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Butterfly count on different habitats in international institute of tropical agriculture (IITA), Ibadan-Nigeria

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ABSTRACT

Butterflies are considered as good ecological indicators for other invertebrate and as surrogate representatives of environmental quality changes. Their occurrence and diversity in populations contribute to thriving ecosystems and can indicate the state of an ecosystem's health. Though, there is high increase in habitat fragmentation of most protected area. However, information on butterfly species abundance, richness on different habitat is limited in the study area. The study assessed the diversity and abundance butterfly species in relation to its environmental factors. Sampling was done quantitatively using three complementary methods, line transect (walk-and-counts), hand nets, and fruit bait traps in June and July 2018. Data was analysed using descriptive statistics, diversity indices and Pearson's correlation. A total of 646 individual representing 40 butterfly species belonging to 5 families in the order Lepidoptera were recorded across the three different habitats. Members of Nymphalidae family occurred most and accounted for 57.5% species and 63.3% total number of individual species with Acrsea serena been the most dominant across the habitats. Forest habitat had the highest species composition (n = 316). Generally, species abundance (31.0%), richness (33.7%) and family composition (33.7%) respectively, were recorded more through visual count method, while mean species abundance (26.1%) encountered higher with hand-net method. There was no significant relationship between the environmental factors and the total number of individuals or species richness. But rainfall was found to be positively correlated with the species diversity and abundance. Hence, understanding the factors affecting butterfly species diversity and abundance in IITA is very important for conservation purposes.

1. Introduction

Insects are a group of organisms belonging to the class Insecta and phylum Arthropoda in the animal kingdom (Chapman, 2006). They are one of the most successful groups of organisms in the animal world, outnumbering other taxa (Wilson, 2009). Insects exploit different regions, from temperate areas to the tropics, which are richer and also found in different habitats.

Butterflies are holometabolous insects belonging to the Lepidoptera order (butterflies and moths) (Mallet, 2007; Yager et al. 2016). They are called butterflies when fully developed and are flying. About 180,000 species of the Lepidoptera are described, in 126 families and 46 super families (Mallet, 2007), accounting for about 10% of the total described species of living organisms. Butterflies are popular, well-known insects with large, colorful wings covered with tiny scales. About twenty thousand different species of butterflies occurred worldwide; the tropics alone holding about 90% (Munyuli, 2010). West Africa holds about 2000 species of butterflies (Viejo et al. 2000), 50% of which were found in Nigeria. Although, butterflies exploits different kinds of habitats, greater percentage prefer forests, which are now increasingly fragmented and restricted to protected patches in some areas such as the National Park and forest reserves. In spite of this anthropogenic disturbance, some fragmented forests such as the Forest Reserve at the International Institute of Tropical Agriculture (IITA) in Ibadan, still maintain significant butterfly diversity.

Among insects, butterflies perform prominent roles in pollination and herbivory (Tiple and Arun, 2009), bearing a history of long-term coevolution with plants (Fermon et al. 2005). Butterflies are considered good indicators of the health of ecosystems, a reflection of human disturbance and habitat feature (Gascon et al. 1999). Butterflies have greater sensitivity than many other taxonomic groups and treated as an important model in ecology and conservation.

Despite the ecological services rendered by butterflies, anthropogenic landuse change poses the greatest threat to their long-term survival. Decreasing species richness, heterogeneity and density, and the alteration of interspecific and intraspecific interactions are some of the resultant biotic effects of habitat loss and fragmentation that can cause biodiversity crisis. Given the mobility and spatial ecology of insects, it is hardly surprising that the size and health of habitat patches play fundamental roles in determining their richness and diversity (Ramesh et al. 2010). The study therefore surveys the abundance, richness and diversity of butterflies within the IITA habitats types (farmland, forest and wetland areas).

2. Materials and Methods

2.1. Study Area

The International Institute of Tropical Agriculture (IITA) Campus is an award-winning, research for development organization. Located South-western region of Nigeria and lies between latitude 7° 30′ N, longitude 3° 55′ E of equator with a land mass covering 1000 ha (Fig. 1). IITA was established in 1967 and seeks to solve the problem of hunger, poverty and the degradation of natural resources in Africa. The habitat consists of lakes, rice paddies, farm plots, marshes and bushes, which provide additional habitats for wildlife conservation. The study area is mainly divided between derived savannah and forest ecosystems; in the form of degraded farmland and secondary forest respectively (Adeyanju et al. 2014).

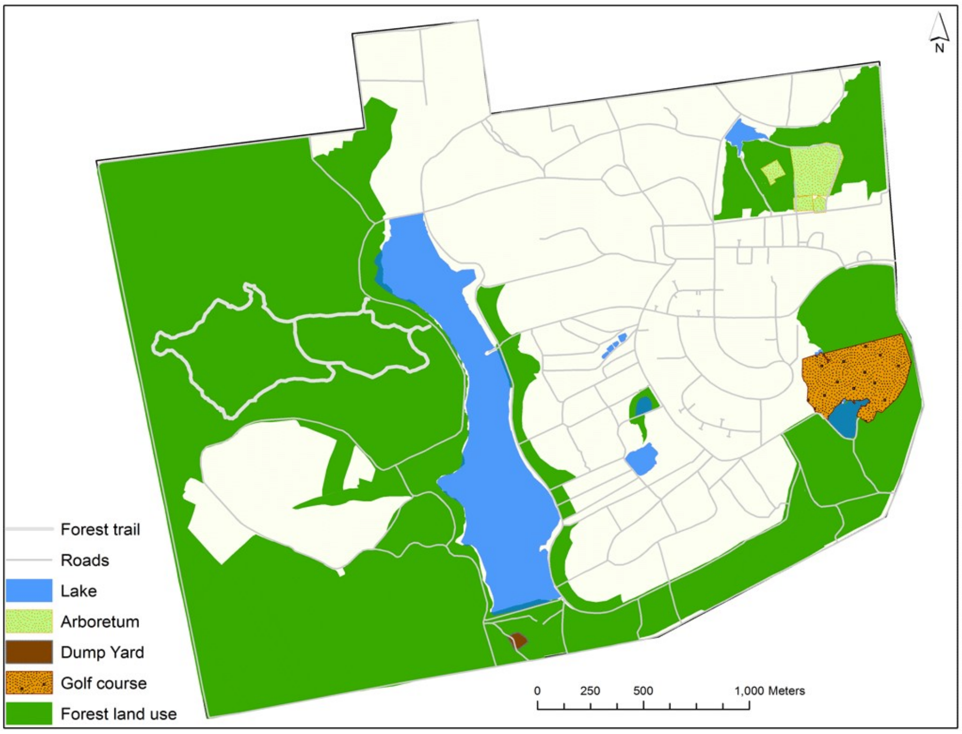

Figure 1. Map of International Institute of Tropical Agriculture (IITA GIS UNIT, 2016)

2.2. Sampling procedure and Data collection

Butterflies sampling was conducted on three different habitats of IITA (forests, wetlands and farm lands). They were sampled quantitatively using three complementary methods; transect walk-and-counts, hand nets and fruit bait traps, universally recommended and extensively used by Munyuli (2010) in the tropics. Sampled were collected for ten consecutive rounds from June 2018 to July 2018. Butterflies were sampled under good weather conditions during sunny and calm days from 10 hours 30 mins to 14:00 hours. Each habitat was observed for ten days using the three methods mentioned above. Species were recorded around a 5meters radius from the observer, covering both sides, above and front. Details of the three sampling methods used are discussed below.

2.2.1. Transect Walk-And-Counts.

Butterfly communities were counted using line transect method also called "visual census method" (Munyuli 2010). During each sampling visit, butterflies were counted while walking at a /steady pace of 10m/min along transect lines, frequently stopping, and observing butterfly species within transect range. With the use of a field guide, Common butterflies of IITA by Safian and Warren (2015), butterflies were identified on the wing (using wing characteristics) while flying out and the total number of butterflies of each species flying within view of the observer was recorded. Although sampling were done on both sides of the transect, caution was taken to avoid double counting of individuals of a given species by walking in one direction and by not moving back to resample a species seen behind. To avoid counting individuals and species more than once, species captured were freed far away from the sampling belt (transect). During transect walks, specimens were not collected.

2.2.2. Hand-Netting Method

Hand-netting was carried out immediately after visual counting was finished. Butter-Sweep-net was used catch butterflies. Hand-netting was conducted for 10m/3min to make a total of 60 min per transect and it involved running and catching butterflies along the transect line; butterflies that were caught in nets were not recorded with those visually counted during visual census. Captured butterflies were counted, many of these captured butterflies were released after field identification, and those that could not be identified were collected in a kilner jar containing ethyl acetate soaked in cotton wool, and taken to the laboratory for proper identification (Plates 1).

2.2.3. Banana Fruit-Bait Traps Method

Butterflies were also captured in traps baited with mashed ripe bananas that had been fermented in a bowl for 2 days. The bait was prepared three days prior to baiting and not replaced unless lost. Traps were made with local materials, based on the Van-Someron-Rydon trap design (Kitahara, 2008). The traps were cylinders of green nylon netting 110 cm high and 40 cm in diameter, sewn onto a frame of two metal rings, closed at the top and open at the bottom with plastic tray tied to it with four twines. The trap nets were 110 centimeters in height so as to minimize the risk of escape once butterflies had entered. Traps were placed at about 50meters interval along transect lines. Each trap was baited with two spoons of fermenting banana, and they were suspended 1.7–2meters above the ground (Plate 2). Samples were counted and removed after 24 hours so as to prevent the trapped butterflies from been eaten by ants. In all, five baited traps were set in each sampling site. Unidentified species were taken to the laboratory at Entomology Museum of the Department of crop Protection and Environmental Biology, University of Ibadan for mounting and identification the rest of the specimens found alive were released after they being recorded. Butterfly specimens were identified by consulting literature, nomenclature, and colored plates of Butterflies “Butterflies of West Africa” and the “common butterflies on IITA”.

Plate 1. Butterfly hand-sweep net

Plate 2. Butterfly fruit trap net

2.3. Statistical Analysis

Results obtained were analyzed using descriptive statistics, diversity indices and Pearson’s correlation.

3. Results and discussions

3.1. Butterfly Species list and distribution in International Institute of Tropical Agriculture

A total number of 40 species, 646 individual belonging to 5 families in the order Lepidoptera were observed and recorded on three different habitats (Table 1). Out of the total individual’s species (n = 646), the forest habitat had the highest individual species (n = 316), followed by the farm portion (n = 177) comprising of cassava site with 55, maize site with 34, plantain with 65 and rice paddy with 24 individual species, respectively, while the wetland habitat had the least number of individual species (n = 153). The high butterfly species encountered in the present study is typical of West African taxa and compare to relatively higher to moderate and rich species reported by Yager et al. (2016); Nwosu and Iwu (2011). The encounter rate per habitats shows that the different environment had a considerable diversity and abundant number of butterfly species owning to its different vegetation types and crops composition. The following species were encountered and recorded higher across the habitats: *Acraea serena, Belenois calypso, Catopsilla florella, Junonia sophia, Acraea serena, Mylothris chloris* and *Hypolimnas anthedon.* However, some like *Amauris naivius, Bouvier elfin, Charaxes tridate, Charexes boueti, Libythea labdaca, Papilio menestheus, Pardaleodes edipus, Pteroteinon laufella* and *Zizeeria knysna*were scary and rarely found across most habitats. The percentage representation of the families indicated Hesperidae with (species 7.5%; individuals 2.5%), Lycaenidae (species 7.5%; individuals 4.2%), Nymphalidae (species 57.5%; individuals 63.3%), Pailionidae (species 7.5%; individuals 1.7%) and Pieridae (species 20.0%; individuals 28.3%) (Table 2). The percentage species composition of Nymphalidae and Pieridae in the study area is higher compare to the findings by Akwashiki et al. (2007) in Amurum forest of Plateau State, but similar to the findings of Yager et al. (2016) in forestry nursery of University of Agriculture Benue State. However, low species representation of Lycaenidae, Pailionidae and Hesperidae is similar to the findings of Aiswarya et al. (2014); Alarape et al. (2015). Obviously, it could be attributed to different in location and other environmental conditions. According to Fermon et al. (2005) butterfly species among Nymphalidae family have much higher diversity of phenotype when larval food plants are more evenly distributed within an environment and can strive and multiply well.

Table 1. Butterfly Species Count on Different Habitats Types of IITA

Species	*Family*	*Farm Categories*				*∑=Farm*	*Forest*	*Wetland*
		Cassava	*Maize*	*Plantain*	*Rice*			
Abadima Acraea	Nymphalidae	0	0	0	2	2	1	1
Acraea alciope	Nymphalidae	1	0	0	8	9	22	2
Acraea serena	Nymphalidae	19	24	21	4	68	41	56
Acraea hyalitis	Nymphalidae	0	0	0	0	0	0	3
Amauris naivius	Nymphalidae	0	0	0	0	0	2	0
Aterica galena	Nymphalidae	0	0	0	0	0	4	0
Belenois calypso	Pieridae	2	0	1	2	5	35	8
Bicyclus dorothea	Nymphalidae	0	0	1	0	1	2	3
Bicyclus safitza	Nymphalidae	0	0	1	0	1	23	1
Bicyclus serena	Nymphalidae	0	0	0	0	0	0	3
Bouvier elfin	Lycaenidae	0	0	0	0	0	1	0
Catopsilla florella	Pieridae	9	2	7	3	21	18	5
Charaxes tridate	Nymphalidae	0	0	0	0	0	1	0
Charaxes boueti	Nymphalidae	0	0	1	0	1	0	0
Colotis euippe	Pieridae	0	0	1	0	1	3	0
Danaus chrysippus	Nymphalidae	2	0	1	0	3	9	5
Euphaedra themis	Nymphalidae	0	0	0	0	0	5	0
Euremahecabe solifera	Pieridae	1	0	1	0	2	26	5
Hamanumida daedalus	Nymphalidae	0	0	6	0	6	1	0
Hypolimnas anthedon	Nymphalidae	1	0	5	0	6	16	16
Junonia oenone	Nymphalidae	0	0	0	1	1	11	4
Junonia serena	Nymphalidae	0	0	0	0	0	3	0
Junonia Sophia	Nymphalidae	6	1	5	1	13	11	11
Junonia terea	Nymphalidae	0	0	0	0	0	17	1
Leptosia alcesta	Pieridae	0	0	0	0	0	8	0
Libythea labdaca	Nymphalidae	0	0	0	0	0	1	0
Melanitis leda	Nymphalidae	0	0	4	0	4	2	6
Mylothris chloris	Pieridae	1	5	4	1	11	14	4
Nepheronia buquetii buquetii	Pieridae	0	0	0	0	0	4	0

Nepheronia thalassina	Pieridae	4	0	2	0	6	1	0
Neptis serena	Nymphalidae	0	0	0	1	1	2	1
Papilio dardanus	Papilionidae	0	0	0	0	0	4	0
Papilio demodocus	Papilionidae	3	2	2	0	7	6	0
Papilio menestheus	Papilionidae	0	0	0	0	0	1	0
Pardaleodes edipus	Hesperiidae	0	0	0	0	0	1	0
Pelopidas mathias	Hesperiidae	0	0	0	0	0	10	1
Pteroteinon laufella	Hesperiidae	0	0	0	0	0	1	0
Ypthima doleta	Nymphalidae	0	0	0	0	0	6	0
Zizeeria Knysna	Lycaenidae	0	0	0	0	0	2	0
Zizula hylax	Lycaenidae	6	0	2	0	8	1	17
Total		55	34	65	23	**177**	**316**	**153**

Table 2. Distribution of Butterfly Species Encountered According to Species and Individuals (Families) in International Institute of Tropical Agriculture

Family	***Number of species %***	***Number of individuals %***
Hesperidae	3 (7.5%)	16 (2.5%)
Lycaenidae	3 (7.5%)	27 (4.2%)
Nymphalidae	23 (57.5%)	409 (63.3%)
Papilionidae	3 (7.3%)	11 (1.7%)
Pieridae	8 (20.0%)	183 (28.8%)
Total	40	646

3.2. Butterfly Species Mean Diversity, Abundance and Richness Across the Habitat and Survey Methods

The result given in Table 3 shows that, the forest habitat has the highest mean number of species diversity of 343.65, followed by farmland with 294.16 and the wetland with 315.83. The mean species abundance and richness were very high with visual counting method compare with traps and hand-nets across the habitats and was higher at forest and at rice paddy respectively (Figures 2 and 3).

Table 3. Mean Species Diversity across the Habitats in IITA

Habitat	***Individual Species***	***Mean***
Farm	177	294.16
Forest	316	343.65
Wetland	153	315.83
Total	646	

The total species abundance (31.0%), richness (33.7%) and family composition (33.7%) respectively, were dominant with visual counting survey method, while the mean abundance (26.1%) was higher with hand-nets survey method (Table 4). The abundance of individual of a species at any given point in a time sequential scale is dependent on abiotic and biotic environmental factors (Alarape et al. 2015). Sites that hosted higher species richness and diversity were secondary forest reserves followed by wetlands sites surrounded by forest patches. In contrast, the least diverse habitat characterized by low butterfly species richness were also study sites of low habitat heterogeneity, this is in accordance with Imam (2015) who stated that an increase in heterogeneity leads to an increase in species diversity.

Also, sites dominated by high management intensities subjected to high cropping intensity (Munyuli, 2010), especially mono cropping as in the case of farm lands in IITA substantiates the findings for low species counts.

Changes in land use have been pointed out as a main strong force of biodiversity loss and biotic homogenization at local and broad scales (González-Varo et al. 2013). However, changes in land use do not only mean shifting from one type of land use to another but also changes in the structure of the vegetation found at a given location. It is suggested that vegetation structure is highly influential for animal diversity and that different taxonomic groups may respond to different components of habitat structure (Davies and Asner, 2014).

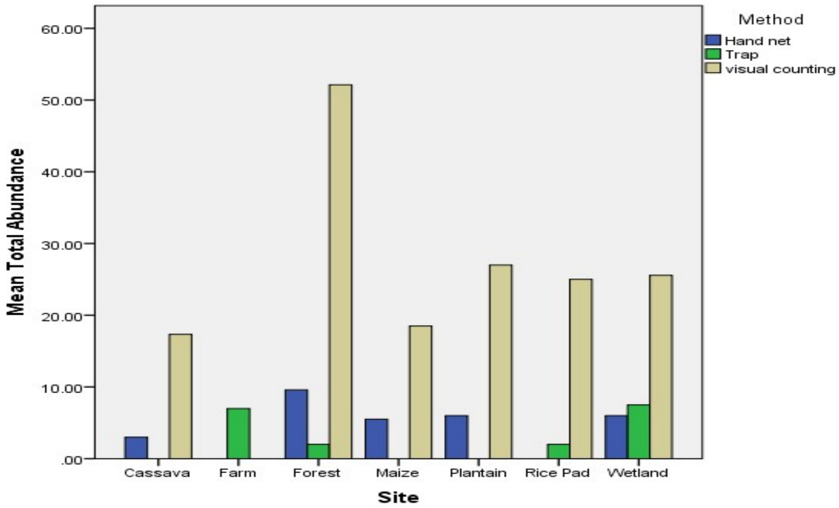

Figure 2. Butterfly total Abundance in each Habitat Type at IITA

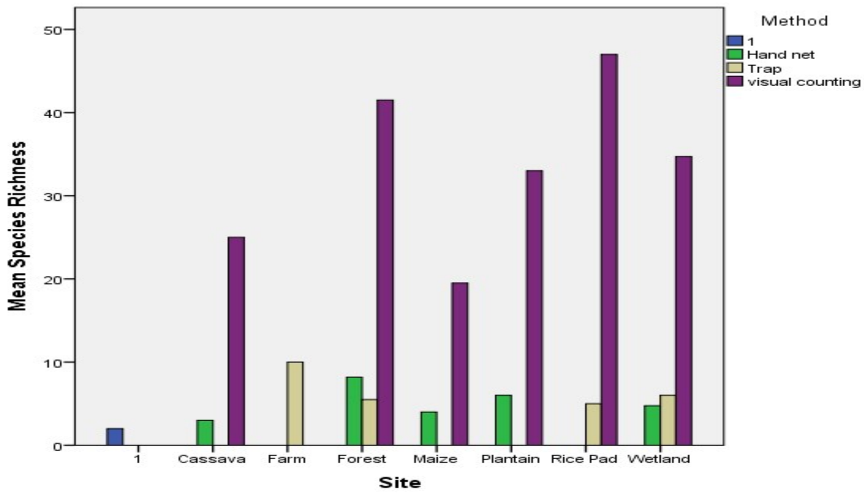

Figure 3. Mean Butterfly Species Richness in each Habitat at IITA

The butterflies' habits of dispersal, reproduction, diet and habitat use given by their functional traits may explain the high importance of vegetation structure. This is because areas with higher habitat heterogeneity may render more varied niches and thus different sets of species adapted to them according to their specific traits (Tews et al. 2004; Molleman et al. 2006).

Much as factors governing butterfly community structure and composition in farmlands are not fully known, taking in to consideration the monoculture system of farming practiced in IITA. Therefore, this result indicates that forest vegetation play a significant role in the distribution, diversity, and abundance of butterfly species in IITA. A probable justification is that butterflies visit farmlands for supplemental nectar resources not found in the adjacent forest ecosystems (Munyuli, 2010).

Table 4. Percentage Abundance, Richness and Mean Species of Butterfly Families Using Different Methods

Method	*Total Abundance*	*Species richness*	*Family*	*Mean abundance*
Hand net	14.23	11.00	11.00	26.13
Trap	10.42	15.42	15.42	22.50
Visual counting	31.04	33.74	33.74	18.17

3.3. Correlation between different weather variables and the abundance of butterflies in IITA

The correlation matrix between the weather variable and butterfly species abundance presented in (Table 5) shows a positive correlation existed between weather variables like the rainfall, evaporation wind speed and minimum relative humidity and a negative correlation between radiation, temperature and sunshine. This result partially agrees with Alarape et al. (2015) study where humidity and rainfall were negatively correlated with the number individuals and species. None of the environmental factors was significantly related to total number of individuals or species richness. This result is consistent with that of Boonvanno et al. (2000). There may be differences between tropical and temperate climate patterns. Weather variation in the temperate countries is relatively greater and may have more severe effects on the abundance and species richness of butterflies. However, the lack of significant correlations between temperature and numbers of butterflies indicated that rainfall did not have an important influence on numbers of butterfly distribution as reported by Alarape et al. (2015). But rainfall positively correlated with the numbers of individuals and species of Nymphalidae, Pieridae and Lycaenidae.

Table 5. Correlation between Different Weather Variables and the Abundance of Butterflies in IITA

Variables	*Numbers of species*
Rain	0.133**
PanEvap	0.122**
W/Speed	0.127**
Solar Rad	-0.009
Tmin	-0.011
Tmax	-0.016
Rhmin	0.027
Rhmax	-0.075*
SunshineHr	-0.005

*** Significant at 0.01%; * significant at 0.05%*

4. Conclusion

Butterfly communities in International Institute of Tropical Agriculture, Ibadan are well supported by abundant floral diversity. As a result of the data collected from this survey, it showed that the number of species of butterflies observed in Forest habitat was consistently greater than both the wetland and Farmland habitat. The butterfly of the family Nymphalidae were the most abundant species and had the highest individual species observed during the study; and the family papilionidae had the least number of species observed respectively from the survey. The result from the study also showed that physical factors had no relationship with butterfly families and species richness. Long term monitoring is needed for analysis of population trends. Furthermore additional work is needed to compare Lepidoptera diversity among general categories of vegetation types within and among different ecosystems, to provide better baseline data. Butterfly plant relationship therefore has to be studied to further understand biotic and abiotic effects on butterfly number and diversity.

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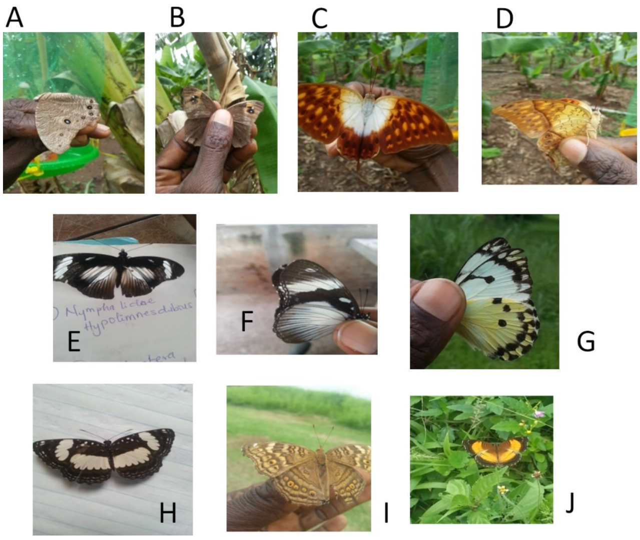
References

1. Adeyanju T.A., Ottosson U. Adeyanju T.E. & Omotoriogun T.C., 2014. Birds of the International Institute of Tropical Agriculture campus, a stronghold of avian diversity in the changing Ibadan area (Nigeria) over the last 50 years. Grimaldi D. and Engel M.S. 2005. Evolution of the insects. Cambridge University Press, pp. 590-606.
2. Akwashiki B.A., Amuga G.A., Nwansat G.S. & Ombugadu R.J., 2007. Assessment of Butterfly Diversity in Eagle Owl Gully of Amurum Forest Reserve, Jos East Local Government Area, Plateau State Nigeria. *The Zoologist*, 5:33-38.
3. Alarape A.A., Omifolaji J.K. & Mwansat G. S., 2015. Butterfly Species Diversity and Abundance inUniversity of Ibadan Botanical Garden, Nigeria. *Open Journal of Ecology*,5:352-360. http://dx.doi.org/10.4236/oje.2015.58029.

4. Aiswarya V.N., Pradarsika M. & Soma A.B., 2014. Studies on the diversity and abundance of butterfly (Lepidoptera: Rhopalocera) fauna in and around Sarojini Naidu college campus, Kolkata,West Bengal, India, *Journal of Entomology and Zoology Studies,* 2 (4):129-133.
5. Boonvanno K., 2001. Physical Effects on Butterfly Diversity at Ton Nga Chang Wildlife Sanctuary, Southern Cyprus. *Science Asia*, 49, 177-188.
6. Chapman, A.D., 2006. Numbers of living species in Australia and the World. Report for the Australian Biological Resources Study, 2nd edition. 84p.
7. Davies A.B. & Asner G.P., 2014. Advances in animal ecology from 3D-LiDAR ecosystem mapping. *Trends in Ecology and Evolution*, (29): 681–691.
8. Fermon H., Waltert M., Vane-Wright R.I. & Muhlenberg M., 2005. Forest use and vertical stratification in fruit-feeding butterflies of Sulawesi, Indonesia: impacts for conservation. *Biodiversity and Conservation*, 14(2): 333-350.
9. Gascon C., Lovejoy T.E., Bierregaard R. O., Malcolm J.R., Stouffer P.C, Vasconceleos, H. L. Laurance W. F. Zim- merman, B. Tocher M.& Borges S., 1999. Matrix Habitat and Species Richness in Tropical Forest Butterflies. *Biological Conservation,* 91: 223-229. http://dx.doi.org/10.1016/S0006- 3207(99)00080-4
10. González-Varo J.P., Biesmeijer J.C. Bommarco R., Potts S.G., Schweiger O. & Smith Vilà, M., 2013. Combined effects of global change pressures on animal-mediated pollination. *Trends in Ecology and Evolution*, 28: 524-530.
11. Imam W., 2015. Diversity of butterflies in four different forest types in Mount Slamet, Central Java, Indonesia. *Biodiversitas*, 16 (2): 197-204.
12. Kitahara M., Yumoto M. & Kobayashi T., 2008. Relationship of butterfly diversity with nectar plant species richness in and around the Aokigahara primary woodland of Mount Fuji. *Open Journal of Ecology,* 5-28.
13. Mallet J., 2007. "Details about the Lepidoptera and Butterfly Taxome Projects". *The Lepidoptera Taxome Project*. University College London. Retrieved 14 November 2018.
14. Molleman F., Kop A., Brakefield P. M., De Vries P. J., & Zwaan. B. J., 2006. Vertical and temporal patterns of biodiversity of fruit-feeding butterflies in a tropical forest in Uganda. *Biodiversity and Conservation*, 15(1):107–121.
15. Munyuli. T.M.B., 2010. *Pollinator biodiversity and economic value of pollination services in Uganda [Ph.D. Dissertation]*, Makerere University, Kampala, Uganda.
16. Nwosu L. C. & Iwu, C. J., 2011. A comparative study of diversity of species of butterflies in protected and unprotected habitats of Okwu Ogbaku forest reserve in Mbaitoli L.G.A., Imo State, Nigeria, *Journal of Environmental Issues and Agriculture in Developing Countries*, 3(1): 129 -135.
17. Ramesh T., Hussain K.J., Selvanayagam M., Satpathy K.K. & Prasad M.V.R., 2010. Patterns of Diversity, Abundance and Habitat Association of Butterflies Communities in Heterogeneous Landscapes of Department of Atomic Energy (DAE) Campus at Kalpakkam, South India. *International Journal of Biodiversity and Conservation*, (2)75-85.
18. Safian T.A. & Warren E. Y., 2015. Common butterflies of IITA. pp. 1-50.
19 Tews J., Brose U., Grimm V. Tielbörger K., Wichmann M. Schwager M. & Jeltsch F. 2004. Animal species diversity driven by habitat heterogeneity/diversity: The importance of keystone structures. *Journal of Biogeography*, 31: 79–92.
20 Tiple A.D. & Arun M. K. 2009. Butterfly Species Diversity, Habitats and Seasonal Distribution in and Nagpur City, Central India. *Journal of Natural History*, 43: 855-884 http://dx.doi.org/10.1080/00222930802610568
21. Viejo. P., Paul L. & Curie N., 2000. Conservation Biology, 1st edition. 300p.
22. Wilson E.O., 2009. "Threats to global diversity". Retrieved 17-5-2019.
23. Yager G. O., Agbidye F.S. & Okoh, A.O., 2016. Diversity and Abundance of Butterfly species (Lepidoptera) Fauna in Federal University of Technology, Makurdi Forestry Nursery, Benue State, Nigeria. *Journal of Research in Forestry, Wildlife* and *Environment,* 8(3):83-89.



Legend. A, *Bicycles safitza* ; bush brown ; **B**, *Charaxes varanes* ; **C**, Pearl emperor ; **D**, *Hypolimnas anthedons* ; **E**, *Variable eggfly* ; **F**, *Belenois Calypso*; **G**, *Neptis Serena* ;**H**, *Junonia chorimene ;* **I**, *Junonia terea;* **J**, *Junonia terea.*

Legend. K, *Nepheronia thalassina ; Byblia ilithyia* ;**L**, *Bicycle dorotheas* ;**M**, *Papilo menestheus* ;**N**, *Byblia ilithyia* ; **O**, *Charaxes boueti* ;**P**, *Papilo menestheus* ;***Q***, *Charaxes boueti* ;**R**, *Bicyclus safitza* ;**S**, *Junonia sophia* ;**T**, *Euphaedra themis* ;**U**, *Pieris brassicea* ;**V**, *Euphaedra themis* ;**W**, *Papilio demodocus* ;**X**, *papilio demodocuss* ;**Y**, *Arangesa bouvieri* ;**Z**, *Aterica galene ;* **Z''**, *Aterica galene*

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