

Observations on the ovipositional behaviour of the Nilgiri forest lizard *Calotes nemoricola* (Jerdon, 1853). (Squamata: Agamidae) in Hulikal, Karnataka, India

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The Nilgiri forest lizard (*Calotes nemoricola*) is a medium sized (maximum length 475 mm, as recorded by Smith, 1935) arboreal lizard known to inhabit the mid elevation evergreen forests of the Western Ghats in India (Das, 2001). The lizards are generally green in colour, diurnal and actively forage on branches of saplings and bushes (Smith, 1935). The information on the ecology and natural history of this species is limited. Though the lizards are known to breed in June, the breeding behavior or ovipositional behaviour has not been clearly documented. In this note, we describe the ovipositional behaviour of this species for the first time.

We observed a female *C. nemoricola* in the evergreen forests of Hulikal, Karnataka State, India (13°72'N and 75°01'E; 423 m elevation.) (Fig. 1). On 4 November 2011 between 1230-1305 hrs we observed the individual digging a hole on the ground under an *Alstonia scholaris* tree. All the observations were made by the observer located about 3 m from the lizard. The nest soil was loosely packed and consisted of a mixture of sandy and clayey soil. The atmospheric temperature (measured using a laboratory thermometer, Mercury filled-ZEAL) was 29° C and the weather was hot and humid. The ground was covered with leaf litter of about 1.5-2 inches thick. *Alstonia scholaris* and *Poeciloneuron indicum* Beddome, 1865 were the most common trees found around the lizard nesting site. The lizard was hand captured and measured using a measuring tape after egg-laying was completed (snout to vent length = 112 mm, tail length = 380 mm).

The ovipositional behaviour was as follows: The lizard began excavating the egg laying burrow with its right fore-limb, scraping the mud out with its claws and its head was partially inside the small hole during the process of digging. It used its right forelimb for a time of 70 seconds and then it pulled itself out of the burrow

and used both its forelimbs to arch up and scanned the area around. The hind-limbs were stretched as wide as possible and the process of digging continued for a period varying between 30-65 seconds with short pauses of 35-130 seconds and alternate use of left fore limb (12 times) and right fore limb (17 times). The process of scanning around and digging was repeated seven times before the completion of the burrow. The whole process spanned 32 minutes resulting in the completion of the excavation. Following completion, the lizard turned around and placed both its hind-limbs inside the burrow and began laying eggs by taking few deep breaths as it pushed the eggs out. After the first egg was laid, the contractions became quicker accompanied with short breaths. The mid body underwent rapid contraction and relaxation accompanied with head bobbing. After the second egg fell into the burrow, the lizard shifted



Figure 1. Map showing the locality Hulikal (red dot), Karnataka, India where *Calotes nemoricola* was observed. Image source Google Earth, 2012.



Figure 2. Plate showing egg laying behavior of *Calotes nemoricola*. A) Excavating the burrow. B) Resting from excavating to scan the surrounding area. C) Aligning its cloacal aperture with the burrow. D) Raising its hind limbs to lay the egg. E) Packing its nest after laying the eggs. F) Resting over its closed burrow.

its left hind-limb out and placed it on the left side of the burrow. The time interval between laying consecutive eggs was between 70-85 seconds but as the process was nearing completion, the interval increased to 120-130 seconds. The eggs fell sequentially into the burrow and a total of eight eggs were laid in the time duration of 17 minutes. Upon completion of egg laying, the lizard resumed the excavating position and using its right limb, closed the burrow with mud for about 30 seconds.

This was followed by short bursts of head butt over the burrow to pack the soil and was repeated for seven times in a span of eight minutes. While packing the soil, the lizard rested 11 times for about 10-90 seconds duration, occasionally scanning the horizon. For about 45 seconds the lizard was near its completed nest and later ascended on a nearby *Alstonia scholaris* tree.

Ovipositional and nesting behaviour has been observed in a few species of agamids belonging to genus

Calotes viz., *C. versicolor*, *C. ceylonensis* (Pradeep and Amarasinghe, 2009), *C. liocephalus* (Amarasinghe and Karunarathna, 2008), *C. nigrilabris* (Karunarathna et al., 2011), *C. liolepis* (Karunarathna, Bandara and Chanaka, 2009) and *C. calotes* (Dinesh, Amarasinghe and Bahir, 2009). The *C. versicolor*, *C. liocephalus*, *C. nigrilabris* and *C. ceylonensis* are closely similar as they are known to dig their burrow at an angle of 45° where as *C. calotes* reportedly digs a shallow burrow which is at an angle of 35° in respect to ground level whereas *C. liolepis* digs its burrow straight into the ground. Out of the five, only *C. liocephalus* places its posterior region inside the burrow whereas *C. versicolor*, *C. nigrilabris*, and *C. ceylonensis* place their cloacal aperture above the opening of the burrow. Further, *C. calotes* and *C. liolepis* positions the cloacal region right at the opening of the burrow and lays eggs without raising its hind limbs where *C. versicolor* raises both the hind limbs while laying eggs, which is not observed in *C. nigrilabris* and *C. ceylonensis*. Observations on *C. liocephalus* show that it raises its anterior part of the body, tilts its head to an angle of ca. 90° and scans the area without turning its head while laying eggs. *C. versicolor*, *C. calotes*, *C. liolepis* and *C. ceylonensis* just turn their head to an angle of 90° to look around without raising the anterior portion of their body, whereas *C. nigrilabris* looks around at an angle of 300°.

We consider the ovipositional behaviour of *C. nemoricola* closely similar to that of *C. liocephalus* from Sri Lanka and partly similar to that of *C. versicolor* of Southern India and Sri Lanka. Further observations should provide a better insight into this aspect of nest building.

The breeding season of *C. nemoricola* spans a maximum of two months starting from June onwards (Smith, 1935). The information on its ecology, behavior and natural history remain sparse. Eggs of arboreal lizards like *C. calotes* require about 79-84 days for hatching and their nesting site requires the presence of moist leaf litter to maintain an optimum temperature needed for incubation (Deraniyagala, 1953; Das, 2005). Leaf litter collection in the Western Ghats is a major cause for concern as it is regularly harvested to be used as mulch and manure (Gadgil, 1987). Furthermore, large tracts of the evergreen forests are being destroyed and degraded along the Western Ghats and this could threaten the populations of arboreal lizards which nest on the ground. Such drastic habitat modification could lead to changes in the thermal environment and thus affecting the populations of lizards which are ground

nesters (Ishwar et al., 2003). Additional empirical studies on the habitat requirements and survival rates of these lizards are essential to strengthen the understanding of this species which in turn could strengthen conservation efforts.

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