wjpmr, 2021,7(12), 5 – 10.

SJIF Impact Factor: 5.922

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

COMPARISON OF TWO TOOLS FOR MOSQUITO RESIDUAL FAUNA SAMPLING: MOUTH ASPIRATOR AND ELECTRONIC RACKET

Nazaire Aïzoun[1]*, Faustin Assongba[2,3] and Arlette Adjatin[4]

[1]Laboratory of Pluridisciplinary Researches of Technical Teaching (LaRPET), Normal High School of Technical Teaching (ENSET) of Lokossa, National University of Sciences, Technologies, Engineering and Mathematics (UNSTIM) of Abomey.

[2,4]Laboratory of Vegetal Biology and Traditional Pharmacopoeia (LaBVephaT), National High School of Applied Biosciences and Biotechnologies (ENSBBA) of Dassa-Zoumè, National University of Sciences, Technologies, Engineering and Mathematics (UNSTIM) of Abomey.

[3]Laboratory of Applied Ecology (LEA), Faculty of Agronomic Sciences, University of Abomey-Calavi (UAC), Cotonou, Bénin.

***Corresponding Author: Nazaire Aïzoun**
Laboratory of Pluridisciplinary Researches of Technical Teaching (LaRPET), Normal High School of Technical Teaching (ENSET) of Lokossa, National University of Sciences, Technologies, Engineering and Mathematics (UNSTIM) of Abomey.

Article Received on 23/08/2021 **Article Revised on 13/09/2021** **Article Accepted on 03/10/2021**

ABSTRACT

Background: Mouth aspirator is usually used for adult malaria vector collection. This sampling is necessary for entomological researches. **Objective:** The current study was aimed to compare two tools for mosquito residual fauna collection: mouth aspirator and electronic racket. **Methodology:** Four bedrooms were selected for adult mosquito collection in the morning in July 2020 during the rainy season in three different districts in Mono department such as Grand Popo, Houéyogbé and Bopa districts. Mosquitoes resting in the houses were collected by two ways. By mouth aspirator after using indoor pyrethrum spray catches (PSC) in the morning in two houses of each district and by electronic racket in two houses of each district from 6 a.m. to 7 a.m. The survey was done simultaneously in the three districts for ten consecutive nights. 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 Mono department such as: *Anopheles gambiae, Anopheles funestus, Anopheles pharoensis, Culex quinquefasciatus, Culex decens, Culex nebulosus, Aedes aegypti* and *Mansonia Africana*. The number of mosquito species collected by electronic racket in the different districts surveyed were higher than those collected by mouth aspirator. **Conclusion:** There are many advantages in the use of electronic racket for the morning collection of mosquito resting in the human houses. The electronic racket is new, important and effective tool for the collection of mosquito resting in the human houses. It is a complementary tool to the traditional mouth aspirator.

KEYWORDS: mouth aspirator, electronic racket, mosquito resting in the human houses, malaria control, Benin.

INTRODUCTION

Despite many efforts and scientific advances, the control and prevention of the malaria disease has still not been achieved, as the WHO estimated 219 million cases of malaria and 435,000 malaria-related deaths for 2017, 93% of which were reported in sub-Saharan Africa, especially in children aged less than 5 years old and in pregnant women. It also estimated that the incidence rate between 2010 and 2017 had only become reduced by 18% [1]. Such statistics increasingly highlight the need for a global attack on malaria, including the development of an integral, multi-epitope, multi-stage, long-lasting vaccine able to induce a cellular and humoral immune response (IR)[2] as a fundamental, complementary and valuable tool for optimizing existing malaria control strategies. Contributing towards eliminating the disease would thereby help save hundreds of thousands of lives every year.[1]

Malaria remains a significant public health problem, disproportionately impacting morbidity and mortality in low-resource communities worldwide. Vector control is an essential component in malaria prevention strategies.[3]

Most malaria-endemic countries in sub-Saharan Africa implement mass insecticide-treated net (ITN) distribution campaigns every 3 years to achieve high ITN access, but few have established effective national-scale continuous distribution mechanisms capable of maintaining ITN coverage between mass campaigns or sustaining coverage in the absence of campaigns.

In Benin, malaria vector control relies mainly on the mass distribution of LLINs, and on IRS operations. Although LLINs and IRS have been shown to be effective, they have performed below expectations in some settings, including several locations in Benin.[4-6] One of the reasons is the emergence and expansion of resistance of Anopheles vectors to insecticides.[7-9] Monitoring is an integral part of any resistance management strategy which allows informed decisions about the choice of insecticides.[10]

The goal of the current study is to compare two tools for mosquito residual fauna sampling: mouth aspirator and electronic racket.

MATERIALS AND METHODS

Study area

The study area is located in Republic of Benin (West Africa) and includes the department of Mono. Mono department is located in the south-western Benin and the study was carried out more precisely in the districts of Grand Popo, Houéyogbé and Bopa (Fig.1). 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 them into account to compare two tools for mosquito residual fauna sampling: mouth aspirator and electronic racket. Mono has a climate with four seasons, two rainy seasons (March-July and August-November) and two dry seasons (November-March and July-August). The temperature ranges from 25 to 30°C with the annual mean rainfall between 900 and 1100 mm.

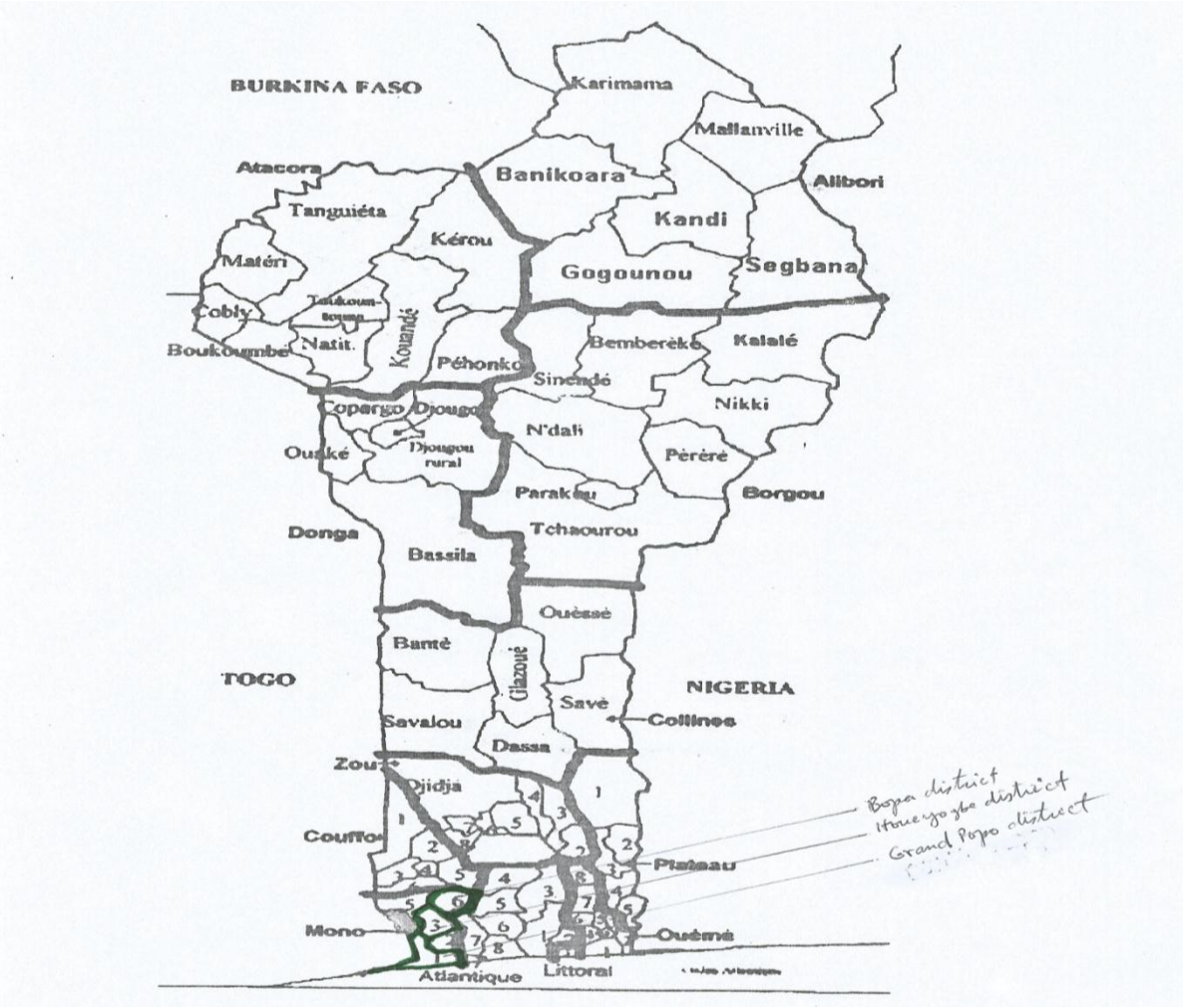

Fig. 1: Map of Republic of Benin showing districts surveyed.

Field mosquito collection

Four bedrooms were selected for adult mosquito collection in the morning in July 2020 during the rainy season in three different districts in Mono department such as Grand Popo, Houéyogbé and Bopa districts. Mosquitoes resting in the houses were collected by two ways. By mouth aspirator (Fig. 2) in two houses of each district and by electronic racket (Fig.3) in two houses of each district from 6 a.m. to 7 a.m. The survey was done simultaneously in the three districts for ten consecutive

nights. 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: Mouth aspirator used during the mosquito collection on the field.

Fig. 3: 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.[11]

Statistical analysis

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

RESULTS

Mosquito species diversity

The analysis of Table 1 shows that many mosquito species were present in Mono department such: *Anopheles gambiae, Anopheles funestus, Anopheles pharoensis, Culex quinquefasciatus, Culex decens, Culex nebulosus, Aedes aegypti* and *Mansonia Africana.* A total of 34082 mosquitoes were collected in an interval of ten consecutive nights. The mosquito specie the most present was *Mansonia africana* (21788 mosquitoes) whereas the less present was *Anopheles funestus* (only 5 mosquitoes). The number of mosquito species collected by electronic

racket in the different districts surveyed were higher than those collected by mouth aspirator.

Table 1: Diversity of mosquito species collected in Mono department.

	Grand Popo				Houéyogbé				Bopa				
Mosquito species	**Number of mosquitoes caught in bedroom 1with mouth aspirator**	**Number of mosquitoes caught in bedroom 2 with mouth aspirator**	**Number of mosquitoes caught in bedroom 3 with electronic racket**	**Number of mosquitoes caught in bedroom 4 with electronic racket**	**Number of mosquitoes caught in bedroom 1with mouth aspirator**	**Number of mosquitoes caught in bedroom 2 with mouth aspirator**	**Number of mosquitoes caught in bedroom 3 with electronic racket**	**Number of mosquitoes caught in bedroom 4 with electronic racket**	**Number of mosquitoes caught in bedroom 1with mouth aspirator**	**Number of mosquitoes caught in bedroom 2 with mouth aspirator**	**Number of mosquitoes caught in bedroom 3 with electronic racket**	**Number of mosquitoes caught in bedroom 4 with electronic racket**	**Total**
Anopheles gambiae	5	2	11	9	2	1	16	12	0	4	8	7	77^{a}
Anopheles funestus	0	0	0	1	0	0	0	0	0	1	2	1	5^{b}
Anopheles pharoensis	43	23	78	65	33	46	98	73	54	59	88	82	742^{c}
Culex quinquefasciatus	78	129	362	411	88	123	301	247	111	98	529	277	2754^{d}
Culex decens	103	219	456	501	109	207	399	589	208	198	626	478	4093^{e}
Culex nebulosus	74	391	468	658	243	89	710	201	283	145	412	394	4068^{e}
Aedes aegypti	15	11	23	17	56	78	103	89	32	12	34	85	555^{f}
Mansonia africana	1093	978	2045	1034	2012	923	3011	2056	3306	799	3459	1072	21788^{g}
Total	1411	1753	3443	2696	2543	1467	4638	3267	3994	1316	5158	2396	34082

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

Advantages and disadvantages of the use of electronic racket and mouth aspirator

The Table 2 shows the advantages and disadvantages of the use of electronic racket and mouth aspirator

Table 2: Comparison of advantages and disadvantages of the use of electronic racket and mouth aspirator.

Electronic racket	**Mouth aspirator**
Electronic racket catches mosquitoes and other insects like flies easily	Mouth aspirator catches mosquitoes but not other insects like flies easily
Electronic racket catches mosquitoes without contact	Mouth aspirator catches mosquitoes with contact
Mosquitoes caught by electronic racket are dead and intact	Mosquitoes caught by mouth aspirator are alive and intact
Mosquitoes caught by electronic racket can be used for entomological researches or bioassays	Mosquitoes caught by mouth aspirator can also be used for entomological researches or bioassays
The use of electronic racket respects human health and environment regarding mosquito collection	Mouth aspirator used after indoor pyrethrum spray catches (PSC) does not respect human health and environment
Electronic racket makes an electronic noise when mosquitoes are caught (To be sure of the catching)	Mouth aspirator does not make noise when mosquitoes are caught (To be sure of the catching)
Electronic racket is held by hand in mosquito collection	Mouth aspirator is also held by hand in mosquito collection
Electronic racket can be used in mosquito residual fauna collection in the morning and collects more mosquitoes	Mouth aspirator can also be used in mosquito residual fauna collection in the morning but collects less mosquitoes
Mosquitoes caught are maintained in the mesh of electronic racket without failing down on the floor of the rooms	Mosquitoes caught by inspiration (or breathing in) are also maintained in the mouth aspirator without failing down on the floor of the rooms
Electronic racket must be loaded (or charged) regularly	Mouth aspirator does not need to be loaded (or charged) regularly
Electronic racket can be used for indoor and outdoor human landing catches (HLC)	Mouth aspirator can also be used for indoor and outdoor human landing catches (HLC)
Electronic racket cannot be used for window traps (WT) collection of mosquitoes	Mouth aspirator can be used for window traps (WT) collection of mosquitoes

DISCUSSION

In the current study, eight mosquito species were collected by electronic racket and mouth aspirator. There were: *Anopheles gambiae, Anopheles funestus, Anopheles pharoensis, Culex quinquefasciatus, Culex decens, Culex nebulosus, Aedes aegypti* and *Mansonia Africana*. The factor that could explain the presence of

these vectors is urbanization.[12] Another author,[13] reported 8 species in Southern Benin with *Mansonia sp.*, *An. gambiae s.l*., *Culex thalassius* and *Culex. gr. decens.* The variability in ecological diversity noted by different authors is probably based on sampling techniques used, periods of study, study area and population dynamics of mosquitoes under external pressure. The presence of *An. gambiae s.l* in all districts surveyed during the rainy season could be explained by the permanent presence and the abundance of small collections of natural waters. In south eastern Benin, the mosquito species collected by Padonou *et al.*[14] in Ouémé department 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.* In the current study carried out in south western Benin, we did not found *Anopheles ziemanni, Anopheles coustani, Culex thalassius, Culex fatigans, Aedes palpalis* and *Mansonia uniformris.* That can be explained by the duration of the survey. In fact, in the study by Padonou *et al*. [14], 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 ten consecutive nights in Mono department.

The comparison of advantages and disadvantages of the use of electronic racket and mouth aspirator shows that the electronic racket catches mosquitoes and other insects like flies easily whereas the mouth aspirator catches mosquitoes but not other insects like flies easily. The electronic racket catches mosquitoes without contact whereas the mouth aspirator catches mosquitoes with contact.

The mosquitoes caught by electronic racket are dead and intact whereas the mosquitoes caught by mouth aspirator are alive and intact. The mosquitoes caught by both electronic racket and mouth aspirator can be used for entomological researches or bioassays. The use of electronic racket respects human health and environment regarding mosquito collection whereas the mouth aspirator used after indoor pyrethrum spray catches (PSC) does not respect human health and environment. The electronic racket makes an electronic noise when mosquitoes are caught (To be sure of the catching) whereas the mouth aspirator does not make noise when mosquitoes are caught (To be sure of the catching). Both electronic racket and mouth aspirator are held by hand in mosquito collection. The electronic racket can be used in mosquito residual fauna collection in the morning and collects more mosquitoes whereas the mouth aspirator can also be used in mosquito residual fauna collection in the morning but collects less mosquitoes. The mosquitoes caught are maintained in the mesh of electronic racket without failing down on the floor of the rooms whereas mosquitoes caught by inspiration (or breathing in) are also maintained in the mouth aspirator without failing down. The electronic racket must be loaded (or charged) regularly whereas the mouth aspirator does not need to be loaded (or charged) regularly. Both electronic racket and mouth aspirator can be used for indoor and outdoor human landing catches (HLC). The electronic racket cannot be used for window traps (WT) collection of mosquitoes whereas the mouth aspirator can be used for window traps (WT) collection of mosquitoes. All these advantages show that the electronic racket is a new and complementary tool to mouth aspirator in adult mosquito sampling.

CONCLUSION

There are many advantages in the use of electronic racket for the morning collection of mosquito resting in the human houses. The electronic racket is new, important and effective tool for the collection of mosquito resting in the human houses. It is a complementary tool to the traditional mouth aspirator.

ACKNOWLEDGEMENT

The authors would like to thank Mister AFFO Johny and people who had helped us in data collection in Mono department.

CONFLICTS OF INTEREST

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

REFERENCES

1. WHO. World malaria report. Geneva: World Health Organization, 2018.
2. Patarroyo ME, Bermúdez A, Alba MP, Vanegas M, Moreno-Vranich A, Poloche LA, *et al*. IMPIPS: the immune protection-inducing protein structure concept in the search for steric-electron and topochemical
principles for complete fully-protective chemically synthesised vaccine development. PLoS ONE, 2015; 10: e0123249.
3. WHO. Global Plan for Insecticide Resistance Management. Geneva: World Health Organization, 2012.
4. N'Guessan R, Corbel V, Akogbéto M, Rowland M. Reduced efficacy of insecticide-treated nets and indoor residual spraying for malaria control in pyrethroid resistance area. Benin. Emerg Infect Dis, 2007; 13: 199–06.
5. Kelly-Hope L, Ranson H, Hemingway J. Lessons from the past: managing insecticide resistance in malaria control and eradication programmes. Lancet Infect Dis, 2008; 8: 387–9.
6. Ranson H, N'Guessan R, Lines J, Moiroux N, Nkuni Z, Corbel V. Pyrethroid resistance in African anopheline mosquitoes: what are the implications for malaria control? Trends Parasitol, 2011; 27: 91–8.

7. Aïzoun N, Ossè R, Azondekon R, Alia R, Oussou O, Gnanguenon V, Aikpon R, Padonou GG, Akogbéto M. Comparison of the standard WHO susceptibility tests and the CDC bottle bioassay for the determination of insecticide susceptibility in malaria vectors and their correlation with biochemical and molecular biology assays in Benin, West Africa. Parasit Vectors, 2013a; 6: 147.
8. Aïzoun N, Aïkpon R, Padonou GG, Oussou O, Oké-Agbo F, Gnanguenon V, Ossè R, Akogbéto M. Mixed-function oxidases and esterases associated with permethrin, deltamethrin and bendiocarb resistance in *Anopheles gambiae s.l.* in the south-north transect Benin, West Africa. Parasit Vectors, 2013b; 6: 223.
9. Aïzoun N, Aïkpon R, Gnanguenon V, Oussou O, Agossa F, Padonou GG, Akogbéto M. Status of organophosphate and carbamate resistance in *Anopheles gambiae sensu lato* from the south and north Benin, West Africa. Parasit and Vectors, 2013c; 6: 274.
10. WHO. The technical basis for coordinated action against insecticide resistance. Preserving the effectiveness of modern malaria vector control, meeting report, 4–6 May Geneva: World Health Organization, 2011.
11. Coluzzi M. Morphological divergences in the *Anopheles gambiae* complex**.** Riv Malariologia, 1964; 43: 197-232.
12. Hamon J, Burnett G, Adam J P, Rickenbach A, Grjebine A. *Culex pipiens* fatigans Wiedemann, Wuchereria bancrofti Cobbold, et le développement économique de Afrique tropicale. Bull. Org. mond. Santé, 1967; 37: 217-237.
13. Akogbéto M. Etude des aspects épidémiologiques du paludisme côtier lagunaire au Bénin. Thèse de doctorat, Université de Paris, 1992; XI.
14. Padonou GG, Sezonlin M, Gbedjissi GL, Ayi I, Azondekon R *et al.* Biology *of Anopheles gambiae* and insecticide resistance: Entomological study for a large scale of indoor residual spraying in south east Benin. Journal of Parasitology and Vector Biology, 2011; 3(4): 59-68.