

**NESTING ECOLOGY OF SOME URBAN PASSERINE BIRDS AND THEIR
RELiance ON ANTHROPOGENIC STRUCTURE AT JAHANGIRNAGAR
UNIVERSITY CAMPUS**

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Abstract: A comprehensive study was conducted to examine the nesting ecology of avian species and their reliance on anthropogenic materials within an urban setting. This investigation took place from December 2023 to June 2024 at Jahangirnagar University, Savar, Dhaka, Bangladesh. The research documented 53 nests from 12 distinct species across 9 families, in 14 tree species. The study area was systematically divided into six transects, and exploration was carried out opportunistically within these regions. The peak number of nests was recorded in June, with the lowest observed in January. Of all nests observed, 47 were located in natural habitats, while the remaining nests were situated in artificial habitats. Out of the total nests, 46 were occupied by birds, with the rest remaining unoccupied. Breeding success was confirmed in 26 of the occupied nests. Notably, 30.19% of the nests incorporated anthropogenic waste as part of their nesting materials. Five different nest structures were identified among the samples, constructed by various avian species. The materials used in six nests were categorized, revealing the frequent utilization of grass, sun grass, small tree branches, feathers, leaves, and bamboo leaves. The nests demonstrated a range of concealment levels from 0% to 100%, with an average concealment rate of 35.91%. This research illuminates the diverse nesting ecology of urban birds and their escalating dependence on human-made materials, highlighting their adaptability as well as the potential challenges faced within urban environments.

Key words: Urban bird, Anthropogenic waste, Plastic pollution, Urbanization, Nesting pattern.

Introduction

Avian species are vital for ecological health and serve as bioindicators of environmental change (Ma *et al.* 2023). The class Aves, comprising approximately 11,195 species, plays a crucial role in ecosystem stability, the economy, and culture (Birdlife International, 2025). Except for a few specialist birds, most of the birds build nests during their breeding season. Bird nest

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DOI: construction is essential for reproduction, egg protection, and the creation of suitable conditions for embryonic development and chick rearing (Jahan *et al.*, 2018; Reynolds, 2019). Nesting sites and architecture vary among species and reflect environmental adaptations. Common urban nesting sites include trees, building crevices, electrical infrastructure, and machinery like air conditioners (Jahan *et al.* 2018). Nesting challenges from urban issues such as habitat loss, pollution, and biodiversity decline threaten bird populations, especially in rapidly urbanizing countries like Bangladesh (Bhatta, 2023).

Rapid urban expansion significantly alters landscapes and drives environmental degradation through pollution and surface runoff, threatening biodiversity (Grimm *et al.* 2008; Forman, 2014). It affects wildlife behavior, physiology, and evolution (Szulkin *et al.* 2020). Over half the world's population lives in cities, projected to rise to 66% by 2050 (Reynolds *et al.* 2019). Bangladesh, densely populated, has seen rapid urbanization, with about 50% living in urban centers by 2030 (Zaman, 2010; Lipi, 2021). Urban areas differ vastly from natural habitats, with less vegetation, more human activity, altered predator-prey relationships, pollution, and higher temperatures (Bailey *et al.* 2022; Ma *et al.* 2023).

Globally, one of the most pressing concerns is plastic pollution, which presents escalating risks to both wildlife and human populations (Beaumont *et al.* 2019). In global context, an estimated three million tons of waste are generated daily—a figure projected to double by 2025, culminating in over two billion tons of annual waste (Kaza and Yao, 2018). Plastic waste is particularly problematic due to its non-biodegradable nature and tendency to fragment into microplastics, thereby contributing to widespread and persistent environmental contamination (Ter Halle *et al.* 2016). This form of pollution poses a significant threat to biodiversity and interacts synergistically with other global stressors, including climate change, habitat modification, and invasive species (UNEP, 2014; Malizia and Monmany-Garzia, 2019).

The purpose of the research is to investigate the nesting ecology of urban birds species that are known to adapt well in urban areas. The study will further focus on identifying the presence of human-made waste, especially plastics, in the nests of birds.

MATERIAL AND METHODS

Study area: Jahangirnagar University campus (JUC) (90.259–90.273°E, 23.867–23.898°N) is located 32 km North-West of Dhaka, covering 280 ha (Figure 1). Once a Sal forest, it now includes secondary vegetation, wetlands, grasslands, scrub, farmland, and settlements (Mohsanin and Khan 2009). The iron-rich soil and gentle topography support diverse habitats for birds. Temperatures range from 33.9°C (April) to 13.7°C (January), humidity 72–90%,

and annual rainfall ~1,800 mm (Department of Geography and Department of Environmental Science, Jahangirnagar University). The campus hosts 917 vascular plant species (574 genera, 145 families) (Khan et al. 2021) and 180 bird species (15 orders, 43 families): 26 very common, 58 common, 34 uncommon, 62 rare; 74 breeding residents, 45 non-breeding residents, 61 migrants (Mohsanin & Khan 2009). The university accommodates 15,000–20,000 students, 800 teachers, and 3,000 staff in 21 dormitories and 70+ structures (www.juniv.edu), along with many shops. The university lacks a proper waste management system at the moment and relies on informal disposal methods.

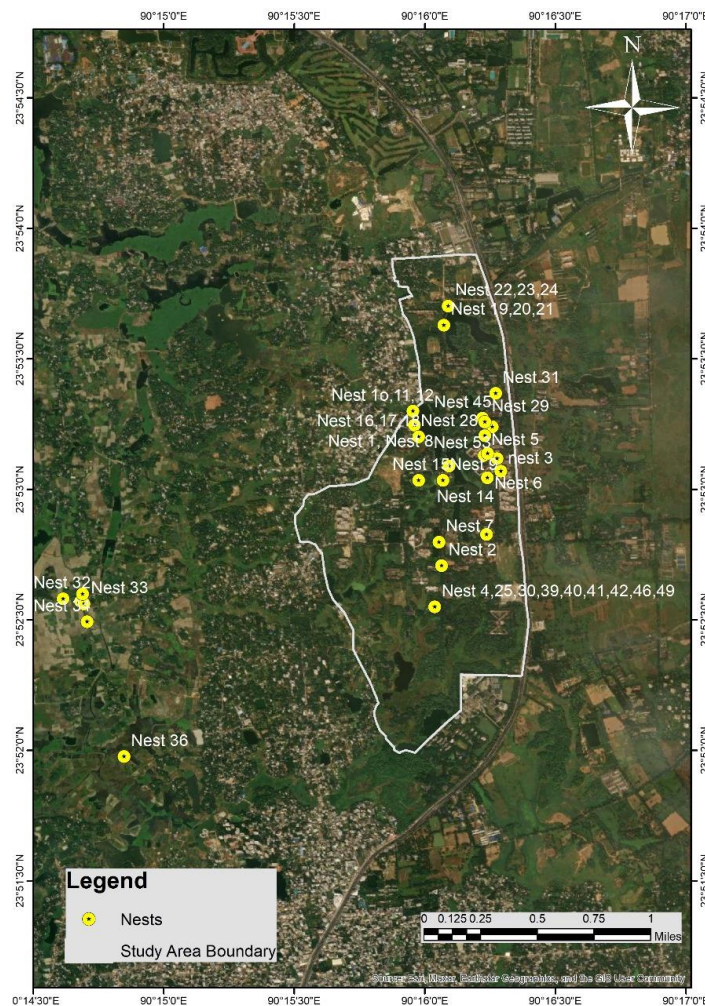


Fig. 1. Spatial distribution of recorded nests within the study area.

Data collection: A line transect method was used, with six transects laid out after a preliminary field examination that included an initial assessment of nesting zones and habitat characteristics to ensure adequate coverage, as well as additional suitable nesting habitat sites were explored opportunistically. The length of each transect was from 1.0 to 1.5 km, and the effective width of transects was 40 m (20 m on each side). The surveys were carried out three times a week in the morning and late afternoon when the species were most likely to be seen, and repeated visits along a transect provided temporal representation, taking 1.5–2.5 hours to complete. When nests were found, GPS coordinates were plotted, habitat type, nesting tree, tree height, nest height from ground, position of the nest within the tree, degree of concealment and distances from anthropogenic structures and from nearby roads were recorded. No nests were disturbed in order to identify their nest materials, and nest materials were identified only after the breeding season. The data collected were analyzed in the GIS to evaluate spatial distribution. The following parameters were recorded:

Nest site & nesting tree selection: Nests were found by observing birds carrying nesting materials or food for nestlings and listening for alarm calls, or contact calls with nestlings or mates. Additionally, we actively searched the shrubs, bushes, and trees in the study area for nest identification. The nesting tree was identified by a pictorial guide of plants or in consultation with a plant taxonomist in special cases.

Tree height, nest height, distance of nest from the nearest road & anthropogenic structure: A graded bamboo stick was used to measure tree height and nest height from the ground. Sometimes, a measuring tape was used to determine the nest height. The distance of the nest from the nearest road and nearest anthropogenic structure was measured using a measuring tape or a handheld GPS device.

Nesting materials: Nests were collected after the completion of breeding season or nests were damaged due to natural calamities. Then the nests were taken to the wildlife laboratory of Zoology Department, JU and dissected to identify the materials used in nest construction.

Nest concealment: To evaluate the concealment level of bird nests, observations were conducted from ground level at four cardinal directions (front, back, left, and right) around each nest. Each observation point was positioned at a 90° interval, forming a complete 360° view around the nest. From each of these four positions, the nest was visually assessed to determine the extent to which the nest is concealed within a 90° field of view. For standardization, a maximum of 25% concealment was recorded from each direction, depending on how well the nest is hidden by vegetation, structures, or other environmental

features. The concealment score from all four directions was summed to yield a total nest concealment score, with 100% representing full concealment from all angles.

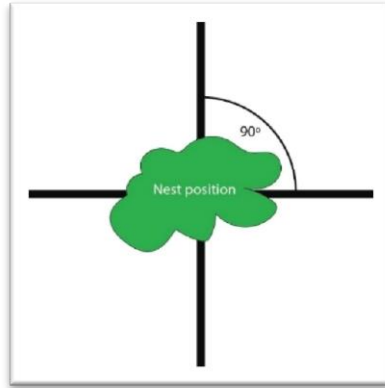


Fig. 2. Determination of nest concealment

RESULT AND DISCUSSION

A total of 53 nests from 12 species across 9 families were observed in the study area. The Common Myna (*Acridotheres tristis*) had the highest number of nests (22 nests), followed by the Jungle Myna (*Acridotheres fuscus*) (n=6) and the Scaly-breasted Munia (*Lonchura punctulata*) (n= 6). The majority of observed nests were located in the Teak tree (*Tectona grandis*) (n=7). Other bird species were frequently observed constructing nests in the following plant species: Mysore trumpet vine (*Thunbergia mysorensis*), Garden croton (*Codiaeum variegatum*), Mahogany (*Swietenia mahogany*), Ipil Ipil (*Leucaena leucocephala*), Raintree (*Samanea saman*), Burflower (*Neolamarckia cadamba*), Ficus (*Ficus benghalensis*), Royal Poinciana (*Delonix regia*), Jungle geranium (*Ixora coccinea*), Syzygium (*Syzygium sp.*), Jackfruit (*Artocarpus heterophyllus*), Acacia (*Acacia sp.*), and Debdaru (*Polyalthia longifolium*). As well as nests were also found in building crevices.

Nesting materials: Six nests were collected and dissected to identify the nesting materials. The study recorded nests built with natural materials (grass, leaves, branches) and anthropogenic wastes (polythene, plastic, paper). Similarly, earlier studies also reported the use of both natural (grass, twigs, straw) and human-derived materials (plastic, nets, hair) (Davis 2003; Jahan *et al.* 2018). The incorporation of anthropogenic materials (30.19%) in the present study is consistent with global patterns of urban-adapted birds. For instance, a large-scale study documented the use of solid waste in nearly 35,000 nests across 176 bird species, suggesting that such behavior is widespread and increasing wi

Table 3: Substrates used for nesting

Nesting Tree	No. of nests	Mean tree height (m) ± 0.1	Mean nest height (m) ± 0.1	Mean Distance from Anthropogenic Structure (m) ± 0.1	Mean Distance from nearest Road (m) ± 0.1	Observed Bird Species
Mysore trumpet vine (<i>Thunbergia mysorensis</i>)	2	2.3	2.1	0.5	3.2	Spotted Dove (<i>Streptopelia chinensis</i>) (n=2)
Garden croton (<i>Codiaeum variegatum</i>)	6	2.0	1.5	4.2	2.4	Spotted Dove (<i>Streptopelia chinensis</i>) (n=1) Scaly-breasted Munia (<i>Lonchura punctulata</i>) (n=5)
Mahogany (<i>Swietenia mahagoni</i>)	3	9.4	6.4	2.3	5	Black Drongo (<i>Dicrurus macrocerus</i>) (n=1) Long-tailed Shrike (<i>Lanius schachii</i>) (n=1) Common Myna (<i>Acridotheres tristis</i>) (n=1)
Ipil ipil (<i>Leucaena leucocephala</i>)	3	9.2	6.9	1.6	2.1	Common Myna (<i>Acridotheres tristis</i>) (n=2) Lineated Barbet (<i>Psilopogon lineatus</i>)

Raintree (<i>Samanea saman</i>)	5	9.8	6.3	4.4	2.1	(n=1) Jungle Myna (<i>Acridotheres fuscus</i>) (n=2) Common Myna (<i>Acridotheres tristis</i>) (n=3)
Burflower (<i>Neolamarckia cadamba</i>)	2	6.0	2.9	0.5	1.9	Asian Pied Starling (<i>Gracupica contra</i>) (n=1)
Teak (<i>Tectona grandis</i>)	7	10.6	7.2	0.3	1.5	Common Myna (<i>Acridotheres tristis</i>) (n=7)
Ficus (<i>Ficus sp.</i>)	4	12.8	7.3	0.3	1.5	Common Myna (<i>Acridotheres tristis</i>) (n=2) Long- tailed Shrike (<i>Lanius schachii</i>) (n=1) Common Tailorbird (<i>Orthotomus sutorius</i>) (n=1)
Royal poinciana (<i>Delonix regia</i>)	2	8.3	6.4	0.3	1.5	Common Myna (<i>Acridotheres tristis</i>) (n=1) Asian Pied Starling (<i>Gracupica contra</i>) (n=1)

		(<i>Ninox</i> <i>scutulata</i>) (n=1)
Unknown	6	Common
(found		Myna
fallen in		(<i>Acridotheres</i>
semi-		<i>tristis</i>) (n=2)
plantatio		Jungle Myna
n areas		(<i>Acridotheres</i>
without		<i>fuscus</i>) (n=3)
human-		Unidentified
made		(n=2)
structure		
s were		
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d natural		
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urbanization (Jagiello et al., 2019; O'Hanlon et al., 2021). Another study conducted in England demonstrated that birds occupying urban areas or human-dominated areas are adapted to frequently use anthropogenic waste as their nesting materials (Evans *et al.*, 2011). The relatively moderate proportion (30.19%) observed in this study, compared to higher values reported in highly urbanized regions, may reflect the semi-urban nature of the study area, where both natural and artificial materials are readily available. Birds may selectively use anthropogenic materials due to their durability, insulation properties, or availability, although these materials can also pose risks such as entanglement or reduced nest success (Townsend and Barker, 2014).

Nesting habitat selection: Two types of nesting habitat were observed in trees (considered natural nesting habitats) and in various spaces of buildings or artificial structures, such as building walls, building crevices, and intersections of building walls (considered artificial nesting habitats). Most of the nests were recorded in natural sites (n=47), while only six nests were found in artificial habitats. Three nests of Common Myna (*Acridotheres tristis*) and one nest of Jungle myna (*Acridotheres fuscus*), Spotted owlet (*Athene brama*) and Brown hawk owl (*Ninox scutulata*) were in artificial site. However, the use of artificial structures by species indicates behavioral flexibility and adaptation to human-modified environments.

This pattern aligns with previous findings that urban-tolerant species often exploit artificial structures as alternative nesting sites when natural habitats are limited (Jahan et al., 2018; Mainwaring, 2015). The relatively low use of artificial habitats in this study compared to highly urbanized cities may indicate that sufficient natural nesting substrates are still available in the study area, reducing dependency on built structures.

Nesting phenology: The number of observed nests varied by month, with the highest count was occurred in June (22 nests) and the lowest was in January (1 nest) (Table 2). This suggests that food availability or other factors essential for successful breeding peak in late May or early June, prompting these species to build their nests during that season for breeding. The timing of nesting in June is a peak, implying that nesting is synchronized with the availability of resources on the breeding season, such as food abundance and favorable climatic conditions. Bird breeding is frequently related to rainfall in tropical and subtropical areas and of insects (Ali and Ripley, 1983) which are believed to rise in late spring and early monsoon seasons. The different peak nesting months reported by (Jahan et al., 2018) (April) and those recorded here (May) may be due to inter-annual climatic variation, sampling intensity or changes in resource availability. This temporal change is indicative of the breeding phenology plasticity caused by environmental cues.

Table 2: Nesting phenology of observed bird species in relation to month of the year

Bird Species Nesting month	Dec 2023	Jan 2024	Feb 2024	March 2024	April 2024	May 2024	June 2024
Spotted Dove							
Common Myna							
Jungle Myna							
Asian Pied Starling							
Long-tailed Shrike							
Scaly Breasted Munia							
Spotted Owlet							
Brown Hawk Owl							
White-breasted Waterhen							
Common Tailorbird							
Black Drongo							
Lineated Barbet							
Unidentified 1							
Unidentified 2							

Nest occupancy and fate of the nest: Of the 53 nests, 49% were successful, while 15% failed and 36% had unknown outcomes. The moderate breeding success observed may be influenced by multiple ecological factors, including predation pressure, habitat disturbance, and nest site characteristics. Studies have shown that nests located closer to anthropogenic structures may experience either reduced predation (due to predator avoidance) or increased disturbance, depending on the context (Rodewald et al., 2011).

The relatively high proportion of unknown nest outcomes (36%) represents a limitation and may have influenced the accuracy of success estimates. Future studies incorporating continuous monitoring (e.g., camera traps) could provide more precise estimates of nesting success and causes of failure.

Nest structure: From the 53 observed nests, five different types of nests were found: hole nest, shallow cup nest, deep cup nest, dome-shaped nest, and hanging nest.

Table 4: Different types of nests of different bird species

Nest types	Species
Hole nest	Common myna (<i>Acridotheres tristis</i>), Jungle myna (<i>Acridotheres fuscus</i>), Spotted owlet (<i>Athene brama</i>), Brown hawk owl (<i>Ninox scutulata</i>), Lineated barbet
Shallow-cup nest	Spotted dove (<i>Streptopelia chinensis</i>), Common myna (<i>Acridotheres tristis</i>), White-breasted waterhen (<i>Amaurornis phoenicurus</i>)
Deep-cup nest	Long-tailed shrike (<i>Lanius schachii</i>), Black drongo (<i>Dicrurus macrocercus</i>)
Dome-shaped nest	Scaly-breasted munia (<i>Lonchura punctulata</i>), Asian pied starling (<i>Gracupica contra</i>)
Hanging nest	Common tailorbird (<i>Orthotomus sutorius</i>)

Presence of anthropogenic materials in the nest

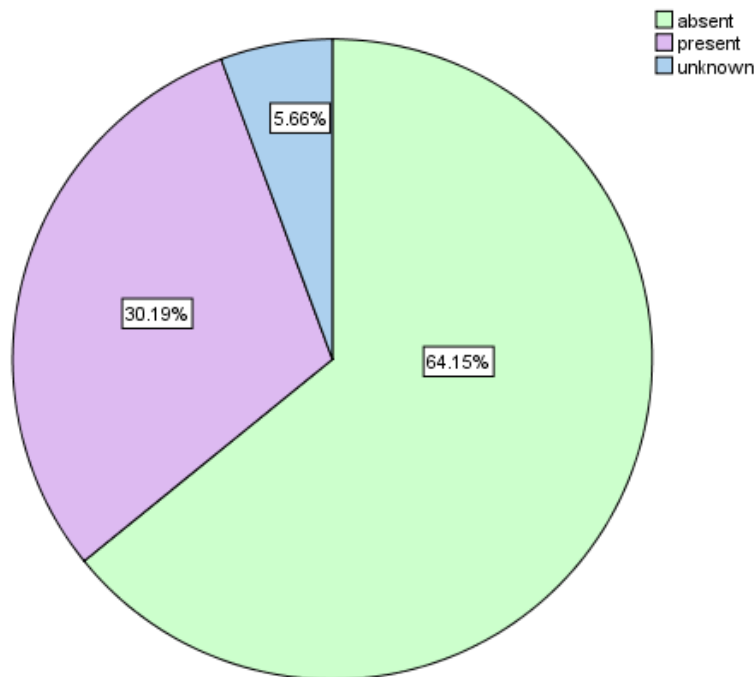


Fig. 4: Percentage of presence or absence of anthropogenic wastes in the observed nests

Nest concealment: The mean nest concealment score (35.91%) indicates a generally low to moderate level of concealment across all nests. This variation likely reflects species-specific nesting strategies and trade-offs between visibility, predator avoidance, and environmental conditions. For example, cavity-nesting species (e.g., mynas and owls) exhibited higher concealment (up to 90%), which is consistent with studies showing that enclosed nests reduce predation risk (Li and Martin, 1991). In contrast, open nests in trees showed a wide range of concealment (0–100%), suggesting that some species rely more on camouflage or strategic placement rather than complete concealment. The relatively low average concealment may indicate either reduced predator pressure in the study area or adaptive trade-offs where increased visibility allows better parental vigilance (Götmark et al., 1995).

CONCLUSION

The study highlights how birds adapt to urbanization by using anthropogenic waste for nesting, though this reliance poses conservation challenges. Urban areas, while different from natural ecosystems, offer resources that birds exploit, but long-term dependence on waste raises concerns. Pollution, habitat loss, and climate change demand urgent conservation measures, including habitat restoration, improved waste management, and bird-friendly urban design. Preserving urban biodiversity is crucial for both avian survival and the health of urban ecosystems.

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