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Nest site selection and Nesting ecology of White-eared Bulbul (*Pycnonotus leucotis*) in Barmer district, Rajasthan

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ABSTRACT:
The study examined nest site selection and nesting ecology of White-eared Bulbul (*Pycnonotus leucotis*) in Barmer district of Rajasthan from February 2022 to September 2024. The entire nesting season of White-eared Bulbul was from March to September, with peak nesting activity observed from April to June. White-eared bulbul breeds and constructs nests in various areas, including urban, rural, uncultivated land areas, scared pasture land and inhabits the forest and agricultural landscape of Barmer district. Nest height of White-eared Bulbul ranges from 1.5 to 4 m above ground level. *Ziziphus mauritiana*, *Salvadora oleoides* and *Acacia senegal* were found most preferably choice of White-eared Bulbul for the construct of nest. Traditional thorn fencing has also been utilized for nest site selection and nest construction. White-eared Bulbul construct deep cup-shaped nests, nest height range between 4.8 to 8 cm, depth ranges between 2.6 to 5.6 cm, diameter ranges between 4.5 to 9.5 cm and nest weight ranges between 5.1 to 40 grams. The height, depth, diameter and weight of White-eared Bulbul nests vary from nest to nest, and usually depend on the utilization of nesting materials as well as the presence of nesting material around the nesting habitat. The external structure of nests is constructed with small, medium and larger-sized slender twigs and midribs of different plants, the middle structure usually contains fine stem fragments and stem fibers of different herbs and shrubs and the inner layer contains inflorescence and fine stem sections and stem fibers of various plant species, including *Leptadenia pyrotechnica* and *Cynodon dactylon* fibers. Cotton and spider webs were found in the innermost layer of the nests. In urban areas, nests of White-eared Bulbul contained human-derived waste materials such as plastic thread, papers, pieces of cloth and animal hair, including human hair. This study highlights White-eared Bulbul's adaptability in nesting behavior and material selection in natural habitats as well as human-modified environments.

Keywords: White-eared Bulbul, Barmer, Nesting, Nest material, Nest side, Habitat

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INTRODUCTION

White-eared Bulbul (*Pycnonotus leucotis*) has a length of 20 to 22 cm, a wingspan of 8.0 to 9.3 cm and a weight of 30 gm (Vyas, 2013). This species displays black and white colors on its crest, throat, and head. The dorsal, lateral, and caudal regions are gray, and the ventral area exhibits a faint yellow coloration. Both genders have similar plumage (Vyas, 2013; Fishpool and Tobias, 2024). The bird's species exhibits square-shaped white markings on its lower cheeks and lateral neck, with a white tip on its tail. The entire family exhibits elongated, supple plumage on the lower back (Vyas, 2013; Fishpool and Tobias, 2024). In *Pycnonotus leucotis*, the crest is simple and the small crest on the neck and crown is entirely black. The species occurs naturally across several Middle Eastern and South Asian nations, including Saudi Arabia, Pakistan, Kuwait, Iraq, Iran and India (Birdlife International, 2018). Furthermore, it has been brought to Bahrain, Oman, Qatar and the United Arab Emirates (Del Hoyo and Collar, 2016). In lowland regions like riverine forests in Thatha district and Margalla hills in Rawalpindi district, nesting usually starts in late February, and broods are usually raised following considerable monsoon rainfall. The breeding season in the Himalayan region spans from April to June. Both male and female participate in nest construction, egg incubation and offspring care, though females take on a more significant role in incubation and nest building. The nest is a cup-shaped, thin-walled building that is normally placed around two meters above the ground. Although *Pycnonotus leucotis* eggs are smaller and have purple patterns (Vyas, 2013; Choudhary and Chishty, 2024).

The shape and materials utilized in nest construction are contingent upon the choice of nesting location and differ among species (Strayer *et al.,* 2006). Duration of nest formation and longevity of nests differed based on the species type. Nests of Red-vented Bulbul (*Pycnonotus cafer*), White-eared Bulbul (*Pycnonotus leucotis*) and House Sparrow (*Passer domesticus*) are ephemeral and are utilized only for one breeding season. Conversely, raptors such as the Indian Vulture (*Gyps indicus*) and Black Kite (*Milvus migrans*) utilize the same nests for multiple years (Chishty and Choudhary, 2020, 2021, 2024; Chishty *et al.,* 2020 a&b, 2021 a&b; Choudhary *et al.,* 2024; Vaishnav *et al.,* 2022).

Nest construction is essential for the survival and reproductive success of animals. Numerous variables, such as the availability of food and nesting materials, vegetation structure, predation risk and the presence of nest ectoparasites, significantly influence nest site selection, breeding success and development (Biddle *et al.,* 2017; Choudhary *et al.,* 2024). These elements have a substantial impact on nest ecology and avian behavior. Nesting material selection is determined by thermal properties and bird size (Mainwaring *et al.,* 2014; Deeming and Mainwaring, 2015; Chishty and Choudhary, 2020; Choudhary and Chishty, 2021; Choudhary *et al.,* 2024). Each species demonstrates unique nest structure and particular site preferences according to their ecological needs (Choudhary *et al.,* 2024; Choudhary and Chishty, 2022, 2023, 2024). Therefore, present study was carried out on the nest site selection and nesting ecology of White-eared Bulbul (*Pycnonotus leucotis*) in Barmer district, Rajasthan.

MATERIAL AND METHODS

The Entire study was carried out from February 2022 to September 2024 to assess nest site selection and nesting ecology of White-eared Bulbul at various study sites, including villages, urban areas, cultivated areas, uncultivated areas and scared pasture land in the Barmer district. Barmer district is located in the western part of Rajasthan and has a desert climate with hot summers and cool winters. The temperature of Barmer district varies significantly throughout the year. During the winter season temperature reaches up –2-3^{o}C, while in summer, the temperature reaches up to 50^{o}C. The average

temperature of the district is approximately 28–30°C. Barmer district receives a very small amount of rainfall during the monsoon season because it is mainly considered a desert area.

Nests of White-eared Bulbul were found through visual inspection and by observing behavioral signs displayed by adult birds, including their collection of nesting materials and the feeding of their offspring, as well as by examining potential nesting sites and incidental sightings of nests. Marini *et al.* (2012), Chishty *et al.,* (2021a), Chatterjee *et al.* (2022) and Choudhary and Chishty (2024) previously employed these approaches to investigate the nesting of different species of birds, including the Pycnonotidae species such as Red-vented Bulbul and White-eared Bulbul. In addition to visual inspection, the focal and scan sampling method (Altmann, 1974) was adopted for the direct identification of nesting material collected by white-eared bulbul.

A field study was conducted throughout the morning and evening hours when bird activity increased relative to other times. The nesting season is defined as the period beginning with the first signs of nest construction, including the gathering of nesting materials and the presence of incomplete nests and concluding with the sighting of fledglings and juveniles of the species (Choudhary and Chishty, 2024). All observations of nesting and breeding were conducted carefully to ensure an appropriate distance from the nest to avoid disturbing birds. To study nest structures, height, diameter, width, number of fibers and types of nest material were examined after the completion of the breeding season. Deserted nests were collected when no juvenile or adult birds were found over a prolonged period. All behavioral observations were taken with the help of Nikon 8x40 Binoculars and photographs of birds, nests, and habitats were taken with the help of a Nikon P1000 camera.

RESULT AND DISCUSSION

Nesting is crucial for bird's reproduction and significantly influences the development of various stages. The selection of nesting sites and nest composition are crucial for the growth and development of various stages of birds (Mahmood et al., 2018). The study included a survey of more than 1500 trees, 1300 shrubs and approximately 30 km of traditional dry thorny fencing in the Barmer district to assess the nesting ecology of White-eared Bulbul. During the study period, 230 White-eared Bulbul nests were found, of which 64 were examined for nesting parameters, including nest site, nest structure, nesting parameters (height, width and depth) and plant material (Table 1).

Breeding season of white-eared bulbul is usually found between the March to September month of every year. However, during the study, most White-eared Bulbul nests were observed in three months, including April, May and June, compared to the others. Choudhary and Chishty (2024) also observed a similar breeding period from March to September for white-eared bulbul in Mount Abu. This study found that White-eared Bulbuls exhibit distinctive adaptability in their nesting behavior relative to numerous other bird species. Although most avian species avoid human-influenced regions for breeding, White-eared Bulbuls have the remarkable ability to build nests in urban and rural environments. This adaptability indicates that this species may have developed a strategy to coexist with human populations, similar to Red-vented Bulbul and House sparrows (Chishty *et al.,* 2020a & 2021a; Choudhary and Chishty, 2021; Choudhary and Chishty, 2024).

The nests of White-eared Bulbul were found between 1.5 meters to 4 meters above the ground level on different plant species. This vertical distribution indicates a preference for low-to mid-level vegetation, which may offer an appropriate balance between protection from ground predators and accessibility to adult birds. Nest height variation may be affected by multiple factors, including the accessibility of appropriate nesting locations, occurrence of adjacent vegetation and particular microhabitat

characteristics within the selected territory of the birds. Nests situated in the lower canopy area may benefit from dense vegetation, potentially providing enhanced camouflage from aerial predators.

The nesting preferences of White-eared Bulbul were investigated across various plant species, with *Ziziphus mauritiana* (Ber/Indian jujube) identified as the most preferred species, supporting 13 nests. *Salvadora oleoides* (Jaal) and *Acacia Senegal* (Kumta/Kumatiya), in conjunction with traditional thorn fencing, were the subsequent most favored choices, each facilitating 8 and 7 nests, respectively. Furthermore White-eared Bulbul utilized several plant species for nesting, including *Vachellia nilotica* (Babool), *Mayterus emarginatus* (Kankeri), *Leptadenia pyrotechnica* (Kheep) and *Calligonum polygonoides* (Phog), with each species hosting three nests. *Clerodendrum phlomidis* (Arani), *Azardiracta indica* (Neem) and *Euphorbia caducifolia* (Danda thore) were selected less frequently and two nests were recorded. Single nests were observed from these plant species: *Prosopis cineraria* (Khejri), *Opuntia elatior* (Nagfani), *Bougainvillea* (Paper flower), *Acacia jacquemontii* (Bu-Bhanwali), and *Prosopis juliflora* (Vilayati babool). The distribution of nests among different plant species indicates that White-eared Bulbul demonstrates adaptability to its nesting behavior. Flexibility in nesting behavior may enhance species survival and reproductive success across various habitats. The incorporation of both native and introduced plant species, along with artificial structures such as thorn fencing, underscores Bulbul's adaptability to varying environmental conditions and anthropogenic landscapes.

During study, various physical properties such as height, depth, diameter, weight and number of long and small nest fibers were examined in the nests of White-eared Bulbul. White-eared Bulbul builds nests that show substantial variations in size and materials used. Usually White-eared Bulbul constructs deep cup-shaped nests and preferably on different species of herbs, shrubs and trees. While the Red-vented Bulbul constructs also cup-shaped nests, they are less deep than the nests of White-eared Bulbul (Chishty *et al.,* 2020 a&b, 2021 a&b; Choudhary and Chishty, 2024). Furthermore, Red-vented Bulbul nesting is frequently observed at different sites, including herbs, shrubs, trees and other human-established structures between telephone cables and road light electric boxes (Chishty *et al.,* 2020 a&b, 2021 a&b; Choudhary and Chishty, 2024).

In the present study, we observed White-eared Bulbul nesting on bushes, shrubs and trees, and no nesting was observed on anthropogenically established structures, such as electric meter boxes. The nests measure between 4.8 cm and 8 cm in height, offering a suitable space for egg-laying and incubation. The nests range in depth from 2.6 cm to 5.6 cm, providing sufficient protection for the eggs and nestlings. The nests have a diameter ranging from 4.5 cm to 9.5 cm, suitable for the breeding pair and their young. The weight of White-eared Bulbul nests varies between 5.1 grams to 40 grams. Variation in nest weight can be linked to the different materials used and overall dimensions of the nest. The nests were composed of a combination of long and short fibers. In nest construction, the number of long fibers can range from 2 to 42, whereas the number of small fibers varies from 76 to 264. The combination of various fiber lengths enhances the structural integrity and insulation capacity of the nest.

During the study, it was observed that White-eared Bulbul utilized nesting materials from 28 plant species. White-eared Bulbul revealed an important ability to choose and utilize particular plant components for nest building. The external and structural layers of their nests predominantly consist of slender twigs and midribs of several plant species. The plants included include *Azadirachta indica* (Neem), *Prosopis cineraria* (Khejri), *Capparis decidua* (Kair), *Calligonum polygonoides* (Phog), *Clerodendrum phlomidis* (Arani), *Salvadora oleoides* (Jaal) and *Senna auriculata* (Anwal). The incorporation of slender twigs and central ribs probably offers a combination of flexibility and durability, enabling the birds to construct a robust external structure for their nests.

The middle layer of the nests consisted of stem fragments from 14 plant species. These include *Acrachnee racemosa* (Safed Bui/Buari),

Achyranthus aspera (Modo kanto-Chaff-flower), *Aristida adscensionis* (Lampro-common needle grass), *Aristida funiculata* (Bhuti), *Cenchrus biflorus* (Bhurat), *Citrulus colocynthis* (Tumba), *Corchrous trilocularis* (Hade-ka-khet), *Crotolaria burhia* (Sanio/Saniya), *Cyperus bulboscus* (Moth/Motho), *Dactyloctenium aegyptium* (Makarro/Manchi), *Heliotropicum crispum* (Kalibui), *Mollugo cerviana* (Chiria-ro-khet), *Plantago ovate* (Isabgol) and *Cuminum cyminum* (Jeera).

The nest may be able to integrate into its surroundings and possibly avoid predators because of the variety of plant materials it contains. White-eared bulbul's complex utilization of indigenous plants while building nests not only demonstrates the bird's ability to adapt but also provides information about the complicated relationships between birds and their natural surroundings. The inner layer of the nests was made using the inflorescence and fine stems sections of the following plant species: *Cenchrus prieurii* (Lambio-burat- Large spike baffle grass), *Lepidium sativum* (Asaliyo) and *Perotis indica* (Lonki-Puncho- Indian comet grass). The nests contained branches and inflorescences of various plants at the bottom. This indicates that these plant components are particularly advantageous for nest insulation, comfort and structural integrity. The abundance of inflorescence components at the bottom of the nests suggests that birds may be placing these materials in a planned manner to produce a soft cushioned base for their eggs or nestlings. The use of stem fibers of *Leptadenia pyrotechnica* (Kheep) and *Cynodon dactylon* (Dhob/Dubai-Dog's tooth grass) in the inner layer of bird nests fulfills several important roles. The selected fibers exhibited softness and pliability, thereby establishing a comfortable and protective environment for nestlings. The cushioning effect of these materials insulates young birds from temperature fluctuations and physical events, thereby promoting optimal development and survival. *Leptadenia pyrotechnica* and *Cynodon dactylon* are recognized for their resilient and adaptable fibers. These characteristics make them suitable for nest building as they can be readily shaped into the desired form while protecting their structural integrity. The inclusion of these fibers improves the stability of the nest and extends its durability, ensuring a secure environment for nestlings during their critical early developmental stages. The dried exocarp of *Cocos nucifera* (Nariyal/Coconut) fibers and stem fibers of *Calotropis procera* (Aak/Aakda) were also found in the innermost layer of the nests. Additionally, White-eared Bulbul nests incorporated twigs from various plant species, including *Prosopis cineraria* (Khejri), *Capparis decidua* (Kair), *Calligonum polygonoides*(Phog), *Clerodendrum phlomidis* (Arani) and *Senna auriculata* (Anwal), within the middle and inner layers and the base of the nests. Present study revealed the presence of cotton and spider webs within the inner nest structures. Cotton and spider webs in the innermost structure of nests fulfill several critical functions for bird species. These flexible materials provide a protective cushioning environment for eggs, thereby minimizing the risk of damage during incubation (Chishty *et al.*, 2021a). The advantages of these soft materials persist even beyond the incubation phase. The cushioned interior of the nest mitigates injury risks associated with movement and sibling interactions as nestlings grow and develop, thereby enhancing survival rates and overall health during this crucial life stage. Human derived materials, including fragments of plastic bags, paper, cotton and plastic threads, as well as human and animal hair, have been found in 14 nests of white-eared bulbul. These 14 nests were collected from the urban areas. The addition of anthropogenic materials to the nests of White-eared Bulbuls in urban environment demonstrates the adaptability of these birds to modified landscapes. The variety of materials illustrates the opportunistic behavior of these birds when using accessible resources for nest building.

In urbanized areas, the scarcity of natural nesting materials such as twigs, leaves and grass has led birds to exhibit notable flexibility by integrating man-made items into their nest construction. This adaptation underscores the birds' capacity to endure fluctuating environments and serves as a significant indicator of the extensive impact of human activities on urban ecosystems (Choudhary and

Chishty, 2021 & 2024). Plastic components can pose an entanglement or ingestion risk to adult birds and young birds. The incorporation of anthropogenic materials in nests may influence insulation properties and microclimate, thereby affecting breeding success and chick survival rates.

Table 1: Nest characteristic and nest site presence of White-eared Bulbul in Barmer district, Rajasthan

S.N.	Height (cm)	Depth (cm)	Diameter (cm)	Weight (gm)	No. of Long fibre	Number of Short fibres	Total number of twigs used for nest fabrication	Plant preference for nest construction
1	7.8	3.6	6.9	8.1	20	112	132	*Vachellia nilotica*
2	6.7	4.7	7.1	10.11	28	106	134	*Ziziphus mauritiana*
3	7.4	3.5	9.5	5.1	2	114	116	*Ziziphus mauritiana*
4	7.5	3.8	6.9	10	23	97	120	*Ziziphus mauritiana*
5	7.2	3.3	7.1	10.14	34	114	148	*Vachellia nilotica*
6	6.5	3.6	7.9	11.14	14	143	157	*Prosopis cineraria*
7	6	4.2	5.8	14	17	87	104	*Prosopis juliflora*
8	6.5	4.3	5.7	12	16	108	124	*Salvadora oleoides*
9	5.9	4.8	5.6	8.11	14	145	159	*Salvadora oleoides*
10	5.3	4.9	5.9	8.14	19	154	173	*Salvadora oleoides*
11	5.8	4.9	5.3	12.1	9	149	158	*Ziziphus mauritiana*
12	6.3	4.6	5.7	14.11	9	142	151	*Ziziphus mauritiana*
13	5.6	4.2	5.1	10.14	12	85	97	*Ziziphus mauritiana*
14	7.3	4.1	5.2	14.15	21	76	97	*Salvadora oleoides*
15	5.4	3.4	5.9	14.34	25	89	114	*Azadirachta indica*
16	6.2	2.7	5.9	15.22	34	88	122	*Bougainvillea spp.*
17	6.9	2.9	4.5	9.22	14	142	156	*Acacia senegal*
18	5.3	2.6	4.7	8.2	12	86	98	*Ziziphus mauritiana*
19	6.3	5.6	8	7.3	19	97	116	*Ziziphus mauritiana*
20	5.8	5.3	4.6	11.12	26	114	140	*Acacia senegal*
21	6.4	3.4	6.4	26	10	189	199	*Acacia senegal*
22	7.2	3.1	6.6	15	15	186	201	*Capparis decidua*
23	5.8	3.3	9.2	24	25	206	231	*Acacia senegal*
24	6.5	2.7	8.7	8	11	116	127	*Capparis decidua*
25	5.7	4.5	7.2	6	4	119	123	*Capparis decidua*
26	7.3	4.2	6.2	14	11	113	124	*Ziziphus mauritiana*
27	5.1	5	7.2	29	14	189	203	*Calligonum polygonoides*
28	5.8	2.9	7.8	32	34	184	218	*Tecomella undulata*
29	8	5.1	6.8	26	17	156	173	Traditional dry thorn fencing
30	5.7	3.2	6.3	9	9	144	153	*Maytenus emarginatat*

31	5.2	4.2	6.9	11	6	134	140	*Clerodendrum phlomidis*
32	5.1	3.45	5.9	14	8	132	140	*Leptadenia pyrotechnica*
33	5.3	4	5.7	16	18	104	122	*Ziziphus mauritiana*
34	7	4.4	8.4	35	39	106	145	*Ziziphus mauritiana*
35	5.4	5	6.4	23	6	264	270	*Leptadenia pyrotechnica*
36	6.4	4.3	7.31	20	2	142	144	*Salvadora oleoides*
37	6.8	4.7	7.22	23	15	131	146	*Vachellia nilotica*
38	4.9	3.6	6.8	24	14	149	163	*Acacia senegal*
39	4.8	4.4	6.4	18	3	196	199	*Azadirachta indica*
40	7.2	4.6	6	26	6	112	118	*Salvadora oleoides*
41	7.2	4.8	6.4	24	9	109	118	*Capparis decidua*
42	4.8	3.2	6.3	28	21	184	205	*Calligonum polygonoides*
43	5.2	4.8	7.4	22	12	214	226	*Maytenus emarginatat*
44	6.4	4.8	7.3	18	4	116	120	*Salvadora oleoides*
45	7.4	3.7	7.5	36	42	89	131	*Maytenus emarginatat*
46	5.5	3.5	7.5	5.4	34	86	120	*Leptadenia pyrotechnica*
47	5.4	3.8	8.4	12.36	16	114	130	*Calligonum polygonoides*
48	5.5	3.4	7.4	16	14	143	157	Traditional dry thorn fencing
49	5.4	3.6	7.2	28	16	212	228	Traditional dry thorn fencing
50	5.2	4	7.9	16	2	125	127	Traditional dry thorn fencing
51	5.4	4.9	7.5	22	24	146	170	*Acacia senegal*
52	5.6	4.1	7.1	24	30	134	164	*Capparis decidua*
53	5.9	4.6	6.9	13	2	126	128	Traditional dry thorn fencing
54	6.9	5.4	6.2	14	4	136	140	Traditional dry thorn fencing
55	6.7	5.6	6.8	16	9	139	148	*Clerodendrum phlomidis*
56	5.2	3.9	8.9	16	4	124	128	*Acacia senegal*
57	5.9	4.14	8.6	14	6	136	142	Traditional dry thorn fencing
58	7.22	5.14	8.9	25	8	142	150	*Ziziphus mauritiana*
59	7.5	5.4	7.3	40	36	112	148	*Ziziphus mauritiana*
60	6.9	4.6	6.9	32	34	116	150	*Salvadora oleoides*
61	6.5	4.3	6.5	18	20	112	132	*Acacia jacquemontii*
62	5.8	4.7	5.8	22	34	119	153	*Euphorbia caducifolia*
63	6.5	5.3	5.9	27.5	30	107	137	*Opuntia elatior*
64	7.3	5.2	5.8	22.34	36	119	155	*Euphorbia caducifolia*

Figure 1: Breeding pair of White-eared Bulbul

Figure 2: Abandoned nest of White-eared Bulbul

Figure 3: Collection of cotton thread for the nest material

Figure 4: White-eared Bulbul in nest, with external structure also representing cotton thread.

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