Distribution and Diversity of Aquatic Insects in River Vami and Fakdangi Dam in Dzakwa Hong Adamawa State Nigeria

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Abstract- ***Study on the distribution and diversity of aquatic insects, was carried out to determine the distribution and diversity of aquatic insects in River Vami (lotic) and Fakdangi dam (lentic) in Dzakwa Hong Local Government Area of Adamawa State. Twenty-one (21) specie samples were collected from the Lotic and Lentic water bodies from the month of June to July by scoop net. In general, 10 scoops were taken at each site. The insects were sorted and screened by placing in a petri dish. The content of each aquatic was shifted in plastic containers (500 ml) with some of water from the habitat. The containers were labeled A, B, C, D and placed in an ice container, and was transported to the Zoology department laboratory for sorting, counting and identification. Descriptive statistics, students T-test and Shannon Weiner were used to analyzed the data obtained in this study. The results reveals a total of sixty (60) aquatic insects with six (6) orders, Twelve (12) families, and Twenty one (21) species of aquatic insects recovered. River Vami has abundance of 23 while Fakdangi dam has 37. In conclusion the results show that dam is a home for more species of aquatic insects. The researchers therefore, recommend that, there is need for further study of on the diversity and distribution of other aquatic insects in River Vami and Fakdangi dam at Dzakwa Hong Local Government Area of Adamawa State.***

Indexed Terms- ***Distribution, Diversity, River-Vami and Fakdangi-Dam, Aquatic, Insects***

I. INTRODUCTION

Insects are invertebrates (animals without backbone), they are part of the larger group of animals called arthropods. Arthropod means, “Joint footed.” That name was given to these animals because all of the arthropods have jointed legs. Some other arthropod relatives of insects are crayfish, crabs, lobsters, millipedes, centipedes, scorpions, spiders, and ticks. Most insects are terrestrial (live on land), and are found in places such as trees, shrubs, flowers, rocks, logs, soil, buildings, and especially our gardens. Everyone is familiar with common terrestrial insects such as butterflies, moths, beetles, ants, bees, wasps, grasshoppers, crickets, cockroaches, and flies (Voshell, 2019).

There are also many kinds of insects that live in the water, these are called aquatic insects, and they are often not seen unless you explore places such as puddles, ponds, lakes, ditches, streams, and lakes. There are many different kinds of aquatic insects and almost every type of freshwater environment have some kind of aquatic insect living in it (Elangol *et al.*, 2021).

In non-marine environments, insects comprise one of the most species-rich and abundant groups of organisms. They have always been the focus of scientific attention on freshwater habitats, such as streams, rivers, lakes, and ponds. Although such habitats cover only 2.3% of the Earth’s surface, they accommodate approximately 10% of all known animal species, and represent “hotspots of endangerment” due to disproportionally high biodiversity and anthropogenic pressures (Reid *et al.,* 2019). More than 60% of the freshwater species diversity is represented by aquatic insects, with approximately 130,000 described extant species (Halian *et al.*, 2014). They spend one or more stages of their life cycle in aquatic habitats, with the majority moving to terrestrial areas as adults. Members of the orders Ephemeroptera, Plecoptera, Trichoptera, Megaloptera and Odonata are exclusively aquatic in their immature stages that is, nymphs and larvae. Several other insect orders, such as Diptera, Coleoptera, Neuroptera, and Hemiptera

also have many aquatic representatives (Halian *et al.*, 2014).

There is an amazing diversity of aquatic insects, but these organisms often go unnoticed because many are secretive and spend most of their life well hidden. Due to the fact that insect is very important in the maintenance and sustainability of the ecosystem, it is very important to determine their diversity and distribution in lotic and lentic water bodies of Dzakwa, Hong Local Government Area, of Adamawa State, Nigeria. Most people do not really appreciate the importance of insect in balancing the aquatic ecosystem, they are not even considered as important. Some aquatic insects are edible and are considered as source of income for people, likewise some aquatic insects serve as food to fishes in the rivers and this shows that, they help in sustaining the food chain and food web of the ecosystem they live. Therefore, it is necessary to explore the types of aquatic insects and their distributions in the lotic and lentic ecosystem in Dzakwa, Hong Local Government Area of Adamawa State.

The outcome of this research will be of significant, in providing information on the diversity and distribution of aquatic insects in lotic and lentic water bodies of Dzakwa, Hong Local Government Area of Adamawa State. It will provide information on the quality of insects in river/stream and ponds in the study area. It will also provide avenue for further research. This research work aimed at determines the diversity and distributions of aquatic insects in lotic and lentic water bodies of Dzakwa.

II. MATERIALS AND METHODS

The study was carried out in lotic and lentic water located in Dzakwa, Hildi District of Hong Local Government Area of Adamawa State, Nigeria. Dzakwa, lies on geographical coordinates of Latitude: N 8° 47’ 0” N and Longitude: N 12° 26’ 0” E in Northern Nigeria. It is also known by mountainous area Adebayo and Tukur, (2004). The bottom of the River Vami tends to be muddy due to calm water flow where silt is deposited; the place is vigorous where fine particles are selectively eroded from the bottom. Similarly, turbidity is high during water flows and this interferes with penetration of light. It is not usually self-supporting in times of fixed energy because the rivers were shed to support much of aquatic insects. Fakdangi dam is also situated in Dzakwa, without distinct seasons with the average temperature of the place put at 32°. It has an average wind speed of 10km/hr and the average wind speed humidity level of the place is put at 23%. (Vorosmarty *et al.,* 2015).

Sample and Sampling Technique

Following the procedure of Morse *et al.,* (2017); McGowan, (2022). the samples were collected from the aquatic bodies fortnightly for the period of two months (June and July, 2024). The samples (larvae, pupae, nymphs, and adults) were collected from River Vami and Fakdangi dam in Dzakwa using a scoop net. In general, 10 scoops were taken at each site to collect insects’ samples. The content of each aquatic site was shifted in plastic containers (500 ml) with some water from the same habitat. The containers were labelled A, B, C, D, placed in an ice-container and were transported to the Zoology Department Laboratory. The insects were sorted and screened and placed in the Petri dish for sorting, counting, and identification. The insects were sorted as in Winterbourn and Cummins, (1984) into the main taxonomic groups, and identification of some samples were done up to the family levels and some members were identified up to genera level through appropriate species keys assisted by an expert (Entomologist) in the Department of Zoology, Adamawa State University, Mubi. Only one technique was used to collect aquatic insects to determine the sample for the study, as in McGowan (2022).

Statistical Analysis

The collected data were analyzed using descriptive statistics to determine the distribution and diversity of aquatic insects. A student t-test was also used to compare the distribution and diversity of aquatic insects in the study area's lotic and lentic ecosystems. The diversity of insect species in the study area was determined and compared using the Shannon-Weiner Data index, using the formula below:

$$H = -\sum_{i=1}^{k} p_i \log p_i$$

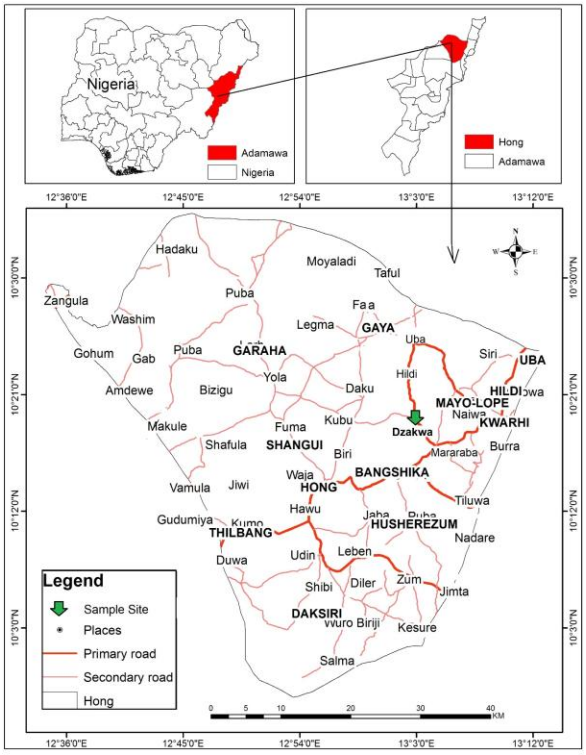

Table 1: Aquatic insects' species found in the River Vami (Lotic) and Fakdangi Dam (Lentic) water and their distribution.

Order	Families	Species	Sites R1	R2	R3	R4	F1	F2	F3	F4
Lepidoptera	Crambidae	*Crambidae*					***	***	**	***
Ephemeroptera	Baetidae	*Cloeon gambiae*	**			**	**		**	**
		Cloeon smaeleni					***	**		
Diptera	Chironomidae	*Chironomus imicola*	***		**	**	**	***	***	**
		Cryptochironomus sp.	***	***	**	**	**		**	
Heteroptera	Nepidae	*Ranatra linearis*			**		***	***	***	***

III. RESULTS

- Results of Aquatic Insect Species and their Occurrence in the Study Area

The distribution and diversity of aquatic insects in River Vami (lotic water) and Fakdangi (lentic water) dam at Dzakwa Hong Local Government Area of Adamawa State, reveals that there are total of 6 orders, 12 families and 21 species of aquatic insects found as presented in table 1.

- Comparison of Aquatic Insects and their Occurrence lotic

Table 2 shows the comparison result of aquatic insects between River Vami and Fakdangi dam, it indicates that there are 11 species of aquatic insects in River Vami, 19 in Fakdangi dam, 8 families in River Vami, 12 in Fakdangi, 4 orders in River Vami, 6 in Fakdangi, and 23 abundances in River Vami while 37 in Fakdangi. The taxa richness indicates that there are 11 species of aquatic insects found in River Vami, 21 found in Fakdangi damn.

		Enithares sp					**		**	**
	Notonectidae	*Anisops sardea*	***	***	***	***	***	***	***	***
		Limnogonus chopardi			**		**	**	***	**
	Gerridae	*Eurymetra sp.*	***	***	**	**	**			
	Veliidae	*Veliidae*					***			
	Corixdae	*Micronecta sp.*					***	**	***	**
	Naucroidae	*Naucoris ci'micoides*		**			**		**	
Odonata	Libellulidae	*Orthetrum sp*	**				***	***	***	**
		Brachythemis leucosticte	***	***	***	***				
		Brachythemis lacustris	***	***	***	***				
		Palpopleura					**		**	
Coleoptera	Dyticidae	*Cybister tripunctatuts*					**	***		
	Hydrophilidae	*Amphiops sp*					***	***	***	**
		Hydrobiinae					**			**
		Hydophilidae					***	***	***	***

Key: *** Very frequent species, ** Frequent species, * Rare species.

R1=River Vami 1, R2=River Vami 2, R3=River Vami, 3, R4=River Vami 4, F1=Fakdangi dam 1, F2=Fakdangi dam 2, F3=Fakdangi dam 3, F4=Fakdangi dam 4.

Table 4.2: Comparison between River Vami and Fakdangi aquatic insects and their occurrence.

Insects	River Vami	Fakdangi damn
Taxa richness	11 (52.4 %)	19 (90.5%)
Families	8 (38.1 %)	12 (57.1%)
Order	4 (19.1 %)	6 (28.6%)
Abundance	23 (109.5 %)	37 (176.2%)

Taxa richness, 30; Families, 20; Order, 10; Abundance, 60

IV. DISCUSSION

A total of 21 aquatic insect species belonging to 12 families and 6 orders were harvested as shown in Table 4.1. Eleven and Nineteen were recorded in River Vami and Fakdangi dam respectively, the species richness of River Vami and Fakdangi dam was lower than those obtained in other lakes. (Kouame *et al.,* 2014) recorded 68, 74 and 123 species in other lakes in Côte d'Ivoire (Ivory Coast), West Africa. The low specific richness recorded in this study could be attributed to various factors. The sampling period which was conducted for only two months, whereas the above mentioned studied covered a whole year. The low richness observed could also be due to the disturbance of River Vami and Fakdangi dam sites by

human activities such as agricultural and fishing. (Schmeller *et al*., 2018) reported that habitat destruction may lead to a reduction in aquatic macroinvertebrate diversity. The order Heteroptera was found to have the higher number of insect species richness, followed by Odonata, and the least order with insects' species richness is Lepidoptera having only one specie. The findings of this study is in line with (Van Klink *et al.,* 2020), who recorded that Lebellulidae are the most diverse and numerous group of Odonates with more than 1000 species in about 140 genera that breed mainly in stagnant water or lentic habitats.

Generally, River Vami appears to record low species richness and abundance as well as high diversity index values. This result concurs with the findings of Xu *et al.,* (2014) who stated that water temperature, pH, conductivity, and substrate type were significant factors influencing aquatic insect distribution and diversity in Yellow River Basin, China.

Fakdangi dam has higher aquatic insects than River Vami 19 species and 11 species, respectively. The result also reveals that Fakdangi dam have more family of insects with value of twelve (12), While River Vami has eight (8) families of insects. In terms of order; the Fakdangi dam has higher order with six (6) different orders compare to River Vami having only four (4). In comparison of the abundance of aquatic insects in the study area, Fakdangi dam has more abundance of insects than River Vami with thirty seven (37) and twenty three (23) respectively. The result of this study is in line with the findings of Anderson *et al.,* (2019), who reported that dam have more insects' taxa compared to River Colorado in United State of America.

CONCLUSION

Study on distribution and diversity of aquatic insects in River Vami and Fakdangi dam, in Dzakwa, Hong Local Government Area of Adamawa State, Nigeria. The result shows that, River Vami and Fakdangi dam are suitable for diversified insects. According to species richness, Fakdangi dam is a home for more species of aquatic insects than River Vami. The value of the Shannon Wiener index and the Eveness were higher in Fakdangi dam (5.03) than in River Vami (2.66). However, with regards to the similarity analysis, the insect's richness was quite different in River Vami than Fakdangi dam. The study of aquatic insect could be useful in determining the distribution and diversity in River Vami and Fakdangi dam in Dzakwa Hong Local Government Area of Adamawa State Nigeria.

Based on the results obtained the researchers therefore proffer the following recommendations:

I. Further study is needed on the distribution and abundance of other aquatic organisms in the River Vami and Fakdangi dam at Dzakwa Hong Local Government Area of Adamawa State.
II. If looking for aquatic insects for research, a dam (lentic water) has more aquatic insects in the study area.

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