

## ANT COMMUNITY STRUCTURE (HYMENOPTERA: FORMICIDAE) IN TWO NEIGHBORHOODS WITH DIFFERENT URBAN PROFILES IN THE CITY OF SÃO PAULO, BRAZIL

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**Abstract** The aim of this study was to compare the structure of ant communities in two neighborhoods (Itaquera and Vila Mariana) with different urban profiles in the city of São Paulo. It also aims to establish the relationship between habits of the residents, the state of conservation and cleaning of homes and distribution of the ant fauna. It was also performed a temporal assessment of ant community in Vila Mariana, comparing the results of surveys carried out in 1998/1999 with results from the collections in 2009/2011. Samples were taken in 292 homes using baits and manual collections. Questionnaires with data on the habits and characteristics of residents and maintenance of asepsis and residences were performed. The most collected species in 1999 and 2010, in both neighborhoods was *Tapinoma melanocephalum*. This species was present in 80% of the collections in the district of Itaquera and has expanded its distribution in Vila Mariana, from 1998/1999 to 2009/2011, displacing the population of other ant species reducing their frequency. *Pheidole megacephala* also had high frequency in Vila Mariana, but it was not collected in Itaquera.

Essa espécie é mais encontrada em sobrados, casas maiores, mais antigas, com menor número de moradores, sem animais domésticos ou crianças. *T. melanocephalum* não mostrou nenhum padrão de distribuição relacionado aos hábitos dos moradores ou conservação e limpeza. Casas em pior estado de conservação apresentam mais espécies de formigas e residências com piores condições de limpeza apresentam mais formigas.

**Key Words** Myrmecofauna, invasive species, households

### INTRODUCTION

The modification of natural environments for the establishment and growth of cities has encouraged the development of species adapted to disturbance and geography of urban environments. In this context the urban ants, on account of its strong association with the synanthropic environments (Passera, 1994) stand out, because even though the number of ant species regarded as pests do not exceed more than a few dozens (Bueno and Campos-Farinha, 1999), they represent a serious problem, since they can cause structural damage, transmission of diseases, food contamination, ecological imbalance as well as uncomfortable when cohabiting with man.

Reproductive behavior of the tramp ant species are very different those species that occur in natural environments. The former have abolished nuptial flight and mating may occur inside the nest. Polygyny is common in many species which promotes colonies to expand fast, and usually large areas are dominated by only one species forming a supercolony. Tramp ant species migrate changing the location of the nest after disturbance (Passera, 1994). Species are highly aggressive with other ant species, but intraespecific aggression is usually not observed (Bueno and Campos-Farinha, 1999; Passera, 1994, Giraud et al., 2002).

One of the most fundamental questions in relation to urban ants is related to the introduction of exotic species and the subsequent dominance of them in relation to native species. According to Holway and Suarez (2006) the introduction of exotic species has contributed to a decline in local biodiversity, and this has been an indirect consequence of urbanization on ant communities in cities. These authors examined the loss of native ant fauna that occurred after the invasion of Argentine ant, *Linepithema humile*, and natural environments invaded by this species showed less diversity than non invaded areas. In Australia, a reevaluation of a place infested by *Pheidole megacephala* showed that the ant-infested area nearly doubled after nine years of the original assessment (Hoffmann and Parr, 2008).

In Brazil, data obtained from surveys carried out in Ilheus, Bahia, showed *P. megacephala* as a dominant species with negative association with other ant species (Delabie et al., 1995). These results are similar to those obtained in São Paulo, where the exotic species *Pheidole megacephala* and *Tapinoma melanocephalum*, had high frequencies, occurring in approximately 44% of sampled households (Piva, 1999).

Several surveys indicated *P. megacephala* as one of the most commonly species found in urban environments, but other ant species are always reported: *T. melanocephalum*, *Nylanderia fulva*, *Brachymyrmex* sp., *Solenopsis* sp., *Paratrechina longicornis*, *Monomorium* spp., *Crematogaster* sp., *Cardiocondyla* sp., *L. humile*, *Dorymyrmex* spp., *Camponotus* spp. and *Pachycondyla* sp. (Piva, 1999; Delabie et al., 1995; Klotz et al., 1995).

The characteristics that make these species so well adapted to urban environments make their control difficult.

In order to contribute to the knowledge of urban ant communities, this work aimed to evaluate temporal changes of ant community in households, to understand if ant community is related to urban profiles and to relate conservation of structures and human habits with ant distribution.

## MATERIAL AND METHODS

Collections were made in households in two neighborhoods in the city of São Paulo: Vila Mariana and Itaquera. The collections were performed in Vila Mariana in two periods: from December 1998 to October 1999 and from December 2009 to January 2011. In Itaquera collections were made from December 2009 to January 2011. Two hundred and ninety-two houses were sampled: 132 in Vila Mariana in the period 1998/1999, 80 in Vila Mariana (2009/2011), and 80 in Itaquera (2009/2011).

Households were randomly chosen. We repeated the ant collection in 25 houses in Vila Mariana, in 2010. Baits based on dehydrated liver, pineapple cake and honey were made and set in 7 cm length straws which were placed in the households; 15 baits in each house, three in each room: living room, bedroom, kitchen, bathroom and outside area. In addition, manual collections were also performed using brushes and a bottle-type vacuum. The baits were left for 24 hours and collected ants taken to the laboratory for identification and counting. In addition to the collections, it was also filled in a form with data relating to the environment as conservation, number of children, presence of pets, use of insecticides and professional pest control services.

Shannon Diversity Index, Equitability Index, Simpson's Index and Sorensen Measure were calculated with the BioDap software (Thomas and Clay, 2008) in order to know ant community in the neighborhoods.

The Mann-Whitney Test compared numerical variables between two variables and the Kruskal-Wallis test for three or more variables, at the significance level of 5% ( $p < 0,05$ ).

## RESULTS AND DISCUSSION

We collected 24 species in Vila Mariana in 1998/1999, 25 species in 2009/2011 (25 species) and 33 species in Itaquera (2009/2010). *T. melanocephalum* showed the highest abundance in the three sampled neighborhoods. Such observation agree with other data in the literature (Delabie et al., 1995, Klotz et al., 1995, Smith et al., 2006). Data comparing the two periods of sampling in Vila Mariana also reveal that the distribution of *T. melanocephalum* has been increasing in the neighborhood. Its relative frequency increased from 19.7% in 1998/1999 to 56.9% in 2009/2011. This expansion is associated to the decrease in frequency of other species such as *Nylanderia fulva*, *Solenopsis* sp. and *Brachymyrmex* sp. 1. The Shannon diversity index analysis corroborate this idea: the index decreased from 1.87 in 1998/1999 to 1.42 in 2009/2011. It is known that exotic species such as *T. melanocephalum*, tend to create large populations and displace the native ant fauna. Thus, diversity decreases, because an entire region is dominated by just one or a few species. The Shannon Diversity Index showed an even lower (0.96) index in Itaquera. Although we have collected 33 species, almost 80% of abundance and relative frequencies were attributed to *T. melanocephalum*. In Itaquera, households are younger with an average of 25.1 years in contrast to Vila Mariana, where houses have an average of 50 years. It is possible that such a new and disturbed site be suitable for *T. melanocephalum* settlement. Similar results were obtained by Plowe et al. (2007) who compared the occupation of the exotic *Solenopsis invicta* with the native *S. geminata* in residential complexes of different ages in Austin (Texas).

Another exotic species with wide distribution in Vila Mariana was *P. megacephala*. Its frequency increased from 24.24% in 1998/1999 to almost 38% in 2009/2011. This species was not collected in Itaquera and its absence should be another factor favoring the high abundance and frequency of *T. melanocephalum*. Eleven native species of the genus *Pheidole* were found, six in Vila Mariana in 1998/1999, 5 species in 2009/2011 and 9 species in Itaquera in 2009/2010. The greatest richness of *Pheidole* species in Itaquera must be related to the presence of

large green areas such as Parque do Carmo and the SESC Itaquera that are remnants of Atlantic Forest, an ecosystem where the species of the genus *Pheidole* are abundant (Wilson, 2003).

The following ant species were also collected in both neighborhoods: *Monomorium floricola*, *Monomorium pharaonis*, *Paratrechina longicornis*, *Cardiocondyla* sp. 1, *Lepthorax* sp. 1, *Linepithema* sp. 1 and sp.2, *Linepithema humile*, 5 species from *Camponotus* genus, *Crematogaster* sp. 1, 2 more species from *Brachymyrmex* genus, *Acromyrmex* sp. 1, *Ectatomma* sp. 1, *Solenopsis (Diplorhoptrum)* sp. 1, *Dorymyrmex* sp. 1, *Wasmannia auropunctata*, 2 species from *Pachycondyla* genus, *Cyphomyrmex* sp. 1, *Pseudomyrmex termitarius*, *Octostruma* sp. 1, *Ponera* sp. 1.

Soerensen Measure showed similarity between ant community from Vila Mariana and Itaquera in the survey from 2009-2011 (62%) and similarity were almost the same in Vila Mariana in the past 10 years (68.3%).

Household structure analysis showed that 80% of households (n=80) had good or excellent conditions of cleanness and maintenance in the Vila Mariana neighborhood. In Itaquera about 40% (n=80) of households showed conditions of regular or poor cleanness and maintenance. Only 30% of households showed very good conditions. The presence of failures on the structures favors the establishment and dispersal of ants (Bueno and Campos-Farinha, 1999), and these characteristics should favor high abundance, species richness and dominance of opportunistic species in Itaquera. The analysis of the Mann-Whitney and Kruskal-Wallis tests revealed that more species are found in households with the worst conditions of conservation (p=0.042) and more specimens in homes with poor cleanness (p=0.047).

*Pheidole megacephala* seems to be more frequent in two-store houses (p<0.001), bigger houses (p<0.003), with less dwellers (p=0.036) and with less children (p=0.007), without pets (p=0.021) and with better cleanness conditions (p=0.047). *T. melanocephalum* seems to be more frequent in single-store houses (p=0.004) with the presence of children (p=0.003). Most tramp ant species occur in single-store houses (p=0.007) with the presence of children (p=0.011) and with gardens and yards (p<0.001).

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