

## Odonata of Itatira, a Brazilian semi-arid area in the state of Ceará

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The present study provides the first odonate survey for the Brazilian Caatinga, including species habitat information. Specimens were collected during five days in both dry and rainy seasons of 2011 in the municipality of Itatira, state of Ceará, located in the semi-arid region of northeastern Brazil. Adult individuals of 37 species were documented, the highest richness value thus far recorded for the region. Individuals of the majority of the species were recovered from small, temporary water bodies. In general, the local odonate community is composed of species with wide continental distributions, with the exception of *Macrothemis lutea*, *M. griseofrons* and *Erythrodiplax letícia*, which are restricted to northeastern Brazil. New occurrences and expanded distribution ranges of species are discussed.

**Keywords:** Anisoptera; aquatic invertebrates; damselflies; dragonflies; tropical dry forest; Zygoptera

### Introduction

The Caatinga is a heterogeneous, semi-arid biome exclusive to Brazil. It is located mainly in the northeastern part of the country and is characterized by a xerophytic deciduous vegetation, with very irregular inter- and intra-annual rain regimes and long periods of severe drought (Prado, 2003; Reis, 1976). Although it occupies about 10% of the Brazilian territory (c.800.00 km<sup>2</sup>; Instituto Brasileiro de Geografia e Estatística, 1985), it is proportionally the most poorly studied and under-protected natural environment of the country (Leal, Silva, Tabarelli, & Lacher, 2005). Moreover, the Caatinga bears a long history of extensive exploitation for wood, hunting, agriculture and pasture, resulting in an extremely human-altered and fragmented landscape (Castelletti, Silva, Tabarelli, & Santos, 2004) that is also very susceptible to desertification (Drumond et al., 2000). Only within the past decade has serious scientific attention been drawn to the Caatinga with an intent of quantifying the influence of human impact, surveying the regional fauna and flora and tracing conservation priorities (review in Leal, Tabarelli, & Silva, 2003). An immense integration of the most important river of northeastern Brazil – the São Francisco river – to its northern hydrographic bay is being conducted (Ministério da Integração Nacional, 2004; Ministério do Meio Ambiente & Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, 2005). This may greatly affect the local aquatic communities, that for example bear an astonishing

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57% endemism rate of fishes (Rosa, Menezes, Britski, Costa, & Groth, 2003). Therefore, basic faunal knowledge has to be generated with urgency in order to better understand the biotic changes to come.

The odonate fauna of the Caatinga is virtually unknown. According to De Marco & Vianna, (2005), no single inventory is available for this region and all data used by them came from sporadic collections that revealed no more than 20 species for a given locality. Within this scenario, those authors suggest that the whole Brazilian northeast should be a priority region for inventories of the group.

Here we provide the first organized Odonata species list for an area of Caatinga, along with information on the habitats where specimens were recorded.

### Study area and methodology

This study was part of a broader insect survey conducted in the municipality of Itatira ( $4^{\circ}31'44''\text{S}$ ,  $39^{\circ}37'20''\text{W}$ ), state of Ceará, northeastern Brazil (Figure 1). The local vegetation is composed of typical shrub and arboreal Caatinga. In the sampling year (2011), annual average temperature of the region ranged from 24 to 26°C and the average precipitation rate was 810 mm (Instituto de pesquisa e estratégia econômica do Ceará, 2011). Historically, the rainy period extends from January to April, but in the sampling year it was prolonged until May. The local hydrography is composed mainly of temporary rivers and streams, with few artificial permanent lakes.

The collections were conducted by the senior author along the margins of water bodies ( $4^{\circ}35'58''\text{S}$ ,  $39^{\circ}44'28''\text{W}$ ;  $4^{\circ}34'25''\text{S}$ ,  $39^{\circ}47'27''\text{W}$ ;  $4^{\circ}33'35''\text{S}$ ,  $39^{\circ}45'28''\text{W}$ ) using an entomological net. Survey was complemented by photographic documentation. Sampling time was from

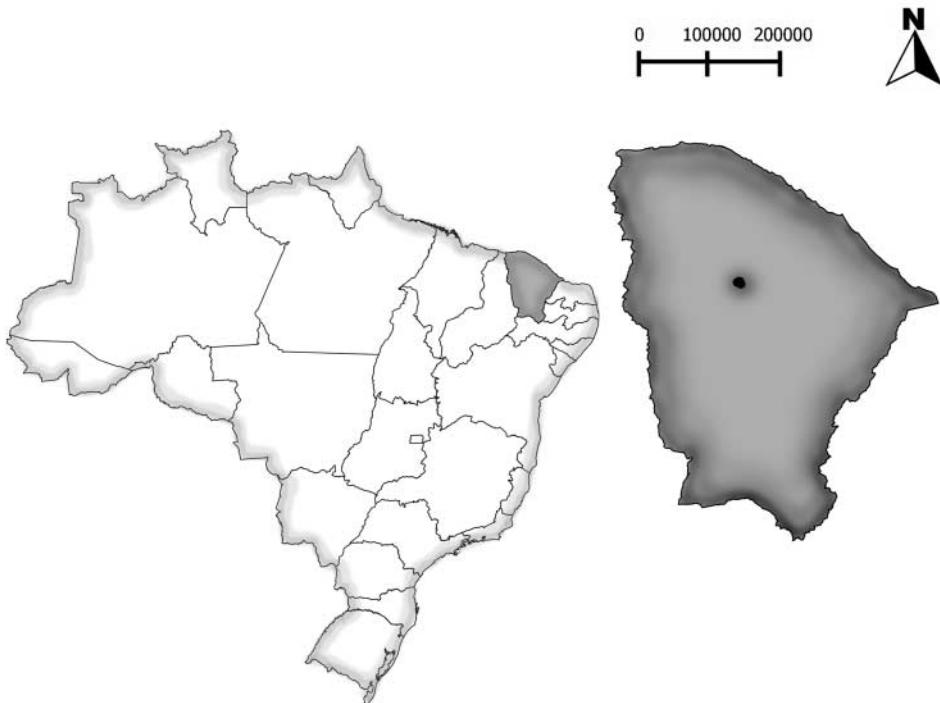


Figure 1. Location of the sampling area in the municipality of Itatira, state of Ceará, northeastern Brazil.

09h00 to 12h30 and 14h00 to 16h00 from 15–19 May (during the rainy season) and from 17–21 August (during the dry season), totaling 55 sampling hours. The collected individuals are deposited at Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ), Rio de Janeiro, and at Museu de Fauna do CEMAFAUNA-CAATINGA, Universidade Federal do Vale do São Francisco (UNIVASF), Petrolina, Pernambuco.

Information regarding the type of habitat in the associated water bodies was recorded and categorized according to [Martens \(2003\)](#).

## Results

A total of 90 individuals of Odonata belonging to 37 species were collected. Libellulidae was the most speciose family, with 25 species. Individuals of the majority of the species were recorded on temporary water bodies (23 species) and in sunny spots (34 species) (Table 1). The most frequent species was *Acanthagrion gracile*, commonly found in streams where individuals were repeatedly observed copulating and ovipositing on floating vegetation (Figure 2m). Individuals of only nine species were recorded in shaded mesohabitats (Table 1).

Individuals of *Miathyria*, *Pantala*, *Tauriphila* and *Tramea* were recorded in open fields and when they flew over the sparse shrub vegetation, far away from water bodies (Table 1).

## Discussion

The odonate fauna within the studied area is generally composed of species with broad continental distribution. As previously observed by [Williamson \(1923\)](#), odonate species whose larvae emerge from temporary pools and whose adult lifespan is long have a tendency to be “wide wanderers,” thus occupying broad geographical ranges. The hydrography of the Caatinga is dominated by intermittent and ephemeral water courses, a consequence of irregular rain regimes, shallow soils and high temperatures and evaporation rates (review in [Prado, 2003](#)). Naturally, in the studied region, the main reproductive habitats for the odonates were temporary rivers, streams and ponds.

Although the sampling effort of this survey was low, the recorded number of species was higher than previously known from any other local survey in the Caatinga ([De Marco & Vianna, 2005](#)). This result was expected, since this is the first focused survey performed within this domain. In fact, for northeastern Brazil, our survey is second only in species richness to a study conducted in the Atlantic Rainforest of the state of Bahia ([De Marco & Vianna, 2005](#)). Further sampling will surely increase the number of species, although according to [Williamson \(1923\)](#), highly seasonal environments have relatively lower dragonfly diversity than tropical environments with uniform climates. Thus, in the Caatinga, one cannot expect such high numbers of species as in the Atlantic and Amazon rainforests. This trend had already been observed for other insect groups (e.g. [Duarte & Schlindwein, 2005](#), for Spingidae; [Leal, 2003](#), for ants; [Maia, Ianuzzi, Nobre, & Albuquerque, 2003](#), for Cerambycidae; [Nobre, Schlindwein, & Mielke, 2008](#), for butterflies; [Zanella & Martins, 2003](#), for bees). The vegetation of the Caatinga exhibits a less complex structure than those of rainforests and this surely limits the occurrence of more specialized taxa of Odonata, such as Pseudostigmatidae.

Some particularities were nonetheless observed, such as the presence of *Erythrodiplax leticia*, which is believed to be exclusive to northeastern Brazil ([Machado, 1995](#)). This survey extends its range over 500 km northwestward. The habitat from which *E. leticia* was recorded is similar to that documented by [Machado \(1995\)](#). Adults perched on the ground and on twigs along margins of a shallow, coarse-grained river (Figure 2d).

Table 1. Species of Odonata recorded in the municipality of Itaitira, state of Ceará, northeastern Brazil, and their local habitats of occurrence.

Taxon	Water movement		Exposure to sunlight		Permanency of water		Size of water body		Height of vegetation at margins			Aquatic vegetation			CI
	Lotic	Lentic	Open	Shaded	Perennial	Temporary	Small	Large	< 0.5 m	0.5–1.5 m	> 1.5 m	Submerged	Floating	Emergent	
<b>ZYGOPTERA</b>															
<b>Calopterygidae</b>															
<i>Hetaerina rosea</i> (Selys, 1853)		x		x		x		x			x		x		2
<b>Lestidae</b>															
<i>Lestes forficula</i> (Rambur, 1842)		x	x	x	x	x	x	x	x	x	x			x	1
<b>Coenagrionidae</b>															
<i>Acanthagrion gracile</i> (Rambur, 1842)	x	x	x	x	x	x	x	x		x	x	x	x		15
<i>Argia cf. modesta</i> (Selys, 1865)	x			x		x	x				x	x	x		7
<i>Enallagma novaehispaniae</i> (Calvert, 1907)	x		x	x		x	x		x	x	x				3
<i>Ischnura capreolus</i> (Hagen, 1861)		x	x			x	x		x	x	x	x	x	x	4
<i>Ischnura fluviatilis</i> (Selys, 1876)		x	x			x	x		x	x	x			x	2
<i>Telebasis corallina</i> (Selys, 1876)	x		x	x		x	x		x	x	x	x	x	x	1
<i>Telebasis filiola</i> (Perty, 1834)	x		x	x		x	x		x	x	x	x	x	x	2
<b>Protoneuridae</b>															
<i>Neoneura sylvatica</i> (Hagen in Selys, 1886)	x	x	x		x	x	x	x	x	x				x	1
<b>ANISOPTERA</b>															
<b>Gomphidae</b>															
<i>Phyllocycla cf. gladiata</i> (Hagen in Selys, 1854)		x	x		x			x		x	x	x		x	4
<i>Progomphus dorsopallidus</i> (Byers, 1934)		x	x		x			x		x	x	x		x	2
<b>Libellulidae</b>															
<i>Brachymesia furcata</i> (Hagen, 1861)			x												2
<i>Brechmorhoga p. praecox</i> (Hagen, 1861)	x		x			x	x			x		x		x	1
<i>Dasythemis esmeralda</i> (Ris, 1910)	x	x	x	x		x	x	x		x	x	x		x	1
<i>Dythemis cf. nigra</i> (Martin, 1897*)		x	x		x			x			x				†

<i>Erythemis plebeja</i> (Burmeister, 1839)	x	x	x		x	x			x	x	x		x	2
<i>Erythemis vesiculosa</i> (Fabricius, 1775)		x	x	x			x	x	x		x		x	2
<i>Erythrodiplax b. basalis</i> (Kirby, 1897)		x	x		x	x		x	x	x	x			1
<i>Erythrodiplax fusca</i> (Rambur, 1842)	x	x	x		x	x	x	x	x	x	x	x	x	3
<i>Erythrodiplax latimaculata</i> (Ris, 1911)			x						x	x				1
<i>Erythrodiplax leticia</i> (Machado, 1996)	x		x		x		x	x	x				x	2
<i>Erythrodiplax umbrata</i> (Linnaeus, 1758)		x	x		x	x				x			x	5
<i>Erythrodiplax</i> sp.	x	x	x		x	x		x				x	x	2
<i>Macrothemis griseofrons</i> (Calvert, 1909)	x		x		x	x		x						3
<i>Macrothemis hemichlora</i> (Burmeister, 1839)		x	x	x			x		x	x	x			1
<i>Macrothemis lutea</i> (Calvert, 1909)	x	x	x	x	x	x	x	x	x		x		x	3
<i>Miathyria marcella</i> (Selys in Sagra, 1857)			x						x	x				1
<i>Micrathyria hesperis</i> (Ris, 1911)	x		x	x	x	x	x		x		x	x		2
<i>Orthemis aequilibris</i> (Calvert, 1909)			x	x						x				1
<i>Orthemis</i> group <i>ferruginea</i> (Fabricius, 1775)	x	x	x	x	x	x	x		x		x	x	x	†
<i>Orthemis flavopicta</i> (Kirby, 1889**)	x		x		x	x		x	x	x	x			2
<i>Pantala flavescens</i> (Fabricius, 1798)			x						x	x				2
<i>Perithemis mooma</i> (Kirby, 1889)	x	x	x	x	x	x	x	x	x	x	x		x	4
<i>Tauriphila australis</i> (Hagen, 1867)			x						x	x				1
<i>Tramea calverti</i> (Muttkowski, 1910)			x						x	x				2
<i>Tramea cophysa</i> (Hagen, 1867)			x						x	x				2

\*Although this individual resembles *D. sterilis* in body and eye color, these features may change with age, and we hesitate to base what would be a new record for Brazil based on this photo alone.

\*\*Confirmed by reference to [Ellenrieder \(2012\)](#). †Species registered only by photographs.

Abbreviation: CI, number of collected individuals.



Figure 2. Examples of odonates sampled in the municipality of Itaitira, state of Ceará, northeastern Brazil: (a) *Dythemis* cf. *nigra*; (b) *Erythrodiplax* sp.; (c) *Perithemis mooma*; (d) *Erythrodiplax leticia*; (e) *Macrothemis griseofrons*; (f) *Phyllocycla* cf. *gladiata*, in copula; (g) *Ischnura capreolus*; (h) *Neoneura sylvatica*, couple in tandem oviposition; (i) *Hetaerina rosea*; (j) *Argia* cf. *modesta*; (k) *Enallagma novaehispaniae*; (l) *Telebasis filiola*; (m) *Acanthagrion gracile*, couple in tandem oviposition. All photos by C. E. B. Nobre.

Although species of *Hetaerina* are typically lotic (Garrison, von Ellenrieder, & Louton, 2010), the two individuals of *H. rosea* were recorded at nearby remaining puddles of an intermittent river, which we considered to be a lentic environment. Probably they were unable to find a lotic environment due to the absence of flowing water in the dry season. On the other hand, individuals of both *Telebasis* species were found on backwater sites of a stream. Although it was a lotic habitat, the water flow was very slow and floating plants had accumulated there (Figure 2l), allowing the colonization of *T. corallina* and *T. filiola*, both lentic species (Garrison, 2009). Larvae of the latter

were recorded also in backwater habitats of a river in the state of Rio de Janeiro (Assis, Carvalho, & Nessimian, 2004).

Two species of *Macrothemis* are probably also restricted to northeastern Brazil: *M. griseofrons* (Figure 2e) and *M. lutea*. The first had previously been recorded from the states of Bahia (Calvert, 1909), Ceará and Pernambuco (Santos, 1946). The three specimens collected in Itatira match the redescription made by Santos (1946), except for a more extended pruinosity on their abdomens, that reach the basal third of the eighth segment. *Macrothemis lutea* was only known from its type locality, in the state of Sergipe (Calvert, 1909). Comparing our material with topotypes from the municipality of Propriá, Sergipe (three males and two females) we confirmed that they belong to the same species. Herein, we confirm that the female specimen of *Macrothemis* from the municipality of Cascavel (coast of the state of Ceará) cited by Pinto (2010) and deposited at MNRJ is also *M. lutea*.

We believe this study can be a starting point to discuss future odonate inventories in all of the Brazilian semi-arid domain, as well as a useful source of information for other aquatic invertebrate studies, since it is also a survey of habitats associated to the odonates. All sampled sites were apparently free from anthropogenic pollution (C. E. B. Nobre, personal observation), which is an uncommon condition for water courses in the region (Empresa Brasileira de Pesquisa Agropecuária, 2005). Since the Odonata can be considered one of the best indicator groups of environmental health (Brown, 1991; Carle, 1979), the understanding of the regional fauna of these insects is an important step to formulate monitoring programs and conservation directives for the Caatinga.

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