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Original article

Studies on nestling growth patterns of three bird species in Southern India

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ABSTRACT

This paper reports the growth of nestlings of Indian Roller Coracias benghalensis, Common Myna Acridotheres tristis and Black Drongo Dicrurus macrocercus in Nagapattinam District of Tamil Nadu, India. The body of newly hatched nestlings was naked, fleshed colored and eyes closed. The newly hatched nestlings of the Indian Roller were 16.33 g in weight and reached maximum of 284.0 g on day 24. The weight of newly hatched Common Myna nestlings was 4.2 g and attained a maxim weight of 116.3 g on day 24. The newly hatched nestlings of the Black Drongo were 5.64 g in weight and reached maximum weight of 43.50 g on day 15. A reduction in weight was noticed in all the three species in the last few days of nestling period. The other body parts attained maximum maturity from hatching to fledging.

1. Introduction

Nestling growth and development studies have been a topic of interest for a greater part of the last century and continue to be of interest today (Walkinshaw 1948). This is not surprising since studies on nestling growth can provide a wealth of biological information that has larger implications for avian management and conservation. Despite this history of studying nestling development, basic information is still limited or absent for many species. Many questions remain unanswered, and contradictory conclusions are often found in the literature (Starck and

Ricklefs 1998). Therefore, much information on aging and development can still be gained from studying the development patterns of similar species and from comparative studies, across avian orders (Saunders and Hansen 1989; Carlsson and Hornfeldt 1993). Additionally, nestling growth studies can yield insight into the effects of different nesting strategies on productivity, as well as the impacts of parental effort and environmental variables on fitness. Various ecological factors that influence nestling growth are generally related to limitations in food availability, weather, habitat differences and quality, predators, competition between nest mates and parental abilities (Ricklefs 1993; Teather and Weatherhead 1994;. Briskie 1995; Burhans et al. 2000; Dawson and Bidwell 2005). Feather development may proceed independently of growth in body size or mass gain (Ricklefs 1968). These qualities make feather development an important component of aging nestlings.

Published information on the growth of Indian birds is limited (Kumar 1983; Kumar and Rao 1984; Nagarajan et al. 2002; Ramanujam and Murugavel 2009; Pande et al. 2011). The aim of this study was to document and to analyze the nestling's growth pattern of Indian Roller Coracias benghalensis, Common Myna Acridotheres tristis and Black Drongo Dicrurus macrocercus. The Indian Roller is the most common avian species in Southern India. It inhabits all types habitat mainly in cultivation, thin forest and grassland and in cities at lower elevations but avoids heavy jungles. Relatively little is known about the behavior the Indian Roller (Mathew et al. 1978; Panicker 1978; Sivakumaran and Thiyagesan 2003; Asokan et al. 2009a). The Common Myna is a familiar urban bird. It is omnivorous and social in habit. Some information on its ecology is previously available (Anil et al. 1990; Anil and Bastawade 1991; Asokan et al. 2009b). The Black Drongo is a familiar bird in cultivated areas and open country. Reports on its ecology are few and sporadic (Mathew et al. 1978; Shukkur and Joseph 1978; Chari et al. 1982; Vena and Lokesha 1993; Ali et al. 2010a).

2. Materials and methods

Growth changes in the Indian Roller, Common Myna and Black Drongo nestlings were measured from hatching to fledging. The method employed for measuring nestlings followed by Pettingil (1985). All the nests were visited every 3 days, taking both photographs of the young and morphometric measurements of the body parts. Disturbances were minimized by handling the nestlings very carefully during the measurements. All the nestlings were allotted individual identification marks. Totally eight measurements were made 1) body weight, using a spring balance of 1g accuracy; 2) body length, from the tip of the bill to the tip of the longest rectrix; 3) bill length, from the tip of the upper mandible to the base of the culmen; 4) bill width, distance between the upper and lower mandible; 5) wing length, as the straight length from the bend of the wing to the tip of the longest primary; 6) wing span, the distance from tip to tip of the longest primaries of the outstretched wings; 7) tarsus length, measurement from the base of the tarsometatarsus to the base of the middle toe and 8) tail length, the distance from the tip of the longest rectrix to the base of the middle rectrices.

2.1. Study area

The present study was conducted at in and around Mannampandal (11°18' N, 79°50' E), situated in the Nagapattinam District of Tamil Nadu, India. Agriculture is the major industry of this area, and contributes a high share of the rice production in the state. Sugarcane, groundnut, green gram, black gram, cotton, etc. are other major crops cultivated in the area. The river Cauvery and its tributaries are major perennial water sources used for irrigation. Woody vegetation is sparse in the form of groves and roadside trees. The predominant tree species found in the study area are Cocos nucifera, Borassus flabellifer, Madhuca indica, Mangifera indica, Enterolobium saman, Tamarindus indicus, Ficus benghalensis, Ficus religiosa, Thespesia populnea, Acacia arabica, Odina wodier and Azadirachta indica. Important shrub species are Prosopis juliflora, Jatropha glandulifera and Adhathoda vesica. Plantations of Casuarina equisetifolia, Tectona grandis and Bamboosa arundinacea are also found in the study area. Based on the north-east monsoon the study area is divided into four seasons, namely post-monsoon, summer, pre-monsoon and monsoon. Summer ranges from April to June (with mean maximum temperature of 38° C) and north-east monsoon starts between October and December. The cold season starts in November and may last until January.

3. Results

3.1. Indian roller

Nestlings grew from 16.33 ± 2.18 g at day three to peak weight of 284.00 ± 6.73 g at day 24 then slowly declined and reached to the weight of 251.33 ± 2.06 g on day 30. The body length of nestlings reached from 6.74 ± 0.26 cm (on day three) to 20.71 ± 0.21 cm by the end of day 30. The bill length was 0.76 ± 0.09 cm at day three and it reached to 2.23 ± 0.12 cm on day 30. The bill depth of the nestling was 0.43 ± 0.05 cm at day three and attained the maximum size of 1.10 ± 0.06 cm. On day three the length of wing was 2.62 ± 0.11 cm and it gradually increased and attained maximum length of 20.23 ± 0.65 cm on day 30. The tarsus length of nestlings grew from 1.38 ± 0.13 cm (at day three) to 3.87 ± 0.12 cm by the end of day 30. The tail length showed a considerable amount of growth during the nestling period. The growth was 0.19 ± 0.06 cm at day three and it increased to 5.33 ± 0.21 cm during day 30 (Table 1).

3.2. Common myna

The weight of the nestlings was 4.2 ± 1.01 g at the age of day one. It gradually increased to 116.3 ± 3.78 g on day 24. Then the weight slowly declined and reached to the weight of 92.2 ± 2.60 g on day 30. The body length of the nestlings on the day one was 4.8 ± 0.88 cm and it increased to 19.4 ± 0.46 cm on day 30. The bill length was 0.2 ± 0.07 cm on day one and attained maximum growth of 2.6 ± 0.11 cm on day 30. The bill depth of the nestlings was 0.2 ± 0.04 cm on day one and attained the size of 0.8 ± 0.12 cm on day 30. The wing length was 1.5 ± 0.47 cm on day one and it gradually increased and attained the maximum length of 19.7 ± 0.62 on day 30. The wing span increased from 4.9 ± 0.08 cm on day one to 43.4 ± 1.08 cm on day 30. The tarsus length showed a considerable amount of growth during the nestling period. The growth was 0.7 ± 0.33 cm on day one and it increased to 4.1 ± 0.10 cm during day 30. The tail length was a maximum of 4.5 ± 0.22 cm on day 30 and minimum of 0.1 ± 0.22 cm on day one (Table 2).

3.3. Black drongo

Nestlings grew from 5.64 ± 1.08 g at hatching to peak weight of 43.50 ± 0.53 g at day 15, then slowly declined and reached to the weight of 37.00 ± 1.07 g on day 24. The body length of nestlings reached from 4.53 ± 0.38 cm at hatching to 15.11 ± 0.35 cm by the end of day 24. The bill length was 0.60 ± 0.08 cm at hatching and it reached to 1.61 ± 0.12 cm on day 24. The bill depth of the nestling was 0.19 ± 0.09 cm at hatching and attained the size of 0.79 ± 0.04 cm. At the time of hatching, the length of wing was 1.74 ± 0.17 cm and it gradually increased and attained maximum length of 14.19 ± 0.37 cm on day 24. The wing span of nestlings reached from 5.11 ± 0.18 cm at hatching to 32.83 ± 1.86 cm by the end of day 24. The tarsus length of the nestling was 1.01 ± 0.10 cm at hatching and attained maximum size of 2.54 ± 0.11cm. The tail length showed a considerable amount of growth during the nestling period. The growth was 0.22 ± 0.08 cm at hatching and it increased to 4.43 ± 0.15 cm during day 24 (Table 3).

4. Discussion

As regards to nestling growth patterns, the weight of chicks was gradually increased from hatching to fledging. However, there was a drop in the mean weight of nestlings were observed at last few days. Many observers have noted a decrease in rate-of-gain in weight as feathers were being produced or as temperature control was being established. Banks (1959) reported that the decrease in actual and relative gain in weight of the final three days of nestling life in the White-crowned Sparrow Zonotrichia leucophrys was probably due to a shift in the energy budget, as more food was utilized in production of feathers and heat. Welty (1982) stated that many nestlings loose body weight few days before leaving the nest. This loss was supposed to be due to the utilization of fat deposits and skeletal muscles for the energy to leave the nest. This phenomenon is related to the maturation of juvenile tissues and loss of water. The weight of the Indian Roller chicks on the third day was 16.33 g which increased to 284.0 g at 24 day of age. Mean weight of nestlings at last few days was dropped and reached 251.3 g at the time of fledging. The weight of the Common Myna nestlings gradually increases to 116.3 g on day 24. However, there is a drop in the mean weight of chicks before leaving the nest and reached 92.2 g at the time of fledging. The weight of the chicks gradually increased at 15 days of age. However, there was a drop in the mean weight of chicks before leaving the nest and reached 37.0 g at the time of fledging. This body weight reduction is helped to the advantage for moving out the nest (Kumar and Rao 1984; Languy and Vansteenwegen 1989; Magrath 1991; Penteriani et al. 2005). Asokan et al. (2009a,b) and Ali et al. (2010a) observed similar pattern of loss of weight in Indian Roller, Common Myna and Black Drongo nestlings in Cauvery Delta of Southern India.

Table 1

Growth patterns (mean ± SD) for 8 measurements of the Indian Roller Coracias benghalensis nestlings, Southern India.

Age (Days)	No. of Chicks	Body weight (g)	Body length (cm)	Bill length (cm)	Bill depth (cm)	Wing length (cm)	Wing span (cm)	Tarsus length (cm)	Tail length (cm)
3	9	16.33 ± 2.18	6.74 ± 0.26	0.76 ± 0.09	0.43 ± 0.05	2.62 ± 0.11	7.02 ± 0.13	1.38 ± 0.13	0.19 ± 0.06
6	9	34.00 ± 2.87	8.18 ± 0.15	0.96 ± 0.09	0.60 ± 0.09	3.40 ± 0.09	8.19 ± 0.17	1.59 ± 0.26	0.43 ± 0.09
9	4	49.25 ± 7.89	9.68 ± 0.70	1.23 ± 0.22	0.78 ± 0.10	5.28 ± 0.41	13.78 ± 0.29	2.05 ± 0.37	0.65 ± 0.19
12	6	58.83 ± 2.04	11.52 ± 0.22	1.67 ± 0.14	0.83 ± 0.15	6.18 ± 0.13	15.68 ± 0.65	2.38 ± 0.08	1.03 ± 0.05
15	7	92.86 ± 8.07	12.19 ± 0.43	1.77 ± 0.08	0.90 ± 0.06	7.87 ± 0.77	22.40 ± 0.66	2.54 ± 0.15	1.34 ± 0.11
18	6	143.50 ± 8.38	13.93 ± 0.23	1.98 ± 0.08	0.98 ± 0.08	9.60 ± 0.37	24.38 ± 0.95	2.98 ± 0.10	2.00 ± 0.17
21	4	232.50 ± 5.50	14.95 ± 0.10	2.10 ± 0.00	1.03 ± 0.05	13.95 ± 0.17	37.78 ± 0.29	3.58 ± 0.05	2.90 ± 0.08
24	5	284.00 ± 6.73	16.98 ± 1.50	2.10 ± 0.10	1.04 ± 0.11	18.97 ± 1.60	41.48 ± 2.42	3.80 ± 0.22	3.96 ± 0.96
27	5	260.00 ± 5.81	20.32 ± 2.48	2.20 ± 0.10	1.10 ± 0.07	20.20 ± 1.65	43.14 ± 1.72	3.86 ± 0.23	4.88 ± 0.77
30	3	251.33 ± 2.06	20.71 ± 0.21	2.23 ± 0.12	1.10 ± 0.06	20.23 ± 0.65	43.87 ± 0.81	3.87 ± 0.12	5.33 ± 0.21

Table 2

Growth patterns (mean ± SD) for 8 measurements of the Common Myna Acridotheres tristis nestlings, Southern India.

Age (Days)	No. of chicks	Body weight (g)	Body length (cm)	Bill length (cm)	Bill depth (cm)	Wing length (cm)	Wing span (cm)	Tarsus length (cm)	Tail length (cm)
1	106	4.2 ± 1.01	4.8 ± 0.88	0.2 ± 0.07	0.2 ± 0.04	1.5 ± 0.47	4.9 ± 0.08	0.7 ± 0.33	0.1 ± 0.22
3	106	7.5 ± 1.25	5.6 ± 0.82	0.3 ± 0.06	0.2 ± 0.04	1.8 ± 0.41	5.2 ± 0.06	0.8 ± 0.31	0.2 ± 0.11
6	101	20.4 ± 1.86	6.8 ± 0.86	0.9 ± 0.24	0.4 ± 0.41	2.5 ± 0.66	7.1 ± 1.19	1.4 ± 0.34	0.5 ± 0.18
9	97	22.5 ± 2.45	7.2 ± 0.80	0.9 ± 0.18	0.4 ± 0.06	4.0 ± 0.29	12.7 ± 1.34	1.8 ± 0.30	1.1 ± 0.33
12	100	42.4 ± 2.62	8.2 ± 0.86	1.1 ± 0.28	0.4 ± 0.03	5.9 ± 0.84	16.9 ± 1.59	2.0 ± 0.21	1.3 ± 0.40
15	96	52.3 ± 2.28	9.3 ± 0.67	1.4 ± 0.26	0.5 ± 0.04	8.4 ± 0.73	22.9 ± 1.63	2.4 ± 0.48	1.9 ± 0.16
18	89	72.4 ± 3.67	11.6 ± 0.75	1.8 ± 0.27	0.6 ± 0.08	12.0 ± 0.56	27.8 ± 1.14	2.6 ± 0.26	2.3 ± 0.48
21	85	85.9 ± 3.35	15.1 ± 0.33	2.1 ± 0.25	07 ± 0.07	13.1 ± 0.84	32.5 ± 1.08	3.1 ± 0.56	3.0 ± 0.99
24	82	116.3 ± 3.78	17.5 ± 0.66	2.5 ± 0.29	0.7 ± 0.15	16.8 ± 0.61	40.1 ± 1.68	4.0 ± 0.96	4.3 ± 0.22
27	76	95.1 ± 3.35	18.5 ± 0.33	2.6 ± 0.12	0.8 ± 0.12	17.9 ± 0.28	42.9 ± 1.26	4.1 ± 0.83	4.5 ± 0.22
30	68	92.2 ± 2.60	19.4 ± 0.46	2.6 ± 0.11	0.8 ± 0.12	19.7 ± 0.62	43.4 ± 1.08	4.1 ± 0.10	4.5 ± 0.22

Table 3
Growth patterns (mean ± SD) for 8 measurements of the Black Drongo Dicrurus macrocercus nestlings, Southern India.

Age (Days)	No. of Chicks	Body weight (g)	Body length (cm)	Bill length (cm)	Bill depth (cm)	Wing length (cm)	Wing span (cm)	Tarsus length (cm)	Tail length (cm)
3	14	5.64 ± 1.08	4.53 ± 0.38	0.60 ± 0.08	0.19 ± 0.09	1.74 ± 0.17	5.11 ± 0.18	1.01 ± 0.10	0.22 ± 0.08
6	13	13.31 ± 1.49	6.04 ± 0.38	0.67 ± 0.09	0.26 ± 0.07	2.73 ± 0.34	7.78 ± 0.70	1.10 ± 0.12	0.34 ± 0.05
9	12	30.17 ± 1.80	9.68 ± 0.53	1.18 ± 0.19	0.48 ± 0.08	5.95 ± 0.30	14.79 ± 1.47	1.45 ± 0.32	0.50 ± 0.15
12	11	37.73 ± 2.10	10.83 ± 0.23	1.31 ± 0.12	0.64 ± 0.08	7.85 ± 0.34	19.78 ± 0.83	1.99 ± 0.18	1.19 ± 0.08
15	12	43.50 ± 0.53	11.70 ± 1.03	1.36 ± 0.10	0.68 ± 0.14	10.89 ± 0.30	24.77 ± 2.19	2.20 ± 0.18	2.98 ± 0.15
18	8	40.75 ± 1.75	13.88 ± 0.74	1.60 ± 0.17	0.75 ± 0.05	13.51 ± 0.64	30.94 ± 1.09	2.46 ± 0.17	4.05 ± 0.35
21	7	38.29 ± 0.76	14.61 ± 0.81	1.67 ± 0.13	0.76 ± 0.05	14.11 ± 0.38	32.66 ± 1.34	2.53 ± 0.13	4.37 ± 0.17
24	8	37.00 ± 1.07	15.11 ± 0.35	1.61 ± 0.12	0.79 ± 0.04	14.19 ± 0.37	32.83 ± 1.86	2.54 ± 0.11	4.43 ± 0.15

This loss of weight was also recorded in several species of birds (Ricklefs 1968; Kumar and Rao 1984; Languy and Vansteenwegen 1989; Haggerty 1994; McCarty 2001; Nagarajan et al. 2002; Penteriani et al. 2005; Greeny 2008; Ali et al. 2010b; Asokan et al. 2010). Development of the different structure of the nestlings was not uniform throughout the nestling period. The body length, bill length, wing length, wing span, tail length and tarsus length attained the maximum maturity at the time of fledging stage. The Indian Roller, Common Myna and Black Drongo used above body parts immediately after fledging for successful survival. These kinds of growth allometry in the adaptive parts had been observed in several avian species (Pinkowski 1975; Best 1977; Zach and Mayoh 1982; Kumar 1983; Teather 1996; Aparicio 2001; Pereyra and Morton 2001; Ramanujam and Murugavel 2009; Asokan et al. 2010; Pande et al. 2011; Ali et al. 2010b).

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