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STUDY ON THE CORRELATION BETWEEN NESTING SITE AVAILABILITY AND THE PREVALENCE OF HOUSE SPARROW IN MADURAI DISTRICT

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Author KR designed the study, performed the field study and statistical analysis and wrote the first draft of the manuscript. Author PMEM helped in the field visits and literature review. Author PR helped in designing the study, proof reading the manuscript and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Among all the wild birds, house sparrows are unique in their close association with humans. Sparrows have successfully adapted to the human habitation accustomed to the available food and nesting sites. Earlier studies have proposed an inconsistency in the sparrow population in various habitats during the last decade. To identify the reason for the fluctuation in number of sparrows, an intricate study is needed on the factors responsible for the presence of house sparrows in a habitat. Previous studies have proposed the importance of nesting sites in the distribution and diversity of house sparrows. In this context, the present study aims at finding the association of the availability of nesting sites with the incidence of the house sparrow in Madurai district in the state of Tamilnadu. The survey was conducted for a period of 3 months, from August 2020 - October 2020, in 205 randomly selected sites in all the 13 blocks of Madurai District using the line transect method. Among the 205 sites observed, the presence of house sparrow was confirmed in 170 sites. The possible nesting sites were digitally documented. A high incidence of house sparrows was observed in Madurai west (703) and Melur (658), while the least population density was noted in Kottampatti (150) and Vadipatti (147) blocks of Madurai district. Six nesting sites were commonly identified which include eaves of buildings, ventilation holes, unused holes in buildings, unused pipes, thatched roofs, and climbers/veins on the walls of buildings. Pearson correlation coefficient showed a positive correlation (R = 0.9) between the prevalence of house sparrows and the

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availability of various nesting sites. The eaves of the buildings and the ventilation holes were found to be the most preferred nesting sites. The uncommon nesting sites were pipes and climbers/veins. House sparrows exhibit a high degree of adaptability and plasticity in their nesting behaviour to achieve reproductive success.

Keywords: Correlation; habitat; Madurai district; *Passer domesticus*; nesting sites.

1. INTRODUCTION

The house sparrow (*Passer domesticus*) is a small, sexually dimorphic bird belonging to the family Passeridae. The species is one of the widely distributed birds in the world, represented by 12 different subspecies [1]. Hanson et al. [2] stated that house sparrows were found living and breeding in climatically extreme environments from deserts in southern California to cities above the Arctic Circle, where they were found almost entirely in propinquity to human habitation. House sparrows are auspiciously anthropodependent species; hence some populations have gone extinct locally devoid of human presence [3-5]. But in recent times, a drastic decline in house sparrow population was reported from countries all over the world. In India, a 70% decline in house sparrow population was reported by Dandapat [6].

House sparrows are sedentary birds that use permanent sites for nesting [7]. They also exhibit colonial nesting behaviour, due to their feeding habits and sedentary behaviour. House sparrows are monogamous and the pairs stay together for the entire season or even multiple years. The pairs also use the same nesting site for several years [8]. The sparrows tend to build their nests in pre-existing cavities, roofs, eaves, and walls of man-made structures [5,9]. Though house sparrows show a high degree of evolutionary conservatism, they also exhibit flexibility and innovation in constructing nests [5,8, 10 and 11]. In Asia, rocky cliffs have been identified as the common nesting site of house sparrows [8]. House sparrows were also found to nest in other birds' nests [5], hornets nests [12], excavated cavities in grounds and tree branches [13], hay bales [14], hanging clothes [15], moving machinery [16,17], and burrows [18]. As nesting sites are a key asset for population persistence and species conservation, the study aims at monitoring the population density of house sparrows in the 13 blocks of Madurai district and identifying the availability of nesting sites in those blocks, to understand the correlation between the availability of nesting sites and the occurrence of the house sparrow.

2. METHODOLOGY

2.1 Study Area

Madurai is one of the oldest inhabited places in Tamilnadu at ~10 N, 78 E, with an average elevation of 101 meters. The district is divided into 13 blocks viz. Madurai East, Madurai West, Thirupparankundram, Melur, Kottampatti, Vadipatti, Alanganallur, Usilampatti, Chellampatti, T.Kallupatti, Sedapatti, Thirumangalam and Kallikudi comprising of 420 Village Panchayats. The habitat of Madurai includes rural, suburban and urban gradients. The population survey of house sparrows was conducted in 205 random sites in the 13 blocks of Madurai District (Fig. 1-A,B,C, & Tab. 1). The study sites were chosen based on the previous knowledge regarding the availability of sparrows.

2.2 Data Collection

The field study was conducted from August 2020 – October 2020, for 3 months, covering 205 sites in the 13 blocks of Madurai district, adopting the line transect method. The occurrence of house sparrows was observed along the length of 500 m in each of the selected transects. The number of birds, droppings, and footprints within each transect was noted. The survey was done throughout the day (0800h to 1700h IST) in each of the selected transects depending upon the activity of sparrows. In each of the study sites, conspicuous sparrows were noted and the vicinity was explored for the presence of available nesting sites. The observed nesting sites were digitally documented.

2.3 Data Analysis

To understand the relation between the occurrence of the house sparrow and the availability of nesting sites, the data were subjected to Pearson correlation, which is a measure of linear correlation between two variables. Pearson correlation coefficient *R* indicates a positive correlation when the *R-value* is +1 and a negative correlation when the *R-value* is -1. The data were also presented in the form of graphs for a clearer understanding.

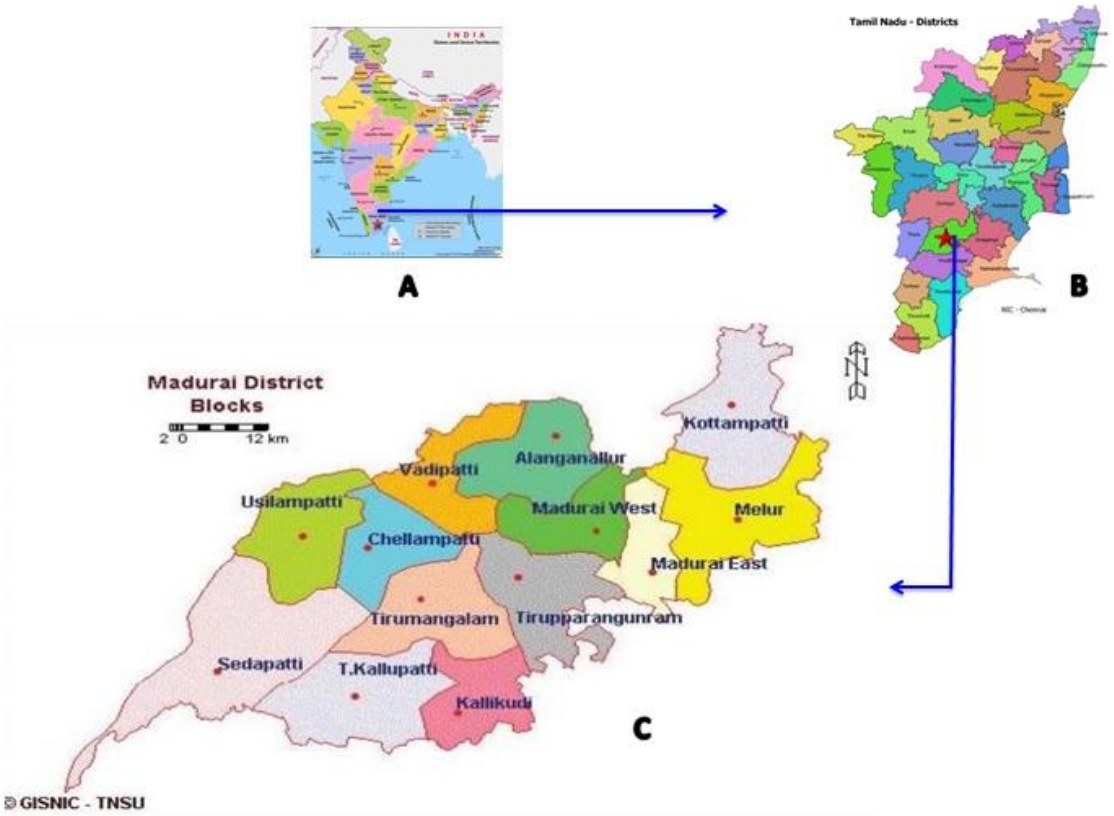

Fig. 1. Study area – Block wise representation of the Madurai district map
A: https://www.mapsofindia.com/
B: https://www.tn.gov.in/DistrictMap
C: https://cdn.s3waas.gov.in/s3f5f8590cd58a54e94377e6ae2eded4d9/ uploads/2019/06/2019061060.pdf

Table 1. Blocks of Madurai district

TOTAL NUMBER OF BLOCKS PRESENT	NAMES OF THE BLOCKS OBSERVED
13 BLOCKS	Alanganallur Chellampatti Kallikudi Kottampatti Madurai east Madurai west Melur Sedapatti T. Kallupatti Thirumangalam Thirupparankundram Usilampatti Vadipatti

3. RESULTS AND DISCUSSION

To understand the factors responsible for the incidence of house sparrows in Madurai district, 205 random sites were chosen representing the 13 blocks. Of the 205 places, the prevalence of house sparrow population was evident in 170 places. The places with a high incidence of house sparrows were Madurai west (703), followed by Melur (658). The least populated blocks were Kottampatti (150) and Vadipatti (147).

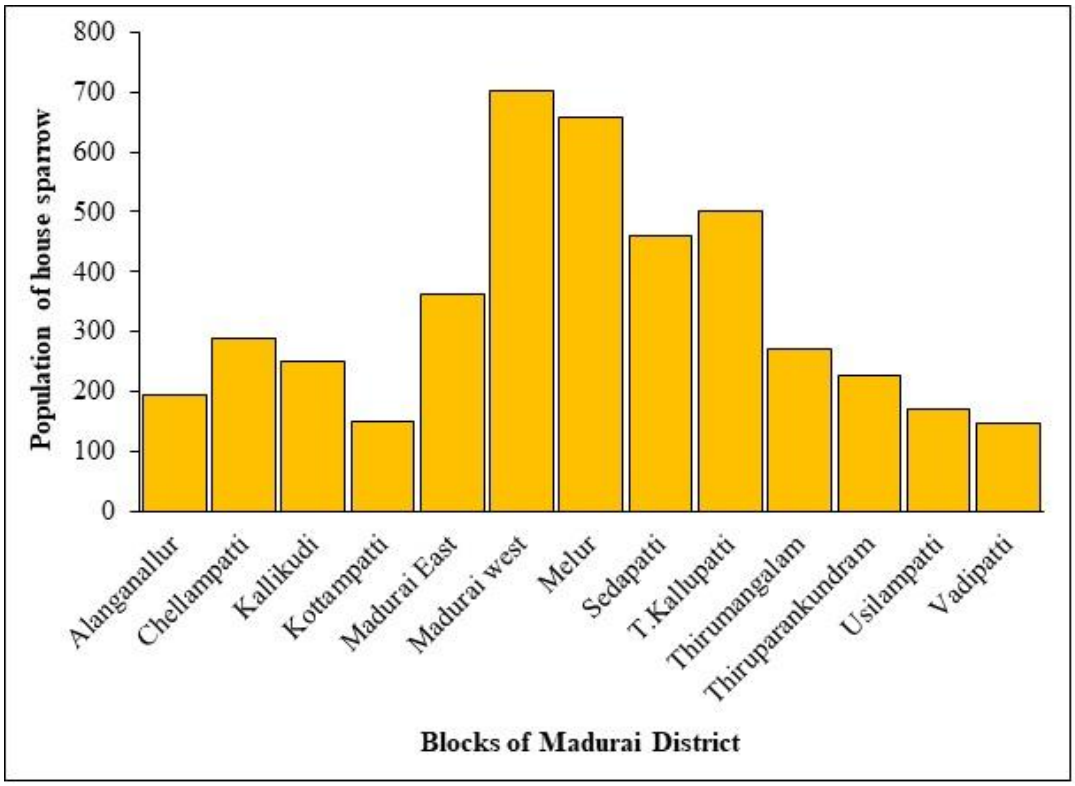

Fig. 2. Status of House sparrow in Madurai District- Block wise

Out of the 205 study sites in the 13 blocks of Madurai district, the house sparrow population was recorded in 170 locations during the study period. The incidence of the house sparrow in each of the 13 blocks of Madurai district was compared to identify the most populated site. Fig. 2, clearly illustrates the incidence of the house sparrow in the various blocks of Madurai, wherein Madurai west recorded the most number of house sparrows (703), followed by Melur (658), T. Kallupatti (500), Sedapatti (459), Madurai East (361), Chellampatti (290), Thirumangalam (270), Kallikudi (250), Thiruparankundram (226), Alanganallur (193), Usilampatti (170), Kottampatti (150), and Vadipatti (147). Madurai west is a densely populated suburban habitat with old buildings and small shops. Propinquity to resources is a determining factor for habitat selection, as it reduces the time and energy of house sparrow spent in foraging distant places. House sparrows are connected with urban areas of lower socioeconomic status and occupy old and damaged buildings that offer more nest sites [19]. House sparrows were reported to exhibit a strong preference for suburban and high-density urban areas with old buildings, grocery shops, open drainage systems, and open household waste dumps, which were shown to be perfect sites for sparrows [20]. In this study, the least populated places like Vadipatti, Kottampatti, and Usilampatti are agricultural areas with rural habitats. The incidence of the house sparrow in these places was less due to the non-availability of suitable nesting sites. Similarly, Choudary [20] reported that agricultural areas were not preferred by house sparrows due to a lack of nesting sites.

3.1 Nesting Site Availability in the 13 Blocks of Madurai District

Among the 170 places surveyed, six nesting sites were commonly identified in all 13 blocks. The nesting sites were confirmed by observing the birds' activities for collecting nesting material, feeding nestlings, and guarding the nest site. The six nesting sites identified in the 13 blocks of Madurai district were 1. eaves of the buildings, 2. ventilation openings, 3. unused holes, 4. pipes in buildings, 5. thatched roofs, and 6. climbers in buildings. Old buildings provided suitable nesting sites, while the presence of shops, small eateries, open drainages, and open household dumps were sources of food for the adult sparrows and nestlings [20]. Several studies have reported the presence of house sparrow nests in pre-existing cavities, roofs, eaves, and walls of human-built structures, densely branched trees and shrubs [2],

old thatched-roof buildings and native buildings [21], electric pipelines, ventilation holes, and space available on the electricity meters [22].

3.2 Eaves of Buildings as Nesting Sites of House Sparrow

Fig. 3. illustrates the association between the occurrence of the house sparrow and the availability of eaves of building in the 13 blocks of Madurai district. The Pearson correlation coefficient $R = 0.99$, clearly denotes a strong positive correlation between the availability of eaves of buildings and the population of the house sparrow. Madurai west had the maximum number of eaves (620), followed by Melur (578) and T.Kallupatti (415), wherein the sparrow population was found to be maximum (Fig. 2.). In substantiation to the present study, eaves of the building have been reported to be the most commonly utilized nesting site by house sparrows [23]. In another study, 30.1% of nests were found in the eaves of buildings [9]. The least number of eaves found in Vadipatti (96) and Kottampatti (103) have affected the occurrence of house sparrow populations in those regions. Vadipatti and Kottampatti have been identified as a rural habitat with mud buildings without eaves or spacious roofs. The houses in rural areas were mostly mud houses covered with thick tarps, leaving no space for sparrows to make nests. The mud houses were low-lying, making them prone to predation and other disturbances [20].

3.3 Ventilation in Buildings as Nesting Sites of House Sparrow

The presence of house sparrow was correlated with the availability of ventilation holes in buildings in Fig. 4. A strong positive correlation ($R = 0.99$) was noted between the availability of ventilation holes in buildings and the population of the house sparrow, through Pearson correlation. The availability of ventilation sites in Madurai west (546) was found to be maximum, followed by Melur (527). The ventilation holes were chiefly found in old buildings found in suburban habitats, which provide natural airflow in buildings. The ventilation holes were preferred by house sparrows because they were secure, undisturbed, and open with easy access to outside. Next to the eaves of buildings, ventilation holes were found to be the second preferred nesting site of the house sparrow. In other studies, Balakrishnan [24] reported that house sparrows occupied ventilators (2.4%) in Manjeri Municipality, Kerala. The preference of house sparrows towards man-made structures like ventilation holes stipulates the close association of sparrows with humans.

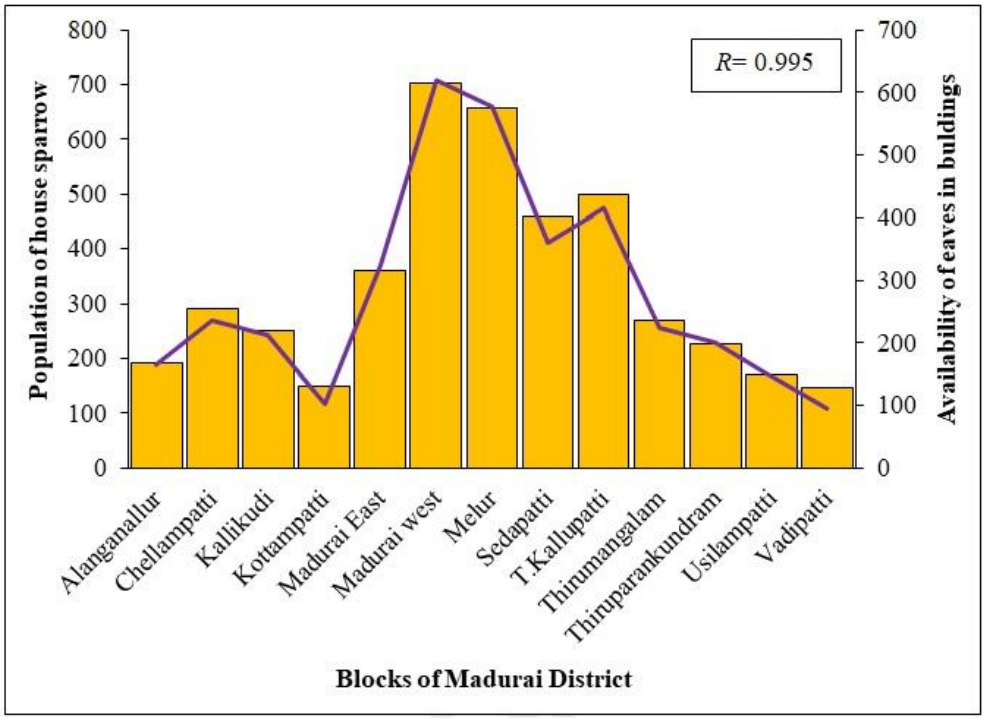

Fig. 3. Correlation between the availability of eaves in buildings to the house sparrow population in Madurai district

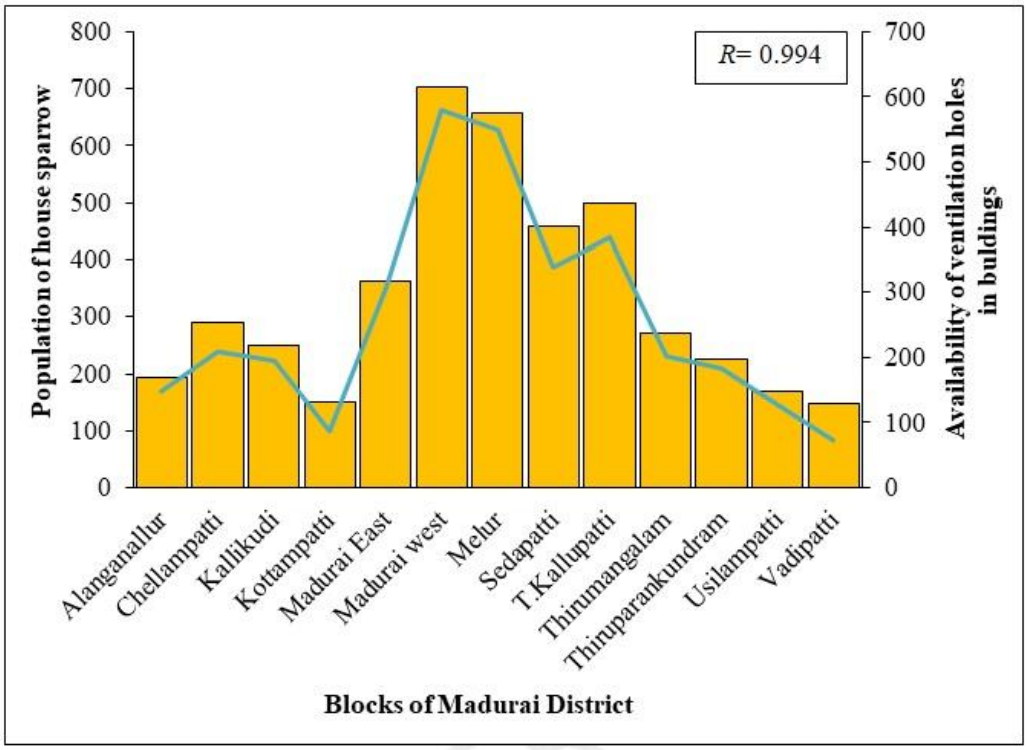

Fig. 4. Correlation between the availability of ventilation holes in buildings to the house sparrow population in Madurai district

3.4 Holes in the Buildings as Nesting Sites of House Sparrow

From, Fig. 5. it was evident that the association between the occurrence of the house sparrow and the availability of unused holes in the building shows a strong positive correlation, wherein the Pearson correlation coefficient value R = 0.99. Among the 13 blocks, Madurai west had the maximum number of unused holes (546), followed by Melur (527), wherein the sparrow population was found to be maximum (Fig. 2.). Supporting the present study, Bhattacharya [25] stated that house sparrows build their nest in holes of structures, under the tiles or around the roof area of houses. House sparrows were reported to nests in holes and crevices of man-made structures [4]. A minimum number of holes in buildings were observed in Vadipatti (58) and Kottampatti (69), which has affected the population density of house sparrows in those regions. Menon [26] has stated that few sparrows have been discovered in the rural matrix in the sidewall holes. Generally, in rural habitats, the presence of favourable nesting sites was found to be scarce, hence there is a decline in the house sparrow population in rural habitat compared to the suburban and urban habitats [20].

3.5 Pipelines in the Buildings as Nesting Sites of House Sparrow

Like unused holes in buildings, unused pipes were also utilized as nesting sites by house sparrows. Fig. 6. indicates the correlation between the availability of unused pipes and the house sparrow occurrence in the 13 blocks of Madurai district. The Pearson correlation coefficient value R was found to be 0.98, which signifies a strong positive correlation. Hence it was evident that the house sparrow population was strongly influenced by the presence/absence of nesting sites in an area. Within the various blocks, a maximum number of unused pipes were used as nesting sites in Madurai west (519) followed by Melur (402). The decrease in the population density of house sparrows in Vadipatti (45) and Kottampatti (55) could be correlated with the availability of a lesser number of pipe holes in those regions. Studies have reported that house sparrows build their nests in similar places like electricity pipelines [20] and drainpipes [27]. Though pipes and pipe holes were not the most preferred nesting sites, in the non-availability of buildings, these served as suitable nesting grounds. The adaptability of house sparrows to accustom pipe holes as nesting sites enumerate the behavioural flexibility and plasticity of house sparrows.

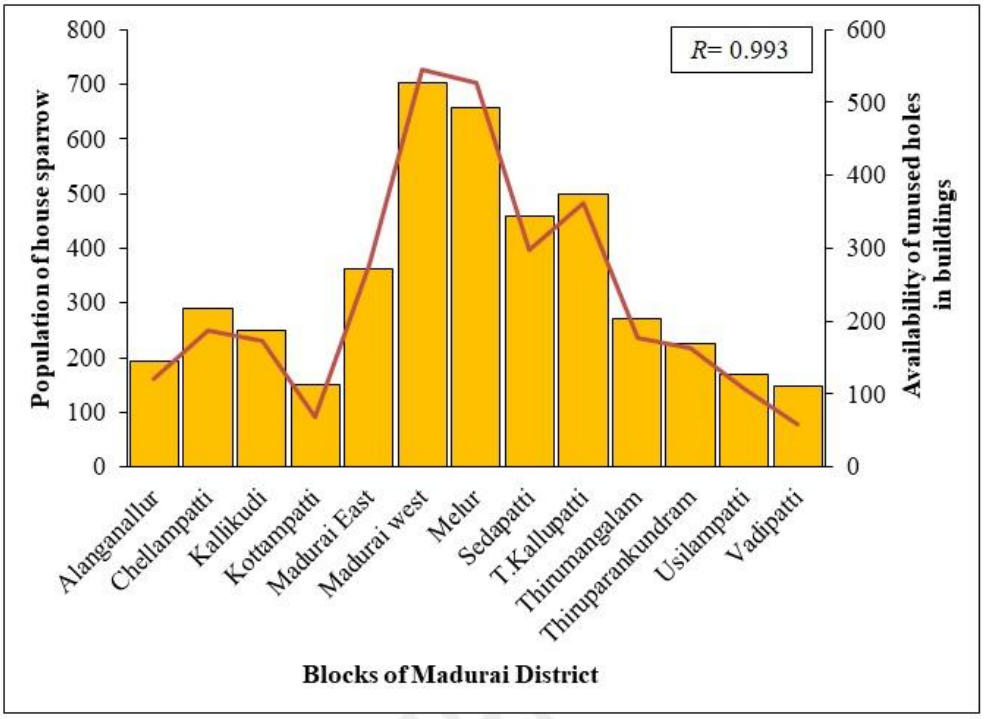

Fig. 5. Correlation between the availability of unused holes in buildings to the house sparrow population in Madurai district

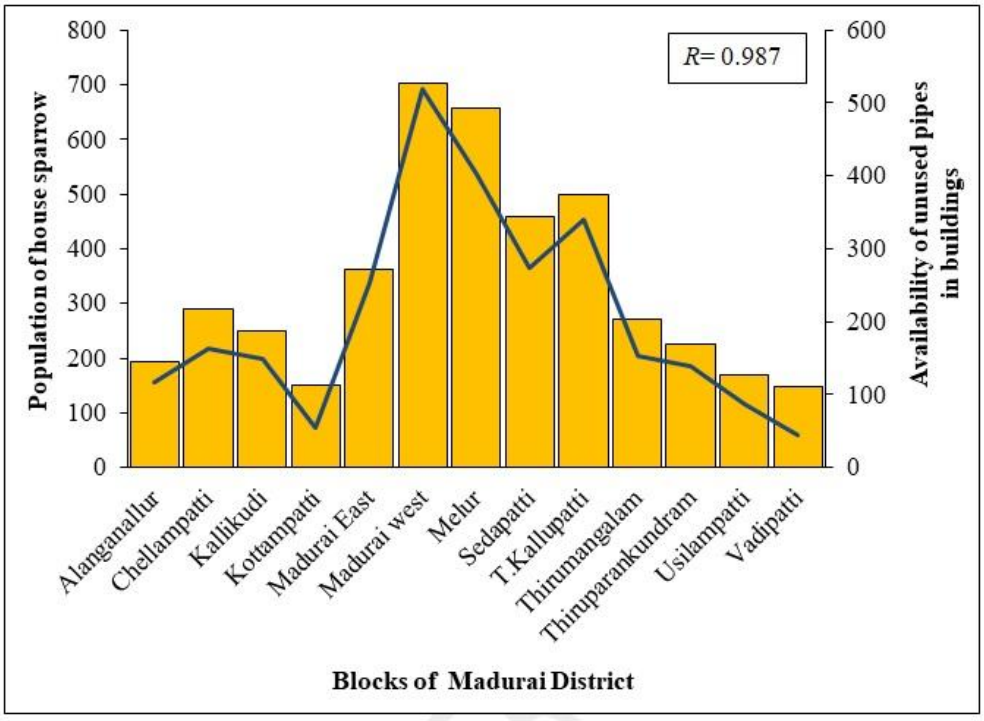

Fig. 6. Correlation between the availability of unused pipes in buildings to the house sparrow population in Madurai district

3.6 Thatched Roofs as Nesting Sites of House Sparrow

The number of thatched roofs were found to be maximum in the Madurai west (486) and Melur (385) blocks and they were in the least numbers in Vadipatti (38) and Kottampatti (39) blocks as represented in Fig. 7. The Pearson correlation coefficient between thatched roofs availability and the house sparrow population was found to be $R = 0.99$, which signifies a strong positive correlation. The availability of thatched roofs in the urban areas was relatively less compared to the other nesting sites studied, however, the sparrows were found to use thatched roofs in the absence of other favourable nesting sites like the eaves of buildings and ventilation holes. Thatched roofs were predominantly found in the traditional houses in villages, wherein paddy straws were used. Due to architectural modernization, the thatched roof buildings were replaced by concrete buildings, hence the availability of thatched roofs was less in urbanized cities [19]. Since house sparrows are known as urban birds, they quickly accommodate to man-made structures than any wild bird [20]. However, in the absence of buildings, they express their evolutionary conservatism in nesting behaviour.

3.7 Climbers and Vines as Nesting Sites of House Sparrow

House sparrows have always been considered as a species that shows flexibility and innovation [8,10]. In the non-availability of any of the favourable nesting sites mentioned above, the house sparrows were even found to nest in climbers or vines found on walls of buildings. Though the availability of climbers and veins is the least preferred nesting site, their availability showed a positive correlation ($R = 0.99$) with the existence of house sparrows (Fig. 8.). Each of the studied nesting sites influenced the population density of house sparrows to a certain extent. The availability of climbers and veins as nesting sites were more in Madurai west (453) and Melur (362) blocks and less in Vadipatti (22) and Kottampatti (28) blocks. Similar results were reported by Sheldon [9], wherein 1.6% of nests were found in-wall/fencing climbers. House sparrows tend to utilize the available nesting sites irrespective of their characteristic. Though there was a decline in the population density of house sparrows, their behavioural adaptability to the rural-suburban-urban gradients makes them a successful species on the planet.

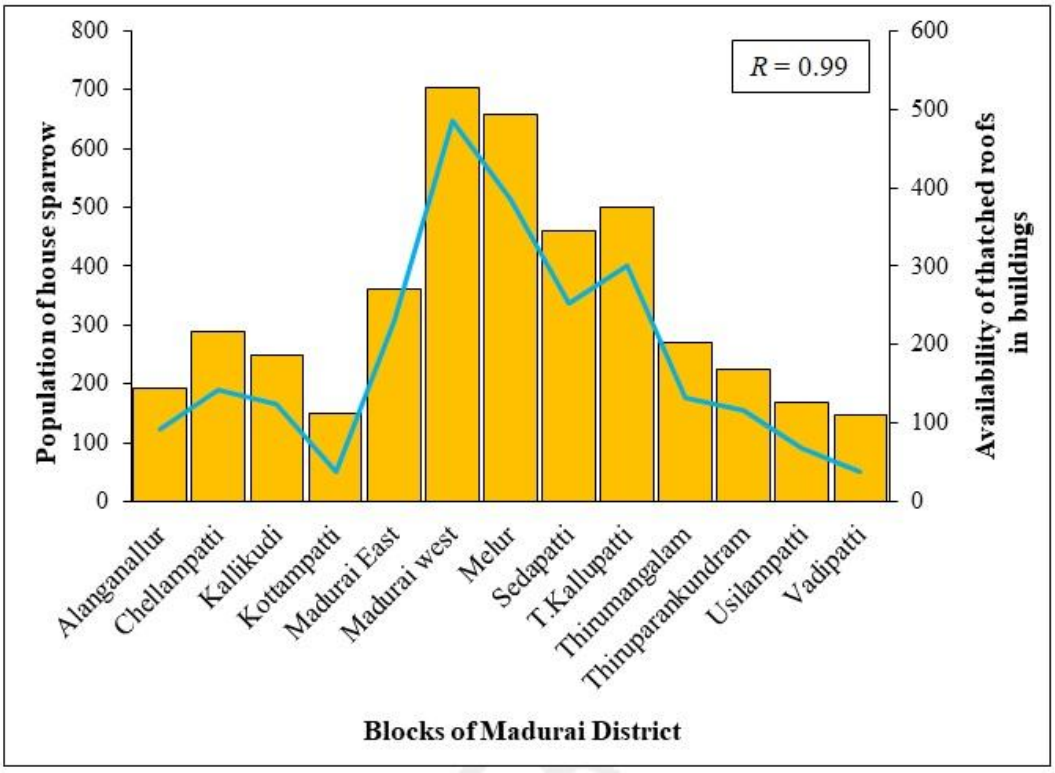

Fig. 7. Correlation between the availability of thatched roofs in buildings to the house sparrow population in Madurai district

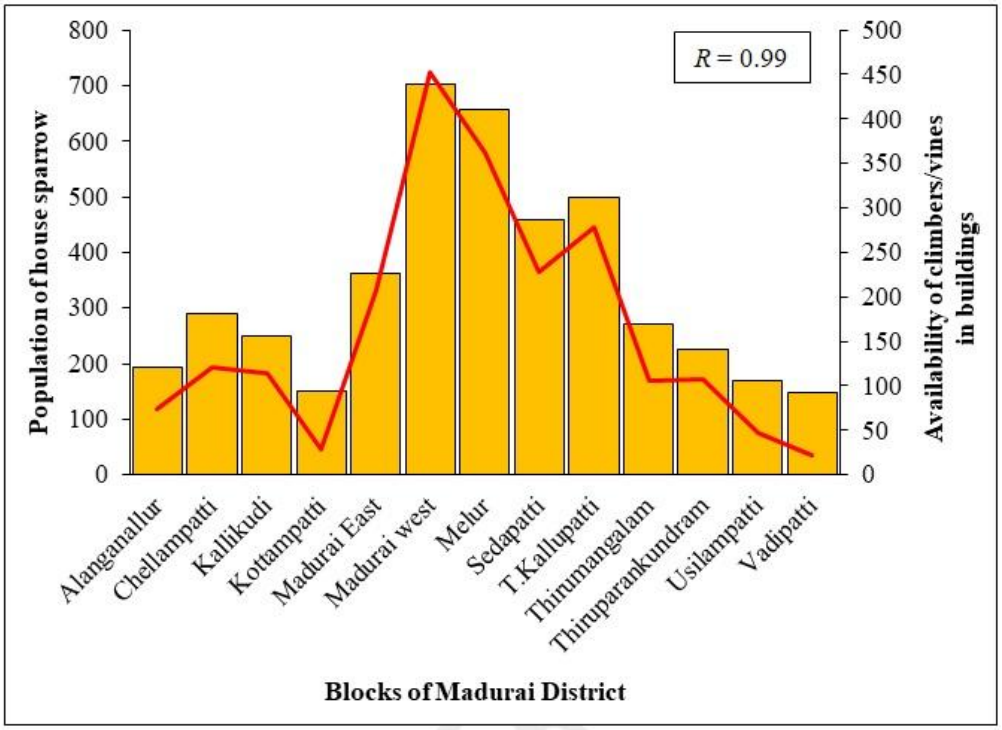

Fig. 8. Correlation between the availability of climbers or veins in buildings to the house sparrow population in Madurai district

4. CONCLUSION

Several studies report the availability of nesting sites as the chief limiting factor for the incidence of house sparrow population. In this regard, 170 places were surveyed and six nesting sites were commonly identified in all 13 blocks. Out of the six nesting sites identified, eaves of buildings and ventilation holes constitutes 22% and 20% respectively , unused holes in buildings accounts for 18%, unused pipes comprises for 15%, as well as thatched roofs and climbers/veins on the walls of buildings constitutes 13% and 12% appropriately. Based on the Pearson correlation coefficient, the association between the population of the house sparrow and the availability of nesting sites were found to be positively correlated (R = 0.9). Among the various nesting sites, eaves of buildings and ventilation holes were found to be the most preferred nesting sites, while the thatched roofs and climbers/veins were the least preferred. Though house sparrows show a strong preference in their nesting behaviour, they tend to easily adapt to human habitats and utilize structures like pipelines and climbers in the non-availability of buildings. Hence, the conservation of house sparrows in the anthropogenic environment can be efficiently practiced by providing artificial nesting sites.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Summers-Smith JD. Densities of house sparrows in different urban habitats in a small town in NE England. Yamashina Institute for Ornithology. 2009;40(2):117-24.
2. Hanson HE, Mathews NS, Hauber ME, Martin LB. The natural history of model organisms: the house sparrow in the service of basic and applied biology. Elife. 2020;9:e52803.
3. Ravinet M, Elgvin TO, Trier C, Aliabadian M, Gavrilov A, Sætre GP. Signatures of human-commensalism in the house sparrow genome. Proceedings of the Royal Society B. 2018;285(1884):20181246.
4. Summers-Smith JD. The sparrows: A study of the genus. Passer. T & AD Poyser, Staffordshire, England; 1988.
5. Anderson TR. Biology of the ubiquitous house sparrow: from genes to populations. Oxford University Press; 2006.

6. Dandapat A, Banerjee D, Chakraborty D. The case of the disappearing house sparrow (*Passer domesticus indicus*). Veterinary World. 2010; 3(2):97.
7. Summers-Smith D. Nest-site selection, pair formation, and territory in the house sparrow Passer domesticus. Ibis. 1958;100(2):190-203.
8. Summers-Smith JD. The house sparrow. London: Collins; 1963.
9. Sheldon EL, Griffith SC. 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. 2017;8(1):1-8.
10. Martin LB, Fitzgerald L. A taste for novelty in invading house sparrows, Passer domesticus. Behavioral Ecology. 2005;16(4):702-7.
11. Price JJ, Griffith SC. Open cup nests evolved from roofed nests in the early passerines. Proceedings of the Royal Society B: Biological Sciences. 2017;284(1848):20162708.
12. Bent AC. Life histories of North American blackbirds, orioles, tanagers, and allies. Bulletin of the United States National Museum; 1958.
13. Pitman CR. Unusual nesting behavior of the house sparrow, *Passer domesticus* (L.). Bull Brit Ornithol Club. 1961;81:148–9.
14. Werler E, Franks EC. Some unusual nest sites of the House Sparrow. The Wilson Bulletin. 1975;113-.
15. Sharma SK. An unusual nesting site of house sparrow *Passer domesticus* (Linn.). J Bombay Nat Hist Soc. 1995;92:422.
16. Tatschl JL. Unusual nesting site for House Sparrows. The Auk. 1968;85(3):514-.
17. Weber WC. House Sparrow nest in a revolving sign. Miss Kite. 1976;6(1):7–8.
18. Chmielewski S, Fijewski Z, Nawrocki P, Polak P, Sułek J, Tabor J, Wilniewczyc P. (Birds of the Świętokrzyskie Mountains and their vicinity. The faunistic monograph)–BoguckiWyd. Nauk, Kielce (in Polish); 2005.
19. Balaji S. Artificial nest box for house sparrow: An apt method to save the dwindling species in an urban environment. International Journal of Biodiversity and Conservation. 2014;6(3):194-8.
20. Choudhary S, Chauhan NP, Kalsi R. Finding clues in cities: nest-site selection by house sparrows across a varied habitat matrix in Delhi, India. Current Science. 2020; 118(8):1304.
21. Balasundaram C, Rathi S. Avifaunal diversity of Tiruverumbur Taluk, Tamil Nadu. Zoos' Print Journal. 2004;19(3):1417-21.
22. Rajashekar S, Venkatesha MG. Occurrence of house sparrow, Passer domesticus indicus in and around Bangalore. Current Science. 2008;94(4):446-9.
23. Wotton SR, Field R, Langston RH, Gibbons DW. Homes for birds. British Birds. 2002;95:586-92.
24. Balakrishnan P, Jijeesh N, Kurikkal MS, Maya T, Lijitha MP, Bhaskar RR, Vipeesh N. Distribution, abundance and nest-site characteristics of the house sparrow passer domesticus in Manjeri Municipality. Kerala. Technical; 2011.
25. Bhattacharya R, Roy R, Goswami C. Studies on the response of house sparrows to artificial nest. International Journal of Environmental Sciences. 2011;1(7):1574-81.
26. Menon M, Devi P, Mohanraj R. Habitat variability and spatial assemblages of house sparrows (*Passer domesticus*) along a gradient of urbanization. J. Environ. Sci., Toxicol. Food Technol. 2013;4(4):1-1.
27. Johnson SA, Violett H. Florida's Introduced Birds: European house sparrow (*Passer domesticus*). EDIS. 2009;2009(5).