

Mosquito Ecology and Malaria Transmission in Guinea Savanna Zone in Taraba State, Nigeria



by

DR TAJUDEEN BABATUNDE LAMIDI
Biological Sciences Department,
Federal Polytechnic Bali, Nigeria
tajudeenlamidi68@gmail.com

**Presented at the World Congress of Epidemiology
2024, School of Public Health, University of Cape
Town**

Thursday 26th September, 2024

Session Theme: Infectious disease epidemiology



INTRODUCTION

- **Mosquitoes** of the family **Culicidae** are considered a nuisance and a major public health problem, because their females feeds on human blood and thus transmit extremely harmful diseases, such as malaria, yellow fever and filariasis ^[1].
- They are estimated to transmit diseases to more than 700 million people annually and responsible for the death of about 1 in 17 people ^[2].
- Effective transmission of mosquito-borne disease requires successful contact between female mosquitoes and their hosts ^[2].
- Among Anophelinae, the members of the genus *Anopheles* are best known for their role in transmitting malaria and filariasis worldwide ^[3].
- Of these diseases, malaria caused by *Plasmodium* parasite is one of the greatest killer diseases in the world ^[4].

INTRODUCTION CONTD.

- [5] reported an estimated 249 million cases of malaria in 2022 globally, out of which 90.0 % cases with 92% deaths were in Africa continent.
- Nigeria accounted for about 27% of this global burden [5]
- Similarly, cases had been reported in Taraba state, North-east zone Nigeria [6] [7] [8].
- The distribution pattern, transmission and intensity of the disease are dependent on the degree of urbanization and the distance from vector breeding sites [9].
- The endemicity of malaria in any region is determined by indigenous Anopheles mosquitoes, abundance, feeding, resting behavior and their Plasmodium infectivity, among other factors [10] [5].

AIM AND OBJECTIVES

- The **aim** of the Study The study is to investigate the population structure/dynamics, longevity and infectivity of Anopheles species in relation to malaria transmission in Bali district of Bali L.G.A of Taraba state. The specific **objectives** are:
 - i. To identify the mosquito species prevalent in Bali district
 - ii. To determine the population structure of the mosquito species in Bali district
 - iii. To determine Man-Biting Rate of the Anopheles species
 - iv. To determine the infection rate of Anopheles with Plasmodium (malaria parasite)
 - v. To determine the longevity and life expectancies of the identified Anopheles species

- **Study Area:** Taraba State is located between longitude 8.5° – 11.6° E and latitude 6.5° – 9.5° N (8° 00'N and 10° 30'E coordinates) in the north-eastern geopolitical zone of Nigeria with a size of 54,473 square kilometers representing 5.89% of the country landmass ^[11].
- **Mosquito Sampling:** Using standard method as described by ^[4].
- **Laboratory Examination of Mosquitoes**
- **Morphological Identification and Sorting out of Mosquitoes**
- **Determination of Parity** ^[12].

- **Estimation of Infective (Sporozoite) Rate of Anopheles** using CSP ELISA
- **Determination of Longevity/Survival Rate** as explained by ^[13]
- **Determination of Vectorial Capacity** using $C = ma^2p^n / -\ln p$; where m=density to man, a=Human Blood index, p^n =probability of surviving incubation, $1/-\ln p =$ longevity/life expectancy
- **Data Analysis using ANOVA**
- **Ethical Consideration** from Bali LG/Health Authority

RESULTS

Table 1: Abundance of mosquito species in the study communities

Mosquito species	Study communities within Ball district			Total (%)
	Daniya Ball No (%)	Fundalara No (%)	Gazabubarkeji No (%)	
<i>Anopheles gambiae</i>	85 (87.5)	316 (97.2)	188 (96.9)	589 (95.9)
<i>Mansonia uniformis</i>	7(7.4)	3 (0.9)	1 (0.5)	11 (1.8)
<i>Culex quinquefasciatus</i>	2 (2.1)	6 (1.8)	4 (2.1)	12 (1.9)
<i>Aedes aegypti</i>	1 (1.1)	0 (0.0)	1 (0.5)	2 (0.3)
Total (%)	95(15.5)	325 (52.9)	194 (31.6)	614

Table 2: Man-Biting Rate and Infective Biting Rate of *Anopheles gambiae*

Seasons	No (N)	ffed (FF)	Man Night (MN)	MBR (FFxHBI / MN)	Sporozoite rate (SR)	IBR (MBR x SR)
Wet	413	186	100	1.86	0.005	0.01
Dry	72	5	88	0.07	0	0
Total	485	191	188	1.93	0.005	0.01

Table 3: Seasonal variation in survivorship and longevity of *Anopheles gambiae* mosquitoes in Bali, June-December, 2018

Seasons	No dissected N	No parous P	Proportion Parous (P/N)	Probability Of daily Survival, $P = \sqrt{P / N}$	Life Expectancy, $L=1/\log p$ (Days)
Wet	160	92	0.57	0.75	8.00
Dry	17	08	0.47	0.68	5.90
Total	177	100	1.04	1.43	13.90
Mean	88.5 (+0.57)	50 (+0.59)	0.44 (+0.35)	0.56 (+0.13)	3.97 (+0.36)

Table 4: Seasonal variation in infection probability and vectorial capacity of *Anopheles gambiae* in Bali district, June – December, 2018

Season	Number collected N	Room occupant O	Density per man N/O	Atm. Temperature (°C)	Duration of sporogony, n (Days)	Probability of surviving sporogony P^s	Infective life L-n (Day)	Vectorial capacity, C
Wet	413	100	4.13	27.0	10	0.06	-2	0.99
Dry	72	88	0.81	26.7	10.4	0.02	-4.5	0.04
Total	485	188	4.94	53.7	20.4	0.08	-6.5	1.03
Mean	242	94	3.11	26.85	10.2	0.04	-6.2	0.5
	(+0.50)	(+0.04)	(+0.55)	(+0.004)	(+0.013)	(+0.02)	(+0.3)	(+0.4)

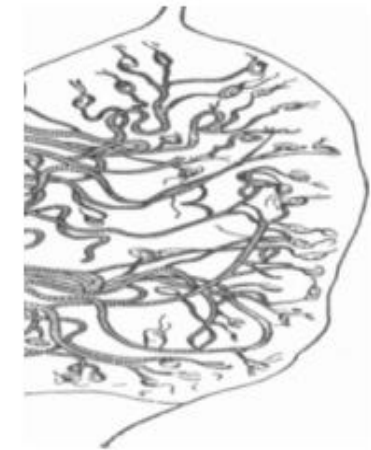


Fig. 4.1. Ovary of newly emerged female *Anopheles* with terminal tracheoles showing characteristic tight skeins indicating that female is nulliparous
(Source: Beklemishev et al., 1959)

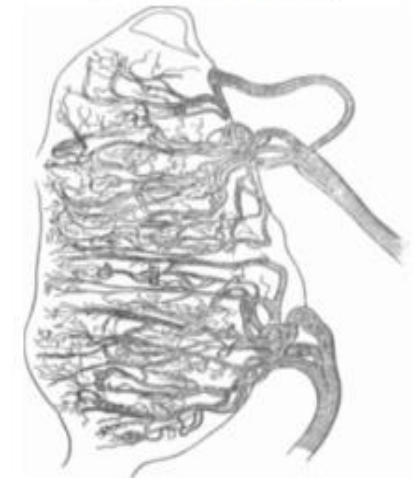


Fig. 4.2. Ovary of female *Anopheles* after oviposition with terminal tracheoles showing net-like formation
(Source: Beklemishev et al., 1959)

CONCLUSION

- The occurrence of these species of mosquitoes in the study areas shows that the communities are at risk of contacting mosquito-borne diseases since all of them are proven vectors of dreadful diseases.
- The intervention efforts should be geared up mostly in the wet/hot season which is of epidemiological significance especially to malaria disease.
- This kind of study with ultimate objective of determining the potential rate of contact between infectious principal malaria vectors and susceptible hosts is very rare.
- The *Anopheles gambiae* population in Bali district was dominated by old mosquitoes due to high rates of daily survival.
- The longevity of this mosquito in this area with the favourable atmospheric temperature for Plasmodium development, make for high vectorial potential to the transmission of malaria.
- This information on the survivorship and vectorial capacity of *Anopheles gambiae* can pave way for more informed vector control measures



THANKS FOR LISTENING

