



OVIPOSITIONAL BEHAVIOR OF *Calotes ceylonensis* MÜLLER, 1887 (REPTILIA: AGAMIDAE) OBSERVED IN THE CENTRAL PROVINCE OF SRI LANKA

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Abstract

This is the first documented observation of the oviposition of *Calotes ceylonensis*. The ovipositional behavior consisted of digging of the hole nest to lay the eggs; the laying of the eggs; the scraping of the soil to bury the eggs; the filling of the spaces between the eggs, and the hole nest; the tight compression of the soil, and camouflage the nest.

Keywords: Agamidae, Draconinae, *Calotes ceylonensis*, Egg-laying behaviour, Sri Lanka, Conservation.

Introduction

There are eighteen species of agamid lizards in Sri Lanka, fifteen (83.33%) of them are endemic to the island (Manamendra-Arachchi *et al.*, 2006). Seven species out of them belong to the genus *Calotes*. Five of them (*C. ceylonensis* Müller, 1887; *C. liocephalus* Günther, 1872; *C. liolepis* Boulenger, 1885; *C. nigrilabris* Peters, 1860; *C. desilvai* Bahir & Maduwage, 2005) are endemic. The remaining two, *Calotes calotes* (Linnaeus, 1758) and *C. versicolor* Daudin, 1802 are probably widespread species throughout South East Asia (Taylor, 1953).

According to the published literature, *Calotes ceylonensis* is a largely arboreal species found only from the low country dry and intermediate zones below 500 m a.s.l (Karunarathna *et al.*, 2009). It is rare and a vulnerable species (Bahir & Surasinghe, 2005; Manamendra-Arachchi & Liyanage, 1994; IUCNSL & MENR, 2007).

The information available on this species is scarce and, therefore, further studies on their behaviour and ecology are needed, which may be very important for the conservation of the species

(Karunaratna *et al.*, 2009). In this paper we describe the ovipositional behaviour of *C. ceylonensis*, which constitutes the first described observation of the ovipositioning for this lizard.

Location and Methods of Observation

Observations were made approximately 3 km from Wewala-Dambulla Road in Kaludiya Pokuna near Kandalama (7° 52.47' N, 80° 44.08' E; alt. 228 m a.s.l.) in Matale District, Central Province, Sri Lanka. The habitat consisted mainly of disturbed home gardens. The ground was covered with large amounts of dry leaf litter and the soil was rough. There was approximately 80% canopy cover and clear undergrowth. Observations of the lizard were made by the naked eye from 2 m away between 10:40 and 12:45 hr. The animal was not disturbed during observation. All measurements were taken to the nearest 0.1 mm using digital caliper.

Observations

A mature female *Calotes ceylonensis* (snout to vent length: 72.1 mm) lying on a *Ficus bengalensis* tree (10 m high) 2 m above the ground level, was observed on 08 September 2008 at about 10:40 hr. The temperature was 28.4 °C and the humidity 53%. The weather was gloomy and the cloud cover was 7/8.

Digging the hole nest

First, the lizard descended down from the *Ficus bengalensis* tree and walked away 2 m from the tree base. Then it was turned its body to make a body pit (diameter about 12 cm) but after few minutes it stopped that activity and moved away about 1 m. At that place it made another body pit as mentioned above. Again, it gave up that action and moved another 2 m away. This time it started to make the body pit near to a *Xylopia nigricans* tree. It took approximately 5 minutes to make the body pit, which was 21 cm away from that tree base. This lizard used its hind limbs to remove leaf litter while making the hole. During this activity it pressed and gripped its lower jaw in addition to the fore limbs. This grip made easier to remove and throw leaf litter backwards using both hind limbs fast and powerfully. After that it lifted the anterior part of its body using its forelimbs. Then it looked around for about 5 minutes. During this time it repeatedly turned its head 180° two times, without moving its body. During this time it changed its body colour to become darker to match the ground.

The female *C. ceylonensis* then began digging the ground while scraping the soil with its forelimbs, which was thrown backwards beside its body. This

continued for approximately 5 minutes. After that it stopped digging and looked around for approximately 5 minutes. while repeatedly turning its head 180° one time, without moving its body. Again it started the digging and this time the female dug the hole continuously for approximately 20 minutes. It stopped and looked around for about 5 minutes. while turning its head 180° around two times, without moving its body. After that it continued to dig the hole for another 20 minutes, stopping one more time for 5 minutes to rest. Sometimes it used one forelimb for digging while other forelimb was kept free on the ground. After short time it changed the fore limbs and dug using the fore limb that was kept free. The hole was dug into the ground at a 45° angle. The final hole was 50.8 mm deep and 38.1 mm in diameter.

Laying the eggs

After the digging, the female turned its body 180° clockwise, placing the posterior part of its body over the hole. It then looked around again. Then it lifted the posterior part of its body to lay eggs. This egg laying was very similar to the egg laying of *Calotes liolepis*. Three eggs were laid at a rate of one per minute (Fig. 1). The eggs were pure white and elliptical, with a mean length of 15.5 mm and a mean width 8.4 mm. After the eggs were laid, the female lowered its posterior part and looked around. Then the female packed and placed the eggs below ground level using the anterior part of its lower jaw.



Fig. 01: The egg laying of *C. ceylonensis*

Burying the eggs and camouflaging the nest

After placing eggs it turned 180° clockwise and began to drag the soil towards the hole nest using its fore limbs. The dragged soil was pressed using anterior half of its lower jaw for half an hour. After looking around, it dragged the surrounding leaves of *Xylopia nigricans* (Family: Annonaceae), *Diospyros*

ebenum (Family: Ebenaceae), *Ficus bengalensis* (Family: Moraceae) and *Mesua nagassarium* (Family: Clusiaceae) over the nest site for camouflage. It remained motionless for 5 minutes and then ran towards the *Ficus bengalensis* tree, where we observed it first. Afterwards it was caught for measurements, and then released.

Discussion

The oviposition behavior of this species varies from the oviposition behavior of *Calotes versicolor* (Amarasinghe & Karunarathna, 2007) and *C. liocephalus* (Amarasinghe & Karunarathna, 2008). According to Amarasinghe & Karunarathna (2007), while laying eggs *C. versicolor* places its cloacal aperture over the opening of the nest hole and it places its hind limbs without expanding them (Fig. 2), but *C. ceylonensis* places its cloacal aperture over the opening of the hole and places its hind limbs expanding and also without much lifting its posterior part (Fig. 3). According to Amarasinghe & Karunarathna (2008) *C. liocephalus* places the posterior part of the body inside the hole while laying eggs (Fig. 4). In comparison, the egg layings of *C. versicolor* (Amarasinghe & Karunarathna, 2007) and *C. liocephalus* (Amarasinghe & Karunarathna, 2008) occurs in wet habitat while this observation was made in a dry habitat.



Fig. 02: The egg laying of *C. versicolor*

The *C. versicolor* lifts the anterior part of the body with its forelimbs while turning its head to look around (Amarasinghe & Karunarathna, 2007) and *C. liocephalus* coils its entire body inside the hole while bending the anterior part of its body to look around (Amarasinghe & Karunarathna, 2008), but *C. ceylonensis* only turned head at an angle of 90° to looking around.

The *C. versicolor* makes a knocking noise while packing and placing the eggs in the hole using its lower jaw (Amarasinghe & Karunarathna, 2007) while the *C. liocephalus* (Amarasinghe &

Karunarathna, 2008) and *C. ceylonensis* places them softly without making any noise.

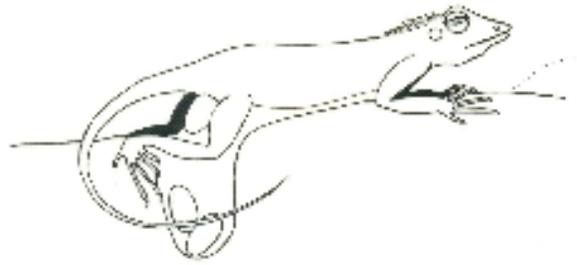


Fig. 03: The egg laying of *C. ceylonensis*

C. versicolor and *C. liocephalus* did not mark the body pit to dig the hole nest (Amarasinghe & Karunarathna, 2007, 2008) as *C. ceylonensis*. *C. ceylonensis* threw the soil backward under its body through its raised hind limbs similar to *C. versicolor* and *C. liocephalus* (Amarasinghe & Karunarathna, 2007).



Fig. 04: The egg laying of *C. liocephalus*

In this ovipositioning, the female had much effort to remove leaf litter and it used its lower jaw also to grip. Additionally, the soil also was comparatively hard and rough. Therefore it used one forelimb to dig the soil at a time while keeping other at rest and then changed them most of times. At that day the weather was very dry and dull even when there was a rain during the previous day. During this observation we could trace *Otocryptis nigristigma*, *Eutropis tammanna* and *Lankascincus fallax* sympatrically. Nonetheless, the female did not show any response to these sympatric species while laying eggs, even when they moved near the hole nest.

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Literature Cited

Amarasinghe, A. A. T. and D. M. S. S. Karunaratna, 2007. Beobachtungen zum Eiablageverhalten der Indischen Schönechse *Calotes versicolor* (Daudin, 1802) (Reptilia: Agamidae) in einem anthropogenen Biotop in Sri Lanka. *Sauria*, 29 (3): 27–30.

Amarasinghe, A. A. T. and D. M. S. S. Karunaratna, 2008. Observation on the Oviposition behaviour of the Crest-less Lizard *Calotes liocephalus* (Reptilia: Agamida) in the Knuckles forest region of Sri Lanka. *Asiatic Herpetological Research*, 11: 13-16.

Bahir, M. M. and T. D. Surasinghe, 2005. A conservation assessment of the agamid lizards of Sri Lanka. *The Raffles Bulletin of Zoology*, Supplement 12: 407-412.

IUCNSL & MENR, 2007. *The 2007 Red List of Threatened Fauna and Flora of Sri Lanka*. Colombo, Sri Lanka. xiii+148.

Karunaratna, D. M. S. S., A. A. T. Amarasinghe and E. Stöckli, 2009. Taxonomical, Biological and Ecological study on *Calotes ceylonensis* Müller, 1887 (Reptilia: Agamidae) of Sri Lanka. *Bonner Zoologische Beiträge*, (in press).

Manamendra-Arachchi, K. and S. Liyanage, 1994. Conservation and distributions of the agamid lizards of Sri Lanka with illustrations of the extant species. *Journal of South Asian Natural History*, 1 (1): 77-96.

Manamendra-Arachchi, K., A. de Silva and T. Amarasinghe, 2006. Description of a second species of *Cophotis* (Reptilia: Agamidae) from the highlands of Sri Lanka. *Lyriocephalus*, 06, Supplement 1: 1–8.

Taylor, E. H., 1953. A review of the lizards of Ceylon. *The University of Kansas science bulletin*, 35 (12): 1525-1585.