Attentive-inattentive Behavioural Pattern of Incubating Male Emu

Sanjay Kumar Mahato [1], Ranjeeta Bhattacharjee [2], Veena Ranjan [3] and M. Palit [4]

Introduction

Incubation is a fundamental component of parental care of nearly all avian species. It appears to be a primitive life history characteristic, which is a part of the group with morphological and behavioural adaptations that differentiates them from their reptilian ancestors. Oviparity and endothermy make it essential that all the eggs should receive a considerable attention after oviposition.

The members of class Aves show diversification in the pattern of incubation. Some of them show primitive pattern of parental care, while others show the common type (Lack 1968, Silver *et al.,* 1985). The roles adapted by the sexes and the types of care provided to the eggs vary greatly among taxa (Ball. 1985).

It had been selected to study the incubation behavior of Emu (*Dromaius novaehollandiae*), a flightless bird, as the bird in unique amongst birds in this regard.

It has been reported earlier that the Emu pair in December and January and with the approaching rains, and cool weather in April, the female will lay one egg every 2-3 days, with the total egg clutch of about twelve. The male takes responsibility for the nest, incubating the eggs over a 56-day period (during which he does not eat or drink), and rearing the striped coloured chicks until they are able to fend for themselves (Global Emu Australia 1997 - 2001). The female Emu is found to dig a shallow hole, which is further bordered by soft materials and care of the nest is taken by the male (Great book of Birds, Alessandro Meneli and Sandro Ruffo, Arch Cape Press, New York, 1990). But the breeding season was changed in zoo captivity, and the birds also did not bother about digging their nest.

The reported breeding pattern of Emu is that of successive polyandry by the female (del Hoyo, Elliot and Sargatal, 1992), while at Tata zoo, the bird had shown polygyny. It raised intense interest to study the breeding and incubation pattern of the Emu at zoo.

Methodology

The proposed short-term project work on Emu was conducted in captivity at the Tata Steel Zoological Park, Jamshedpur. The study was only confined with the enclosure of Emu. The enclosure is located almost in between the Marine Drive Road on the bank of river Swarnarekha and the Jubilee Lake. A rectangular enclosure of Emu covers of 5625 sq.ft. area with a boundary of thick wire-net. It has a triangular asbestos shade of 800 sq.ft for feeding and roosting purposes inside the enclosure. The ground of the enclosure is covered with grasses while the ground of the roosting house is covered with sand. A small water canal adjacent to the enclosure is found in the south.

Food was being supplied in the morning at 9:00 a.m. and in evening at 3:00 p.m., everyday which include a mixture of cereals like wheat bran, yellow maize, jwar, bajra and soybean grains. Temperature and relative humidity of the study area were recorded by the minimum/maximum thermometer and a hygrometer respectively, at each hour every day during the incubation period of the bird. The effective length of the expanded wings, standing height of the bird and length & breadth of the study area (Emu enclosure) were measured using a measuring tape. The length of the long axis and short axis of the eggs was measured by a vernier scale.

Direct visual observations were made every day from morning 7:00 hour till evening 17:00 hour for 60 days (08th Jan, 2003 to 08th Mar, 2003). Incubation period of the bird was differentiated into attentive & inattentive periods. During attentive period the bird remained sitting on the eggs (see web supplement) while during inattentive period, the bird remained roaming nearby or in standing posture. The total inattentive period was categorized into two types; stand on hock and stand on feet. The volume of eggs was measured by applying the formula ¾ □ab^2 (where, 'a' stands for half of the long axis and 'b' stands for half of the short axis).

Results

It was observed that only male Emu was incubating the eggs. There were two females and one male in the captivity.

External feature of Emu

Body	Covered with drab coloured plumage
Sexual dichromatism	Absent
Sexual dimorphism	Present (Considerable extent; height & female is little bulky)

Height of the male (Standing position)	3.5 feet
Average height of the female (Standing position)	3.4 feet
Expanded wings (Male)	2.8 feet
Average expanded wing length (Female)	2.45 feet

All 11 eggs laid by two females were collected by the male in a selected site of the enclosure. The site was located in the western part of the enclosure, adjacent to the water reservoir.

The male bird incubated the eggs for about 60 days. The bird started incubation on 7th January 2003 at 15:00 hour and the data was collected from 8th January 2003 from 07:00 hour to 17:00 hour daily.

Feature of eggs (see web supplement)

Colour	Dark Green
Average weight of Egg.	500 gm
Average volume	1868. 19 sq.cm.

Some interesting findings during period of observation are as follows;

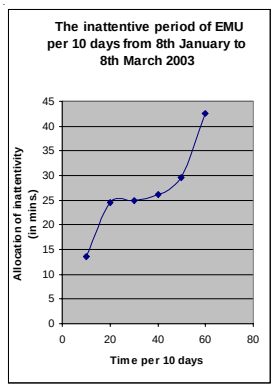
- The breeding season was found to be shifted from April-July to November-March.
- The bird had shown polygyny instead of polyandry.
- Nest building did not occur but feathers and dried grasses were found to be scattered around the eggs.

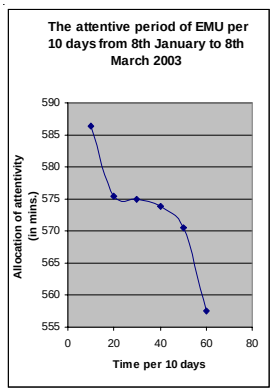
[1]. M.Sc. Zoology, E.mail: skmahato196@rediffmail.com; [2]. Lecturer, Dept. of Zoology, Karim City College, Jamshedpur, E-mail: ranjita_74@sify.com, ria_mtnet@yahoo.com; [3]. M.Sc. Zoology, sonari, Kagalnagar, Jamshedpur, Jharkhand; [4]. Zoo Veterinary Doctor, Tata Steel Zoological Park, Jamshedpur

• It was interesting to notice that the bird used to change its body position in opposite direction after every inattentive period.
• Even not a single feeding excursion was noticed throughout the incubation period but was found drinking the water.
• Sometimes the bird was evident standing on hock and tended to roll eggs by its beak (see web supplement).
• The bird with fluffed feather was evident during the session of inattentive period.
• Whenever females intended to disturb the incubating male, the male used to chase her from the site
• Eventually, eyes were found closed during attentive session and occasionally tended to open its beak.
• The bird was found very alert, whenever got disturbed by noisy environment.
• Temperature and relative humidity did not affect the attentiveness of the bird.
• The relative humidity of the enclosure was moderate.

Discussion

It is evident that immediately after first 10 days, the average attentive period gets declined. Thereafter the male bird





almost maintained the average attentive period for 40 days. It was also observed that the average attentive period become declined again during last 10 days of the incubation period (Table I) indicating that there is a declining trend of attentiveness as incubation period gets advanced, while the average frequency of inattentive session also shows an increasing trend (Table I).

Since the incubating male bird doesn't feed throughout the incubation period, substantial amount of food material might be reserved in its body prior to incubation. Moreover cessation of almost all the routine activities, suggest that the male bird utilizes its major metabolic energy, derived from its food reserves during incubation period.

However, it is found that the breeding season of the Emu as well as the breeding behaviour had altered in the captivity. In natural habitat, i.e., in Australia, it breeds when there is moderate rainfall and temperature is relatively cool during April, while at Jamshedpur zoo, the female laid eggs in first week of November and the eggs started hatching from third week of February. In contrary to the earlier findings, the male had shown polygyny, while it is very uncommon in Emu, which generally shows successive or sequential polyandry.

Conclusion

It was recorded that the maximum average attentive period, i.e., 9.77hrs. (per 10 days) during the first phase and minimum average attentive period, i.e., 9.29hrs. (per 10 days) during the last phase of the incubation period (Table-I), while the rest middle phase did not vary much.

The average inattentive frequency was least, i.e., 0.05 hrs. (per 10 days) during the first phase and it gradually showed almost increasing trend and was maximum, i.e., 0.09 hrs. (per 10 days) during the last phase of incubation (Table-I).

The breeding season was found to be altered than the wild and incubation took place even during the cold climatic condition. The bird showed instead of polyandry, which was very striking.

References

Lack, D. (1968). Ecological adaptations to breeding in birds, London Methuen.
Silver, R., H. Andrews and G.F. Ball (1985). Parental care in an ecological perspective: A quantitative analysis of Avian Subfamilies. *American Zoologist* 25: 823-840.
Ball. G.F. (1985). Endocrine mechanisms and the evolution of Avian parental care. *ACTAXX congressus Internationalis ornithologici* 984-991.
Lands borough Thomson, A. (Ed.) (1964). *A New Dictionary of Birds*. Nelson, London, 928pp.
Global Emu Australia,1997-2001.
Alessandro M. and S. Ruffo (1990). *Great book of Birds*. Arch Cape Press, New York, pp. 35-36.
del Hoyo, J., A. Elliot and J. Sargatal (1992). Handbook of the *Birds of the World*, Vol. 1. Lynx Edicions, Barcelona.
Phillip and M. Minnaar (1992, 1994). *The Emu farmers Handbook*. Induna company.
Grzimek, B. (1972). *Grzimek's Animal Life Encyclopedia*. Van Nostrand Reinhold Company, New York.
Kapala, M. (1995). http://www.ostrich-emu.com/ostremu1.html.
Perrin, C. and A. Middleton (1985). *Encyclopedia of Birds*. Facts on File Publications, New York, 1985.
Eastwood, K. (2000). 'Superbird', Australian Geographic, April-June, pp. 34-49.
http://animaldiversity.ummz.umich.edu/local/redirect.php
http://www.hub.ofthe.net/emu/ index.htm

Table: I - Quantitative study of the incubation period of Emu per 10 days from 8th January to 8th March'2003.

Sl. no.	Avg. Attentive period (in min)	Avg. Inattentive period (in min)	Avg. Frequency of inattentive period	Avg. Temp (ºC)	Avg. Humidity (%)
I.	586.40 + 2.13	13.60 + 2.13	3.0+0.39	19.23+0.34	40.18+2.08
II.	575.50+1.32	24.50+1.32	4.5+0.16	21.76+0.47	39.39+1.72
III.	575.00+1.09	25.00+1.09	4.2+0.20	24.13+0.45	55.57+2.21
IV.	573.80+1.09	26.20+1.09	3.8+0.20	25.23+0.44	49.82+3.48
V.	570.50+2.82	29.50+2.82	4.1+0.27	25.76+0.49	52.35+1.82
VI.	557.50+7.56	42.50+7.56	5.3+0.67	27.00+0.83	49.10+2.03