

Some Aspects of Breeding Biology of the Bengal Lizard (*Varanus bengalensis*) in Bangladesh

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Abstract. - Some aspects of breeding biology of the Bengal, or Gray, Monitor Lizard (*Varanus bengalensis*) were studied in the farm area of Azra Produces Impex (a private enterprise) at Bhaluka, Mymensingh from 1995 to 1997. The feeding success, caring, egg-laying, clutch-size, incubation of neonate care were observed. The eggs were laid between August and October with a mean clutch-size of 21.1 (range 10-32, n=25). The mean incubation period was 192.7 days (range 189-216 days, n=678) with a hatching success of 3.3% which was very low due to many reasons. Some problems regarding farming of the species are discussed.

Key words. - *Varanus bengalensis*, Bengal lizard, breeding, farming, Bangladesh.

Introduction

The Bengal, or Gray, Monitor Lizard (*Varanus bengalensis*) is one of the three varanid species found in Bangladesh. It is most widely distributed throughout the country, including many islands, in both forested and non-forested open wooded areas. It is economically important for its valuable skin and its role in the ecosystem, especially in controlling some pests. In Bangladesh, some tribes like the Shawtal, Kulee, Kukis, etc., also eat its meat.

The few research works that have been done on varanids in Bangladesh mainly deal with their distribution. However, Whitaker and Hikida (1981) and Akond et al. (1982) briefly worked on the ecology and stomach contents of varanids. There is no published report on the captive breeding of varanids of Bangladesh. Azra Produces Impex, a private enterprise, started a project in Bangladesh on the farming of *V. bengalensis*. As advisor (MFA) and consultant (MAS) we looked into the biological aspects of the project. This paper deals with the preliminary observations on feeding, caring, egg-laying, clutch-size, incubation of eggs, and caring of hatchlings. Some problems regarding farming of the species have also been discussed.

Study Area and Study Animals

The *Varanus* breeding farm of Azra Produces Impex is situated at Habirbari of Bhaluka Thana (Mymensingh District, Bangladesh, 24° 21' N and 90° 21' E). It is 71 km north of Dhaka City and located adjacent to the Dhaka-Mymensingh Highway. The farm was inaugurated in June, 1995 within a concrete boundary wall (about 3



Figure 1. Adult *Varanus bengalensis* eating supplied food.

m high including wire rope) enclosure with an entrance (gate) on the western side along the said Highway. The total area of the farm is 37.74 acres (16.77 ha). There are 50 ponds inside the farm and a lake excavated around the periphery of the farm. One open wire-net enclosure (37 m x 61 m x 1 m) with a concrete base (of 25.4 cm) has also been made inside the farm area for some of the lizards (about 200 individuals).

A total of 2,112 Bengal lizards (685 [32.4%] males and 1427 [67.6%] females) were released inside the farm area. These lizards were captured by professional hunters from wild stock (with the permission of the concerned authority, Ministry of Environment and Forests, Government of the People's Republic of Bangladesh) of Greater Mymensingh and Tangail districts between 4 June and 9 September, 1995. Before releasing, each lizard was physically checked and sex recorded. Injured and immature lizards were rejected.

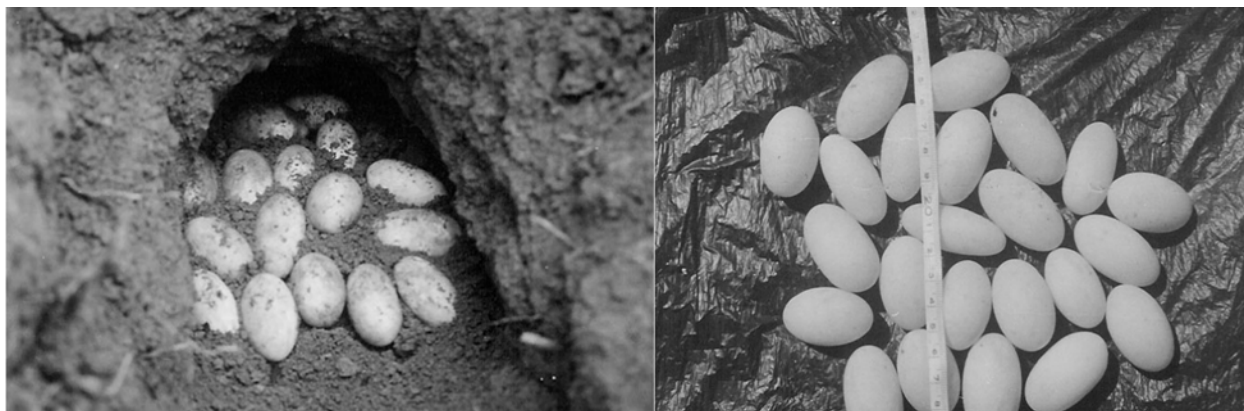


Figure 2. Eggs of *Varanus bengalensis* in a natural nest (left) and being prepared for artificial incubation (right).

Methods

Food. Cleaned pieces of stomach (omasum part only) of bovines, collected from different slaughter houses of Dhaka city, were supplied to the lizards as food. Food was supplied only inside the wire-net enclosure in trays (25.4 cm x 25.4 cm x 5 cm, made up of tin sheet). In other parts of the farm, food was thrown near the roosting places (close to bushes) of the lizards. Usually foods were supplied to the lizards every alternate day (except for Sunday) - half of the farm area was covered in one day and the rest half in the next day. About 100-150 such stomachs were offered to the lizards on every feeding day (Fig. 1).

Eggs. Eggs (Fig. 2, Table 1) were collected from holes in the soil (dug obliquely) and holes of termite mounds (either natural or made by lizards) and placed inside artificial holes made in the incubation cages. Special precautions were taken during handling of eggs to avoid shaking or turning upside down, so that, embryos do not get loose or shift from the original position.

Incubation. An incubation area was selected inside the farm where two cages were built (Fig. 3), each one having a small entrance. Cage-I was closed cart-shaped (12.5 m x 4.6 m x 2.6 m), made of wire-net (mesh size 5 mm x 5 mm) with a concrete base and supported by rods. Inside the cage three artificial incubation beds were built - western (1240 cm x 116 cm x 55 cm), middle (1240 cm x 110 cm x 48 cm) and eastern bed (1240 cm x 95 cm x 32 cm). Spaces between western and middle beds were 53 cm, and between middle and eastern beds were 43 cm. In each bed, two storied oblique holes were excavated - the western bed had holes only in the eastern side, the eastern only in the western side, and the middle bed had holes on both sides. Sandy, granular, and dry soils were placed on the floor of each hole and dry

sands on the hole mouth. The roof of each hole was made by moist sandy loam. The top of each bed was covered with grasses. Each hole (length 30 cm and diameter 10 cm) was marked by numbered stick plate. Altogether there were 190 holes in cage-I and 30 eggs were placed in each hole. When all holes of cage-I were filled with eggs (totalling 5,700), the second cage (cage-II) was built in the eastern periphery of the cage-I. Cage-II was closed rectangular-shaped (12.5 m x 7.9 m x 2.5 m) formed of wire-net (mesh size 5 mm x 5 mm) and supported by rods and poles. Here, only pits were dug, and 30 eggs were placed in each pit. There were 500 such pits (containing 14,499 eggs in total) in this cage and each one was marked with numbered stick plate. These pits were filled with loose soils in such a way that a 5-7 cm thick soil layer was on the eggs. The pits were covered with broad (palm) leaves during hot days to retain moisture in the soil. When topsoil of cage-II was too dry, water was added. Later on, some grasses grew naturally.

Hatching and Hatchability. After two months of incubation, several nests were excavated weekly to check for hatching and 2-5 eggs were opened to see the development of embryos (Fig. 4). Those hatched (Fig. 5) were immediately transferred into baby nursery. When sufficient number of hatchlings were obtained in cage-I, all the remaining eggs which seemed to be still alive were transferred into 7 big trays (0.5 m x 2.5 m x 0.25 m) in the nursery, these trays were kept separate from the hatched lizards by a wall of 1 m within the nursery. The earlier mentioned precautions were taken during this transfer. Eggs were placed half-buried in the tray soil with the usual cover. Each tray was checked twice a day (morning and late afternoon) and the number of hatchlings was recorded. Then hatchlings were released immediately in the nursery after careful noting of their measurements (Table 2).



Figure 3. Incubation cages for *Varanus bengalensis*. Cage I (left), Cage II (right). See text for description.

Table 1. *Varanus bengalensis* egg sizes (n=24).

Size	Mean \pm SD	Range
Length (cm)	5.71 \pm 0.41	4.92 - 6.18
Width (cm)	2.92 \pm 0.06	2.80 - 3.04
Weight (gm)	26.93 \pm 5.45	25.2 - 31.5

Baby Nursery. The concrete floor of the nursery (9.5 m x 3.6 m x 3 m) was covered with sandy loam soil. Tin sheets (40 cm high) were fitted against the nursery walls to prevent the escape of the baby lizards. Lumps of termite mounds containing termites (adults, mostly eggs and larvae) were placed in the periphery of the nursery as food for the hatchlings. Other foods offered to the babies were crushed boiled poultry eggs, minced beef and minced clean stomach of bovine. Two artificial small water reservoirs (25.4 cm x 25.4 cm x 5 cm) were made in the nursery.

All non-hatched eggs were piled and randomly 100 eggs from incubation cage-I and 150 from incubation cage-II were opened to determine the percentage of undeveloped eggs and dead embryos (Fig. 4).

Observations, Results, and Discussion

Food. Besides the supplied food, lizards were also seen to eat arthropods especially beetles and grubs from cow-dung, and small fish (mainly *Tilapia*, which were

Table 2. Size of hatchling *Varanus bengalensis* (n=39).

Size*	Mean \pm SD	Range
Total length (cm)	19.72 \pm 1.31	17.2 - 22.2
Body length (cm)	9.24 \pm 0.59	8.3 - 10.4
Tail length (cm)	10.52 \pm 1.02	7.5 - 12.5
Total weight (gm)	13.61 \pm 3.73	8.3 - 22.1

* Total length (snout to tail tip), body length (snout to anus), and tail length (anus to tail tip).

released in the lake for propagation).

Caring. Sick lizards were provided with food closer to them. Medical treatment was not given.

Eggs. Eggs were white, oval, with soft leathery skin and contained a large yolk supply. The farm staff collected a total of 20,499 eggs from the holes of termite mounds during 11 September to 30 October, 1995. Although the first clutch of eggs (18) were found on 10 August, 1995 inside a termite mound on the embankment of a pond inside the farm, this was not recorded by the farm staff (so it is excluded from the total count). The average collection of eggs was 512.67 \pm 134.49 (range 160-1210, n=38 days) per day.

Whitaker and Hikida (1981) and Akond et al. (1982) stated that the egg-laying period of Bengal lizard in Bangladesh is November and December. Daniel (1983), however, reported that eggs were collected from mid April to October in India. In Sri Lanka, the peak breeding period of Bengal lizard is January to April, but eggs also occur during June to December in ground logs or termite mounds (Deraniyagala, 1958). In the present study the egg-laying period was much earlier than that recorded by Whitaker and Hikida (1981) and Akond et al. (1982).

The mean size of egg was 5.71 cm in length, 2.92 cm in width and 26.93 gm in weight (Table 1). From India, Daniel (1983) reported that the average egg size of gray lizard was 4.9 x 3.8 cm (range 4.7 x 3.6 to 5.5 x 4.4 cm, n=50) and weighed 11.4 gm (range 8.3-14.3 gm, n=25). The size of eggs in this study (Table 1) is close to that reported by Daniel (1983), but the weight data are very different.

Clutch size. Clutch size varies according to the size and age of the females, larger and older females lay more eggs than younger and smaller ones. The average clutch size was 21.1 \pm 7.4 (range 10 - 32, n=25). The clutch size of Bengal lizard was 8-32 (Whitaker and Hikida,

Table 3. Minimum and maximum air temperatures and soil temperature (°C) during study period.

Month	Air		Soil	
	Minimum	Maximum	Morning	Late afternoon
November 1995	20.4	25.6	22.4	24.8
December 1995	18.0	22.4	18.0	22.1
January 1996	16.7	20.8	16.5	22.5
February	19.8	20.8	19.6	25.1
March	22.7	26.7	22.3	28.1
April	NR	NR	NR	NR
May	27.3	35.0	29.8	30.4
June	25.4	32.8	27.7	29.6

NR- Not recorded.

1981; Akond et al., 1982) and 20-30 (Khan, 1987) in Bangladesh, while 8-30 in India (Daniel, 1983). The range of present observation is close to the mentioned works except for Khan (1987).

Incubation period. On average, the incubation period of egg was 192.72 ± 4.59 days (range 189-216 days, $n=678$ eggs). The first lizard hatched on 18 March and the last on 4 June, 1996. Most of the lizards hatched late at night or early in the morning; some also hatched during the day.

Previously recorded incubation periods for the Bengal Monitor Lizards of Bangladesh were 7-8 months (i.e., 210-240 days) (Whitaker and Hikida, 1981); 6-8 months (i.e. 180-240 days) (Akond et al., 1982) and 7-8 months (i.e. 210-240 days) (Khan, 1987). Daniel (1983) mentioned that the incubation period of Bengal lizard in India was 8-9 months (i.e. 240-270 days). The present incubation period is closer to that recorded by Whitaker and Hikida (1981) and Akond et al. (1982), but smaller than that reported by Daniel (1983). The egg-hatching month has been mentioned as July (Whitaker and

Hikida, 1981) and June-July (Akond et al., 1982) while in the present observation it spreads over mid March to early June.

The variation in the incubation period of the present work and those of the above mentioned works could be due to the effect of some ecological factors like temperature, moisture, rainfall, etc. We recorded air temperature in the farm and soil temperature of nest of the incubation cage-I (and later baby nursery) which give an indication of these conditions (Table 3).

Hatchlings and hatching success. The average total length and weight of the hatchlings were 19.72 cm and 13.61 gm, respectively (Table 2). Out of 20,499 eggs, only 678 babies hatched. The hatching success, in this case, was 3.3%. (All the hatched eggs [678] were from cage-I only and the hatching success was 11.9%, but the eggs from cage-II resulted the poor hatching success i.e., 3.3%). After hatching out, a baby lizard did not eat for the next 2-3 days due to a continued absorbance of its yolk reserve. Neonate lizards ate termite eggs and larvae from the supplied lumps of termite mounds inside the

Figure 4. *Varanus bengalensis* in two stages of development: embryo (left), newly hatched (right).



Figure 5. *Varanus bengalensis* neonates.

nursery and crushed boiled poultry eggs from the feeding trays. They showed less interest to eat minced beef and minced bovine stomach. Babies also drank water and preferred to roost in cold, damp areas inside grasses or water hyacinths, which were kept in a few places inside the nursery.

The poor hatching success of eggs in this study was most probably due to: (1) soil in the incubation cage-II became compact due to rain and killed embryos; (2) mis-handling of eggs by the staff during egg transplantation; (3) unregulated temperature and moisture in the incubation cages. Of these reasons, the first one was most important because only 12 eggs hatched from the incubation cage-II (where 14,799 eggs were transplanted) and dead embryos or babies were found in 70% of the eggs ($n=140$). On the other hand, we were not sure whether all the unhatched eggs were fertilized or not. The additional reason for this huge damage of eggs was the negligence of the Managing Director of the project to implement our suggestions in constructing incubation cage-II.

Problems regarding farming

The following problems were faced during the study period:

1. The set up of the project is not well designed and scientific.
2. Lack of electricity.
3. Instructions/suggestions given (jointly by the advisor and consultant) to the Managing Director (MD) of the project were not properly followed.
4. Research facilities provided by the farm are poor.

Recommendations

1. Lizards should be caged rather than distributing them throughout the farm. A few small cages should be built for research.
2. Needs devoted staff.
3. Needs electricity.
4. Incubation cages should be constructed like cage-I.

5. Needs incubation chamber, or at least a place(s) where temperature and moisture fluctuations are not drastic.
6. Needs separate “nursery” cages for neonates and juveniles.
7. Above all, instructions and suggestions proposed jointly by the advisor and consultant should be considered in all activities.

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