SOME NOTES ON EGG LAYING OF *CALOTES LIOLEPIS* BOULENGER, 1885 (REPTILIA: AGAMIDAE) OBSERVED IN TWO WET ZONE FORESTS OF SRI LANKA

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Lizards belonging to the family Agamidae are widely distributed from the coastal plains to highlands among different climatic zones in Sri Lanka (Deraniyagala, 1953). Family Agamidae in Sri Lanka is represented by 17 species, of which 14 are endemic, with three endemic genera (Bahir & Surasingha, 2005). These 17 species are classified under three subfamilies: Calotinae, Lyriocephalinae and Sitaninae. Subfamily Calotinae consists of one genus and seven species. The genus *Calotes* is represented by *Calotes calotes*, *C. ceylonensis*, *C. desilvai*, *C. liocephalus*, *C. liolepis*, *C. nigrilabris* and *C. versicolor*. Apart from *C. calotes* and *C. versicolor* others are endemic to Sri Lanka (Das & De Silva, 2005; De Silva, 1996; Manamendra-Arachchi, 1998).

According to the existing literature *C. liolepis* is believed to be restricted to lowland wet zone forests of Sri Lanka. This species is categorized as Vulnerable (de Silva *et al*., 2000) and Threatened in the national list of threatened species of Sri Lanka (IUCN Sri Lanka, 2000). *Calotes liolepis* can be distinguished from other nonendemic *Calotes* (*Calotes calotes* and *Calotes versicolor)* by having costal scales and lateral scales pointed downward or downwards and backwards (Manamendra-Arachchi, 1998). Even though *Calotes liolepis* can be misidentified with *Calotes leocephalus*, these two species are well separated by the combination of following characters (in *C. liocephalus*), an oblique fold in front of shoulder; lower jaw rather short. Head without spines or rarely a rudimentary spine above one ear. Supraocular scales enlarged. Dorsinuchal crest poorly developed, strongest on head, low on neck and rudimentary on body (Manamendra-Archchi, 1990).

The newly described *Calotes desilvai* is distinguished from *Calotes liolepis* by having the fifth toe 42.6-47% of head length in males, 41.9-45.9% in females; bands in gular area distinct, black; shoulder pit black; and scales on ventral surface of high smooth (Bahir & Maduwage, 2005). In addition, *Calotes liolepis* can be distinguished from all other species by having following characters, a shoulder fold with granular scales present; gular sac present; very small. Two story spines set far apart over ear; dorsinuchal crest of male consists of ten well-developed spines on neck, rudimentary on anterior half of body and then disappears; the spines of crest are as long as orbit, narrow and apart from each other (Manamendra-Archchi, 1990).

Calotes liolepis is mainly distributed throughout the southwestern wet zone and are restricted to patches of dense, high canopy natural forests. The populations of these species are therefore restricted to discrete "land islands", in which the area and habitat quality is threatened by deforestation. (Erdelen, 1978; Manamendra-Arachchi & Liyanage, 1994). This species is recorded in anthropogenic vegetation around human settlements as well (Manamendra-Arachchi, 1998).

We made three observations on egg laying behaviour of *Calotes liolepis* lizard at three different localities. The first observation was made at the Delwala proposed forest reserve (DPFR), while the second and third observations were made from Rojersongama in Kothmale. Direct observations were made, 2m away from the lizard from 1300-1400hr, 1400-1500hr and 1500-1540hr. No disturbance was made to the animal during the time of observation. All measurements were taken to the nearest 0.1mm with dial caliper after the every egg laying activity. The identification of the species was confirmed using Deraniyagala (1953); Manamendra-arachchi & Liyanage (1994). Plant nomenclature is based on Senaratna (2001).

Delwala Proposed Forest Reserve (DPFR) is situated in Nivithigala Government Secretariat Division of Ratnapura district, in southwestern Sri Lanka. The area belongs to tropical wet evergreen forest, dominant with *Mesua*, *Dipterocarpus* and *Doona* community (Gunatilleke & Gunatilleke, 1990). This area lies between 6'29"-6'31"40"N & 80'25"-80'30"E. DPFR belongs to the lowland wet zone of the Sri Lanka and hence mean annual rainfall ranges between 3500-4000mm. Average temperature is about 27.1C (Young Zoologists Association of Sri Lanka, 2003).

A very clear stratification can be observed in the DPFR. Canopy layer is composed with trees of genera *Dipterocarpus*, *Anisophyllea*, *Shorea*, *Palaquium*, *Diospyrus*, *Syzygium*, *Mangifera* and *Pometia*, which are about 30-40m in height. Subcanopy layer is about 15-30m in height and includes tree species of the genera *Syzygium*, *Diospyrus*, *Semecarpus* and *Chatocarpus*. Undergrowth is about 1-15m in height. This includes *Wormia triquetra*, *Pavatta indika* and *Hamboldtia laurifolia* (Young Zoologists Association of Sri Lanka, 2003).

Rojersongama locality is situated in the Kothmale divisional secretary division in Rojersongama north GS division in Nuwara-Eliya district, central Sri Lanka. The area consist of tropical montane forest, dominant with *Calophyllum walkeri* and *Syzygium* community (Gunatilleke & Gunatilleke, 1990). This locality is called *Akkara namaya*. This is a small natural forest patch with still good natural habitats. We observed egg laying of *Calotes liolepis* lizard, in two occasions on two different days in two different localities within the same area.

In Rojersongama, the forest consists of three main layers. The canopy layer about 30-35m, *Shorea gardneri*, *Stemonoporus* spp., *Eleacarpus montanus*, *Syzygium* spp., *Miristica* spp., *Calophyllum* spp. are the dominant plants. But some introduced plant species can also be seen in the canopy layer, such as *Swietenia macrophylla* and *Toona* spp. The subcanopy layer is about 15-20m, consisting of species such as *Wormia triquetra*, *Michelia champaka*, *Eleacarpus* spp., *Semercarpus gardneri*, *Rejoua dichotoma*, and *Ficus hispida*. The undergrowth includes *Cinnamomun* and *Cardamom* bushes.

Details of observations: Egg laying of *Calotes liolepis* was observed on 28.ii.2003 at DPFR between 1300-1400hr under

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a *Schumacharia castinafolia* tree. There was a layer of leaf litter with a thickness of about 1.5 inches around the tree, and the canopy cover was about 75%. The lizard was using its fore limbs to dig the nest at the time of observation. When the lizard was first sighted, light green colour bands were observed across its body. But at the time it finished laying eggs, the whole body transformed into a dark colour. The pit that the lizard dug for laying eggs was about 4.5cm in width, 4cm in depth and 14cm in circumference. Two eggs were layed (Table 1).

The second observation was made on 28.ii.2004 between 1400-1500hr at Akkara namaya. Cloud cover was 8/5 at the time of observation, but it was a clear day. The soil in the habitat of *Calotes liolepis* was containing lot of humus and leaf litter with a thickness of about 1-1.5in. Dimensions of the pit were 3.3cm in width and 4.8cm in depth. The lizard was observed laying four eggs (Table 1).

The third observation was made on 29.ii.2004, between 1500-1540hr. The cloud was 6/8 but there was no precipitation. The pit was about 3cm in width and 3.8 in depth. Two eggs were observed (Table 1).

Discussion: According to Deraniyagala (1953) and Amarasinghe & Karunarathna (2006), *Calotes calotes* and *C. versicolor* are known to be laying up to 6-14 eggs. Endemic *Calotes* species; *Calotes liocephalus*, *Calotes ceylonensis* and *Calotes nigrilabris* are known to lay three, five and two eggs respectively (Deraniyagala, 1953). Newly discovered *Calotes desilvai* lay two eggs (Bahir & Maduwage, 2005). The egg clutch and reproduction of *Calotes liolepis* has not been documented previously. Therefore, we were keen to document their egg-laying behaviour, and measure the sizes of eggs and egg holes. We deposited the eggs in the same holes after taking measurements. After few weeks, we were able to observe juvenile *Calotes liolepis* lizards at the Rojersongama locality. Those juvenile lizards were approximately 3-4cm in length and were observed to be in good health. But we couldn't observe DPFR location after the initial data collection.

Some similarities were observed in all three observations of *Calotes liolepis* nesting. All three occasions were recorded during the month of February and all occasions after 1300hr in days with good clear weather. According to the present literature information on general behaviours, feeding and breeding habits is not properly understood for many of our endemic lizard species. Therefore, research on the above aspects of endemic lizards are essential, for the planning and implementation of scientific conservation and management programmes.

Table 1. Egg measurements of* Calotes liolepis *(Measurements were taken with a vernier caliper)

Location	Egg Measurements (1)	(2)	(3)	(4)	Average of egg size
DPFR	17mm	16mm			16.5mm
Rojersongama - 1	16.7mm	18.1mm	18.4mm	17.6mm	17.7mm
Rojersongama - 2	16mm	15.6mm			15.8mm
	Average egg size				**16.9mm**

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