

# Aspects associated with foraging ecology of Sri Lanka Bush Warbler (*Elaphrornis palliseri*) in Montane forests of Horton plains National Park, Sri Lanka

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## ABSTRACT

Foraging ecology of *Elaphrornis palliseri* was investigated from January to December 2017 in Horton Plains National Park (HPNP) in randomly placed three 100 m line transects in each of the three major habitats of HPNP as Cloud Forest (CF), Cloud Forest Die Back (DB) and Grassland (GL). Usage of vegetation, foraging substrates, foraging height and attack manoeuvres of *E. palliseri* were recorded. Focal observations of 83 individuals were recorded from CF and DB but none from GL. *Ageratina riparia* (15.50±12.23) and *Pteridium sp.* (10.13±10.74) vegetations were highly utilized by *E. palliseri* whereas *Sarcococca brevifolia* (7.50±5.64) and *Arundinaria debilis* (7.53±4.97) were moderately preferred. Foraging substrates such as Leaf litter (9.80±5.33%) was mostly utilized. Height ranged from 0-2.5m was usually utilized for foraging. During breeding and rearing season in SWMS and SIMS while 4m height was exceeded for foraging purpose but ground foraging was dominated in SIMS (18.53%) due to highest wind speed. Glean (12.99±8.61%) and Probe (10.06±5.50%) were mostly used as prey attack manoeuvres. In SIMS probing (16.74%) was dominated and Hang method was used comparatively high percentage (0.69%) revealing willfulness of obtaining maximum food matter to withstand harsh conditions and successful breeding. Findings of the present study hang the need of future studies related with *E. palliseri*.

**Key words :** Foraging ecology, *Elaphrornis palliseri*, Horton Plains National Park, Sri Lanka

## Introduction

In the field of ornithology, consumption of food by birds, with reference to temporal and spatial scales has been a major study area, since it reveals important insights on avian ecology which can be effectively used in initiating sound conservation and management strategies. This "Foraging behaviour" is defined as any movements which are terminated by or punctuated with food- getting motions. Other information included: the manoeuvre(s) used to obtain food, the location of the food item, and when possible, the identification of food items

(Williamson, 1971; Robinson and Holmes, 1982). Several aspects of foraging behaviour have predictable relationships with prey abundance and provide information on food availability (Thiollay, 1988). In birds, the functional response of predators to the variation in prey density involves adjustment to two aspects of foraging behavior which are attack rate (e.g., attacks per minute) and foraging speed (e.g., locomotive moves per minute) (Wolda, 1990). Moreover, foraging behaviour of birds may influence their effectiveness as dispersers (Witmer and Van Soest, 1998). Similarly, insectivorous birds are important components of ecosystems as they may con-

trol populations of insect herbivores on certain plant species (Van Bael, 2003); their preferences for some foraging microhabitats generally determine what species or type of prey are eaten (Wolda, 1990).

The island of Sri Lanka is situated in the Indian Ocean between latitudes 5° 55' - 9° 51' N and longitudes 79° 41' - 81° 53' E (Gunatilleke and Gunatilleke, 1990). The geographic position and the topography of Sri Lanka have given the island three major climatic zones and there is a huge variety of habitats that support large biodiversity (Gunatilleke and Gunatilleke, 1990). Hence, the country provides a diverse array of foraging habitats for inhabiting avifauna which consist a total of 453 species with 240 breeding residents, 213 migrants and 72 vagrants (Warakagoda *et al.*, 2012; Weerakoon and Gunawardena, 2012).

The Sri Lanka Bush Warbler, *Elaphrornis palliseri* (Legge, 1983) is an endemic, Near Threatened avifaunal species with a decreasing population trend due to its restricted range (Birdlife International, 2016). *E. palliseri* is categorized under the Order Passeriformes, family Locustellidae/Silviidae. It is called as *Kanduhambu Kurulla* or *Wanaravia* in Sinhala language. This species prefers to inhabit areas with higher elevations above 3,000 feet and occupy the dense undergrowth of mountain forests, or thick scrub. The species was recorded in most of the birds' studies conducted in the montane region of Sri Lanka (Partridge and Ashcroft, 1976; Sriyani, 2000; Wijesundara and De Silva, 2005). Specifically, *Elaphrornis* genus is a Monotypic genus in Sri Lanka,



Fig. 1. Capture of Sri Lanka Bush Warbler, *Elaphrornis palliseri* recorded in the cloud forest of the Horton Plains National Park

containing only one resident species, *E. palliseri*.

*E. palliseri* is slightly larger than a house sparrow and is ash in colour (Figure 1). Appearances of both males and females are somewhat similar with an exception of males having red irides while that of females are pale buff.

It seldom ascends more than a yard or two above ground level and can be seen in pairs occasionally (Henry, 1955; Harrison and Worfolk, 2011). It is considered as an insectivore's bird and prefers green crickets with soft bodies (Family-Tettigoniidae) (Henry, 1955; Harrison and Worfolk, 2011). It can be seen in mixed-species flocks in Horton Plains National Park and is known to be territorial (Partridge and Ashcroft, 1976). Its breeding season is considered to be from February to May, with a secondary season in September. Moreover, though the abundance of *E. palliseri* is not significantly different in four climate seasons in Horton Plains National Park, the seasonal distribution of *E. palliseri* within and between the habitats differs significantly (Fernando *et al.*, 2019). Although much of its habitats remains secure, it may be declining as a result of habitat loss in some areas, and these situations should be carefully monitored (Birdlife International, 2016). Furthermore, scientific researches on *E. palliseri* are needed to be conducted on aspects associated with life history and ecology, population size and population and habitat trends (Birdlife International, 2016). Therefore, with the purpose of providing important information to conserve this endemic near threatened bird species, current study was conducted to determine its foraging ecology.

## Materials and Methods

The study was carried out in Horton Plains National Park (HPNP) of Sri Lanka (6° 47' - 6° 50' northern latitudes and 80° 46' - 80° 50' eastern longitudes) for three consecutive days per month from January to December 2017 in three main habitat types, which are Cloud forest habitat, Cloud Forest Die Back habitat and Grassland habitat. In each habitat, three 100m fixed length transects were randomly placed and marked using Global Positioning System (Garmin Etrex euro handheld GPS receiver) and Bush Warblers within 10m distance from each transect (10 m from both sides of the transect) were recorded while travelling slowly along these transects from 0600h to 1830h in three time periods in each day, from 0600h to 1000h (Morning) 1030h to

1430h (Midday) and 1430 to 1830h (Evening). Birds were observed using 10 × 50 Nikon binocular. Opportunistic data and incidental observations were also used for further behavioural studies. Casual walks were taken outside the sampling sites in order to maximize the encounters with the Bush Warbler. Focal animal sampling method was used to record their behaviours according to the constructed ethogram. When there were more individuals of *E. palliseri*, behaviours were recorded using video recorder (Nikon D5300) and transcribed into spreadsheets. Data was obtained only the absence of heavy mist and heavy rain. Each encountered Bush Warbler was thoroughly observed within 5 m distance without obviously altering their natural behaviours (Swihart and Slade, 1997; Brag *et al.*, 2005; Freitas and Rodrigues, 2012) as long as they could be kept in sight (Sabo and Holmes, 1983; Holmes and Recher, 1986).

All the vegetation types utilized by Bush Warblers for foraging were identified using plant identification guide (Ashton *et al.*, 1997). Height at which the Bush Warblers were seen foraging was recorded. Heights were visually estimated, but these approximated heights were often checked by actually measuring the foraging heights with meter ruler. The gross heights of vegetation types were also randomly checked using meter ruler.

Foraging attempts were assigned in to 10 height categories measure from the ground as 0 (ground level), 0.1m-0.5m, 0.6m-1m, 1.1m-1.5m, 1.6m-2m, 2.1m-2.5m, 2.6m-3.5m, 3.6m-4m and >4m.

Foraging substrates where the Bush Warblers were seen foraging were recorded as branches/twigs with mosses and lichens (<5m diameter), leaf litter, ground vegetation, coarse woody debris, and bare ground. Foraging attempts (attack maneuvers) were categorized as Gleaning (Picking food from a nearby substrate without full extension of legs or neck), Stretching (completely extending the legs or necks to reach the food items), Hanging (Hanging head down in order to reach food not obtainable by any other perched position), Probing (To insert the bill into softer substrate such as dead leaves to capture hidden food) and Sally (To fly from a perch to attack a food item and then return to a perch) according to Remsen and Robinson (1990).

Environmental data such as ambient temperature at chest height, Relative Humidity (RH) and Wind Speed (using Kestrel 4000 pocket weather meter) were recorded from 3 randomly selected data points

in each transect. Monthly rain fall data for the region (Station Identity: 43473) during the study period was obtained from the Department of Meteorology, Sri Lanka. Obtained data were categorized according to the climate experienced at the Horton Plains National Park to four climatic seasons as First Inter Monsoon Season - FIMS (March- April), South West Monsoon Season - SWMS (May-September), Second Inter Monsoon Season - SIMS (October- November) and North East Monsoon Season – NEMS (December- February).

Fecal matter was collected at the field and stored in 80% alcohol. Later, these samples were placed in a hot water bath (45°C) for 1-2 h to soften the feces and subsequently treated with about 2 ml of a concentrated solution, then rinsed with distilled water, centrifuged and stored in 95% ethanol (Burger *et al.*, 1999). Treated samples were observed under the light microscope. Undigested insect particles were identified to lowest taxonomic level using illustrations in Ralph *et al.*, (1985), Moreby (1987) and Borrer *et al.*, (1989).

#### Data Analysis

“Minitab version 16” statistical software package and Microsoft excel 2007 were used for statistical analysis and graphical representation of results. Sample data were checked for normality and other assumptions of parametric tests (ANOVA) when required.

#### Results

Focal observations were carried out in 83 individuals in both cloud forest and die back but none of them were encountered in grassland. Majority of the birds tend to utilize forest edges of the cloud forest habitats, followed by forest middle and lesser number of birds utilized deeper areas in the cloud forests (Fernando *et al.*, 2019).

#### Seasonal variations in Environmental factors in HPNP

SIMS could be identified as the season with harsh environment conditions at HPNP in 2017. The lowest average temperature of  $15.58 \pm 0.56$  °C, highest average wind speed of  $15.25 \pm 5.71$  km/h (Figure 2), highest average relative humidity (R.H) of  $99.40 \pm 0.32\%$  and highest average rain fall of  $(221.8 \pm 32.81)$  mm (Figure 3) were recorded during the Second Inter Monsoon season (SIMS).

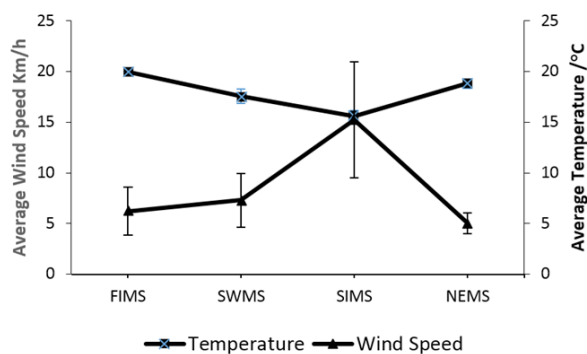


Fig. 2. Seasonal Variation of average wind speed and average temperature throughout the study period

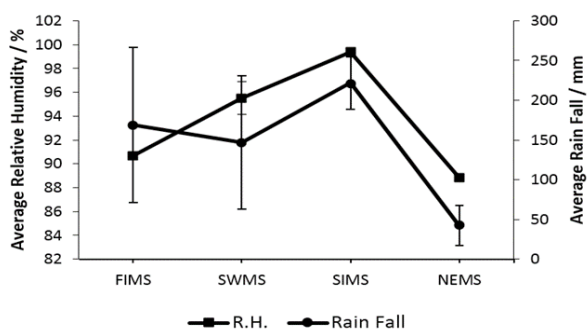


Fig. 3. Seasonal Variation of average relative humidity and average rainfall throughout the study period

**Vegetation Preference of *E. palliseri* for foraging**

Birds may use certain plant species preferentially for foraging and this is important to understand patterns of avian community structure (Anderson and

Shugart, 1974). *Ageratina riparia* (*Eupatorium riparium*), *Pteridium sp.*, *Axonopus fissifolius* are ground cover vegetation which were highly utilized by bush warblers whereas *Stobilanthes spp.* is a short shrub that they highly utilized in most of the time. *Sarcococca brevifolia*, a large shrub and *Arundinaria debilis*, undergrowth covered bamboo species also moderately preferred by the bush warblers (Table 1).

**Foraging substrate utilization**

Leaf litter was the mostly utilized foraging substrate (Percent average number of times used by birds per season ± SD %; 9.80 ± 5.33%). Ground vegetation (6.64 ± 3.63) % and branch/ twigs with mosses and lichens (5.55 ± 2.77) % were also moderately used. Coarse woody debris (1.95 ± 3.09) % and bare ground (1.05 ± 1.37) % can be considered as the least utilized foraging substrates (Figure 4).

**Foraging height utilization**

Usually height range 0-2.5m was used for foraging throughout the study period. Bush warblers mostly utilized ground for foraging (percent average number of times used by birds per season ± SD %; 10.19 ± 6.17 %) and also 0.1-0.5m (6.61 ± 3.35) %, 0.6-1m (3.38 ± 2.44) %, 1.1-1.5m (2.36 ± 2.50) % were moderately used. Height levels 1.6-2m (0.96 ± 1.03) % and 2.1-2.5m (0.71 ± 0.60) % were used in low percentages while height exceed 2.5m were rarely used in minimum amount (Figure 5).

**Table 1.** Preference for utilizing different vegetation species by *E. palliseri*

Vegetation type	Average Height of vegetation(m)	Category	Average number of times used
<i>Sarcococca brevifolia</i>	4.36 ± 0.84	Shrub	7.50 ± 5.64
<i>Cinnamomum ovalifolium</i> *	7.14 ± 0.75	Small tree	3.67 ± 2.35
<i>Arundinaria debilis</i> *	6.22 ± 3.13	Grass	7.53 ± 4.97
<i>Eupatorium riparium</i> #	0.175 ± 0.06	Ground vegetation	15.50 ± 12.23
<i>Stobilanthes spp.</i>	1.246 ± 0.36	Shrub	8.5 ± 5.09
<i>Cryspogon nodulibarbis</i>	0.46 ± 0.21	Grass	2 ± 1
<i>Garnotia exaristata</i>	0.9 ± 0.42	Grass	1.5 ± 0.71
<i>Pteridium sp.</i> *	0.48 ± 0.19	Ground vegetation	10.13 ± 10.74
<i>Axonopus fissifolius</i> #	0.05 ± 0.02	Ground vegetation	10.00 ± 8.65
<i>Syzygium microphyllum</i>	8.32 ± 0.68	Tree	2
<i>Osbeckia lanata</i> *	0.86 ± 0.24	Shrub	1
<i>Elaeocarpus montanus</i> *	7.94 ± 0.85	Tree	1
<i>Rhodomyrtus tomentosa</i>	2.94 ± 0.24	Shrub	1
<i>Rhododendum sp.</i> *	5.22 ± 1.48	Shrub	0

\*Endemic varieties

+ Invasive varieties

# Exotic varieties



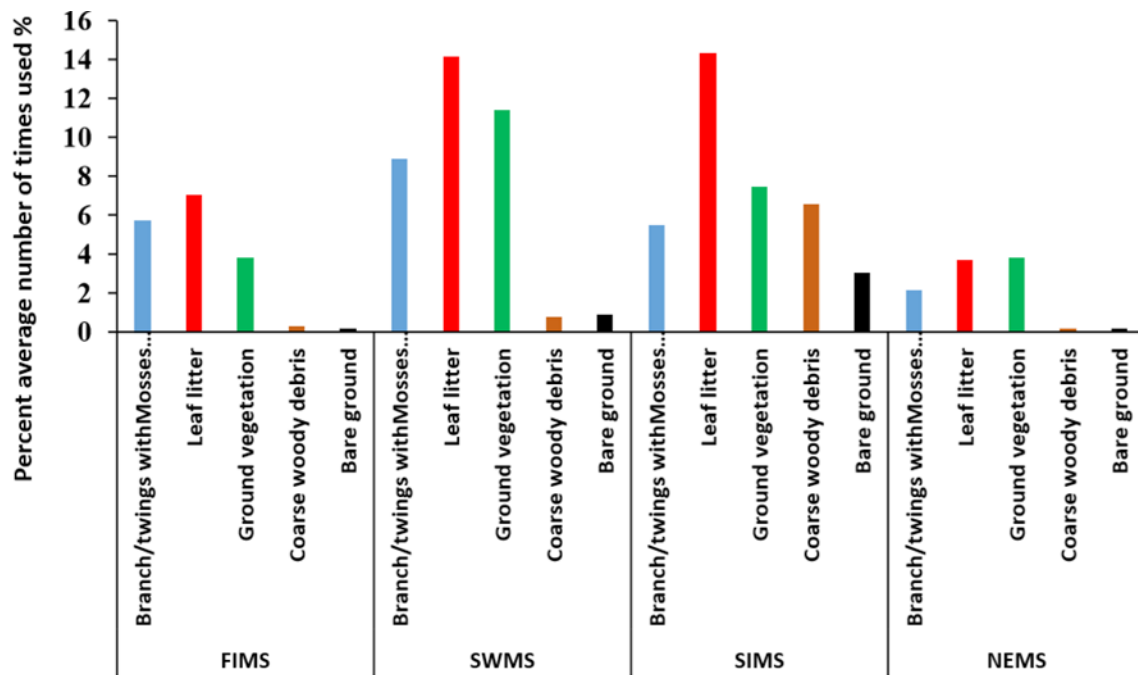


Fig. 4. Comparison of average utilization (%) of different foraging substrates during the study period

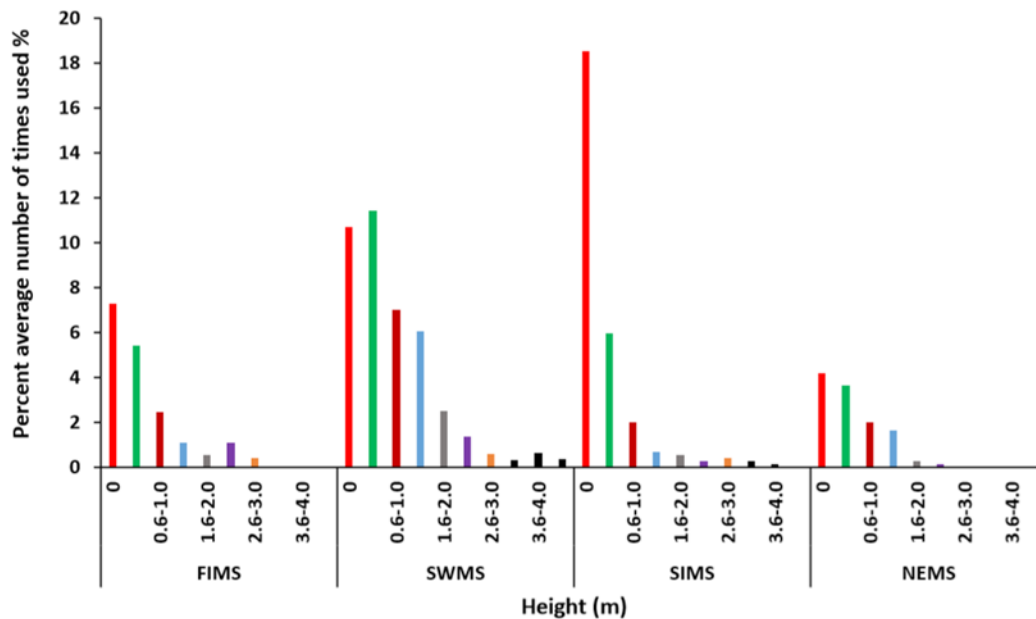


Fig. 5. Comparison of average utilization (%) of different heights for foraging during the study period

**Attack Manoeuvres**

Glean was the most commonly used manoeuvre (Percent average number of times used by birds per season  $\pm$  SD %;  $12.99 \pm 8.61\%$ ) and Probe also used moderately ( $10.06 \pm 5.50\%$ ). Hang method was rarely used ( $0.30 \pm 0.28\%$ ) than Stretch method ( $1.65$

$\pm 1.36\%$ ) and Sallying was not observed throughout the study period (Figure 6).

**Fecal Matter Analysis**

Body fragments of Coleopterans were identified from fecal matter analysis of *Elaphornis palliseri* (Figure 7).

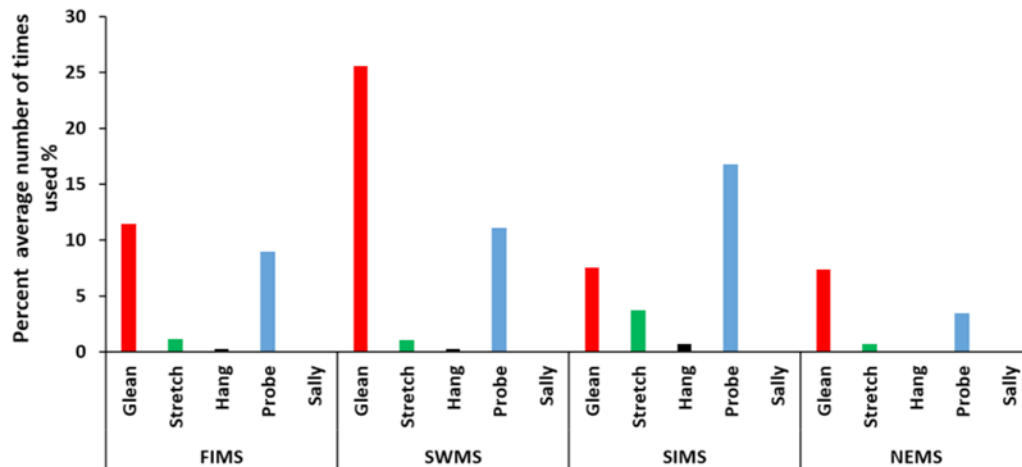


Fig. 6. Comparison average usage(%) of different attack manoeuvres during the study period

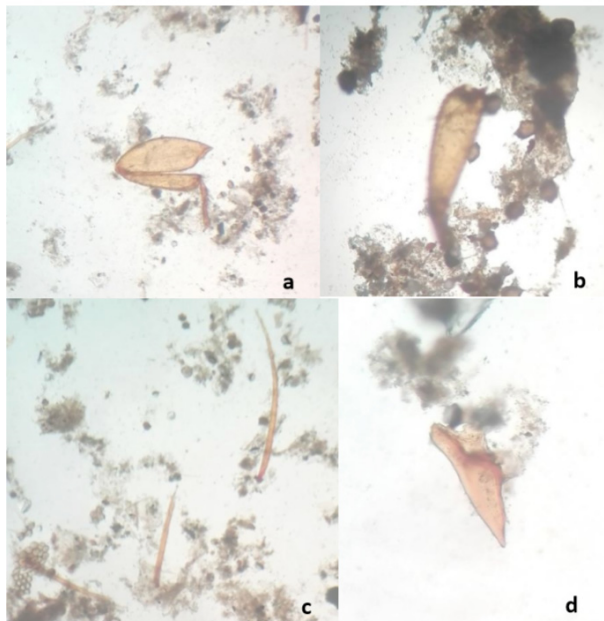


Fig. 7. Coleopteran fragments (10×4) found in the fecal matter analysis of *Elaphrornis palliseri*: under the examination of light microscope. a. Leg (femur, tibia and claws) b. Fragment of a leg (femur and tibia) c. Parts of antennae d. miscellaneous part

## Conclusion

*E. palliseri* highly prefers to exist associated with *Ageratina riparia* ground cover vegetation and leaf litter is the main substrate that utilize for foraging. Foraging method and the height range are slightly altered as a manoeuvre for adapting to changing environmental conditions in the habitat. However, Bush warblers generally use Gleaning as the prey

attack manoeuvre method and exist 0-2.5m height range for efficient foraging. Finding of the present study warrants the future studies of *E. palliseri* and further studies need to be conducted to understand whether there is a relationship between seasonal variations of prey availability for *E. palliseri* and their foraging behaviours.

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