FOOD PREFERENCES AND FORAGING ECOLOGY OF THE BLACK AND WHITE MANNIKIN BIRD (Spermestes bicolor) FOUND IN ILARO, OGUN STATE, NIGERIA.

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ABSTRACT
This study was conducted in Ilaro, Ogun State, Nigeria, in 2023, aiming to understand the food preferences and feeding behaviours of the Spermestes bicolor, commonly known as the Black and White Mannikin, to support sustainable tourism initiatives. This investigation spanned 12 months and focused on 20 pairs of Black and White Mannikins, ranging in size from one to ten, observed across three distinct areas: Residential zones, Farmland, and Fallowland. Data collection utilised the Direct Observation method, with researchers employing Bushnell 750 binoculars from dawn to dusk to minimize bird disturbance during feeding activities. Throughout the study period, detailed records were maintained regarding foraging locations, feeding techniques, feeding duration, bird population density, types of food consumed, and interactions with other avian species. Analysis of the gathered data revealed that the Black and White Mannikin's diet predominantly comprised plant-based resources, accounting for 70% of their intake. In comparison, insects constituted 27%, and the remaining 3% comprised leaves and flowers. Among plant-based foods, Panicum Maximum seeds were the most commonly consumed at 14.5%, followed by Lawsoniainermis fruits at 10.7%, and Ficus thonningii seeds at 8.6%. Regarding insects, Macrotermes bellicosus exhibited the highest frequency of observation at 16.2%, trailed by Parasysciasudanensis at 13%. Examination of habitat utilization patterns indicated that residential areas constituted 55% of the Black and White Mannikin's habitat, while farmland and fallow areas collectively represented 25%. These findings offer insights into the dietary preferences and habitat usage tendencies of the Black and White Mannikin within the study area, thereby providing valuable information for the development of strategies aimed at sustainable tourism management.

Keywords: Diet, foraging ecology, habitat, utilization, sustainable tourism

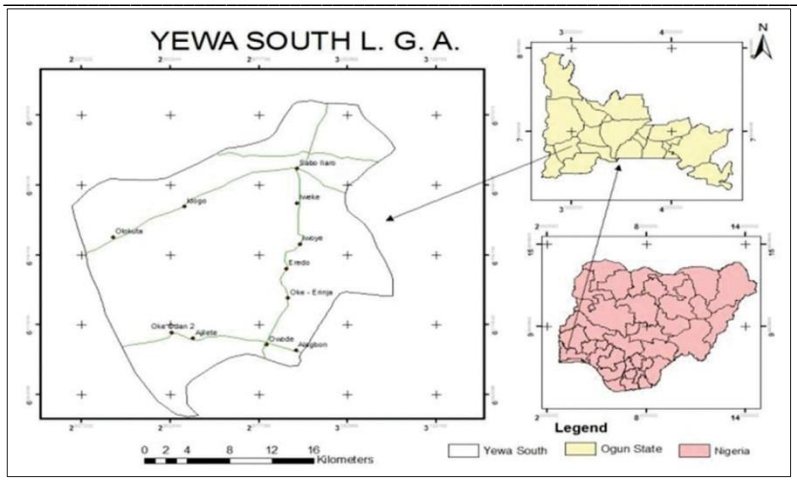
1.0 INTRODUCTION

The Black and White Mannikin (*Spermestes bicolor*), also known as the Bronze Munia or Bronze Finch, is a small songbird indigenous to sub-Saharan Africa. This species thrives in diverse open environments throughout the region, including grasslands, savannas, and wooded areas such as forest edges, gallery forests, and acacia woodlands (Aerts, Lerouge & November, 2019). They are frequently observed near water bodies like rivers, streams, or marshes. Black and White Mannikins demonstrate adaptability to human-modified landscapes, commonly found in locations such as gardens, parks, farmlands, and even urban areas with appropriate vegetation (Chen& Hsieh, 2019). While the overall conservation status of the Black and White Mannikin is categorised as least concern by the International Union for Conservation of Nature (IUCN), specific populations and regions face distinct threats and conservation challenges. Among the primary threats are deforestation, conversion of land for agriculture, and urban expansion, which result in habitat fragmentation and degradation as human populations grow (Birdlife International, 2016). Moreover, Black and White Mannikins are vulnerable to capture for the pet trade, particularly in areas where they are prized as cage birds (Birdlife International, 2016). Unregulated trapping can lead to declines in local populations. Competition and predation from non-native birds and mammals, especially in areas where they have been introduced, pose significant risks to bird populations (Clement, Harris, & Davis, 1993). Changes in climate patterns, such as alterations in rainfall and temperature, can affect the availability of suitable habitat and food resources for the Black and White Mannikin. Furthermore, agricultural pesticides and pollutants from urban runoff have the potential to contaminate water sources and food supplies, potentially jeopardizing the health and reproductive success of Black and White Mannikins (Gill, Donsker & Rasmussen, 2021). Understanding the dietary preferences and feeding ecology of birds is crucial for conservation endeavors and ecosystem management, as it offers insights into their ecological roles, habitat needs, and susceptibilities to environmental changes, thereby facilitating the promotion of sustainable tourism.

2.0 MATERIALS AND METHOD

Study area

Ilaro is located within the Yewa South Local Government Area of Ogun State, Nigeria, positioned at coordinates 6.8894° N, 3.0471° E. It serves as the home to notable institutions like the Federal Polytechnic. Ilaro, The rainy season typically spans from March to November in the region, with December through February marking its conclusion, receiving an average annual rainfall ranging between 1700 to 2000 mm (Megistu & Salami, 2007). The mean yearly temperature in the area averages 26°C. The native vegetation of the region comprises a tropical rainforest with emergent growth, numerous canopies, and lianas (Isichei, 1995). However, except for designated farming areas, the natural vegetation has largely been reduced to grassland and secondary regrowth forest thickets (Manu, 2005).



Firgure1, Map of the study area

Data Collection

For the purpose of this investigation, the study area was segmented into three sections: The Residential block, The Forest/Fallowland block, and The Farmland block. Over a continuous 12-month period from January to December 2023, data concerning the diet and feeding behavior of 20 pairs of Northern Grey Headed Sparrows, each consisting of one to three individuals, were compiled. The Direct Observation technique described by (Okosodo, Orimaye & Odewumi, 2016) was employed for this study. Field observations were conducted from dawn until dusk utilizing binoculars (specifically Bushnell 750) to observe the birds' feeding activities with minimal disruption. Each pair of sparrows was observed for a duration ranging from a few hours to up to five hours during each visit. While it was typically feasible to keep several birds within sight simultaneously, observing the entire flock concurrently was seldom achievable. During each observation session, data regarding the foraging location, feeding method, duration of feeding activity, number of birds present, types of diets consumed, and any interactions with other bird species were recorded. Additionally, seasonal variations in the birds' dietary patterns were examined. Due to the size of the trees and the height of the nests above the ground, further investigation into the birds' pellets was not feasible.

Data Analysis

The data gathered from the observations were analyzed using descriptive statistics. The diversity index of tree species in the study area was analyzed using the computer software PAST Model version 3.

Results

Although the Black and White Mannikin primarily consumes grains, it also incorporates fruits, leaves, flowers, and insects into its diet. The findings reveal that 70% of the Black and White Mannikin's diet is sourced from plant resources, while 27% comes from insects, and 3% from leaves and flowers (Figure 2). Among the plant-based foods, *Panicum Maximum* seeds are the most heavily consumed at 14.5%, followed by *Lawsonia inermis* fruits at 10.7%, and *Ficus Thonningii* seeds at 8.6% (Table 1). Regarding insects, *Macrotermes bellicosus* exhibits the highest frequency of observations at 16.2%, followed by *Parasyscia sudanensis* at 13% (Table 2). The assessment of habitat utilization indicates that the residential block constitutes 55%, while farmland and fallow areas collectively make up 25% (Figure 3). The family composition of the plant species utilized by the Black and White Mannikin shows that Poaceae is the most predominant with 14 species, followed by Apocynaceae with 3 species (Figure 4). Similarly, in terms of insects, the family composition reveals that Formicidae is represented by 3 species (Figure 5).

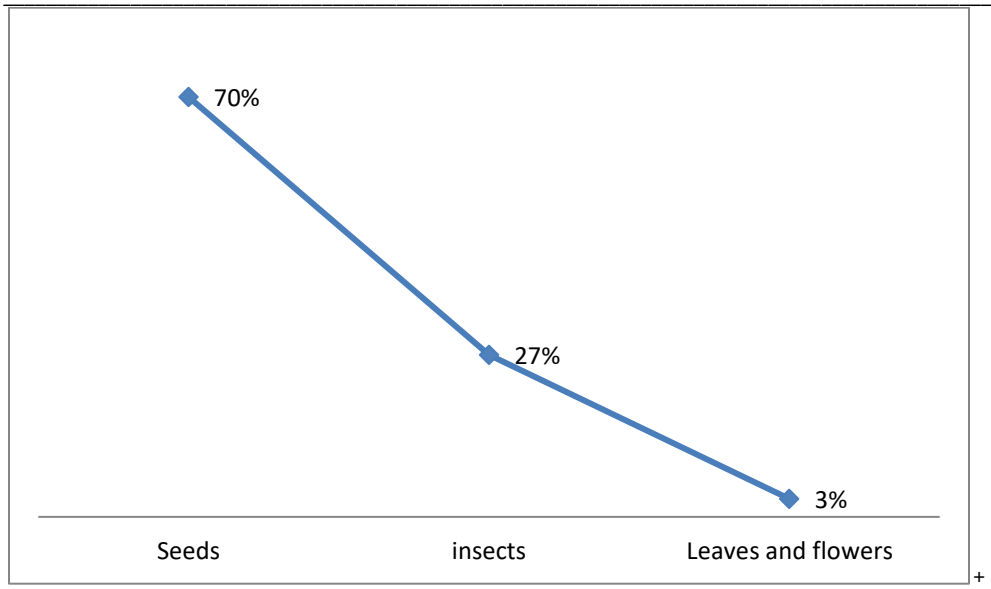


Figure 2, Depicts the rate of diet consumption by the bird species within the study area.

Table 1, Checklist of plantspeciesutilized in the study area

Name if plant species	Family	Parts used	Observations%
Amaranthus retroflexus	Amaranthaceae	Seeds	1.1
Andropogon gayanus	Poaceae	Seeds	0.06
Andropogon tectorum	Poaceae	Seeds	0.07
Aspiliaafricana	Asteraceae	Seeds	3.1
Bambusa vulgaris	Poaceae	Seeds	2.2
Boerhaviadiffusa	Nyctaginaceae	Seeds	4.3
Carica papaya	Caricaceae	Fruit and seeds	6.8
Chromolaena odorata	Asteraceae	flowers and seeds	2.2
Cymbopogon citratus	Poaceae	Seeds	5.1
Cynodonplectostachyus	Poaceae	Seeds	2.8
Cyperus rotundus	Poaceae	Seeds	1.4
Diallumguineense	Fabaceae	Fruits	1.1
Duranta repens	Verbenaceae	Fruits	6.7
Ficus Thonningii	Moraceae	Seeds	8.6
Hyparrheniarufa	Poaceae	Seeds	2.9
Hyptisspicigera	Lamiaceae	Seeds	1.1
Lawsoniainermis	Lythraceae	Fruits	10.7
Loudetiaorundinacea	Poaceae	Seeds	0.07
Moringa oleifera	Moringaceae	Flowers and leaves	1.02
Nauclea latifolia	Rubiaceae	Seeds	4.4
Olea europaea	Oleaceae	Fruits	3.3
Ocimumgratissimum	Lamiaceae	Seeds	1.4

Oryza sativa	Poaceae	Seeds	9.3
Panicum maximum	Poaceae	Seeds	14.5
Pennisetum polystachion	Poaceae	Seeds	0.04
Psidium guajava	Myrtaceae	Seeds	0.05
Rauvolfia vomitoria	Apocynaceae	Fruits	0.03
Senna alata	Fabaceae	Seeds	0.06
Setaria barbata	Poaceae	Seeds	0.02
Solanlum nigrum	Solanaceae	Seeds	0.06
Sporobolus pyramidalis	Poaceae	Seeds	0.08
Trama orientalis	Cannabaceae	seeds	0.03
Tridax procumbens	Asteraceae	Flowers	2.1
Zea mays	Poaceae	Seeds	3.4

Table 1, Checklist of insectspeciesconsumed in the study area

Name of insect species	Family	Observation%
Parasysciasudanensis	Formicidae	13.7
Zasphinctusrufiventris	Formicidae	2.1
Simoponeconradti	Formicidae	7.2
Parasysciacribrinodis	Formicidae	3.7
Dorylussavage	Formicidae	9.4
Dorylus nigricans	Formicidae	3.2
Dorylusbraunsi	Formicidae	8.4
Dorylusdepili	Formicidae	1.1
Aenictusvagans	Formicidae	2.1
Dorylusaffinis	Formicidae	4.2
TechnomyrmexAndrei	Formicidae	2.2
Lebistinasubcruciata	Chrysomelidae	7.8
Diphasiastrum alpinum	Chrysomelidae	2.9
Macrotermesbellicosus	Termitidae	16.2
M. subhyalinus	Termitidae	4.7
Odontotermessudanensis	Termitidae	11.1

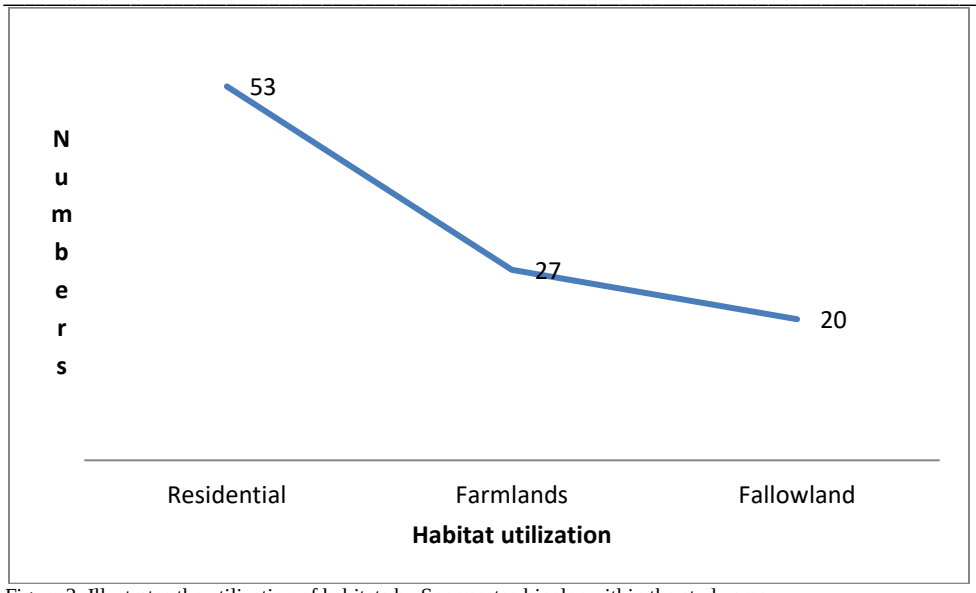


Figure 3, Illustrates the utilization of habitats by Spermestes bicolor within the study area.

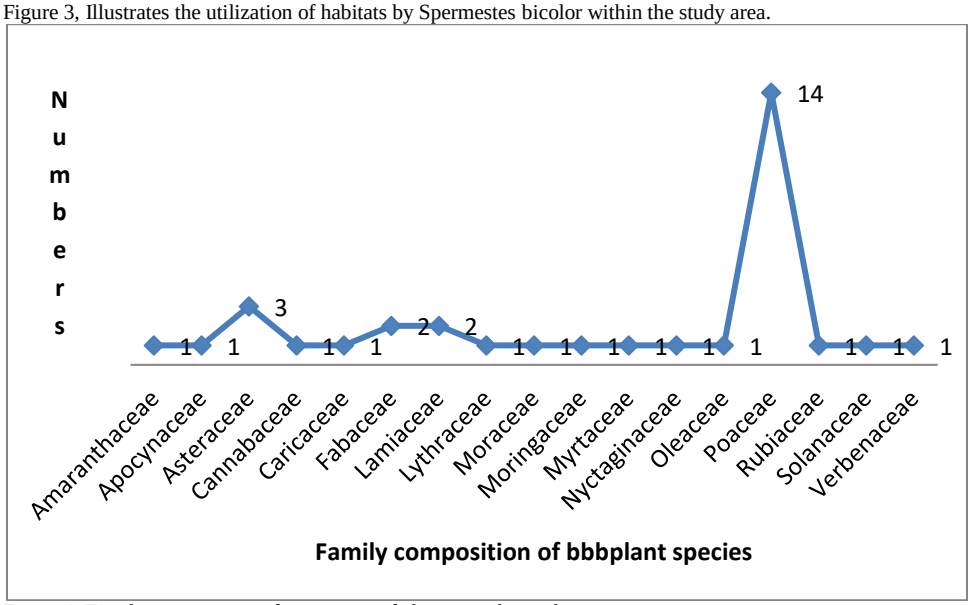


Figure 4, Family composition of tree species fed upon in the study area

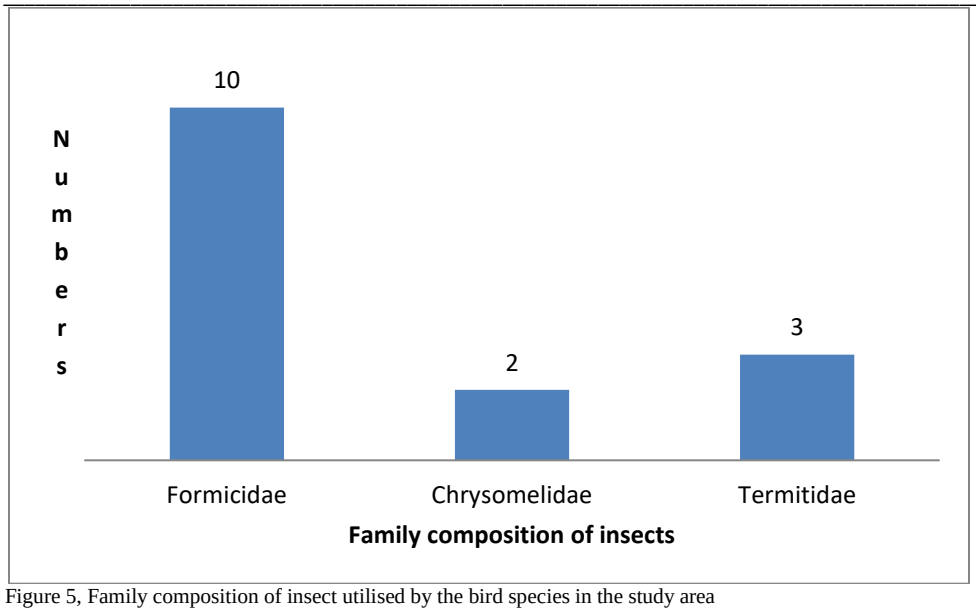


Figure 5, Family composition of insect utilised by the bird species in the study area

DISCUSSION

The Black and White Mannikin (Spermestescucullatus) primarily subsists on seeds, indicating a granivorous diet. However, they are also known to partake in insects, fruits, leaves, and flowers. Their foraging behaviour spans ground, shrub, and tree habitats, and they are even observed frequenting bird feeders for seeds and suet. During the breeding season, they supplement their offspring's diet with insects, including leaf beetles and termites. This dietary pattern is supported by various researchers. (Marques, Oiero, Canario & Luis, 2003) documented *Turdus pelios*, a related species, consuming insects, blank ants, and fruits of Azadirachta indica in South Africa. Similarly, (Sagrario, Ronald, Gurr, Kinross, Anantanarayanan & Helen,2007) found that insects constituted the primary portion of *Turdus pelios'* diet, with Orthoptera, Coleoptera, and Isoptera being the most numerically significant, comprising almost two-thirds of the insects consumed. They are known for consuming a diverse assortment of seeds sourced from grasses, weeds, and various plants. Additionally, they may occasionally consume insects, particularly during the breeding season when their dietary needs shift to accommodate more protein for egg production and nurturing their offspring. In this research, it was observed that these species primarily feed on the ground within residential areas and within the middle layer of trees in forest and farmland blocks. This observation aligns with the findings of (Yusufu, Yakubu and Madziga,2004),who noted that during the breeding season, the northern green-headed sparrow can often be observed foraging on the ground or in low vegetation. They employ a "hop and scratch" technique to uncover seeds and insects from the leaf litter or grass. In the non-breeding season, they may form mixed-species flocks and search trees and shrubs for seeds. The feeding behavior of the northern grey-headed sparrow, like many bird species, can vary depending on several factors, including the season, weather conditions, and food availability. Nonetheless, typically, sparrows exhibit peak activity and feed most actively during the morning and late afternoon or early evening hours.During the breeding season, Spermestescucullatus often commence foraging shortly after sunrise to gather sufficient food for themselves and their offspring throughout the day. They may take breaks from feeding during the hottest part of the day and resume activity in the late afternoon. Northern grey-headed sparrows are predominantly granivorous, indicating that seeds constitute the majority of their diet. However, similar to numerous bird species, they may occasionally consume other plant materials such as flowers and leaves. There are several reasons why a *Spermestes bicolor* might opt to consume flowers and leaves. One potential explanation is their search for additional nutrients or minerals that may be lacking in their predominant seed-based diet. Certain flowers and leaves contain a rich array of vitamins, minerals, and other micronutrients essential for avian health. Another rationale is that Black and White Mannikin could be turning to flowers and leaves to supplement their diet during periods of seed scarcity, such as the winter months when food sources may be more limited. This dietary supplementation could aid in their survival during lean times. Moreover, some manikins might simply derive pleasure from the taste of flowers and leaves and consume them solely for that reason. Nonetheless, it's crucial to recognize that while flowers and leaves offer some nutritional advantages, they shouldn't constitute a substantial portion of a northern grey-headed sparrow's diet, as highlighted by (Marshall, Kanczler & Oreffo, 2020) and (McWilliams &Karasov, 2014). In a study of house sparrows in Italy, (McKilligan, 2005) observed mannikins consuming a diverse range of plant material, including flowers and leaves, across different seasons. This behavior appears to be influenced by the availability of seeds and other primary food sources in the surrounding environment.

CONCLUSION

The research clearly demonstrates that Spermestes bicolor feeds on a variety of food sources including grain seeds, fruits, leaves, flowers, and insects within the study area. Regarding habitat usage, the bird species predominantly utilizes residential blocks over other areas. It was also noted that they forage on the ground as well as on the upper shrub and middle layer trees. Despite being categorized as least concern in terms of conservation status, the fact that they utilize degraded forest ecosystems and urbanized residential areas underscores their importance for sustainable development. Preserving habitats and ecosystems that sustain diverse bird populations is crucial for biodiversity conservation.Sustainable tourism plays a significant role in this conservation effort by encouraging the preservation of habitats. Tourists participating in birdwatching or bird-focused activities often contribute to habitat conservation by supporting eco-tourism initiatives that prioritize conservation efforts. Avitourism and bird-related tourism can provide economic incentives for local communities to conserve natural habitats. This can include revenue generated from birdwatching tours, sales of birding equipment, and services such as accommodation and dining for birdwatchers. By promoting activities that attract birdwatchers, sustainable tourism

simultaneously supports local economies and conserves bird habitats.

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