

BED BUG (HETEROPTERA, CIMICIDAE) INFESTATIONS IN THE METROPOLITAN REGION OF SÃO PAULO, BRAZIL

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Abstract Once common, infestations caused by these hematophagous insects practically disappeared at the 1950's. However, its recurrence has been observed in several countries, including Brazil. This fact, although concerning, lacks deeper studies. The objective of this research was to describe bed bugs overrun situation in the metropolitan region of São Paulo from 2004 to 2009. Reports of infestations were provided by private companies of pest control and by public institutions of control and surveillance in the metropolitan region of São Paulo. There were received 369 bed bugs occurrence records during this study. *Cimex lectularius* was the predominant species. São Paulo city reports are concentrated in regions where socioeconomic indices are higher. Probably underreporting occurs throughout the region.

Key Words *Cimex lectularius*

INTRODUCTION

Cimicidae family insects are popularly known as bed bugs. They are reddish-brown insects with a small body size. All members of this family are known as blood-feeding insects and two species, *Cimex lectularius* (L) and *Cimex hemipterus* (F), have distinct anthropophilic behavior, which makes their infestations very important (Usinger, 1966; Forattini, 1990).

After decades of rare occurrences, bed bugs infestations started showing intense growth in several countries (Doggett et al., 2004). While in Brazil the increase in the number of infestations has been informally reported, the nuisance generated by infestations is not considered a relevant reason to justify the compulsory notification in a surveillance system. Therefore, research projects that aim the knowledge of the current situation of bed bugs infestations are essential because they can contribute to the better understanding of the adaptation process of these insects' populations to the human environment. Besides, those studies can also provide subsidies for enabling rapid identification techniques for the infestations.

The objective of this study was to describe bed bugs overrun situation in the metropolitan region of São Paulo (MRSP) from January 2004 to December 2009, investigating, at the same time, possible socioeconomic relationship between those infestations in São Paulo.

MATERIALS AND METHODS

Reports of bed bug infestations that occurred in MRSP were requested from 78 private companies of pest control and 43 public institutions involved in the research, identification, surveillance and control of insects and vectors. The reports were requested by telephone or electronic means. The main points of the project were clarified. After the confirmation of joining in the research, the collaborators received a data collection sheet to be filled with information about bed bugs infestations held on their records of bug termination and/or notification, respectively. For this purpose, two slightly different sheets were made and delivered, one to private companies and the other one to public institutions.

The data studied were: address of occurrence, date of occurrence, complainant agent (residential or commercial and/or service establishments), infestation focus and species. Reports from São Paulo city were divided once by district and then again by: occurrences recorded in residences and occurrences recorded at commercial and/or service establishments (hotels, hostels, cinemas etc.). Values of Human Development Index (HDI) and per capita income were obtained for each district.

Data Analysis

The data was analyzed defining the distribution and frequency of each variable. Windows Office Excel 2007 software was used for management and analysis of databases. The effect of socioeconomic indicators in São Paulo city notifications was verified through Multivariate regression analysis. The dependent variables (y) were: occurrence of bed bugs in residences and occurrence of bed bugs in commercial and/or service establishments. The explanatory variables (x) were: HDI and per capita income. Multivariate regression analysis was processed through the program SPSS 15.0 for Windows.

RESULTS AND DISCUSSION

A total of 369 occurrences of bed bugs infestations were reported in the MRSP. From these, 269 were provided by public research, identification, surveillance and control institutions, representing 72.9% of the amount. Despite the low number of cases registered by private companies if compared to public institutions, there was a higher prevalence of occurrences in the first one (33.3%) than it was in the second (25.6%). The prevalence of the total collaborators was 30.58%.

Hwang et al. (2005), however, reported a prevalence of 59% on records of bed bugs infestations at pest control companies in Toronto (Canada), in 2003, and Fickle et al. (2009) reported a prevalence of 72% on private companies at the island of Oahu (Hawaii) in the year of 2007. These values are still much higher than those found in this study and they indicate that the MRSP occurrences are poorly notified by the population.

As a result, it is possible to assume that there has been underreporting of infestations by bed bugs in the MRSP, since there is no entomological surveillance programme targeted to detect these infestations in Brazil so far, which, as a consequence, would possibly increase the number of cases registered.

Among the total records, 325 were placed at São Paulo city (88.1%) and 44 at the neighbouring municipalities (11.9%). Out of the 39 cities in the MRSP, 17 (43.6%) reported at least one record, showing that, despite the low frequency of occurrence reports presented by most cities, the infestations occur unevenly in the region.

In general, the number of records showed a significant increase, from 50 occurrences in 2004 to 82 events in 2009 (table 1). We cannot, however, assert that the infestations in the municipalities studied are increasing with a similar pattern to that observed in other countries, that because there are not known scientific data available about the early occurrence of bed bugs in the MRSP, but informal and sparse reports. The short period of data collection also turns difficult a deeper analysis about the ascending or descending tendency in the reports.

Table 1. Distribution and frequency (%) of bed bugs occurrence reports by year. MRSP, 2004 to 2009.

ANO	Nº	%
2004	50	13,6
2005	53	14,4
2006	67	18,2
2007	67	18,2
2008	50	13,6
2009	82	22,2
TOTAL	369	100

The infestations were recorded in a wide variety of environments, demonstrating the great adaptability of bed bugs. However, the majority of the reports pointed to the residences, might that be houses or apartments, as the most common location, with 48.2% of the reports (Table 2).

Only 187 records indicated the infestation focus. In 77 of them (41.18%), the findings were restricted to only one type of furniture. However, in 110 records (58.82%) they were present in more than one type of furniture or room of the house, indicating delay in diagnosis. According to the records, *C. lectularius* was the predominant species, accounting for 92.3% of the reports. *C. hemipterus* appeared in only one report.

Among the 31 districts in São Paulo city, 30 submitted at least one report. The number of cases increased along with the HDI and the per capita income (Figures 1 and 2).

Table 2. Distribution and frequency (%) of bed bugs occurrence reports by complainant agent. MRSP, 2004 to 2009.

COMPLAINANT AGENT	Nº	%
House	116	31,4
Apartment	62	16,8
Hostels	39	10,6
Hosting services	22	6,0
Nursery	4	1,1
Housing cores	3	0,8
Movie theater	3	0,8
Prision	3	0,8
Others	15	4,1
Reports not informed	102	27,6
TOTAL	369	100

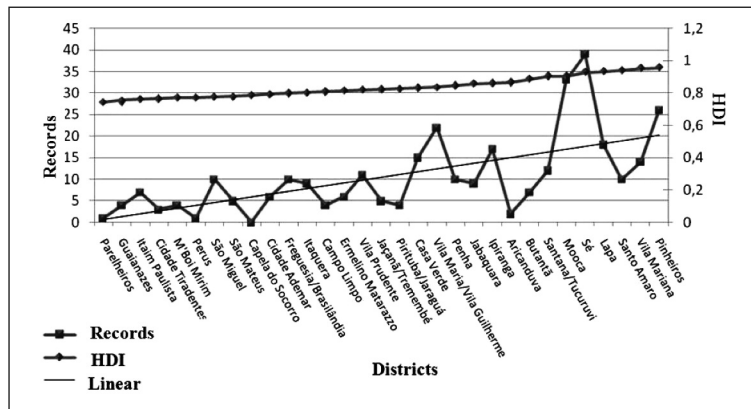


Figure 1. H I and total number of occurrences of bed bugs by districts of São Paulo. São Paulo, 2004 to 2009.

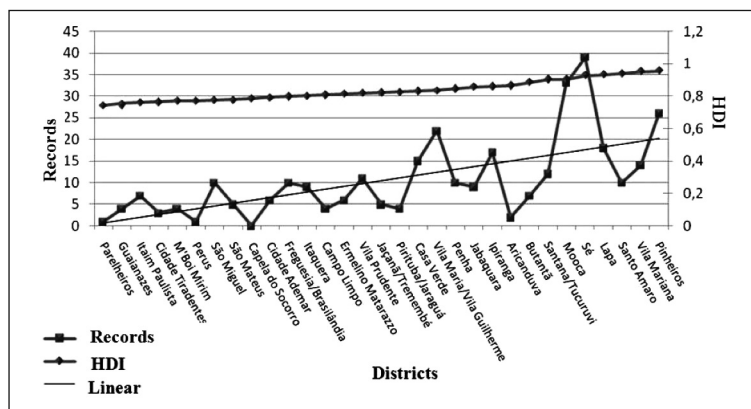


Figure 2. Per capita income (R\$) and total number of bed bugs by districts of São Paulo. São Paulo, 2004 to 2009.

The multivariate regression explained 45.9% ($r^2 = 0.459$) of the variability in the number of residential occurrences and 42.7% ($r^2 = 0.427$) of the variability in the number of occurrences at commercial and/or service establishment in relation to socioeconomic indicators (Figures 3 and 4, respectively).

Historically, bed bugs have always been strongly related to low levels of socioeconomic and health conditions of the affected population. However, the current infestations appear to be more associated with high flow and large concentration of people, as described by Reinhardt and Siva-Jothy (2007) and Wang et al. (2010).

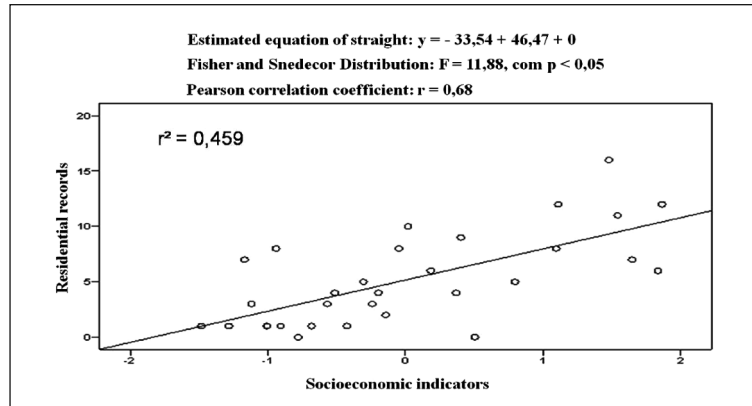


Figure 3. Average effect of socioeconomic indicators in relation to the number of bed bugs records in São Paulo residences between 2004 and 2009.

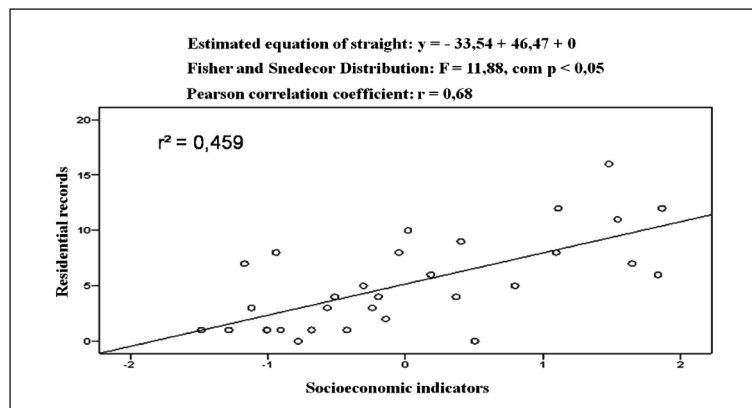


Figure 4. Average effect of socioeconomic indicators in relation to the number of bed bugs records in commercial and/or service establishments of São Paulo between 2004 and 2009.

CONCLUSIONS

The records indicate that bed bugs infestations occurred regularly in the metropolitan region of São Paulo from January of 2004 to December of 2009. The results showed a significant positive correlation between higher socioeconomic patterns and high number of cases reported in São Paulo. The data suggests that underreporting is not only due to population economic conditions. According to the statistical analysis, the HDI had a greater effect than the per capita income in the number of occurrences, which might imply that behavioural or social aspects also measured by this indicator, stimulate the notifications.

REFERENCES CITED

- Doggett, S.L., Geary, M.J. and Russell, R.C. 2004.** The resurgence of bed bug in Australia: with notes on their ecology and control. *Environ Health*. 4(2):30-38.
- Fickle, V.J., Yang, P. and Olmsted, G.K. 2009.** Examination of Bed Bug (*Cimex lectularius* Linnaeus) Infestations on the Island of Oahu, Hawaii. *Hawaii J Pub Health*. 1(1):36-39.
- Forattini, O.P. 1990.** The cimicidae and their importance in public health (Hemiptera-Heteroptera; Cimicidae). *Rev Saúde Pública*. 24(supl): 1-37.
- Hwang, SW, Svoboda, T.J., De Jong, I.J., Kabasele, K.J. and Gogosis, E. 2005.** Bed bug Infestations in an urban environment. *Emerg Infect Dis*. 11(4):533-538.
- Reinhardt, K. and Siva-Jothy, M.T. 2007.** Biology of the bed bugs (Cimicidae). *Ann Rev. Entomol*. 52:351-374.
- Usinger, R.L. 1966.** Monograph of Cimicidae (Hemiptera: Heteroptera). Vol. VII. Lanham: Thomas Say Foundation.
- Wang, C., Saltzmann, K., Chin, E., Bennett, G.W. and Gibb, T. 2010.** Characteristics of *Cimex lectularius* (Hemiptera: Cimicidae), infestation and dispersal in a high-rise apartment building. *J Econ Entomol*. 103(1): 172-177.