



Journal of Nursing

Revista de Enfermagem

UFPE On Line

ISSN: 1981-8963

ORIGINAL ARTICLE

LARVAL INFESTATION INDICATORS AND ENVIRONMENTAL FACTORS RELATED TO IMPACT OF DENGUE

INDICADORES DE INFESTAÇÃO LARVÁRIA E FATORES AMBIENTAIS RELACIONADOS COM INCIDÊNCIA DE DENGUE

INDICADORES DE INFESTACIÓN LARVARIA Y LOS FACTORES AMBIENTALES RELACIONADOS CON EL IMPACTO DEL DENGUE

Ana Flávia de Moraes Oliveira¹, José Rodrigues do Carmo Filho², Ana Luiza Lima Sousa³, Denismar Borges de Miranda⁴

ABSTRACT

Objective: relating the distribution of cases of dengue and its features. **Method:** an observational, analytical, ecological and retrospective study conducted with secondary data (2000-2010) of cases of dengue and its environmental characteristics in Araguaína (TO), Brazil. There was calculated the Pearson's Correlation between the variables, considering a significance level of 5%. **Results:** there were reported 13,969 suspected cases of dengue, and confirmed 4,657 (33.3%), of these 63 (1.4%) were classified as serious. It was identified a significant correlation between the occurrence of dengue cases and index of infestation rate ($p=0.0003$ and $r=0.7$), pending index ($p=0.0005$ and $r=0.8$) and rainfall ($p=0.003$ and $r=0.7$). There was no significant correlation between the occurrence of dengue and temperature ($p=0.5$ $r=-0.19$). **Conclusion:** the index of infestation rate, pending index, rainfall are correlated to the increased occurrence of dengue cases in Araguaína (TO). **Descriptors:** Dengue; Demography; Environment.

RESUMO

Objetivo: correlacionar a distribuição dos casos de dengue e suas características. **Método:** estudo observacional, analítico, ecológico e retrospectivo realizado com dados secundários (2000 a 2010) de casos de dengue e suas características ambientais em Araguaína (TO), Brasil. Foi calculada a Correlação de Pearson entre as variáveis, considerando nível de significância de 5%. **Resultados:** foram notificados 13.969 casos suspeitos de dengue, sendo confirmados 4.657 (33,3%), destes 63 (1,4%), classificados como graves. Identificou-se correlação significativa entre ocorrência de casos de dengue e índice de infestação predial ($p=0,0003$ e $r=0,7$), índice de pendência ($p=0,0005$ e $r=0,8$) e precipitação pluviométrica ($p=0,003$ e $r=0,7$). Não houve correlação significativa entre a ocorrência de casos de dengue e temperatura ($p=0,5$ $r=-0,19$). **Conclusão:** o índice de infestação predial, índice de pendência, pluviosidade estão correlacionados ao aumento da ocorrência de casos de dengue em Araguaína (TO). **Descritores:** Dengue; Demografia; Meio Ambiente.

RESUMEN

Objetivo: relacionar la distribución de los casos de dengue y sus características. **Método:** estudio observacional, analítico, ecológico y retrospectivo realizado con datos secundarios (2000-2010) de los casos de dengue y sus características ambientales en el medio ambiente en Araguaína (TO), Brasil. Correlación de Pearson fue calculado entre las variables, considerando un nivel de significación del 5%. **Resultados:** se registraron 13.969 casos sospechosos de dengue, y confirmaron 4.657 (33,3%) de estos 63 (1,4%) fueron clasificados como graves. Se identificó una correlación significativa entre la aparición de casos de dengue y la tasa de infestación edificio ($p=0,0003$ y $r=0,7$), en espera de índice ($p=0,0005$ y $r=0,8$) y la precipitación ($p=0,003$ y $r=0,7$). No hubo correlación significativa entre la ocurrencia de dengue y la temperatura ($p=0,5$ $r=-0,19$). **Conclusión:** la tasa de infestación de la construcción, a la espera de índice, las precipitaciones se correlaciona con el aumento de la incidencia de casos de dengue en Araguaína (TO). **Descriptor:** Dengue; Demografía; Medio Ambiente.

¹Nurse, Public Health Specialist, Master of Environmental and Health Sciences. Araguaína (TO), Brazil. Email: enf.anamorais@gmail.com;

²Nurse, Professor Specialist in Epidemiology, Master of Tropical Medicine, Doctor of Science, Biomedical and Lawyer, Departments of Medicine, Nursing, Biomedicine, Mastership of Environmental Science and Health, PUC/GO. Goiânia (GO), Brazil. Email: biomedico53@gmail.com;

³Nurse, Professor Specialist in Public Health, Master of Education, Doctor of Public Health, School of Nursing, Health Sciences Program, College of Medicine, Federal University of Goiás/UFG. Goiânia (GO), Brazil. Email: demmilima@gmail.com;

⁴Nurse, Specialist in Management Systems and Health Services from the University of Brasília, Pediatrics and Neonatology Nursing, Master of Health, Environment and Labor, Doctor student in Epidemiology at the Institute of Tropical Medicine and Public Health/UFG. Goiânia (GO), Brazil. Email: denismarmiranda@hotmail.com

INTRODUCTION

Dengue is an acute febrile infectious disease widespread in the entire Brazilian territory, with the sole vector *Aedes aegypti*.¹⁻² Urban growth and deficiencies in sanitation infrastructure, as well as the favorable environmental conditions contribute to vector adjustment at home and peridomicile.³

Brazil also has locations with structural deficiencies. The permanence of garbage concentrations or unusable materials in inappropriate places and the lack of sanitation, contributing to the increase of vector infestation.³⁻⁴ The infestation index predial⁵ (IIP) reflects these conditions by identifying the percentage of real estate where larvae of *A. aegypti* were found from all properties inspected by Endemic Disease Control Agents (ACE).

Another relevant factor is the permanence of potential breeding grounds in real estate not inspected. This is identified by the pendency rate⁵ (IP), which assesses the percentage of properties were not inspected by ACE for refusal or the property meet closed at the time of inspection in relation to the total inspected properties.

The environmental factor should also be taken into account, given that high rainfall, as high temperatures are closely correlated with the occurrence of dengue.⁶ The environmental factor, although it is far from being fully understood, is of fundamental importance to the execution of studies that relate to human health.⁶⁻⁷

The aim of this study is to correlating the distribution of cases of dengue and its environmental characteristics.

METHOD

Observational, analytical, ecological and retrospective study conducted with secondary data for the period from 2000 to 2010, in order to analyze the frequency and distribution of dengue cases we used information included in the Notifiable Diseases Information System (SINAN) and the variables referred to the IIP and IP available in the Information System of Yellow Fever and Dengue (SISFAD).

The city of Araguaína/GO has a population of 150.520 inhabitants, with population density of 37,6 inhabitants/km², tropical climate with an average maximum temperature of 32°C and a minimum of 20°C.

The seasons are divided into two well-defined periods; the rainy season that occurs between November and May, and the dry season that occurs between the months of June to October, with an annual rainfall above 1.700mm.⁸

Information regarding the average monthly temperature and rainfall were obtained from the Ministry of Agriculture of Tocantins, in the meteorological station of Araguaína (TO), located at the School of Veterinary Medicine/Animal Science of the Federal University of Tocantins.

The cases of confirmed dengue were classified as classic dengue (DC), dengue with complications (DCC) and hemorrhagic dengue fever (DHF) and dengue shock syndrome (DSS). DCC cases, DHF and DSS, for resolutions of this study were categorized as severe dengue (DG).

The criteria adopted for confirmation of cases of dengue fever were clinical/epidemiological/laboratory and for severe cases the criterion was exclusively laboratory.⁹

The IPI was classified as: satisfying (<1%), warning status (1% to 3,9%) and risk of outbreak (> 3,9%).⁹ To obtain IIP it was used (positive estate/total real estate inspected x 100). But the IP is considered satisfactory when: <10%.⁹ The IP was obtained through the following calculation (closed real estate or refusals/total of properties inspected x 100).

The correlations were analyzed between the monthly average of confirmed dengue cases with IIP, IP, temperature and average monthly rainfall through the Pearson correlation coefficient. There was considered 5% statistical significance level.

RESULTS

During the period 2000-2010, there were reported 13,969 suspected dengue cases, with 4,657 confirmed cases, of which 4,594 (98.6%) were classified as DC, 63 (1.4%) as DG, and these evolved an individual to death.

The higher frequency of DC cases were identified from January to May (3,575; 76.7%) and the DG in the months from September to December (52; 82.5%). The monthly average of IIP was higher in the months from January to May and the IP in the months from July to December. The average monthly rainfall was higher in the months from October to May. The monthly average temperature had little variation (Table 1).

Table 1. Distribution of the number and proportion of classical and serious cases of dengue fever, and severe infestation index, index of pending and average monthly precipitation and temperature in the municipality of Araguaína (TO), in the period from 2000 to 2010.

Month	Classical Dengue		Serious Dengue		Index of Infestation Rate (IIP)	Index of Pendency (IP)	Precipitation	Temperature
	n	%	n	%	%	%	Average	Average
Jan	606	13.19	0	0.00	3.04	7.56	249.38	27.91
Feb	845	18.39	0	0.00	1.98	7.18	321.09	27.78
Mar	794	17.28	1	1.59	2.72	7.26	299.70	27.86
Abr	779	16.96	1	1.59	1.97	7.58	258.95	27.93
May	551	11.99	1	1.59	1.44	7.95	102.79	28.09
Jun	261	5.68	2	3.17	0.45	8.30	16.65	27.02
Jul	107	2.33	2	3.17	0.23	10.52	10.30	26.99
Aug	78	1.70	4	6.35	0.19	9.64	18.12	27.93
Sep	35	0.76	7	11.11	0.30	10.69	67.73	28.98
Oct	73	1.59	13	20.63	0.67	10.70	144.07	28.59
Nov	194	4.22	13	20.63	1.87	10.86	195.48	28.26
Dec	271	5.90	19	30.16	2.09	11.89	247.69	28.39
Total	4,594	100.00	63	100.00	-	-	-	-

Source: INMET/SINAN-SES/TO

Positive correlation of identified cases of dengue with IIP ($p=0.0003$, $r=0.76$) and IP ($p=0.0005$, $r=0.84$) (Figure 1 and 2).

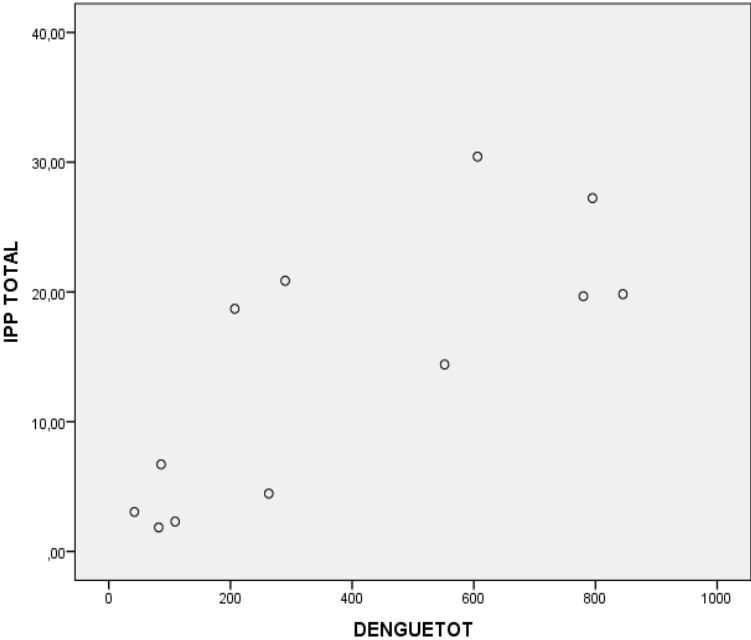


Figure 1. Correlation of the index of infestation rate and the monthly average of dengue cases in the city of Araguaína (TO), from 2000 to 2010. Source: SINAN/SISFAD/SES/TO.

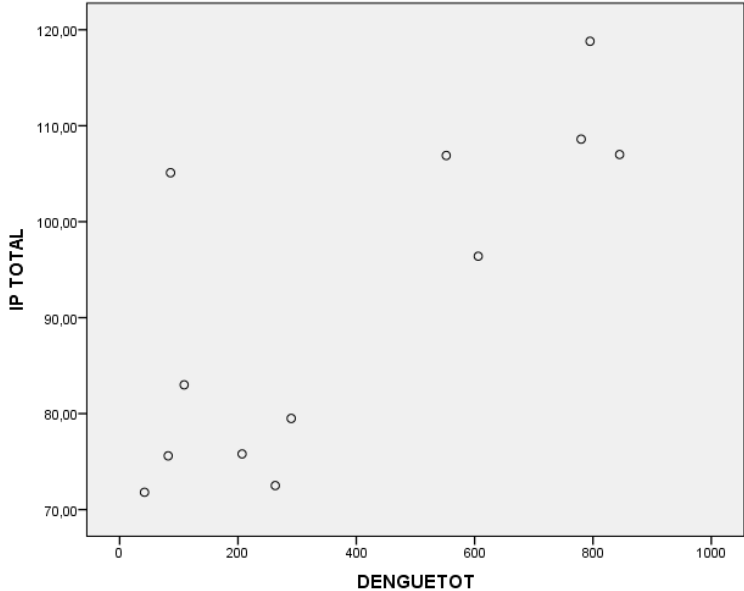


Figure 2. Correlation of the index of pendency and the monthly average of dengue cases in the city of Araguaína (TO), in the period 2000-2010.Source: SINAN/SISFAD/SES/TO

There was a correlation between dengue cases and the average monthly rainfall ($p=0.003$, $r=0.76$) (Figure 3). There was no significant correlation between the frequency of cases of dengue and the monthly average temperature ($p=0.5$ $r= -0.19$).

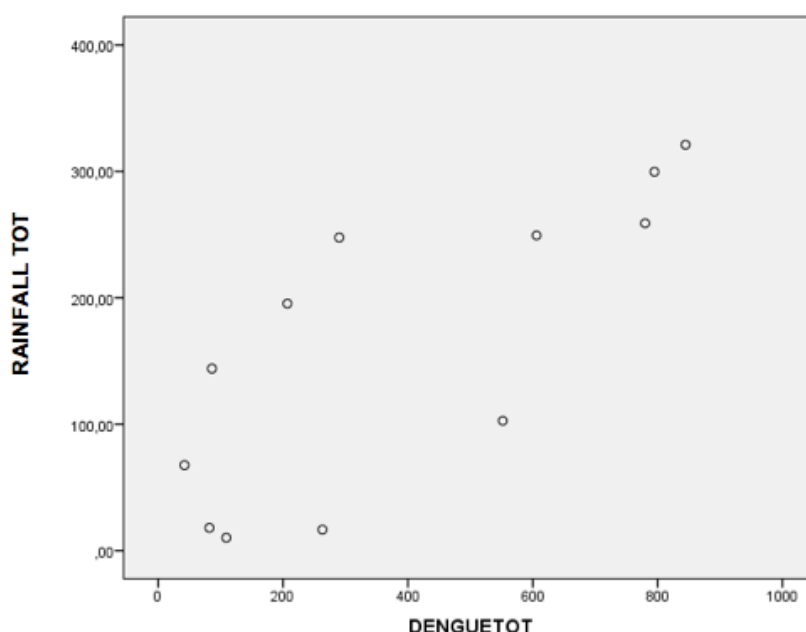


Figure 3. Average monthly correlation of rainfall and monthly average of dengue cases in the city of Araguaína (TO), in the period 2000-2010. Source: INMET/SINAN-SES/TO

DISCUSSION

In this study there was a predominance of DC, following the standard of other studies.¹⁰⁻¹³ Some indicators used to monitor dengue acting as a predictive factor in epidemic risk situations. Constant monitoring of IIP is essential to define the areas of greater or lesser risk of transmission of this disease.⁵ The municipality of Araguaína (TO) showed variations related to the monthly average of IIP between alert and satisfactory situation. IIP was observed higher in the period defined as rainy, favoring the existence of as many breeding contributing to vector proliferation. A similar result was found in a study conducted in São Sebastião (SP) and São Luis (MA), which showed high vector density in the first and last months of the year.^{11,14}

In the situation under study the positive correlation between reported cases of dengue and the IIP indicated increased risk of occurrence of this disease, corroborating with surveys conducted in the States of Alagoas, Paraíba and Piauí.^{10,15-6}

Between the largest IP analyzed there were recorded in the rainy season, as well as higher frequency of DG.¹⁷ The high IP has serious negative implications for injury control strategy. This may show weakness in operational service field, leading to the maintenance of containers with possibility of increasing density and vector infestation in several locations, in order that the environment there are various breeding that do not depend on rain for keeping focus of

vector, as disused swimming pools, water tanks and cisterns uncovered, among others.

It also noted a positive correlation between the occurrence of dengue cases and the IP, such a result diverged from the study presented in Teresina (PI), and surely this difference is related to methodological differences used in the studies. In the study in the screen analysis there was performed in the municipality in general, while the other was added by strata.¹⁶

In Araguaína (TO), there were not investigated the determining reasons for the high IP. While in the city of São José do Rio Preto (SP) the reasons for refusal were suspicion of theft, racism, constant presence of service on the property.⁶

There is a correlation between high temperature and the incidence of dengue.¹⁶ However, in the municipality of Araguaína (TO), despite the low variation of the average temperature, with a predominance of high temperatures throughout the year there was not demonstrated this correlation. A similar result was found in São Luís-MA¹¹, but diverging from what occurred in other regions.^{15,16} The temperature has a direct influence on vector infestation making favorable playback.^{16,18}

Dengue epidemics usually begins in less wet season, which suggests a viral movement closely linked in the hottest season of the year.¹¹ Even though there is low rainfall *A. aegypti* can play in private homes depositing their eggs during the rainy season, hatching when rainfall decreases and the temperatures increase.¹¹

Study on the occurrence of dengue and the weather in Rio Janeiro¹⁶, in the state and in other states^{15-6,19} there was observed that epidemics began when temperatures were significantly higher suggesting the temperature as critical to the beginning of epidemics.

In the municipality of Araguaína (TO) the increased incidence of dengue has seasonal characteristics, related to the rainy season. A similar result was found in a study conducted in Teresina (PI), São Luís (MA) and Mossoró (RN).^{11-2,14} On the other hand, in Roraima the results were different, and the incidence of dengue was not associated or correlated with seasonal changes.²⁰ This we demonstrate the dengue occurrence surges can occur independently of the climatic variables.²¹

This study showed some limitations such as lack Registration vector monitoring during 2000, so that there were no statistical analyses this year regarding the IIP and IP.

CONCLUSION

In Araguaína (TO) among confirmed cases of dengue the highest prevalence was in classic form, with benign evolution.

Increased rainfall, IIP and IP are correlated with an increased occurrence of dengue cases, but there was no significant correlation with the monthly average temperature.

REFERENCES

1. Pan American Health Organization. Guidelines for the prevention and control of dengue and dengue hemorrhagic fever in the Americas [Internet]. Washington, DC: PAHO; 1994 [cited 2015 feb 20]. Available from: <http://www.who.int/csr/disease/dengue/en>
2. Lucena LT, Aguiar LO, Bogoevich ACA, Azevedo FS, Santos ACP, Vale DBAP et al. Dengue na Amazônia: aspectos epidemiológicos no Estado de Rondônia, Brasil, de 1999 a 2010. Rev pan-amaz saúde [Internet]. 2011 [cited 2015 Jan 22];2(3):19-25. Available from: <http://scielo.iec.pa.gov.br/pdf/rpas/v2n3/v2n3a03.pdf>.
3. Barbosa GL, Donalísio MR, Stephan C, Lourenço RW, Andrade VR, Arduino MB et al. Spatial distribution of the risk of dengue and the entomological indicators in Sumaré, State of São Paulo, Brazil. Plos neg trop dis [Internet]. 2014 [cited 2015 Feb 22];8(5):1-9. Available from: <http://www.plosntds.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pntd.0002873&representation=PDF>.

4. Almeida AS, Medronho RA, Valencia LIO. Análise espacial da dengue e o contexto socioeconômico no município do Rio de Janeiro, RJ. Rev saúde pública [Internet]. 2009 [cited 2015 Feb 01];43(4):666-73. Available from: <http://www.scielo.br/pdf/rsp/v43n4/493.pdf>.
5. Wemeling ED, Cohen SC, Thaumaturgo C, Silva AA, Ramos FAF, Souza MB. Avaliação do acesso aos criadouros do *Aedes aegypti* por agente de saúde do programa saúde da família do município do Rio de Janeiro. Rev baiana saúde pública [Internet]. 2008 [cited 2015 jan 15];32(2):151-8. Available from: <http://inseer.ibict.br/rbsp/index.php/rbsp/article/viewFile/1403/1058>.
6. Ferreira AC, Chiaravalloti Neto F. Infestação de área urbana por *Aedes aegypti* e relação com níveis socioeconômicos. Rev saúde pública [Internet]. 2007 [cited 2014 Dec 28];41(6):915-22. Available from: <http://www.scielo.br/pdf/rsp/v41n6/6136.pdf>.
7. Santos IM, Calado D. Captura de mosquitos antropofílicos (Diptera, Culicidae) em uma área urbana da região oeste da Bahia, Brasil. Iheringia sér zool [Internet]. 2014 [cited 2015 Feb 10];104(1):32-8. Available from: <http://www.scielo.br/pdf/isz/v104n1/04.pdf>.
8. Brasil. Instituto Brasileiro de Geografia e Estatística. Dados socioeconômicos de 2010 [Internet]. [cited 2014 Apr 25]. Available from: <http://www.ibge.gov.br/estadosat/temas.php?sigla=to&tema=2010>
9. Brasil. Ministério da Saúde. Diretrizes nacionais para prevenção e controle de epidemias de dengue [Internet]. Brasília: Ministério da Saúde, 2009. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/diretrizes_nacionais_prevencao_controle_dengue.pdf.
10. Fernandes DR, Santos EA, Araújo AFDV, Zannoni C, Sardinha AHL, Rodrigues ZMR. Epidemiologia da dengue em São Luís - Maranhão, Brasil, 2000 a 2007. Cad pesqui (são luis) [Internet]. 2013 [cited 2015 Jan 03];20(2):68-75. Available from: <http://www.periodicoeletronicos.ufma.br/index.php/cadernosdepesquisa/article/view/1795/1420>
11. Neto SG, Rebêlo JMM. Aspectos epidemiológicos do dengue no município de São Luís, Maranhão, Brasil, 1997-2002. Cad saúde pública [Internet]. 2004 [cited 2014 Dec 22];20(5): 1424-31. Available from: <http://www.scielo.br/pdf/csp/v20n5/39.pdf>.

12. Evangelista LSM, Oliveira FLL, Gonçalves LMF. Aspectos epidemiológicos do dengue no município de Teresina, Piauí. BEPA, bol epidemiol paul [Internet]. 2012 [cited 2015 Feb 22];9(103):32-9. Available from: <http://periodicos.ses.sp.bvs.br/pdf/bepa/v9n103/v9n103a04.pdf>.

13. Pinto DPSR, Gaetti-Jardim EC, Loureiro MDR, Cunha RV, Quintanilha ACF, Ferreira Júnior MA. Aspectos epidemiológicos e clínicos dos casos de internação hospitalar durante epidemia de dengue. Rev enferm UFPE on line [Internet]. 2014 [cited 2015 jan 22];8(6):1568-76. Available from: http://www.revista.ufpe.br/revistaenfermage/index.php/revista/article/view/5787/pdf_5246.

14. Ribeiro AF, Marques GRAM, Voltolini JC, Condino MLF. Associação entre incidência de dengue e variáveis climáticas. Rev saúde pública [Internet]. 2006 [cited 2014 Nov 13];40(4):671-6. Available from: <http://www.scielo.org/pdf/rsp/v40n4/17.pdf>

15. Lima EA, Firmino JLN, Filho MG. A relação da previsão da precipitação pluviométrica e casos de dengue nos Estados de Alagoas e Paraíba nordeste do Brasil. Rev bras meteorol [Internet]. 2008 [cited 2015 Jan 04];23(3):264-9. Available from: <http://www.scielo.br/pdf/rbmet/v23n3/v23n3a01.pdf>.

16. Monteiro ESC, Coelho ME, Cunha IS, Cavalcante MAS, Carvalho FAA. Aspectos epidemiológicos e vetoriais da dengue na cidade de Teresina, Piauí - Brasil, 2002 a 2006. Epidemiol serv saúde [Internet]. 2009 [cited 2015 Jan 12];18(4):365-74. Available from: <http://scielo.iec.pa.gov.br/pdf/ess/v18n4/v18n4a06.pdf>.

17. Câmara FP, Gomes AF, Santos GT, Câmara DCP. Clima e epidemias de dengue no Estado do Rio de Janeiro. Rev soc bras med trop [Internet]. 2009 [cited 2015 Jan 03];42(2):137-40. Available from: <http://www.scielo.br/pdf/rsbmt/v42n2/v42n2a08.pdf>.

18. Poole-Smith BK, Hemmem RR, Delory M, Felix G, Gonzalez AL, Amador M et al. Comparison of vector competence of *Aedes mediovittatus* and *Aedes aegypti* for dengue virus: implications for dengue control in the Caribbean. Plos negl trop dis [internet]. 2015 [cited 2015 Apr 01];9(2):1-11. Available from: <http://www.plosntds.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pntd.0003462&representation=PDF>.

19. Valadares AF, Filho JRC, Peluzio KM. Impacto da dengue em duas principais cidades

do Estados do Tocantins: infestação e fator ambiental (2000 a 2010). Epidemiol serv saúde [Internet]. 2013 [cited 2015 Jan 12];22(1):59-63. Available from: <http://scielo.iec.pa.gov.br/pdf/ess/v22n1/v22n1a06.pdf>.

20. Oliveira GB, Fonseca ZAAS, Moura ESR, Sousa RS, Araújo LB, Moreira JO et al. Aspectos epidemiológicos do dengue no município de Mossoró, Rio Grande do Norte (2006-2010). Rev patol trop [Internet]. 2012 [cited 2014 Dec 15];41(2):136-44. Available from: <http://www.revistas.ufg.br/index.php/iptsp/article/view/19327/11226>.

21. Siqueira JB, Martelli CMT, Coelho GE, Simplício ACR, Hatch DL. Dengue and dengue hemorrhagic fever, Brazil, 1981-2002. Emerg infect dis [Internet]. 2005 [cited 2015 Feb 20];11(1):48-53. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/15705322>.

Submission: 2015/04/21

Accepted: 2015/11/03

Publishing: 2015/12/01

Corresponding Address

José Rodrigues do Carmo Filho
Rua 222, n. 467 / Ap. 803
Setor Leste Universitário
CEP 74603-160 – Goiânia (GO), Brazil