



THE USE OF ELECTRONIC RACKET IN MALARIA VECTOR SAMPLING: A NEW AND EFFECTIVE TOOL

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ABSTRACT

Background: The entomological researches on adult malaria vectors need the sampling of these vectors. This sampling uses some tools as mouth aspirator which has some limits. **Objective:** The current study was aimed to study the use of electronic racket in malaria vector collection. **Methodology:** Four bedrooms were selected for adult mosquito collection in the morning in July 2019 during the rainy season in Dogbo district. Mosquitoes resting in the houses were collected by electronic racket from 6 a.m. to 7 a.m. The survey was done for fourteen consecutive nights (two weeks). All collected mosquitoes were put in netted plastic cups and transferred to the Laboratory for identification. **Results:** The results show that many mosquito species were present in Dogbo district mainly *Anopheles gambiae*, *Culex quinquefasciatus*, *Aedes aegypti* and *Mansonia Africana*. There are many advantages in the use of electronic racket for the morning collection of mosquito resting in the human houses. **Conclusion:** Our study is the first carried out in Benin country using the electronic racket in the collection of mosquito resting in the human houses. This tool is new, important and effective for malaria vector collection.

KEYWORDS: electronic racket, mosquito residual fauna collection, malaria control, Republic of Benin.

INTRODUCTION

Despite the impressive efforts made in the past 2 decades, progress in the fight against malaria has stagnated in recent years.^[1-3] A large proportion of the reduction in malaria has been attributed to vector control, yet research and operational practice have concentrated on the development of chemotherapy and vaccines, with vector control not expanding its arsenal beyond long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS).^[4] Increased pyrethroid resistance in malaria vectors^[5,6], shifts in mosquito biting behaviour from predominately endophagic to more exophagic populations^[7,8] and earlier biting^[9] demand the re-evaluation of contemporary practices and the development of additional tools addressing current limitations. The World Health Organisation (WHO) endorsed the universal use and application of LLINs and IRS as tools in the fight against malaria.^[10] Both of these tools primarily target indoor-biting mosquitoes, which contribute to almost 80% of all malaria transmission.^[11] Whilst the remaining outdoor transmission increases in importance once the indoor tools are effectively

applied^[12, 13], no outdoor tools have been approved by WHO for supplementary mass application.^[1]

The burden of malaria is managed by a multi-disciplinary approach which combines targeting the parasite (artemisinin combination therapy)^[14,15], the vector (World Health Organization [WHO]-approved insecticides and long-lasting insecticide treated bednets)^[16,17] and, to some extent, the environment (habitat modification or larval source management).^[18-20] Additionally, two vaccines are currently under trial: RTS, S and AGS-v.^[21-24] The pre-erythrocytic stage antimalarial vaccine RTS, S targets the circumsporozoite surface protein of *Plasmodium falciparum* and is currently in phase IV clinical trials in Ghana, Kenya, and Malawi.^[22,23,25] In contrast, the AGS-v vaccine targets four conserved saliva peptides in *Anopheles* spp., *Aedes* spp. and *Culex* spp., and has shown promising results in terms of safety and immunogenicity during its phase I clinical trial in humans.^[21] Of all these interventions, vector control plays a central role. In fact, the WHO has stated that “vector control is a vital component of malaria prevention, control, and elimination strategies because it

can be highly effective in providing personal protection and/or reducing disease transmission”.^[17]

The traditional mouth aspirator is usually used in adult mosquito sampling. However, it has some limits and there is a need to search for complementary tools.

MATERIALS AND METHODS

Study area

The study area is located in Republic of Benin (West Africa) and includes the department of Couffo. Couffo department is located in the south-western Benin and the study was carried out more precisely in Dogbo district (Fig.1). The southern borders of this district are Lokossa and Bopa districts. The northern border is Djakotomey district. The eastern border is Lalo district and the western border of Dogbo district is Togo republic. Dogbo district covered 475 km² and belongs to geographic region of ADJA. The choice of the study site took into account the economic activities of populations, their usual protection practices against mosquito bites, and peasant practices to control farming pests. We took these factors into account to study the use of electronic racket in malaria vector collection in Dogbo district in Couffo department. Couffo has a climate with four seasons, two rainy seasons (March to July and August to November) and two dry seasons (November to March and July to August). The temperature ranges from 25 to 30°C with the annual mean rainfall between 900 and 1100 mm.

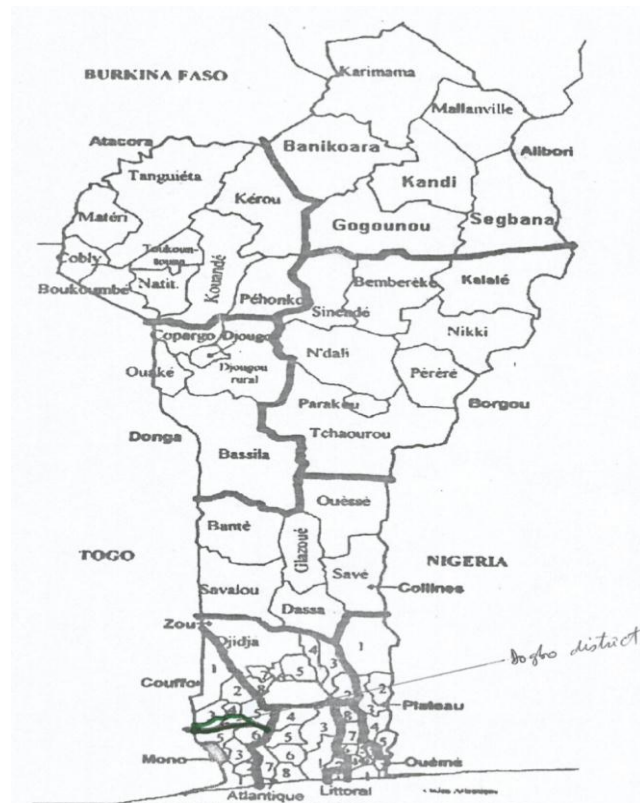


Fig. 1: Map of Republic of Benin showing Dogbo District.

Field mosquito collection

Four bedrooms were chosen or selected for adult mosquito collection in the morning in July 2019 during the rainy season in Dogbo district. Mosquitoes resting in the houses were collected by electronic racket (Fig.2) from 6 a.m. to 7 a.m. The survey was done for fourteen consecutive nights (two weeks). All collected mosquitoes were put in netted plastic cups and transferred to the Laboratory of Applied Entomology and Vector Control (LAEVC) of the Department of Sciences and Agricultural Techniques located in Dogbo district for identification.



Fig.2: Electronic rackets used during the mosquito collection on the field.

Collected mosquito identification

Adult collected mosquitoes were identified to species based on morphological characters using identification keys.^[26]

Statistical analysis

A chi-square test for proportion comparison was performed to compare the proportions of mosquito species related to each bedroom.

RESULTS

The analysis of Table 1 shows that many mosquito species were present in Dogbo district mainly *Anopheles gambiae*, *Culex quinquefasciatus*, *Aedes aegypti* and *Mansonia Africana*. A total of 1572 mosquito were collected in an interval of fourteen consecutive nights. The mosquito specie the most present was *Culex quinquefasciatus* (608 mosquitoes) whereas the less present was *Anopheles gambiae* (18 mosquitoes).

Table 1: Diversity of mosquito species collected in Dogbo district.

Mosquito species	Number of mosquitoes caught in bedroom 1	Number of Mosquitoes caught in bedroom 2	Number of Mosquitoes caught in bedroom 3	Number of mosquitoes caught in bedroom 4	Total
<i>Anopheles gambiae</i>	4	6	3	5	18 ^a
<i>Culex quinquefasciatus</i>	143	112	88	265	608 ^b
<i>Aedes aegypti</i>	77	156	224	93	550 ^b
<i>Mansonia Africana</i>	102	66	24	204	396 ^c
Total	326	340	339	567	1572

Noted: Means followed by the same letter do not differ significantly (p<0.05 chi-square test).

The Table 2 shows the advantages in the use of electronic racket. However, very few disadvantages were also noted.

Table 2: Advantages and disadvantages of the use of electronic racket.

Advantages	Disadvantages
Electronic racket catches mosquitoes and other insects like flies	Must be loaded (or charged) regularly (is the main disadvantage)
Electronic racket catches mosquitoes without contact Mosquitoes caught by electronic racket are dead and intact	
Mosquitoes caught by electronic racket can be used for entomological researches or bioassays	
Electronic racket respects human health and environment	
Electronic racket make an electronic noise when mosquitoes are caught (To be sure of the catching)	
Electronic racket is held by hand in mosquito collection	
Electronic racket can be used in mosquito residual fauna collection in the morning	
Mosquitoes caught are maintained in the mesh of electronic racket without failing down on the floor of the rooms	

DISCUSSION

In the current study, four mosquito species were collected by electronic racket. There were: *Anopheles gambiae*, *Culex quinquefasciatus*, *Aedes aegypti* and *Mansonia Africana*. Researches were carried out in Benin using indoor pyrethrum spray catches (PSC) in the morning followed by mosquito collection with mouth aspirators.^[27] In that study, adult mosquitoes were collected on white tissues put on the floor of the human rooms or habitations after indoor pyrethrum spray catches (PSC) in the morning. The mosquito species collected by Padonou *et al.*^[27] in Ouémé department in South eastern Benin were *Anopheles gambiae*, *Anopheles funestus*, *Anopheles pharoensis*, *Anopheles ziemanni*, *Anopheles coustani*, *Culex quinquefasciatus*, *Culex decens*, *Culex nebulosus*, *Culex thalassius*, *Culex fatigans*, *Aedes aegypti*, *Aedes palpalis*, *Mansonia africana* and *Mansonia uniformris*. However, it is important to note that this study used in addition to indoor pyrethrum spray catches (PSC) in the morning, the mosquito collection by window traps (WT) and by indoor and outdoor human landing catches (HLC). If only four mosquito species were collected in the current study, that can be explained by the duration of the survey. In fact, in the study by Padonou *et al.*^[27], the mosquito species were collected in Ouémé department in Adjohoun, Dangbo, Misséreté and Sèmè districts during the dry (January to March 2008) and rainy (April to July

2008) seasons (with 2 catch session per month) whereas the duration of the survey in the current study was fourteen consecutive nights (two weeks) in Dogbo district.

There are many advantages in the use of electronic racket. In fact, electronic racket catches mosquitoes and other insects like flies. The electronic racket catches mosquitoes without contact by contrast to mouth aspirator. The mosquitoes caught by electronic racket are dead and intact. The mosquitoes caught by electronic racket can be used for entomological researches or bioassays. The electronic racket respects human health and environment by contrast to indoor pyrethrum spray catches (PSC). Electronic racket make an electronic noise when mosquitoes are caught (To be sure of the catching). The electronic racket is held by hand in mosquito collection by contrast to window trap which is put on window of rooms. The electronic racket can be used in mosquito residual fauna collection in the morning. The mosquitoes caught are maintained in the mesh of electronic racket without failing down on the floor of the rooms until it is put or transferred on netted plastic cups. However, electronic racket must regularly be loaded (or charged).

CONCLUSION

The use of the traditional mouth aspirator in adult mosquito sampling has some limits and our study is the first carried out in Benin country using the electronic racket in the morning collection of mosquito resting in the human houses. This tool is new, important and effective for malaria vector collection.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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