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Diet and feeding ecology of Double-Spurred Francolin (*Pternistis bicalcaratus*) in Olabel farms, Ilaro, Southwest Nigeria for sustainable ecotourism development

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Abstract

The study investigated the diet and feeding ecology of the Double-spurred Francolin (*Pternistis bicalcaratus*) at Olabel Farms, Ilaro, in southwestern Nigeria, with the aim of promoting sustainable ecotourism development. The primary objective was to gain a comprehensive understanding of the species' ecological role, behavior, and conservation needs within its natural habitat, thereby supporting ecotourism initiatives. The farm's land use was categorized into three blocks: arable farmlands, plantation fields, and fallow lands. The study was conducted over 12 months (October 2023 to October 2024), during which data were collected on 16 pairs of francolins, with group sizes ranging from one to four individuals. A direct observation method was employed for data collection. Field data were entered into an Excel spreadsheet (version 20) for subsequent analysis using descriptive frequency, percentage frequency, and graphical representations (including graphs, pie charts, and bar charts), as well as analytical statistical methods. The findings revealed that the omnivorous diet of *Pternistis bicalcaratus* enables them to thrive in diverse habitats with varying food availability, making them highly adaptable foragers. Plant species constituted 70% of their diet, insects accounted for 22%, and small vertebrates made up 8%. Among plant resources, tubers were the most consumed, with Colocasia esculenta contributing 10.6%, followed by Zea mays at 7.6%, and Elaeis guineensis at 6.6%. Insect consumption was dominated by Macrotermes natalensis (5.8%), followed by Anapha venata (2.6%) and members of the Termitidae family (1.7%).

Keywords: Diet, foraging, ecology, farm, ecotourism development

Introduction

The Double-spurred Francolin (*Pternistis bicalcaratus*), also referred to as the Double-spurred Partridge, belongs to the family Phasianidae, which encompasses various game birds such as pheasants, quails, and partridges (Bird Life International, 2020). This species is native to parts of Africa, particularly the western and southern regions of the continent (Jobling & James, 2010). The Double-spurred Francolin is a medium-sized bird with a compact body, characterized by brownish-grey plumage adorned with intricate patterns of darker markings that provide effective camouflage in its natural environment (Bird Life International, 2016). Its most distinctive feature is the presence of two spurs on each leg, used for defense, territorial displays, and courtship. These spurs are modified scales that curve backward, are notably sharp, and are utilized in fights with predators and rivals (Mandiwana-Neudani et al., 2019). This species inhabits a variety of ecosystems, including grasslands, savannas, shrublands, and forest edges (McGowan & Kirwan, 2020). While the Double-spurred Francolin is classified as a species of least concern in terms of conservation status, its populations are susceptible to threats such as habitat loss and hunting. A bird's diet plays a crucial role in shaping its morphological and physiological adaptations (Bird Life International, 2020). Traits such as the shape of the beak, the length of the digestive tract, and feeding behaviors are closely aligned with dietary preferences (Owolabi et al., 2020). The primary aim of studying the diet and feeding ecology of the Double-spurred Francolin is to achieve a deeper understanding of its ecological role, behavior, and conservation requirements, which can, in turn, support ecotourism development.

Materials and methods

Study Area

The study was conducted at Olabel Farms (6° 54'N, 2° 57'E), which spans a landmass of 1,350 hectares. The farm is located in Ilaro, within the Yewa South Local Government Area (LGA) of Ogun State, southwestern Nigeria. Ilaro serves as the administrative headquarters of Yewa South LGA and is a privately owned property (Okosodo, 2018). Ilaro experiences a tropical climate characterized by distinct wet and dry seasons. The dry season typically occurs between November and March, marked by significantly reduced rainfall and prolonged dry periods. Annual rainfall in the region ranges from 1,800 to 3,000 mm (Isichei, 1995), and the average yearly temperature is approximately 26°C. The vegetation in Ilaro varies based on location, local climatic conditions,

and the extent of human activities. Historically, natural vegetation in the area has been impacted by deforestation and agricultural expansion, reflecting broader patterns observed across Nigeria (Keay et al., 1989; Manu, 2003).

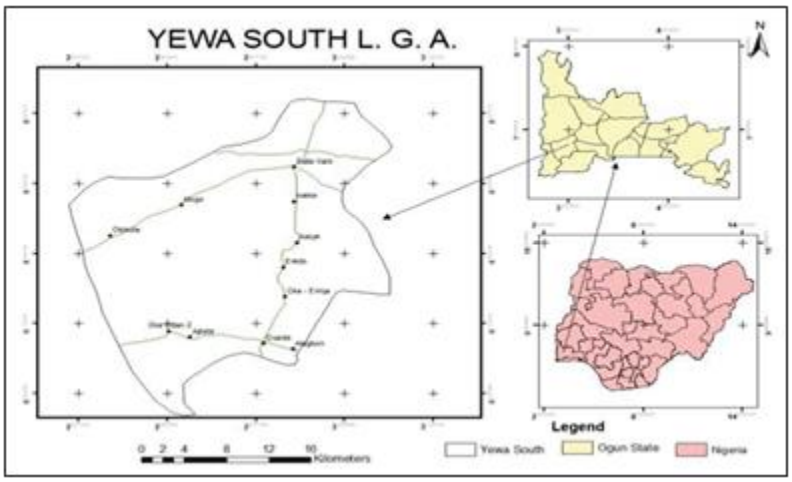

Figure 1. Map of the study area

Data Collection

The study farm was divided into three distinct land-use blocks: arable farmlands, plantation fields, and fallow land. The feeding ecology of *Pternistis bicalcaratus* was observed continuously over 12 months (October 2023 to October 2024), with data collected from 16 pairs of birds, each consisting of 1 to 4 individuals. The Direct Observation technique, as described by Okosodo et al. (2016), was employed for this study. Field observations were conducted using binoculars (Bushnell 750), primarily during early mornings or late evenings when the birds were most active and disturbances were minimal. Individual pairs were tracked for periods ranging from 2 to 5 hours, ensuring that at least some members of the group remained visible most of the time, although it was rare to observe the entire group simultaneously. During each observation session, data were recorded on various aspects of feeding behavior, including the foraging area, feeding techniques, duration of feeding sessions, number of birds present, types of food consumed, and interactions with other bird species. Seasonal variations in feeding habits were also examined. Due to the height of the nests and the size of the trees, pellet inspection was not feasible.

Data Analysis

Before conducting descriptive analyses (using tables, frequency and percentage distributions, graphs, pie charts, and bar charts) and applying analytical statistical methods, the field survey data were organized and entered into an Excel spreadsheet (version 20).

Results

The omnivorous diet of the Double-spurred Francolin (**Pternistis bicalcaratus**) enables it to thrive in diverse habitats with varying food availability, highlighting its adaptability as a versatile forager. By consuming both plant and animal matter, the species meets its nutritional needs for health, growth, and reproduction. The study revealed that 70% of its diet consists of plant material, 22% of insect species, and 8% of small vertebrates (Figure 2). Among plant resources, tubers were the most frequently consumed, with Colocasia esculenta accounting for 10.6%, followed by Zea mays at 7.6%, and Elaeis guineensis at 6.6% (Figure 3). Regarding insect consumption, Macrotermes natalensis constituted 5.8% of the diet, followed by Anapha venata at 2.6%, and Termitidae at 1.7% (Figure 4). Small vertebrate consumption was led by Lumbricus terrestris at 1.6%, with Pontoscolex corethrurus and Amyntha spp. contributing 1.2% and 0.9%, respectively (Figure 5). Habitat utilization analysis indicated that 54% of the bird's daily activities were concentrated in specific areas, arable block 54% and plantation block 25%, reflecting its ecological preferences Figure 6.

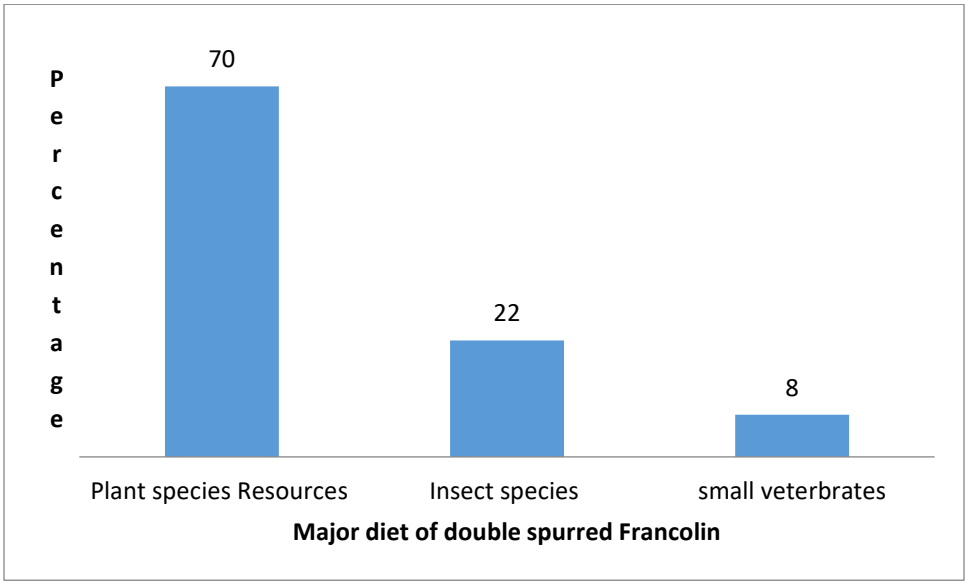

Figure 2. The major diet type fed upon by the Double Spurred Francolin in the study area

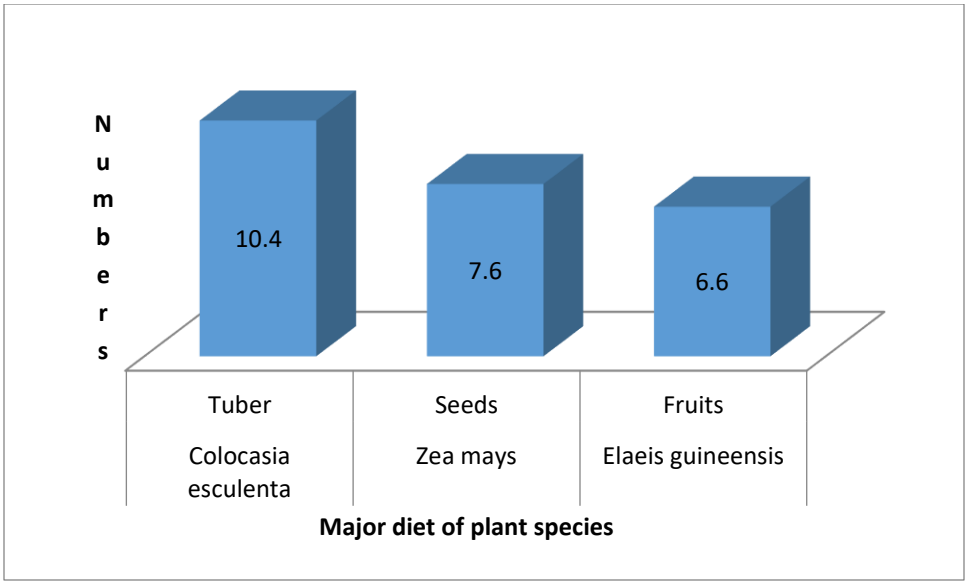

Figure 3. Major diet of the Double Spurred Francolin in the study area

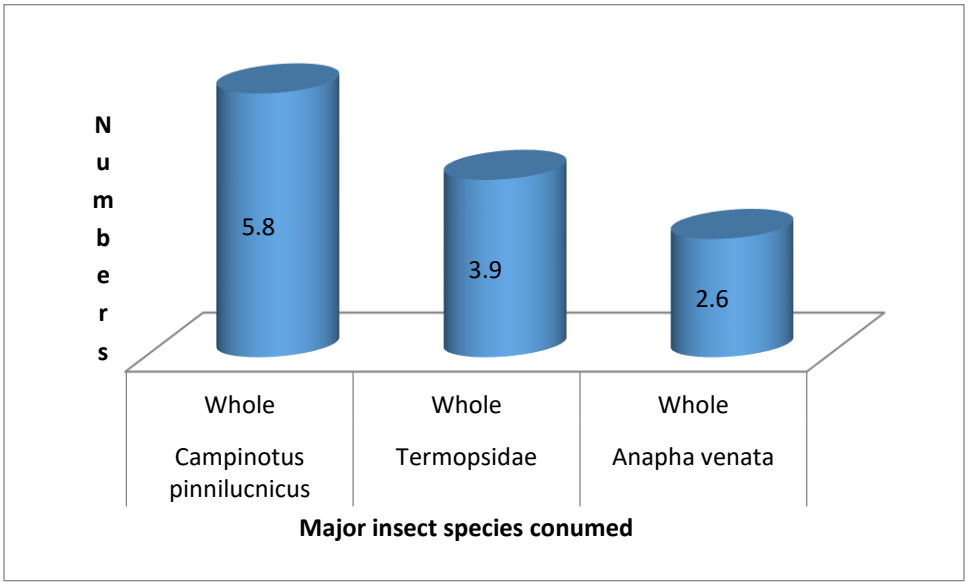

Figure 4. Major insect species fed upon by the Double Spurred Francolin in the study area

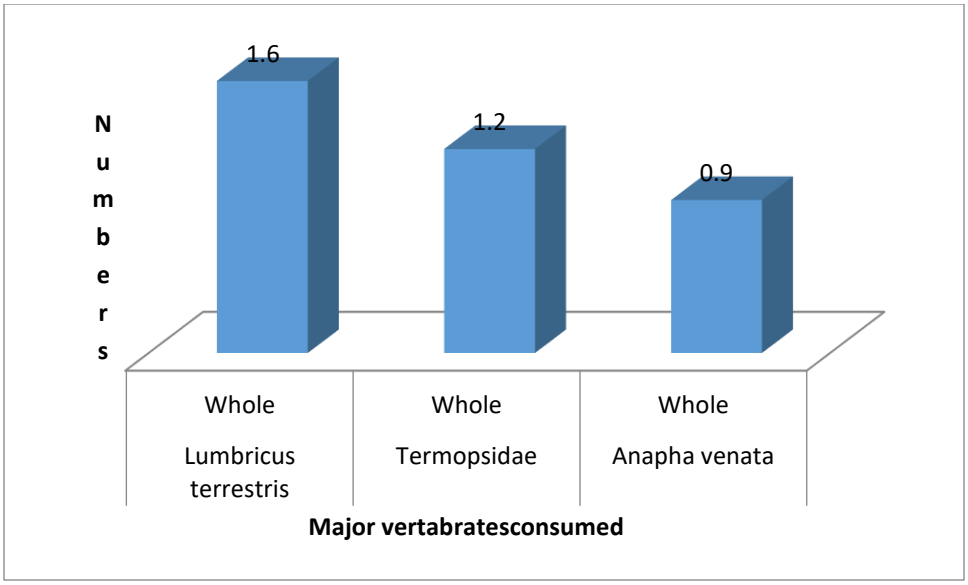

Figure 5. The major small vertebrates fed upon by the Double Spurred Francolin in the study area

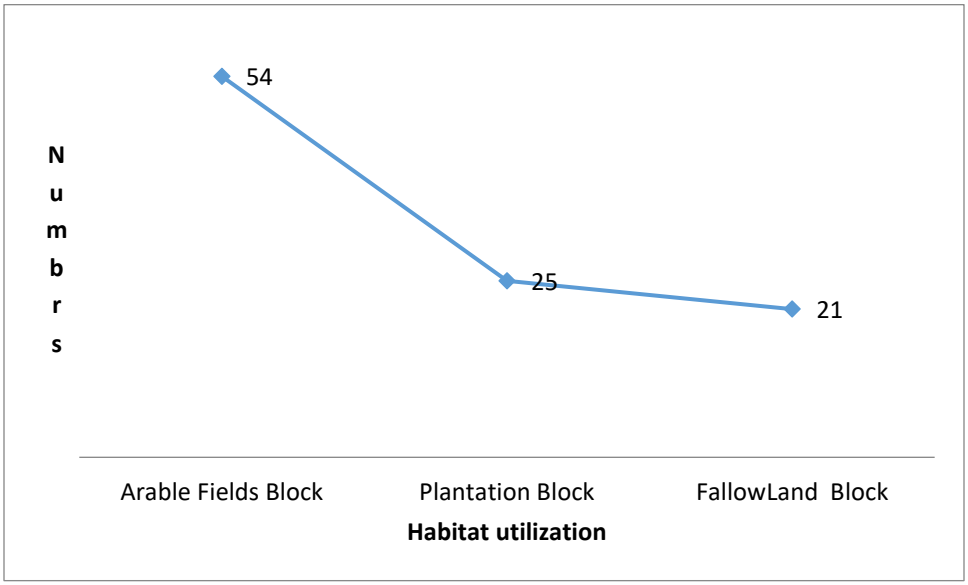

Figure 6. Habitat Utilization by Double Spurred Francolin in the study area

Discussion

Double-spurred Francolins (*Pternistis bicalcaratus*) are omnivorous birds with a varied diet comprising insects, seeds, fruits, leaves, and flowers. They are primarily ground foragers, with feeding behaviors adapted to their natural habitats and the seasonal availability of food resources. The study found that their diet consists of 70% plant material, 22% insects, and 8% small vertebrates. This aligns with findings by David (2010), who noted that their diet is highly diverse

and varies with habitat and food availability. Millet seeds, for example, are particularly favored by birds capable of handling medium to hard-shelled nuts, such as sparrows, cardinals, and juncos (Ali & Ripley, 2003). Double-spurred Francolins forage extensively on the forest floor or in grassy areas, using their sharp bills to peck and probe for insects, seeds, fruits, and other edible items. Insects and invertebrates, including beetles, ants, grasshoppers, and worms, are a vital component of their diet, especially during the breeding season when protein-rich food is crucial for chick development (Gill et al., 2010). Their ability to switch between food sources based on seasonal availability highlights their adaptability as opportunistic feeders. This foraging behavior is consistent with observations by Johnsgard (1986), who described these birds as using digging and scratching techniques to uncover food and engaging in dust bathing. Habitat utilization studies revealed that Double-spurred Francolins predominantly use arable land but also forage in other land-use types. These findings align with Owolabi et al. (2020), who reported that the birds are strongly associated with habitats offering their preferred food sources. However, they also noted that while the birds can negatively impact agricultural activities, some farming practices attract them by providing feeding opportunities.

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