Biota Neotropica 21(3): e20201182, 2021
www.scielo.br/bn

biotaneotropica
ISSN 1676-0611 (online edition)

Inventory

Dragonflies and Damselflies in a region of the Triângulo Mineiro, Minas Gerais: checklist and taxonomic additions

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VENÂNCIO, H., VILELA, D.S., BARBOSA, M.S., SANTOS, J.C. **Dragonflies and Damselflies in a region of the Triângulo Mineiro, Minas Gerais: checklist and taxonomic additions**. Biota Neotropica 21(3): e20201182. https://doi.org/ 10.1590/1676-0611-BN-2020-1182

Abstract: Remaining freshwater systems are historically under threat mainly due to human activities such as agriculture and urbanization. The consequences of such activities are innumerous, and among them there is a decrease of suitable habitats for threatened fauna. In the Brazilian Cerrado, the odonatofauna of palm swamps and riparian forests are still poorly explored, a fact that difficult conservation efforts of the group. Thus, we performed an inventory in several urban and rural sites containing these phytophysiognomies in Uberlândia, Triângulo Mineiro region, western Minas Gerais state. In total, we found 101 Odonata species, seven families and 46 genera in the municipality, with 76 and 66 species, respectively, belonging to palm swamp and forest sites. From this diversity, eight species were first records in the state of Minas Gerais: *Neuraeschna claviforcipata* Martin, 1909, *Phyllocycla* cf. *medusa* Belle, 1988, *Diastatops intensa* Montgomery, 1940, *Oligoclada pachystigma* Karsch, 1890, *O. xanthopleura* Borror, 1931, *Angelagrion nathaliae* Lencioni, 2008, *Telebasis sanguinalis* Calvert, 1909 and *Telebasis simulacrum* (Calvert, 1909). We also sampled *Erythrodiplax ana* Guillermo-Ferreira & Vilela 2016, a species listed as endangered (EN) by the IUCN red list. Additionally, we include some taxonomic notes of Forcepsioneura machadorum females, a newly discovered species in the region. Our results contribute to the Odonata database in Brazil and highlights the importance inventories in poorly explored aquatic ecosystems.
Keywords: *Odonata; Cerrado; Brazil; inventory; female description.*

Libélulas de uma região do Triângulo Mineiro, Minas Gerais: lista de espécies e adições taxonômicas

Resumo: Os sistemas remanescentes de água doce estão historicamente ameaçados, principalmente devido às atividades humanas, como agricultura e urbanização. As consequências de tais atividades são inúmeras, e entre elas há a diminuição de habitats adequados para a fauna ameaçada. No cerrado brasileiro, a odonatofauna de veredas e matas ripárias ainda são pouco exploradas, fato que dificulta os esforços de conservação do grupo. Assim, realizamos um inventário em diversos pontos urbanos e rurais com essas fitofisionomias em Uberlândia, na região do Triângulo Mineiro, oeste de Minas Gerais. No total, foram encontradas 101 espécies de Odonata, sete famílias e 46 gêneros no município, com 76 e 66 espécies, respectivamente, pertencentes a pontos de veredas e de matas. Dessa diversidade, oito espécies foram os primeiros registros no estado de Minas Gerais: *Neuraeschna claviforcipata* Martin, 1909, *Phyllocycla* cf. medusa Belle, 1988, *Diastatops intensa* Montgomery, 1940, *Oligoclada pachystigma* Karsch, 1890, *O. xanthopleura* Borror, 1931, *Angelagrion nathaliae* Lencioni, 2008, T*elebasis sanguinalis* Calvert, 1909 e *Telebasis simulacrum* (Calvert, 1909). Nós também coletamos *Erythrodiplax ana* Guillermo-Ferreira & Vilela 2016, uma espécie listada como em perigo (EN) pela lista vermelha da IUCN. Além disso, incluímos algumas notas taxonômicas de fêmeas de *Forcepsioneura machadorum*, uma espécie recém-descoberta na região. Nossos resultados contribuem para o banco de dados Odonata no Brasil e destacam a importância dos inventários em ecossistemas aquáticos pouco explorados.
Palavras-chave: *Odonata; Cerrado; Brasil; inventário; descrição de fêmea.*

Introduction

Freshwater systems comprise a large part of the planet's biodiversity, although being also some of the most vulnerable ecosystems in the current global biodiversity crisis (Albert et al. 2020). The anthropic effects (e.g., deforestation, waste deposit and exotic species) in these environments modify aquatic and terrestrial integrity, endangering future populational stability of several species (Calvão et al. 2016, Reid et al. 2019, Araújo et al. 2020). Thus, to mitigate these impacts, it is important to fill biodiversity gaps as an initial step for determining conservationist actions in aquatic ecosystems. Surveys have helped to fill gaps for many freshwater organisms (Troia & McManamay 2017, Bolpagni et al. 2018, Guerra et al. 2020) as species distribution and cataloging (Wallacean and Linnean shortfalls, respectively) (Hórtal et al. 2015). However, these shortfalls are still predominant for some threatened and little-known groups, such as aquatic insects (Sánchez-Bayo & Wyckhuys 2019).

Odonata compose a small portion of aquatic insect, totalizing 6,300 species (Paulson & Schorr 2020) that occupies freshwater habitats associated to different vegetation types in almost all continents (Corbet 1980). Brazil holds circa of 30% of this diversity, with approximately 900 described species, being more than 20% of this number in endemism (Pinto 2020). Many odonate species are known to be endangered with the overexploitation in many regions of the country (ICMBio 2018, Araújo et al. 2020). This situation has encouraged great effort in preservation measures in the last years, including inventories in priority regions (e.g., Cerrado) and species conservation categorizations (De Marco & Viana 2005, Koroiva et al. 2017, Rodrigues & Roque 2017, Dalzochio et al. 2018a, Bastos et al. 2019, Garcia Junior et al. 2021, Koroiva et al. 2020, Vilela et al. 2020a). Despite this progress, distribution and taxonomic gaps are still frequently reported problems in the literature, even in explored regions. For example, more than one third of odonate fauna from Serra da Bodoquena and some regions of southeast and west of Minas Gerais could not be classified in an IUCN red list category due to data deficiency (Koroiva et al. 2017, Ávila Júnior et al. 2020, Vilela et al. 2020a).

The majority of odonate studies are concentrated in the Cerrado, one of the Brazilian hotspots (Myers et al. 2000, Miguel et al. 2017). Nonetheless, new recent taxonomic and distribution discoveries have been indicating gaps in little explored and endangered phytophysiognomies of this biome, such as riparian forest (including gallery forest) and veredas (i.e., palm swamps) (Rodrigues et al. 2018, Barbosa et al. 2019, Palacio et al. 2020, Lozano & Rodrigues 2018). Both formations are associated with important water courses to local and regional biodiversity and hydrographic maintenance (Ribeiro & Walter 1998, Latrubesse et al. 2019). Despite this similarity, these environments differ in aquatic and terrestrial characteristics, including plant community composition (Oliveira-Filho & Ratter 2002). Water bodies of palm swamps are mainly composed by a variety of macrophytes species surrounded by terrestrial grassy-shrubby plants, generally associated to "buriti" palms [Mauritia flexuosa L.f. (Arecaceae)], while large canopy trees cover riparian zones in forests (Ribeiro & Walter 1998, Araújo et al. 2002, Oliveira-Filho & Ratter 2002). These characteristics, including aquatic types (i.e., lotic and lentic systems), are determinant for the diversity of dragonflies of the Cerrado. For example, the low solar radiation in extensive areas of closed canopy riparian forests is essential for adults of small size Zygoptera (De Marco et al. 2015), while open palm swamps favor the presence of endemic macrophytes (Araújo et al. 2002), which are sites for oviposition and development of some heliothermic dragonflies (Vilela et al. 2016, Brito et al. 2020). In relation to types of aquatic systems, lotic and lentic environments have unique physical-chemical, biotic and geographic distribution characteristics that have resulted in distinct dragonfly diversifications of these habitats during the evolutionary history of the group (Letsch et al. 2016). Consequently, the composition of species between lotic and lentic bodies of water are distinct, differing at broader taxonomic levels, such as family (Vilela et al. 2020a, Pires et al. 2019). Such habitat heterogeneity is known to harbor different Odonata communities (Dutra & De Marco 2015), reflecting in great species diversity and endemism (Calvert 1909, Guillermo-Ferreira et al. 2016, Vilela et al. 2016, 2018).

Despite the habitat heterogeneity, the diversity of palm swamps and riparian forests are highly threatened by human activities (Sano et al. 2010, Colli et al. 2020). Modifications generated by land use, such as monoculture, livestock and urban areas, replace native vegetation by exotic species and impermeable surfaces (i.e., buildings), resulting in local microclimate change and other aquatic and terrestrial physicochemical characteristics of riparian zones (McKinney 2002, Wen et al. 2017, Brasil et al. 2021). These effects convert natural environments into areas with homogeneous biotic and abiotic characteristics that also affect the diversity and composition of odonates (Calvão et al. 2018, Renner et al. 2018, Borges et al. 2021, Sganzerla et al. 2021). In anthropic areas, sensitive species (e.g., some Zygoptera) are substituted by generalist groups with tolerant traits (e.g., multivoltine, r-strategist and heliothermic), often simplifying odonate communities (De Marco et al. 2015, Dalzochio et al. 2018b, Oliveira-Júnior & Juen 2019). Considering the vulnerability of many odonates species to environmental degradation, more inventories are needed to fill gaps about the diversity in these phytophysiognomies, even in anthropized areas.

Minas Gerais state present a great area composed by riparian forests and palm swamps, which are constantly decreasing with the intensification of urbanization and agriculture (Ratter et al. 1997, Velazco et al. 2019). The state has currently over 304 dragonfly species inventoried (Vilela 2020), with more than 20 new records and new species recently reported (Ávila Júnior et al. 2020, Vilela et al. 2020a, Vilela et al. 2020b). Mostly of these new data were obtained in poorly explored areas, such as Uberlândia, in Triângulo Mineiro region, western of the Minas Gerais state. Three inventories in this municipally found more than 60 species of adult dragonflies in just two palm swamp areas and in a degraded riparian forest (Vilela et al. 2016, Barbosa et al. 2019, Vilela et al. 2020a). Then, it is expected that a robust checklist can record a greater diversity of local dragonflies, since previous inventories explored few portions of the municipality territory. Moreover, some new species were also discovered in region, opening new opportunities for taxonomic studies. This is the case of *Forcepsioneura machadorum* Vilela, Venâncio and Santos, 2020, which was recently discovered, but species description was based only on males (Vilela et al. 2020b), remaining a taxonomic description of the female.

Thus, the main objective of this study is to conduct an inventory of dragonfly fauna in riparian forests and palm swamps of Uberlândia. As aquatic environments of the municipality are mainly represented by these types of vegetation, we will also indirectly perform a general inventory of the municipality. In addition, we also present some taxonomic notes on the females of *F. machadorum*. Our study aims to complement the state's Odonata record and distribution, contributing to reduce Linnean and Wallacean shortfalls.

Material and Methods

1. Study area

The territory of Uberlândia (18º55'23" S, 48º17'19" W) is approximately 4,115 km² (IBGE 2020), consisting of typical Cerrado biome vegetation and areas with agricultural (mainly livestock farming and monocultures) and urban activities. Local remnants of riparian vegetation consist of riparian forests, palm swamps and humid fields are located in areas with some type of protection (Cardoso & Schiavini 2002, Maywald & Marçal-Júnior 2013). The hydrography is represented by sub-basins and microbasins of the Paranaíba River, such as the Araguari and Uberabinha basins (Rosa et al. 2019). Part of this water is used for urban supply and agricultural activities in the municipality, which causes the pollution of some courses (Netto et al. 2011). Climate of region is AW type, according to the Köppen classification, characterized by hot and rainy summers (October-March) and dry and cold winters (April-September) (Alvares et al. 2013). The local mean annual temperature and rainfall are approximately 22ºC and 1,500 mm, respectively.

2. Sampling

We performed the samplings in 111 water bodies in the municipality (Figure 1). These localities consisted in lentic (ponds and lakes; n = 50) and lotic habitats up to third order (springs, streams and rivers; n = 61), located in or next to palm swamps (n = 54) and riparian forests (n = 56) in urban and rural areas (Figure 2; Table1). Site 57 was located in a highly urbanized area and the nearest riparian vegetation was more than 1.5 Km away from this point. Therefore, we did not classify this site with a phytophysiognomy type and we excluded it from the phytophysiognomy analyses (see below). The urbanization class was determined according to urban limits of municipality. Two ponds (sites 3 and 57) and a small lotic section (site 89) were temporary and the others were permanent.

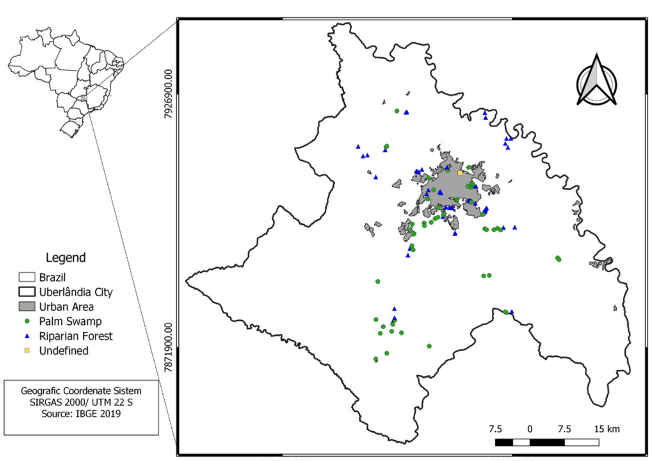

Figure 1. Sampled sites in Uberlândia, Minas Gerais, Brazil. Detailed information about the sites is presented in Table 1.

Collections in urban area were performed in parks with remnants of native vegetation and private lands. In rural area, seven localities were sampled in Conservation Units (sites 86-89, 90 and 92), and remaining areas in private farms with agricultural activities (fish farming, livestock and monoculture). Aquatic habitats and riparian vegetation in some degraded urban and rural areas have been intensively modified, losing their original characteristics. In some sites, there was a change in the type of habitat, usually due to damming or deviation of water from lotic courses to artificial ponds used for urban landscaping, animal drinking or fish tanks. The native vegetation in altered sites were partially or entirely replaced by exotic species (e.g., *Brachiaria* spp., *Hyparrhenia* spp. and *Saccharum* sp.). Despite these changes, we decided to maintain the original local phytophysiognomy classification, following other studies in the region (Borges et al. 2019, Barbosa et al. 2019).

We sampled most adult dragonflies with entomological nets, but light traps and larvae rearing were also used in some sites in order to sample species that are not so easily captured through traditional methods (Almeida et al. 2013, Pinto 2019). Active samplings were performed by one or two people during often one hour in a 100 m transect of each water body, from December 2018 to November 2020, during dry and rainy seasons. We sampled the dragonflies on hot, sunny days with few clouds between 9:00 am and 3:00 pm, conditions and period of greatest diversity and activity of the group (Calvão et al. 2018). Each site was sampled once, totaling an effort of approximately 110 hours. Collections with light trap (type "Luiz de Queiroz") were performed only at site 93 in October 2018. The trap was placed 3 m above the ground, with illumination effectuated by two black ultraviolet light that were activated for 12 hours (18:00 - 6:00 h) during seven days, totaling 84 sampling hours. We did not perform any other type of sampling method at this site. Finally, larvae specimens were sampled during two expeditions in August 2018 and May 2020 at site 10. The larvae were collected through D-network (250 µm) scans close to emerged macrophytes. All F1-F0 larvae were reared in aquariums until adult emergence. Entomological nets were also used to sample adults at this site. Only larvae species not previously collected were reared.

Collected adults were stored in glassine envelopes (Cezário et al. 2020), kept in pure acetone during 12 hours and dried for 30 minutes under direct solar irradiation. The identification occurred at species level following the keys of Lencioni (2017), Garrison et al. (2006, 2010), Needham et al. (2000), and genus specific literature (e.g., revisions, synopses and species description). Collections were carried out under the authorization of ICMBio (SISBIO: 28398-1 and 28398-3) and IEF (064/2018). The material is deposited in the collection of the Laboratory of Ecology and Biodiversity of the Federal University of Sergipe.

3. Statistical analysis

Interpolation and extrapolation curves were performed for palm swamp and riparian forest, and from the combination of both to evaluate the effectiveness of odonate sampled for phytophysiognomies and municipality, respectively. Specimens of the site 57 were included only in overall municipality curve estimation due to absence of a defined phytophysiognomy. The curves (Hill number q = 0) were based on specimen abundance, and confidence intervals (95%) were determined from 1,000 bootstraps, with the extrapolation estimated to the triple of sampled specimens (Chao et al. 2014). The rarefaction curves were generated using the iNEXT (Hsieh et al. 2020) in software R version

Figure 2. Environment characteristics of some sampled sites in Uberlândia, Minas Gerais, Brazil: (a) urban lotic palm swamp (site 53); (b) urban lotic palm swamp (site 8); (c) urban lentic palm swamp (site 25); (d) riparian forest located in public urban green area (site 26); (e) urban riparian forest located at urban park (site 41);(f) lentic urban pond near riparian forest; (g) rural palm swamp stream (site 94); (h) preserved rural lentic palm swamp (site 66); (i) rural riparian forest stream (site 103); (j) stream in a rural gallery forest (site 99); (k) lentic section surrounded by riparian forest (site 92); (l) rural pond in riparian forest segment (site 80).

4.0.2 (R Core Team 2020). Image editions were performed in Gimp version 2 (The GIMP Development Team 2019).

4. *Taxonomic notes*

To perform the female description, lateral views of habitus were scanned with an Epson V600 Perfection at colored 1,200 dpi with 200% magnification. Structure images were made from multiple photographs focused at different levels, using Canon EOS T5 digital camera coupled to Tecnival stereomicroscope. Free hand illustrations were made using trace paper and scanned with Epson V600 Perfection at black and white 1,200 dpi with 100% magnification. Morphological terminology follows Lencioni (1999) and Garrison et al. (2010). All measurements are in millimeters (mm).

Abbreviations: AB: abdomen length; Fw: fore wings; Hw: hind wings; MP: media posterior vein; Px: postnodal crossvein; Pt: pterostigma; RP2: radius posterior, second branch; S1–10: abdominal segments; TL: total length.

Results

1. *Odonata diversity*

We collected 2,154 individuals belonging to seven families, 46 genera and 101 species in the municipality (Table 2). Of this total, Anisoptera and Zygoptera presented 61% and 50%, respectively, of species richness. Among the families, Libellulidae was the most specious group, comprising more than half of the species (51%), followed by Coenagrionidae (36%), Aeshnidae (5%), Gomphidae (4%), Calopterygidae, Dicteriadidae and Lestidae (4%). Libellulidae and Coenagrionidae also presented the two richest genera (*Erythrodiplax*: 12% spp. and *Telebasis*: 8% spp.), and abundant [*Erythrodiplax*: 556 (~ 25%); *Argia*: 424 (~ 20%)], while *Dicteriadidae* and *Lestidae* were the less rich families (1% each).

In general, sampled sites presented a mean richness of 6.43 (SD: ± 3.18) species, varying from 1 to 18 species per water body. Urban sites presented 77 (mean ± SD: 6.74 ± 3.39) and rural 81 (6.98 ± 2.92) of the richness of this study, with 20 species occurring exclusively in the

Table 1. Detailed information of the sampled sites in Uberlândia, Minas Gerais, Brazil. Legends: Liv: Livestock farming; Urb: Urbanization; Mono: Monoculture; Pisc: Pisciculture; Preserv: Preserved.

Site	Coordinates	Sampling date	Sampling method	Area	Habitat	Vegetation	Environmental change in the channel	Land Use beyond riparian zone
1	18°58'11"S-48°17'42"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Liv/Urb
2	18°53'03"S-48°20'48"W	Mar/2020	EN	Urban	Lentic	RF	Yes	Liv/Urb
3	18°52'53"S-48°21'03"W	Mar/2020	EN	Urban	Lentic	RF	Yes	Liv/Urb
4	18°52'53"S-48°20'58"W	Mar/2020	EN	Urban	Lotic	RF	No	Liv/Urb
5	18°58'18"S-48°18'17"W	Out/2019	EN	Urban	Lentic	PS	Yes	Liv/Urb
6	18°52'45"S-48°17'08"W	Mar/2019	EN	Urban	Lotic	PS	Yes	Urb
7	18°55'03"S-48°18'50"W	Jul/2019	EN	Urban	Lotic	PS	Yes	Urb
8	18°53'40"S-48°19'31"W	Jul/2019	EN	Urban	Lotic	PS	Yes	Urb
9	18°56'34"S-48°13'41"W	Jul/2019	EN	Urban	Lotic	PS	Yes	Liv/Urb
10	18°57'42"S-48°12'38"W	May/2019 Jul/2020	EN DN	Urban	Lentic	RF	Yes	Pisc/Urb
11	18°57'32"S-48°12'34"W	May/2019	EN	Urban	Lotic	RF	Yes	Pisc/Urb
12	18°57'26"S-48°12'28"W	May/2019	EN	Urban	Lentic	RF	Yes	Liv/Urb
13	18°57'29"S-48°12'29"W	Out/2019	EN	Urban	Lotic	RF	Yes	Liv/Urb
14	18°57'21"S-48°12'21"W	Jul/2020	EN	Urban	Lotic	RF	Yes	Liv/Urb
15	18°57'38"S-48°12'40"W	Dez/2019	EN	Urban	Lotic	RF	No	Liv/Urb
16	18°57'51"S-48°12'43"W	Dez/2019	EN	Urban	Lentic	PS	Yes	Pisc/Urb
17	18°57'26"S-48°12'33"W	Nov/2019	EN	Rural	Lotic	RF	No	Liv
18	18°57'08"S-48°12'13"W	Out/2019	EN	Urban	Lotic	RF	No	Liv
19	18°57'13"S-48°12'23"W	Out/2019	EN	Urban	Lotic	RF	No	Liv
20	18°59'08"S-48°21'31"W	Mar/2019	EN	Urban	Lentic	PS	Yes	Urb/Liv
21	18°58'02"S-48°17'36"W	Dez/2019	EN	Urban	Lentic	PS	Yes	Urb
22	18°57'54"S-48°17'35"W	Dez/2019	EN	Urban	Lentic	PS	Yes	Urb
23	18°52'22"S-48°14'32"W	Jul/2019	EN	Urban	Lotic	PS	Yes	Urb
24	18°56'11"S-48°19'35"W	Jul/2019	EN	Urban	Lentic	PS	Yes	Urb
25	18°57'09"S-48°18'18"W	Mar/2019	EN	Urban	Lentic	PS	Yes	Urb
26	18°55'37"S-48°19'44"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Urb
27	18°57'10"S-48°16'32"W	Feb/2019	EN	Urban	Lentic	RF	Yes	Urb
28	18°57'09"S-48°16'35"W	Feb/2019	EN	Urban	Lotic	RF	Yes	Urb
29	18°57'09"S-48°16'43"W	Feb/2019	EN	Urban	Lotic	RF	Yes	Urb
30	18°57'06"S-48°16'51"W	Feb/2019	EN	Urban	Lotic	RF	Yes	Urb
31	18°55'03"S-48°19'32"W	Mar/2019	EN	Urban	Lentic	RF	Yes	Urb
32	18°56'10"S-48°15'59"W	Mar/2019	EN	Urban	Lotic	PS	Yes	Urb
33	18°54'23"S-48°13'56"W	Feb/2019	EN	Urban	Lentic	RF	Yes	Urb
34	18°54'29"S-48°13'53"W	Feb/2019	EN	Urban	Lotic	RF	Yes	Urb
35	18°54'31"S-48°13'41"W	Feb/2019	EN	Urban	Lotic	RF	No	Urb
36	18°54'13"S-48°14'07"W	Feb/2019	EN	Urban	Lentic	PS	Yes	Urb
37	18°54'40"S-48°14'15"W	Feb/2019	EN	Urban	Lentic	PS	Yes	Urb
38	18°54'35"S-48°14'37"W	Feb/2019	EN	Urban	Lentic	PS	Yes	Urb
39	18°54'23"S-48°14'02"W	Jan/2019	EN	Urban	Lentic	PS	Yes	Urb
40	18°54'19"S-48°14'04"W	Feb/2019	EN	Urban	Lentic	PS	Yes	Urb
41	18°56'16"S-48°14'19"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Urb
42	18°56'17"S-48°14'12"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Urb
43	18°56'20"S-48°14'10"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Urb
44	18°56'15"S-48°14'24"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Urb
45	18°56'23"S-48°14'13"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Urb
46	18°56'16"S-48°14'31"W	Mar/2019	EN	Urban	Lotic	RF	Yes	Urb
47	18°56'26"S-48°14'10"W	Mar/2019	EN	Urban	Lentic	PS	Yes	Urb

Continue...

Continuation..

48	18°52’23”S-48°17’14”W	Jan/2019	EN	Urban	Lotic	RF	Yes	Urb
49	18°57’04”S-48°17’19”W	Jul/2019	EN	Urban	Lentic	RF	Yes	Urb
50	18°55’24”S-48°17’57”W	Feb/2019	EN	Urban	Lentic	RF	Yes	Urb
51	18°55’17”S-48°17’59”W	Feb/2019	EN	Urban	Lotic	RF	Yes	Urb
52	18°55’18”S-48°18’09”W	Feb/2019	EN	Urban	Lentic	RF	Yes	Urb
53	18°58’28”S-48°18’43”W	Out/2019	EN	Urban	Lotic	PS	Yes	Urb/Liv
54	19°00’15”S-48°21’13”W	Jan/2019	EN	Urban	Lentic	PS	Yes	Liv
55	19°00’19”S-48°21’15”W	Jan/2019	EN	Urban	Lentic	PS	Yes	Liv/Pisc
56	19°00’15”S-48°21’09”W	Feb/2019	EN	Urban	Lotic	PS	No	Liv
57	18°53’02”S-48°15’38”W	Out/2019	EN	Urban	Lentic	-	Yes	Urb
58	18°59’17”S-48°08’45”W	Jan/2019	EN	Rural	Lentic	RF	Yes	Liv/Mono
59	19°00’02”S-48°16’07”W	Jan/2019	EN	Rural	Lotic	RF	Yes	Liv
60	19°00’08”S-48°16’10”W	Jan/2019	EN	Rural	Lotic	RF	Yes	Liv
61	19°13’26”S-48°19’03”W	Mar/2020	EN	Rural	Lotic	PS	Yes	Mon
62	18°59’34”S-48°12’26”W	Apr/2020	EN	Rural	Lotic	PS	No	Liv/Mono
63	18°52’27”S-48°20’29”W	Fev/2019	EN	Urban	Lotic	RF	Yes	Liv
64	18°59’20”S-48°10’10”W	Apr/2020	EN	Rural	Lotic	RF	No	Mon
65	19°04’59”S-48°11’49”W	Mar/2020	EN	Rural	Lentic	PS	Yes	Liv/Mon
66	19°05’05”S-48°12’30”W	Mar/2020	EN	Rural	Lentic	PS	No	Mon
67	19°02’02”S-48°21’55”W	Apr/2019	EN	Rural	Lotic	PS	Yes	Liv
68	19°01’40”S-48°21’26”W	Apr/2019	EN	Rural	Lentic	PS	Yes	Mon
69	19°02’08”S-48°21’18”W	Nov/2019	EN	Rural	Lentic	PS	Yes	Liv
70	19°14’20”S-48°24’23”W	Mar/2020	EN	Rural	Lentic	PS	Yes	Mon
71	18°58’39”S-48°18’54”W	Out/2019	EN	Urban	Lentic	PS	Yes	Liv
72	19°11’44”S-48°23’46”W	Mar/2020	EN	Rural	Lentic	PS	Yes	Mon
73	19°11’14”S-48°24’48”W	Mar/2020	EN	Rural	Lentic	PS	Yes	Mon
74	19°12’03”S-48°25’11”W	Mar/2020	EN	Rural	Lentic	PS	Yes	Mon
75	19°09’06”S-48°23’26”W	Mar/2020	EN	Rural	Lentic	RF	Yes	Liv/Mono
76	19°11’53”S-48°22’36”W	Apr/2020	EN	Rural	Lentic	PS	Yes	Mon
77	18°59’14”S-48°19’56”W	Dez/2019	EN	Rural	Lentic	PS	Yes	Liv
78	18°58’59”S-48°19’22”W	Dez/2019	EN	Urban	Lotic	PS	Yes	Liv/Urb
79	18°45’55”S-48°22’20”W	May/2020	EN	Rural	Lotic	RF	Yes	Liv
80	18°45’59”S-48°22’25”W	May/2020	EN	Rural	Lentic	RF	Yes	Liv
81	18°59’28”S-48°10’53”W	Fev/2020	EN	Rural	Lotic	PS	Yes	Liv/Mono
82	18°59’38”S-48°11’19”W	Apr/2020	EN	Rural	Lotic	PS	Yes	Liv
83	19°09’16”S-48°09’45”W	Fev/2020	EN	Rural	Lentic	PS	Yes	Liv
84	19°09’23”S-48°09’35”W	Fev/2020	EN	Rural	Lotic	PS	Yes	Liv
85	19°09’11”S-48°08’58”W	Fev/2020	EN	Rural	Lotic	RF	Yes	Liv
86	19°10’57”S-48°23’39”W	Feb/2019	EN	Rural	Lentic	PS	No	Preserv
87	19°10’36”S-48°23’40”W	Jan/2020	EN	Rural	Lotic	RF	No	Preserv
88	19°10’10”S-48°23’27”W	Jan/2020	EN	Rural	Lotic	RF	No	Preserv
89	19°09’39”S-48°23’13”W	Jan/2020	EN	Rural	Lotic	PS	Yes	Liv
90	18°49’30”S-48°10’03”W	Dez/2018	EN	Rural	Lotic	RF	No	Preserv
91	18°49’56”S-48°09’46”W	Mar/2019	EN	Rural	Lotic	RF	Yes	Liv
92	18°48’52”S-48°09’24”W	Apr/2019	EN	Rural	Lentic	RF	Yes	Liv
93	18°49’04”S-48°09’48”W	Oct/2018	LT	Rural	Lotic	RF	No	Preserv
94	19°02’39”S-48°21’57”W	Jul/2019	EN	Rural	Lotic	PS	Yes	Liv
95	19°05’55”S-48°25’37”W	Mar/2020	EN	Rural	Lotic	PS	Yes	Liv
96	18°45’50”S-48°23’29”W	Mar/2020	EN	Rural	Lotic	RF	Yes	Liv
97	19°15’04”S-48°25’43”W	Mar/2020	EN	Rural	Lotic	PS	Yes	Mono
98	19°10’22”S-48°25’40”W	Mar/2020	EN	Rural	Lotic	PS	Yes	Liv
99	18°53’39”S-48°26’03”W	Mar/2020	EN	Rural	Lotic	RF	No	Liv
100	18°46’27”S-48°12’33”W	May/2020	EN	Rural	Lotic	RF	Yes	Liv

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https://doi.org/ 10.1590/1676-0611-BN-2020-1182

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101	18°50'06"S-48°28'16"W	Apr/2020	EN	Rural	Lotic	RF	Yes	Liv
102	18°51'07"S-48°27'09"W	Apr/2020	EN	Rural	Lentic	RF	Yes	Liv
103	18°51'12"S-48°27'40"W	Apr/2020	EN	Rural	Lotic	RF	Yes	Liv/Mono
104	18°59'34"S-48°10'25"W	Fev/2020	EN	Rural	Lentic	PS	Yes	Liv
105	18°45'38"S-48°12'31"W	May/2020	EN	Rural	Lentic	RF	Yes	Pisc
106	18°59'39"S-48°12'15"W	Apr/2020	EN	Rural	Lotic	PS	Yes	Liv/Mono
107	18°50'06"S-48°24'49"W	Mar/2020	EN	Rural	Lentic	PS	Yes	Mon
108	18°50'01"S-48°24'40"W	Mar/2020	EN	Rural	Lentic	PS	Yes	Mon
109	18°50'33"S-48°24'55"W	Mar/2020	EN	Rural	Lotic	RF	No	Mon
110	19°02'50"S-48°03'16"W	Feb/2019	EN	Rural	Lentic	PS	Yes	Liv
111	19°02'57"S-48°03'17"W	Feb/2019	EN	Rural	Lentic	PS	No	Liv

first class, 24 in the second and 57 in both areas. Lentic habitats were richer than lotic (lentic: 79 species, 7.47 ± 3.56; lotic: 61 species, 6.35 ± 2.77) and also presented more exclusively species (lentic: 40; lotic: 21; both: 39). Considering the phytophysiognomies, palm swamps and forests presented, respectively, a richness of 76 (7.79 ± 3.15) and 66 (6.02 ± 2.93) of the sampled species; and approximately 36 species were exclusive to palm swamps, 25 to forests and 41 were common to both habitats. Lestidae was the only family with all species common to all classes, while Dicteriadidae was specific to lotic forested sites.

Four specimens of four species (*Aphylla distinguenda* Campion, 1920, *Phyllocycla* cf. *medusa* Belle, 1988, *Miathyria marcella* Selys in Sagra, 1857, *Tholymis citrina* Hagen, 1867) were captured through light trap. One individual of *Anax amazili* Burmeister, 1839, several of *Acanthagrion truncatum* Selys, 1876 and three of *Angelagrion nathaliae* Lencioni, 2008 emerged in the laboratory. Some *A. truncatum* and all other species were sampled using entomological net.

Almost 50% of the sampled species are not included in any of the IUCN conservation categories; one species (*Oligoclada xanthopleura* Borror, 1931) was classified as Data Deficient (DD) and ~45% were listed as (LC) least concern. However, *Erythrodiplax ana* Guillermo-Ferreira & Vilela 2016 is considered endangered (EN).

The rarefaction and extrapolation curves suggested that samples were satisfactory, although the sampling of more specimens indicate a diversity increment in all cases (Figure 3). Considering the triple of estimated richness was approximately 93 for palm swamps, 72 for riparian forest and 126 for all habitats, we sampled more than 80% of the richness of dragonflies in each phytophysiognomy and in the municipality.

2. *New records for the State*

We found eight new species records for Minas Gerais: one Aeshnidae, one Gomphidae, three Libellulidae and three Coenagrionidae. Below, we present the distribution in the Brazilian states and a brief description of occurrence sites. Brazilian states are represented by respective acronyms: Acre (AC), Amapá (AP), Amazonas (AM), Bahia (BA), Espírito Santo (ES), Goiás (GO), Maranhão (MA), Mato Grosso (MT), Mato Grosso do Sul (MS), Pará (PA), Pernambuco (PE), Rio de Janeiro (RJ), Rio Grande do Sul (RS), Roraima (RO) and São Paulo (SP).

2.1 *Neuraeschna claviforcipata* Martin, 1909 - 1♂; 1♀ (Figure 4a). Distribution: AM (Koroiva et al., 2020). The two individuals were flying next to a spring of preserved riparian forest at site 35 (urban park). Due to low solar incidence in the course, both specimens had low flight speed during sampling.

2.2 *Phyllocycla* cf. *medusa* Belle, 1988 - 1♀ (Figure 4b). Distribution: PA (Belle 1988). The specimen was collected in light trap at a riparian forest of the site 93, a conservation unit. The stream bed received direct sunlight and margins were completely shaded by tree vegetation.

2.3 *Diastatops intensa* Montgomery, 1940 - 4♂; 2♀ (Figure 4c). Distribution: PA, AP, RS, MT, MS, SP, PE and RJ (Ferreira-Peruquetti & Fonseca-Gessner 2003, Silveira 2003, Costa et al. 2004, Garrison et al. 2006, Heckman 2006, Calvão et al. 2014, Dalzochio et al. 2018a, Rodrigues & Roque 2017). All specimens were collected at site 92, in a lentic stretch of a riparian forest of a conservation unit. Despite the predominance of grasses in the area, there was a preserved forest nearby and some macrophytes near the sampled transect, where specimens often were perching.

2.4. *Oligoclada pachystigma* Karsch, 1890 - 3♂ (Figure 4d). Distribution: AM, MS, MT, PA, SP (Costa et al. 2000, Pinto & Lamas 2011, Carvalho et al. 2013, Rodrigues & Roque 2017, Koroiva et al. 2020). All males were collected during mid-flight. The first specimen was found in the edge of a closed canopy palm swamp (site 62) and the other in a small pond in the same phytophysiognomy (site 65). Both areas were small fragments surrounded by livestock farming and corn crops (*Zea mays* L.).

2.5. *Oligoclada xanthopleura* Borror, 1931 - 1♂ (Figure 4e). Distribution: AM, PA, MT, MA (Pinto & Lamas 2011, Carvalho et al. 2013, Calvão et al. 2014, Côrrea et al. 2014, Veras 2017, Koroiva et al. 2020). The specimen was collected in a palm swamp (site 5) with margins predominantly composed by *Brachiaria* sp. and exotic herbaceous species. Although the site was inserted in urban area, the nearest impervious structure was ~500 m from the pond.

2.6. *Angelagrion nathaliae* Lencioni, 2008 - 2♂; 1♀ (Figure 4f). Distribution: SP (Lencioni 2008). The immature individuals were collected on *Eichhornia crassipes* Mart. in fish farming tanks near an urban gallery forest (site 10). The adults were reared during approximately one month until emergence at the laboratory. The larva and the male of this species are currently being described by Frederico Lencioni (pers. comm.).

2.7. *Telebasis sanguinalis* Calvert, 1909 - 1♂ (Figure 4g). Distribution: MT, MS, AM, MA (Pinto & Carvalho 2012, Koroiva et al. 2017, Rodrigues & Roque 2017, Veras 2017, Koroiva et al. 2020). An individual was collected at a small palm swamp at 86, a different conservation unit from previous new records. The adjacent vegetation was composed of grasses and shrubs native to the Cerrado, near some *M. flexuosa* L.

Table 2. List of dragonfly species sampled in Uberlândia, Minas Gerais, Brazil, indicating aquatic habitat type, vegetation type, area type, sampled season, abundance (N) and occurrence sites. Le: Lentic; Lo: Lotic; R: Riparian Forest; P: Palm Swamp; Ru: Rural, U: Urban, D: Dry, R: Rainy. IUCN Red List Status: EN: Endangered, LC: Least Concern, DD: Data Deficient, "-": Not categorized in the UCN list. New records for Minas Gerais are marked with an asterisk (*); "r" indicate larvae reared up to adults; l indicate species collected by light trap. Conservation status of the species were extracted from IUCN database (IUCN 2020).

Taxon	Habitat	Vegetation	Area	Season	N	IUCN Status	Collection sites
Anisoptera							
Aeshnidae							
Anax amazili (Burmeister, 1839)[r]	Le	R	U	D	1	LC	10
Anax concolor Brauer 1865	Le	P	Ru	R	1	LC	86
Gynacantha nervosa Rambur,1842	Le	-	U	R	1	LC	57
Coryphaeschna adnexa (Hagen, 1861)	Lo	R	U	R	1	LC	35
Neuraeschna claviforcipata Martin. 1909*	Lo	R	U	R	2	-	35
Gomphidae							
Aphyla distinguenda (Campion, 1920)[l]	Lo	R	Ru	R	1	-	93
Gomphoides perdita (Förster, 1914)	Le	P	Ru	R	3	-	73, 104
Phyllocycla cf. *medusa* Belle, 1988*[l]	Lo	R	Ru	R	1	-	93
Progomphus intricatus Hagen in Selys, 1858	Le, Lo	P, R	Ru, U	D, R	7	LC	30, 67, 68, 85, 106
Libellulidae							
Brachymesia herbida (Gundlach, 1889)	Le, Lo	P, R	Ru, U	R	2	LC	5, 88
Dasythemis venosa (Burmeister, 1839)	Lo	P	Ru	D, R	2	-	89, 106
Diastatops intensa Montgomery, 1940*	Le	R	Ru	D	6	-	92
Diastatops obscura (Fabricius, 1775)	Le	R	Ru	D	1	-	102
Elasmothemis cannacrioides Calvert, 1906	Le, Lo	R	Ru, U	D, R	11	-	15, 26, 41, 62, 90, 111
Elasmothemis constricta (Calvert, 1898)	Le	P	Ru	R	1	-	5
Erythemis credula (Hagen, 1861)	Le	P	Ru, U	R	4	-	16, 73, 86
Erythemis peruviana (Rambur, 1842)	Le	P	Ru	R	7	LC	25
Erythemis vesiculosa (Fabricius, 1775)	Le	P	Ru	R	2	LC	21
Erythrodiplax ana Guillermo-Ferreira & Vilela 2016	Le, Lo	P	Ru, U	D, R	3	EN	37, 40, 94
Erythrodiplax castanea (Burmeister, 1839)	Le, Lo	P, R	Ru, U	D, R	79	-	6-8, 14, 22, 23, 36-38, 49, 54, 60, 61, 63, 68, 73, 74, 82, 84, 92, 94, 101, 102, 105,108, 110
Erythrodiplax fusca (Rambur, 1842)	Le, Lo	P, R	Ru, U	D, R	193	LC	2, 3, 5, 8, 10-12, 14, 16, 20, 23-25, 28, 29, 31-33, 42, 43, 46, 47, 49, 50, 52, 55, 56, 61, 62, 64, 65, 67, 68, 70, 72, 73, 75, 77, 78, 80-82, 89, 92, 94, 100, 101, 104, 106, 107, 108, 109
Erythrodiplax juliana Ris, 1911	Le, Lo	P, R	Ru, U	D, R	43	LC	9, 36, 40, 49, 66, 68, 69, 74, 78, 80-82, 85, 86, 100, 105
Erythrodiplax lygaea Ris, 1911	Le	P	U	R	1	LC	71
Erythrodiplax latimaculata Ris, 1911	Le, Lo	P, R	Ru, U	D, R	62		5, 11, 19, 21, 22, 25, 40, 53, 54, 61, 65, 66, 69, 70-73, 75, 78, 80, 83, 85, 86, 102, 104, 107, 110, 111
Erythrodiplax maculosa (Hagen, 1861)	Le	P	Ru, U	R	8	LC	40, 70, 71, 78
Erythrodiplax media Borror, 1942	Le, Lo	P, R	Ru, U	D, R	104	-	5, 8, 10, 21, 22, 24, 25, 27, 29, 31-33, 36-38, 40, 45-47, 49-52, 65, 66, 72, 77, 78, 83, 86, 92, 94, 101, 102, 104, 111
Erythrodiplax ochracea (Burmeister, 1839)	Le	R	Ru	R	2	LC	58
Erythrodiplax paraguayensis (Förster, 1904)	Le, Lo	P, R	Ru, U	D, R	34	LC	5, 9, 10, 16, 21, 22, 31, 32, 40, 49, 53, 65, 66, 68, 70, 76, 77, 104, 111
Erythrodiplax umbrata (Linnaeus, 1758)	Le, Lo	P, R	Ru, U	D, R	21	LC	6, 3, 10, 21, 31, 40, 77, 78, 54, 111
Erythrodiplax venusta (Kirby, 1897)	Le	P	Ru, U	R	6	-	21, 110
Gynothemis venipunctata Calvert. 1909	Le, Lo	P	Ru, U	D, R	7	-	5, 53, 82, 106
Idiataphe amazonica (Kirby, 1889)	Le	P	Ru	D, R	3	-	73, 76

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Idiataphe longipes (Hagen, 1861)	Le	P	Ru, U	R	2	-	65, 71
Macrothemis heteronycha (Calvert, 1909)	Lo	P	Ru	D, R	4	LC	53, 85, 106
Macrothemis imitans Karsch, 1890	Le, Lo	P, R	Ru, U	D, R	6	LC	9, 61, 88, 98
Miathyria marcella (Selys in Sagra, 1857)[1]	Lo	R	Ru	R	1	LC	93
Miathyria simplex (Rambur, 1842)	Le	R	Ru	D	1	-	92
Micrathyria catenata Calvert. 1909	Le	P	Ru, U	R	11	LC	16, 25, 72, 74
Micrathyria cf. *hypodidyma* Calvert, 1906	Lo	R	Ru	R	1	-	87
Micrathyria hesperis Ris, 1911	Le	P	Ru, U	R	9	-	25, 27, 47, 52, 72, 75
Micrathyria ocellata Martin, 1897	Le	P	U	R	9	-	21, 25, 50, 54
Micrathyria pirassunungae Santos, 1953	Le	P	Ru, U	R	7	-	20, 55, 66, 73
Micrathyria pseudeximia Westfall, 1992	Le, Lo	P, R	Ru, U	D, R	20	-	16, 25, 29, 45, 46, 52, 69, 71, 73, 86, 87, 102
Micrathyria spuria (Selys, 1900)	Le	P	Ru, U	D, R	6	LC	5, 102, 110
Nephepeltia berlai Santos, 1950	Le	P	U	R	3	-	5, 21, 22
Oligoclada laetitia Ris, 1911	Le	P	Ru, U	R	4	LC	40, 110
Oligoclada pachystigma Karsch, 1890*	Le, Lo	P	Ru	D, R	3	-	62, 65
Oligoclada xanthopleura Borror, 1931*	Le	P	U	R	1	DD	5
Orthemis aequilibris Calvert, 1909	Le, Lo	P	Ru, U	D, R	3	-	24, 32, 104
Orthemis cultriformis Calvert, 1899	Lo	R	Ru, U	R	3	-	43, 87
Orthemis discolor (Burmeister, 1839)	Le, Lo	P, R	Ru, U	D, R	18	LC	2, 10, 19, 23, 46-48, 55, 69, 73, 85, 102, 108
Pantala flavescens (Fabricius, 1798)	Le, Lo	P, R	Ru, U	D, R	6		7, 10, 26, 67, 68, 91
Perithemis icteroptera (Selys in Sagra, 1857)	Le	P	U	R	6	LC	47
Perithemis lais (Perty, 1834)	Le	P, R	Ru, U	R	14	LC	22, 39, 52, 54, 55, 75
Perithemis tenera (Say, 1840)	Le, Lo	P, R	U	D, R	13	LC	5, 8, 24, 25, 27, 54, 55
Tauriphila argo (Hagen, 1869)	Le	P	U	R	1	LC	5
Tholymis citrina Hagen, 1867[1]	Lo	R	Ru	R	1	LC	93
Tramea abdominalis (Rambur, 1842)	Le	P	U	R	3	LC	16
Tramea binotata (Rambur, 1842)	Le	P	Ru, U	R	3	LC	39, 72, 110
Uracis siemensi Kirby, 1897	Lo	P	U	R	1	-	17
Zenithoptera lanei Santos, 1941	Le, Lo	P	Ru, U	R	10	-	5, 22, 53, 66, 71
Zygoptera							
Calopterygidae							
Hetaerina rosea Selys, 1853	Le, Lo	P, R	Ru, U	D, R	90	-	1, 4, 6, 7, 11, 13, 15, 19, 26, 30, 32, 41, 42, 45, 46, 51, 58, 67, 88, 90, 94-98, 103, 109
Mnesarete guttifera (Selys,1873)	Lo	R	Ru	R	1	LC	90
Coenagrionidae							
Acanthagrion aepiolum Tennessen, 2004	Le, Lo	P, R	Ru, U	D, R	79	LC	9, 21, 24, 31, 33, 39, 41, 43, 45, 46, 54, 55, 58, 59, 64, 75, 103, 105
Acanthagrion gracile (Rambur, 1842)	Le, Lo	P, R	Ru, U	D, R	110	-	2, 3, 5-8, 10-12, 14, 20-23, 27-29, 33, 38, 39, 47, 49, 52, 54, 55, 59, 61, 64, 70, 72, 74, 75, 79, 80, 83, 94, 100, 102, 105
Acanthagrion lancea Selys, 1876	Le	R	U	R	2	LC	5, 31
Acanthagrion minutum Leonard, 1977	Le	P	Ru, U	D, R	5	LC	5, 73, 77, 102
Acanthagrion temporale Selys, 1876	Le	P, R	Ru, U	D, R	16	-	5, 10, 16, 24, 65, 69, 71, 72, 80, 102
Acanthagrion truncatum Selys, 1876[r]	Le, Lo	P, R	Ru, U	D, R	201	LC	2, 3, 5, 10, 16, 24, 25, 28, 36, 37, 40, 47, 49, 53, 54, 60, 61, 65, 69, 71, 72, 80, 89, 94, 101, 102, 104, 106, 107, 108, 110, 111
Angelagrion nathaliae Lencioni, 2008[r]*	Le	R	U	D	3	-	10
Argia lilacina Selys, 1865	Le, Lo	P, R	Ru, U	D, R	82	-	8, 9, 10, 14, 17, 33, 53, 54, 61, 62, 67, 68, 78, 81, 83, 84, 85, 89, 100, 109
Argia mollis Hagen in Selys, 1865	Lo	P, R	Ru, U	D, R	56	LC	6, 17, 18, 35, 41, 42, 44, 46, 56, 60, 62, 79, 87, 89, 96, 100
Argia reclusa Selys, 1865	Lo	P, R	R, U	D, R	275		1, 4, 8, 9, 11, 13, 15, 18, 19, 26-30, 32, 34, 35, 41-46, 56, 59, 60, 64, 83, 89, 90, 91, 94, 95, 96-99, 103, 109

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Argia tamoyo Calvert, 1909	Lo	R	Ru, U	D, R	8	LC	51, 59, 60, 63
Argia sp.	Lo	R	U	R	3	-	17,18
Cyanallagma nigrinuchale (Selys, 1876)	Le, Lo	R	Ru	D, R	4	-	84, 102
Epipleoneura venezuelensis Rácenis, 1955	Le, Lo	P, R	Ru, U	D, R	27	-	2, 4, 33, 34, 53, 88, 90, 91, 95, 98, 103
Epipleoneura williamsoni Santos, 1957	Le, Lo	P, R	Ru, U	D, R	20	LC	11, 12, 17, 18, 55, 64, 103
Forcepsioneura machadorum Vilela, Venâncio & Santos, 2020	Lo	R	U	R	5	-	17-19
Homeoura chelifera (Selys, 1876)	Le, Lo	P, R	Ru, U	D, R	20	-	17, 24, 36, 58, 68, 104, 110, 111
Homeoura lindneri (Ris, 1928)	Le	P, R	Ru, U	D, R	16	-	10, 21, 31, 65, 92, 110
Ischnura capreolus (Hagen, 1861)	Le, Lo	P, R	Ru, U	D, R	23	-	8, 10, 49, 71, 72, 77, 83, 92, 101, 102, 104, 108
Ischnura fluviatilis Selys, 1876	Le, Lo	P, R	Ru, U	D, R	10	LC	10, 25, 40, 47, 51, 63, 85
Nehalennia minuta (Selys in Sagra, 1857)	Le	P	Ru	R	1	-	86
Neoneura sylvatica Hagen in Selys, 1886	Le, Lo	P, R	Ru, U	D, R	14	-	4, 11, 12, 30, 64, 67, 92, 95, 101, 103, 105
Oxyagrion basale Selys, 1876	Lo	R	U	R	8	-	29, 42, 43
Oxyagrion chapadense Costa, 1978	Le, Lo	P, R	Ru, U	D, R	56	-	6, 8, 13, 14, 19, 26- 28, 30, 32, 41, 42, 48, 51, 64, 79, 87, 89, 98, 103
Oxyagrion microstigma (Selys, 1876)	Le, Lo	P, R	Ru	D, R	7	-	62, 71, 72, 80, 82
Oxyagrion terminale Selys, 1876	Le, Lo	P, R	Ru, U	D, R	31	-	6, 17, 23, 28, 29, 36, 38, 42, 43, 51, 79
Protoneura tenuis Selys, 1860	Lo	R	U	R	2	LC	18, 19
Telebasis carmesina Calvert, 1909	Le	P, R	Ru, U	D, R	51	LC	10, 16, 36, 37, 66, 69, 70, 72, 74, 77, 80, 86, 108
Telebasis coccinea (Selys, 1876)	Lo	P, R	Ru, U	D, R	31	-	20, 22, 39, 66, 70, 71, 73, 77, 80, 86, 102, 104
Telebasis corallina (Selys, 1876)	Lo	P	Ru	D	1	LC	80
Telebasis filiola (Perty, 1834)	Le, Lo	P, R	U	R	20	-	25, 28, 50
Telebasis griffinii (Martin, 1896)	Le, Lo	R	Ru, U	D, R	20	LC	38, 51, 92
Telebasis sanguinalis Calvert, 1909*	Le	P	Ru	R	1	LC	86
Telebasis simulacrum (Calvert, 1909)*	Le	P	Ru, U	R	8	LC	22, 111
Telebasis willinki Fraser, 1948	Le	P, R	Ru, U	D, R	9	LC	2, 27, 92
Tigriagrion aurantinigrum Calvert, 1909	Le, Lo	P, R	Ru, U	D, R	22	-	7, 11, 12, 17, 22, 58, 64, 75, 87, 94, 101
Dicteriadidae							
Heliocharis amazona Selys, 1853	Lo	R	Ru, U	R	10	-	15, 88, 90
Lestidae							
Lestes forficula Rambur, 1842	Le, Lo	P, R	Ru, U	R	15	LC	3, 16, 21, 59, 72, 74, 77, 111

2.8. *Telebasis simulacrum* (Calvert, 1909) - 7♂; 1♀ (Figure 4h). Distribution: RO, MT, MS, (Garrison 2009, Juen & De Marco 2012, Rodrigues & Roque 2017). We recorded these specimens at a degraded urban palm swamp adjacent to some small forest fragments (site 22), and at a rural palm swamp with a predominance of native grasses (site 111). All specimens were perching in emerged macrophytes at the time of sampling.

3. *Taxonomy*

Few months after the publication of *F. machadorum*, we collected three females in the type locality, including a tandem pair. Thus, here we describe the female of *F. machadorum* (Figure 5).

Head (Figure 5a). Labium, mandible and genae pale colored; anteclypeus dark brown with a brown spot at the center; remainder of the head black, except for a longitudinal pale dorsal stripe covering along postocular spots and occipital bar areas; antennifer pale colored with a pale ring at the apex; antenna dark brown, except for pale coloration on the posterior surface of pedicel; rear of the head pale colored.

Thorax (Figures 5a–d). Anterior lobe of prothorax dark brown dorsally, pale laterally; medial lobe dark brown except for pale areas in the propleuron, with two lateral tubercles; hind lobe rectangular with a slightly concave medial depression, laterally blunt with posterolateral corners forming rounded angles. Pterothorax with a thick black/metallic green stripe dorsally, except for a brown stripe on the interpleural suture; metepisternum and metepimeron pale colored except for a darker stripe

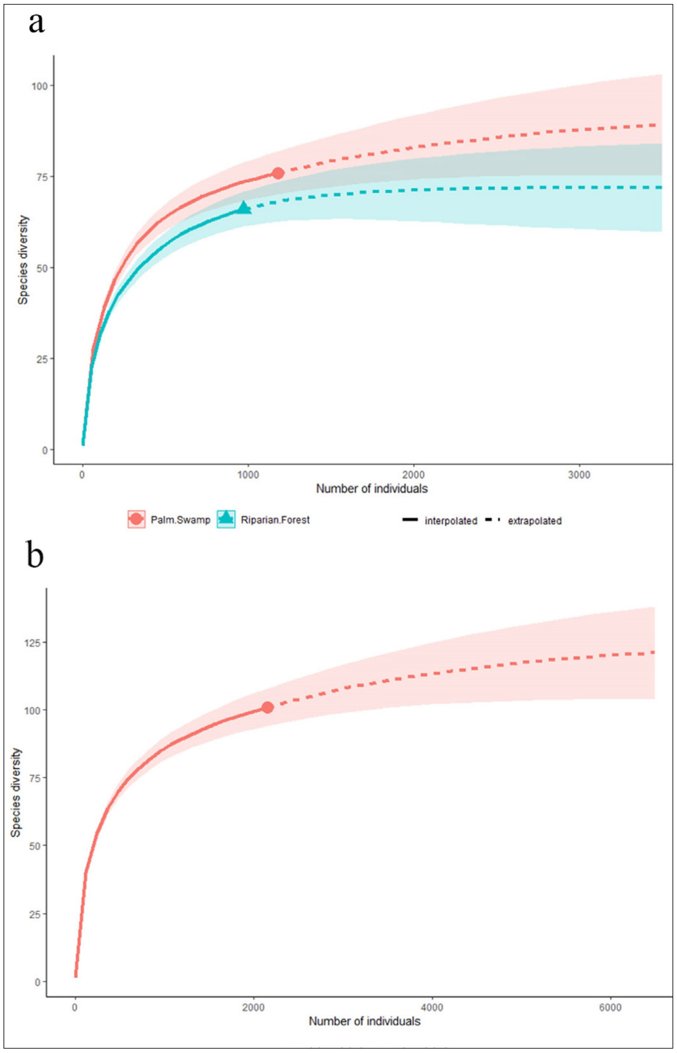

Figure 3. Accumulation curve (solid curve) and extrapolation (hatched curve) with 95% confidence interval (shaded area) of dragonflies sampled in (a) palm swamps and riparian forests and (b) general samples of Uberlândia, Minas Gerais, Brazil.

on the upper posterior portion of metepimeron and a small dark spot on the posterior metepisternum/metepimeron suture; venter pale.

Legs (Figure 5a). Overall coloration pale, femoral-tibial and tarsal articulations brown; spurs light brown.

Wings (Figure 5a). Hyaline; venation dark brown; Pt dark brown with pale contours; MP reaches anal margin 0.5 cell distal to the vein descending from subnodus; RP2 originating at Px 5 in Fw, at Px 4 in Hw; 11 Px in Fw, 10 Px in Hw.

Abdomen (Figure 5a). S1−8 dark brown dorsally, pale laterally, with pale apical rings, black color broadly extending on dorsal and lateral S8; S9 black/dark brown with a pale spot on its posterior dorsal 1/2; S10 pale dorsally, black laterally; cerci black; ovipositor valves pale, surpassing posterior margin of S10.

Measurements. TL: 32.3; AB: 27.3; head width: 3; FW: 19.2; HW: 17.9; Pt: 0.6; metathoracic femur 2.3; metathoracic tibia 1.9.

Diagnosis. Similarly to the male, the female of *F. machadorum* can be easily separated from the other female congeners by the morphology of the prothoracic hind lobe. It presents a roughly squared hind prothoracic lobe (Figure 5d), whereas in *F. sancta* (Hagen in Selys, 1860), its closely related species, the hind lobe is rounded. Among the examined females, the morphology is identical, although some coloration variation could be observed, as seen in Figure 4.

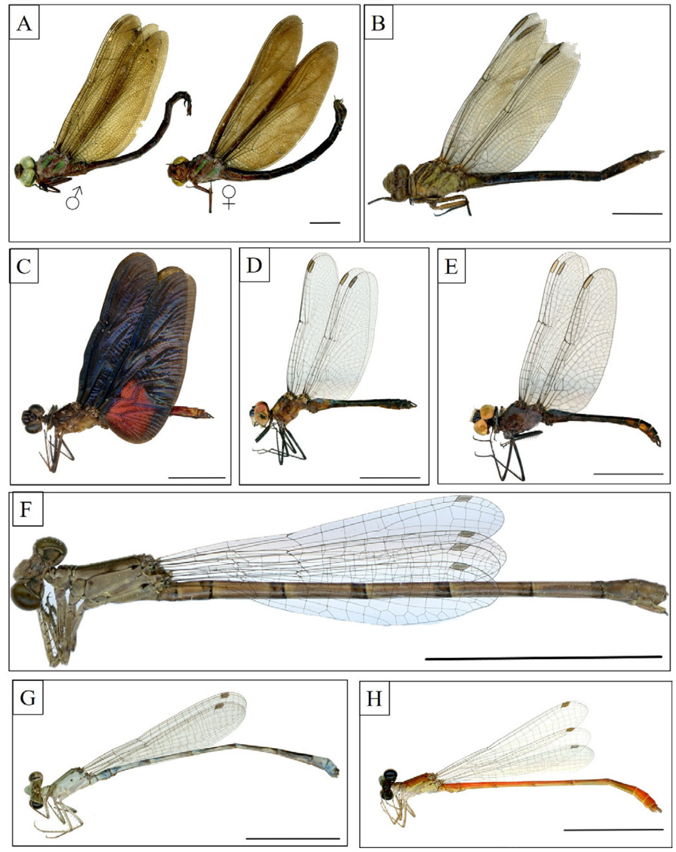

Figure 4. New species records for the state of Minas Gerais found in Uberlândia: a) male and female of *Neuraeschna claviforcipata* (Aeshnidae); b) female of *Phyllocycla* cf. *medusa* (Gomphidae); c) male of *Diastatops intensa* (Libellulidae); d) juvenile male of *Oligoclada pachystigma* (Libellulidae); e) male of *Oligoclada xanthopleura* (Libellulidae); f) female of *Angelagrion nathaliae* (Coenagrionidae); g) male of *Telebasis simulacrum* (Coenagrionidae); h) male of *Telebasis sanguinalis* (Coenagrionidae). Specimens were scanned at 1.200 dpi with the scanner Epson® V600 Perfection. Scale = 1 cm.

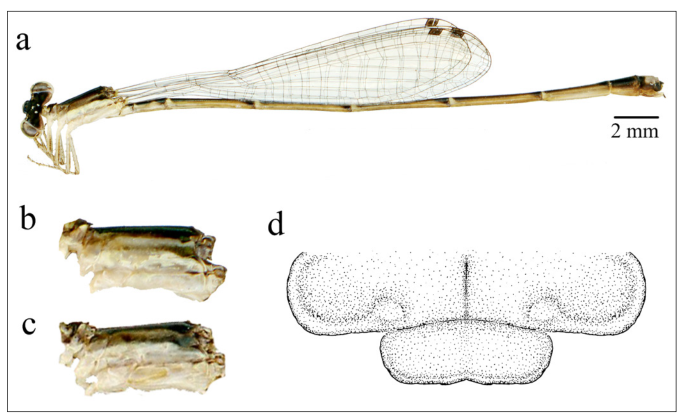

Figure 5. The female of *Forcepsioneura machadorum* Vilela, Venâncio & Santos, 2020: (a) lateral view of habitus; (b−c) lateral close-up of thorax; (d) dorsal view of prothoracic hind lobe.

Discussion

Considering the knowledge gaps of Odonata in the Cerrado, we conducted an inventory in palm swamps and riparian forests of

Uberlândia, Minas Gerais, in addition to the taxonomic description of the female of *Forcepsioneura machadorum*, and the description of the larvae of *Acanthagrion truncatum* (Vilela et al. 2020c). Altogether, we found 101 odonate species in the municipality, representing approximately 32% and 11% of the total richness in Minas Gerais and Brazil, respectively. Our study also added eight new records for the state, which now has 312 recorded species (Vilela 2020). This number represents the second highest Odonata richness reported to a Brazilian state, being only surpassed by Amazonas, with 335 species (Koroiva et al. 2020).

The number of species in palm swamp, riparian forest and both habitats, are greater in relation to standard diversity found in others inventories in the Cerrado, which, on average, are close to 50 species (Vilela et al. 2016, Barbosa et al. 2019, Borges et al. 2019). Possibly the heterogeneity of sampled sites can justify this difference. Other inventories with this pattern presented similar diversity to ours, even with fewer sampling effort. For example, in Minas Gerais, Bedê et al. (2015), Vilela et al. (2020a) and Amorim et al. (2018) sampled 128, 90 and 71 species, respectively, in more than 13 lotic and lentic sites. In other states, with less than 12 water bodies, Ferreira-Peruquetti & Fonseca-Gessner (2003) registered 85 species in lotic and lentic sites of riparian forests of São Paulo, and Juen et al. (2014) found more than 2,000 specimens and 79 species in streams of three Cerrado phytophysiognomies in Mato Grosso. In addition, some extensive inventories of heterogeneous habitats in Cerrado and Atlantic Forest presented great numbers of new records for Minas Gerais (Bedê et al. 2015, Souza et al. 2017), which may also explain the novelties found in this study. Regardless of the comparisons, all surveys of dragonflies in the country are of great importance, since it contributes to Odonata database, ecology and taxonomy, even with small sampling effort.

The abundance and number of new records in our study were concentrated mainly on Libellulidae and Coenagrionidae. This result was expected, since these groups are represented by a great diversity of species present in numerous aquatic habitats in worldwide (Garrison et al. 2006, Garrison et al. 2010), and are commonly representative in Brazilian inventories (Souza et al. 2013, Calvão et al. 2014, Pires et al. 2019, Garcia Junior et al. 2021). Nevertheless, Aeshnidae and Gomphidae were slightly diverse in our study compared to other Cerrado inventories. This representativity may be justified due to larvae rearing and use of light traps methods, which, only in two sites, sampled almost 30% of the group diversity. Our results reinforce the adoption of alternative methods to sample these families, since adults of aeshnids and gomphids are strongfliers, cryptic and some species are crepuscular (Ferreira-Peruquetti & Fonseca-Gessner 2003, Garrison et al. 2006, Almeida et al. 2013). Other families, such as Cordullidae and Megapodagrionidae were not recorded in our study. Despite nearly 50 or more species of these groups are known to occur in the neotropics (von Ellenrieder 2009), there are few inventoried species in Minas Gerais, with approximately 10 records in the Cerrado or ecotone zones of this biome and Atlantic Forest (Vilela 2020).

The riparian vegetation of many sampled sites were open with native grasses in palm swamp or, almost always, exotic grasses in disturbed forests. This may explain the great diversity of some libellulids, such as *Erythrodiplax* and *Micrathyria*. These groups are predominantly habitat generalists, abundant in open areas and some species are indicators of degraded sites, such as *Erythrodiplax fusca* Rambur, 1842 (Dutra & De Marco 2015, Dalzochio et al. 2018b), the most abundant libellulid in our study. However, even if anthropized areas are diverse in generalist dragonflies, they may contain not reported species with restricted distribution (Barbosa et al. 2019, Santos et al. 2020). In this context, we found *Oligoclada xanthopleura* and *Angelagrion nathaliae* in degraded ponds. The first species was not yet reported for the southeastern region, and the second occurred only in São Paulo state.

Despite the prevalence of generalist groups, few inventoried species and often restricted to integer habitats, such as *Neuraeschna claviforcipata*, *Mnesarete guttifera* Selys, 1873, *Perithemis icteroptera* Selys in Sagra, 1857 and *Telebasis willinki* Fraser, 1948 were found in the municipality. These records occurred mainly in urban green areas and conservation units, that even representing a small portion of the sampled locations, also held for approximately 50% of the novelties of this study. These results show that vegetation remnants hold a great richness of Odonata species, even being near or at urban areas. New species for science and states are often reported in protected urban or rural areas (e.g., Bedê et al. 2015, Pinto 2019), even if adjacent matrixes are unfavorable for odonates. For example, *Erythrodiplax ana* and *F. machadorum* were first discovered, respectively, at a preserved palm swamp and forest fragment adjacent to urban and cattle areas (Guillermo-Ferreira et al. 2016, Vilela et al. 2020b). Moreover, *Acanthagrion marinae* Lozano & Rodrigues, 2018, a recent discovered coenagrionid, was also recorded in preserved urban palm swamps in Brazil (Lozano & Rodrigues 2018, Rodrigues et al. 2019). In addition to provide suitable habitats to sensitive and low dispersion populations, most part of regional dragonfly community can also be benefited in conserved fragments, since these areas hold resources and microhabitats absent in degraded matrices (Ferreira-Peruquetti & Fonseca-Gessner 2003, Paulson et al. 2006, Araújo et al. 2020). These benefits can extend to surrounding zones of low degradation level that contain some environmental characteristics of preserved fragments, being also favorable to sensitive species and different communities (Monteiro-Júnior et al. 2016, Rodrigues et al. 2019). This highlights the importance of preserving and increase the number of such preserved areas and surrounding low disturbed zones to maintain riverine species (Oliveira et al. 2017, Azevedo-Santos et al. 2019). Despite this importance, the number of protected areas with incorporated aquatic environments is scarce in the Brazil, not ideally protecting most of aquatic taxa, including Odonata (Nóbrega & De Marco 2011, Azevedo-Santos et al. 2019).

The IUCN red list is an important indicator of the conservation of global species for communities within and outside the scientific and conservation ambits (IUCN 2020). Considering some population characteristics, such as size, dynamics and geographic distribution (Rodrigues et al. 2006), several species are categorized under some conservation status (IUCN 2020). Nonetheless, data of some threatened groups, such as dragonflies, are still incomplete (Clausnitzer et al. 2009, Koroiva et al. 2017, Ávila Júnior et al. 2021). Our results showed that more than half of the species sampled in this study (including not evaluated species) do not present enough data to be listed in a threaten category, confirming the knowledge gap of Odonata for Brazil (Vilela et al. 2020b). With the increment of inventories and updates of vulnerability statuses in the future, many species restricted to a single habitat or that have been recently discovered will be included in some risk of extinction. For example, *E. ana*, a species restricted to preserved palm swamps (Guillermo-Ferreira et al. 2016, Vilela et al. 2020b), is listed at risk of extinction due to the low number of individuals, low geographic coverage and to the vulnerability of this phytophysiognomy. Thus, we believe that our present data will contribute to fill the gaps about the vulnerability of odonates. However, we emphasize again the need for more surveys of the group in palms swamps, riparian forests and other phytophysiognomies of Brazil.

All phytophysiognomies present unique species occurrence. Forest habitats had a higher diversity of exclusive damselflies, mainly composed by shade demand species (ex., *Oxyagrion basale* Selys, 1876 and *Protoneura tenuis* Selys, 1860), while palm swamps were diverse in open habitat dragonflies (ex., *Micrathyria* spp. and *Erythemis* spp.). This result indicates bank vegetation as an important regulator of local species for each habitat due to thermoregulatory demands of many Zygoptera and Anisoptera, as presented by many studies (De Marco et al. 2015, Carvalho et al. 2013, Oliveira-Júnior & Juen 2019). Moreover, aquatic vegetation and abiotic factors are also related to Odonata structure of these habitats (Juen et al. 2007, Borges et al. 2021). For example, palm swamp and open habitats, such as degraded areas (Fares et al. 2020), are diverse in macrophytes, which are used as oviposition site or substrate during larvae development of some dependent libellulids and coenagrionids species (Vilela et al. 2016, Brito et al. 2020). Notably, degradation level, biased sample methods and time effort between phytophysiognomies must also be considered in our results, since some species found in a specific habitat in our study were present or absent in other palm swamp and forest studies (Rodrigues et al. 2018, Barbosa et al. 2019, Vilela et al. 2020a).

Here we demonstrated that inventories and taxonomic studies in poorly explored phytophysiognomies are important to overcome knowledge gaps of Brazilian odonatofauna. In addition to contributing to the knowledge of the diversity of dragonflies, new species reports, with other groups that inhabit palm swamps and forests, reinforce the importance of conserving these habitats, since many endemic species are at risk of extinction with land use expansion in these habitats. Therefore, we recommend more inventories of such phytophysiognomies in other regions.

Acknowledgments

We thank Afonso Galhardo, Guilherme Viana and Rodrigo Reis for support during fieldwork and Frederico A. A. Lencioni for the identification of *A. nathaliae*. We are also grateful to secretariat of the environment and urban services of Uberlândia, FUTEL, to Instituto Estadual de Florestas (IEF), Universidade Federal de Uberlândia (UFU) and to farms owners for access to urban parks, conservation units and rural properties. HV thanks Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for a doctoral scholarship grant (#140158/2018-9) and research productivity grant #312752/2018-0 to JCS.

Author Contributions

Henrique Venâncio: Substantial contribution in the concept and design of the study. Contribution to data collection. Contribution to data analysis and interpretation. Contribution to manuscript preparation. Contribution to critical revision, adding intellectual content.

Diogo Silva Vilela: Substantial contribution in the concept and design of the study. Contribution to data collection. Contribution to data analysis and interpretation. Contribution to manuscript preparation. Contribution to critical revision, adding intellectual content.

Marcela Silva Barbosa: Contribution to data collection. Contribution to critical revision, adding intellectual content.

Jean Carlos Santos: Substantial contribution in the concept and design of the study. Contribution to data analysis and interpretation. Contribution to manuscript preparation. Contribution to critical revision, adding intellectual content.

Conflicts of interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

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Received: 29/12/2020
Revised: 01/04/2021
Accepted: 06/04/2021
Published online: 12/05/2021