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AEDES AEGYPTI AND *AEDES ALBOPICTUS* IN URBAN GREEN AREAS AND HOUSES IN TWO MOUNTAIN TOWNS: OURO PRETO AND MARIANA, MINAS GERAIS, BRAZIL

[1]MICHELLE CRISTINE PEDROSA, [2]JÚLIO FONTENELLE, [3]ÁLVARO EIRAS, [4]EVERALDO ARASAHIRO, AND [1]SÉRVIO PONTES RIBEIRO
[1]DEBIO-ICEB- Universidade Federal de Ouro Preto
[2]Instituto Federal de Ensino Técnico-Ouro Preto
[3]Departamento de Parasitologia- ICB-Universidade Federal de Minas Gerais
[4]DEFIS-ICEB-Universidade Federal de Ouro Preto

Abstract The present study tests the hypothesis that *Ae. aegypti* and *Ae. albopictus* respond differently to urban green areas and houses nearby in the towns of Ouro Preto, at 1100 metres and of Mariana, lower, at 700 metres above sea level. We investigate the prediction that *Aedes* populations may have been growing recently due to climate warming of montane ecosystems. We sampled immatures by use of ovitraps. Preliminary results showed 2.243 immatures of the both species. *Aedes albopictus* was the most abundant species in the green areas. Both species were correlated positively for abundance, thus reflecting no temporal or spatial niche specificity separation. *Ae. albopictus* was more abundant than *Ae. aegypti* in green areas. Both species were more abundant in the green area of Mariana. Records of *Aedes* in Ouro Preto are recent, and the difference in abundance between low and high altitude may reflect a recent and gradual occupancy of high altitude habitats by these vectors. A prediction is to find endemic dengue cases in a couple of years.
Key Words Climatic change, Culicidae, dengue vector, urban green areas.

INTRODUCTION

Mosquitoes *Aedes* (*Stegomyia*) *aegypti* (Linnaeus 1762) and *Ae.* (*Stegomyia*) *albopictus* (Skuse 1894) are the species responsible for transmitting dengue. *Ae. aegypti* is the main vector in the Americas and *Ae. albopictus* is a generalist species with less anthropophilic than *Ae. aegypti* (Tauil, 2002) being is responsible for the transmission of dengue in Southeast Asia and considered as a secondary vector in the Americas (Tauil, 2002).

The occurrence of dengue is directly related with the ecology and distribution of the vector, the host abundance and environmental variables (Forattini, 1992), and thus the spread of dengue is the result of ecological circumstances and socio-environmental factors that favor the spread of vector (Aguila et al., 2009).

The knowledge of the social and environmental conditions of each region is of extreme importance for more effective control measurements. Thus, the urban green areas can be important elements to be considered for investigation of Culicidae as they may reveal the presence of species of epidemiological importance (Tissot and Navarro-Silva, 2004).

The present work aims to analyze the occurrence of *Ae. aegypti* and *Ae*. *albopictus* in two urban green spaces located in the cities of Ouro Preto and Mariana, Minas Gerais, and in houses and buildings adjacent to these spaces, thus investigate the relevance of these sites as vectors refuges. We also intend to investigate components of the population dynamics of *Aedes* obtained in two years. The hypotheses here tested are that 1) both species have larger populations in lower altitudes, which is a early sign of recent colonization of altitudinal habitats; 2) *Ae. albopictus* is more abundant than *Ae. aegypti* in green areas and the inverse inside the buildings; finally, that 3) regardless habitat preferences, both species respond positively to temperature, namely, to increasing numbers of continuously warm days. The prediction of this work is that such pattern may reflect regional warming and consequent colonization of high altitude towns by the genus, after the occurrence of minimum ecological conditions installed (Machado et al., 2011).

MATERIALS AND METHODS

The study was conducted in the towns of Ouro Preto, at 1100 m mean altitude above sea level and annual mean temperatures lower 19ºC, and Mariana, at 750 metres above sea level and mean temperatures between 19ºC and 22ºC (IGA, 1995 apud Amaral, 2009). Two urban green areas were chosen for this work. The green area in Ouro Preto is a private landscape garden made mostly of native trees, situated in the historic centre, and has approximately 1.4 ha. The green area in Mariana is a waste land, partially covered with pioneer, spontaneous trees, has approximately 2.0 ha and is located in the of Rosario, suburban neighborhood.

The collection was performed using ovitraps for the collection of mosquitoes eggs. At the edges of each green area we set three blocks B1, B2 and B3, distant approximately 30m from the pavement. The blocks were distant 50 meters from each other (except B1 and B2 in Ouro Preto which were separated by only 20 m). Each block was composed of 10 ovitraps, summing up 30 ovitraps per area. Two buildings in each town, at 50 meters far from the edge of the fragments, were used as house habitats. The outside (garden, yard) of each building were used to install 10 ovitraps, thus summing up 50 traps in each city. Samples were done between March to May 2009 (13 samples) and March to April 2011 (period of highest Aedes abundance in 2009).

Data Analysis

We performed a two-way ANOVA to test the present hypotheses. To check whether differences in total abundance of *Ae. aegypti* and *Ae. albopictus* were significant in scale ovitraps was performed paired t-test. The Spearman correlation coefficient was used to investigate the correlation between the abundance of both species.

RESULTS

Preliminary results here presented correspond to five samples taken between March 12, 2009 to April 16, 2009, only to green areas. We collected 2,243 immature larvae and pupae of the species *Aedes aegypti* (N = 414) and *Ae. albopictus* (N = 1829). In total, 1,589 were collected immature Mariana, and 314 corresponding to *Ae. aegypti* and 1275 *Ae. albopictus*. In Ouro Preto, 654 of 100 belong to the immature *Ae. aegypti* and 554 *Ae. albopictus.*

The abundance of *Ae. albopictus* was significantly greater than that of *Ae. aegypti* in both averaged scale (ANOVA, F 1, 20 = 16.2, p <0.001) as at trap scale (pared t-test, t = 7.5 p <0.001). Considering the two species together, the number of individuals was higher in Mariana (ANOVA, F 1, 20 = 7.1, p <0.017), and there was no significant interaction between species and site (ANOVA, F 1, 20 = 2.1, p <0.169).

In the analysis with each species separately to test the effects of period of sampling and place was found for *Ae. aegypti* a significantly higher abundance in Mariana than in Ouro Preto (ANOVA, F 1, 20 = 8.23, p <0.01). There was no significant difference between the sampling dates (ANOVA, F 1, 20 = 1.78, p <0.17), although a marginally significant interaction between this variable and site occurred (ANOVA F 4, 20 = 2.50, p <0.07), due to a inversion in the abundance of *Ae. aegypti* in the fifth sampling date, while abundances decreased in Mariana and increased in Ouro Preto (Figure 1).

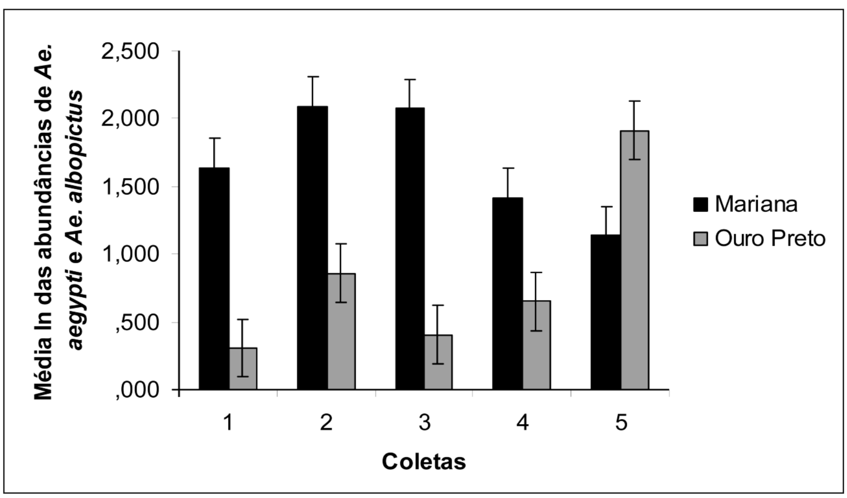

Figure 1. Average total abundance of immature *Ae. albopictus* and *Ae. aegypti* in every collection in the green areas of Mariana and Ouro Preto.

The abundance of *Ae. albopictus* was also significantly higher in Mariana (F 1, 20 = 39.4, p <0.001). However, the effect of sampling dates was not significant (ANOVA F 4 20 = 3.6, p <0.24). For *Ae. aegypti* a significant interaction between sampling period and site was found (ANOVA F 4; 20 = 9.7, p <0.001), due to, again, to a inversion in abundance in the fifth sampling date, thus when Ouro Preto presented a higher number of immature (Figure 2).

Mariana presented higher abundance than Ouro Preto also when the two species are analyzed together (F 1, 20 = 38.7, p <0.001). However, the effect of sampling period was not significant (ANOVA F 4; 20 = 2.7, p <0.061). Again the interaction between site and sampling period was significant (ANOVA F 4; 20 = 10.0, p <0.001). There was found a correlation between the abundances of *Ae. albopictus* and *Ae. aegypti* at the scale of each block, all blocks per site and sampling period. That is, favorable locations and dates for one species were also favorable to the other (rho = 0.27, p <0.001).

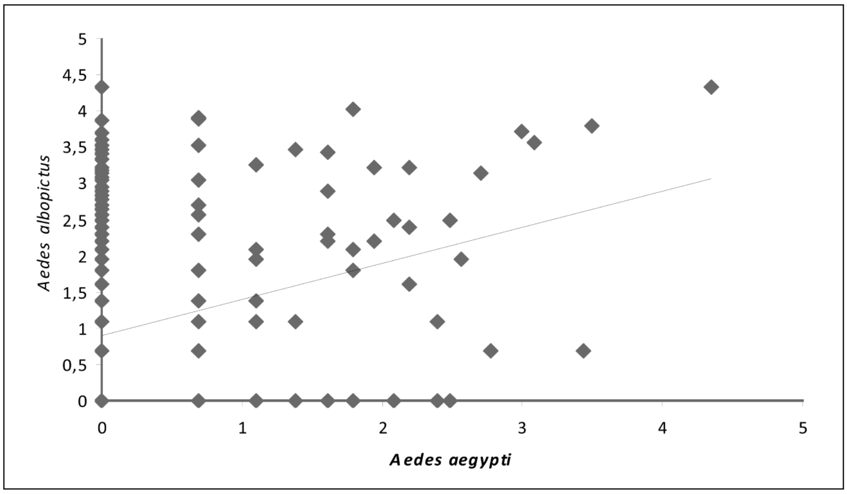

Figure 2. Relationship between the abundances of *Ae. aegypti* and *Ae. albopictus* considering each of the three blocks, with ten ovitraps, as samples from different locations and dates (rho = 0.27, p <0.001).

DISCUSSION

The greatest abundance of *Ae. albopictus* (81.5%) in both areas corroborates that this species has ecological demands typically related to open vegetated habitats. From the epidemiological point of view, the infestation of *Ae. albopictus* in the two areas studied may represent a public health problem, if considering the potential of the species of acting as vector of several arboviruses (Hawley, 1988). The presence of *Ae. aegypti* is also of great importance both for being the exclusive vector of dengue in the country and also a vector of urban yellow fever (Urbinatti, 2004), and by having been found in both green and household habitats. Regarding the presence of both species one must be consider that the virus circulation and eventual establishment (of different serotypes of dengue) may be enhanced in the towns studied due to increasing touristic flow in the region.

The highest abundance of *Ae. albopictus* and *Ae. aegypti* in Mariana may be related to site temperature, since Mariana has higher average temperatures due to its lower altitude compared to Ouro Preto. This positive relationship between *Aedes* abundance and temperature has been commonly described in literature (Machado et al., 2011).

Aedes aegypti and *Ae. albopictus* showed a similar population variation in time and space. Thus, the species seem to coexist in the study sites, with no clear temporal niche separation, although there was a obvious prevalence of *Ae. albopictus* due to its greater plasticity and ability to distribute their eggs among different types of breeding (artificial and natural).

In general these preliminary results demonstrate the need for studies on urban green areas in order to verify the existence and density of vector species, as these species may pose risks of disease transmission in the region in which they operate. The knowledge of the vectors in these places can be extremely important for vector control measurements and monitoring population for epidemiological surveillance, aiming to contribute to the prevention and control measures more effective.

CONCLUSION

We found immature *Ae. aegypti* and *Ae. albopictus* in the green areas of Mariana and Ouro Preto, and *Ae. albopictus*, the most abundant species. The green area in Mariana showed greater abundance of both species compared to Ouro Preto. It was found that the species found appear to coexist in the study sites, with no temporal niche separation. The presence of vectors in the green areas shows the importance of studies in these locations for prevention and vector control in the region.

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