Oecologia Australis
26(1):19–33, 2022
https://doi.org/10.4257/oeco.2022.2601.03

MEDIUM- AND LARGE-SIZED MAMMALS AT THE URUCUM MASSIF IN THE BRAZILIAN PANTANAL: CAMERA TRAP AS AN EFFECTIVE SAMPLING METHOD TO ESTIMATE SPECIES RICHNESS, RELATIVE ABUNDANCE, AND ACTIVITY PATTERNS

*William Oliveira de Assis[1], Filipe Martins Santos[1], Leonardo França do Nascimento[2], Wanessa Teixeira Gomes Barreto[3], Wesley Arruda Gimenes Nantes[1], Carlos Fonseca[4], Heitor Miraglia Herrera[1, 3] & Grasiela Edith de Oliveira Porfirio[1,5]**

[1] Universidade Católica Dom Bosco, Programa de Pós-Graduação em Ciências Ambientais e Sustentabilidade Agropecuária. Avenida Tamandaré, 6000, CEP 79117-900, Campo Grande, MS, Brazil.

[2] Universidade Federal de Mato Grosso do Sul, Mestrado em Biologia Animal, Avenida Costa e Silva s/n, CEP 79070-900, Campo Grande, MS, Brazil.

[3] Universidade Federal de Mato Grosso do Sul, Programa de Pós-Graduação em Ecologia e Conservação, Avenida Costa e Silva s/n, CEP 79070-900, Campo Grande, MS, Brazil.

[4] Universidade de Aveiro, Campus de Santiago, Departamento de Biologia, Av. João Jacinto de Magalhães, 3810-193, Aveiro, Portugal.

[5] Universidade Federal de Mato Grosso do Sul, Pós-graduação em Recursos Naturais, Avenida Costa e Silva s/n, CEP 79070-900, Campo Grande, MS, Brazil.

E-mails: william.oliveira.assis@gmail.com, filipemsantos@outlook.com, leonardonascimentoleo@gmail.com, wanessatgbarreto@gmail.com, wesley_anantes@hotmail.com, cfonseca@ua.pt, herrera@ucdb.com.br, grasi_porfirio@hotmail.com (*corresponding author).

Abstract: The Urucum Massif (UM) is recognized as a region of flora and fauna endemism, and it is one of the few mountain ranges found in the western edge of the Brazilian Pantanal, in Mato Grosso do Sul state. Despite the lack of knowledge on mammalian species occurrence, several mining companies established in this region, and have rapidly rapidly changed its landscape. Therefore, this study aims to carry out an inventory of medium- to large-sized mammals in the UM to estimate their relative abundance and activity patterns using data provided by camera trapping surveys. Two main camera-trapping surveys were carried between October 2014 and July 2015, in addition to a small survey in July 2016. Results showed 25 species from medium- to large-sized mammals. *Dicotyles tajacu, Dasyprocta azarae* and *Dasypus novemcinctus* presented the highest relative abundance indices. Overall, *D. azarae, Nasua nasua* and *Euphractus sexcinctus* were diurnal, while *Tamandua tetradactyla, D. novemcinctus, Tapirus terrestris* and *Sylvilagus paraguensis* were nocturnal, in turn, *D. tajacu* and *Cerdocyon thous* were associated with the crepuscular period. Overall, 28 % (N = 7) and 12 % (N = 3) of the recorded species are threatened nationally and globally, respectively. Due to the scarcity of protected areas in the UM, we recommend long term monitoring of mammals and ecological studies to support conservation actions for this group in the region.

Keywords: conservation; inventory, Mammalia, Pantanal.

INTRODUCTION

Species inventories comprise a basic approach in biodiversity studies and are elementary for insights, planning, and designing strategies for conservation (Tobler *et al.* 2008, Santos *et al.* 2016). Approximately 22 % (N = 166) of the 762 mammal species recorded in Brazil (Abreu *et al.* 2021) are known to occur in Mato Grosso do Sul state (Tomas *et al.* 2017), a remarkable location in terms of biodiversity for encompassing portions of the Cerrado, Atlantic Forest, Chaco, and most of the Brazilian Pantanal (Graciolli *et al.* 2017).

The Pantanal is known worldwide as a hotspot for mammal abundance in South America (Tomas *et al.* 2010a), sheltering up to 170 mammalian species, according to updated records for the region (Alho *et al.* 2011). Although currently more is known about mammalian occurrence in the region since the first surveys in the 80s (*e.g.* Schaller 1983, Alho *et al.* 1987, Trolle 2003, Godoi *et al.* 2010, Porfirio *et al.* 2014), basic information on species occurrence is yet to be provided regarding some parts of the region (Tomas *et al.* 2010a, Alho *et al.* 2011).

Urucum Massif (UM) is one of the few mountain ranges found in the western edge of the Brazilian Pantanal (Assine *et al.* 2015), in Mato Grosso do Sul state. The unique characteristics of the region derive from the influence of neighboring ecosystems and occurrence of endemic species, as well species with restricted geographic distribution in Brazil (Tomas *et al.* 2010b, Hannibal *et al.* 2017). However, not much information is published regarding medium- to large-sized mammals for this region. Mauro and Campos (2000) provided a list of fauna for the geo-environmental zoning of the western edge of the Brazilian Pantanal, whose records included the UM and surroundings of Corumbá during 1989 to 1994. Hannibal *et al.* (2017) carried out another long effort to study the mammals of the region, between 2000 and 2014 (Hannibal *et al.* 2017). The study included the UM until Porto Morrinho, on the banks of Paraguai river. Therefore, in addition to the insufficient knowledge on the presence of species in the UM (Tomas *et al.* 2010b), such scenario also implies a conservation concern due to the presence of large deposits of iron and manganese, bringing economic importance to the region (Del'Arco *et al.* 1982). The activities of the many mining companies settled in the region widely result in habitat reduction or modification, compromising wild species in several aspects (Hannibal *et al.* 2017). Considering the huge environmental impacts related to mining activity (Facury *et al.* 2019, Thompson *et al.* 2019), it is undoubtedly important to learn the species occurrence for wildlife monitoring and restoration of degraded habitats. Moreover, medium- and large-sized mammals can be considered environmental bioindicators, since most of them need large areas of good-quality habitat, with sufficient food resources and shelter (Campos *et al.* 2012). In addition, their absence or reduced population suggest habitat fragmentation or landscape changes (Campos *et al.* 2012).

The survey of medium- to large-sized mammals have encompassed different methods, such as track plots, track census, transect census, search for evidences (scratches, burrows, feces), in addition to camera trapping more specifically over the last decades (Alho *et al.* 1987, Silveira *et al.* 2003, Trolle 2003, Lyra-Jorge *et al.* 2008, Cabral *et al.* 2017, Campos *et al.* 2019). Camera trapping has become one of the main methodologies used in mammalian surveys, accounting for a substantial part of species records (Tobler *et al.* 2008, Lyra-Jorge *et al.* 2008, Porfirio *et al.* 2014, Estrela *et al.* 2015, Oliveira *et al.* 2019). Therefore, this study aims to contribute to the knowledge of terrestrial mammalian species occurrence in the Urucum Massif based on camera trapping surveys. Thus, our goal is to estimate species richness (S) of medium- to large-sized mammals in the Urucum Massif, as well as to estimate their relative abundance and activity patterns.

MATERIAL AND METHODS

Study Site

The study was carried out in the region of Urucum Massif, located 20 km South of Corumbá, Mato Grosso do Sul state, Brazil (Figure 1). Urucum Massif is a peninsula of non-floodable terrains that enters the Pantanal wetland (Tomas *et al.* 2010b). It is bordered on the north by the Paraguay River, west by Bolivia, and on the south and east by the Pantanal floodplain, which consists of

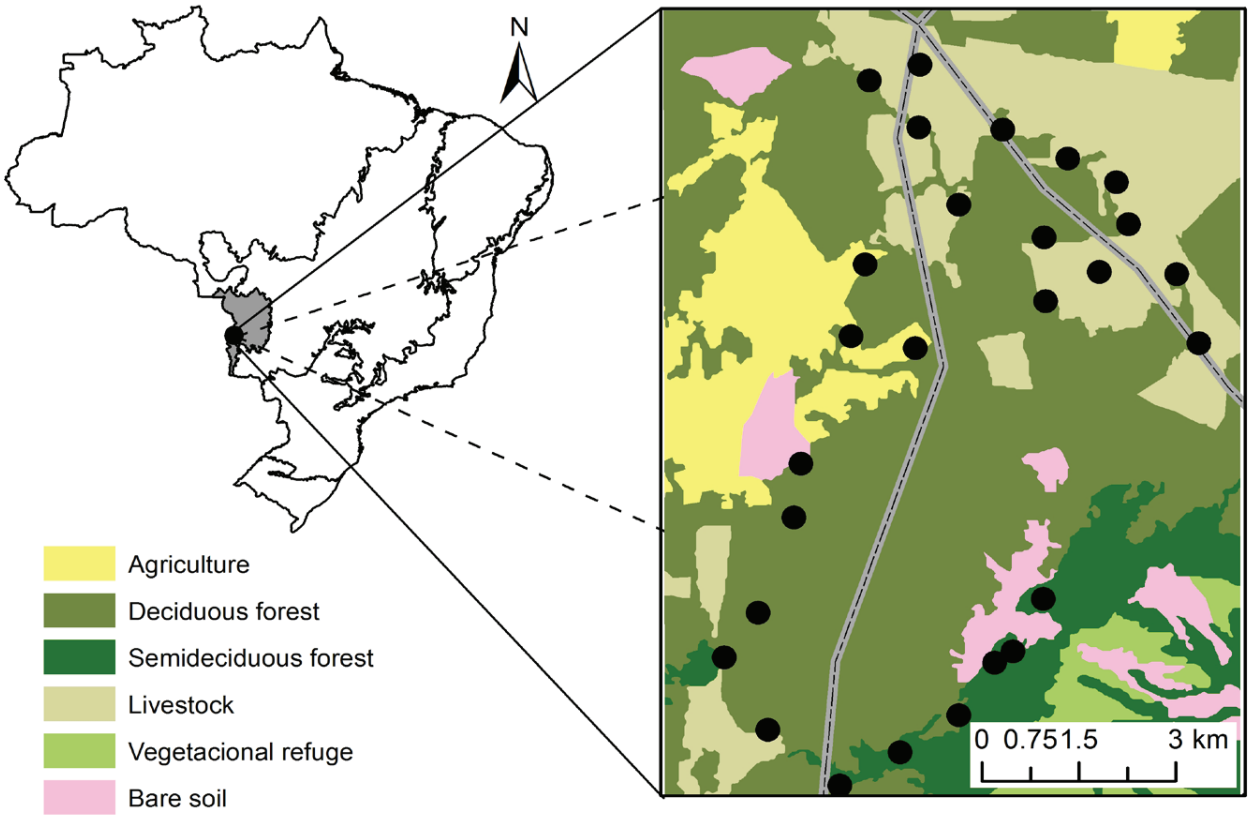

Figure 1. Location of camera traps in the region of the Urucum Massif, Mato Grosso do Sul state, Brazil (from October 2014 up to December 2014; May 2015 to July 2015 and July 2016). In gray color: Pantanal biome. Dashed grey line: Highway. Map author: Marina Zanin Gregorini.

an area of 1,300 km^2 (Godoi *et al.* 2010). It has a seasonal climate with two well-defined seasons: rainy season, from October to March, and dry season, from April to September (Godoi *et al.* 2010). Its vegetation ranges from semideciduous seasonal forest to deciduous seasonal forest, as well as altitudinal grasslands. Gallery forest and island of xerophytic vegetation are also found in the region (Tomas *et al.* 2010b). In addition to mining companies, the region is characterized by the presence of private areas of different sizes dedicated to cattle ranching, rural settlements, and balnearies.

Data collection

We performed two main camera-trapping surveys in the following periods: (I) from October 2014 to December 2014, and (II) from May 2015 to July 2015. We also used data of an additional survey from July 2016 to complement our samples. In the first field campaign, we installed 21 camera traps for 58 days, totalizing a sample effort of 1,218 camera-days, and 27 camera traps for 43 days in the second campaign, with a sample effort of 1,161 camera-days. The data obtained from the additional survey (three camera traps for eight days) generated a total sample effort of 2,403 camera-days. These data were pooled to the first and second surveys for the analyses.

We installed camera traps in different habitats, such as gallery forests, altitudinal grasslands, and deciduous and semi-deciduous forests within a distance of at least one kilometer. All cameras (Bushnell Trophy Cam®, Overland Park, Kansas, USA) were programmed to operate continuously (24 h/day) and take three consecutive pictures at an interval of five seconds between records. No bait was used to attract the animals, and stations were checked continuously to change batteries and download pictures (Porfirio *et al.* 2014). This study was authorized by SISBIO (nº 47821-1).

Data analysis

We identified the species according to the procedure of Borges and Tomás (2004). Data obtained during the study were used to provide a

list of medium- to large-sized terrestrial mammals in the region, as well as to estimate their relative abundance; however, the activity patterns were estimated only for species with ≥ 10 detections (Monterroso *et al*. 2014). The conservation status of each species was obtained and discussed based on the red lists of the International Union for Conservation of Nature (IUCN 2020) and Brazilian Environment Ministry (MMA 2018), following the method described by Campos *et al*. (2019).

Using the *vegan* package in R environment (Oksanen *et al*. 2020), we performed randomizations (1000 runs) of samples with different sizes to generate the species accumulation curve aiming to assess the effort employed in the mammalian survey by camera-trapping. The curve was developed considering each day as an independent sample (Tobler *et al*. 2008). The relative abundance of mammals was assessed based on the capture rates of camera trapping surveys through the relative abundance index (RAI), which is calculated through the number of independent pictures from each species divided by the total sampling effort of camera-trapping (O'Brien *et al*. 2003). To guarantee independence between the images, we performed the analysis at an interval of 24 hours between pictures of the same species (Tobler *et al*. 2008).

To assess activity patterns, all records were screened to avoid pseudoreplication; in addition, aiming at data independence, like in the aforementioned analysis, we considered one-hour interval for records of the same species at each station (Silveira *et al*. 2003, Campos *et al*. 2019). In contrast, upon identifying different individuals of the same species within the interval, the records were considered independent. The time of each record was converted into solar time (Foster *et al*. 2013) and classified into the following three categories: day-time (from one hour after sunrise to one hour before sunset), night-time (from one hour after sunset to one hour before sunrise), and crepuscular (one hour before and after both sunrise and sunset) (Ikeda *et al*. 2016).

We generated activity curves of medium- to large-sized mammals using kernel density estimates function (Ridout & Linkie 2009) on the software package *Circular* (Lund *et al*. 2017). Activity patterns were estimated based on the proportion of records in each category: diurnal, nocturnal, crepuscular, and cathemeral (activity throughout the diurnal and nocturnal periods). Relationships between mammal species and categories of activity patterns were assessed through correspondence analysis (CA) on the package *MVar.pt* (Ossani & Cirilo 2016), in addition to a Bray Curtis matrix considering the number of independent records of each species in each time category. CA allows a visual interpretation between these relationships: the shorter the distance of the species from its category of activity pattern the greater the proportion of records in the respective category (Leps & Smilauer 2003). All analyses were performed on the software R 3.5.0 (R Development Core Team 2015).

RESULTS

Twenty-five species of medium to large-sized mammals (N = 1,009 independent records) from nine orders and 17 families were recorded in the Urucum Massif (Table 1; Figure 2) throughout the study. Of all the species recorded, 28 % (N = 7) and 12 % (N = 3) among all the recorded species are threatened nationally and globally, respectively (Table 1).

Carnivora was the richest order, with eight species recorded, followed by Artiodactyla and Rodentia, with four species each. Lagomorpha, Perissodactyla and Primates had only one species recorded. Based on camera trapping, *Dicotyles tajacu*, *Dasyprocta azarae*, and *Dasypus novemcinctus* had the highest indexes of relative abundance, while the lowest RAIs were given for the species with only one record: *Didelphis albiventris*, *Coendou prehensilis*, *Thrichomys fosteri*, *Leopardus wiedii*, *Herpailurus yagouaroundi*, and *Myrmecophaga tridactyla* (Figure 3). The species accumulation curve did not stabilize (Figure 4). Activity patterns were estimated for *D. tajacu*, *D. azarae*, *D. novemcinctus*, *Nasua nasua*, *Tapirus terrestris*, *Cerdocyon thous*, *Euphractus sexcinctus*, *Tamandua tetradactyla*, and *Sylvilagus paraguensis*. The correspondence analysis (CA) demonstrated that 82.7 % of the data variation was explained in the first axis of the graph. *Dasyprocta azarae*, *Nasua nasua* and *E. sexcinctus* were diurnal; *T. tetradactyla*, *D. novemcinctus*, *T. terrestris* and *S. paraguensis*

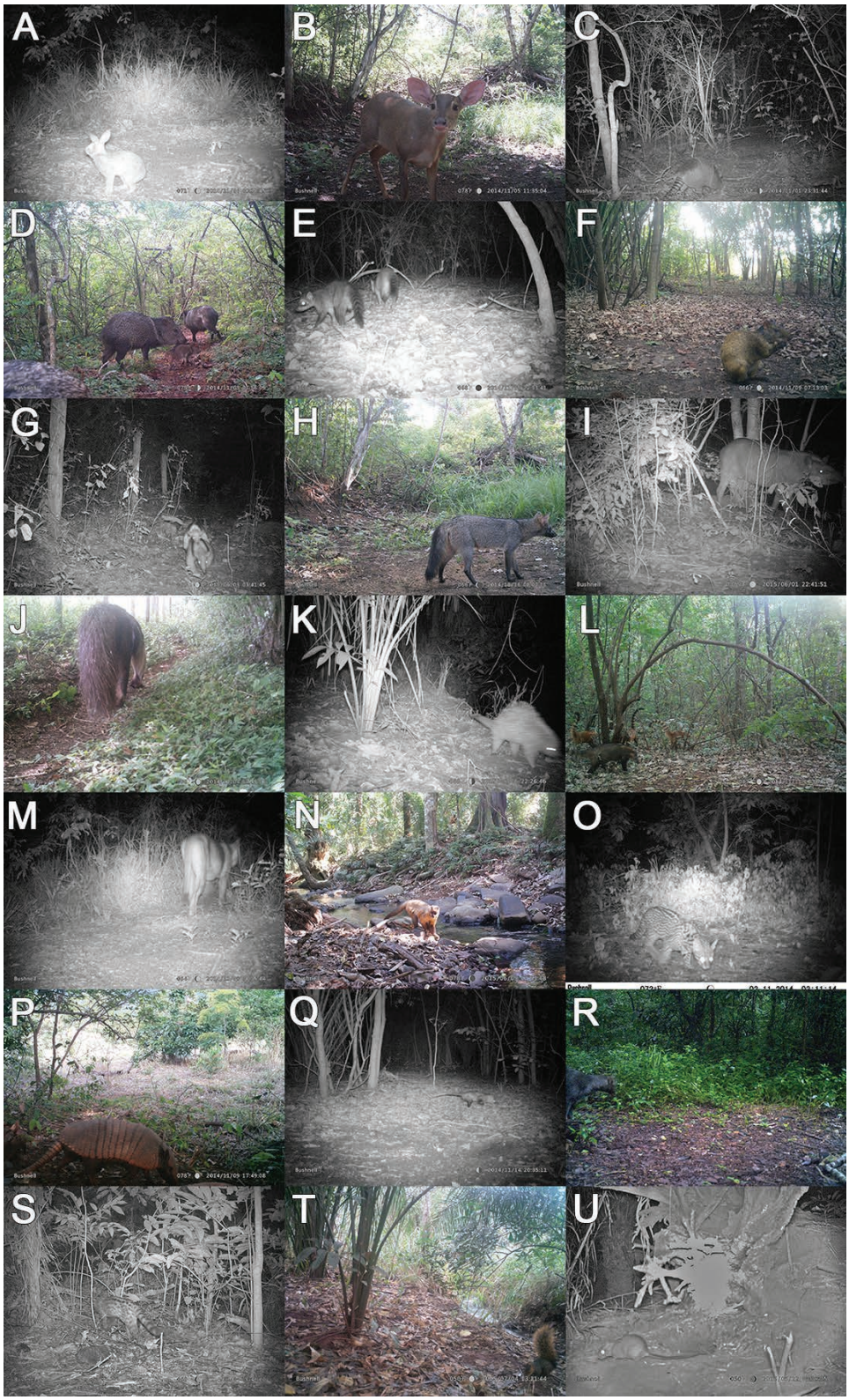

Figure 2. Mammal species recorded by camera trapping in the Urucum Massif, Mato Grosso do Sul state, Brazil, (from October 2014 up to December 2014; May 2015 to July 2015 and July 2016). A. *Sylvilagus paraguensiss*; B. *Mazama gouazoubira*; C. *Dasypus novemcinctus*; D. *Dicotyles tajacu*; E. *Procyon cancrivorus*; F. *Dasyprocta azarae*; G. *Tamandua tetradactyla* ; H. *Cerdocyon thous*; I. *Tapirus terrestris*; J. *Myrmecophaga tridactyla*; K. *Coendou prehensilis*; L. *Nasua nasua*; M. *Puma concolor*; N. *Sapajus cay*; O. *Leopardus pardalis*; P. *Euphractus sexcinctus*; Q. *Didelphis albiventris*; R. *Herpailurus yagouaroundi*; S. *Leopardus wiedii*; T. *Hadrosciurus spadiceus*; U. *Thrychomis fosteri.*

Table 1. List of species, common name, habitat type of detections, conservation *status* according to IUCN Red List[1] (2020) and according to the Environment Ministry of Brazil[2] (MMA, 2018), and number of records of mammals identified at Urucum Massif, Mato Grosso do Sul state, Brazil, using camera trapping from October 2014 up to December 2014; May 2015 to July 2015 and July 2016. GF=Gallery Forest; DF=Deciduous Forest; SDF= Seasonal Semi Deciduous Forest; AG= Altitudinal Grassland; WS= Woodland Savanna; SS = Shrubby Savanna. DD= Data Deficient; EN= Endangered; V= Vulnerable; NT= Near Threatened; NR=Not reported.

Taxon and Scientific Name	Common Name	Habitat Type	Conservation *status*[1, 2]	Number of records
Artiodactyla				
Cervidae				
Mazama americana (Erxleben, 1777)	Red brocket deer	DF, SDF, WS, SS	DD[1], NR[2]	33
Mazama gouazoubira (Fischer, 1814)	Gray brocket deer	GF, DF, SDF, WS, SS	LC[1], NR[2]	83
Tayassuidae				
Dicotyles tajacu (Linnaeus, 1758)	Collared peccary	GF, DF, SDF, WS, SS	LC[1], NR[2]	248
Tayassu pecari (Link, 1795)	White-lipped peccary	GF	VU[1], VU[2]	3
Carnivora				
Canidae				
Cerdocyon thous (Linnaeus, 1766)	Crab-eating fox	GF, DF, SDF, WS, SS	LC[1], NR[2]	27
Felidae				
Leopardus wiedii (Schinz, 1821)	Margay	GF	NT[1], VU[2]	1
Leopardus pardalis (Linnaeus, 1758)	Ocelot	SS, SDF, DF, WS	LC[1], NR[2]	5
Puma concolor (Linnaeus, 1771)	Puma	SDF, SS, GF	LC[1], VU[2]	5
Herpailurus yagouaroundi (É. Geoffroy, 1803)	Jaguarundi	SDF, WS, DF	LC[1], NR[2]	1
Procyonidae				
Nasua nasua (Linnaeus, 1766)	South America coati	GF, DF, WS, SDF, SS	LC[1], NR[2]	82
Procyon cancrivorus (C.[Baron] Cuvier, 1798)	Crab-eating raccoon	GF, SDF	LC[1], NR[2]	7
Mustelidae				
Eira barbara (Linnaeus, 1758)	Tayra	GF, SDF	LC[1], NR[2]	5
Cingulata				
Dasypodidade				
Dasypus novemcinctus Linnaeus, 1758	Nine-banded armadillo	GF, DF, SDF, WS, SS, AG	LC[1], NR[2]	156
Chlamyphoridae				
Euphractus sexcinctus (Linnaeus, 1758)	Six-banded armadillo	GF, DF, SDF, SS	LC[1], NR[2]	19

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Taxon and Scientific Name	Common Name	Habitat Type	Conservation *status*[1,2]	Number of records
Didelphimorphia				
Didelphidae				
Didelphis albiventris Lund, 1840	White-eared opossum	SDF	LC[1], NR[2]	1
Philander opossum (Linnaeus, 1758)	Gray-four-eyed Opossum	GF	LC[1], NR[2]	2
Lagomorpha				
Leporidae				
Sylvilagus paraguensis Thomas, 1901	Tapeti	SDF, DF, WS, AG	NR[1], NR[2]	10
Perissodactyla				
Tapiriidae				
Tapirus terrestris (Linnaeus, 1758)	Lowland tapir	GF, DF, SDF, SS, WS	VU[1], VU[2]	56
Pilosa				
Myrmecophagidae				
Myrmecophaga tridactyla Linnaeus, 1758	Giant anteater	SDF, SS	VU[1], VU[2]	1
Tamandua tetradactyla (Linnaeus, 1758)	Southern tamandua	SDF, DF, WS, SS	LC[1], NR[2]	10
Primates				
Cebidae				
Sapajus cay (Illiger, 1815)	Azara's capuchin	GF, DF, SDF, WS, SS	LC[1], VU[2]	20
Rodentia				
Dasyproctidae				
Dasyprocta azarae Lichtenstein, 1823	Azara's agouti	GF, DF, SDF, SS, AG	DD[1], NR[2]	229
Echimyidae				
Thrichomys fosteri Thomas, 1903	Sauía	SDF, WS, SS, AG	LC[1], NR[2]	1
Erethizontidae				
Coendou prehensilis (Linnaeus, 1758)	Brazilian porcupine	GF, SDF	LC[1], NR[2]	1
Sciuridae				
Hadrosciurus spadiceus (Olfers, 1818)	Southern Amazon squirrel	SDF, SS, DF, WS	LC[1], NR[2]	3

were nocturnal, while *D. tajacu*, and *C. thous* were associated with the crepuscular period (X^2 = 577.75; df = 16; $p < 0.0001$; Figure 5 and 6).

DISCUSSION

The camera trapping surveys revealed the presence of 25 medium- to large-sized species of mammals in the Urucum Massif. Two previous studies focused on medium to large size mammalian fauna in the region (Mauro & Campos 2000, Hannibal *et al.* 2017). Mauro and Campos (2000) reported 39 species of mammals at the mountain ridges around Corumbá, including UM,

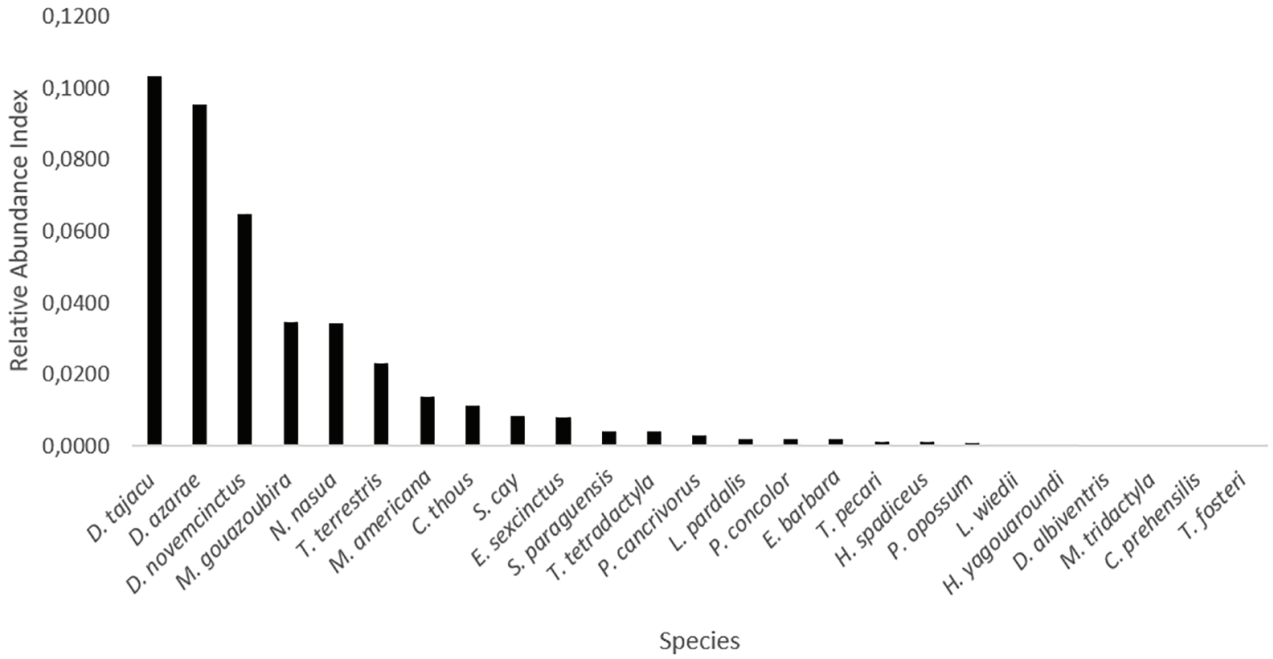

Figure 3. Relative Abundance Index (RAI) calculated by the number of independent records of each mammal species recorded by camera trapping in the Urucum Massif, Mato Grosso do Sul state, Brazil, carried out from October 2014 up to December 2014; May 2015 to July 2015 and July 2016.

while Hannibal *et al.* (2017) reported 32 species of medium- and large-sized mammals in the Urucum Mountains and surroundings. In turn, this study reported about 80% of the medium- to large-sized mammalian species recorded in previous studies in the Urucum region (Mauro & Campo, 2000, Hannibal *et al.* 2017) using exclusively camera trapping as survey method. It is important to considered that the other aforementioned studies (Mauro & Campos 2000 and Hannibal *et al.* 2017) used a wide variety of sampling methods, as active search, vocalisations, views, presence of faeces, carcasses, and tracks; in addition, only Hannibal *et al.* (2017) used camera traps. Therefore, both

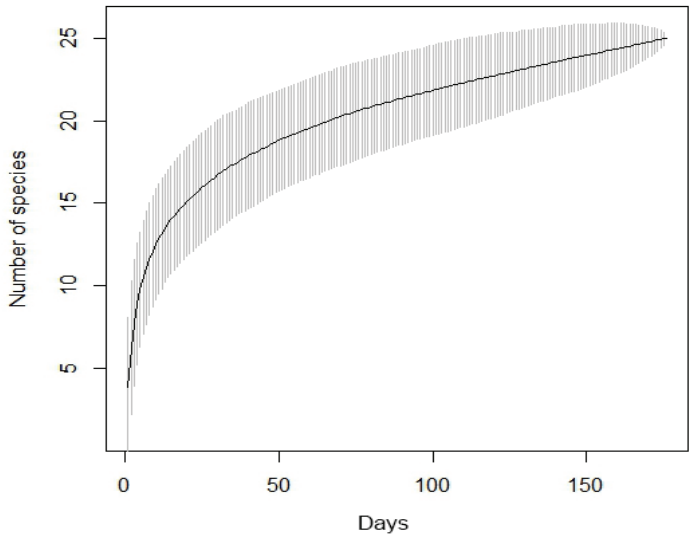

Figure 4. Species accumulation curve of mammals recorded by camera trapping in the Urucum Massif, Mato Grosso do Sul state, Brazil, from October 2014 up to December 2014; May 2015 to July 2015 and July 2016. Grey bars mean 95 % Confidence Intervals.

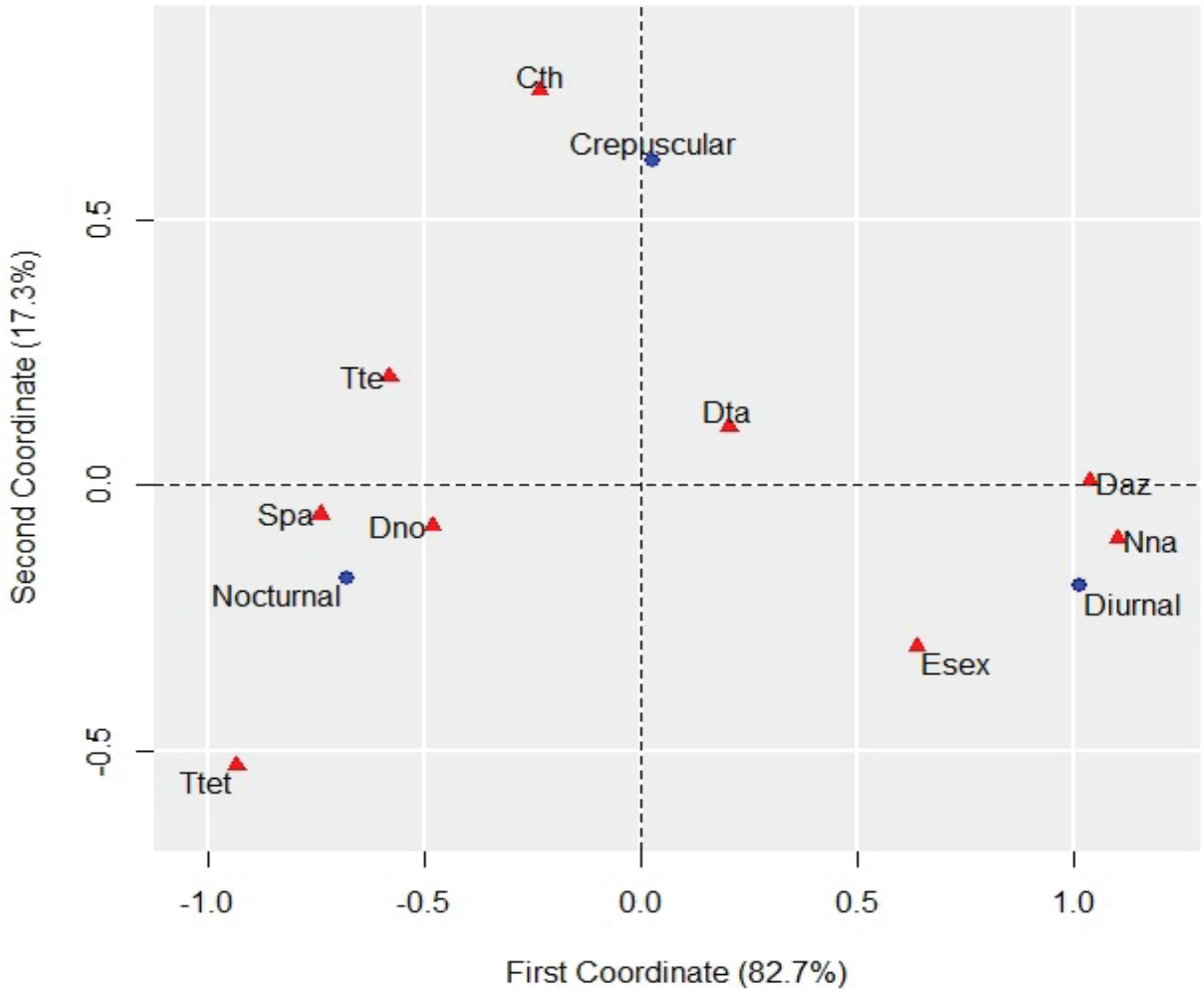

Figure 5. Correspondence analysis (CA) of mammal species and time categories using the number of independent records of each species registered in camera trapping surveys carried out in the Urucum Massif, Mato Grosso do Sul state, Brazil (from October 2014 up to December 2014; May 2015 to July 2015 and July 2016). Tte: *Tapirus terrestres;* Dta: *Dicotyles tajacu;* Daz: *Dasyprocta azarae;* Dno: *Dasypus novemcinctus;* Ttet: *Tamandua tetradactyla;* Esex: *Euphractus sexcintus;* Cth: *Cerdocyon thous;* Spa: *Sylvilagus paraguensis* Nna: *Nasua nasua.*

studies include mammalian species other than those essentially terrestrial that are sampled in our study (due to our sampling design). The species accumulation curve demonstrates that the sampling did not contain all species of the region, which is a consistent finding when considering species with cryptic habits or low densities, such as *Panthera onca* and *Cuniculus paca* detected by Hannibal *et al.* (2017). In contrast, our sampling photo-traped for the first time a specimen of *Leopardus wiedii*, which seems to be rare in the region.

The detection of species in relation to Hannibal *et al.* (2017) confirms the efficiency of the sampling method used in our study. In fact, camera trapping has proved a quick and satisfactory method, present in a practically inseparable manner from current fauna survey studies, especially when addressing medium- and large-sized terrestrial mammals (Tobler *et al.* 2008, Rowcliffe & Carbone 2008, Rowcliffe 2017). Moreover, our study also detected some of the terrestrial small-sized mammal species and primates that used the ground. In this context, other different sampling designs have allowed broader use of the technique in ecological studies even with small-sized mammals and arboreal species (Oliveira-Santos *et al.* 2008, De Bondi *et al.* 2010, Di Cerbo & Biancardi 2013, Rowcliffe 2017).

The RAI indicated the highest detection rates for *D. tajacu*, *D. azarae*, and *D. novemcinctus*. In this instance, it is worth highlighting that RAI

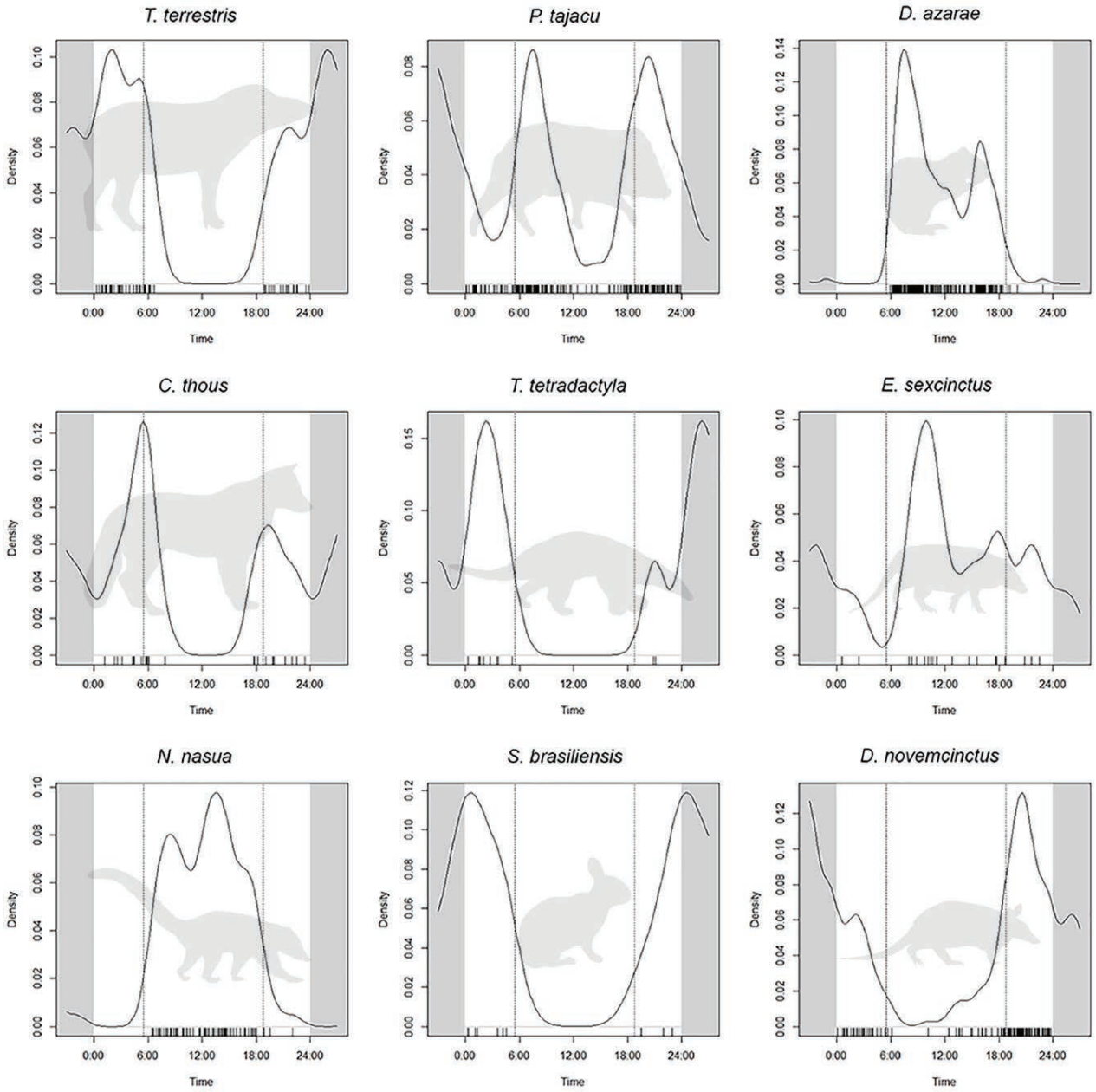

Figure 6. Activity patterns of mammal species registered by camera trapping in the Urucum Massif, Mato Grosso do Sul state, Brazil, from October 2014 up to December 2014; May 2015 to July 2015 and July 2016.

provides a general idea on the most detectable species considering the total sampling effort deployed. Neotropical mammals have different detection probabilities that vary depending on species behaviour, model of camera trap (with conventional or infrared flash), and trap location (Sollmann *et al*. 2013). In this study, such differences became clear through the finding that although the sampling design employed focused on terrestrial mammals, species with arboreal habits such as *C. prehensislis*, *H. spadiceus* and *Sapajus cay* were also recorded on ground level. The ability to detect them in this research was not constant (see also Harmsen *et al*. 2010, Sollmann *et al*. 2013); therefore, our data cannot be used as an inference on population size (Sollmann *et al*. 2013).

The highest species richness were found in Carnivora, Rodentia, and Artiodactyla, following a pattern also observed in similar studies carried out in the Pantanal and Cerrado (Trolle 2003, Porfirio *et al*. 2014, Estrela *et al*. 2015, Oliveira *et al*. 2019). In turn, the lowest species richness occurred in Lagomorpha and Perissodactyla, a pattern that is expected since only one species of these orders occur within the area (Bonvicino *et al*. 2015, Abreu

et al. 2021). Although only one species (*S. cay*) of primates was detected by camera trapping in this study, Hannibal *et al.* (2017) reported four other species (*Mico melanurus, Aotus azarae, Plecturocebus pallescens,* and *Alouatta caraya*) in the region. However, the other species detected in the previous study are essentially arboreal, which were not targeted by our terrestrial sample design.

On a broader scale, the activity patterns recorded in this research were similar to those reported in previous studies, with few exceptions. Some subtle differences were observed in relation to *D. tajacu* (crepuscular in this study), which was mostly diurnal in Bolivian Amazon (Gómez *et al.* 2005), and cathemeral in other areas of the Pantanal (Porfirio *et al.* 2017b). *Dasyprocta azarae* and *N. nasua* are diurnal, as observed in other areas of the Pantanal and Bolivian Amazon (Gómez *et al.* 2005, Porfirio *et al.* 2017b, Porfirio *et al.* 2018), while *T. tetradactyla* was nocturnal, as observed in the humid Chaco of Argentina (Huck *et al.* 2017). *Euphractus sexcinctus* and *D. novemcinctus* are diurnal and nocturnal, respectively, which confirmed activity patterns found in other sites of the Pantanal and Cerrado (Maccarini *et al.* 2015, Oliveira *et al.* 2019). Additionally, *S. paraguensis* and *T. terrestris* are nocturnal, as observed for other regions (Gómez *et al.* 2005, Maffei *et al.* 2002, Porfirio *et al.* 2016, 2017b), and *C. thous* followed the crepuscular pattern found in the Cerrado (Oliveira *et al.* 2019). Porfirio *et al.* (2017a) and Rucco *et al.* (2019) discuss the activity patterns of *Sapajus cay*, *Mazama americana* and *M. gouazoubira*. Considering that (i) the observed patterns were similar to those reported in the literature, and (ii) since the samplings were carried out in a mining, agricultural area, we suggest that neither of the activities seem to exert direct influence on the activity patterns of the most detected species; however, it is worth further exploring their impact on a spatial scale.

Three of the species currently classified as vulnerable by the IUCN (2020) – *T. pecari*, *T. terrestris* and *M. tridactyla* –were detected in this study. Furthermore, the herein recorded *L. wiedii* is classified as near threatened. The red list of Brazilian Environment Ministry (MMA 2018) considers the seven following threatened species, all vulnerable: *M. tridactyla*, *T. terrestris*, *T. pecari*, *S. cay*, *L. wiedii*, *P. concolor*, and *H. yagouaroundi*. Although *L. wiedii* and *H. yagoaroundi* naturally occur at low densities (Tortato *et al.* 2013, Giordano 2016), most of these species depend on well-conserved forested areas (Tortato *et al.* 2013, Keuroghlian & Eaton 2008, Hannibal *et al.* 2019) and/or needs large areas for their home range, such as *P. concolor* (Silveira 2004, de la Torre *et al.* 2017). Despite the Urucum Massif covers an area of 1,300 km^2 (Godoi *et al.* 2010), only 19.28 km^2 integrate a protected area (*Parque Natural Municipal de Piraputangas*; Municipal Decree of Corumbá nº 078; 22/05/2003). Although every conservation effort should be encouraged in the region, only a small area is currently protected, which does not fully represent the habitat diversity in the Urucum Massif (Tomas *et al.* 2010a) and possibly does not meet all ecological requirements of several large-sized species. Furthermore, the threats related to mining and expansion of agriculture, livestock, rural settlements, and urban centres are a matter of concern for regional mammalian conservation (Tomas *et al.* 2010a). In this context, further ecological studies in the region should aim to subsidize conservation actions for a long-term monitoring of mammals. Moreover, other protected areas should be established and efforts should be put into management and conservation investment in endangered species in the Urucum Massif.

In conclusion, we successfully estimated the diversity of terrestrial mammals in the Urucum Massif using camera traps. It is worth pointing that the activity patterns of most of the analyzed species did not differ from the literature reports. Among many other efforts, the data generated in this research can benefit further actions to verify the impact of mining and agriculture on the studied mammal species.

ACKNOWLEDGMENTS

Field procedures were conducted in accordance with a license granted by the Biodiversity Information and Authorization System of the Chico Mendes Institute for Biodiversity Conservation [license number 47821-3]. We thank the owners of Fazenda Bom Jesus, Nhuporã, Bandalta (Missão Salesiana de Mato Grosso), and Paraíso for granting permission to the authors to

work on their lands. Special thanks to Arackén Porfirio for logistical support. This study was supported by Universidade Federal de Mato Grosso do Sul - MEC, and financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brazil (CAPES) – [Finance Code 001]. Herrera, H. M. thanks Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) [Process number 308768/2017-5].

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Submitted: 8 June 2021
Accepted: 22 October 2021
Published on line: 05 November 2021
Associate Editor: Rosana Gentile