

Inventory of Butterfly Species Across Varied Microhabitats in the University of Ilorin, Nigeria

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ABSTRACT

Butterflies are key bioindicators of habitat quality, yet species-level data from urban and peri-urban landscapes in West Africa remain limited. This study presents an inventory of butterfly species occurring across two contrasting microhabitats – less-disturbed habitat (LDH) and much-disturbed habitat (MDH) – within the University of Ilorin, Nigeria. Butterflies were surveyed over a 12-week period using line transects and sweep nets. In total, 1,316 individual butterflies were recorded, representing 18 species across 4 families. The most abundant butterfly family recorded was Pieridae with 775 individuals (58.89%), Nymphalidae with 353 individuals (26.81%), Papilionidae with 100 individuals (7.60%), and Hesperidae with 88 individuals (6.69%). The African emigrant butterfly, *Catopsilia florella* (Fabricius, 1775) had the highest abundance in both habitats. Conversely, the dark blue pansy, *Junonia oenone oenone* (Linnaeus, 1758), blue pansy, *Junonia orithya madagascarensis* (Guenee, 1865) and common leopard fritillary, *Phalanta phalanta aethiopica* (Rothschild & Jordan, 1903) were not found in the MDH sites. Generally, the LDH supported a greater number of species, highlighting the importance of habitat heterogeneity and reduced disturbance in maintaining butterfly diversity. This inventory contributes valuable baseline data on butterfly fauna in Nigeria and can inform future ecological or conservation assessments.

Keywords: Butterfly inventory, University of Ilorin, Microhabitats, Nymphalidae, Pieridae

INTRODUCTION

The order Lepidoptera comprises of both moths and butterflies (Perveen, 2017). In Sub-Saharan Africa, over 20,000 species of Lepidoptera have been documented, highlighting their incredible diversity and prominence among terrestrial invertebrates (Van Huis, 2019). Butterflies are among the most extensively studied diurnal flying insects and represent a significant component of Lepidoptera, the second-largest order in the Phylum Arthropoda (Yarger *et al.*, 2016). Globally, there are over 28,000 butterfly species, with about 80% occurring in tropical regions (Larsen, 2005). Monitoring butterfly species diversity in a region provides valuable insights into their functional roles within ecosystems (Mukherjee *et al.*, 2015).

Butterflies are essential components of biodiversity and serve as reliable indicators of environmental disturbances (Abaynew & Emanu, 2021). Their role as indicators forms the foundation for studying butterfly diversity across spatial and temporal scales (Stefanescu *et al.*, 2004). With their short life cycles, high dispersal abilities, and reproductive capacity, butterflies are widely studied in relation to their ecology, evolution, behavior, and habitat requirements (Ojjanwuna, 2015). Many species are particularly effective indicators of anthropogenic disturbances and habitat quality (Kocher & Williams, 2000). As noted by Nkwabi *et al.* (2017), different types and scales of disturbance uniquely affect biodiversity, with varying impacts on species. For instance, Ombugadu *et al.* (2021) demonstrated that urban features such as roads, buildings, and mowed lawns are linked to reduced butterfly species richness, diversity, and abundance. The University of Ilorin, located in the southern Guinea savanna agroecological zone, is a rich ecological hub at the intersection of Nigeria's rainforest and northern guinea savanna (grassland) agroecological zones. Spanning approximately 15,000 hectares, it is one of Nigeria's largest university campuses. A significant portion of this land remains undeveloped, preserving its natural vegetation and ecological integrity. However, over the past decade, increased infrastructural development – including road construction and new buildings – has led to habitat alterations, such as tree felling and vegetation clearing. These anthropogenic changes have likely fragmented habitats, yet their impact on butterfly diversity, an essential indicator of insect pollinator biodiversity, remains unexamined. This study addresses that gap by providing a comprehensive inventory of butterfly species across distinct microhabitats, offering essential baseline data to support future biodiversity monitoring, ecological research, and conservation planning.

MATERIALS AND METHODS

Description of Sampling Sites

The study was conducted at the University of Ilorin, Ilorin, Nigeria, located between latitude 8°24' N and 8°36' N and longitude 4°10' E and 4°36' E. The area lies in a transitional ecological zone, connecting the deciduous woodlands of southern Nigeria and the dry savannah of the north (Ajadi *et al.*, 2016). Sampling was carried out across two functional broad-scale microhabitats within the study area. These were classified as Less Disturbed Habitat (semi-natural microhabitats) and Much Disturbed Habitat (urbanized microhabitats). For each microhabitat, two sites were selected as sampling sites: The first site in the Less Disturbed Habitat (LDH) had fruit trees such as mango, cashew, and orange surrounded by dense natural vegetation and landscape, including shrubs and rocky areas. Anthropogenic activities are minimal with occasional small-scale farming of staple crops.

The second sampling site in the LDH is a riparian agricultural habitat located near the University of Ilorin dam. The dam's banks feature dense natural vegetation and flora. Both sites in the LDH lack buildings, paved roads, and significant vehicular or human disturbance. In contrast, the first site in the Much-Disturbed Habitat (MDH) is located near a major administrative office complex while the second site is surrounded by student lecture theatres in the study area. Both areas are urbanized and thus characterized by numerous buildings, sparse trees, and high levels of vehicular and human activity throughout the day. In the last ten years, both sites in the MDH have undergone significant anthropogenic modifications and habitat fragmentation, with patches of natural vegetation widely separated.

Butterfly Sampling Procedure

Butterfly monitoring followed the line transect method outlined by Yarger *et al.* (2016) to assess abundance, and diversity. A 200 m permanent transect was established at each site and traversed slowly at a uniform pace for 30 minutes daily between 8:30 and 11:30 a.m. over four weeks in May, 2023. Observations were conducted during favorable weather conditions, avoiding heavy rain or strong winds. Butterflies within a five-meter radius of the observer – including the sides, above, and in front – were recorded. Butterflies were either visually identified on-site or captured with an adjustable sweep net for closer examination. Precautions were taken to minimize damage to wing scales, and photographs were taken with an android smartphone for subsequent identification using the guide described by Larsen (2006) and taxonomic information provided on the Global Biodiversity Information Facility database (GBIF, 2024). Readings on temperature (°C), amount of rainfall (mm), relative humidity (%) and wind speed (m/s) were recorded daily. Species presence, occurrence frequency, and habitat association were recorded. No inferential statistical analyses were conducted; instead, data are presented descriptively.

RESULTS AND DISCUSSION

Butterfly species and abundance

A total of 1,316 individual butterflies were sampled and they comprised 18 species and four families namely Pieridae (58.89%), Nymphalidae (26.81%), Papilionidae (7.60%), and Hesperidae (6.69%). The African emigrant, *Catopsilia florella* was the most abundant (17.48%) of all sampled butterfly species while the Common leopard fritillary, *Phalanta phalanta aethiopica* accounted for just 2.05% of the total (Table 1). Figure 1 present all butterfly species collected and identified during the one-month survey.

Table 1. Overview of abundance and species of butterflies found in the University of Ilorin

Family	Species	Common name	Abundance (N)	Relative Abundance (%)
Hesperidae	<i>Gomalia elma elma</i> (Trimen, 1862)	Marbled skipper	88	6.69
Nymphalidae	<i>Acraea serena</i> (Fabricius, 1775)	Dancing Acraea	69	5.24
Nymphalidae	<i>Phalanta phalanta aethiopica</i> (Rothschild & Jordan, 1903)	African leopard	27	2.05
Nymphalidae	<i>Byblia ilithya</i> (Drury, 1773)	Spotted joker	39	2.96
Nymphalidae	<i>Hypolimnys misippus</i> (Linnaeus, 1764)	False plain tiger	74	5.62
Nymphalidae	<i>Junonia oenone oenone</i> (Linnaeus, 1758)	Dark blue pansy	37	2.81
Nymphalidae	<i>Junonia orithya madagascarensis</i> (Guenee, 1865)	African blue pansy	33	2.51
Nymphalidae	<i>Telchinia serena</i> (Fabricius, 1775)	Cabbage Acraea	74	5.62
Papilionidae	<i>Papilio demodocus</i> (Esper, 1798)	Citrus swallowtail	100	7.60
Pieridae	<i>Appias epaphia epaphia</i> (Cramer, 1779)	Diverse white	91	6.91
Pieridae	<i>Belenois aurota</i> (Fabricius, 1793)	Brown-veined White	72	5.47

Pieridae	<i>Catopsilia florella</i> (Fabricius, 1775)	African emigrant	230	17.48
Pieridae	<i>Dixeia orbona orbona</i> (Geyer, 1837)	Creamy small white	42	3.19
Pieridae	<i>Mylothris aburi</i> (Larsen & Collins, 2003)	Savannah dotted border	40	3.04
Pieridae	<i>Nepheronia phaxis phaxis</i> (Biosduval, 1836)	Round-winged vagrant	50	3.80
Pieridae	<i>Pseudopontia paradoxa</i> (Felder & Felder, 1869)	Paradox ghost	36	2.74
Pieridae	<i>Terias floricola</i> (Boisduval, 1833)	Malagasy grass yellow	111	8.43
Pieridae	<i>Terias senegalensis</i> (Biosduval, 1836)	Forest grass yellow	103	7.83
		Total	1316	100

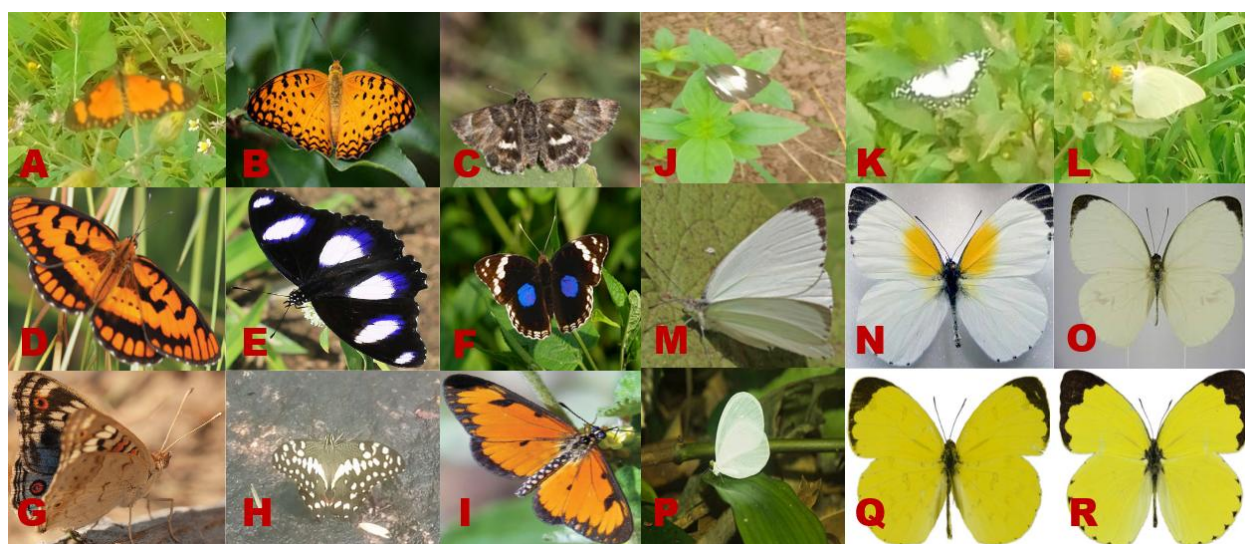


Figure 1. Butterfly species identified in selected microhabitats in the University of Ilorin, Nigeria (A) *Acraea serena* (B) *Phalanta phalanta aethiopica* (C) *Gomalia elma elma* (D) *Byblia ilithya* (E) *Hypolimnas missippus* (F) *Junonia oenone oenone* (G) *Junonia orithya madagascarensis* (H) *Papilio demodocus* (I) *Telchinia serena* (J) *Appias epaphia epaphia* (K) *Belenois aurota* (L) *Catopsilia florella* (M) *Dixeia orbona orbona* (N) *Mylothris aburi* (O) *Nepheronia phaxis phaxis* (P) *Pseudopontia paradoxa* (Q) *Terias floricola* (R) *Terias senegalensis*

The high abundance of Pieridae butterflies observed in this study is consistent with findings from previous studies conducted at the botanical and zoological gardens of the University of Ibadan (Alarape *et al.*, 2015) and the Federal University Lafia (Ombuguadu *et al.*, 2021), where Pieridae also emerged as the most abundant butterfly family. Similarly, several researchers have similarly noted that the family Nymphalidae ranks second to the family Pieridae in terms of their abundance in urban and peri-urban areas (Ramesh *et al.*, 2010; Fang *et al.*, 2024). The prevalence of butterfly species in the Pieridae and Nymphalidae families is likely due to the higher number of urban-tolerant species within these groups compared to others. Urban-adaptable species such as the African emigrant, *Catopsilia florella*; Brown-veined white, *Belenois aurota*; False plain tiger, *Hypolimnas misippus*; and Dark

blue pansy, *Junonia oenone* are commonly found in gardens and other suburban areas with flowering plants or weedy vegetation that support their larvae (Larsen, 2005). Their ability to feed on a broad range of host plants enables them to thrive in human-modified landscapes. The family HesperIIDae recorded the fewest species and individuals in this study, aligning with findings of Efenakpo *et al.* (2021) and Ojjanwuna and Umoru (2023), who investigated butterfly species abundance at the University of Port Harcourt Park and Okomu National Park, respectively, in Nigeria. In contrast to previous authors who reported *Pardaleodes edipus* and *Coeliades forestan forestan*, both common skippers in many West and Central African countries, the only hesperiid observed in our study was the Marbled skipper (*G. elma elma*). This species is primarily found in southern Africa and is less frequently recorded in Nigeria or West Africa (Larsen, 2005; GBIF, 2024).

Butterfly species occurrence in the Less-Disturbed and Much-Disturbed Habitats

While all 18 species were found in the Less-Disturbed Habitats (LDH), three species namely the dark blue pansy, *J. oenone oenone*, African blue pansy, *J. orithya madagascarensis* and African leopard, *P. phalanta aethiopica* were not found at any time in the Much-Disturbed Habitats (MDH). Even though the other 15 butterfly species occurred in both microhabitat types, their abundance varied widely (Figure 2). Some butterfly species, for instance, were found in substantially higher numbers in the LDH than in the MDH. These includes *A. epaphia epaphia* and *M. aburi* both of which occurred approximately twice as many times in the LDH compared to the MDH. Similarly, *P. demodocus*, *H. missippus* and *D. orbona orbona* occurred roughly three-, six-, and ten times more in the LDH than in the MDH sites, respectively. Conversely, species like *N. phaxis phaxis* and *B. aurota* occurred approximately two- and four times more in the MDH than in the LDH sites. On the other hand, the abundance of *B. ilithya* and *P. paradoxa* in MDH sites was roughly six times more than in the LDH while *A. serena* species occurred approximately nine times more in the MDH sites. Nevertheless, five butterfly species – *C. florella*, *G. elma elma*, *T. serena*, *T. floricola* and *T. senegalensis* were observed to occur in roughly the same numbers in both microhabitats (Figure 2).

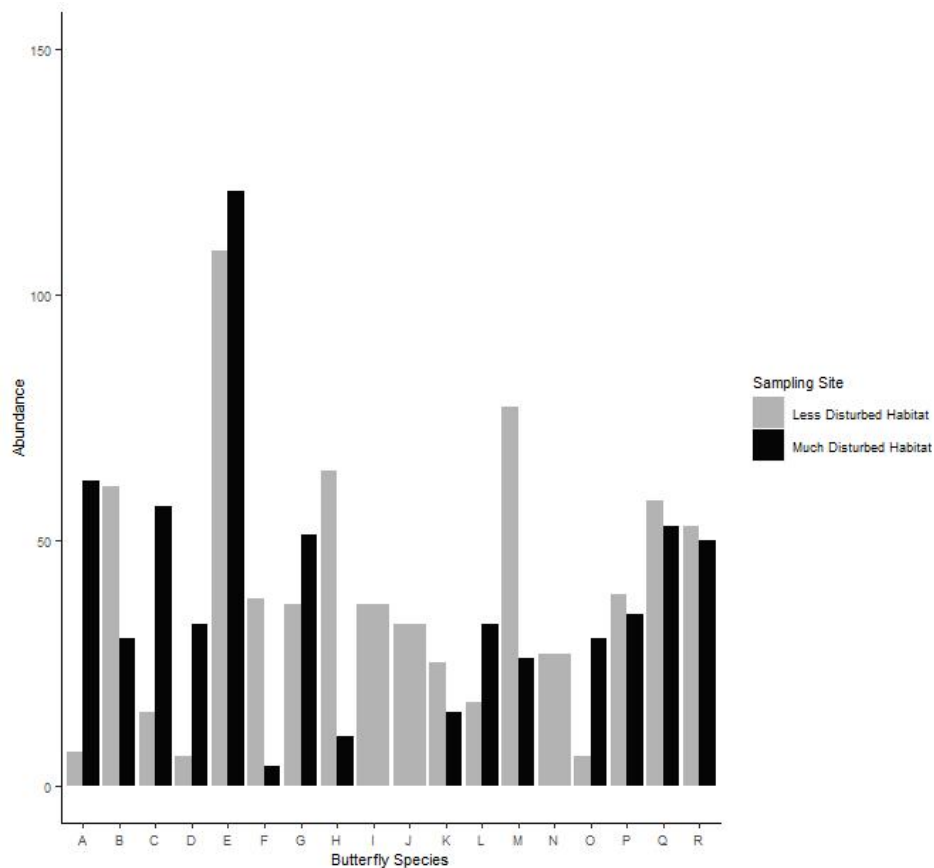


Figure 2. Occurrence and abundance of butterfly species in Less-Disturbed and Much-Disturbed microhabitats in the University of Ilorin (A) *Acraea serena* (B) *Appias epaphia epaphia*, (C) *Belenois aurota*, (D) *Byblia ilithya* (E) *Catopsilia florella* (F) *Dixiea orbona orbona*, (G) *Gomalia elma elma* (H) *Hypolimnas missippus* (I) *Junonia oenone oenone* (J) *Junonia orithya madagascarensis* (K) *Mylothris aburi* (L) *Nepheronia phaxis phaxis* (M) *Papilio demodocus* (N) *Phalanta phalanta aethiopica* (O) *Pseudopontia paradoxa* (P) *Telchinia serena* (Q) *Terias floricola* (R) *Terias senegalensis*

Urban butterfly communities predominantly comprise species well-adapted to urban environments, characterized by high mobility and minimal reliance on specific habitats (Lin *et al.*, 2023; Fang *et al.*, 2024). In the present study, the butterfly species *A. serena*, *B. ilithya*, and *P. paradoxa* were at least six times more abundant in Much-Disturbed Habitats compared to Less Disturbed Habitats, reflecting their strong preference for and better adaptation to urbanized environments. Supporting this observation, previous studies (Bhupathi Rayalu *et al.*, 2011; Echude *et al.*, 2020) have documented the frequent presence of these species in zoological gardens, botanical gardens, parks, and butterfly houses, underscoring their tolerance for urban environments. Similarly, the dark blue pansy, *J. oenone oenone* and the African blue pansy *J. orithya madagascarensis* are common butterfly species in gardens, parks, and roadside vegetation within urban areas (Kyerematen *et al.*, 2014; Habel *et al.*, 2023; Fang *et al.*, 2024). Their presence in these environments indicates that they are at least moderately adapted or tolerant of urban settings. However, their absence in the Much-Disturbed Habitats surveyed during this study was unanticipated and may be attributed to the relatively short observation period of four weeks. Extending the observation period could provide a more comprehensive assessment and potentially reveal their presence in MDH sites.

Weather variables in the Less-Disturbed and Much-Disturbed Habitats

Temperature generally promotes the growth of food and ornamental plants while butterflies usually show increased sensitivity to thermal conditions (Alarape *et al.*, 2015). Over the four weeks of butterfly sampling at the University of Ilorin, average daily temperature remained fairly stable, ranging between 20–25°C, with minor fluctuations. Himanshu *et al.* (2019) reported that the highest abundance of butterflies was recorded when the average monthly temperature was maximum (36.5°C) whereas lowest abundance was recorded when the average temperature was minimum (18.9°C). Studies have shown that tropical insect communities have higher diversity during high precipitation season (Valtonen *et al.*, 2013). Rainfall was not frequent and episodic in the habitats studied, occurring on only a few days with heavy pours (Figure 3). Relative humidity was consistently high (70–85%) during this study, showing moderate daily variation and peaking after rainfall events while wind speed varied throughout the period, generally moderate, with a few days of notably higher winds (Figure 3). Lepidoptera are exposed to quite a range of environmental influences; thus, they are highly sensitive to alterations in temperature, humidity, wind speed, rainfall and altitudes (Akwashiki *et al.*, 2007).

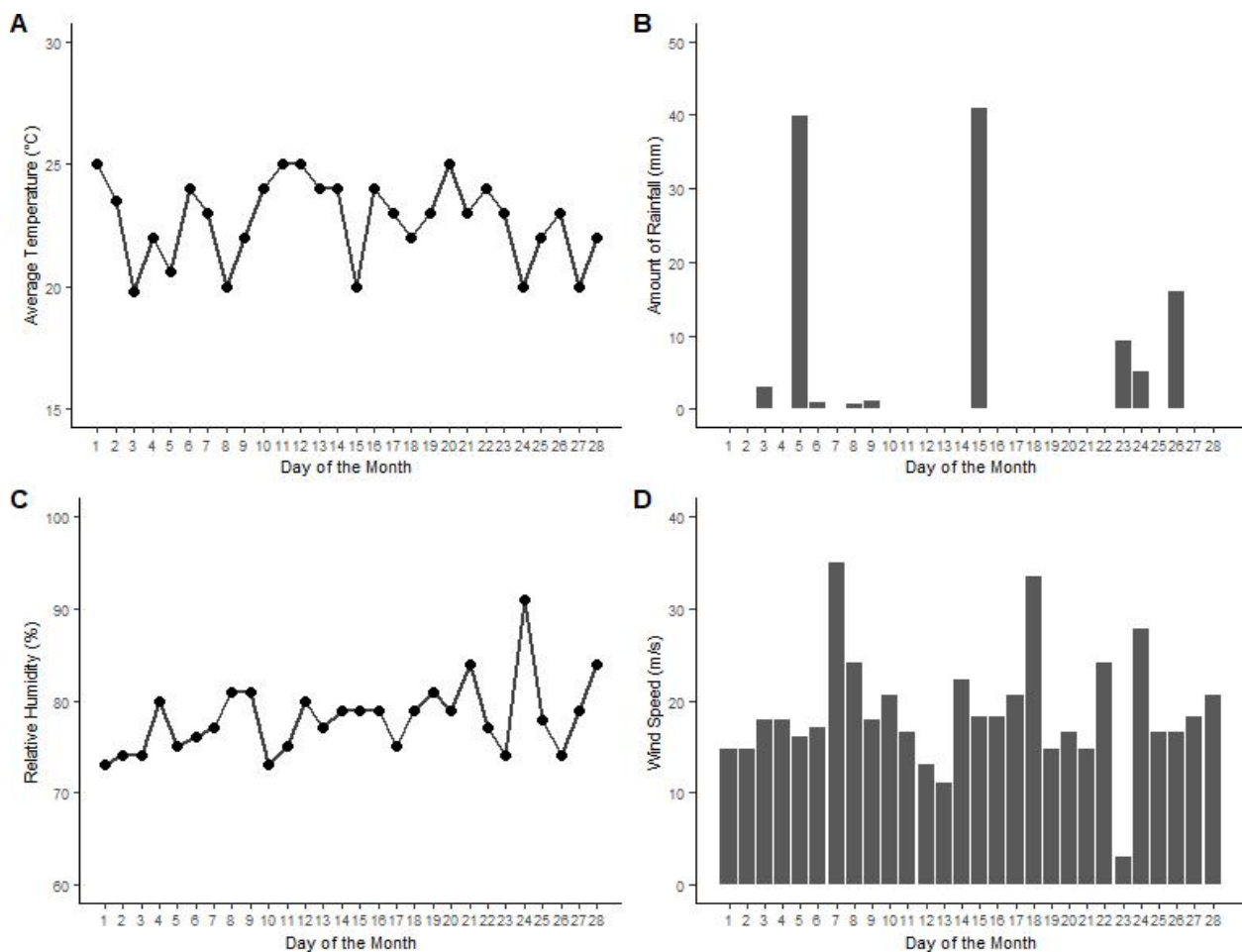


Figure 3. Daily weather data collected over the four weeks of butterfly sampling at the University of Ilorin (A) Average daily temperature (B) Amount of rainfall (C) Relative humidity (D) Wind Speed

CONCLUSION

A total of 1,316 individuals representing 18 species from four families were recorded, with Pieridae being the most abundant on the University of Ilorin campus in Nigeria. This study has shown that the African emigrant butterfly, *C. florella* (family: Pieridae) remains dominant in both less-disturbed (semi-natural) microhabitats and highly disturbed (urbanized) microhabitats. Notably, three species – *J. oenone oenone*, *J. orithya madagascarensis*, and *P. phalanta aethiopica* – were completely absent from the much-disturbed habitats. These findings highlight the need to preserve natural and semi-natural areas within urban environments to sustain butterfly diversity. The variation in species distribution between habitats reflects differences in ecological resilience and adaptability, offering valuable insights for conservation planning and habitat restoration. The data generated can guide campus land-use decisions and contribute to broader pollinator conservation efforts in the region. For future studies, longer-term monitoring is recommended to capture seasonal variations and species turnover more accurately.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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