MLP); 2 ♂, 2 ♀ same but (RWG); 1 ♂ Laguna Cangrejos (32°04'08"S, 69°09'46"W) JM leg. (MLP); 2 ♂, 2 ♀ Cacheuta (33°01'S, 69°07'W; 1,310 m) 15 xii 1967, R. Ronderos leg. (RWG). — Salta province: 8 ♂ Cachi, Río Calchaquí (25°8'22"S, 66°10'8"W; 2,250 m) 14 i 1998, NE leg. (MLP); 1 ♀ same but 01 xi 2005, RG and NE leg. (RWG); 3 ♂, 1 ♀, Angastaco, 31 x 2005, RG and NE leg. (RWG); 1 ♂ Animaná (25°58'S, 65°58'W; 1,616 m) 26 iii 1969, Ronderos, Mauri and Schnack leg. (MLP). — Tucumán province: 4 ♂, 1 ♀ Quilmes, laguna, 06 xii 1968, Willink and Stange leg. (MLP). — Catamarca province: 6 ♂, 2 ♀ Loro Huasi, 26 iii 1969, Ronderos, Mauri and Schnack leg. (MLP). — Buenos Aires province: 2 ♂ Arroyo Indio Rico at Rt 3, NW to Irene, 14 xi 1970 (MLP); 7 ♂, 1 ♀ Sierra de la Ventana, Arroyo del Loro (38°08'S, 61°47'W; 250 m) 29 i 1995, RG leg. (RWG); 1 ♂, 2 ♀

Balcarce, unnamed stream, national route 226, 39 km N to Balcarce (37°39'42"S, 58°33'11" W; 130 m) 20 xii 1999, NE leg. (MLP). — Neuquén province: 3 ♂ Junín de los Andes, Ruta 61, 5 km Ruta 234, temporary pond in steppe (740 m) 18 xi 1994, JM leg. (MLP); 3 ♂; 6 ♀ P.N. Lanin, Termas de Lahuen-Có, bog (850 m) 20 xi 1994, JM leg. (MLP); 4 ♂, 1 ♀ same but Lago Epulauquen, 20 xi 1994. — Río Negro province: 4 ♂, 5 ♂, 1 ♂♀ in copula, 1 ♂♀ in tandem, Meseta de Somuncurá, Arroyo Valcheta (40°42'S, 66°09'W; 165 m) 28 i 1999, JM and NE leg. (MLP); 1 ♂ same but (RWG); 17 ♂, 8 ♀ same but 30 xi 1999 (MLP); 8 ♂, 12 ♂ Meseta de Somuncurá, Estancia El Rincón (40°59'24"S, 66°40'36"W; 620 m) 28-30 i 1999, JM and NE leg. (MLP); 1 ♀ same but (NE); 4 ♂, 8 ♀, 1 ♂♀ in copula same but 30 xi 1999 (MLP); 6 ♂, 5 ♀ same but 11 i 1992, JM leg. (MLP); 4 ♂, 6 ♀ Arroyo Lonco Vaca, Sierra de Pailemán (41°11'52"S, 65°59'15"W; 310 m) 6 xii 1999, JM and NE leg. (MLP); 1 ♂, 1 ♀ Arroyo Los Berros, Sierra de Pailemán (41°25'59"S, 66°4'31"W; 400 m) 6 xii 1999, JM and NE leg. (MLP); 3 ♀ pond, Arroyo de La Ventana (41°39'47"S, 66°04'33"W; 400 m) 06 xii 1999, JM and NE leg. (MLP); 4 ♂ Choele Choel, 11 i 1992, JM leg. (MLP); 2 ♂, 6 ♀ Comi-Có, Arroyo Comi-Có (41°06'24"S, 67°27'43"W; 870 m) 31 i 1999, JM and P. Marino leg. (MLP); 2 ♂, 2 ♀ Ruta 5, 15 km S of Maquinchao (41°29'46"S, 68°34'54"W; 1,000 m) 03 ii 1999, JM and P. Marino leg. (NE); 4 ♂, 20 ♀ Bajo de M. Ramos Mexía, spring (40°29'50"S, 67°15'48"W; 500 m) 30/31 i 1999, JM and P. Marino leg. (MLP); 1 ♂, 1 ♀ same but (NE); 4 ♂, 4 ♀ same but 03 xii 1999, JM and NE leg. (MLP); 2 ♂ bog at route 23, ca 16 km E to C. Onellie (41°17'13"S, 69°53'55"W; 1,010 m) 04 ii 1999, JM and P. Marino leg. (MLP).

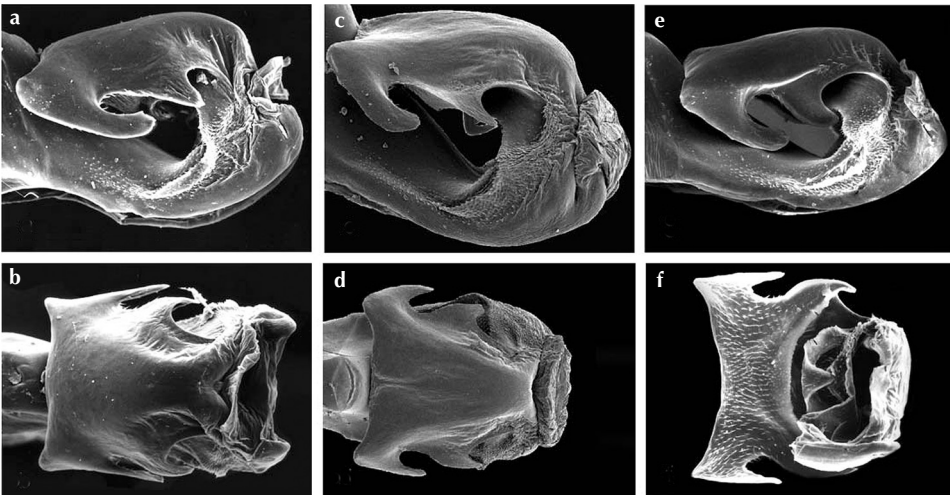


Figure 8: Distal segment of male genital ligula of *Andinagrion peterseni* — (a-b) Cachi, Río Calchaquí; (c-d) Meseta de Somuncurá, Estancia El Rincón; (e-f) Buenos Aires, Balcarce — (a, c, e) lateral view; (b, d) ventral view; (f) ventral view with distal portion sectioned to show internal lobe; not to scale.

## Male lectotype

**Head:** labium, mandibles, and distal half of labrum pale yellow; basal half of labrum, clypeus, and frons reddish brown (Fig. 1b). Frons rounded; top of head reddish brown.

**Thorax:** prothorax largely reddish brown. Pterothorax largely reddish brown, with some diffuse pale yellowish orange stripes as illustrated in Figure 1b. Venter of thorax, coxae, and trochanters pale yellow. Legs largely yellow, with black slender spines on femora and tibiae. Wings (Fig. 3b) hyaline; pterostigma reddish yellow, covering less than one cell; petiolation reaching midpoint between Ax 1 and 2; Px 10 in Fw, 8 in Hw; RP2 branching between px 4-5 in Fw, between 3-4 in Hw; IRP2 arising at level of Px 7.

**Abdomen:** venter pale yellow; dorsum and sides of S1-3 red (Fig. 1d); dorsum of S4- S10 black, sides yellowish brown; S9 with a quadrangular mediodorsal light blue spot (Figs 1f, 1h). Cerci yellow with external surface and tip of ventral branch black; paraprocts yellow with pointed mediodorsal projection black. Apex of cercus with acutely pointed tip (Fig. 7e); in posteromedial view triangular and slightly longer than wide; in lateral view (Fig. 7d) about as wide as 0.65 of its length. Genital ligula (Fig. 7b) with two lateral lobes with basally directed tips; tip of distal lobe rounded, of basal lobe pointed; base of distal lobe wider than base of basal lobe.

**Dimensions:** total length 24.5; abdomen length 19; Fw 14.5; Hw 13.5.

## Variation

**Dimensions:** average and standard deviation; range in square brackets;  $n$  males = 15;  $n$  females = 12): total length males  $27.3 \pm 0.9$  [26.0-28.6], females  $27.0 \pm 1.5$  [25.1-29.1]; abdomen length males  $21.4 \pm 0.7$  [20.0-22.6], females  $21.0 \pm 1.9$  [16.2-23.2]; Fw males  $15.3 \pm 0.7$  [14.4-16.6], females  $17.0 \pm 1.2$  [15.6-20.5] ( $n = 11$ ); Hw males  $14.2 \pm 0.7$  [13.1-15.7], females  $16.0 \pm 0.7$  [13.9-16.6] ( $n = 11$ ); costal side of Fw pterostigma males 0.4 [0.4], females  $0.6 \pm 0.14$  [0.3-0.7] ( $n = 11$ ); male cercus width in lateral view  $0.38 \pm 0.04$  [0.3-0.4]; male cercus length in lateral view  $0.5 \pm 0.04$  [0.4-0.6].

## Diagnosis

Males of *A. peterseni* differ from those of *A. saliceti* by the presence of a light blue spot on S9 (Fig. 1h) versus abdomen entirely red and black in *A. saliceti*; and by the shape of ventral branch of cercus: subquadrate in *A. saliceti* (Figs 10c, 10f, 10i) versus approximately triangular in *A. peterseni* (Figs 10b, 10e, 10h). In *A. peterseni* basal lobe of distal segment of the genital ligula is pointed (Fig. 8a-f) while in *A. saliceti* both basal and distal lateral lobes have rounded tips (Fig. 9d). Females differ by the shape of the mesostigmal plates: in *A. peterseni* the postero-medial carina is projected half way to anterior margin (Figs 4e, 7a), while in *A. saliceti* it reaches the anterior margin (Fig. 4f).

*A. peterseni* can be separated from *A. garrisoni* by dorsum of male S7 always black (Fig. 1h) versus light blue in *A. garrisoni* (Fig. 1g), and S8-10 predominantly black with light blue usually restricted to a mediodorsal spot on S9 and intersegmental membranes of S8-9 (Fig. 1h), although light blue is occasionally extended along entire S9 (in some specimens from Mendoza), and very rarely also as a

mediodorsal spot on S8 (in one male from Quilmes, Tucumán and another from Loro Huasi, Catamarca), while in *A. garrisoni* S8-9 are predominantly light blue, with black restricted to a few spots or areas (Fig. 1g). Male cercus is as long (B) as 0.83-0.9 of its width (A) in posteromedial view in *A. peterseni* (Fig. 10b), with acutely pointed dorso-lateral tip (Figs 7e, 10b, 10h, 10k); in *A. garrisoni* as long (B) as 1-1.3 of its width (A), (Fig. 10a) and bluntly pointed (Fig. 10a, 10g, 10j). Distal lobe of male genital ligula distal segment has a rounded tip in *A. peterseni* (Fig. 8a, 8c, 8e), and base of basal lobe is narrower than base of distal lobe (Fig. 8a-f); in *A. garrisoni* distal lobe is always pointed, and base of basal lobe is wider than base of distal lobe (Figs 9a, 9b). Females differ by the shape of mesostigmal plate: in *A. peterseni* its dorsal surface has a marked longitudinal sulcus paralleling medial margin, and the postero-medial carina is projected anteriorly along the outer margin of the sulcus (Fig. 4e); in *A. garrisoni* (Fig. 4d) it is almost flat with a slight longitudinal depression paralleling medial margin, and the postero-medial carina is transverse. They also differ by the anterior margin of mesostigmal plates approximately straight to slightly concave in *A. garrisoni* (Fig. 4d), versus markedly concave in *A. peterseni* (Fig. 4e). Andromorph females (60% of examined females) of *A. peterseni* share the overall color pattern with females of *A. garrisoni*, except for the sides of S4-7 being yellow with no traces of blue. Heteromorph females are mostly black, with some reddish reflections on head, thorax and S1-3, and with or without a light blue spot on dorsum of S9.

Larva is diagnosed under *A. garrisoni* account.

#### Distribution

41°39' - 25°6'S, 71°4' - 58°33'W; 80 - 2,250 m a.s.l. (Fig. 11). — Argentina: Salta (MLP, RWG), Tucumán (MLP), Catamarca (MLP), Mendoza (MLP, RWG), Neuquén (MLP), Río Negro (MLP, NE, RWG) and Buenos Aires (MLP, NE) provinces; Distribution range included in Monte, Subantarctic, and Patagonic biogeographic provinces of the Neotropical region.

#### Biology

Preferred environments and behavioral observations as for *A. garrisoni*.

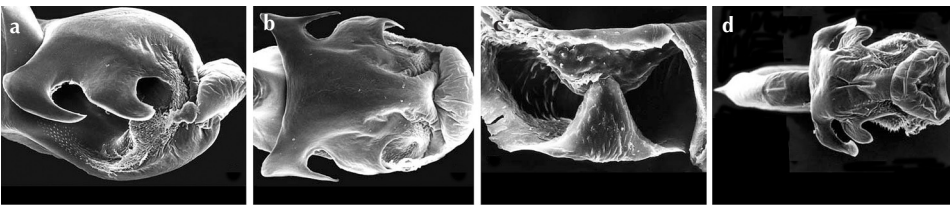


Figure 9: Distal segment of male genital ligula of all *Andinagrion* species — (a-b) *A. garrisoni* sp. nov., Salta, Lesser; (c) *A. peterseni*, Buenos Aires, Balcarce; (d) *A. saliceti*, Buenos Aires, Laguna de Los Padres — (a) lateral view; (b, d) ventral view; (c) detail internal lobe, frontal view; not to scale.

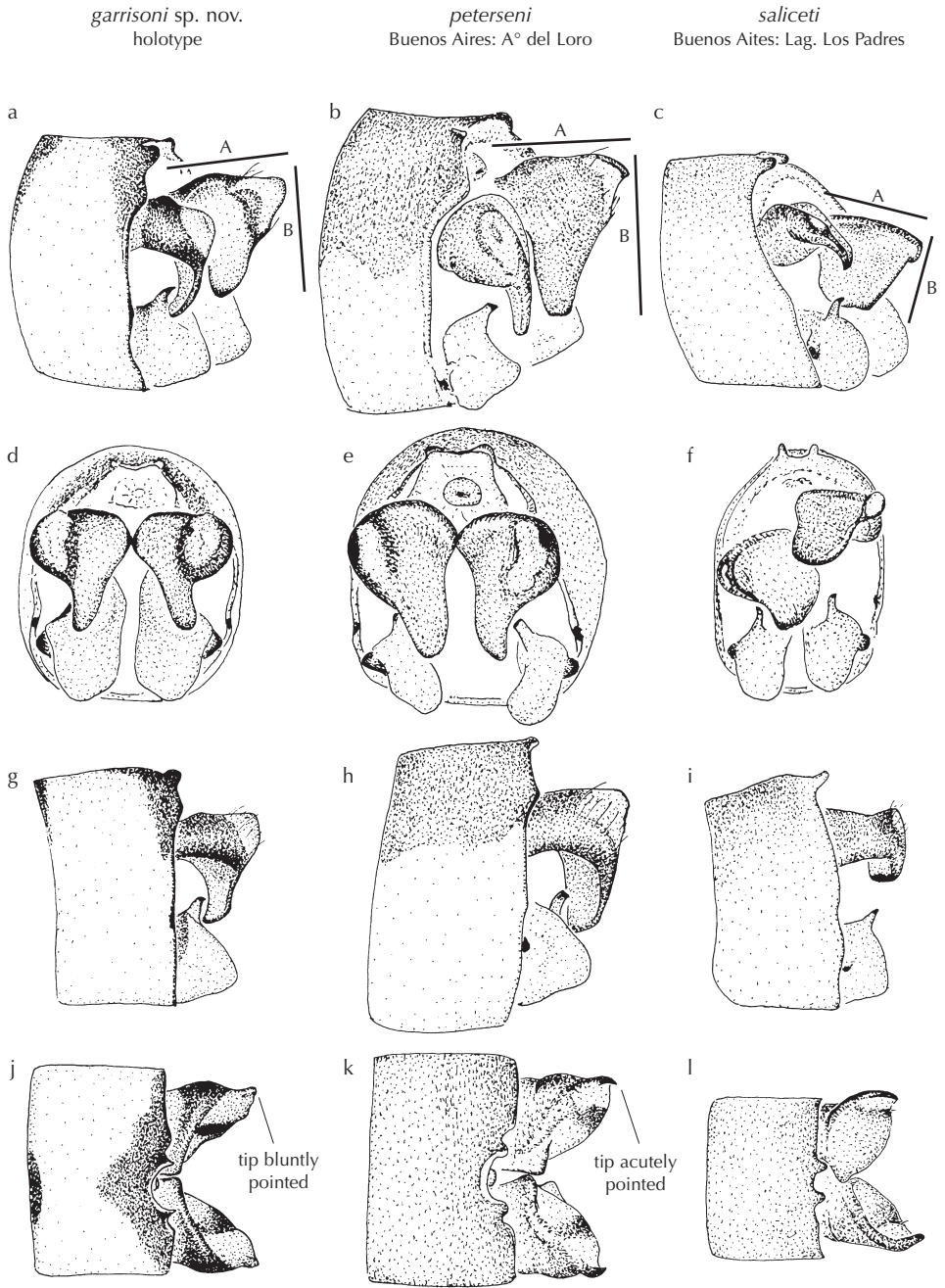


Figure 10: Male S10 of all *Andinagrion* species — (a-c) medio-posterior view; (d-f) posterior view; (g-i) lateral view; (j-l) dorsal view.

*Andinagrion saliceti* (Ris, 1904)  
(Figs 4c, 4f, 9d, 10c, 10f, 10i, 10l, 11)

*Oxyagrion saliceti* Ris, 1904: 9-10, fig. 3 (description of ♂♀, illustration of ♂ S10).  
*Andinagrion saliceti* (Ris) — Bulla (1973b: 515-518, figs 25-29, 49-50, redescription of ♂♀, key, map); — Bulla (1973c: 222, 225, fig. 12, key); — Rodrigues Capítulo (1992: 54, fig. 160, distribution in Argentina); — Muzón & von Ellenrieder (1998: 25, distribution in Argentina); — Muzón & von Ellenrieder (1999: 122, 124, 128, conservation status).

**Type locality:** Argentina, San Isidro near Buenos Aires.

**Type status:** 1 ♂, 2 ♀ syntypes.

**Type depository:** SMFD.

Specimens examined

Total number of specimens examined: 12 ♂, 11 ♀. — Argentina, Buenos Aires province: 2 ♂, 2 ♀ Laguna de Los Padres (37°57'S, 57°46'W; 35 m) 21 xii 1999, col. NE (RWG); 2 ♂, 2 ♀ same but (NE); 5 ♂, 7 ♀ same but (MLP); 1 ♂ same but 21 i 1993, JM leg. (MLP); 1 ♂ same but x 1992 (MLP); 1 ♂ Punta Indio, Ayo s/n km 223 rd 11, 1.5 km N of Ayo. La Matilde, 35°20'36"S 57°11'4"W, 35 m a.s.l., 25 xi 1998 21 xii 1999, col. JM & NE (MLP).

Diagnosis

Males of *Andinagrion saliceti* differ from males of both *A. garrisoni* and *A. peterseni* by the abdomen entirely red and black lacking any light blue spots, ca. subquadrate ventral branch of cercus (Figs 10c, 10f, 10i), which is triangular in *A. garrisoni* and *A. peterseni* (Figs 7c-d, 10a, 10b, 10d, 10e, 10g, 10h), and both basal and distal lateral lobes of genital ligula distal segment with rounded tips (Fig. 9d), with at least one lateral lobe pointed in the other two species (Figs 7b, 8a, 8c, 8e, 9a, 9b). Females differ by the shape of the mesostigmal plates: in *A. saliceti* the postero-medial carina reaches the anterior margin (Fig. 4f), whereas in *A. garrisoni* (Fig. 4d) it is transverse and in *A. peterseni* (Figs 4e, 7a) it is projected half way to anterior margin.

Distribution

37°57' - 34°28'S, 58°31' - 56°10'W; 7 - 43 m a.s.l. (Fig. 11). — Uruguay: Montevideo department (Bulla 1973b). — Argentina: Buenos Aires province (MLP, NE, RWG); distribution range included in the Pampean biogeographic province of the Neotropical region.

Biology

Preferred environments were ponds with abundant emergent vegetation. Adults were observed flying for only short distances to change perches on stems of thick marginal vegetation.



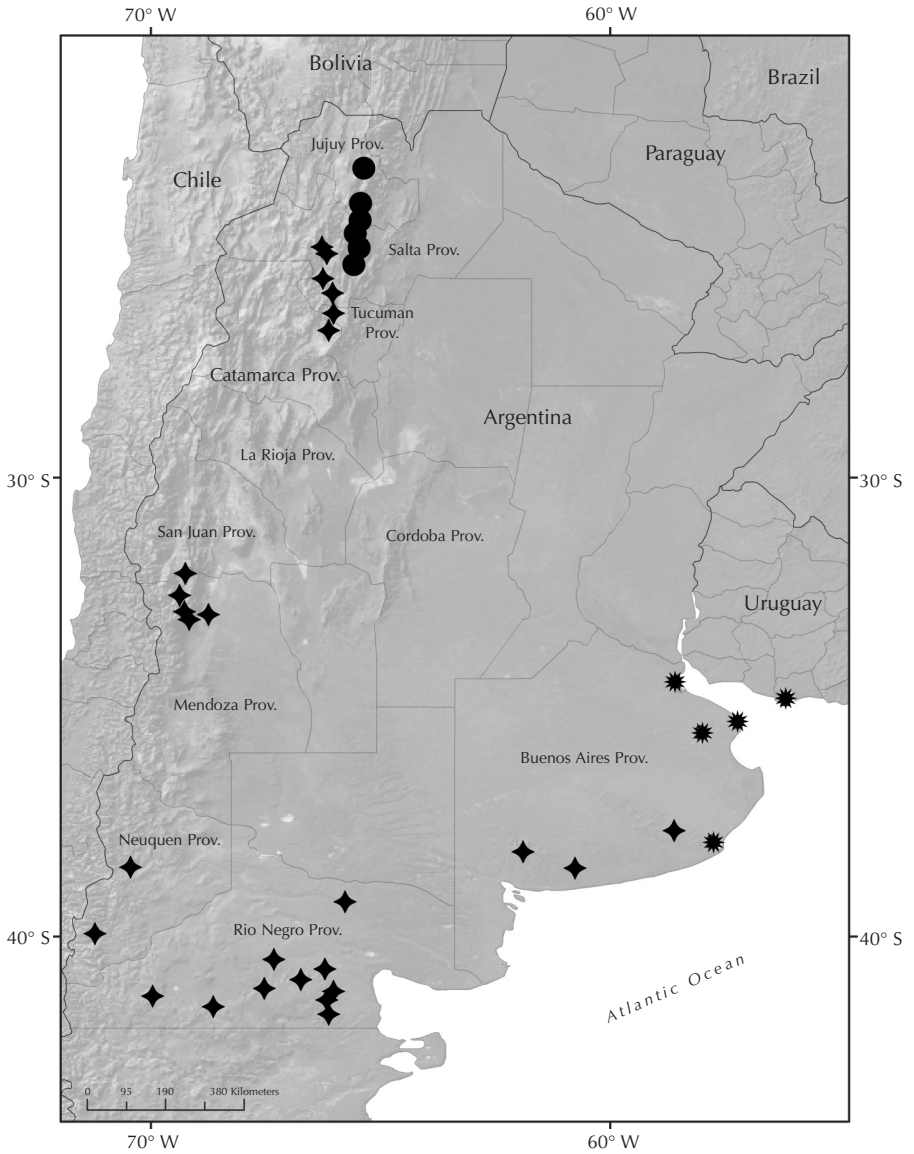


Figure 11: Distribution of all *Andinagrion* species — ● *A. garrisoni* sp. nov.; ◆ *A. peterseni*, \* *A. saliceti*.

## DISCUSSION

In his revision of *Andinagrion*, Bulla (1973b) considered the shape of the posterior lobe of female prothorax to be rectangular and of diagnostic value for the genus. We found this structure to be variable within the genus – it is usually bilobed (Fig. 4b) in *A. peterseni*, rectangular in *A. saliceti* (Fig. 4c), and trilobed (Fig. 4a) in *A. garrisoni*, although in all three species there is some variability – different shapes are found within the same population – and it is not possible to identify clear boundaries between them using this character.

Bulla (1973b) included specimens of *A. garrisoni* (from Arroyo Castaños, Salta province) as *A. peterseni*; he mentioned that the light blue areas of the abdomen were more extensive in these specimens (from S7 to S10), but considered that part of the variability of the species. He mentioned ‘intermediates’ with more extensive blue areas, but we found only two specimens among his material (one male from Laguna de Quilmes, Tucumán province, and one male from Loro Huasi, Catamarca province) with a light blue spot on medio-dorsal surface of S8, and they agree with our diagnosis for *A. peterseni*, showing no differences in cerci and genital ligula from ‘typical’ *A. peterseni*.

Fraser (1947: 431) – and later Rodrigues Capítulo (1992) following Fraser – mentioned *A. saliceti* from Córdoba province with no specific locality. We consider this to be in error, since this species was never been found in that province.

*A. peterseni* is distributed along the eastern slope of the Andes in Argentina, from the SW of Salta to Neuquén and Río Negro provinces, and along an arch to the east encompassing the Meseta de Somuncurá plateau in Río Negro and the hills of Sierra de la Ventana in Buenos Aires province. In the north, *A. garrisoni* occupies the wet, eastern slopes of the Sub Andean mountain chains in Salta and Jujuy provinces, and in the south, *A. saliceti* inhabits grassland ponds in Buenos Aires province and Uruguay (Fig. 11). Thus, the three species are allopatric, and each seems to be restricted to particular biogeographic provinces; *A. peterseni* to the Monte, Subantarctic and Patagonic, *A. garrisoni* to the Yungas, and *A. saliceti* to the Pampas. Although *A. peterseni* and *A. garrisoni* have been found only in Argentina so far, it would not be unlikely to find them in the Andes of S Bolivia as well.

## ACKNOWLEDGEMENTS

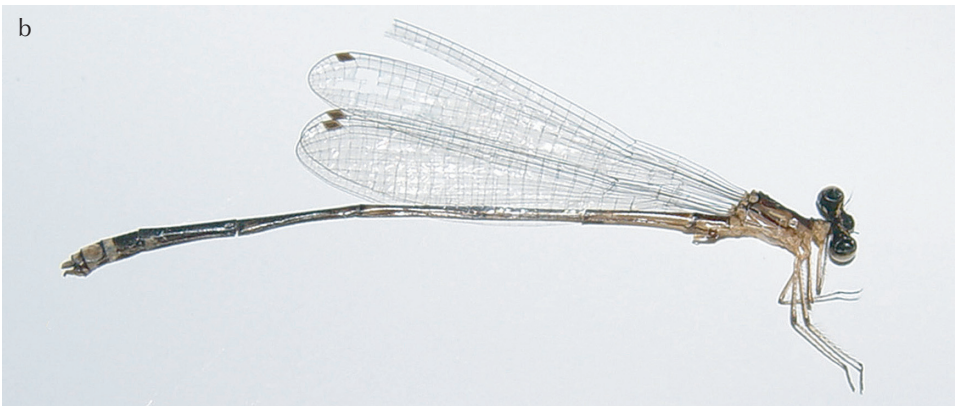
We thank Heinz Schröder (SMFD) for allowing the senior author to examine a pair of syntypes of *A. peterseni* from the Ris collection, Rosser Garrison for the loan of specimens and critical reading of the manuscript, and Analía Garré for kindly illustrating larval mandibles and cerci of *Andinagrion peterseni*. This study was supported by the CONICET and an ANPCyT project.

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Colour plate VIIa: *Andinagrion garrisoni* sp. nov. in tandem — La Angostura, Jujuy Province, Argentina, 8 January 2006. Photo by Natalia von Ellenrieder.



Colour plate VIIIb: *Coelliccia mingxiensis* sp. nov. — holotype from China, Fujian Province, Mingxi County (26°24'N, 116°56'E), 26 July 2004, leg. Xu Q.-h. Scan by Xu Qi-han.