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Ecological and attachment profile of *Simulium damnosum* s.l larval in breeding sites along Ogun river, Ogun State, Nigeria.

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Abstract
This study reports the ecological and attachment profile of *Simulium damnosun sl* larvae, water physico-chemical parameters and in-situ plants associated with larvae breeding along Ogun River systems, Ogun State from March to November 2012. A line transect 50m × 50m vegetation plot measured at the four cardinal points of the breeding sites was used to calculate the frequency of occurrence of dominant flora species. Plant leaves collected were preserved and identified at the herbarium. Water temperature and pH were obtained using Hanna™ handheld temperature and pH device. Global Positioning System device was used to obtain coordinates of the sites sampled. Data were analyzed using SPSS version 17. The result revealed the abundance of *Simulium* larvae from March to May and a decrease in population from June to September, with subsequent increase from October to November. Studies on surrounding vegetation revealed *Pterocarpus santalinoides* tree (23.4%) as the most predominant and *Tithonia diversifocia* (7.6%) as the least vegetation. On choice of attachment, *Simulium* larvae preferred plant attachments (34.92%) which were of four plants species *Oryza barthii, Pterocarpus santalinoides, Andropogon gayanus and Lawsonia inermis* followed by submerged twigs (27.83%), rock crevices (19.84%) and decaying leaf matters (17.87%). The pH values ranged from 7.3 - 8.1, and mean temperature value was 27.8^{0}C. No significant difference (p>0.05) was observed between abundance of *S. damnosum* sl, pH and water temperature. The results provide information on the ecology and attachment profile of *Simulium damnosum* s.l larval in breeding sites along Ogun River.

Keywords: *S. damnosum* sl larvae, vegetation, larval attachment, pH, Ogun State.

1. Introduction

Black fly (Diptera: Simuliidae) is a large group of medically and economically important insect. This is because they are central to the transmission of the parasitic nematode *Onchocerca volvulus* a causative agent of human onchocerciasis [1] .The disease is debilitating and of major public health problem in many riverine communities of Africa, Yemen, Central and South America [2]. These simuliids comprise an assemblage of sibling species out of which nine has been recorded for West Africa [3, 4, 5].

Female Simuliids are hematophagous while male feeds on plant juices [1]. *Simulium* larvae is limited to fluvial ecosystem and its ecology have been recorded in watercourses which run through quaternary sediments, large pebbles and coarse sharp sand bed with earth stones or from bedrocks of tertiary volcanic and or Precambrian origin [6]. Larvae are attached to sun exposed substrata near the surface of water while some are found in completely shaded areas. The breeding sites of *Simulium* species are well aerated clean streams with rocky rapids [7].

Plant species growing along tropical streams in Nigeria have an impact on the type of fauna found in the area [8]. In South-West Nigeria, human activities on these plant species are gradually diminishing the rain forest, altering ecology and geographical distribution of various faunas. These activities include burning, cultivation, tree felling and cattle grazing [5]. The ecology of the *Simulium* larvae gives an overview of the behavior of the vectors and possible control strategy as different strains of onchocerciasis are localized to bioclimatic zone within different regions; this is symbolized by the clinical manifestation of the disease [9, 1]. Earlier reported information from [1, 11, 7] described the attractiveness of *Simulium* species to some botanicals. This study evaluated plants associated with *Simulium* larvae, surrounding vegetation cover, and impact of physico-chemical parameters on abundance of *S. damnosum*

s.l in breeding sites of Ogun State, Nigeria.

2. Materials and method

2.1 Study Area

The evaluation was carried out at Lisa River (N007.7241, E003.2022) a tributary of Ogun River and a breeding site of *Simulium damnosum* s.l in Ogun State, South West Nigeria. The river is a fast flowing stream with rocky rapids embedded with large pebbles and coarse, sharp sand bed. The vegetation profile was determined using a line transect 50m × 50m vegetation plots at the four cardinal points of the breeding sites to calculate the frequency of occurrence of dominant flora species. Plant leaves were collected and preserved using a plant press and identified at the herbarium of the Forestry Unit, Federal University of Agriculture, Abeokuta.

2.2 Sampling of larval colony and Physico-chemical parameters

Larval attachments sampled included inclined rock crevices hit by fast flowing water, trailing roots, submerged vegetation, twigs and decaying leaf matter. Physico-chemical parameters (Temperature and pH) were obtained using Hanna™ handheld temperature and pH device.

2.3. Data analysis

Chi-square (SPSS 17.0 version) was used to compare P values and determine the relationship between physico-chemical parameters obtained and *Simulium* larvae abundance. Descriptive statistics was also employed to categorize data into tables and percentages.

3. Result

3.1 Larval Distribution at the Study Area

A total of 528 *Simulium* larvae were collected (Table 1). Larval samples were collected all through the period. Higher number of larvae were collected in May (15.9%) and the lowest number in August (6.3%).

Table 1: Abundance and Seasonal Dynamics of *S. damnosum* sl Larvae from Lisa River

Species	March	April	May	Jun	July	Aug	Sept	Oct	Nov	Total
S. damnosum s.l	79	81	84	69	35	33	39	58	50	528
Percentage	14.96	15.34	15.90	13.07	6.63	6.30	7.40	10.90	9.50	100%

3.2 Vegetational Profile of Larval Habitat

A total of 158 plants were counted in the study area. The plants that were observed to be most predominant in the surrounding vegetation belonged to 7 different species (Table 2). *Pterocarpus santalinoides* tree (23.4%) was most abundant and *Tithonia diversifolia (*7.6%) was the least in occurrence. In assessment of submerged and trailing plants which supports *Simulium* larval attachment in the river, *Oryza barthii* (47.37%) had the highest population of larval attachment while *Lawsonia inermis* (5.92%) had the least (Table 3). Four larval substratum where assessed for frequency of larvae attachments (Table 4). They include submerged rock crevice, trailing plants, twig sticks and decaying plant matter. Trailing plants constituted the highest choice of *Simulium* larvae attachment (57.58%) while decaying plants had the least (6.25%).

Table 2: Vegetational Profile of Larval Habitat

Plant Species	Population	Percentage
Pterocarpus santalinoides	37	23.40
Gliricidia sepium	29	18.40
Enterolobium spp	23	14.60
Lawsonia inermis	22	13.90
Alconia cordifolia	20	12.70
Militia tonigi	15	9.50
Tithonia diversifocia	12	7.60
Total	**158**	**100.00**

Table 3: Description of Plants Associated With Larval Attachment

Plant Species	Number of Larvae Collected	% Percentage
Oryza barthii	144	47.37
Pterocarpus santalinoides	98	32.24
Andropogon gayanus	44	14.47
Lawsonia inermis	18	5.92
Total	**304**	**100**

Table 4: Larval Habitat of *Simulium* Species at Lisa River

Habitat	Number of Larvae Collected	Percentage (%)
Trailing Plants	304	57.58
Twigs Sticks	127	24.05
Rock Crevices	64	12.12
Decaying Plants	33	6.25
TOTAL	**528**	**100**

3.3 Water pH and temperature in relation to larval dynamics

In-situ water temperature and pH were recorded to check impact on larval abundance (Figure 1 and Figure 2). Average temperature during the study was 27.8˚ C and pH values ranged from 7.3 - 8.1. There was no significant difference (p>0.05) in pH, water temperature and abundance of *S. damnosum* sl.

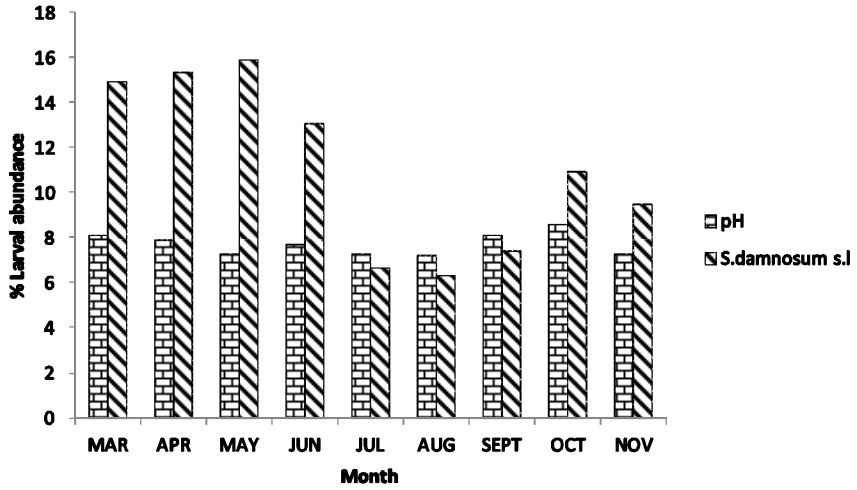

Fig 1: Monthly dynamics of *S. damnosum* sl larvae at Lisa in relationship to water pH.

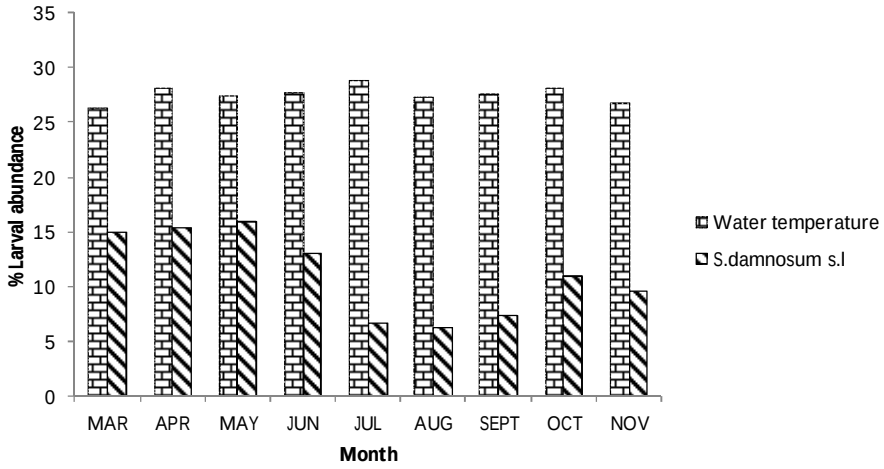

Fig 2: Monthly abundance of *S. damnosum* s.l larvae in relationship to water temperature.

4. Discussion

The study observed two distinct peaks in the abundance of *S. damnosum* larva. These peaks were the onset of rain (March – May) and dry season (October – November). In the high peak of rainfall (June – September) disruption in the population of larva could be attributed to over-flooding of the breeding sites that had been initially colonized. These flooding often times wash off possible attachments of *Simulium* larvae. Seven major trees and shrubs were observed as the surrounding vegetation with *Pterocarpus santalinoides* as the highest distributed plant tree. Sam-Wobo *et al.* [10] had earlier described the attractiveness of the adult flies of *S. damnosum* sl to *P. santalinoides*, and opined that *S. damnosum* sl attraction to this plant species could be a factor to be used for control. The occurrence of *S. damnosum* sl could suggest that the plant canopy serves as cover for adult flies.

Larvae were found in submerging twigs which had been trapped in the water with some parts exposed as offshoot in the stream, then followed by coarse rock crevices hit by water tides. Decaying leaf matter had the lowest count of larval attachment; this may be attributed to loss in nutrients in decaying leaf matters which may have rendered them less attractive for *Simulium* attachment. In this study, plants associated with larval breeding attachments were *Oryza barthii*, *Pterocarpus santalinoides*, *Andropogon gayanus* and *Lawsonia inermis*. At the early stage of the study, larvae were collected along the trailing roots of *P. santalinoides* in the heavily shaded parts of the river. Subsequently, larvae were collected on the leaves and hollow openings in the plant *Oryza bartii* which were growing in the un-shaded areas of the river.

Previous studies by [4] described the average pH range of *Simulium* breeding colony to be from 5.4-7.4. However, this study revealed pH to be from 7.3 - 8.1 while average temperature was 27.8 ^{0}C. This could be attributed to change in adaptation of *S. damnosum* sl to change in climate and human

activities which is gradually turning the study area into a derived savannah from its original forest bio-clime. Statistics show no significant difference between pH, water temperature and the abundance of *S. damnosum* sl.

The description of plants associated with *Simulium* larvae attachment and vegetation profile type will help in proper understanding of its larval ecology. However, further studies on the phyto-chemical composition of these plants are recommended to compare if they had similarities and deduce why they are the preferred choices for larval attachment. The classification of the vegetational types using satellite imageries is recommended so as to cover the whole landscape; digital image analysis of *Simulium* breeding sites can be integrated into the control of onchocerciasis. This will help in explaining any change in breeding pattern of the *Simulium* vector which may result from human activities or change in climate. It will also constitute a major step toward the establishment of reliable data base on the biotic environment and capacity building for biologist utilizing this technology.

5. Acknowledgements

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