



Breeding Biology of White Cheeked Bulbul (*Pycnonotus leucogenys*) in Margalla Hills National Park, Pakistan

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ABSTRACT

Present study was designed to investigate breeding biology of white-cheeked bulbul (*Pycnonotus leucogenys*) in Margalla Hills National Park Pakistan (MHNP). Eighty nests were located in the study area out of which 43 were used by birds for breeding. Highest successful nests were located on fork 38.75%, followed by middle 25%, terminal 20% and other position of the plants 16.25%. Preferable height for nest construction by white-cheeked bulbul was 1-2m (60%) followed by 2-3m (23.7%) and 0-1m (16.25%). Outer diameter of nest was recorded ($16.0 \pm 4.22\text{cm}$) while inner diameter was ($10.8 \pm 2.95\text{cm}$). The preferred plant species used by white-cheeked bulbul for nest construction was garanda (*Carrisa opaca*; 58.7%) followed by sanatha (*Dodonaea viscosa*; 26.25%), panch phuli (*Lantana camera*; 6.25%), beri (*Zizyphus mauritiana*; 3.75%), krona (*Carissa macrocarpa*; 2.5%) and mallah (*Zizyphus nummularia*; 2.5%). Clutch size in white-cheeked bulbul ranged from 1 to 5 eggs with mean clutch size of 2.6 eggs. Maximum percentage of nests (30.2%) had clutch size of 2 and 3 eggs. The overall hatching success in active nests was 61.7% and fledging success was 67.6%. During month of May, maximum number of eggs and nestlings were recorded while no breeding activity was recorded during month of February. It is concluded that (MHNP) is a favorable site for breeding activity of white-cheeked bulbul.

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Authors' Contribution

BAR and FQ conceived and design the study. MSA and AA proofread the manuscript. FQ, KS, JB, FA and SH conducted field work.

Key words

Breeding success, Clutch size, Hatching success, Fledging success, Nest survival, Predation, White-cheeked bulbul

INTRODUCTION

White-cheeked bulbul (*Pycnonotus leucogenys*) belongs to order Passeriformes of family Pycnonotidae and distributed in south-western Asia from India to Arabian Peninsula (Hoyo *et al.*, 2005). White-cheeked bulbul is widespread in Pakistan and inhabits Indus plains and cultivated areas of Balochistan. It is also found in cantonment areas of Quetta, lower hilly tracts of Bannu, Kohat, Peshawar, Swat, Dir and Chitral. While in Sindh, it is only found in the extreme South East region of Tharparkar (Roberts, 1991). According to IUCN red list of

threatened species, white-cheeked bulbul is categorized as Least Concern. However, population trends are declining due to habitat fragmentation and deforestation (Birdlife International, 2017; IUCN, 2018).

White-cheeked bulbul eats mainly insects, fruit and berries, seeds, buds and nectar (Lever, 1987; Roberts, 1991). It also hawks flying insects. It starts to pursuit perch in the evening and perches on bush top, bowing, fluttering wings and tail, and constantly uttering calls in series. It is an energetic and noisy bird. White-cheeked bulbul has an agile flight to chase insects from perches. Most bulbuls have distinctive voices, and often the best way of distinguishing similar species is by their song. Typically, their voices have a gravelly quality; many are chattery, noisy and some with whistles. Very few are actually musical. Most sing in the morning or evening and many of the more social species will chatter as they forage. White-cheeked bulbul song is generally melodious (Hoyo *et al.*, 2005).

White-cheeked bulbul is greyish brown bird with conspicuous white cheeks that contrast with the entirely black hood. It has a black head and throat. The upper parts

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are dull grey with darker flight feathers, and black-brown tail whose feathers show terminal white spots. The chest is pale dusky-brown. Eyes are red-brown, with narrow yellow eye ring. It has black bill and legs. There is no sexual dimorphism. Juvenile has duller, browner head than adult (Hoyo *et al.*, 2005).

Pairing of white-cheeked bulbul is monogamous. Time of reproduction varies greatly according to climate and region (Whistler, 1930). The white-cheeked bulbul is reported from Margalla Hills National Park (MHNP). However, there is scarcity of information about breeding biology of white-cheeked bulbul. Here, present study was designed to provide detailed description of the breeding biology of white-cheeked bulbul including breeding success (clutch size, hatching success and fledging rate) and nesting success (characteristics of nesting site and nest structure) in Margalla Hills National Park (MHNP), Pakistan.

MATERIALS AND METHODS

Study area

The current study was carried out in Margalla Hills National Park (33°43'N, 72°55'E) covering an area of 17,386 hectares (173.86 km²/67.13 sq mi) and located in the north of Islamabad Capital Territory, Pakistan. The topography of the area is rocky and furrowed varying in elevation, 685 meters at the western end and 1,604 meters on its east (Shinwari and Khan, 2001). Vegetation in southern slopes is short, stunted, comprising deciduous and evergreen trees with diverse shrub growth and in the north, stand pines and groves of oak. Average monthly precipitation is 254mm (Masud, 1977).

Study design

A reconnaissance survey was conducted to search for nests of white-cheeked bulbul in branches by using binoculars (8 -16 x 40 Zoom DPS I, Porro Prism type). Nests were marked as vacant or occupied. A total of 80 nests were marked during August 2017 to July 2018 and data were collected at 2-day interval by direct observation with a minimal disturbance to birds during the breeding season. Six potential sampling sites (1km² each) viz., Margalla Hills Trail 3 (Site: 1; 33° 44.54.144N, 73° 45.736E; 689 meters above sea level (masl), Margalla Hills Trail 5 (Site: 2; 33° 44.95N, 73° 05.12E; 699 masl), Margalla Hills Trail 6 (Site: 3; 33° 44.185N, 73° 02.014E; 885 masl), Lake View Park (Site: 4; 33° 42.850N, 73° 08.168E; 533 masl), Shakarparian (Site: 5; 33° 68.81N, 73° 07.25E; 622 masl) and Quaid-e-Azam University (Site: 6; 33° 45.05N, 73° 08.037E; 627 masl) were selected on the basis of nesting and breeding activity. Field observations were taken with

binocular, GPS, Camera, measuring tape and ribbons for marking the nesting trees.

Nesting success in white-cheeked bulbul was recorded by observing nest structure and nest site characteristics. Nest structure includes inner, outer diameters, outer nest height and inner depth of nest. Nest site characteristics like nesting tree, nest height from ground, nest position and nesting material were recorded.

Breeding success was observed by recording clutch size, incubation period, hatching and fledging success, egg and nestling loss from the active nests. Hatching success and fledging success were calculated by following formula suggested by Murray (2000).

$$\text{Hatching success} = \frac{\text{Number of chicks hatched}}{\text{Total number of eggs}}$$

$$\text{Fledging success} = \frac{\text{Number of chicks fledged}}{\text{Total number of chicks hatched}}$$

Daily survival probability

Daily nest survival probability was recorded by visiting the cavity nest after every two days. Signs of predation, loss and failure of breeding due to broken eggs, hatchling loss, poaching, fallen from cavity nest and abandoned nests (usually from loss or theft of eggs and nestlings) were recorded. The stage/fate of nests was calculated by following Mayfield (1975).

Daily survival probability = 1 – (total number of failed nests ÷ total number of exposure days)

Statistical analysis

The data on nesting success like nest structures are given as Mean ± SEM and minimum and maximum range is provided. However, nesting site characteristics data and breeding success are provided as percentages and probability using MS Excel data analysis tool.

RESULTS

Nest construction, placement and success

A total of 80 nests were found in the potential sampling sites of study area. Maximum number of nests were found in Quaid-e-Azam University (23) followed by Margalla Hills Trail 5 (15), Margalla Hills Trail 6 (13), Margalla Hills Trail 3 (13), Shakarparian (10) and Lake View Park (6) (Fig. 1). The data on the nesting success of white-cheeked bulbul are given in Table I. White-cheeked bulbul nest is located in a low bush, or sometimes, in branches of short height tree. Nests are made up of stems, roots and twigs. White-cheeked bulbul built nests on different plants at different heights. It is preferred to make nest on the forks (38.75%) of trees followed by middle (25%) of the trees as compared to terminal (20%) of trees and other (16.25).

Interestingly, nest failure was also high on the fork, middle and terminal of trees (37.8%, 24.3% and 21.6%) and other as (16.2%), respectively.

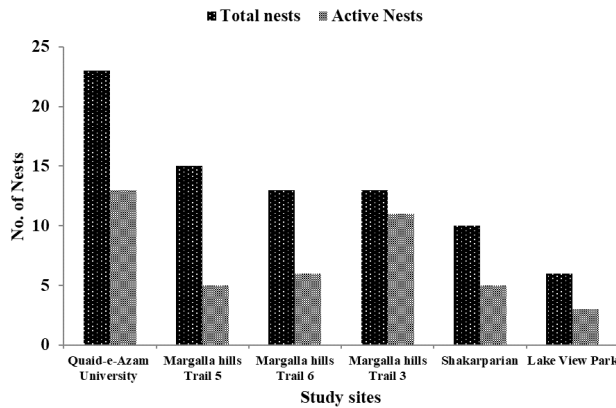


Fig. 1. Total number of nests (80) and successful nests (43) used/built by white-cheeked bulbul (*Pycnonotus leucogenys*) in the potential sampling sites of MHNP, Pakistan.

Table I. Nesting Success of white-cheeked bulbul (*Pycnonotus leucogenys*) in potential sampling sites of MHNP, Pakistan (n = 80).

	Total nests		Successful nests	
	No.	%	No.	%
Position of nest				
Terminal	16	20	8	18.6
Fork	31	38.75	17	39.5
Middle	20	25	11	25.5
Others	13	16.25	7	16.2
Total	80	100	43	100
Height of nest				
0 - 1.0 m	13	16.25	7	16.2
1.1 – 2.0 m	48	60	27	62.7
2.1 – 3.0 m	19	23.7	9	20.9
Total	80	100	43	100
Vegetation type				
<i>Carrisa opaca</i>	47	58.7	25	58.1
<i>Dodonaea viscosa</i>	21	26.25	13	31.04
<i>Lantana camera</i>	5	6.25	2	4.64
<i>Zizyphus mauritiana</i>	3	3.75	2	4.64
<i>Carissa macrocarpa</i>	2	2.5	0	0
<i>Zizyphus nummularia</i>	2	2.5	1	2.32
Total	80	100	43	100

The data on the height of the nest from the ground show that maximum number of nests (60%) were found at 1.1-2.0 meters while at height of 2.1–3.0 m, (23.7%) of nests were present and (16.25%) of nests were found at 0 - 1.0m height. Similarly, successful nests (62.7%) and failed nests (56.7%) were also found in higher number at 1.1-2.0 meter height, 16.2% successful and failed nests were found at 0-1.0m height.

In all potential study sites, white-cheeked bulbul preferred to construct nests on garanda (*Carrisa opaca*; 58.7%) followed by snatha (*Dodonaea viscosa*; 26.25%), panch phuli (*Lantana camera*; 6.25%), beri (*Zizyphus mauritiana*; 3.75%), krona (*Carissa macrocarpa*; 2.5%) and mallah (*Zizyphus nummularia*; 2.5%).

Nest characteristics

The data on nest structure of white-cheeked bulbul are given in Table II. The mean outer diameter of nest was 16 ± 4.22 cm (range = 10-19 cm) and mean inner diameter of nest was 10.82 ± 2.95 cm (range = 5.5-13.5 cm). The mean outer nest height was 5.6 ± 1.23 cm (range = 4.4-9.0 cm) and mean inner nest depth was 4.99 ± 1.82 cm (range = 2.4-8.1 cm). The nest of white-cheeked bulbul was built with the help of dry grasses, dead leaves, twig lets, rootlets, hairs and other fine materials. The nest was well hollow in the center and roughly hemisphere in structure.

Table II. Measurements of nests of white-cheeked bulbul (*Pycnonotus leucogenys*) in the Margalla Hills National Park, Pakistan. (n = 43).

Particulars	Mean \pm SEM	Range
Outer diameter (cm)	16 ± 4.22	10 -19
Inner diameter (cm)	10.8 ± 2.95	5.5-13.5
Outer nest height (cm)	5.6 ± 1.23	4.4 - 9
Inner depth (cm)	4.99 ± 1.82	2.4 - 8.1

Clutch size and reproductive success

Breeding season of the white-cheeked bulbul starts from February and lasts till July. During this period, it was observed that the birds start pairing and nest construction in February; egg laying starts by the end of March. May and June were the peak breeding months, whereby maximum egg laying and nestlings were recorded (Fig. 2). The data on the breeding activity during different months from February 2018 to July 2018 indicated that active nests in terms of egg laying and nestlings were recorded higher in May (21) followed by June (15), April (14), July (5) and very few in March (02). In these months, number of active nests, eggs and nestlings was the highest and very low or no breeding activity was observed in February.

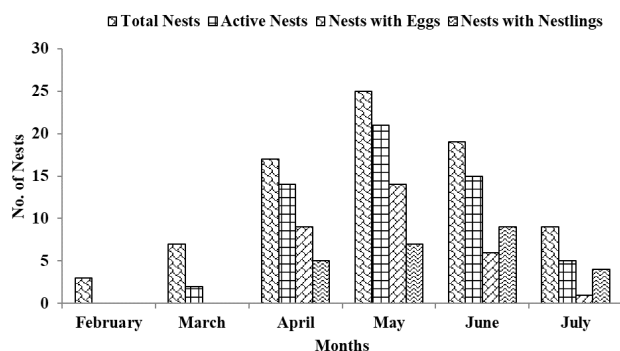


Fig. 2. Monthly Variation in the total number of nests, active nests, Nests with eggs and nestlings recorded from potential sampling sites of MHNP, Pakistan.

Breeding success on individual sampling sites indicated that number of (active nests: 30.23%; eggs: 30.43%; hatched chicks: 33.3%; and fledged chicks: 33.3%) were recorded higher in Quaid-e-Azam University followed by Margalla Hills Trail 3 (active nests: 25.58%; eggs: 26.08; hatched chicks: 27.7% and fledged chicks: 25.0%) , Margalla Hills Trail 6 (active nests: 13.9%; eggs: 14.78%; hatched: 12.5; fledged: 16.6%), Margalla Hills Trail 5 (active nests: 11.62%; eggs: 11.3%; hatched: 9.72% and fledged chicks: 10.5%), Shakarparian (active nests: 11.62%; eggs: 10.43%; hatched: 9.72% and fledged chicks: 4.1%) and Lake View Park (active nests: 6.97%; eggs: 6.95%; hatched: 6.95% and fledged chicks: 10.5%) respectively shown in Figure 3.

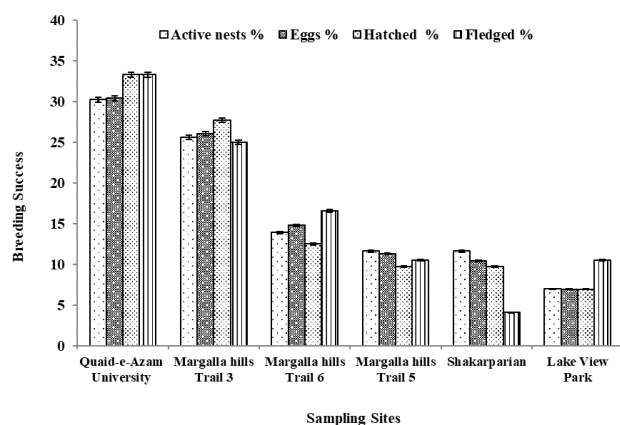


Fig. 3. Breeding success of white-cheeked bulbul (*Pycnonotus leucogenys*) in potential sampling sites of MHNP (n = 43).

Clutch size of white-cheeked bulbul ranged from 1 to 5 eggs with mean clutch size of 2.6 eggs. Maximum percentage of nests (30.2%) had the clutch size of 2 and

3 eggs followed by 16.2 % nests having clutch size of 1 and 4 eggs and 6.97 % nests having 5 eggs. The hatching and fledging success in nests having three eggs (36.1% and 39.5%) was significantly higher as compared to nests with four eggs (26.3% and 31.2%), two eggs (20.5% and 12.5%), five eggs (11.1% and 14.5%) and one egg (5.5 % and 2.08%) respectively. The overall hatching success in active nests was 61.7% and fledging success was 67.6%.

Daily survival probability

The data on survival probability show that the daily survival probability of hatchlings was higher at Lake View Park (0.96) followed by Quaid-e-Azam University (0.95), Margalla Hills trail 3 (0.93), Shakarparian (0.92), Margalla Hills Trail 6 (0.91) and Margalla Hills Trail 5 (0.89), respectively.

Egg and nestling losses

The data on egg and nestling losses of white-cheeked bulbul are given in Table III. In present study, egg infertility was reported as 6.08% and other losses were 12.1% due to cutting of plants, fast wind blowing and rain. Only 9.8% of nestling loss was recorded due to fall of young ones from the nest. In present study, predation rate of eggs and nestlings was 20% and 22.5%, respectively.

Table III. Eggs and nestling losses in white-cheeked bulbul (*Pycnonotus leucogenys*) in MHNP, Pakistan.

	Number (%)
Egg stages	
Number of eggs found	115(100)
Infertile eggs	7(6.08)
Predated	23(20)
Other losses	14(12.1)
Hatched	71(61.7)
Nestling stages	
Number of nestlings found	71(100)
Predated	16(22.5)
Fell out from nests	7(9.8)
Fledged	48(67.6)

DISCUSSION

The findings of the present study are similar to the study conducted by Sharma (2018), who reported that white-eared bulbul nests could be found at height of 1-2 meters at the forks of branches. In another study, Manju and Sharma (2013) reported that red-vented bulbul *Pycnonotus cafer* preferred to construct nests at 1.5 to 3.25

meter height. Mazumdar and Kumar (2007) also reported that in red-whiskered bulbul *Pycnonotus jocosus* all nests were constructed on thorny plants, bushes, shrubs and the mean height of nests was 12 feet. The variations in the construction of nests at different heights might be due to different habitats, presence of predators and climatic conditions (Zia *et al.*, 2014; Awais *et al.*, 2015). Our findings are in agreement to previous studies that described the highest percentage of successful nests on forks (48%) while nests on middle, terminal and other positions were recorded as 17%, 10% and 25%, respectively (Zohaib *et al.*, 2022).

Balakrishnan (2009) reported that red-vented bulbul preferred to construct nest on *Glochidion ellipticum* (25.23%), *Wendlandia notoniana* (22.22%), *Symplocos cochinchinensis* (11.11%) and *Clerodendrum viscosum* (8.6%). Another study reported that the nests of *Pycnonotus leucotis* were located on neem (*Azadirachta indica*) trees, China rose (*Hibiscus rosa-sinensis*), mallah (*Zizyphus nummularia*) and in the flowering pots in the houses of urban area (Sharma, 2018). Robinson *et al.* (2000) reported that the Pycnonotid species avoided dense vegetation but they could be found in trees having secondary growth. However, in natural environment, they preferred beri trees, weeds like *Lantana lantana*, blackberry bramble (*Rubus fruticosus*), privet (*Ligustrum* spp.), African olive (*Olea europaea*), coral trees (*Erythrina* spp.) and asparagus fern (*Asparagus* spp.) (Gibson, 1977; Morris, 1986; Leishman, 1994; Wood, 1995).

Observations about nesting characteristics are similar with previous studies conducted by Vijayan (1980), Balakrishnan (2009), Zia *et al.* (2014), Awais *et al.* (2015) and Sharma (2018). Earlier it was reported by Beruldsen (2004) that nests were shaped as shallow open cups usually located in dense foliage. Nest materials included twigs, bark, grass, leaves, fine roots and spider silk, as well as non-natural materials such as paper, plastic, wool and string (Chaffer, 1933; van Riper *et al.*, 1979; Beruldsen, 2004).

Breeding season of white-cheeked bulbul varies with location and even in different months of the year and coincides with the monsoon (Ali and Ripley, 1988). These results are in agreement with previous studies conducted by Rao *et al.* (2013). They observed breeding performance of red-vented bulbul and concluded that hatchling success was 50.0%, fledging success was 36.0% and nesting success 18.0%. Similarly, Balakrishnan (2010) reported nesting success rate was 12.84% in square-tailed bulbul *Hypsipetes ganeesa* in Western Ghats, India. Another study conducted by Sharma (2018) reported that fledging success was 45.16% in white-eared bulbul and 59.4% of nest success in red-vented bulbul. Prajapati *et al.* (2011) recorded hatching success of 53.0% and nesting success

37.0%. The variation in the breeding success is due to different species and different habitats.

Data about reproductive success are similar to previous studies, which concluded that the clutch size in white-eared bulbul was 2 to 3 eggs (Srivastava, 2012). Ali and Ripley (1988) reported that the clutch size in species of Pycnonotids was two and rarely three. Balakrishnan (2007, 2010) also indicated that 96% of nests in Pycnonotid species had two, and remaining had three eggs. Similarly, Huan *et al.* (2015) reported the average clutch size in red-whiskered bulbul in Xinshuangvanna, in the region of Southeast China was 2.53 eggs. Vijayan (1980) reported that the variation of the clutch size was correlated with availability of food thus large number of eggs were laid when food was most abundant for young ones.

The study conducted by Balakrishnan (2009) reported that the daily survival rate in the hatchlings of red-vented bulbul was 0.921, that confirmed the results of the present study. In present study, predation rate of eggs and nestlings was 20% and 22.5 % respectively which is quite higher than reported in red-vented bulbul as 6% eggs and 9% nestlings by Zia *et al.* (2014). However, in the present study, eggs and nestling predation rate (20.0 % vs 22.5 %) was lower than other Pycnonotids as reported by Watling (1983) and Kruger (2004) as 70%. Zohaib *et al.* (2022) reported 32.47% egg losses while 23.08% nestling losses in red-vented bulbul at Okara, Punjab.

The study concludes that the breeding season of white-cheeked bulbul in Margalla Hills National Park starts from the month of March and lasts up to July, with successful nesting, egg laying and hatching. Egg poaching, trapping, illegal hunting and predation at MHNP were found to be the major threats to the population of white-cheeked bulbul.

Statement of conflict of interest

The authors have declared no conflict of interest.

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