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CLIMATIC EFFECTS ON THE PREVALENCE OF THE *Onchocerca* ARTHROPOD VECTOR IN SOME RURAL AREAS OF SOUTHWESTERN NIGERIA

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ABSTRACT. There is increasing alarm and awareness about the health danger posed by the arthropod vector causing Onchocerciasis. This study was carried out with the aim to throw more light on the prevalence of the arthropod vector, *Simulun damnosum.* This research enabled us to proffer preventive advice to government and citizens. In carrying out this study, villages around flowing waters were used as sample sites. The method applied was direct observation, coupled with efficient recording. Atmospheric temperature readings were periodically taken along with the density of the insect population observed under such temperature. The same was done for relative humidity (%), solar radiation (gm-ca/cm^2, lum) and luminescence (cd/m^2) in relation to the insect population of available FMH at every given period (fly per man hour).

Our findings showed that climate conditions influence the reproductive level and numbers of the vector. The wet season is most conducive for the arthropod vector to reproduce and multiply. The humidity is high and temperature seems to be at the average. It is during this period that greater preventive measures need to be intentionally heightened to subdue the dangerous activities of the vector.

Keywords: prevalence, arthropod vector, *Onchocerca*, *S. damnosum*, rural areas, climate

INTRODUCTION

Several species of *Simulum* exists in Africa but *Simulum damnosum,* which is the object of this study, is mostly found around the banks of slowly flowing rivers. The females lay eggs on rocks submerged under water and on wet stems of vegetation flanking the river (Basanez *et al.*, 2006; Bush and Hopkins, 2011). They lay their eggs in rivers, flowing at speeds of not more than 3 km/hr (Basanez *et al.*, 2009). It chooses the type of water with neutral chemical concentrations i.e. weak acidity level and weak alkaline condition. They lay their eggs in closely packed clusters, strongly cemented under water, stuck on to the rocks beneath the water level (Basanez *et al.*, 2009). Eggs are mostly laid at sunset when atmospheric temperature is at 27-

28 ºC and relative humidity of 50-63% (Bush and Hopkins, 2011).

According to Bush and Hopkins (2011), *S. damnosum* hatches its eggs depending on certain weather conditions, with time ranging between 4 to 36 hours, at 26 ºC. The eggs and the larvae remain in the same place attached to stones and weeds, feeding on inert objects found around it (Bush and Hopkins., 2011). Larva life is just between 5-15 days under laboratory condition, depending on the availability of food, oxygen and suitable weather conditions (Basanez *et al*., 2009). The pupa life lasts only 4 days and once the pupa hatches into *S. damnosum*, it flies into the vegetation ready for its first blood meal. Known in some communities as "Buffalo gnats" and "Amukuru" among the Yorubas, *S. damnosum* is very different in appearance compared to other arthropod vectors of its family. Different studies on *Onchocerca* have been carried out at different sites within Nigeria (Adeyeba and Adegoke, 2002; Opara and Fagbemi, 2008; Adeoye *et al*., 2010; Anong *et al*., 2014 and Ojurongbe *et al*., 2015).

Despite all the data above, enough studies are still not done on the *S. damnosum*. The negligence of researchers on this subject is becoming disturbing considering the level of health problems related to the vector. In the southwestern zone of Nigeria, information about possible breeding sites of this vector is scanty. It is for this reason that a more recent study concerning the *S. damnosum* is very necessary, starting with the conditions enhancing its breeding and reproduction. We will then be able to attack it from there, even before it comes to life to do any damage.

MATERIALS AND METHODS

Scientific observation methodology was adopted. Direct record keeping for a continuous period of eight months was carried out, on the basis of two to three days observation visits per week. Each observational recording was then interpreted into collections of factual information, to describe the scientific observations. This was done to provide a report that would be understandable to scientists and people in other fields.

This research, by its aim, requires knowledge of the breeding sites. A search for a suitable site for the study was carried out with the help of local men. After two weeks of rigorous search, three sites were found, two of which presented the best conditions for our observations.

The search for the breeding sites started around the second week of April and by the end of that month, observation points were set. At these two points, larvae were found patched on various underwater stones and woods.

Along with the observational procedure, some local teenagers were employed as 'fly boys'. This method was adapted from Grillet *et al.* (2001). Starting from the last week of the month of April, the fly boys sat by the breeding site, waiting for the flies to bite them and as the bite is about to happen, the flies were caught and placed inside a designed insect tray. The flies were then transferred into bijou bottles for exanimations at the laboratory. The most important reason for the fly catching exercise was to record the frequencies of the flies coming on to take bites. The number of fly frequencies per hour is therefore recorded for a period of about 8-10 hours per day. This recording was used to calculate the mean population of the flies available for bites at any given period. As this dramatic activity was recorded, the atmospheric conditions, in terms of temperature (°C), relative humidity (%), luminescence (cd/m^2), solar radiation etc. were also recorded in relation to the number of flies caught or those trying to bite (FMH) were also recorded. With this, the mean value of the infective bites per person per day was worked out as 0.45. Hence, the population of the vector at various climatic conditions as recorded.

Having in mind that the aim of this study was to find out how climatic conditions affect the population increase or decrease of the *S. damnosum* vector, the correlation of increase in the number of bite incidences with changes in climatic conditions of the study area was meticulously recorded. Two 'fly boys' were appointed and closely supervised, working two days a week (Tuesdays and Thursdays), with each one of them interchanging catching points (or zero point) every week in order to reduce the slight differences that may occur in the number of catches at every point. The 'fly boys' appointed were local experts, who can catch the flies before they bite. Each day, the catch takes up to 10 hours, with only one hour of lunch break.

The universal bottles used for collecting the catches were plastic, with cotton wool soaked with formalin and packed in the bottles to preserve the flies. They were later taken to the laboratory for dissection to determine the presence of the parasite in the fly caught, hence ascertaining that the fly was a vector. The presence of the parasite *O. volvulus* would confirm that the fly was truly *Simulum damnosum*. The dissection was carried out as described by Adeleke *et al.* (2010).

RESULTS

The results are presented in Figure 1, and Tables 1 and 2.

DISCUSSION

Climatic effects on the prevalence of this arthropod are clearly outlined in this research. The curve in Figure 1 shows monthly mean of fly population. It should be noted that the population of the flies greatly increased from the month of March reaching its alarming peak in July which indicates that the months of April to July is the period when the fly is most abundant and dangerous. This period is also the rainy season of the year which is classified with thick vegetation, wet land and high levels of flowing water. This study corroborates

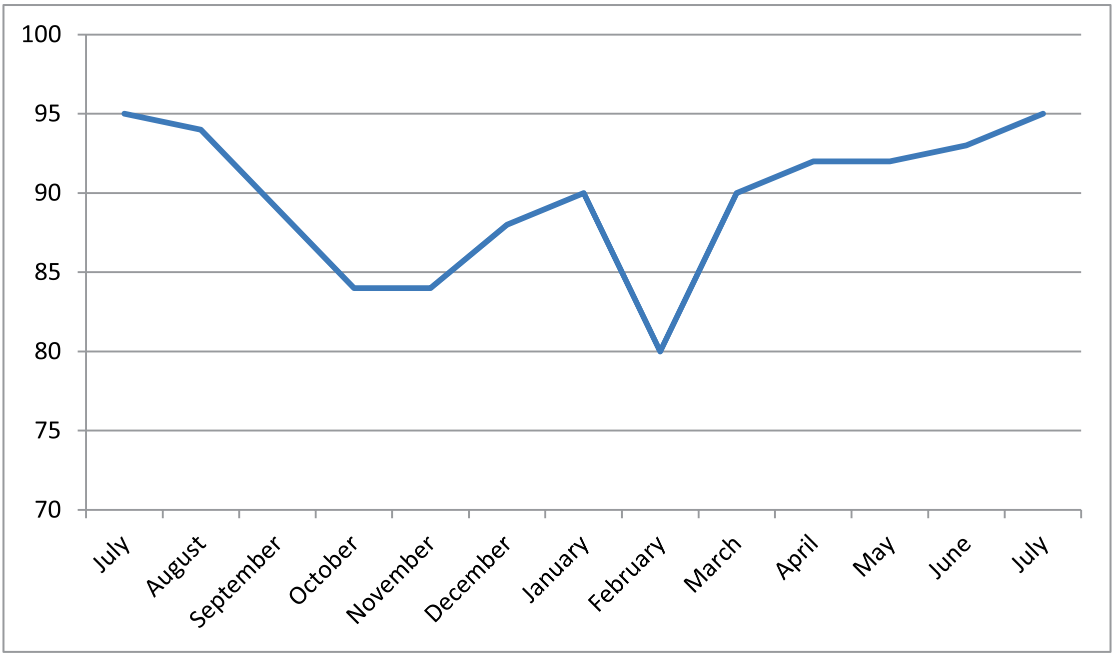

Figure 1. Effects of number of bites, temperature, humidity and luminescence on period of time.

Table 1. Result showing the months of the rainy season and the presence of infective larvae in fly

Month of the year	No of flies with infective larvae	Total No of infective larvae in head
April	0	0
May	11	11
June	11	11
July	4	132
	26	154

Table 2. Effects of No of bites, temperature, humidity and luminescence on period of time.

	HOURS OF THE DAY										
	7-8 am	8-9 am	9-10 am	10-11 am	11-12 am	12-1 pm	1-2 pm	2-3 pm	3-4 pm	4-5 pm	5-6 pm
No. of bites/ hr (FMH)	10	19.80	25.28	22.95	22.80	19.10	19.00	18.55	17.10	16.85	24.60
Temp (°C)	23.02	24.29	26.38	26.86	27.07	28.48	28.63	28.96	30.07	29.78	29.33
Humidity (%)	98.63	98.35	96.32	95.89	94.09	92.31	92.43	92.60	92.06	92.49	93.16
Lumines-cence (cd/m^2)	237	280	709	913	985	1103	994	823	747	652	406

with the study carried out by Lamberton *et al.* (2014) in Ghana.

From Table 1, it is obvious that the flies caught in the month of July are most dangerous because the presence of the nematode they can transmit is greatest during that month. The period of this transmission pose the highest risk and peaks in July.

The mean hourly population of the insect vector, calculated from the hourly bite attempts was recorded in Table 2. This recording was done in the month of July and was recorded in relation to atmospheric temperature, relative humidity and luminescence. It will be noticed that the greatest number of fly population was recorded during the hours of 9 to 10 a.m. (25.28 per hour). This is why famers have been advised to keep off their farmlands around that period. They have been advised to wait till later before going to the farm and also leave before sunset as the bite per hour rises again (24.60). This study result is similar to those from Mafiana (1988); Opara *et al.* (2008) and Adeleke *et al.* (2010)

Since the arthropod vector reproduces and multiplies during the rainy season, rural dwellers have been advised to put on covering cloth during the period. It is even good if they can find means of covering their faces and avoid sandals as footwear. Fortunately, the rainy season comes with the cold period which normally predisposes one to wear thick clothing to ward off cold. The more modern use of insect repellant is recommended (Adeleke *et al.*, 2010).

It is also recommended to clear away bushes especially around residential areas to reduce the risk of the insects coming in to bite. All flowing rivers around should also be treated with larvicide to destroy the larvae before they hatch. Such larvicidation should start during the month of April as it may be too late during the month of June. The use of appropriate insecticide is also recommended to wash off the insect from wherever they are, day or night.

Government agencies should also be advised to help rural dwellers in providing adequate education and chemicals to aid community-directed intervention (Njepuome *et al.*, 2008), and other necessary things to support the war against the vector.

CONCLUSION

Though we cannot control the climatic conditions that enhance the multiplication of the vector *S. damnosum*, the knowledge about it helps us to know what time of the year to raise our guard against it. The effect of climate suggests that the best time to fight the prevalence, reproduction and multiplication of *S. damnosum* is during the wet season between the months of April and July.

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