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ABUNDANCE OF *CULEX QUINQUEFASCIATUS* SAY MOSQUITOES IN DOGBO DISTRICT IN SOUTH-WESTERN REPUBLIC OF BENIN, WEST AFRICA

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ABSTRACT

Background: *Culex quinquefasciatus* mosquitoes transmitted lymphatic filariasis which is a disease of significant public health importance. **Objective**: The current study was aimed to investigate on the abundance of *Culex quinquefasciatus* mosquitoes in Dogbo district in south-western Republic of Benin, West Africa. **Methodology**: Larvae and pupae of *Culex quinquefasciatus* mosquitoes were collected by dipping method in July 2021 during the great rainy season in the locations of Ayomi, Dévé, Honton, Lokogohoué, Madjrè and Totchangni. After each of four dipping methods in four different breeding sites in each location surveyed, the number of collected mosquito larvae were accounted and recorded. During the same period, four houses were selected in each location surveyed for adult mosquito collection in the morning. Mosquitoes resting in the houses were collected by electronic racket from 6 a.m. to 7 a.m during fourteen consecutive days (two weeks). They were also accounted and recorded. **Results:** The results showed that a total of 596 larvae of *Culex quinquefasciatus* were collected in the six locations surveyed whereas a total of 7819 adult *Culex quinquefasciatus* were collected in an interval of fourteen consecutive days in the six locations surveyed. The mean of the number of mosquito larvae collected per dipping method in a breeding site surveyed ranged from 24 to 25 mosquito larvae whereas the mean of the number of adult mosquitoes collected by day per house surveyed ranged from 16 to 29 adult mosquitoes. **Conclusion:** The control planning against *Culex quinquefasciatus* which is vector of many diseases of significant public health importance and *Anopheles gambiae* which is malaria vector has to focus on breeding site elimination or treatment by improving the basic sanitary infrastructure of water supply and waste destination, as well as activities to promote community engagement within an environmental agenda.

KEYWORDS: Dipping method, electronic racket, *Culex quinquefasciatus*, lymphatic filariasis, Benin.

INTRODUCTION

Mosquito belongs to the family Culicidae, order Diptera. Over 3,000 known species had been identified. The family Culicidae is a large, abundant, well-known and important group of flies. The early stages; egg, larval and pupal are aquatic. Mosquito larvae or wigglers are found in variety of aquatic situations such as ponds, pools, water in artificial containers, in tree holes with each species occurring in particular type of aquatic habitat.[1,2] The larvae of most species feed on algae and organic debris but a few are predaceous and feed on other mosquito larvae. When considering human welfare, mosquitoes are important because the females of many species are blood suckers, they annoy humans and other animals, and they may transmit the pathogens that cause human and animal diseases. The pathogens transmitted by mosquitoes include viruses (arboviruses), filarial worms (helminths) and protozoa. Mosquitoes are the indirect cause of more morbidity and mortality among humans than any other group of organisms.[3]

Dispite *Culex quinquefasciatus* is not implicated in malaria transmission; it is a mosquito of medical importance. *Culex quinquefasciatus* Say, a member of the Culex pipiens group, is a medically important mosquito and major pest species with a worldwide distribution.[4] *Culex quinquefasciatus* is known to be a major vector of filariasis,[4] St. Louis encephalitis virus (SLEV)[5] West Nile virus (WNV)[6] and Rift Valley Fever virus (RVFV).[7-8] It is considered to be an

opportunistic feeder, and while host choice is regionally variable, it feeds on many species of birds, mammals, and occasionally reptiles and amphibians.[9-10]

A study carried out by Corbel *et al.*[11] in Benin, showed a multiple insecticide resistance mechanisms in *Anopheles gambiae* and *culex quinquefasciatus*. In addition, very recently, Aïzoun and Assongba.[12] showed the temephos tolerance in larvae of mosquitoes, vectors of malaria and in *Culex quinquefasciatus* in Dogbo district in south-western of Benin republic. Therefore, there is a need to investigate the abundance of *Culex quinquefasciatus* mosquitoes in Dogbo district in south-western Republic of Benin.

Very few researches were published on the abundance of *Culex quinquefasciatus* mosquitoes in Dogbo district in south-western Republic of Benin. Therefore, there is a need to carry out new researches for this purpose.

The goal of the current study is to investigate the abundance of *Culex quinquefasciatus* mosquitoes, which are the vectors of many human diseases.

MATERIAL 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.1a) in the locations of Ayomi, Dévé, Honton, Lokogohoué, Madjrè and Totchangni (Fig.1b). The southern borders of Dogbo district are Lokossa and Bopa districts. The northern border is Djakotomey district. The eastern border is Lalo district and the western border of this district is Togo republic. Dogbo district covered 475 km^2 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 investigate the abundance of *Culex quinquefasciatus* mosquitoes, which are the vectors of many human diseases. 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.

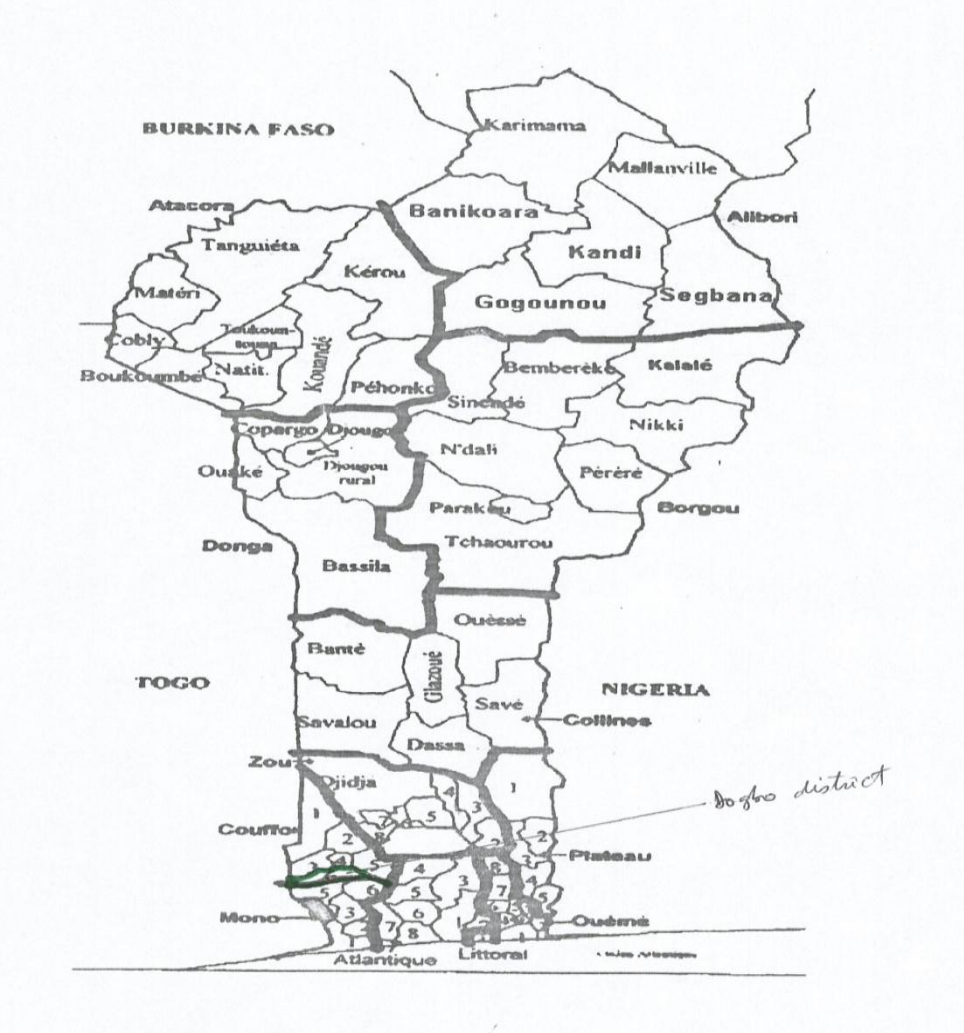

Figure 1a: Map of Republic of Benin showing Dogbo district.

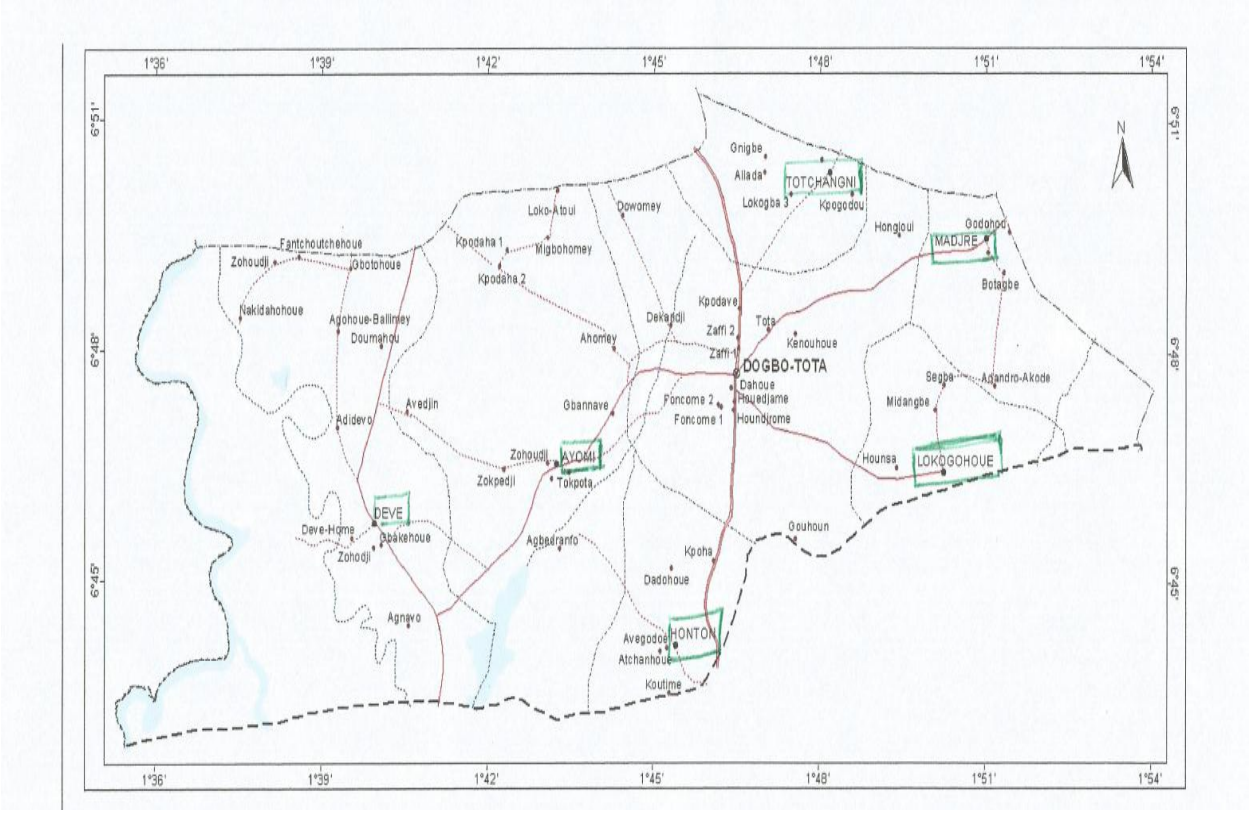

Figure 1b: Map of Dogbo District showing the study area.

Mosquito larvae sampling

Culex quinquefasciatus mosquito larvae were collected in July 2021 during the great rainy season in the locations of Ayomi, Dévé, Honton, Lokogohoué, Madjrè and Totchangni in Dogbo district. Larvae and pupae were collected from four potential breeding sites in each location using the dipping method [13]. After each dipping method in each breeding site, the number of mosquito larvae were accounted and recorded.

Figure 2: A breeding site of *Culex quinquefasciatus* larvae surveyed in Dogbo district.

Adult mosquito collection

Four houses were selected in each location surveyed for adult mosquito collection in the morning. Mosquitoes resting in the houses were collected by electronic racket from 6 a.m. to 7 a.m. The survey was done simultaneously in the four houses during fourteen consecutive days (two weeks). All collected adult mosquitoes were put in netted plastic cups and transferred to the Laboratory for identification, accounting and recording.

Fig. 3: Electronic rackets used during the mosquito collection in the houses.

Statistical analysis

A chi-square test for proportion comparison was performed to compare the proportions of *Culex quinquefasciatus* mosquito larvae collected in each breeding site and the proportions of adult Culex *quinquefasciatus* mosquitoes collected in each house.

RESULTS

Productivity in *Culex quinquefasciatus* larvae of breeding sites surveyed

The analysis of Table 1 showed that a total of 596 *Culex quinquefasciatus* larvae were collected in the six locations surveyed. The highest number (103mosquito larvae) was collected in Honton location whereas the lowest number (96 mosquito larvae) was collected in Dévé location. The mean of the number of mosquito larvae collected per location surveyed by dipping method was 99 mosquito larvae otherwise the mean of the number of mosquito larvae collected per dipping method in a breeding site surveyed ranged from 24 to 25 mosquito larvae.

Table 1: **Recording of number of *Culex quinquefasciatus* larvae after each dipping method in each breeding site.**

Locations	Number of larvae collected after a dipping method in potential breeding site 1	Number of larvae collected after a dipping method in potential breeding site 2	Number of larvae collected after a dipping method in potential breeding site 3	Number of larvae collected after a dipping method in potential breeding site 4	Total
Ayomi	24	27	18	32	101[a]
Dévé	36	16	23	21	96[a]
Honton	19	17	26	41	103[a]
Lokogohoué	14	33	29	22	98[a]
Madjrè	38	19	32	12	101[a]
Totchangni	45	18	15	19	97[a]
Total	176	130	143	147	**596**

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

Density of adult *Culex quinquefasciatus* in house surveyed

The analysis of Table 2 showed that a total of 7819 adult *Culex quinquefasciatus* were collected in an interval of fourteen consecutive days in the six locations surveyed. The highest number (1636 adult mosquitoes) was collected in Totchangni location whereas the lowest number (908 adult mosquitoes) was collected in Lokogohoué location. The mean of the number of mosquitoes collected by day per location surveyed ranged from 64 to116 adult mosquitoes otherwise the mean of the number of adult mosquitoes collected by day per house surveyed ranged from 16 to 29 adult mosquitoes.

Table 2: **Recording of number of adult *Culex quinquefasciatus* caught by electronic rackets in each house.**

Locations	Number of adult mosquitoes collected in house 1 during the survey	Number of adult mosquitoes collected in house 2 during the survey	Number of adult mosquitoes collected in house 3 during the survey	Number of adult mosquitoes collected in house 4 during the survey	Total
Ayomi	252	408	277	302	1239[a]
Dévé	577	318	288	268	1451[a]
Honton	321	317	244	411	1293[a]
Lokogohoué	189	264	99	356	908[b]
Madjrè	89	478	336	389	1292[a]
Totchangni	493	501	289	353	1636[a]
Total	1921	2286	1533	2079	**7819**

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

DISCUSSION

In the current study, the number of *Culex quinquefasciatus* larvae collected per dipping method in a breeding site was high. In the similar way, the number of adult *Culex quinquefasciatus* caught by day per house was also high. *Culex quinquefasciatus* mosquitoes are predominant in most cities across Sub-Saharan Africa and they are of major epidemiological significance as vectors of important diseases like West Nile Virus and filariasis. This vector displays a variety of breeding habitats including swamps, drains, pit latrin and permanent or semipermanent stagnant water bodies full of organic matters [14-15], commonly found within and around African cities. Notably, the rapid unplanned urbanization of major cities in Africa, has favoured the installation of *Culex quinquefasciatus* within the urban environment [16-17]. Although *Culex* spp. females preferentially lay their eggs in collections of water, either stagnant or gentle flow, rich in organic matter, *Cx. quinquefasciatus* is very opportunistic so that any permanent or temporary collection of water may serve as a potential breading site for their larvae.[18-19]

The density of *Culex quinquefasciatus* mosquito larvae were significantly influenced by several environmental factors that are associated with mosquito breeding sites. The higher numbers of *Culex quinquefasciatus* larvae is an indication that the species, which was once considered an urban mosquito is also colonizing rural pockets that were once free of this mosquito [20]. If *Culex quinquefasciatus* mosquito breeding sites are often found in areas polluted by industrial effluents, rotting vegetation, human faeces, cow urine, as well as oil and grease mostly, the most Anopheles mosquitoes traditionally breeds in clear, clean and apparently less contaminated surroundings usually around human habitation. However, both mosquitoes were often found in sympatric life.

The density of adult mosquitoes is determined by the number and productivity of larval habitats and their proximity to human hosts where they can obtain a blood meal.[21] The densities of mosquito vector population vary with seasons due to fluctuating availability of favourable breeding site.[22] Availability, distribution and abundance of mosquitoes depend on types of breeding sites including water surface area and other biological factors.[23-24]

A recent study by Aïzoun *et al*.[25] showed that four mosquito species were collected by electronic racket in Dogbo district. There were: *Anopheles gambiae*, *Culex quinquefasciatus, Aedes aegypti* and *Mansonia Africana.* The factor that could explain the presence of these vectors is urbanization. However, the current study focuses mainly on *Culex quinquefasciatus* mosquito abundance.

CONCLUSION

The control planning against *Culex quinquefasciatus* which is vector of many diseases of significant public health importance and *Anopheles gambiae* which is malaria vector has to focus on breeding site elimination or treatment by improving the basic sanitary infrastructure of water supply and waste destination, as well as activities to promote community engagement within an environmental agenda.

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Conflict of interest

The authors declared no conflict of interest.

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