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Installation of artificial nests and response of Indian house sparrows *Passer domesticus* (Linnaeus, 1758) in urban and rural areas near Nagpur, Maharashtra

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Abstract
The present study was conducted from October, 2016 to October, 2021 in the urban and rural areas of Nagpur, Maharashtra, India. In urban areas artificial nests were placed at RajBhavan area, RTMNU campus area, Sevadal Mahila Mahavidyalaya premises and in rural area at Narsala, Sevadal Mahila Mahavidyalaya's girls hostel premises which is a residential area. In this study, 150 wooden nests were erected on the trees at the height of 3 to 10 meters. Overall occupancy of the artificial nest by the house sparrow was reported to be 74% whereas 18% of the artificial nests were occupied by other species of birds like Magpie Robin, Indian Robin, Scaly breasted Munia, Silver billed Munia, Brahminy Myna, Common Myna, Rose- ringed parakeet etc. 8% of the installed artificial nests remained unoccupied. Study showed the 92% and 89% acceptance rate of artificial nests by the birds in rural and urban areas respectively. Breeding and reproductive success rate in these artificial nests was observed to be 71%.

Keywords: artificial nest, house sparrow, Nagpur, Rajbhavan

Introduction
House sparrows are among the most abundant birds found globally everywhere and closely associated around human habitation in cities and villages (Lowther & Clink, 1992; Chamberlain *et al*., 2007) [5]. These are absent from undisturbed forests and grassland due to lack of food material (Monika, 2005) [14]. These are omnivorous species. In rural and urban areas these mostly feed on grains, seeds, insects, worms, larvae of mosquitoes, flowers, fruits etc. During the last decade, there is a sharp decline of the house sparrows in the urban areas due to loss of foraging habitat (Robinson *et al*., 2005) [16], high level of environmental pollution, poor quality diet, higher levels of oxidative damage and a higher activity of antioxidant enzymes linked to urban environments (Herrera *et al*., 2014; 2017) [10, 11]. Balmori and Hallberg (2007) [3] had suggested the possible role of electromagnetic radiation in the decline of the population of house sparrows in urban areas. Samson and Ramakrishnan (2020) [17] has described the decline of house sparrow due to habitat loss, lack of nesting sites, urbanizations, Modern infrastructures, Environmental pollution, Cell Phone Tower radiation, Biocides effects and climate change. As the college is concerned about the various environmental issues, present study was undertaken to save, survive and control the declining population of house sparrows and other birds by installing the artificial wooden nests in the natural rural and urban habitat.

Materials and Methods
Study area: The study was conducted in and around Nagpur, Maharashtra representing the urban and rural areas. The Latitudinal range is 21°8'46.72"N and the Longitudinal extension is 79°5'5.68"E. Different sites and Locations selected for installing artificial nests were

1. Premises of Sevadal Mahila Mahavidyalaya, Sakkardara square, Nagpur.
2. RajBhavan, Sadar, Nagpur.
3. RTM Nagpur University Campus Premises, Amaravati road, Nagpur.
4. At Narsala, Sevadal Girls hostel premises.
5. Gorewada International Park and Bahadura Village (Installed nests but were not included in the study)

Methods
The study was conducted over a period of five years i.e. from October, 2016 to October, 2021. Regular field visits were made throughout the entire study period for getting the data. We have involved the college students in this activity to make them aware regarding this issue and sensitize those regarding environmental problems. The artificial nests were made by using the wooden scrap material purchased from the saw mill as it was cheaper and durable material. Artificial nests made were approximately 30 cm in height, 15 cm in width with an entrance hole of 3.2 cm in diameter (Chetan, 2012) [6] (Fig. 1,2,3,4). Artificial wooden nests were erected on the trees at the height of 3 to 10 meters. Nesting material, feeding pans and water bowls were kept near these installed artificial nests (Fig. 5). All the artificial nests were painted to make them decorative. For purchase of the material used for making artificial nests, grains, water bowls and feeding pans, a special drive was initiated to collect scrap newspaper and old books from the college students and staff. Students and staff had brought the old newspaper and old books from their home in the college and the college has collected it and sold it to raise the fund to complete the financial need of the study and to improve the declining population of sparrows in the urban area. Occupancy of the artificial nests by the sparrows and other birds was noted in the morning from 06:00 hrs. to 10:00 hrs.

(IST) at regular intervals. The activity of these birds around the nests was recorded by using the canon DSLR camera and Sony binocular lens.

Fig 1: Showing the installed artificial nest at Sevadal Mahila Mahavidyalaya, Nagpur

Fig. 2: Showing the installed artificial nest at RajBhavan, Nagpur

Fig 3: Showing the installed artificial nest at RTM Nagpur University, Premises

Fig 4: Showing artificial nest occupied by sparrow at Narsala, Sevadal Girls hostel premises.

Fig. 5: Showing the installed water bowls and at Sevadal Mahila Mahavidyalaya, Nagpur

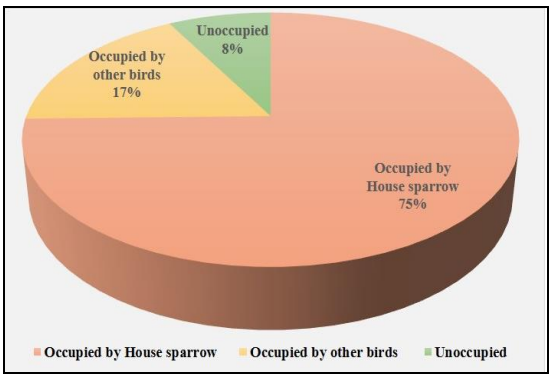

Fig 6: figure showing occupancy of artificial nest

Fig 7: Birds quenching thirst at water bowls installed at various locations.

Result and Discussion

House Sparrow is a small bird belonging to order Passeriformes. This bird exhibits sexual dimorphism. Males have black throat, black bib and white cheeks however females have brown colour with eye strip. The decline of the house sparrow populations have been recorded from many parts of the world including India (Anderson, 2006; Dott 2006; Joshi, 2009; Dhanya 2012; Dhanya et. al., 2016; Samson and Ramakrishnan, 2020). Various reasons documented for the declining population of house sparrows are loss of foraging habitat (Robinson *et al*., 2005) [16], electromagnetic radiation (Balmori and Hallberg, 2007) [3], loss of nest sites especially in modern architectural style buildings (Pineda *et al*., 2013), high level of environmental pollution and poor quality diet (Herrera *et al*., 2014) [10], higher levels of oxidative damage (Herrera *et al*., 2017) [11] and habitat loss, lack of nesting sites, urbanizations, Modern infrastructures, Environmental pollution, Cell Phone Tower radiation, biocides effects and climate change (Samson and

Ramakrishnan, 2020) [17]. Shaw *et al*. (2008) had reported the flexibility of house sparrow in choice of nest sites in the absence of nesting sites due to modern infrastructure. Considering the decline of the population of house sparrows at this alarming rate mostly in urban areas, present work was undertaken to conserve them and increase their population by providing the wooden artificial nests. Positive response of the house sparrows was noted towards the occupancy of the artificial nests.

Out of 150 artificial nests 138 were occupied by the birds whereas 12 nests remained unattended and were not occupied. The overall 92% of the artificial nests were accepted by the house sparrows and other birds of similar size. The number of installed artificial nests at various urban and rural areas and their occupancy is shown in the table 1. Out of the total 150 artificial nests 112 (74.7 %) were occupied by the house sparrows and 26 (17.3 %) were occupied by the other birds like Magpie Robin, Indian Robin, Scaly breasted Munia, Silver billed Munia, Brahminy Myna, Common Myna, Rose- ringed parakeet etc. However 12 (8%) artificial nests were not occupied the any birds (Figure.6). No significant differences were recorded in the occupancy of artificial nests regarding the rural and urban locality. From the occupied artificial nests 98 nests shows the successful nesting, egg laying and chicks were fledged from the nests after 17th to 20th day of the hatching. In some nests mortality of the chicks was observed. The productivity in artificial nests was maximum at Raj Bhavan as compared to other areas. Productivity rate was higher, may be due to the ample availability of invertebrates. High illumination and high noise level may be the reason for non-occupancy of the artificial nests in some cases (Bhattacharya *et al*., 2011) [4]. It has been observed that this activity of erecting artificial nests for birds has played important role in controlling the declining population of sparrows in urban area and hence conservation of these birds. Feeding pans and water bowls were also used by the birds for quenching their thirst (Fig. 7). Present investigation revealed that availability of safe nesting sites at undisturbed places is the key factor which play direct role in influencing the number of sparrows in urban areas. Our results are in agreement with Anderson (2006) [1], Shaw *et al*., (2008) and Balakrishnan *et al*. (2011). This activity was also an instrumental in spreading the awareness about conservation and the declining numbers of birds among the students.

Table 1: Occupancy of the birds in artificial nest at different locations.

Study site	Number of Artificial nests installed	Number of nests occupied by house sparrows	Number of nests occupied by birds other than house sparrows	Number of nests remain unoccupied by the birds
Urban area				
Sevadal Mahila Mahavidyalaya, Nagpur	25	19 (76%)	03 (12%)	03 (12%)
RajBhavan, Nagpur	50	34 (68%)	12 (24%)	04 (8%)
RTM Nagpur University Campus, Amaravati Road, Nagpur	50	41 (82%)	06 (12%)	03 (6%)
Rural area				
Narsala, Sevadal Girls hostel premises.	25	18 (72%)	05 (20%)	02 (8%)
Gorewada International Park	25	These nests were not included in the study.		
Bahadura Village	20	These nests were not included in the study.		

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