
ORIGINAL ARTICLE

Mud nests of Wire-tailed Swallow (*Hirundo filifera*): Biomarkers of Ecological niche in Godavari river ecosystem, Nanded, Maharashtra State

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ABSTRACT

Wire-tailed swallows were found nesting in a cluster of 556 mud nests in Godavari river basin, Nanded district, Maharashtra on the eastern side of a road bridge. The mud nest mainly composed of 99% mud collected from river mud banks in the form of pellets. 1000-1400 pellets were used to construct a single mud nest. To construct the nest a group of birds was involved but they construct their own nest and each nest gets the support of other nest in the nest cluster. To study the nesting ecology of these swallow species, 12 habitats were observed especially bridges on the rivers. House crow *Carvus splendance*, was found the main enemy to damage the nests of swallow. Availability of mud as main resource, presence of water bodies in the river and non-polluted water with less anthropogenic disturbance was the favorable site found selected for the nest building by the wire-tailed swallow *Hirundo filifera*. Occurrence of mud nest colonies in an area is an indication of healthy and non-polluted ecological niche.

Keywords: Wire-tailed, Swallow, Mud-nest, Godavari river, Nanded

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INTRODUCTION

Swallows and Martins are classified under the Order: Hirundinidae of Class: Aves. There are 90 different species of swallows found all over the World; they show cosmopolitan distribution in both the Northern and Southern Hemisphere. Most of the swallows are insectivorous, they search the dipteran flies and to collect the food they may search 3-4 sq. km. area. Hence, the swallows are one of the effective biological controlling agents of insects [1]. Both the sexes are involved in nest building, the swallow species have a clutch size of 3-4 eggs, laid during each breeding season. Once, the main part of nest gets constructed, the eggs are laid in many species of swallow then the remainder is completed. During winter season in the Southern parts of India, occurrence of small birds with long wings flying in a crowded flock of 100 to 5000 with sharp cuts and turns, flying at a height of about 100 to 200 ft. to the ground. They were found sitting in a row on electric wires with equidistance between each other is a common scene. All these birds are swallows (*Hirundo species*). Swallows found in major parts of the world [2]. Swallows migrate to southern parts of India from Himalayan region and to the southern continental regions of the world in overall global migration during cold winters [2]. Many times, the swallows may be misidentified as swifts but the major difference between these two is the swifts do not sit on the wires and other similar kinds of objects due to absence of oppositely directed fourth digit hence unable to grip. Therefore, swifts are more vigorous, random and fast flying birds compared to swallows during feeding. Swifts also return to their nests in shorter time. *H. filifera* has total body weight of 17.0 to 18.0 gms, wing surface area 118-120 cm², length of hairy fili-form tail feather 12-14 cm margin of tail feather square shaped almost, tail feathers shorter than wings.

Barn swallow species (*Hirundo rustica*), wire-tailed swallow (*Hirundo smithii*, *Hirundo filifera*) and Cliff swallow (*Petrochelidon pyrrhonota*) are the common species of swallow found in India [3, 4]. As like busy bees, the swallows are very enthusiastic, busy and active birds representing gregarious behavior during feeding and nesting activities in particular [5]. Locally available mud from non polluted habitats, dropped feathers of other birds, small and soft twigs of grass and plants, pieces of cotton and plastics, polythene threads etc. are some of the materials found to be used by swallow species for their nest construction [6]. Nests are constructed in clusters where each nest gets support of other nest in the cluster (Fig. 1.). Nest construction process was carried out in a group but each swallow contributes its efforts to construct the nest for its own use in a cluster.

Barn swallow and wire tailed swallow prepare nests of specific gourd shape having typical blue print design with specific architectural structure [7]. Swallows prefer higher elevations from ground to construct their nests near to raw materials required for nest building at safe distance from the reach of enemies like ants, snakes and predators like crow, hawks, kite and nuisance from human being. There are reports on the mud nests preparation by swallow species in parts of India but it has been least studied to correlate with the characteristics of an ecological niche in the river ecosystem of Maharashtra. In a detailed report on the annotated checklist of birds from Godavari river in Nanded District of Maharashtra [8]. the need of studies on avifaunal nesting in the region was emphasized.

MATERIALS AND METHODS

In the context of studying the nest building process of Wire-tailed swallow (*Hirundo filifera*, Stephans, 1826) and to correlate the presence of mud nest colonies with various factors of an ecological niche in river ecosystem, mud nest colony sites located in Godavari river basin were surveyed from 2013 to May 2014. Various possible nesting sites of Wire-tailed swallows located especially under the large and high bridges of tar roads and railway were monthly visited. One day at each nesting site was spent to observe the nest building process by swallows and various anthropogenic activities. A NIKON Cool-pix 510 model of digital camera with autofocus and inbuilt 46 X zooming lance and 14.6 mega pixels was used to photo record the activities of swallows. BENRO Tripod stand was used to avoid the shaking of the camera during photography. A waterproof and cold proof field study tent of cloth was used to reach to the nearest possible distance of swallow habitats for close observation of the nest building activities. Entire day was spent at one site by changing the observation points at 2-3 places to prevent the sun radiations and to avoid the sun radiation impacts during photography. Insect nets were used to collect flying insects and aquatic insects from the nesting niche of the swallows. Essential tools for avifaunal ecological studies like GPS, Meter Tape, Binocular, sound recorder were used. The collected images are preserved in Zoology Research Laboratory, School of Life Sciences, Swami Ramanand Teerth Marathwada University, Nanded, Maharashtra State, India. Presence of thick, yellow-green algal bloom on the stagnant water pools in the river and foul smell of water from 50 meters' distance was decided as the study parameter to classify water as polluted water from the selected study area.

RESULTS

Presence of mud nest colony at an ecological niche has a definite positive correlation with availability of essential resources and suitable factors for the nest building of swallow species in the selected study area. From the observed twelve different possible nesting sites in Godavari river basin (Table 1.) Cherli Bridge (Road Bridge) near village Cherli, 2 km. from Jarikot Taluka Dharmabad District Nanded, MS was the most successful nesting site having 556 nests, the details of other nesting sites are as in table: 1. The mud nests of swallows were not found at six other observed different sites near Nanded city were the remarkable findings to represent non availability of nesting materials and high levels of ecological degradation of ecological niche. To identify the swallow species, the recorded photographs of the swallows from nesting sites were used to analyze it with the data from website [3].

1. Mud Nest site selection:

The wire-tailed swallow (*Hirundo filifera*) were found very particular in site selection for their nest building. Usually 50-60 ft. above the ground on the flat surfaces of cement concrete roofs of road bridges. The nests were found constructed at eastern direction of the bridges probably to prevent damage from south west monsoon in the region. The nests were found on flat surfaces from downside and lateral inclined part of cement concrete bridges. The nest sites were well away from the reach of some commonly reported enemies like fire ants [9]. As the nests were having confined area around the nests it was difficult for the birds like House Crow (*Carvus splendance*), Cuckoo Hawk (*Aviceda cuculoides*) and Black kite (*Malvus migrance*) [8] which were commonly found in the river area to damage the nests to devour the nestlings from the swallow nests. In the present study, common house crow was found sitting

near the mud nests. The local fishermen reported that the crow breaks the mud nest with beak by sitting on the nest and devour the nestlings. Besides the presence of large number of crows at the site about 0.8 to 1.0 % nests were found randomly broken in the dome region which is the breeding chamber of the nests.

2. Nest construction process:

The swallow carry the main nesting material wet mud pellets in their mouth (Fig. 4.). To collect the suitable mud, they were found digging the coastal mud bank near the water in river; they prepare a mud pellet within 1-2 minutes and carry in their wide mouth supported by small, thin and short black colored beak. Mud pellets were carried one by one every time by each bird to the nesting site. Mud pellet diameter was 1.0 to 1.4 cm. About 1000-1400 mud pellets were used to construct single nest. Details of time required to construct various parts of mud nest are variable from few hours to few days (Table 2.). In mud pellet carrying activity about 35 to 50 swallows were involved from a group of 500-550 swallows at nesting site No. 9 (Table 1.). Rest of the members in the group was flying around the nest and river area.

3. Nesting material and anthropogenic activities at the nesting site:

The nesting material mainly composed of sand, silt and clay; also consists of crushed parts of bivalve shells. From inner side of the nests small, soft and thin feathers of their own from their chest region get attached to the wet mud during their in and out movement through the nest during nest construction process. Randomly selected abandoned nests were 170-190 gm in weight, that mainly contains 99% mud part composing sand, clay and silt whereas rest of the 1 % other materials consisting of Dry and small sized grass twigs, hairs, some plant leaves, plastic pieces were also found attached firmly from inner side of the nest. Wet mud containing silt, fine sandy particles and crush of bivalve shells was the main material used for nest construction by swallows. This kind of mud was useful for these birds to prepare a pellet form to carry to the nesting site and to fix to the mud pellets already fixed in the nest. During mud pellet formation, the time spent (1-2 minutes) by each bird indicate they roll the mud with their beak and intentionally or unintentionally their saliva gets mixed into the mud pellet during its formation. Actually the birds are not famous for producing saliva and the role of saliva in the process is indistinct but the stickiness of mud in the pellet was higher than the mud in coastal river. During the study period at the selected nesting sites, such useful mud (mud banks) was available at different distance from nesting sites (Table 1.) whereas it was not available at few places as mentioned in Table 1. Safe places for nesting were found available but due to high level of pollution in the river water and non availability of required quality mud were the major factors for not constructing the mud nests by the swallows. At the nesting site 9 on a bridge (Table 1.) the width of Godavari river from one to next coast was 300 to 700 ft. with plain sandy and dry bottom. At every 100 ft. distance the electric pump sets were fixed by the local farmers for lift irrigation to agriculture. Heavy quantity of water pumping from Godavari river and shortage of rainfall in the area with few stagnant water pools in the river were notable factors observed as major activities during the current study. Frequently the entry of cattle herds and sheep goat herds into river for drinking of water was found, but all these activities were not much affecting on nesting activity of the swallows. As a religious activity the ash remains after fire cremation of Hindu community people were also found released into the river at this bridge, it consists of mainly ash of human body mixed with the ash of wood used during cremation. Dumping of statues of Hindu Religious Goddess and Gods Like 'Devi' and 'Ganesh' made from Plaster of Paris (POP) and asbestos cement mixture was also found at this site. Remains after the religious ceremony that containing flowers, garlands, bouquets and other waste materials were also found dumped at this site.



Figure 1. Cluster of Mud Nests of Wire-tailed Swallow (*Hirundo filifera*)Figure 2. Individual close view of Wire-tailed Swallow (*Hirundo filifera*)Figure 3. Nesting site of Wire-tailed Swallow (*Hirundo filifera*) on Godavari river bridge, Cherli, Taluka Dharmabad, Dist. Nanded, MS.Figure 4. Wire-tailed Swallow (*Hirundo filifera*) busy in digging the mud and carrying the mud pellet in mouth for nest construction.**Table 1. Habitats selected for observation of birds in Nanded area, Maharashtra State, India.**

Sr. No.	Bird Habitat	Name of River and Distance of mud-banks from nesting site	Total Mud nests, Location height from ground level	Coordinates and pollution status of niche
1.	Godavari bridge -I Near SP Office Nanded	Godavari, 800 meters	Nests = 00, Height of bridge = 80 ft.	19° 08' 51" N 77° 20' 03" E Polluted water, no mud banks
2.	Godavari Bridge- II, New Mondha, Nanded	Godavari, 500 meters	Nests = 00, Height of bridge = 80 ft.	19° 08' 20" N 77° 19' 03" E Polluted water, no mud banks
3.	Godavari Old Bridge- III, Degloor Naka, Nanded	Godavari, 30 meters	Nests = 00, Height of bridge = 70 ft.	19° 08' 53" N 77° 0' 04" E River water and nearby area highly polluted, mud available
4.	Railway bridge Near Purna Railway Station.	Purna, 30 meters	Nests = 04 (Not in use), Height of bridge = 82 ft.	19° 10' 33" N 77° 19' 03" E River water and nearby area Highly polluted, mud for nesting available
5.	Purna Road Bridge	Purna, 50 meters	Nests = 10, Height of bridge = 80 ft.	19° 09' 58" N 77° 00' 22" E River water and nearby area polluted, mud for nesting available
6.	Dudhna River Bridge at Rahtee 16 km. NE to Parbhani	Dudhna 10 meters	Nests = 350 in 4 clusters Height of bridge = 72 ft.	19° 16' 26" N 76° 54' 03" E Clean water source for drinking water to Parbhani city, both coasts with mud
7.	Vishnupuri Dam, Nanded	Godavari, 50 meters	Nests = 108 in 2 clusters. Height of nest location on the barrage from water = 65 ft.	19° 06' 48" N 77° 17' 03" E
8.	Shahapur road Bridge Near Degloor, Dist Nanded	Manyad, 5000-6000 meters	Nests = 00	18° 34' 22" N 77° 33' 07" E No water, no mud, exposed rocky area in river
9.	Cherli Bridge, Jarikot	Godavari, 10-15 meters	Nests = 566, all in use, (551 completed, 06 damaged, 9 incomplete) Height of bridge = 60 ft.	18° 52' 13" N 77° 45' 53" E Mud available with easy access, least disturbance to collect mud.
10.	Babhali Barrage dam at Babhali, taluka: Dharmabad	Godavari, 200 meters	Nests = 00 300 meters	18° 51' 22" N 77° 50' 03" E No water, no mud, exposed rocky area in river, coastal area sandy
11.	Road Bridge near Pasadgaon, Nanded	Aasna, 20-25 Meters	Nests = 00 Height of bridge = 14 ft. 10-20 meters	19° 12' 23" N 77° 18' 05" E Highly polluted water with garbage dump, muddy and sandy coastal area
12.	Karadkhed dam Ta. Degloor	Lendi, 6000-7000 meters	Nests = 06 (abandoned, damaged) Height of bridge = 60 ft.	18° 33' 13" N 77° 34' 06" E Dry river basin,, with exposed rocks, sandy basin, no mud

Table 2. Time required to construct various parts of mud-nest, incubation and breeding activities for Wire-tailed swallow *Hirundo filifera*

Sr. No.	Nest part and dimensions	Time required to construct the nest part and other details
1.	Nest base (14-25 cm.)	04 days
2.	Cup shaped base (15-21 cm.)	06 days
3.	Globular gourd shaped main part (15-27 cm.)	05 days
4.	Entrance tube length (8-11 cm.) Diameter of entrance Tube at opening= 4-5 cm.	03 days (Total days required for nest completion 17-18 days)
5.	Thickness of nest wall	1.5 - 2.0 cm.
5.	Mud-Pellet formation	1-2 minutes
6.	Diameter of mud pellet	1.5-2.5 cm.
7.	Number of nests in mega-cluster	50-5000
8.	Number of nests in a sub-cluster of mega-cluster	30-70
9.	Number of swallows in a group during mud collection	10-28
Breeding activities		Details
1.	Clutch size	3-4 eggs
2.	Incubation period	12-15 days
3.	Fledging time	25-30 days after hatching (late May to Mid June)

DISCUSSION

Occurrence of mudnests of swallow (*Hirundo smithii* and *Hirundo filifera*) is reported in parts of Maharashtra State like Mumbai, Western Ghats region [10]. In Tamil Nadu also the swallow nests and details of structural engineering skills used to prepare gourd shaped nests by these birds have been studied by [7, 11]. Delbert et. al. (1977) had analyzed the type of nest material used by Cliff swallow and Barn Swallow and found major part of nest was mud that containing sand, clay and silt and rest of the material were 1-2%, whereas in the present study the wire-tailed swallow mud nest were similar except variation in other materials; only feathers from their own body were major components that found attached from inner side of the dome region and entrance tube. The cluster of mud nest consists of 5 to 600 nests supported by parts of each nest to one another with main body of nest of dome shape remain attached from its base to down side, lateral vertical or inclined flat surface of cement concrete, it is no doubt a structural marvel [7]. By using only mud as construction material still it was not possible for human being to construct such kind of structures at such a difficult location but only using its beak and mouth these tiny birds prepare laterally or inverted fixed domes of these gourd shaped nests is one of the remarkable nest types in the avian world. Occurrence of 556 mud nests at site No. 9 (Table 1.) is the first report of swallow nests in such a large number in Maharashtra State and in Godavari river basin in Nanded District in special. This is an indication of safe and suitable ecological niche like Cherli Bridge (Site No. 9) are still available in this parts of World that is supporting as best site for mud nest construction for wire tailed swallows. Local fishermen reported that few 25-30 years back the mud nests of this swallow species were in such an enormous number that, they were on the both eastern and western side of the bridge attached to the bridge all along the length of 216 meters of bridge there were nests. But, now this nesting has been limited and restricted to 556 numbers and it has remained only between two supporting poles of the bridge out of total nine poles of the bridge. Therefore, the number of mud nests might have existed between 4, 500 to 5, 000 at this site few 20-25 years ago. The fact of existing such large number of nests at this bridge was supported by the opinion of fishermen of age group 30-35 that, they were playing with the flying swallows when they were kids living with their parents at this place and they remember the existence of swallow nests on both side of the bridge. At several places the mud pellets attachment marks on the bridge still existed.

Reduced water level of river, overuse of water for human welfare, shortage of rainfall in the region was the main causative factors for reduction in number of mud nests in the region. During early morning and late evening the flock of swallows having approximately 200-300 were found free flying nearby the area of nests and might be collecting small Dipteran flies from air and carrying them to nests, swallows enter in to the nest through tubular entrance and might be feeding to young ones [13]. They were repeating this cycle of going away from nest in to the air and coming back to enter into the nest 2-3 times in about 5-6 minutes' time. Smythies [14] reported that the swallows also feed on small berries from locally available shrubs but this kind of feeding by swallows in this study was not found. Presence of swallows' mud nests

in an ecological niche represents normal and ecologically balanced niche characters. Therefore, to maintain the ecological niches in river ecosystem the presence of mud nests of swallows will be positive marker of normal, non-polluted and eco-friendly conditions for the survival need and nest building in swallow species *H. rustica* and *H. flifera* [15]. Water lifting from the river using several electric pumps to agriculture need to be monitored and it is an essential need to maintain the water in Godavari river otherwise it will be difficult for the several aquatic bird species, swallows, turtles, wild boar, crab eating foxes and other unexplored biota in Godavari river ecosystem to get their basic needs like water, food and shelter. Tehre and Parasharya [16] reported that release of treated sewage water into the pond during dry season maintain the habitat ecology for water birds in arid parts of Gujarat State of India; similarly, in Nanded area especially from Nanded city major influx of sewage in to river Godavari was untreated hence no mud nests of Wire-tailed Swallow were found at four different bridges constructed across river Godavari close to Nanded city

CONCLUSION

Therefore, human beings living in this part of India have to keep in mind that, the planet earth and available natural resources on the earth are not made only for themselves but every other living individual also has an equal right on these resources. To realize this fact is an urgent need of time and this small bird species 'Wire-tailed Swallow'*Hirundo flifera* through its nest building activities it is alarming us to stop the anthropogenic activities providing harms to the nature and ultimately destroying the bird nesting sites and environmental degradation.

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