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Original Article

Habitat, feeding ecology and breeding biology of Jerdon's Babbler (*Chrysomma altirostre*) in the Indus plains of Pakistan

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Abstract

Chrysomma altirostre (Jerdon's Babbler) is vulnerable passerine species native to grasslands and wetlands of the Indian subcontinent. Although aspects of its distribution and habitat have been documented, detailed investigation into its feeding ecology and reproductive biology remains limited. The aim of current research work was to study its preferred habitat, feeding and breeding biology. Jerdon's Babbler was found to prefer habitats dominated by *Phragmites karka*, *Typha* spp., *Saccharum arundinaceum*, *S. spontaneum*, and *S. munja*. Large proportion of the adult bird's diet consisted of insects along with arachnids and grains. Young ones were fed with caterpillars, larvae, butterflies, moths, bugs and beetles. Breeding season was marked with territorial male calls from mid of March to the mid of August. Both parents shared in nest building and caring of nestlings, but the incubation of the eggs was carried out by female bird only. Mean clutch size (n = 7) was 3.42 ± 0.5. Mean length, width and weight of eggs (n = 10) were 1.91 ± 0.13 cm, 1.67 ± 0.08 cm, and 2.16 ± 0.16 g respectively. Incubation and nestling period lasted for 16.4 ± 0.7 (n = 6) and 13.45 ± 0.85 days (n = 5) respectively. The total time period from nest building to fledging counted for 34.5 ± 1.5 days (n = 5). Overall breeding success was recorded at 42%. Predation and habitat destruction are main threats. Low survival rate, mainly due to predation and habitat destruction, indicates an urgent need for adapting targeted strategies for the conservation of habitat and protection of this vulnerable species.

Keywords: Jerdon's Babbler, Feeding, Breeding, Vulnerable species, Habitat degradation

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Introduction

Jerdon's Babbler (*Chrysomma altirostre*), a grassland specialist bird, belongs to family Paradoxornithidae (Jønsson and Fjeldså, 2006). This species has been listed as "Vulnerable" since 1994 by IUCN (BirdLife International, 2017), distributed discontinuously across South Asia from Myanmar to Pakistan (Sadanandan et al., 2018). It strongly prefers habitats consisting of dense, tall, perennial grasses mixed with reed beds (Roberts, 1992) and avoids degraded and shorter grasslands (Showler and Davidson, 1999). It inhabits reed-dominated wetlands, supporting vegetation such as *Imperata cylindrica, Phragmites*, and *Typha* (BirdLife International, 2024). Showler and Davidson (1999) have confirmed its presence in alluvial habitats along the Rohri Canal and Indus River in Sindh and Punjab respectively. Khan et al. (2014) studied this species in Punjab, along Chashma and Panjnad Barrages, and in Sindh, along Guddu Barrage. Progressive degradation of the habitat has been posing a major threat to the survival of this species (BirdLife International, 2020). A decline has been observed in the population of this species across its range (BirdLife International, 2023). A dramatic contraction has been observed in its historical range, which has been reduced by 47% (Parengal et al., 2025a). Habitat loss due to conversion of native grassland ecosystems to agriculture and urbanization, together with climate change has resulted in its population fragmentation (Parengal et al., 2026). This fragmentation is relatively a recent phenomenon caused by habitat modification through anthropogenic activities (Sadanandan et al., 2018). *Chrysomma altirostre* has three subspecies; the nominate subspecies (*C. a. altirostre*) from Myanmar, was thought to be extinct as no individual had been observed since 1941, until it was rediscovered by Rheindt et al. (2014). *C. a. griseigularis,* is the only known subspecies to occur in protected areas like Sukla Phanta Wildlife reserve and Chitwan National Park in Nepal, and Manas National Parks in Assam (Sadanandan et al., 2018). *C. a. scindicum* is restricted to Indus plains of Pakistan, inhabiting tall alluvial grasslands. This subspecies has been extending its range eastward, as it was recently observed in Harike Wildlife Sanctuary, Punjab, India (Arora et al., 2012a, 2012b).

Knowledge of microhabitat requirements of this grassland specialist species is essential to formulate effective management and conservation strategies. Our study assesses habitat selection patterns, breeding biology (based on 7 nests), and feeding ecology (based on 89 observation sessions for foraging behavior and 261 sessions for diet composition) to evaluate the ecological requirements of this restricted range vulnerable species and provide conservation recommendations. Although the sample sizes are small, this is consistent with studies of other rare grassland passerines (Rahmani et al., 2023).

Material and Methods

Study Area

The field work for this study was conducted over three years (2022-2024) in grassland ecosystems situated along the River Ravi and River Chenab in the Punjab province of Pakistan (Figure 1). Both of these rivers are part of the five-river system in the Punjab province, running through the Indus plains. The surrounding alluvial conditions assist the growth of reeds and other tall grasses such as *Phragmites karka, Typha* spp. (*T. latifolia* and *T. angustifolia*)*, Saccharum munja, S. spontaneum*, and *S. arundinaceum*, which form irregular patches. The area denotes a hot, semi-arid climate, with summer temperature ranging between 40° C to 54° C, while the winter temperature remains 4° C to 25° C (Pakistan Meteorological Department). Mean annual rainfall is 127-225 mm. The region is mostly flat with gentle slopes, characteristic of alluvial plains, formed by the Indus River and its tributaries. The soil is very fertile and suitable for intensive agriculture, particularly wheat, cotton, sugarcane, and rice (Ahmad et al., 1998). Although the study area itself has not been designated as protected area, but it falls within the Indus Basin which was announced a UN World Restoration Flagship under the Living Indus Initiative in February 2024 (UN Decade on Restoration, 2024), which aims to restore as much as 25 million hectares of the Indus Basin by 2030, highlighting the key importance of these riparian ecosystems.

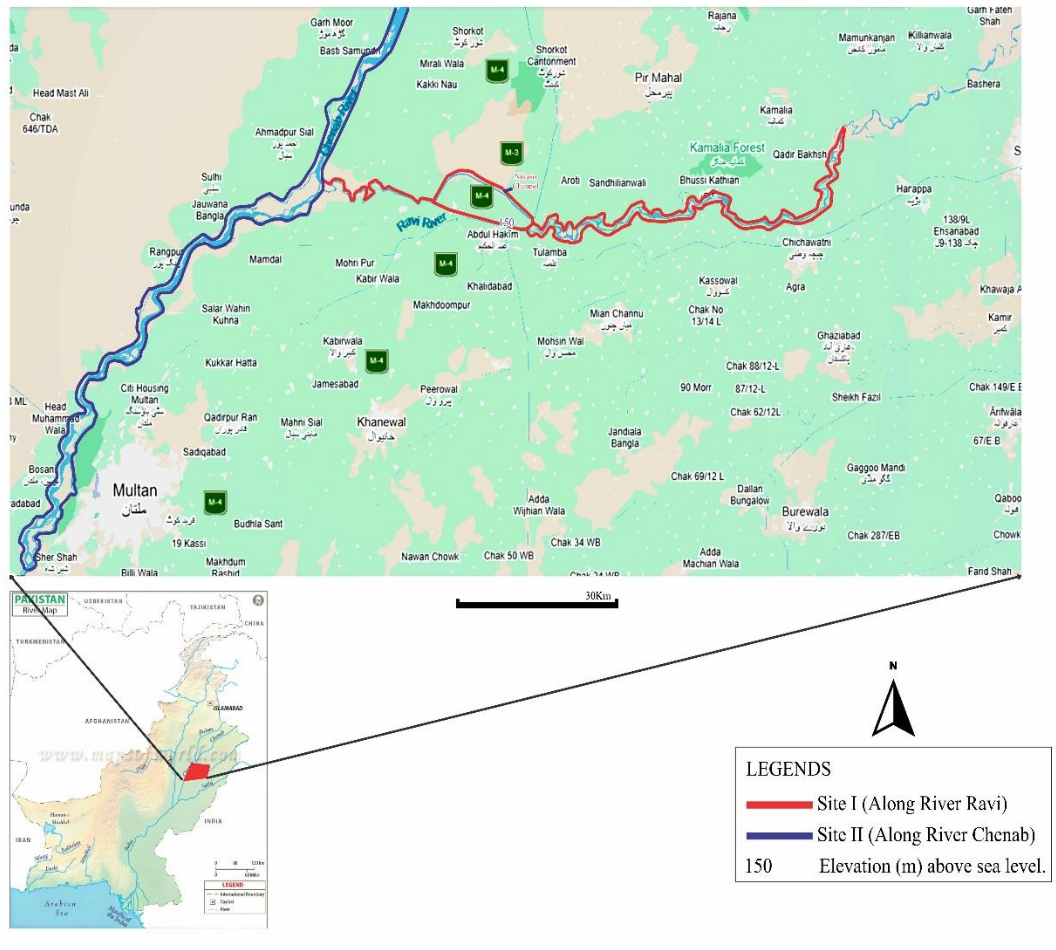

Figure-1. Map of study area.

Methods

Sampling was carried out mainly on weekends (Saturday and Sunday) during most months. During the peak breeding and monsoon months of June, July, and August, extended field visits of 22 ± 4 days per month were undertaken to intensively monitor nesting activity, arthropod abundance, and foraging behavior. In total, 392 field days were spent in the study area over the three-year period. Line transect method, following Bibby et al. (1992), was employed to systematically survey floral composition, quantify arthropod abundance, estimate ground cover, and assess anthropogenic impact within the study area. At each study site, 10 line transects were established across representative habitat patches. Transect length varied from 100 to 500 meters depending on the size and continuity of the grassland patches at each location. Each transect was divided into 100 m sections, which were further subdivided into 10 × 10 m units for standardized data collection. Floral composition was recorded from 140 randomly selected units, 70 at each site.

Foraging behavior, prey abundance and prey preference

Direct focal observations were used to study diet composition and feeding habits (Akinpelu and Oyedipe, 2004), instead of stomach content analyses. Observations were conducted during morning and evening hours: 07:00–11:00 and 16:00–sunset in summer, and 08:00–12:00 and 15:00–sunset in winter. We recorded prey capture techniques employed (Gleaning, pouncing, probing and sallying; Remsen and Robinson, 1990), feeding substrates utilized, i.e. plant, ground, and air (Rosenberg, 1993), and the kind of food eaten during each feeding event. Arthropod prey abundance was assessed by sweep net sampling (Spafford and Lortie, 2013), pitfall trap (Nemec et al.,

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2014), and knockdown methods (Rudd and Jensen, 1977). Preferred insect prey was determined by comparing the proportion of identified prey species consumed by the birds during observed feeding sessions.

Reproduction

Although data regarding floral composition, arthropod abundance, ground cover, and anthropogenic impact was obtained along transect lines, yet comprehensive scans of the habitat across all accessible areas were performed to locate nests, which were georeferenced using GPS. Nest searches were also carried out through visual tracking of birds carrying nesting materials or food for nestlings. Alarm calls produced by parental birds also served as an additional cue. Once located, nests were monitored daily to authenticate the eggs count, predation incident, hatching, and offspring development. Nesting plant height and nest height from ground was measured using a measuring tape. Nests were described in terms of shape (Simon and Pacheco, 2013), materials used, and the plant species they were built in. Measurements were taken post-abandonment using Vernier calipers and rulers. Egg dimensions were similarly measured and weighed using digital scales. On completion of egg laying process, the total number of eggs was considered as clutch size. Incubation duration was calculated from the laying of final egg to the hatching of first chick. For the nests to be considered successful, at least one fledging was necessary (Innes and Johnston, 1996). Breeding success was determined by calculating the proportion of successful nests to the total nests studied. The time duration from hatching to fledging was termed as nestling phase. Observations were made through hides without disturbing the natural behavioral activities. Binoculars were used if required. Food delivery rates were calculated by counting the nest visits of parental birds per hour. Mayfield method (Mayfield, 1975) was used to estimate daily survival rate and overall breeding success.

Statistical analysis

Microsoft Excel 2019 program was used for compilation and analysis of data. RStudio software (version 4.3.2) was used for further statistical analyses. Mann-Whitney U tests were used to conduct univariate comparison between used and available sites for habitat variables. Resource selection functions (Manly et al., 2002) were used to assess habitat preferences. Firth' s penalized likelihood logistic regression (Firth, 1993) was used to assess multivariate habitat selection, accounting for rare events like 16 units where birds were detected and the seven nest sites. The logistf package was used for these analyses in R. Chi Squared Test of independence was used to compare the consumption of diet during breeding and non-breeding season. Ivlev's (1961) electivity index ($E = (r - p) / (r + p)$) was measured for each prey order to determine dietary preference. Shapiro- Wilk tests were used for data normality assessment. Wilcoxon signed-rank tests were used to compare substrates utilized during food capture and to compare food handling techniques. Friedman test was used to compare food capturing techniques.

Results

Habitat

All the sightings of Jerdon's Babbler were in the alluvial grassland habitats associated with riverine flood plains, and adjoining crop fields. These environments consisted predominantly of *Typha* spp. (10.27 stands/100 m^2, IVI = 95.53), *Phragmites karka* (5.99 stands/100 m^2, IVI = 57.59), *Saccharum munja* was also a key component with IVI value of 53.04. *Saccharum spontaneum* and *S. arundinaceum* contributed moderately to the floral composition, while *Prosopis juliflora* and *Calotropis procera* were sparsely distributed. *Desmostachya bipinnata* formed the ground layer throughout the study area. *Acacia nilotica* and *Bombax ceiba* were recorded in only 2 and 4 sampling units respectively, hence excluded from analyses (Table 1).

Table-1. Floral composition of the study area.

Plant Species	Density/ 100^2m	Relative Density (RD %)	Frequency	Relative Frequency (RF %)	Relative Cover (RC %)	IVI
Typha spp.	10.27	37.39	117	20.75	37.39	95.53
P. karka	5.99	21.79	79	14.01	21.79	57.59
S. munja	4.19	15.26	127	22.52	15.26	53.04
S. spontaneum	2.39	8.68	122	21.63	8.68	38.99
S. arundinaceum	0.94	3.43	82	14.15	3.43	20.87
P. juliflora	0.61	2.21	47	8.33	2.21	12.75
C. procera	0.19	0.68	20	3.55	0.68	4.91

Of the total sampled units, the specimen bird was found in 16 units (11.4%). Univariate comparisons revealed that preferred sites had higher cover of *P. karka* (Mann- Whitney U test: W = 165.5, $p < 0.001$), *Typha* spp. (W = 691.0, p = 0.048), and higher total ground cover (W = 141.5, $p < 0.001$). No significant difference was observed for all other plant species between used and un used sites ($p > 0.05$). In the multivariate Resource Selection Function (Firth's penalized logistic regression), ground cover (OR = 1.11, 95% CI: 1.01-1.31, p = 0.03) and *P. karka* (OR = 1.12, 95% CI: 1.04-1.34, $p < 0.001$) proved to be positive significant predictors. However, *Typha* spp. showed no significance in this model (p = 0.239), indicating that its univariate significant effect was due to other vegetation variables (Table 2).

Table-2. Univariate and multivariate analysis of habitat variables associated with site preference.

Predictor	Mann-Whitney (W)	p-value (Univariate)	Firth β	SE	p-value (Firth)	Odds Ratio	95 % CI
P. karka	165.5	< 0.001	0.11	0.037	< 0.001	1.12	1.04-1.34
S. munja	1452.5	0.002	–0.647	0.289	0.032	0.52	0.16-0.95
S. spontaneum	1122	0.39	–0.233	0.234	0.426	0.79	0.39-1.37
S. arundinaceum	935.5	0.69	–0.255	0.366	0.637	0.77	0.24-1.97
P. juliflora	946.5	0.701	–0.148	0.289	0.648	0.86	0.36-1.56
Typha spp.	691	0.048	0.058	0.045	0.239	1.06	0.96-1.22
C. procera	1061	0.429	–0.577	1.542	0.8	0.56	0.00-13.3
Ground cover (%)	141.5	< 0.001	0.102	0.043	0.03	1.11	1.01-1.30

Nests were found in only 9 units (6.4%). Univariate tests revealed that *P. karka* (W = 9.5, $p < 0.001$) and ground cover (W = 84.5, $p < 0.001$) were significantly higher at nest sites compared to available sites. In the multivariate Firth regression, *P. karka* (OR = 1.22, 95% CI: 1.06-1.92, $p < 0.001$) proved to be positive significant predictor, while *S. munja* proved to be non-significant positive predictor (OR = 1.83, 95% CI: 0.79-7.42, p = 0.126). However, ground cover showed no significance in this model (p = 0.921), indicating that its univariate significant was due to floral composition (i.e., nest association is with density of vegetation, but this density was the result of *P. karka* cover (Table 3).

Table-3. Univariate and multivariate analysis of habitat variables associated with nest site selection.

Predictor	Mann-Whitney (W)	p-value (Univariate)	Firth β	SE	p-value (Firth)	Odds Ratio	95 % CI
P. karka	9.5	< 0.001	0.196	0.063	< 0.001	1.12	1.04-1.34
S. munja	696.5	0.36	0.605	0.239	0.126	0.52	0.16-0.95
S. spontaneum	738	0.202	0.087	0.25	0.25	0.807	0.39-1.37
S. arundinaceum	619.5	0.785	–0.055	0.419	0.637	0.77	0.24-1.97
P. juliflora	557	0.723	0.865	0.414	0.648	0.86	0.36-1.56
Typha spp.	403	0.112	0.085	0.055	0.239	1.06	0.96-1.22
C. procera	599	0.893	–4.628	2.591	0.8	0.56	0.00-13.3
Ground cover (%)	84.5	< 0.001	0.011	0.048	0.03	1.11	1.01-1.30

During each year of study period, 85-90% of the grassland area was cleared of vegetation during December and January, resulting in extensive anthropogenic habitat modification. Fires were set intentionally, by local communities to burn the remaining stubble, based on traditional belief of luxurious grass regrowth after burning.

Feeding

The analyses showed that the larger proportion of the diet of *C. altirostre* consisted of insects, with supplementary intake of grains from the crops like *Sesamum indicum*, *Sorghum vulgare*, and *Pennisetum typhoidum*, cultivated at the edges of alluvial habitats. Bulk of the diet (65%) consisted of the insects belonging to the orders Lepidoptera, Orthoptera, Coleoptera, Hymenoptera, and Odonata. Insects from the order Ephemeroptera and Isopoda constituted the smallest proportion (Figure 2).

C. altirostre actively selected Blattodea, Ephemeroptera, Isopoda, Mantodea, and Odonata, avoiding Orthoptera, despite its higher abundance. Coleoptera, Diptera, and Lepidoptera were consumed roughly in proportion to their availability (Table 4).

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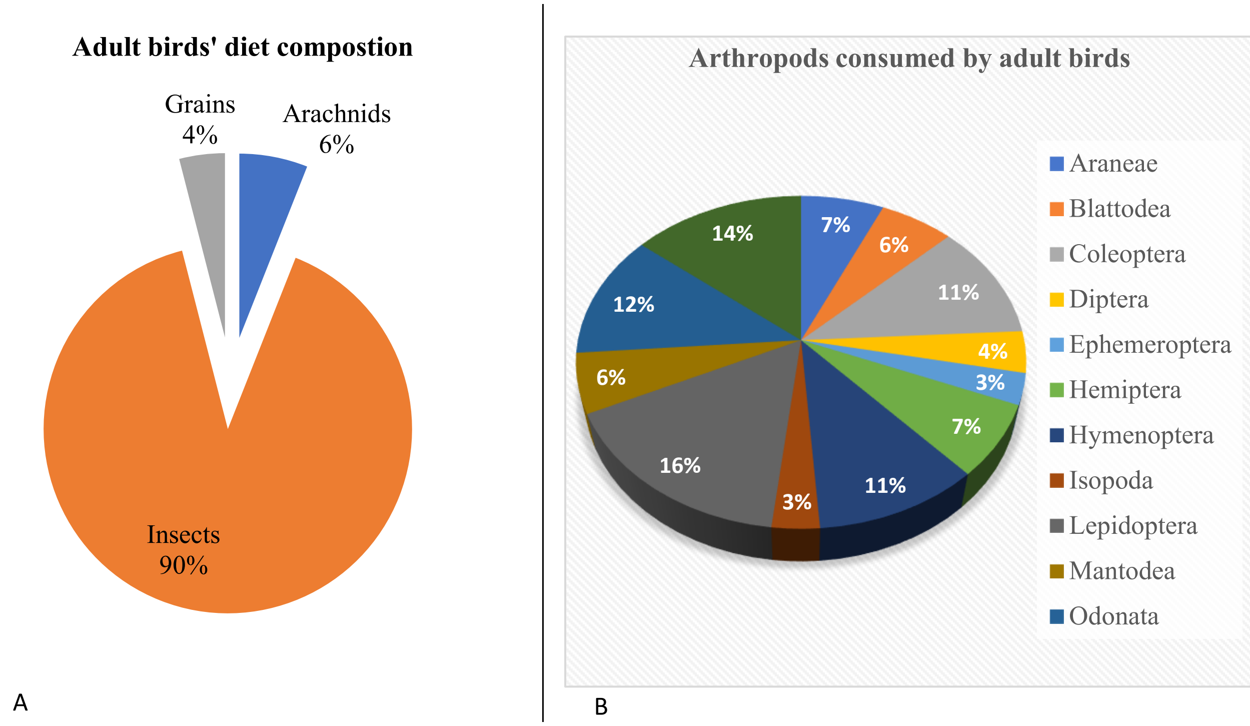

Figure-2. Percentage proportion of diet ingested by adult birds (A, B).

Table-4. Environmental proportion (p), diet proportion (r), and Ivlev's electivity (E) for each prey order (all data pooled).

Order	Environment (p)	Diet (r)	Ivlev's E	Selection
Araneae	0.0469	0.0664	+0.172	Slight preference
Blattodea	0.0376	0.0592	+0.223	Preference
Coleoptera	0.0991	0.1114	+0.058	Neutral
Diptera	0.0421	0.0403	-0.022	Neutral
Ephemeroptera	0.0190	0.0308	+0.237	Preference
Hemiptera	0.0987	0.0687	-0.179	Avoidance
Hymenoptera	0.1380	0.1043	-0.139	Slight avoidance
Isopoda	0.0089	0.0308	+0.552	Strong preference
Lepidoptera	0.1481	0.1611	+0.042	Neutral
Mantodea	0.0243	0.0569	+0.401	Preference
Odonata	0.0558	0.1303	+0.400	Preference
Orthoptera	0.2816	0.1398	-0.336	Strong avoidance

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Higher diet intake was observed during the months of May, June and July which coincided with the breeding season of the *C. altirostre*. There was significant difference in the composition of diet ingested during breeding and non-breeding season ($\chi^2 = 34.2$, df = 11, $p < 0.001$). During the breeding season, arthropods belonging to the orders Lepidoptera, Odonata, and Isopoda were eaten in higher amount, while during the non-breeding season, Orthopterans were eaten more frequently (Table 5).

Table-5. Seasonal distribution of prey capture by *C. altirostre* during the three-year study period.

Season	Months	% of Annual Diet
Pre-breeding	March-April	19.3
Core breeding	May-July	35.7
Post-breeding	August-October	29.9
Winter	Nov-February	15.2

During the breeding season, arthropods of the orders Isopoda and Odonata were highly preferred, and Lepidoptera was also selected more strongly. Orthopterans were avoided again during this season (Table 6).

Table-6. Prey selection during the core breeding season (May-July).

Order	Diet proportion (r)	Ivlev's E (Breeding)	Selection tendency
Lepidoptera	0.159	+0.36	Preference
Odonata	0.140	+0.42	Strong preference
Orthoptera	0.133	-0.29	Avoidance
Coleoptera	0.116	+0.07	Neutral
Hymenoptera	0.106	-0.13	Slight avoidance
Isopoda	0.033	+0.58	Strong preference
Mantodea	0.043	+0.28	Preference

Birds preferred plant substrate over ground for food capture, with mean capture rates of 2.04 ± 2.87 and 1.55 ± 2.16, per minute, respectively (Mean ± SD). However, the difference was not statistically significant (Wilcoxon signed rank test: V = 2145, p = 0.08). The main foraging method used was gleaning (3.33 ± 3.25), followed by probing (0.71 ± 1.66), and sallying (0.20 ± 0.49). There was significant difference among three foraging methods employed by the birds (Friedman Test: $\chi^2 = 112.4$, $p < 0.001$). Food handling involved 'gulping' (3.34 ± 3.13) as main technique employed, followed by 'tearing and gulping' (0.78 ± 1.10). A significant difference was observed between food handling techniques involved (Wilcoxon signed rank test: V = 3241, $p < 0.001$) (Figure 3 a, b).

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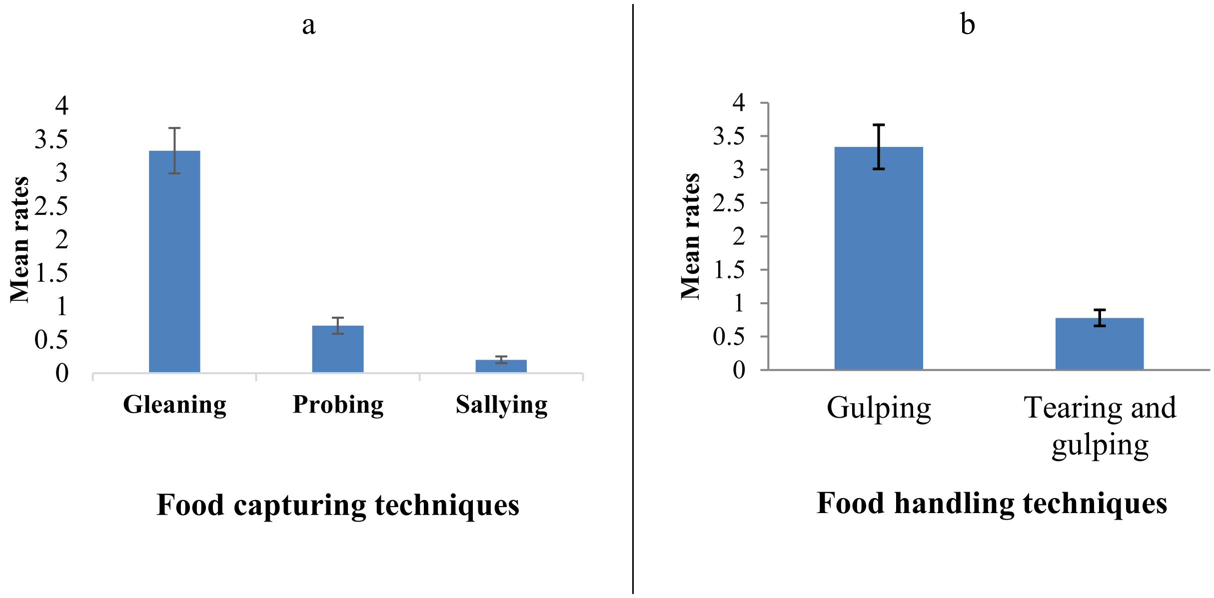

Figure-3 (a, b). Food capturing and handling techniques employed by C. altirostre (Mean ± SEM).

Breeding

Breeding season began with territorial male calls in mid-March. Nest construction began in May, with the final nest built in July and activity peaking during June and July.

Nesting plants and nesting material

A total of nine nests were found over the three-year study period—six were built in *S. munja* thicket and three in *S. spontaneum*. The nests were positioned between vertical stems, with these upright supports forming part of its structure. All nests were cup-shaped, constructed from woven grasses, lined with fine materials and strengthened with cobwebs. Nest construction took an average of 3.20 ± 0.5 days (n = 5), with both sexes participated in nest construction (Table 7).

Table-7. Location and measurements of nests (n = 7).

No.	GPS Readings	Depth (cm)	Internal Width (cm)	External Width (cm)	Nesting plant height (m)	Nest height from ground (m)
1	**30°34'14" N, 72°9'42" E**	4.6	5.8	7.1	3.1	1.2
2	**30°36'46" N, 72°8'52" E**	4.8	5.7	7.0	2.6	0.9
3	**30°36'39" N, 72°8'49" E**	4.9	6.0	7.2	2.9	1.15
4	**30°40'13" N, 72°11'00" E**	5	5.9	7.1	3.1	1.25
5	**31°58'16" N, 72°00'45" E**	5.3	6.2	7.4	2.8	1.1
6	**30°46'56" N, 71°53'43" E**	4.8	5.5	6.9	2.7	1.2
7	**30°36'09" N, 71°48'44" E**	5.1	6.0	7.0	3.1	1.1
Mean ± SD	**-**	4.92±0.22	5.87±2.20	7.1±0.16	2.9±0.20	1.12±0.11

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Nests were always found in close vicinity of water body i.e. to rivers and attached ponds, primarily in dense growths of *Typha*, *Phragmites*, and *Saccharum*. The eggs were ovoid having light red or pinkish color with irregular chestnut red or dark red patches. The clutch size ranged from three to four per nest (n = 7). Eggs were laid on consecutive days, with incubation beginning post-laying. Egg incubation was carried out solely by the female, which remained at the nest for 65% of the total observation period. Male visits were limited (3.5 ± 1.4 times per incubation period) (n = 6 nests). All the eggs of a clutch hatched within 1.0 ± 0.05 days. Hatching success was 75% (Table 8).

Table-8. Nest site parameters.

Characteristics	Mean ± SD
Nest plant height (m), (n=7)	2.9 ± 0.25
Nest height from ground (m), (n=7)	1.12 ± 0.11
Depth of nest (cm), (n=7)	4.92 ± 0.22
Internal width of nest (cm), (n=7)	5.87 ± 2.20
External width of nest (cm), (n=7)	7.1 ± 0.16
Length of egg (cm), (n=10)	1.91 ± 0.13
Width of egg (cm), (n=10)	1.67 ± 0.08
Weight of fresh egg (g), (n=10)	2.15 ± 0.13
Clutch size (n=7)	3.42 ± 0.53
Incubation Period (days), (n=6)	16.4 ± 0.7
Total time period from nest building to fledging (days)	34.5 ± 1.5

Parental care, Nestlings' diet and Survival rate

Among six nests studied keenly, 1,098 feeding observations were recorded. Of these, 769 prey items (70%) were identified up-to species level, whereas the remaining 30% were thought to be small insects. Of the 769 prey items identified, 372 items were insect larvae. Rest of the prey items included butterflies, moths, bugs, and beetles (Figure 4). Based on 336 observations across two nests, the rates of food provisioning by paternal and maternal birds did not differ significantly from a 1:1 ratio (Wilcoxon Signed rank test; V = 313, $p > 0.05$). An increase was observed in the food delivery rates from 3.14 ± 1.21 items per hour on day 1 to 4.28 ± 1.79 items per hour by day 13 (n = 5 nests). Significant positive correlation was found between feeding rates and nestling age ($r = 0.75$, $p < 0.05$). Parents maintained nest hygiene by removing waste. Eyes opened and feathers emerged around day 6 ± 1.1. Post-fledging care lasted about one week. No cases of nest abandonment were observed during study period. The description of different life stages of Jerdon's Babbler is shown in figure 5 (a-g).

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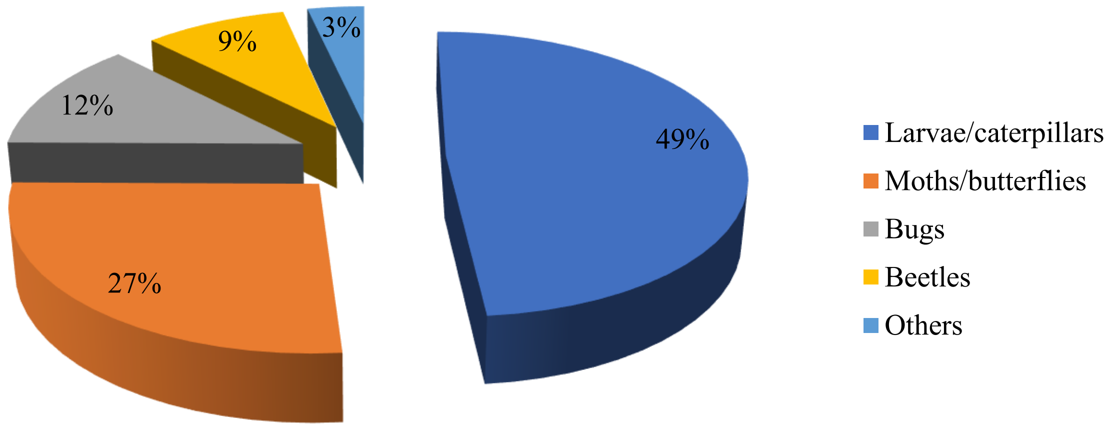

Figure-4. Percentage proportion of food items in the nestlings' diet.

Figure-5. Different life stages of Jerdon's babbler.

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Discussion

During this study, the Jerdon's Babbler was found restricted to the alluvial grasslands dominated by *Typha* spp., *P. karka, S. munja*, *S. spontaneum*, and *S. arundinaceum* (Figure 6). Water was present throughout the year in 87.5% of occupied units. The presence of water was the main reason that these sites remained undisturbed by activities like grass cutting and overgrazing. (Choudhury, 2023; Sawant and Sudhagar, 2013) also reported similar type of habitat utilized by this species. The occurrence of *C. altirostre* restricted to 16 out of 140 sampled units clearly confirms its narrow ecological range, consistent with the findings of Parengal et al. (2025a), who reported a 47% decrease in the species' historical range. The association of the species with *P. karka* (OR = 1.12, $p < 0.001$), and relative higher ground cover (OR = 1.11, $p = 0.03$), found in current study, shows its specific habitat requirements. *P. karka* proved to be a strongest predictor of both bird's presence and nest site selection (OR = 1.22, $p < 0.001$ for nests), along-with *S. munja* (OR = 1.83, $p = 0.126$), indicating narrow habitat tolerance for *C. altirostre.* Similar patterns have been found in other grassland specialist avian species, where microhabitat floral composition proves to be more important than broad vegetation type (Stanton et al., 2022). The *C. altirostre* avoided the areas with sparse ground cover ($p < 0.001$), and highly disturbed patches resulting from grass cutting and fire, demonstrating its low tolerance to habitat degradation through anthropogenic activities. Seasonal fires and unauthorized playbacks were identified major threats for *C. altirostre* by Parengal et al. (2025a), which supports our findings regarding fires.

Although *C. altirostre* was found to be insectivorous bird, with arthropods comprising 96% of the total diet intake, it also consumed plant grains (4%). It also showed clear selectivity, favoring some arthropods groups (Lepidoptera, Odonata, Mantodea, Isopoda) and avoiding others (Orthoptera). This selectivity with seasonal shift in diet intake clearly shows its adaptivity, optimizing prey choice according to its nutritional requirements and prey availability. Jerdon (1862) observed small ants and beetles, while analyzing its stomach content. Stevens (1915) found that vegetable matter and small seeds were part of its diet. Roberts (1992) concluded insectivorous nature of this species. Findings of our study are in accordance with those of Jerdon (1862), Stevens (1915), and Roberts (1992). Breeding season (May-July) coincides with the strongest selection of energy rich prey (Lepidoptera and Odonata) and period of highest prey consumption. The alignment of breeding season with peak arthropod abundance ensures adequate food supply for both adults and rapidly growing nestlings. Insects were the primary prey items fed to the nestlings, especially caterpillars, and larvae (48.3% of the total identified arthropod prey), followed by butterflies and moths, true bugs and beetles. Caterpillars made up 44% of the diet provided to the nestlings of Great tit (*Parus major*) (Pagani- Núñez et al., 2011). Food supply rates have increased day by day. Schulze et al. (2000) observed similar patterns in their study on the Double-toothed Kite *Harpagus bidentatus*. It is well-established that reduced food delivery rates can negatively impact nestling survival (Mullers and Tinbergen, 2009). Therefore, observed increase in feeding rates in present study may be linked to the growing nutritional requirements and survival needs of nestlings.

Nests were placed towards the center of the thickets of *S. spontaneum and S. munja*. entwined around numerous thin stems, likely enhancing the support for clutches of 3-4 eggs and nestlings, and improved protection from predators. Nests were built high above the ground (1.12 ± 0.11 m), perhaps to reduce the risk of predation by small mammals and flooding. Nest sites selection was associated with higher vegetation density and increased abundance of food resources. Similar pattern was observed during the study of ecology of *Prinia burnesii* (Hussain et al., 2025), where height of nesting plant was found an important physical covariate for nest success, while nest height and nest type were important physical covariates in the study of (Brown and Collopy, 2008).

Male birds started producing territorial calls from the mid of March each year, with nest building beginning during the month of May. Breeding season continued to early August, Same breeding season has been reported by (Baker, 1932; Krishnan, 2023). Ovoid eggs had light red or pinkish color with irregular dark red or chestnut red patches, with clutches of three or four. Baker (1932) described full complement of two or three eggs, possibly as many as four or five. Incubating females were never observed being fed by their male partners during the whole period. Nest building and chick provisioning was carried out by both parental birds. Despite nest concealment within dense grasses, predation was the primary cause of breeding failure. Crows (*Corvus splendens*) and Greater Coucals (*Centropus sinensis*) were the main observed predators, particularly during the nestling stage when the nest locations were revealed by parental feeding visits. Daily survival rate (DSR) during egg incubation phase was 0.981 ± 0.027 (n = 24 eggs, 301 exposure days) with an apparent survival rate (ASR) of 71% (17-day incubation period), while DSR during nestling phase was 0.966 ± 0.01 (n = 18 nestlings. 229 exposure days), with ASR of 65% (12-day rearing period). Overall breeding success (fledging per egg) was 42%. This is comparable to other threatened passerines (Weiser, 2021).

Conclusion

Current study found that habitat, preferred by Jerdon's Babbler, consisted of *Typha* spp., *P. karka*, *S. arundinaceum*, *S. spontaneum*, and *S. munja* as dominant plants. Large proportion of the adult bird's diet consisted of insects along with arachnids and grains. Young ones were fed with larvae/caterpillars, moths/butterflies, bugs, and beetles. The breeding season was marked by territorial male calls from mid-March to August. Both parents took part in nest building and caring for nestlings but only the female bird performed the duty of egg incubation. Egg incubation took 16.4 ± 0.7 days (n = 6), while nestling rearing period spanned for 13.45 ± 0.85 days (n = 5). Total duration from nest construction to fledging consisted of 34.5 ± 1.5 days (n = 5). Overall breeding success was 42%. Habitat degradation and predation are main threats.

Conservation Recommendations

As this species has specialization for dense and tall grassland habitats, it is extremely vulnerable to destruction of grasslands. The maintenance of undisturbed grassland patches is critical for the species' long-term survival, as population decline may proceed further due to continued habitat degradation. Furthermore, this species depends on specific prey groups particularly Odonata (which require aquatic habitats), and Lepidoptera (which have association with diverse vegetation), highlighting the importance of maintenance of heterogenous landscapes comprising both wetland and grassland elements. Predation being a natural factor is difficult to avoid, yet anthropogenic activities, including grass harvesting, burning, and uncontrolled grazing, can be controlled. We recommend restricting these activities, especially during the breeding season. Following this study, a local awareness program has been initiated with community and academic partners to promote sustainable grassland use.

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Contribution of Authors

Khan AA: Analyzed and interpreted data, edited the manuscript and supervised the study,
Hussain M: Conceived idea, designed research methodology, conducted the field experiments, collected & analyzed data and wrote the first draft of manuscript.
Ahmad S: Analyzed data and edited final draft of the manuscript.

All authors read and approved the final draft of the manuscript.

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