

Description of the last instar larva of *Erythrodiplax paraguayensis* (Anisoptera: Libellulidae)

MUZÓN, Javier and Analía GARRÉ

Instituto de Limnología "Dr. Raúl A. Ringuelet", C.C. 712, 1900 La Plata, Argentina; e-mail: muzon@ilpla.edu.ar

■ **ABSTRACT.** The last instar larva of *Erythrodiplax paraguayensis* (Förster) is described and illustrated, based on Iberá (Corrientes, Argentina) specimens. A comparative analysis of all hitherto known larvae from Argentina is provided.

KEY WORDS. Taxonomy. Odonata. *Erythrodiplax paraguayensis*. Larvae.

■ **RESUMEN.** Descripción del último estadio larval de *Erythrodiplax paraguayensis* (Anisoptera: Libellulidae). Se describe e ilustra por primera vez al último estadio larval de *Erythrodiplax paraguayensis* (Förster) sobre la base de especímenes recolectados en los esteros del Iberá (Corrientes, Argentina). Se brinda además un análisis comparativo de las larvas de especies citadas en la Argentina.

PALABRAS CLAVE. Taxonomía. Odonata. *Erythrodiplax paraguayensis*. Larva.

INTRODUCTION

The American genus *Erythrodiplax* Brauer is mainly neotropical in distribution. It is composed by more than 50 species, 21 of which are presently known from Argentina (Muzón & von Ellenrieder, 1998). At present, the last instar larva of 18 species has been described (Santos, 1988; von Ellenrieder & Muzón, 2000; Needham *et al.*, 2000; Costa *et al.*, 2001), from which 10 are found in Argentina, *i.e.* *E. anomala* (Brauer), *E. basalis* (Kirby), *E. fusca* (Rambur), *E. juliana* Ris, *E. latimaculata* Ris, *E. lygaea* Ris, *E. melanorubra* Borrer, *E. nigricans* (Rambur), *E. ochracea* (Burmeister) and *E. umbrata* (Linnaeus). Von Ellenrieder & Muzón (2000) provided a comparative table for the larvae of the known species; later Costa *et al.* (2001) re-assigned the larval description given by Carvalho *et al.* (1991) for *E. connata* to *E. fusca* and provided a key for the Brazilian species.

Erythrodiplax paraguayensis (Förster) has a large distribution area in South America, ranging from Venezuela to Argentina (Borrer, 1942). It is an inhabitant of lentic environments in northeastern and central Argentina (from Misiones and Chaco to Buenos Aires and Córdoba

provinces) (Muzón & von Ellenrieder, 1998). Its larva was cited as described by Costa *et al.* (2000); nevertheless Costa *et al.* (2001) established later that it is at present not described.

The aim of this contribution is to give a description of last instar larva of *Erythrodiplax paraguayensis* (Förster) and compare it with all the larvae described.

MATERIAL AND METHODS

Material examined. ARGENTINA. Corrientes, Colonia Pellegrini, laguna Iberá, 28°32'16''S, 57°11'12''W, 2/9-X-2004, coll. Garré & Lozano, 1 male (reared) [emergence 24-X-2004]; Estancia El Dorado, esteros del Iberá, 28°44'34''S, 58°07'36''W, 20/21-II-2003, coll. Muzón & Pessacq, 1 male. The specimens are deposited in the Collection of the Departamento Científico Entomología, Museo de La Plata, Argentina. Synonymic list includes original description and records from Argentina.

RESULTS

Genus *Erythrodiplax* Brauer

Diagnosis of larvae. Body without long hairs (except on prothorax); head longer than thorax; antenna third segment the longest; mandibles with four incisives, molar teeth variable (2-4) but never with molar crest; prementum distal margin obtuse and crenulated; abdomen without dorsal hooks (some species with middorsal tubercles bearing tufts of hairs); lateral spines on abdominal segments VIII-IX (also on VII in some species); epiproct, paraprocts and cerci recurved ventrad (except *E. umbrata*).

Erythrodiplax paraguayensis (Förster)

Diplacodes paraguayensis Förster, 1904: 4 (Type locality: Costa Aquaray).

Erythrodiplax minuscula (Rambur). Calvert, 1906: 249, 267, in part (Argentina); Ris, 1911: 483, 524, in part (Corrientes, Misiones); Ris, 1913: 90, 97 (Chaco, Corrientes and Misiones); Navás, 1927: 22 (Córdoba); Rodrigues Capítulo & Muzón, 1987: 128 (E. Ríos); Rodrigues Capítulo & Muzón, 1989: 150 (E. Ríos).

Erythrodiplax paraguayensis (Förster). Borrer, 1942: 152-154 (new comb., redescription, Corrientes and Misiones); Rodrigues Capítulo & Muzón, 1990: 106 (Chaco, Corrientes and E. Ríos). Muzón & von Ellenrieder, 1998: 24 (Bs.As., Chaco, Córdoba, Corrientes, E. Ríos and Misiones).

Description of the last instar larva

(Figs. 1 – 7)

Head. Pale, with diffuse dark pattern on dorsum, setose; 2.4 times as wide as long. Occiput with four pale strips, posterior margin concave. Mandibular formula according to Watson (1956) (Figs. 1-2): $L \ 1 \ 2 \ 3 \ 4 \ 0 \ a \ b / R \ 1 \ 2 \ 3 \ 4 \ y \ a \ b \ d$. Labium (Fig. 3-4) reaching caudad to second coxae; prementum pale, anterior margin slightly crenulated with 18 or 19 setae, ligula obtuse, ratio of maximum width to maximum length 1, lateral setae 10 (1.3 mm the longest). Labial palp with minute black spots and a large one on the inner angle, with 7 or 8 setae; anterior margin slightly crenulated with 10 or 11 setae, inner margin no crenulated with nine setae.

Thorax. Pale; prothorax with a mid-dorsal diffuse black spot. Wing pads reaching caudad to

abdominal segment VII; femora with two annular dark bands, one subbasal and one subapical.

Abdomen. brownish, with a middorsal pale stripe in segments VIII-X and epiproct; lateral spines on segments VIII and IX brown with a transverse pale stripe at 0.3 from base, ratio of spine length to maximum length of corresponding segment 0.4 / 0.33 (reared specimen) and 0.62 / 0.5 (reared specimen) respectively (Fig. 5). Paraprocts (Figs. 6-7) nearly five times as long as segment X; ratio relative to paraprocts: epiproct 1, cerci 0.61. Epiproct wide at the base, apex acute. Paraprocts, epiproct and cerci tips slightly recurved ventrad.

Measurements (exuviae in brackets, if different) (mm): Head maximum length: 1.4 [1.5]; head maximum width: 3.4 [3.6]; prementum maximum length: 2.3 [2.5]; prementum maximum width 2.4 [2.5]; labial palp maximum length: 1.6 [1.7]; movable hook length 0.5; inner wing pads: 3.7; length of femora: I, 1.7 [1.9]; II, 2.1 [2.3]; III, 2.75 [2.8]; length of tibiae: I, 1.9 [2.1]; II, 2.2 [2.4]; III, 2.95 [3.3]; length of abdominal terga: VI, 0.55 [0.65]; VII, 0.5 [0.6]; VIII, 0.5 [0.6]; IX, 0.4 [0.5]; X, 0.15; width of abdominal terga: VI, 3.4 [4.3]; VII, 3.4 [4.1]; VIII, 3.1 [3.7]; IX, 2.1 [2.7]; X, 1.1 [1.3]; lateral spines on abdominal segment VIII: 0.2; on segment IX: 0.25; cerci: 0.5; paraprocts: 0.7; epiproct: 0.7.

DISCUSSION

The current knowledge of the immature stages of the genus *Erythrodiplax* is still scarce, with only a third of its species presently known from the larval stage. Considering that most of the larval descriptions were made on non Argentinean specimens, and that the larvae of many of the species sympatric with *E. paraguayensis* in Argentina are still unknown, the elaboration of a useful regional key is not yet possible. Nevertheless, Costa *et al.* (2001) provided a key to the Brazilian species including all the known larvae recorded from Argentina. In order to include *E. paraguayensis* in that key we propose a modification from couplet 7, as follows:

7. Labial palp with 7 – 9 setae. 9
 7'. Labial palp with 6 setae. 8
 8. Two setae at the labial palp articulation *E. basalis*
 8'. Three setae at the labial palp articulation *E. fusca* (in part)

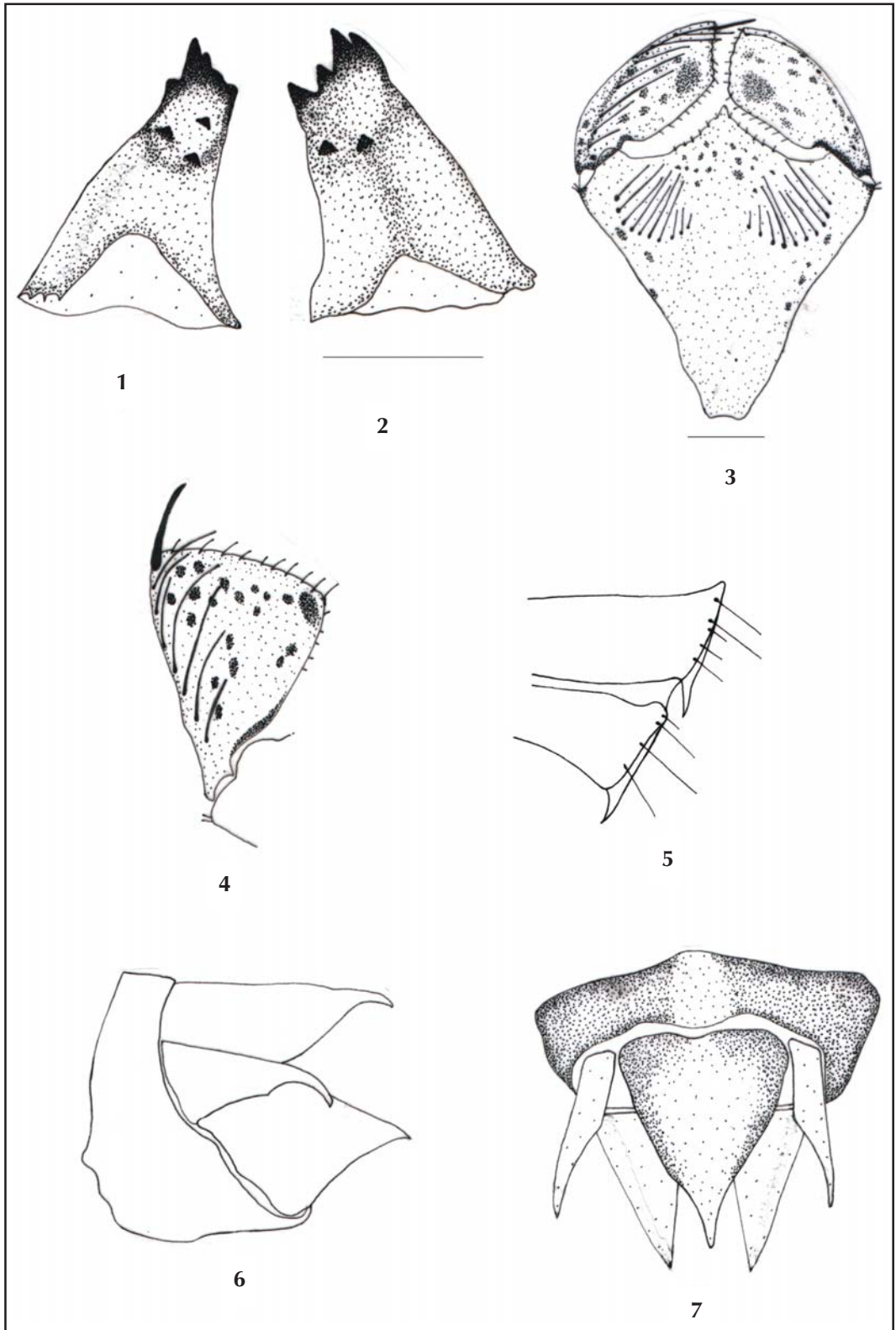


Fig. 1-7. Last larval instar of *Erythrodiplax paraguayensis*. 1, right mandible, inner view; 2, left mandible, inner view; 3, prementum, dorsal view (left palp without setae); 4, Labial palp, dorsal view; 5, lateral spines on terga VIII-IX, dorsal view; 6, terminalia, lateral view; 7, terminalia, dorsal view. Scales 0.5mm, (in Figs. 1 and 4-7 as in Fig. 2).

Table 1. Head main characters of the last larval instar of *Erythrodiplox* species recorded from Argentina. Additional sources: ¹Venezuelan specimens cited by Limongi, 1991; ²Klots, 1932; ³Needham & Westfall, 1955; ⁴Calvert, 1928; ⁵Costa *et al.*, 2001; ⁶Carvalho *et al.*, 1991; ^{*}based upon the description's figures.

	Max. length	Max. width	Prementum max. length	Prementum max. width	Prementum setae	Labial palp setae	N° setae on each crenulation	Mandibular formula	Reference
<i>E. anomala</i>	1.82/1.71	3.88/3.77	3.22/3.04	2.71	11-12	7	1	1234 y ² ab 1234 y abc-d	Carvalho <i>et al.</i> , 1991
<i>E. basalis</i>	1.5	3.5	2.16	2.33	10	6	1	1234 0 ab 1234 y abc	Costa <i>et al.</i> , 2001
<i>E. fusca</i>	2 [*] ; 2.4 ⁶	4; 4.1/3.99 ⁶	3.5; 2.94/3.4 ⁶	2.8; 3.22/2.94 ⁶	10; 9-11 ¹ ; 10 ⁶	8 7 ⁵ , 6 ^{1,6}	1 [?] ; 1 ⁶		Santos, 1967
<i>E. juliana</i>	1.71/2.28	3.88/4.21	3.63	2.94/2.18	11	9	1	1234 0 ab 1234 y abc-d	Carvalho <i>et al.</i> , 1991
<i>E. latimaculata</i>	2	3.5	3.4	3	10	6	1	1234 0 ab 1234 y abc	Costa <i>et al.</i> , 2001
<i>E. lygaea</i>					10	6	1	1234 y ab	Costa <i>et al.</i> , 2001
<i>E. melanorubra</i>	2.58 [*]	4	4.16 [*]	4.44 [*]	11	7	1		Limongi, 1991
<i>E. nigricans</i>	1.86±0.2	4.1±0.08	2.86±0.17	2.75±0.23	11-13	8-9	1, without crenulations	1234 0 ab 1234 y abd	von Ellenrieder & Muzón, 2000
<i>E. ochracea</i>	1.93/1.82	4.33/4.22	3.64/3.76	3.53	12	9	1	1234 0 abb [*] 1234 y abcd	Carvalho <i>et al.</i> , 1991
<i>E. paraguayensis</i>	1.4 [1.5]	3.4 [3.6]	2.3 [2.5]	2.4 [2.5]	10	8-7 [7]	1	1234 0 ab 1234 y abd	This work; exuviae in brackets
<i>E. umbrata</i>	2.17/2.85 2 ⁵	4.79/4.56; 4.8 ² ; 3.5 ⁵ 4.88-5.18 ⁴	4.09 3 ⁵	3.5/3.86	13-15; 13-14 ² ; 13 ³ 13-16 ¹ ; 14 ⁵	10-11; 10 ³ 10-11 ^{2,4} 12 ⁵	2-3; 2 ³ ; 2-3 ^{2,4,5}	1234 0 a 1234 y abc ⁵	Carvalho <i>et al.</i> , 1991

Table II. Thorax and abdomen main characters of the last larval instar of *Erythrodiplax* species recorded from Argentina. Additional sources: ¹ Venezuelan specimens cited by Limongi, 1991; ² Klots, 1932; ³ Needham & Westfall, 1955; ⁴ Calvert, 1928; ⁵ Costa *et al.*, 2001; ⁶ Carvalho *et al.*, 1991; ⁷ based upon the description's figures.

	Inner W.P. length	3 rd . Femur length	3 rd . Tibia length	Spine seg. VIII	Spine seg. IX	Dorsal hook	Cerci/Paraproct	Epipect/Paraproct	Abd. max. width	Abd. length	Total length	Reference
<i>E. anomala</i>	3.99/3.88	3.19	3.99/3.88	0.3 [*]	0.3 [*]	0	<1	1	4.33	6.61/ 6.72	11.97/12.08	Carvalho <i>et al.</i> , 1991
<i>E. basalis</i>	3.5	2.5	3	0.4 [*]	0.4 [*]	0	0.69	0.9	3.7	6.8	12.5	Costa <i>et al.</i> , 2001
<i>E. fusca</i>	4; 4.45/4.33 ⁶	3 [*] ; 3.08/3.31 ⁶	3 [*] ; 3.99/3.88 ⁶	? 0.4 [*]	? 0.6 [*]		0.7	1	4; 4.22 ⁶	4; 7.07/ 6.95 ⁶	10; 10.8 -12 ¹ ; 12.8 ⁶	Santos, 1967
<i>E. juliana</i>	3.99/3.87	3.42/3.07	3.88/2.96	0.3 [*]	0.4 [*]	0	<	1	4.1	6.61 7.52	12.2/13.11	Carvalho <i>et al.</i> , 1991
<i>E. latimaculata</i>	4	2.5		0.2 [*]	0.4 [*]	0	0.61	0.92	4	7	11.2	Costa <i>et al.</i> , 2001
<i>E. lygaea</i>	4			0.25 [*]	0.48 [*]	0	0.19	0.39				Costa <i>et al.</i> , 2001
<i>E. melanorubra</i>	5.48 [*]	3.5	4.3	0.4	0.4	0	0.8	aprox. 1	4.8	7	13	Limongi, 1991
<i>E. nigricans</i>	5.03±0.17	3.71±0.28	4.47±0.26	0.42	0.75	0	0.6	0.84	4.92±0.38			von Ellenrieder & Muzón, 2000
<i>E. ochracea</i>	4.21/4.1	3.3/3.88	4.44/4.67	0.4 [*]	0.5 [*]	0	<	1	4.67/4.52	7.52	13.33/13.91	Carvalho <i>et al.</i> , 1991
<i>E. paraguayensis</i>	3.7	2.75 [2.8]	2.95 [3.3]	0.2	0.25	0	0.7	1	3.4 [4]	5.7 [5.9]	9.7 [12.3]	This work; exuviae in brackets
<i>E. umbrata</i>	5.24/5.13	4.33/4.1; 3.9 ² ; 3.85-4.6 ⁴	5.13/4.79	0.5 ² ; 0.3 ³	0.5 ² ; 0.4 ³	0 ³	0.6 ³ ; 0.5 ⁴	0.9 ³ ; 0.77 ⁴	4.79/5.24; 5.5 ² ; 5.03-5.48 ⁴	8.32 /9.01	14.84/16.3; 14 ² ; 16-17 ³ ; 16-19 ⁴	Carvalho <i>et al.</i> , 1991

9. Two setae at the labial palp articulation 10
 9'. Three setae at the labial palp articulation 12
 10. Cerci in dorsal view as long as or longer than 0.5 epiproct length. Labial palp with 7-8 setae. Prementum with 10-11 setae. 11
 10'. Cerci in dorsal view shorter than 0.5 epiproct length. Labial palp with 9 setae. Prementum with 12 setae ***E. ochracea***
 11. Labial palp with 7 setae. Prementum with 11 setae. Spines on abdominal segments VIII-IX long (0.4 mm) ***E. melanorubra***
 11'. Labial palp with 8-9 setae. Prementum with 10 setae. Spines on abdominal segments VIII-IX short (0.2-0.25 mm) ***E. paraguayensis***
 12. Epiprocts shorter than paraprocts *nigricans*
 12'. Epiprocts as long as paraprocts .. ***E. fusca*** (in part)

The information provided in the descriptions and redescrptions of the Argentinean *Erythrodiplax* larvae shows uniformity of metric and morphological characters, being the distinction between species very difficult (Tables I-II). The last larval instar of *E. paraguayensis* is similar in size to *E. basalis* and can be distinguished from it by the number of labial palp setae, the mandibular formula and short lateral spines of abdominal segments VIII - IX (see Tables I-II). It can be distinguished from the other hitherto known Argentinean species by its smaller size and by the number of labial palp setae (from *E. ochracea* and *E. umbrata*), the number of prementum setae (except from *E. fusca*, *E. latimaculata* and *E. lygaea*) and the mandibular formula (except from *E. nigricans*) (see Tables I-II).

ACKNOWLEDGEMENTS

We thank very much to Natalia von Ellenrieder for their critical reading of the manuscript. This work was partially financed by The National Geographic Society project # 7104-01.

LITERATURE CITED

- BORROR, D.J. 1942. A revision of the libelluline genus *Erythrodiplax* (Odonata). *The Ohio State University, Contributions in Zoology and Entomology* 4: 1-286.
 CALVERT, P.P. 1906. Neuroptera. Odonata. In: *Biologia Centrali Americana*. Vol. 50. Godman,

- F.D. y O. Salvin, eds. Porter and Dulau and Co., Londres, pp. 17-420.
 CALVERT, P.P. 1928. Report on Odonata, including notes on some internal organs of the larvae. *Univ. Iowa Stud. nat. Hist.* 12: 3-44.
 CARVALHO, A.L., N. FERREYRA, JR. & J.L. NESSIMIAN. 1991. Descrição das larvas de tres especies do genero *Erythrodiplax* Brauer (Odonata, Libellulidae). *Revta. bras. Ent.* 35 (1): 165-171.
 COSTA, J.M., A.B.M. MACHADO, F.A.A. LENCIONI & T.C. SANTOS. 2000. Diversidade e distribuição dos Odonata (Insecta) no estado de São Paulo, Brasil: Parte I – Lista das espécies e registros bibliográficos. *Publ. Avul. Mus. Nac.*, Rio de Janeiro 80: 1-27.
 COSTA, J.M., L.P. VIEIRA & A.N. LOURENÇO. 2001. Descrição de três larvas de *Erythrodiplax* Brauer, 1868, e redescrção das larvas de *E. pallida* (Needham, 1904) e *E. umbrata* (Linnaeus, 1758), com chave para identificação das larvas conhecidas das espécies brasileiras (Odonata, Libellulidae). *Bol. Mus. Nac.*, N.S., Zool., Rio de Janeiro, 465: 1-16.
 FÖRSTER, F. 1904. Neotropische Libellen II. *Insekten-Börse* 21: 1-5.
 KLOTS, E.B. 1932. Insects of Puerto Rico and The Virgin Islands, Odonata or dragonflies. *Scient. Surv. P. Rico and Virgin Islands* 16 (1): 1-107 + 7 pl.
 LIMONGI, J. 1991. Estudio morfo-taxonómico de náyades de algunas especies de Odonata en Venezuela (II). *Mem. Soc. Cs. Nat. La Salle* 50 (133-134): 405-420.
 MUZON, J. & N. VON ELLENRIEDER. 1998. Odonata. In: Morrone, J.J. & S. Coscarón (Compiladores), Biodiversidad de Artrópodos argentinos. Una perspectiva biotaxonomica, cap. 2, Ed. Sur, La Plata. pp. 14-25.
 NAVÁS, L. 1927. Insectos de la Argentina y Chile. Tercera Serie. *Estudios*, Julio 1927: 22-28.
 NEEDHAM, J.G. & M.J. WESTFALL. 1955. *A manual of the dragonflies of North America (Anisoptera), including The Greater Antilles and the Provinces of the Mexican border*. Univ. Calif. Press, Berkeley.
 NEEDHAM, J.G., M.J. WESTFALL & M.L. MAY. 2000. *Dragonflies of North America*. Scientific Publishers, Gainesville, XV + 939 pp.
 RIS, F. 1911. Libellulinen 4. In: Collns. Zool. du Baron Sélys-Longchamps. Catalogue Systématique et Descriptif Fasc. 12, 4. Bruxelles. 385-527 pp.

- RIS, F. 1913. Neuer Beitrag zur Kenntnis der Odonatenfauna von Argentina. *Mémoires de la Société Entomologique de Belgique* 22: 55-102.
- RODRIGUES CAPÍTULO, A. & J. MUZÓN. 1987. Anisópteros del Parque Nacional El Palmar, Prov. De Entre Ríos (Odonata). *Rev. Soc. Entomol. Argent.* 44 (2): 128.
- RODRIGUES CAPÍTULO, A. & J. MUZÓN. 1989. Nuevas citas y localidades para los Odonata de la Argentina. *Rev. Soc. Entomol. Argent.* 47 (1-4): 143-156.
- RODRIGUES CAPÍTULO, A. & J. MUZÓN. 1990. Sobre el material de *Erythrodiplax paraguayensis* (Odonata, Libellulidae) de la colección del Museo de La Plata (Argentina). *Rev. Soc. Entomol. Argent.* 48 (1-4): 106.
- SANTOS, N.D. 1967. Notas sobre a ninfa de *Erythrodiplax connata fusca* (Rambur, 1842) Brauer, 1868 (Odonata, Libellulidae). *Atas Soc. Biol. Rio de J.* 10 (6): 145-147.
- SANTOS, N.D. 1988. Catálogo bibliográfico de ninfas de Odonatos Neotropicais. *Acta Amazonica* 18 (1-2): 265-350.
- VON ELLENRIEDER, N. & J. MUZÓN. 2000. Description of the last instar larva of *Erythrodiplax nigricans* (Rambur) (Anisoptera: Libellulidae). *Odonatologica* 29 (3): 267-272.
- WATSON, M.C. 1956. The utilization of mandibular armature in taxonomic studies of anisopterous nymphs. *Trans. Am. Ent. Soc.* 81:155-202.

Recibido: 10-III-2005
Aceptado: 16-V-2005