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DIVERSITY AND ABUNDANCE OF BUTTERFLY SPECIES (LEPIDOPTERA) FAUNA IN FEDERAL UNIVERSITY OF AGRICULTURE, MAKURDI FORESTRY NURSERY, BENUE STATE, NIGERIA

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ABSTRACT

Butterflies belong to one of the most important taxa of insects. Understanding their significance in an ecosystem as an environmental health indicator and pollination of flowering plants is crucial to achieving sustainability and conservation of floral diversity. Owing to habitat destruction due to some anthropogenic activities, butterflies are fast disappearing and at present, their survival is under threat. The study assessed the diversity and abundance of butterfly species in the Federal University of Agriculture, Makurdi forestry nursery, Nigeria. Line transects were used to survey three habitats within and around the forestry nursery using handheld sweep nets in March and April, 2016. Data were analyzed using descriptive statistics and One-way analysis of variance. A total of 337 individuals representing 17 butterfly species belonging to 5 families were recorded across the three habitat types. Out of these, members belonging to the family Nymphalidae were the most common with 7 species being recorded accounting for 41.2% of the total species and 26.7% of total number of individuals collected. Species richness, evenness and diversity varied from habitat to habitat and decreased from dry land area to swampy area (D= 2.336 – 1.966), (J= 0.336 – 0.236), (H^1= 1.394 – 0.955). There was no significant different in species composition/richness across habitat types at 0.05%. 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, Forestry Nursery, Diversity, Abundance

INTRODUCTION

Insects comprise more than half of earth diversity of species (May, 1992). Butterflies are in the order Lepidotera, which are insects with scaled wings (Emily, 2010). They are a taxonomically well studied group, which have received a reasonable amount of attention throughout the world (Ghazoul, 2002). Butterflies have been studied systematically since the early 18th century and about 28,000 species are documented worldwide (Aiswarya *et al.*, 2014). In West Africa, about two thousand species of butterflies abound with Nigeria alone habouring greater than one thousand species (about 50%) (Viejo *et al.*, 2000). However, the figure is not constant because of continuous addition and discovery of new butterfly species.

Many butterfly species are strictly seasonal indicators in terms of anthropogenic disturbance and habitat quality (Kocher and Williams, 2000). Butterflies enable sustenance of ecosystem service through their role in pollination and serving as important food chain component. They also serve as indicator of health and quality of their host plant and the ecosystem as a whole. Lepidoptera community assembly and the factors

which influence it have long been a topic of interest to ecologists and conservationists. Human dominated landscape form a substantial and ever increasing amount of the earth's surface. These modified habitats often influence butterfly species and their dynamics (Gascon *et al*., 1999 and Rickets *et al*., 200l).

Arthropods are good indicators of habitat biodiversity because they respond quickly to environmental changes, and are highly diverse taxa. Lepidoptera (butterflies and moths) are the second largest order of arthropods and are most easily identified, making them particularly useful for biodiversity survey (Tiple and Arun, 2009). Butterflies occur in a wide range of situations but are particularly characteristics of humid tropical forests, in which the known species occur. Two important aspect of its diversity are species richness and relative abundance of individuals (Landau *et al*., 1999). However, Hammond and Miller (1998) observe that species richness is a critical variable in conservation planning, habitat management and natural resource management.

A large proportion of the earth's planet's plant species including many trees depends on insects to pollinate their flowers. In turn, humans and other land-dwelling animals depend on plants (Ramesh *et al*., 2010). Indeed, concern for the status of the earth's biodiversity (to which butterflies are part) is on the increase and need to be intensified (Okali, 2010). Alarape et al., (2015) recorded that they are highly sensitive to changes in climatic factors such as rainfall, temperatures, wind, humidity and altitudes. Studies have suggested a range of factors that affect the pattern of distribution of butterflies. These include competition, predation, numerical abundance of species, food web structure, genetic factors, short and long- term aspects of evolutionary rates and size of the insect (Thomas, *et al*., 1992 and Charles, 2001).

Disappearance of insects could lead to extinction of earth's animals because of the disappearance of so much plant life. Today they are by far the planet's most diverse, abundant and successful insects. The roles that insects play in nature require us to understand how insects and other organisms living in a biological community interact with living and non-living environment (Miller, 2006). The objective of the present investigation is to assess the species richness of butterflies, provide species list and determine the composition and diversity pattern of butterfly species in the study area.

MATERIALS AND METHODS

Study area

University of Agriculture, Makurdi Forestry Nursery is located within the University of Agriculture Makurdi campus at the south core part which is situated in the Northern part of Makurdi town within Benue State. It is located within the Guinea Savannah zone between latitudes 8º35E and 8º41E and longitudes 7º45N and 7º52N; it is on the Southern bank of river Benue, close to River Guma in the East and to the West of the (Route A3) Makurdi to Lafia and is about 16.5 kilometers to the North of the Makurdi city (Ikyaagba, 2008). Rainfall distribution is bimodal in the area occurring in June and September. Mean annual rainfall is between 1000mm – 15000mm. Mean annual temperatures is 29^{o}C - 30^{o}C, relative humidity is between 60% and 80% but decreases in the early months of the dry season (Ikyaagba, 2008). The area is characterized by undulating rolling plain with irregular river valleys and ridges with steep slope. The drainage pattern is dendritic. The surrounding of the area is open savannah woodland which is relatively rich with high diversity of species comprising of a wide variety of woody trees, predominately fewer trees, more shrubs, and a collection of herbs, palms, climbers and predominately tall grasses up to 2m tall. Forest formations are found in low-land areas and river banks. Some of the species found in the area include: *Daniellia oliverri, Vitelleria paradoxa, Vitex doniana, Hymenocordia acida, Burkia africana, Khaya senegalensis* and *Parkia biglobosa* (Ikyaagba, 2008).

Method of data collection

Monitoring (Line Transect)

The study area was stratified into three habitats on the bases of vegetation and the land composition. Butterfly species were assessed quantitatively across different habitats and the adjacent cultivated land area with handheld sweep net and trapping method. A 0.23km line transect was established at every site and attempts were made to catch every butterfly seen following Alarape's transect walking techniques (Alarape *et*

al., 2015). In total, 6 transect walks were done. Random sweep netting formed the basis for species list rapid biodiversity assessments. Sampling was carried out at different habitats from 3rd March to 4th April, 2016. Line transect count was used to determine the butterfly abundance and richness. Each transect was slowly traversed at a uniform pace of 30minutes at each habitat from 8 – 10 am during good weather condition period (no heavy rain or strong wind). Butterfly species collected were identified using Butterflies of West Africa (Larsen, 2005) and identification guides of Bernard (1982) and James (2002).

Data analysis

Butterfly species, individual diversity and abundance were calculated by using descriptive statistics. One–way ANOVA was used to determine the difference in family and species richness across habitat. Data was analyzed using SPSS 17. Butterfly species composition in various habitat types were expressed using diversity indices such as species richness, diversity and evenness.

RESULTS

A checklist of butterfly species of 17 species and 337 individuals belonging to 5 families where recorded (Table 1). Out of this number 111 individuals in 12 species were recorded in Dry land part of the nursery, 162 individuals in 11 species were recorded in the swampy land area while 64 individuals in 10 species were recorded in the adjacent cultivated land area (Table 1). The result of the study also revealed that only six (6) out of the 17 species were recorded in all the habitat types while seven (7) out of the species number were recorded in only one habitat. Nymphalidae has the highest percent of species and second in individuals (41.2%, 26.7% respectively). However, Pieridae has the second highest percent of species and highest in individuals (29.4%, 67.9% respectively) while Papilionidae and Hesperiidae had the least percent of species and individuals (Table 2).

The result of the study as presented in (Table 3) revealed that the cultivated land area had the high value for butterfly diversity and evenness (H’ = 1.594), (J’ = 0.492). This was followed by dry land area (H’ = 1.394), (J’ = 0.336) while the swampy are had the lowest values (H’ = 0.955), (J’ = 0.236). However, dry land area had the highest value of species richness (D = 2.336), followed by cultivated land area (D = 2.164), and the least was swampy area (D = 1.966). Jaccard similarity index showed high similarity for butterfly species composition between dry-land area and cultivated land 0.67 and the low value between dry-land area and swampy 0.44. (Table 4). There was no significant different in species composition/richness across habitat at 0.05%.

Table 1: Butterfly Species Captured at FUAM Forestry Nursery and the adjacent cultivated land in March and April 2016.

Family	Species	Habitat			
		DLA	**SWA**	**CLA**	**∑individuals**
Pieridae	*Exials Pyrene (Linnaeus)*	34	127	32	193
	Eurema hecabe (Linnaeus)	1	10	4	15
	Eurema blanda (Boisdwal)	8	0	2	10
	Leptosia nina (Fabricius)	3	0	0	3
	Pieris brassica	2	4	2	8
Nymphalidae	*Tirumala limniace (cramer)*	56	1	14	71
	Danaus genutia (cramer)	1	3	0	4
	Ariadne merione (cramer)	1	3	3	7
	Moduza procris (cramer)	1	0	1	2
	Danaus chrysippus (Linnaeus)	0	1	0	1
	Elynias hypermnestra (linnaeus)	0	0	1	1
	Euploea core (cramer)	0	4	0	4
Lycaenidae	*Prosotas dubiosa indica (evan)*	1	0	0	1
	Spalgis epius (westwood)	0	1	0	1
	Chilades pandava (horsfield)	2	7	3	12
Papilionidae	*Papilio demoleus (linnaeus)*	1	0	0	1
Hesperiidae	*Pelopidas mathias (fabricius)*	0	1	2	3
	Grand total	**111**	**162**	**64**	**337**

Source: *Field survey*, 2016

Key: DLA= Dry land of the Nursery
SWA= Swampy area
CLA= Adjacent Cultivated land

Table 2: Frequency distribution of butterfly species encountered according to family in the forestry nursery, FUAM, Benue State in March and April 2016.

S/no.	Family	Number of Species (%)	Individual (%)
1	Pieridae	5 (29.4)	229 (67.9)
2	Nymphalidae	7 (41.2)	90 (26.7)
3	Lycaenidae	3 (17.6)	14 (4.2)
4	Papilionidae	1 (5.9)	3 (0.9)
5	Hesperiidae	1 (5.9)	1 (0.3)
		17(100)	337(100)

Source: *Field survey*, 2016

Table 3: Species diversity index of butterfly species in FUAM forestry nursery across habitat type.

0	DLA	SWA	CLA
Taxa_S	12	11	10
Individuals	111	162	64
Shannon_H	1.394	0.955	1.594
Evenness_e^H/S	0.336	0.236	0.492
Margalef	2.336	1.966	2.164

Table 4: Similarity Index of Butterfly Species Composition across Habitat Type

Pairing	Index value
Dry-land area vs Swampy area	0.44
Dry-land area vs Cultivated land area	0.67
Swampy area vs Cultivated land area	0.54

Table 5: One Way ANOVA Difference in Species Composition across Habitat Type

	Sum of Square	Df	Mean Square	F	p- VALUE
Between groups:	282.627	2	141.314	0.3484	0.7076
Within groups:	19469.5	48	405.615		
Total:	19752.2	50			
omega^2:	-0.02622				

There is no significant difference at 5%

DISCUSSION

The high species number recorded is typical of West African taxa (Nwosu and Iwu, 2011) who reported rich butterfly fauna in protected area. This result indicated that the habitat had a considerable diversity and abundant number of butterfly species. This is in line with Nwosu and Iwu, (2011). The high species number in both dry land and the swampy part of the forestry nursery was attributed to the presence of flowering and ornamental tress present.

The high number of species recorded in the families of Nymphalidae, Pieridae and Lycaenidae in the study is contrary to the findings of Akwashiki *et al*., (2007) in Eagle owl gully of Amurum forest reserve Jos East L.G.A, Plateau State and Nwosu and Iwu (2011) in Okwu Ogbaku forest reserve in Imo State. This could be attributed to difference in study location and other environmental factors. The lower number of species recorded in the families of Papilionidae and Hesperiidae is similar with other studies of Aiswarya *et al*., (2014) and Alarape *et al*., (2015). The preference of butterflies for particular habitats is associated with the availability of larval host plants and adult nectar plants (Majumder et al. 2013), thus, the dominance of Nymphalidae could be attributed to varied assemblage of fruit bearing plants and some ornamental plants present in the study area. Fermon et al. (2005) indicated that Nymphalidae butterflies have a much higher diversity of phenotypes when larval food plants are more evenly distributed across all habitats. The study area is dominated by plant species like *Magnifera indica, Terminalia captapar, Tectona grandis, Khaya senegalensis, Lucina species, Tridax procumbens, Lantana camara, Elaeis guineensis, Azadirachta indica* and other ornamental flowering plants which promoted the butterfly richness. This is obvious that some of the tree species in the nursery are attractive to the butterflies. This finding is similar to the finding of Alarape *et al*., (2015) who reported some species being attractive to butterfly in botanical garden of University of Ibadan.

The variation in species composition recorded between the habitat types in the study area could be attributed to the distribution of some flora species composition and ornamental plants. According to Imam (2015) and Alarape *et al*., (2015) food web structure and ornamental plants forms one of the factors responsible for butterfly species diversity and richness. Even though the cultivated land area had high value of butterfly species diversity and evenness (H' = 1.594), (J' = 0.492) the forestry nursery habitat were more in species richness (D = 2.336). This could be attributed to high representation of seedlings and fruits bearing plants in the area. However**,** dry-land area and cultivated habitat is more similar in species composition (0.67). This could be attributed to the similarity in habitat even though the dry land area forms part of the forestry

nursery. Thus, there was no significant different in species composition/richness across habitat type at 0.05%. This means that species composition was well represented across habitats.

Conclusion and Recommendation

The findings of the present study underline the diversity and composition of butterfly species in University of Agriculture forestry nursery. The study provides baseline information on the butterfly species in the study area. This will help in a control measures 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. This is the first effort in exploring the butterfly wealth of University of Agriculture, Makurdi. The present list of butterfly species is not exhaustive and so further exploration of butterfly species be continued to update this checklist. It is recommend that Management strategies towards conservation of both flora and butterflies species should be intensified in the campus at large.

REFERENCES

Aiswarya, V. N. Pradarsika, M. and 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.

Akwashiki, B. A., Amuga, G. A., Nwansat, G. S. and 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.

Alarape, A. A., Omifolaji, J. K. and Mwansat G. S. 2015. Butterfly Species Diversity and Abundance in University of Ibadan Botanical Garden, Nigeria. *Open Journal of Ecology*, 5, 354 – 357. http://dx.doi.org/10.4236.oje.2015.58029.

Bernard. D. F. R. (1982). Butterflies of Afro-tropical Region. Land-wone edition.

Charles J. K. (2001). Ecology. 5th Edition.

Emily, K. (2010). The Biology of Butterflies Compiled by Emily Kearny, Cornell University. Pp1-5.

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. Biodiv Conserv 14: 333-350.

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. and Borges, S. 1999. Matrix Habitat and Species Richness in Tropical Forest Butterflies. Bio- logical Conservation, 91, 223-229. http://dx.doi.org/10.1016/S0006-3207(99)00080-4

Ghazoul, J. 2002. Impact of Logging on the Richness and Diversity of Butterflies in a Tropical Dry Forest in Thailand. Biodiversity and Conservation, 11, 521-541. http://dx.doi.org/10.1023/A:1014812701423

Hammond, P. C. and Miller, J. C. 1998. Comparism of the Biodiversity of Lepidoptera within Three Forested Ecosys- tems. Journal of Conservation Biology and Biodiversity, 91, 323-328.

Ikyaagba, E. T. 2008. Plant biodiversity and Ethnobotanical potential of University of Agriculture Makurdi Wildlife Park and Ikwe Game Reserve, Benue State, Nigeria. unpublish M.Sc thesis in the Department of Forest Resources Management University of Ibadan, Ibadan, Nigeria 56.

Imam, W. 2015. Diversity of butterflies in four different forest types in Mount Slamet,

Central Java, Indonesia. BIODIVERSITAS ISSN: 1412-033X 16 (2): 197-204.

James, L. C. 2002. Photographic Atlas of Entomology and Guide to Insect Identification. 2nd edition. 238pp.

Kocher, S. D. and Williams, E. H. 2000. The Diversity and Abundance of North America Butterflies Vary with Habitat Disturbance and Geography. *Journal of Biogeography*, 27, 785-794. http://dx.doi.org/10.1046/j.1365-2699.2000.00454.x

Landau, D., Prowell, D. and Carlton, C. E. 1999. Intensive versus Long-Term Sampling to Access Lepidopteran Di- versity in a Mixed Mesophytic Forest. Journal of Conservation Biology and Biodiversity, 92, 435-441.

Larsen, T. B. (2005). Butterflies of West Africa 2 vols., 596pp., 125 plates. Apollo Books

Majumder J, Lodh R, Agarwala B. K. 2013. Butterfly species richness and diversity in the Trishna wildlife sanctuary in South Asia. J Insect Sci 13: 79. DOI: 10.1673/031.013.7901.

May, P. G. 1992. Flower Selection and the Dynamics of Lipid Reserves in two Nectarivorous Butterflies. Ecology, 73, 2181-2191. http://dx.doi.org/10.2307/1941466

Miller, G.T. (2006) Environmental Science, Working with Earth. 10th Edition, Brooks Cole Thompson, Nelson. Pp 5-25

Nwosu, L. C. and 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.

Okali, D. 2010. Many species one planet; one future. Proceeding of the 3rd Annual Conference of the Institution of Ecology and Environmental studies Vol.3 Held at Oduduwa Hall, Obafemi Awolowo University Ile- Ife, Nigeria 15-17th June, 2010 pp 1-11.

Ramesh, T., Hussain, K.J., Selvanayagam, M., Satpathy, K.K. and Prasad, M.V.R. (2010) Patterns of Diversity, Abun- dance 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.

Rickets, T. H., Daily, G. C. and Fay, J. P. 200l. Countryside Biogeography of Moths in a Fragmented Landscape: Bio-diversity in Native and Agricultural Habitats. Conservation Biology, 15, 378-388

Thomas, C. D., James, A. and Warren. M. S. 1992. Distribution of occupied and vacant butterfly habitats in fragmented land-scapes. Ecology, 62, 563-567.

Tiple, A. D. and 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

Viejo. P.; Paul L. and Curie. N. (2000). Conservation Biology 1st edition 300pp.