



Current status of *Calotes liocephalus* Günther, 1872 (Reptilia: Agamidae) of Sri Lanka

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Abstract: *Calotes liocephalus* Günther, 1872 is an endemic and threatened, arboreal agamid lizard of Sri Lanka, which is found only in the forests of the Knuckles Mountain Range and Peak Wilderness up to 1850m. This work is mainly based on examination of the type specimen and WHT specimens as well as published literature and our observations of ecology, behaviour and threats on *Calotes liocephalus*.

Keywords: Behaviour, biology, *Calotes liocephalus*, conservation, ecology, natural history, taxonomy, Sri Lanka.

INTRODUCTION

Eighteen species of agamid lizards, family Agamidae, have been reported from Sri Lanka (Manamendra-Arachchi et al. 2006; Somaweera & Somaweera 2009), representing one subfamily: Draconinae (Macey et al. 2000; Manthey 2008). The genus *Calotes* extends through southern Asia to most of the East Indian Archipelago (Taylor 1953).

Seven species of *Calotes* occur in Sri Lanka. Five of them (*C. nigrilabris* Peters, 1860; *C. liocephalus* Günther, 1872; *C. liolepis* Boulenger, 1885; *C. ceylonensis* Müller, 1887; *C. desilvai* Bahir & Maduwage, 2005) are endemic. The remaining two, *C. calotes* (Linnaeus, 1758) and *C. versicolor* (Daudin, 1802) are widespread throughout South and South East Asia. *Calotes liocephalus* is an arboreal species found only in the forests of the Knuckles Range and Peak Wilderness up to 1850m (Erdelen 1984; Manamendra-Arachchi & Liyanage 1994; Das & de Silva 2005; de Silva et al. 2005). It is a threatened species (Manamendra-Arachchi & Liyanage 1994; Bahir & Surasinghe 2005; IUCN & MENR 2007).

MATERIALS AND METHODS

The examined holotype is at the Natural History Museum, London, UK (BMNH) and others are with the Wildlife Heritage Trust of Sri Lanka, Colombo, Sri Lanka (WHT). Diagnoses and descriptions are based on morphology. The locality record for each species includes WHT specimen data, published information and our observations during the past decade.

All measurements were taken with dial calipers to the nearest 0.1mm.

Scale counts: SUP - Supralabials were counted from the first scale anterior to that at the angle of gape, not including the median scale (when present); INF - infralabials were counted from the first scale posterior to mental, to the angle of gape; DS - dorsal spines were counted from the first spine to the last of mid-dorsal row; CR - canthus rostralis (counted from rostral scale along scale row passing over nostril to posterior end of supraciliary ridge); MDS - mid dorsal scales (counted from scale behind the rostral to the posterior margin of the thigh); MBS - mid body scales were counted from center of the mid-dorsal row forwards and downwards across ventrals (this count is unreliable, by the unequal size and uneven arrangement of the lateral scales); MVS - mid ventral scales were counted from the first scale posterior to mental, to the last scale anterior to vent; SAT - Spines around tympanum were counted from the first spine to the last above tympanum.

External measurements (in mm): SVL - snout-vent length (distance between tip of snout to anterior margin of vent); HL - head length (distance between posterior edge of mandible and tip of snout); HW - head width (maximum width of head); DHL - dorsal head length (distance between posterior edge of cephalic bone and tip of snout); NFE - nostril - front eye length (distance between anterior most point of orbit and middle of nostril); UAL - upper-arm length (distance between axilla and angle of elbow); LAL -



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lower-arm length (distance from elbow to wrist with both upper arm and palm flexed); FL - finger length (distance between tip of claw and the nearest fork); FEL - femur length (distance between groin and knee); TBL - tibia length (distance between knee and heel, with both tibia and tarsus flexed); TL - toe length (distance between tip of claw and nearest fork); AG - axilla-groin length (distance between axilla and groin); SA - snout-axilla length (distance between tip of snout and axilla); TAL - tail length (measured from anterior margin of vent to tail tip); PAL - palm length (taken from posterior most margin of palm and tip of longest finger); FOL - foot length (distance between heel and tip of longest toe, with both foot and tibia flexed); TBW - width of tail base (greatest width of the tail base); IOW - inter orbital width (minimum distance between the upper margins of orbits); ED - eye diameter (horizontal diameter of orbit); SFE - snout-front eye length (distance between anterior most point of orbit and tip of snout); SBE - snout-back eye length (distance between posterior most point of orbit and tip of snout); SFT - snout-front tympanum length (distance between anterior most point of tympanum and tip of snout); TD - Tympanum diameter (minimum distance between the inner margins of tympanum).

Calotes liocephalus Günther, 1872

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English Name: Crestless Lizard; Sinhala Name: Nosilu Katussa

Holotype: Male (90.0mm SVL); Cat.no. BMNH 1946.8.11.33; Loc. Peradeniya District, Ceylon (= Sri Lanka); Coll. G. H.K. Thwaites; Date. Unknown (Images 1 & 2).

Other material examined: WHT 1667, male, 87.4mm, Sri Pada; WHT 6241, male, 85.4mm, Corbetts Gap; WHT 6211, male, 90.8mm, Knuckles; WHT 6154, male, 89.4mm, midlands Est.-Knuckles; WHT 0106A, female, 83.6mm, Maussakanda-Gammaduwa; WHT 6504, male, 89.1mm, Agra-Bopath; WHT 6503, female, 82.5mm, Torrington Est.-Agra-Bopath.

Diagnosis: Head without spines or rarely a rudimentary spine above the tympanum; dorsinuchal crest poorly developed; lateral scales directed backwards and downwards.

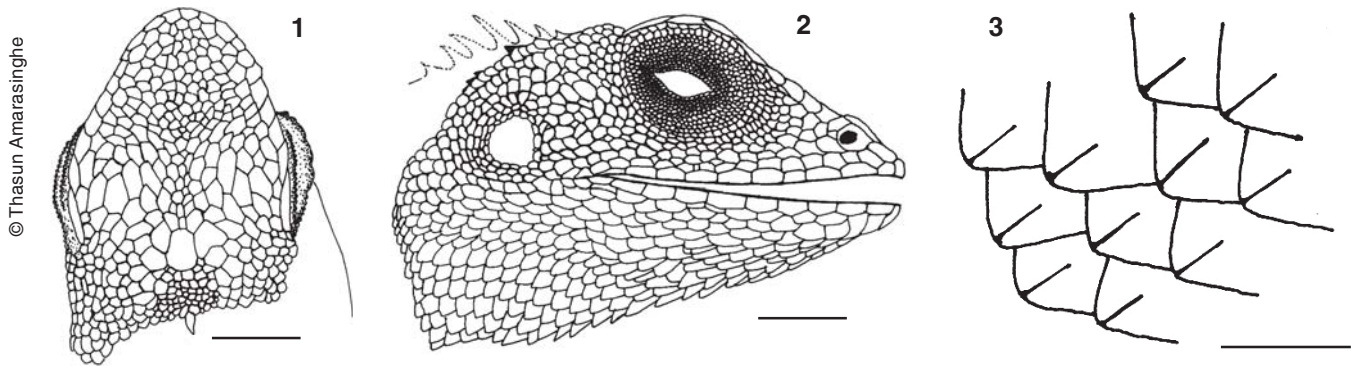


Image 1. *C. liocephalus*, BMNH 1946.8.11.33; holotype, male, 90.0mm SVL; dorsal aspect of the body.



Image 2. *C. liocephalus*, BMNH 1946.8.11.33; holotype, male, 90.0mm SVL; lateral aspect of the head.

Description: [Based on Holotype and WHT collection: (Images 1-2; Figs. 1-3) the range of morphometric data for holotype and WHT specimen shown at the end of the description]. Head without spines or rarely a rudimentary spine above ear, an oblique fold in front of shoulder, lower jaw rather short. Canthus rostralis not very prominent, its outline straight. Six scales from eye to nostril. Tympanum about half size of the orbit. Supraocular scales enlarged. Dorsinuchal crest poorly developed and the spines strongest on head, low on neck and rudimentary on body, scales on sides point backwards and downwards; dorsal scales smaller, feebly keeled, about as large as the ventrals; gular sac undeveloped; gular scales as large as or larger than the ventrals; faintly carinate. Body compressed; Body scales faintly carinate; Ventrals strongly carinate. Limbs moderate; third and fourth fingers equal or fourth finger a little longer than the third. Relative length of fingers; $1 < 5 < 2 < 3 < 4$. Fourth toe distinctly longer than the third. Relative length of toes; $1 < 2 < 5 < 3 < 4$. Hind limb reaches to the eye or nearly as far. In a fully-grown male the head is larger and tail is markedly swollen at the base, with



Figures 1-3. *C. liocephalus*, WHT 6504; male, 89.1 mm SVL. (scale = 1cm)
1 - dorsal scalation of head; 2 - lateral scalation of head; 3 - mid body lateral scales.

large, thick, keeled scales. SVL: 82.5-90.0; HL: 27.2-32.4; HW: 17.1-22.0; DHL: 21.4-26.8; NFE: 7.0-8.2; UAL: 16.0-23.5; LAL: 15.5-17.3; FL I: 5.2-6.4; FL II: 7.4-9.6; FL III: 11.4-13.1; FL IV: 11.5-13.4; FL V: 6.8-7.7; FEL: 20.6-27.3; TBL: 19.6-24.2; TL I: 5.4-6.8; TL II: 8.1-10.2; TL III: 13.8-16.6; TL IV: 15.5-19.7; TL V: 11.3-14.0; AG: 40.7-51.0; SA: 34.1-45.0; TAL: 241-267; PAL: 15.6-18.1; FOL: 27.9-30.9; TBW: 6.5-11.2; IOW: 1.3-2.3; ED: 5.2-8.1; SFE: 11.4-14.2; SBE: 16.7-19.1; SFT: 22.4-25.8; TD: 4.0-4.4; SUP: 9-10; INF: 9-9; MDS: 70-78; CR: 8-13; MBS: 45-56; MVS: 68-78; DS: 13-25; SAT: 0-1.

Remarks: [Based on WHT collection and other observations on live specimens: (Images 3 & 4)]. The body colour is green or bluish-green dorsally with five or six transverse dark cross bars. The throat is yellowish-green. Three black cross bands from eye to eye. A black band runs along posterior half or upper lip through the tympanum. Sides of the lower jaws are with black spots, sometimes dark cross bars on the top of the head; base of the tail light olive brown, the rest of it alternately banded with light and dark; below greenish-white.

Distribution and habitat: *Calotes liocephalus* appears to be rare and has been recorded only from the forests of the Knuckles Range (from 800-1850 m) and Peak Wilderness (from 800-2000 m) and this species is endemic to Sri Lanka. This species is largely arboreal and its diet comprises of young leaves, buds, insects and worms (de Silva et al. 2005).

Hemipenis morphology: The hemipenis of *Calotes liocephalus* (Image 5) is well developed. The pedicel is slightly shorter than the head; below the head, it is broadened out in to two shallowly concave shoulders; there are no spines. The head is quadrangular, shallowly divided longitudinally into four lobes, two being slightly larger. Surface of the head is reticulatedly pitted, the pits being larger on the outside, diminishing in size towards the divisions between the lobes.

Nest hole and eggs: A female dug a hole in the ground 92.6mm deep and 79.1mm in diameter. 3-8 eggs were deposited in June. The bottom of the hole is conical and is dug at 45° angle. The eggs were white and elliptic, with a mean length of 14.8mm and 8.6mm width (n=8). While laying eggs *C. liocephalus* places the posterior part of its body inside the hole (Fig. 4) and it does not lift the posterior part of the body to lay eggs. Its entire body curls inside the hole, bending the anterior part of its body to look around (see Amarasinghe & Karunarathna 2008).

Other behaviour: This species is active during daytime, largely arboreal and sometimes on trees 5m above ground level.



Image 3. *C. liocephalus* mature male.



Image 4. *C. liocephalus* mature female.

C. liocephalus is widespread within moderately open riverine-forested areas and uncommon in home gardens. Hatchlings typically ambush their prey on *Strobilanthes* bushes, camouflaging in light green. On threat, these hatchlings creep in to the bush. Adults usually perch vertically on branches. In the Knuckles Range we located this species on *Mallotus tetracoccus* (Euphorbiaceae) trees. When threatened the lizard rapidly climbs on a tree or shrub and flattens against a branch. They



Image 5. *C. liocephalus*, WHT 6154; male, 89.4 mm SVL; left hemipenis.

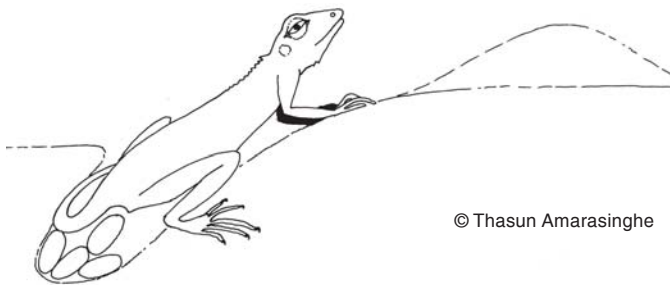


Figure 4. Egg laying of *C. liocephalus*.

also change their body colour to black.

Threats: Forest clearing and habitat fragmentation are major threats to *Calotes liocephalus* (de Silva et al. 2005), exacerbated by montane forest fragments surrounded by cardamom plantations involving intensive pesticide application. We observed many dead sub-adults of *C. liocephalus* individuals, after very cold nights in December and January on the branches of trees in the Knuckles Range, reasons for mortality unknown.

DISCUSSION

According to Manamendra-Arachchi et al. (2006) the lowlands (elevation ~500m) of the Mahaweli River, which separates the Dumbara Hills (= Knuckles Hills) from the Central Mountains, appears to have served as a barrier to the dispersion of highland species. According to Günther (1872) the holotype of *Calotes liocephalus* (BMNH 1946.8.11.33), was collected from “Peradeniya District” presumably, Peradeniya (alt. ~500m) in the Kandy District. However, Peradeniya is on the margin of the Knuckles and Central Hills and the Mahaweli River flows across Peradeniya. If the report is correct, *C. liocephalus* was once distributed throughout the low elevations

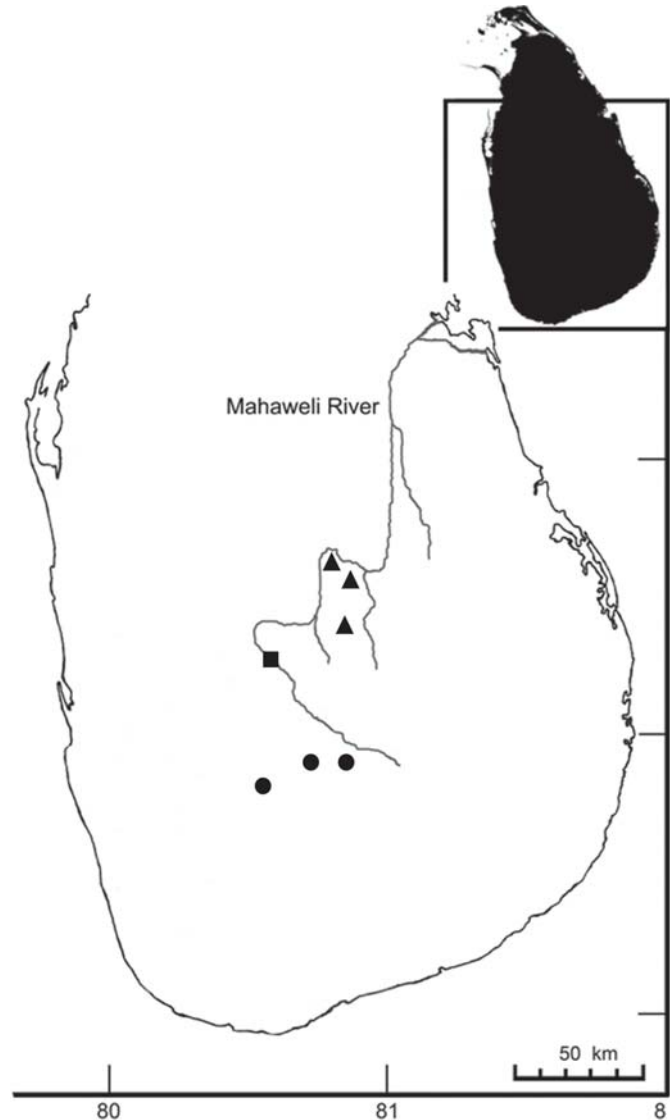


Figure 5. Distribution of *C. liocephalus* populations
 ● - Central-hill population; ▲ - Knuckles population,
 ■ - Type locality

of Central and Knuckles Mountains. We could not locate any *Calotes liocephalus* specimen in Peradeniya. Two isolated populations in the Central Hills and Knuckles Region occur and these have not been compared critically (Fig. 5). Therefore, a morphological and morphometric analysis of the two isolated *C. liocephalus* populations is needed. If the Knuckles population is a distinct morphospecies, its range would be restricted to the Knuckles massif and it would be at risk of extinction before it is even named.

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