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A new species of the genus *Calotes* (Squamata: Agamidae) from high elevations of the Knuckles Massif of Sri Lanka

A. A. THASUN AMARASINGHE[1,6], D. M. S. SURANJAN KARUNARATHNA[2], JAKOB HALLERMANN[3], JUNICHI FUJINUMA[4], HEINZ GRILLITSCH[5] & PATRICK D. CAMPBELL[6]

[1]*Research Center for Climate Change, University of Indonesia, Gd. PAU Lt. 8.5, Kampus UI, Depok 16424, Indonesia*
[2]*Nature Exploration and Education Team, No. B–1 / G–6, De Soysapura Housing Scheme, Moratuwa 10400, Sri Lanka*
[3]*Zoologisches Museum Hamburg, Universität Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany*
[4]*Graduate School of Environmental Science, Hokkaido University, Sapporo, Hokkaido, Japan*
[5]*Natural History Museum, Herpetological Collection, Burgring 7, A–1010 Wien, Austria*
[6]*Department of Life Sciences, Darwin Centre, Natural History Museum, Cromwell Road, South Kensington, London SW7 5BD, England*
[6]*Corresponding author. E-mail: thasun.taprobanica@gmail.com*

Abstract

A new species of agamid lizard, of the genus *Calotes,* is described based on morphological evidence. This species is restricted to the Knuckles massif (>900 m elevation) of Sri Lanka. The genus *Calotes* consists of seven species in Sri Lanka, five of which appear to form an endemic radiation. The new species most closely resembles *C. liocephalus* Günther, 1872 which has an isolated population in the central highlands and is only known from Pundaluoya (~1000m), Dickoya (~1200m), Upcot (~1400m), Agrapatanas (1665m) and Peak Wilderness (Sri Pada) (>1400m). The populations from Pundaluoya and Dickoya appear to be locally extinct from the wild and are known only from museum specimens collected over 120 years ago. Males of the new species are different from males of *C. liocephalus* because of the absence of a gular pouch; by having mid gular scales smaller in size than those of its counterpart; scales on the snout which are larger in size than those on the occipital and forehead; pectoral scales which are not enlarged; elongated subcaudal scales; slightly carinate and acuminate abdominal scales; and scales on venter which are somewhat larger in size than those on dorsum at the same level. Finally, we also redescribe *Calotes liocephalus*, and provide a key to the Sri Lankan species of genus *Calotes*.

Key words: biogeography, *Calotes liocephalus*, conservation, Reptilia, systematics, taxonomy

Introduction

The agamid genus *Calotes* Cuvier, 1817, currently consists of 24 species (Hartmann *et al.* 2013; Uetz & Hallermann 2013). Seven are represented in Sri Lanka; five of which appear to form an endemic radiation (Macey *et al.* 2000; de Silva 2006; Somaweera & Somaweera 2009; Wickramasinghe 2012): *C. nigrilabris* Peters, 1860; *C. liocephalus* Günther, 1872; *C. liolepis* Boulenger, 1885; *C. ceylonensis* Müller, 1887; and *C. desilvai* Bahir and Maduwage, 2005. *Calotes calotes* (Linnaeus, 1758) is distributed in India, and *C. versicolor* (Daudin, 1802) is widely spread throughout tropical Asia (Smith 1935; Deraniyagala 1953; Taylor 1953; Moody 1980; Manthey 2008; Das 2010; Venugopal 2010). Both complexes in Sri Lanka are in need of further taxonomic clarification (see Zug *et al*. 2006; Hartmann *et al.* 2013).

Calotes liocephalus is considered to be restricted to the Knuckles massif (Erdelen 1984; Manamendra Arachchi & Liyanage 1994) even though there were some older records from the central highlands (Deraniyagala 1953; Smith 1935; Taylor 1953). In 1981 one specimen (ZSM 219/1981) was collected from Upcot (~1400 m elevation) and in 2005 two specimens (WHT6503, WHT6504) were collected from Agrapatanas (1665 m elevation) in the central highlands. In addition, Amarasinghe *et al.* (2009) recorded *C. liocephalus* from the Peak Wilderness. After examining several museum specimens at the BMNH, NMB, and ZSM we found three specimens from Pundaluoya (~1000 m), Dickoya (~1200 m) and Upcot (~1400 m) respectively, in the central highlands of Sri

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Lanka. The species, *C. liocephalus* was described using a single male specimen (BMNH 1946.8.11.33) by Günther (1872) without a precise location; therefore we had to compare the holotype with museum specimens and live specimens (not collected) from the Knuckles massif and central highlands, where both areas are known to be world heritage sites (UNESCO, 2013). After identifying the specimens,we saw that the holotype resembled the central highlands populations. Hence, here we describe the population distributed in the Knuckles massif as a distinct species with a redescription of *C. liocephalus* based on the holotype.

Material and methods

Museum acronyms follow Sabaj Pérez (2013). Specimens were examined at the Natural History Museum, London, UK (BMNH); Museum national d'Histoire naturelle, Paris, France (MNHN); Naturhistorisches Museum, Basel, Switzerland (NMB); National Museum of Sri Lanka, Colombo, Sri Lanka (NMSL); Naturhistorisches Museum Wien, Vienna, Austria (NHMW); Wildlife Heritage Trust, Colombo, Sri Lanka (WHT); Zoologische Staatssammlung München, Munich, Germany (ZSM); and Zoological Museum Hamburg, Hamburg, Germany (ZMH). The WHT collection is now deposited at NMSL (not yet catalogued). Morphometric data for species comparisons were obtained from examined specimens (Appendix I). We used a Leicawild M3Z and a ZEISS DCR dissecting microscope to examine the external morphology of specimens and a Cannon EOS 7D SLR digital camera to take Photographs. The map was made by using Arc Gis 10.1 (ESRI© 1995-2012) software. The conservation status of the new species was evaluated based on IUCN Red List Categories and Criteria (2001) and IUCN Standards and Petitions Subcommittee (2013): Versions 3.1, 4.0, and 10.1 to assess their risk of extinction. Sex was determined by the presence or absence of hemipenes or hemipenal bulges.

The following characters were measured with a Mitutoyo digital caliper to the nearest 0.1 mm and on the left side of the body for symmetrical characters: eye diameter (ED), horizontal diameter of orbit; eye–nostril length (EN), distance between anteriormost point of orbit and middle of nostril; snout length (ES), distance between anteriormost point of orbit and tip of snout; tympanum–eye length (TYE), distance between anterior most margin of tympanum and posterior most margin of eye; tympanum diameter (TYD), longest diameter of the tympanum; internarial distance (IN), shortest distance between the inner margins of nares; interorbital width (IO), shortest distance between upper margins of orbits; head length (HL), distance between posterior edge of mandible and tip of snout; head width (HW), maximum width of head; head depth (HD), distance between occiput and throat; upper arm length (UAL), distance between axilla and angle of elbow; lower arm length (LAL), distance from elbow to wrist with both upper arm and palm flexed; palm length (PAL), distance between wrist (carpus) and tip of longest finger, with both palm and lower arm flexed; femur length (FEL), distance between groin and knee; tibia length (TBL), distance between knee and heel, with both tibia and tarsus flexed; foot length (FOL), distance between heel and tip of longest toe, with both foot and tibia flexed; toe length (TL), distance between tip of claw and nearest fork; axilla–groin length (AG), distance between axilla and groin; snout–vent length (SVL), measured from tip of snout to anterior margin of vent; tail base width (TBW), largest diameter of the tail base; tail length (TAL), measured from anterior margin of vent to tail tip; Meristic characters were taken as follows: supralabials (SUP) and infralabials (INF), first labial scale to last labial scale towards gape, which is distinctly larger than the granular scales at gape; canthus rostralis (CR), counted from first scale posterior to supranasal, to end of supraciliary ridge; mid body scales (MBS), counted from center of mid dorsal row forwards and downwards across ventrals; dorsonuchal crest spines (DS), counted from first spine of nuchal crest to the level of axilla; mid ventral scale row (MVS), counted from first scale posterior to mental, to last scale anterior to vent; subdigital lamellae on toe IV (SDL), from first proximal enlarged scansor wider than twice the width of the largest palm scale, to distalmost lamella at tip of digit. All the measurements were normalised to the percentage of HL (HL itself is given as a percentage of SVL), because we are confident that HL is more accurate than SVL, especially when measuring older museum specimens.

Natural history observations were made by looking at the animal at a distance of at least 3–4 m away being careful not to make a disturbance. The eggs were measured with a Mitutoyo digitmatic caliper to the nearest 0.1 mm, and the eggs were carefully deposited back in the original nest hole. A standard thermometer, hygrometer and lux meters were used to record the environmental parameters during the observations.

Standard morphometric and meristic statistics are presented in Table 1. Statistically informative tests could not be performed because of the lack of *C. liocephalus* specimens.

TABLE 1. Morphometric (as a percentage of HL; HL itself is given as a percentage of SVL), and meristic characters of four males (including holotype) and three females of *C. liocephalus*, and three males (including holotype) and three females of *C. pethiyagodai* **sp. nov.**

character	males				females			
	C. liocephalus (n = 4)		*C. pethiyagodai* **sp. nov.** (n = 3)		*C. liocephalus* (n = 3)		*C. pethiyagodai* **sp. nov.** (n=3)	
	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
SVL	255.0–284.4	273.4 ± 13.6	280.4–286.2	282.4 ± 3.3	303.5–313.4	308.5 ± 4.9	304.6–310.0	307.3 ± 2.7
AG	109.4–129.7	120.2 ± 10.0	151.4–153.3	152.2 ± 0.9	138.6–159.8	149.8 ± 10.6	147.5–149.8	148.4 ± 1.2
HL (%SVL)	35.2–39.2	36.6 ± 1.9	34.9–35.6	35.4 ± 0.4	31.9–32.9	32.4 ± 0.5	32.2–32.8	32.5 ± 0.3
HW	49.7–66.2	59.2 ± 7.2	57.4–58.0	57.7 ± 0.3	52.9–60.9	57.6 ± 4.2	54.8–55.8	55.4 ± 0.5
HD	49.0–56.3	53.7 ± 3.4	49.8–51.7	50.8 ± 0.9	48.6–57.0	52.9 ± 4.2	53.4–54.8	54.3 ± 0.8
TYD	12.3–16.2	14.0 ± 1.9	10.4–11.6	11.1 ± 0.6	12.6–14.2	13.6 ± 0.8	14.7–15.2	14.9 ± 0.2
ED	26.6–28.5	27.7 ± 0.8	28.7–29.5	29.1 ± 0.4	27.7–37.2	31.5 ± 5.0	27.7–29.7	28.6 ± 1.0
TYE	21.6–22.3	22.0 ± 0.3	22.6–24.1	23.1 ± 0.8	20.1–22.4	20.9 ± 1.2	24.3–25.3	24.9 ± 0.5
EN	17.5–19.2	18.3 ± 0.7	20.1–20.2	20.2 ± 0.0	19.0–19.9	19.6 ± 0.5	22.8–23.2	22.9 ± 0.2
ES	27.8–33.7	31.4 ± 2.6	36.6–37.9	37.4 ± 0.7	34.0–36.0	35.1 ± 1.0	38.5–39.5	38.9 ± 0.5
IN	18.4–19.6	18.9 ± 0.5	21.8–22.9	22.4 ± 0.6	16.9–23.4	21.1 ± 3.6	24.3–25.3	24.8 ± 0.5
IO	13.4–14.5	14.1 ± 0.5	15.0–15.4	15.2 ± 0.2	15.4–17.4	16.5 ± 1.0	15.8–17.5	16.6 ± 0.8
FEL	57.3–64.0	60.3 ± 3.0	65.6–68.5	67.0 ± 1.4	63.8–82.2	73.7 ± 9.3	71.9–77.1	74.4 ± 2.6
TBL	65.5–67.9	67.0 ± 1.0	69.4–73.7	71.6 ± 2.1	80.2–81.1	80.6 ± 0.4	81.4–85.5	83.0 ± 2.2
FOL	87.9–100.6	94.0 ± 5.4	94.0–95.3	94.7 ± 0.6	104.9–115.4	110.2 ± 2.9	105.7–111.2	107.8 ± 2.9
TL 1	15.2–19.2	17.1 ± 1.9	11.0–15.9	14.2 ± 7.4	14.9–20.5	18.1 ± 2.9	18.2–25.3	21.1 ± 3.7
TL 2	23.3–31.5	25.9 ± 3.7	18.9–31.8	26.7 ± 6.9	29.0–31.1	30.2 ± 1.0	27.0–33.9	30.7 ± 3.5
TL 3	39.2–49.4	44.8 ± 4.4	43.1–52.3	48.3 ± 4.7	54.6–60.5	56.8 ± 3.2	51.7–57.8	54.2 ± 3.2
TL 4	51.9–59.7	55.4 ± 3.2	63.0–75.7	70.3 ± 6.5	65.2–93.7	74.8 ± 16.4	72.2–96.9	88.5 ± 14.1
TL 5	33.9–39.9	36.8 ± 2.8	32.8–41.4	35.7 ± 4.9	41.2–45.4	42.7 ± 2.3	41.1–43.8	42.2 ± 1.4
TBW	25.2–29.6	28.2 ± 2.0	32.2–33.5	32.8 ± 0.6	24.6–34.4	29.3 ± 4.9	35.1–36.9	35.9 ± 0.9
UAL	47.7–51.3	49.3 ± 1.8	51.4–53.9	52.3 ± 1.3	53.6–57.7	55.2 ± 2.2	50.6–58.2	55.2 ± 4.0
LAL	53.1–58.8	55.9 ± 2.8	55.3–59.6	57.3 ± 2.1	59.1–68.8	65.3 ± 5.4	61.6–69.1	66.5 ± 4.2
PAL	52.1–59.2	55.3 ± 3.6	59.6–59.9	59.7 ± 0.2	56.3–63.6	61.1 ± 4.1	56.6–61.8	59.7 ± 2.7
TAL	711.7–814.3	762.8 ± 51.6	660.8–708.8	684.8 ± 33.9	904.2–1007.8	945.8 ± 54.7	880.2	880.2
SUP	9–10		9–10		9–1		8–10	
INF	9–10		8–9		8–9		8–9	
CR	7–9		7–8		7–8		8–9	
MBS	46–50		52–54		44–53		47–52	
DS	12–15		12–15		13–15		12–14	
MVS	68–79		86–94		75–87		78–82	
SDL	27–32		36–38		30–32		36–38	

Taxonomy

***Calotes pethiyagodai* sp. nov. Amarasinghe, Karunarathna & Hallermann**
(Figs. 1–4, 7; Tables 1, 2)

Holotype. Male, WHT6211, 91.8 mm SVL, near Midland Estate, Knuckles, Sri Lanka, 7°31'N, 80°44' E, alt. 915 m, coll. M. M. Bahir, A. Silva & K. Maduwage, 24 IX 2004.

Paratypes. Male, WHT6154A, 91.3 mm SVL, Midlands Estate-Knuckles, alt. 915 m, coll. M. M. Bahir & M. Meegaskumbura, 5 VI 2004; Male, WHT6241, 88.9 mm SVL, Cobet's Gap-Knuckles, alt. 1,000, coll. K. Manamendra-Arachchi & M.M. Bahir; Males, ZSM 215/1981/3–4, 59.4 mm SVL (sub adult), 76.8 mm SVL, Gammaduwa-Knuckles, W. Erdelen, 21 VI 1980; Male, ZSM 216/1981/1, 86.1 mm SVL, Cobet's Gap-Knuckles, W. Erdelen, 27 VI 1980; Male, ZSM258/1979, 76.3 mm SVL, Cobet's Gap-Knuckles, W. Erdelen, 01 IV 1979; Males, ZSM 218/1981/1–3, 81.5 mm SVL, 85.5 mm SVL, 76.7 mm SVL, Midcar-Knuckles, W. Erdelen, 05 XII 1979; Female, WHT 6154B, 80.8 mm SVL, Midlands Estate-Knuckles, alt. 915 m, coll. M. M. Bahir & M. Meegaskumbura, 5 VI 2004; Female, WHT106A, 78.9 mm SVL, Gammaduwa Estate-Knuckles, alt. 915 m, coll. K. Manamendra-Arachchi & D. Gabadage, 23 X 1993; Female, WHT1435, 77.2 mm SVL, Midlands Estate-Knuckles, coll. D. Gabadage & M.M. Bahir, 3 IX 1996. Females, ZSM 215/1981/1–2, 75.8 mm SVL, 78.3 mm SVL, Gammaduwa-Knuckles, W. Erdelen, 21 VI 1980; Female, ZMH R06165, 76.5 mm SVL, Gammaduwa-Knuckles, W. Erdelen, 7°34'00"N 80°42'00"E, coll. W. Erdelen, 1972; Female, ZSM 217/1981, 66.5 mm SVL, Cobet's Gap-Knuckles, W. Erdelen, 19 VI 1979; Females, ZSM 218/1981/4–5, 71.8 mm SVL, 55.8 mm SVL (sub adult), Midcar-Knuckles, 05 XII 1979.

Diagnosis. Males of *C. pethiyagodai* **sp. nov.** differ from the males of *C. liocephalus* by the absence of a gular pouch (vs. present); mid gular scales smaller (vs. equal or larger) than the scales besides; scales on snout larger (vs. smaller) than the scales on occipital and forhead; pectoral scales not enlarged (vs. enlarged); subcaudals elongated (vs. shortened); abdominal scales partially and slightly carinate, and acuminate (vs. completely and strongly carinate, and mucronate); scales on venter somewhat larger in size than those on dorsum at same level (vs. smaller); tubercle like spine above the tympanum, one (vs. two); axila–groin, tibia, forth toe, upper arm, and snout, longer (151.4–153.3%, 69.4–73.7%, 63.0–75.7%, 51.4–53.9%, and 36.6–37.9% of HL respectively) vs. shorter (109.4–129.7%, 65.5–67.9%, 51.9–59.7%, 47.7–51.3%, and 27.8–33.7% of HL respectively); larger eye, diameter 28.7–29.5% of HL (vs. smaller, diameter 26.6–28.5% of HL); mid body scales, 50–54 (vs. 46–50); and subdigital lamellae, 36–38 (vs. 27–32). *C. pethiyagodai* **sp. nov.** further differs from congeners by the following opposing characters of Sri Lankan and Indian species of the genus *Calotes*; *C. andamanensis*: enlarged keeled scales on ventral surface of thigh; *C. aurantolabium*: shoulder pit absent; *C. rouxii*: two small groups of spines on each side of the neck; *C. calotes*, *C. grandisquamis*, *C. jerdoni*, *C. nemoricola*, *C. versicolor*: lateral scales directed backwards and upwards; and *C. ceylonensis*, *C. desilvai, C. elliotti*, *C.emma*, *C. liolepis*, *C. maria*, *C. nigrilabris*: well-developed spines above the tympanum.

Description. (Based on holotype). Fig. 1. An adult male, 91.8 mm SVL; head moderately large (HL 35.6% of SVL), elongate (HW 57.8% of HL), narrow (HW 20.6% of SVL), distinct from neck; snout elongate (ES 65.1% of HW); snout length greater than eye diameter (ED 77.2% of ES); interorbital distance narrow (IO 15.0% of HL); eye large (ED 29.0% of HL); pupil rounded; ear opening shallow, its greatest diameter dorsoventrally; smooth scales around ear; tympanum smaller than orbit (TYD 40.0% of ED); one tubercle like spine above the tympanum separated from the tympanum by three smaller scale rows; diameter of eyes greater than eye to ear distance (ED 128.4% TYE); forehead concave; scales on snout smooth, larger in size those of occipital region and forehead; scales on interorbital and supercillium area smooth; nuchal crest continue with dorsal crest and dorsal crest rudimentary, consist of 15 spines till the level of axilla; rostral scale width greater than its height, ventroposteriorly in contact with first supralabial, also in contact posteriorly with three equal sized postrostral scales; around nostrils on each side one supranasal, two postnasals, a prenasal and two subnasals; among postnasals the lower one being larger; nostrils oval and located slightly more posterior in an undivided nasal plate; canthus rostralis and supraciliary edges soft; 7 scales on canthus rostralis; parietal plate larger than adjacent plates, 11 scales around the parietal plate; Mental subtriangular, lengthen posteriorly, its length approximately equal to its width, posteriolaterally in contact with two enlarged postmentals separated by a smaller scale with no contact between them; each postmental pair bordered posteriorly by 3 smooth scales including the medial scale, but exclusive of

infralabial. No gular pouch; throat scales slightly keeled, bluntly pointed and overlapped; mid gular scales strongly keeled, smaller in size than those of besides, pointed and overlapped; five scale rows separate orbit from supralabials; supralabials 10 (7th in mid orbit position); infralabials 9, decreasing in size towards gape; ventral scales on the neck keeled, mucronate and overlapping.

Body slender (AG 53.9% of SVL); mid dorsal scales equal, smooth, with pointed dorsal scales at midbody; scales on dorsum at midbody smaller in size than those of venter at same level; lateral body scales keeled, smaller than dorsals; directed backwards and downwards; 54 scales around the midbody; pectoral scales not enlarged, keeled, pointed and overlapping; abdominal scales partially and slightly carinate, and acuminate, and keels forming regular and parallel continuous ventral ridges; ventrals, 88.

Forelimbs moderately short (LAL 19.7% of SVL, UAL 18.4% of SVL); hind limbs relatively long (TBL 24.7% of SVL, FEL 24.4% of SVL); tibia comparatively long (FEL 98.7% of TBL). Dorsal scales on fore and hind limbs keeled, overlapped; ventral scales on upper and lower arm keeled, overlapped, and pointed; scales on ventral surface of thigh strongly keeled, overlapped and pointed; keels on tibia forming a series of continuous parallel ridges. Digits elongate, slender, all bearing slightly recurved claws; claws are sharp and elongate; subdigital lamellae entire and regular, subdigital lamellae on toe IV, 36; inter-digital webbing absent; relative length of digits (fingers) 3 > 4 > 2 > 5 > 1; (toes) 4 > 3 > 5 > 2 > 1.

Tail complete (216.1 mm); tail base swollen, ventral scales on tail base bluntly pointed, keeled, overlapped; dorsal scales on tail pointed, elongate, overlapped, directed backwards, keels forming continuous parallel ridges; tail with subcaudals elongated, median row not enlarged, keeled, and overlapped.

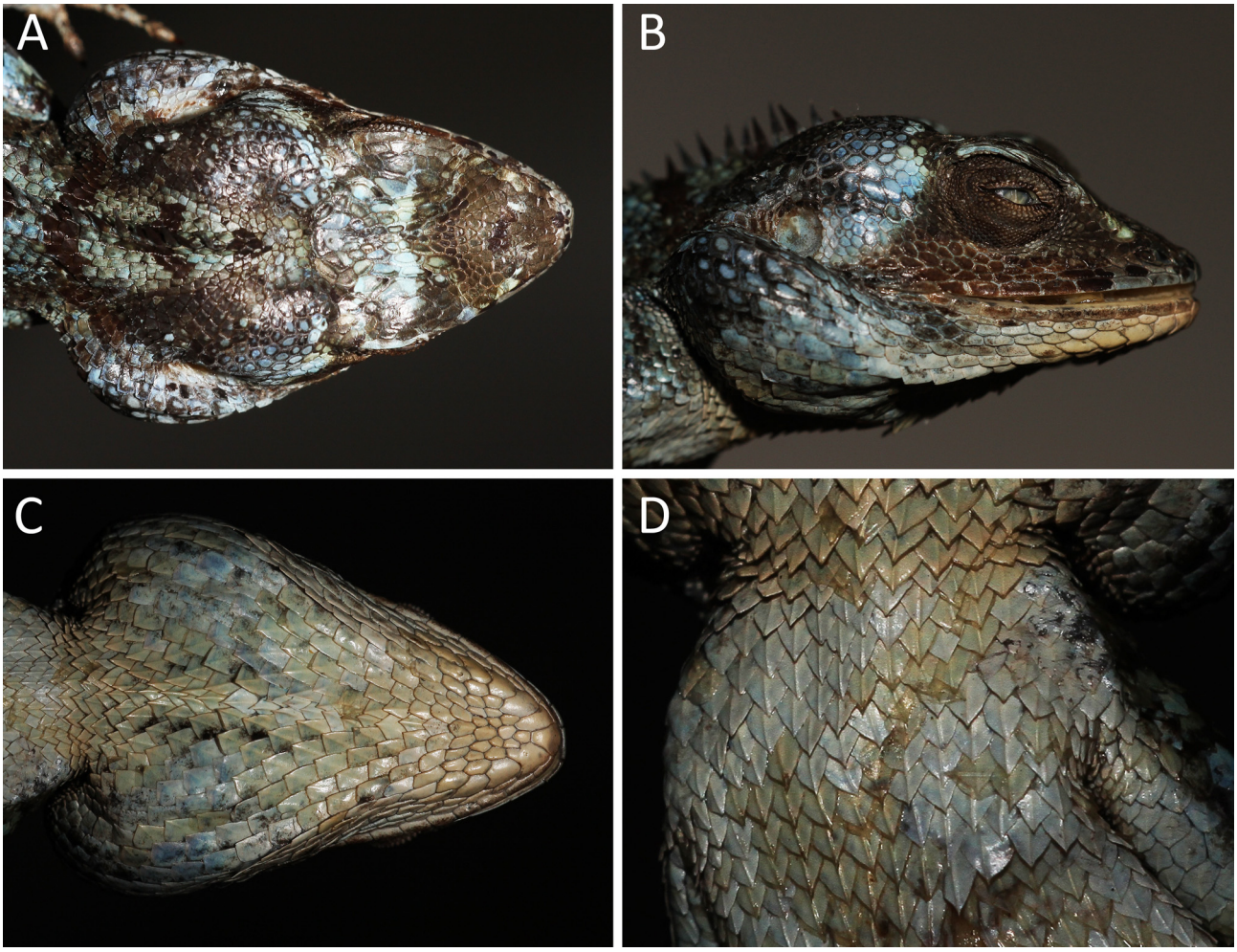

FIGURE 1. Holotype male (86.6 mm SVL) of *Calotes pethiyagodai* **sp. nov.**, WHT6211; *a*, dorsal head; *b*, lateral head; *c*, ventral head; *d*, pectoral scales: note greater snout scales and smaller occipital scales (*a*); longer snout (*b*); smaller mid gular scales (*c*), and not-enlarged pectoral scales (*d*), (Photos: M. De Silva).

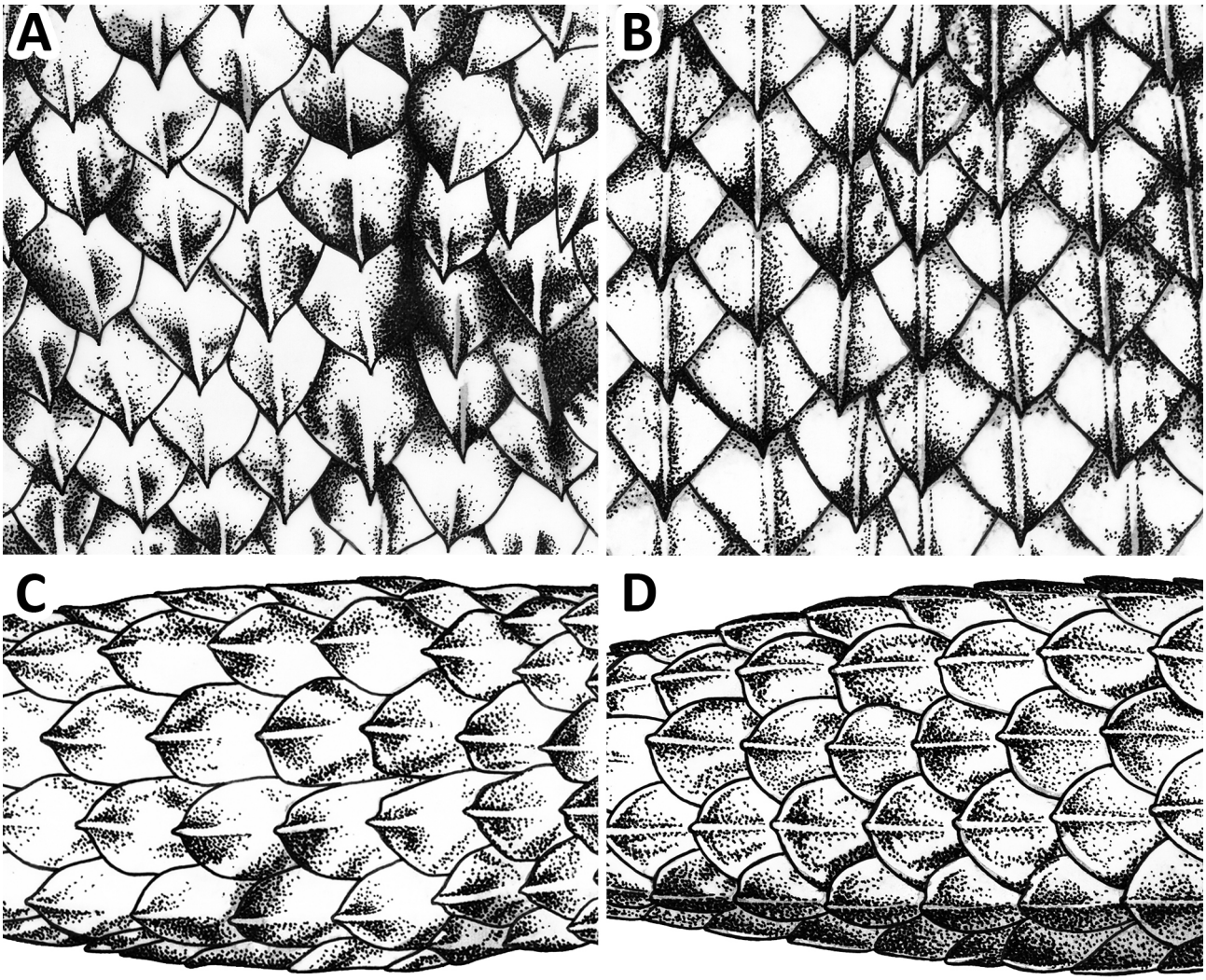

FIGURE 2. Scales on abdomen of; *a*, *Calotes pethiyagodai* **sp. nov.**, WHT6211, holotype (86.6 mm SVL) and; *b*, *Calotes liocephalus*, BMNH 1946.8.11.33, holotype (91.4 mm SVL): note partially and slightly carinate, and acuminate abdominal scales of *C. pethiyagodai* **sp. nov.** and completely and strongly carinate, and mucronate scales of *C. liocephalus*; subcaudals of; *c*, *Calotes pethiyagodai* **sp. nov.**, WHT6211, holotype (86.6 mm SVL) and; *d*, *Calotes liocephalus*, BMNH 1946.8.11.33, holotype (91.4 mm SVL): note elongate subcaudal scales of *C. pethiyagodai* **sp. nov.** and shortened scales of *C. liocephalus* (Illustration: A.A.T. Amarasinghe).

Measurements in millimetres. HL, 32.7; HW, 18.9; HD, 16.3; EN, 6.6; ES, 12.3; TYD, 3.8; IN, 7.4; IO, 4.9; TBW, 10.7; SVL, 91.8; AG, 49.5; TAL, 216.1; ED, 9.5; TYE, 7.4; UAL, 16.9; LAL, 18.1; FEL, 22.4; TBL, 22.7; FOL, 31.0; T1, 5.2; T2, 10.4; T3, 14.1; T4, 23.6; T5, 10.8.

Colour in preserved specimen. Dorsum greenish blue; 8 "V" shaped black markings along the vertebral, incomplete black cross bars on limbs; tail brownish, light coloured 8 cross bars; tail base olive green; venter light bluish white, throat white; palm cream colour; tympanum sky blue; shoulder pit brownish black.

Colour in life. Fig. 3. Based on personal observations of five males (not collected) from Riverstone-Knuckles; have dorsum bright green and colour can be bluish, or light brown in hind parts of the body, tail base olive green; around eight "V" shaped light blue or black coloured markings along the dorsal surface, incomplete greenish brown or black cross bars on limbs; two to six black cross bands between eyes; labials sky blue or yellowish green; tympanum light yellow; tail brownish, cream coloured or black 8–10 cross bars; venter bright yellow or creamy white, throat bright yellow, yellowish green or sky blue; palm dirty white. When aggressive: supralabials, around eye and tympanum darken and the rest of the body becomes dark brown. Juveniles are generally bright green in colour with brown tails, when disturbed: body colour they become dark brown.

Variation in male paratypes. dorsal crest consists of 6–13 spines up to the point of the axilla; 7–8 scales on canthus rostralis; 12 scales around the parietal plate; each postmental pair bordered posteriorly by 3 and 4 smooth

scales including the medial scale, but exclusive of infralabial; supralabials, 8–11; infralabials, 8–10; mid-ventral scale row, 65–94; subdigital lamellae on the toe IV, 36–38.

Description of female. (Based on paratype WHT 6154B). An adult female, 80.8 mm SVL; head moderately large (HL 32.5% of SVL), elongate (HW 55.5% of HL), narrow (HW 18.1% of SVL), distinct from neck; snout elongate (ES 71.2% of HW); snout length greater than eye diameter (ED 70.2% of ES); interorbital distance narrow (IO 17.5% of HL); eye large (ED 27.7% of HL); pupil rounded; ear opening shallow, its greatest diameter dorsoventrally; keeled scales around ear; tympanum smaller than orbit (TYD 54.8% of ED); one tubercle like spine above the tympanum separated from the tympanum by three smaller scale rows; diameter of eyes greater than eye to ear distance (ED 114.0% TYE); forehead concave; scales on snout keeled, larger in size those of occipital region and forehead; scales on interorbital and supercillium area keeled; nuchal crest continuous with dorsal crest and dorsal crest rudimentary, consist of 14 spines till the level of axilla; rostral scale width much greater than its height, ventroposteriorly in contact with first supralabial, posteriorly in contact with three equal sized postrostral scales; around nostrils on each side one supranasal, two postnasals, a prenasal and a subnasals; among postnasals the upper one is larger; nostrils oval located slightly more posterior in an undivided nasal plate; canthus rostralis and supraciliary edges soft; 8 canthus rostralis; parietal plate larger than adjacent plates, 11 scales around the parietal plate; Mental subtriangular, lengthen posteriorly, the width and length of which equal, posteriolaterally in contact with two enlarged postmentals separated by a smaller scale with no contact between them; each postmental pair bordered posteriorly by 3 smooth scales including the medial scale, but exclusive of infralabial. No gular pouch; throat scales slightly keeled, bluntly pointed and overlaped; mid gular scales slightly keeled, pointed and overlapped; three scale rows separate orbit from supralabials; supralabials 9 (7^{th} in mid orbit position); infralabials 9, decreasing in size towards gape; ventral scales on the neck keeled, mucronate and overlapping.

Body slender (AG 48.8% of SVL); mid dorsal scales equal, smooth, with pointed dorsal scales at midbody; scales on dorsum at midbody smaller in size to those of venter at same level; lateral body scales keeled, smaller than dorsals; directed backwards and downwards; 52 scales around the midbody; pectoral scales not enlarged, keeled, pointed and overlapping; abdominal scales partially and slightly carinate, and acuminate. Keels forming regular and parallel continuous ventral ridges; mid-ventral scale row, 78.

Forelimbs moderately short (LAL 20.0% of SVL, UAL 16.5% of SVL); hind limbs relatively long (TBL 26.8% of SVL, FEL 23.4% of SVL); tibia comparatively long (FEL 88.3% of TBL). Dorsal scales on fore and hind limbs slightly keeled, overlapped; ventral scales on upper and lower arm keeled, overlapped, and pointed; scales on ventral surface of thigh strongly keeled, overlapped and pointed; keels on tibia forming a series of continuous parallel ridges. Digits elongate, slender, all bearing slightly recurved claws; claws are sharp and elongate; subdigital lamellae entire and regular, subdigital lamellae on the toe IV, 36; inter-digital webbing absent; relative length of digits (fingers) 3 > 4 > 2 > 5 > 1; (toes) 4 > 3 > 5 > 2 > 1.

Tail complete (231.5 mm); tail base swollen, ventral scales on tail base bluntly pointed, keeled, overlapped; dorsal scales on tail pointed, elongate, overlapped, directed backwards, keels forming continuous parallel ridges; tail with subcaudals elongated, median row not enlarged, keeled, and overlapped.

Variation in female paratypes. dorsal crest consists of 5–13 spines up to the point of the axilla; 7–9 scales on canthus rostralis; supralabials, 8–11; infralabials, 8–10; mid-ventral scale row, 65–94; subdigital lamellae on the toe IV, 36–38.

Etymology. The species epithet is an eponym latinized in the genitive singular, honouring Tilak Rohan David Pethiyagoda (Pethiyagoda, R.), a Rolex awarded conservationist and the founder of the Wildlife Heritage Trust of Sri Lanka (WHT), for his dedication and contribution to biodiversity conservation in Sri Lanka; his leading contribution to herpetological and ichthyological explorations in the Indian Subcontinent; and the great work he has done in order to restore and preserve the forests in the central highlands is highly commendable. His contributions are extremely important and they undoubtedly inform the many new taxonomists emerging out of India and Sri Lanka, especially at a time such as now when new taxonomists are very much in demand. Suggested English name: Pethiyagoda's Crestless Lizard; Sinhala (local) name: Pethiyagodagë Nosilu Katussa; Tamil (local) name: Pethiyagodavin Oonan.

Distribution and habitat. Fig. 4. We have observed a number of live specimens (not collected) from Riverstone (1200 m elevation), Dotalugala (~1500 m elevation), Gammaduwa (~900 m elevation), Kobonilagala (1400 m elevation), Rangala (1400 m elevation), Cobet's Gap (1000 m elevation) and Thangappuwa near Cobet's Gap (1000 m elevation) of the Knuckles massif.

FIGURE 3. A live adult male (86.6 mm SVL) of *C. pethiyagodai* **sp. nov.** (not collected) at 1300 m elevation of the Knuckles (Photo: V. Weeratunge).

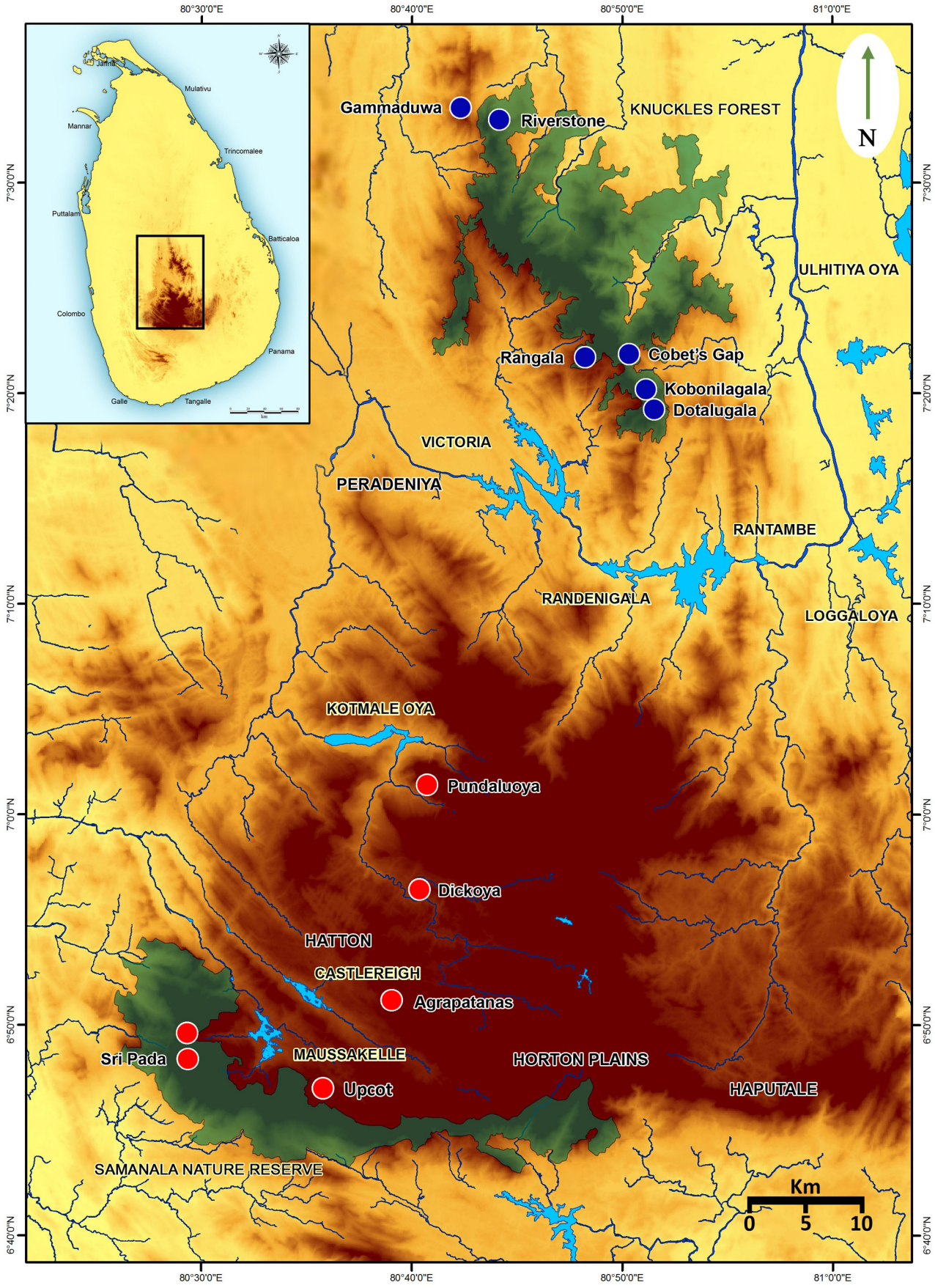

FIGURE 4. Distribution map of *C. liocephalus* (red), and *C. pethiyagodai* **sp. nov.** (blue) based on examined specimens and personal observations made over the past 10 years.

The habitats where *C. pethiyagodai* **sp. nov.** occurs, is home to many medium canopy trees (~8 m) such as *Creteava religiosa*, *Phyllanthus indica*, *Sterculia foetida*, *Bombax ceiba*, *Dimocarpus longan*, *Palaquium hinmolpedda* and *Vitex altissima* species. The subcanopy level (~5 m) consists of *Breynia vitisidea*, *Miliusa indica*, *Pavetta indica* and *Streblus asper* species. Ground cover (~2 m) consists of *Begonia hirtella*, *Carex filicina*, *Carex jakiana*, *Curculio orchioides* and *Procris crenata* species. The Knuckles forest range is extremely wet throughout the year, with an average annual rainfall >4000 mm, though the lower eastern slopes are much drier. Most of the habitats had 50–65% (mean 57.7 ± 7.5%) canopy cover and the undergrowth consists of shrubs and herbs. The range of temperature and range of relative humidity are 25.5–26.8°C (mean 26.2 ± 0.7°C) and 65–74% (mean 69.0 ± 4.6%), respectively. The evergreen submontane forests represent the major natural vegetation type in the Riverstone area.

Natural history. This species seems to be extremely rare, but we have observed higher numbers of this species in the ecotone than in the dense forest. *C. pethiyagodai* **sp. nov.** is sympatric with *Calotes* cf. *liolepis* (see Amarasinghe *et al*. 2014), *Ceratophora tennentii* (see Pethiyagoda & Manamendra-Arachchi 1998) and *Cophotis dumbara* (see Manamendra-Arachchi *et al.* 2006; Samarawickrama *et al.* 2006). During the mid-day time, most individuals prefer to inhabit trees (>3 m from the ground level) in shady areas, in the early morning and at night they are found on shrubs (~2 m). Juveniles are usually found on shrubs (~1 m), especially basking in the sun between 9:00–11:00 hr as bright sunlight is not very common in the Knuckles. We observed predation on dragonflies, butterflies, and moths. This species is a fast moving agamid, well adapted to climbing trees and it also jumps from one shrub to another (~1 m distance). The ovipositional behaviour of *C. liocephalus* described by Amarasinghe & Karunarathna (2008) in the Knuckles also refers to *C. pethiyagodai* **sp. nov.**

TABLE 2. External morphological character variation in Sri Lankan *Calotes* based on examined specimens (modified after Bahir & Maduwage 2005)

character	*C. calotes*	*C. versicolor*	*C. ceylonensis*	*C. liolepis*
gular pouch	present	present	absent	present
lateral body-scale orientation (backwards)	upwards	upwards	straight	downwards
Shoulder pit	present	absent	present	present
supratympanic spines	single continuous row	two clusters	two clusters	two clusters
size of ventral scales relative to dorsals	similar	smaller	smaller	smaller
scales on ventral thigh	keeled	keeled	smooth	keeled

TABLE 2. (Continued).

character	*C. desilvai*	*C. pethiyagodai* **sp. nov.**	*C. liocephalus*	*C. nigrilabris*
gular pouch	present	absent	present	present
lateral body-scale orientation (backwards)	downwards	downwards	downwards	downwards
Shoulder pit	present	present	present	present
supratympanic spines	two clusters	absent	absent	single continuous row
size of ventral scales relative to dorsals	smaller	larger	smaller	larger
scales on ventral thigh	smooth	keeled	keeled	keeled

Calotes liocephalus **Günther, 1872**

(Figs. 2, 4–7; Tables 1, 2)

Holotype. BMNH 1946.8.11.33, adult male, SVL 91.4 mm, collected from Sri Lanka by G. H. K. Thwaites; date unknown.

Measured voucher specimens. Male, (NMB 3353), 78.8 mm SVL, Talawakelle-Dickoya. Male, (BMNH

95.7.24), 85.8 mm SVL, Pundaluoya. Male, WHT6504, 89.3 mm SVL, Agrapatanas. Male, (ZSM 219/1981), 90.1 mm SVL, Upcot (6°46′56″N, 80°37′32″E). Female, WHT6503, 79.3 mm SVL, Agrapatanas. Female, (WHT1667), 86.8 mm SVL, Moray Estate, Rajamally. Female, NMB3354, 63.9 mm SVL, Talawakelle-Dickoya.

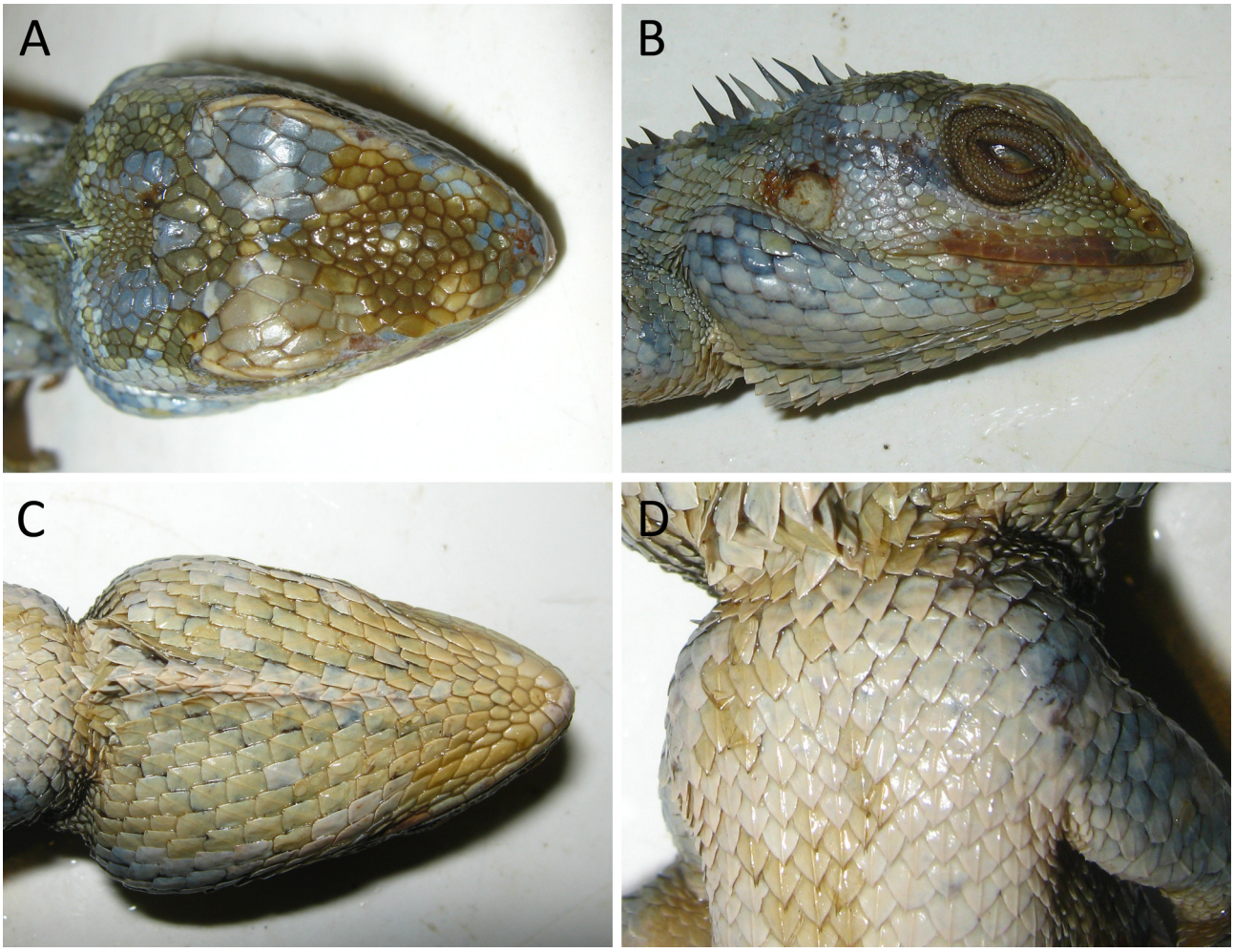

FIGURE 5. Holotype male (91.4 mm SVL) of *Calotes liocephalus*, BMNH 1946.8.11.33; *a*, dorsal head; *b*, lateral head; *c*, ventral head; *d*, pectoral scales: note greater snout scales and occipital scales (*a*); shorter snout (*b*); larger mid gular scales (*c*), and enlarged pectoral scales (*d*) respectively (Photos: A.A.T. Amarasinghe).

Description. (Based on holotype). Fig. 5. An adult male, 91.4 mm SVL; head moderately large (HL 35.3% of SVL), elongate (HW 66.2% of HL), narrow (HW 23.4% of SVL), distinct from neck; snout elongate (ES 22.0% of HW); eye diameter greater than snout length (ED 183.0% of ES); interorbital distance narrow (IO 14.5% of HL); eye large (ED 26.6% of HL); pupil rounded; ear opening shallow, its greatest diameter dorsoventrally, around ear with keeled scales, tympanum smaller than orbit (TYD 57.0% of ED); two tubercle like spines above the tympanum separated from the tympanum by four smaller scale rows; diameter of eyes greater than eye to ear distance (ED 119.4% TYE); forehead concave; scales on snout smooth, similar in size to those of occipital region and forehead; scales on interorbital and supercillium area smooth; nuchal crest continuous with dorsal crest and dorsal crest rudimentary, consist of 14 spines till the level of axilla; rostral scale with equal width and height, ventroposteriorly in contact with first supralabial, contacted posteriorly 3 equal sized postrostral scales, but exclusive of prenasals; around nostrils on each side one supranasal, two postnasals, one prenasal and two subnasals; among postnasals the lower one is larger; nostrils oval located slightly more posterior in an undivided nasal plate; canthus rostralis and supraciliary edges soft; 8 scales on canthus rostralis; parietal plate larger than adjacent plates, 11 scales around the parietal plate; Mental subtriangular, lengthen posteriorly, posteriolaterally in contact with two enlarged postmentals separated by a smaller scale preventing contact between them; each postmental pair bordered posteriorly by 3 smooth scales including the medial scale, but exclusive of infralabial. Gular pouch present; throat scales keeled; mid gular scales equal in size with those besides, strongly keeled,

pointed and overlapping; 3 scale rows separate orbit from supralabials; supralabials 10 (8th in mid orbit position) on left side; infralabials 9, decreasing in size towards gape; ventral scales on the neck keeled, pointed and overlapping.

Body slender (AG 45.8% of SVL); mid dorsal scales equal, keeled, with pointed dorsal scales at midbody; scales on dorsum at midbody larger in size with those of venter at same level; lateral body scales slightly keeled, smaller than dorsals; directed backwards and downwards; 46 scales around midbody; pectoral scales enlarged, carinate and overlapping; abdominal scales completely and strongly carinate, and mucronate, not enlarged, pointed, overlapped with keels forming regular, parallel, continuous ventral ridges; mid ventral scale row, 70.

Forelimbs moderately short (LAL 20.8% of SVL, UAL 16.8% of SVL); hind limbs relatively long (TBL 24.6% of SVL, FEL 64.1% of SVL); tibia comparatively long (FEL 92.0% of TBL). Dorsal scales on fore and hind limbs slightly keeled, overlapped; ventral scales on upper arm smooth and lower arm, keeled, overlapped, and pointed; scales on ventral surface of thigh slightly keeled, overlapped and pointed; keels on tibia forming a series of continuous parallel ridges. Digits elongate, slender, all bearing slightly recurved claws; claws are sharp and elongate; subdigital lamellae entire and regular, subdigital lamellae on the toe IV, 32; inter-digital webbing absent; relative length of digits (fingers) $4 \geq 3 > 2 > 5 > 1$; (toes) $4 > 3 > 5 > 2 > 1$.

FIGURE 6. A live adult male (104.9 mm SVL) of *C. liocephalus* (not collected) at 1500m elevations of Peak Wilderness (Photo: D. Samarasinghe).

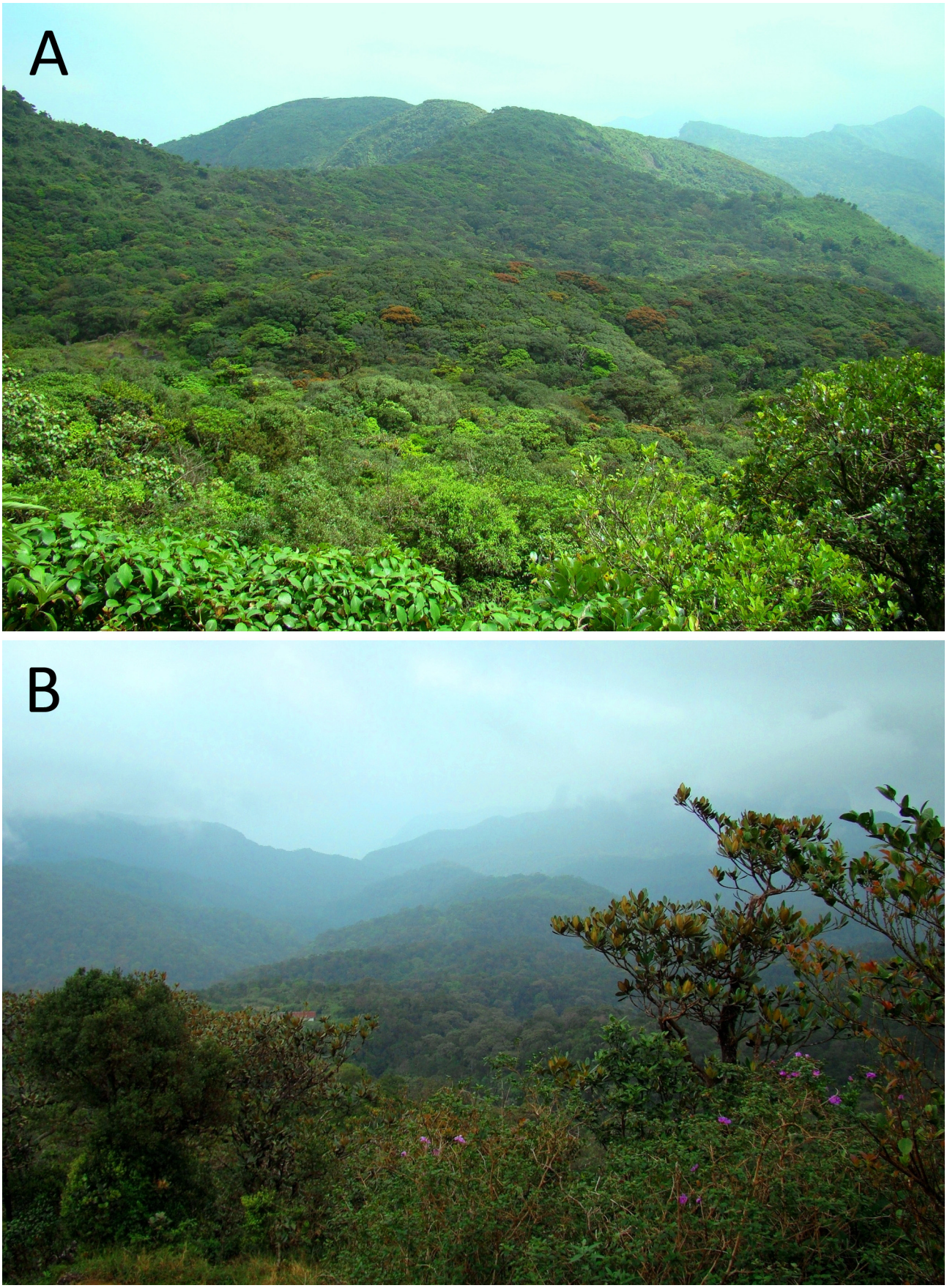

FIGURE 7. Habitat of; *a*, *C. pethiyagodai* **sp. nov.** at high elevations of the Knuckles massif; *b*, *C. liocephalus* at mid elevations of Peak Wilderness (Photos: W.M.S. Botejue).

Tail complete (258.0 mm); tail base swollen, ventral scales on tail base bluntly pointed, keeled, overlapped; dorsal scales on tail pointed, not elongate, overlapped, directed backwards, keels forming continuous parallel ridges; tail with subcaudals shortened, median row not enlarged, keeled, mucronate, overlapped.

Measurements in millimetres. HL, 32.3; HW, 21.4; HD, 18.2; EN, 6.2; ES, 4.7; TYD, 4.9; IN, 6.0; IO, 4.7; TBW, 9.4; SVL, 91.4; AG, 41.9; TAL, 258; ED, 8.6; TYE, 7.2; UAL, 15.4; LAL, 19.0; FEL, 20.7; TBL, 22.5; FOL, 31.0; TL1, 6.2; TL2, 8.1; TL3, 15.2; TL4, 19.3; TL5, 12.9.

Colour in preserved specimen. Head and dorsum bluish grey, posteriorly becomes brown; six "V" shaped lighter sky blue markings on the body posteriorly becoming brown, the first marking on the neck reaches the eye which is black in colour, across the tympanum; lighter cross marking on inter orbital; spines black grey and pale white in colour; limbs with darker 6–7 cross bars on each limb, but unclear markings on the hind limb; throat and gular are a pale sky blue colour; ventral surface of the limbs, pectoral region, abdomen, and ventral surface of tail pale white; shoulder pit sky blue in colour; dorsal surface of the tail base bright olive green and the rest pale grey.

Colour in life. Fig. 6. Based on personal observations of five males (not collected) from Peak Wilderness (1500–1800 m elevations); head and dorsum bright olive yellow, or light olive green, posteriorly becoming brown and grey; six "V" shaped dark chocolate brown markings on the body, the first marking on the neck continues to SUP under the eye across the tympanum; black colour markings on the supranasals, temporal, supracilliars and inter orbital; spines black and olive-yellow in colour; limbs with dark brown 6–7 cross bars on each limb; throat and gular pale white or very light sky bluish-white, with black, brown, grey colour with faint blotches; ventral surface of the fore limbs bright olive yellow and pectoral region bright orange-yellow or completely brownish orange; abdomen, ventral surface of thigh and ventral surface of tail are an off white colour with faint light brown markings; tibia an off white colour with light brown cross bars on the ventral surface; digits black with brownish-grey cross markings; tail brown in colour and with grey and dark brown markings.

Variation of males. Rostral scale width greater than its height; dorsal crest consists of 10–15 spines till the level of axilla; 7–9 scales on canthus rostralis; 9–10 scales around the parietal plate; each postmental pair bordered posteriorly by 4 smooth scales including the medial scale, but exclusive of infralabial (NHMW21097 has two medial scales); supralabials, 9–10; infralabials, 9–10; 48–50 scales around the midbody; ventrals, 64–79; subdigital lamellae on the toe IV, 27–32.

Description of female. (Based on WHT1667). An adult female, 86.8 mm SVL; head moderately large (HL 33.0% of SVL), elongate (HW 59.1% of HL), narrow (HW 19.5% of SVL), distinct from neck; snout elongate (ES 60.9% of HW); snout length greater than eye diameter (ED 82.5% of ES); interorbital distance narrow (IO 16.8% of HL); eye large (ED 29.7% of HL); pupil rounded; ear opening shallow, its greatest diameter dorsoventrally; keeled scales around ear; tympanum smaller than orbit (TYD 42.3% of ED); two tubercle like spines above the tympanum separated from the tympanum by four smaller scale rows; diameter of eyes greater than eye to ear distance (ED 132.8% TYE); forehead concave; scales on snout smooth, similar in size those of occipital region and forehead; scales on interorbital and supercillium area smooth; nuchal crest continuous with dorsal crest and dorsal crest rudimentary, consist of 10 spines till the level of axilla; rostral scale much wider than high, ventroposteriorly in contact with first supralabial, in contact posteriorly with four equal sized postrostral scales; around nostrils on each side one supranasal, two postnasals, two prenasal and a subnasals; the upper postnasals beings larger in size; nostrils round are located posteriorly in undivided nasal plate; canthus rostralis and supraciliary edges sharp; 7 canthus rostralis; parietal plate slightly larger than adjacent plates, 10 scales around the parietal plate; Mental subtriangular, lengthen posteriorly, about as long as wide, posteriolaterally in contact with two enlarged postmentals separated by a smaller scale with no contact between them; each postmental pair bordered posteriorly by three smooth scales including the medial scale, but exclusive of infralabial. No gular pouch; throat scales strongly keeled, bluntly pointed and overlaped; mid gular scales strongly keeled, similar in size to those of adjacent, pointed and overlapped; three scale rows separate orbit from supralabials; supralabials 9 (7^{th} in mid orbit position); infralabials 8, decreasing in size towards gape; ventral scales on the neck keeled, mucronate and overlapping.

Body slender (AG 52.6% of SVL); mid dorsal scales equal, keeled, with pointed dorsal scales at midbody; scales on dorsum at midbody larger in size to those of venter at the same level; lateral body scales smooth, smaller than dorsals; directed backwards and downwards; 52 scales around the midbody; pectoral scales not enlarged, keeled, pointed and overlapping; abdominal scales partially and slightly carinate, and acuminate, and keels forming regular and parallel continuous ventral ridges; ventrals, 78.

Forelimbs moderately short (LAL 19.5% of SVL, UAL 17.8% of SVL); hind limbs relatively long (TBL 26.5% of SVL, FEL 24.8% of SVL); tibia comparatively long (FEL 93.5% of TBL). Dorsal scales on fore and hind limbs smooth, overlapped; ventral scales on upper arm smooth and on lower arm keeled, overlapped, and pointed; scales on ventral surface of thigh slightly keeled, overlapped and pointed; keels on tibia forming a series of continuous parallel ridges. Digits elongate, slender, all bearing slightly recurved claws; claws are sharp and elongate; subdigital lamellae entire and regular, subdigital lamellae on the toe IV, 36; inter-digital webbing absent; relative length of digits (fingers) 3 > 4 > 2 > 5 > 1; (toes) 4 > 3 > 5 > 2 > 1.

Tail complete (231.5 mm); tail base swollen, ventral scales on tail base bluntly pointed, keeled, overlapped; dorsal scales on tail pointed, elongate, overlapped, directed backwards, keels forming continuous parallel ridges; tail with subcaudals shortened, median row not enlarged, keeled, and overlapped.

Variation of females. Dorsal crest consists of 13 and 15 spines up to the point of the axilla; 7 and 8 scales on canthus rostralis; supralabials, 11; infralabials, 9; 44 and 53 scales around the midbody; ventrals, 87; subdigital lamellae on the toe IV, 30.

Distribution and habitat. Fig. 4. We have observed live specimens (not collected) from Madahinna (~1500 m elevation), Haramitipana (1700 m elevation), and Dharmaraja gala (1600 m elevation) of the Peak Wilderness.

The habitats where *C. liocephalus* occur, is home to many large canopy trees (~30 m) such as *Adinandra lasiopetala*, *Bhesa ceylanica*, *Calophyllum trapezifolium*, *Cullenia ceylanica*, *Shorea affinis*, *S. gardneri*, *Litsea gardneri*, and *Palaquium rubiginosum* and subcanopy level (~15 m) consists of *Apodytes dimidiata*, *Artocarpus nobilis*, *Calophyllum walkeri*, *Caryota urens*, *Cinnamomum ovalifolium*, *Cryptocarya wightiana*, *Dillenia triquetra*, *Elaeocarpus amoenus*, *Eugenia mabaeoides*, *Garcinia quaesita*, *Gordonia speciosa*, *Madhuca moonii*, *Mesua ferrea*, *Oncosperma fasciculatum*, *Schumacheria alnifolia*, *Stemonoporus gardneri*, *S. oblongifolia*, *Syzygium firmum*, and *S. turbinatum*. Also ground cover (~3 m) consists of *Acronychia pedunculata*, *Agrostistachys coriacea*, *Alpinia abundiflora*, *Amomum echinocarpum*, *Amomum masticatorium*, *Amorphophallus paeoniifolius*, *Arundina graminifolia*, *Calanthes* sp., *Cinnamomum verum*, *Clusia rosea*, *Cyathea crinita*, *Hedychium coronarium*, *Hortonia ovalifolia*, *Ipsea speciosa*, *Macaranga indica*, *Neolitsea cassia*, *Osbeckia aspera*, *Osbeckia lantana*, *Rhodomyrtus tomentosa*, *Strobilanthes* sp., *Syzygium cordifolium*, *Syzygium revolutum*, and *Utricularia striatula*. Most of the habitats had 60–70% (mean 62.4 ± 4.7%) canopy cover and the undergrowth consists of shrubs and herbs. Average annual rainfall varies from 3,000–4,500 mm and the average annual temperature is 27.9°C. The range of temperature and range of humidity were 26.4–28.6°C (mean 27.3 ± 0.5°C) and 66–78% (mean 71.4 ± 3.2%), respectively.

Natural history. This species also seems to be extremely rare, but we have observed higher numbers of this species in the ecotone than in the dense forest. In Peak Wilderness (>1400 m elevations), *C. liocephalus* is sympatric with *Ceratophora stoddartii* and *Calotes calotes*, but allopatric with *C. nigrilabris* (see Amarasinghe *et al*. 2012). This species is a fast moving agamid. We have observed six ovipositioning at Peak Wilderness during October –November in 2010–2012. All the ovipositioning were observed during cool and shady weather conditions (cloud cover, 50–70%; canopy cover, 15–30%) during 10:00–15:00 hr (temperature, 26.4–28.2°C; humidity, 60–70%; light intensity, 5.3–7.3 lux). The soil was always soft-tan colouration and the leaf litter was usually 12–18 mm thick. The nest-holes were 52–58 mm (55 ± 2 mm) deep at an angle of 40–50° to the ground. The diameters of the holes were 32–38 mm (35 ± 2 mm) and the body pits were in 30–35mm radius (32 ±2 mm). This species lays 3–4 eggs at a time, and the eggs were 18.5–18.9 mm (18.7 ± 0.1 mm) in length and 10.1–10.4 mm (10.2 ± 0.1 mm) in width. The weight ranged between 1.4–1.8 g (1.6 ± 0.1 g) in a range. The incubation period varies from 65–72 days. The ovipositional behaviour of *C. liocephalus* is not described here.

Discussion

Günther (1872), in his original type description was obviously not absolutely clear of its precise locality, documenting that the specimens appear to have been collected chiefly in the neighbourhood of the locality named "Peradeniya district". All subsequent museum documents (the various catalogues including that of Boulenger and the specimen label jar itself) relating to this specimen lists the locality as "Ceylon" only. There are no further details for locality recorded in the museum. The collector, George Henry Kendrick Thwaites was appointed superintendent of the botanical gardens at Peradeniya, Sri Lanka from March 1849 until he retired in 1879 (Lee

1898). There remains the possibility of collecting a specimen around Peradeniya. Peradeniya "District" was restricted to a smaller administration division during 1849–1872. On the other hand, it is possible that the *C. liocephalus* holotype was actually collected somewhere else in the central highlands. There is no other record confirming *C. liocephalus*'distribution around Peradeniya except Deraniyagala (1953). We could not find any specimens collected from Peradeniya deposited either at NMSL or at BMNH. It is possible that Deraniyagala (1953)'s location in Peradeniya is anecdotal to Günther's (1872) statement. It is also a possibility is that Günther made the presumption that the specimen was collected from Peradeniya District, as it had been sent by G. H. K. Thwaits who worked in Peradeniya District, but in actual fact the specimen may have been collected from somewhere else. In 1860, G. H. K. Thwaites established chinchona nurseries at Hakgala (~1500 m elevation in central highlands) and he sent many specimens to England around 1869 (Lee 1898). The older catalogue number of the holotype of *C. liocephalus* (71.12.16.4) indicates the year of first registration 1871, Therefore there is a possibility that the specimen was collected around Hakgala.

Also it has been claimed that the species described from Kandy during the 19th century [e.g. *Adenomus kandianus* (Günther, 1872)], is currently not found in Kandy, but at higher elevations of Peak Wilderness in the central highlands (see Wickramasinghe *et al.* 2012). The morphological characters and morphometrics show that the holotype of *C. liocephalus* belongs to the central highland population, and not to the Knuckles range. Therefore we can confirm that the holotype of *C. liocephalus* was collected from central highland, but that the exact location or elevation cannot be confirmed for certain. Smith (1935) and Deraniyagala (1953) observed this species from Pandalu Oya (~1000 m), and Agrapatanas (~1500 m) in central highlands. However Erdelen (1984), and Manamendra-Arachchi & Liyanage (1994) recorded *C. liocephalus* (now *C. pethiyagodai* **sp. nov.**) only from the Knuckles range. In 1981, one specimen was collected from Upcot (ZSM219/1981) and in 2005, two specimens from Agrapatanas (WHT6503 and WHT6503). In addition, Amarasinghe *et al.* (2009) reported *C. liocephalus* from 800–2000 m at Peak Wilderness (the elevation should be corrected as above 1400 m). Even though, Erdelen (1984) recorded *C. liocephalus* (now *C. pethiyagodai* **sp. nov.**) at 800 m elevations, we failed to record any below 900m. This may be due to habitat destruction in the Knuckles over the past three decades. In addition, the population in Pundaluoya, which is known from BMNH95.7.24, Smith (1935), and Deraniyagala (1953)] and Dickoya (known from NMB3353–4) are known to be locally extinct the past 60 years.

It is also argued that "There may sometimes be stronger faunal differentiations between wet, dry, and cloud forest zones within Sri Lanka than between that island's dry zone and the dry region of South India" (Helgen & Groves 2005). Also the lowlands (~500m) of the Mahaweli River, appears to have served as a barrier (see Fig. 4) separating the central highlands from the Knuckles massif (Manamendra-Arachchi *et al.* 2006), and the Knuckles population is well separated from the river Mahaweli from the central mountain chain of the country (see the Fig.1 in Fernando *et al.* 2007). However, two isolated populations of *C. liocephalus* in the central highlands and the Knuckles massif occur and these have not been compared critically (Amarasinghe *et al.* 2009). Therefore, here we compare the specimens based on few available museum collections and based on the observations of live specimens from the Knuckles massif and Peak Wilderness. *C. liocephalus* and *C. pethiyagodai* **sp. nov.** are completely allopatric and isolated to small populations in two mountain ranges. This isolation has led to a significant morphological and morphometric variation between these two species.

We only had nine male specimens from the Knuckles and five males from the central highland to conduct this study. However, we feel it is useful to describe this species, *C. pethiyagodai* **sp. nov.** as it is significantly different, and we hope that future exploration will produce more individuals, and so we also recommend that this rare species should receive immediate conservation attention. Due to the lack of specimens to conduct enhanced statistically informative tests, the first two authors of this manuscript had requested permission twice from the Department of Wildlife Conservation (DWC). Permission was requested to collect only 3 individuals from the Knuckles massif and Peak Wilderness, but the applications were rejected (due to reasons other than the rarity of the species). The limited scientific capacity of DWC (Bahir & Gabadage 2009; Pethiyagoda *et al.* 2007), suggest that wildlife officials be immediately educated and that the department should be furnished with biology graduates (Pethiyagoda *et al.* 2007). Because of the reasons above, we found it absolutely necessary to describe this new species based on nine available male museum specimens (Appendix I) at WHT (now at NMSL), ZSM and ZMH, we only had five male specimens of *C. liocephalus* for the comparison. The massive effort we undertook tracking down European museum specimens which were collected from central highland proved unfruitful, despite the fact that the central highland population was first discovered nearly 150 years ago. Therefore, here we highlight the

importance of extensive field work. We also suggest that proper phylogenetic studies be carried out to further understand the biogeography of the genus *Calotes*. This is particularly necessary for the *C. liolepis* and *C. liocephalus* complexes (Erdelen 1984).

The results of the application of the IUCN Red List criteria (2001: Versions 3.1, 4.0, and 2013: version 10.1) shows that *C. pethiyagodai* **sp. nov.** is Endangered (EN) and *C. liocephalus* is Critically Endangered (CR). *C. pethiyagodai* **sp. nov.** is restricted to an area of occupancy (AOO) <25 km^2 (six spotting sites) and extent of occurrence (EOO) <180 km^2 in Knuckles massif [Applicable criteria is B2-b (iii)] with the same forest area. *Calotes liocephalus* is restricted to an area of occupancy (AOO) <15 km^2 (four spotting sites during the last 50 years) and extent of occurrence (EOO) <100 km^2 in Peak Wilderness, Upcot, and Agrapatanas [Applicable criteria is B1-b (i)] with the same area. See the map (Fig. 4) for distribution data of *C. pethiyagodai* **sp. nov.** and *C. liocephalus* in separate forest reserves.

Chena cultivations, illegal timber felling, encroachments, manmade fire, soil erosion, garbage dumping, habitat destruction, unplanned constructions, rock exploitations, illegal gem mining, and land fillings are all identified as main reasons for habitat loss and fragmentation in the Knuckles region (Amarasinghe & Karunarathna 2010; Lindström *et al.* 2012). These threats to *Calotes pethiyagodai* **sp. nov.** could be exacerbated by the surrounding cardamom cultivations that indiscriminately use pesticides (Bahir & Surasinghe 2005). Road kills are an additional threat to *C. pethiyagodai* **sp. nov.** (personal observations during the past decade in the Riverstone area). Specimens of *C. pethiyagodai* **sp. nov.** have been recorded by Amarasinghe *et al.* (2009) that were dead for reasons unknown. There are several previously unknown species awaiting description from the Knuckles massif (Amarasinghe *et al*. 2014) and they would be at risk of extinction before they are even described fully (Amarasinghe & Karunarathna 2010). Threats to the unique recognised biodiversity and the challenges to its conservation (Pethiyagoda 2012), demand urgent international and national level scientific attention, policy and planning (Pethiyagoda *et al.* 2007; Bahir & Gabadage 2009; Amarasinghe & Karunarathna 2010). Therefore, it is our own responsibility to conserve our natural heritage without any further delay.

Key to Sri Lankan species of genus *Calotes*

1.	Shoulder pit present	2
-	Shoulder pit absent	*C. versicolor*
2.	Row of well-developed, compressed spines above tympanum	3
-	Well separated, rudimentary or prominent spines above the tympanum	4
3.	Ventral scales larger than dorsal scales	*C. nigrilabris*
	Ventral scales smaller than dorsal scales	*C. calotes*
4.	Well separated spines prominent and developed	5
	Well separated spines rudimentary and tubercle like	7
5.	Lateral scales pointing backwards, and downwards	6
-	Lateral scales pointing backwards, and straight	*C. ceylonensis*
6.	Scales on ventral surface of thigh smooth	*C. desilvai*
	Scales on ventral surface of thigh keeled	*C. liolepis*
7.	Abdominal scales mucronate, pectoral scales enlarged	*C. liocephalus*
-	Abdominal scales acuminate, pectoral scales not enlarged	*C. pethiyagodai* **sp. nov.**

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APPENDIX I. Specimens examined.

***Calotes calotes*.** Male, (NRM 106), 112.0 mm SVL, Sri Lanka. Male, (WHT 108A), 85.8 mm SVL, Laggala–Knuckles. Male, (WHT 108B), 83.0 mm SVL, Laggala–Knuckles. Male, (WHT 182), 107.4 mm SVL, Puttalam. Male, (WHT 187), 128.4 mm SVL, Yatapatha (Lihinigala). Male, (WHT 188), 100.8 mm SVL, Yatapatha (Lihinigala). Male, (WHT 381A), 114.2 mm SVL, Warnagalla (near Erathne). Male, (WHT 616), 123.0 mm, Koskulana near Panapola.

***Calotes ceylonensis*.** Male, (NMB 3340), 81.9 mm SVL, Kumbukkan Oya. Male, (NMB 3341), 67.6 mm SVL, Northeastern Sri Lanka. Male, (WHT 7397), 59.1 mm SVL, Wasgamuwa. Male, (WHT 7514), 74.8 mm SVL, Giritale. Male, (WHT 1427A), 79.6 mm SVL, Wasgamuwa. Male, (WHT 1427B), 75.0 mm SVL, Wasgamuwa. Male, (WHT 1428), 80.3 mm SVL, Tatugala–Bulupitiya. Male, (WHT 0515), 72.9 mm SVL, Pallegama. Male, (WHT 1625A), 77.2 mm SVL, Wasgamuwa. Male, (WHT 1625B), 71.9 mm SVL, Wasgamuwa. Male, (WHT 0511), 82.5 mm SVL, Konketiya–Buttala. Male, (WHT 0522), 73.2 mm SVL, Konketiya–Buttala. Male, (WHT 0519), 73.0 mm SVL, Yala. Male (WHT 0520), 73.4 mm SVL, Yala. Male, (WHT 1624A), 65.1 mm SVL, Wasgamuwa.

***Calotes desilvai*.** Female, (WHT 1412), 59.2 mm SVL, Morningside. Female, (WHT 5998), 73.7 mm SVL, Morningside.

***Calotes liocephalus*.** Male, (BMNH 1946.8.11.33), 91.4 mm SVL, Sri Lanka. Male, (NMB 3353), 78.8 mm SVL, Talawakelle-Dickoya. Male, (BMNH 95.7.24), 85.8 mm SVL, Pundaluoya. Male, WHT6504, 89.3 mm SVL, Agrapatanas. Male, (ZSM 219/1981), 90.1 mm SVL, Upcot. Male, (NHMW21097), 97.0 mm SVL), Ceylon. Female, WHT6503, 79.3 mm SVL, Agrapatanas. Female, (WHT1667), 86.8 mm SVL, Moray Estate, Rajamally. Female, NMB3354, 63.9 mm SVL, Talawakelle-Dickoya.

***Calotes liolepis*.** Female, (BMNH 69.7.24.2), 76.7 mm SVL, Sri Lanka. Female, (NMB 3345), 75.8 mm SVL, Peradeniya. Female, (WHT 491B), 64.8 mm SVL, Kottawa. Female, WHT 495, 66.8 mm SVL, Kottawa. Female, (WHT 491A), 65.9 mm SVL, Kottawa. Female, (WHT499B), 69.8 mm SVL, Mederipitiya. Female, (WHT192), 76.6 mm SVL, Batadomabalena near Kuruwita. Female, (WHT1415), 63.1 mm SVL, Richmond Hill near Galle. Female, (WHT489), 68.8 mm SVL, Hapugala near Galle. Female, (WHT 176), 59.5 mm SVL, Dimbula near Kotagala. Female, (WHT 6162), 73.4 mm SVL, Kumaradola Group, Moneragala. Female, (WHT 6186), 77.4 mm SVL, Puwakpitiya. Female, (WHT 6184), 75.6 mm SVL, Puwakpitiya.

***Calotes nigrilabris*.** Male, (NHMW 23355), 99.8 mm SVL, Nuwara Eliya. Male, (WHT 380C), 87.9 mm SVL, Horton Plains. Male, (WHT 1555), 84.3 mm SVL, Hakgala. Male, (WHT 2262), 91.8 mm SVL, Hakgala**.**

***Calotes pethiyagodai*.** Male (WHT6211), 91.8 mm SVL, near Midland Estate, Knuckles. Male, (WHT6154A), 91.3 mm SVL, Midlands Estate-Knuckles. Male, (WHT6241), 88.9 mm SVL, Cobet's Gap-Knuckles. Female, (WHT 6154B), 80.8 mm SVL, Midlands Estate-Knuckles. Female, (WHT106A), 78.9 mm SVL, Gammaduwa Estate-Knuckles. Female, (WHT1435), 77.2 mm SVL, Midlands Estate-Knuckles. Male, (ZSM 215/1981/3–4), 59.4 mm SVL, 76.8 mm SVL, Gammaduwa-Knuckles. Male, (ZSM 216/1981/1), 86.1 mm SVL, Cobet's Gap-Knuckles. Male, (ZSM258/1979), 76.3 mm SVL, Cobet's Gap-Knuckles. Males, (ZSM 218/1981/1–3), 81.5 mm SVL, 85.5 mm SVL, 76.7 mm SVL, Midcar-Knuckles. Female, (WHT 6154B), 80.8 mm SVL, Midlands Estate-Knuckles. Female, (WHT106A), 78.9 mm SVL, Gammaduwa Estate-Knuckles. Female, (WHT1435), 77.2 mm SVL, Midlands Estate-Knuckles. Females, (ZSM 215/1981/1–2), 75.8 mm SVL, 78.3 mm SVL, Gammaduwa-Knuckles. Female, (ZMH R06165), 76.5 mm SVL, Gammaduwa-Knuckles. Female, (ZSM 217/1981), 66.5 mm SVL, Cobet's Gap-Knuckles. Females (ZSM 218/1981/4–5), 71.8 mm SVL, 55.8 mm SVL, Midcar-Knuckles. Juvenile (ZSM 214/1981), Gammaduwa-Knuckles. Juvenile, (ZSM 216/1981/2), Cobert's Gap.

Calotes versicolor. Male, (WHT 165), 95.0 mm SVL, Mousakanda–Knuckles. Male, (WHT 105), 81.5 mm SVL, Pallegama–Knuckles. Male, (WHT 384), 80.5 mm SVL, Peradeniya. Male, (WHT 382), 86.0 mm SVL, Warnagalla near Kuruwita. Male, (WHT 104), 94.6 mm SVL, Laggala–Knuckles. Male, (WHT 164A), 98.0 mm SVL, Mahapelassa near Kirinda. Male, (WHT 181), 119.0 mm SVL, Nagagamuwa–Puttalam. Male, (WHT 204), 125.3 mm SVL, Bundala–Hambantota. Male, (WHT 205), 101.0 mm SVL, Siribopura–Hambantota. Male, (WHT 199), 66.5 mm SVL, Pannipitiya–Maharagama.