

## Practique Clinique et Investigation

# Ant Assembly (Hymenoptera, Formicidae) in Health Units in Southern Brazil

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### ABSTRACT

The presence of ants in health care environments is dangerous because these insects can carry multi resistant pathogens. We assessed the ants assembly found in Family Health Centers (FHC) of health and evaluated their association among the genera sampled. Daytime samplings were performed in 33 FHC in the urban areas in Southern of Brazil with a sampling effort 14 hours for each FHC at a total of 462 hours in the entire study. A faunistic analysis was performed calculating abundance, constancy, dominance and frequency indices. The association of the ant genera with the FHC environments was determined by a Principal Component Analysis. Thirty-four species of ants were identified. The occurrence of ants in these environments poses risks to the health of users and workers and needs to be carefully evaluated by the managers.

**Keywords:** *Diversity; Public health; Urban ants; Urban environments; Wealth*

### INTRODUCTION

The presence of ants in healthcare facilities (hospitals, clinics, and primary health care centers), where these insects can carry pathogens such as fungi and bacteria, including multiresistant strains [1,2]. Ants inventories must be performed in health care institution in the implement action of efficient control strategies [3,4]. Information on the species tolerance to urban environments and the ability to nest and forage indoors, is an essential element in the planning management and conservation of the mirmecofauna in urban environments [5].

In Brazil, research on urban ants began in 1980 [6], generating a significant scientific production mainly in the Southeast Region [7-9], which triggered the development of research on these insects in Brazil. Bueno e Campos-Farinha [10], list the species *Camponotus spp.*, *Crematogaster spp.*, *Linepithema humile* (Mayr 1868), *Monomorium pharaonis* (Linnaeus 1758), *Nylanderia fulva* (Mayr 1862), *Paratrechina longicornis* (Latreille 1802), *Pheidole spp.*, *Solenopsis spp.*, *Tapinoma melanocephalum* (Fabricius 1793) and *Wasmannia auropunctata* (Roger 1863) among the ants of outstanding medical and sanitary importance. In the southern region of Brazil, the most abundant ant genera in urban environments are *Acromyrmex*, *Camponotus*, *Crematogaster*, *Pheidole*, *Linepithema* and *Solenopsis* [5]. The few fauna urban ants studies has benn coucted

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in southern Brazil is composed of 41 genera and eight subfamilies. The greatest richness sampled is concentrated in the cities of Santa Catarina (113 species), followed by Rio Grande do Sul (41 species) and Paraná (28 species) [11].

The few studies on urban ants conducted in the southern Brazil, with five in Santa Catarina [11-15], 4 in Rio Grande do Sul [16-19] and one study in the State of Paraná [20]. However, only one study Bicho et al. [17] was carried out in Health Facilities (Family Health Centers. The present study aimed to: a) inventory the ants assembly found in Family Health Centers (FHC) in Pelotas, Rio Grande do Sul, Brazil; b) describe the myrmecofauna in terms of richness, abundance and composition.

## **MATERIAL AND METHODS**

### **Sampled Environments**

The study was carried out in the city of Pelotas (31°46'34"S, 52°21'34"W), Rio Grande do Sul, Brazil. 33 Family Health Centers were sampled throughout the urban area of the municipality and, in these spaces, seven internal environments: offices, kitchens, sluice room, pharmacy, reception, tours and vaccine rooms. They have a built area that can vary, generally, between 100 m<sup>2</sup> and 500 m<sup>2</sup>. The outdoor area consists of sidewalks, gardens and parking lots.

The internal environments are characterized as follows: Offices: they are characterized with rooms of attendance to the patients where nurses and doctors work. They have a size varying between 20 m<sup>2</sup> and 50 m<sup>2</sup> and have furniture and equipment used during the visits. Kitchens: Environments with areas of approximately 40 m<sup>2</sup> intended for the conviviality of health workers, where food is stored and prepared meals. Sluice room: they are small rooms (approximately 10 m<sup>2</sup>) destined to the storage of materials and residues of the health service until they are sent to the external treatment. Pharmacy: With an approximate area between 20 m<sup>2</sup> and 50 m<sup>2</sup>, they are characterized as rooms for the storage and dispensing of medicines. Reception: Environment with an area between 20 m<sup>2</sup> and 50 m<sup>2</sup> intended for reception of users seeking the FHC. They are open spaces that only have chairs and/or benches to accommodate the population while waiting to be attended. Rides: These are corridors through which FHC workers and users transit. They may vary in area (between 20 m<sup>2</sup> and 100 m<sup>2</sup>) depending on the total size of the FHC and the number of services provided. Vaccine rooms: Environments with approximately 40 m<sup>2</sup> areas for first aid services and medication for FHC users.

### **Sampling and Identification**

Twelve bimonthly diurnal samplings in each FHC. Ant collected using a brush moistened with alcohol, and were conditioned in test tubes containing 70% ethanol. A sample effort of ten minutes at each sampling date, totaling 14 hours of sampling in each FHC and 462 hours throughout the study. The sampled in bottles were transported to the Laboratory of Entomology of the Federal University of Pelotas (UFPeL) for sorting and ant identification. Specimens were identified using the keys proposed by Gonçalves [21], Trager [22], Lattke [23], Fernández [24], Seifert [25] and Wilson [26].

### **Statistical Analysis**

Richness was defined as total number of ant species that occurred in each of the samples. Abundance was defined based on the relative frequency (number of records of a given species in relation to the total number of ants each trap) and not on the number of individuals which minimizes the effect of foraging habits and colony size and is more appropriate for studies of ant assemblages [27]. Fauna analysis was performed by calculating the indices of abundance, constancy, dominance and

frequency according to Lutinski and Garcia [28]. For the species with very abundance, constancy, dominance and very frequency, the location within the FHC.

In order to verify the sample sufficiency, a comparison was made between the species observed in the samples (Sobs) with the value generated by the Chao 2 estimator. This comparison allows to infer how much a study approaches to sample all the species of a given environment. The estimates of richness for each environment were obtained from EstimateS 8.2 software. The richness of ants sampled in each environment was compared by means of a rarefaction analysis based on the occurrences and performed using the program EcoSim 7 [29].

The association of the ant genera with the FHC environments was verified with a Principal Component Analysis (PCA). All registered genres were included in the analysis, and the data were transformed using Log (x + 1) and analyzed using the Past statistical program [30].

## RESULTS

A total of 34 ant species belonging to 17 genera and four subfamilies (Table 1) were identified from FHC in Pelotas, RS, Brazil. In relation to abundance, it was found that *Camponotus mus* Roger, *Linepithema humile*, *Paratrechina longicornis* (Mayr, 1862), *Pheidole megacephala* (Fabricius, 1793), *Pheidole* sp. 1 and *Solenopsis saevissima* (Smith, 1855) were the most abundant species. Most of the species occurring during most of the year (65.7%) were constant.

Taxon	Occurences	A	C	D	F
<b>Dolichoderinae subfamily</b>					
<b>Dolichoderini Tribe</b>					
<i>Dorymyrmex brunneus</i> Forel, 1908	81	Cm	Co	Nd	Fr
<i>Dorymyrmex</i> sp.	17	Ra	Co	Nd	If
<i>Linepithema humile</i> (Mayr,1868)	322	VA	Co	Do	VF
<b>Formicinae subfamily</b>					
<b>Camponotini Tribe</b>					
<i>Camponotus crassus</i> Mayr, 1862	83	Cm	Co	Nd	Fr
<i>Camponotus mus</i> Roger, 1863	367	VA	Co	Do	VF
<i>Camponotus rufipes</i> (Fabricius, 1775)	25	Ra	Co	Nd	If
<i>Camponotus</i> sp. 1	14	Ra	Co	Nd	If
<i>Camponotus</i> sp. 2	109	Cm	Co	Nd	Fr
<b>Plagiolepidini Tribe</b>					
<i>Brachymyrmex</i> sp.	20	Ra	Ac	Nd	If
<i>Nylanderia fulva</i> (Mayr, 1862)	25	Ra	Ac	Nd	If
<i>Paratrechina longicornis</i> (Latreille, 1802)	428	VA	Co	Do	VF
<i>Paratrechina</i> sp.	4	Ra	Ad	Nd	If
<b>Myrmicinae subfamily</b>					
<b>Attini Tribe</b>					
<i>Acromyrmex lobicornis</i> (Emery, 1888)	147	Cm	Co	Do	Fr
<i>Acromyrmex</i> sp. 2	69	Cm	Co	Nd	Fr

<i>Acromyrmex</i> sp. 3	8	Ra	Ac	Nd	VF
<i>Mycocepurus</i> sp.	4	Ra	Ac	Nd	If
<b>Blepharidattini Tribe</b>					
<i>Wasmannia auropunctata</i> (Roger, 1863)	153	Cm	Co	Do	Fr
<b>Creematogastrini Tribe</b>					
<i>Creematogaster nigropilosa</i> (Mayr, 1870)	101	Cm	Co	Nd	Fr
<b>Myrmicini Tribe</b>					
<i>Pogonomyrmex naegelli</i> (Forel, 1878)	48	Di	Co	Nd	Fr
<b>Pheidolini Tribe</b>					
<i>Pheidole megacephala</i> (Fabricius, 1793)	364	VA	Co	Do	VF
<i>Pheidole</i> sp. 1	545	VA	Co	Do	VF
<i>Pheidole</i> sp. 2	36	Ra	Co	Nd	If
<i>Pheidole</i> sp. 3	94	Cm	Co	Nd	Fr
<b>Solenopsidini Tribe</b>					
<i>Monomorium pharaonis</i> (Linnaeus, 1758)	2	Ra	Ad	Nd	If
<i>Monomorium</i> sp.	4	Ra	Ac	Nd	If
<i>Solenopsis saevissima</i> (Smith, 1855)	746	VA	Co	Do	VF
<i>Solenopsis</i> sp. 1	30	Ra	Co	Nd	If
<i>Solenopsis</i> sp. 2	123	Cm	C	Do	Fr
<i>Solenopsis</i> sp. 3	116	Cm	Co	Nd	Fr
<b>Tetramoriini Tribe</b>					
<i>Tetramorium bicarinatum</i> (Nylander, 1846)	3	Ra	Ac	Nd	If
<b>Ponerinae subfamily</b>					
<b>Ponerini Tribe</b>					
<i>Hypoponera</i> sp. 1	4	Ra	Ac	Nd	If
<i>Hypoponera</i> sp. 2	6	Ra	Ad	Nd	If
<i>Pachycondyla striata</i> Smith, 1858	2	Ra	Ad	Nd	If
<i>Pachycondyla</i> sp.	1	Ra	Ad	Nd	If

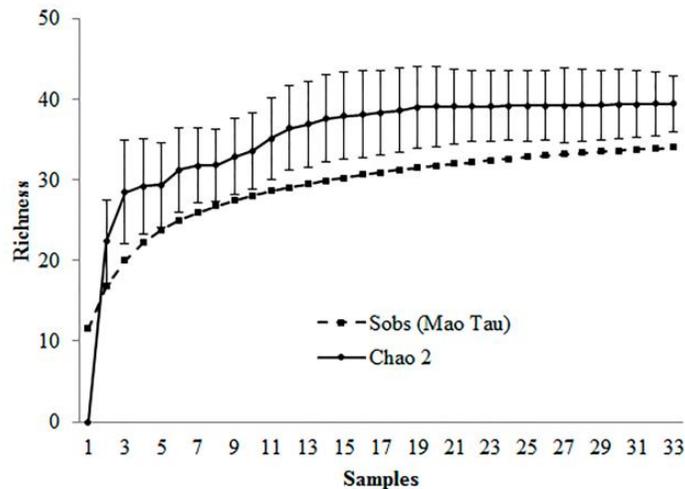
**TABLE 1:** Fauna analysis of ant species in bimonthly samples from January 2006 to November 2007 in 33 Family Health Centers (FHC) in the city of Pelotas, RS

Where A = abundance (Cm = Common, Di = Dispersed, VA = Very Abundant, Ra = Rare), C = Constancy (Ac = Accessory, Ad = Accidental, Co = Constant); D = Dominance (Do = Dominant; Nd = Not Dominant) F = Frequency (Fr = Frequent; VF = Very frequent; If = infrequent); n = Total of individuals.

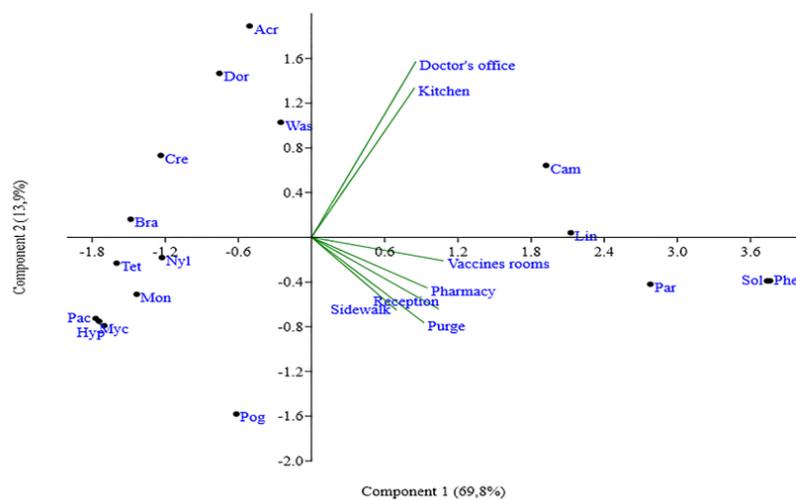
The species *Acromyrmex lobicornis* (Emery, 1888), *C. mus*, *L. humile*, *P. longicornis*, *P. megacephala*, *Pheidole* sp. 1 and *S. saevissima* were characterized as dominant and were very frequent. *Camponotus mus* and *Pheidole* sp. 1 had a wide geographic distribution in the city of Pelotas, RS, being present in all FHC, followed by *S. saevissima* that occurred in 90.9% of FHC (Table 1).

The accumulation curve of species richness showed sample adequacy (Figure 1), since it was close to the asymptote at the end of the sampling, both for observed and estimated richness (Chao 2). The difference between observed (Sobs) and estimated (Chao 2) richness was only 15.8%.

In all, 83.7% of the variation of occurrences of ant genera, according to the environments sampled, was explained by the components 1 (eigenvalue: 4.0% of variance: 69.8) and 2 (eigenvalue: 0.8; % of variance: 13.9) of PCA. Four genera presented occurrences of species positively associated with samples taken in kitchens and offices: *Acromyrmex*, *Camponotus*, *Dorymyrmex* and *Wasmannia*. Four others, *Linepithema*, *Paratrechina*, *Pheidole* and *Solenopsis*, with the sluice room, pharmacy, tours, reception and vaccine rooms. The other genera occurred independently of the environment (Figure 2).



**FIGURE 1:** Sample weed (Sobs) and estimated (Chao 2) in 33 Family Health Centers (FHC), Pelotas, Brazil.



**FIGURE 2:** Association, by Principal Component Analysis (PCA), of ant genera of seven types of environments, in 33 Family Health Centers (FHC), Pelotas, RS, Brazil (January 2006 to November 2007).

Acr: *Acromyrmex*; Bra: *Brachymyrmex*; Cam: *Camponotus*; Cre: *Crematogaster*; Pain: *Dorymyrmex*; Hyp: *Hypoconer*; Lin: *Linepithema*; Mon: *Monomorium*; Myc: *Mycocetopus*; Nyl: *Nylanderia*; Pac: *Pachycondyla*; Par: *Paratrechina*; Phe: *Pheidole*; Pog: *Pogonomyrmex*; Sol: *Solenopsis*; Tet: *Tetramorium*; Was: *Wasmannia*.

## DISCUSSION

The richness of urban ants obtained in this work is the largest ever obtained in Rio Grande do Sul, when compared to previous results in Pelotas (S = 24) by Silva and Loeck [16] and Gonçalves et al. [21], in Bagé (S = 11) by Bicho et al. [17] and Porto Alegre (S = 19) by Garcia et al. [18]. The high richness observed is attributed to the greater sample effort carried out in this study, confirmed by the sample effort employed and by the proximity of the wealth estimate (Chao 2) obtained with the observed richness.

The species *C. mus*, *L. humile*, *P. longicornis*, *P. megacephala*, *Pheidole sp.1* and *S. saevissima* were outstanding in the faunistic analysis, that is, they were very abundant, constant, dominant and very frequent in the samples. Of these, three species (*L. humile*, *S. saevissima* and *C. mus*), are commonly found in urban areas of Pelotas city [17], are typically urban species that probably colonize FHC due to being abundant in the city.

The genus *Dorymyrmex* and *Linepithema* combine species characteristic of anthropic environments [5,31] that exert a strong dominance over food sources and recruit massively. According to Fernández, belong to these genera some of the most important species of ants with potential to become pests, highlighting *L. humile*. Studies carried out in homes in the city of Pelotas recorded *L. humile* in high densities, being one of the most frequent in this environment [16].

Ants of the genus *Camponotus* vary in size from very small to very large. Approximately 400 species are described for the neotropical region, among which a marked polymorphism is observed and onivory is very frequent. Chemical defense and mutualism are commonly observed in relationships with other organisms [32]. Some species of *Camponotus* have a habit of occupying structures such as wood ceilings, door and window stops, and even electronic devices [6]. The occurrence of these ants inside buildings indicates structural deficiencies favoring ants nesting [33].

Ants of the genus *Nylanderia*, *Pheidole* and *Solenopsis* are known as dominant omnivores. The wide geographic distribution and the great dispersal ability make some of these species locally abundant. These genera are associated with soil formation of large colonies, small individuals, generalist and aggressive behavior and a strong association with urban environment. *Nylanderia fulva* (Mayr, 1862) is considered predominant in homes [16] and in hospitals [21] in Pelotas (RS) and in hospitals and clinics in Bagé (RS) [17]. However, in this study it was rare, accidental, non-dominant and infrequent in this study. Species of the genus *Pheidole* have been sampled in urban environments of several Brazilian states, Rio de Janeiro [34], Goiás [35], Minas Gerais [5,12,36], Rio Grande do Sul [17], Mato Grosso do Sul [37] and Ceará [38]. *Solenopsis saevissima* has been sampled in homes [16] and in hospitals [21] in urban areas. It is widely distributed in Brazil and has medical importance due to its painful stings [12].

Ants belonging to the ant genera *Acromyrmex*, *Crematogaster*, *Hypoponera*, *Pachycondyla*, *Pogonomyrmex* and *Wasmannia*, occur commonly in places where vegetation is present. For example, *Acromyrmex* consists of relatively large-sized ants, cutters, fungus growers who build their nests on the ground, under logs or stones [32]. *Wasmannia* are small ants, litter dwellers [32]. *Hypoponera* and *Pachycondyla* depend on favorable conditions of soil and litter, where they nest and forage [32] and their occurrences in FHC are due to the external environments where their nests meet and the accesses such as cracks and doors through which they enter the environments of the FHC. The occurrence of species of the genus *Hypoponera* and *Pachycondyla* in indoor environments of FHC is called attention. According to Lattke [39], the ants of these genera share, in

addition to the predatory habit. The occurrence of the species of these genera in the internal environments can be considered as accidental and indicates the lack of hygiene care of the internal environments of FHC.

A similarity of conditions was observed for the occurrence of ants in the FHC, between the environments of the kitchens and clinics and between sluice rooms, pharmacies, tours, reception and vaccine rooms. The positive association of some of the genera sampled with the evaluated environments (PCA) points to a) existence of structural and building deficiencies, and lax hygiene care in these spaces and b) conditions outside of the FHC building that are conducive to nesting and foraging a myrmecofauna comparable to other urban environments. The access and the occurrence of these ants in the internal environments of the FHC represent important risks for the health of the users of the service and for the workers in these spaces [12]. Managers should be conduct carefully evaluating of these environments with attention to the structures and with the implementation of integrated vector management.

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