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Vectorial Potential of *Anopheles* and *Culex* species in the Transmission of Bancroftian Filariasis in the Localities of Makurdi, North Central Nigeria.

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Abstract
The vectorial potential of Anopheline and Culicine mosquitoes in the transmission of *Wuchereria bancrofti* in High-level, Wurukum, North- bank and Wadata localities of Makurdi were determined over a 12-month period. Adult female mosquitoes (4,320) were identified and dissected following standard keys and procedures. The microfilarial infection rates were: 11.2%, 7.3%, 16.1% and 7.8% for High-level, Wurukum, North- bank and Wadata respectively. Chi- square analysis showed significant differences ($P< 0.05$) between vectorial potentials across the study months and the vector species. The order of vector importance was *Culex quinquefasciatus* [2,418 (56.0%)] > *Anopheles gambiae* [1,040 (24.1%)] > *Anopheles funestus* [641 (14.8%)] > 'unidentified' species of *Anopheles* [221 (5.1%)] respectively. *Anopheles gambiae* s.l. and *Anopheles funestus* were potential vectors of *Wuchereria bancrofti* while *Culex quinquefasciatus* was recorded as the major vector in the study area. The present investigation may provide entomological data that would be useful in future vector control interventions in Makurdi.

Keywords: Anophelines, Culicines, microfilarial infection rate, Vectorial potential Makurdi, Nigeria.

1. Introduction
Filariasis is an infection of the human lymphatic system caused by filarial nematodes that are vectored by mosquitoes [1]. According to [2], 1.3 billion people are at risk of the disease globally and the disease is classified into two groups, Bancroftian (*Wuchereria bancrofti)* and Malayan (*Brugia malayi* and *B. timori).*
These three filarial parasites affect over 120 million people in 83 endemic countries worldwide, located primarily throughout tropical and subtropical regions of South America, Asia, the Pacific Islands and Africa [2]. Although designated by the WHO as the world's second leading cause of permanent and long-term disability, this mosquito-borne disease is "potentially eradicable" through drug therapy and vector control [2].
The parasite *W. bancrofti*, which is responsible for the disease in Africa is transmitted by *Culex quinquefasciatus* in urban and semi-urban areas where increased pollution of freshwater bodies and the introduction of pit latrines favour the breeding of the mosquito [3, 4]. In West Africa, *Anopheles gambiae* complex and *A. funestus* are the major transmitters of *W. bancrofti* infections [5].
It has been reported that transmission of bancroftian infection occurs mainly during rainy season when mosquitoes are most abundant, thus demarcating well-defined seasons when transmission is high and low [3]. The epidemiology of the disease in Nigeria is complicated because of the diversity of the environmental conditions of the different regions [6]. Only Bancroftian filariasis has been known to be endemic in Nigeria, as reported for rural communities in the lower Cross River Basin [7, 8]; for Ezza in Ebonyi State [9]; for Igwu basin of Rivers State and parts of the Niger Delta [10, 11] as well as parts of Central Nigeria particularly rural communities in Plateau, Nassarawa and Benue States [12].
Reports have shown that bancroftian filariasis, caused by *W. bancrofti* is widespread in Nigeria and constitutes a major public health problem being the major cause of acute and chronic morbidity [13].

A. gambiae and *A. funestus* are the major vectors in rural Nigeria while *C. quinquefasciatus* is the major vector in urban and semi-urban areas [14]. These mosquito vectors which breed and transmit bancroftian filariasis in Nigeria are reportedly aided by human activities, brought about by urbanization and overcrowding as well as industrialization which together create abundant breeding sites [13]. The availability and proximity of human settlements to these numerous breeding sites have played an important role in the disease transmission and intensity in both rural and urban areas [6, 13].

Nigeria is ranked second highest with lymphatic filariasis (LF) globally [15]. The National Lymphatic Filariasis Elimination Programme (NLFEP) was established in 1997 with the mandate to eliminate the disease as a Public Health problem [15]. In 2007, the NLFEP was merged with the National Onchocerciasis Control Programme (NOCP) in order to integrate implementation of mass drug administration (MDA) in areas that are co-endemic for both LF and Onchocerciasis [3, 15]. However, the NLFEP has not yet completed the mapping of the disease, and as a result, MDA is yet to commence in most of the States likely to be endemic [3]. Records from the Federal Ministry of Health [18] have shown that MDA has been implemented in only five States (Plateau, Nassarawa, Ekiti, Ondo and Osun).

Therefore, the need to determine the vectorial potential of mosquito vectors in other parts of the country like Benue State is very important for the commencement of MDA. Thus, the present investigation was carried out to determine the vectorial potential of some Anopheline and Culicine mosquito species in the transmission of bancroftian filariasis in the major localities of Makurdi, Central Nigeria.

2. Materials and Methods

2.1 Study Area

The present investigation was carried out during July, 2011 to June, 2012 in Makurdi to cover wet and dry season periods. Makurdi is the capital of Benue State located in the middle belt region, North Central Nigeria [16]. It is intersected by the river Benue which is a major source of water with other networks of streams, standing pools, over filled and blocked drainages. Over-grown bushes and fields, even around residential homes and offices are prominent in Makurdi. These provide suitable breeding sites for mosquitoes throughout the wet and dry seasons. There is also characteristic high temperature in Makurdi, (30^{O}C-39^{O}C), which helps in the speedy development and hatching of mosquito eggs. It is suspected that temperature may have an impact on transmission of vector diseases in the selected localities throughout the year. Makurdi is located between longitude 8º35'E and 8º41'E and latitude 7º45'N and 9º52'N. Other detailed geographical and regional indices of the study area have been provided by [17, 18, 19] and some of the features have been depicted in Fig. 1.

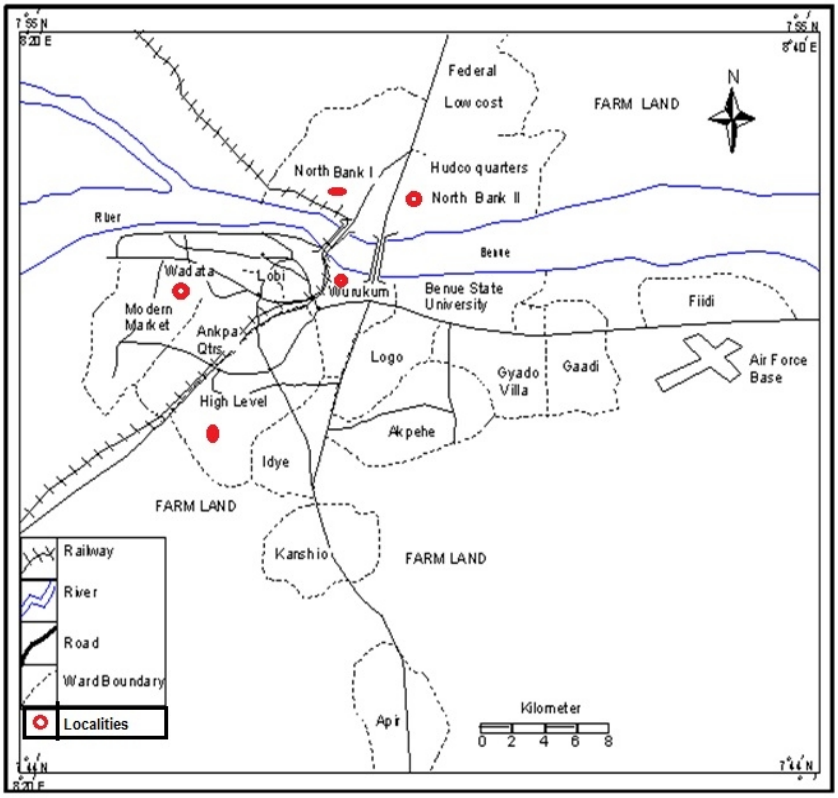

Fig 1: Map of Makurdi Showing the Study Localities (Ministry of Lands and Survey Makurdi, 2012).

2.2 Ethical Consideration and Collection of Mosquito Samples

Verbal informed consent was obtained from the head of each of the randomly selected households before their houses were accessed for mosquito collection in all the study localities. All mosquito samples were collected using standard procedures as provided by [20]. Sampling units were randomly selected from four localities and due to the present security challenges in Nigeria, the mosquito samples were collected with the help of "fly boys" who were recruited from the various study localities where they were well known by the residents of the localities sampled.

Mosquito samples were collected between the hours of dawn and dusk; specifically from 0600-0900 hours at dawn and

1800-2100 hours at dusk from living rooms in the study localities, either alive or dead, most of which were engorged (blood fed). These periods of sample collection were chosen because previous studies have shown that most mosquitoes enter houses to feed at early hours of the night and struggle to go out in the early hours of the day to rest outdoors [21].

The mosquitoes were collected from dark corners, walls, ceilings, clothing and other objects inside living rooms with the aid of mouth-aspirators, mosquito sweep nets, pyrethrum spray sheets and window trap method where applicable.

The mosquito specimens were kept in holding tubes, inside cooling boxes, and carried to the laboratory on the same day or the following day for characterization, identification, dissection and examination as adopted by [20, 22, 23, 24, 25] . The mosquito samples that could not be processed on the same day were refrigerated and worked upon the next day according to the methods of [22].

Even though, the mosquito population for this study was only drawn from indoor-resting mosquitoes, which were expected to be only females, some male mosquitoes were also caught along with the females. Male mosquitoes were therefore, distinguished from the females using key morphological features as described by [4].

2.3 Identification of Mosquito Samples

Dissecting microscope was used for detailed observation and identification of the mosquitoes with particular reference to the head, thorax, wings and hind-legs according to [26]. Morphological characteristics such as length of maxillary palps, wing spots, leg shape, mouthparts and abdominal end model as presented by [27, 28], were used to identify the *Anopheles* species that co-exist in Makurdi. Observations of the morphological features were made at 40 X magnification of the microscope.

2.4 Preparation of Mosquitoes for Dissection

Live blood fed mosquitoes were killed with chloroform, ether or carbon (IV) oxide while unfed mosquitoes were collected in a test tube and while at the bottom, the end of the tube was rubbed sharply against the palm of the hand to stun the mosquitoes according to the WHO standard [1]. After immobilization, each mosquito was placed on a slide and held by one wing while the legs were being removed one at a time and after wards, the other wing was pulled off. The mosquito was then placed on a fresh dry slide and arranged in a more suitable position for dissection of the stomach/abdominal region and salivary glands as described by [20] and as adopted by [25].

2.5 Dissection of the Salivary Glands for Determination of vectorial Potential

This was carried out on the mosquito vectors in terms of microfilarial infection rates for both *Anopheles and Culex* species, using the procedure described by [25]. The salivary glands of the nulliparous mosquitoes were not dissected since they are not infected [4].

The anterior part of the mosquito to be dissected was placed on a slide with the head pointing to the right hand side and a drop of saline was added to keep the specimen fresh. Meanwhile, the left dissecting needle was placed gently on the thorax, just below the region where the glands lie. The right needle was also placed at the same point but pulled towards the right direction to bring out the head with the salivary glands attached. Some salivary glands however, did not come out with the head of the mosquito but these were located by carefully teasing the lower part of the thorax and examining carefully using a dissecting microscope.

The glands were detached from the head and then placed on another microscope slide with a little drop of saline and covered with a cover slip and a gentle pressure was exerted on the cover slip to rupture the gland cells.

The thoracic muscles were also teased carefully in a saline solution to search for microfilariae. If the salivary glands contained microfilariae, they were seen to emerge from the glands as minute spindle-shaped structures (≈ 130 - 320 *μm in* length).

All the microfilariae identified in the mosquitoes for this investigation had nuclei which did not reach their tails, the tails tapered evenly and they also had sheaths. The features above were used as a basis to classify the microfilariae as those of *W. bancrofti* as described by [28].

W. bancrofti larval stages (L_1, L_2 and L_3) were also found during dissection from the three parts of the female mosquitoes (abdomen, thorax and head respectively) using their morphological features after they were stained with Giemsa's stain as described by [28, 29].

Vectorial potential of the vector species was therefore, calculated in terms of microfilarial infection rate using the formula adopted by [33] as follows:

$$\text{Infection Rate} = \frac{\text{Number of Mosquitoes carrying } L_1 + L_2 + L_3}{\text{Number of Mosquitoes dissected}} \text{ X } 100$$

2.6 Statistical Analysis of Data

The Predictive Analytical Software (PASW) Version 18 was used in running Chi-square (χ^2) statistic on the data collected.

Chi-square (χ^2) statistic was considered the best statistic for test of homogeneity across sample localities so as to determine whether or not the nature of the sample localities affected the distribution of data across them.

Significant levels were measured at 95% confidence level with significant differences considered at $P < 0.05$.

3. Results

The results of the present investigation are as depicted in Tables 1- 4. In terms of study localities, North-bank had the highest vectorial potential of 16.1%, followed by High-level (11.2%) while Wadata and Wurukum localities had similar vectorial potentials of 7.8% and 7.3% respectively. These differences in vectorial potential across the localities were significantly different ($P < 0.05$). *C. quinquefasciatus* had the highest population in the dry season than all the *Anopheles* mosquitoes across the four localities.

Table 1 presents the monthly vectorial potentials in the mosquito vector population from High-level locality where the total vectorial potential was 11.2%. Specifically, *C. quinquefasciatus* had the highest vectorial potential of 9.3% and this was recorded in all other study months except for July, 2011. The least vectorial potential (0.2%) was recorded in *A. gambiae* in only two of the study months (October and November, 2011).

There were significant differences in the vectorial potential both within the *Anopheles* group and, between *C. quinquefasciatus* and *Anopheles* species dissected from High-level locality ($P < 0.05$).

Results showing the vectorial potential of the mosquitoes dissected from Wurukum locality are presented in Table 2, with a total vectorial potential of 7.3%. *C. quinquefasciatus* had the highest vectorial potential of 5.1% spread across both the dry and wet season months of this study. In the *Anopheles*

vector species, vectorial potential was predominantly recorded in the dry season months with *A. gambiae* being more infected of *Anopheles* had the lowest infection rate of 0.4%. Statistical analysis showed a significant difference in the vectorial potential between *C. quinquefasciatus* and the *Anopheles* vector group encountered in this study ($P < 0.05$). However, (1.0%) than *A. funestus* (0.8%) while the 'unidentified' species

there was no significant difference in the vectorial potential among the *Anopheles* species dissected in the Wurukum locality ($P < 0.05$).

Table 1: Monthly Vectorial Potential of *Anopheles* and *Culex* Mosquitoes Dissected from High Level Locality in Makurdi

Month of Study	No of Mosquitoes dissected		Species of Mosquitoes/ Infection Rates (%)			
		C. quinquefasciatus	*A. gambiae*	*A. funestus*	Unidentified *An. species*	Total Infection
July, 2011	121	-	-	-	-	-
August, 2011	132	6(4.5)	-	-	-	6(4.5)
September, 2011	101	4(4.0)	-	-	-	4(4.0)
October, 2011	65	3(4.6)	1(1.5)	1(1.5)	1(1.5)	6(9.2)
November, 2011	46	19(41.3)	1(2.2)	4(8.7)	2(4.3)	26(56.5)
December, 2011	32	23(71.9)	-	3(9.4)	2(6.2)	28(87.5)
January, 2012	46	37(80.4)	-	3(6.5)	1(2.2)	41(89.1)
February, 2012	60	3(5.0)	-	1(1.7)	1(1.7)	5(8.3)
March, 2012	75	1(1.3)	-	-	-	1(1.3)
April, 2012	139	4(2.9)	-	-	-	4(2.9)
May, 2012	146	3(2.0)	-	-	-	3(2.0)
June, 2012	165	2(1.2)	-	-	-	2(1.2)
Total	**1,128**	**105(9.3)**	**2(0.2)**	**12(1.1)**	**7(0.6)**	**126(11.2)**

(a) Anopheles group: $\chi^2 = 7.143, d.f = 2, P = 5.99$ (b) *Culex* vs *Anopheles:* $\chi^2 = 56.000, d.f = 1, P = 3.84$

Table 2: Monthly Vectorial Potential of *Anopheles* and *Culex* Mosquitoes Dissected from Wurukum Locality in Makurdi

Month of Study	No of Mosquitoes dissected		Species of Mosquitoes/Infection Rates (%)			
		C. quinquefasciatus	*A. gambiae*	*A. funestus*	Unidentified *An. species*	Total Infection
July, 2011	230	-	-	-	-	-
August, 2011	191	2(1.0)	-	-	-	2(1.0)
September, 2011	114	3(2.6)	-	-	-	3(2.6)
October, 2011	108	10(9.2)	3(2.8)	1(0.9)	2(1.8)	16(14.8)
November, 2011	83	8(9.6)	2(2.4)	1(1.2)	1(1.2)	12(14.5)
December, 2011	38	6(15.8)	1(2.6)	3(7.9)	-	10(26.3)
January, 2012	52	16(30.8)	6(11.5)	3(5.8)	1(1.9)	26(50.0)
February, 2012	43	12(27.9)	-	1(2.3)	1(2.3)	14(32.6)
March, 2012	50	2(4.0)	-	-	-	2(4.0)
April, 2012	68	1(1.5)	-	-	-	1(1.5)
May, 2012	110	-	-	-	-	-
June, 2012	106	1(0.9)	-	-	-	1(0.9)
Total	**1,193**	**61(5.1)**	**12(1.0)**	**9(0.8)**	**5(0.4)**	**87(7.3)**

(a) Anopheles group: $\chi^2 = 2.846, d.f = 2, P = 5.99$ (b) *Culex* vs *Anopheles:* $\chi^2 = 14.080, d.f = 1, P = 3.84$

Table 3: Monthly Vectorial Potential of *Anopheles* and *Culex* Mosquitoes Dissected from North-bank Locality in Makurdi

Month of Study	No of Mosquitoes dissected		Species of Mosquitoes/Infection Rates (%)			
		C. quinquefasciatus	*A. gambiae*	*A. funestus*	Unidentified *An. species*	TOTAL Infection
July, 2011	68	-	-	-	-	-
August, 2011	110	-	-	-	-	-
September, 2011	121	-	-	-	-	-
October, 2011	111	16(14.4)	3(2.7)	2(1.8)	-	21(18.9)
November, 2011	32	24(75.0)	6(18.7)	2(6.2)	-	32(100.0)
December, 2011	47	16(34.0)	11(23.4)	2(4.3)	-	29(61.7)
January, 2012	60	19(31.7)	5(8.3)	3(5.0)	-	27(45.0)
February, 2012	34	11(32.3)	4(11.8)	-	-	15(44.1)
March, 2012	40	1(2.5)	-	-	-	1(2.5)
April, 2012	42	3(7.1)	1(2.4)	-	-	4(9.5)
May, 2012	76	2(2.6)	1(1.3)	-	-	3(3.9)
June, 2012	93	1(1.1)	1(1.1)	-	-	2(2.1)
TOTAL	**834**	**93(11.2)**	**32(3.8)**	**9(1.1)**	**-**	**134(16.1)**

(a) Anopheles group: $\chi^2 = 12.902,\ d.f = 1,\ P = 3.84$ (b) *Culex* vs *Anopheles:* $\chi^2 = 20.179,\ d.f = 1,\ P = 3.84$

Table 3 provides data for the vectorial potential of the mosquito vectors across the twelve months (12) months from North-bank locality. The total microfilarial infection rate here was recorded as 16.1% with the highest vectorial potential of 11.2%, as recorded in *C. quinquefasciatus* vectors, followed by *A. gambiae* (3.8%) and *A. funestus* (1.1%). There was no infection recorded in the 'unidentified' *Anopheles* species during the study period. There were significant differences in the vectorial potential between *C. quinquefasciatus* and the *Anopheles* group, and also among the *Anopheles* species dissected in this study (P < 0.05).

The vectorial potential of the mosquito vector population dissected from Wadata locality is presented in Table 4. The total vectorial potential from this locality was 7.8%, with the vectorial potentials generally being higher in the dry season months than during the wet season months for all vector species dissected (P < 0.05). Also *C. quinquefasciatus* had the highest vectorial potential of 5.5%, followed by *A. gambiae* (1.2%) while *A. funestus* and the 'unidentified' species of *Anopheles* had similar vectorial potentials of 0.6% and 0.5% respectively. There was a significant difference in the vectorial potential between *C. quinquefasciatus* vectors and the *Anopheles* group (P < 0.05), but there was no significant difference in the vectorial potential among the *Anopheles* vectors (P < 0.05).

Table 4: Monthly Vectorial Potential of *Anopheles* and *Culex* Mosquitoes Dissected from Wadata Locality in Makurdi

Month of Study	No. of Mosquitoes dissected	Species of Mosquitoes/Infection Rates (%)				
		C. quinquefasciatus	*A. gambiae*	*A. funestus*	Unidentified *An. species*	Total Infection
July, 2011	84	-	-	-	-	-
August, 2011	125	2(1.6)	1(0.8)	-	-	3(2.4)
September, 2011	233	5(2.1)	-	1(0.4)	-	6(2.6)
October, 2011	37	12(32.4)	2(5.4)	1(2.7)	2(5.4)	17(45.9)
November, 2011	41	16(39.0)	2(4.9)	1(2.4)	2(4.9)	21(51.2)
December, 2011	69	14(20.3)	5(7.2)	3(4.3)	1(1.4)	23.(33.3)
January, 2012	16	6(37.5)	3(18.7)	1(6.2)	1(6.2)	11(68.7)
February, 2012	41	3(7.3)	1(2.4)	-	-	4(9.8)
March, 2012	132	2(1.5)	-	-	-	2(1.5)
April, 2012	60	1(1.7)	-	-	-	1(1.7)
May, 2012	178	1(0.6)	-	-	-	1(0.6)
June, 2012	149	2(1.3)	-	-	-	2(1.3)
TOTAL	**1,165**	**64(5.5)**	**14(1.2)**	**7(0.6)**	**6(0.5)**	**91(7.8)**

(a) Anopheles group: $\chi^2 = 4.222,\ d.f = 2,\ P = 5.99$ (b) *Culex* vs *Anopheles:* $\chi^2 = 15.044,\ d.f = 1,\ P = 3.84$

4. Discussion

In the present study, *C. quinquefasciatus* had the highest population in the dry season across the four localities. This agrees with the findings of [13, 14], who stated that *A. gambiae* and *A. funestus* are the major vectors in rural Nigeria while *C. quinquefasciatus* remains the major vector in the urban and semi-urban areas. This is linked to the fact that the latter species is known to breed in poorly sanitized areas with filthy and foul smelling water collections which are eminent in the Makurdi area [31]. This may explain why [32] reported *W. bancrofti* infection to be a major public health problem in Benue State and advocated for the inclusion of the state in the National Programme to Eliminate Lymphatic Filariasis (NPELF). Also working in Ebonyi State, in Nigeria, [33] reported *C. quinquefasciatus* as the major vector with *A. gambiae* and *A. funestus* also playing significant roles in the transmission of lymphatic filariasis in the area.

The incrimination of *C. quinquefasciatus* in this study is in line with the earlier observations by [34] on the possible involvement of *Culex* species in the transmission of lymphatic filariasis in Northern Nigeria. It is also in consonance with the findings of [35] that *C. quinquefasciatus* is a potential vector of bancroftian filariasis in most West African cities. The vectorial potentials of 11.2%, 7.3%, 16.1% and 7.8% respectively obtained across the localities in the present study are therefore, comparable to reports from filariasis endemic countries [36, 37]; but are much higher than that obtained by [38], who reported an overall vectorial potential of only 0.5% in the Kainji Lake area of Nigeria. This variation may be attributed to the fact that the malaria vector control using pyrethroid treated nets carried out at the Kainji Lake area at that time may have controlled the vectors of bancroftian filariasis in communities where both diseases co-existed.

Other records of vectorial potential exist from works carried out in Nigeria [39] which reported an experimental vectorial potential of up to 74.6% in laboratory reared *C. quinquefasciatus* in the Jos area (middle belt region). An overall vectorial potential of 5.5% has also been reported in the Jos area [40]. A total vectorial potential of 2.3% has been reported in Makurdi [31]. Explanations for the variations when compared to the 11.2%, 7.3%, 16.1% and 7.8% vectorial potentials obtained from the four localities in the present study could not be exactly ascertained. However, the explanations may be similar to those provided by [41] as having to do with vector sample size, changes in environmental conditions and vulnerability of the human hosts in the respective areas.

Although the vectorial potential reported in the present study is similar to the findings of [42], who reported vectorial potentials of 9.2% and 11.1% in *A. gambiae* s.s. and *A. arabiensis* respectively in Central Nigeria, they did not report *C. quinquefasciatus* as a vector in the study area.

With regard to seasons, there have not been any documented

records on comparison between vectorial potential in the wet and dry seasons in Makurdi except for the present study. The vectorial potentials obtained in the present study were at variance with those reported by [30] in a similar study on seasonal changes of vectorial potentials of bancroftian filariasis vectors in coast province, Kenya. It is likely that these variations were as a result of differences in rainfall amount, human population density and availability of suitable breeding sites in the study localities where the present study was carried out.

The results of the present investigation have shown that the vectorial potentials were low during the wet season and high during the dry season in the study area. This implies that the potential risk of transmission of *W. bancrofti* larvae was more pronounced during the dry season in the Makurdi area. This is at variance with, and opposite to the findings of [30]. The present observation at Makurdi is also contrary to that reported by [43] who pointed out three discrete periods of *W. bancrofti* transmission in West Africa from May to July (early wet season), August to September (end of wet season) and October to November (early dry season) as periods of low, intense and moderate transmissions respectively. The sharp contrast between the result of the present study as compared to those of [30, 42] may be attributed to factors such as those that control the movement of microfilariae. For instance according to [29], the microfilariae prefer warm, moist skin in warm weather to be able to leave the mosquito's salivary glands and penetrate the host; cold makes them inert and dryness destroys them.

According to [1], high ambient humidity and skin moisture favour successful transmission of lymphatic filarial microfilariae, since the vector's salivary glands play no role in the transmission process, unlike malaria. This may also be one reason why more mosquitoes were carrying microfilariae during the dry season than the wet season; biting activity and transmission were reduced during the dry season, making the vectors to harbour more microfilariae in their salivary glands than during the wet season in the study area.

It has been reported [29] that optimum conditions for microfilarial growth are $\leq$ 80°F (26.9 ^{0}C) and 90% humidity. This implies that only a small percentage of the ingested microfilariae would have developed to L_3 infective larvae. The high temperature usually experienced in the Makurdi area ($\leq$100 ^{0}F) may also have contributed in reducing the activity of the microfilariae during mosquito bites, thus leaving them lodged in the salivary glands of the vectors.

The vectorial potentials recorded in the present study were lower as compared to other records elsewhere. One reason for these comparatively low vectorial potentials may be the initial control effort during December, 2004 and March, 2005 by the Global Programme to Eliminate Lymphatic Filariasis (GPEWLF) in Benue State where mass chemotherapy using invermectin and Albendazole was done as part of efforts to eliminate the disease [32]. This may also be the reason why [32] working on the mapping of lymphatic filariasis in Benue State, Nigeria, did not record a single infection out of the 100 individuals (human) examined for the disease. Another possible reason for the low vectorial potential in the Makurdi area may be derived from [29] who have reported that in order for an infective human host to infect mosquitoes, there must be about 15 or more microfilariae per drop of blood (20 cu.mm), and that a high concentration of 100 or more microfilariae per drop of blood is fatal to the mosquitoes. This implies that though, the human host might be a reservoir, the mosquitoes would not get infected if the recommended dosage is not met by the host.

5. Conclusion

Vectorial potential was significantly higher in *Culex quinquefasciatus* than in *Anopheles* species, implying that *C. quinquefasciatus* was the major lymphatic filariasis vector in Makurdi. *Wuchereria bancrofti* was the only filarial parasite encountered during the study.

The results obtained in the present study have shown that the vectorial potentials of both *Anopheles* and *Culex* species were lower during the wet season and higher during the dry season in the study area. This implies that the potential risk of transmission of *W. bancrofti* larvae was more in the dry season. Hence, dry season breeding sites and adult populations of these vectors in the study area should be controlled.

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