

Conservation and distribution of the agamid lizards of Sri Lanka with illustrations of the extant species

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Abstract

Of the 13 species of agamid lizards in Sri Lanka, only *Calotes versicolor*, *C. calotes*, *C. nigrilabris*, *Sitana ponticeriana* and *Otocryptis wiegmanni* are considered not to be under threat. The populations of the other eight species are considered to be endangered, largely due to habitat loss by way of deforestation. The southwestern wet zone of Sri Lanka, the Knuckles range of hills and the highest (ca. 2,000 m elevation) hills of the central hill country are identified as the habitats associated most closely with the endangered species. These are also the habitats most at risk. Distribution maps based on recent observations and colour photographs of all the taxa have been provided in order to illustrate the zoogeography of this group in Sri Lanka and the taxa themselves.

KEYWORDS: Agamidae, *Calotes*, *Sitana*, *Otocryptis*, *Cophotis*, *Ceratophora*, *Lyriocephalus*, Sri Lanka, biogeography, conservation.

Introduction

Thirteen species of agamid lizards have been recorded from Sri Lanka (those marked with an asterisk are endemic in Sri Lanka): *Calotes versicolor* (Daudin, 1802), *C. calotes* (Linnaeus, 1758), *C. liocephalus* Günther, 1872*, *C. ceylonensis* (Müller, 1887)*, *C. liolepis* Boulenger, 1885*, *C. nigrilabris* Peters, 1860*, *Sitana ponticeriana* Cuvier, 1829, *Otocryptis wiegmanni* Wagler, 1830*, *Cophotis ceylanica* Peters, 1861*, *Ceratophora stoddarti* Gray, 1835*, *C. tennentii* Günther, 1861*, *C. aspera* Günther, 1864* and *Lyriocephalus scutatus* (Linnaeus, 1776)*. The genera *Ceratophora* Gray, 1834 and *Lyriocephalus* Merrem, 1820 are endemic in Sri Lanka. The distribution of *Cophotis* Peters, 1861 is discontinuous, the only other species of this genus being *C. sumatrana* Hubrecht, 1872, restricted to Sumatra and western Java.

The zoogeography of the Sri Lankan agamids has not been investigated up to now except by Erdelen (1978; 1984; 1989), who discussed mainly the population dynamics and distribution of the genus *Calotes* in Sri Lanka. The abundance and distribution of the other genera have also not been investigated, and the evidently restricted ranges of some of the species make imperative the early determination of their systematic status and zoogeography.

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A further obstacle to the popular understanding of Sri Lanka's Agamidae has been the lack of clear colour illustrations of all the species, enabling easy identification. We have here presented distribution maps for all 13 species based primarily on our own observations but showing also the localities of collection in the National Museum of Sri Lanka and those mentioned by Deraniyagala (1953).

Materials and methods

Specimens of agamid lizards were collected from throughout Sri Lanka except from the Northern and Eastern Provinces. After photography, voucher specimens were preserved and deposited in the collection of the Wildlife Heritage Trust of Sri Lanka, (WHT) Colombo, against reposition in the National Museum of Sri Lanka and the Department of Zoology, University of Peradeniya. Sampling methodology involved collecting all observed agamids in each of the 29 locations sampled, identifying them and preserving voucher specimens when the identity of a taxon was in doubt or where the collection was from an unusual or unexpected locality or habitat. Only a minimal number of voucher specimens were so preserved. All photographs were taken in life, and most were taken in the respective natural habitats of the various species. No chemical restraint was used.

Species were identified on the basis of the diagnoses and descriptions in Deraniyagala (1953) and Taylor (1953). The nomenclature used follows Welch (1990) and Daniel (1983). The lengths of specimens referred to, unless otherwise qualified, are snout-vent lengths. Elevations are given in metres above mean sea level. Unless otherwise qualified, all specimen lengths referred to are snout to vent (SV) lengths.

In Figures 1-6, the wet zone (rainfall $> 2,500$ mm yr⁻¹) is indicated in green; areas more than 500 m elevation above mean sea level are stippled.

NOTE ON AUTHORSHIP. The field work for this paper was done by both authors. All the photographs published here were made by the second author.

Results

Calotes versicolor (Figs. 1 & 7), the most common of the Sri Lankan agamids, occurs mainly in scrub jungle throughout the island except in elevations of more than ca. 1,000 m. Its frequency is highest in anthropogenic vegetation around human settlements. The species is largely arboreal. Conservation status: large, widely-dispersed, stable population.

Calotes calotes (Figs. 1, 8-10), the largest of the Sri Lankan agamid species, reaches a total length greater than 550mm. This species is largely arboreal and occurs throughout Sri Lanka up to elevations of ca. 1,500 m. It is more abundant in the wet zone than in the dry zone. In May, 1983 a female was observed at Sinharaja Forest laying six eggs in a 7 cm deep hole excavated by her. Conservation status: large, widely-dispersed, stable population.

Calotes liocephalus (Figs. 3, 11, 36), appears to be extremely rare and was recorded by us only from the forests of the Knuckles range. In life it is easily confused with *C. calotes* which it resembles closely except for the absence of supratympanic spines (present in *C. calotes*). Conservation status: very rare and

apparently restricted to parts of the Knuckles Range despite a much more extensive former distribution (Deraniyagala, 1953). The principal threat appears to be the from deforestation as a result of cardamom (*Elettaria cardamonium*) cultivation in much of its range.

Calotes ceylonensis (Figs. 2, 12, 13), was recorded by us only from the semi-evergreen monsoon forests of the dry zone. We failed to locate specimens in the vicinity of Kandy, despite an earlier record by Deraniyagala (1953). The type locality, "Kumbukan Aar [river], southwest Ceylon" is unclear, the only major river by this name being in southeastern Sri Lanka. Conservation status: rare.

Calotes liolepis (Figs.3, 14-16) has been recorded only from a few widely-separated localities in Sri Lanka, primarily heavily shaded areas of forest in the wet zone below ca. 1,000m elevation. Conservation status: endangered. Habitat (forest) loss appears to be the principal threat.

Calotes nigrilabris (Figs. 2, 17-19, 37) was recorded only from montane forests above ca. 1,000m elevation. This usually subarboreal species was observed spending much of its time on the ground in search of insects and worms. Conservation status: stable population. Erdelen (1984) observed that this was the only species of *Calotes* endemic in Sri Lanka that still occurred in man-modified habitats.

Sitana ponticeriana (Figs.4, 20-22), is (in Sri Lanka) restricted to warm lowland habitats and is most abundant in the drier coastal areas. It is primarily a ground-dwelling species (living in burrows) but is sometimes found on trees. *Sitana* is monotypic and greatly resembles *Otocryptis* except for the absence of the fifth toe. Males have a large gular sac extending to the base of the thorax. Conservation status: large, widely-dispersed, stable population.

Otocryptis wiegmanni (Figs. 4, 23, 24), occurs throughout the wet zone up to elevations of ca. 1,200m, but is commoner in rain forests than in coastal areas where it is encountered most frequently in the neighborhood of shaded forest streams. The species is ground-dwelling and runs bipedally. Males have a large gular sac. Conservation status: relatively large, widely-dispersed, stable population.

Cophotis ceylanica (Figs. 5, 25, 26, 35) is a rather slow-moving lizard found usually on moss-covered trees in mountain and cloud forest above 1,300m, observed both on trees and on the ground. Conservation status: endangered.

Ceratophora stoddarti (Figs. 6, 27-29, 35), was recorded only from the central hills above about 1,200m (pers. obs.; Erdelen, 1989). Males have an elongate rostral appendage. A slow-moving subarboreal species found on moss-covered tree trunks in mountain and cloud forest. In sampling known habitats in the month of December of the years 1989-1993 (usually very dry months), we failed to record any specimens. Conservation status: endangered.

Ceratophora tennentii (Figs. 6, 30, 31, 36) was recorded only from the Knuckles hills. The species was found only in forest underplanted with cardamom, on which, according to the local inhabitants, it feeds. Conservation status: endangered.

Ceratophora aspera (Fig. 6, 32), is the smaller member of the genus (we have not recorded specimens > 90mm total length). The species appears to be very rare and is restricted to the moist lowland and submontane dipterocarp forests

(Sabaragamuwa hills) below ca. 900 m. It is a slow moving, purely ground-dwelling lizard, most frequently found in pairs, occurring only in undisturbed patches of forest with heavy shade. Conservation status: endangered.

Lyriocephalus scutatus (Figs. 5, 33, 34) is restricted to elevations below approx. 1,650 m. It is a very slow-moving lizard found both on the ground and on trees. It was recorded only from forested areas with a dense canopy. Conservation status: endangered.

Discussion

Calotes versicolor, *C. calotes*, *C. nigrilabris*, *Sitana ponticeriana* and *Otocryptis wiegmanni* are the only Sri Lankan agamid lizards whose populations we consider are not in trouble. These four species are more or less capable of adapting to man-modified environments such as secondary forests, plantations etc. Of the four, only *C. nigrilabris* is endemic in Sri Lanka.

At present, *Calotes liocephalus* and *Ceratophora tennenti* appear to be restricted to the Knuckles hills, although both species formerly enjoyed a wider range (Deraniyagala, 1953). *Cophotis ceylanica* and *Ceratophora stoddarti* are found primarily in the highest montane forests of the central massif, including those around Nuwara Eliya and the Horton Plains. *Calotes liolepis*, *Ceratophora aspera* and *Lyriocephalus scutatus*, although being distributed throughout the south western wet zone, are restricted to patches of dense, high canopy natural forest. The populations of all these species are therefore restricted to discrete "land islands", the area and quality of each of which is threatened by deforestation. *Calotes ceylonensis* appears to be restricted to the dry zone and warrants concern.

The loss of adequate forest habitat is without doubt the most serious threat the agamid lizards face in Sri Lanka. Little is known of their biology, and many of the species are difficult to maintain and breed in captivity.

The Knuckles hills themselves have been identified as a biotope of great interest, and are host to a significant endemic fauna (Gurusinghe, (1988); Pethiyagoda, 1991). Vast expanses of these forests have been underplanted with cardamom during the past 30 years, and although the canopy appears to be good, the regeneration of natural forest has been almost completely inhibited (see Fig. 36). The long-term prospects for this habitat and its fauna are therefore not good.

Elsewhere in Sri Lanka too, the rate of deforestation has been very rapid. Gunatilake & Gunatilake (1983) estimated that only 9.1% of the island's wet zone was still forested as at 1983, and estimated that only 22% of this forest was undisturbed. The trend since then has not been positive, as most reforestation programmes have involved monocultures of exotic tree species. These forests tend to be "sterile" and do not lend themselves as habitats for the vertebrate fauna that inhabited the natural forests they have replaced (pers. obs.).

Official recognition of the critical conservation status of the Sri Lankan agamids has also been slow in coming. Only *Ceratophora tennenti* is listed in IUCN (1990), and even then, only as "threatened."

Unless urgent measures are taken to preserve the existing forest habitats of these taxa, their status will be critical and extinctions should be expected.

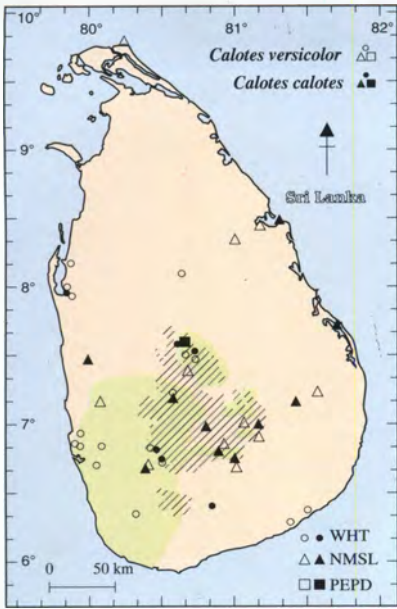


Figure 1. Distributions of *Calotes calotes* and *C. versicolor*.

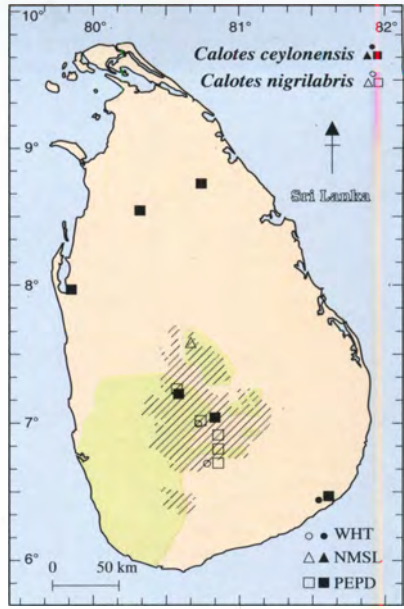


Figure 2. Distributions of *Calotes ceylonensis* and *C. nigrilabris*.

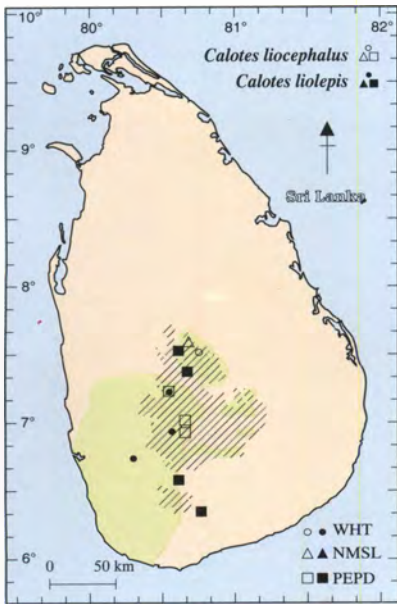


Figure 3. Distributions of *Calotes liocephalus* and *C. liolepis*.

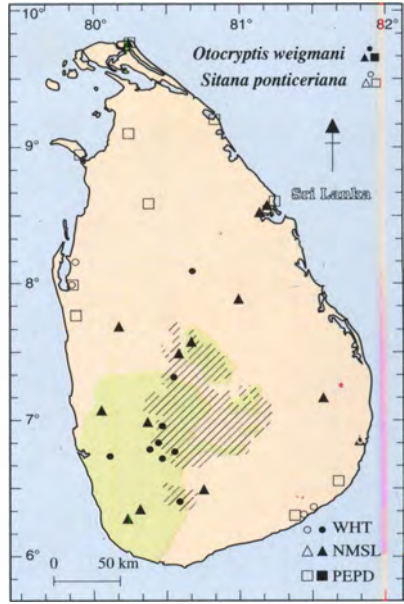


Figure 4. Distributions of *Sitana ponticeriana* and *Otocryptis weigmanni*.

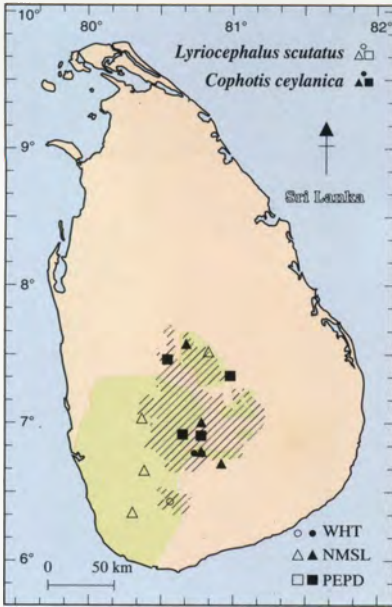


Figure 5. Distributions of *Cophotis ceylanica* and *Lyriocephalus scutatus*.

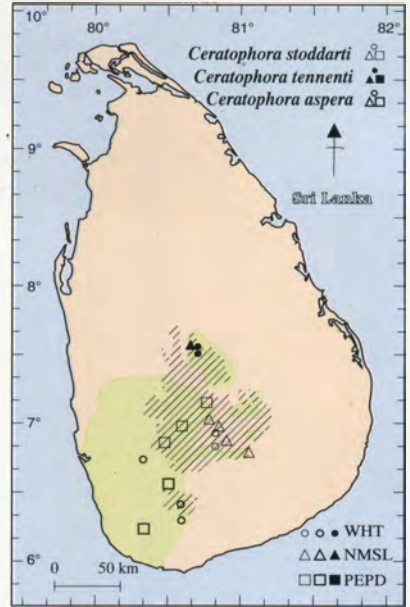


Figure 6. Distributions of *Ceratophora stoddarti*, *C. tennentii* and *C. aspera*.



Figure 7. *Calotes versicolor* male, WHT00181, SV: 119.0 mm.



Figure 8. *Calotes calotes* male, WHT 00182, SV: 107.4 mm.



Figure 9. *Calotes calotes* male, WHT 00182, SV: 107.4 mm.



Figure 10. *Calotes calotes*, female, WHT00107, SV: 101.5 mm.



Figure 11. *Calotes liocephalus*, juv., WHT00106B, SV: 44.3 mm.



Figure 12. *Calotes ceylonensis*, male, not preserved.

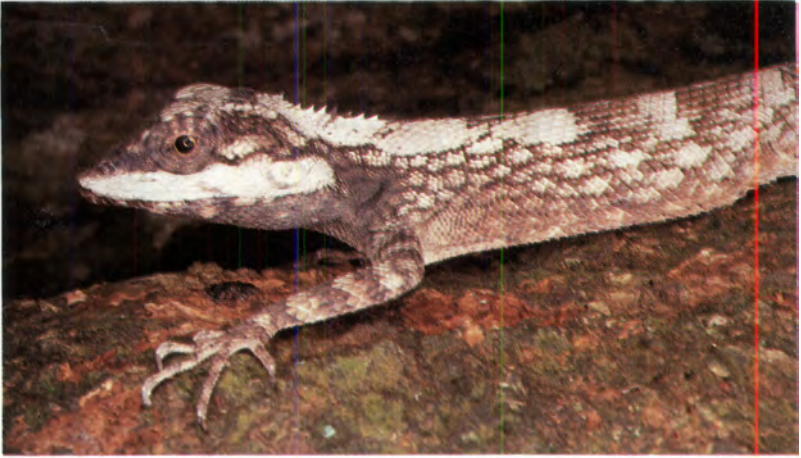


Figure 13. *Calotes ceylonensis*, male, not preserved.



Figure 14. *Calotes liolepis*, male, WHT00191, SV: 81.7 mm.



Figure 15. *Calotes liolepis*, male, WHT00191, SV: 81.7 mm.

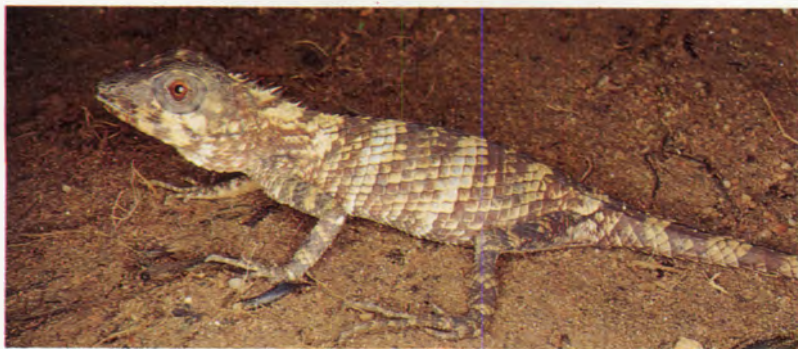


Figure 16. *Calotes liolepis*, female, WHT00192, SV: 74.2 mm.



Figure 17. *Calotes nigrilabris*, male, WHT00173A, SV: 104.5 mm.



Figure 18. *Calotes nigrilabris*, male, WHT00173A, SV: 104.5 mm.



Figure 19. *Calotes nigrilabris*, female, WHT00173B, SV: 80.9 mm.

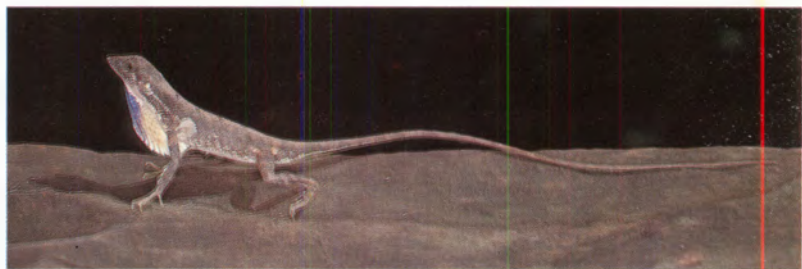


Figure 20. *Sitana ponticeriana*, male, WHT00174A, SV: 41.5 mm.

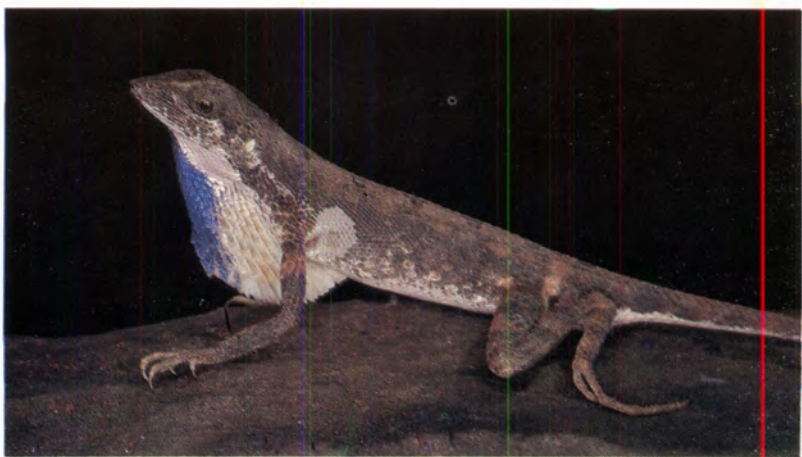


Figure 21. *Sitana ponticeriana*, male, WHT00174A, SV: 41.5 mm.



Figure 22. *Sitana ponticeriana*, female, WHT00111C, SV: 45.1 mm.

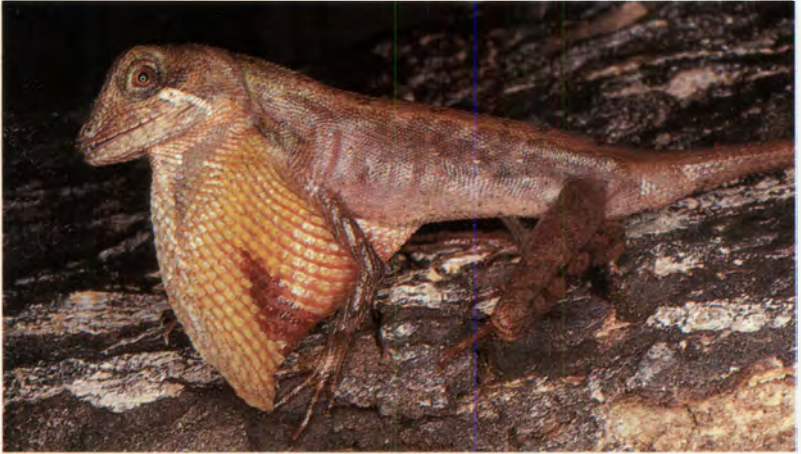


Figure 23. *Otocryptis wiegmanni*, male, WHT00109B, SV: 68.3 mm.



Figure 24. *Otocryptis wiegmanni*, female, WHT00109A, SV: 54.0 mm.



Figure 25. *Cophotis ceylanica*, female, WHT00177, SV: 56.7 mm.



Figure 26. *Cophotis ceylanica*, female, WHT00177, SV: 56.7 mm.

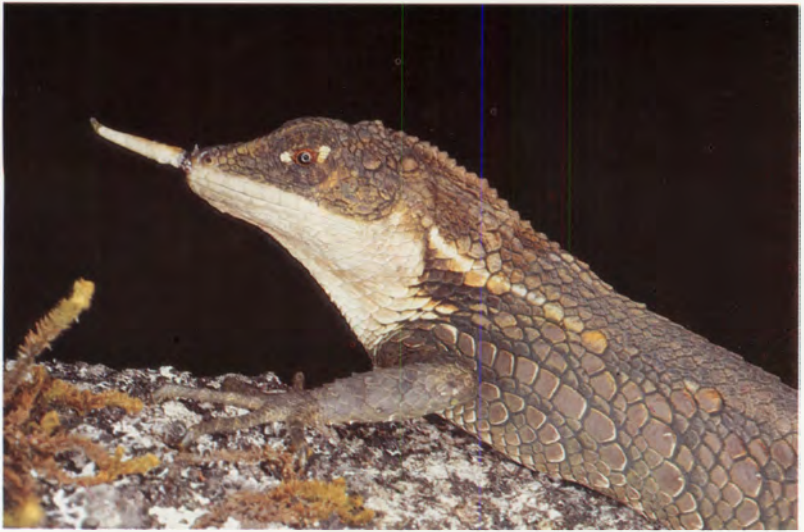


Figure 27. *Ceratophora stoddarti*, male, WHT00170A, SV:75.5 mm.



Figure 28. *Ceratophora stoddarti*, male, WHT00170A, SV:75.5 mm.



Figure 29. *Ceratophora stoddarti*, juv., WHT00170B, SV:30.0 mm.



Figure 30. *Ceratophora tennenti*, male, WHT00103A, SV: 59.1 mm.



Figure 31. *Ceratophora tennenti*, juv., WHT00103C, SV: 23.6 mm.



Figure 32. *Ceratophora aspera*, male, WHT00167, SV: 32.7 mm.



Figure 33. *Lyriocephalus scutatus*, female, WHT00175, SV: 115.7 mm.



Figure 34. *Lyriocephalus scutatus*, female, WHT00175, SV: 115.7 mm.



Figure 35. Horton Plains, elevation ca. 2,000 m a.s.l., habitat of *Cophotis ceylanica* and *Ceratophora stoddarti*.



Figure 36. Vegetation of Knuckles hills at Gammaduwa, habitat of *Calotes liocephalus* and *Ceratophora tennenti*; forest regeneration is inhibited, the existing canopy being underplanted with cardamom.



Figure 37. Horton Plains, habitat of *Calotes nigrilabris*.

Material examined

Calotes versicolor: WHT00104 ♂, 94.6mm, Laggala (Knuckles); WHT00105 ♂, 74.5mm, Pallegama (Knuckles); WHT00112 (J), 48.7mm, WHT00165 ♂, 93.5mm, Mousakanda-Gammaduwa (Knuckles); WHT00164A ♂, 98.0mm, WHT00164B (J), 28.8mm, WHT00164C (J), 34.6mm, Mahapelassa, near Kirinda; WHT00166 ♀, 69.7mm, Koskulana (Panapola); WHT00181 ♂, 119.0mm, WHT00183 ♀, 92.3mm, Puttalam; WHT00184 ♀, 86.5mm, Nagagamuwa (Puttalam); WHT00185 ♀, 77.0 mm, WHT00186 ♀, 75.0mm, Palavi (Puttalam); WHT00189 ♀, 83.1mm, Yatapatha (Lihinigala); WHT00193 ♀, 83.6mm, Attidiya-Bellanwila; WHT00194 ♀, 71.6mm, Nawalamulla (Migoda); WHT00204 ♂, 125.3mm, Bundala (Hambantota); WHT00205 ♂, 101.0mm, Siribopura (Hambantota); WHT00208 ♀, 72.0mm, WHT00220 (Juv.), 60.3 mm, Dombagaskanda (Ingiriya); WHT 00199 ♂, 66.5 mm, Pannipitiya (Maharagama); WHT00210 ♀, 76.7 mm, Borella, Colombo; WHT00376A ♂, 55.4mm, WHT00376B ♀, 83.4mm, Ritigala; WHT00382 ♂, 85.6mm, Warnagalla (near Erathne); WHT00384 ♂, 77.6mm, Peradeniya.

Calotes calotes: WHT00107 ♀, 101.5mm, Induruwa (Ratnapura); WHT00108A ♂, 85.8mm, WHT00108B ♂, 83.0mm, Laggala (Knuckles); WHT00182 ♂, 107.4mm, Puttalam; WHT00187 ♂, 128.4mm, WHT00188 ♂, 100.8mm, Yatapatha (Lihinigala); WHT00377 ♀, 99.8mm, Udawalawe; WHT00381A ♂, 114.2mm, WHT00381B (J), 49.2mm, Warnagalla (near Erathne).

Calotes liocephalus: WHT00106A ♀, 84.3mm, WHT00106B (J), 44.3mm, WHT00106C (J), 31.4mm, Mousakanda-Gammaduwa (Knuckles).

Calotes ceylonensis: uncatalogued, Mahapelassa, near Kirinda.

Calotes liolepis: WHT00176 ♀, 61.7mm, Bogahawatta (Dimbula); WHT00191 ♂, 81.7mm, Peradeniya; WHT00192 ♀, 74.2mm, Batadombalena (near Kuruvita).

Calotes nigrilabris: WHT00173A ♂, 104.5mm, WHT00173B ♀, 80.9mm, WHT00173C ♀, 68.9mm, WHT00173D ♀, 78.5mm, WHT00380A ♀, 76.8mm, WHT00380B ♀, 79.1mm, WHT00380C ♂, 94.1mm, Nagrak Division, Nonpareil Estate, adjoining Horton Plains; WHT00379 ♀, 78.2mm, Kuda-Oya (near Labugolla).

Sitana ponticeriana: WHT00111A ♀, 38.7mm, WHT00111B ♀, 42.5mm, WHT00111C ♀, 45.1mm, WHT00111D ♀, 38.9mm, WHT00111E ♂, 43.7mm, Nagagamuwa (Puttalam); WHT00174A ♂, 41.5mm, WHT00174B ♂, 39.5mm, WHT00174C ♀, 43.9mm, Palavi (Puttalam); WHT00195A ♀, 45.2mm, WHT00195B ♀, 45.2mm, Mahapelassa, near Kirinda; WHT00206A (J), 20.2mm, WHT00206B (J), 20.0mm, WHT00206C (J), 20.8mm, WHT00206D ♀, 43.5mm, WHT00206E ♀, 45.2mm, WHT00206F ♂, 48.8mm, WHT00206G ♂, 49.5mm, Siribopura (Hambantota).

Otocryptis wiegmanni: WHT00109A ♀, 54.0mm, WHT00109B ♂, 68.3mm, Induruwa (Ratnapura); WHT00113 ♂, 62.5mm, Kitulgala; WHT00168 ♀, 56.5mm, Beraliyakele (near Alpitiya); WHT00169A ♀, 58.2mm, WHT00169B (J), 29.1mm, WHT00169C (J), 21.3mm, WHT00171A ♂, 61.5mm, WHT00171B (J), 30.6mm, Silverkanda (near Deniyaya); WHT00172A ♀, 55.6mm, WHT00172B ♂, 64.4mm, WHT00172C ♂, 41.2mm, Koskulana (Panapola); WHT00219 ♀, 53.1 mm, Dombagaskanda (Ingiriya), WHT00239 ♂, 63.2mm, Peradeniya; WHT00375 (J), 21.3mm, Ritigala; WHT00383 (J), 22.9mm, Warnagalla (near Eratne).

Cophotis ceylanica: WHT00177 ♀, 56.7mm, Nagrak Division, Nonpareil Estate, adjoining Horton Plains.

Ceratophora stoddarti: WHT00170A ♂, 75.5mm, WHT00170B (J), 30.0mm, Nagrak Division, Nonpareil Estate, adjoining Horton Plains; WHT00209 ♀, 70.4 mm, Hakgala (Nuwara Eliya).

Ceratophora tennentii: WHT00103A ♂, 59.1mm, WHT00103B ♂, 65.9mm, WHT00103C (J), 23.6mm, Laggala (Knuckles); WHT00114A ♂, 64.2mm, WHT00114B ♂, 62.8mm, WHT00114C ♀, 71.9mm, WHT00114D ♀, 68.2mm, WHT00114E (J), 46.9mm, WHT00114F (J), 52.0mm, Mousakanda-Gammaduwa (Knuckles).

Ceratophora aspera: WHT00167 ♂, 32.7mm, Induruwa (Ratnapura); WHT00178 ♂, 31.2mm, Beraliyakele (near Alpitiya); WHT00190 ♀, 38.5mm, Silverkanda (near Deniyaya).

Lyricephalus scutatus; WHT00175 ♀, 115.7mm, Koskulana (Panapola).

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