

# An overview of the ant fauna (Hymenoptera: Formicidae) of the state of Maranhão, Brazil

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**Abstract.** The state of Maranhão, located in northeastern Brazil, comprises three biomes: Amazonian, Caatinga, and the Cerrado. To date, 99 ant species have been recorded in the literature from the state. In the present work, we provide for the first time a profile of the ant fauna in the state based on data from the historical literature and Brazilian institutional collections. The updated records on ant diversity for the state of Maranhão revealed a total of 279 species, belonging to 71 genera and 10 subfamilies. In total, 180 species are recorded for the first time in the state, of which four species recorded for the first time in Brazil. In summary, apart from documenting the ant fauna of the region, these results provide a basis for further studies and may contribute to future conservation efforts for the biomes present in this complex landscape.

**Key-Words.** Distribution, Amazon, Caatinga, Cerrado, Checklist.

## INTRODUCTION

Understanding the distribution of species is essential to determine regional and global patterns of biodiversity (Dalzochio *et al.*, 2018). In this sense, taxonomic inventories contribute to characterize areas of endemism, reveal taxonomic novelties and improve scientific collections (Moura *et al.*, 2014; Freitas *et al.*, 2017). Further, the analysis of species distribution databases can

help to identify gaps in sampling and species records, and can also be used in macroecological studies, species distribution modeling and to promote conservation strategies (Gasper *et al.*, 2016).

Maranhão is a northeastern state in Brazil and comprises a total area of 329,642.170 km<sup>2</sup> (IBGE, 2018). Its political boundaries are the Atlantic Ocean to the north, the state of Tocantins to the south, the state of Piauí to the east, and the state of Pará to the west (Chaves *et al.*, 2016). The state

is located in a heterogeneous landscape area under the influence of three biomes: Amazon, Cerrado, and the Caatinga. The vegetation cover – encompassing 14 different vegetation types – reflects the transition between super-humid and semi-arid climates (Santos *et al.*, 2010; IBGE, 2018).

Similar to other states in Brazil, Maranhão has suffered with high human impact, mainly from the early 1960s, through the construction of highways, agricultural and mining projects (Celentano *et al.*, 2017). Impacts include large-scale forest conversion to pasture or by “babaçu” palm trees (*Orbignya phalerata* Mart.) (Santos *et al.*, 2010), and the expansion of agroindustry has converted large natural areas into grain crops (Brasil, 2009; Santos *et al.*, 2010). In addition, other human activities, such as occupation, recreation and tourism (Chaves *et al.*, 2016) have also a negative impact and have caused severe loss of biodiversity, resulting in drastic changes of the landscape.

The biodiversity of Maranhão is extremely diverse (Chaves *et al.*, 2016; Desidério *et al.*, 2017). Compared to other Brazilian states, however, the ant diversity is poorly known. The most recent information on ant species diversity in the state recorded 99 species, belonging to 37 genera and seven subfamilies (Janicki *et al.*, 2016). This represents about ¼ of ant diversity in the state of Goiás and 35% of the ant species richness described for the state of Mato Grosso do Sul (Janicki *et al.*, 2016), two other Brazilian states comparable in size to Maranhão.

Since the end of the 20<sup>th</sup> century, collective efforts of several research groups, carrying out inventories in different areas and employing complementary sampling methodologies, resulted in a significant increase in our

knowledge about ant diversity in this state. Thus, the aim of this study is to present an updated list of the ant species in the state of Maranhão, considering recent field expeditions as well as material deposited in the main Brazilian ant collections. We also discuss some relevant aspects about the profile of the ant fauna, recovering the history of ant studies historically carried out in the state. Overall, our findings should be of great help in creating measures for species preservation and species recovery plans and represent the basis for future research.

## MATERIAL AND METHODS

### Data from collections and literature

We listed material obtained from six Brazilian ant collections (Table 1), which have historically acted as main depositary institutions for samples collected in the state of Maranhão. We also compiled data from literature, including collection events focused on partial surveys of Maranhão ant fauna (Table 2).

### Identifications and taxonomic validation

Ants were identified by the authors of the present study using taxonomic keys, comparing specimens with myrmecological collections, or by sending them to specialists (see “Acknowledgements”). The final list containing all specimens was verified by authors of this study (JAS, LPP and RMF). Species with dubious identification were carefully examined and, when necessary, have been removed from final data set.

### Distribution and maps

The biomes present in Maranhão are the Amazon Forest, characterized by tall trees and periodic to permanently flooded plains; this biome is present in the north and, essentially, in the west portion of the state. The Cerrado covers the south, central and northeast areas of the state, formed by open grasslands (*Cerrado aberto*) to patches of dense vegetation (*Cerradão*). Finally, Maranhão presents a small and fragmented portion of

**Table 1.** List of ant collections consulted in this study.

Repositories
Coleção Entomológica, Museu Paraense Emílio Goeldi, Pará, Brazil
Laboratório de Biologia, Universidade Federal do Maranhão, Campus Imperatriz, Maranhão, Brazil
Laboratório de Entomologia e Vetores, Universidade Federal do Maranhão, Campus São Luís, Maranhão, Brazil
Laboratório de Hymenoptera, Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
Laboratório de Artrópodes e Microbiologia do Solo, Universidade Estadual do Maranhão, Campus São Luís, Maranhão, Brazil
Laboratório de Solos e Meio Ambiente, Universidade Federal do Maranhão, Campus São Luís, Maranhão, Brazil

**Table 2.** References and their respective areas that have records of ants collected in the state of Maranhão.

Context	Source
Behavioral	Wheeler, 1922; Monnin <i>et al.</i> , 2003; Silva, 2007; Pereira <i>et al.</i> , 2014
Ecological	Brandão <i>et al.</i> , 2011; Ramos <i>et al.</i> , 2015; Silva <i>et al.</i> , 2017; Gutiérrez <i>et al.</i> , 2017
Forensic	Andrade-Silva <i>et al.</i> , 2015; Pereira <i>et al.</i> , 2017
Genetics	Wauters <i>et al.</i> , 2018
Inventory	Dáttilo <i>et al.</i> , 2012
Occurrence	Dáttilo <i>et al.</i> , 2010
Sanitary	Carvalho <i>et al.</i> , 2011; Silva <i>et al.</i> , 2012; Lima <i>et al.</i> , 2013
Taxonomic	Forel, 1904; Mann, 1916; Gonçalves, 1942, 1947; Borgmeier, 1955; Kempf, 1959, 1960a, 1960b; Gonçalves, 1961; Kempf, 1964, 1968, 1971, 1972a, 1972b, 1975; Watkins, 1976; Ward, 1989; Brandão, 1991; De Andrade & Baroni Urbani, 1999; Ward, 1999; Cuzzo, 2000; Longino & Snelling, 2002; Ward & Downie, 2005; Shoemaker <i>et al.</i> , 2006; Wild & Cuzzo, 2006; Feitosa <i>et al.</i> , 2007; Ward, 2007; Wild, 2007; Feitosa <i>et al.</i> , 2008; Lattke, 2011; Fernandes <i>et al.</i> , 2014; Brandão <i>et al.</i> , 2015; Johnson, 2015; Ulysséa <i>et al.</i> , 2015, 2017; Jesovnik & Schultz, 2017; Dias & Lattke, 2019

the Caatinga biome, in the extreme east of the state, characterized by the presence of bushy vegetation with deep roots, cacti and bromeliads (Spinelli-Araujo *et al.*, 2016).

We used shapefiles from the state of Maranhão made available by the *Ministério do Meio Ambiente* (MMA) (<http://mapas.mma.gov.br/i3geo/datadownload.htm#>). We used a classification in “meso-regions” pre-established by the government agency, in order to describe and discuss our results. We also used shapefiles provided by MMA for the three main biomes present in the state, to overlap sampling points and the main ecosystems in Maranhão.

For the confirmation of sampled sites (Table 3) and maps preparation, the geographical coordinates, when not available on the specimens’ label, were obtained from the IBGE (2011) or georeferenced using Google Earth Pro. In those cases, because we did not have access to the exact point of the sample site, we adapted a classification by the IBGE. Whenever the IBGE classified a municipality covering two biomes, we used the “transition” term after the government classification. For instance, the municipality of Imperatriz, which is classified by IBGE as “Amazon/Cerrado” biomes, becomes for the purpose of this study, “Amazon-Cerrado transition”. For specific sites and localities for which names have been historically altered, we consulted Vanzolini & Papavero (1968) and Vanzolini (1992). The geographical records were mapped using QGIS v2.18.2 (QGIS Development Team, 2019).

## RESULTS

Based on data from Brazilian collections (Table 1) and published literature (Table 2), we recorded a total of 279 ant species for the state of Maranhão, belonging to 71 genera and 10 subfamilies (Table 4), and sampled across 65 localities (Table 3). The subfamily Myrmicinae was the most diverse, with 126 species, followed by Ponerinae (36 species), Formicinae (35 species), Dolichoderinae (27 species), Ectatomminae (25 species), Pseudomyrmecinae (16 species), Dorylinae (10 species), Amblyoponinae (2 species), and Paraponerinae and Proceratiinae (1 species each).

The majority of records (214 species) was concentrated along the Amazon region, followed by the Cerrado (129 species), the Amazon-Cerrado transition regions (80 species) and finally the Cerrado-Caatinga transition region where only one species was recorded (Fig. 1). A total of 180 ant species were recorded for the first time in the state, and four species were recorded for the first time in Brazil (Table 4).

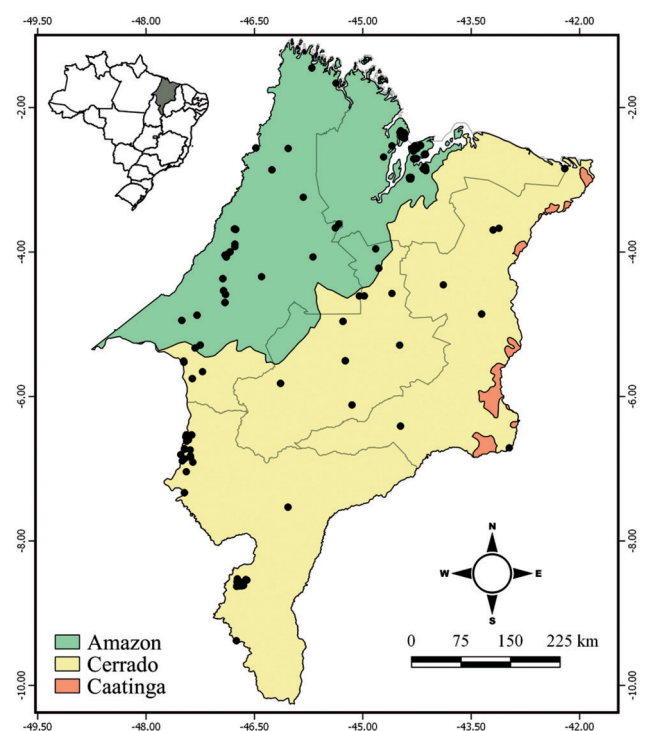
## DISCUSSION

The first expeditions focused on studying the ant fauna of the state of Maranhão were performed in the late 1940s, with collections in the Cerrado areas undertaken by the myrmecologists Cincinnato Gonçalves and Walter

W. Kempf. During the next three decades, collections by researchers, enthusiasts, and professional collectors had pursued the same goal – discovering new taxa and increasing the coverage of ants in scientific collections (Kempf, 1972a). Differently, from the 1980s until the beginning of the 21<sup>st</sup> century, the main purpose of the expeditions was to carry out environmental impact assessment programs (Brandão *et al.*, 2011). On the other hand, from the late 20<sup>th</sup> century, with the hiring of researchers at universities in the state of Maranhão, several expeditions have been conducted focusing on ecological studies and reporting faunal inventories (Ramos *et al.*, 2015; Gutiérrez *et al.*, 2017; Silva *et al.*, 2017).

Museums, scientific collections, and historical published literature all contain important information on species distributions recorded as presence data (Newbold, 2010). The accuracy of the distribution data is important for several applications in biology and for species conservation planning (Graham *et al.*, 2008). Despite the concern to accurately document of species distribution that began in the first half of the 19<sup>th</sup> century (Vanzolini, 2004), for the ants this occurred in the second half of the 20<sup>th</sup> century. In the case of the records analysed in this work, the specific localities and geographic coordinates became available in the late 20<sup>th</sup> century.

Most of the ant records for the state of Maranhão remained unavailable to the specialized public for a long time, while many other records remained unidentified at a specific level. In this sense, our study has analyzed both the material deposited in Brazilian collections (Table 1) and the records in the published literature (Table 2), revealing that 64% of species were recorded in the state for the first time. Further, we made an additional effort



**Figure 1.** Map of the state of Maranhão showing its location in Brazil. Black points indicate the sampling sites within the state that were georeferenced and recorded in the literature and collections according to biomes.

**Table 3.** Information from the sampled sites for the state of Maranhão. The abbreviations are as follows: (Am) Amazon, (Ce) Cerrado, (ACT) Amazon-Cerrado transition, (CCT) Cerrado-Caatinga transition. (\*) For the geographic coordinates attributed in this work.

Locality	Coordinate	Physiognomy	Code
15 km E of Canindé, Aldeia Araçu, Igarapé Gurupi-Uma	02°34'S, 46°02'W*	Am	1
Açailândia	04°52'30"S, 47°17'40"W	Am	2
Açailândia, Fazenda Pedro Maranhão	04°56'48"S, 47°30'17"W	Am	3
Açailândia, Horto Fazenda Pompéia	04°52'30"S, 47°17'40"W	Am	4
Alcântara	02°20'56"S, 44°29'01"W	Am	5
Alcântara, Só Assim	02°20'53.48"S, 44°28'50.71"W	Am	6
Aldeia do Ponto	06°07'01.21"S, 45°08'59.99"W*	Ce	7
Alto Turiaçu	01°39'46"S, 45°22'19"W*	Am	8
Alto Turiaçu, Aldeia Gurupiuna	02°51'44.66"S, 46°15'29.79"W*	Am	9
Bacabal	04°13'30"S, 44°46'48"W*	ACT	10
Balsas	08°34'19.6"S, 46°42'28.2"W	Ce	11
Balsas, Córrego Xupé	07°31'58"S, 46°02'09"W	Ce	12
Balsas, Gerais de Balsas	08°34'06"S, 46°42'38"W	Ce	13
Balsas, Gerais de Balsas, Rio Mandacaru	08°32'32"S, 46°36'18"W	Ce	14
Balsas, Mata do Capão do Catulé	09°22'53.8"S, 46°44'59.3"W	Ce	15
Barão de Grajaú, Bem Quer	06°09'24.5"S, 42°58'02.0"W	CCT	16
Barra do Corda	05°30'21"S, 45°14'34"W*	Ce	17
Bom Jardim	03°55'32.90"S, 46°46'16.33"W	Am	18
Buriticupu	04°20'45"S, 46°24'03"W*	Am	19
Buriticupu, Fazenda Cacique	04°20'34"S, 46°24'06"W*	Am	20
Cajazeiras	02°50'43"S, 42°12'20"W*	Ce	21
Carolina	07°19'58"S, 47°28'08"W*	Ce	22
Carolina, Pedra Caída	07°02'30.39"S, 47°26'35.95"W*	Ce	23
Caxias	04°51'32"S, 43°21'21"W	Ce	24
Centro Novo do Maranhão	03°40'55.70"S, 46°46'40.73"W	Am	25
Chapadinha, Anapurus	03°40'19"S, 43°06'57"W	Ce	26
Chapadinha, Fazenda Unha de Gato	03°41'42.3"S, 43°11'48.1"W	Ce	27
Codó	04°27'18"S, 43°53'09"W*	Ce	28
Estreito	06°50'45"S, 47°23'00"W	Ce	29
Estreito, Fazenda Itaueiras	06°31'54.4"S, 47°22'16.0"W	Ce	30
Estreito, Fazenda Planalto	06°35'59.3"S, 47°24'50.4"W	Ce	31
Estreito, Ilha do Cabral, Rio Tocantins	06°31'54.1"S, 47°26'32.6"W	Ce	32
Grajaú, Rio Santana	05°49'08"S, 46°08'20"W*	ACT	33
Gurupi	04°22'09.04"S, 46°56'16.05"W	Am	34
Imperatriz	05°30'38"S, 47°28'46"W*	ACT	35
Imperatriz, Bananal	05°39'26"S, 47°13'07"W*	Ce	36
Imperatriz, Reserva do 50º Batalhão de Infantaria e Selva	05°30'37.60"S, 47°28'46.11"W	ACT	37
Imperatriz, Ribeirãozinho	05°45'11.15"S, 47°21'36.36"W*	Ce	38
Imperatriz, Tocantinópolis	05°31'33"S, 47°28'33"W*	ACT	39
Itinga do Maranhão	04°02'05.50"S, 46°52'51.00"W*	Am	40
João Lisboa	05°19'46.30"S, 47°19'13.00"W	Am	41
Lago do Junco	04°36'32"S, 45°02'56"W*	ACT	42
Lago dos Rodrigues	04°36'32"S, 44°58'48"W*	Ce	43
Lago Verde	03°57'25"S, 44°49'19"W*	Am	44
Lagoa Grande do Maranhão	04°57'38.77"S, 45°16'27.88"W*	Ce	45
Livramento	02°25'33.19"S, 44°25'26.59"W	Am	46
Mirador, Parque Estadual do Mirador	06°24'38.62"S, 44°28'42.24"W	Ce	47
Pedreiras	04°34'26"S, 44°35'49"W*	Ce	48
Pindaré-Mirim, Sítio Moisés	03°36'44.00"S, 45°19'59.90"W	Am	49
Presidente Dutra	05°17'24"S, 44°29'24"W	Ce	50
Rio Maracatumé	01°27'09"S, 45°42'19"W	Am	51
Rosário	02°51'11.8"S, 44°09'02.6"W	Am	52
Santa Inês	03°40'01"S, 45°22'48"W	Am	53
Santa Luzia	04°04'08"S, 45°41'24"W	ACT	54
São Francisco do Brejão	05°17'19.0"S, 47°15'01.7"W	Am	55
São José de Ribamar, Sítio Aguahy	02°38'59.30"S, 44°08'49.63"W	Am	56
São Luís	02°31'48"S, 44°18'10"W*	Am	57
São Luís, Área de Preservação Ambiental do Itapiracó	02°31'28.81"S, 44°12'00.33"W	Am	58
São Luís, <i>Campus</i> da Universidade Federal do Maranhão	02°33'36"S, 44°18'33"W	Am	59
São Luís, Maracana, Sítio Mangalho	02°36'13.39"S, 44°17'56.78"W	Am	60
São Luís, Mata do Quebra Pote	02°42'26.75"S, 44°15'23.87"W	Am	61
São Luís, Reserva Alumar	02°42'39.31"S, 44°17'47.40"W	Am	62
São Luís, Reserva da CAEMA	02°34'01.01"S, 44°15'04.03"W	Am	63
São Mateus	04°02'24"S, 44°28'12"W	ACT	64
Zé Doca	03°14'34"S, 45°49'26"W*	Am	65

**Table 4.** List of taxa recorded in the state of Maranhão and the occurrence data of the species in the literature and localities and biome present in the state. The codes of localities follow Table 3. (\*) new record for Maranhão, (\*\*) new record for Brazil, (Am) Amazon, (Ce) Cerrado, (ACT) Amazon-Cerrado transition, (CCT) Cerrado-Caatinga transition.

Taxon name	Locality	Biome	Source
<b>Amblyoponinae Forel, 1893*</b>	—	—	—
<b>Fulakora Mann, 1919*</b>	—	—	—
<i>Fulakora degenerata</i> (Borgmeier, 1957)*	4, 41	Am	Collection
<b>Prionopelta Mayr, 1866*</b>	—	—	—
<i>Prionopelta antillana</i> Forel, 1909*	46	Am	Collection
<b>Dolichoderinae Forel, 1878</b>	—	—	—
<b>Azteca Forel, 1878*</b>	—	—	—
<i>Azteca alfari</i> Emery, 1893*	13, 37	Ce, ACT	Collection
<i>Azteca chartifex</i> Emery, 1896*	57	Am	Collection
<i>Azteca schimperi</i> Emery, 1893*	57	Am	Collection
<b>Dolichoderus Lund, 1831</b>	—	—	—
<i>Dolichoderus abruptus</i> (Smith, 1858)*	8	Am	Collection
<i>Dolichoderus attelaboides</i> (Fabricius, 1775)*	1, 2, 56	Am	Collection
<i>Dolichoderus bidens</i> (Linnaeus, 1758)*	19	Am	Collection
<i>Dolichoderus bispinosus</i> (Olivier, 1792)*	5, 24, 35, 37, 39	Am, Ce, ACT	Collection
<i>Dolichoderus debilis</i> Emery, 1890*	19	Am	Collection
<i>Dolichoderus diversus</i> Emery, 1894*	5, 43	Am, Ce	Collection
<i>Dolichoderus imitator</i> Emery, 1894*	5, 13, 31, 40, 52, 57, 50	Am, Ce	Collection
<i>Dolichoderus lamellosus</i> (Mayr, 1870)	3, 10, 31, 45	Am, Ce, ACT	Kempf, 1972a, 1972b; Collection
<i>Dolichoderus lutosus</i> (Smith, 1858)	14, 57, 59	Am, Ce	Andrade-Silva et al., 2015; Collection
<i>Dolichoderus quadridenticulatus</i> (Roger, 1862)	5, 24, 45, 57, 64	Am, Ce, ACT	Kempf, 1972a; Collection
<b>Dorymyrmex Mayr, 1866</b>	—	—	—
<i>Dorymyrmex biconis</i> Forel, 1912*	52	Am	Collection
<i>Dorymyrmex brunneus</i> Forel, 1908	5, 13, 34, 40, 52, 57, 59, 61	Am, Ce	Andrade-Silva et al., 2015; Pereira et al., 2017; Collection
<i>Dorymyrmex goeldii</i> Forel, 1904*	61	Am	Collection
<i>Dorymyrmex jheringi</i> Forel, 1912	11, 13	Ce	Brandão et al., 2011; Collection
<i>Dorymyrmex pyramicus</i> (Roger, 1863)	11	Ce	Brandão et al., 2011; Collection
<i>Dorymyrmex spurius</i> Santschi, 1929	11, 13	Ce	Brandão et al., 2011; Collection
<i>Dorymyrmex thoracicus</i> Gallardo, 1916	4, 10, 11, 13, 45, 57	Am, Ce, ACT	Brandão et al., 2011; Collection
<b>Forelius Emery, 1888</b>	—	—	—
<i>Forelius brasiliensis</i> (Forel, 1908)	11, 13	Ce	Brandão et al., 2011; Collection
<i>Forelius maranhaoensis</i> Cuzzo, 2000	11, 13, 35, 37, 57, 62	Am, Ce, ACT	Cuzzo, 2000; Brandão et al., 2011; Ulysséa et al., 2017; Collection
<i>Forelius pusillus</i> Santschi, 1922*	13	Ce	Collection
<b>Gracilidris Wild &amp; Cuzzo, 2006</b>	—	—	—
<i>Gracilidris pombero</i> Wild & Cuzzo, 2006	11, 13	Ce	Wild & Cuzzo, 2006; Brandão et al., 2011; Collection
<b>Linepithema Mayr, 1866</b>	—	—	—
<i>Linepithema cerradense</i> Wild, 2007	11	Ce	Brandão et al., 2011; Collection
<i>Linepithema neotropicum</i> Wild, 2007	11, 13, 45	Ce	Wild, 2007; Brandão et al., 2011; Collection
<b>Tapinoma Foerster, 1850*</b>	—	—	—
<i>Tapinoma melanocephalum</i> (Fabricius, 1793)*	5, 34, 40, 52, 57, 60	Am	Collection
<b>Dorylinae Leach, 1815</b>	—	—	—
<b>Acanthostichus Mayr, 1887*</b>	—	—	—
<i>Acanthostichus brevicornis</i> Emery, 1894*	34, 52	Am	Collection
<b>Eciton Latreille, 1804</b>	—	—	—
<i>Eciton burchellii</i> (Westwood, 1842)*	1, 21, 31, 33	Am, Ce, ACT	Collection
<i>Eciton mexicanum</i> Roger, 1863*	60	Am	Collection
<i>Eciton quadriglume</i> (Haliday, 1836)	1, 35, 45	Am, Ce, ACT	Kempf, 1972a; Watkins, 1976; Collection
<i>Eciton rapax</i> Smith, 1855*	3, 31	Am, Ce	Collection
<b>Labidus Jurine, 1807</b>	—	—	—
<i>Labidus coecus</i> (Latreille, 1802)*	5, 11, 13, 14, 37, 41, 52, 56, 57	Am, Ce, ACT	Brandão et al., 2011; Collection
<i>Labidus mars</i> (Forel, 1912)*	34	Am	Collection
<i>Labidus praedator</i> (Smith, 1858)	45	Ce	Borgmeier, 1955; Watkins, 1976; Kempf, 1972a; Collection
<b>Neocerapachys Borowiec, 2016*</b>	—	—	—
<i>Neocerapachys splendens</i> (Borgmeier, 1957)*	5, 31, 40	Am, Ce	Collection
<b>Nomamyrmex Borgmeier, 1936*</b>	—	—	—
<i>Nomamyrmex esenbeckii</i> (Westwood, 1842)*	23	Ce	Collection
<b>Ectatomminae Emery, 1895</b>	—	—	—
<b>Ectatomma Smith, 1858</b>	—	—	—



Taxon name	Locality	Biome	Source
<i>Ectatomma brunneum</i> Smith, 1858	2, 4, 5, 10, 11, 12, 13, 17, 19, 21, 34, 35, 37, 43, 48, 49, 54, 56, 57, 59	Am, Ce, ACT	Kempf, 1972a; Brandão et al., 2011; Dáttilo et al., 2012; Andrade-Silva et al., 2015; Pereira et al., 2017; Collection
<i>Ectatomma edentatum</i> Roger, 1863	11, 13, 44	Am, Ce	Brandão et al., 2011; Collection
<i>Ectatomma lugens</i> Emery, 1894*	3, 19, 34, 40	Am	Collection
<i>Ectatomma muticum</i> Mayr, 1870	11, 13, 22, 24, 35, 45	Ce, C	Kempf, 1972a; Brandão et al., 2011; Collection
<i>Ectatomma opaciventre</i> (Roger, 1861)	11, 13	Ce	Brandão et al., 2011; Collection
<i>Ectatomma permagnum</i> Forel, 1908*	35, 37	ACT	Collection
<i>Ectatomma planidens</i> Borgmeier, 1939	11, 13	Ce	Brandão et al., 2011; Collection
<i>Ectatomma ruidum</i> (Roger, 1860)*	5	Am	Collection
<i>Ectatomma suzanae</i> Almeida Filho, 1986*	37, 56	Am, ACT	Collection
<i>Ectatomma tuberculatum</i> (Olivier, 1792)	2, 3, 5, 21, 37, 40, 41, 56, 57, 59	Am, Ce, ACT	Andrade-Silva et al., 2015; Collection
<b>Gnamptogenys Roger, 1863</b>	—	—	—
<i>Gnamptogenys acuminata</i> (Emery, 1896)*	31, 40, 57, 58	Am, Ce	Collection
<i>Gnamptogenys ammophila</i> Lattke, 1990	11, 13	Ce	Brandão et al., 2011; Collection
<i>Gnamptogenys annulata</i> (Mayr, 1887)*	60	Am	Collection
<i>Gnamptogenys caelata</i> Kempf, 1967	34	Am	Dias & Lattke, 2019 Collection
<i>Gnamptogenys haenschi</i> (Emery, 1902)*	5, 6, 34, 40	Am	Collection
<i>Gnamptogenys horni</i> (Santschi, 1929)*	5, 37, 40, 52	Am, ACT	Collection
<i>Gnamptogenys lanei</i> Kempf, 1960*	40	Am	Collection
<i>Gnamptogenys mina</i> (Brown, 1956)*	34, 57	Am	Collection
<i>Gnamptogenys minuta</i> (Emery, 1896)	30, 41, 52	Am, Ce	Dias & Lattke, 2019 Collection
<i>Gnamptogenys moelleri</i> (Forel, 1912)*	30, 41, 52, 57, 63	Am, Ce, ACT	Collection
<i>Gnamptogenys rastrata</i> (Mayr, 1866)*	30	Ce	Collection
<i>Gnamptogenys striatula</i> Mayr, 1884*	30, 32, 34, 41	Ce, ACT	Collection
<i>Gnamptogenys sulcata</i> (Smith, 1858)*	34, 37	Am, ACT	Collection
<i>Gnamptogenys triangularis</i> (Mayr, 1887)*	40	Am	Collection
<b>Typhlomyrmex Mayr, 1862*</b>	—	—	—
<i>Typhlomyrmex rogenhoferi</i> Mayr, 1862*	1	Am	Collection
<b>Formicinae Latreille, 1809</b>	—	—	—
<b>Acropyga Roger, 1862*</b>	—	—	—
<i>Acropyga goeldii</i> Forel, 1893*	57	Am	Collection
<i>Acropyga smithii</i> Forel, 1893*	4	Am	Collection
<b>Brachymyrmex Mayr, 1868</b>	—	—	—
<i>Brachymyrmex australis</i> Forel, 1901	11, 13	Ce	Brandão et al., 2011; Collection
<i>Brachymyrmex heeri</i> Forel, 1874*	5, 34, 37, 40, 46, 52, 56, 57	Am, ACT	Collection
<i>Brachymyrmex patagonicus</i> Mayr, 1868	11, 13	Ce	Brandão et al., 2011; Collection
<b>Camponotus Mayr, 1861</b>	—	—	—
<i>Camponotus arboreus</i> (Smith, 1858)	10, 45	Ce, ACT	Mann, 1916; Kempf, 1972a; Collection
<i>Camponotus atriceps</i> (Smith, 1858)	9, 29, 37, 38, 53, 57	Am, Ce, ACT	Dáttilo et al., 2012; Collection
<i>Camponotus balzani</i> Emery, 1894*	37	AST	Collection
<i>Camponotus bidens</i> Mayr, 1870*	5, 31, 34	Am, Ce	Collection
<i>Camponotus blandus</i> (Smith, 1858)	5, 11, 17, 24, 28, 31, 34, 35, 40, 43, 56, 57, 59, 65	Am, Ce, ACT	Brandão et al., 2011; Andrade-Silva et al., 2015; Collection
<i>Camponotus cameranoi</i> Emery, 1894*	34	Am	Collection
<i>Camponotus chartifex</i> (Smith, 1860)*	5	Am	—
<i>Camponotus crassus</i> Mayr, 1862	5, 10, 11, 30, 31, 35, 37, 40, 45, 52, 56, 57	Am, Ce, ACT	Kempf, 1972a; Brandão et al., 2011; Collection
<i>Camponotus fastigatus</i> Roger, 1863*	37, 56	Am	Collection
<i>Camponotus femoratus</i> Fabricius, 1804)*	4	Am	Collection
<i>Camponotus godmani</i> Forel, 1899*	5, 34, 60	Am	Collection
<i>Camponotus latangulus</i> Roger, 1863*	5, 34, 40, 52, 58	Am	Collection
<i>Camponotus leydigii</i> Forel, 1886	5, 10, 17, 40, 43, 44, 45, 47, 53, 56	Am, Ce, ACT	Kempf, 1972a; Collection
<i>Camponotus melanoticus</i> Emery, 1894	37, 56, 57, 59	Am, ACT	Andrade-Silva et al., 2015; Collection
<i>Camponotus novogradensis</i> Mayr, 1870*	5, 35, 37, 57	Am, ACT	Collection
<i>Camponotus personatus</i> Emery, 1894	11	Ce	Brandão et al., 2011; Collection
<i>Camponotus rectangularis</i> Emery, 1890*	62	Am	Collection
<i>Camponotus renggeri</i> Emery, 1894	11, 19, 27, 37, 42, 43, 45, 53, 56, 64	Am, Ce, ACT	Kempf, 1972a; Brandão et al., 2011; Collection
<i>Camponotus rufipes</i> (Fabricius, 1775)	57, 59,	Am	Andrade-Silva et al., 2015; Pereira et al., 2017
<i>Camponotus senex</i> (Smith, 1858)	57, 59	Am	Andrade-Silva et al., 2015
<i>Camponotus sexguttatus</i> (Fabricius, 1793)*	58	Am	Collection
<i>Camponotus silvestrii</i> Emery, 1906	35	ACT	Janicki et al., 2016
<i>Camponotus substitutus</i> Emery, 1894*	4, 10, 30, 41, 57	Am, Ce, ACT	Collection

Taxon name	Locality	Biome	Source
<i>Camponotus tenuiscapus</i> Roger, 1863*	34	Am	Collection
<i>Camponotus trapeziceps</i> Forel, 1908*	5, 34, 46	Am	Collection
<i>Camponotus trapezoides</i> Mayr, 1870*	5, 34, 40	Am	Collection
<b>Gigantiops Roger, 1863</b>	—	—	—
<i>Gigantiops destructor</i> (Fabricius, 1804)	12, 13, 14, 45, 57	Am, Ce	Forel, 1904; Wheeler, 1922; Kempf, 1972a; Collection
<b>Nylanderia Emery, 1906*</b>	—	—	—
<i>Nylanderia fulva</i> (Mayr, 1862)*	5, 10, 13, 52, 57	Am, Ce, ACT	Collection
<i>Nylanderia guatemalensis</i> (Forel, 1885)*	34, 40	Am	Collection
<b>Paratrechina Motschoulsky, 1863*</b>	—	—	—
<i>Paratrechina longicornis</i> (Latreille, 1802)*	10, 13, 37, 57, 58	Am, Ce, ACT	Collection
<b>Myrmicinae Lepeletier de Saint-Fargeau, 1835</b>	—	—	—
<b>Acromyrmex Mayr, 1865</b>	—	—	—
<i>Acromyrmex hystrix</i> (Latreille, 1802)	29	Ce	Dáttilo et al., 2010
<i>Acromyrmex landolti</i> (Forel, 1885)	11, 45, 57	Am, Ce	Gonçalves, 1961; Kempf, 1972a; Brandão et al., 2011; Collection
<i>Acromyrmex laticeps</i> (Emery, 1905)*	22	Ce	Collection
<i>Acromyrmex nigrosetosus</i> (Forel, 1908)	22, 45	Ce	Gonçalves, 1961; Kempf, 1972a; Collection
<i>Acromyrmex rugosus</i> (Smith, 1858)	4, 11, 22, 45, 57, 59	Am, Ce	Gonçalves, 1961; Brandão et al., 2011; Andrade-Silva et al., 2015; Collection
<i>Acromyrmex subterraneus</i> (Forel, 1893)*	40	Am	Collection
<b>Aptostigma Mayr, 1865*</b>	—	—	—
<i>Aptostigma robustum</i> Emery, 1896*	34, 40, 52	Am	Collection
<b>Atta Fabricius, 1804</b>	—	—	—
<i>Atta cephalotes</i> (Linnaeus, 1758)	45	Ce	Kempf, 1972a; Collection
<i>Atta laevigata</i> (Smith, 1858)	45	Ce	Kempf, 1972a; Collection
<i>Atta opaciceps</i> Borgmeier, 1939*	35, 37, 63	Am, ACT	Collection
<i>Atta sexdens</i> (Linnaeus, 1758)	11, 31, 45, 57	Am, Ce	Gonçalves, 1942, 1947; Kempf, 1972a; Brandão et al., 2011; Collection
<b>Basiceros Schulz, 1906</b>	—	—	—
<i>Basiceros militaris</i> (Weber, 1950)	4, 34, 55	Am	Janicki et al., 2016; Collection
<i>Basiceros scabognathus</i> (Brown, 1949)	30	Ce	Feitosa et al., 2007; Collection
<b>Blepharidatta Wheeler, 1915</b>	—	—	—
<i>Blepharidatta conops</i> Kempf, 1967	11, 13, 30, 32	Ce	Silva, 2007; Brandão et al., 2011; Pereira et al., 2014; Brandão et al., 2015; Collection
<b>Cardiocondyla Emery, 1869*</b>	—	—	—
<i>Cardiocondyla emeryi</i> Forel, 1881*	10, 13	Ce, ACT	Collection
<i>Cardiocondyla obscurior</i> Wheeler, 1929*	52	Am	Collection
<b>Carebara Westwood, 1840*</b>	—	—	—
<i>Carebara arabara</i> Fernández, 2010*	4	Am	Collection
<i>Carebara brevipilosa</i> Fernández, 2004*	4	Am	Collection
<i>Carebara urichi</i> (Wheeler, 1922)*	34, 40	Am	Collection
<b>Cephalotes Latreille, 1802</b>	—	—	—
<i>Cephalotes atratus</i> (Linnaeus, 1758)	3, 5, 9, 13, 17, 21, 27, 33, 51, 52, 57, 60	Am, Ce, ACT	De Andrade & Baroni Urbani, 1999; Brandão et al., 2011; Collection
<i>Cephalotes clypeatus</i> (Fabricius, 1804)	5, 3, 30	Am, Ce	De Andrade & Baroni Urbani, 1999; Collection
<i>Cephalotes cordatus</i> (Smith, 1853)	45, 57	Am, Ce	Kempf, 1972a; Kempf, 1960a; Brandão, 1991; Collection
<i>Cephalotes eduarduli</i> (Forel, 1921)*	10	ACT	Collection
<i>Cephalotes grandinosus</i> (Smith, 1860)*	63	Am	Collection
<i>Cephalotes maculatus</i> (Smith, 1876)*	5, 57	Am	Collection
<i>Cephalotes marginatus</i> (Fabricius, 1804)	38	Ce	De Andrade & Baroni Urbani, 1999; Collection
<i>Cephalotes minutus</i> (Fabricius, 1804)	5, 38, 40, 41, 52, 61	Am, Ce, ACT	De Andrade & Baroni Urbani, 1999; Collection
<i>Cephalotes pavonii</i> (Latreille, 1809)	11, 13, 45, 52	Am, Ce	Kempf, 1972a; Kempf, 1960a; Brandão, 1991; Collection
<i>Cephalotes pilosus</i> (Emery, 1896)*	35, 43, 64	Ce, ACT	Collection
<i>Cephalotes pusillus</i> (Klug, 1824)	1, 10, 11, 13, 17, 29, 31, 34, 35, 37, 43, 45, 57, 61, 64	Am, Ce, ACT	Kempf, 1972a; Kempf, 1960a; Brandão, 1991; De Andrade & Baroni Urbani, 1999; Collection
<i>Cephalotes serraticeps</i> (Smith, 1858)	9	Am	De Andrade & Baroni Urbani, 1999; Collection
<i>Cephalotes umbraculatus</i> (Fabricius, 1804)*	57	Am	Collection
<b>Crematogaster Lund, 1831</b>	—	—	—
<i>Crematogaster abstinens</i> Forel, 1899*	13, 56	Am, Ce	Collection
<i>Crematogaster acuta</i> (Fabricius, 1804)*	13	Ce	Collection
<i>Crematogaster brasiliensis</i> Mayr, 1878*	63	Am	Collection
<i>Crematogaster curvispinosa</i> Mayr, 1862*	10	ACT	Collection
<i>Crematogaster erecta</i> Mayr, 1866	5, 13, 34, 40, 45, 52, 57	Am, Ce	Kempf, 1968; Kempf, 1972a; Collection
<i>Crematogaster evallans</i> Forel, 1907*	13, 57	Am, Ce	Collection
<i>Crematogaster limata</i> Smith, 1858*	34, 35, 37, 40, 52, 57, 63	Am, ACT	Collection
<i>Crematogaster tenuicula</i> Forel, 1904*	5, 34, 35, 37, 52, 57, 60	Am, ACT	Collection
<i>Crematogaster victima</i> Smith, 1858	57, 59	Am	Andrade-Silva et al. 2015; Collection

Taxon name	Locality	Biome	Source
<b>Cyphomyrmex Mayr, 1862*</b>	—	—	—
<i>Cyphomyrmex laevigatus</i> Weber, 1938*	4, 40	Am	Collection
<i>Cyphomyrmex major</i> Forel, 1901*	5, 40	Am	Collection
<i>Cyphomyrmex minutus</i> Mayr, 1862*	30, 31	Ce	Collection
<i>Cyphomyrmex peltatus</i> Kempf, 1966*	4, 5, 30, 34, 37, 40, 57, 60	Am, Ce, ACT	Collection
<i>Cyphomyrmex transversus</i> Emery, 1894*	5, 37, 40, 62	Am, ACT	Collection
<b>Daceton Perty, 1833*</b>	—	—	—
<i>Daceton armigerum</i> (Latreille, 1802)*	4, 19	Am	Collection
<b>Hylomyrma Forel, 1912*</b>	—	—	—
<i>Hylomyrma balzani</i> (Emery, 1894)*	34, 37, 40, 57	Am, ACT	Collection
<i>Hylomyrma immanis</i> Kempf, 1973*	4	Am	Collection
<i>Hylomyrma longiscapa</i> Kempf, 1961*	4	Am	Collection
<i>Hylomyrma praepotens</i> Kempf, 1973*	55	Am	Collection
<i>Hylomyrma reginae</i> Kutter, 1977*	55	Am	Collection
<b>Megalomyrmex Forel, 1885*</b>	—	—	—
<i>Megalomyrmex drifti</i> Kempf, 1961*	60	Am	Collection
<b>Monomorium Mayr, 1855*</b>	—	—	—
<i>Monomorium floricola</i> (Jerdon, 1851)*	5, 40, 43, 52	Am, Ce	Collection
<i>Monomorium pharaonis</i> (Linnaeus, 1758)*	37, 57	Am, ACT	Collection
<b>Mycetarotes Emery, 1913*</b>	—	—	—
<i>Mycetarotes parallelus</i> (Emery, 1906)*	57	Am	Collection
<b>Mycocepurus Forel, 1893</b>	—	—	—
<i>Mycocepurus goeldii</i> (Forel, 1893)	11, 37, 52, 56, 57	Am, Ce, ACT	Brandão et al., 2011; Collection
<i>Mycocepurus smithii</i> (Forel, 1893)*	4, 63	Am	Collection
<b>Nesomyrmex Wheeler, 1910</b>	—	—	—
<i>Nesomyrmex asper</i> (Mayr, 1887)*	52	Am	Collection
<i>Nesomyrmex brasiliensis</i> (Kempf, 1958)	11, 13	Ce	Brandão et al., 2011; Collection
<i>Nesomyrmex spininodis</i> (Mayr, 1887)*	5, 52	Am	Collection
<i>Nesomyrmex wilda</i> (Smith, 1943)*	60	Am	Collection
<b>Ochetomyrmex Mayr, 1878</b>	—	—	—
<i>Ochetomyrmex neopolitus</i> Fernández, 2003*	4, 37	Am, ACT	Collection
<i>Ochetomyrmex semipolitus</i> Mayr, 1878	11, 12, 13, 45	Ce	Brandão et al., 2011; Collection
<b>Octostruma Forel, 1912</b>	—	—	—
<i>Octostruma balzani</i> (Emery, 1894)	30, 45, 60	Am, Ce	Janicki et al., 2016; Collection
<i>Octostruma iheringi</i> (Emery, 1888)*	34, 40	Am	Collection
<b>Oxyepoecus Santschi, 1926*</b>	—	—	—
<i>Oxyepoecus vezenyii</i> (Forel, 1907)*	15	Ce	Collection
<b>Pheidole Westwood, 1839</b>	—	—	—
<i>Pheidole allarmata</i> Wilson, 2003*	34, 52	Am	Collection
<i>Pheidole diligens</i> (Smith, 1858)*	37	ACT	Collection
<i>Pheidole dolon</i> Wilson, 2003**	34	Am	Collection
<i>Pheidole fallax</i> Mayr, 1870*	5, 37	Am, ACT	Collection
<i>Pheidole fimbriata</i> Roger, 1863*	4	Am	Collection
<i>Pheidole flavens</i> Roger, 1863	45	Ce	Janicki et al., 2016; Collection
<i>Pheidole fracticeps</i> Wilson, 2003*	31	Ce	Collection
<i>Pheidole gauthieri</i> Forel, 1901*	34	Am	Collection
<i>Pheidole impressa</i> Mayr, 1870*	10, 57	Am, ACT	Collection
<i>Pheidole jeannei</i> Wilson, 2003*	37	ACT	Collection
<i>Pheidole microps</i> Wilson, 2003**	41	Am	Collection
<i>Pheidole midas</i> Wilson, 2003*	41, 52	Am	Collection
<i>Pheidole obscurithorax</i> Naves, 1985	29	ACT	Dáttilo et al., 2012
<i>Pheidole radoszkowskii</i> Mayr, 1884	5, 34, 35, 37, 40, 52, 56, 57, 59	Am, ACT	Andrade-Silva et al., 2015; Collection
<i>Pheidole scolioceps</i> Wilson, 2003*	4, 37	Am, ACT	Collection
<i>Pheidole sensitiva</i> Borgmeier, 1959**	30	Ce	Collection
<i>Pheidole susannae</i> Forel, 1886*	37	ACT	Collection
<i>Pheidole synarmata</i> Wilson, 2003	57, 59	Am	Andrade-Silva et al., 2015; Pereira et al., 2017; Collection
<i>Pheidole transversostriata</i> Mayr, 1887*	37	ACT	Collection
<b>Pogonomyrmex Mayr, 1868</b>	—	—	—
<i>Pogonomyrmex naegelii</i> Emery, 1878	14	Ce	Johnson, 2015
<b>Procryptocerus Emery, 1887</b>	—	—	—
<i>Procryptocerus goeldii</i> Forel, 1899	45,	Sa	Kempf, 1972a
<i>Procryptocerus hylaeus</i> Kempf, 1951	10, 45	Ce, ACT	Longino & Snelling, 2002; Collection



Taxon name	Locality	Biome	Source
<i>Procryptocerus pictipes</i> Emery, 1896*	5, 40	Am	Collection
<b>Rogeria Emery, 1894</b>	—	—	—
<i>Rogeria alzatei</i> Kugler, 1994*	5, 34, 52, 57	Am	Collection
<i>Rogeria besucheti</i> Kugler, 1994*	40	Am	Collection
<i>Rogeria germaini</i> Emery, 1894*	40	Am	Collection
<i>Rogeria lirata</i> Kugler, 1994*	58	Am	Collection
<i>Rogeria scobinata</i> Kugler, 1994	11	Ce	Brandão et al., 2011; Collection
<b>Sericomyrmex Mayr, 1865</b>	—	—	—
<i>Sericomyrmex mayri</i> Forel, 1912	18, 29, 35, 37, 45	Am, Ce, ACT	Jesovnik & Schultz, 2017; Collection
<i>Sericomyrmex parvulus</i> Forel, 1912	18, 25, 45	Am, Ce	Jesovnik & Schultz, 2017; Collection
<i>Sericomyrmex saussurei</i> Emery, 1894	18, 29, 45	Am, Ce	Jesovnik & Schultz, 2017; Collection
<b>Solenopsis Westwood, 1840</b>	—	—	—
<i>Solenopsis geminata</i> (Fabricius, 1804)	5, 34, 37, 52, 57, 58	Am, ACT	Wauters et al., 2018; Collection
<i>Solenopsis globularia</i> (Smith, 1858)	5, 45, 52, 57, 59, 61	Am, Ce	Kempf, 1972a; Andrade-Silva et al., 2015; Collection
<i>Solenopsis pollux</i> Forel, 1893*	37	ACT	Collection
<i>Solenopsis saevissima</i> (Smith, 1855)	37, 57, 59, 61, 65	Am, ACT	Shoemaker et al., 2006; Andrade-Silva et al., 2015; Pereira et al., 2017; Collection
<i>Solenopsis substituta</i> Santschi, 1925*	57, 61	Am	Collection
<i>Solenopsis virulens</i> (Smith, 1858)*	5, 34, 40, 52	Am	Collection
<b>Stegomyrmex Emery, 1912</b>	—	—	—
<i>Stegomyrmex olindae</i> Feitosa, Brandão & Diniz, 2008	2, 29, 45	Am, Ce	Feitosa et al., 2008; Ulysséa et al., 2015; Collection
<b>Strumigenys Smith, 1860*</b>	—	—	—
<i>Strumigenys alberti</i> Forel, 1893*	4	Am	Collection
<i>Strumigenys crassicornis</i> Mayr, 1887*	30, 32, 55	Am, Ce	Collection
<i>Strumigenys denticulata</i> Mayr, 1887*	5, 13, 30, 31, 34, 40, 52, 55	Am, Ce	Collection
<i>Strumigenys eggersi</i> Emery, 1890*	4, 30, 31, 32, 41, 60	Am, Ce, ACT	Collection
<i>Strumigenys elongata</i> Roger, 1863*	4, 13, 30, 31, 41	Am, Ce	Collection
<i>Strumigenys gytha</i> Bolton, 2000*	41	Am	Collection
<i>Strumigenys hyphata</i> (Brown, 1953)*	4, 30	Am, Ce	Collection
<i>Strumigenys metopia</i> (Brown, 1959)*	4	Am	Collection
<i>Strumigenys mirabilis</i> Mann, 1926*	4	Am	Collection
<i>Strumigenys orchibia</i> (Brown, 1953)**	60	Am	Collection
<i>Strumigenys schmalzi</i> Emery, 1906*	30, 31	Ce	Collection
<i>Strumigenys subdentata</i> Mayr, 1887*	30, 31, 40	Am, Ce	Collection
<i>Strumigenys trufifera</i> Kempf & Brown, 1969*	4, 5, 40	Am	Collection
<i>Strumigenys urrhobia</i> (Bolton, 2000)*	56	Am	Collection
<i>Strumigenys villiersi</i> (Perrault, 1986)*	30	Ce	Collection
<i>Strumigenys zeteki</i> (Brown, 1959)*	12	Ce	Collection
<b>Tetramorium Mayr, 1855*</b>	—	—	—
<i>Tetramorium simillimum</i> (Smith, 1851)	10	ACT	Kempf, 1972a, 1975; Brandão, 1991; Collection
<b>Trachymyrmex Forel, 1893</b>	—	—	—
<i>Trachymyrmex bugnioni</i> (Forel, 1912)	11, 30	Ce	Brandão et al., 2011; Collection
<i>Trachymyrmex relictus</i> Borgmeier, 1934*	34, 35, 37, 40, 52, 57, 61	Am	Collection
<b>Tranopelta Mayr, 1866*</b>	—	—	—
<i>Tranopelta gilva</i> Mayr, 1866*	5, 57	Am	Collection
<b>Wasmannia Forel, 1893</b>	—	—	—
<i>Wasmannia auropunctata</i> (Roger, 1863)	5, 11, 12, 13, 15, 30, 31, 32, 34, 35, 37, 40, 52, 55, 57, 61	Am, Ce, ACT	Brandão et al., 2011; Collection
<b>Paraponerinae Emery, 1901</b>	—	—	—
<b>Paraponera Smith, 1858</b>	—	—	—
<i>Paraponera clavata</i> (Fabricius, 1775)	2, 3, 7, 19, 36, 38, 42, 45, 50	Am, Ce, ACT	Ward & Downie, 2005; Ward, 2007; Collection
<b>Ponerinae Lepeletier de Saint-Fargeau, 1835</b>	—	—	—
<b>Anochetus Mayr, 1861*</b>	—	—	—
<i>Anochetus bispinosus</i> (Smith, 1858)*	5, 34	Am	Collection
<i>Anochetus diegensis</i> Forel, 1912*	5, 34, 40, 57, 60	Am	Collection
<i>Anochetus horridus</i> Kempf, 1964*	4, 27, 37	Am, Ce, ACT	Collection
<i>Anochetus mayri</i> Emery, 1884*	5, 34, 52, 57	Am	Collection
<b>Centromyrmex Mayr, 1866*</b>	—	—	—
<i>Centromyrmex brachycola</i> (Roger, 1861)*	5, 34, 57, 61	Am	Collection
<b>Cryptopone Emery, 1893*</b>	—	—	—
<i>Cryptopone guianensis</i> (Weber, 1939)*	34	Am	Collection
<b>Dinoponera Roger, 1861</b>	—	—	—

Taxon name	Locality	Biome	Source
<i>Dinoponera gigantea</i> (Perty, 1833)	1, 11, 13, 33, 45	Am, Ce, ACT	Kempf, 1971, 1972a; Monnin <i>et al.</i> , 2003; Brandão <i>et al.</i> , 2011; Collection
<b>Hypoponera Santschi, 1938*</b>	—	—	—
<i>Hypoponera distinguenda</i> (Emery, 1890)*	34	Am	Collection
<i>Hypoponera opacior</i> (Forel, 1893)*	61	Am	Collection
<i>Hypoponera trigona</i> (Mayr, 1887)*	5, 34, 52, 57	Am	Collection
<b>Leptogenys Roger, 1861</b>	—	—	—
<i>Leptogenys guianensis</i> Wheeler, 1923*	57	Am	Collection
<i>Leptogenys unistimulosa</i> Roger, 1863	30, 63	Am, Ce	Lattke, 2011; Collection
<b>Mayaponera Schmidt &amp; Shattuck, 2014*</b>	—	—	—
<i>Mayaponera constricta</i> (Mayr, 1884)*	5, 30, 35, 37, 40, 60	Am, Ce, ACT	Collection
<b>Neoponera Emery, 1901</b>	—	—	—
<i>Neoponera commutata</i> (Roger, 1860)	7, 21, 45, 56	Am, Ce	Kempf, 1959; Kempf, 1972a; Collection
<i>Neoponera marginata</i> (Roger, 1861)*	57	Am	Collection
<i>Neoponera striatinodis</i> (Emery, 1890)*	5	Am	Collection
<i>Neoponera unidentata</i> (Mayr, 1862)*	34	Am	Collection
<i>Neoponera veranae</i> Forel, 1922*	34, 37	Am, ACT	Collection
<i>Neoponera villosa</i> (Fabricius, 1804)	11, 13, 19, 60	Am, Ce	Brandão <i>et al.</i> , 2011; Fernandes <i>et al.</i> , 2014; Collection
<b>Odontomachus Latreille, 1804</b>	—	—	—
<i>Odontomachus bauri</i> Emery, 1892*	11, 22, 35, 37, 57, 59, 60	Am, Ce, ACT	Brandão <i>et al.</i> , 2011; Andrade-Silva <i>et al.</i> , 2015; Collection
<i>Odontomachus brunneus</i> (Patton, 1894)*	22	Ce	Collection
<i>Odontomachus chelifera</i> (Latreille, 1802)*	57, 26	Am, Ce	Collection
<i>Odontomachus haematodus</i> (Linnaeus, 1758)	1, 45, 57	Am, Ce	Janicki <i>et al.</i> , 2016; Collection
<i>Odontomachus meinerti</i> Forel, 1905*	34, 52	Am	Collection
<i>Odontomachus opaciventris</i> Forel, 1899	29	ACT	Dáttilo <i>et al.</i> 2012
<i>Odontomachus sculptus</i> Brown, 1978*	5	Am	Collection
<b>Pachycondyla Smith, 1858*</b>	—	—	—
<i>Pachycondyla crassinoda</i> (Latreille, 1802)*	5, 30, 32, 35, 37, 52, 57, 60	Am, Ce, ACT	Collection
<i>Pachycondyla harpax</i> (Fabricius, 1804)*	5, 30, 31, 32, 34, 35, 37, 40, 46, 52, 55, 56, 57	Am, Ce, ACT	Collection
<i>Pachycondyla impressa</i> (Roger, 1861)*	5	Am	Collection
<i>Pachycondyla lenis</i> Kempf, 1961*	34	Am	Collection
<b>Platythyrea Roger, 1863</b>	—	—	—
<i>Platythyrea angusta</i> Forel, 1901	45	Ce	Forel, 1904; Kempf, 1964, 1972a; Collection
<i>Platythyrea pilosula</i> (Smith, 1858)*	60	Am	Collection
<b>Pseudoponera Emery, 1900*</b>	—	—	—
<i>Pseudoponera gilberti</i> (Kempf, 1960)*	5, 34, 40, 52, 61	Am	Collection
<i>Pseudoponera stigma</i> (Fabricius, 1804)*	41	Am	Collection
<b>Rasopone Schmidt &amp; Shattuck, 2014*</b>	—	—	—
<i>Rasopone arhuaca</i> (Forel, 1901)*	5, 34, 41, 52, 55, 57	Am, ACT	Collection
<i>Rasopone ferruginea</i> (Smith, 1858)*	5, 30, 31, 34, 40, 55	Am, Ce	Collection
<b>Proceratiinae Emery, 1895*</b>	—	—	—
<b>Discothyrea Roger, 1863*</b>	—	—	—
<i>Discothyrea sexarticulata</i> Borgmeier, 1954*	4, 5	Am	Collection
<b>Pseudomyrmecinae Smith, 1952</b>	—	—	—
<b>Pseudomyrmex Lund, 1831</b>	—	—	—
<i>Pseudomyrmex curacaensis</i> (Forel, 1912)	5, 10, 40, 45, 52	Am, Ce, ACT	Ward, 1989; Brandão, 1991; Collection
<i>Pseudomyrmex elongatus</i> (Mayr, 1870)	10, 45	Ce, ACT	Kempf, 1972a; Ward, 1989; Collection
<i>Pseudomyrmex ethicus</i> (Forel, 1911)*	4	Am	Collection
<i>Pseudomyrmex filiformis</i> (Fabricius, 1804)*	5, 34	Am	Collection
<i>Pseudomyrmex flavidulus</i> (Smith, 1858)	11, 13	Ce	Brandão <i>et al.</i> , 2011; Collection
<i>Pseudomyrmex gracilis</i> (Fabricius, 1804)	5, 16, 38, 40, 45, 46, 56, 57, 63	Am, Ce, CCT	Janicki <i>et al.</i> , 2016; Collection
<i>Pseudomyrmex kuenckeli</i> (Emery, 1890)	35, 43	Am, ACT	Ward, 1999; Collection
<i>Pseudomyrmex oculatus</i> (Smith, 1855)	5, 34, 40, 45, 56, 57, 63	Am, Ce	Kempf, 1972a; Collection
<i>Pseudomyrmex penetrator</i> (Smith, 1877)*	3	Am	Collection
<i>Pseudomyrmex pupa</i> (Forel, 1911)*	56, 40	Am	Collection
<i>Pseudomyrmex schuppi</i> (Forel, 1901)	52, 57, 59	Am	Andrade-Silva <i>et al.</i> , 2015; Collection
<i>Pseudomyrmex sericeus</i> (Mayr, 1870)*	5, 40	Am	Collection
<i>Pseudomyrmex tenuis</i> (Fabricius, 1804)	5, 13, 20, 27, 34, 37, 40, 45, 47, 56, 58, 60, 61, 62, 63	Am, Ce, ACT	Forel, 1904; Kempf, 1960b, 1972a; Ward & Downie, 2005; Collection
<i>Pseudomyrmex tenuissimus</i> (Emery, 1906)	5, 10, 45	Am, Ce, ACT	Mann, 1916; Kempf, 1972a; Ward, 1989; Brandão, 1991; Collection
<i>Pseudomyrmex termitarius</i> (Smith, 1855)	5, 13, 27, 43, 45, 47	Am, Ce	Kempf, 1972a; Brandão <i>et al.</i> , 2011; Collection
<i>Pseudomyrmex urbanus</i> (Smith, 1877)	13, 45	Ce	Ward, 1989; Brandão, 1991; Collection

to identify the morphospecies in ant collections. For instance, 73 ant morphospecies, belonging to 31 ant genera and two subfamilies were here identified at the specific level for the first time (Table 4).

In our data compilation, we found a number of species that were recorded for the first time in the state of Maranhão, but are widely distributed in Brazil (Janicki et al., 2016), as is the case of *Dolichoderus imitator* Emery, 1894 and *Gnamptogenys striatula* Mayr, 1884, among others (Table 4). On the other hand, some hyperdiverse and taxonomically challenging genera, such as *Pheidole*, had a considerable increase in the number of new records. Of the 19 species of *Pheidole* known to the state, 12 were recorded for the first time in the state of Maranhão, and three species were recorded for the first time in Brazil.

Not surprisingly, the data obtained from the ant literature clearly indicates that taxonomy is the discipline that most contributed to the knowledge of the ant fauna in the state. This is especially true for taxonomic revisions, which deal with large numbers of specimens (e.g., De Andrade & Baroni Urbani, 1999; Lattke, 2011). The high number of taxonomic publications in our survey is justified by the fact that this discipline was the first area of myrmecology to be developed in Brazil, allowing the formation of large repositories. However, although taxonomy is the discipline with the greatest number of published studies in relation to other areas, in the last 20 years the potential of ant fauna data has been explored in different study areas (Table 2).

Other factors that have contributed to increasing our knowledge of the ant fauna in the state of Maranhão are online tools, which provide high definition images of species (AntWeb, 2019), taxonomic literature (Bolton, 2019), geographic distribution of ant specimens (Janicki et al., 2016), and general information on ant taxa (AntWiki, 2019). These tools facilitate the identification of specimens and provide a fast and effective access to information. In addition, the improvement and development of collection methodologies (Figueiredo et al., 2013) has made the sampling more efficient.

Despite the increased understanding of biodiversity in this region, sampling coverage of ant fauna in Maranhão is strongly irregular (Fig. 1). Our study showed that the Amazon is the better sampled biome and also houses the largest number of species recorded in the state (Table 4). Most collection points are concentrated in the northern region of the state (Fig. 1), which corresponds to the Coastal region of Maranhão, with the highest population density (Chaves et al., 2016), and where the main research centers are located.

While the Cerrado, which corresponds to the biome with the highest coverage in the state (64%) (MMA, 2011; Stella, 2011), remains poorly sampled with extremely sparse collections (Fig. 1). In relation to this biome, it is in the southern part of the state where most of the collection points are concentrated, which in most cases came from samples derived from environmental impact assessment programs (e.g., Brandão et al., 2011).

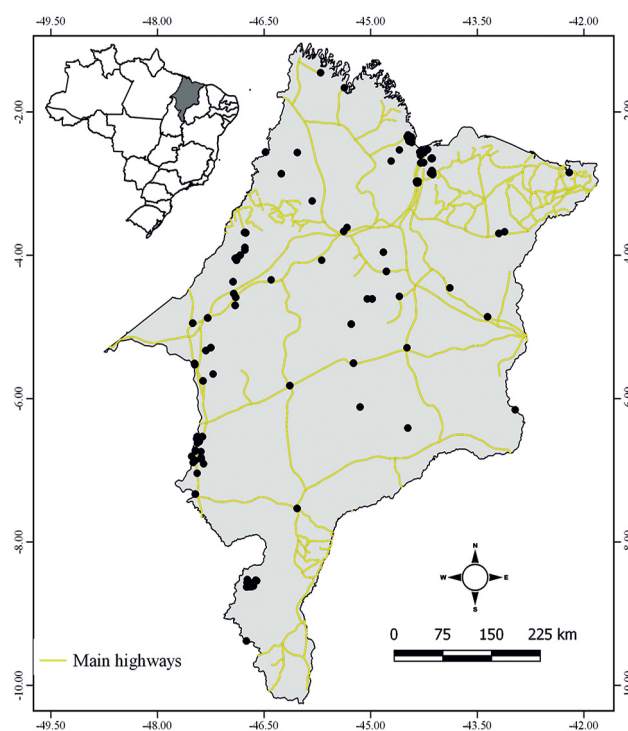
The Amazon-Cerrado transition regions are also undersampled in the state, with few records available from

taxonomic papers (Kempf, 1972a; Brandão, 1991) and collections. If we want to understand the association between species and forest formations it is essential to characterize species diversity in ecotones, as already observed by other groups (Santos et al., 2010; Maracahipes-Santos et al., 2018).

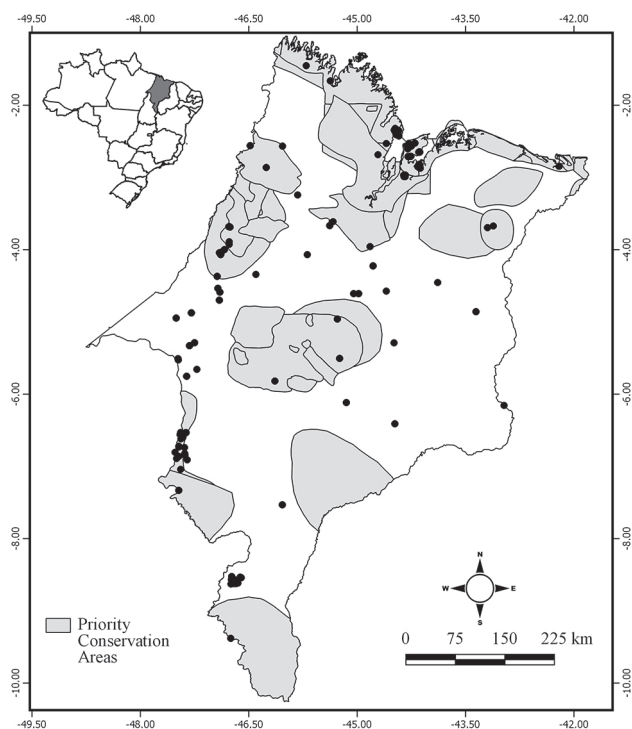
The Caatinga biome remains largely unknown in Maranhão, represented in our study by a single record in the Cerrado-Caatinga transition region (Fig. 1). Although the biome presents a small and fragmented spatial coverage (1% of the state territorial area) (Stella, 2011), the scarcity of information about the ant fauna in the Caatinga has also been observed in other regions of Brazil (Santos et al., 1999; Ulysséa & Brandão, 2013; Leal et al., 2017). This result illustrates the need for greater collection effort to understand and preserve biodiversity in the Caatinga and, consequently, in the state of Maranhão.

One of the main limitations of the data available to date on the ant fauna in Maranhão was a strong sampling bias, with most samples being collected near the main roads (Fig. 2). This pattern of biased sampling near highways, rivers, coasts, and cities has been reported in several taxonomic groups (Hijmans et al., 2000; Kadmon et al., 2003; Reddy & Dávalos, 2003; Newbold, 2010; Santos & Hoppe, 2018), which is explained by the ease access, researchers' interest in certain areas or taxa, and limited financial resources. However, further studies are required to reduce this sampling bias by using different collection methodologies and accessing previously unexplored sites.

Low levels of sampling in conservation areas of the state were also observed (Fig. 3). Conservation areas (i.e., national parks, ecological stations, extractive reserves,



**Figure 2.** Map of the state of Maranhão emphasizing the main highways and sampling sites of ant species within the state.



**Figure 3.** Map of the state of Maranhão emphasizing the Priority Conservation Areas and sampling sites of ant species within the state.

national forests, biological reserves, among others) are of fundamental importance for biodiversity conservation (Peres, 2005) and preserving ecosystem (Hallmann et al., 2017).

To the best of our knowledge, this is the first compilation focused on studying the ant fauna of Maranhão, one of the largest geopolitical regions of Brazil. Our study significantly increase the number of ant species recorded in the state and demonstrates the importance of carrying out planned inventories for a more detailed understanding of the regional ant fauna. Finally, our data provide the baseline information to further explore the ant fauna in Maranhão, to improve current knowledge and to accurately determine the occurrence of several species.

## CONCLUSION

This paper represents an updated record of the ant species occurring in the state of Maranhão, with numbers increasing from 99 to 279 species. Further collection efforts in different biomes are essential for a better understanding of the biodiversity of the state, and for planning long-term conservation action. Ongoing studies on taxonomy, natural history, and ecology are certainly expected to contribute to this.

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