Journal of Research in Forestry, Wildlife & Environment Vol. 16(4) December, 2024
E-mail: jrfwe2019@gmail.com; jfewr@yahoo.com
http://www.ajol.info/index.php/jrfwe
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ISBN: 2141 – 1778
Mbakuuv et al., 2024
364-474

BUTTERFLY SPECIES ABUNDANCE AND HABITAT PREFERENCE IN FARIN RUWA WATERFALL IN WAMBA LOCAL GOVERNMENT AREA OF NASARAWA STATE, NIGERIA.

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ABSTRACT

Butterflies are considered as good ecological bio-indicators of the environment and play significant roles as pollinators of Agricultural crops, aesthetics and range forage productivity. Their occurrence and diversity in populations contribute to ecosystems and can indicate the state of environmental health. Though, there is a high increase in human disturbances in most protected area. However, information on butterfly species abundance and richness on different habitats is limited in the study area. The study assessed the diversity and abundance of butterfly species in relation to its environmental factors. Sampling was done quantitatively using three complementary methods, line transect (walk-and-counts), hand sweep nets, and fruit bait traps in April to August 2023. Data was analysed using descriptive statistics, diversity indices and Pearson's correlation. A total of 34 butterfly species belonging to 4 families in the order Lepidoptera were recorded across the three different habitats. Members of Nymphalidae family occurred most and accounted for 58.81% species in riparian, 56.25% species in waterfall and 55.97% species in farmland with Acrsea serena been the most dominant across the habitats. Farmland habitat had the highest species composition (n = 1196). 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 farin ruwa waterfall is very important for conservation purposes.

Keywords: Butterfly species, abundance, transect, habitat.

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INTRODUCTION

Butterflies are a set of insect fauna that belong to a subdivision (phylum) of the Animal Kingdom Arthropoda in the order Lepidoptera (Alarape *et* live within the world today adding to one-quarter of all named species on earth (Melaku and Sofia, 2021). They are holometabolous insects (Yager *et al.*, 2016). Butterflies engage in an important position as pollinators of Agricultural crops, aesthetics (Ghazanfar *et al*., 2016). Butterflies also play a vital role in the food chain components of birds, reptiles, spiders and predatory insects specifically as larvae (Elanchezhyan *et al.*, 2017). Also, provision of raw materials such as silks in the textiles industry, indicators of good health and *al*., 2022; Sadiq *et al*., 2022). Over 245,000 species of Lepidoptera (butterflies and moths)

quality of plants, climatic change, and healthy environment (Efenakpo *et al.*, 2021).

Butterflies are very well recognized for their beauty as their wings are of various colour patterns. They are benign and aesthetically pleasing that they are greatly appreciated in ecotourism. They are the sensitive insects which react quickly to any kind of disturbances like changes in microclimate, temperature, solar radiation and the availability of host plants for oviposition and larval development.

Butterfly sectorial proboscis carries out the basic role of feeding and in performing this task, they sometimes add to pollination (Yager *et al*., 2016; Stewar *et al*., 2021). While there is differential utilization of flowering plants among butterfly species, they tend to be opportunistic generalists and usually, the plant selection of butterflies are determined by flower color, nectar concentration, nectar quantity and quality, flower structure, flower shape, and size (Tiedge and Lohaus, 2017). Despite butterfly ecological roles played, anthropogenic activities and human disturbances pose great threat to their survival. Declining in species richness, density and the modification of butterly interaction result to some the effect of habitat loss and deforestation that cause biodiversity setback. Movement and ecology of insects, it is difficult that the magnitude and health of the habitat play important roles in regulating their richness and diversity (Ramesh *et al.*, 2010). The study therefore surveys the butterfly species abundance and habitat preference in Farin Ruwa Waterfall Wamba Local Government Area of Nasarawa, State, Nigeria.

MATERIALS AND METHODS

Study Area

Farin Ruwa Development Area was carved out from Wamba Local Government Area. It has a landmass of 661.11Km^2 and is located between Latitudes 09^{0}03'N and 09^{0}14'N and Longitudes 08^{0}50^{1}E and 08^{0}45^{1}E. A total of eight flowing streams of different sizes were crossed while on transit to Farin Ruwa Waterfall from Sisimbaki Community in Wamba Local Government Area.

The water has its source in Bokkos, Plateau State but is seen gushing out from a point in Masenge Community. The course of the river is only visible from a sharp turning point where it splashes due to the alignment of the rock basement. Water is just seen falling from a height of 150 meters and width of 50 meters into a rocky basin. A large and circular rock at the center position of fall obstructs the falling water; resulting in the formation of a thick ring of vapour-like flow, with a thin flow through the top of the rock.

Farin Ruwa waterfall is well shaded by *Anogeissus schimperi* multi storey vegetation. The surrounding vegetation to the closest stream to Farin Ruwa Waterfall is thicker, being a riparian forest. This stream is visibly colourless unlike the water collection in the basin of the fall that is brownish. This dark picnic site opens up at the "fall basin" which is devoid of vegetation.

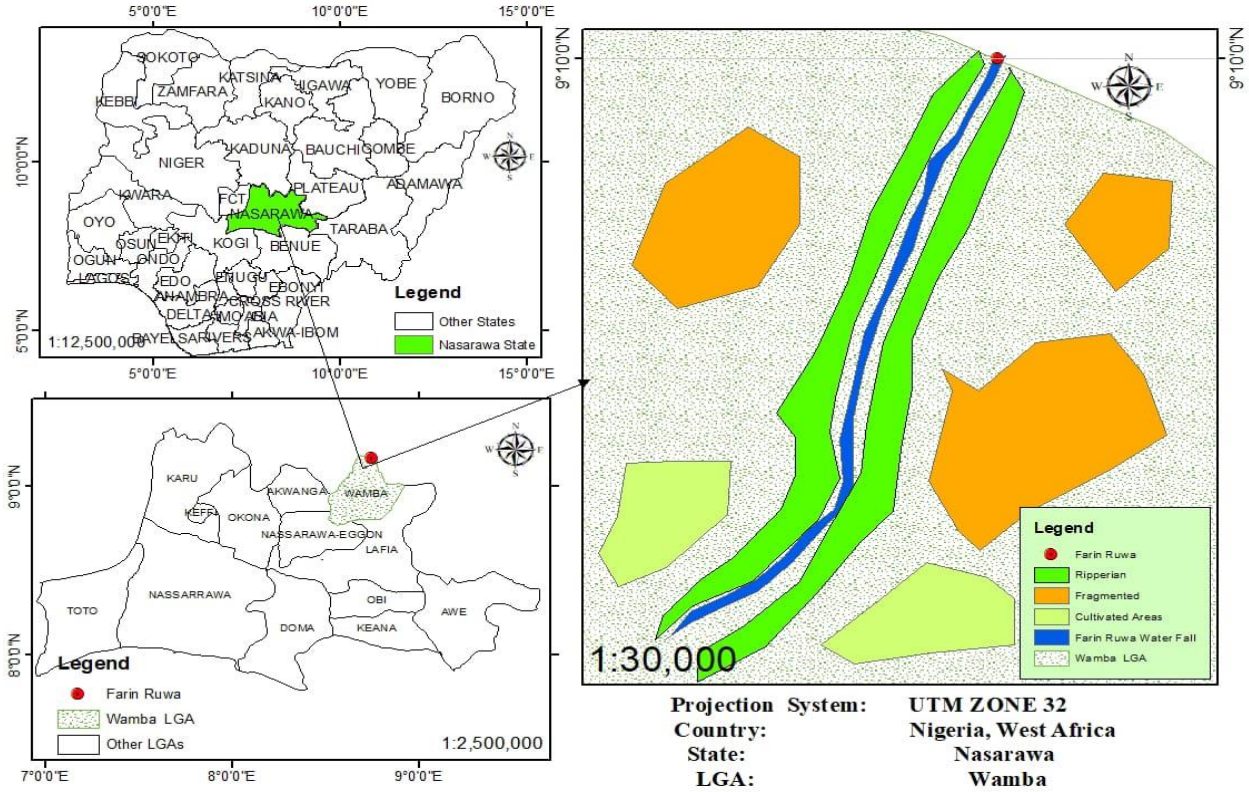

Figure 1. Map of Nigeria to Nasarawa Showing the Study Area

Sampling Procedure and Data Collection

Butterflies sampling was conducted on three different habitats of Farin Ruwa Waterfall namely; riparian forest, waterfall area and farmland areas. Quantitative sampling was done using three separate complementary methods; transect walk-and-counts, hand sweep nets and fruit bait traps, globally suitable and largely used by Munyuli (2010) in the tropics. Sampled were collected twice a month for 3 consecutive days from March, 2024 to August, 2024. Butterflies were sampled under good weather conditions during sunny and calm days from 07 to 09hrs morning and 15:00 to 18:00 hrs. Two line transect of 1km each per habitat was laid. Each habitat was observed for six consecutive days using the three methods mentioned above. Species were recorded around a 5meters radius from the observer, covering both sides, above and front. Weather data was collected from Nigeria Air Force Base, Makurdi within the months covering the study locations. Details of the three sampling methods used are discussed below.

Transect Walk-And-Counts.

Butterfly sections was counted using line transect method also called "visual census method" (Munyuli, 2010). During each sampling visit, butterflies was counted while walking at a steady pace of 10m/min along transect lines, habitually stopping, and detecting butterfly species within transect range. With the use of a field guide, Field Guide for Butterfly Identification Madeira Islands (Sevilleja *et al*., 2021) 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 were recorded. Despite the fact that sampling were carried out on both sides of the transect, carefulness was observed to prevent double counting of individual of a particular species by walking in one direction and not going back to resample a species seen behind. Also, species captured were freed far away from sampling area to avoid counting individual species more than once.

Hand-Netting Method

Hand-netting was carried out immediately after visual counting will be over. Butterfly-Sweep-net was use to catch butterflies. Hand-netting will be conducted for 10m/3min to make a total of 60 min per transect and it includes 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 the butterflies that were captured was release after field identification and those that could not be identified were snapped and taken to a butterfly specialist for identification.

Fruit-Bait Traps Method

Butterflies were also captured in traps. Traps were made with local materials, based on the Van-Someron-Rydon trap design (Kitahara *et al*., 2008). The traps were cylinders of white netting, closed at the top and open at the bottom with plastic tray tied to it with four twines. Traps was placed at about 50meters interval along transect lines. Each trap was suspended above the ground (Plate 2). Samples were counted and removed after 24 hours so as to avoid the trapped butterflies from been fed upon by ants. In all, six baited traps were set in each sampling site.

Plate 1: Hand Sweep Net

Plate 2: Fruit Bait Trap

Statistical Analysis

Results obtained were analyzed using radial bar chart, diversity indices and Pearson's correlation.

RESULTS

Butterfly species in the study area

The radial bar chart displays the total counts of different butterfly species observed across sampled regions in the study area which are presented in Figure 1 and the most ranked butterfly species across the three habitats is presented in Figure 2. The total number of butterfly species in the order Lepidoptera were observed and recorded on three different habitats (Table 1).

The correlation between the weather variables and the families of butterfly species, papilionidae, lycaenidae, and hesperiidae (figure 3). Also, the correlation between the weather variables and the families of butterfly species pieridae and nymphalidae are presented in figure 4 and figure 5 respectively.

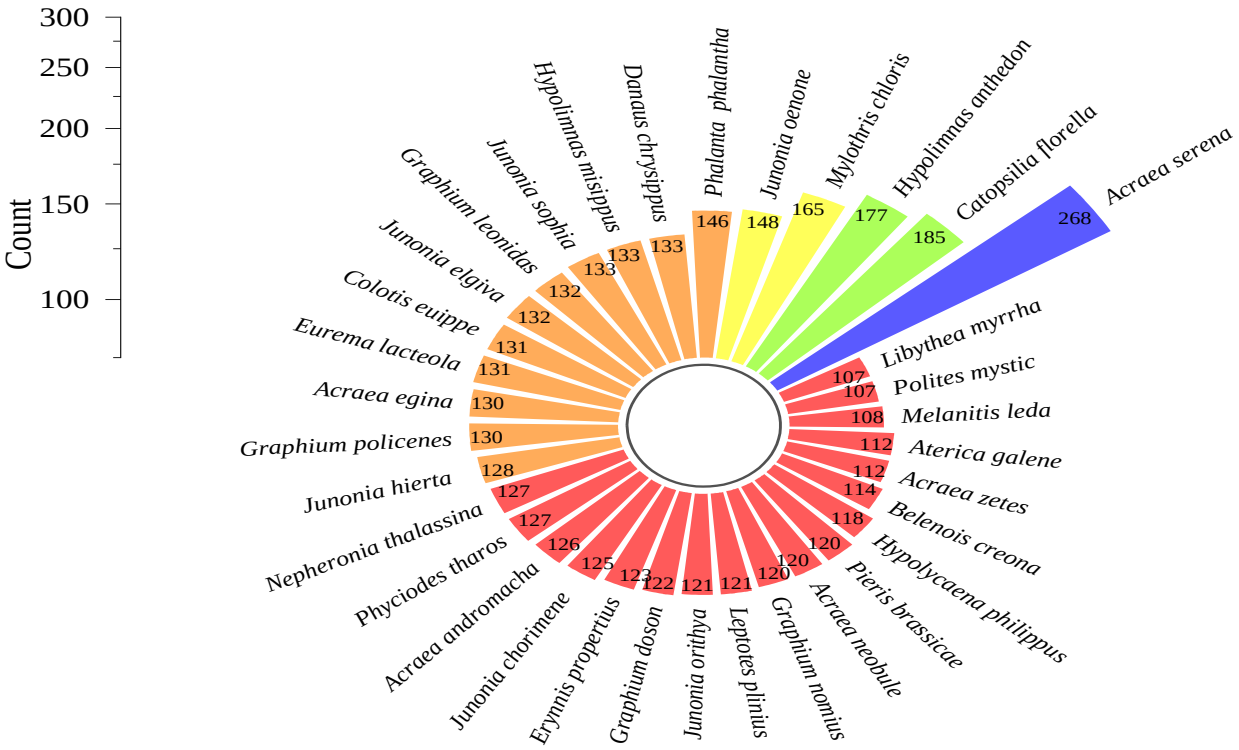

Figure 1: Radial Plot of abundance of butterfly species in the entire study area

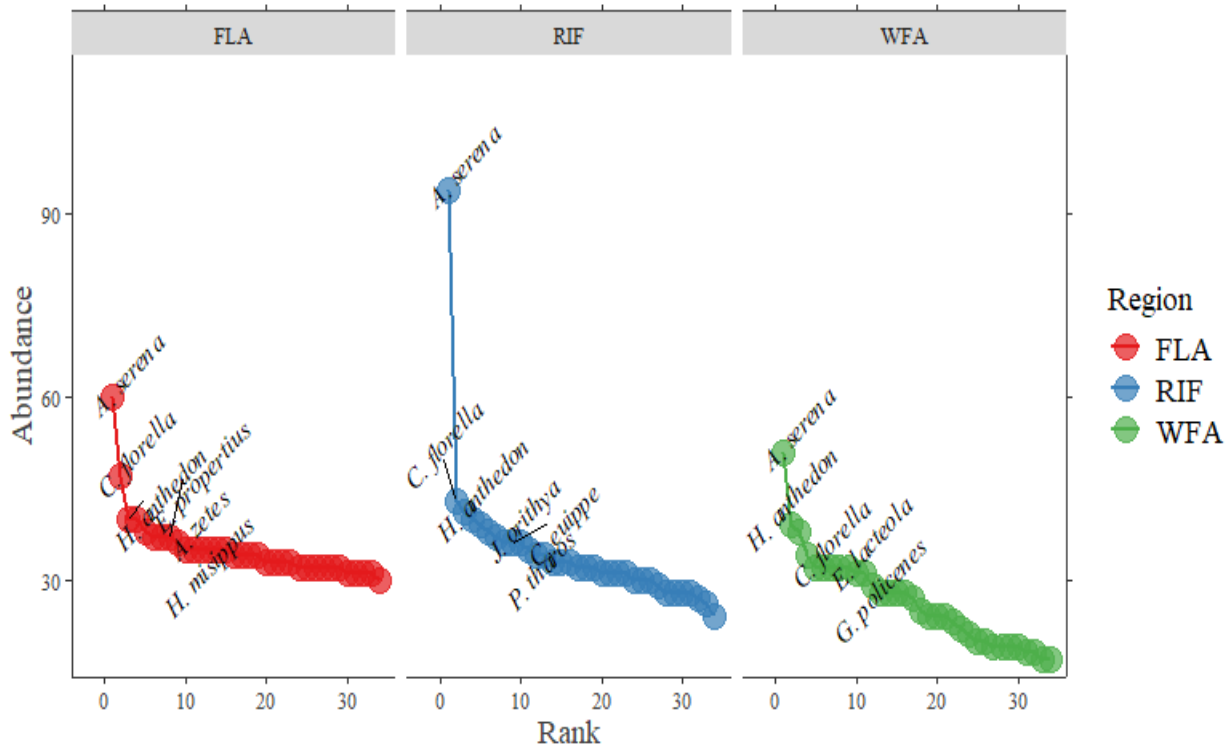

Figure 2: Rank-Abundance Plot of Butterfly species from the various regions (Labels on the graph show top species

Table 1: Butterfly Species Abundance and Diversity for each Area Sampled

	Habitat	Abundance	Density	Species Richness	Species Diversity	Simpson	Species Evenness
Waterfall Area	WFA	901	150.1667	4.850441	3.489262	0.968284	0.274585
Riparian Forest	RIF	1170	195	4.671072	3.486818	0.967444	0.274346
Farmland Area	FLA	1196	199.3333	4.656585	3.51584	0.969887	0.275039

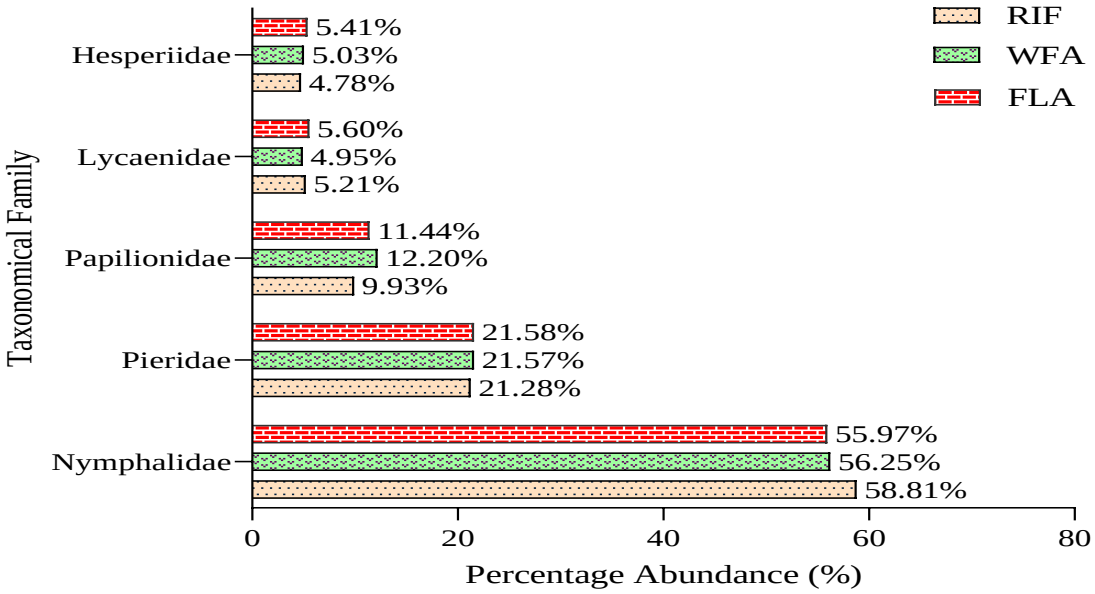

Figure 3: The abundance of species populations within the taxonomical families encountered.

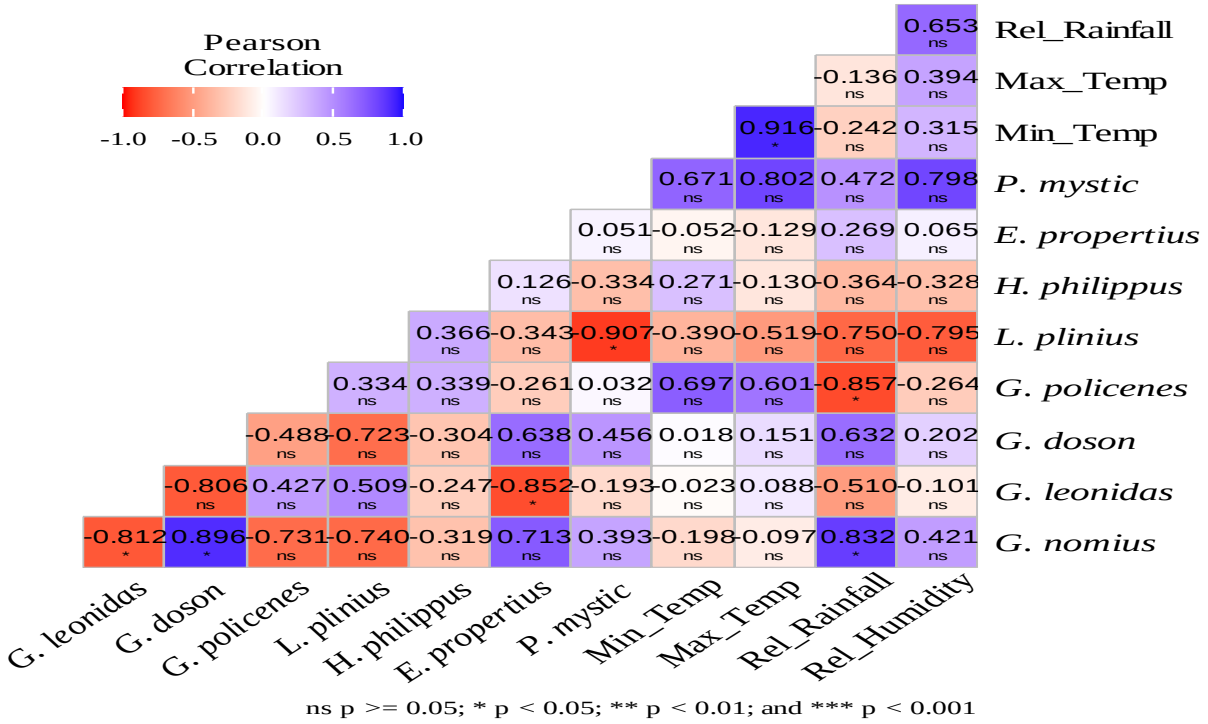

Figure 4: Correlation Plot for Papilionidae, Lycaenidae, and Hesperiidae

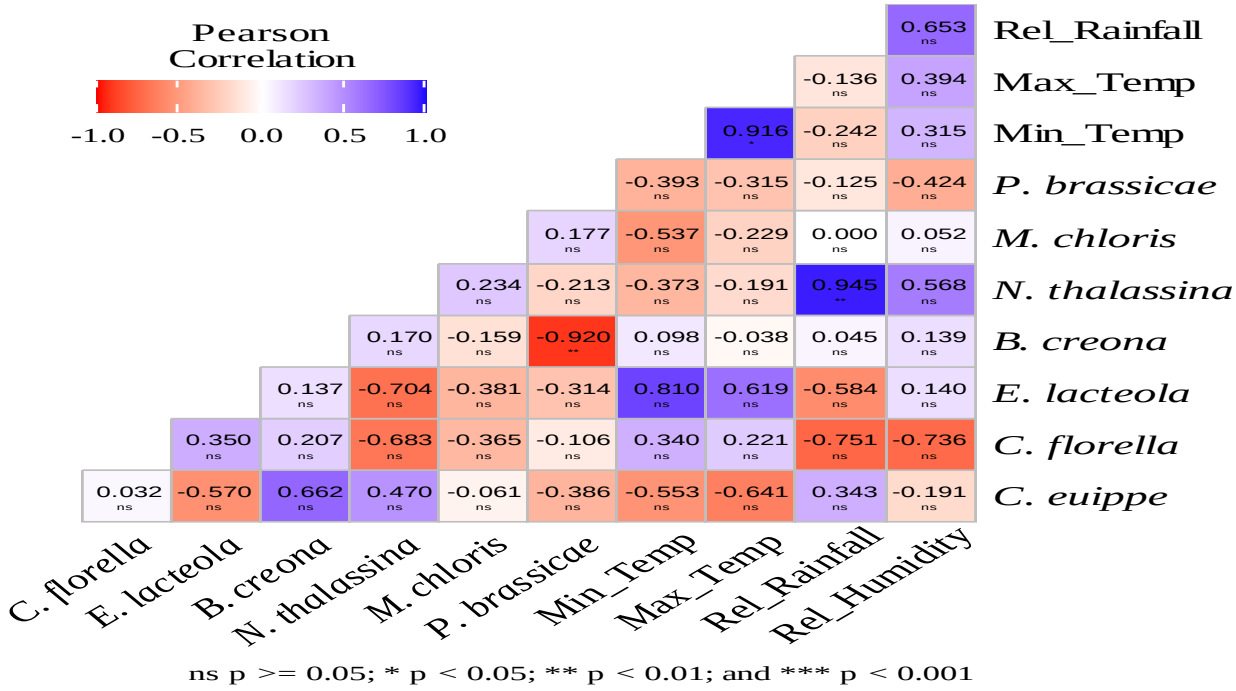

Figure 5: Correlation Plot Pieridae

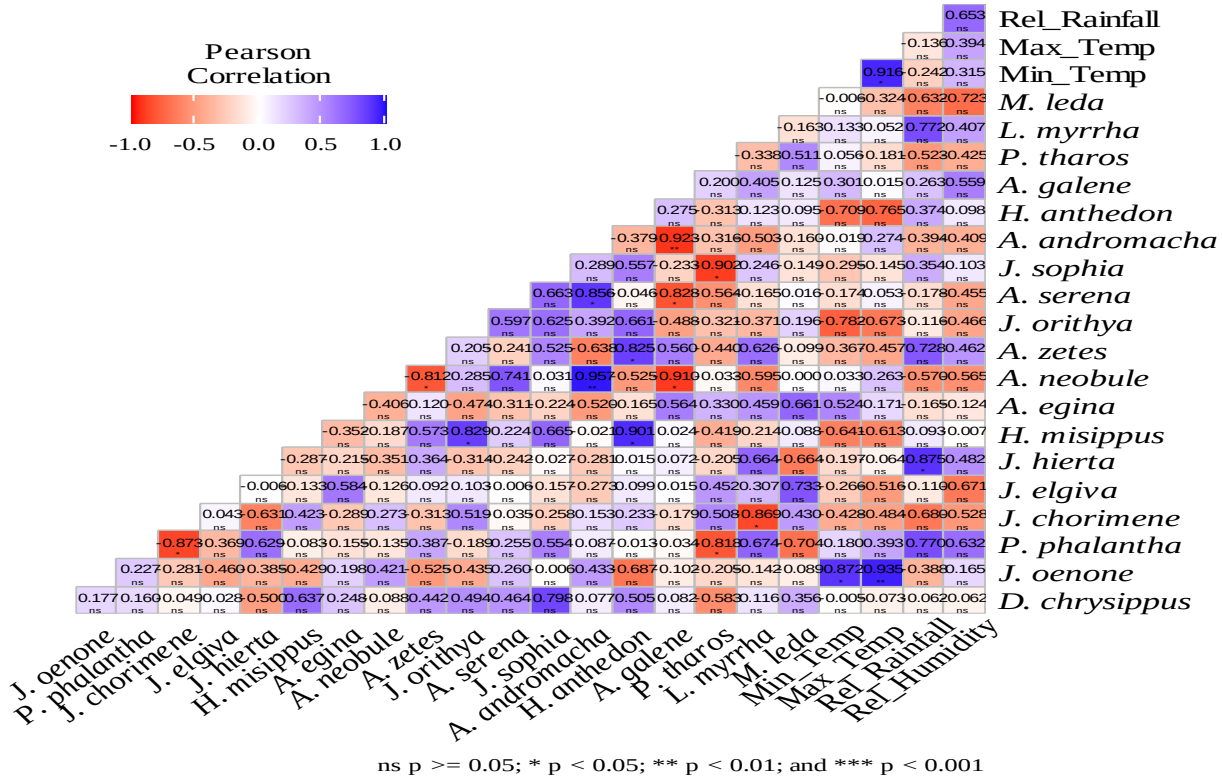

Figure 6: Correlation Plot Nymphalidae

DISCUSSION

The 34 species belonging to 5 families recorded in the study area were lower compared with the findings made by Ojianwuna (2015) survey in Okomu National Park, Edo State, Nigeria, who recorded 76 species belonging to 5 families. The experience rate per habitat shows that the different environment had a considerable diversity and abundance of butterfly species owning to different vegetation types. *Acraea serena* was observed to have the highest relative abundance in the entire study area, followed by *C. florella, H. melicerta, E. lyce, H. misippus*, *P. sevorsa* , *D. chrysippus, P. demodocus*, *T. elis*, *G. polydamas*, and *P. demoleus*. This observation agrees with the findings of Kemabonta *et al*. (2015), who ranked *Acraea serena* as highest.

The result of species distribution count was highest on farmland areas followed by Riparian forest and was very low in waterfall area. The correlation matrix between the weather variable and butterfly species abundance presented in (figure 4) shows a positive correlation existed between weather variables like maximum temperature, relative rainfall and minimum temperature and a negative correlation between relative humidity. This result somehow agrees with Alarape *et al.* (2015) study where humidity and rainfall were negatively correlated with the number of individual species. No environmental factors were notably associated to the total number of species richness of individuals. This result is in line with that of Boonvanno *et al*. (2000). There may be variances between tropical and temperate climate patterns.

CONCLUSION AND RECOMMENDATION

Butterfly communities in Farin ruwa water fall in Wamba Local Government Area of Nasarawa State are well supported by abundant flora diversity. The result of the data collected from this survey showed that the number butterfly species observed in farmland habitat was hugely greater than both the waterfall and riparian 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 Hesperiidae had the least number of species observed respectively from the survey. There would be a need for a long-term insect monitoring programme for butterflies' species to determine the population trend. It is most important to understand the relation between the habitats and the butterflies to protect them. Furthermore,

additional work needed to be carried out to compare Lepidoptera diversity among vegetation types within different ecosystems and provide a baseline data.

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