

Odonata of the Serra de São José – Brazil's first Wildlife Reserve aimed at the conservation of dragonflies

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Abstract. Surveys of the odonate fauna of the Serra de São José were carried out between 1996 and 2012, resulting in records of 128 species, including 49 Zygoptera and 79 Anisoptera, grouped in 10 families and 53 genera, with seven new species records for the state of Minas Gerais. The high species richness can be attributed to the existence of a varied set of natural and artificial freshwater biotopes, placed in distinct physiographic contexts along a contact zone between Brazil's Atlantic Forest and Cerrado hotspots. This area figures as a priority site for biodiversity conservation in the State of Minas Gerais, and in 2004 became Brazil's first protected area dedicated to the conservation of odonates and their freshwater habitats.

Key words. Anisoptera, Zygoptera, survey, South America, Minas Gerais

Introduction

Despite the major contribution of the Neotropics to the global diversity of Odonata (KALKMAN et al. 2008), comprehensive assessments of the group are scarce for most South American countries. The paucity of species occurrence data hinders general conservation efforts.

In Brazil, an extensive compilation of Odonata species records in the scientific literature and collections by DE MARCO & VIANNA (2005) showed the sampling effort to be highly concentrated in areas with the largest number of researchers, with data on species richness restricted to less than a third of the country's territory. Faunistic assessments of Odonata are rather scarce in the peer-reviewed literature and, to our knowledge, available only for the south-eastern states and a few municipalities and protected areas. Considering the continental dimensions of Brazil and the diversity of its ecosystems, many more local species lists would be desirable.

In this paper we provide a checklist of odonate species of the Serra de São José, an extensively sampled small mountain range in the south-eastern state of Minas Gerais, where the discovery of an outstandingly rich fauna motivated the creation, in 2004, of a wildlife refuge. This was Brazil's first protected area aimed at the protection of odonates and their habitats. We also discuss the likely factors related to local species richness and elements of concern regarding its conservation.

Study area and methods

The Serra de São José is a small mountain range located in the central-southern portion of Minas Gerais state, in south-eastern Brazil (21°05'S, 44°10'W). It extends 12 km with elevations varying between 1,000 m a.s.l. and 1,430 m a.s.l., and is topped by a ridge of quartz arenite outcrops covered with rupestrian grasslands (campos rupestres), which marks a sharp contact zone between the biodiversity hotspots of the Atlantic rain forest, with the occurrence of secondary growth, semi-deciduous forests along its south-eastern face, and the Brazilian savannah (Cerrado) along its north-western slopes.

The Serra de São José is regarded as of »very high importance for conservation« in the Minas Gerais state atlas of priority conservation areas (DRUMMOND et al. 2005) and, due to the assemblage of unique natural, historical and scenic attributes, it was targeted by a series of formal state governmental acts aimed at its protection. It received the status of Area of Special Protection (APE Serra de São José) in 1981; followed by the creation, in 1990, of the São José Environmental Protection Area (APA São José, an IUCN category VI protected area), with 4,758 ha; and finally, in 2004, motivated by the discovery of an outstandingly rich assembly of odonate species, the creation of Brazil's first protected area dedicated to the conservation of odonates and their freshwater habitats – the Wildlife Refuge for Dragonflies of the Serra de São José (Refúgio de Vida Silvestre Libélulas da Serra de São José), an IUCN category IV protected area.

The numerous springs and low-order streams of the Serra de São José drain into the Mortes River, a tributary of the Grande River basin. The local climate corresponds to Köppen's Cwb (КОТТЕК et al. 2006) – mesothermic with humid summers, and a mean annual precipitation of 1,400 mm. The location of the study area and the boundaries of both São José Environmental Protection Area and Wildlife Refuge are shown in Figure 1.

Initial assessments of the odonate fauna were conducted in the Serra de São José and immediate surroundings between November 1996 and March 1997. Emphasis was placed on obtaining a representative spectrum of odonate species associated with distinct freshwater biotopes (SCHMIDT 1985). Odonates were collected at 49 sampling sites (Fig. 1), of which 31 representing the area's main aquatic biotope types were sampled monthly, until representative spectra of species were attained. These included urban streams, artificial ponds and reservoirs, and natural lentic

and lotic, perennial and temporary biotopes. Additional assessments were made on different occasions until 2012, with the aim of augmenting the species list.

Lentic biotopes were sampled along the full extent of the perimeter that could be accessed by walking, while lotic biotopes were sampled along a minimum stretch of 100 m of similar riparian structure. Odonate specimens were collected with hand nets from 09:30 until 16:30 h BRT/BRST on sunny days, with temperatures varying between 23 and 35°C. The time spent at each sampling site varied from one to three hours per visit, until most species occurring at the site were represented in the sample. Collections were occasionally extended between 17:00 and 18:00 h for the capture of crepuscular flyers. All specimens are deposited in the A.B.M. Machado collection, to be incorporated in the entomological collection of the Department of Zoology at the Federal University of Minas Gerais, Brazil. Collection permits were issued by Brazil's Institute for the Environment and Renewable Natural Resources – IBAMA (process # 014/98) and by the Minas Gerais State Forestry Institute – IEF (process # UC 112/11).

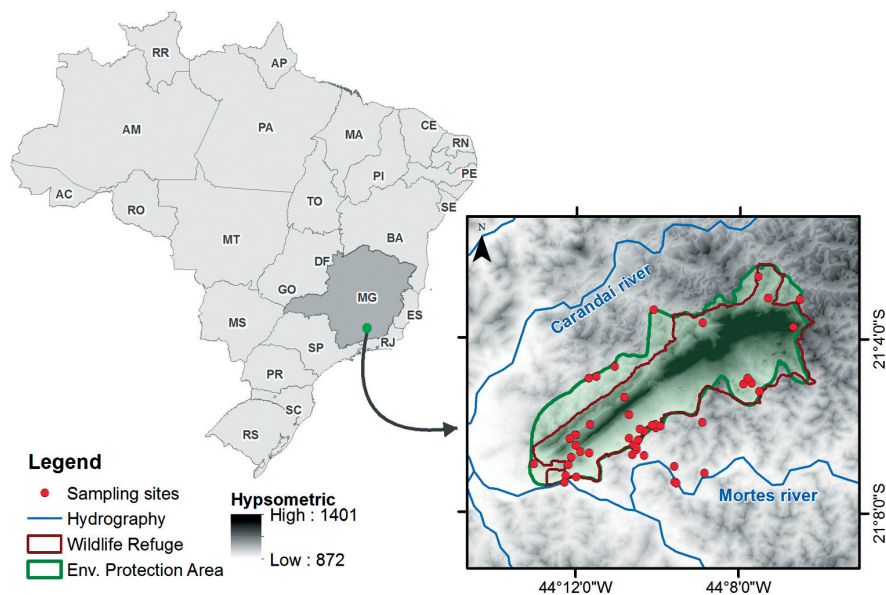


Fig. 1. Map of Brazil showing the location and topography of the Serra de São José Environmental Protection Area and Wildlife Refuge, with the sampling sites for Odonata. Brazilian States acronyms: **(AM)** Amazonas; **(BA)** Bahia; **(CE)** Ceará; **(DF)** Distrito Federal; **(ES)** Espírito Santo; **(GO)** Goiás; **(MA)** Maranhão; **(MG)** Minas Gerais; **(MS)** Mato Grosso do Sul; **(MT)** Mato Grosso; **(PA)** Pará; **(PB)** Paraíba; **(PE)** Pernambuco; **(PI)** Piauí; **(PR)** Paraná; **(RJ)** Rio de Janeiro; **(RN)** Rio Grande do Norte; **(RO)** Rondônia; **(RR)** Roraima; **(RS)** Rio Grande do Sul; **(SC)** Santa Catarina; **(SP)** São Paulo; **(TO)** Tocantins.

Results

In total, 128 species of Odonata were recorded at the Serra de São José and immediate surroundings (Tab. 1), including 49 Zygoptera and 79 Anisoptera, grouped in 10 families and 53 genera. Libellulidae was the family with the largest number of species (56), followed by Coenagrionidae (33) and Aeshnidae (17). The remaining species records were in the families Lestidae (5), Calopterygidae (5), Megapodagrionidae (1), Heteragrionidae (2), Protoneuridae (3), Gomphidae (5), and Corduliidae (1). Seven of the species records are new for the state of Minas Gerais (Tab. 1).

Discussion

The creation of a wildlife refuge in the Serra de São José stemmed from the perceived conservation value of both its rich odonate fauna and abundant freshwater resources, placing it among a rare set of initiatives aimed at the creation of nature reserves for the protection of odonates over recent decades. Known examples include a number of sanctuaries in Japan, where dragonflies enjoy special cultural significance (MOORE 1997; LEMELIN 2007; PRIMACK et al. 2000) and a few sites in Europe, namely in Great Britain (MACKENZIE DODDS 2014), The Netherlands (BOUWMAN et al. 2007), and Finland (MÄKINEN 2010; TUOMISTO & KARJALAINEN 2014).

In the Serra de São José, as in most faunistic assessments of odonates carried out in Brazil (Tab. 2), Libellulidae is the most species-rich family, followed by Coenagrionidae. Notably though, Aeshnidae figures as the third ranking family in the Serra de São José, with 17 species, with the noteworthy presence of four species of *Castoraeshna* (one of which is undescribed) and four *Gynacantha* species. Among the Aeshnidae, the *Castoraeshna* were most abundant along the well preserved cerrado streams bordered by gallery forests on the north-western face of the Serra, with *C. januaria* and *C. longfieldae* particularly common all year round. The *Gynacantha* species were captured mostly along forest borders and trails, with *G. bifida* being the most abundant (BEDÊ et al. 2000).

One of the most pristine forest sites on the south-eastern face of the Serra de São José is the type locality of *Heteragrion tiradentense* (MACHADO & BEDÊ 2006), where a single population was found in 1998 and 1999 at a heavily shaded, narrow forest stream. Several subsequent attempts to find it there again failed, but the species has been recently recorded at locations further south (SOUZA et al. 2013; LENCIONI 2013). Additional efforts to locate and study other populations of the species are still needed, in order to evaluate its conservation status.

The Serra de São José hosts a variety of lentic and lotic, permanent and temporary freshwater biotopes, either in a natural state or under varied levels of human interference, and in distinct physiographic contexts, thus providing a broad array of habitats required by its diverse odonatofauna. Lotic biotopes with the richest species assemblages were cerrado streams flanked by well-preserved gallery forests, in the northwestern slopes of the Serra, as well as those running through rupestrian

Tab. 1. Checklist of the 128 Odonata species recorded at the Serra de São José, Minas Gerais, Brazil, on surveys carried out between 1996 and 2012. New records for Minas Gerais State are marked with an asterisk.

Lestidae	<i>Argia reclusa</i> Selys, 1865
<i>Lestes bipupillatus</i> Calvert, 1909	<i>Argia smithiana</i> Calvert, 1909
* <i>Lestes dichrostigma</i> Calvert, 1909	<i>Argia sordida</i> Hagen in Selys, 1865
<i>Lestes paulistus</i> Calvert, 1909	<i>Argia</i> sp1.
* <i>Lestes pictus</i> Hagen in Selys, 1862	<i>Argia</i> sp2.
<i>Lestes</i> sp.	<i>Argia</i> sp3.
Calopterygidae	<i>Cyanallagma nigrinuchale</i> (Selys, 1876)
<i>Hetaerina longipes</i> Hagen in Selys, 1853	<i>Homeoura chelifera</i> (Selys, 1876)
<i>Hetaerina mendezi</i> Jurzitza, 1982	<i>Ischnura capreolus</i> (Hagen, 1861)
<i>Hetaerina rosea</i> Selys, 1853	<i>Ischnura fluviatilis</i> Selys, 1876
<i>Mnesarete guttifera</i> (Selys, 1873)	<i>Minagrion waltheri</i> (Selys, 1876)
<i>Mnesarete pudica phryne</i> Costa, 1996	<i>Nehalennia minuta</i> (Selys in Sagra, 1857)
Megapodagrionidae	<i>Oxyagrion basale</i> Selys, 1876
<i>Allopodagrion contortum</i> (Hagen in Selys, 1862)	<i>Oxyagrion chapadense</i> Costa, 1978
Heteragrionidae	<i>Oxyagrion microstigma</i> Selys, 1876
<i>Heteragrion aurantiacum</i> Selys, 1862	<i>Oxyagrion simile</i> Costa, 1978
<i>Heteragrion tiradentense</i> Machado & Bedê, 2006	<i>Oxyagrion terminale</i> Selys, 1876
Protoneuridae	<i>Telebasis carmesina</i> Calvert, 1909
<i>Neoneura sylvatica</i> Hagen in Selys, 1886	* <i>Telebasis coccinea</i> (Selys, 1876)
<i>Peristicta aeneoviridis</i> Calvert, 1909	<i>Telebasis corallina</i> (Selys, 1876)
<i>Forcesioneura sancta</i> Hagen in Selys, 1860	<i>Telebasis filiola</i> (Perty, 1834)
Coenagrionidae	<i>Tigriagrion aurantinigrum</i> Calvert, 1909
* <i>Acanthagrion aepiolum</i> Tennessen, 2004	Aeshnidae
<i>Acanthagrion gracile</i> Rambur, 1842	<i>Rhionaeschna cornigera</i> (Brauer, 1865)
<i>Acanthagrion lancea</i> Selys, 1876	<i>Rhionaeschna pauloi</i> (Machado, 1994)
<i>Acanthagrion minutum</i> Leonard, 1977	<i>Anax concolor</i> Brauer, 1865
<i>Acanthagrion temporale</i> Selys, 1876	<i>Castoraeschna colorata</i> (Martin, 1908)
<i>Acanthagrion truncatum</i> Selys, 1876	<i>Castoraeschna januaria</i> (Hagen, 1867)
* <i>Acanthagrion</i> n. sp.	<i>Castoraeschna longfieldae</i> (Kimmins, 1929)
* <i>Aceratobasis cornicauda</i> (Calvert, 1909)	* <i>Castoraeschna</i> n. sp.
* <i>Aceratobasis mourei</i> (Santos 1970)	<i>Coryphaeschna perrensi</i> (McLachlan, 1887)
<i>Argia lilacina</i> Selys, 1865	<i>Coryphaeschna viriditas</i> Calvert, 1952
<i>Argia mollis</i> Hagen in Selys, 1865	<i>Gynacantha adela</i> Martin, 1909
	<i>Gynacantha bifida</i> Rambur, 1842
	<i>Gynacantha laticeps</i> Williamson, 1923
	<i>Gynacantha nervosa</i> Rambur, 1842

- Limnetron debile* (Karsch, 1891)
Remartinia luteipennis luteipennis
 (Burmeister, 1839)
 **Triacanthagyna nympa* (Navás, 1933)
Triacanthagyna sp.
- Gomphidae**
Aphylla theodorina (Navás, 1933)
Phyllocycla viridipleuris (Calvert, 1909)
Progomphus complicatus Selys, 1854
Progomphus intricatus Hagen in Selys, 1858
Zonophora campanulata machadoi
 (St. Quentin, 1973)
- Corduliidae**
Neocordulia volxemi (Selys, 1874)
- Libellulidae**
Brachymesia furcata (Hagen, 1861)
Brechmorhoga nubecula (Rambur, 1842)
Brechmorhoga sp.
Dasythemis mincki mincki (Karsch, 1890)
Dasythemis venosa (Burmeister, 1839)
Dythemis nigra Martin, 1897
Elasmothemis constricta (Calvert, 1898)
Elasmothemis schubarti (Santos, 1945)
Erythemis atalla (Selys in Sagra, 1857)
Erythemis plebeja (Burmeister, 1839)
Erythemis vesiculosa (Fabricius, 1775)
Erythrodiplax fusca (Rambur, 1842)
Erythrodiplax juliana Ris, 1911
Erythrodiplax latimaculata Ris, 1911
Erythrodiplax melanorubra Borrer, 1942
Erythrodiplax ochracea (Burmeister, 1839)
Erythrodiplax pallida (Needham, 1904)
Erythrodiplax paraguayensis (Förster, 1904)
Erythrodiplax sp1.
Erythrodiplax sp2.
Erythrodiplax umbrata (Linnaeus, 1758)
- Gynothemis venipunctata* Calvert, 1909
Idiataphe longipes (Hagen, 1861)
Macrothemis declivata Calvert, 1909
Macrothemis heteronycha (Calvert, 1909)
Macrothemis imitans imitans Karsch, 1890
Macrothemis sp.
Miathyria marcella (Selys in Sagra, 1857)
Micrathyria almeidai Santos, 1945
Micrathyria atra (Martin, 1897)
Micrathyria catenata Calvert, 1909
Micrathyria didyma (Selys in Sagra, 1857)
Micrathyria divergens Westfall, 1992
Micrathyria hesperis Ris, 1911
Micrathyria hypodidyma Calvert, 1906
Micrathyria ocellata dentiens Calvert, 1909
Micrathyria pirassunungae Santos, 1953
Micrathyria spuria (Selys, 1900)
Micrathyria stawiariskii Santos, 1953
Micrathyria sp.
Nephepeltia berlai Santos, 1950
Nephepeltia flavifrons (Karsch, 1889)
Oligoclada borrori Santos, 1945
Oligoclada nemesis (Ris, 1911)
Orthemis discolor (Burmeister, 1839)
Pantala flavescens (Fabricius, 1798)
Perithemis icteropectera (Selys in Sagra, 1857)
Perithemis mooma Kirby, 1889
Planiplax phoenicura Ris, 1912
Tauriphila argo (Hagen, 1869)
Tremea abdominalis (Rambur, 1842)
Tremea binotata (Rambur, 1842)
Tremea calverti Muttkowski, 1910
Tremea cophysa Hagen, 1867
Tremea rustica De Marmels & Rácenis, 1982
Zenithoptera lanei Santos, 1941

grasslands in the elevated plains. The richest lentic biotopes were the largest natural or semi-natural ponds, with a relatively small coverage of aquatic macrophytes (<30%) and mixed (forest, grassland) marginal vegetation. The freshwater biotopes

Tab. 2. Location and species richness records of other 20 published faunistic assessments of odonates in Brazil. See Fig. 1 for the location of the Brazilian states.

Site	Number of species	Reference
São Paulo State (SP)	251	COSTA et al. (2000)
Rio de Janeiro State (RJ)	245	CARVALHO & NESSIMIAN (1998)
Minas Gerais State (MG)	218	MACHADO (1998)
Espírito Santo State (ES)	180	COSTA & OLDRINI (2005)
Luis Antônio municipality (SP)	85	FERREIRA-PERUQUETTI & FONSECA-GESSNER (2003)
Marambaia municipality (RJ)	77	ANJOS-SANTOS & COSTA (2006)
Nova Xavantina, Mato Grosso do Sul State (MS)	67	CALVÃO et al. (2014)
Maracá Biological Station, Roraima State (RR)	61	MACHADO et al. (1991)
Itatiaia National Park (RJ)	59	SANTOS (1970)
Poços de Caldas municipality (MG)	58	SANTOS (1966)
Restingas do Recreio dos Bandeirantes (RJ)	57	SANTOS (1965)
Mata do Baú (MG)	57	SOUZA et al. (2013)
Rio Grande do Sul State (RS)	49	KITTEL & ENGELS (2014)
Reserva Guapi-Açu (RJ)	46	VICK & CHELMICK (2001)
Ilha Grande (RJ)	36	CARVALHO & PUJOL-LUZ (1992)
Maricá municipality (RJ)	34	CARVALHO (1991)
Serra da Bodoquena (MS)	33	DALZUCHIO et al. (2011)
Santa Maria municipality (RS)	29	COSTA (1971)
Parque Nacional da Serra do Cipó (MG)	27	DE ALMEIDA et al. (2014)
Parque Estadual de Itapuã – Viamão (RS)	15	MARINS & ROMANOWSKI (2004)

supporting most of the stenotopic ecologically specialised taxa were shaded forest streams along the south-eastern slopes and marshes in altitudinal plains, with emergent grassy vegetation.

Among the matters of concern regarding the conservation of freshwater resources and the associated odonate fauna in the Serra de São José are frequent wildfires on its savannah and rupestrian grassland expanses, the encroachment of intensively managed agriculture along its north-western fringes and the urban sprawl and resulting forest fragmentation on its south-eastern slopes. The creation of the Wildlife Refuge is expected to help mitigate these threats, through enhanced land management. In 2006, an information centre was built in the area by the State Forestry Institute, with the aim of disseminating knowledge about the biodiversity of the Serra de São José, with dragonflies and their connection to freshwater habitats as a thematic focus.

With its 128 species of Odonata, the small territory of the Serra de São José has up to 15.5% of the 828 species known to occur in Brazil (COSTA et al. 2012) and tops the list of published site assessments (Tab. 2) in the country, as regards species richness. To our knowledge, it is second only to the Amazonian municipality of Manaus, where an assessment recorded 163 species (A.B.M. Machado unpubl.). Globally, the odonate species richness of the Serra de São José compares well to the known highlights of the Peruvian Amazon sites of Tambopata Reserve (151 species), Iquitos (Loretos province, with 123 species), and Pakitza (at the Manu National Park, with 117 species), reported by PAULSON (1985), BUTT (1995), and LOUTON et al. (1996).

Considered in isolation, species richness estimates offer limited potential as an ecological indicator for site conservation, prioritization or comparison among locations, as they are affected by area, scale and intensity of sampling and the intrinsically dynamic nature of species richness, among other factors (FLEISHMAN et al. 2006). Rather than serving primarily for this purpose, the impressive results obtained in the Serra de São José illustrate both the relevance of undertaking comprehensive site assessments of odonates in Brazil and other poorly assessed South American countries, and their potential for contributing to the knowledge, conservation and education regarding the Odonata.

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References

- ANJOS-SANTOS D. & COSTA J.M. 2006. A revised checklist of odonata (Insecta) from Marambaia, Rio de Janeiro, Brazil with eight new records. *Zootaxa* 1300: 37-50
- BEDÊ L.C., PIPER W., PETERS G. & MACHADO A.B.M. 2000. Phenology and oviposition behaviour of *Gynacantha bifida* Rambur in Brazil (Anisoptera: Aeshnidae). *Odonatologica* 29: 317-324
- BOUWMAN J., BOER D.P., HIJUM V.E. & HYLKEMA G. 2007. Wyldemerk eerste officiële libellenreservaat. *Vlinders* 3: 18-19
- BUTT M. 1995. Odonata collected from the Tambopata-Candamo Reserved Zone, southeastern Peru, August 1992

- January 1993. *Notulae odonatologicae* 4: 93-97
- CALVÃO L.B., DE MARCO JR. P. & BATISTA J.D. 2014. Odonata (Insecta) from Nova Xavantina, Mato Grosso, Central Brazil: Information on species distribution and new records. *Check List* 10: 299-307
- CARVALHO A.L. 1991. Notas sobre a odonofauna de restinga. Maricá, Rio de Janeiro (Insecta, Odonata). *Revista brasileira de Biologia* 51: 197-200
- CARVALHO A.L. & NESSIMIAN J.L. 1998. Odonata do Estado do Rio de Janeiro, Brasil: Habitats e hábitos das larvas. In: Nessimian J.L. & Carvalho A.L. (Eds), *Ecologia de Insetos Aquáticos. Series Oecologia Brasiliensis V*: 3-28. PPGE-UFRJ, Rio de Janeiro
- CARVALHO A.L. & PUJOL-LUZ J.R. 1992. On the odonate fauna of Ilha Grande and some other coastal islands of the State of Rio de Janeiro, Brazil. *Notulae odonatologicae* 3: 157-159
- COSTA J.M. 1971. Contribuição ao conhecimento da fauna odonológica do município de Santa Maria, Rio Grande do Sul. *Atas da Sociedade de Biologia do Rio de Janeiro* 14: 193-194
- COSTA J.M., MACHADO A.B.M., LENCIONI F.A.A. & SANTOS T.C. 2000. Diversidade e distribuição dos Odonata (Insecta) no Estado de São Paulo, Brasil: Parte I – Lista das espécies e registros bibliográficos. *Publicações avulsas do Museu Nacional* 80: 1-27
- COSTA J.M. & OLDRINI B.B. 2005. Diversidade e distribuição dos Odonata (Insecta) no Estado do Espírito Santo, Brasil. *Publicações avulsas do Museu Nacional* 107: 1-15
- COSTA J.M., SANTOS T.C. & OLDRINI B.B. 2012. Odonata. In: Rafael J.A., Melo G.A.R., Carvalho C.J.B., Casari S.A. & Constantino R. (Eds), *Insetos do Brasil: Diversidade e Taxonomia*: 246-256. Holos Editora, Ribeirão Preto
- DALZUCHIO M.S., COSTA J.M. & UCHOA M.A. 2011. Diversity of Odonata (Insecta) in lotic systems from Serra da Bodoquena, Mato Grosso do Sul State, Brazil. *Revista brasileira de Entomologia* 55: 88-94
- DE ALMEIDA M.V., PINTO A.P., CARVALHO A.L. & TAKIYA D.M. 2014. When rare is just a matter of sampling: unexpected dominance of clubtail dragonflies (Odonata, Gomphidae) through different collecting methods at Parque Nacional da Serra do Cipó, Minas Gerais State, Brazil. *Revista brasileira de Entomologia* 57: 417-423
- DE MARCO JR. P. & VIANNA D.M. 2005. Distribuição do esforço de coleta de Odonata no Brasil: subsídios para escolha de áreas prioritárias para levantamentos faunísticos. *Lundiana* 6 (supplement): 13-26
- DRUMMOND G.M., MARTINS C.S., MACHADO A.B.M., SEBAIO F.A. & ANTONINI Y. 2005. Biodiversidade em Minas Gerais: Um atlas para sua cons.. Fundação Biodiversitas, Belo Horizonte
- FERREIRA-PERUQUETTI P.S. & FONSECA-GESSNER A.A. 2003. Odonata community on natural areas of Cerrado and monoculture of northeastern São Paulo State, Brazil: relationship between land

- use and richness. *Revista brasileira de Zoologia* 20: 219-224
- FLEISHMAN E., NOSS R.F. & NOON B.R. 2006. Utility and limitations of species richness metrics for conservation planning. *Ecological Indicators* 6: 543-553
- KALKMAN V.J., CLAUSNITZER V., DIJKSTRA K.-D.B., ORR A.G., PAULSON D.R. & VAN TOL J. 2008. Global diversity of dragonflies (Odonata) in freshwater. *Hydrobiologia* 595: 351-363
- KITTEL R.N. & ENGELS W. 2014. Diversity of damselflies (Insecta: Odonata: Zygoptera) of the state Rio Grande do Sul, Brazil with four new records. *Notulae odonatologicae* 8: 49-55
- KOTTEK M., GRIESER J., BECK C., RUDOLF B. & RUBEL F. 2006. World map of the Koppen-Geiger climate classification updated. *Meteorologische Zeitschrift* 15: 259-263
- LEMELIN R.H. 2007. Finding beauty in the dragon: the role of dragonflies in recreation and tourism. *Journal of Eco-tourism* 6: 139-145
- LENCIONI F.A.A. 2013. Diagnoses and discussion of the group 1 and 2 Brazilian species of *Heteragrion*, with descriptions of four new species (Odonata: Megapodagrionidae). *Zootaxa* 3685: 1-80
- LOUTON J.A., GARRISON R.W. & FLINT O.S. 1996. The Odonata of Parque Nacional Manu, Madre de Dios, Peru: Natural history, species richness and comparison with other Peruvian sites. In: Wilson D.E. & Sandoval A. (Eds), Manu: The biodiversity of southeastern Peru: 431-449. Smithsonian Institution, Washington D.C.
- MACHADO A.B.M., MESQUITA H. & MACHADO P.A.R. 1991. Contribuição ao conhecimento dos odonatos da Estação Ecológica Maracá, Roraima. *Acta amazonica* 21: 159-173
- MACHADO A.B.M. 1998. Insetos. In: Machado A.B.M., da Fonseca G.A.B., Machado R.B., Aguiar L.M.S. & Lins L.V. (Eds), Livro Vermelho das Espécies Ameaçadas de Extinção da Fauna de Minas Gerais: 495-497. Fundação Biodiversitas, Belo Horizonte
- MACHADO A.B.M. & BEDÊ L.C. 2006. *Heteragrion tiradentense* spec. nov. from the state of Minas Gerais, Brazil (Zygoptera: Megapodagrionidae). *Odonatologica* 35: 47-54
- MACKENZIE DODDS R. 2014. The dragonfly diaries: The unlikely story of Europe's first dragonfly sanctuary. Saraband, Glasgow
- MÄKINEN J. 2010. Sudenkorennoille oma suojelualue. *Crenata* 3: 38-39 [In Finnish]
- MARINS A. & ROMANOWSKI H.P. 2004. Lista preliminar da odonatofauna do Parque Estadual de Itapuã – Viamão, R.S., Brasil e sua relação com ambiente. Resumos do XXV Congresso Brasileiro de Zoologia: 34, Brasília
- MOORE N.W. 1997. Dragonflies – Status survey and conservation action plan. IUCN/SSC Odonata Specialist Group. IUCN, Gland, Switzerland
- PAULSON D.R. 1985. Odonata of the Tambopata Reserved Zone, Madre de Dios, Peru. *Revista peruana de Entomologia* 27: 9-14

- PRIMACK R., KOBORI H., & MORI S. 2000. Dragonfly pond restoration promotes conservation awareness in Japan. *Conservation Biology* 14: 1553-1554
- SANTOS N.D. 1965. Contribuição ao conhecimento da fauna do Estado da Guanabara. 55. Odonata da região de restingas do Recreio dos Bandeirantes. *Atas da Sociedade de Biologia do Rio de Janeiro* 9: 103-108
- SANTOS N.D. 1966. Odonatos da região de Poços de Caldas, Minas Gerais. *Atas da Sociedade de Biologia do Rio de Janeiro* 10: 65-68
- SANTOS N.D. 1970. Odonatos de Itatiaia (Estado do Rio de Janeiro) da Coleção Zikan, do Instituto Oswaldo Cruz. *Atas da Sociedade de Biologia do Rio de Janeiro* 13: 203-205
- SCHMIDT E. 1985. Habitat inventarization, characterization and bioindication by a “representative spectrum of Odonata species (RSO)”. *Odonatologica* 14: 127-133
- SOUZA M.M., SOUZA B., PEREIRA M.C.S.A. & MACHADO A.B.M. 2013. List of odonates from Mata do Baú, Barroso, Minas Gerais, Brasil. *Check List* 9: 1367-1370
- TUOMISTO H. & KARJALAINEN S. 2014. Suojelusuo Etelä-Pohjanmaalle Suomen sudenkorentoseuran tuella. *Crenata* 7: 42 [In Finnish]
- VICK G.S. & CHELMICK D.G. 2001. A preliminary report on the odonate fauna of Guapi-Açu, a nature reserve in the Atlantic coast forest of Brazil with taxonomic notes and annotations. *Opuscula zoologica fluminensia* 200: 1-11

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