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Buterfly Species Diversity and Abundance in Taraba State College of Agricultural Science and Technology, Jalingo Taraba State, Nigeria

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Abstract

Butterflies are in the order Lepidoptera, which are insect with scaled wings. Over 28,000 species of butterflies exist in the world today contributing to one-quarter of all named species on the earth. Lepidoptera is important to man and the health of the environment. Butterflies play a significant role in the pollination of crops and as aesthetics. The study assessed the diversity and abundance of butterfly species in the Taraba State College of Agricultural Science and Technology, Jalingo, Nigeria. Line transects were used to survey two study sites within the School using handheld sweep nets in January to March, 2024. Data were analyzed using descriptive statistics. A total of 1,153 individuals representing 21 butterfly species belonging to 3 families were recorded across the two study sites. Out of these, members belonging to the family Lyceanidae were the most csommon with 6 species being recorded accounting for 46.2% of the total species and 93.2% of total number of individuals collected in engineering complex while members belonging to the family Nymphalidae were the most common with 10 species being recorded accounting for 52.6% of the total species and low in the total number of

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individuals with 37.8% collected in staff quarters. Species richness, evenness and diversity varied from study sites to sites (R= 2.7014 – 2.0293), (e= 0.6691 – 0.6317), (H1= 1.9700 – 1.6203). It was recommended that management effort towards conservation be put in place so as to ensure sustenance of butterflies and ecosystem services derived from them, and further exploration of butterfly species be done to update this checklist.

Keywords: Butterfly, Species, Engineering complex, Staff quarters, Diversity, Abundance

INTRODUCTION

The Butterflies, classified under the order Lepidoptera, are insects known for their scaled wings (Emily, 2010). With over 28,000 species identified worldwide, they represent about one-quarter of all named species on Earth (Aiswarya *et al.*, 2014). These insects are crucial to both human welfare and environmental health. Butterflies significantly contribute to crop pollination and enhance the aesthetic value of ecosystems (Ramesh *et al.*, 2010; Ghazanfar *et al.*, 2016). Additionally, they provide raw materials, such as silk for the textile industry, and serve as reliable indicators of plant health, climate change, and overall environmental quality (Kocher & Williams, 2000). Butterflies are particularly effective in studying the loss of traditional pastures and the effects of vegetation encroachment (Koch *et al.*, 2015; Ubach *et al.*, 2020).

Belonging to one of the most well-documented insect orders, butterflies are excellent ecological indicators for other invertebrate taxa (Kremen, 1994; Kumar *et al.*, 2009). They are commonly used as proxies to assess changes in environmental quality. Moreover, they play a role in food chains by serving as prey for birds and other predators and hosting parasitoids that help manage crop pests (Summerville *et al.*, 2001). Their responsiveness to environmental changes, clear life history patterns, and ease of observation make them particularly suitable for monitoring forest disturbances (Cleary, 2004). However, habitat loss and modification have threatened many butterfly species, prompting increased global concern about biodiversity loss (Okali, 2010). This decline in biodiversity poses a significant threat to nature's capacity to support human development and survival.

Butterflies are known seasonal indicators of anthropogenic disturbances (Kocher & Williams, 2000). By contributing to ecosystem services such as pollination and acting as

components of food chains, they reflect the health and quality of their host plants and ecosystems. The organization and dynamics of butterfly communities have long intrigued ecologists and conservationists. The increasing expansion of human-modified landscapes has significantly influenced the distribution and behavior of butterflies (Rickets *et al.*, 2001).

Arthropods, including butterflies, are effective biodiversity indicators due to their rapid response to environmental changes and their high diversity. As the second-largest arthropod order, Lepidoptera (butterflies and moths) is one of the most easily identifiable groups, making them ideal for biodiversity studies (Tiple & Arun, 2009).

Butterflies inhabit a wide range of environments but are most commonly associated with humid tropical forests, where the majority of species are found. Their diversity is often characterized by species richness and the relative abundance of individuals (Landau *et al.*, 1999). According to Hammond and Miller (1998), species richness is a crucial factor in conservation planning, habitat management, and natural resource utilization.

Many plant species, including numerous trees, rely on butterflies for pollination. Consequently, humans and other terrestrial animals indirectly depend on the ecological services provided by butterflies (Ramesh *et al.*, 2010). Concerns about the declining status of global biodiversity, including butterflies, have intensified (Okali, 2010).

Alarape *et al.* (2015) observed that butterflies are highly sensitive to climatic factors such as rainfall, temperature, wind, humidity, and altitude. Various studies have identified factors influencing butterfly distribution, including competition, predation, species abundance, food web structures, genetic factors, and both short- and long-term evolutionary processes (Thomas *et al.*, 1992; Charles, 2001).

The loss of butterflies could lead to widespread ecological disruptions, including the extinction of many animal species due to the decline in plant life. Butterflies are among the most diverse, abundant, and successful insects on the planet. Understanding their roles in nature requires examining their interactions with both living organisms and the non-living environment within biological communities (Miller, 2006). This study aims to investigate the diversity and abundance of butterfly species within the study area to better understand their ecological significance and contribute to conservation efforts.

METHODS

Study area

Taraba State College of Agricultural, Science and Technology, Jalingo, Ardo-Kola Local Government Area of Taraba State, with latitude and longitude of the study area being 8.9° N, 11.3667° E. Is located in ATC, northern part of Ardo-kola local Government Area of Taraba State sharing boundary with Taraba State University, Jalingo (Fig 1). marked by an annual average temperature of 34°C but high level of cold in January and an increased rainfall in August. The percentage of rainfall in Taraba State College of Science and Technology is 40.35% with 54.98% relative humidity. The area is usually very warm in March with 40.44°C, and an average wind of 8.84km/h (Ikyaagba, 2008). The surrounding of the area consists of open savannah woodland with small or medium size trees, whose crowns are almost continuous, but through which light is able to penetrate widely. They have partial grass cover and the tree layer is virtually continuous (10-20m and 40-60 percent cover) (Girei *et al.*, 2014).

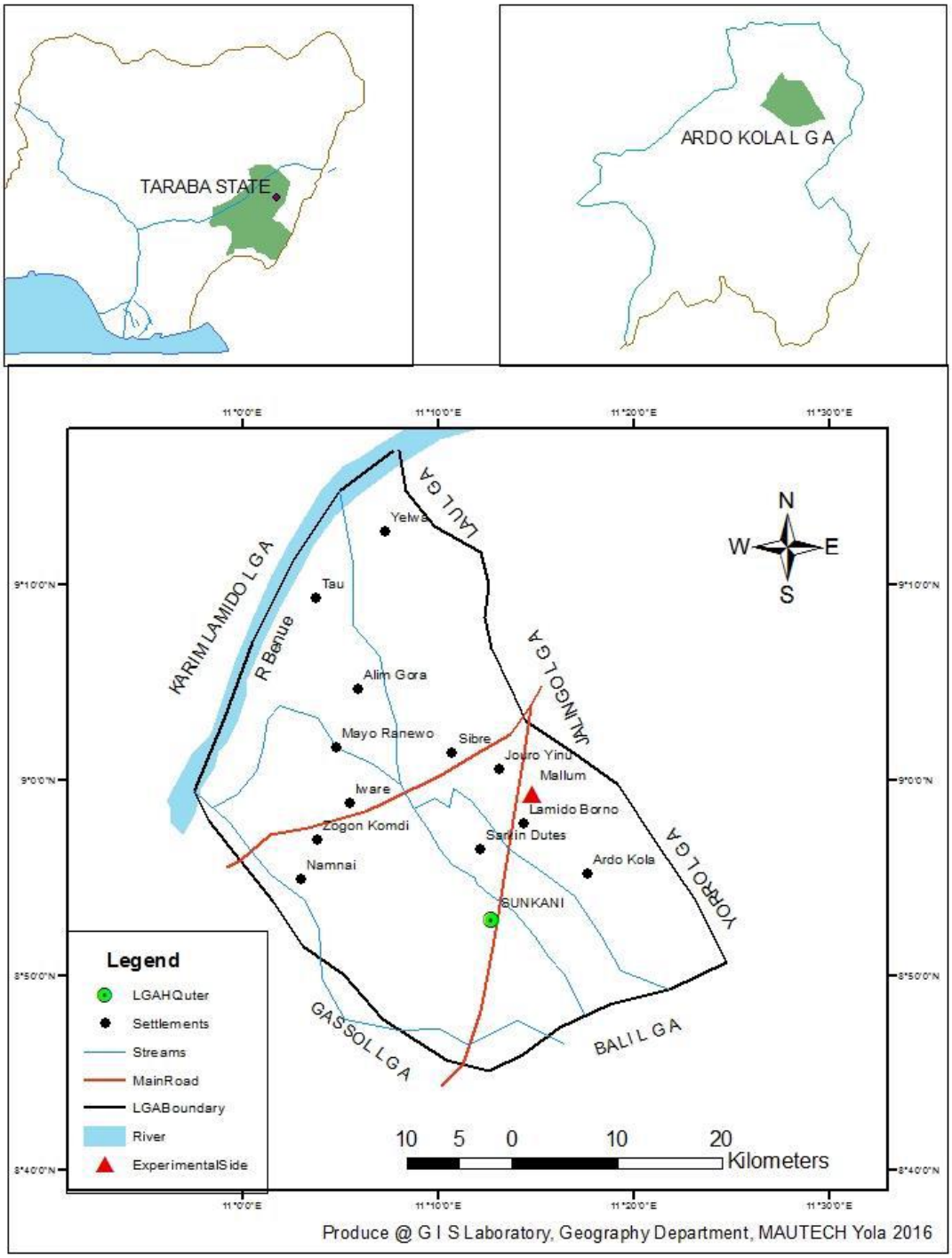


Figure 1. Map of Nigeria Showing Taraba State and Study Area

Method of data collection

Monitoring (Line Transect)

A standard transect counting method was used. In total, two (2) transects walk each of 50m x 50m was identified in the two (2) study sites to monitor the butterfly species. The butterflies observed in each transect was recorded three (3) times a week for a period of three months (January - March 2024). Observations were taken once a day (8:00-10:00 am) when the butterflies are most active. All the butterflies observed were recorded, and the identification of butterflies was done on the two (2) study sites which was confirmed with the help of field guides of Amurun_ Butterflies_2020. While walking on the transect, some rare and small butterflies which are difficult to identify were caught using insect net (Nylon net with long handle was used for sweeping the free flying butterflies) and was closely observed after placing them in clear cardboard paper. Enough precautions were taken, so that, by no means the entire procedure can cause any damage to the collected specimens. All sighted species were photo-documented. Altitude of the study area was recorded with the help of GPS device (Rija *et al.*, 2011).

Data analysis

Data was analyzed by using Shannon Wiener Diversity Index. Butterfly species, individual diversity and abundance were calculated by using descriptive statistics. Margalef's index was used to determine species richness. The butterflies' species composition in the study area was expressed using diversity indices such as species richness, diversity and evenness.

RESULTS

A Checklist of 21 butterfly species and 1,153 individuals belonging to 3 families were recorded (Table 1). Out of this Number 370 Individuals in 13 species were recorded in Engineering Complex and 783 individuals in 19 species were recorded in staff quarters. (Table 1) the result of the study also revealed that only eleven (11) out of the 21 species were recorded in all the two study sites. (Table1). In Engineering Complex Lyceanidae has the highest percent of species and in individuals (46.2%, 93.2%) respectively (Table 2) while in Staff Quarters Pieridae has the highest individuals percent and second in species (59.1% and 26.3%) respectively followed by Nymphalidae with the highest species percent and second in individuals (52.6% and 37.8%) respectively. (Table3). However, the result of

the study as presented in (Table 4) revealed that the staff quarters had the highest value for butterfly diversity and evenness (H = 1.9700), (e = 0.6691). While the Engineering Complex had low value for butterfly diversity and evenness (H = 1.6203) (e = 0.6317). However, staff quarter had the highest value of species richness (D = 2.7014).

Table 1: Checklist of Butterfly Species Captured at Taraba State College of Agricultural Science and Technology, Jalingo

FAMILY	SCIENTIFIC NAME	STUDY SITES		Total Individual	Relative Abundance
		Eng. Com.	Staff Q.		
	Eurema brigitta	4	180	184	0.159
	Eurema hecabe solifera	9	242	251	0.186
Pieridae	*Belenois aurota*	1	15	16	0.014
	Appias libythea	3	20	23	0.019
	Catopsilia florella	0	6	6	0.005
	Acraea serena	5	16	21	0.018
	Danaus chrysippus	0	154	154	0.134
	Junonia orithya	1	63	64	0.055
Nymphalidae	*Humanumidia daedalus*	0	15	15	0.013
	Précis antilope	0	3	3	0.003
	Junonia chorimene	2	25	27	0.023
	Junonia hierta cebrene	0	12	12	0.010
	Précis Octavia	0	5	5	0.004
	Byblia ilithyia	0	1	1	0.001
	Catacroptera cloanthe	0	2	2	0.002
Lyceanidae	*Taracus balkanicus*	8	0	8	0.007
	Azanus isis	22	9	31	0.027
	Azanus moriqua	12	1	13	0.011
	Lampides boeticus	36	0	36	0.031
	Euchrysops cnejus	136	13	149	0.129
	Zizula hylax	131	1	132	0.114
	GRAND TOTAL	**370**	**783**	**1,153**	**0.965**

Source: Field Survey, 2024; Keys: Eng. Com. Engineering Complex; Staff Q.-Staff Quarters

Table 2: Frequency distribution of Butterfly species encountered according to family in the Engineering Complex

Family	Number of Species (%)	Individuals (%)
Pieridae	4 (30.8)	17 (4.6)
Nymphalidae	3 (23.1)	8 (2.2)
Lycearidae	6 (46.2)	345 (93.2)
	13 (100)	370 (100)

Source: Field Survey, 2024

Table 3: Frequency of distribution of butterfly species encountered according to family in the staff quarters

Family	Number of Species (%)	Individuals (%)
Pieridae	5 (26.3)	463 (59.1)
Nymphalidae	10 (52.6)	296 (37.8)
Lyceanidae	4 (21.1)	24 (3.1)
	19 (100)	783 (100)

Source: Field Survey, 2024

Table 4: Species diversity index of butterflies' species in Taraba State College of Agriculture Science and Technology, Jalingo. On the two study sites.

O	Engineering Complex	Staff Quarters
Taxa S	13	19
Individuals	370	783
Shannon _H[1]	1.6203	1.9700
Evenness/e = $^{(H)}/_{lnS}$	0.6317	0.6691
Margalef's IndexR = ($^{s-1}/_{InN}$)	2.0293	2.7014

Source: Field Survey, 2024

DISCUSSION

The findings of this study reveal significant diversity and abundance of butterfly species within the study area, aligning with similar studies in tropical regions but also differing in some key aspects. The total of 21 species recorded across two sites highlights the ecological importance of butterflies in pollination and biodiversity maintenance, as reported by recent studies (Aiswarya *et al.*, 2019; Kumar *et al.*, 2021). However, the species composition and

dominance patterns observed differ due to local environmental factors and anthropogenic pressures.

The dominance of Lycaenidae in the engineering complex aligns with findings by Alarape *et al.* (2019), who observed a similar prevalence of this family in environments with scattered vegetation. Lycaenidae's adaptability to diverse ecological conditions allows them to thrive in urban and semi-urban areas with ornamental plants. Similarly, Nymphalidae's dominance in the staff quarters supports the assertion by Ramesh *et al.* (2020) that this family thrives in areas with higher plant diversity and fruiting species. The presence of flowering plants and nectar sources in the staff quarters likely contributed to their higher abundance and diversity in this study.

The variation in diversity indices across the two study sites is consistent with findings by Tiple *et al.* (2020), who demonstrated that butterfly diversity is positively correlated with vegetation richness and habitat complexity. The Shannon-Wiener Diversity Index (H = 1.9700) and Margalef's richness values (R = 2.7014) in the staff quarters reflect the availability of diverse resources, as noted in prior research (Ubach *et al.*, 2020). This reinforces the importance of habitat heterogeneity in sustaining butterfly populations.

Contrary to findings by Majumder *et al.* (2021), which reported Pieridae as the most dominant family in similar tropical environments, this study found that Pieridae had a relatively lower presence in both study sites. This discrepancy could be attributed to differences in habitat structure and floral resources. The engineering complex, dominated by Lycaenidae, lacked the dense vegetation and open spaces that typically favor Pieridae. Additionally, the absence of certain larval host plants in the study area may have limited their abundance.

While Cleary and Mooers (2018) emphasized that butterfly diversity tends to decrease in urbanized landscapes, this study observed a relatively high diversity even in the engineering complex, which is a semi-urban environment. This divergence may result from ongoing conservation efforts and the planting of ornamental plants that serve as nectar and larval sources. However, human activities such as construction and deforestation could still pose long-term threats, as highlighted by Ghazoul (2019).

The high abundance of Nymphalidae in the staff quarters is indicative of their role as ecological generalists capable of exploiting diverse habitats. This supports the findings of Imam (2020), who highlighted their resilience and adaptability to both natural and human-

altered environments. On the other hand, the lower diversity in the engineering complex accentuates the importance of maintaining habitat quality to support specialist species, as emphasized by Kumar *et al.* (2021).

This study also corroborates recent research on the sensitivity of butterflies to climatic factors such as temperature, rainfall, and humidity (Alarape *et al.*, 2019). The seasonal variation in species abundance observed in the study area aligns with findings by Rija *et al.* (2020), who noted that butterfly populations peak during favorable climatic conditions. This highlights the need for continuous monitoring to understand the impact of climate change on butterfly dynamics.

CONCLUSION

The College of Agricultural Science and Technology, Jalingo has floral diversity that supports butterfly species diversity and abundance in the area. The results of the data obtained from this study shows that the number of species of butterflies observed in staff quarters was more than that of engineering complex. The butterfly of the family Pieridae were the most abundant species and had the highest individual species observed during the study, the findings of this study also underline the diversity and abundance of butterfly species in study area and also provides baseline information on the butterfly species in the study area. This will help in a control measure against the damage caused by the caterpillar stage of the butterflies. From the study we can conclude that the area is rich and diverse in butterfly species. It is recommended that the school management should encourage trees planting and stop the ongoing human activities which has ruined and affected butterfly species abundance and diversity, because such human encroachment requires an immediate intervention to protect biodiversity loss. This is the first effort in exploring the butterfly wealth of Taraba state College of Agricultural Science and Technology, Jalingo and so further exploration of butterfly species be continued so as to update this checklist as this list of butterfly species is not exhaustive because so many species were seen from a distance but were not captured due to time frame. This present study is the first of this type of study in the area. Therefore, it is very difficult to say whether the diversity of butterflies in the area is increasing or decreasing. Therefore, it is recommended that the area under the study should be continuously monitored to observe any changes in this discovery of butterflies,

because the change in diversity can only be observed through continuous monitoring and comparing the data of every year.

Limitations and Future Research

Although this study provides valuable baseline data, certain limitations must be acknowledged. The short duration of the survey (three months) may not fully capture seasonal variations in butterfly diversity. Future studies should adopt a year-round sampling approach to obtain more comprehensive data. Additionally, expanding the study to include other habitats within the region could provide a broader understanding of butterfly diversity and distribution patterns.

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