

Redescription of *Erythrodiplax pallida* (Needham, 1904) (Odonata: Libellulidae)

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A redescription of both sexes of *Erythrodiplax pallida* (Odonata: Libellulidae) is provided based on specimens collected in shallow wetlands associated with flood plains from small streams to large rivers in Corrientes and Buenos Aires provinces, Argentina. The vesica spermalis morphology resembles those of the basalis and nigricans groups due to the presence of median and posterior lobes and the lack of paired lobes. *Erythrodiplax pallida* is easily distinguished from the other congeners by the white frons.

Keywords: dragonfly; vesica spermalis; adult; Neotropics; Argentina

Introduction

The primarily Neotropical genus *Erythrodiplax* Brauer is one of the most speciose libellulid genera in the New World and currently comprises 57 species distributed from 46° N in southern Canada to 45° S in Patagonia (Garrison, von Ellenrieder, & Louton, 2006; Haber, Wagner, & De La Rosa, 2015). The species are inhabitants of different types of wetlands, and many of them can be abundant in temporary ponds, marshes and stream pools.

Erythrodiplax pallida was described by Needham (1904) as *Micrathyria pallida* from a male reared by Adolph Hempel at São Paulo, Brazil. In that work, Needham also provides a general description of the holotype's last instar larval exuviae and the female's wing size and vulvar lamina. Ris (1911), after studying material borrowed by Needham, transferred *M. pallida* to *Erythrodiplax* and considered it a junior synonym of *E. chloropleura* (Brauer, 1865). Borror (1942) based on the study of the vesica spermalis and wing venation of the teneral holotype re-established *E. pallida* as a valid species, and mentioned that the holotype lacked the abdomen's terminal segments. Costa, Vieira, and Lourenco (2001) redescribed the last instar larva of *E. pallida* based on the exuvia of a male from Brasilia, and included it in a key for the larvae of *Erythrodiplax* species present in Brazil.

Although there have been a few works treating *Erythrodiplax pallida*, few records have been made since its description and no other adult morphological characteristics have been documented (Bueno, 1982; Costa et al., 2001; Resende, 2010; Santos, 1953, 1956). When studying material from Corrientes and Buenos Aires provinces, we found an *Erythrodiplax* species not

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previously recorded from Argentina. Based on vesica spermalis morphology we concluded it was a new record for *E. pallida*. Given that the characters given by Needham (1904) for *E. pallida*, e.g. wing venation and body color pattern, are known to vary intraspecifically within this genus (Borror, 1942; Paulson, 2002) and morphology for this species stems from the general holotype, we consider it appropriate here to redescribe both sexes of this poorly known and infrequently encountered species.

Methodology

Specimens are deposited in the Collection of the Departamento Científico Entomología, Museo de La Plata, Argentina (MLP) and R. W. Garrison collection (RWG), Sacramento, CA. Holotype photographs were provided by Jason Dombroskie (Cornell University Insect Collection). At Corrientes' collecting sites, the pH, water temperature, electrical conductivity, salinity, and turbidity were measured using a handheld multiparameter water-quality meter (model: Horiba U-10, HORIBA, Ltd. 2, Miyanohigashi, Kisshoin Minami-KuKyoto 601-8510 Japan; Instituto de Limnología "Dr. Raúl A. Ringuelet", Buenos Aires, Argentina). Elevation and longitude/latitude coordinates were obtained by using a handheld GPS unit (model: Garmin eTrex Vista Cx, Garmin International, Inc. Olathe, Kansas, U.S.A; BioGeA, Laboratorio de Biodiversidad y Genética Ambiental, Departamento de Ambiente y Turismo, Universidad Nacional de Avellaneda (UNDAV), Argentina).

All drawings were made with the aid of a Leica MS5 stereomicroscope coupled to a digital camera DFC and the use of graphic design software and photo editor. Photographs were taken with the aid of a digital camera setup on a Nikon SMZ1500 stereomicroscope (Plant Pest Diagnostics Branch, California Department of Food & Agriculture Sacramento, California, USA). Male vesica spermalis were extracted and treated with 10% KOH at a constant temperature of 80–90°C for 15 min, washed with acetic acid, rinsed in water and stored in a vial with glycerin. Vesica spermalis terminology follows Borror (1942). Wing terminology follows Riek & Kukalová-Peck (1984). Abbreviations: S1–10 = abdominal segments 1–10, FW = forewing, HW = hind wing.

Material

Argentina, Corrientes, Parque Nacional Mburucuya, casco central estancia, 28° 03' S, 58° 14' W, col. C. Molinari, 12–14 December 1999, 2♂♂ (RWG); Corrientes, arroyo Batel sobre RP 6, 28° 17' 39.18" S, 58° 01' 52.92" W, 69 m.a.s.l., col. J. Muzón, F. Lozano & L. Ramos, 29–30 November 2010, 1 ♂ (MLP); Corrientes, Curuzú Cuatiá, arroyo Vaca Cúa sobre RN 119, 29° 36' 45.4" S, 58° 07' 07.7" W, 75 m.a.s.l., col. J. Muzón, F. Lozano & L. Ramos, 27 January 2012, 1 ♂ (MLP); Buenos Aires, Lima, charca del Club de Pesca, 33° 58' 22" S, 59° 10' 51" W, 19 December 1994, col. J. Muzón, 3 ♂♂ (RWG).

Results

Erythrodiplax pallida (Needham, 1904) *Figures 1–5*

Micrathyria pallida Needham, 1904: 710–712 [orig. descr. male holotype from São Paulo, Brazil; descr. last instar larvae exuviae and comments on female's wings and vulvae morphology and size], figures 4–6 [male apps, secondary genitalia and larvae abd.].

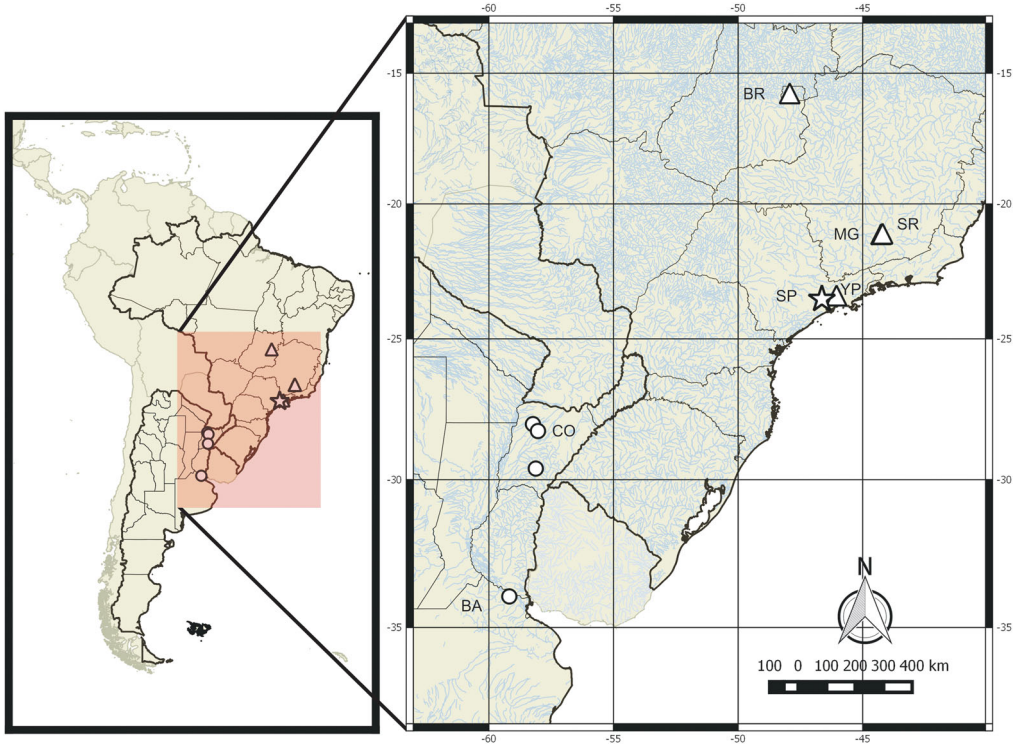


Figure 1. *Erythrodiplax pallida*, distribution map. ☆: Type locality. Δ: previous known localities; o: this work.

Erythrodiplax chloropleura (Brauer): Ris, 1911: 510–512 [in part: specimens from São Paulo, São Joao del Rey and Ypiranga; new combination and synonymy].

Erythrodiplax pallida (Needham): Borror, 1942: 130–131 [descr. holotype's vesica spermalis], figures 124, 204, 256, plate XXXVII [holotype's vesica spermalis, male apps and secondary genitalia, distribution map]; Santos, 1953: 500 [comparison with *E. anomala*]; Santos, 1956: 4 [comparison with *E. luteofrons*]; Bueno, 1982: 140 [cytogenetic study]; Costa et al., 2001: 1–2, 7–9 [record from Brasilia, descr. last larval instar]; Resende, 2010: 111–114 [behavior study, record from Minas Gerais, Brazil].

Erythrodiplax sp.: Muzón & von Ellenrieder, 1998: 24 [record from Buenos Aires province, Argentina].

Erythrodiplax n. sp.: Garrison et al., 2006: 243 [species included under “potential new species”].

Erythrodiplax sp. 1: von Ellenrieder & Muzón, 2008: 63–64 [record from Entre Ríos and Corrientes provinces, Argentina].

Male

Head. Vertex rounded, metallic light blue; occipital triangle black; frons and clypeus bluish white; labrum, labium, base of mandibles and genae yellowish white (Figure 2a).

Thorax. Prothorax black dorsally, becoming pale brown ventrally. Pterothorax dark brown becoming black dorsally and laterally along sutures, olive green ventrally (Figures 2b, 3a). Pruinosity extending dorsally from mesepimeron to articular sclerites, and with dorsolateral patches on metepisternum. Immature specimen color pattern paler, similar to female. Legs: coxae and

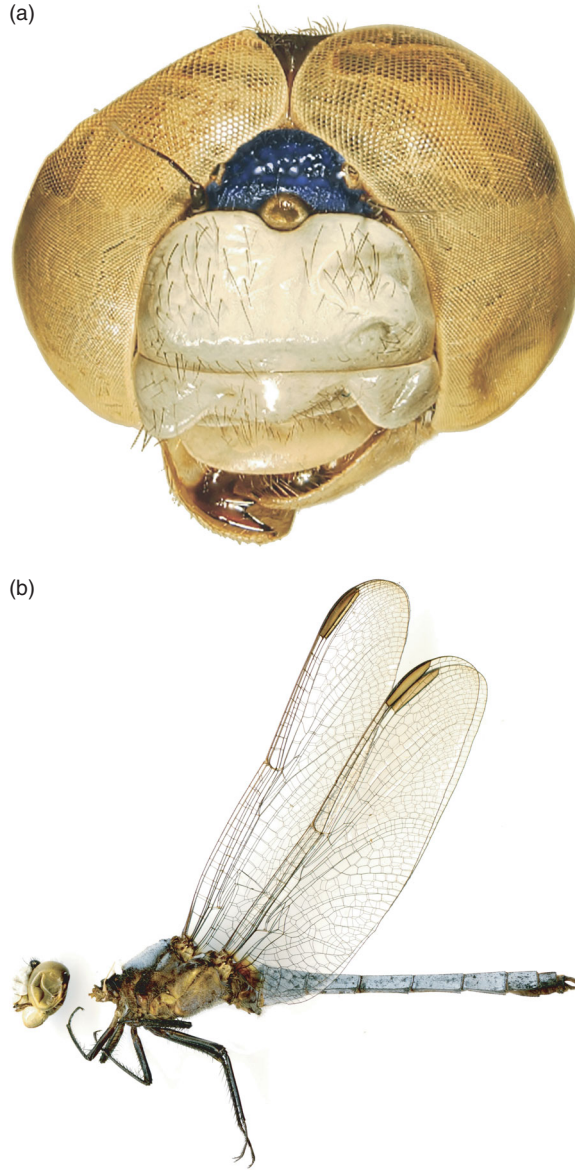


Figure 2. *Erythrodiplax pallida*, male (Lima, Buenos Aires): (a) head, anterior view; (b) imago, lateral view.

trochanters yellowish; femora black, external (posterior) side pale brown; tibiae, tarsi and armature black; metafemora with 19 to 21 spines, the last one two times as long as the penultimate (Figure 3b). Wings hyaline, venation black, pterostigma pale brown (Figure 2b, 3c); FW with a small basal reddish brown spot not surpassing basal 0.1 of cubito-anal space; HW with a basal triangular reddish brown spot reaching the base of anal loop. FW: antenodals $8\frac{1}{2}$, $9\frac{1}{2}$ or $10\frac{1}{2}$; postnodals 7–8; triangle 2 celled (3 in one wing); subtriangle 3 celled (4 in one wing); discoidal field with 3 rows of cells. HW: antenodals 7–8; postnodals 7–8; triangle free; CuP separated from anal angle of triangle.

Abdomen. S1 and S2 pale yellow, dorsally black. S3–10 black with a dark red mid-dorsal stripe, tapered caudally or with only a faint trace in S8–10; sterna reddish brown; pruinulent

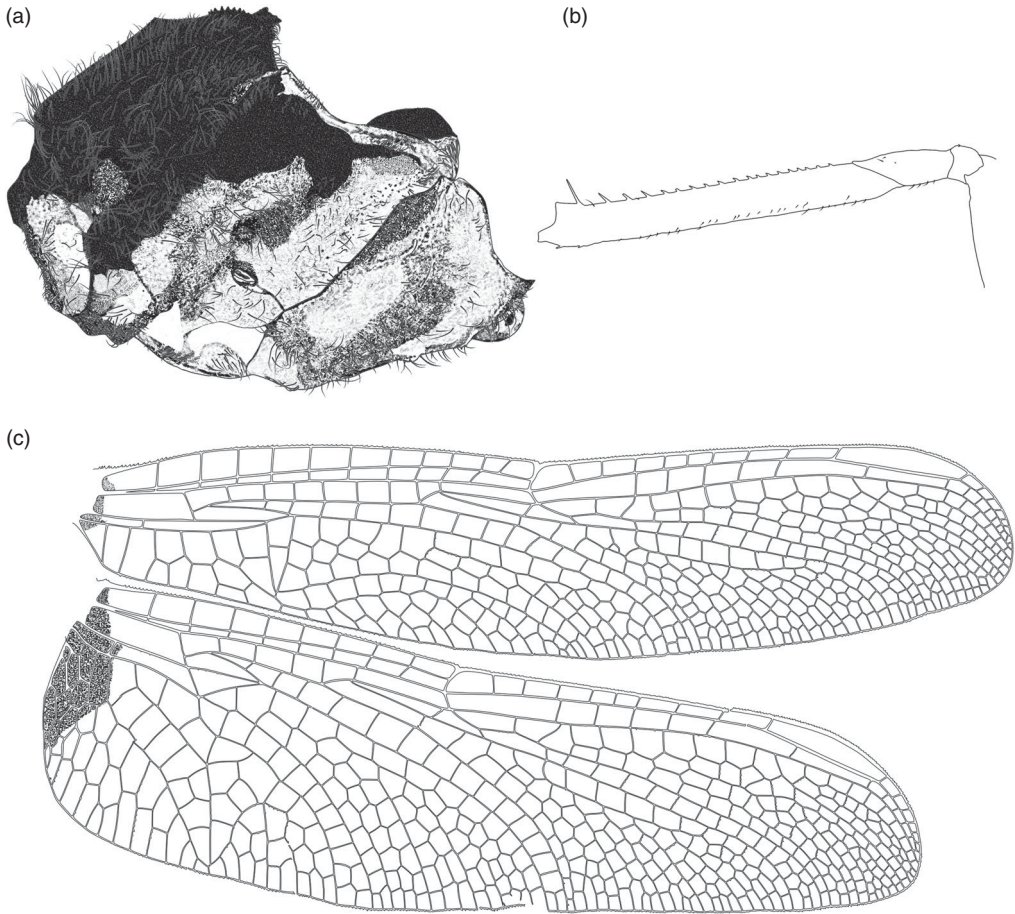


Figure 3. *Erythrodiplax pallida*, male: (a) pterothorax, lateral view; (b) femur III; (c) wings.

dorsally from S1 to S9 (Figure 2b). Cerci dark red with 7–8 denticles at distal 0.5 (Figures 2b, 4a). Anterior outer branch of hamule larger than inner (Figure 4b). Vesica spermalis medial lobe large, surface micropunctated; without internal paired lobes; small to medium size posterior lobe, with rows of long setae; median process developed, not erectile; lateral lobes quadrangular, not reaching distal apex of the median process (Figure 4c).

Measurements. ($n = 3$, in mm): total length (without cerci): 34–36.3, femur III 4.4–4.6, FW length 29–30.5, HW length 27–29, FW pterostigma length 4.4–4.6.

Female

Color pattern as male with the following exceptions: frons, post- and anteclypeus greenish white; pterothorax paler (Figure 5a); coxae, trochanters and external (posterior) side of femora light brown, remainder of legs black; cerci pale brown. Wing basal spots paler. FW: antenodals $9\frac{1}{2}$; postnodals 7; triangle 2-celled, subtriangle 3-celled; discoidal field with 3 rows of cells. HW: antenodals 7; postnodals 7; triangle free. Vulvar lamina as long as 0.8 of S9 length (Figure 5b).

Measurements. ($n = 1$, in mm): Body total length (without cerci) 36.9, FW length 30.0 HW length 28.0, femur III 5.3, FW pterostigma length 4.7.

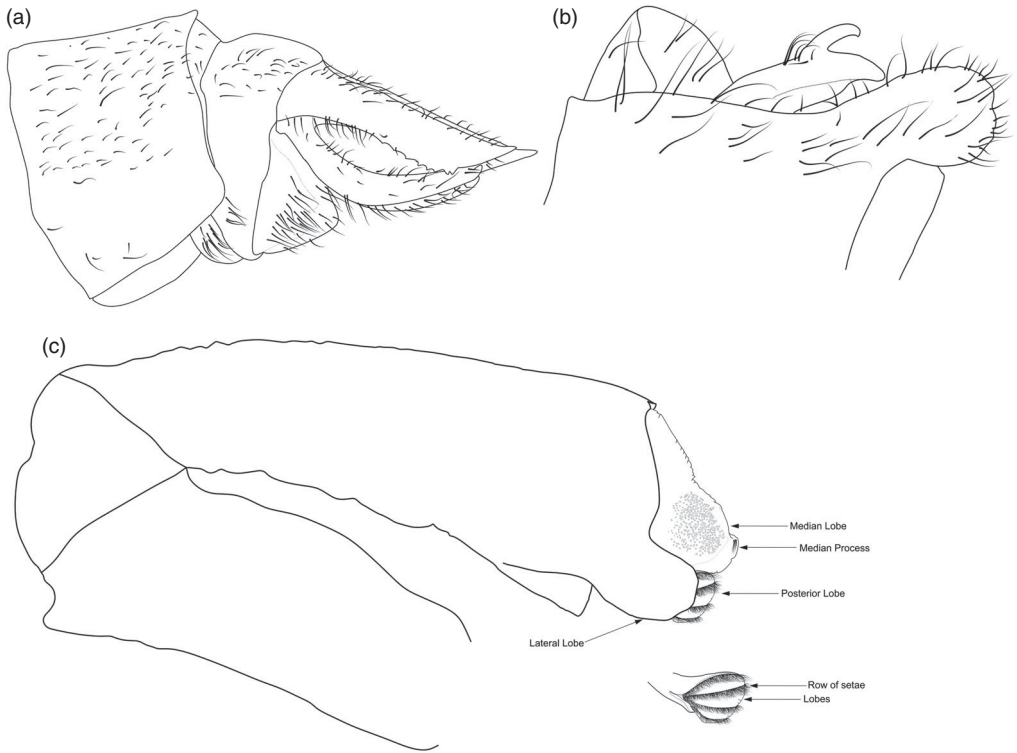


Figure 4. *Erythrodiplax pallida*, male: (a) S9–10, lateral view; (b) accessory genitalia, lateral view; (c) vesica spermalis, lateral view.

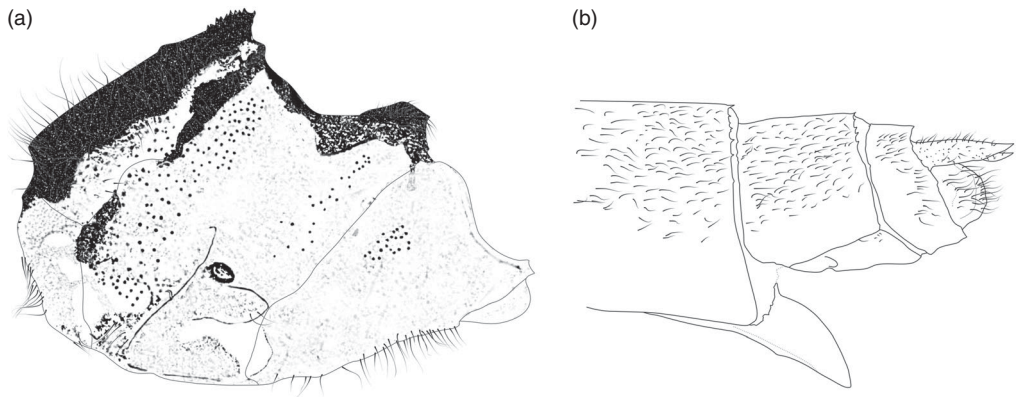


Figure 5. *Erythrodiplax pallida*, female: (a) pterothorax, lateral view; (b) S8–10, lateral view.

Diagnosis

Both sexes of *Erythrodiplax pallida* are easily distinguished from the other congeners by the white frons (either with bluish or greenish reflections). Presence of the median and posterior lobes and absence of paired lobes of vesica spermalis in *E. pallida* resembles those of the basalis group; nevertheless, *E. pallida* differs from species within this group by the small to

medium posterior lobe, mostly hidden behind the lateral lobes (Figure 4c). In some specimens of *E. nigricans* a smaller posterior lobe can be observed but this is due to postmortem preservation; those specimens may look similar to *E. pallida*; however, they can be separated by the form of lateral lobes (quadrangular in *E. pallida*). In addition to the head color pattern, females of *E. pallida* can be distinguished from other sympatric congeners by the presence of a complete abdominal lateral black stripe on S4–9 (occupying posterior 0.5 or absent in *E. atroterminata* Ris, 1911, *E. fusca* (Rambur, 1842), *E. media* Borror, 1942, *E. melanorubra* Borror, 1942, *E. nigricans* (Rambur, 1842), *E. paraguayensis* (Förster, 1905) and *E. umbrata* Linnaeus, 1758)).

According to the key provided by Borror (1942), males of *Erythrodiplax pallida* run to couplet 46 and females to couplets 68 and 74. In order for the key to include mature specimens of *E. pallida* we propose a modification of those couplets as follows:

<i>Males</i>	
46	Frons of adults blue-black, without yellow lateral spots; hind wing 21.5–24.5 mm <i>andagoya</i>
46'	Frons of adults blue-black, with a small yellow spot on each side next of compound eye, below the base of antenna; or, if frons in adult is entirely blue-black, then from southern and southeastern Brazil and Paraguay; hind wing 16.5–25.0 mm <i>basalis</i>
46''	Frons white, greenish yellow in teneral; hind wing 22–28 mm; southern Brazil and Argentina <i>pallida</i>
<i>Females</i>	
68	Cu1 in HW usually separated from anal edge of triangle; thorax variable, but without a definite dark antehumeral stripe; last antenodal in front wing complete or incomplete; HW 15.0–28.0 mm; South America, Central America, and the West Indies 69
68'	Cu1 in HW usually arising at anal angle of triangle or only slightly separated from it; last antenodal in front wing usually incomplete; usually a dark antehumeral stripe on thorax; HW 20.0–31.5 mm; South America, Central America, West Indies, Mexico, and United States 74
74	HW 15.0–20.0 mm; triangle in front wing free or crossed 75
74'	HW 20.0–28.0 mm; triangle in front wing usually crossed 86
86	CuP usually arising at or slightly separated from anal triangle, abdomen with dark lateral stripe occupying posterior 0.5 or absent in S4–9, pterothorax pale brown with black antehumeral stripe <i>media</i>
86'	CuP separated from anal triangle, abdomen with lateral black stripe complete on S4–9, pterothorax dark brown becoming black dorsolaterally, olive green ventrally <i>pallida</i>

Remarks

Argentinean specimens of *Erythrodiplax pallida* were collected in shallow and sunny wetlands associated with small streams to large rivers flood plains, mainly in the Parana river basin (Lozano, Muzón, & Scattolini, 2012; Schnack, Muzón, & Pérez Goodwyn, 1998). Although

Table 1. Water quality parameters.

	Vaca Cúa stream*	Batel stream
pH	8.18	7.16
Turbidity (NTU)	2	12
Conductivity (mS cm ⁻¹)	0.38	0.27
Salinity (%)	0.01	0
Temperature (°C)	23.8	28.1
Depth (cm)	50	60
O ₂	19.1	10.6

*From Lozano et al. (2012).

extensive and intensive fieldwork has developed in the area over the last 20 years, findings of *E. pallida* have been rare and never twice within the same locality. Nevertheless, the known ecosystem type and water quality parameters (available for Vaca Cuá and Batel streams, Table 1) suggests that this species does not require particular environmental conditions.

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References

- Borror, D. J. (1942). *A revision of the Libelluline genus Erythrodiplax (Odonata)*. Columbus: Ohio State University Graduate Studies, Contributions in Zoology and Entomology, 4, Biological Series.
- Bueno, A. M. S. (1982). *Estudos cromossômicos na Ordem Odonata (Dissertação (Mestrado em Zoologia))*. São Paulo: Instituto de Biocécia, Universidade Estadual Paulista Julio de Mesquita Filho. 140 p.
- Costa, J. M., Vieira, L. P., & Lourenco, A. N. (2001). Descrição de três larvas de *Erythrodiplax* Brauer, 1868, e rediscrção das larvas de *E. pallida* (Needham, 1904) e *E. umbrata* (Linnaeus, 1758), com chave para identificação das larvas conhecidas das espécies brasileiras (Odonata, Libellulidae). *Boletim do Museu Nacional. Nova Serie, Zoologia. Rio de Janeiro*, 465, 1–16.
- Garrison, R. W., von Ellenrieder, N., & Louton, J. A. (2006). *Dragonfly genera of the new world. An illustrated and annotated key to the Anisoptera*. Baltimore: The Johns Hopkins University Press. 368 p.
- Haber, W. A., Wagner, D. L., & De La Rosa, C. (2015). A new species of *Erythrodiplax* breeding in bromeliads in Costa Rica (Odonata Libellulidae). *Zootaxa*, 3947(3), 386–396. doi:10.11646/zootaxa.3947.3.5.
- Lozano, F., Muzón, J., & Scattolini, C. (2012). Description of final stadium larva of *Telebasis obsoleta* (Selys, 1876) (Odonata: Coenagrionidae). *Zootaxa*, 3186, 54–58. Retrieved from <http://www.mapress.com/jzt/article/view/12908>
- Muzón, J., & von Ellenrieder, N. (1998). Odonata. In J.J. Morrone & S. Coscarón (Eds.), *Biodiversidad de Artrópodos argentinos. Una perspectiva biotaxonómica* (pp. 14–25). La Plata: Ediciones Sur.
- Needham, J. G. (1904). New dragonfly nymphs in the United States National Museum. *Proceedings of the United States National Museum*, 27, 685–720. Retrieved from <http://www.biodiversitylibrary.org/part/3305>
- Paulson, D. R. (2002). Comments on the *Erythrodiplax connata* (Burmeister, 1839) group, with the elevation of *E. fusca* (Rambur, 1842), *E. minuscula* (Rambur, 1842), and *E. basifusca* (Calvert, 1895) to full species (Anisoptera: Libellulidae). *Bulletin of American Odonatology*, 6, 101–110.
- Resende, D. C. (2010). Residence advantage in heterospecific territorial disputes of *Erythrodiplax* Brauer species (Odonata, Libellulidae). *Revista Brasileira de Entomologia*, 54 (1), 110–114. doi:10.1590/S0085-56262010000100014.
- Riek, E. F., & Kukulová-Peck, J. (1984). A new interpretation of dragonfly wing venation based upon Early Upper Carboniferous fossils from Argentina (Insecta: Odonatoidea) and basic character states in pterygote wings. *Canadian Journal of Zoology*, 62, 1150–1166. doi:10.1139/z84-166
- Ris, F. (1911). Collections Zoologiques du Baron de Selys Longchamps; catalogue systématique et descriptif. Fasc. XII. *Libellulinen*, 4, 385–528. doi:10.5962/bhl.title.9137
- Santos, N. D. (1953). Fauna do Distrito Federal. 2. Redescrção de *Erythrodiplax anomala* (Brauer, 1865) Brauer, 1868 (Odonata, Libellulidae). *Anais da Academia Brasileira de Ciências*, 25, 499–504.
- Santos, N. D. (1956). *Erythrodiplax luteofrons* n. sp. (Odonata: Libellulidae). *Boletim do Museu Nacional. Nova Serie, Zoologia. Rio de Janeiro*, 141, 1–5.
- Schnack, J. A., Muzón, J., & Pérez Goodwyn, P. J. (1998). Belostomatidae (Heteroptera) en el area de influencia de la central nuclear atucha. Inventario y estudio poblacional. *Aquatec*, 5, 53–57. Retrieved from <http://www.ilpla.edu.ar/revistas/aquatec/aquatec5.pdf>
- von Ellenrieder, N., & Muzón, J. (2008). An updated checklist of the Odonata from Argentina. *Odonatologica*, 37, 55–68. Retrieved from <http://natuurtijdschriften.nl/download?type=document&docid=592615>