

Research Article

Wintering of Leaf Warblers (*Phylloscopus* Boie, 1826) in Gangajalghati: First Photographic Evidence of Four Species from Northern Bankura, West Bengal, India

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ABSTRACT

Leaf warblers are small insectivorous passerine birds that belong to the genus *Phylloscopus* (Boie, 1826) and exhibit great similarity in plumage and morphology. These songbirds have been reported with the maximum diversity in the eastern Himalayas and southern China. No comprehensive studies with photographic evidence on *Phylloscopus* have been conducted so far in the Southern parts of West Bengal, including Bankura district in India. Three types of habitats of Gangajalghati village in Bankura district were surveyed during winter for 8 months between November 2015 and February 2017 and bird counts were recorded and photographed. A total of 49 individuals from four species of *Phylloscopus* were recorded. The most abundant species recorded in the study was the dusky warbler (*Phylloscopus fuscatus*, Blyth, 1842) followed by greenish warbler (*Phylloscopus trochiloides*, Sundevall, 1837), common chiffchaff (*Phylloscopus collybita*, Vieillot, 1817) and Hume's leaf warbler (*Phylloscopus humei*, Brooks, 1878). Further, the prey abundance of leaf warblers (lepidopteran caterpillar and other arthropods) were determined in the early winter session (first week of November and December). The study recorded maximum bird abundance and species richness in the wetland associated habitats with higher prey abundance followed by barren land and agriculture field. The work documented the visit of dusky and greenish warblers to Bankura for the first time in the past 40 years and recorded the wintering of common chiffchaff and Hume's leaf warblers as the first evidence from the district.

Keywords: Bankura, Gangajalghati, *Phylloscopus*, Prey abundance, West Bengal, Wetland, Wintering

Introduction

Leaf warblers are small insectivorous passerine birds that belong to the genus *Phylloscopus* (Boie, 1826), family Phylloscopidae and order Passeriformes [1]. These Old World leaf warblers exhibit great similarity in plumage and morphology, making it very difficult to observe and identify these accurately in the wild [2-3]. They have been observed throughout the Old World, from Europe, Australasia, and Africa, with the maximum diversity in the eastern Himalayas and southern China, where up to 16 species may occur along with altitudinal gradients and at least 20 species in the Qinling mountains in north-central China [1-2]. These canopy-dwelling songbirds are adapted

to a wide range of ecosystems in Asia and in some localities of the western Himalayas they might comprise up to 40% of the bird population [4].

The total number of recognised species under the genus *Phylloscopus* has increased significantly in the past three decades, with a total of 77–78 species at present and the majority of these species are found in Asia [1,3]. Both migratory and resident populations of classic leaf warblers have been reported worldwide with more migratory populations from northerly breeding species and more resident or short distance migrants from southern breeders [1, 5, 6].

A large number of studies have reported these

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migratory birds in almost all the states of India including Jammu & Kashmir, Himachal Pradesh, Madhya Pradesh, Andhra Pradesh, Bihar [7]; Uttarakhnad [8]; Assam [9]; Karnataka [10]; Maharashtra [11] and others [7, 12, 13, 14] during their winter visit. A number of studies have also reported the occurrence of these songbirds in different parts of West Bengal [7, 12, 15, 16, 17]. However, no comprehensive studies with photographic evidence on *Phylloscopus* have been conducted so far in the Southern parts of West Bengal, including Bankura district. The present study provides first photographic evidence of regular wintering of four species of *Phylloscopus* (Boie, 1826) in the Gangajalghati village of Bankura district.

Material and Methods

Study area

The present observations were made in the Gangajalghati village (23°25'12.0" N 87°07'12.0" E) under Gangajalghati community development block in the northern part of Bankura District, West Bengal, India (Figure 1). The area is encircled by a number of landforms including a Sal forest on the North, Damodar River (18 km) on the North and Northeast, Koro hill (400 feet, 5 km) and Sali River (5 km) on the South, Sali Reservoir or Gangdua Dam (4 km) on the Southwest and Susunia hill (1,470 feet, 18 km) on the West. The region belongs to a sub topical climate characterized by high temperatures during summer and low temperatures during winter, with

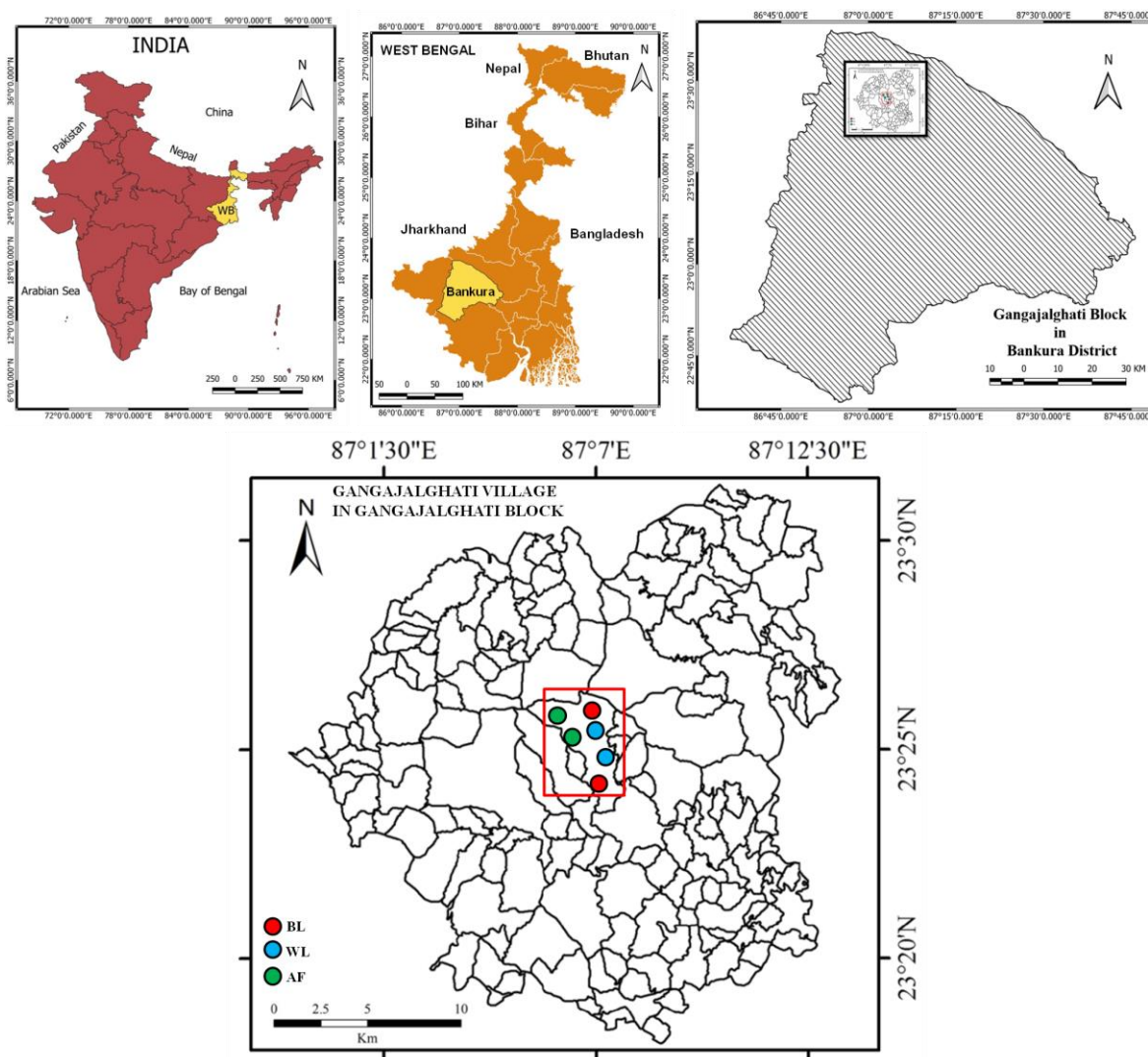


Figure 1. Geographical location of the study area: Gangajalghati village in Gangajalghati block of Bankura district, West Bengal, India. (Map data: India and West Bengal from [18] with permission from the publisher; Bankura district was generated using QGIS and modified using Gangajalghati Block map; Gangajalghati Block modified after [19])



Figure 2. Habitat types surveyed in Gangajalghati Village. (Notes: a. Barren land, b & c. Wetland with scrub vegetation and d. Agriculture Field)

an annual average rainfall in the district being 1350 mm [19]. The soils in the study area has been described as loamy skeletal mixed Typic Ustorthents (38.1%), fine loamy mixed hyperthermic Ultic Paleustlafs (26.4%) and fine loamy mixed hyperthermic Typic Haplaquepts (14%). The monsoon season (June to September) experiences about 80% of the total rainfall [19]. Birds were observed in the following habitat types (Figure 2).

Barren land

Unused agricultural lands characterize these with brushes and grass cover interspersed with *Acacia* sp, *Argemone mexicana*, *Azadirachta indica*, *Bambusa* sp, *Borassus flabellifer*, *Calotropis gigantea*, *Datura* sp, *Justicia adhatoda*, *Opuntia* spp, *Clerodendrum infortunatum*, *Phoenix sylvestris* e.t.c. trees.

Wetland with scrub vegetation

These are characterized by man-made and natural water bodies with distinct vegetation assemblages dominated by *Aegle marmelos*, *Azadirachta indica*, *Bambusa* sp, *Borassus flabellifer*, *Carica papaya*, *Cocos nucifera*, *Datura* sp, *Gmelina arborea*, *Haldina cordifolia*, *Justicia*

adhatoda, *Moringa oleifera*, *Musa paradisiaca*, *Phoenix sylvestris*, *Psidium guajava*, *Tabernaemontana divaricata*, *Tamarindus indica*, and *Terminalia arjuna*.

Agriculture field

These habitats are areas used for cultivating crops such as rice, mustard crops and some common vegetables (bottle gourd, brinjal, cabbage, carrot, cauliflower, potato, onion, radish, tomato). Besides crop plants, these lands are also colonized by a number of shrubs and weedy plants.

Bird surveys and identification

The above-mentioned habitats of Gangajalghati village were surveyed during winter for 8 months between November 2015 and February 2017. The total survey period was divided into two seasons (November 2015 to February 2016 and November 2016 to February 2017) to focus on these migratory birds. Bird counts were carried out within six squares (250 × 250 m) where two such square areas represented each type of habitat. Bird observations were conducted three times per month between 7:00 to 9:00 AM and 3:00–5:00 PM devoting 20 minutes in each square each ses-



Figure 3. Leaf warblers (*Phylloscopus* Boie, 1826) documented in the study area. a. common chiffchaff (*Phylloscopus collybita*, Vieillot, 1817), b. dusky warbler (*Phylloscopus fuscatus*, Blyth, 1842), c. Hume's leaf warbler (*Phylloscopus humei*, Brooks, 1878) and d. greenish warbler (*Phylloscopus trochiloides*, Sundevall, 1837)

sion. Bird counts were recorded and photographed using a Canon EOS 1200D DSLR Camera with a 55–250 mm lens and a Sony DSC-H400 compact camera with 63× Optical Zoom to support further identification. During adverse weather conditions like fog, prolonged precipitation, or strong winds, no surveys were conducted. Birds were identified based on physical features with the help of field guides and reference books [20–21] as well as with the assistance of The British Trust for Ornithology.

Estimation of Prey Abundance

In order to investigate the prey abundance of leaf warblers in three different habitats, the mean abundance of lepidopteran caterpillar and other arthropods were determined in the early winter session (first week of November and December). In this study, caterpillar numbers were recorded by surveying 180 trees, 30 trees per site. It was done by striking the live branches of the tree and shrub layers and counting the numbers falling on a white plastic sheet below. Further, the caterpillar colonies on the tree trunk were photographed and counted. For determination of other arthropod abundance, light trapping was done using a high power (30-Watt) LED lamp. A total of 12 night surveys, two in each study site, were conducted. The total number of all arthropods was recorded.

The survey data were analysed with Microsoft Office Excel, 2010. None of the species was captured or killed during the entire period of the study.

Results and Discussion

A total of 49 individuals from four species of *Phylloscopus* (Boie, 1826) were recorded in all the habitats (Figure 3). The most abundant species recorded in the study was the dusky warbler (*Phylloscopus fuscatus*, Blyth, 1842) followed by greenish warbler (*Phylloscopus trochiloides*, Sundevall, 1837), common chiffchaff (*Phylloscopus collybita*, Vieillot, 1817) and Hume's leaf warbler (*Phylloscopus humei*, Brooks, 1878) (Figure 4). Maximum species richness and mean bird abundance was recorded from the wetland associated habitats with scrub vegetation followed by barren land and agriculture field (Figure 5A).

These observations are in accordance with previous studies, which showed that some of these species (e.g. *Phylloscopus collybita tristis* Blyth 1843) prefer to visit marshy as well as scrubland with thorny shrubs especially reeds and sedges growing in water, groves of babul (*Acacia* spp.), ber (*Zizyphus* spp.) and Tarmarisk near about water [12]. The plants on which the birds were recorded most frequently are *Datura* sp. *Justicia adhatoda*, *Moringa oleifera*, *Psidium guajava* and

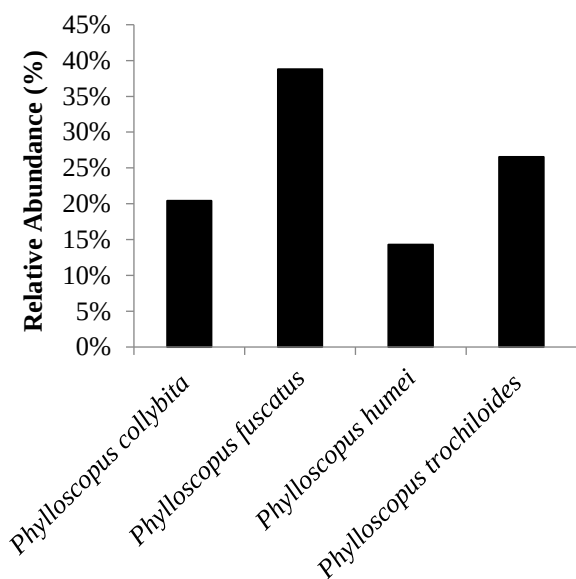


Figure 4. A relative abundance histogram for all four species of *Phylloscopus* observed in the present study

Tabernaemontana divaricata located near the pond-side with human habitation.

All these birds have been documented during the winter months from November to February and none were found in the other months of the year either by systematic or opportunistic screening approaches. The winter migration period recorded in this study are consistent with previous studies on leaf warblers in West Bengal [7]. The results of the prey abundance study from three habitat types demonstrated that wetland associated habitats were the most prey abundant sites followed by barren land and agriculture field (Figure 5A). These results might explain the similar individual abundance pattern in those three habitat types (Figure 5B). A number of previous studies have shown that lepidopterous larvae and other invertebrates especially arthropods constitute the bulk of the diet of migrant warbler populations [22-24]. Further, high abundance (data not shown) of chironomid larvae in the ponds of these wetland habitats might contribute to the understanding of frequent visit of all four leaf warbler species to this type of habitat. Previous studies have reported that chironomid larvae may constitute a significant part of the warbler diet including the wintering Common Chiffchaff [25-27].

Leaf warblers have body feathers of green or yellow-green color and have been observed to move frequently in the upper and middle layers of the canopy [3]. It is very difficult to determine the

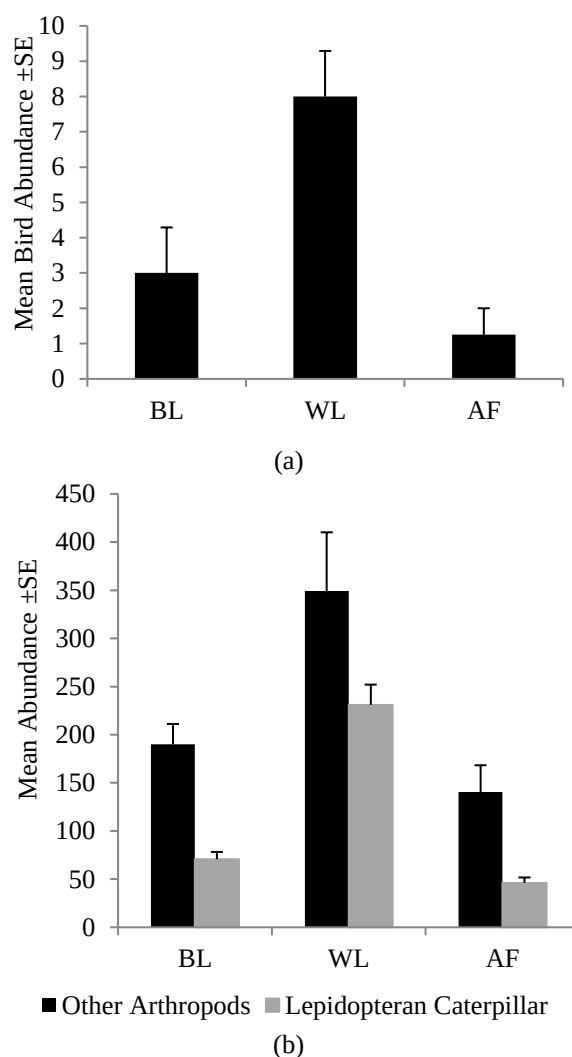


Figure 5. (A) Mean bird (*Phylloscopus*) abundance per habitat type recorded in the study area. (B) Mean prey abundance (lepidopteran caterpillar and other arthropods) per habitat type in early winter (first week of November and December of 2015 and 2016). Error bars ± 1 standard error (SE). Total number of plants sampled: 180, 30 plants per habitat. BL: Barren land, WL: Wetland with scrub vegetation, AF: Agriculture Field.

precise diversity of these song birds due to having a large number of cryptic species in the genus *Phylloscopus*, exhibiting morphologically similar or identical natural populations [28]. Modern methods such as molecular genetics and song spectrogram analysis both are needed for their accurate identification and classification [3, 29]. However, being astonishingly species-rich, the genus has remained a focus of evolutionary studies to better understand ecological and evolutionary

traits in the leaf warbler assemblage [30]. Although wintering of some these species (e.g. *P. trochiloides*) have been studied in many parts of North and South India, no such comprehensive work has been done so far about the migratory route of leaf warblers in West Bengal [13]. A number of previous studies have recognized South Bengal districts as the distribution points for these four species of *Phylloscopus* [2, 21]. Prior to this study, only two species of leaf warblers (*P. trochiloides*, Sundevall, 1837 and *P. fuscatus*, Blyth, 1842) have so far been reported from Bankura district by the work of Zoological Survey of India on specimen collected in the year 1979 and 1982 respectively [7]. The present study and the results of the previous study by Majumdar et al. 1992 [7] also establish that these warblers are visiting the district over the past four decades. However, to date, there is no substantive evidence on wintering of *P. collybita*, Vieillot, 1817 and *P. humei*, Brooks, 1878 from any part of the Bankura district.

The present study documented highest bird abundance and species richness in the wetland associated habitats with most prey abundance. Previous studies have shown that there is a strong association between arthropod biomass and warbler abundance and food resources constitute a strong stimulus for warblers wintering [31]. Further works have revealed a close similarity between the timing of emergence of lepidopterous larvae and the seasonal timing of bird migration [22]. The study recorded highest caterpillar abundance in *M. oleifera*, a very common tree of the wetland habitats with human habitation in the study area. The plant has previously been reported to serve as a multipurpose Indian vegetable and host of several arthropod pests including many lepidopterous larvae in the winter season [32-33]. The light-trapping detected a number of adult moths, including *Noorda blitealis* Walker, 1859, *Eupterote molifera* Walker, 1865, *Helicoverpa armigera* Hübner, 1808 that affect *M. oleifera* and their larvae feed voraciously on leaves and other plant parts.

Conclusion

In conclusion, the present study reports for the first time, Gangajalghati block of Bankura district as wintering ground of these beautiful song birds. Further studies are warranted to investigate the complete migratory route of these birds in Bankura and other South Bengal districts.

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