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A Study on the Nesting Site Preference and Adaptability of House Sparrow to Various Locations in the Rural, Suburban and Urban Gradients

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Abstract

House sparrow is one of the most familiar species that has a strong association with human habitation. The incidence of house sparrow is often considered as an indicator of sustainable ecosystem. This study aimed at identifying the preference in natural nesting site locations of house sparrows in the rural, suburban and urban gradients and recognizing their adaptability across various gradients. The study area chosen was Madurai district, which is one of the oldest inhabited city in India, with rural, suburban and urban habitats. The study was conducted from January 2019 to September 2021, in 205 random sites, adopting line transect method. The nesting sites were digitally documented and analyzed. Among the 205 sites, 164 sites were rural, 19 were suburban and 22 were urban gradient. The presence of nests were observed in 169 places, of which 80.4% were in rural, 94.7% in suburban and 86.3% in urban gradients. The identified nesting site locations were categorized into nine types. In rural gradient, 53% preferred nesting in houses, 11% in wells, 10% in schools and shops, 9% in community buildings, 7% in temples, 6% in Highway bridges, 3% on trees and 1% on climbers. In the suburban habitat, houses were the most preferred (64%) location, followed by the shops and schools (20%). In urban gradient, houses were preferred by 61% of the species, followed by shops and school buildings with 14% and 9% occupying the pipe holes in bridges. In the urban gradient, due to the non-availability of old houses, the house sparrows were found to occupy the pipe holes in the highway bridges, which enumerates the behavioral plasticity of house sparrow in urban environment. Further study on the nesting characteristics might determine the influence of location type in the nesting success of house sparrow.

Key words: *House sparrow; Madurai District*; *Nesting adaptability*; *Passer domesticus*; *Tamilnadu; India*

1. Introduction

Climatic change and urbanization are considered to be the major threats for the survival of most birds, including house sparrow. Urbanization has a great impact on the distribution and population status of house sparrow, by influencing their habitat, food availability, predator diversity, disease outbreaks, competitors, etc [1, 2]. The urban ecosystem differs from the natural ecosystem in terms of food resources, climate, pollution and predation. The replacement of natural habitat with exotic species often leads to species extinction and biotic

homogenization, which might cause a threat to biodiversity. Moreover, urbanization directly affects birds by impeding in the arthropod abundance, which is the primary source of food for birds during reproductive stages [3]. Habitat loss and fragmentation caused by urbanization, made the birds to migrate to more suitable habitats or adapt to new conditions[2]. Several studies report that urbanization also affects the nesting behavior of birds. Hence, it becomes necessary to extensively evaluate the effects of urbanization on the nesting behavior of house sparrow. This study aims at identifying the nesting adaptability of house sparrow in the rural, suburban and urban gradients and comparing the different location types preferred by the species or nesting in the above mentioned gradients with respect to their occurrence.

2. Materials and methods

2.1. Study area

Madurai is one of the oldest inhabited cities of India, which is a well-known destination of the pilgrims and the tourists. The geographical location of Madurai is 9 °56 ' N and 78 °07 ' E with an area covering 10, 88,622 sq.km with an average elevation of 101 m (**Figure 1**). Madurai lies on the plains of river Vaigai with tropical climate, receiving rainfall from the northeast monsoon during October – December. The vegetation of Madurai includes paddy, millet, pulses, sugarcane, fruits and vegetables. The study area, Madurai district comprises of 13 blocks viz. Madurai East, Madurai West, Thirupparankundram, Melur, Kottampatti, Vadipatti, Alanganallur, Usilampatti, Chellampatti, T.Kallupatti, Sedapatti, Thirumangalam and Kallikudi (**Figure 1a**) covering 420 Village Panchayats. The 205 randomly selected study sites in the 13 blocks of the Madurai district has been represented in Google map (**Figure 1b**).

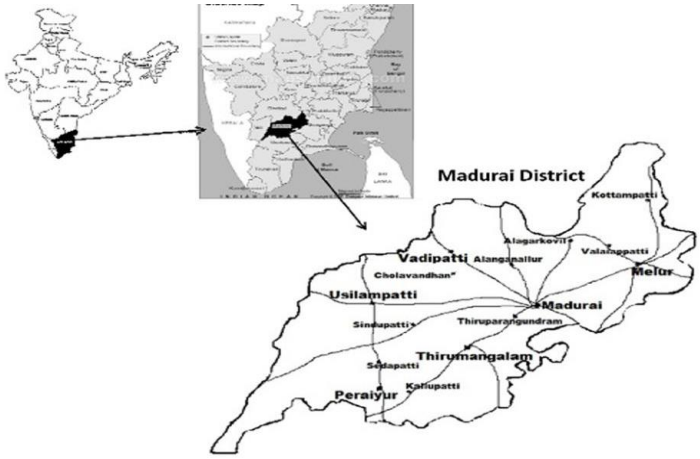

Figure 1a The study area representing the blockwise division of Madurai District

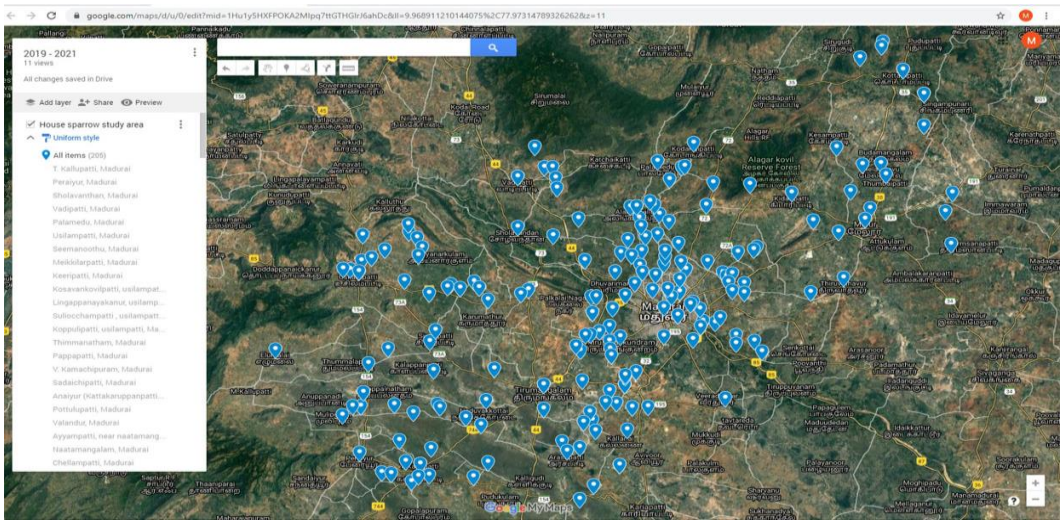

Figure 1b Randomly selected study sites in the 13 blocks of the Madurai district

2.2. Data collection

Field study was conducted from January 2019 to September 2021, in 205 random sites in Madurai district comprising of rural, suburban and urban places. The nesting sites were observed based on the line transect method, wherein a fixed transect approximately 500m long and 10m wide was chosen such that each transect covered the majority of the study area. Nest observations were done in the morning from 08:00 h to 04:00 h (IST) at regular interval. The study area was carefully observed and documented for the presence of feeding grounds and other social activities of the sparrow. The nesting sites were documented through photographs and videos using Nikon p900 Camera featured with GPS.

3. Results and Discussion

Distribution and availability of nesting sites is considered to be a major factor influencing the abundance of house sparrow population in an environment[4]. Of the 205 random study sites in Madurai district, 164 were categorized as rural, 19 places as suburban and 22 places as urban based on its habitat characteristics. Among the 205 study sites, the presence of nests and nesting behavior was observed in 169 places, of which 80.4% (132/164) nesting sites were found in the rural gradient, 94.7% (18/19) in suburban and 86.3% (19/22) in urban gradients. Based on the observation, the nesting site locations were categorized into nine types as houses, shops/school buildings, temples, community building, unused chimneys/electricity posts/street light frames, wells, bridges, trees and climbers. Places like houses, shops, schools were reported to show a positive correlation with the presence of sparrow nests, as they provided adequate food and nesting sites, food for both adults and nestlings, roosting and foraging grounds[1,2]. House sparrows are also known to build nests in pre-existing cavities[2] like crevices in wells and pipe holes in bridges. Other nesting sites include electric pipelines, ventilation holes, electricity meters[5]. Though, Passerines are reported to be evolutionarily conservative in their nesting behavior, they also adapt and exploit the urban resources well[6]. They further increase their geographic range by exploiting the anthropogenic changes in their habitat[2]. House sparrows show high degree of behavioral plasticity, wherein they are capable of identifying and utilizing unfamiliar resources available in the various habitats (rural, suburban and urban) for nest construction[7]. The presence of house sparrow in human dominated habitats reflects their commensal relationship with humans[3]. Depending on the habitat, the nest material was also found to vary, which includes grass, straw, jute threads, leaves, weeds, paper strips, feathers, etc[6].

3.1. Preference of nesting site location of house sparrow in rural gradient

During the study period, a total of 540 nests of house sparrows were recorded in the 132 sites in rural habitat. The different nesting site locations preferred by house sparrow in the rural gradient is represented in Figure 2. Around 53% of the species are found to prefer nesting on houses, 11% in the walls and crevices of wells, 10% in schools and shops, 9% in community buildings, 7% in temples, 6% on the open holes found in Highway bridges, 3% on trees and 1% on climbers (**Figure 2**). The house sparrow in rural habitat did not prefer unused chimneys/electricity posts or street light frames for nesting either due to the availability of other favorable nesting sites. In similar studies, house sparrow was reported to clearly prefer nesting in building roofs, eaves and walls of human-built structures[8,5] and uses other sites only when those in buildings are not available. Sheldon and Griffith[9] reported that 55.3% of nests were found in buildings, 30.1% under eaves or walls, 22.6% under roofing structures and 1.3% in chimneys and hollow posts. The socio-economic condition of people in rural areas favor the co-existence of house sparrows. Rural habitats are dominated by old buildings, conventional shops, open drainage system and open household waste dumps which provides lots of nesting space and food to sparrows[1]. Hence it was evident from the present study that house sparrows prefer houses for nesting than other resources in rural habitat. In the absence of preferable nesting sites, the sparrows were even found to utilize unconventional structures like the pipe holes found in highway bridges, which clearly stipulates the behavioral plasticity of house sparrows.

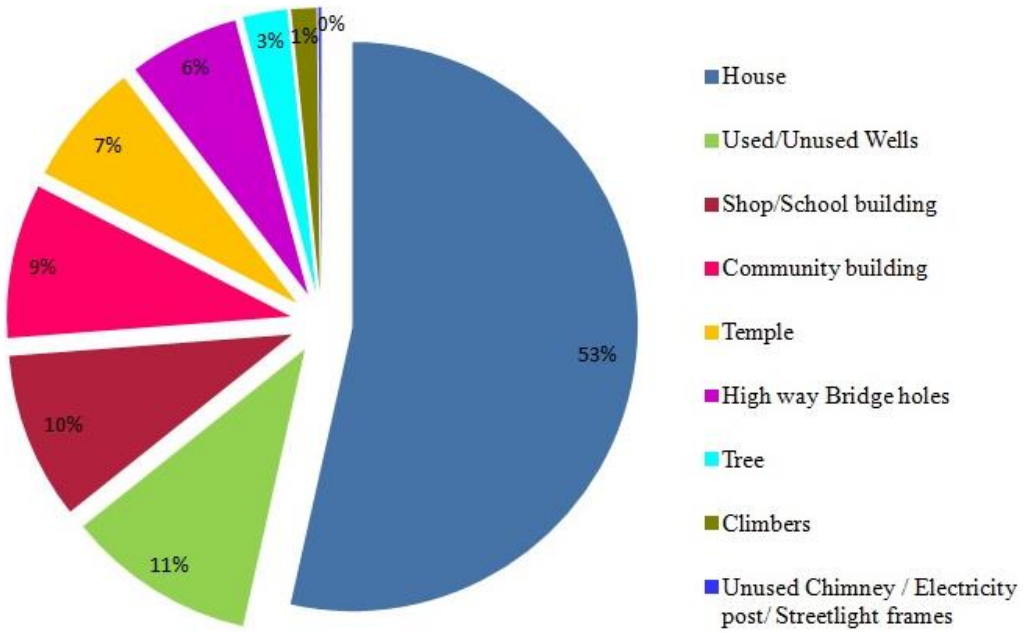

Figure 2 Preference of nesting site location (in percentage) of house sparrow in the rural gradient of Madurai District.

3.2. Preference of nesting site location of house sparrow in suburban gradient

Suburban gradient has been considered as 'habitat edges' or 'ecotones' due to the presence of vegetative complexity and diversified landscapes that supports population density[3]. Of the 18 suburban places surveyed in Madurai district, 48 house sparrow nests were recorded. As represented in **Figure 3**, houses are the most preferred (64%) location for nesting in the suburban habitat, followed by the shops and schools (20%). Only 4% of the population preferred nesting in temples and 2% in other nesting sites. The houses in the suburban habitat consisted of old thatched roof buildings and native buildings, which were reported to favor the nesting characteristics of house sparrow[10], hence 64% of the species preferred houses in suburban places as compared to the 53% occupancy in rural houses. In comparison to the rural gradient, the number of suburban sites studied were less, hence the nesting site preference of house sparrow towards other resources were less. Several studies have reported high rates of sparrow nests in suburban areas, wherein factors like availability of food and nesting grounds were favorable[2]. The maximum used habitat was reported to be suburban areas due to the presence of residential areas, old buildings, grocery shops, small eateries, and the open drainage system and open household waste dumps which play an important role in habitat selection[11]. Further detailed studies on the nest characteristics are required to determine the influence of site selection in the nesting success of house sparrow.

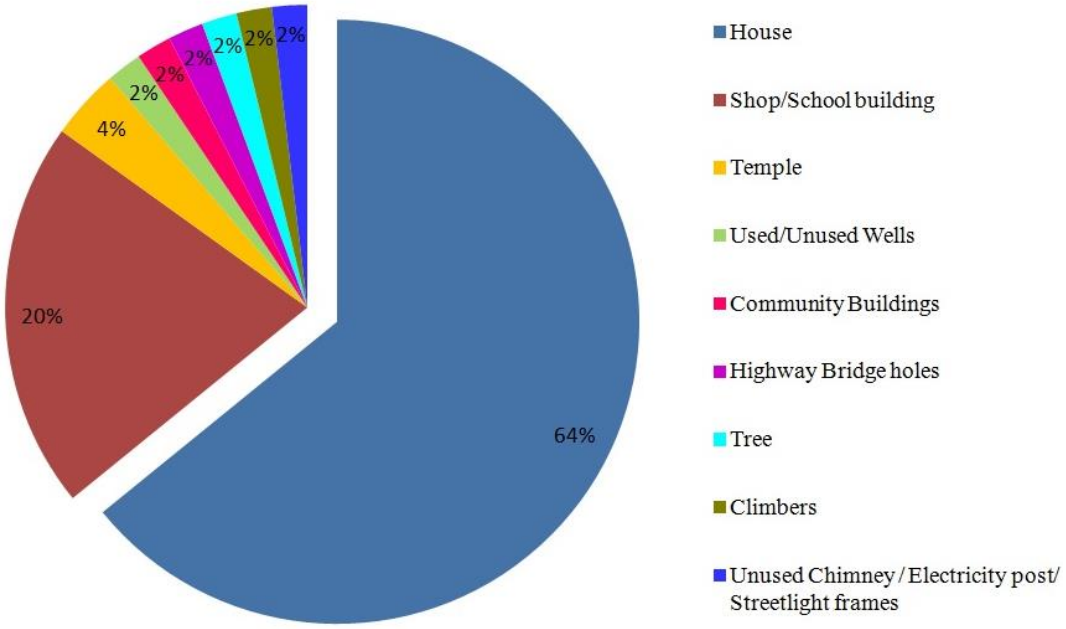

Figure 3 Preference of nesting site location (in percentage) of house sparrow in the suburban gradient of Madurai District.

3.3. Preference of nesting site location of house sparrow in urban gradient

Habitat quality influences the house sparrow population through the availability of food sources. In the present study, a total of 70 nests were located and identified in the urban gradient, which accounts for the availability of 86.3% of nesting sites. **Figure 4**, illustrates the preference of house sparrow towards different nesting locations in urban locality, wherein houses were preferred by 61% of the species, followed by shops and school buildings with 14%, 9% occupying the pipe holes in bridges, 5% in community buildings, 4% in trees, 3% in unused chimneys/electricity posts or street light frames, 2% in temples and 1% found in climbers and wells. In similar studies, Choudhary[11] has reported that house sparrows showed a strong preference for high-density urban areas to construct nests. Significant positive correlation was identified between the house sparrow density and human population[12] and between adult house sparrow pairs and the availability of buildings[13]. In urban gradient, the house sparrow distribution was reported to be patchy and dependent on the socio-economic status of the urban community[14]. Urbanization has motivated the sparrows to explore new substrates like AC^2 vents and shop shutters, which provide closed and protected space for nests. House sparrows have been reported to show high degree of behavioral plasticity[7], and adaptability to the anthropogenic modifications, which makes them successful urban birds.

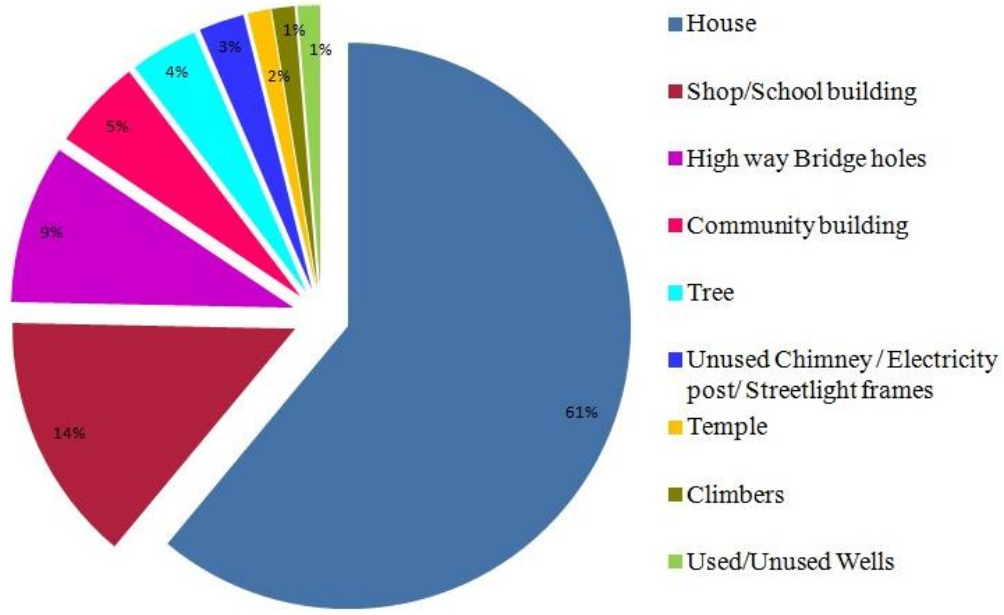

Figure 4 Preference of nesting site location (in percentage) of house sparrow in the urban gradient of Madurai District.

3.4. Comparison of nesting site locations preferred by house sparrow in rural, suburban and urban gradients.

The selection of suitable nesting site location is influenced by the availability of food and water, predation, competition and nest ectoparasites[2]. The location of nesting sites not only ensures the successful rearing of the clutch, but also the health of the parents and nestlings[11]. As represented in **Figure 5**, in all the three gradients, houses were identified as the most preferred nesting site location of house sparrows. In the non-availability of houses, the sparrows preferred various other locations to build their nests. The shops and school buildings were found to be second preferred location in the suburban and urban gradients, whereas in rural habitat, the wells were found to be the second preferred location. Similarly, residential areas[15] and grocery shops[16] were reported to have a positive effect on habitat selection by sparrows. The different locations of nesting sites studied showed the adaptability of house sparrow to anthropogenic conditions. In urban gradient, due to the non-availability of old houses, the house sparrows were found to occupy the pipe holes in the highway bridges, which enumerates the behavioral plasticity of house sparrow in urban environment. The identification of pipe holes in bridges as a nesting site location has not been mentioned previously. From this study, it was evident that house sparrow population tends to exploit anthropogenic changes for expanding their geographic range.

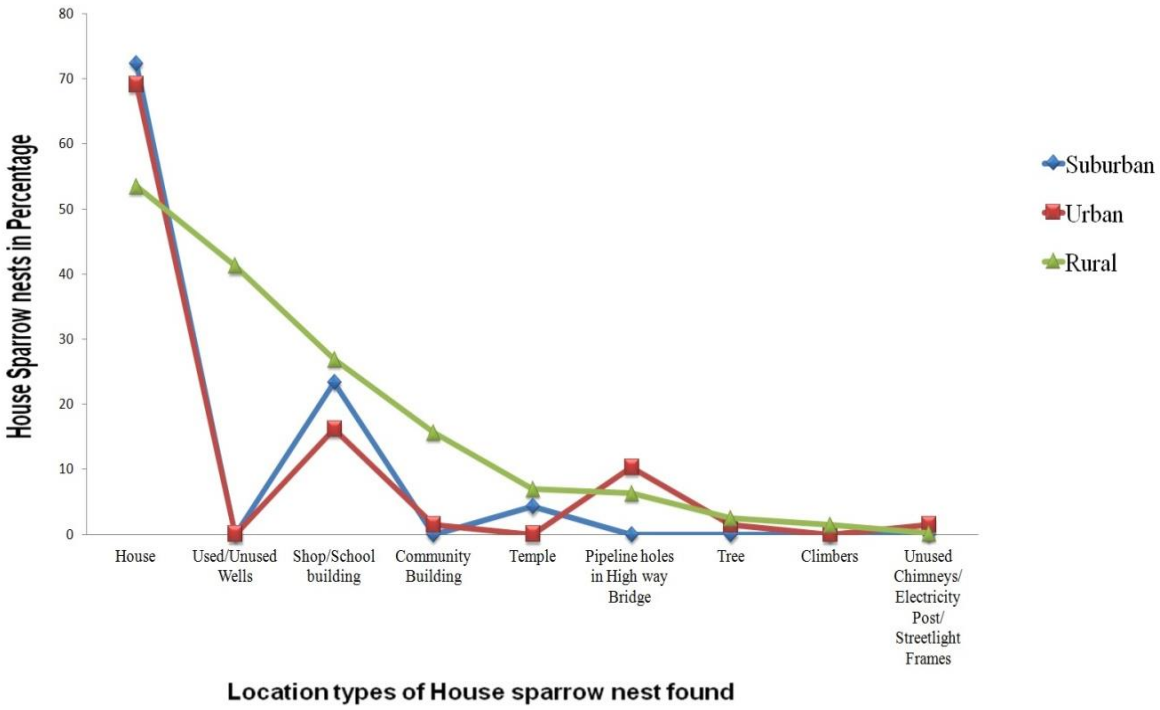

Figure 5 Comparison of nesting site locations preferred by house sparrow in rural, suburban and urban gradients of Madurai District.

In similar studies, Shaw[14] reported that house sparrows build nests in other places including nest boxes, when those in buildings were not available. Among the three gradients, house sparrows were found to strongly prefer suburban and high-density urban areas for nesting[2] due to the availability of food and nesting sites. In agreement with the present findings, Modak[17] has reported large number of sparrows from high-density urban areas and suburban areas. Also the abundance of house sparrow was found to be more in residential localities as compared to dense forest[18]. House sparrows have been constantly associated with humans since ancient times, though their abundance were reported to decline in recent times, their association with human habitation has not declined.

4. Conclusion

The availability of favorable nesting sites is one of the most important factors influencing the abundance of sparrow in an environment[4]. In recent times, the effects of urbanization on the existence of house sparrow has been highlighted. The availability of suitable nesting site has been considered as a major factor determining the sparrow population in an area. In this context, it becomes essential to identify the natural nesting site locations of house sparrow to monitor their distribution and diversity in various habitats. The present study has identified nine types of house sparrow nesting site locations, viz. houses, shops/school buildings, temples, community building, unused chimneys/electricity posts/street light frames, wells, bridges, trees and climbers. The preference of house sparrow towards to the various nesting site location differed with respect to the rural, suburban, and urban gradient. Among the nine types of nesting site locations, the houses were the most preferred location by house sparrows regardless of the gradient. In the absence of houses, the shops and school buildings were preferred in suburban and urban gradients, whereas wells were preferred in the rural habitat. In the urban and rural gradients, the pipe holes in highway bridges were identified as a new type of nesting site location favored by house sparrows, which clearly stipulates that house sparrows show flexibility and innovation in accommodating to anthropogenic changes. In comparison to the rural habitat, the occurrence of house sparrow nests were found to be more in the suburban and urban gradients, which enumerates the close association of house sparrows with human habitation. Further study on the nest-site characteristics of house sparrow could reveal the significance and limitations in choosing the nesting sites.

References

[1] Choudhary S, Chauhan NS, Kalsi R (2019) Seasonal habitat selection by house sparrows across the urbanization matrix in Delhi, India. Journal of Wildlife and Biodiversity 3 (4): 57-65.

[2] Choudhary S, Chauhan N, Kalsi R (2020) Finding clues in cities: nest site selection by house sparrows across a varied habitat matrix in Delhi, India. Current Science 118 (8): 1304.

[3] Menon M, Devi P, Mohanraj R (2013) Habitat variability and spatial assemblages of House Sparrows (Passer domesticus) along a gradient of urbanization. J Environ Sci, Toxicol Food Technol 4 (4): 1-11.

[4] Anderson TR.(2006) Biology of the ubiquitous house sparrow: from genes to populations. Oxford University Press.

[5] Hanson HE, Mathews NS, Hauber ME, Martin LB (2020) The house sparrow in the service of basic and applied biology. eLife 9 e52803. 10.7554/eLife.52803

[6] Rajashekar S, Venkatesha M (2008) Occurrence of house sparrow, Passer domesticus indicus in and around Bangalore. Current Science 94 (4): 446-449.

[7] Radhamany D, Das KSA, Azeez PA, Wen L, Sreekala LK (2016) Usage of nest materials by house sparrow (Passer domesticus) along an urban to rural gradient in Coimbatore, India. Tropical life sciences research 27 (2): 127.

[8] Balaji S (2014) Artificial nest box for house sparrow: An apt method to save the dwindling species in an urban environment. International Journal of Biodiversity and Conservation 6 (3): 194-198.

[9] Sheldon EL, Griffith SC (2017) A high incidence of non-cavity nesting in an introduced population of House Sparrows suggests that the species should not be constrained by cavity-nest site availability. Avian Research 8 (1): 1-8.

[10] Baskaran S, Rajesh P, Pavaraj M, Bakavathiappan G (2010) Occurrence of house sparrow Passer domesticus indicus L. Sivakasi, Virudhunagar District, Tamil Nadu, India Indian Journal of Natural Sciences 1 (3): 155-158.

[11] Choudhary S, Chauhan N, Kalsi R (2020) Impact of urbanization on seasonal population status and occupancy of house sparrows in Delhi, India. Current Science (00113891) 119 (10):

[12] Heij CJ, Moeliker CW (1990) Population dynamics of Dutch house sparrows in urban, suburban and rural habitats. Granivorous birds in the agricultural landscape 54 195-207.

[13] Bengtson S-A, Eliasen K, Jacobsen LM, Magnussen E (2010) Man-dependence of House Sparrows (Passer domesticus) in the Faroe Islands: habitat patch characteristics as determinants of presence and numbers. Dorete—Her Book: Being a Tribute to Dorete Bloch and to Faroese Nature

[14] Shaw LM, Chamberlain D, Evans M (2008) The House Sparrow Passer domesticus in urban areas: reviewing a possible link between post-decline distribution and human socioeconomic status. Journal of Ornithology 149 (3): 293-299.

[15] Chamberlain DE, Toms MP, Cleary-McHarg R, Banks AN (2007) House sparrow (Passer domesticus) habitat use in urbanized landscapes. Journal of Ornithology 148 (4): 453-462.

[16] Balakrishnan P, Jijeesh N, Kurikkal M, Maya T, Lijitha M, Bhaskar R, Vipeesh N (2011) Distribution, abundance and nest site characteristics of the House Sparrow Passer domesticus in Manjeri Municipality. Kerala Technical

[17] Modak BK. Impact of urbanization on House sparrow distribution: A case study from Greater Kolkata, India, p 21-27. In (ed), Springer,

[18] Dandapat A, Banerjee D, Chakraborty D (2010) The case of the Disappearing House Sparrow (Passer domesticus indicus). Veterinary World 3 (2): 97.

Appendix

Plate 1 Presence of House Sparrow nests in Houses

Plate 2 Presence of House Sparrow nests in used/unused wells

Plate 3 Presence of House Sparrow nests in shops / school building

Plate 4 Presence of House Sparrow nests in Community building

Plate 5 Presence of House Sparrow nests in Temple

Plate 6 Presence of House Sparrow nests in National Highways

Plate 7 Presence of House Sparrow nests in Trees

Plate 8 Presence of House Sparrow nests in Climbers

Plate 9 Presence of House Sparrow nests in Unused Chimney/Electricity ost/Street light frames