INTEGRATIVE LITERATURE REVIEW ARTICLE

COPING WITH AEDES AEGYPTI IN THE BRAZILIAN CONTEXT*
ENFRENTAMENTO AO AEDES AEGYPTI NO CONTEXTO BRASILEIRO

Diane Sales Vieira¹, Ítala Keane Rodrigues Dias², Cicerã Luciana da Silva Sobreira³, Francisco Eliazaudo de Britto Júnior⁴, Maria do Socorro Vieira Lopes⁵

ABSTRACT

Objective: to synthesize the actions developed to confront Aedes aegypti in the Brazilian context. Method: this is a bibliographic, descriptive, integrative review study. The search was performed at MEDLINE, LILACS and BDENF. The filters were used: full text available; language (Portuguese, English and Spanish), type of document (article) and year of publication (2013-2018). The process of definition and selection of studies was organized through the PRISMA flowchart. IRAMUTEQ software was used for data processing and analysis. Data was analyzed from Descending Hierarchical Classification and word cloud. Results: 31 studies were selected. Six classes originated with the following strategies: entomo-pathogenic fungi; larval fish; Wolbachia pipientis; RILD and SIT techniques; botanical insecticides; larvicides Diflubenzuron and Deltamidine; Piriproyfen; technological monitoring; regular visits by ACS and ACE; eco-health approach; MIV and campaigns. Conclusion: it is concluded that there are a variety of strategies for coping with arboviruses and how much the improvement and development of innovative techniques for the control of this disease are necessary. Descriptors: Aedes; Mosquito Control; Brazil; Disease Prevention; Arbovirus Infections; Infection Control.

RESUMO

Objetivo: sintetizar as ações desenvolvidas para o enfrentamento ao Aedes aegypti no contexto brasileiro. Método: trata-se de um estudo bibliográfico, descritivo, tipo revisão integrativa. Realizou-se a busca na MEDLINE, LILACS e BDENF. Utilizaram-se os filtros: texto completo disponível; idioma (português, inglês e espanhol), tipo de documento (artigo) e ano de publicação (2013-2018). Organizou-se o processo de definição e seleção dos estudos por meio do fluxograma PRISMA. Utilizou-se o software IRAMUTEQ para o processamento e a análise dos dados. Analisaram-se os dados a partir da Classificação Hierárquica Descendente e da nuvem de palavras. Resultados: selecionaram-se 31 estudos. Originaram-se seis classes com as seguintes estratégias: fungos entomopatogênicos; peixes larvívoros; Wolbachia pipientis; técnicas RILD e SIT; inseticidas botânicos; larvicidas Diflubenzuron e Deltamidine; Piriproyfen; monitoramento tecnológico; visitas regulares pelo ACS e ACE; abordagem ecosalud; MIV e campanhas. Conclusão: conclui-se que há uma variedade de estratégias de enfrentamento às arbovírus e o que são necessários o aperfeiçoamento e o desenvolvimento de técnicas inovadoras para o controle deste agente. Descritores: Aedes; Controle de Mosquitos; Brasil; Prevenção de Doenças; Infecções por Arbovírus; Controle de Infecções.

RESUMEN

Objetivo: sintetizar las acciones desarrolladas para enfrentar al Aedes aegypti en el contexto brasileño. Método: este es un estudio bibliográfico, descriptivo, tipo revisión integradora. La búsqueda se realizó en MEDLINE, LILACS y BDENF. Se utilizaron los filtros: texto completo disponible; idioma (portugués, inglés y español), tipo de documento (artículo) y año de publicación (2013-2018). El proceso de definición y selección de estudios se organizó a través del diagrama de flujo PRISMA. El software IRAMUTEQ se utilizó para el procesamiento y análisis de datos. Los datos se analizaron a partir de Classificación Jerárquica Descendente y nube de palabras. Resultados: se seleccionaron 31 estudios. Seis clases se originaron con las siguientes estrategias: hongos entomopatógenos; peces larvívoros; Wolbachia pipientis; Técnicas RILD y SIT; insecticidas botánicos; larvicidas Diflubenzuron y Deltamidine; Piriproyfen; monitoreo tecnológico; visitas regulares de ACS y ACE; enfoque de ecosalud; MIV y campañas. Conclusión: se concluye que hay una variedad de estrategias para hacer frente a los arbovírus y cuánto es necesaria la mejora y el desarrollo de técnicas innovadoras para el control de esta enfermedad. Descriptores: Aedes; Control de Mosquitos; Brasil; Prevenção de Enfermedades; Infecções por Arbovírus; Control de Infecciones.

1²Cariri Regional University/URCA. Crato (CE), Brazil. ³https://orcid.org/0000-0003-3228-0791. ⁴https://orcid.org/0000-0003-2380-9606. ⁵https://orcid.org/0000-0003-3585-8467. ⁶https://orcid.org/0000-0003-1135-5487. ⁷Federal Institute of Ceará/IFCE. Táru (CE), Brazil. ⁸https://orcid.org/0000-0003-3027-825X.

*Article extracted from monograph << Coping with Aedes aegypti in the Brazilian context >>. Cariri Regional University, 2018.

How to cite this article
INTRODUCTION

It is understood that arboviruses transmitted by the mosquito Aedes aegypti, dengue, Zika and chikungunya have had negative impacts on public health, resulting in human suffering and massive socioeconomic losses worldwide, especially in tropical countries such as Brazil, given the environmental conditions favorable to vector proliferation. Between 2000 and 2007, an annual cost in the Americas of about $ 2.1 billion was reported for dengue alone.1

Arboviruses are known to range from febrile, undifferentiated, moderate or severe disease with rash, chronic arthralgia, and may progress to severe cases from hemorrhagic syndromes to congenital syndromes with irreversible neurological complications.2,3

It was stated that the interventions performed to intervene in these health problems are seen, in some aspects, as difficult to implement because it transcends the health sector with the need to perform intersectoral actions. Thus, it is sought that the Unified Health System (UHS) provides the states and municipalities with better conditions for the proper handling of this situation.4

It should be noted that one of the strategies developed to fight dengue was the development of a vaccine, Dengvaxia or CYD-TDV, produced by Sanofi Pasteur. This vaccine was licensed in 2015 and 19 countries accepted it, including Brazil. However, it is revealed that it is only available in the state of Paraná. Strategies for further development of a Zika vaccine are being studied through further research, but are still at an early stage of development.5

In addition, the use of insecticides for the elimination of mosquitoes has been a widely used practice in recent years, as it has immediate action, but recent studies have shown the development of resistance in mosquitoes, especially Aedes aegypti, due to the process known as “evolutionary adaptation”, making it more difficult to cope.6

When glimpsing the impacts of arboviruses at the world and national levels, along with the limitations of some prevention strategies, it can be seen how important the actions of the three spheres of government face in view of the great challenge of vector control and the complexity of the factors that cause the expansion of arboviruses in the country.7

Continued development of strategies for coping with arboviruses is needed, as well as the strengthening and refinement of techniques already in place, in order to rethink more effective and effective coping strategies for this ancient and, at the same time, current problem of public health.8

The following guiding question is pointed out: “What actions against Aedes aegypti developed in the Brazilian context have been reported in the scientific literature?”

It is noteworthy that this research assumes remarkable relevance due to its contributions to the field of health care, from the sharing of information regarding the activities developed in the various realities, focused on coping with arboviruses, and significantly contributing to the planning of public management.

OBJECTIVE

- To synthesize the actions developed to confront Aedes aegypti in the Brazilian context.

METHOD

This is a bibliographic, descriptive, integrative review (IR) study,9 in six stages: first - establishment of the research question; second - establishment of sampling and literature search; third - categorization of studies; fourth - study evaluation; fifth - interpretation of the results; sixth - synthesis of knowledge and presentation of results.9

It was defined as a research question: “What are the actions to combat Aedes aegypti developed in the Brazilian context have been reported in the scientific literature?”.

The study was conducted in August 2018 from the following sources: Medical Literature Analyzes and Retrieval System Oline (MEDLINE); Latin American Literature on Health Sciences (LILACS) and the Nursing Database (BDENF). The advanced search method was used, which allowed linking the descriptors to refine the search and categorization by title, abstract and subject.

The descriptors were defined: Aedes; Mosquito Control; Brazil; Prevention of diseases; Arbovirus Infections; Infection Control. Descriptors were used in all data sources by crossing with the boolean operator AND.

Two crosses were performed with the aforementioned Boolean operator as search strategy: Aedes AND Mosquito control AND Brazil AND Disease Prevention; Brazil AND Arbovirus infections AND Infection control.

The search filters used were: five-year scope; language (Portuguese, English and Spanish); document type (article) and full text available. The titles and abstracts of the studies were read, with subsequent analysis, according to the inclusion criteria: original research that answered the research question. Studies that were not developed in the Brazilian context, repeated studies and those that did not answer the research question were excluded.
Studies regarding the level of evidence were classified as: Level I - studies from systematic review or meta-analysis; Level II - randomized controlled studies; Level III - Evidence from quasi-experimental studies; Level IV - evidence from descriptive (non-experimental) or qualitative studies; Level V - evidence from case or experience reports; Level VI - Evidence Based on Expert Opinion.10

Included are original studies, with level of evidence IV, which constitute qualitative or descriptive studies.

Thirty-one studies were selected after applying the inclusion and exclusion criteria to be fully analyzed. It was organized and presented the process of definition and selection of articles through the flowchart Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA), as shown in Figure 1.

The data was submitted for processing and analysis in the software IRAMUTEQ (R interface for Multidimensional Analysis of Textes and Questionnaires), which is a computer program with the function of performing statistical analysis on textual corpus and tables of individuals by words.12-13

In addition, the textual corpus of this review consisted of the abstracts of the 31 previously selected studies, which were placed in a single text file in LibreOffice, version 5.4, as recommended.

Two methods were used for the analysis of the studies: the word cloud, in which words are grouped and organized graphically according to their frequency, and the Descending Hierarchical Classification (DHC), in which texts are classified according to their respective vocabularies and their set is divided by the frequency of the reduced forms.12 The software analysis results were presented in a dendrogram.

RESULTS

A total of 1,094 records were identified on the researched theme. After applying the filters, 415
records were tracked. At the end of reading the titles and abstracts of the 415 publications, 31 studies for full reading were selected, all of which were included in the integrative review.

From the word cloud, in the first data analysis, the most frequent keywords were obtained: control; Aedes aegypti; mosquitoes; dengue; wolbachia and pipientis, as shown in Figure 2.

![Word cloud](https://periodicos.ufpe.br/revistas/revistaenfermagem/index)

The Descending Hierarchical Classification (DHC) performed from IRAMUTEQ’s corpus processing was analyzed. The following results were obtained: Initial Context Units (ICU) or number of texts - 31; Elementary Context Units (ECU) or number of text segments - 234; number of forms - 2,259; number of occurrences - 8,504; average frequency of forms - 36,341,880; number of clusters - six; retention of text segments - 196 classified segments out of 234, equivalent to 83.76% of use for analysis.

Six classes were registered in the DHC, presented in a dendrogram, in which they sought to identify and interpret their textual domains, naming them as shown in Figure 3.

![Dendrogram](https://periodicos.ufpe.br/revistas/revistaenfermagem/index)

It was named class 1, “Use of biological control as a strategy for coping with Aedes aegypti”, consisting of six studies, with 34 ECUs out of 196, equivalent to 17.4% of the textual corpus, directly
related to the classes 3 and 4. The most frequent and expressive words of these text segments were observed: case; pathogens; public; America; zika; virus; serious; DENV; Chikv; chikungunya; species; dengue; transmit and zika, both with \( p < 0.0001 \).

This class includes studies that present approaches to biological control through the use of entomo-pathogenic fungi; the impact on the environment due to the release of mosquitoes carrying the bacterium Wolbachia pipiens; the release into the environment of sterile mosquitoes by the Sterile Insect Technique (SIT) and the use of botanical insecticides to control the Aedes aegypti vector.

It was named class 2, “Social participation and performance of the FHS in facing Aedes aegypti”, with a total of seven studies, presenting in 45 ECU, of 196, equivalent to 23% of the textual corpus, and this class is the least related to the others. The most frequent and expressive words of these segments were presented: health; Social; activity; FHS; cost; community; County; action; student and agent, both with \( p < 0.0001 \).

It is noteworthy that this class favored mechanical control over chemical control. Actions involving the community and the FHS are mentioned: conducting community workshops addressing Aedes control; cleaning campaigns; distribution of education and information materials to the community; establishment of partnerships; intersectoral meetings; regular visits by the community health agent (CHA) and vector control professionals, keeping the population informed about prevention measures, identifying mosquito outbreaks and larvicide application.

Class 3, “Technological monitoring of the Aedes aegypti mosquito outbreaks” was designated, consisting of four studies, equivalent to 12.24% of the textual corpus. It points to the most frequent and expressive words of these segments: population; technology; City; introduction; monitoring; system and egg, both with \( p < 0.0001 \). It is evident that studies in this class address innovative themes, such as the technology monitoring system and mosquito population control, Integrated Vector Management (IVM), as well as techniques already used as the release of individuals with Wolbachia pipiens and the application of insecticides by heavy equipment.

It was named class 4, “Using Wolbachia pipiens to control Aedes aegypti”, consisting of five studies, with 27 ECU out of 196, equivalent to 13.8% of the textual corpus. It is revealed that the most frequent and expressive words of these text segments were: pipiensis; wolbachia; infected; infection; high; larval; to affect; bacterium; streaming; density; substitute; blood; parameter; incompatibility; cytoplasmic and ADM, both with \( p < 0.0001 \). All studies in this class refer to the use of Wolbachia pipientis as an excellent method for vector control.

Class 5, “Release of genetically modified mosquitoes”, was formed from three studies, presenting in 30 ECU out of 196, equivalent to 15.31% of the textual corpus. It is directly related to class 1. The most frequent and expressive words are: insect; release; sterile; male; dominant; lethal; genetically; strain; carrier; technique; program; OX513A; released; dispersal; environment; eliminate and create, both with \( p < 0.0001 \). It is noteworthy that studies of this class bring in common the use of techniques such as the release of insects carrying the dominant lethal gene and the release of genetically sterile Aedes aegypti, which prevent larvae from developing.

Class 6, “Use of larvicides and larvivorous fish as a control strategy for Aedes aegypti”, was constructed based on six studies, with 36 ECU out of 196, equivalent to 18.4% of the textual corpus, directly related to class 5. The most frequent words were observed: larva; concentration; fish; Water; pyriproxyfen; larvicide; temephos; juvenile; xiphophorus; maculatus; larvivore; to integrate; mortality; dissemination; drain; emergency; use; adult and effect, both with \( p < 0.0001 \). Studies of this class bring approaches of joint interventions, such as the use of larvivorous fish associated with the use of Pyriproxyfen, a pesticide used in cotton plantations that was also used in vector control.

All studies used in the integrative review and their respective classes were organized in a table, according to the IRAMUTEC analysis, as shown in Figure 4.
### Discussion

It is recalled that all classes elaborated by the IRAMUTEQ software are related to the strategies used to fight the Aedes aegypti mosquito in Brazil, however, the first class is less specific.

It was observed that all the results obtained in the integrative review point to the use of various types of actions developed in the fight against Aedes, which are: use of the endosymbiont bacteria Wolbachia piapn, larval fish, transgenic mosquitoes; use of larvicides and insecticides and eco-biosocial approach.

It is noteworthy that, similarly to this study, an analysis made in Brasilia presented similar results, with the identification of ten strategies developed worldwide, namely: Wolbachia; transgenic mosquitoes; pyriproxyfen dissemination stations, Israeli Bacillus thuringiensis, pyriproxyfen, 

---

Figure 4. Results found in studies according to author, year of publication, class and journals. Crato (EC), Brazil, 2018.
spinoseade, space repellent, Temephós; ecobiosocial approach and lethal ovitraps.\textsuperscript{44}

In addition, another study conducted in Goiânia-Goiás pointed out other strategies not evidenced in this study, besides presenting them separating them into isolated and combined techniques. They were presented in the isolated techniques: ecobiosocial approach; natural compounds or essential oils of plants; Wolbachia; insecticide spreading mosquitoes; residual intradomiciliary space nebulization; insecticide devices; transgenic mosquitoes; insect sterilization by irradiation. The following techniques were identified: Wolbachia and SIT by irradiation; insecticide-impregnated clothing and insecticide-impregnated fabrics.\textsuperscript{4}

It is revealed that class 1, “Use of biological control as a strategy for coping with Aedes aegypti”, although it does not clearly show, in the words presented, which strategies used to cope with the mosquito, points to actions aimed at biological control, as the use of entomopathogenic fungi and bacteria Wolbachia piipiensis. It is pointed to the use of fungi as an innovative technique. In a study conducted in São João da Barra, Santa Catarina, the reduction in the number of eggs found in Aedes aegypti from the use of fungi was evidenced.\textsuperscript{40}

It is pointed out that, in class 2, with 23% of success, the most used strategies in coping with the vector in Brazil are evidenced, constituting the social participation and performance of the Family Health Strategy (FHS) in coping with Aedes aegypti. The importance of the development of collective actions involving the whole population, together with health agencies and other entities, through intersectoral actions is emphasized. The activities that involve coping with Aedes aegypti are shown to be related to a set of actions related to Primary Health Care (PHC), health surveillance, health education and social participation.\textsuperscript{44}

It is noteworthy that the FHS is inserted in the first level of actions and services of the UHS, therefore, constitutes an essential element in the prevention and control of arboviruses, because, through this, it is possible to perform awareness activities and information dissemination about the disease, including control measures.\textsuperscript{46}

Two key actors in this process involving the FHS stand out: the community health agent (CHA) and the endemic control agent (CHA). It is believed that through home visits, these professionals are able to perceive irregularities or lifestyle habits that endanger the health of residents, including inadvertent exposure of containers that can store water without proper protection.

It is reported that a study conducted in the state of Goiás, Brazil, showed that health education activities approximate the management of the population, breaking with the traditional vertical relationship existing between health professionals and the population. It was also evidenced in this study that health education promotes the empowerment of the population, making them aware that they are mainly responsible for their health care.\textsuperscript{4}

It is pointed out, however, that educational campaigns alone are unsuccessful if the population is not deeply aware of the importance of promoting health and collective well-being.\textsuperscript{48} It is mentioned that the educational actions, in most cases, are limited to lectures, being strongly practiced in certain periods of the year, assuming a campaign character,\textsuperscript{49} not achieving satisfactory results.\textsuperscript{50} Therefore, horizontal health education actions are needed, strengthening the relationship between users and professionals.\textsuperscript{44}

In class 3, technological monitoring is evidenced as an important means of coping with mosquito outbreaks. It is a method of Dengue Vector Population Monitoring and Control System (SMCP-Aedes), which continuously collects eggs with georeferenced ovitramps and semi-automatic egg counting by the Computer Assisted Counting System (CACS). The collected data are sent to the Geographic Database and then maps of the risk areas that can guide control actions.\textsuperscript{50}

It is noteworthy that a research carried out in 15 villages of the oceanic island of Fernando de Noronha, aiming to discover the spatial and temporal distribution of Aedes aegypti in this territory, also made use of SMCP - Aedes, which was easy to handle, \textit{a}, with true results that could help in understanding the dynamics and diffusion of arboviruses.\textsuperscript{51}

It is mentioned that, IMV, proposed by the World Health Organization (WHO), is also present in this class. It is the optimization of resources through a rational decision-making process based on the availability of human and structural resources, reinforcing the importance of social participation.

Another action used to combat Aedes aegypti, pointed out by IRAMUTEC, in class 4, was the use of Wolbachia piipiensis, a gram-negative endosibiotic bacterium. Its use is linked to the fact that it changes causes in host biology, such as: feminization; parthenogenesis; cytoplasmic incompatibility and male death. Wolbachia also inhibits additional human mosquito-borne pathogens.\textsuperscript{52}

It is noteworthy that studies conducted in Australia revealed suppression of DENY replication and Aedes aegypti dissemination by up to 70%,\textsuperscript{53} however, measuring the precise epidemiological impact of Wolbachia implantation to reduce the transmission of some viruses is still a challenge,

https://periodicos.ufpe.br/revistas/revistaenfermagem/index
and the lack of infrastructure for mass breeding of Wolbachia pipiens infected mosquitoes.34

Class 5 includes the use of genetically modified mosquitoes: Insect Release Technique Carrying Dominant Lethal Gene, also known as the Release of Insect carrying a Dominant Lethal gene (RILD), and the Sterile Insect Technique (SIT), being the first most used. It is believed that this RILD technique has advantages over other genetic modification techniques because it makes insects more sexually competitive in nature. It is explained that insects can be released at any stage of development as they do not cause environmental damage or generate high costs. The RILD technique is said to be far more effective than SIT due to male copulation performance.55

It is emphasized that SIT is the artificial sterilization of mosquitoes and subsequent release to the environment; In this case, male mosquitoes will be mass-raised in captivity where they will undergo a radiation process that will cause their sterility. It is noteworthy that, as a consequence, the mosquito will be unable to reproduce, causing the decrease in its population. Some factors that limit the success of this technique are pointed out, such as competitiveness for reduced copulation.56

According to Oxitec, pilot projects conducted in Brazil, Panama and the Cayman Islands in 2010 measured the effects of the release of these genetically modified mosquitoes among local populations. The results revealed a reduction of up to 80% of the population of Aedes aegypti in the test sites.

In class 6, the use of insecticides, larvicides and larvivorous fish as control strategies is noteworthy, and chemicals such as insecticides are the most used means due to their immediate action. It is currently pointed out that several insecticides are being used in this control or are in the experimental phase. It is noted that one of the studies in this class deals with the use of insecticides formulated from cashew nut bark and ricinoleic acid from the Ricinus communis plant, popularly known as castor bean.14

It was noticed during the study analysis that one of the identified larvicides is the Temephós-based organophosphate, which acts on the inhibition of the enzyme acetylcholinesterase. It is noteworthy that studies indicate the development of resistance against Temephós and that it is currently little used. A study in the municipalities of Maracaju and Navirai, in the state of Mato Grosso do Sul, showed that the populations of Aedes aegypti have a well-established resistance, since the average mortality rate was below 80%.57

Other larvicides were detected during the analysis of the studies, Diflubenzuron and Deltamethrin, both used as a government strategy to eliminate household outbreaks through visits by trained professionals. Diflubenzuron is believed to be a potent inhibitor of chitin synthesis, causing insect death as a result of cuticle malformation.58

Another strategy is emphasized in a research developed in the city of Manacapuru, State of Amazonas: the use of mosquitoes capable of spreading Pyripoxyfen, a larvicide that interferes with the development of mosquitoes, causing female sterilization. Results show an increase in mosquito mortality of 80-90%.59

However, it was observed that a research carried out in Madeira Island, using the same strategy mentioned above, did not obtain such satisfactory results, since there was no considerable reduction in the number of Aedes aegypti females, however, there was a reduction in the number of eggs laid in the ovitraps.59

It has been identified that the use of entomo-pathogenic fungus Metarhizium anisopliae, in association with neem oil, is capable of infecting from the egg to the adult phase of the mosquito. It has been shown that oil formulations can improve the efficiency of entomo-pathogenic fungi. It was shown in a research that the blastopores of this fungus increases the mortality rate of up to 90% of Aedes.19

It is noticed that the strategy of using fish in water reservoirs is widespread in Brazil. In some studies included in the review, fish species that are used for this practice were mentioned: Betta splendens; Trichogaster trichopterus; Xiphophorus maculatus and Poecilia reticulata, being effective in eliminating mosquito larvae. It is noteworthy that, in addition to its ease of use, such practice does not cause harm to human health and is economically positive.60

When placed in an environment where, in addition to the existence of larvae, there is a greater amount of other substrates, fish choose to feed on these substrates instead of Aedes larvae.34

From the results, it was observed that the use of strategies for the control of arboviruses requires a continuous assessment of their effectiveness, as it is necessary that they are safe, have timely results, do not negatively impact the environment, and are sustainable and present reasonable costs for their execution.

This research was limited by the occurrence of some studies, which did not show their results in the abstract, considering that the textual corpus was constituted only by the abstract.

CONCLUSION

It is concluded that the strategies for coping with arboviruses implemented in Brazil, according to the scientific literature, are: use of entomo-pathogenic fungi, larvivorous fish, Wolbachia pipiens, RILD and SIT techniques, botanical

https://periodicos.ufpe.br/revistas/revistaenfermagem/index
insecticides, Diflubenzuron and Deltametrine Piriproxfeno larvicides; technological monitoring; regular visits by CHA and CEA; eco-health approach; IVM and campaigns to mobilize communities.

It is noteworthy that, in class 2, strategies involving actions performed by health units together with the population are evidenced, that is, actions of a social character, which are the most widespread and used in Brazil because they are more effective and promising compared to actions that occur in isolation without the participation of society.

It is evident how important it is for society to be the main actor in actions to combat mosquitoes, in view of its strong influence on the environment in which it finds itself, continuously monitoring and eliminating vector outbreaks and significantly contributing to the prevention of diseases.

Based on this study, the most used strategies for coping with Aedes aegypti in Brazil were determined. It is confirmed that the development of new techniques that address the weaknesses of the strategies hitherto used is necessary.

From the strategic planning point of view, it is recommended to develop review studies, focused on the analysis of strategies individually, weighing positive and negative points, in order to contribute significantly to the improvement or development of new strategies for integration, with different mechanisms for controlling and preventing Aedes aegypti mosquito-borne diseases.

REFERENCES


15. Porto KRDA, Motti PR, Machado AA, Roel AR. In vitro evaluation of the effect of botanical


34. Dutra HLC, Rocha MN, Dias FBS, Mansur SB, Caragata EP, Moreira LA. Wolbachia blocks


Corresponding author
Diane Sales Vieira
E-mail: dianesales.enf@hotmail.com

Submission: 2018/06/28
Accepted: 2019/10/07

Copyright © 2019 Journal of Nursing UFPE on line/JNOUR
This is an Open Access article distributed under the terms of the Creative Commons Attribution-ShareAlike 4.0 International License. This license lets others distribute, remix, tweak, and build upon your work, even commercially, as long as they credit you for the original creation. Recommended for maximum dissemination and use of licensed materials.

https://periodicos.ufpe.br/revistas/revistaenfermagem/index