

Nesting Behaviour and Breeding Success in Indian Robin in Semi-urban Area of Himalayan Foothills

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ABSTRACT: Indian robin (*Copsychus fulicatus* L.) prefer fragmented, degraded, mixed forest patches with scattered settlements in semi-urban areas. Breeding season initiated by the first fortnight of March with the onset of singing by territorial males. Breeding behaviour of total 54 individuals was observed during March 2021 to August 2023 with post-breeding dispersal behaviour in Himalayan foothills, valley area of Dehradun, India. Nest building period was observed 11.31 ± 1.08 days, both sexes participated in nest formation and parental caring. Nests were made up of thin twigs with fine inner lining, having a shallow cup shaped structure. Four type of nest were observed based on the morphological parameters labelled as: Type-I, Type-2, Type-3, and Type-4. Significant differences were observed among the nest types for all measured parameters, as indicated by highly significant p-values ($p \leq 0.001$). Clutch size and number of brood were 3.34 ± 0.14 eggs and 2-4 respectively. Incubation was performed by only female individuals, while males were seen guarding the nest during incubation phase. Average incubation period was about 11.99 ± 0.26 days with hatching success 81 % and the young ones fledged in 13.09 ± 0.30 days.

Keywords: Nesting, Breeding, Hatching Success, Indian Robin.

INTRODUCTION

Indian Robin *Copsychus fulicatus* L. belonging to the family Muscicapidae (Ali and Ripley 1998), is an endemic, small-sized (19 cm) passerine species distributed throughout the Indian subcontinent except north-eastern, higher Himalayas. It is a common, resident, territorial and sexually dimorphic bird. Males have glossy black under parts and a white shoulder patch, while females have grayish-brown upper parts and greyish under parts and lack white shoulder patch (Rasmussen and Anderton, 2005; Grimmett *et al.*, 2016; Das *et al.*, 2017). It prefers dry, stony areas with sparse scrub, arid stony ridges, low rocky hills outcrops, edges of cultivation and deserted buildings, gardens and groves (Ali and Ripley 1983; Grimmett *et al.*, 1998).

The Breeding Biology of Indian Robin has not been studied well having very few articles are available. Nesting and breeding biology of a bird can provide valuable insights into its reproductive cycle, nesting behaviour, incubation period, parental care, and other key aspects (Rajashekhar *et al.*, 2015). Generally, this species construct cup-shaped nests using grass, leaves, twigs, and other plant materials typically placed in concealed locations, such as shrubs, dense vegetation, providing protection from predators and adverse weather conditions (Das *et al.*, 2017). Initiation of nesting of Indian Robin varies depending on local climate and food availability (Kaur and Kler 2018). In

Northern India, breeding season typically begins in late winter or early spring, with courtship displays and territorial behaviour displayed by males (Kaur and Kler 2018). Males vigorously defend their territories, engaging in song flights and aggressive interactions with intruders to attract and secure a mate (Thyagaraju, 1955). The female invests considerable effort in ensuring the nest is secure and well-insulated, providing a suitable environment for egg incubation, during which the female diligently sits on the eggs to maintain an optimal temperature for their development (George, 1961). Both male and female birds actively participate in feeding the young, indicating their cooperative breeding behaviour (Vanjari and Vanjari 2022; Kaur and Kler 2018). This cooperative effort not only contributes to the survival and growth of the offspring but also enhances the reproductive success of the parents (Assersohn *et al.*, 2021). The division of feeding duties between the sexes may be influenced by factors such as foraging efficiency, territory defines, and resource availability (Rahn and Amos 1974; Ferreira *et al.*, 2015). As no study has been carried out in the valley areas of Himalayan foothills for breeding and nesting of Indian Robin therefore the aim of present study was to provide a detailed description of the breeding biology of Indian Robin in Himalayan foothills. The specific objectives were to obtain information on the breeding season, nest formation,

clutch size, breeding success, nest failure, development period and nest site characteristics.

MATERIALS AND METHODS

Study area. The study was conducted between March 2021 and July 2023 in outskirts area of Doon valley roughly about Location I (30°21'23.36"N; 77°59'24.38"E), Location II (30°21'19.58"N; 77°59'0.30"E), Location III (30°22'7.65"N; 77°58'48.76"E) altitude about 450 above the sea level, selected area preferred for population.

Data collection tool and techniques

Data Collection Tools

Nikon 10-22X50 Binoculars and CanonDS126701 were used to aid in the visual identification of the Indian Robin and their behavior.

Data Collection Techniques

Line Transect Method. The line transect method was employed to systematically collect data along each transect during the initial period of finding nesting sites of the bird. Observations were made by walking along the transects at a slow pace, ensuring thorough coverage of the study area. All observations were conducted during the breeding season when the Indian Robin are most active (Verner, 1985; Plumptre, 2000).

Nesting Behaviour. The collection of nesting materials and nest building activities were closely observed and recorded from the day their construction began and inspect daily throughout the study period. The type of materials, nest guarding, nesting Days, incubation days, clutch size, hatching success were recorded.

Data Analysis and statistics. Data analysis included calculating the abundance of Indian Robin in each transect, determining sex ratios, and quantifying the frequency of mating activities. Additionally, the types of nesting materials used and the patterns of nest building and placement were analysed and compared between the different transects. Year-wise variation in hatching success was done by calculating ANOVA, Kruskal-Wallis test and t- test in SPSS 16.0.

RESULTS

Nesting success

• **Nest construction.** The nesting phase, which represents the period of nest building and preparation, showed slight variations among the three years. In 2021, Indian Robin spent an average of 10.06 ± 0.66 days in the nesting phase, while in 2022 and 2023, the

duration increased to 10.41 ± 0.51 and 13.47 ± 0.37 days, respectively. The longer duration of the nesting phase in 2023 suggests potential differences in nest construction behaviours or resource availability during that breeding season.

• **Nest Characteristics.** During the present study we have observed four type of nests on the basis of morphometric. We assessed various measurements for four different nest types: Type-I, Type-2, Type-3, and Type-4. Significant differences were observed among the nest types for all measured parameters, as indicated by highly significant p-values ($p \leq 0.001$) (Table 3). Outer diameter, inner diameter, outer depth, inner depth, cup thickness, cup volume, total volume and material volume were calculated. Cup volume was calculating using inner diameter, Total volume was calculated by using outer diameter (Table 3). These variations in nest characteristics suggest distinct nesting strategies and adaptations among Indian Robin in response to their environmental conditions. Nesting material variation shown by Fig. 4 among 4 type of nests. These nests were found at height of 1.56 ± 0.04 meter minimum 0.0 to maximum 4.56 meter above the ground in heavy lantana bushes, some of them were attached to big stones and some of them were found into human plastic waste. Mostly the location of nest near to construction site because the Indian robin prefers habitat, near to human settlement

• **Egg laying and clutch size.** The results of our study revealed interesting findings regarding the clutch size and reproductive success of Indian Robin. Table 1 presents the summary of the results obtained for three consecutive years (2021-2023). Across the three years, the clutch size of Indian Robin remained relatively stable, with mean values ranging from 3.26 ± 0.18 to 3.47 ± 0.12 having minimum 2 to maximum 4. This indicates that Indian Robin in the study area tend to produce clutches consisting of approximately two to four eggs during the breeding season. To assess the reproductive success of Indian Robin, we examined the rates of egg hatching, egg loss, and successful fledging. The hatching success rates exhibited a decreasing trend over the study period, with mean values of 0.91 ± 0.10 , 0.81 ± 0.03 , and 0.71 ± 0.02 for 2021, 2022, and 2023, respectively (Fig. 3). Clutch size with their frequency increases initially shown in Fig. 1, maximum frequency was clutch size 03 was 60 %.

Table 1: Year -wise nesting variable (clutch size- hatching success) in Indian robin.

	2021 (n=15)	2022 (n=18)	2023 (n=17)
Clutch size	3.26 ± 0.18	3.27 ± 0.13	3.47 ± 0.12
Egg hatched	2.8 ± 0.17	2.61 ± 0.11	2.47 ± 0.12
Egg lost	1.33 ± 0.12	0.72 ± 0.15	0.82 ± 0.12
Successful fledging	2.13 ± 0.16	2.38 ± 0.14	1.94 ± 0.16
Hatching success	0.91 ± 0.10	0.81 ± 0.03	0.71 ± 0.02

• **Incubation.** The incubation period, which represents the time spent by the female incubating the eggs, displayed consistent durations across the three years. Incubation was performed by only female individuals,

while males were seen guarding the nest during incubation phase. In 2021, Indian Robin had an average incubation period of 12.16 ± 0.33 days, while in 2022 and 2023, the durations were 11.47 ± 0.50 and 12.35 ± 0.32 days, respectively (Table 2).

• **Fledgling phase.** During the fledgling phase, which represents the period from hatching to the young birds leaving the nest, minor variations were observed among the years. The average duration of the fledgling phase

in 2021 was 13.7 ± 0.38 days, followed by 12.80 ± 0.37 days in 2022 and 12.79 ± 0.31 days in 2023. May and June has maximum number of nest found in breeding season showing in Fig. 2.

Table 2: Number of days spent (Year-Wise) in Different phase of breeding in Indian Robin.

Reproductive Phase	2021 (n=15)	2022 (n=18)	2023 (n=17)
Nesting (Day)	10.06 ± 0.66	10.41 ± 0.51	13.47 ± 0.37
Incubation period (Day)	12.16 ± 0.33	11.47 ± 0.50	12.35 ± 0.32
Fledgling (Day)	13.7 ± 0.38	12.80 ± 0.37	12.79 ± 0.31

Table 3: Variation in morphometric of nests in Indian Robin.

Nest Parameter	Type-I	Type-2	Type-3	Type-4	Chi-Square value	F	Sig.
Outer diameter (cm)	15.77 ± 0.58	8.22 ± 0.32	9.58 ± 0.41	6.71 ± 0.37	36.12	82.68	≤ 0.001
Inner diameter (cm)	13.55 ± 0.55	6.60 ± 0.29	8.18 ± 0.40	6.50 ± 0.38	31.76	58.28	≤ 0.001
Outer depth (cm)	4.09 ± 0.30	2.80 ± 0.25	2.83 ± 0.08	2.37 ± 0.06	24.90	16.05	≤ 0.001
Inner depth (cm)	2.70 ± 0.25	1.98 ± 0.22	1.50 ± 0.08	1.98 ± 0.07	18.32	8.65	≤ 0.001
Cup thickness (cm)	2.22 ± 0.15	1.62 ± 0.11	1.40 ± 0.09	0.21 ± 0.01	39.63	83.89	≤ 0.001
Cup volume (cu cm)	384.18 ± 36.45	68.75 ± 8.43	81.40 ± 9.31	68.84 ± 8.00	26.01	70.69	≤ 0.001
Total Vol (cu cm)	803.68 ± 67.53	151.54 ± 8.23	207.62 ± 18.02	88.88 ± 0.26	37.33	97.14	≤ 0.001
Material volume (cu cm)	419.50 ± 41.60	82.77 ± 10.38	126.22 ± 10.78	20.03 ± 3.11	43.17	78.43	≤ 0.001

Hatching success. Out of 167 egg under observation, 131 hatched in three years. The hatching success, the number of egg hatched per total number of egg laid was, 81 % (Table 1). The newly hatched chicks were naked, weak, and with bulging abdomen. Empty egg shell was removed from the nest by the attending parent immediately after hatching.

Young and parental care. Nest construction is done by both the parents, but mostly by male. Nest were guarded by either of the parents one by one. If the male was busy in collecting the food materials, at that time female were guarded the nest and vice-versa too. Parent feed the young one soft larvae of arthropods and soft small lizards until the ready to fly. Fledging period was found 13.09 ± 0.02 days.

DISCUSSION

These results indicate a potential decline in the overall reproductive success of Indian Robin in recent years. Various reasons can influence the fledging to leave the nest including body weight (Kouba *et al.*, 2015), predation risk (Chiavacci *et al.*, 2015), parental behaviour and wing development (Martin *et al.*, 2018). These results suggest consistent patterns in the development and fledgling of Indian Robin across the study years. Kaur and Kler (2018) has reported average incubation period of 11.5 ± 0.22 days in Punjab region however in present study the incubation period has been found to be increased. It might be due to difference in climatic factors including temperature. These results indicate a relatively stable incubation period for Indian Robin in the study areas. The observed decrease in hatching success rates raises concerns and warrants further investigation. The clutch size of Indian Robin remained relatively stable, with mean values ranging from 3.26 ± 0.18 to 3.47 ± 0.12 . Similar results has

been reported by Kaur and Kler (2018); Kumar (2012). In case of some passerine species like blue and great tits the intensity of urbanization was negatively correlated with clutch size (Vaugoyeau *et al.*, 2016).

Avian species want to lay their eggs and care for them in a place where they are protected from predators (Lima 2009). Different species go about choosing a nesting site in various ways. In many species, both partners work together to decide on the site, while in others, the female takes the lead (Collias, 1997). So, they chose safe place and sometime it results into adaptation and variation in nest according to continue changing climate and suitable habitat. In this study we found Type-I nests exhibited the largest outer diameter, inner diameter, and cup volume. The larger size of Type-I nests might be advantageous for maintaining stable nest temperatures, providing sufficient space for nestlings to grow, and enhancing parental incubation efficiency (Akresh *et al.*, 2017). These nests were characterized by a wider and more spacious structure, potentially providing greater protection or accommodating larger broods (White *et al.*, 2015). In contrast, Type-IV nests displayed the smallest measurements across all parameters, those were observed on barred land without any grasses. Smaller nests could potentially offer advantages in terms of thermal regulation, reducing the risk of predation, or efficient utilization of resources (Brekke *et al.*, 2010). Nests were usually located 3–6 m from the top of the tree (mean 4.5 ± 2.6 m) meaning that nests were, on average, 25.20 ± 5.75 m above ground (Prashant *et al.*, 2022). The variations in nest characteristics among the different types likely reflect specific adaptations to the local environment and resource availability (Briggs and Deeming 2016).

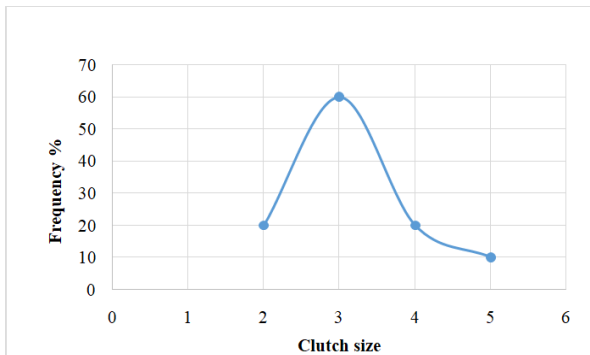


Fig. 1. Clutch size and their frequency in Indian Robin.

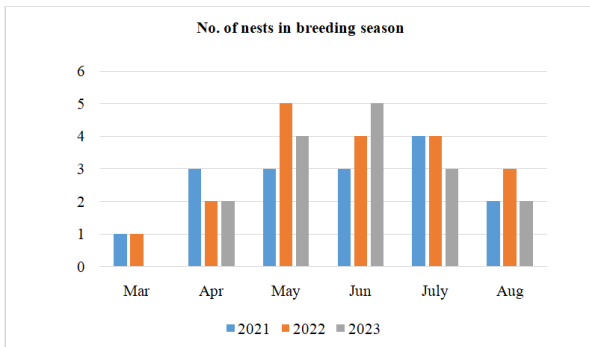


Fig. 2. New Nest found every month during breeding season in Indian Robin.

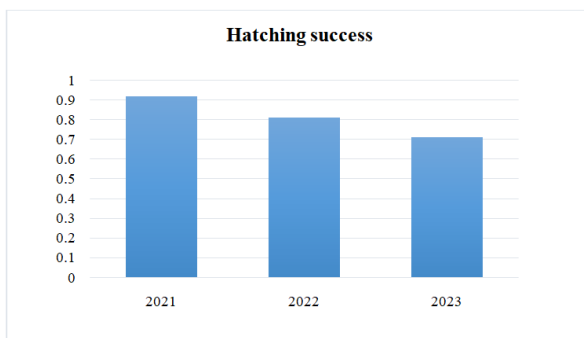


Fig. 3. Year-wise hatching success in Indian Robin.

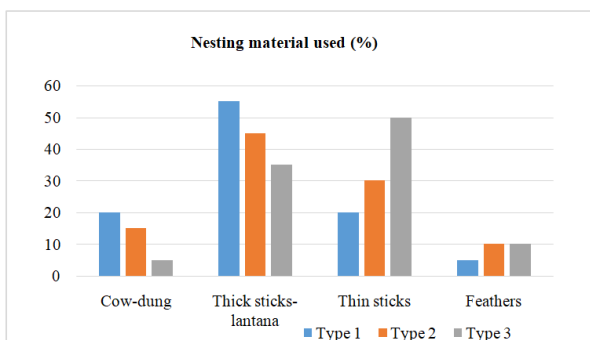


Fig. 4. Showing nesting material percentage used in Different type of nest in Indian robin.

CONCLUSIONS

This study provides valuable insights into the nesting behaviour, nest characteristics, and breeding phases of Indian Robin in Northern India. The results highlight the need for conservation actions to address the declining hatching success and preserve suitable nesting

habitats. By understanding the reproductive biology of Indian Robin, we can contribute to their long-term survival and contribute to the broader field of avian ecology and conservation. The examination of nest characteristics provided valuable insights into the nesting behaviour and adaptations of Indian Robin in the selected area of Northern India. In generally birds of a species make almost same type of nests however some anomalies could be observed.

FUTURE SCOPE

This study is first detailed study on breeding of Indian Robin. It will lead to conservation of Indian robin in next decade.

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Conflict of Interest. None.

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