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LESTES SPATULA FRASER: DESCRIPTION OF THE FINAL LARVAL INSTAR AND REDESCRIPTION OF MALE AND FEMALE ADULTS (ZYGOPTERA: LESTIDAE)*

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The detailed description is supplemented with SEM micrographs. The geographic distribution in Argentina is reviewed, and the sp. is for the first time recorded from Uruguay.

INTRODUCTION

In Neotropics, the genus *Lestes* Leach is represented by more than 30 species. Only 8 of these are known from southern South America (PAULSON, 1977), and are distributed principally in the tropical region; among them *L. spatula* Fraser has been recorded only in Argentina.

Of the neotropical species only few larval descriptions are known, at present, i.e. *L. tenuatus* Ramb., *L. forficula* Ramb.[?], *L. pictus* Sel. (CALVERT, 1927; KLOTS, 1932; GEIJSKES, 1941; ROLDAN PEREZ, 1988). Some of these authors fail either to establish the correct specific identification of the specimens (CALVERT, 1927; KLOTS, 1932; ROLDAN PEREZ, 1988), or to give complete descriptions, for example, the mandibular and maxillar characters are not given (SANTOS, 1971).

FRASER (1946) described the male and female adults of *Lestes spatula* on material collected in Concordia (Entre Rios prov., Argentina). This description

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is ambiguous with respect to the color pattern and does not mention penis morphology. BULLA (1971) redescribed and figured the male and female adults and described the final larval instar from specimens from the provinces of Misiones, Santa Fe and Delta del Paraná, under *L. bipupillatus*, and included (1974) *L. spatula* in his key for Argentine zygopterans under the former name.

In this paper the final larval instar of *L. spatula* is described and the male and female adults are redescribed. The penis morphology is described for the first time using scanning electron microscopy. The geographic distribution of this species is extended with aditional records for Argentina and a new one for Uruguay.

LESTES SPATULA FRASER, 1946

Lestes spatula Fraser, 1946: 46-48 (fig. 1, a-b: caudal app., thorax), type series: 1 ♂, 1 ♀, Concordia, Entre Ríos prov., Argentina; – FRASER, 1948: 63 (rec. Villa Ana & La Gallareta, Santa Fe prov.); – JURZITZA, 1981: 117 (rec. Parque Nacional "Iguazú", Misiones prov., Argentina)

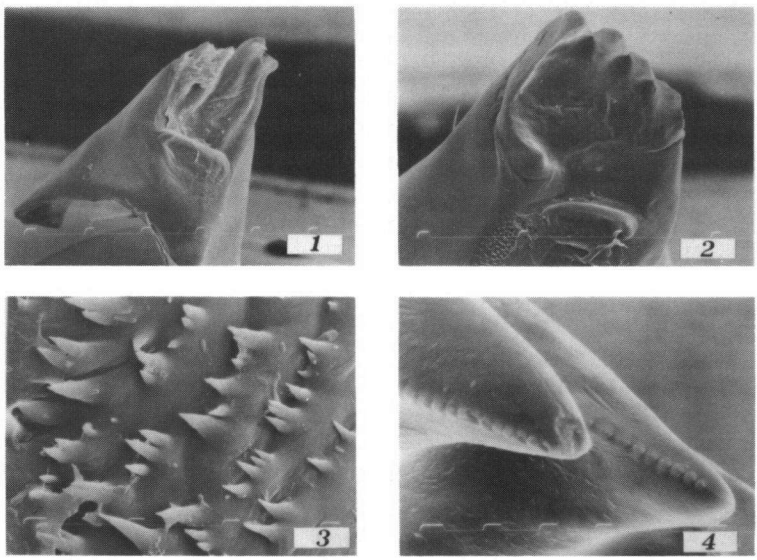
Lestes bipupillatus Calvert 1909; – BULLA, 1971: 202-203, 210-215, 219, figs 262-273: abd. ♂, ♀, pterothorax, pectus, head, penis, caudal app. labium, X abd. segm. of final larval instar (misident., redesc. ♂, ♀ adults, descr. final larval instar; rec. delta Paraná R., Loreto, Misiones, Cayasta, Santa Fe); – BULLA, 1974: 217-218, fig. 8 (misident., key, fig. pectus).

The following collections have contributed to this study: British Museum of Natural History, London (BMNH); – Museo de La Plata, Argentina (MLP); – Museo Argentino de Ciencias Naturales, Buenos Aires (MACN); – Instituto Miguel Lillo, S.M. de Tucumán, Argentina (IML); – U.S. National Museum, Washington D.C. (USNM); – Rosser W. Garrison private collection, Azusa, California, USA (RWG); – Facultad de Ciencias y Humanidades de Montevideo, Uruguay (FCH).

DESCRIPTION OF THE FINAL LARVAL INSTAR
Figures 1-10

Material. – Magdalena, Buenos Aires prov., Argentina, 22-III-1991, J. Muzón leg., 1 ♀ final instar; – 2 ♀ exuviae (MLP).

HEAD. – About three times as wide as long. Antenna 3rd segment the longest; length of segments (in mm): 0.27 – 0.40 – 0.79 – 0.64 – 0.40 – 0.29 – 0.22. Labrum free margin concave medially with long setae on sides, short setae centrally. Labium (Fig. 9a-b) reaching caudad to 3rd coxae; 5 premental setae on each side (longest 0.37 mm), the three external about same length, the two internal shorter. Sides of dilated portion with 14-15 short spines (0.02 mm), anterior margin serrate with 1 short spine (0.02 mm) in each concavity. Palpus with three long setae (longest 0.46 mm), two of them on the movable hook, and a minute seta (0.02 mm) externally posterior to movable hook; movable hook 0.67 mm long;



Figs 1-4. *Lestes spatula*, final larval instar mandibles: (1) left, inner surface; – (2) right, inner surface; – (3) left, scaly ornamentation behind molar crest; – (4) right, row of tubercles on incisors. – [Scale in figs 1-2, 100 µm; figs 2-4: 10 µm].

anterior margin of palpus with two principal hooks, the external curved and longer than the inner one, with 5-6 teeth between these hooks; inner margin serrate; minute spines on external side of movable hook, and inner margin and anterior portion of palpus.

M a n d i b l e. – Mandibular formula according to WATSON (1956), as follows (Figs 1-4):

L 1 2 3 4 5 0 molar crest

R 1+2 3 4 5 y molar crest

Left A 1. less prominent than incisors
2. without any separate tooth; margin of crest straight

B 1. apex of 1, 2 and 3 angulated and straight 4 and 5 tapered with margins slightly rounded
2. 4 > 5 > 2 > 3 > 1, or 2 = 3
3. incisors less distinct than on right
4. broadest teeth are 4 and 5, base of 5 with an internal depression

Right A 1. less prominent than incisors
2. without any separate tooth; margin of crest slightly curved, with edge recurved and prominent

B 1. all incisors angulated except 1; 3, 4 and 5 recurved; 1 truncated

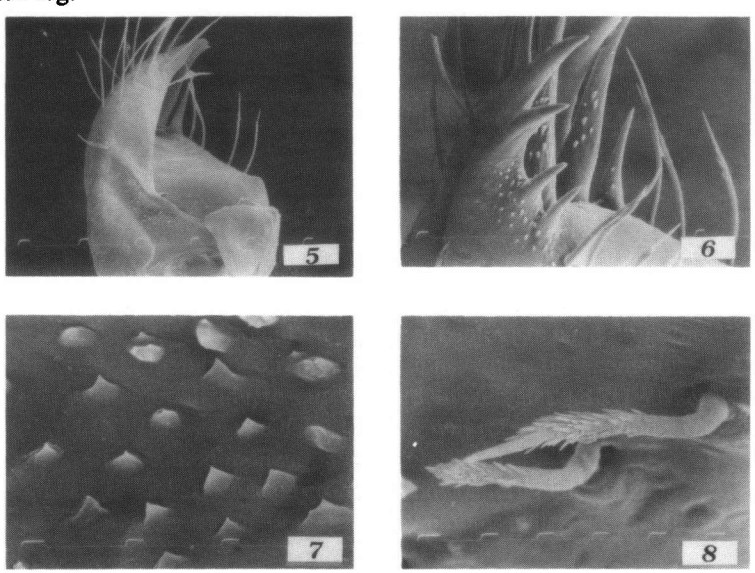
2. 5 > 4 > 3 > 2 > 1, or 4 = 5
3. clefts between incisors more distinct than on left
4. 4 and 5 broadest

C 1. y a well-developed tooth, with a wide base extending from base of 5.

Both right and left mandibles present a scaly ornamentation on the posterior margin of the inner surface, behind the molar crest (Fig. 3). In addition, a row of rounded tubercles (2.2 µm) is present on each side of the incisors of both mandibles (Fig. 4).

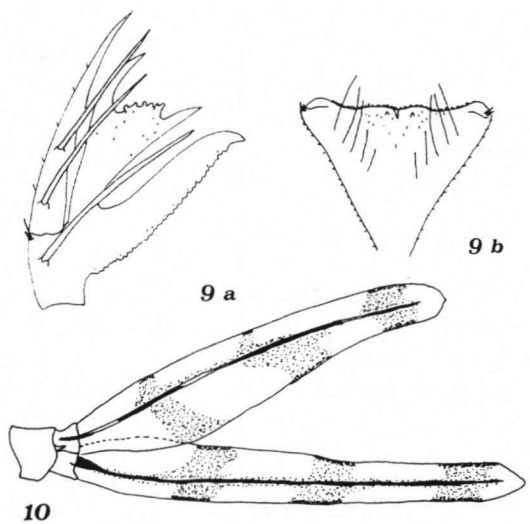
M a x i l l a e (Figs 5-8). – with 7 teeth, two (44 µm) on the inner margin, 3 on the outer (100 µm, 190 µm, 200 µm) margin and 2 (80 µm, 120 µm) at the tip fused on the base (Figs 5-6). The teeth and clefts between them with tubercles. Maxillary palp without teeth, with tubercles on its outer surface at the base (Fig. 7). All setae on the maxillae appear covered by minute scales (4 µm) in their central portions (Fig. 8); these setae at different lengths, the longest at the apex of the palp (170 µm), the shortest on the inner surface of the maxilla (50 µm).

THORAX. – Pale brown, with a dorsal dark stripe. Wingpads reaching the anterior margin of the 5th abdominal segment (external: 4.9 mm). Legs long and slender (femur I: 1.8 mm, femur II: 1.9 mm, femur III: 5.1 mm), pale brown with annular dark stripe subapically on femur, and apically on tibia and tarsus of each leg.



Figs 5-8. *Lestes spatula*, final larval instar maxillae: (5) left, dorsal view; – (6) right, tubercles on teeth and between them; – (7) scaly ornamentation on palpus outer surface; – (8) seta with central scales. – [Scale in figs 5-6: 100 µm; – figs 7-8: 10 µm].

ABDOMEN. – Cylindrical, long and slender. Segments I-VIII with two posterior and central dark spots on the ventral and dorsal surfaces, and a dark spot on each apical ventro-lateral angle of terga connected by a fine dark lateral stripe along the segments. Pleura of segments I-IX with an anterior dark spot, and a row of minute spines ending, in segments V-X, in a conspicuous spine (0.1 mm) three times as long as the remaining ones. Segment IX dark ventrally. Segment X dark latero-ventrally; posterior margin armed with minute spines, except at level of cerci. Female gonapophyses reaching the end of segment X, ventral margin with 15-16 short spines. Cerci slender and conical (0.7 mm). Gills (Fig. 10) brownish, with three transversal dark stripes; obtuse, tip rounded; median gill 9.4 mm, lateral 8.6 mm long; transverse tracheae simple, perpendicular on the axis; margins finely spinulose; median gill with a slight subapical concavity.



Figs 9-10. *Lestes spatula*, final larval instar: (9) labium: (a) palpus, (b) prementum; – (10) gills.

COMMENTS. – The description is in agreement with the general generic characteristics given by GEIJSKES (1941) and KLOTS (1932): long and slender body; wide head; long and stalky legs; linear to oblong and black (dark brown) banded gills; tracheae of gills simple and transverse; spoon-shaped mentum, with setae on the movable hook of the palp, etc. Regarding the generic characteristics of the mandibles, the larvae of *L. tenuatus* present, as in *L. spatula*, a distinct molar crest on both mandibles, and an additional tooth (y) on the right one; but, for example, on those of *plagiatus* from Africa (CAMMAERTS, 1966) these features are absent, showing instead two molars on each mandible.

BULLA (1971) based the description of *L. spatula* larvae on 3 specimens (1 ♂, 2 ♀ from Loreto, Province of Misiones) which are, at present, lost. This description agrees with that given above, but several features, such as maxillar and mandibular characteristics or some measurements, were not given.

Due to the fact that the available information about *Lestes* larvae is scarce, a key is premature.

REDESCRIPTION OF ADULTS
Figures 11-18

Material. – **Lectotype** (designated from the type series deposited at the BMNH): ARGENTINA, Entre Ríos prov., Concordia, XII-1935, Hayward leg., 1 ♂ (BMNH). – Entre Ríos prov., Parque Nacional "El Palmar", 20-IX-1987, J. Muzón leg., 10 ♂ (MLP); – same date except: 3--XII-1988, 1 ♂, 1 ♀ (MLP); – Entre Ríos prov., Ayo. Perrucho Verna, Rt 14, km 355, N Villa San José, 16-XI-1973, O.S. Flint leg., 1 ♂ (USNM); – Entre Ríos prov., Rt. 6, 20 km N Sauce de Luna, 8-IV-1991, J. Muzón leg., 6 ♂ (MLP); – Entre Ríos prov., Gob. Echagüe, J. Muzón leg., 8-IV-1991, 4 ♂ (MLP); – Corrientes prov., Rt. 12, km 1169, Ayo. Santa Isabel, 10-IV-1991, J. Muzón leg., 1 ♂ (MLP); – Corrientes prov., 15 km E Goya, 9-IV-1991, J. Muzón leg., 1 ♂ (MLP); – Corrientes prov., Virasoro, 6-V-1971, Porter-Stange leg, 1 ♂ (FML); – Corrientes prov., Corrientes, Ca. Cambá Poata, 5-II-1971, Porter leg., 1 ♂, 1 ♀ (FML); – Buenos Aires prov., Magdalena, 22-III-1991, J. Muzón leg., 2 ♂, 3 ♀ (MLP); – Chaco prov., Pcia, Roque Saenz Peña, 1-XII-1980, A. Willink leg., 1 ♂ (FML); – Chaco prov., Dpto Resistencia, 10-XII-1935, J.B. Daguerre leg., 1 ♂ (MACN); – Misiones prov., Puerto Rico, 4-IV-1971, C.M. & O.S. Flint leg., 1 ♂ (RWG); – URUGUAY, Río Tacuarí, P. de Rodrigues, 6-IV-1966, Achaval leg., 1 ♂ (FCH).

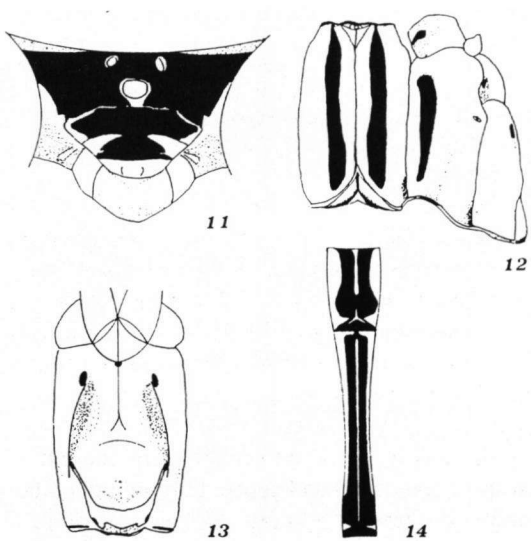
DIAGNOSIS. – *L. spatula* can be separated from the other neotropical *Lestes* species because of: superior appendages straight in lateral view and inner margin with only a basal tooth; inferior appendages as long as the superior ones, with a basal inner carina; internal lobe of penis half as wide as 2nd segment, with a small anterior portion grooved anteriorly, and a posterior portion reniform and bilobated; mesepisternal stripe ⅓ as wide as mesepisternum; mesepimeral stripe variable in development; sternum with two minute anterior black spots, and two external and diffuse brown stripes.

MALE. – Head (Fig. 11). – Black. Light blue on genae, lateral margin of clypeus, and around ocelli; brown spots on occiput and genae. Labrum light blue, central black spot on its posterior margin, free margin brown. Antennae darkish brown or black. Labium whitish. Postgenae pale brown or whitish, black around the foramen magnum; in several specimens brown on the lateral ¼.

Thorax. – Prothorax: Anterior lobe light blue; except anterior margin and a circular median spot, black; pale brown with a central black spot on the posterior margin in the lectotype. Median lobe light blue, brownish laterally, with 2 central longitudinal black spots; pale brown with two longitudinal diffuse dark brown stripes in the lectotype. Posterior lobe light blue with a central black spot, as wide as ½ lobe.

Pterothorax (Figs 12-13): Light blue. Mesepisternal stripe iridescent black, as wide as ⅓ of the mesepisternum, narrowed at mesostigmal plates and not reaching antealar sinus. Dorsal carina and area between it and mesepisternal stripe brownish in several specimens. Antealar sinus pale brown with posterior edges black. Mesostigmal plates light blue. Mesinfraepisternum dorsal ½ brownish with a central black spot, not present in the lectotype. Mesepimeron with a central black stripe on its dorsal ½, about ⅓ mesepimeron width, slightly expanded posteriorly

(as in the lectotype); this stripe appears in several specimens narrowed or broken; in others, anteriorly continued by diffuse brown confluent with mesinfraepisternal brown spot; pale brown on interpleural and metapleural suture, in the lectotype these brown spots are confluent and expanded posteriorly. Metinfraepisternum dorsal-posteriorly brown with a minute black spot. Pectus whitish, with 2 minute and anterior black spots on metepimeron; poststernum with two external diffuse brown stripes; in several specimens with minute darkish brown spots on metepimeron contiguous to metasternum, on ventral portion of metinfraepisternum, anterior part of metapostepimeron, and on posterior margin of poststernum.



Figs 11-14. *Lestes spatula*, adult: (11) head, dorso-anterior view; – (12) pterothorax; – (13) pectus; – (14) abdominal tergites II-III.

Legs: Coxae light blue, with a circular brown spot on inner and outer surfaces; inner surface of trochanters brownish, outer surface black; tibiae and femora black, with marginal pale yellowish stripes on inner and outer surfaces; tarsi black.

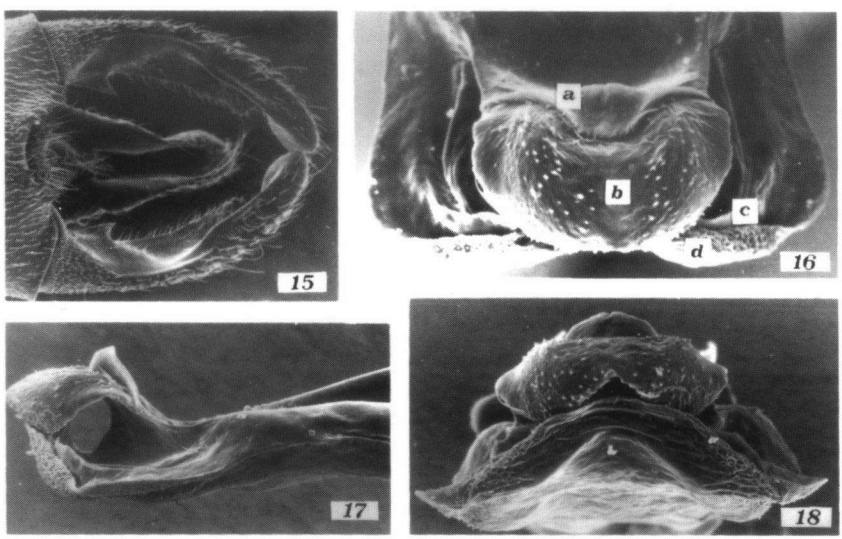
Wings: Hyaline, venation and pterostigma black or dark brown. Fore wings 20.24 ± 0.70 mm (lectotype 21.6 mm), pterostigma 1.55 ± 0.10 mm (lectotype 1.6 mm). Antenodals: 12 (6.25%), 11 (37.5%), 10 (31.25%), 9 (25%), (lectotype 12/10). Poststigmals: 5 (32.25%), 4 (62.5%), 3 (6.25%) (lectotype 3/3). Hind wings 20.16 ± 0.93 mm (lectotype 21.5 / 20.4 mm), pterostigma 1.56 ± 0.09 mm (lectotype 1.6 mm). Antenodals: 11 (18.75%), 10 (31.25%), 9 (37.5%), 8 (12.5%) (lectotype 9/10). Poststigmals: 6 (18.75%), 5 (43.75%), 4 (31.25%), 3 (6.25%) (lectotype 4/4).

Abdomen (Fig. 14). – Total length (without appendages) 28.60 ± 1.20 mm (lectotype 28.2 mm). Tergite I brown, posterior margin light blue, posteroventral angle with a circular black spot. Tergites II-VI light blue with a dorsal iridescent black stripe expanded posteriorly, dorsal carina pale blue. Tergites VII--VIII black, with dorsal carina pale. Tergite IX dark brown with ventral margin black. Tergites VIII-IX light blue posteriorly. Tergite X dark brown. In the lectotype tergites VIII-X dark brown. Sternum I pale brown, with a posterior and

minute black spot. Sterna III-VII black. Sternum VIII black or darkish brown with ventral carina black. Sternum IX darkish brown with ventral carina black; genital plates brown, with a basal black spot in several specimens; postgenital plate dark brown. Sternum X pale brown, in lectotype posterior margin black.

Pruinescence on back of head, prothorax, pterothorax, (except dorsum), all coxae and trochanters and abdominal segments I, II, and VIII-X.

Superior appendages (Fig. 15): Very pilose, black, about 1.5 times as long as tergite X; curved toward each other in apical half. With 5-6 stout external spines on outer margin; basal tooth sharp; inner margin about 0.50 of appendage, nearly straight with 6-7 spines on distal half. Dorsal surface with a subapical, elongated fossea delimited by an internal rib. Apex rounded and expanded. In lateral view appendages straight.



Figs 15-18. *Lestes spatula*, adult: (15) caudal appendages, dorsal view; – (16) penis, ventral view [a: anterior portion of internal lobe; – b: posterior portion of internal lobe; – c: anterior fold; – d: posterior fold]; – (17) penis, lateral view; – (18) penis, posterior view.

Inferior appendages: Very pilose, brown, nearly as long as superior appendages. Basally globose with an internal carina. Beyond the carina tip the appendage is narrowed distally with apex slightly expanded and rounded.

Penis (Figs 16-18): Internal lobe of 2nd segment as wide as ½ of the segment; divided into anterior and posterior parts: the anterior (Fig. 16a) small; ventrally trapezoidal; smooth surface; with a median, anterior groove; and two slender, lateral arms; laterally with an apophysis curved anterad. Posterior portion (Fig. 16b) swollen, reniform, wrinkled surface. Tip of the penis with 2 folds, anterior

(Fig. 16c) smooth, and posterior (Fig. 16d) bearing heavy wrinkles latero-ventrally, which are anteriorly fused. In posterior view (Fig. 18) the penis is subtriangular and composed of 3 portions: ventral (= anterior portion of internal fold); medial (= posterior portion of internal fold), bilobate; and dorsal (= posterior fold) with lateral margins projected ventrally, and concave in the middle part.

FEMALE. – Colour pattern as male except: sternum VIII pale brown with a longitudinal black stripe, expanded in anterior 1/4; ventro-lateral margin of tergite IX black; subgenital plates pointed posteriorly, anterior ½ black, posterior ½ pale brown; anal appendages brown, posterior ½ black. Ovipositor black, pale brown centrally on superior half.

Wings. – Hyaline, venation and pterostigma brown or darkish brown. Forewings 22.8 ± 0.74 mm, pterostigma 1.74 ± 0.01 mm, postnodals: 11 (10%), 10 (50%), 9 (40%); poststigmals: 5 (56%), 4 (44%). Hindwings 21.95 ± 0.63 mm, pterostigma 1.72 ± 0.08 mm, postnodals 11 (10%), 10 (50%), 9 (40%), poststigmals 6 (10%), 5 (60%), 4 (30%).

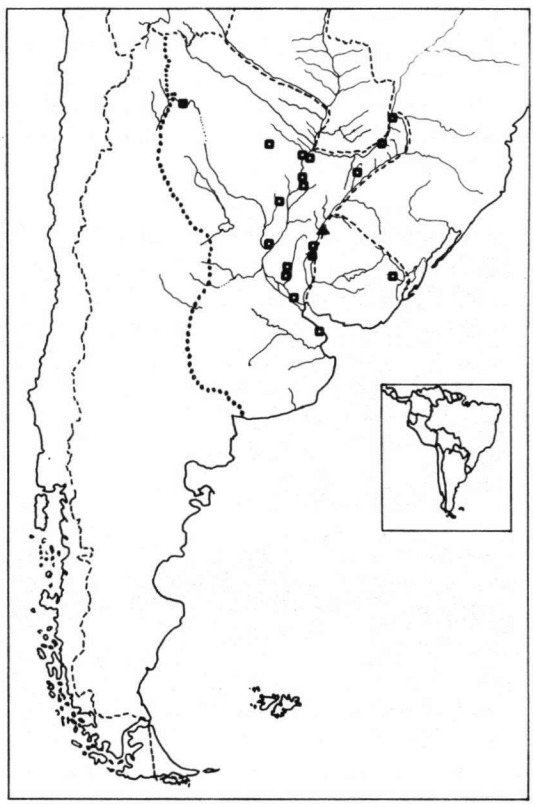


Fig. 19. *Lestes spatula*: geographical distribution. – [Dotted line: boundary between the two neotropical subregions in Argentina (after RINGUELET, 1961); – ▲: type locality].

Abdomen. – Total length (without anal appendages) 29.25 ± 1.48 mm; anal appendages 0.5 mm. Anal plates length: 0.42 ± 0.04 mm. Ovipositor: maximum length 2.65 ± 0.1 mm; maximum height 0.5 mm. Ventral margin of ovipositor serrate with about 25 minute teeth.

COMMENTS. – The original description of *L. spatula*, based only on two specimens (♂, ♀), establishes the pectus color pattern as "almost pure white with pruinescence and with no perceptible dark marking present"; this assumption is erroneous because the study of the lectotype has shown several dark markings

as figures (Fig. 13); that pattern is present in all specimens examined, both males and females. The pterothorax color pattern exhibits a remarkable variation, principally the mesepimeral stripe.

As to the specific relationships of *L. spatula*, FRASER (1946) suggested that this species is referable to the *forficula* group (SELYS, 1862), but I believe that the current knowledge on the neotropical *Lestes* species does not allow us to establish species groups within this genus.

Due to the presence of an inner basal tooth and the straight inner margin, the morphology of the superior caudal appendages of *L. spatula* is similar to that of *L. mediorufus* Calvert and *L. paulistus* Calvert. Nevertheless, *L. spatula* differs from these species principally in the length and shape of the inferior caudal appendages.

BULLA (1971, 1974) misidentified the material he examined; his drawings do not agree with the original description of *L. bipupillatus* by CALVERT (1909). The specimens, both larvae and adults, are missing in the Museo de La Plata, where they were originally deposited. On the other hand, Bulla's redescription is in agreement with that of FRASER (1946) and with the material examined in this study. Finally, if the specimens identified by BULLA (1971, 1974) are excluded, *L. bipupillatus* is recorded in Argentina only by a single male from Prov. of Chaco (RIS, 1913).

BIONOMICS

Lestes species can be characterized by their aptitude in exploiting the ecological niche of temporary ponds, therefore they can survive the dry season as eggs in endophytic positions and have a rapid larval development (CORBET, 1962). The specimens of *L. spatula* studied were collected in temporary shallow ponds, with emergent vegetation dominated by rush (*Juncus* sp. & *Cyperus* sp.).

In two cases populations of *L. undulatus* Say were found, which inhabited the same temporary pond as *L. spatula*. These localities were P.N. "El Palmar" (3--XII-1988) and Magdalena (22-III-1991); adults of both species were found in copula.

DISTRIBUTION

The distribution area of *L. spatula* (Fig. 19) is very extensive in southern South America, and is characterized by a diverse climate (tropical, subtropical and temperate).

The localities where this species was recorded are all included in the Neotropical region, which is zoogeographically divided into two subregions: the Guiana--Brazilian and the Andean-Patagonian. Both subregions are represented in Argentina, but their demarcation is subject to the specific criteria adopted by a particular

worker. We adopt the separation proposed by RINGUELET (1961) since it is mainly based on the aquatic invertebrate and fish distribution. According to this author, the Guiana-Brazilian subregion and the tropical conditions extend into Argentina approximately to 38°S. In addition, the Paraná River is postulated as a dispersion route for tropical and subtropical elements into the southern regions of South America.

As far as the Lestidae distribution in southern South America is concerned, the species of this family are distributed only in the Guiana-Brazilian subregion, except *L. undulatus* which occurs also in the Andean-Patagonian faunal area. An analysis of *L. spatula* distribution shows that this species probably has used the Paraná Basin for its dispersion, throughout the marginal forest along the Paraná und Uruguay rivers and their tributaries, or, perhaps, following a stepping-stone model (WILSON, 1980), making use of the abundant semi-permanent ponds in this area.

L. spatula is here recorded for the first time from Uruguay and from the Argentinian provinces of Chaco, Corrientes and Buenos Aires (except the Paraná R. Delta). The latter province represents the southernmost point in its known range.

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