

Factors enhancing the survival and activities of the *Simulium damnosum*Anong C.I.N¹, Akinboade O.A¹, Abiola J.O², Uwalaka E.C¹¹Department of Veterinary Microbiology and Parasitology, University of Ibadan²Department of Veterinary Medicine, University of Ibadan.emmauwalaka@gmail.com

Abstract: Certain studies have rendered useful information concerning those climatic conditions supporting the mass reproduction of *S. damnosum* vector. This information has further helped us to discover some existential secret about this deadly arthropod. For further exposition however, it is worthwhile to study its survival needs; in terms of what supports its growth and development from the period of hatching to adulthood. This study was therefore carried out to find those factors which naturally support the survival i.e. growth and development of the dreaded *S. damnosum*, the insect which carries that parasite causing the disease known as onchocerciasis. The study site for this research was villages around the bank of Osun River, very close to Asejire village along Ibadan-Ife axis of S.W. Nigeria. Some of these insects were observed and captured in their natural breeding sites. They were kept alive on artificial diets, under atmospheric conditions close to what naturally obtains around their natural habitat in the forest. Three (3) different artificial diets were formulated for their feeding i.e. Eagle's minimal essential medium, human whole blood and thirdly, sugar solution (Sucrose & Glucose). The Eagle minimal was prepared according to the original specifications and given to the flies. At the end of the laboratory diet experiments, the human blood meal and the sugar solution provided the best diet for their survival, while the vector also appeared very active in behaviour while under some illuminations. Brightness or illuminations appeared to support its increased behavioral activities. These findings will help us to deliberately seek ways of stopping the growth and development of the vector by negating the survival needs and supports.

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1. Introduction

Every living organism has some survival needs peculiar to it, though such survival supports revolve around two major concepts i.e. (a) diet (b) atmospheric condition, environment or habitat. For any living thing to survive, it must feed on such things naturally assigned for its system to cope with and also live within an atmospheric condition suitable for existence. These areas of survival needs must be satisfied if a living being will live comfortably healthy. It must however, be explained that the survival needs mentioned here are those needs necessary for an active healthy life after birth. Survival need of a foetal life is different from the ones needed once life actually begins.

So, in the case of *Simulium damnosum*, the survival needs related to this study are those things needed after it would have been hatched, growing and developed into adulthood.

WHO (2009) estimated that about 20million human beings are suffering from onchocerciasis, a disease that has a devastating ocular effect on the victim, particularly in tropics. The disease is very important as it cuts across about 35 countries of the world, with 123 million being at risk of infection (Etyaale, 2001). In Nigeria, onchocerciasis is widespread and a cause of blindness in most rural

communities. Of all the countries of the world, Nigeria has the largest number of persons with onchocerciasis, accounting for about a third of the global prevalence with about seven million Nigerian infected, 1.5 million blind by it and about 40 million at risk of infection. (Edungbola, 1991; WHO, 2009) therefore an understanding of the transmission dynamics of onchocerciasis as in other forms of filariasis is important in advancing knowledge of how vectorial capacity (vector abundance, survival rate, feeding habit and behaviour) influence the level of infection and disease in susceptible human population (Bockarie *et al.*, 1996; Opara *et al.*, 2005). Black flies constitute serious public health and socio-economic problems as vectors of human onchocerciasis and biting nuisance in many rural parts of the world (Adeleke *et al.*, 2010). The flies have a wide distribution in America, Mexico, Yemen, Brazil, Venezuela, Ecuador, Colombia and Africa (Shelley, 2002; Malau and James, 2009). *Simulium damnosum* is the major vector of onchocerciasis in West Africa and in some countries in Eastern and Southern Africa (Mustapha *et al.*, 2004; Adeleke *et al.*, 2011). This is why all efforts must be put in place to fight the vector severely. This is why meticulous research into survival support of a living being is always necessary

either to enhance its survival or to further discover what could be applied to poison such living thing.

This study is necessary to find out the exact survival supportive factors for *Simulium damnosum* so as to know what to apply in order to achieve either total extermination, reduced incidences of bites or reduce the population of the dreaded vector.

2. Material and Methods

For this kind of control research, it is necessary to know the breeding sites of this arthropod vector. Presently in Nigeria, the belief is that the vector does not exist in places of geologically sedimentary landform. It is accepted by researchers that the vector can be found in areas with Precambrian basement land form with Rocky River beds. These baseline pre-control data though scanty and imprecise, would help our attempt to find out the survival needs of the vector once we can find its breeding site during the wet season (Crosskey 1981). However, it has been proven that this might not necessarily be true (Okwa, 2004). In this type of onchocerciasis control research (O.C.P) programme, a range of about 400km can be used as study site during the raining season (Garms et al 1979) and where there is maximum spread of the insect during raining season, they are always abundant for researchers to study easily in the wild (Grosskey 1956).

Empirical observational method was adopted before proceeding into scientific laboratory experimental method in which those things observed and gathered at the study site was further examined and analyzed before a conclusive finding was recorded. For the observation at study site, a set of consented fly attractants were employed to help catch the fly alive. The flies were caught as they patched on the bodies of the fly attractants before they bite. Hand nets were ineffective in catching the flies; the local boys used their bare hands to do the catching (Sofoluwe et al, 1978). Fly collection was done during the "clear part of the day" by "fly boys" collectors working alternately as described by Walsh et al (1978) and Adewale et al (1999). Each fly collector was dressed in short-sleeved shirt, knickers and no shoes and was seated or standing in shade. The number of flies caught per hour is known as bite incidences or bite rates. (F.M.H) and all the flies caught are treated for survival because we needed them to be alive for us to study their survival support factors. A survival "Cool Box" was designed to keep all the flies caught alive. The idea of the "Cool box" is a modification of the type used by Duke et al (1966) for a forest study in Cameroon. Once caught, the flies were dropped on the tray before they were transferred into the bottles inside the "cool box" and then taken to the laboratory for study.

Forty (40) flies were originally caught and brought into laboratory with the "Cool box" the flies were left till the next morning: by the following morning, 19 of the 40 flies were dead. It was the 21 survivors that were divided into 3 groups of 6 flies per group, while the engorged flies were used as control group. These control group flies were deliberately not given any diet throughout the experiment. To keep the *S.damnosa* alive, three (3) types of diet were formulated for them (1) Human whole blood (2) Sugar solution (3) Eagle's minimal Essential medium (Eagle 1959). The diet were individually administered to the insects at different points for control; this is done by dividing the flies caught into three groups and given different diet to find out which diet mostly supports their survival.

The blood meal was obtained from a meal donor at the Blood Bank, University College Hospital, Ibadan and dispensed in 100ml aliquot, while another 100ml was preserved for analysis. The sugar solution was 30% sucrose w/v into which 0.5 grams of glucose was added to every 100ml. This sucrose/glucose solution was sterilized by seitz filtration and dispensed at 2ml aliquots. All the three diets were well tested for bacterial, through culture on McConkey medium (McConkey 1908) on Blood agar (Emmons et al 1970). This was done to exclude bacterial contamination and yeast (candida). All the diets were stored frozen at - 20 °C.

The first group of flies was charged with blood meal soaked in foam, place in an aluminum tray, while there is also a wick of cotton wool soaked with sugar solution and placed horizontally at a corner of the fly bottle. The second group of flies was charged with Eagle's medium meal and the second meal on a wick, soaked with sugar solution placed at the horizontal position, the third group flies were served with sugar solution, one on foam and the other on the wick hung vertically in the feeding bottle.

The flies were allowed to feed for 30 minutes after which they were returned into the "Cool box". The same procedure was repeated daily. The death cases were recorded daily before the survivor were returned into the "Cool box" after daily observation. The flies fed with sugar solution displayed the pattern of survival as the ones fed with the blood meal. Two (2) of them died after 48hrs, while 4 survived till the fourth day before they died.

3. Results

The result of the control experiment wherein no diet was introduced is that all the flies survived till the fourth day when the entire 3 flies eventually died.

When the flies were experimented with illumination or light intensity, the flies were excited with the light exposed to them. They quickly alighted

from their resting position immediately they were exposed to light and this continues until they were returned into darkness of “Cool box “. The flies were also observed at the photographic dark room. An amber coloured 15 watt bulb was mounted on an orange coloured Patterson lamp, emitting intensity at 5.5 lux per square metre.

Once they were exposed to light, they reacted with darting flights showing excitement and joyful restlessness. The findings are as outlined below in table 1.

4. Discussions

From the findings, it could be deduced that black flies can survive for 4days after taken their last meal .This is because the set of flies without meal survived while the ones given artificial meals even have some dead ones among them. Thus, survival factor of *S.damnosum* as far as diet is concerned does not depend on which meal or diet supporting their survival but the space of time they have their last meal. Sugar could survive them since we have some of them surviving with sugar diet as well as the whole blood diet. Therefore, to disturb the survival of this vector through their diet may be difficult since they survive on almost anything and can live without food for the next four (4) days

Secondly, keeping the vector under the light condition may excite them and increase the rate of their activity but this finding does not show that darkness destroy or harm them. Therefore, light intensity issue cannot also be used to determine their survival factor. (Adewale et. al, 1999, Porter and

Collins, 1988, Nwoke, 1988) Light may affect the rate of their activities but not their survival.

One natural thing that seem to affect their survival is the climatic factor in terms of temperature, relative humidity etc. this is because the flies naturally reduce in population during the dry seasons. They naturally die or withdraw till the next raining season, when survival for them is naturally possible.

In conclusion, If scientists are therefore looking for survival factors in order to cause extermination for the *Simulium damnosum* vector, other artificial means are better sort for .The use of insecticides may be better considered than survival factors like diet, atmospheric or habitat conditions ,which may not be the immediate solution. It is therefore recommended that,

(1) Futher studies on the survival supports of *Simulium damnosum* be carried out if we thoroughly want to tackle the menace cause by this vector. This study may be the one igniting more of such researches and results of this study can also be a lead to the next point of research

(2) Government are implored to sponsor further research on this issue as this will encourage researchers to plunge into the wild for a research on an arthropod vector which can also infect them

(3) Since no natural survival support factor can help us determine our weapon against the vector, scientists are implored to manufacture vaccines as the only form of preventive or immune builder against the parasite causing the onchocerciasis disease. Both the government and scientists are called upon to wake up their responsibility to save the vulnerable villagers.

Table 1: Summary Of The Factors Affecting Suvivability Of The Flies

C1	Expt No	Flies caught	Capture time	Transport mode	Dead flies on transit	Flies alive	Survivors used	Diet applied	Flies alive after 24 hrs	Temp during feeding	Feeding mode	Life span of flies after					
												48 hrs		72 hrs		96 hrs	
												Dead	Alive	Dead	Alive	Dead	Alive
30 th May	Prelim Expt		14.00-14.30	On Ice	1	2	2	Sugar and blood	2	25-28°C	Blood in Foam	2	0	-	-	-	-
2 nd June	2 nd		14.00-16.00	Cool Box	10	3	3	Sugar and blood	3	25-28°C	Foam and wick	0	3	3	0	-	---
3 rd June	3 rd		11.10-13.10	Cool Box	0	40	21	Sugar and blood	6	25-28°C	Foam and wick	2	4	0	4	4	0
												2	4	1	3	3	0
												2	4	0	4	4	1
												0	3	0	3	3	0

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