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ENVIRONMENTAL FACTORS DO INFLUENCE THE NESTING BEHAVIOUR OF FAN-THROATED LIZARD *SITANA PONTICERIANA* (CUVIER)

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ABSTRACT
The extraneous factors those are driving the organism in nest site selection have received hardly any attention in nesting ecology studies despite their importance in drawing effective conservation and management programmes. The current study presents the results of a careful study made on the nest site selection and the behavioral mechanisms of Fan-throated Lizard, *Sitana ponticeriana*. The females were observed to show a choice for the selection of nesting sites, out of 10 nests 7 were found under a bush and the rest 3 nests were in the open ground. Temperature and humidity were observed to be the most important factors governing the nest site selection. Pseudo-nests were also recorded around the main nests that were made on open ground; which were perhaps constructed to deceive the predators and hence, protect the clutch. The activity of egg lying was found commences from late June and continued till the end of September. The clutch size was observed to be larger in the nests dug under the bush as compared to the nests that were constructed in the open ground. Though, parental care is not often seen in reptiles, the selection of cover to hide the clutch and construction of pseudo-nests observed in the current species has anything to indicate it is nothing but an ample testimony to the existence of primitive parental care in this group of animals.

INTRODUCTION

Reproduction is an important event in life of any organism and the ecology of reproduction is a defining aspect of an organism's life-history strategy and has received substantial scientific interest focusing primarily on reproductive investment of the species (Vitt and Congdon, 1978; Seigel and Fitch, 1984). Data from several taxa demonstrate that females utilize a wide range of cues to select oviposition sites (Bernardo, 1996). Oviposition site selection has been well documented in insects, however, far less is known concerning the ability of vertebrates' females to define potential oviposition sites (Bull, 1980) except for a few rare and endangered species *viz*. the Bahamian Andros Iguana (*Cyclura cychlura cychlura*), the only Iguanid that is reported to deviate from its usual nesting strategy of depositing eggs in subterranean chambers excavated in sand or organic soil rather use the termitoria as incubation chambers (Alberts, 2000). Nevertheless, such studies are highly lacking even on the commonest of the agamids.

Fan-throated Lizard *Sitana ponticeriana* a medium sized, ground dwelling agamid lizard, widespread throughout the country (Das, 2002), occurring in all the biotopes was selected for the present study. A good population of *S. ponticeriana* was observed in an open scrubland on the outskirts of Vadodara city. *S. ponticeriana* can be easily distinguished from rest of agamid lizards by the characteristic diamond shape markings on to its dorsum and being the only agamid with four toes in its hind limb (Smith, 1935). The species exhibits a distinct sexual dimorphism wherein males possess a gular flap which is extended like a fan during courtship display (Daniel, 2002). This dewlap extension develops a bright blue colour in peninsular population (Gunther Albert, 1861; Smith, 1935) whereas yellow to orange color with a mid-ventral blue streak was observed in the Western Indian population during the breeding season.

MATERIALS AND METHODS

The present study was conducted in a scrubland of Amrapura village, covering an area of 2 km^2 and located at a distance of 16 km from Vadodara city (22º08′ N – 22º10′ N and 73º06 E – 73º11′ E: Garmin, GPS 12XL). This scrubland is a part of the ravines of river Mahi, one of the major rivers of central Gujarat. The terrain is highly undulating with steep slopes at many locations. The area supports a dense population of *Sitana ponticeriana*.

The study was initiated in the month of April 2008, the time when the courtship activity of the *S. ponticeriana* commences, and the observations were recorded till the end of August (2008) which marks the termination of the breeding season. Surveys were conducted on regular basis (twice in a week) both during morning and evening hours. The morning surveys were undertaken from 0700h to 1100h and the evening surveys were conducted from 1600 h to 1830 h. Observations were recorded and properly videotaped for frame-by-frame analysis of behavioural displays using digital camera (OLYMPUS FE-330). Visual Encounter Survey (VES) was the

method adopted for the current study. The area was thoroughly searched for the occurrence of the species; being a cryptic species it tries to conceal itself with the environment. Though active searches were done to locate the individuals, however combing operations were avoided since that would disturb the species and the natural behaviour would not have been observed. Once the gravid females were sighted, they were observed from an approx distance of 2 m so as to record the behavioural acts. Nest dimensions were recorded using a standard graduated measuring tape and environmental parameters *viz*. the ambient temperature and humidity were recorded using Digital Hygrothermometer.

RESULTS AND DISCUSSION

Nest site selection: Many studies have been conducted on the breeding biology of lizards (Pianka, 1970; Parker and Pianka, 1973; Andrews and Rand 1974); however the parameter of nest site selection is poorly understood. Some of the earlier literature does mention about the nest site (Ramsey, 1956; Van Devender and Howard, 1973) but its relevance in the breeding of the species is not signified. In the current study a total of 10 nests of *S. ponticeriana* were located in the study area, of which 7 nests were under a bush cover and the rest 3 nests were on the open ground (Table 1). Females dug the nest holes soon after the first few showers of rain, which made the soil loose enough and enabled the individuals in digging out the holes. Moreover, soil of the nest holes was found to be moister than the surface soil. In the process of search for the nest site, it was also observed that, the females showed a preference towards the shrubs present in the area. Of the 7 nests under the bush cover 4 nests were recorded under *Capparis* sp., 2 nests were encountered under *Tamarix* sp. and 1 nest was recorded under the canopy of *Zizipus* sp. Similar nest site preference was reported by Asela *et al.* (2007) for *Calotes liolepis*, that selected soil covered with leaf litter for laying of its clutch.

Nest construction: Ambient temperature and humidity played a crucial role in nest construction activity. The mean temperature recorded in the month of July was 29.3, which is an ideal temperature for reptiles to nest. The relative humidity in July was recorded to be 73 ± 8.77 (mean $\pm$ SD) which was significantly higher than the values recorded for June and was marginally lower than the values recorded during August (Figs. 1 and 2). As the soil became wet after the rains, the moisture content and the permeability of the soil increases, from the current observation it could be logical to surmise that these

Table 1: Depth and digging time of different type of nests

Nest type	Depth	Digging time
Under bush	6.2	36.2
	6	34.2
	6.3	36.4
	6.4	40.3
	6.2	36.4
	6.3	37.1
	6.1	35
Open land	5.3	39.2
	5.9	44.5
	5.8	42.5

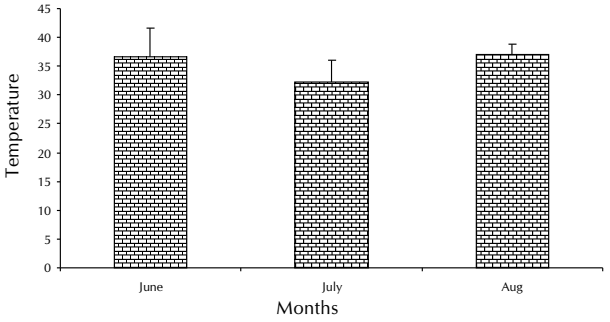

Figure 1: Ambient temperature (°C) of the study sites during June to August 2008

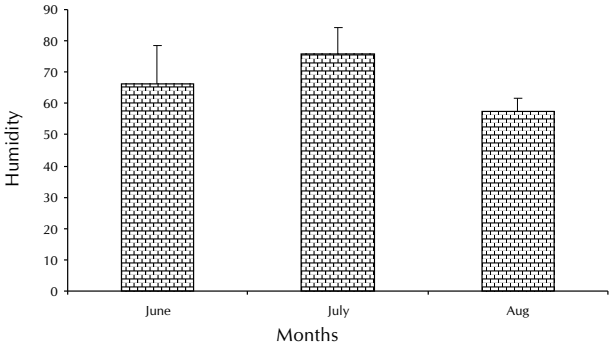

Figure 2: Average humidity in percentage during the span of study

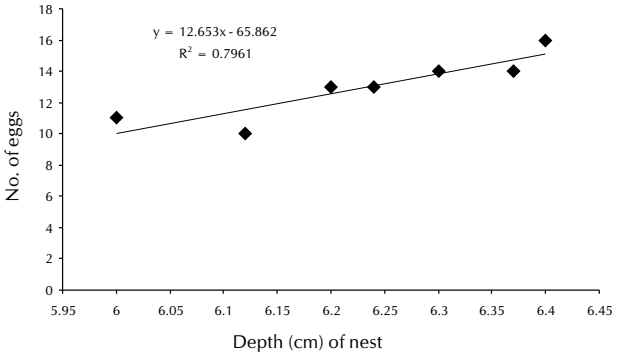

Figure 3: Depth vs cluthch size under bush

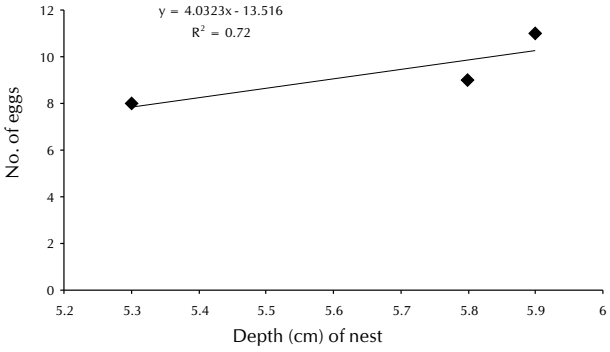

Figure 4: Depth vs cluthch size open land

are the two prime factors helping the animals to dig deep into the depth of the nest holes.

Moreover, it was observed during the study that the average depth and width of the nests varied in both the nesting sites *i.e.* the nests under the cover and the nests in the open ground and this could be attributed to the difference in the temperature and humidity at both the sites. The average depth and width of nests under shrub cover was 6.2 cm and 1.3cm respectively whereas, those in the open ground were recorded to be 5.66 cm deep and 1.21 cm wide. These observations are in agreement with that of Chopra (1964), who recorded the average depth of nest in case of *S. ponticeriana* as 6 cm, but there are no reports of any pseudo-nests that are constructed by the species.

The average digging time recorded for nests under the shrub cover and for those nests in the open were 36.20 min and 42.06 min respectively. This difference in the time to dig out the nests in different locations is justified, since the sites on the open ground were directly exposed to sun light and hence, the soil dried out relatively faster as compared to the sites under the shrub canopy, thus the time consumed in digging out the nests in these sites was more. The drying of the soil directly influence the depth of the nest hole which was observed to be less as compared to the nests constructed in the cover. Moreover, remaining active in the open area for longer make these females more vulnerable to the predators and hence these females perhaps avoided making deeper nest holes compared to their allies. Table 1 depicts the depths of each nest and the time taken to dig out the nest hole. However no strong correlation could be established between the depth of the nest hole and the time involved in digging.

Having observed the activity of nest site selection and nest construction, these nests were then carefully dug open to observe the number of eggs in a clutch (the nests were again restored in their original condition). The mean clutch size for the nests under the shrub canopy was recorded to be 13 eggs and that for the nests in the open ground was 9. A significant correlation (Figs. 3 and 4) was established between the depth of the nest hole and clutch laid therein, hence it could be asserted that the depth of the nest hole played a crucial role in the deciding the clutch size. Moreover, the temperature of the nest holes in both sites was found to approximately 2°C less as compared to the ambient temperature. The average temperature recorded in the nests under the shrub cover was 27°C and for the nests in the open ground was 29°C.

It was clearly evident that the nests that were under the shrub cover were more protected from the predators as compared to the nests in the open. But, we observed a strange behaviour in this species, the females that selected open ground for nesting, after having laid their own clutch these females dug two shallow holes in the vicinity of their nest and gave it an appearance of the nest hole. The dimensions these holes are as follows, depth 2 ± 0.25 cm and width - 1.22 ± 0.13 cm. We termed these holes as 'Pseudo-Nests'. Since it appeared that these pseudo-nests were solely constructed for the purpose of deceiving the predators and protect the clutch.

The results of the current study strongly support the notion that the females of *Sitana ponticeriana* have a choice over the nest site selection, which also includes the choice of the shrub for concealing and possibly regulating the important physical environment of the proposed nest site. Environmental factors namely temperature and humidity played a major role in the selection of the nest sites as well as the nest building activity. The strategy of pseudo-nest construction was adopted by the females that nested on the open ground for deceiving predators since this behaviour was not observed in case of the females that constructed their nests under the shrub cover.

REFERENCES

Alberts, A. C. 2000. *West Indian Iguanas, status survey and conservation action plan,* IUCN, Switzerland.

Andrews, R. and Rand, A. S. 1974. Reproductive efforts in anoline lizards. *Ecology*. **55:** 1317-1327.

Asela, M. D. C., Karunarathna, D. M. S. S., Priyankara, S. K. I. U., Abeywardena, U. T. I. and Sirimanna, D. G. R. 2007. Some notes on egg laying of *Calotes liolepis* Boulenger, (Reptilia: Agamidae) observed in two wet zone forest of Sri Lanka. *Zoos' Print J.* **22(12):** 2941-2942.

Bernardo, J. 1996. Maternal effects in animal ecology. *American Zoologist*. **36:** 83-105.

Bull, J. J. 1980. Sex determination in reptiles. *Quarterly review of Biology*. **55:** 4-21

Chopra, R. N. 1964. Observation on the egg-laying of the Fan-throated Lizard, *Sitana ponticeriana* Cuv. *J.BNHS.* **61:** 190-191.

Daniel, J. C. 2002. The Book of Indian Reptiles and Amphibians. Bombay Natural History Society and Oxford University Press, BNHS, Mumbai, India. pp. 53-54.

Das, I. 2002. A photographic guide to the snakes and other reptiles of India, New Holland Publishers (U.K.) Ltd., London. p. 144.

Gunther Albert, C. L. G. 1861. *The Reptiles of British India,* Oxford and IBH Publishing Co. Bombay, India. pp.134-136.

Parker, W. S. and Pianka, E. R. 1973. Notes on the ecology of the iguanid lizard, *Sceloporus magister. Herpetologica.* **29:** 143-152.

Pianka, E. R. 1970. Notes on the biology of *Varanus gouldii flavirufus. Western Australian Naturalist.* **11:** 76-82.

Ramsey, L. W. 1956. Nesting of Texas horned lizards. *Herpetologic.* **12:** 239-240.

Seigel, R. A. and Fitch, H. S. 1984. Ecological Patterns of relative clutch mass in snakes. *Oecologia.* **61:** 293-301.

Smith, M. A. 1935. The Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II. Sauria. Taylor and Francis, London. **xiii:** 440-1.

Van Devender, T. R. and Howard, C. W. 1973. Notes on natural nests and hatching success in the regal horned lizard (*Phrynosoma solare*) in southern Arizona. *Herpetologica.* **29:** 238-239.

Vitt, L. J. and Congdon, J. D. 1978. Body shape, reproductive effort and relative clutch mass in lizards: resolution of a paradox. *American Naturalist.* **112:** 595-608.