

# Nesting ecology of house sparrow (*Passer domesticus* L) in Punavasipatty and Kuthoor, Tamil Nadu, India

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# Abstract

Nesting ecology of house sparrow, *Passer domesticus*, was studied from August 2013 to December 2013 in Punavasipatty and Koothur Villages, Tamil Nadu, India. In total, 111 and 109 nests of house sparrows were located and used for the present study in Punavasipatty and Koothur Villages respectively. Nests were constructed on both plants and man-made substrates using largely small twigs, rootlets, fibers, rugs, etc. Number of eggs laid by house sparrow varied from a minimum of one to a maximum of five eggs. The incubation period varied from seven to 12 days. The nestlings remain in the nest from nine to 14 days. Irrespective of study areas, nests were largely constructed on plants (180) followed by man-made structures (40). Among the man-made structures, majority of the nests were on concrete-roofed houses.

Keywords : House sparrow, Passer domesticus, nest, breeding, Tamil Nadu, India

# INTRODUCTION

Human impacts, particularly urbanization and pollution, have resulted in overwhelming biodiversity loss throughout the world in recent decades. Besides rare species, often known to be affected by urbanization and pollution (Ricketts et al., 2005; Mcdonald et al., 2008), even common and widely distributed species are affected by such factors in the recent years. House sparrow Passer domesticus. L, a common and widely distributed species, has also been facing massive decline across several countries especially in the United Kingdom and in several western European countries. In England, the populations in rural areas have declined by 47% since the mid 1970s, whereas those in urban and suburban areas they declined by about 60% (Crick et al., 2002; Summers-Smith, 2003; Robinson et al., 2005; Vincent, 2005). Although no such detailed statistics of the population of house sparrow is available in India, it has been reported that house sparrow population has decreased considerably at present in India (Rajashekar and Venkatesha 2008; Daniels 2008; Khera et al., 2010; Bhattacharaya et al., 2010; Ghosh et al., 2010). Despite there is a growing concern over the decline of house sparrows in India (Vijayan 2003; Daniels 2008; Joshi 2009; Dandapat et al., 2010), there has been limited research aimed at understanding the ecological requirements of the species besides a very few attempts on population (Balakrishnan, 2005; Goyal, 2005; Rajashekar and Venkatesha, 2008; Dhanya and Azeez 2010; Ghosh et al., 2010). The present paper deals with the nesting ecology of house sparrow in Punavasipatty and Kuthoor Villages, Tamil Nadu, India.

#### Study area

The present study was carried out in Punavasipatty and Kuthoor Vilages in Tamil Nadu, India. The

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ISSN 0973-9157

Punavasipatty Village, comes under Karur District, Tamil Nadu, is situated between 10° 57' 7.8" N, 78° 20' 29.0" E. The village receives major portion of its annual rainfall during north-east monsoon (October-December). A moderate amount of rainfall is received during the southwest monsoon (July-September). The climate is humid and tropical. The mean maximum temperature of the village is about 36.5°C in May and the mean minimum temperature is 22.1° C to in December. The relative humidity varies between 70 and 85 per cent, maximum during the months of December-January and the lowest during the month of June. It has a human population of c.4685: 2458 male and 2227 female. The village has around 721 households: 81 Thatched houses, 437 Country-tile-roofed houses, 154 concrete-roofed houses and 49 asbestos-roofed houses. The river Cauvery and two canals flowing on the northern side of the village are the water sources for agriculture. Paddy is cultivated largely on the southern side of the village while millets are cultivated in the northern side.

The Koothur Village, another study area comes under Thiruvaiyaru Taluk, Thanjavur District in Tamil Nadu, is situated between 10° 52′ 04" N, 78° 57′ 56" E. It is a part of River Cauvery basin. The average annual rainfall is about 763 mm. The village receives major portion of its annual rainfall during north-east monsoon (October-December). A moderate amount of rainfall is received during the southwest monsoon (July-September). The climate is humid and tropical. The mean maximum temperature of the village is about 36.5° in May and the mean minimum temperature is 22.1° C to in December. The relative humidity varies between 70 and 85 percent, highest occurs during the months of December-January and the lowest during the month of June. It has a human population of c.720:289 male and 431 female. The village has 450 households: 50 thatched houses, 30 tile-roofed houses and 370 concrete-roofed houses. The rivers

Cauvery and Coleroon are flowing on either side of the village which are the main water sources for agriculture. However, agriculture largely depends on the north-east monsoon.

### MATERIALS AND METHODS

To understand the nesting ecology of house sparrow, breeding pairs of house sparrows were identified by their breeding activities viz. courtship display, collection of nest materials, construction of nests, incubating, feeding the nestlings, etc. Besides, nests were located by searching all the probable nest sites (roofs of the buildings, on plants, on holes, crevices, etc present on the natural and man-made structures) following Gokula (2008). Once the nest is located, variables viz., nest height, nest-substrate (plant/manmade structure), nest plant species name, nest plant height and orientation of the nest were recorded for each nest. Identified nests were monitored once in three days till the completion of breeding without disturbing the nests/eggs/nestlings. Based on the collected information, clutch size, incubation period and nestling period were calculated.

Accurately estimating the nest success (the fraction of observed nests that fledges at least one young) is a critical goal of any nest-monitoring program. True nest success is almost never the proportion of nests that fledged offspring. This is because nests are not at all found at the same stage of nesting. For instance, a nest that is destroyed before the entire clutch is laid has a very low chance of being found, whereas a nest that survives until fledging is likely to be noticed, both because it is around longer and because the parents become more conspicuous as they begin feeding and defending their brood. For this reason, nests that survive the longest are most likely to be found and nests that fail very early are often missed entirely. Since this detection bias means that one find more successful than unsuccessful nests, it becomes important to correct for the fact that data will tend to overestimate nest success in a population. To eliminate this bias, Mayfield (1961, 1975) developed the new data entry system to achieve accurate estimates of nest success that has widely been used (Bart and Robson, 1982; Dinsmore et al., 2002; Johnson, 1979; Manolis, 2000; Miller and Johnson, 1978; Nur et al., 2004; Rotella et al., 2000; Stanley, 2000). It is based on daily nest survival (i.e., the proportion of nests that did not fail on a given day, while the nests were under observation). The total number of nest-days of observation is called exposure days.

To understand infuence of the thatched roof structure on the nesting behaviour of sparrow, all the houses present in the village were personally visited and searched for sparrow nests with owner's permission. Owners were also interviewed for the history of sparrow nests in their house. For this purpose, houses were categorized into concrete-roofed houses, thatched houses, asbestos-roofed and tile-roofed houses. Statistics were performed using PAST software (PAST -PAlaeontological STatistics, ver. 1.81, Øyvind Hammer, D.A.T. Harper and P.D. Ryan, April 25, 2008)

### **RESULTS AND DISCUSSION**

Breeding success is a key variable in demographic studies of birds and the estimation of the natality of species is fundamental to understand the population dynamics. Although the house sparrow is among the most common sedentary birds in India, information on breeding success is scarce in India. In both the villages, both male and female involve in nest-building behaviour. Male largely brings the nest material while female constructs the nest by using the male-brought nest material. Besides female also collects the nest material and uses for construction as reported by Ali and Ripley (1987). Nests were built largely using small twigs, rootlets, fibers, rugs, etc. Indykiewicz (1991) also reported that house sparrows use a broad range of materials for nest building including feathers, grass inflorescences, stalks and roots of plants, bark, threads, string and even pieces of paper and wool.

In Totally, 111 and 110 nests of house sparrows were found in Punavasipatty and Kuthoor Villages respectively during the study period. One nest in each village was abandoned due to unknown reason soon after the nest construction. No eggs/nestlings were found predated/damaged during the study period in both the villages.

In both the villages, number of nests, eggs and nestlings were found more during the month of September (Figure 1). As the study was conducted for a period of five months, exact breeding season of house sparrow could not be determined. In Punavasipatty, breeding activity showed a bimodal trend while in Kuthoor breeding activity showed a declining trend from the month of September during the study period.

The clutch size normally ranged from a minimum of two eggs to a maximum of four with three being the modal (SD = 0.6 and SE = 0.06) in Punavasipatty. In Kuthoor, the clutch size varied from a minimum of one egg to a maximum of five with two being the modal (SD = 1.07 and SE = 0.10). For house sparrows, the clutch size normally ranges from two to five eggs, with modal values being four in the UK and five in continental Europe and North America (Summers-Smith, 1988). Vincent (2005) reported that the clutch size normally ranges from two to five eggs with four being the modal number in the UK. However, no such statistics is available for India to compare with the present study. The present results are within the range, reported by Summers-Smith (1988) and Vincent (2005) and

ISSN 0973-9157

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numerical difference in the modal number may be attributed to either the sample size or other environmental factors that influence the parental investment or reproductive output.

The interval between the laying of each egg is approximately 24 hours and both sexes take part in incubation in both the villages as reported elsewhere (Seel, 1968). The incubation period is defined as the interval between the laying of the last egg of the clutch and the hatching of the first young (Seel, 1968). The incubation period ranged from a minimum of nine days to a maximum of 11 days with an average of 10.26 days (SD=0.66, SE=0.04,) in Punavasipatti . In Kuthoor, it varied from a minimum of 7 days to a maximum of 12 days with an average of 8 days (SD = 0.69 and SE = 0.10). Summers-Smith (1988) reported that incubation lasts between 10–17 days while Lowther and Cink (1992) showed an average of about 11 days if measured from the last egg to the first hatch. The fledging period also varied from a minimum of nine days to a maximum of 12 days with an average of 10.6 days (SE=0.03, SD=0.69) in Punavasipatty. In Kuthoor, it varied from a minimum of nine days to a maximum of 14 days with an average of 11 days (SD =0.87 and SE = 0.12). Summers-Smith (1988) reported that the nestlings remain in the nest for between 12-18 days and typically averaging 14-16 days. The incubation and fledging periods recorded in the present study are somewhat shorter than Summers-Smith (1988) and Lowther and Cink (1992), which could be attributed to either the sample size or other environmental factors that influence the parental investment.

Mayfield survival probability showed that the probability of nest surviving throughout the nest construction period was 0.98171 and 0.97637 in Punavasipatty and Kuthoor respectively (Table 1). However, Mayfield survival probability showed the maximum value of one in the probability of nest surviving throughout the incubation and nestling period as no damage was recorded during these two periods in both of the villages. Hence, there is a 98% chance that a nest will fledge at least one young in both the Villages. As presented in Koronkiewicz et al. (2004), comparing Mayfield survival probabilities at the study areas with results from other studies may be somewhat problematic because of difference in the duration of nest stages (egg laying, incubation, and nestling stage) used in calculations.

Of the 111 nests in Punavasipatty, majority of them were constructed on plants (79) followed by man-made structures (Table 2). The results proved that nests of house sparrow were not placed at random but showed significant level of preference towards plants to construct their nests ( $\chi^2_{0.00,1}$ =19.901). Although 79 nests were constructed on 10 plant species, 83% of the nests ISSN 0973-9157

were found only on two plant species (Jasminum grandiflorun 38% and Acacia nilotica 45%). The results further proved that nests of house sparrow were not constructed at random but showed some level of preference towards certain plant species ( $\chi^2_{0.01,2}$  = 9.139). Of the 109 nests Kuthoor, majority of them were constructed on plants (101) followed by man-made structures (Table 2). The chi square (  $\chi^2_{0.00,1}$  =79.349) test proved that nests of house sparrow were not constructed at random but showed significant level of preference towards plants. Although 101 nests were constructed on 15 plant species, majority of the nests were found only on two plant species (Morinda coreia and *Acacia nilotica*). The chi square (  $\chi^2_{0.00, 14}$  =56.376) test proved significant that nests of house sparrow were not constructed at random but showed some level of preference towards certain species of plants. Of the 32 nests constructed on man-made structures in Punavasipatty, majority of them were on thatched houses (Table 2). The results proved significant that nests of house sparrow were not constructed at random but showed some level of preference towards thatched structures ( $\chi^2_{0.00.3}$  = 24.5). Of the 8 nests constructed on man-made structures in Kuthoor, majority of them were on concrete houses (Table 2). All the man-made structures in Punavasipatty (thatched-, tiled-, asbestos, and concrete-roofed houses) were used by the house sparrows to construct their nests. However, all the manmade structure available in Kuthoor (thatched, tiledand concrete-roofed houses) were not effectively used by the house sparrows to construct their nests. In general, constructing nests on various substrates (plants and man-made structure) by house sparrows indicate the adaptive nature of the species to all the environments. Murphy (1983) and Martin (1992, 1993) suggested that the predation, which is the primary cause of nest failure, should be the key factor influencing the nest-substrate selection. Hence, selection of certain structures would give better protection to the eggs/ nestlings from the predators and from extreme weather conditions than other substrates.

The nest height, regardless of substrates, varied from a minimum height of 65cm to a maximum height of 350cm with a mean value of 219cm in Punavasipatty (Table 3). However, minimum nest height differed between plants and man-made substrates. It was 65cm in plant category and 160cm in the man-made substrate category. Similarly maximum height also varied between substrates. It was 350cm in the plant category and 290cm in the man-made substrate category. However, in Kuthoor, the nest height, regardless of substrates, varied from a minimum height of 15 cm to a maximum height of 610 cm with a mean value of 162 cm (Table 3). However, minimum nest height diffrered between plants and man-made substrates. It was 15 cm in plant category and 150 cm in the man-made substrate www.bvgtjournal.com

Table 1. Daily survival rates and Mayfield Survival Probabilities (MSP) for house sparrow nest stages in Punavasipatty and Koothur Villages, Tamil Nadu, India

Nest stage	Nest losses/ observation days	Daily survival Rate	Mayfield probability	survival
Nest-construction	1/163	0.99387		0.98171
Incubation	0/838	1.0000		1.0000
Nestlings	0/1122	1.0000		1.0000
Overall	1/2123	0.99958		0.98882
Kuthoor Village				
Nest-construction	1/126	0.992063		0.97637
Incubation	0/765	1.0000		1.0000
Nestlings	0/987	1.0000		1.0000
Overall	1/1878	0.99946		0.98836

# Punavasipatty Village

Table 2. Percentage of nests of house sparrow found on various substrates in Punavasipatty and Kuthoor Villages, Tamil Nadu, India

Punavasipatty village		Kuthoor village			
Nest-substrates	# of nests	%	Nest-substrates	# of nests	%
Plant species	79	71	Plant species	101	93
Man-made structures	32	29	Man-made structures	8	7
Total	111		Total	109	
I. Plant species					
Jasminum grandiflorun	30	38	Jasminum grandiflorum	12	12
Jasminum officinale	4	5	Jasminum officinale	6	6
Acacia nilotica	35	44	Acacianilotica	14	14
Citrus limon	1	1	Citrus limon	7	7
Opuntia vulgaris	2	3	Punica granatum	8	8
Clitoria ternatea	1	1	Citrus aurantifolia	10	10
Catharanthus roseus	1	1	Bambusa aurundinacea	3	3
Sorghum valgare	3	4	Saccharum spontaneum	13	13
Cocus mucifera	1	1	Pithecellobium dulce	2	2
Punicagranatum	1	1	Prosopis juliflora	2	2
Total	79		Morinda coreia	14	14
			Psidium guajava	5	5
			Neriumindicum	2	2
			Thevetia neriifolia	2	2
			Mangifera indica	1	1
			Total	101	
II Man-made structure					
Tile-roofed houses	1	3	Tile-roofed houses	0	0
The-roored nouses	1	59	Thatched houses	2	25
Concrete houses	0	- <del>39</del> - 28	Concrete houses	<u>~</u>	25 75
Ashestes reafed houses	2	20 0	Ashestes reafed houses	0	75
Total	27	7	Total	-	-
10(a)	32		10(a)		0

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Punavasipatty Village		Kuthoor Village	
Nest height	Range, Mean, SD, and SE (in cm)	Nest height	Range, Mean, SD, and SE (in cm)
overall	65-350, 219.1, 60.8, 5.7	Overall	30-610,162.8,113.4,10.9
plant over	65-350, 212.7. 67.4. 7.6	Plant over	30-610,150.7,101.5,10.1
man-made over	160-290,235,34,6.36	Man-made overall	150-610, 316.3, 149.3, 52.8
Plant species name			
Jasminum grandiflorun	110-320, 195.2, 50.5, 9.2	Jasminum grandiflorum	110-270,173.3,59.4,17.2
Acacia nilotica	65-350, 236.7, 73.0, 12.3	Acacia arabica	390-670, 514.3, 130.5, 34.9
Jasminum officinale	160-320, 232.5,71.8,35.9	Jasminum officinale	130-250, 186.7, 40.3, 16.5
Citrus limon	280	Citrus limon	110-210, 74.3, 33.6, 12.7
Opuntia vulgaris	160-260,210,70.7,50	Psidium guajava	40-430, 222, 174.6, 78.1
Clitoria ternatea	145	Punicagranatum	170-570, 335, 195.3, 69
Catharanthus roseus	210	Citrus aurantifolia	120-390, 273, 105.6, 33.4
Sorghum valgare	90-110,98.3,10.4,6	Bambusa aurundinacea	610
Cocus mucifera	210	Saccharum spontaneum	30-140, 93.8, 34, 9.4
Punica granatum	180	Pithecellobium dulce	210
		Prosopis juliflora	210-240, 225, 21.2, 15
		Morinda coreia	120-310, 192.9, 56.9, 16.2
		Nerium indicum	210
		Thevetia neriifolia	360
		Mangifera indica	70
Man-made structure			
Thatched houses	160-290,229.5,30.1,6.9	Thatched houses	360-410,385,35.4,25
Concrete-roofed houses	160-290,240,51.23,17.07	Concrete-roofed houses	150-610, 293.3, 168.6, 68.8
Tile-roofed houses	280	Tile-roofed houses	-
Asbestos-roofed houses	240		-

Table 3. Descriptive statistics of the nest-height of house sparrow recorded on various substrates in Punavasipatty and Kuthoor Villages, Tamil Nadu, India

Table 4. Number of nests of house sparrow found in various man-made structures from 2011 to 2013 in Punavasipatty and Koothur Village, Tamil Nadu, India

Punavasipatty Village				
Types of houses	Number of houses in the village	Number of nests constructed in various house types during various years		
		2011	2012	2013
Concrete-roofed houses	154	5	6	9
Thatched houses	81	3	3	19
Tile-roofed houses	437	10	7	1
Asbestos-roofed houses	49	1	1	3
Kuthoor Village				
Types of houses	Number of houses in the village	Number of nests constructed in various house types during various years		
		2011	2012	2013
Concrete-roofed houses	370	26	6	6
Thatched houses	50	3	2	2
Tile-roofed houses	30	1	1	0

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Figure 1. Numbers of nests, eggs and nestlings of house sparrow found in various months (August 2013 – December 2013) in Punavasipatty and Kuthoor Villages, Tamil Nadu, India Figure 2. Numbers of eggs laid in each nest by the house sparrow in Punavasipatty and Koothur Villages, Tamil Nadu, India



Figure 3. Orientation of nests of house sparrow found in Punavasipatty and Kuthoor Villages, Tamil Nadu, India

# 1. Punavasipatty Village





# 2. Kuthoor Village







Overall



■ Overall

ISSN 0973-9157

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category. Similarly maximum height also varied between substrates. It was 440 cm in the plant category and 610 cm in the man-made substrate category. Indykiewicz (1990) found that the most common height when analyzing the location of sparrow nests was between three and four meters high.

All the nests in Punavasipatty were oriented towards 0-45° (north to northeast direction, Figure 3). On the contrary, nests were oriented almost in all the direction (particularly on plants) in Kuthoor (Figure 3). Selection of certain direction would give better protection than other direction from predators and harsh weather. Similarly, non-specific orientation may also be a strategy to protect the eggs and nestlings by mislaeding the predators. In general, adapting any one of the above mentioned twostartegies by the house sparrow depends on the knowledge gained through previous successful/failure nesting attempts over the years in the respective villages.

In order to find out whether the house sparrow effectively utilizes all the thatched houses available in the villages or not and whether the house sparrow avoids concrete houses or not, all the houses present in both the village were inspected for nests. Although, house sparrow showed some preference towards thatched house but it failed to prove that it avoids concrete-roofed houses to construct its nests in Punavasipatty village (Table 4). Although less number of nests were found on man-made structures in Kuthoor village, nests were comparitively more inconcrete than thatched houses (Table 4). In both the villages, nests were found even in concretee houses. The local people from both villages were also of the opinion that unlike past years, the house sparrow nests even in concrete houses in thier villages. However, the concrete-roofed houses in the study area are not as modern as the houses found in urban to provide no room for house sparrows to construct their nests.

#### Conclusion

The present study on nesting ecology of house sparrow indicated the adaptive nature of the species to all the environments in both the villages to place its nest: nests of house sparrow were found both on plants and manmade structures. Moreover, it is most likely that the house sparrow is no longer dependant of man-made structure, particularly in both the villages as nests were found mostly on plants. The house sparrow lays upto five eggs and incubates upto 12 days. The nestlings remain in the nest for about a maximum of 14 days.

#### Acknowledgement

The authors thank the management of National College, Tiruchirapalli-1, Tamil Nadu, India for their support to carry out the study.

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ISSN 0973-9157

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