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Nesting and Breeding Aspects of Terrestrial Avifauna of Mount Abu Wildlife Sanctuary (India) and its Vicinity

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Abstract: This study was carried out from December 2021 to September 2023 in the Mount Abu Wildlife Sanctuary and its surrounding areas. A total of 374 nests of 44 bird species were observed. The maximum number of nests were found of the Rock Pigeon, Spotted Owlet, House Sparrow, Indian Pied Starling, Red-vented Bulbul and Bank Myna. Ten types of nest structures were observed viz., hole or cavity nest, cup-shaped, platform nest, globular, cone-shaped, pendant nest, ball-shaped, dome-shaped, saucer-shaped and ground nest.

Different bird species use a variety of nesting materials, such as twigs, branches, grasses, stems, leaves, cloths, thread and pieces of plastic, for the construction of their nests. Nest site selection also varies according to species. We observed nesting on trees, bushes, electric boxes, electric pylons, mobile towers, tree cavities, wall and rock holes, telephone cables, electric transformers, streetlights and lamp posts.

Various breeding aspects, such as breeding seasons, clutch size, hatchling, nestling, fledgling and juvenile stages of birds were observed. Juveniles and sub adults of eight species (Aravalli Red-Spurfowl, Yellow-footed Green-pigeon, Greater Coucal, Small minivet, Jungle Babbler, Large Grey Babbler, Green Avadavat and Crested Serpent Eagle) were observed, but for these species, active nesting was not found. High speeds of winds, heavy rainfall, thunderstorms, forest fires, anthropogenic activities and predators also influenced the nesting and breeding success of birds.

Keywords: Birds, Nest, Nest structure, Breeding, Clutch size, Mount Abu Wildlife Sanctuary

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Introduction

Most of studies have been carried out on the diversity, abundance and distribution of various birds. But no compressive information is available on the nesting and breeding behavior of several

species of birds. Nesting is a general phenomenon in bird reproduction that plays a crucial role during the different stages of a bird's development. Nest composition and sites are also

important (Mahmood *et al.*, 2018). Birds build various types of nests and use them for a variety of purposes and their shapes and utilization of materials also vary according to location (Clayton and Moore, 1997; Strayer *et al.*, 2006). Nest construction time and nest life vary from species to species; the nests of Chaffinch (*Fringilla coelebs*) and Red-vented Bulbul (*Pycnonotus cafer*) are generally short-lived and used for a single breeding season, whereas raptors, including Indian Vulture (*Gyps indicus*), utilize the same nests for many years (Harrison, 1975; Chishty *et al.*, 2020; Chishty and Choudhary, 2020c).

In general, the nests have species-specific characteristics, each species has unique nesting features (Collias and Collias, 1984; Hansell, 2000; Alvarez *et al.*, 2013). Some birds utilize local plant materials, whereas some birds use specific nest materials (Hansell, 2000). Construction of nests may be affected by a variety of factors, such as the accessibility of nest materials and may require significant investment of energy and time (Moreno *et al.*, 2008, 2009), owing to the carrying of the nest material for the nest construction (Putnam, 1949). These costs are decreased by material utilization by old nests and the finding or collection of nesting materials near the nest sites (Collias and Collias, 1984; Nores and Nores, 1994). Nest material selection is also affected by its availability and the majority of bird species construct their own distinctive nests (Hansell, 2000; Alvarez *et al.*, 2013).

The nest's physical structure is influenced by the level of cohesion among the various material arrangements, which can impact the development of embryos and the growth of chicks. As a result, the quality of the nests can have a significant and wider impact on the reproductive success of parents (Lombardo *et al.*, 1995; Alvarez and Barba, 2011; Dawson *et al.*, 2011; Lambrechts *et al.*, 2012). Birds construct nests in order to provide a suitable environment that offers adequate protection and microclimate conditions for the growth and maturation of their eggs and offspring (Collias and Collias, 1984).

Several studies have been carried out on the avian diversity and nesting and breeding aspects of a particular species in Rajasthan (Chhangani, 2002; Bhardwaj, 2018; Chishty and Choudhary, 2020a, b, c; Chishty *et al.*, 2020, 2021; Joshi, 2023), including the Mount Abu region (Sangha and Devarshi, 2006; Choudhary *et al.*, 2022; Choudhary and Chishty, 2022 a, b, c, 2023). However, no study has been carried out on the nesting patterns and breeding aspects of terrestrial bird species in Mount Abu Wildlife Sanctuary and its surrounding areas. The present study was carried out on the nesting ecology and some breeding aspects of terrestrial avian species in the Mount Abu Wildlife Sanctuary and its surrounding areas.

Materials and Methods

Field visits were conducted from December 2021 to September 2023 in the sanctuary and its surrounding areas. Birds were identified using standard field guides: birds of the Indian Subcontinent (Grimmett *et al.*, 2011) and birds of Rajasthan (Vyas, 2013). Bird nests were found through visual inspection and by follow the behavioral cues exhibited by the adult birds, such as the collection of nesting materials or feeding their young, by viewing probable nest sites and by chance sighting of nests. These methodologies were previously adopted by Marini *et al.* (2012) and Chatterjee *et al.* (2022). A field study was carried out in the morning and evening hours; during these hours, birds are more active as compared to other times. The nesting period or season was defined as the time between the earliest signs of nest building, such as the collection of nesting materials and incomplete nests, and the last indication of the nesting period or season was the sighting of fledgling and juvenile stages of species. All nesting and breeding observations were taken very carefully and an appropriate distance was maintained without disturbing the birds. All observations were made with the help of a Nikon 8x42 binocular and photographs were taken with the zooming Nikon P1000 and SLR cameras.

Results and Discussion

Nest site and nesting material selection by birds:

Birds and nests were sighted on the tree branches, tree canopy, tree holes, bushes, electric pylon, communication towers, lamp posts, artificial nesting boxes, pipes, pillars of flyover and other suitable places where nests were properly constructed. Plant twigs, leaves, grasses fibers, stems, roots and leaves, feathers, hairs, plastic bags, straws, cloths, cottons, threads and spider silk were found to be the nesting materials of the birds. Selection of nesting sites and nesting material also depend on the characteristics and features of the habitat, the availability of nesting material and the location where nests are constructed (Clayton and Moore, 1997; Strayer *et al.*, 2006).

A total of 374 nests of 44 species were observed. Out of them, the highest numbers of Rock Pigeon (42) nests were found, followed by Spotted Owllet (35), House Sparrow (27), Indian Pied Starling (25), Red-vented Bulbul (19) and Bank Myna (16). 14 nests of each species, such as Indian Robin, Common Myna, Laughing Dove and Baya Weaver were observed. The remaining species nests numbers are mentioned in Table 1. Eight species, juvenile and sub adult were also found, but nests were not found for these eight species (Table 2).

Nest materials play an important role in the construction of nests. Nesting material selection also varies from species-to-species. Plum-headed Parakeet, Rose-ringed Parakeet, Spotted Owllet, Coppersmith Barbet, Indian Grey Hornbill, Yellow-crowned Woodpecker, White-napped Woodpecker and Black-rumped Flameback Woodpecker have been found to build nests only in tree cavities. During the study period, we did not observe any nesting material collection by these species. Parakeets are referred to as primary nesters because they construct their own nests, while species that use natural cavities, artificial holes, or holes constructed by primary cavity nesters are

called secondary cavity nesters, such as the Spotted owl, Mynas and Robins (Ali *et al.*, 2011).

Brahminy Starling, Indian Pied Starling, Common Myna, Bank Myna, Yellow-throated Sparrow, Indian Robin and Oriental Magpie have been observed to collect fine twigs, grasses, stem, leaves, pieces of plastic bags and threads as nesting materials. Crows, Kites, Shikra, Ibis and Eagles constructed nests on large trees and utilized large sized twigs for the buildup of the outer structure of the nest. Similarly, Columbiformes species such as doves and pigeons utilized small plant materials like sticks and fibers and constructed simple platform nests (Ali *et al.*, 2011). The House Sparrow utilized a wide variety of nesting materials, including plant matter as well as animal matter and human-derived matter and constructed nests on a variety of nesting sites (Choudhary and Chishty, 2021).

Both species, such as Red-vented Bulbul and White-eared Bulbul, utilized a variety of nesting materials, such as small twigs, grass stems, coconut fibers, hair and grasses roots. The nest of the White-eared Bulbul was deeper as compared to that of the Red-vented Bulbul. Birds frequently preferred various man-made structures for nesting where natural nesting sites were scarce (Mainwaring, 2014).

Types of nest structures among various species of birds:

(i) Hole or cavity nest: Hole or cavity nesters are bird species that make nests in tree cavities or other structures, such as holes in walls or holes in buildings, burrow in sand walls, or river margins. Plum-headed Parakeet, Rose-ringed Parakeet, Spotted Owllet, Coppersmith Barbet, Indian Grey Hornbill, Yellow-crowned Woodpecker, White-napped Woodpecker and Black-rumped Flameback Woodpecker have been found to build nests only in tree cavities. Whereas the Brahminy Starling, Common Myna, Yellow-throated Sparrow, Indian Robin and Oriental Magpie-robin nests were found in tree holes as well as other hole-like structures such as wall and building holes, pipes

Table 1: Various nesting and breeding aspects of birds observed from Mount Abu Wildlife Sanctuary and its vicinity (ELS= Egg laying stage, HS= Hatchling stage, NS= Nestling stage, FS= Fledgling stage, JS= Juvenile stage, + = represent stages was sighted, - = Represent stages was not sighted)

S. No.	Species	Breeding season	Various nesting aspects			Various breeding stages				
			Number of nest	Nest site	Nest type	ELS	HS	NS	FS	JS
1	Plum-headed Parakeet (<i>Himalayapsitta cyanocephala</i>)	January to April	6	Trees	Hole nest	-	-	-	-	+
2	Rose-ringed Parakeet (<i>Alexandrinus krameri</i>)	January to April	10	Trees	Hole nest	-	-	-	-	+
3	Spotted Owlet (<i>Athene brama</i>)	January to April	35	Trees	Hole nest	-	-	-	-	+
4	Coppersmith Barbet (<i>Psilopogon haemacephalus</i>)	February to June	4	Trees	Hole nest	-	-	-	-	+
5	Indian Grey Hornbill (<i>Ocyrceros birostris</i>)	March to June	5	Trees	Hole nest	-	-	-	-	+
6	Yellow-crowned Woodpecker (<i>Leiopicus mahrattensis</i>)	February to May	1	Trees	Hole nest	-	-	-	-	-
7	White-napped Woodpecker (<i>Chrysocolaptes festivus</i>)	November to March	1	Trees	Hole nest	-	-	-	-	-
8	Black-rumped Flameback Woodpecker (<i>Dinopium benghalense</i>)	March to April	1	Trees	Hole nest	-	-	-	-	-
9	Brahminy Starling (<i>Sturnia pagodarum</i>)	February to August	8	Trees, wall holes	Hole nest	-	-	-	+	+
10	Common Myna (<i>Acridotheres tristis</i>)	March to September	14	Trees, Pipes	Hole nest	-	-	-	+	+
11	Bank Myna (<i>Acridotheres ginginianus</i>)	March to August	16	Wall holes	Hole nest	-	-	-	-	+
12	Yellow-throated Sparrow (<i>Gymnoris xanthocollis</i>)	February to May	2	Wall holes	Hole nest	-	-	-	+	+
13	Indian Robin (<i>Copsychus fulicatus</i>)	March to August	14	Trees, Boxes, Wall platform	3 Hole nest & 11 Platform nest	+	+	+	+	+
14	Oriental Magpie-robin (<i>Copsychus saularis</i>)	March to July	3	Trees, Telephone cable	1 Hole nest & 2 platform	-	-	-	+	+
15	Asian Green Bee-eater (<i>Merops orientalis</i>)	February to May	2	Sand and Mud bank	Hole nest	-	-	-	-	+
16	Red-vented Bulbul (<i>Pycnonotus cafer</i>)	Throughout year peak season January to October	19	Trees, Bushes, Telephone cable	Cup nest	+	+	+	+	+
17	White-eared Bulbul (<i>Pycnonotus leucotis</i>)	March to September	1	Bushes	Cup nest	+	-	-	-	+
18	Common Babbler (<i>Argya caudata</i>)	March to June	1	Bushes	Cup nest	+	-	-	+	+
19	White-browed Fantail (<i>Rhipidura aureola</i>)	March to June	12	Trees, Bushes	Cup nest	-	-	+	+	-
20	Black Drongo (<i>Dicrurus macrocercus</i>)	April to August	13	Trees, electric poles	Cup nest	-	+	+	+	+
21	White-bellied Drongo (<i>Dicrurus caeruleus</i>)	March to June	4	Trees	Cup nest	-	-	+	+	+
22	Ashy Prinia (<i>Prinia socialis</i>)	March to September	2	Bushes	Cup nest	-	-	-	-	-
23	Common Tailorbird	March to	4	Bushes	Cup nest	-	-	-	+	+

	(<i>Orthotomus sutorius</i>)	September								
24	House Sparrow (<i>Passer domesticus</i>)	Throughout year	27	Wall gaps, boxes	Cup nest	+	+	+	+	+
25	Red-naped Ibis (<i>Pseudibis papillosa</i>)	March to October	9	Trees, mobile tower	Platform nest	-	-	+	+	+
26	Black Kite (<i>Milvus migrans</i>)	March to June	7	Trees, mobile tower	Platform nest	-	-	+	+	+
27	Short-toed Snake-eagle (<i>Circaetus gallicus</i>)	December to May	1	Trees	Platform nest	-	-	-	-	-
28	Shikra (<i>Accipiter badius</i>)	March to June	6	Trees	Platform nest	-	-	-	+	+
29	Rock Pigeon (<i>Columba livia</i>)	Throughout year	42	Cracks in walls, gaps, buildings, and other Pillar of bridge.	Platform nest	+	+	+	+	+
30	Laughing Dove (<i>Spilopelia senegalensis</i>)	Throughout year peak season January to October	14	Trees, electric poles	Platform nest	+	+	+	+	+
31	Spotted Dove (<i>Spilopelia suratensis</i>)	Throughout year	3	Trees, Bamboo Plant	Platform nest	+	-	-	-	-
32	Eurasian Collared-dove (<i>Streptopelia decaocto</i>)	Throughout year	8	Trees, electric poles	Platform nest	+	-	-	-	+
33	Red Turtle-Dove (<i>Streptopelia tranquebarica</i>)	April to September	2	Trees	Platform nest	+	+	+	-	-
34	House crow (<i>Corvus splendens</i>)	March to July	7	Trees	Platform nest	-	-	-	+	+
35	Large-billed Crow (<i>Corvus macrorhynchos</i>)	February to June	4	Trees	Platform nest	-	-	-	-	+
36	Indian Pied Starling (<i>Gracupica contra</i>)	March to September	25	Trees, electric poles, boxes, lamp posts	Globular nest	-	-	-	+	+
37	White-spotted Fantail (<i>Rhipidura albogularis</i>)	March to July	6	Trees	Cone shape nest	-	-	-	+	+
38	Purple Sunbird (<i>Cinnyris asiaticus</i>)	March to June	10	Trees	Pendant nest	-	-	-	+	+
39	Baya Weaver (<i>Ploceus philippinus</i>)	April to August	14	Trees	Pendant nest	-	-	-	-	+
40	Indian Silverbill (<i>Euodice malabarica</i>)	July to December	4	Trees, Bushes	Ball shape nest	-	-	-	+	+
41	Scaly-breasted Munia (<i>Lonchura punctulata</i>)	May to September	2	Trees, Bushes	Dome Shape nest	-	-	-	-	+
42	Dusky Crag Martin (<i>Ptyonoprogne concolor</i>)	February to August	3	Rocky substratum	Saucer shape nest	-	-	+	+	+
43	Grey Francolin (<i>Ortygornis pondicerianus</i>)	Throughout year	1	Ground	Ground nest	+	-	-	-	+
44	Indian Peafowl (<i>Pavo cristatus</i>)	January to October	1	Ground	Ground nest	+	-	-	+	+

and other structures. Asian Green Bee-eaters were found to build hole-like nests and their nests were located in vertical mud banks and along riverbanks. Near the vicinity of the riverbank, we

found two nests of Asian Green Bee-eater.

Total 16 nests of Bank Myna were observed, and all of these nests were located in plastic pipes located beneath the bridge and flyover (Fig. 1).

Table 2- Bird species: only juvenile and sub adult stages were observed, but nesting was not found (+ = Represent stages was sighted)

S. No.	Name	Juvenile	Sub adult	Duration of Observation
1	Aravalli Red-Spurfowl (<i>Galloperdix spadicea caurina</i>)	+	+	December
2	Yellow-footed Green-pigeon (<i>Treron phoenicopterus</i>)	+	+	September, October
3	Greater Coucal (<i>Centropus sinensis</i>)	+	+	October
4	Small Minivet (<i>Pericrocotus cinnamomeus</i>)	+	+	May, June
5	Jungle Babbler (<i>Argya striata</i>)	+	+	June, August, September
6	Large Grey Babbler (<i>Argya malcolmi</i>)	+	+	July, August
7	Green Avadavat (<i>Amandava formosa</i>)	+	+	October, November, December
8	Crested Serpent Eagle (<i>Spilornis cheela</i>)	+	+	May, June

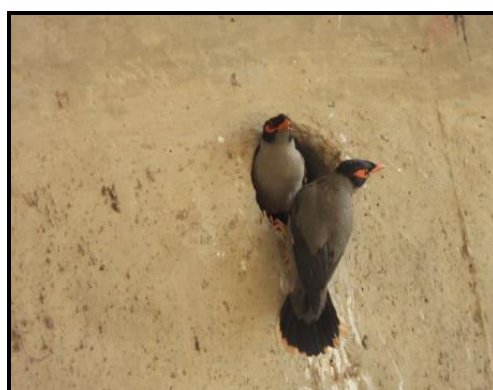


Fig. 1: Nest of Bank Myna.



Fig. 2: Nest of Indian Robin.

We found that the 6 nests of Plum-headed Parakeet, 10 nests of Rose-ringed Parakeet, 35 nests of Spotted Owlet, 4 nests of Coppersmith Barbet, 5 nests of Indian Grey Hornbill and three species of Woodpeckers, such as Yellow-crowned Woodpecker, White-napped Woodpecker and Black-rumped Flameback Woodpecker, had single nests of each.

Eight nests of Brahminy Starling were found, out of which four were built in tree cavities and four in wall holes. 14 nests of Common Myna have been found, of which two were in tree cavities and the remaining 12 in plastic pipes located beneath the road bridge. Two nests of Yellow-throated Sparrows were found, and they were built in the

wall holes. A total of 14 nests of Indian Robins were found, of which three were on the open platform-like structure of the house wall, eight were platform nests located in open electric meter boxes and three were in a tree cavity. Only three nests of Oriental Magpie Robin were found, of which two were found on the platform like nests on the coiled cable of the telephone line and one in a tree cavity. Ali *et al.* (2011) found nesting of Indian Robin and Oriental Magpie Robin in wall and tree holes. But we found Indian Robin and Oriental Megpie-robin nesting in holes as well as platform-like nests (Figs. 2, 3).

(ii) *Cup shaped nest*: Birds that make cup-like nests that attach to the branches of trees, bushes and



Fig.3: Nest of Oriental magpie-robin.



Fig. 4: Nest of Red-vented Bulbul.



Fig. 5: Nest of Black Drongo.



Fig. 6: Nest of Black Drongo.

other suitable places. We found a total of ten species, such as the Red-vented Bulbul, White-eared Bulbul, Common Babbler, White-browed Fantail, Black Drongo, White-bellied Drongo, Ashy Prinia, Tailor Bird and House Sparrow, that constructed cup-shaped nests. Red-vented bulbuls usually construct nests in bushes, garden trees and tree branches of large plants (Chishty *et al.*, 2020), but we found one nest in the coiled cables of telephone lines (Fig. 4).

A total of 19 nests of Red-vented Bulbul were found: 11 nests on trees, 7 nests in bushes and one nest in a coiled cable of telephone lines. One nest of each species, such as the White-eared Bulbul and Common Babbler was observed in bushes. Two nests of Ashy Prinia were observed; one contained cotton threads and leaf sealed by these threads. Common Tailorbird also constructs nests with the help of fine grass materials and an outer side covered by leaves. The four nests of Common

Tailorbird were observed.

A total of 13 nests of Black Drongo were found in these three nests on electric poles and the remaining ten nests were constructed on the branches of trees (Figs. 5, 6). Four nests of White-bellied Drongo were found, and those were made up on side branches of medium-sized trees (Fig. 7). Total 12 nests of White-browed Fantail were found; out of them, eight nests were built up on tree branches, while five nests were observed in bushes. Total 27 nests of House sparrows were observed, out of which 13 nests were in wall cavities, 7 nests were in street light boxes, 5 nests were in artificial nest boxes and 2 nests were built in electric transformers.

(iii) *Platform nest*: These types of nests were constructed on tree branches and other manufactured structures like mobile towers, human buildings, electric pylons, etc., and were usually built with the help

These types of nests were constructed on tree branches and other manufactured structures like mobile towers, human buildings, electric pylons, etc., and were usually built with the help of large twigs and sticks of plants. We found that 11 species, such as the Red-naped Ibis, Black Kite, Short-toed Snake-eagle, Shikra, Laughing Dove, Spotted Dove, Eurasian Collared Dove, Red Turtle-Dove, Rock Pigeon, House Crow and Large-billed Crow, constructed platform nests. Black kites, Short-toed Snake-eagle, Shikra, Red-naped Ibis, House Crow and Large-billed Crow have constructed nests on the large trees, and those nests were generally located in the upper and middle canopy covers of plants. Seven nests of Black kites were found, of which four were on *Azadirachta indica* trees and two on *Eucalyptus* trees and a single nest was observed on the mobile tower. Out of the seven nests, five were located in urban habitats and two were in agricultural landscapes.

Nine nests of Red-naped Ibis were observed: six on *Eucalyptus* trees (Fig. 8), two on *Ficus* trees and a single nest found on mobile tower. Mobile tower nesting of Black-kites and Red-naped Ibis was also previously observed by Vaishnav *et al.* (2022) in Udaipur district. One nest of a Short-toed Snake-eagle was observed and the nest was located on the *Eucalyptus* tree. Six nests of Shikra were found; out of them, three were found in urban habitat and three in forest habitat. Seven nests of House crows and four nests of Large-billed crows were observed.

Five species of the Columbidae family, such as the Rock Pigeon, Laughing Dove, Spotted Dove, Eurasian Collared Dove and Red Turtle-Dove, nests were found. Rock Pigeons usually prefer nests built around human habitation, old temples, forts, rocky crevices and between the air conditioner and wall. They also preferred nest construction in rocky crevices, windows and other platform structures. Nesting material was found to be small twigs, grasses, stems, threads, etc. Laughing Dove, Spotted Dove, Eurasian Collared Dove and Red Turtle Dove build nests up on the

tree branches, shrubs, bamboo trees and other manufactured platform like structures.

We found 42 nests of Rock Pigeon, 14 of Laughing Doves, 8 of Eurasian Collared-doves, three of Spotted Doves and two of Red Turtle-Doves. Out of these, two nests of the Laughing Dove (Fig. 9) and one nest of the Eurasian Collared Dove were found on the electric poles. Most nests of Rock Pigeon were found in cracks in walls, gaps between the wall and air conditioning, windows of buildings and other structures with gaps, like those present under bridges and flyovers. Rock Pigeons generally construct nests on any platform-like structure.

(iv) *Globular nest*: Indian Pied Starlings construct large globular nests on the branches of trees, lamp posts, street lights, coiled telephone cables and electric poles and utilize a large variety of nesting materials. We found a total of 25 nests of Indian Pied Starling, of which ten were on the electric poles, six on the trees, three on the electric meter boxes, four nests in garden lamp posts and two on streetlights.

(v) *Cone shape nest*: White-spotted Fantail built cone-shaped nests and constructed them on the branches of lower-height trees and bushes. They utilized fine grasses for the construction of the outer structures of the nests and the inner structures constructed by the spider webs. We found a total of six nests of the White-spotted Fantail and those were constructed on the tree branches. Four nests on *Prosopis juliflora* and two on *Azadirachta indica* trees.

(vi) *Pendant nest*: Purple Sunbird and Baya Weaver construct usually hanging nests where one end is attached to the substrate, such as branches of trees and the other side freely swoops in the air. Purple Sunbirds utilized soft plant materials such as grasses leaves, fibres, cotton threads, while Baya Weavers utilized palm tree leaf fibres as nesting material for the construction of nests. 14 complete nests of Baya Weaver and 10 nests of Purple Sunbird were found.

(vii) *Ball shaped nest*: Indian Silverbill constructed



Fig.7: Nest of White-bellied Drongo.



Fig. 8: Nest of Red-naped Ibis.



Fig.9: Nest of Laughing Dove.



Fig. 10: Nest of Indian Silverbill.



Fig. 11: Nest of Scaly-breasted Munia.



Fig. 12: Nest of Dusky Craig-Martin.

ball-shaped nests by utilization of grasses stems and leaves (Fig. 10). We found that the Indian Silverbill also utilized deserted nests as roosting and resting places during resting time. Four nests of Indian Silverbill were observed- two on *Acacia nilotica* trees and two in bushes.

(viii) Dome shape nest: Scaly-breasted Munia build ball-shaped nests and utilize the leaf fibres of palm trees (Fig. 11). Two nests of Scaly-breasted Munia were found.

(ix) Saucer-shape nest: Dusky Craig-Martin nesting has been observed on the rocky substratum. They build nests on the lower face of the rocks, and the shape of the nests is saucer-shaped (Fig. 12). We found that the nests were constructed with the help of thin grass stems, feathers and other tiny materials connected by the mud. Three nests of Dusky Craig Martins were found in the rocky mountain area.

(x) Ground nest: Single nests of each species, such

as Indian Peafowl and Grey Francolin were observed on the ground. Both species build their nests in shallow depressions on the ground.

Some breeding aspects of birds:

Various breeding aspects such as breeding season, clutch size, hatchling, nestling, fledgling and juvenile stages of different species of birds were observed (Table 1). The breeding season of birds varies from species to species. Some common birds, such as the Red-vented Bulbul, House Sparrow, Rock Pigeon, Spotted Dove and Eurasian Collard Dove breed throughout the year.

A clutch size of 12 species was observed. The clutch sizes of these species were Indian Robin (2 to 3), Red-vented Bulbul (2 to 3), White-eared Bulbul (3), Common Babbler (3), House Sparrow (3 to 6), Rock Pigeon (2), Laughing Dove (2), Spotted Dove (2), Eurasian Collard Dove (2 to 3), Red-Turtle Dove (2 to 3), Grey Francolin (5) and Indian Peafowl (4).

Hatchling stages of seven species were observed and these species were the Indian Robin, Red-vented Bulbul, Black Drongo, House Sparrow, Rock Pigeon, Laughing Dove and Red Turtle Dove. Hatchling and nestling numbers also depend on egg clutch size and vary accordingly from species to species.

Nestling stages of 12 species were observed: Indian Robin, Red-vented Bulbul, White-browed Fantail, Black Drongo, White-bellied Drongo, House Sparrow, Red-naped Ibis, Black Kite, Rock Pigeon, Laughing Dove, Red-Turtle Dove and Dusky Crag-Martin.

Fledgling stages of 24 species and juvenile stages of 36 species were observed (Table 1). Table 2 shows various species for which nests were not found during the study, but juveniles and sub-adults were sighted. These species were Aravalli Red-Spurfowl, Yellow-footed Green-pigeon, Greater Coucal, Small minivet, Jungle Babbler, Large Grey Babbler, Green Avadavat and Crested Serpent Eagle. These species, juveniles and sub-adults, indicate that these species may be

breeding in this area and nesting season occurred prior to the observational months (Table 2).

Factors affecting nesting and breeding of birds:

Adverse climatic conditions, high-speed wind, heavy rainfall, forest fires and anthropogenic interference also influenced the breeding activity of the birds. Furthermore, natural predators such as raptors, Monitor lizards, Indian Grey Mongoose, Ruddy Mongoose and Snakes contribute to the limiting breeding success of birds. Various types of natural predators exist for different bird species that influence various life stages of birds. Similarly, Chatterjee *et al.* (2022) also found that bird nesting success is influenced by environmental factors including high-speed wind, storms, heavy rainfall and predators. Shikra, House Crow, Large-billed Crow, Greater Coucal and Rufous Treepie are common predators of egg, hatchling and nesting stages of small-sized birds.

Conclusion

The present study concludes that various terrestrial bird species are breeding in and around Mount Abu Wildlife Sanctuary due to the variety of habitats found in the area, including forest, grassland, agricultural land, wetland, rocky mountain and urban habitat. High wind velocity, forest fire and human interference play a negative role in the survival of the nest.

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References

- Alvarez E and Barba E. (2011) Nest characteristics and reproductive performance in Great Tits *Parus major*. *Ardeola* 58: 125-136.

- Ali AMS, Asokan, S, Manikannan R and Radhakrishnan P. (2011) Checklist and nesting patterns of avifauna in and around Mayiladuthurai region, Tamil Nadu, India. *J Threatened Taxa* 3(6): 1842-1850.
- Alvarez E, Belda EJ, Verdejo J and Barba E. (2013) Variation in Great Tit nest mass and composition and its breeding consequences: a comparative study in four Mediterranean habitats. *Avian Biol Res.* 6: 39-46
- Bhardwaj DK. (2018) Diversity and status of terrestrial avifauna in Jamwa Ramgarh Wildlife Sanctuary, Rajasthan, India. *Life Sci Leaflets* 105: 17-29.
- Chatterjee L, Samanta T, Sinha S, Besra S and Roy AB. (2022) Nesting pattern and nest predators of some resident birds of Ecopark, an Urban Park In Kolkata, West Bengal, India. *Int J Adv Res.* 10(08): 110-119.
- Chhangani AK. (2002) Avifauna of Kumbhalgarh Wildlife Sanctuary, in the Aravalli hills of Rajasthan. *Zoo's Print J.* 17(4): 764-768.
- Chishty N and Choudhary NL. (2020a) Ornithofaunal diversity, abundance and feeding guild in different microhabitat of Udaipur district, Rajasthan. *Uttar Pradesh J Zool* 41(5): 30-40.
- Chishty N and Choudhary NL. (2020b) Avian diversity and their feeding behavior in different urban habitats of Udaipur, Rajasthan, India. *Bioinfolet* 17(2): 266-277.
- Chishty N and Choudhary NL. (2020c) Successful breeding rate and population status of Indian vulture (*Gyps indicus*) at Kailashpuri, Udaipur District, Rajasthan. *Environ Ecol.* 38(4): 929-936.
- Chishty N, Choudhary NL, Sharma P, Parveen R, Patel P and Kumawat P. (2020) Nesting behavior of red vented bulbul (*Pycnonotus cafer*, Linnaeus 1766) in Udaipur District, Rajasthan, India. *Indian J Ecol.* 47(2): 529-532.
- Chishty N, Parveen R, Choudhary NL, Patel P and Kumawat P. (2021) Breeding behavior and egg clutch size variation in Red vented bulbul (*Pycnonotus cafer*) at Udaipur district, Rajasthan. *Indian J Appl Pure Biol* 36(1):11-14.
- Choudhary NL and Chishty N. (2021) Studies on nests of house sparrow. *Bioinfolet* 18(4): 443-446.
- Choudhary NL, Kumawat P and Chishty N. (2022) Predator, interspecific interaction and anti-predatory behaviour of Red-wattled lapwing (*Vanellus indicus*) in Mount Abu Wildlife Sanctuary and Kumbhalgarh Wildlife Sanctuary. *Bull Environ Pharmacol Life Sci.* 11(11): 13-19.
- Choudhary NL and Chishty N. (2022a) Birds diversity and feeding guild in and around Abu road and Mount Abu Municipal area, Rajasthan, India. *Biospectra* 17(1): 9-16.
- Choudhary NL and Chishty N. (2022b) Avian mortality in Mount Abu Wildlife Sanctuary and its vicinity areas due to electrocutions and road vehicles collisions. *Ambient Sci.* 9(2): 37-42.
- Choudhary NL and Chishty N. (2022c) Nesting characteristic of Spotted owl in and around Mount Abu Wildlife Sanctuary, Rajasthan. *Biospectra* 17(2): 197-200.
- Choudhary NL and Chishty N. (2023) Nesting ecology and breeding behavior of Black-winged stilt (*Himantopus himantopus*) in wetland habitat of Mount Abu Wildlife Sanctuary, Rajasthan. *Indian J Appl Pure Biol.* 38(2): 652-660.
- Clayton DH and Moore J. (1997) Host parasite evolution: General principles and avian models. Oxford University Press, Oxford.
- Collias NE and Collias EC. (1984) Nest building and bird behavior. Princeton University Press, Princeton, New Jersey.
- Dawson RD, O'Brien EL and Mlynowski TJ. (2011) The price of insulation: costs and benefits of feather delivery to nests for male Tree Swallows *Tachycineta bicolor*. *J Avian Biol.* 42: 93-102.
- Grimmett R, Inskipp C and Inskipp T. (2011) Birds of the Indian Subcontinent. Oxford University Press.
- Hansell M. (2000) Bird nests and construction behaviour. Cambridge: Cambridge University Press.
- Harrison C. (1975) A field guide to the nests, eggs and nestlings of British and European Birds. London: Collins.
- Joshi AK. (2023) Seasonal diversity and dietary guild structure of birds in two Vindhyan gorge forests of Rajasthan, India. *J Threatened Taxa* 15(2): 22597-22605.
- Lambrechts MM, Aime C, Midamegbe A, Galan MJ, Perret P, Gregoire A and Doutrelant C. (2012) Nest size and breeding success in first and replacement clutches: an experimental study in Blue Tits *Cyanistes caeruleus*. *J Ornithol.* 153: 173-179.
- Lombardo MP, Bosman RM, Faro CA, Houtteman SG, and Kluisza TS. (1995) Effect of feathers as nest insulation on incubation behavior and reproductive performance of Tree Swallows (*Tachycineta bicolor*). *Auk* 112: 973-981.
- Mahmood T, Shah SWA, Rais M, Fatima H, Akrim F and Nadeem SM. (2018) Nesting use of tree species by avifauna inhabiting Pabbi Range Forest, Kharian, Punjab, Pakistan. *Pakistan J Zool.* 50(1): 329-338.

- Mainwaring MC, Hartley IR, Lambrechts MM and Deeming DC. (2014) The design and function of birds' nests. *Ecol Evol* 4(20): 3909-3928.
- Marini MA, Borges FJ, Lopes LE, Sousa NO, Gressler DT, Santos LR, Paiva, LV, Duca, C, Manica LT, Rodrigues SS, Leonardo F. Franca LF, Costa PM, Franca LC, Heming NM, Silveira MB, Pereira ZP, Lobo Y, Medeiros RCS and Roper JJ. (2012) Breeding biology of birds in the Cerrado of central Brazil. *Ornitologia Neotropical* 23(3): 385-405.
- Moreno J, Martínez J, Corral C, Lobato E, Merino S, Morales J, Martínez-de la Puente and Tomas G. (2008) Nest construction rate and stress in female Pied Flycatchers *Ficedula hypoleuca*. *Acta Ornithol* 43: 57-64.
- Moreno J, Merino S, Lobato E, Ruiz-De-Castañeda R, Martínez-De La Puente J, Del Cerro S and Rivero-De Aguilar J. (2009) Nest-dwelling ectoparasites of two sympatric hole-nesting passerines in relation to nest composition: an experimental study. *Ecoscience* 16(3): 418-427.
- Nores AI and Nores M. (1994) Nest-building and nestling behavior of the brown cacholote. *Wilson Bull* 106: 106-120.
- Putnam LS. (1949) The life history of the Cedar Waxwing. *Wilson Bull* 61: 141-182.
- Sangha HS and Devarshi D. (2006) Birds of Mount Abu Wildlife Sanctuary, Rajasthan, India. *Indian Birds* 2: 26-32.
- Strayer DL, Eviner VT, Jeschke JM and Pace ML. (2006) Understanding the long-term effects of species invasions. *Trends Ecol Evol* 21: 645-651.
- Vaishnav M, Choudhary NL and Chishty N. (2022) Egyptian vulture, Woolly-necked stork, Black ibis and Black kite nesting on Mobile towers in and around Udaipur district, Rajasthan. *Indian J Natural Sci* 13(73): 46419- 46427.
- Vyas R. (2013) Birds of Rajasthan. Bombay Natural History Soc Oxford University Press, pp xiv+326.