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Nesting Resource Partitioning of Four Species (*Acridotheres tristis*, *Acridotheres ginginianus, Sturnia pagodarum* and *Gracupica contra)* of Sturnidae Family in Peri-Urban Region of Ajmer City, Rajasthan, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

Aims: The study aims to study the resource partitioning and nesting behaviour in four species namely Common Myna, Bank Myna, Brahminy Starling, and Asian Pied Starling nesting in human settlements.

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Place and Duration of Study: The study was conducted from January 2022 to July 2023 in peri-urban areas of Ajmer city, Rajasthan, India.
Methodology: Using observations and point-count transects, we examined the nesting preferences, heights, and materials used by these species.
Results: The findings reveal that all four species demonstrated a remarkable adaptability to urban environments by selecting man-made structures as their preferred nesting sites. Common Mynas, in particular, displayed a preference for a variety of human constructions, such as buildings and building cracks, and utilized materials like twigs, straws, plastic, paper, and cotton.
Conclusion: This study highlights the importance of considering wildlife adaptation in urban planning and conservation efforts, as these birds thrive in human-altered landscapes. The nesting behaviors and adaptation of these Sturnidae species in urban environments reveal their ability to coexist with human development. Understanding these interactions is crucial for both avian ecology and urban planning, as it sheds light on the intricate relationships between wildlife and changing landscapes.

Keywords: Sturnidae; nesting biology; Ajmer; anthropogenic influence.

1. INTRODUCTION

Ornithologists and birdwatchers have studied and documented many aspects of nesting biology for a wide range of bird species, including: Formation of pairs, Breeding Displays, Copulation, Nest site selection, Building and Maintenance of nests, Incubation, Fledgling survival and growth, Parent-Offspring behaviour, Nest Re-use, and Population dynamics [1]. Nesting season is a vulnerable time for birds since their eggs and young are almost defenceless against predators, yet parent birds may go to great efforts to safeguard nests and young via defensive, or evasive, behaviour and meticulous nest site selection in secure or concealed locations. It is also an energetically difficult and sensitive stage, since parents provide the nestlings, return to the same spot several times, and spend a significant amount of time incubating eggs and feeding young. During this critical nesting season, when birdwatchers and researchers examine birds to investigate and document their nesting ecology or behaviour, the presence of human observers and their techniques of observation may impact birds in a variety of ways. Human observer-related disruptions may jeopardise the accuracy of study findings or the wellbeing of the birds involved, according to scientific and ethical considerations [2]. Field research or disturbances caused by human observers, such as ecotourists and birdwatchers, may cause changes in nesting habitat, nest site availability and safety, increase exposure and stress, compromise chick and adult survival, cause nest desertion, or modify predator behaviour and predation rates, all of which may affect nesting birds in negative, neutral, or even positive ways [3]. Individual bird reproductive biology (e.g., nest location, brood size, and to produce offspring) can be impacted by a number of proximal factors, including, social structure [4], population density [5], availability of food [6], predator pressure [7], habitat alteration [8] due to environmental fluctuations [9], logging [10], and environmental pollution [11].

Mynas and starlings are passerine birds of the Sturnidae family [12]. These birds are sociable and may be found in open terrain, woodland areas, and agricultural grounds. They are primarily omnivorous, preferring to consume insects, fruits, cereals, and so on. They are typically monogamous and reproduce between March and September [13]. Nest site selection is thought to be an important component in bird species' reproductive success. Birds are more likely to select nest locations that protect their nests from predators and provide a larger food supply [14]. Sturnid species' selection of varied nesting places, including human settlements, demonstrates their excellent tolerance to urbanisation [15].

For this study following four species of sturnidae family were selected:

1) **Common Myna** (*Acridotheres tristis*)**:** A starling family member and one of the most common birds in India [16]. its nest may also be found in walls near air conditioners, water drainpipes, open-ended steel rafters, narrow ledges, traffic signals, palm and other structure [17]. It mostly nests in human dwellings and their nearby surroundings. The nest is often comprised of twigs, grass, straw, and feathers, with the addition of paper on occasion.

2) **Bank Myna (***Acridotheres ginginianus*)**:** This species is found throughout the Indian subcontinent, from Bangladesh, Bhutan, and Nepal to India and Pakistan [18]. It may be spotted foraging for insects and leftover food in its natural habitat [19]. Bank Myna is commonly seen with Common Myna, but has a somewhat smaller and softer voice than Common Myna. They mainly make nests in tree holes and in man-made environments such as buildings, bridges, and tunnels.

3) **Brahminy Starling (***Sturnia pagodarum*)**:** The Indian subcontinent is home to the Brahminy Starling. It lives in open broadleaf woodland, gardens, second growth, and agriculture [20,21]. Its breeding range extends into north-eastern Afghanistan [22].

4) **Asian Pied Starling** *(Gracupica contra)***:** This species is an important biocontrol agent [23]. It is an insectivorous bird that plays a significant role in pest management in agricultural areas by scooping up a large number of insect larvae from the ground [24]. This species is mostly found in Indian subcontinent plains, Southeast Asia, and foothills up to 700 m above sea level. Damp grazing meadows, pond and tank banks, sewage farms, municipal trash damps, flooded fields, and riverine belts are among its favoured feeding places [25].

2. MATERIALS AND METHODS

The study of nesting patterns and behaviour was conducted at Peri-Urban areas of Ajmer city [26], due to the fact that it is one of the city's most rapidly sprawling areas without planned urban development. Dominated by scrub vegetation and modest anthropogenic activity [27]. From January 2022 to July 2023, observations were carried out three times each week, and each transect was meticulously examined throughout data collection. Nesting activity observations included the number of nests, kind of nests, structures chosen for nest construction, nesting material used, and nesting environment. At urban-openland, urban-shrubland, and urban-cropland ecotones, we set up point-count transects to monitor the birds, nests, and nesting sites in peri-urban areas. We used Ravi-altimeter to estimate the height of structures and nests.

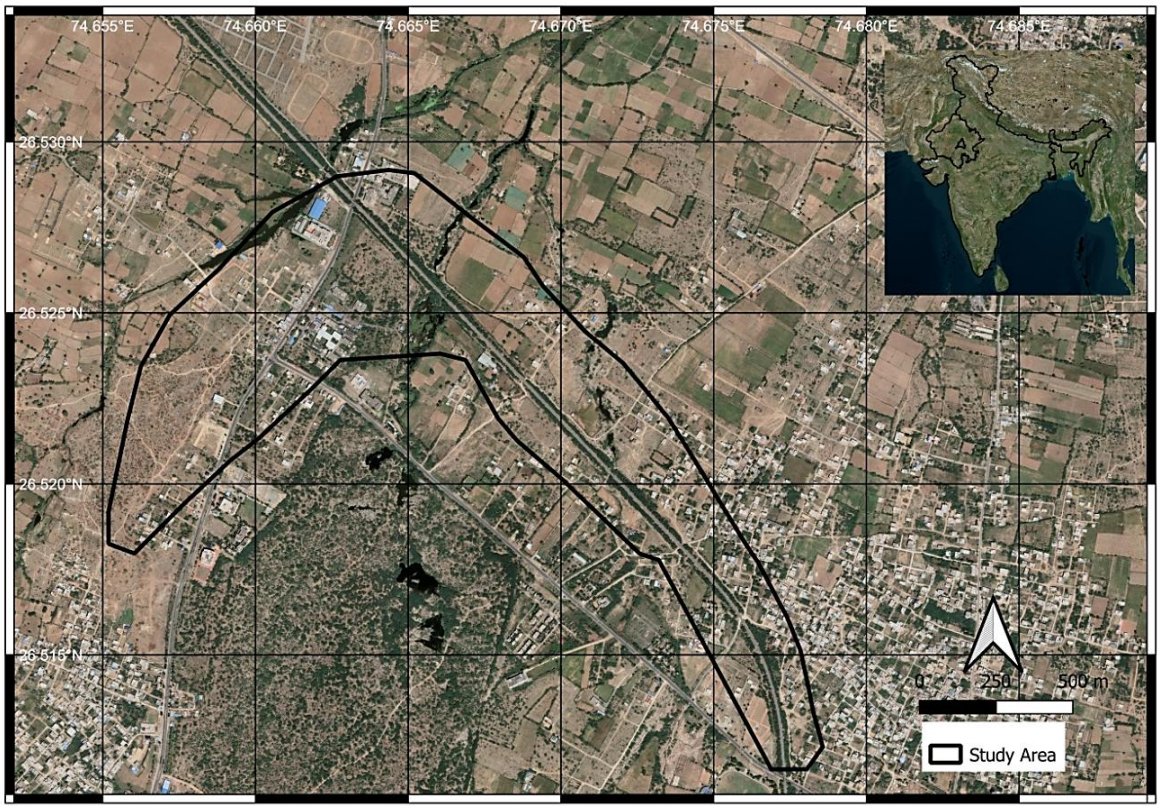

Fig. 1. Study area highlighting the peri-urban habitat used for nesting by selected birds

3. RESULTS AND DISCUSSION

During the nesting season all the four members of sturnidae family *A. tristis, A.giginianus, G. contra* and *Sturnia pagodarum* were observed to be monogamous and territorial. The birds' exclusively defended nesting places during the breeding season and choose various nesting locations. A total of 163, 201, 129 and 116 nests of Common Myna, Bank Myna, Asian Pied Starling and Brahminy Starling were observed respectively. Nests were generally built in buildings, rooftops, pipe tunnels in bridges, electric poles, trees and electric street lights. Observations indicates that the nesting habitats of the four separate species differed; Common myna nested in cracks of buildings and dwellings, whereas Bank myna nested in pipe tunnels of bridges. The Asian pied starling nested on power poles, building a large nest out of diverse nesting materials such as garments, long strands of plastic, dried grasses, dry straws, and so on. The Brahminy Starling was observed nesting in electric street lights and tree cervices using various sorts of nesting material such as dried leaves, long thread, soft twigs, and so on. During the study period, the Asian pied starling was primarily active and involved in nesting activity in the early hours, while the nest was being built. They were frequently spotted with sticks in their jaws, flying from agricultural areas to nests and back. Both parents shared the nesting efforts in the four species. The height of the nest for each individual was discovered to be varied. In compared to other members, common myna was found to be nesting the most. Distance from food and water resources was important in nest site selection for all four members of the sturnidae family. Eggs for all members were discovered to be shiny blue in colour with no markings. Males conducted head bobbing displays to their mates and fluffing of feathers in cases when Asian Pied Starling courting display began prior to nest site selection. When the mating season arrived, a pair chose a nesting structure and placed wheat straws on the available supporting materials. The bank Myna is a social bird that stays in flocks even during the mating season; it makes its nest on the walls of bridges or in holes that the bird excavates for itself, always near water. Its colony growth is frequently constrained by the availability of holes in man-made constructions like as bridges.

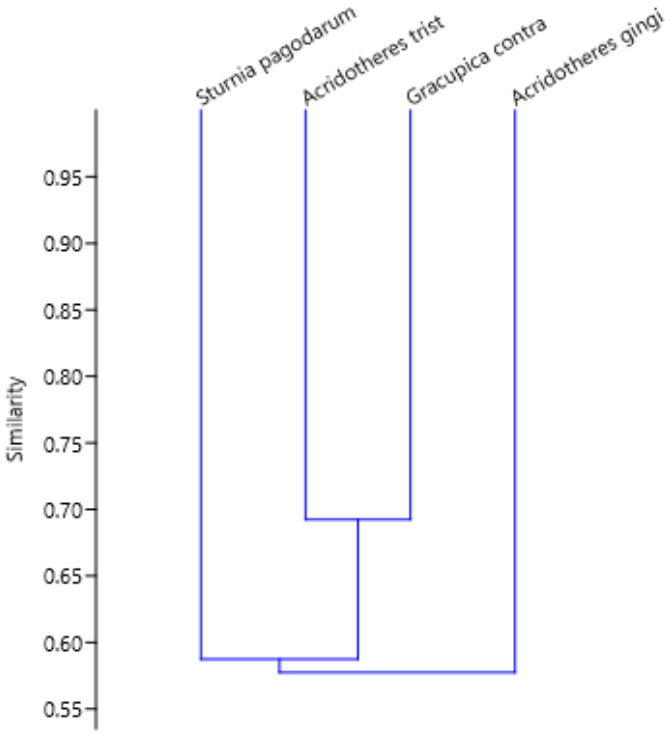

Fig. 2. Similarity between nesting of species based on various traits

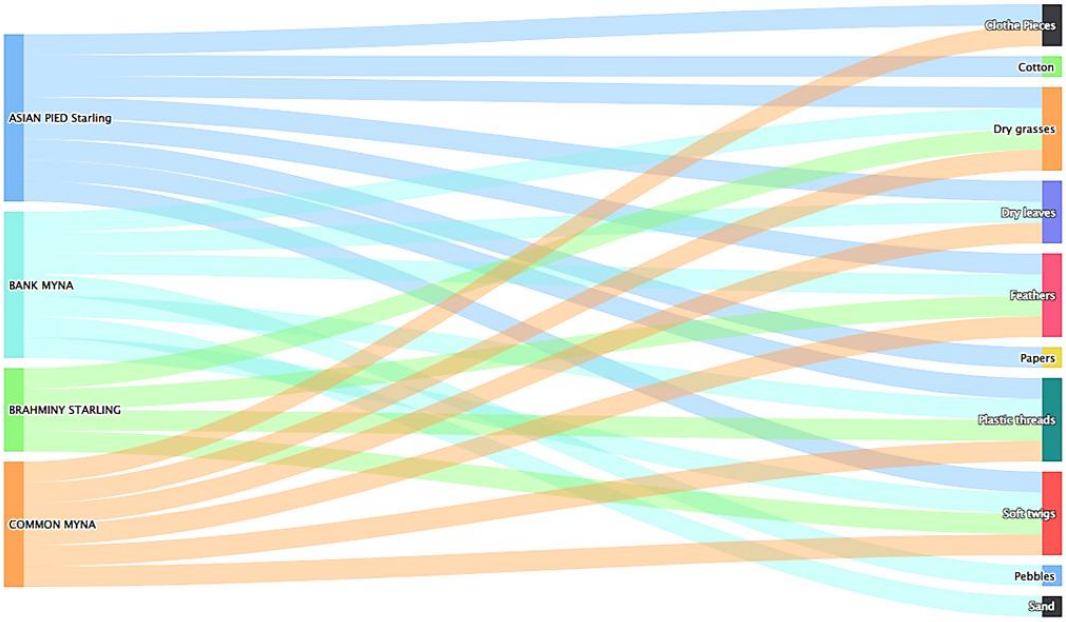

Fig. 3. Nesting material used by observed species

Table 1. Summarized observations on Nesting material, Range of nest height and mean values

Common Name	Scientific Name	Nesting Material	Height range of Nest	Mean Nest Height ± Standard Daviation
Common Myna	*Acridotheres tristis*	Cloth Pieces, Dry Grass, Dry Leaves, Feathers, Plastic Threads, Soft Twigs	2m -20m	8±5.3
Bank Myna	*Acridotheres ginginianus*	Dry Grass, Dry Leaves, Feathers, Plastic Threads, Soft Twigs, Pebbles, Sand	4m-12m	6.92±3.5
Asian Pied Starling	*Gracupica contra*	Cloth Pieces, Cotton, Dry Grass, Dry Leaves, Feathers, Paper, Plastic Threads, Soft Twigs	8-11m	10.5±1.1
Brahminy Starling	*Sturnia pagodarum*	Dry Grass, Feathers, Plastic Threads, Soft Twigs	1.5m-15m	6.52±5.6

4. CONCLUSION

The findings of this study reveal intriguing insights into the nesting behaviors of four species within the Sturnidae family in relation to urbanization. These species exhibit a remarkable adaptability to urban environments, opting for man-made structures as their preferred nesting sites.

Nesting Preferences and Material Selection: The study emphasize the preference of the four Sturnidae species for man-made structures as nesting sites. Notably, the Common Myna (*Acridotheres tristis*) exhibited a predilection for nesting on various human constructions such as buildings, eaves of homes, and building cracks. The nesting materials utilized by this species include twigs, straws, long strands of plastic, papers, and cotton. These materials serve a dual purpose, offering both structural stability and comfort for incubating eggs and nurturing chicks. The careful selection of materials aligns with the avian instinct to provide a suitable environment for successful reproduction.

Nesting Heights and Structural Variation: The observed nesting heights vary among the studied species, showcasing distinct ecological adaptations. Common Mynas were documented nesting at heights ranging from 2m to 20m, indicating their versatility in utilizing a wide range

of vertical spaces. Bank Mynas (*Acridotheres ginginianus*), on the other hand, were primarily found nesting in pipe tunnels of bridges and walls, with nesting heights spanning 0.5m to 7m. The nesting height of the Asian Pied Starling (*Gracupica contra*) was predominantly 11m, with a preference for electric poles. Brahminy Starlings (*Sturnia pagodarum*) displayed an interesting nesting behavior by utilizing artificial nests, electric lights, and power poles. The variation in nesting heights reflects the species' ecological niche and adaptation to specific urban structures.

Nesting Material Composition and Functionality: The diversity of nesting materials employed by the species highlights their resourcefulness and adaptation to urban waste. The nests of Asian Pied Starlings were constructed from a diverse array of materials, including straws, plastic strands, twigs, clothing, feathers, cotton, and dry leaves. This diverse selection of materials contributes to nest robustness and insulation, essential for safeguarding eggs and nestlings from environmental stresses. Similarly, Brahminy Starlings employed straws, twigs, papers, and feathers in nest construction, showcasing a pragmatic selection of materials for both structural integrity and insulation.

Ecological Implications and Urban Adaptation: The overarching trend of all studied species favoring man-made structures for nesting underscores their adaptability to urbanization. This adaptation might be attributed to the availability of sheltered spaces, as well as the accessibility to anthropogenic materials that can be repurposed for nesting. The study's location being conducive to the nesting behaviors of the Sturnidae family implies that urban environments offer suitable conditions for their reproduction. The findings provide valuable insights into the ways in which these avian species thrive amidst urbanization, shedding light on the intricate interactions between wildlife and human-altered landscapes.

The research findings explain the nesting behaviors of four Sturnidae species in urban environments. The species' selection of nesting sites, materials, and heights is a testament to their adaptability and resourcefulness in the face of urbanization. The study contributes to our understanding of avian ecology within changing landscapes and underscores the importance of considering wildlife adaptation in urban planning and conservation efforts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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