

Breeding data on Blanford's Rock Agama *Psammophilus blanfordanus* (Stoliczka, 1871) from Gujarat State, India

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Abstract

Blanford's Rock Agama, *Psammophilus blanfordanus* is an Indian endemic species of lizard in family Agamidae. A pair of the species was kept in captivity for six months for a breeding biology study. The female laid six eggs (average size 12.61 x 8.13 mm) in the month of August and hatchlings emerged after 34 days of incubation. Ambient temperature ranged between 27.5 to 31.5 °C. Average hatchling size was 24.15 mm snout to vent length and 33.63 mm tail length. All of the six eggs hatched.

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Introduction

The reptile fauna of India is rich with a total of 572 species of which over 50% are endemic, among them 56 species of the family Agamidae (Aengals et al., 2018). Although these endemics are a key element of the Indian herpetodiversity many aspects of their reproductive biology remain poorly known (Saidapur and Shanbhag, 1999).

Blanford's Rock Agama, *Psammophilus blanfordanus* was described by Stoliczka (1871), as *Charasia blanfordana*, on the basis of a few specimens collected from Central India, without any specific locality mentioned. It is an Indian endemic Agamid and is widely distributed across the extents of the Peninsular India, along with closely related sister species, the Peninsula Rock Agama *Psammophilus dorsalis* (Gray) (Smith, 1935; Srinivasaulu et al., 2014).

So far, the limited information available discusses the breeding habits of the species, including a study by Mukherjee and Parida (2014) and Jee et al. (2016). This note presents some additional observations relating to the reproductive biology of the species.

Psammophilus blanfordanus is a sexually dimorphic species. The dull gray body color with reticulation on the back differs between the sexes (Fig. 1A). Males have larger, more distinct markings and a small, but

prominent, crest on the head. Sexual dimorphism is most evident during the breeding season, when the male's head and dorsal body surface become brilliant red and the lateral and ventral body color turns darker – to almost black (Fig. 1B). During the breeding season males possess a dark, thick black stripe running from nostril to eyes, and then posteriorly above the tympanum to the shoulders. Females remain dull and cryptic grey in color (Fig. 2) without any contrasting markings, as seen in other agamids (Smith, 1935; Radder et al., 2005; Rao et al. 2015).

The common name 'rock-agama' suggests exclusive rock-dwelling habits but they are also found on tree trunks (Fig. 3), owing to their arboreal habits (Vyas, 2011). This species naturally prefers rocky deciduous forest with large rocks and boulders mixed with vegetation (Fig. 4).

Material and Methods

A pair of adult individuals of *P. blanfordanus* were held captive in a terrarium for a six-month period, from 1st April 2016 to 30 September 2016 for detailed observations. They were obtained from the outskirts of Khuntaliya (22°19'21.80" N; 74° 0'14.77" E, elevation 550 meters) Chhota Udaipur City, Gujarat, India in the third week of March 2016. This species is listed as 'Least Concern' under IUCN

criteria. This pair was kept in a wooden receptacle measuring 50 x 30 x 30 cm with a viewing glass pane in front and an opening on the topside. The cage was equipped with pieces of dry tree bark and rocks. The floor was covered with an 8 cm thick mixture of small

pebbles, loose soil and peat to provide a substratum. The nest soil was kept moist by sprinkling with water (Vyas, 1998). The lizards were fed ad-libitum with small insects, such as cockroaches and white ants, with occasional mealworm supplements.



Figure 1: Sexual dimorphism in *Psammophilus blanfordanus* from Gujarat State, India: (A) male in non-breeding body color - dull gray with reticulation on the back from the Ratnmahal Wildlife Sanctuary, Gujarat State; (B) male in breeding body color - brilliant red with lateral and ventral body sides in black and a small yet prominent crest on the head.

For the duration of captivity, temperature, humidity and daylight were maintained as per requirements of the species (See: Mukherjee and Parida, 2014; Saikrishna et al., 2017). The nest temperature was

recorded three times daily at 8:00, 15:00 and 18:00 hrs with a maxi-mini thermometer (G.H. Zeal Ltd, England™). Hatchlings were measured with folded printed grid graph paper (0.1 mm scale).



Figure 2: A captive adult female of *Psammophilus blanfordanus* with cryptic color from the Kevadi, on the outskirts of Chhota Udaipur District, Gujarat State, India.

Results

Observations

Both the male and female *P. blanfordanus* were found to be active during the daylight hours and hid within stone refugia at night. Towards the end of May 2016, it was noted that the male turned bright red. In the fourth week of July, the female was eating more than usual, and was more active than the male. By the end of first week of August, the female exhibited a larger abdomen, and at the end of the 2nd week of August, she was presumed to be gravid. Apart from the dimorphic color change noted in the male, no courtship and/or mating behaviors were observed.

Nesting Behavior

On 22nd August 2016, at 1400 hrs, the female, started excavating the floor of the cage, with its forelimbs, digging a small depression into the loose soil. After 30 minutes of active digging, the lizard managed to create a cavity almost the size of its own body. Soon after,

the female stopped excavating, then sat over, almost covering, the pit and within a few minutes, began to lay eggs. After laying eggs, the female immediately covered the pit with loose soil. The topsoil was pressed back over the pit, and the female managed to do this using both pairs of limbs and her head. In total, there were six eggs laid, and the female took 22 minutes for the entire process of digging the nest pit, laying the eggs and burying them.

Nest and egg dimensions

The nest pit measured 6.8 cm in depth and 2.9 cm in width (diameter of opening), with the first egg found at 5 cm depth. The eggs were white, leathery and oval in form. The dimensions of the eggs are given in Table 1.

Incubation and hatchlings

The first hatchling emerged on 25th September 2016 at 1430 hrs (Fig. 5), following 34 days of incubation. The remaining five hatchlings emerged from the nest between 1440 and 1530 hrs on the same day (Fig. 6).

The hatchlings were dark grey with black markings on the body. The body length of the hatchlings ranged from 55.5 to 60 mm (Table 1). The hatchlings

were released after a week at the locality from where the adults were collected. The daily nest temperature is given in Table 2.



Figure 3: An adult male of *Psammophilus blanfordanus*, on a tree trunk, from the Shoolpaneswar Wildlife Sanctuary, Narmada District, Gujarat State, India. The photo is rotated to the right.



Figure 4: The natural habitat of *Psammophilus blanfordanus* at Ratanmahal Wildlife Sanctuary, Gujarat State, India.

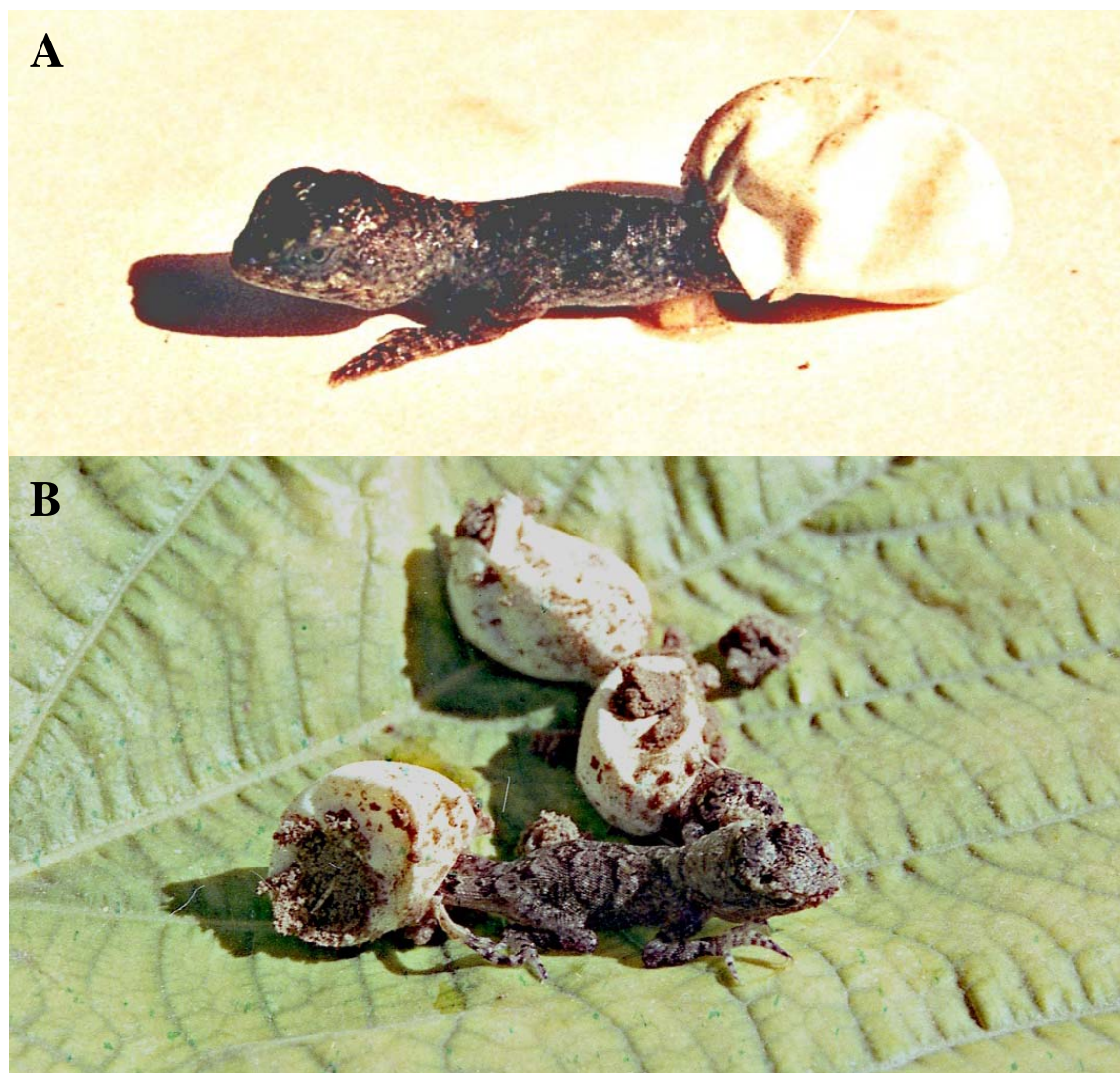
Table 1: Measurements of eggs and hatchlings of *Psammophilus blanfordanus* in captivity from Gujarat State, India.

| No. | Size of egg (in mm) | | Body size of hatchlings (in mm) | | |
|-----|---------------------|-------|---------------------------------|-------|-------|
| | Length | Width | SVL | TL | TBL |
| 1 | 13.0 | 8.0 | 25.0 | 35.0 | 60.0 |
| 2 | 12.7 | 8.4 | 24.2 | 35.0 | 59.2 |
| 3 | 12.6 | 7.8 | 24.0 | 31.5 | 55.5 |
| 4 | 12.6 | 8.3 | 24.0 | 34.0 | 58.0 |
| 5 | 12.5 | 8.0 | 23.5 | 32.0 | 55.5 |
| 6 | 12.3 | 8.3 | 24.2 | 34.3 | 58.5 |
| A | 12.61 | 8.13 | 24.15 | 33.63 | 57.78 |

A= Average; SVL= Snout to Vent Length; TL= Tail Length; TBL= Total Body Length.

Table 2: Temperature records (in Celsius) of the nest of *Psammophilus blanfordanus* in captivity from Gujarat State, India.

| Time | 0800 | 1500 | 1800 |
|---------|------|------|------|
| Minimum | 27.5 | 28.0 | 28.5 |
| Maximum | 31.0 | 31.5 | 30.0 |
| Mean | 28.5 | 29.1 | 28.7 |

**Figure 5:** First hatchling (A), and remaining hatchlings of *Psammophilus blanfordanus* (B) emerging after incubation and within one hour of the first hatchling from the present study, respectively.

Discussion

Most Indian reptiles are seasonal breeders, including agamids. The breeding season coincides with the monsoons from June to September (Saidapur, 1989). Similar breeding activity has been noted in other family members like the Common Garden Lizard *Calotes versicolor*, the Kashmir Agama, *Laudakia tuberculata* (Daniel, 2002) and the closely related *Psammophilus dorsalis* breeding from May to August (Radder et al., 2005). Usually, both sexes become active with the gradual rise in temperature as the winters come to an end during the months of March to July, and oviposition is later observed in the rainy season from July to September (Saidapur and Shanbhag, 1999; Shanbhag, 2002; Saikrishna et al., 2017).

The breeding period of *Psammophilus blanfordanus* lasts from the pre-monsoon through to the post-monsoon period (April-October) and peaks in the breeding months between June and August (Dutta et al., 2009; Mukherjee and Parida, 2014). However, the maximum number of mature males and gravid females of *P. blanfordanus* are usually found from May to July (Mukherjee and Parida, 2014; Jee et al., 2016). In the present study, a similar pattern was observed in the captive *P. blanfordanus*, as the male turned bright red during the month of May and the female laid eggs in August. Mukherjee and Parida (2014) recorded egg laying in June and Jee et al. (2016) recorded oviposition in July. However, oviposition in the present study was observed one month later, presumably due to the local monsoon pattern and geographical location of the study area or the influence of captivity?. The study area of Mukherjee and Parida (2014) and Jee et al. (2016) was Odisha (East India) where the monsoons commence earlier than the current observation site in Gujarat State, Western India.

In the present observation, the clutch size was six eggs and incubation lasted 34 days with 100% hatching success. Mukherjee and Parida (2014) recorded a clutch size of eight eggs with an incubation period of 75 days, with only 75% hatching success. Jee et al. (2016) noted a range of 12–14 eggs in five clutches and an incubation period of 41–44 days. Clutch size and incubation periods may vary due to female size and varying incubation temperatures. During the early monsoon, both sexes have been found to be active and mating usually occurred during the daytime. Occasionally, hatchlings and juveniles of the species have been collected from May through August (Saikrishna et al., 2017), which is indicative of early breeding, perhaps before May. Hence, courtship and mating can be considered to last typically from March to May with the eggs being laid from June to September. This study shows that this agamid species has a breeding season related to the monsoon, but that there is some variation from region to region

when monsoon patterns and local environmental conditions are considered.

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Conflict of interest

The author declares that there are no conflicting issues related to this research article.

References

- Aengals, R., Sathish Kumar, V. M., Palot, M. J. and Ganesh, S. R. (2018). A checklist of reptiles of India. 35 pp. Version 3.0. Online publication is available at www.zsi.gov.in (Last update: May 2018).
- Daniel, J. C. (2002). *The book of Indian reptiles and amphibians*. Bombay Natural History Society/Oxford University Press, Bombay. 238 pp.
- Dutta, S. K., Nair, M. V., Mohapatra, P. P and Mahapatra, A. K. (2009). *Amphibians and reptiles of Similipar Biosphere Reserve*. Regional Plant Resource Centre, Bhubaneswar, Orrisa, India. 174 pp.
- Jee, J., Mohapatra, B. K., Dutta, S. K. and Sahoo, G. (2016). Sources of calcium for the agamid lizard *Psammophilus blanfordanus* during embryonic development. *Acta Herpetologica*, 11 (2): 171–178. https://doi.org/10.13128/Acta_Herpetol-15109
- Mukherjee, R. K. and Parida, P. (2014). Behavioral ecology, breeding period, sexual dimorphism and ovipositional behavior of *Psammophilus blanfordanus* (Family: Agamidae): case study. *Indian Journal of Applied Research*, 4 (1): 28–32.
- Radder, R. S., Saidapur, S. K. and Shanbhag, B. A. (2005). Population density, microhabitat use and activity pattern of the Indian Rock Lizard, *Psammophilus dorsalis* (Agamidae). *Current Science*, 89 (3): 560–565.
- Rao, G. B., Narayana, B. L., and Swamy, K. (2014). A note on behaviour of the peninsular rock agama (*Psammophilus dorsalis*) at Yellampet, in Telangana, India. *The Herpetological Bulletin*, 130: 24–25.
- Saidapur, S. K. (1989). Reproductive cycles: An overview, In: Saidapur, S. K. (Ed.), *Reproductive cycles of Indian vertebrates*. Allied Press, New Delhi, India. pp. 427–437.
- Saidapur, S. K. and Shanbhag, B. A. (1999). Evolution of testis in nonmammalian vertebrates, In:

- Comparative endocrinology and reproduction*. Joy, K. P., Krishna, A. and Haldar, C. (Eds.). Naros Publishing, New Delhi, India. pp. 183–200.
- Saikrishna, S., Sri Survesh, N. V., Narender, S., Divakar, V. and William, S. J. (2017). A preliminary study on the behaviour of Blanford's Rock Agama (*Psammophilus blanfordanus*) in captivity. *International Journal of Innovative Research and Advanced Studies (IJIRAS)*, 4 (6): 388–394.
- Shanbhag, B. A. (2002). Reproductive biology of Indian reptiles. *Proceedings of Indian National Science Academy*, B68 (6). 497–528.
- Smith, M. A. (1935). *The fauna of British India, including Ceylon and Burma. Reptiles and Amphibia, Volume II. Sauria*. Taylor and Francis, London. 440 pp.
- Srinivasulu, C., Srinivasulu, B. and Molur, S. (Compilers) (2014). *The status and distribution of reptiles in the Western Ghats, India. Conservation Assessment and Management Plan (CAMP)*. Wildlife Information Laision Development Society, Coimbatore, Tamil Nadu, India. 148 pp.
- Stoliczka, F. (1871). Notes on new or little-known Indian lizards. *Proceedings of the Asiatic Society of Bengal (Calcutta)*, 1871: 192–195.
- Vyas, R. (1998). Breeding of Indian spectacled cobra *Naja naja* (Linnaeus). *Zoos' Print*, 13 (10): 26–27.
- Vyas, R. (2011). Reptilian diversity in and around the Shoolpaneshwar Wildlife Sanctuary, Gujarat, India. *Reptile Rap* (11): 5–15.