Short Communication

Habitat Characterization and Spatial Distribution of Anopheles Sp Mosquito Larvae in Luanda, Angola

María del Carmen Marquetti Fernández1*, Yoenys Hidalgo Flores2, and Duniarliz Lamothe Naviola2

1Department Vector Control, Institute of Tropical Medicine Pedro Kourí, Cuba
2Cuban Control Programanti-Larval Malaria Vectors with Biolarvicides in Angola, Cuba

Abstract

Anophelesgambiae and Anophelesfunestus are the main vectors of malaria in Angola. The objective of this work was to obtain information about the habitat characterization of Anopheles sp. Mosquito larvae in Luanda. Mosquito larvae sampling was conducted to determine the presence or absence of Anopheles mosquito larvae during January and March 2015. A total of 512 potential mosquito breeding sites were sampled, 437 (85,3%) were productive for mosquitos About 135 of 179 (75,4%) of all available Anopheles sp. habitats were man-made. Anopheles sp. Larvae presence was much more likely to found in ground drains, concrete drains, puddles, ground wells and concrete wells than other habitats. Breeding sites with sunlit presence and semi-polluted and clear water were more likely to contain Anopheles sp. larvae than others. This results combined with improved knowledge of mosquito ecology and their interactions with humans, is crucial to understand the epidemiology of urban malaria in the capital of Angola.

INTRODUCTION

In the Afro tropical Region, where Malaria is transmitted mainly by Anopheles funestus and members of the Anopheles gambiae complex, gaps in information on larval ecology and the ability of An. gambiae to exploit a wide variety of larval habitats have discouraged efforts to develop and implement larval control strategies [1].

In recent years there is increasing interest in the Implementation of the reduction and management of larval populations of mosquito vectors of Malaria in Africa, highlighting the use of two bacteria Bacillus thuringiensis and Bacillusphaericus because these are highly effective against mosquito larvae [2,3].

In Angola Malaria vector control is directed primarily to the anti-larval fight using these larvicides (Bacillus thuringiensis (Bactive®) and Bacillusphaericus (Griselesf®), which are applied by brigades anti larval struggle, at the level of municipalities, created to support Cuban cooperation, which has been developing this activity within the Program of National Malaria Control since 2009, in addition limited actions of intra household spraying with use of pyrethroids and more over since 2006 has increased the distribution of impregnated mosquito net sare made in the populational though to date coverage is insufficient (Plano Estrategico Nacionalpara o Control da Malaria em Angola 2015 to 2020).

Anophelesgambiae and Anophelesfunestus are the main vectors of malaria in Angola, but other species such as Anophelesarabiensis, Anopheles nili, Anophelesmelas and Anophelespharoensis are also reported [4].

Studies carried out in Luanda found low Malaria parasitaemia (5.5%) in children under5 years compared with 29% in neighboring provinces [5], while a low prevalence of confirmed cases reported with Malaria in Luanda, which increased with distance from the city center [6]. However, the province of Luanda was the most cases of Malaria reported in the country with over 30% and 3% mortality during 2013, although most of these cases were clinically diagnosed and no information is available on where they were acquired.

The objective of this work was to obtain information about the habitat characterization of Anopheles sp. Mosquito larvae in Luanda, Angola. This work was carried out in order to collect base line information for to improve the larval control mosquito through the biolarvicides application implemented in Luanda.
The study was carried out in Luanda, the capital of Angola, as a population estimated of 6,542,944 inhabitants (National Census data conducted from 15-31 May, 2014; National Institute of Statistics). A large proportion of the residents of Luanda live in densely populated urban slums. The city is divided into 7 municipalities Belas, Cacuaco, Caçanga, Icôlo de Bengo, Quissama, Viana and Luanda municipal which has the same name as the province and conformed by Ingombota, Maianga, Rangel, Samba, Sambizanga and Kilamba Kíaxi districts respectively. Each municipality is divided into cemences and these in neighborhoods. The rainy season is between November-May but the most accumulation of rain in Luanda occurs in March-April. Luanda had an annual rainfall of 323 millimeters in May but the most accumulation of rain in Luanda occurs in these in neighborhoods. The rainy season is between November-March. From every potential breeding sites in all municipalities of Luanda. Open natural and artificial water bodies were selected randomly in all municipalities for to sampling with the mainly objective to determine the presence or absence of Anopheles mosquito larvae using standard procedures. A total of 512 were selected; 185 in Luanda municipality conformed by Ingombota, Maianga, Rangel, Samba, Sambizanga and Kilamba Kíaxi districts; 95 for Cacuaco y Vianaperi urban municipalities; 52 for Belas coastal municipal; 30 for Icôlo de Bengo and Quissama the most rural municipalities of the province and 25 for Caçanga situated in the center of the province. From every potential breeding site up to 5 dips were taken with a standard white 350 ml dipper (WHO 1992). Habitat characterization only was carried out in the breeding sites with Anopheles mosquitoes’ presence.

The staff (5 persons) that performed the sampling belongs to the malaria program established in the province and trained for the activity by Cuban specialist in vector control. All sample included different parameters: location of breeding sites; man-made or not breeding sites; presence/absence of Anopheles larvae; presence/absence of sunlit; partly sunny (sun receives only part of the day) and shaded; presence/absence of any vegetation, water turbidity (pollute, semi-pollute or clear water) (qualitative appreciation) and the classification in permanent or semi permanent breeding sites. The sampled mosquito larvae was transferred to small labelled vials and sent to the entomology laboratory belonging to Malaria Control Program at the Ministry of Health in Luanda for the identification only at genus level. Pupae were not recorded as they cannot be differentiated from non-Anopheles species in the field.

Each site was categorized as one of the following habitat type: concrete drains, ground drains, flooded yards, flooded houses, natural lagoons, cisterns, tanks, swampy areas, puddles, ground wells, concrete wells, wells covered with tires of used cars and sewerage.

A total of 512 potential mosquito breeding sites were sampled, 75 (14.6%) were negative to mosquito larvae at the time of visit. Of the 512 sites 258 (50.4%) were productive for culicines, 143 (27.9%) were productive for culicine and Anopheles sp. larvae and 36 (7.1%) were productive only for Anopheles sp. mosquitoes.

The majority of the breeding sites with Anopheles sp. larvae presence were founded in the most urban municipality (Luanda) 100 (55,9%) of the total. Icôlo de Bengo and Quissama showed the most low percentages (4,5%) and (5,6%). The rest of the municipalities Viana, Cacuaco, Caçanga y Belas showed percentages between 7,2% to 9,5%.

Presence/absence of Anopheles sp. Larvae

Ground drains, concrete drains, puddles, ground wells and concrete wells were much more likely to contain Anopheles sp. larvae than other habitats, (Figure 1). Breeding sites with sunlit presence and semi-polluted water and clear water were more likely to contain Anopheles sp. larvae. However Anopheles larvae presence not showed prediction for presence or absence of vegetation at the breeding sites. Despite the study was carried out in rainy season 148 (82,7%) of the total of Anopheles sp breeding sites were classified as permanent breeding sites. About 135 of 179 (75,4%) of all available habitats were man-made, of them 48 (35,5%) for drainages and 66 (48,8%) for water storage purposes (Table 1).

Breeding sites of Anopheles mosquitoes in general can be natural or artificial permanently or semi-permanent prominent among them the lagoons, streams, back waters of rivers, irrigation

![Figure 1 Totals of Anopheles sp larva presence in different breeding sites in Luanda, January- March 2015.](image)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Total (N= 179)</th>
<th>% del total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunlit</td>
<td>136</td>
<td>75,9</td>
</tr>
<tr>
<td>Partially sunlit</td>
<td>34</td>
<td>19,1</td>
</tr>
<tr>
<td>Shaded</td>
<td>9</td>
<td>5,0</td>
</tr>
<tr>
<td>Any vegetation presence</td>
<td>86</td>
<td>49,1</td>
</tr>
<tr>
<td>No vegetation presence</td>
<td>93</td>
<td>51,9</td>
</tr>
<tr>
<td>Clear water</td>
<td>72</td>
<td>40,2</td>
</tr>
<tr>
<td>Semi-polluted water</td>
<td>80</td>
<td>44,7</td>
</tr>
<tr>
<td>Polluted water</td>
<td>27</td>
<td>15,1</td>
</tr>
<tr>
<td>Permanent breeding sites</td>
<td>148</td>
<td>82,7</td>
</tr>
<tr>
<td>Semi- permanent breeding sites</td>
<td>31</td>
<td>17,3</td>
</tr>
<tr>
<td>Man-made breeding sites</td>
<td>135</td>
<td>75,4</td>
</tr>
<tr>
<td>Natural breeding sites</td>
<td>44</td>
<td>24,6</td>
</tr>
</tbody>
</table>
canals, animal foot prints, small holes in the ground associated with the presence of vegetation. Recently studies in urban areas of some cities in Africa and America have also reported the presence of Anopheles. In water with high organic pollution content [7-13]. It is possible, however, that these habitats have always been capable of supporting larvae, if not to the same frequency as ‘cleaner’ sites. Indeed, the definition of ‘clean’, ‘dirty’ and ‘polluted’ water itself is unclear when examining the original literature.

The ecological processes associated with urbanization should, in theory, limit Malaria transmission by reducing the opportunity for vector breeding and the degree of contact between humans and vectors. Improved access to health care and Malaria control measures also should contribute to a reduced burden of Malaria disease. Evidence from the field largely bears out this theory but also suggests that the existence of diverse epidemiological situation in most urban areas makes generalization difficult. In most cases, a human settlement initially favours the multiplication of Anopheles and culicine larvae as they keep water for considerably longer time than natural habitats. Furthermore, they are often re-filled with water from human activities and waste so that the number of available habitats is artificially kept higher than rain alone would support.

Coexistence of anophelines and culicinesmosquito was found at sites during the study. Researchers about setting Anopheles sp. Here these habitats would be necessary for a better understanding of the distribution of breeding sites of the vectors of malaria in Luanda.

Main limitations of the study

The goal of the study was to characterize important breeding sites of Anopheles species. Mosquito larvae in Luanda (Angola). More intensive studies are currently being undertaken to complement these results. The study was implemented only during rainy season. It’s recommended to repeat in dry season when the selectivity of mosquitoes for ovi position sites can be greatly diminished. Very small breeding sites could not be selected and were, therefore, largely excluded from the study and Anopheles sp. mosquitoes were not classified down to species level.

In conclusion, all potential breeding sites need to be considered as sources of malaria risk and exhaustively targeted in any larval control intervention. These finding about malaria vectors breeding sites provides an approach to the understanding of vector distribution and ecology about the malaria vectors in Luanda that is essential for the malaria larval control programs and for to malaria control in the Angola capital. On the other hand mapping of malaria risk on the basis of breeding sites plays an important role for urban malaria control programs. Also, initial risk mapping of breeding sites, combined with improved knowledge of mosquito ecology and their interactions with humans, is crucial to understand the epidemiology of urban malaria in the country.

REFERENCES

10. Marquetti MC, Rojas L, Birniwa MM, Sulaiman HH, Adamu HH.


Cite this article