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ARTICLE

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^2 (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

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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 20th century, collective efforts of several research groups, carring 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.

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

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

Context	Source
Behavioral	Wheeler, 1922; Monnin *et al.,* 2003; Silva, 2007; Pereira *et al.,* 2014
Ecological	Brandão *et al.,* 2011; Ramos *et al.,* 2015; Silva *et al.,* 2017; Gutiérrez *et al.,* 2017
Forensic	Andrade-Silva *et al.,* 2015; Pereira *et al.,* 2017
Genetics	Wauters *et al.,* 2018
Inventory	Dáttilo *et al.,* 2012
Occurrence	Dáttilo *et al.,* 2010
Sanitary	Carvalho *et al.,* 2011; Silva *et al.,* 2012; Lima *et al.,* 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; Cuezzo, 2000; Longino & Snelling, 2002; Ward & Downie, 2005; Shoemaker *et al.,* 2006; Wild & Cuezzo, 2006; Feitosa *et al.,* 2007; Ward, 2007; Wild, 2007; Feitosa *et al.,* 2008; Lattke, 2011; Fernandes *et al.,* 2014; Brandão *et al.,* 2015; Johnson, 2015; Ulysséa *et al.,* 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 21st 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 20th 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 19th century (Vanzolini, 2004), for the ants this occurred in the second half of the 20th century. In the case of the records analysed in this work, the specific localities and geographic coordinates became available in the late 20th 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

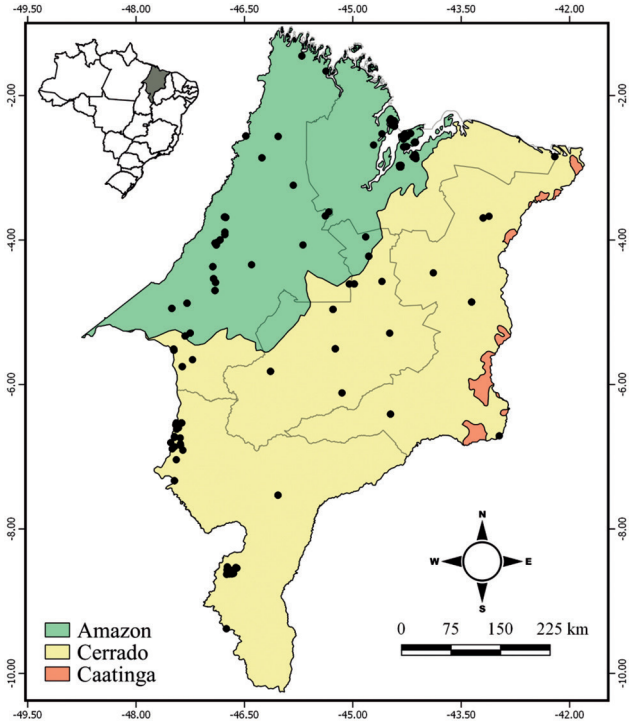

Figure 1. Map of the state of Maranhão showing its location in Brazil. Black points indicate the sampling sites within the state that were georeferenced and recorded in the literature and collections according to biomes.

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

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

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

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

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

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

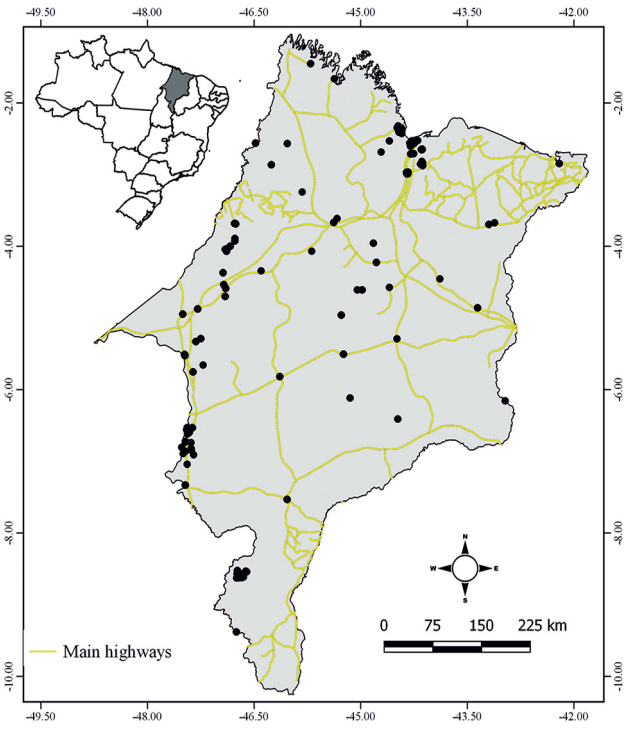

Figure 2. Map of the state of Maranhão emphasizing the main highways and sampling sites of ant species within the state.

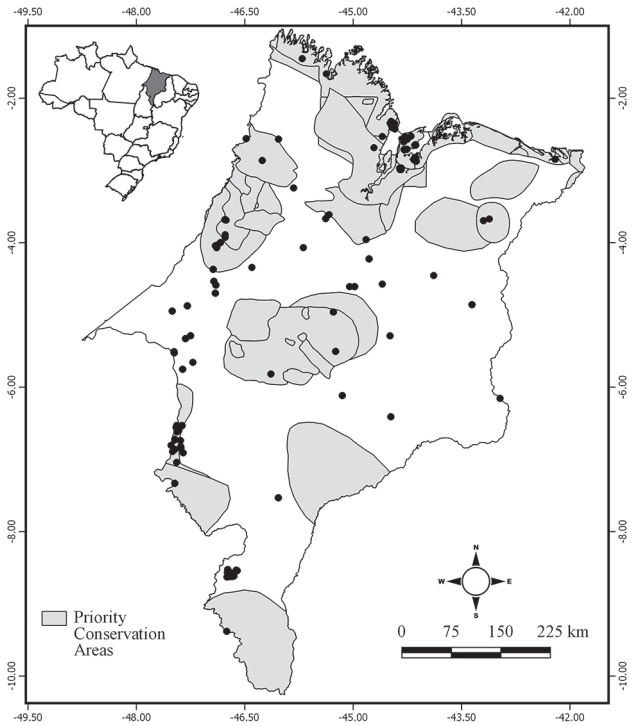

Figure 3. Map of the state of Maranhão emphasizing the Priority Conservation Areas and sampling sites of ant species within the state.

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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