An Investigation on the Distribution of Mosquito Species in Guyuk L.G.A of Adamawa State, Nigeria

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Abstract: Mosquitoes are vectors of parasites causing diseases and are distributed in various ecological niches. This research work was set to determine the distribution and relative abundance of mosquito larvae in Guyuk Local Government Area of Adamawa State within the months of August 2014 and January 2015. Banjiram, Guyuk, Bobini and Chikila districts were surveyed using standard entomological procedures. Dipping Method was used in collecting larval samples from the field and reared to adult in insectaria. Results revealed two hundred and one (201) potential mosquito breeding sites, which were grouped with respective densities: cans/containers/tyres (16.75); ditches/pools/swamps (10.44); domestic runoffs/gutters (14.04); tree holes/leaf axils (5.16); and vehicle tyre tracks/human and animal foot prints (1.62). A total of two thousand, six hundred and eighty nine (2689) mosquito larvae were collected and subsequently reared to adults. The types of breeding sites, species of mosquito, as well as their seasonal distribution varied when analyzed.

Key words: Breeding, Larvae, Mosquito, Species

I. Introduction

Mosquito have successfully adapted to climates from the arctic to the equator, and everywhere they have solved fundamental survival problems. They must locate carbohydrate to fuel their flight muscles, blood to supply protein to the egg clutch, and suitable habitats in which to lay their eggs. They breed in natural or man-made, temporary, semi-permanent as well as permanent water bodies [6].

More than five hundred thousand people worldwide die from mosquito-borne diseases every year [13]. Not only can mosquitoes carry diseases that afflict humans, they also transmit several diseases and parasites that dogs and horses are very susceptible [12]. These include dog heartworm, West Nile Virus and Eastern Equine Encephalitis. In addition, mosquito bites can cause severe skin irritation through an allergic reaction to the mosquito's saliva – this is what causes the red bump and ditching. Mosquito vectored diseases include protozoan diseases i.e. malaria, filarial diseases such as dog heartworm, and viruses such as dengue, encephalitis and yellow fever. CDC Travelers' Health provides information on travel to destinations where human-borne diseases might be a problem (American Mosquito Control Association).

Interest in environmental management of mosquito larval habitats has been rekindled due to the debilitating effects of malaria in tropical Africa. Appropriate management of larval habitats in Sub-Saharan countries, particularly during the dry season may help suppress vector densities and mosquito-borne diseases transmission. Permanent breeding sites during the dry season may serve to seed the additional habitats formed during the rainy season [7]. The indications for larval control are limited to densely populated areas with relatively few breeding places, such as urban or irrigated arid areas [1].

II. Materials and Method

Mosquito larvae, particularly the common Culex, Aedes and Anopheles, are usually found at the water's surface and frequently next to vegetation or surface debris. In larger pools and ponds, they are usually near the margins, not in open, deep water. Dipping was concentrated around floating debris and aquatic and emergent vegetation. If there is a strong wind, dipping was done on the windward side of the habitat where larvae and pupae were most heavily concentrated [8].

Each water body may contain a number of different microhabitats which could contain different mosquito species. Microhabitats are such places as under tree roots within clumps of emergent vegetation, under floating or overhanging vegetation and in open water. Different microhabitats within an area were identified and many are sampled in order to obtain an accurate picture of the areas' species composition.

The larvae collection method was adopted from [9] which includes the following seven steps;

The shallow skim consists of submerging the leading edge of the dipper, tipped about 45^o, about an inch below the surface of the water and quickly but gently, moving the dipper along a straight line in open water or in water with small floating debris. End the stroke just before the dipper was filled to prevent overflowing. The shallow skim is particularly effective for anopheles larvae that tend to remain at the surface longer than Aedes and culex. Anopheles is usually associated with floating vegetation and debris.

The second method in open water with or without floating objects is the complete submersion. Many mosquito larvae, particularly those of the genera Aedes and Psorophora, are very active and usually dive below the surface quickly if disturbed. In this case, a quick plunge of the dipper below the surface of the water is required, bringing the dipper back up through the diving larvae. The dipper carefully brought up to avoid losing the larvae in the overflow current.

Partial submersion technique was employed when sampling at the edges of emergent vegetation. Here the dipper is tilted at about 45^o, straight down adjacent to the vegetation. This causes the water around the vegetation to flow into the dipper, carrying the larvae with the flow. There is no need to move the dipper horizontally, and the dipper is pulled up before it is full.

In very shallow water, the flow-in method is used. Larvae was collected by pushing the dipper into the substrate of the pool and letting the shallow surface water, debris and larvae flow into the dipper, the dipper is not moved horizontally.

Scraping technique was used to sample the larvae that may be under floating or emergent vegetation. This method was used in habitats that contain clumps of vegetation such as tussocks of sedges, floating mats of cattails or water lettuce or other plants that were too large to get in the dipper, or clumps of submerged vegetation such as hydrilla or bladderwort. The water was dipped in towards the vegetation and ended by using the dipper to scrape up against the base or underside of the vegetation to dislodge larvae.

The simple scoop is the method used and consists of simply scooping a dipperful of water. It is often the method referred to in much of the literature as "the standard dipping procedures", while it can be successfully used to collect culex larvae, it is still not the method of choice. This was especially useful in pools and the other shallow water or when larvae are disturbed and dive to the bottom. The dipper was submerged completely to the bottom litter and slowly moved around. The darker mosquito larvae and pupae stood out against the background of a white or aluminium dipper. Once larvae appeared in the dipper, it is lifted upward.

One or more of these methods was used to determine the mosquito species composition of most aquatic habitats, excluding those whose openings are smaller than dipper, such as tires, rock pools, tree-holes and tree root systems like those found in swamps. In those cases, a smaller container, such as vial, measuring spoon or tea strainer was used in the same seven ways as the dipper and the content transferred to smaller containers. Then there was the tubular dipper, the chef's poultry baster, for those really hard to get to places like plant axils, tree-holes and tee root holes.

The contents of smaller containers of the same type/group in a compound or area were carefully pooled together into a white bowl. Natural tree hole collections was carried out by means of a bore glass pipette (0.5-1cm) attached to a squeeze bulb rubber. Samples collected were labelled according to the types of containers, the macro habitat and ecological foci. Larvae and a sample of water from each habitat was placed in plastic bags and transported to the laboratory for further examination.

Thereafter, the larvae were reared to adults in the laboratory in bowls containing a diet of baker's yeast and mashed Yale cabin biscuit. Data characteristics of each aquatic habitat were recorded on a field sampling form using [3] method. These include; water quality, categorized into three types as clear, turbid and polluted. Clear water refers to water from opaqueness while turbid water was having sediments and suspended particles and polluted water as water containing high organic and oily matter.

The turbidity of the water was estimated by placing water samples in a glass test tube and holding against a white background and was classified into two levels ranging from clear or not clear. Canopy cover was by visual estimate of the area of habitat covered by shade as a percentage. Emergent plants included both aquatic and immersed terrestrial vegetation. This was measured as percentage of water surface covered by flora [3]

Other physical parameters noted included depth and the nature of breeding site either temporary or permanent.

III. Result and Discussion

Table 1: Mosquito Breeding and Abundance in Guyuk

Habitat type	District	Cans/	Ditches/	Gutters/	Tree	Prints	subtotal	total

		containers H1	swamps H2	run-offs H3	holes H4	H5		
Total number of sites examined	Bobini	56	16	12	2	5	91	331
	Guyuk	41	12	16	3	4	76	
	Banjiram	67	5	6	3	2	83	
	Chikila	56	8	9	3	5	81	
Number of sites with larvae	Bobini	31	8	5	1	2	48	201
	Guyuk	29	9	9	2	1	50	
	Banjiram	36	2	4	3	2	47	
	Chikila	41	4	5	3	3	56	
Number of larvae sampled	Bobini	468	92	97	21	5	683	2689
	Guyuk	274	212	178	56	0	720	
	Banjiram	506	58	49	00	8	621	
	Chikila	494	87	63	21	0	665	

Table 2: Mean Larval Densities in Different Habitat Types in Guyuk

Habitat type	Number of sites containing larvae	Number of larvae collected	Density (larvae/habitat)
H1 Cans/containers/tyres	107	1792	16.75
H2 Ditches/swamps	43	449	10.44
H3 Run off/gutters	24	337	14.04
H4 Tree holes/leaf axils	19	98	5.16
H5 Foot print/tyre tracks	8	13	1.62

Table 2 reveals the larval densities of mosquitoes, cans and containers (H1) had highest larval densities of 16.75 followed by domestic run-offs and gutters which had 14.04, tyre tracks had the least larval densities.

Table 3: Distribution of Mosquito in Different Habitat in Guyuk

Location	Species	H1	H2	H3	H4	H5
Bobini	Culex	133	27	18	7	1
	Anopheles	132	13	25	5	0

	Aedes	223	52	46	9	4
Guyuk	Culex	57	31	26	16	0
	Anopheles	81	0	34	15	0
	Aedes	162	181	86	25	0
Banjiram	Culex	167	26	13	0	0
	Anopheles	78	0	7	0	0
	Aedes	271	32	29	0	0
Chikila	Culex	164	25	7	0	0
	Anopheles	41	10	10	0	0
	Aedes	283	52	36	21	0

Table 3 reveals the distribution of mosquito larvae in the various habitats, in Banjiram, only anopheles species were found to be absent in habitats 2, 4 and 5 but Aedes and Culex species were found in all the habitats in Bobini districts.

Table 4: Distribution of Mosquito Larvae in Habitats of Different Qualities in Guyuk

Habitat quality		**Aedes**	**Anopheles**	**Culex**	**Total**
Water quality	Clear	336	81	113	560
	Turbid	1134	98	567	1799
	Organic	36	218	76	330
Depth	Shallow <1m	1536	386	756	2678
	Deep >1m	0	11	0	11
Light	Sun lit	948	229	388	1565
	Shaded	588	168	368	1124

Table 4 reveals larvae collected in different water qualities, mosquito larvae were predominantly found in turbid water totally to 1799 larvae, shallow water at depth below 1m, 2678 mosquito larvae were collected. Both shaded and lit water habitat had fairly equal distribution of mosquito larvae.

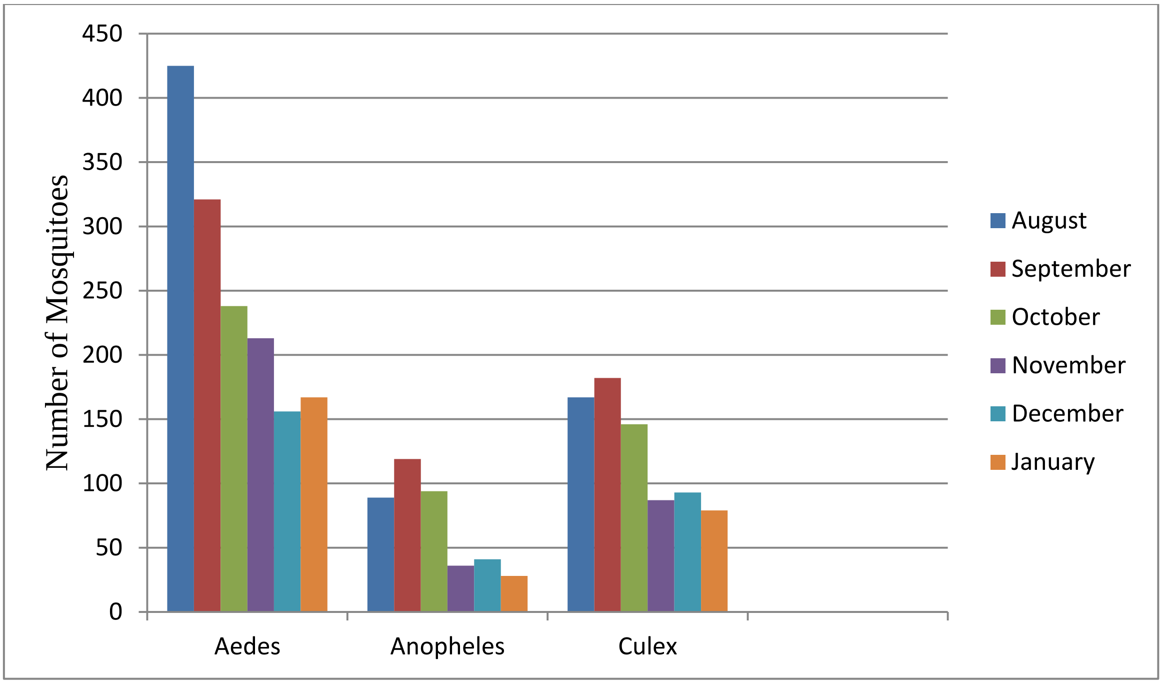

Figure 1: Mosquitoes Species Distribution across the study in Months

Mosquito species use different natural and artificial habitats as sources of water for oviposition and breeding. These breeding sites are numerous in Guyuk. This was due to varied human activities, poor economic conditions, poor sanitation level, digging of earth (mud) for building of mud houses, uncovered water storage containers and indiscriminate disposal of discarded household materials. The resultant effect is abundance of ponds, puddles, water collections in tins, bowls, drums and containers of varying sizes. This observation is in line with [5]. Guyuk L.G.A is bordered by kiri Dam to the East and River Gongola to the North which also serves as conducive breeding and survival sites for mosquitoes of different species [12].

Chikila and Guyuk villages have high number of breeding sites than Bobini and Banjiram districts. This is as a result of differences in the human activities, water storage and microhabitat conditions of these two paired districts. During the study, it was observed that Banjiram and Guyuk districts are low lying, prone to flood water and had swampy terrain in the rainy season. The districts also had a more rural setting with inhabitants more often, keeping water holding vessel around their homes. Also due to the swampy terrain of the districts especially in the rainy season, the grounds were able to retain water for a longer period of time thus serves as breeding sites for mosquitoes.

Result reveals that a total of 2689 larvae were sampled in the four selected districts of Guyuk L.G.A with Guyuk district having the highest number of mosquito larvae (714) examined in the five categories of breeding habitats. Bobini has the highest number of breeding sites being examined, 91 sites in total. Cans and containers as breeding habitat examined, out-number all other types of habitat.

IV. Summary and conclusion

Mosquitoes are not evenly distributed in the five habitats. The richest of the habits is habitat 3 (domestic run-offs/gutters). The presence of any of these mosquito species may be affected by some physical parameters like shade, sunlit, debris, turbidity of the water and depth.

Increased water storage, digging of earth for clay, indiscriminate disposal of tins and cans used for food and procuring cooking ingredients by inhabitants of the town, and a breakdown of public pipe for water supply are chiefly accountable for increase in the number of possible sites in the study area. A combination of factors; abundant rainfall, tropical temperatures and a high relative humidity accounts for mosquito breeding in wet periods in the study area. The abialability of Aedes, Culex and Anopheles, which are known vectors of urban yellow fever, lymphatic filariasis and malaria, suggests that the residents of Guyuk are at risk of mosquito-borne diseases.

It is therefore recommended that residents of the town are enlightened on the environmental factors that contribute to mosquito breeding and for the government to institute proper sanitation measures to reduce mosquito breeding sites.

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