



ECOLOGICAL STUDIES ON SIMULIID FLIES (DIPTERA: SIMULIIDAE) IN A FAST-FLOWING RIVER ALONG LAJE ROAD, ONDO CITY, ONDO STATE, NIGERIA

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ABSTRACT

Simuliid flies (blackflies) of the family Simuliidae are ecologically and epidemiologically significant in as obligate vectors of *Onchocerca volvulus*, responsible for onchocerciasis. Their breeding habitats, seasonal abundance, biting activity, and developmental characteristics is essential for assessing transmission risk and improving vector surveillance. Despite onchocerciasis endemicity in Ondo State, ecological documentation of simuliid populations in specific river systems within Ondo City remains limited. This study investigated the ecological characteristics of simuliid flies along a river on Laje Road, Ondo City. Field sampling was conducted at three sites along a fast-flowing river section during the late rainy season (June–August 2024) and early dry season (October–November 2024). Water depth ranged from 16.5–59.0 cm and velocity averaged 0.8 m/s at the fastest site. Overall seasonal mean air temperatures were 27.1°C (rainy season) and 29.9°C (dry season onset) while water temperature exhibited considerably narrower variation, ranging only from 25.2°C to 27.2°C. The narrow thermal range falls within the optimal developmental range (20–28°C) for *Simulium damnosum*. A total of 55 adult flies were captured, with peak abundance in June and July, and peak biting activity between 1400 and 1700 hours. Adult morphometric measurements showed wing length (mean 8.41 ± 0.47 mm). Thorax length (mean 5.62 ± 0.48 mm); thorax depth (mean 5.28 ± 0.56 mm). Head length (mean 4.04 ± 0.51 mm) and leg length (mean 8.50 ± 0.59 mm). Dimensions are consistent with reference measurements for female *S. damnosum*. These findings confirm the river as an active simuliid breeding and biting habitat.

Keywords: Simuliidae, Blackfly ecology, Onchocerciasis, Larval/pupal biometry, Seasonal abundance

INTRODUCTION

The family Simuliidae (Diptera), comprising the true blackflies, encompasses approximately 2,200 described species worldwide, with the genus *Simulium* (Latreille, 1802) accounting for the overwhelming majority of medically and ecologically significant species in sub-Saharan Africa (Adler & Crosskey, 2022). Simuliid flies are small, robust, hump-backed insects whose larvae and pupae are exclusively associated with fast-flowing, well-oxygenated riverine environments, attaching to submerged solid substrates by means of silk pads and posterior hooks. This dependence on lotic habitats creates strong associations between river hydrology, physicochemical conditions, and vector population dynamics (Okumagba & Oboh, 2020).

The medical importance of simuliid flies is primarily attributable to their role as obligate vectors of *Onchocerca volvulus* (Leuckart, 1893), the filarial nematode responsible for onchocerciasis (river blindness), a neglected tropical disease (NTD) that places over 200 million people at risk globally, with more than 99% of cases in sub-Saharan Africa (WHO, 2025). In Nigeria, the *Simulium damnosum* sensu lato species complex serves as the primary vector, maintaining transmission foci along river systems in endemic states, including Ondo (Okunlola *et al.*, 2025).

The ecology of simuliid flies is governed by the physicochemical properties of breeding river environments. Water temperature, flow velocity, dissolved oxygen, substrate type, and seasonal hydrological dynamics all influence larval developmental rates, pupal maturation, adult emergence, and population density. Blackfly populations typically exhibit seasonal abundance patterns driven by the alternation of wet and dry seasons, with peak larval densities coinciding with optimal river conditions during the rainy season (Adler & Crosskey, 2022; Surakat *et al.*, 2023).

Ondo City, the traditional headquarters of Ondo State in southwestern Nigeria, is traversed by several fast-flowing

river systems providing year-round *Simulium* breeding habitats. The fast flowing river under study, a perennial lotic system flowing along Laje road has been identified as a site of active simuliid breeding, yet no systematic ecological study has characterized its physicochemical properties, fly abundance, or immature stage biometry. This information gap constrains the Ondo State National Onchocerciasis Control Programme's ability to map transmission foci and prioritize urban surveillance activities.

The present study was therefore designed to fill this gap through an original field ecological investigation of the river along Laje road, characterizing its physicochemical conditions, documenting seasonal simuliid fly abundance and diurnal biting activity, and recording biometric measurements of all life-history stages. The study contributes an original ecological data layer to support Ondo State's onchocerciasis elimination efforts under the WHO 2030 NTD roadmap (Okunlola *et al.*, 2025; WHO, 2024).

MATERIALS AND METHODS

Study Area

The study was conducted on a fast flowing River along Laje road, Ondo City (approximately 7°06'N, 4°50'E; elevation ~350 m a.s.l.), Ondo State, southwestern Nigeria. Ondo City lies in the forest-savanna mosaic ecotone zone, characterised by a bimodal rainfall pattern (April-July and September-October peaks), mean annual rainfall of approximately 1,200-1,400 mm, and mean annual temperatures ranging from 24°C to 30°C.

The river is a medium-gradient, perennial river fed by upland headwater springs and surface runoff from the Ondo Plateau. At the Laje road study stretch, the river flows over a predominantly rocky substrate interspersed with coarse gravel and submerged vegetation, creating a turbulent, well-oxygenated water column suitable for *Simulium* larval attachment and development. The river exhibits marked

seasonal variation, in depth and flow velocity, with peak discharge during the rainy season (June-August) and reduced but uninterrupted flow during the dry season (November-March).

Three sampling sites were demarcated along a 400-metre stretch at Laje Road. Site I was positioned at the uppermost location, characterized by the fastest flow and shallowest depth, with exposed rocky outcrops and minimal riparian shade. Site II was located approximately 200 metres

downstream, representing the deepest section, with a combination of rocky and sandy substrate and moderate riparian vegetation. Site III was positioned at the lowermost point, approximately 350 metres downstream of Site I, with intermediate depth, moderate velocity, and a predominantly gravelly substrate. All three sites had confirmed simuliid larval presence at the commencement of the study period. (Figure 1)

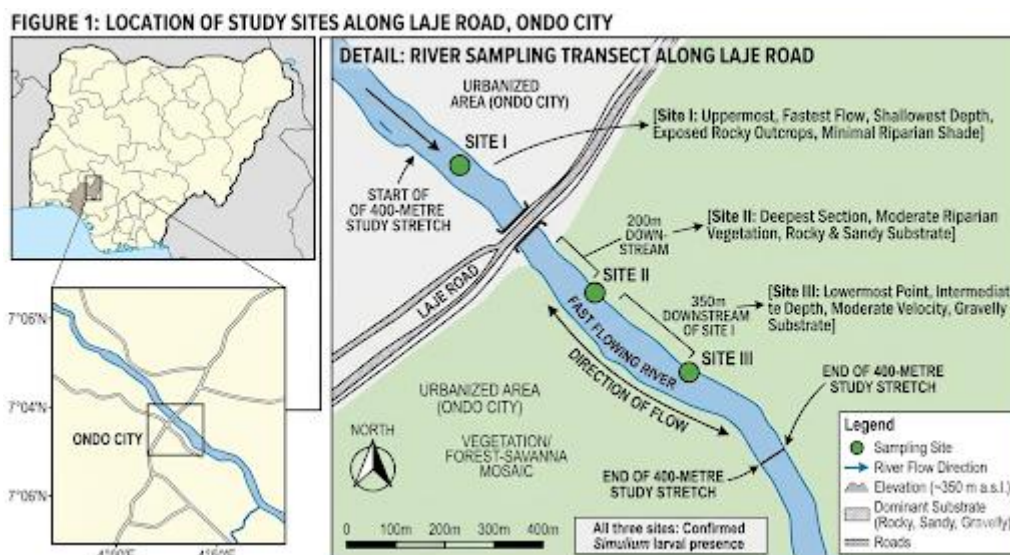


Figure 1: Location of Study Sites along Laje Road, City

Study Period

Field sampling was conducted over 24 weeks spanning two climatological seasons: the late rainy season (26 June to 7 August, weekly intervals) and the onset of the dry season (9 October to 27 November, weekly intervals). This temporal design captured population dynamics and physicochemical conditions during two contrasting hydrological regimes, consistent with biannual sampling frameworks recommended for simuliid ecological assessments in West African rivers (Idowu et al., 2021).

Physicochemical Parameters

Water Depth

Water depth at each of the three sampling sites was measured on each sampling date using a graduated measuring rod inserted vertically at a standardized transect point. Three replicate measurements were taken per site per date and the mean recorded. Depth was expressed in centimetres (cm).

Water Speed

Water flow velocity was determined using the float method, in which a small buoyant object was released at the water surface and timed over a known distance of 1 metre. Three replicate trials were conducted per site per date, and mean velocity was expressed in metres per second (ms⁻¹).

Air and Water Temperature

Air temperature was recorded at each site using a mercury-in-glass thermometer placed in ventilated shade at approximately 1.2 m above the ground, at hourly intervals from 0800 to 1700 hours on each sampling date. Water temperature was simultaneously recorded by immersing a thermometer to 10 cm depth and reading after 3 minutes. Both temperatures were recorded in degrees Celsius (°C).

Adult Fly Collection

Adult simuliid flies were collected by the hand-catch method (Crosskey, 1990), involving manual capture of landing blackflies from the exposed skin of two trained, consenting field collectors stationed at Site I from 0800 to 1700 hours on each sampling date. Captured insects were transferred immediately to vials containing 70% ethanol.

Immature Stage Collection and Biometry

Larvae and pupae were collected by removing infested stones, vegetation, and debris from all three sites and washing the attached simuliids into collection trays. Specimens were preserved in 70% ethanol and transported to the laboratory. Total length (TL) of each larva and pupa was measured from the anterior tip of the cephalic fan base to the posterior cerclet tip using a calibrated eyepiece micrometer (Leitz Wetzlar Ortholux II, 10x eyepiece, 40x objective), following Crosskey (1990) and Adler & Crosskey (2022). A total of 67 larvae and 51 pupae were measured; all measurements are in millimetres (mm).

Adult Morphometric

Adult specimens were mounted on microscope slides using canada balsam after maceration in 10% KOH. Five morphometric parameters were measured from 45 adult specimens: head length (HL), head width (HW), wing length (WL), thorax length (TL), thorax depth (TD), and hind leg length (LC), following Crosskey (1990) and Adler & Crosskey (2022).

Statistical Analysis

Descriptive statistics (mean, range, standard deviation) were computed for all continuous variables using Microsoft Excel 2019. Fly catch data were summarised by month, hour, and

season. All data are presented as mean ± SD unless otherwise stated.

RESULTS AND DISCUSSION

Water Depth

Table 1 presents water depth across all sampling dates. Site II consistently recorded the greatest depths, ranging from 31.0 cm to 59.0 cm with a seasonal mean of 42.1 cm. Site I was the

shallowest (16.5-30.4 cm; mean 23.7 cm). Site III was intermediate (23.4-37.0 cm; mean 32.5 cm). Maximum depths were recorded during early-to-mid July (10-7: Site II = 59.0 cm), corresponding to peak runoff. Depths progressively declined toward late July and August. The lowest depths across all sites were recorded on 20 November (Site I: 18.5 cm; Site II: 31.2 cm; Site III: 23.4 cm), coincident with the advancing dry season.

Table 1: Water Depth (cm) at Three Sampling Sites on the Study River along Laje Road, Ondo City

Season	Date	Site I	Site II	Site III	Average Depth
Rainy Season	26-6	30.4	57.1	36.4	41.3
	3-7	29.8	57.0	37.0	41.3
	10-7	30.2	59.0	36.3	41.8
	17-7	26.2	31.0	31.3	29.5
	24-7	17.3	31.5	32.3	27.0
	31-7	17.0	29.6	33.3	26.6
	7-8	16.5	36.8	35.3	29.5
Onset of Dry Season	9-10	27.3	45.2	33.0	35.2
	16-10	27.9	45.6	36.1	36.5
	23-10	26.7	45.0	36.6	36.1
	30-10	24.0	44.0	33.0	33.7
	6-11	20.4	43.0	30.0	31.1
	13-11	20.0	36.1	26.2	27.4
	20-11	18.5	31.2	23.4	24.4
	27-11	23.5	40.1	27.0	30.2
Mean	—	23.7	42.1	32.5	—

Site I = uppermost (fastest, shallowest); Site II = deepest; Site III = intermediate
 Values in cm. Dates as day-month.

Water Speed

Table 2 presents water speed at all three sites. Site I consistently recorded the highest velocities (0.5-1.8 ms⁻¹; mean 0.8 ms⁻¹). Sites II and III each had a mean of 0.5 ms⁻¹,

with Site II ranging 0.3-0.9 ms⁻¹ and Site III 0.2-1.0 ms⁻¹. All sites exceeded the minimum threshold of approximately 0.2 ms⁻¹ required for larval attachment throughout the study (Okumagba & Oboh, 2020).

Table 2: Water Speed (ms⁻¹) at Three Sampling Sites on the Study River, Laje Road, Ondo City

Season	Date	Site I (ms ⁻¹)	Site II (ms ⁻¹)	Site III (ms ⁻¹)
Rainy Season	26-6	1.8	0.4	0.4
	3-7	1.4	0.5	0.4
	10-7	0.9	0.5	0.4
	17-7	0.5	0.3	0.4
	24-7	0.5	0.3	0.2
	31-7	0.5	0.3	0.2
	7-8	0.5	0.3	0.2
Onset Dry Season	9-10	1.0	0.9	1.0
	16-10	0.9	0.7	1.0
	23-10	0.8	0.9	1.0
	30-10	0.7	0.6	0.8
	6-11	0.6	0.5	0.7
	13-11	0.9	0.5	0.3
	20-11	0.9	0.4	0.3
	27-11	0.7	0.3	0.3
Mean	—	0.8	0.5	0.5

All values in meters per second (ms⁻¹). Sites as defined in Table 1

Air and Water Temperature

Table 3 presents hourly air temperature data. Air temperature exhibited clear diurnal cycling, rising from morning minima toward afternoon maxima. The lowest mean daily air temperature (25.4°C) was recorded on 3 July during the height

of the rainy season; the highest (31.3°C) on 27 November during the advancing dry season. Overall seasonal mean air temperatures were 27.1°C (rainy season) and 29.9°C (dry season onset).

Table 3: Hourly Air Temperature (°C) at the Study Site, along Laje Road, Ondo City

Time	Rainy Season Dates							Onset Dry Season Dates							
	26-7	3-7	10-7	17-7	24-7	31-7	7-8	9-10	16-10	23-10	30-10	6-11	13-11	20-11	27-11
0800-0900	24.5	23.0	23.0	23.5	24.0	24.0	23.5	24.0	26.0	25.0	28.0	28.0	26.0	26.0	29.5
0900-1000	25.0	23.5	23.5	25.0	24.0	25.0	25.0	27.0	26.0	26.0	31.0	28.0	26.0	28.0	31.0
1000-1100	25.5	23.0	23.5	27.5	24.5	26.0	26.0	32.0	29.0	26.0	32.5	28.0	27.5	27.8	32.0
1100-1200	26.4	25.0	25.0	28.0	30.0	27.0	28.0	31.0	30.0	31.0	32.5	34.0	28.0	27.4	32.6
1200-1300	26.8	27.0	26.0	28.5	31.0	28.0	28.0	31.0	30.0	32.0	33.0	34.0	28.0	27.0	32.8
1300-1400	27.3	28.0	27.0	29.0	30.0	29.0	28.0	34.0	32.0	33.0	33.5	33.0	30.6	30.6	33.0
1400-1500	27.0	27.0	27.0	30.0	31.5	31.0	28.0	33.0	33.0	33.0	31.9	32.0	31.0	28.0	34.0
1500-1600	27.0	26.0	26.0	29.0	29.0	27.5	27.5	29.0	32.0	29.0	29.5	31.0	29.0	26.5	33.5
1600-1700	26.5	26.0	26.0	28.5	28.0	26.0	27.0	28.0	33.0	28.0	28.0	31.0	28.0	27.0	29.0
Mean	26.2	25.4	27.8	27.7	28.0	27.6	26.8	29.9	30.0	29.2	31.1	31.0	28.2	27.6	31.3

Values in °C. Readings taken hourly 0800-1700 h at 1.2 m in ventilated shade. Bold Mean rows are daily means

Table 4 presents water temperature data. In contrast to air temperature, water temperature exhibited considerably narrower variation, ranging only from 25.2°C to 27.2°C. This thermal buffering is characteristic of rivers with significant

sub-surface groundwater contribution. The narrow thermal range falls within the optimal developmental range (20-28°C) for *Simulium damnosum* s.l. (Adler & Crosskey, 2022; Idowu et al., 2021).

Table 4: Hourly Water Temperature (°C) at Three Sampling Sites on the Study River, Laje Road, Ondo City

Time	Rainy Season Dates							Onset Dry Season Dates							
	26-6	3-7	10-7	17-7	24-7	31-7	7-8	9-10	16-10	23-10	30-10	6-11	13-11	20-11	27-11
0800-0900	25.0	24.0	24.0	25.0	25.0	26.0	26.0	24.0	26.0	25.0	26.0	24.0	25.0	24.0	25.0
0900-1000	25.0	24.0	24.5	26.0	25.0	27.0	26.5	25.0	26.0	25.0	26.0	26.0	25.0	25.0	26.0
1000-1100	25.0	24.0	24.5	26.0	25.0	27.0	26.5	26.0	27.0	26.0	26.0	26.0	25.0	26.0	27.0
1100-1200	25.7	24.0	24.5	26.0	25.0	27.0	26.5	26.0	26.0	26.0	26.0	26.0	26.0	26.0	28.0
1200-1300	25.8	26.0	27.0	27.0	26.0	27.0	27.0	26.0	26.0	26.0	26.0	27.0	26.0	27.4	28.0
1300-1400	25.5	26.0	27.5	27.0	26.0	27.0	27.0	26.0	27.0	26.0	27.0	28.0	26.0	27.4	28.0
1400-1500	25.0	26.0	27.0	27.0	25.0	27.0	27.0	27.0	26.0	27.0	26.0	27.0	26.5	26.0	28.0
1500-1600	25.0	26.0	27.0	26.0	25.0	27.0	26.0	26.0	26.0	26.0	27.0	26.0	26.4	27.5	
1600-1700	25.0	26.0	27.0	26.0	25.0	27.0	26.0	25.0	27.0	25.0	26.0	27.0	26.0	26.0	27.5
Mean	25.2	25.3	26.2	26.3	25.3	26.9	26.7	25.7	26.3	25.7	26.1	26.5	25.8	26.3	27.2

Values in °C. Immersion at 10 cm depth at all three sites. Dates as in Table 1.

Fly Catch

Table 5 presents hourly fly catch on each sampling date. A total of 55 adult simuliid flies were collected. Rainy-season

dates accounted for 47 catches (85.5%), with only 8 flies collected during the dry-season onset. No flies were caught on 31 July and on several October-November sampling dates.

Table 5: Number of Simuliid Flies caught Hourly at the Study River, Laje Road, Ondo City

Time (H)	Rainy Season Date							Onset Dry Season Date							Total
	26-6	3-7	10-7	17-7	24-7	31-7	7-8	9-10	16-10	23-10	30-10	6-11	13-11	20-11	
0800-0900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
0900-1000	-	1	-	1	-	-	1	-	-	-	-	-	-	-	3
1000-1100	-	-	-	3	-	-	1	2	-	-	-	-	-	-	6
1100-1200	1	-	-	-	-	-	-	1	-	-	-	-	-	-	2
1200-1300	-	-	-	-	-	-	-	2	-	-	-	-	-	1	3
1300-1400	1	-	1	-	-	-	-	1	-	-	-	-	-	-	3
1400-1500	6	1	3	3	-	-	1	-	-	-	-	-	-	1	15
1500-1600	3	-	-	3	-	-	-	-	-	-	-	-	-	-	6
1600-1700	9	-	3	3	2	-	-	-	-	-	-	-	-	-	17
Total	20	2	7	13	2	-	3	6	-	-	-	-	-	2	55

(-) = zero catch. Hand-catch from exposed skin of collectors at Site I. Dates as day-month.

Table 6 summarises monthly fly catch. July recorded the highest total (n=22; 40.0%), followed by June (n=20; 36.4%), October (n=8; 14.5%), August (n=3; 5.5%), and November (n=2; 3.6%). September had no catch. Diurnal analysis

revealed 58.2% of all catches occurring between 1400-1700 h, with the single largest hourly catch between 1600-1700 h (n=17; 30.9%).

Table 6: Monthly Summary of Simuliid Fly Catch, at the Study River, Laje Road, Ondo City

Month	Flies Caught (n)	Percentage (%)
June	20	36.4
July	22	40.0
August	3	5.5
September	0	0.0
October	8	14.5
November	2	3.6
Total	55	100.0

Monthly totals from all sampling dates within each calendar month

Biometry of Immature Stages

Larvae (n = 67)

Larval total length (TL) ranged from 5.99 mm (specimen No. 45) to 11.50 mm (specimen No. 44), with an overall mean TL of 8.72 ± 1.14 mm. The bimodal size distribution — with clusters around 7-8 mm and 9-10 mm — suggests the co-occurrence of early (L5-L6) and late (L7) instar larvae, consistent with continuous recruitment in a thermally stable perennial river (Adler & Crosskey, 2022). Specimens with TL > 10 mm (Nos. 28 [11.40 mm], 44 [11.50 mm], 52 [10.74

mm]) represent mature final-instar larvae approaching pupation.

Pupae (n = 51)

Pupal TL ranged from 5.04 mm to 7.69 mm (mean 6.22 ± 0.56 mm). The compressed range compared to larval lengths reflects the more uniform body size at pupation, where final-instar larval size largely determines pupal dimensions (Crosskey, 1990). The mean pupal TL falls within previously documented ranges for West African *Simulium dammosum* s.l. populations (Okumagba & Oboh, 2020).

Table 7: Summary Biometric Statistics for all Life Stages at the Study River, Laje Road, Ondo City

Measurement	n	Range (mm)	Mean ± SD (mm)
Larval Total Length (TL)	67	5.99 - 11.50	8.72 ± 1.14
Pupal Total Length (TL)	51	5.04 - 7.69	6.22 ± 0.56
Adult Wing Length	45	7.4 - 9.0	8.41 ± 0.47
Adult Thorax Length	45	4.8 - 6.7	5.62 ± 0.48
Adult Head Length	45	3.3 - 5.7	4.04 ± 0.51
Adult Leg Length	45	7.6 - 10.9	8.50 ± 0.59

TL = Total Length. SD = Standard Deviation. All measurements in millimetres (mm). n = number of specimens measured

Adult Morphometry

Adult morphometric measurements (n=45 specimens, Appendix III) showed wing length ranging from 7.4 to 9.0 mm (mean 8.41 ± 0.47 mm). Thorax length ranged 4.8-6.7 mm (mean 5.62 ± 0.48 mm); thorax depth 4.3-6.7 mm (mean 5.28 ± 0.56 mm), reflecting the characteristic hump-backed simuliid morphology. Head length ranged 3.3-5.7 mm (mean 4.04 ± 0.51 mm); leg length 7.6-10.9 mm (mean 8.50 ± 0.59 mm). Dimensions are consistent with reference measurements

for female *S. dammosum* s.l. (Crosskey, 1990; Adler & Crosskey, 2022).

Morphological Notes

All specimens displayed defining diagnostic features of the family Simuliidae. Larvae showed well-developed paired cephalic fans, a thoracic proleg with hooks, lateral eyespots, gill tufts, posterior rectal gills, and a posterior cirlet with hook rows (Fig.1).

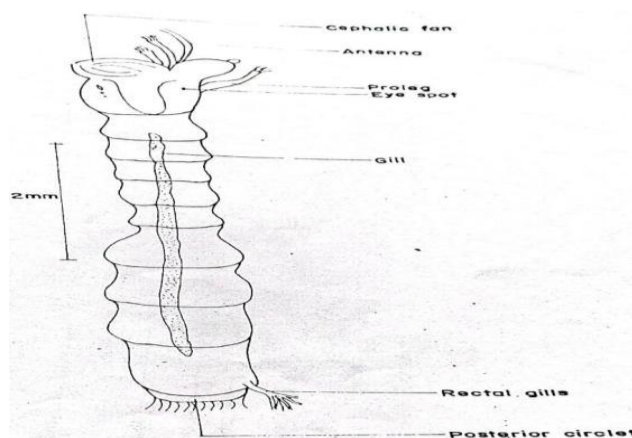


Figure 2: Dorsal View of a Simulid Larva (Source: Awe O.O. (2024))
 Labelled Structures: • Cephalic fan • Antenna • Proleg • Eye spot • Gill
 • Rectal gills • Posterior cirlet. Scale: 2mm

Pupae were contained in silken cocoons from which paired gill filaments projected the primary pupal diagnostic character of the genus *Simulium* (Fig.2). Adult females displayed the characteristic hump-backed thorax, widely separated

compound eyes, short antenna, a blood-feeding proboscis, broad wings with strongly thickened anterior venation, and short recumbent hairs on the abdomen (Fig. 3).

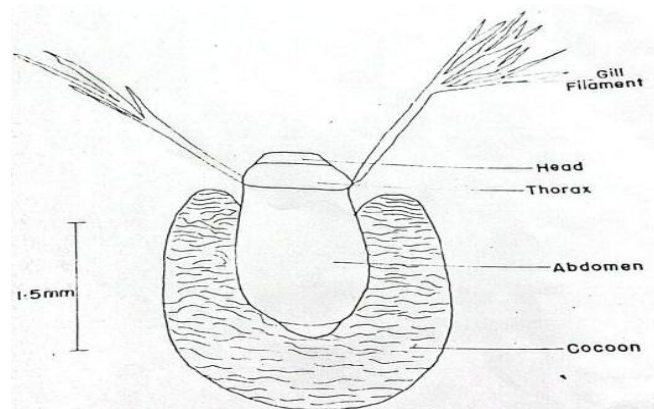


Figure 3: The Dorsal View of the Pupa of Simulid Fly (Source: Awe O.O. (2024))
 Labelled Structures: • Gill Filament • Head • Thorax • Abdomen • Cocoon Scale: 1.5mm

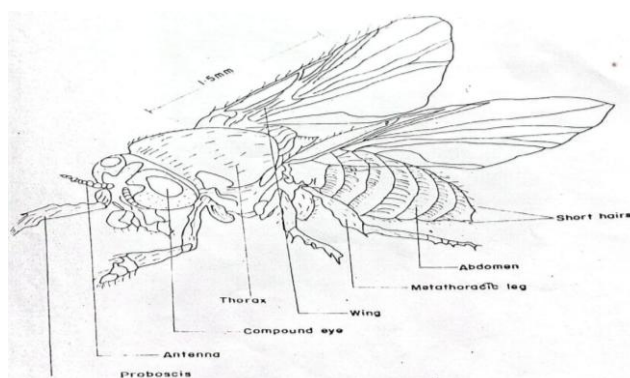


Figure 4: The Lateral View of Female Simulid Fly (Source: Awe O.O. (2024))
 Labelled Structures: • Proboscis • Antenna • Compound eye • Thorax • Wing • Metathoracic leg • Abdomen • Short hairs Scale: 1.5mm

Discussion

This study presents the first systematic ecological characterization of simuliid flies in the study river at Laje Road, Ondo City, documenting physicochemical habitat conditions, seasonal and diurnal adult abundance, and biometric profiles of all three life-history stages. The findings collectively establish that this urban river focus maintains conditions necessary for sustained *Simulium* breeding and adult biting activity, particularly during the rainy season, with implications for onchocerciasis transmission risk within Ondo City.

The physicochemical characterization revealed a habitat profile comparable to established west african *Simulium* breeding rivers. Water velocities exceeded the minimum threshold of 0.2 ms⁻¹ required for larval attachment and oxygenation (Okumagba & Oboh, 2020) at all sites throughout the study, with site I's mean of 0.8 ms⁻¹ particularly favourable for *S. damnosum* s.l. The notably stable water temperature regime (25.2-27.2°C), maintained within a narrow 2°C envelope across 24 weeks, reflects significant groundwater buffering and explains the persistent presence of larvae and pupae throughout the study period (Idowu *et al.*, 2021).

The seasonal pattern of fly catch, with 85.5% of captures during rainy-season dates, is consistent with the well-established positive relationship between rainy-season discharge, simuliid larval productivity, and adult emergence rates across west africa (Surakat *et al.*, 2023). Higher velocities and greater substrate availability during peak rainy-season flow create optimal conditions for larval filter-feeding and growth, accelerating adult fly production.

The distinctly afternoon-biased diurnal biting pattern 58.2% of all catches between 1400-1700 h has practical public health significance. Agricultural workers, children, and community members spending afternoon hours near the Laje road riverbank are at greatest exposure risk. This is consistent with the diurnal biting rhythms of west african forest-zone simuliids (Okumagba & Oboh, 2020), and should inform community education messaging regarding personal protection timing.

The larval biometric data (mean TL 8.72 ± 1.14 mm; range 5.99-11.50 mm) are consistent with published measurements for *S. damnosum* s.l. from comparable Nigerian lotic environments (Okumagba & Oboh, 2020; Crosskey, 1990). The observed spread across a ~6 mm TL range confirms multi-instar larval cohorts, implying continuous recruitment from a sustained adult egg-laying population, evidence of an established, self-maintaining breeding population.

A critical limitation is the absence of dissection and PCR-based *O. volvulus* infectivity assays on caught females, which would have provided direct evidence of filarial transmission. Future studies should incorporate pool-screen PCR for *O. volvulus* O-150 DNA in simuliid head pools to generate annual transmission potentials (ATPs) comparable with the national surveillance framework (Adeleke *et al.*, 2024). Cytotaxonomic or molecular analysis would resolve specific species identities within the *S. damnosum* complex at this focus.

CONCLUSION

This study demonstrates that the river along Laje Road, Ondo City, constitutes an ecologically suitable and active habitat for

simuliid flies. The physicochemical parameters, including moderate-to-fast water velocity and stable temperature, support year-round larval development. Peak adult activity during the rainy season and afternoon biting patterns highlight potential periods of increased human exposure. The findings indicate that this site may serve as a focal point for *Onchocerca volvulus* transmission within the study area.

RECOMMENDATION

The following specific recommendations are made:

- i. The study river at Laje road should be formally designated a vector surveillance sentinel site within the state NTD monitoring framework, with annual fly catch assessments at the commencement of each rainy season.
- ii. Pool-screen PCR analysis for *O. volvulus* DNA should be introduced at this site to determine filarial transmission status.
- iii. Community education along Laje Road and surrounding neighbourhoods should include information on peak afternoon biting times, encouraging avoidance of riverbank exposure between 1400-1700 hours.

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