Rwanda Journal ISSN 2305-2678 (Print); ISSN 2305-5944 (Online)
DOI : http://dx.doi.org/10.4314/rj.v1i1.5E

Abundance, Distribution and Ecology of Flycatchers in the Arboretum of Ruhande in Rwanda

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Abstract

Forest ecosystems are recognized as important biodiversity conservation areas. We studied abundance, distribution and activity budget of flycatchers within the Arboretum of Ruhande in Southern Rwanda. The point observation method was used to collect data along line transects from May to June 2012. A total of 177 individuals belonging to 6 bird species were recorded. The African paradise flycatcher (Terpsiphone viridis) was the most abundant species with 63.27% followed by White-eyed slaty flycatcher (Melaenornis fischeli) species with 29.94% observation frequency. The main activities of flycatchers were feeding, followed by flying and resting. There was an uneven distribution of flycatchers in all transects in the study site. Further study must be undertaken in order to investigate the causes of uneven distribution of the flycatchers in that forest plantation.

Keywords*: Flycatchers, Abundance, Distribution, Arboretum of Ruhande.*

1. Introduction

Biodiversity has tremendous benefits and functions including mainly ecological benefits and functions (Costanza et al., 1997). Birds are categorized among the best ecological indicators of ecosystem status and environmental conditions (Spellerberg, 1992; Bibby et al., 2000) due to their capability to disperse and diversify in all terrestrial regions, altitudes and habitats (BirdLife International, 2000) and their contribution in pollination and seed dispersion (Wilson and Willis, 1975; Clout and Hay, 1989; Estrada et al., 1993; Bennum et al., 2002).

The sub-Saharan Africa has high species diversity, over 2300 bird species, which constitute about 20% of the world's total, of which 408 species are endemic to Africa (Stattersfield et al., 1998; BirdLife International, 2000; Brooks and Thompson, 2001). Even there is accumulated information on bird species in many areas; gaps are still remarkable in some areas due to the lack of continuous recordings following disturbances in many terrestrial areas (Groombridge, 1992; UNEP 1995), as a result of increasing human population around conservation areas (Balmford et al., 2001).

The abundance of bird population in their ecological habitat is a function of weather, predation, competition, diseases, and human activities including pollution and urbanization, as well as food availability (Willson et al., 1994; Sillett et al., 2000). Availability of habitat requirements significantly contributes to the distribution of birds (Lennon et al., 2000). Bird species are distributed in the range of habitats they occupy, some species are replaced by others as the habitat type or structure changes between habitats in a local or regional landscape mosaic (Cody, 1983; Wiens, 1997).

Flycatcher lives in open forest to some extent and gardens or cultivated lands (Hockey et al, 2005). Surrounded by cultivated lands, the Arboretum of Ruhande creates a good habitat for Flycatchers. They are insectivores, feeding on a variety of insects, usually obtained on the wing (Hockey et al, 2005). The arboretum of Ruhande is also dominated by Eucalyptus habitats and has a large number of flowering plants which attract insects, suggesting a potential abundance and distribution of Flycatchers in this habitat, as it was noted by other authors (Stone and Bacon, 1994).

Although a number of studies have been carried out in the Arboretum of Ruhande, little is documented on bird diversity, especially flycatcher's distribution and abundance, which is suggested for a present study. Therefore, the aims of this study were to: (i) determine the abundance and distribution of flycatchers and (ii) define the activity budget of flycatchers in the Arboretum of Ruhande.

2. Materials and Methods

2.1. Study area

Data were collected in May to June 2012 in the Arboretum of Ruhande, located in Southern Rwanda, Huye District, between 29°46′ E and 2°33′S, from 1,638–1,728m altitude above sea level. This forest plantation was initiated between 1933 and 1934 with the prime objective to select and produce tree seeds adapted to Rwanda ecology; it is a research centre for forest and agroforestry (ISAR, 1987; Stanga, 1991). It covers an area of about 200 ha divided into 529 plots, each measuring 50x50m and it is composed of over 207 native and exotic species, including 143 hardwoods with 69 Eucalyptus species, 57 softwood and 3 bamboo species (Nsabimana et al., 2008). This forest plantation is surrounded by agricultural fields, and human settlements. The cultivated areas were dominated by maize, sorghum, sweet potato and bean crops at the south side of the forest and fish ponds at the north side of the forest, the Rwasave pisciculture research station.

2.2 Field data collection

Line transects were used to register avian species composition (Bibby et al., 2000). Six transects were selected in forest plantation and each had 7 observation points except transect 5 and 6 which had 8 observation points, making 44 observation points in total. The distance between transects was 100m, and distance between observation points was 200m. Selected counting points were located on transects selected randomly in the study area from the reconnaissance trail starting at the forest edge near the farms in south of the forest which acts as a transition zone near the crops planted at valley to Cyarwa village going to North of the Arboretum. Each transect was visited three times. During each visit, transects were walked slowly along

predetermined routes (already existing forest trails, tracts, and paths), listening, looking for and recording flycatchers.

Observations were made in morning (6:30–10:30 a.m.) and afternoon (3:30–5:30 p.m.). For each observation point, note was taken on arrival time, bird species, number of individuals, and the activities of every species, including feeding, flying, grooming, singing and resting. A radius of 25m from the standing point of the observer was used and observation was made for 10 minutes recording all flycatcher birds' species observed. Environmental weather (like cloudy, sunny, and rainy) was recorded before beginning the data collection, but point observations couldn't run during adverse weather conditions, because birds were not active.

2.3 Data analysis

All data were entered and analysed using Excel and presented into Biodiversity Professional version 2**.** Similarity indices were calculated and dendrograms created using Bray-Curtis linked cluster analysis using the birds point count data. The indices measure the degree to which the species and their relative abundances are shared between different communities. The abundance of flycatchers in the Arboretum of Ruhande was analyzed by computing the percentage abundance in Microsoft Excel 2007.

3. Results

3.1 Abundance of flycatcher species

A total of 177 flycatchers observation counts were recorded during the two months data collection, suggesting 177 Individuals of flycatchers were recorded. These were classified into 6 species comprising two families (Monarchidae and Muscicapidae). The most abundant species was African Paradise-flycatcher Terpsiphone viridis, followed by Melaenornis fischeri. The family Muscicapidae was the most abundant among flycatcher birds observed in that site, counting five species (Table 1). Observed flycatchers were most abundant in Eucalyptus plantation habitats followed by Cedrela serrata habitats (Fig. 2). The results showed that transect 6 had the highest Shannon diversity index for Flycatcher diversity and distribution, while transect 2 was the less

diverse. The evenness showed a non uniform distribution of the species (Table 2).

Table 1: **Abundance of flycatchers in the arboretum of Ruhande**

Species Common name	**Species Scientific name**	**Family**	**Abundance (%)**
African Paradise-flycatcher	Terpsiphone viridis	Monarchidae	63.27
White-eyed Slaty Flycatcher	Melaenornis fischeri	Muscicapidae	29.94
Ashy Flycatcher	Muscicapa caerulescens	Muscicapidae	2.82
Semi-collared Flycatcher	Ficedula semitorquata	Muscicapidae	2.25
Collared Flycatcher	Ficedula albicollis	Muscicapidae	0.56
African Dusky Flycatcher	Muscicapa adusta	Muscicapidae	1.12

Table 2: Shannon-Wiener Diversity values for Flycatcher species observed in six transects

Index	T1	T2	T3	T4	T5	T6
Shannon H' Log Base 10.	0.389	0.208	0.287	0.361	0.383	0.406
Shannon Hmax Log Base 10.	0.602	0.301	0.477	0.477	0.477	0.602
Shannon J'	0.647	0.691	0.601	0.756	0.803	0.675

The similarity between flycatcher communities within 17 Genera plot habitats calculated based on point count data, indicated that Genera Copdia and Tetraclinis were the most similar habitats followed by Alnus and Auracaria habitats. The habitats with Alnus and Grevillea stands were the most dissimilar (Fig. 2).

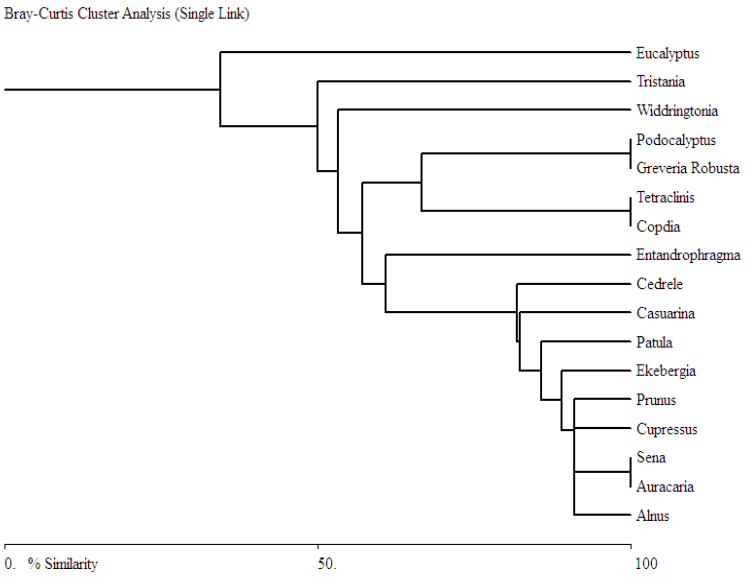

Figure 2: Cluster analysis for the seventeen genera plot habitats surveyed using point count data of the study area.

Row Labels	Feeding (%)	Flying (%)	Grooming (%)	Resting (%)	Singing (%)
African Dusky Flycathcer	**0.00**	**0.00**	**100.0**	**0.00**	**0.00**
African Paradise-flycatcher	**28.57**	**33.93**	**2.68**	**26.79**	**8.04**
Ashy Flycatcher	**40.0**	**40.0**	**0.00**	**0.00**	**20.00**
Collared Flycatcher	**0.00**	**0.00**	**0.00**	**0.00**	**100.0**
Semi-collared Flycatcher	**75.0**	**0.00**	**25.00**	**0.00**	**0.00**
White-eyed Slaty Flycatcher	**24.53**	**18.87**	**5.66**	**18.87**	**32.08**
Grand Total	**28.25**	**28.25**	**5.08**	**22.60**	**15.82**

3.2 Activity budget of flycatchers

The results showed that flycatchers engage mostly in feeding and flying followed by resting activities (Table 4). The observed Flycatcher activities were of little difference in morning and afternoon hours (Fig. 3).

Table 4. Activity budget of Flycatchers as observed in the Arboretum of Ruhande in May–June 2012.

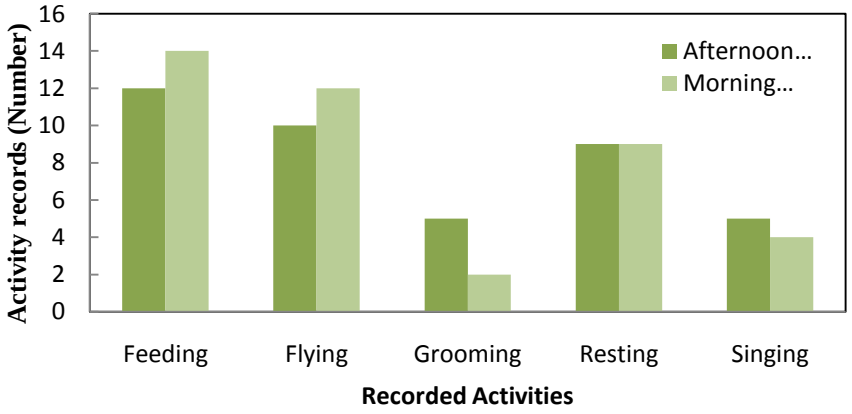

Figure 3. Daily variation of Flycatcher activities in morning and afternoon observed in May to June 2012 at the Arboretum of Ruhande.

4. Discussion

4.1. Flycatcher abundance and distribution

Understanding the factors that regulate the richness of biological communities is fundamental in contemporary ecology. In this study, the Shannon-Wiener Diversity value was highest in Transect 6 (Table 2). This transect was made of complex vegetation structure and heterogeneous floristic composition which increases niche diversity, including flycatchers (Wiens, 1989). This transect passes near the undisturbed habitat, a 4ha area that was left intact since 1934 when this arboretum was created. This area is considered a secondary forest, and is protected, thus allowing a large number of plant species to develop.

Grazing and browsing pressures by livestock is detrimental to the ecosystem. The relatively lower diversity index in other transects may be a result of disturbance, including cow grazing, firewood collection by surrounding human populations, lumbering, leisure and recreation activities by students from National University of Rwanda and neighboring inhabitants. Removal of significant amount of primary production may prevent regeneration; reduce the structural diversity of

habitats and the plant species diversity with consequent reduction in availability of food and other essential requirements for birds (Stuart, 1985; Macleod and Parrott, 1992). Habitat deterioration has been suggested to be the cause of rapid disappearance of African-Paradise Flycatcher in East Africa (Valentine, 1987). This confirms our finding in which the less disturbed area (Transect 6) had the highest diversity index. Therefore, the conservation of this forest needs to be strengthened for the security and increased abundance of bird diversity.

4.2. Activities budget of Flycatchers

The flycatchers spent the majority of their daily time by feeding (Table 4), which provides raw material for self-maintenance, growth and reproduction (Krebs and Davies, 1997). In addition, Flycatchers feed on flying insects attained on the wings and fly while following their food (Drost *et al*, 1998). They were mostly observed flying from a tree to another chasing food in space, but this does not mean that feeding is related to flying.

Feeding and flying activities were almost equal in morning and in the afternoon (Fig. 3). This may have resulted to short observation period, otherwise it is known that birds are more active in morning, because they need to be actively feeding and flying before weather changes to sunny or any other adverse condition (Krebs and Davies, 1997; Sirima and Warui, 2006). In the afternoon, these species are exhausted and it is too sunny, causing Flycatchers to rest. Singing serves several purposes that are not mutually exclusive, such as territorial defense, mate guarding, or attraction of extra-pair mates (Atienza and Illera, 1997). Singing is also used for intra- and extra-specific communication, and in intraspecific communication, indicating fitness and good signal for mating or rivals (Rasoul and Camenzind, 2006).

5. Conclusions

Terpsiphone viridis was the most dominant among Flycatcher bird species studied in the Arboretum of Ruhande, with a non uniform distribution along transects. Highest species richness was observed in *Eucalyptus* habitat due to their dominance in the study area. Flycatcher's main activities were feeding and flying, but activity

budget was not different in morning and afternoon periods. The results of this study suggested that the Arboretum of Ruhande may be habitat for large bird diversity. It is therefore, recommended for further studies including: (i) the feeding and nesting ecology and seasonal variation of flycatchers especially African paradise flycatcher species (*Terpsiphone viridis*) since they were most observed; (ii) an inventory of threatened bird species and an auditory survey of birds in this area due to the fact that there are some suspected to migrate from Nyungwe National Park or from Bugesera and Mayaga regions. The managers of this forest plantation may strengthen the strategies of carrying timbers from self-broken trees so as to mitigate further deterioration of the forest for it harbors diverse biological parameters and to maintain the goods and services gained from this forest plantation.

Acknowledgements

The authors are grateful to the authority of Arboretum of Ruhande that has authorized to conduct this study using this site. We also express our gratitude to Etiènne Zibera for assistance in field data collection.

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