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Dear Hamadryad Readers,

With this issue of Hamadryad, we come to a crossroads point, unsure whether we will be able to continue publishing or not. If we do, it will be online. But for the moment our excellent editors Prof Aaron Bauer and Dr Indraneil Das find themselves unable to sustain the piles of extra work this involves.

First, we at MCBT want to thank them both for the amazing job they've done. They began with, and sustained, such high standards that we don't now want to hand it over to lesser mortals. (And the mortals with similar herpetological backgrounds and depth simply don't have the time.) Between them, they have helped further the Croc Bank's reach, range and reputation. This morning, walking around our shelves of Hamadryad issues in the library, I thought, how does one thank this duo. This was of course mingled with a sadness that an important chapter is coming to an end. Thank you Aaron and Indraneil, for the wonderful service you have rendered. Thanks also to everyone who has been on the Editorial Board. Ashok Captain, Varad Giri, Patrick David and Stephen Mahony are among the more recent members who have provided thoughtful reviews and responded promptly to questions and requests.

All the Editorial Board members were great but even more important have been 1) authors, 2) reviewers, 3) many MCBT staff and passing volunteers, who were commandeered to help via proofing, copy editing, carrying journal loads for dispatch, etc. Our special thanks to Luk Gastmans who helped make it a modern journal, Harry Andrews, who somehow found the money to keep it going and the printers (Sudarshan Graphics and later, Auroville Press).

Hamadryad started its 40 year career in 1974, as a ragged, cyclostyled newsletter which I used to type on an old Smith-Corona typewriter at the Madras Snake Park. It was mainly a compilation of herpetological work being done at the Snake Park and reptile news from the sub-continent, courtesy of several correspondents in India as well as Nepal, Pakistan, Bangladesh, Myanmar, Bhutan and Sri Lanka. A few bad jokes were usually thrown in for good measure. Initially the stencils were sent out for cyclostyling but later we became the proud owners of a cyclostyling machine. On "printing" days, we would all be covered in black ink; humans, furniture, floor. A couple of years later we found a generous printer, who printed it for us almost pro bono. However, proof-reading was a laborious process because those were the days of manually fitting little brass letters together, often by people who were not literate in English. Since those seed days, there have been over 100 issues of Hamadryad, an innings we can be proud of.

Zai Whitaker, Director
Madras Crocodile Bank

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A taxonomically and biogeographically important new record of *Eugongylus* Fitzinger, 1843 (Scincidae: Lygosominae) from the Maluku Archipelago, Indonesia, and the status of *Lygosoma sulaense* Kopstein, 1927

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ABSTRACT.– **A newly discovered *Eugongylus* specimen from the Obi island group in the central Maluku Archipelago of Indonesia fills a gap in the known distribution of the genus, between the three previously described taxa from the Maluku Archipelago. The specimen is identified as *E. mentovarius* (Boettger, 1895) a species previously known only from the northern Maluku Archipelago, and its concordance with this species maintains the morphological distinction of *E. mentovarius* from the poorly known *E. sulaensis* (Kopstein, 1927), despite the specimen being geographically intermediate between the two taxa, providing evidence for the taxonomic distinction of the two species.**

KEYWORDS.– ***Eugongylus*, Indonesia, Maluku Archipelago, systematics, biogeography.**

Introduction

The systematics of the scincid lizard genus *Eugongylus* Fitzinger, 1843 remain poorly resolved. Two widespread species, *E. rufescens* (Shaw, 1802) and *E. albofasciolatus* (Günther, 1872) are generally recognised, but the distinction between these two species is subject to debate, particularly with respect to the presence of the latter species on the main island of New Guinea (de Rooij 1915; Adema 1968; Mys 1988; Zug 2013). If New Guinea mainland records of *E. albofasciolatus* are referable to *E. rufescens*, as implied by Mys (1988), the remaining distribution of *E. albofasciolatus* is peculiar, distributed on islands to the east (Solomon Islands and Bismark Archipelago, and further north in Micronesia and the Marshall Islands) and to the west (the Maluku Archipelago) of New Guinea, but not in intervening areas. The name *E. mentovarius* (Boettger, 1895) applies to the latter population, but the status of this taxon also remains uncertain, variously treated as a full species (de Rooij 1915; Mertens 1934), a subspecies of *E. albofasciolatus* (Sternfeld 1918; Brongersma 1948; Adema 1968; Monk *et al*. 1997) or not taxonomically distinguishable from *E. albofasciolatus* (Loveridge 1948). The status of two additional taxa, *Eugongylus sulaensis* (Kopstein, 1927) from the Sula Archipelago and *Eugongylus albofasciolatus poehli* Mertens, 1924 (a replacement name for *Lygosoma* (*Riopa*) *albofasciolatus boettgeri* Sternfeld, 1918, preoccupied by *Lygosoma* (*Emoa*) *boettgeri* Sternfeld, 1918) from Pohnpei in the Caroline Islands and Jaluit in the Marshall Islands is also unclear. The latter taxon, represented by populations from Micronesia, has also been variously assigned to nominate *E. albofasciolatus* (e.g., Schnee 1902; Brown 1956; Marshall 1975; Buden 1995, 1996, 1999, 2007, 2011a, 2011b; Zug 2013) or treated as a subspecies of *E. rufescens* (Adema 1968). More recently, an additional species, *Lygosoma* (*Homolepida*) *unilineatus* de Rooij, 1915, from northern New Guinea, was transferred to the genus from the distantly related *Sphenomorphus* (Greer & Shea 2000). It is only this latter species whose taxonomic distinction within the genus is clear.

Geographically, the three nominal taxa from the islands to the west of New Guinea have non-overlapping distributions. *Eugongylus mentovarius* has been recorded from Morotai, Halmahera and Ternate in the northern Maluku archipelago (Boettger 1895, 1902; de Rooij 1915; Brongersma 1948; Tanner 1950; Adema 1968), *E. sulaensis* was described from the Sula Islands in the western Maluku Islands, although it is not clear from which of the islands in that group the types were collected (Kopstein 1927), and *E. rufescens* has been recorded from Seram and Ambon in the southern Maluku archipelago (de Rooij 1915; Kopstein 1926; Adema 1968; Edgar & Lilley 1993), although de Rooij (1915) and de Jong (1928) also assigned to the latter species specimens from Lirung, Pulau (= Island) Salibabu, and Goenoeng Doeata (= Mount Duata), Pulau Karakelang (Karakelong), both in the Talaud Islands to the north of the Maluku Archipelago, an identification supported by Adema (1968) (see also Koch *et al*. 2009; Koch 2012). A *Eugongylus* population in the Palau Islands, even further to the north-east of the Maluku Archipelago, reported as *E. mentovarius* by Dryden and Taylor (1969), was not considered conspecific with that species by Crombie and Pregill (1999), but was also not assigned to any other taxon in the genus; Adema (1968) considered it to represent an undescribed subspecies of *E. rufescens*.

Until now, no *Eugongylus* has been recorded from Pulau Obi and its associated islands in the central Maluku Archipelago, geographically intermediate between the distributions of *E. mentovarius*, *E. sulaensis* and *E. rufescens*. The Obi group has rarely been visited by herpetologists; Barbour (1912) was apparently the first to make herpetological collections from it, reporting just four species of lizard: *Hemidactylus frenatus* Duméril & Bibron, 1836, *Lamprolepis smaragdina* (Lesson, 1829), *Lygisaurus novaeguineae* (Meyer, 1874) and *Emoia sorex* (Boettger, 1895) (the same list of species was provided by de Rooij (1915), presumably copying Barbour's work). More recently, there have been collections of varanids reported from the island (Koch & Böhme 2010; Weijola 2010), but the small lizard fauna remains poorly studied.

This paper reports the first *Eugongylus* specimen from the Obi group, and considers the taxonomic and biogeographic implications of this record.

Materials and Methods

Head scale definitions follow those of Taylor (1935). Measurements were made with a steel ruler for body and limb measurements (to the

Figure 1. Dorsal view of *Eugongylus mentovarius* AM R178570.

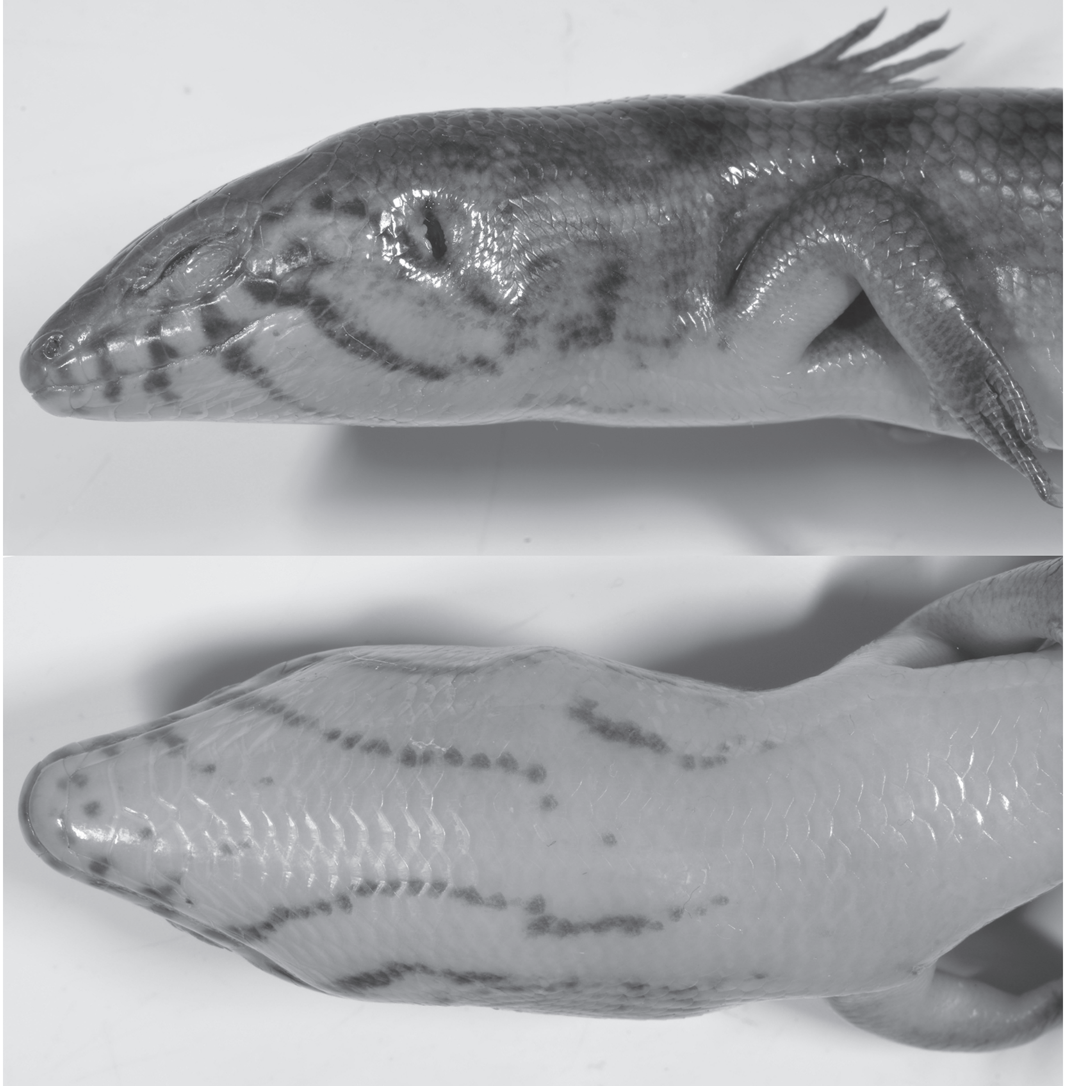

Figure 2. Lateral and ventral views of the head of *Eugongylus mentovarius* AM R178570.

nearest 0.5 mm), and with digital calipers (to the nearest 0.1 mm) for head measurements. Reference points for measurements follow Greer & Shea (2000).

Results

A single *Eugongylus* specimen (Australian Museum [AMS] R178570; Figs. 1, 2) was collected by Dr. Tim Flannery on Pulau Bisa (1°13’S 127°34’E), a small island on the north side of Pulau Obi, on 15 January 1991. This specimen (Figs. 1, 2) has the following characters useful in *Eugongylus* systematics:

Supranasals present, moderately separated on the midline; prefrontals moderately separated; supraoculars 4, first two contacting the frontal; supraciliaries 8L/7R (the lower count on the right seemingly due to fusion of the fourth and fifth scales in the left series); a single pair of nuchals; supralabials 8, with the sixth below the centre of the eye (on the right side, the fourth is excluded from the labial margin by contact of the third and fifth supralabials); first supralabial not fused to nasal; last two supralabials divided into upper and lower scales; primary temporal single; secondary temporals two, the upper overlapping the lower; ear with 4 lobules along anterior margin; infralabials 6; postmental contacting first two infralabials; first pair of chin shields in median contact, and laterally contacting infralabials; second pair of chin shields separated medially by a single scale, and separated laterally from infralabials by one row of oblique scales; third pair of chin shields only slightly larger than following scales, medially separated by a single scale, and separated laterally from infralabials by two rows of oblique scales; midbody scales *circa* 36 (there is some damage to the midventer of the specimen due to postmortem decomposition prior to preservation, precluding an accurate count in this region, but the count is certainly higher than 34); paravertebral scales from first scale posterior to parietal to last scale anterior to the level of the thighs 74 (78 to the level of the posterior margin of the thighs); subdigital lamellae below the fourth toe 17L/18R.

Snout-vent length (SVL) 130 mm, axilla-groin interval 71 mm (54.6% of SVL); forelimb length 28 mm (21.5% of SVL); hindlimb length 41 mm (31.5% of SVL); head length 23.2 mm (18.1% of SVL); head width 17.4 mm (75.0% of head length); head depth 13.5 mm (58.2% of head length).

The specimen is male (testes present and hemipenes extruded), and appears to be adult, although the testes are not markedly enlarged.

Head and body dorsum mid-brown with a dull metallic sheen, neck and anterior body with five broad pale brown bands, equal in width to the interspaces. A dark brown vertebral streak 11 scales long at the level of the forelimbs, preceded by a few obscure short dark brown streaks on the nape along the margins of the longitudinal scale rows.

Upper lip pale brown, with dark brown vertical bars extending ventromedially across the lower lip and onto throat as a series of narrow broken stripes. The stripe commencing below the eye is the longest. A narrow broken dark brown stripe from posterior canthus of eye, arcing caudoventrally and then ventrally, anteroventral to ear, and followed posteriorly by coarse brown marbling on sides of neck. Flanks grey-brown.

Venter pale yellow, junction between grey-brown flanks and pale venter not sharply defined.

Discussion

Before considering the identity of this specimen, it is important to recognise several difficulties with interpreting the literature on the morphology of *Eugongylus* species. Firstly, there is disagreement in the literature as to the number of supraocular scales present in the genus, either four (Ogilby 1890; Werner 1900; Greer & Shea 2000) or five (Boulenger 1887; Boettger 1895, 1902; Kopstein 1927; Kinghorn 1928; Brongersma 1948; Adema 1968). De Rooij (1915) gave four supraoculars for *E. unilineatus* (then in the subgenus *Homolepida* of *Lygosoma*) and five supraoculars for *E. albofasciolatus*, *E. mentovarius* and *E. rufescens* (then in the subgenus *Riopa*). This variation seems to be due to varying but unspecified definitions of supraocular scales. I adopt the definitions of Taylor (1935), which would give four supraoculars for all *Eugongylus* species, as in most skinks, followed posteriorly by a smaller scale, the lateral end of which is aligned with the supraciliary row, which Taylor defines as the last of the supraciliary scales (this is also in agreement with the illustrations of the head shields of *E. mentovarius* provided by Boettger 1902 and Tanner 1950). Greer (1983) provides an alternative nomenclature for this scale, referring to it as the anterior pretemporal. Use of Taylor's definitions here results in an increase in number of supracilaries by one scale from literature recognizing five supraoculars in this genus. Secondly, the number of transverse rows of scales along the vertebral line (often referred to as paravertebral scales) varies in the way it has been counted by different authors. While most modern authors on skink systematics begin the count with the first scale contacting the parietal scale, and hence including any enlarged nuchal scales in the count, some of the previous authors who have presented values for paravertebral scales in this genus state that their count is "from the nuchals", which I interpret to mean does not include the single pair of nuchal scales typical of *Eugongylus* species. I have hence added one scale to their counts. The posterior end of the paravertebral scale counts also varies among authors, either being to the anterior edge of the thighs (Adema 1968) or the "base of the tail" (Peters & Doria 1878; Burt & Burt 1932; Brongersma 1948). As the latter counts are greater than the former when given for the same taxon, I assume that counts to "base of the tail" are to the posterior margin of the thigh, and the tail is deemed to commence immediately posterior to the thighs (even though the "body" would normally end ventrally with the terminal end of the cloacal plate, or internally with the caudal end of the kidneys, or the "tail" could be defined by the cranial extent of the postsacral vertebrae). Thirdly, there is extensive ontogenetic change in coloration in many populations, with the bold bands of juveniles largely or completely disappearing in adults (de Rooij 1915; Loveridge 1948; Adema 1968), and hence comparisons of coloration between specimens should be between individuals at similar growth stages. Finally, skinks often show strong allometric growth in body proportions, such that relative length of limbs and head, as a proportion of snout-vent length, decreases with growth in body size, while axilla-groin length increases with SVL (e.g., Lande 1978; Griffith 1990; Shea 1995; Shea & Miller 1995; Greer *et al*. 2004, 2005; Shea *et al*. 2009). Early literature tends to assess limb length simplistically as the degree of overlap or separation of the front and hind limbs when pressed towards each other along the body (adpressed) rather than providing specific measurements, and this will also change with growth. Again, comparisons of body proportions between taxa should take into account growth patterns.

The Pulau Bisa specimen agrees well with previous accounts of variation in *E. mentovarius* by Boettger (1895, 1902), Brongersma (1948), Tanner (1950) and Adema (1968). Taking into account the examination of some specimens by both Brongersma and Adema, the maximum sample size for *E. mentovarius* is 25 specimens (although some counts were not provided by all authors), with a range of variation of usually sixth (rarely fifth, and then only unilaterally) supralabial below the centre of the eye, usually 9 (occasionally 10) supraciliaries, 32–36 midbody scales, 66–71 paravertebral scales to thigh, and 71–76 to base of tail, and 20–24 subdigital lamellae below the fourth toe, with AMS R178570 within the range of variation for midbody scales and supralabial scales, slightly above the number of paravertebral scales, and with fewer supraciliaries and subdigital lamellae. Maximum reported SVL for *E. mentovarius* is 165 mm, with AMS R178570 a little less than this (130 mm). Using raw values provided by Brongersma (1948), forelimb length in large individuals of *E. mentovarius* (SVL 118–165 mm, n = 8) ranges from 21.9–24.3% of SVL (R178570: 21.5%) and hindlimb length ranges from 29.8–32.3% of SVL (R178570: 31.5%). The coloration of the specimen closely matches the descriptions provided by previous authors, and the drawing of the lateral face and neck pattern provided by Tanner (1950), particularly the extension of the labial pattern onto the throat, and the marbling on the side of the neck.

Comparative data for *E. sulaensis* are much less complete. The only description of the species is the type description (Kopstein 1927), based on three specimens. Two of these are present in the Museum Zoologicum Bogoriense collection at Bogor, Indonesia (MZB; Iskandar & Mumpuni 2002), and these authors suggested that the third might be in the Naturalis collection in Leiden (RMNH). However, Adema (1968), who examined the RMNH *Eugongylus*, did not locate any specimens of *E. sulaensis* in that collection, or in the Amsterdam collection

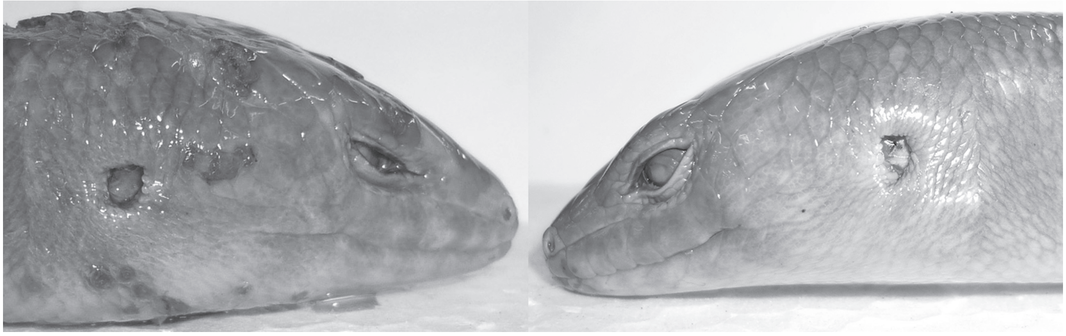

Figure 3. Lateral views of the heads of the two syntypes of *Lygosoma sulaense* Kopstein (left: MZB lace 4166; right: MZB lace 361). Photographs courtesy of Dr. A. Hamidy.

Figure 4. Dorsal view of MZB lace 361, one of the two extant syntypes of *Lygosoma sulaense* Kopstein. Photograph courtesy of Dr. A. Hamidy.

(ZMA, now housed in Naturalis). Likewise, no syntype of *E. sulaensis* was listed for the ZMA collection in the type lists by Daan and Hillenius (1966) or van Tuijl (1995). Kopstein (1927) was unable to determine the specific island in the Sula Archipelago from which the syntypes, stated to have been part of a small collection of reptiles made by the ethnologist Pieter van Hulstijn in 1913–14, were collected, although he suggested that it was most likely to have been Sanana (Sula Besi). He also did not nominate a holotype. However, Iskandar and Mumpuni (2002) list, apparently incorrectly, one of the two MZB syntypes as holotype, and the locality for both of these specimens as Sanana (collected by Tarip in 1914).

Of the salient characters from the description, *E. sulaensis* has the sixth supralabial below the centre of the eye (and hence 8 supralabials – the description states 7 supralabials, but this is improbable; more likely, Kopstein did not include the last supralabial in his count due to division making the scale bordering the lip in this position much smaller, as seen at least unilaterally in both extant syntypes – Fig. 3), 9 supraciliaries (stated as 8, but with the last supraciliary in my definition being the “fifth” supraocular of Kopstein, giving an extra scale), 34 midbody scales, 18–22 subdigital lamellae below the fourth toe, maximum SVL 137 mm, longer limbs than *E. mentovarium* (toes of front and hind limbs overlap when adpressed; forelimb

Figure 5. Dorsal view of MZB lace 4166, the other extant syntype of *Lygosoma sulaense* Kopstein. Photograph courtesy of Dr. A. Hamidy.

length 28% of SVL; hindlimb length 36% of SVL, and combined length of fore and hindlimbs (88 mm) 126% of axilla-groin interval), possesses indistinct pale bands across the dorsum, and has some dark barring on the lower labials, but not extending onto the throat. The longer limbs and lack of throat markings were given as diagnostic characters for the species by Kopstein (1927). The relatively long limbs and lack of throat markings of this taxon are apparent in photographs of the syntype MZB lace361 available online (http://biologi.lipi.go.id/bio_bidang/zoo_english/scincidae_syn.php), and in photographs of both specimens provided to me (Figs. 4, 5). The *Eugongylus* specimen from Pulau Bisa agrees with *E. sulaensis* in having the sixth supralabial below the eye, a similar number of midbody scales and subdigital lamellae, and is of similar SVL, but differs in both primary diagnostic characters, having shorter limbs and prominent throat markings (in a specimen of similar size to the types of *sulaensis*).

Comparative data for *E. rufescens* from Ceram and Ambon are provided by Adema (1968), who examined 17 specimens. This population of *E. rufescens* has fewer midbody scales (29–33, mean = 30.6) and paravertebral scales (66–71) than R178570, and consistently has the fifth supralabial below the centre of the eye, but has a similar number of subdigital lamellae (18–21) below the fourth toe. It also differs from R178570 in having 12–16 white bands on the neck and body, even in adults, extending the full length of the body, and often with pale bands on the tail. Adema (1968) stated that most individuals had the forelimb overlapping the adpressed hindlimb, but in the only specific measurements provided, for the largest specimen (SVL 153 mm), the combination of forelimb (29 mm; 19.0% of SVL) and hindlimb (40 mm, 26.1% of SVL) is 69 mm, noticeably less than the 76 mm given for axilla-groin interval. Adema only provided pooled supraciliary counts (7–8, i.e., 8–9 when the last supraciliary is included) for the species throughout its range.

The Pulau Bisa specimen is most closely in agreement with *E. mentovarius*, particularly in coloration, and I consider it to represent this species (confirmation of the diagnostic coloration features for the holotype of *E. mentovarius* comes from the illustration of the type by Boettger 1902). Differences in the number of supraciliary scales and paravertebral scales are the same differences as for other *Eugongylus* in the region, and only in the number of subdigital lamellae does it instead approach other taxa rather than *E. mentovarius*. It hence extends the range of this taxon to the Obi group of islands, approximately 80 km southwest of the nearest point of Halmahera (Fig. 6). In turn, it extends the range of *E. mentovarius* to just 200 km from Sanana, and 130 km from the nearest point of land in the Sula Archipelago, bringing it to the closest possible land approach to *E. sulaensis*

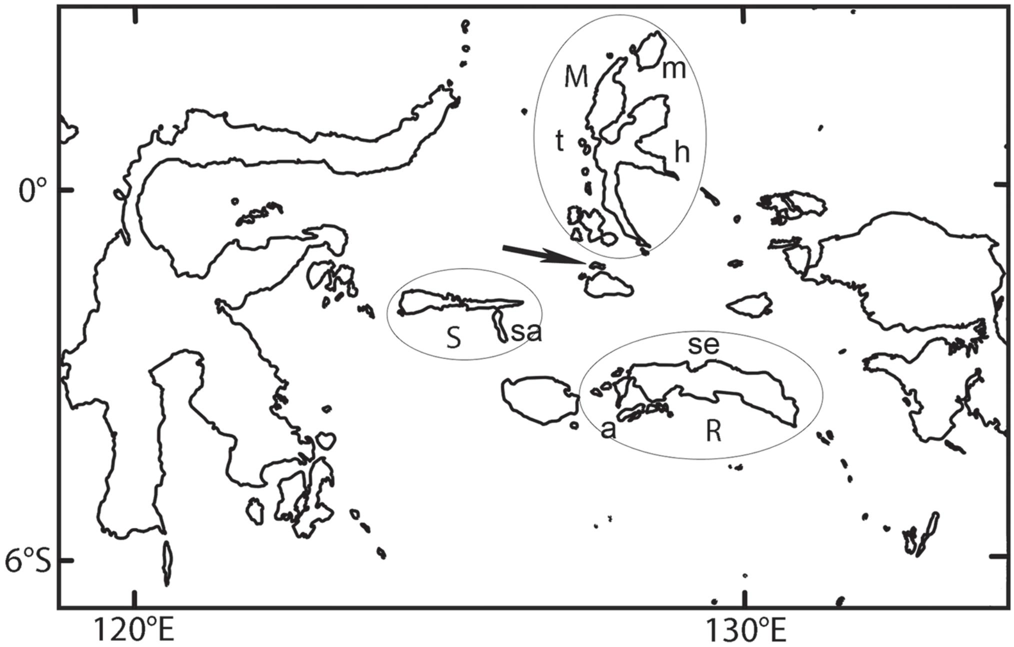

Figure 6. Distribution of *Eugongylus* species in the Maluku Archipelago. Ellipses surround the reported distributions of *E. mentovarius* (M), *E. sulaensis* (S) and *E. rufescens* (R); the arrow indicates Pulau Bisa. Lower case letters represent individual islands from which these taxa have been previously reported: Morotai (m), Halmaheira (h), Ternate (t), Seram (se), Ambon (a) and Sanana (sa).

while still maintaining the diagnostic characters of coloration and limb length that differentiate *E. sulaensis* from *E. mentovarius* without any evidence for morphological intermediacy at the only possible geographically intermediate locality. Based on the lack of evidence for morphological intermediacy or clinal variation, I recognise *E. sulaensis* as a distinct species from *E. mentovarius*, despite the similarities in the species in the supralabial below the eye and number of midbody scales. The Pulau Bisa specimen also brings the distribution of *E. mentovarius* to within 180 km from Seram, inhabited by *E. rufescens*. If *E. mentovarius* also occurs in the other islands in the Obi group, the geographic distance between the two taxa will be just 130 km, all overwater without intervening land, supporting the recognition of *E. mentovarius* as a species distinct from *E. rufescens*. The differences between *E. mentovarius* and *E. rufescens* in coloration and scalation are of comparable degree to those between *E. sulaensis* and Maluku *E. rufescens*, and hence provide evidence that *E. sulaensis* should also be considered distinct from *E. rufescens*.

Geologically, despite its current proximity to Halmahera, the Obi group was derived from the margin of the Australian plate, and broke away as a microcontinent incorporating the Sula archipelago in the Miocene (*circa* 18 mya), sliding west along the Sorong Fault approximately 1000 km to collide with Sulawesi. Halmahera emerged in the late Miocene (*circa* 10 mya) much further to the north-east, north of the Vogelkop, and then moved south-west to its present position close to Obi only in the late Pliocene (*circa* 3 mya) (Hamilton 1979; Burret *et al*. 1991; Monk *et al*. 1997; Hall 2013). Hence, the occurrence of *Eugongylus mentovarius* in the Obi group rather than *E. sulaensis* is of biogeographic interest, suggesting a relatively recent arrival of this taxon in the Obi group. In contrast, Seram, inhabited by *E. rufescens*, only became aerial sometime after 6 mya, and is separated by deep marine troughs from New Guinea (Audley-Charles 1993), suggesting that its fauna has similarly arrived by transmarine migration. Ambon, also inhabited by *E. rufescens*, is even more recent, formed by volcanism about 4.5 mya (Audley-Charles *et al*. 1979; Milsom

1979), and is most likely to have been colonized from Ceram.

Given the likely relatively recent arrival of *Eugongylus* in the Maluku Archipelago, the recent report of a skink ascribed to *Eugongylus rufescens* from a locality on Sumatra (Darevsky & Orlov 2004) requires confirmation.

Acknowledgements

I thank Cecilie Beatson (AMS) for drawing the specimen to my attention, Dr. Amir Hamidy (MZB) for sending me photographs of the two syntypes of *Lygosoma sulaense* in that collection, and Frits Adema for permission to cite data from his thesis.

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First Record of the Species *Gongylosoma scriptum* (Theobald, 1868) (Squamata: Colubridae) From India

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ABSTRACT.– **Two specimens of the species *Gongylosoma scriptum* (Theobald, 1868) were found in Suangpuilawn village and Saithah village respectively, in the Indian state of Mizoram. This is the first record of this species for India. The distribution of this species is discussed.**

KEYWORDS.– **Asia, Colubroidea, Oriental region, *Gongylosoma,* distribution.**

Introduction

The genus *Gongylosoma* Fitzinger, 1843 currently includes five described species (Grismer *et al.* 2003). These are secretive small colubrids, often found among leaf litter. They are diurnal but rarely encountered and their biology is not well known (David & Vogel 1996). For a long time members of the genus *Gongylosoma* were subsumed within *Liopeltis* Fitzinger, however, Leviton (1964) split the genus and revalidated *Gongylosoma* based on meristic and other morphological characters. The most obvious characters are the number of scale rows, which Leviton gave as 13 in *Gongylosoma* and 15–17 in *Liopeltis*, and the shape of the head, which is given as short, deep and convex in profile with large eyes in *Gongylosoma* and long, shallow and flattened with smaller eyes in *Liopeltis*. A discussion on the validity and characters of these two genera is beyond the scope of this work, but this division has been followed in subsequent works (e.g., David & Vogel 1996; Grismer *et al.* 2003).

Theobald (1868) described *Gongylosoma scriptum* from a single specimen found in Martaban (today Mottama) in Mon State of Myanmar. Dowling & Jenner (1988) mentioned specimens from two collections from Myanmar without giving any details or exact localities. Smith (1930) reported the species from Thailand and mentioned that up to that time only four specimens were known. Inger & Colwell (1977) found the species below the surface of the soil, under cover of leaves, rocks, and logs, or on the surface of soil and leaves in dry evergreen forest at approximately 200 m elevation in Thailand. Neang *et al.* (2015) recorded it recently from Cambodia for the first time. Despite these valuable reports, this species is still poorly known and remains rare in collections. Here, we report the collection of two additional specimens of this species in the Indian state of Mizoram, representing a new country record.

Materials and Methods

The two newly discovered Indian specimens were compared to specimens of the genera *Gongylosoma* and *Liopeltis*. The external morphological characters and coloration of all the specimens were examined in detail (Appendix 1).

Measurements were taken with a slide-caliper to the nearest 0.1 mm, except for the body and tail lengths, which were measured to the nearest millimetre with a measuring tape. The number of ventral scales was counted according to Dowling (1951). Half ventrals were count-

Figure 1. Dorsal view of *Gongylosoma scriptum*, MZMU 892 from Suangpuilawn village, Mizoram, India. Photographed by H. T. Lalremsanga.

ed as one. The first enlarged shield anterior to the ventrals was regarded as a preventral and was present in all examined specimens. The first scale under the tail meeting its opposite was regarded as the first subcaudal, and the terminal scute was not included in the number of subcaudals. The dorsal scale rows were counted at one head length behind head, at mid-body, and at one head length before the vent. As for the number of supralabials touching the subocular, those only touching the presubocular were not included. Infralabials were considered being those shields that were completely below a supralabial and bordering the mouth gap. The first sublabial was defined as the scale that starts between the posterior chin shield and the infralabials and that also borders the infralabials. Values for paired head characters were recorded on both sides of the head, and are reported in left/right order. Sex was determined by using a probe or by

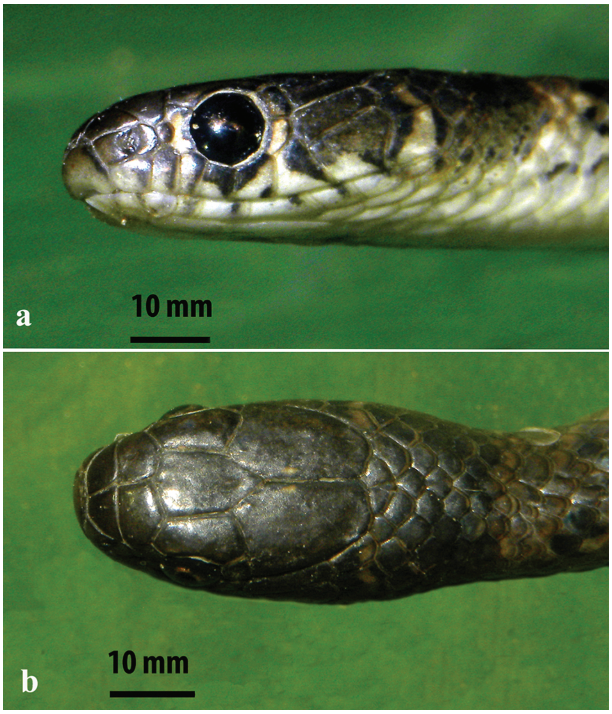

Figure 2. Lateral and dorsal views of the head of *Gongylosoma scriptum*, MZMU 892 from Suangpuilawn village, Mizoram, India. Photographed by Vanlalhrima.

dissection of the ventral tail base. Rainfall data for the localities were collected from the Directorate of Agriculture, Government of Mizoram.

Museum abbreviations.– BMNH: The Natural History Museum, London, UK; NHMB: Naturhistorisches Museum, Basel, Switzerland; MZMU: Departmental Museum of Zoology, Mizoram University, Aizawl, India; NHMW: Naturhistorisches Museum Wien, Vienna, Austria; RMNH: Nationaal Natuurhistorisch Museum (Naturalis), Leyden, The Netherlands; SMF: Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt-am-Main, Germany; USNM: United States National Museum, Washington, D. C., USA; ZFMK: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; ZSM: Zoologische Staatssammlung, München, Germany.

Morphological abbreviations.– EyD: Eye diameter; EN: Eye-nostril distance; SW: Snout-width; SLe: Snout-length; HL: Head-length; HW: Head-width; SVL: Snout-vent length (mm); TaL: Tail length (mm); TL: Total length (mm); Rel TL: Relative tail length TaL/TL, Ve: ventral scales; Sc: subcaudal scales; DSR: Dorsal scale rows; SLb: Supralabials; SLE: Supralabials touching the eye; ILb; Infralabials; Ls: Loreal scale; At: Anterior temporal; Pt: Posterior temporal; PrO: Pre-ocular; PoO: Post-oculars.

Results

Two specimens recently encountered in Mizoram were assigned by us to the genus *Gongylosoma* based on the definitions described by Leviton (1964) and Malkmus *et al.* (2002): small, slender snakes; head not distinct from the body, short, deep and convex in profile; tail long; eyes large, pupil round; a small loreal shield is present; nasal shields divided; 13 rows of dorsal scales without apical pits or keels; anal scute divided; subcaudals in two rows.

Comparison with data from the last review of that genus (Grismer *et al.* 2003) showed that these specimens perfectly fit the species definition of *G. scriptum*. They are here described in greater detail:

Specimen 1

(Figure 1)

MZMU 892; subadult female, Government Middle School Compound, Suangpuilawn village (23°56’59.81”N, 93°02’ 15.98”E, 1,072 m elevation), Aizawl District, about 149 km northeast of the state capital, Aizawl, Mizoram, India, coll. J. C. Lalmuanawma, H. Laltlanchhuaha, Lalrinsanga and H.T. Lalremsanga, 3 June 2016.

Linear measurements include a SVL of 273.2 mm, TaL of 41.3 mm (tail tip broken), and TL of 314.5 mm (Table 1). Body elongate, slender; head slightly distinct from the neck, somewhat depressed, snout blunt; eye large, pupil round and dark. Rostral slightly visible from above; a single nasal; two internasals, widely in contact with each other with a diagonal suture on the front; two large irregular pentagonal prefrontals, much larger than internasals and with a diagonal suture; one pentagonal-shaped frontal, longer than wide, smaller than parietals; nostril large; nasal shields divided; one small loreal shield, preocular much higher than wide, in contact with 3rd supralabial, loreal, prefrontal, and supraocular; 8/8 supralabials, 3rd to 5th supralabials touching the eye, 7th the largest, elongate; 1/1 elongated anterior temporal and 2/2 posterior temporals; 8/8 infralabials, 5th and 6th touching the 1st sublabial (Fig. 2). Dorsal scales in 13–13–13 rows, smooth. Vertebral row not enlarged. No apical pits. 139 ventrals, half scale on the left side at 138th; 41 paired subcaudal; anal scute divided.

Coloration: Head and dorsal body chocolate-brown, paler in the lateral region; posterior margins of the scales darker; two rows of small dark widely separated dots on the forepart of the body, separated by three central rows of dorsal scales; nape with a broad dark band that extends through the posterior edges of the posterior temporals and eighth supraocular on both sides; a prominent white stripe passes through the middle parts of posterior temporals and the 8th supraocular; the darker coloration extends from the posterior ridges of the postoculars and the 6th supralabial to the mid-posterior temporals and the anterior of 8th supraocular. The venter is pale light brown and plain. The tail dorsum is coloured like the body, the tail venter and chin and throat are coloured like the body venter.

Table 1. Morphometrics and pholidosis of *Gongylosoma scriptum* reported from Mizoram, India compared with data given by Smith (1943).

	MZMU 892	**MZMU 914**	**Smith, 1943**
Sex	**female**	**male**	**—**
EyD [mm]	2.1	2.2	n.s.
EN [mm]	0.9	1.1	n.s.
SW [mm]	2.6	3.0	n.s.
SLe [mm]	2.5	2.9	n.s.
HL [mm]	9.9	10	n.s.
HW [mm]	4.6	7.2	n.s.
SVL [mm]	273.2	347.1	male up to 465 female up o 495
TaL [mm]	70.3*	120.2	male up to 155
TL [mm]	315.5	467.3	670
TaL/TL	*	0.257	n.s.
Ve	139	127	126–145
Sc	45*	88	87–98
DSR	13:13:13	13:13:13	13:13:13
SLb	8/8	8/8	8/8
SLE	3rd –5th /3rd –5th	3rd –5th /3rd –5th	3rd –5th /3rd –5th
ILb	8/8	8/8	n.s.
At	1/1	1/1	1/1
Pt	2/2	2/2	2/2
PrO	1/1	1/1	1/1
PoO	2/2	2/2	2/2

** Tail tip broken, TaL/TL is not evaluated; n.s. not specified*

Specimen 2

(Figures 3 & 4)

MZMU 914; adult male, near Saithah village (23°35’13.37”N, 92°27’ 24.81”E, 730 m elevation), Mamit District, about 129 km southwest of Aizawl, Mizoram, coll. Lalnunkima, Vanlalhrima and H. T. Lalremsanga, 27 August 2016.

Similar to specimen number one except differening in the following: SVL 347.1 mm; TaL 120.2 mm; TL 467.3 mm; Rel TL: 0.257. 127 Ve, a half scale on the left side of 127th; 88 Sc (Table 1). The head and body coloration is similar except that the lower head, venters of body and tail are plain whitish-cream rather than the pale light brown of specimen number one.

Natural History

Specimen MZMU 892 was collected on 3 June 2016 at around 1020 hr under bushes of mixed species inside the compound of the Government Middle School (Fig. 5). This area receives about 2,042 mm of precipitation per year. It is covered with montane sub-tropical forest. The flora of this locality includes *Acrocarpus fravinifolius, Cordia dichotoma, Ficus hirta, Querchus leucotrichophora, Alstonia scholaris, Derris robusta, Schima wallichii, Polygonum chinese, Mikania micrantha, Blumea alata,* etc. Plantations include *Musa paradisiaca, Ensete glaucum* and *Acacia gageana.*

Specimen MZMU 914 was collected on 27 August 2016 along at approximately 0930 hr at a stream near the roadside between Saithah village and Lallen village (Fig. 6). This locality falls inside the buffer area of Dampa Tiger Reserve. It is covered with a mix of tropical wet evergreen and semi-evergreen forests receiving about 2,428 mm of precipitation per year. Some of the common vegetation within this habitat includes *Setaria palmifolia, Thysanolaena maxi-*

Figure 3. Dorsal view of *Gongylosoma scriptum*, MZMU 914 from Saithah village, Mizoram, India. Photographed by Vanlalhrima.

ma, Solanum torvum, S. viarum, Chromolaena odorata, Bidens biternata, Curculigo crassifolia, Robus rugosus, Clerodendrum sp., *Urena lobata, Cassia* sp., *Polygonum* sp., *Impatiens* sp., etc. and trees like *Dillenia indica, Mesua ferrea, Schima wallichii,* etc.

In captivity, both specimens were very timid. They did not feed on offered prey including froglets and juvenile lizards. They preferred to stay in the moist part of the enclosure underneath vegetation. Unfortunately, specimen 2 (MZMU 914) died on the way from the site of capture (where it was observed for a few days) before any photographs in life could be taken. Specimen 1 died in a terrarium after one week in captivity.

Discussion

These new findings of *Gongylosoma scriptum* are quite unexpected as the new locality is 1,300 km from its type locality and the only record from Myanmar so far (Fig. 7). The IUCN regards this species as possibly extinct in Myanmar (Grismer *et al.* 2012). This is obviously due to the fact it has not been found there again since its description in 1868 despite extensive expeditions into this country by members of the California Academy of Sciences and others (see also Vogel 2015). However, a recent record has been published from Umphang, Tak Province, in northwestern Thailand, a few kilometers away from the border to Myanmar, which makes the probability of extinction unlikely, as the forests of Umphang continue far into Myanmar (Hauser,

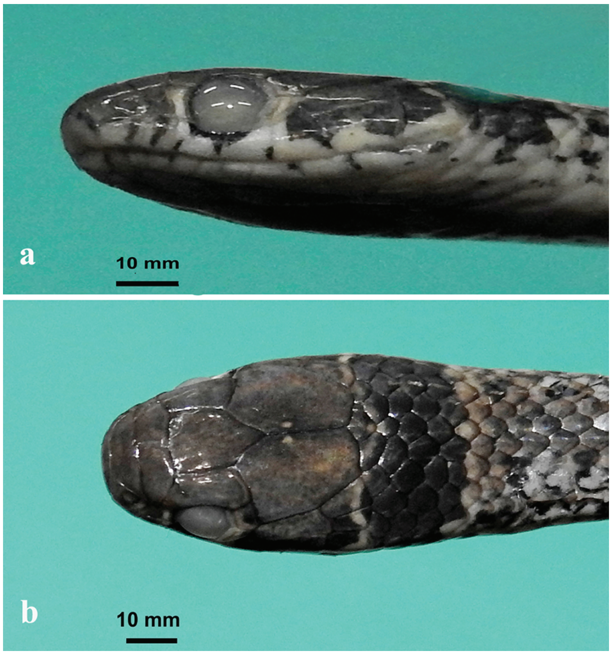

Figure 4. Lateral and dorsal views of the head of *Gongylosoma scriptum*, MZMU 914 from Saithah village, Mizoram, India. Photographed by Vanlalhrima.

2016). This finding was published on the internet and was accompanied by a series of pictures, so a determination is without doubt. Beside Umphang (Tak province), the species has been found in the Thai provinces of Nakhon Ratchasima: Sakaerat (Inger & Colwell 1977), Nakhon Si Thammarat: Khao Luang (Cochran 1930), Kanchanaburi: Say Yok (Taylor 1965), Petchaburi, Phuket: Pulau Panjang (Smith 1930), Chaiyaphum and Udon Thani (Cox *et al.* 2012). Little has been published of the elevation of the habitats of this species but it appears to be a species inhabiting mid-elevations (the Mizoram specimens were found at 730 and 1,072 m), following the mountainous areas that extend from the northeast of India along the Myanmar border to the north of Myanmar and from there southward along the Thai-Burmese border to the Isthmus of Kra. However, Udon Thani and Kanchanaburi are west of this supposed distribution, and the total distribution remains to be fully clarified.

Both specimens were collected during morning hours. Inger & Colwell (1977) found 35 specimens in ten months of intense search which yielded in 4,004 amphibians and reptiles. All specimens of *G. scriptum* were found in evergreen forests. Seven of them were found below surface of soil, 11 under leaves and 11 under rocks. Only six specimens were exposed on soil or leaves. This shows that the species can locally be abundant but also shows that they are usually hidden and only rarely exposed. This is surely one reason why the species is rarely recorded and might easily have been overlooked. Despite our extensive research in the state of Mizoram, only these two specimens were found.

The pholidosis of these two specimens lies within the variation given by Smith (1943) and Taylor (1965). The subcaudal count of the male (88) is at the lower end of the variation (87–103 according to Taylor 1965), which seems

Figure 5. Habitat of *Gongylosoma scriptum*, MZMU 892 from Suangpuilawn village, Mizoram, India. Photographed by J. C. Lalmuanawma.

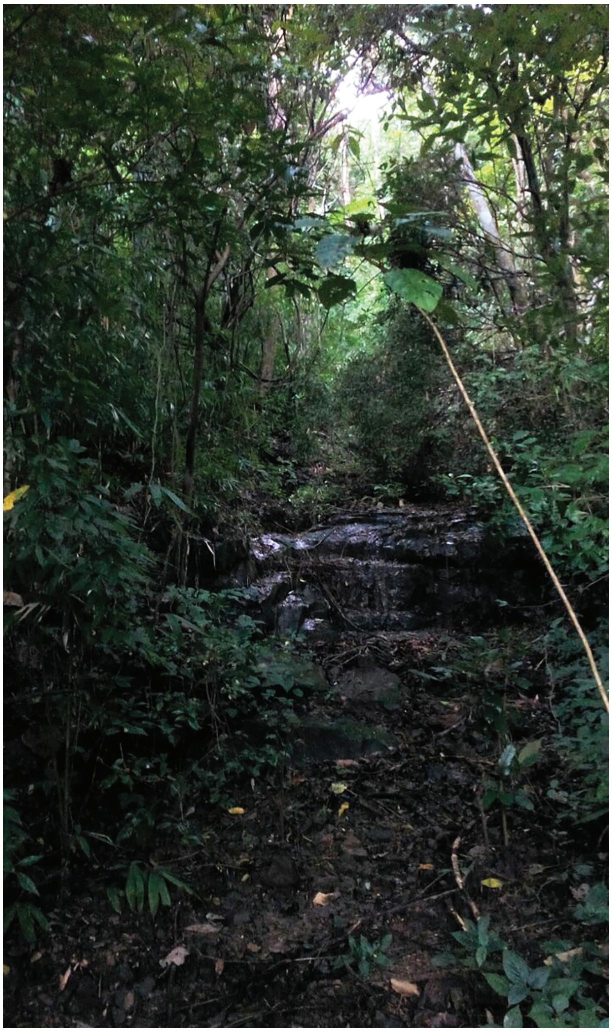

Figure 6. Habitat of *Gongylosoma scriptum*, MZMU 914 from Saithah village, Mizoram, India. Photographed by Lalnunkima.

Figure 7. Map indicating the type locality and the new localities of *Gongylosoma scriptum*. 1 = Mottama (type locality); 2 = Suangpuilawn; 3 = Saithah.

to be unusual but nothing is known about the sexual dimorphism of this species

Recent research in the province of Mizoram has yielded new reptile species (e.g. Vogel *et al.* 2018) and new records. Northeast India has a rich herpetofauna, which is largely underexplored. In Mizoram, there are large areas with little disturbed primary forest, but the situation is worse in some neighboring areas, and systematic inventories of the fauna for these regions are desperately needed.

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Appendix 1. Examined material. Localities as indicated.

Gongylosoma baliodeirum (6 specimens): **Indonesia**: ZSM 236/2000 “Ravas, Süd-Sumatra”; ZSM 208/1907 “Tanjong Morawa, Sumatra”; RMNH 188 “Sumatra”; RMNH 4035 “East Indian Archipel”; **Thailand:** USNM 94826 “Kao Soi Dao, Trang”, Holotype of *Liopeltis baliodeirus cochranae* Taylor, 1962.

Gongylosoma longicaudum (4 specimens): **Indonesia:** SMF 19326 “Deli, Sumatra”; SMF 43964 “Sumatra”; NHMB 1638 “Sumatra”, Syntype of *Ablabes quinquestriatus,* Müller, 1878; NHMB 5127 “Palembang, Sumatra”.

Liopeltis tricolor (8 specimens): **Indonesia**: BMNH 1946.1.5.37 “Java” syntype of *Ablabes tricolor* Schlegel, 1837; BMNH no number “Indonesia”, Syntype of *Ablabes schlegelii* Bleeker, 1859; NHMW 26968:2 “Padang, Sumatra”; RMNH 554 “Banka”; RMNH 4036 “East Indian Archipel”, Syntype of *Ablabes schlegelii* Bleeker, 1859; SMF 81197 “Sumatra”; ZFMK 33533 “Sumatra”; **Malaysia**: NHMW 26968:1 “Penang”.

Liopeltis frenatus (3 specimens): **India**: MZMU 874–876 “Mizoram”.

Liopeltis stoliczkae (5 specimens): **India**: MZMU 877–881 “Mizoram”.

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Behavioural observations of the Burmese flapshell turtle (*Lissemys scutata*) with comments on the functional significance of Rathke's glands

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ABSTRACT.–**The Burmese flapshell turtle (*Lissemys scutata*) is a poorly-studied chelonian endemic to Myanmar. We found a turtle buried in a shallow excavation at Minzontaung Wildlife Sanctuary and villagers living nearby unearthed 10 turtles from the mud of a drying pond; these are apparently the first reports of aestivation by *Lissemys scutata*. An adult *Lissemys scutata* we captured at Lawkanandar Wildlife Sanctuary emitted jets of mild-tasting, odorless (to us) fluid from carapacial pores of Rathke's glands. We question the oft purported defensive role of these secretions and suggest intraspecific pheromonal signaling is a more likely function.**

KEYWORDS.–**Trionychidae, Myanmar, aestivation, secretion, pheromonal signaling.**

Introduction

The Burmese flapshell turtle (*Lissemys scutata* Peters, 1868) is endemic to the Ayeyarwady (formerly Irrawaddy) and Thanlwin (formerly Salween) basins of Myanmar, occurring at least as far north as Mandalay (Smith 1931; Iverson 1992) where it inhabits natural and anthropogenic wetlands (Platt *et al*. 2012). With the exception of a single, brief paragraph in Smith (1931; as *L. punctata scutata*) containing general information on abundance, nesting phenology, and egg size, nothing appears to be known concerning the ecology of *L. scutata*. We here report observations of previously undescribed aestivation and defensive (or alarm) behaviours of *L. scutata*.

Materials and Methods

Our observations were made opportunistically during fieldwork in central Myanmar, an arid region in the rain shadow of the western mountains where most precipitation (500 to 1000 mm) occurs from June through September (Terra 1944; Platt *et al*. 2003). We measured turtles with a tree caliper and present morphometric data as straight-line carapace length (CL) and plastron length (PL).

Results

On 5 December 2014, we encountered a village dog excavating an aestivating female *Lissemys scutata* at Minzontaung Wildlife Sanctuary (Mandalay Region; site described by Platt *et al.* 2003). The turtle (CL = 118 mm; PL = 112 mm), which appeared alert and well-hydrated, was buried in a shallow depression (bottom ca. 10 cm below soil surface) excavated in hard, compact clay soil at the base of a *Tectona hamiltoniana* tree. Based on the dimensions of the depression and debris scattered about the site, the aestivating turtle was probably covered with 2–3 cm of soil and leaf litter before this material was removed by the dog. The aestivation site was located in scrub forest about 100 m (straight-line distance) from a drying irrigation reservoir that contained some water (< 1.0 m deep) at the time of our observation. To avoid further attention from the dog, we released the turtle in the reservoir.

In addition to our observations, villagers at nearby Mya Taung (21°26.90'N; 95°26.63'E) reported unearthing 10 living *L. scutata* while deepening an existing livestock pond during April 2011. At that time, the pond contained a layer of deep mud, but very little water; the turtles were found buried in the mud. We visited the village on 19 September 2011 and observed at least five adult and juvenile *L. scutata* in the pond, which was filled to capacity by wet season rains.

Our observation of defensive (or alarm – see below) behaviour by *L. scutata* occurred at Lawkanandar Wildlife Sanctuary, an urban park on the outskirts of Bagan (Mandalay Region) on 16 July 2015. At 1304 hr we encountered an adult female *L. scutata* (CL = 190 mm; PL = 180 mm) moving overland towards a pond (0.8 ha) housing a captive-breeding colony of Burmese roofed turtles, *Batagur trivittata* (Duméril & Bibron, 1835). About one minute after picking up and carrying the turtle a short distance, two fine jets of fluid were ejected approximately 10–15 cm from the carapace and away from the turtle. No discernible odor was associated with the discharge. A closer inspection revealed droplets of a viscous, yellow-brown fluid beside two small pores on the rim of the carapace above each foreleg (Fig. 1A). At the same time we also noted similar droplets emanating from four pores (two pores about 10 mm apart and 10–15 mm from edge of carapace on each side of the body) in the inguinal region (Fig. 1B). One of us (SGP) tasted droplets of the almost odorless, oil-like fluid; the taste was mild and akin to an uncooked chicken egg.

Discussion

Aestivation by *Lissemys scutata* is not unexpected. All flapshell turtles (*Lissemys* spp.) are morphologically well-adapted for aestivation with the femoral flaps and movable anterior lobe of the plastron allowing complete shell closure, thereby reducing the likelihood of desiccation during dormancy (Bhupathy *et al.* 2014). Aestivation has already been reported in the congeneric Indian flapshell turtle, *Lissemys punctata* (Bonnaterre, 1789), which like *L. scutata* inhabits ephemeral waterbodies in highly seasonal environments (Auffenberg 1981; Bhupathy & Vijayan 1994; Bhupathy *et al*. 2014). Similar to our observation, Auffenberg (1981) found that *L. punctata* (N = 86) moved overland an average of 237 m (±1SD = 78 m; maximum overland movement = 1050 m) from drying water bodies to aestivate in shallow depressions (carapace 3–6 cm below substrate) under grass tussocks, fallen logs, and among tree roots in grassland and forest. The discovery by villagers of *L. scutata* in a drying pond during the late dry season (April) suggests that some turtles remain buried in mud until the onset of wet season rains (early June) rather than move to terrestrial aestivation sites (see also Annandale 1912). By doing so, turtles could avoid potentially hazardous overland movements with the associated threat of predation, but risk entombment and death if the mud should dry and harden (Auffenberg 1981; Bhupathy *et al*. 2014).

Auffenberg (1981) observed *L. punctata* discharging a fluid resembling "egg yolk" when harassed by foraging white vultures, *Neophron percnopterus* (Linnaeus, 1758), noting the "smell is very objectionable" and "the taste is probably vile". Auffenberg (1981) watched vultures repeatedly drag turtles through grass before consuming them, and speculated this behaviour stimulated evacuation of the glands and wiped away the distasteful secretions, rendering the turtle more palatable. Similarly, Khan (2006) stated that *L. punctata* voids foul-smelling secretions when handled. These secretions are produced by Rathke's glands (Ehrenfeld & Ehrenfeld 1973; Plummer & Trauth 2009; Trauth & Plummer 2013; Bhupathy *et al.* 2014) and consist of a carbohydrate-protein compound rich in yellowish lipids, hence the resemblance to egg yolk (Ehrenfeld & Ehrenfeld 1973; Eisner *et al*. 1977; Weldon *et al.* 2008). Some report the secretions of Rathke's glands are strongly malodorous (e.g., Legler 1960; Eisner *et al*. 1977; Auffenberg 1981; Khan 2006), although Ehrenfeld & Ehrenfeld (1973) described the compound as only faintly odiferous when excised from the glands, and others have been unable to detect any odor associated with the secretions (Plummer & Trauth 2009; this study). Although the function of Rathke's glands remains largely unknown (Plummer & Trauth 2009; Trauth & Plummer 2013), various roles have been suggested, including excretion, courtship and mating, facilitating social aggre-

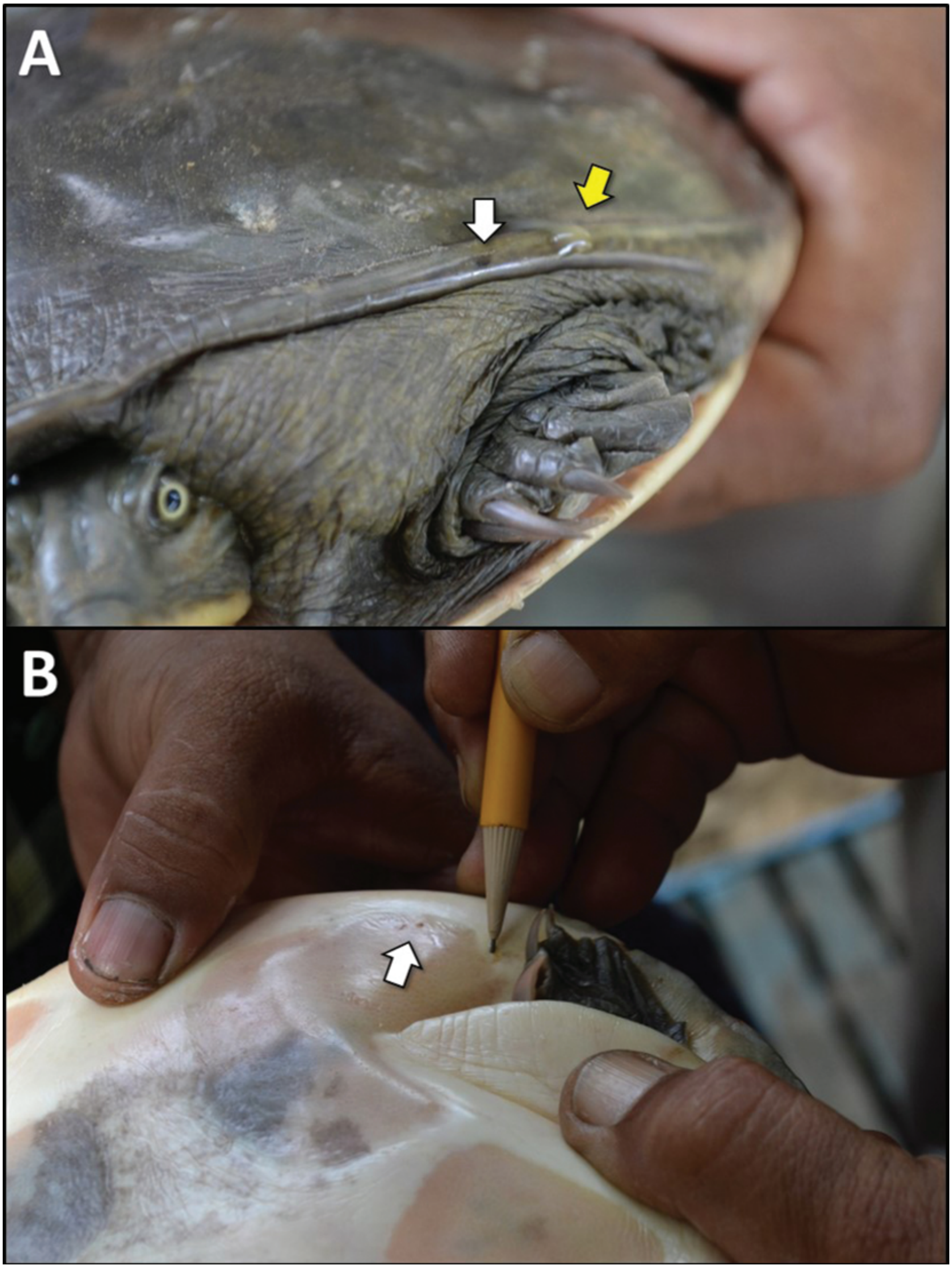

Figure 1. Arrows (white) denoting location of pores on the carapacial rim (A) and inguinal region (B) of a Burmese flapshell turtle (*Lissemys scutata*) at Lawkanandar Wildlife Sanctuary, Myanmar. Note droplets of fluid remaining on rim of carapace (yellow arrow) and inguinal region (tip of pencil) after being discharged from pores.

gations, intraspecific alarm, individual recognition, orientation, shell maintenance, and predator deterrence (Ehrenfeld & Ehrenfeld 1973; Eisner *et al*. 1977; Kool 1981; Krishna *et al.* 1995; Plummer & Trauth 2009) with the latter being favored by many authors (Neill 1948; Ehrenfeld & Ehrenfeld 1973; Auffenberg 1981; McCord *et al*. 2001; Bhupathy *et al*. 2014).

While recognizing that potential compositional differences in Rathke's gland secretions and consequently different functions may exist among species (Weldon & Tanner 1990; Krishna *et al*. 1995; Weldon *et al*. 2008; Trauth & Plummer 2013), we question a defensive role for these compounds in *L. scutata*. A compound with a mild egg-like taste (to humans) seems unlikely to deter predators, especially vultures that consume carrion in varying stages of putrefaction and successfully feed on turtles that produce odiferous secretions (Auffenberg 1981). Furthermore, the olfactory abilities of Old World Vultures (Aegypiinae and Cypaetinae) as well as most other birds are poorly developed (Stager 1964; Birkhead 2012) and the reported foul odor of this compound (indiscernible to us) would therefore seem of little deterrence to most avian predators. That said, it should be noted that the "wiping behaviour" described by Auffenberg (1981) could be explained by an unpleasant taste (to the avian palate) of the secretions produced by *L. punctata*. Nor in our opinion does such a compound appear capable of discouraging reptiles (*Varanus* spp.) or mammals (*Canis aureus* and *Sus scrofa*) reported to prey on flapshell turtles. Indeed, Eisner *et al*. (1977) suggested the quantity of secretions produced by common musk turtles (*Sternotherus odoratus* Latreille *in* Sonnini & Latreille, 1801) was insufficient to chemically deter predators, and in a series of laboratory trials Kool (1981) found that mixing Rathke's gland secretions with food provided to captive test subjects did little to discourage its consumption by various reptile, avian, and mammalian predators of the eastern long-necked turtle (*Chelodina longicollis* Shaw, 1794).

We instead hypothesize that intraspecific pheromonal signaling (perhaps as an alarm) rather than predator deterrence is more likely the function of Rathke's gland secretions, at least in *L. scutata*. Ehrenfeld & Ehrenfeld (1973) noted that an intraspecific alarm function is consistent with the rapid emptying of Rathke's glands, but discounted this hypothesis because turtles are "asocial organisms", an assumption called into question by more recent findings (e.g., Ferrera *et al*. 2012, 2014). Given the limitations of field observations, we concur with Ehrenfeld & Ehrenfeld (1973); questions about the functional significance of Rathke's gland secretions are probably best resolved through controlled laboratory experimentation.

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Hoplobatrachus litoralis (Anura: Dicroglossidae) in India

India is reported to have 432 species of amphibians, of which 390 species are anurans (Frost 2017). The genus *Hoplobatrachus* Peters, 1863, (Family Dicroglossidae) is represented by five species worldwide (Frost 2017). In India, these large sized frogs are represented by only two species, namely *Hoplobatrachus crassus* (Jerdon, 1853) and *Hoplobatrachus tigerinus* (Daudin, 1802). In this paper we present evidence demonstrating the occurrence of an additional species of *Hoplobatrachus* from Northeast India, thereby adding to the amphibian fauna of the country.

Hoplobatrachus litoralis (Hasan *et al.*,2012) was described from Bangladesh and is known only from southeastern coastal Bangladesh (Ukhia, Teknaf Upazila and the town of Cox's Bazar in the Cox's Bazar District). On 3 September 2016, four individuals belonging to the genus *Hoplobatrachus* were collected (one adult female and three subadult males) from Panisagar (24°14'59.96"N, 92° 8'28.05"E), North Tripura, Tripura (Fig. 1). The largest specimen has a snout-urostyle length (SUL) of 91.02 mm (Fig. 2). The head is a little broader than long, head length/head width (HL/HW): 1.064, (Fig. 3B). The hind limb (HLL) is more than one and a half times the SUL (HLL/SUL: 1.641). Relative finger size is F3 > F1 > F2 ≥ F4 and relative toe length is T4 > T5 > T3 > T2 > T1. The interorbital distance is slightly less than the internarial distance (N-N/E-E: 1.006). The specimens we collected havea broad black band running from the anterior corner of the eyes through the nostrils to the anterior edge of the upper jaw (Fig. 3A). Another distinct and continuous band runs along the lateral margin of upper jaw (Fig. 3A–

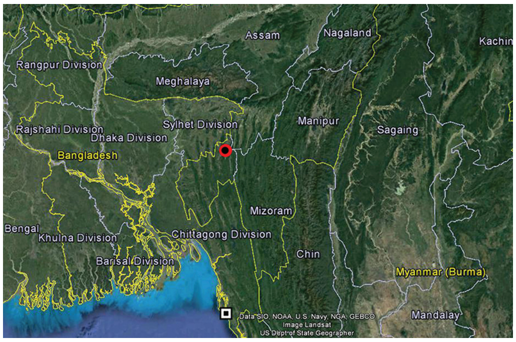

Figure 1. Map showing locality records of *Hoplobatrachus litoralis* (white square: Cox's Bazar, Bangladesh, type locality; red circle: Panisagar, North Tripura, Tripura, India). Map from Google Earth.

Figure 2. Live *Hoplobatrachus litoralis* from Panisagar, North Tripura, Tripura, India.

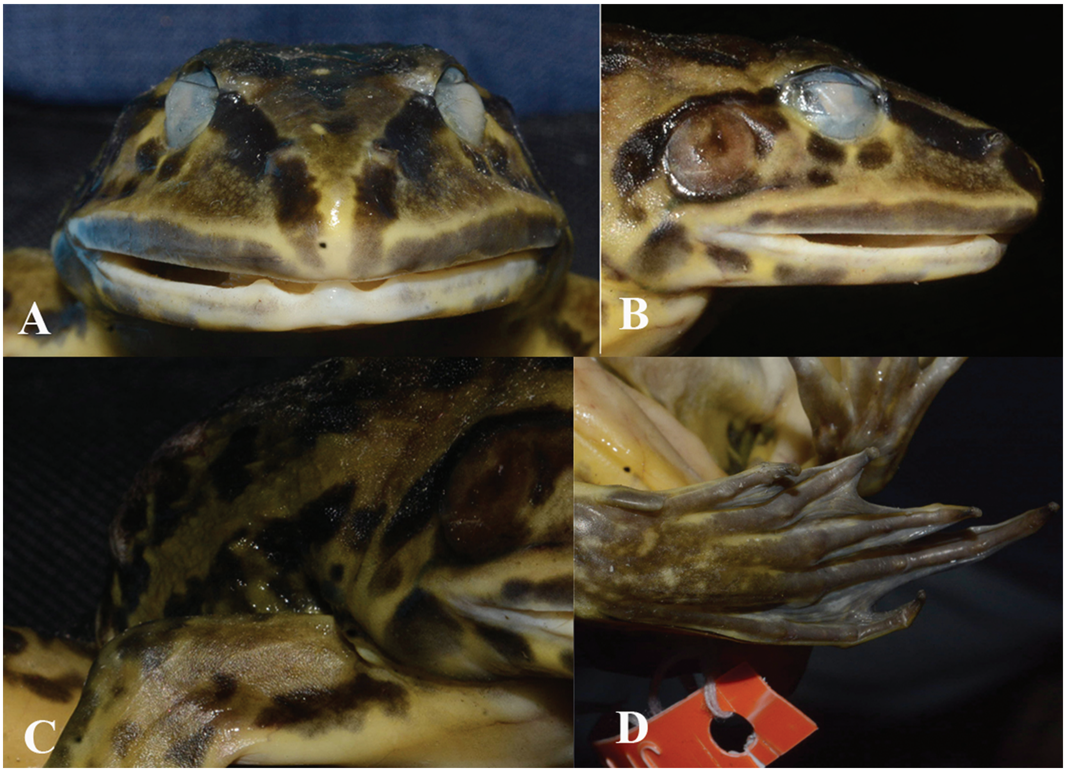

Figure 3. *Hoplobatrachus litoralis* from Panisagar illustrating:(A) a broad black band running from anterior corner of the eyes through the nostrils to the anterior edge of upper jaw; (B) a distinct and continuous band running along the lateral margin of upper jaw; (C) a distinct black margin is present in the inner side of upper arm; (D) a black inner metatarsal tubercle.

B). A distinct black margin is present on the inner side of upper arm (Fig. 3C). The species has an inner metatarsal tubercle which is black in colour (Fig. 3D). The above diagnostic characters fits well with the description of *Hoplobatrachus litoralis*. Its sister taxon, *H. tigerinus* was found to live in sympatry with *H. litoralis* in the study area. The habitat was a secondary degraded forest with paddy fields and with a few small natural ponds. With respect to microhabitat, *H. litoralis* was found in leaf litter and under small bushes. This is the first record of *Hoplobatrachus litoralis* from India and extends the known range of the species by 321 km northwards.

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New record of *Scincella apraefrontalis* (Squamata: Scincidae) from Pu Hoat Nature Reserve, Nghe An Province, Vietnam

In 2009, Nguyen, Ho and Nguyen recognised three species of genus *Scincella* (Mittleman 1950) in Vietnam: *Scincella doriae* (Boulenger, 1887), *S. melanosticta* (Boulenger, 1887) and *S. reevesii* (Gray, 1838). Between 2010 and 2011, six more species were reported for the country or transferred to *Scincella* from *Sphenomorphus*, giving nine species for the country: *S. darevskii* (Nguyen, Ananjeva, Orlov, Rybaltovsky & Böhme, 2010), described from a single specimen from Tuan Giao District, Dien Bien Province, and *S. ochracea* (Bourret, 1937), resurrected from the synonymy of *S. reevesi* for specimens from Lai Chau Province (Nguyen *et al*. 2010a); *S. monticola* (Schmidt, 1925) discovered in Mau Son Commune, Loc Binh District, Lang Son Province (Nguyen *et al*. 2010b); *S. apraefrontalis*, described from Huu Lien Nature Reserve, Huu Lung District, Lang Son Province (Nguyen *et al*. 2010c), and *S. rufocaudatus* (Darevsky & Nguyen, 1983) and *S. devorator* (Darevsky, Orlov & Ho, 2004), transferred to the genus by Nguyen *et al*. (2011).

Until now, *Scincella apraefrontalis* was now only known from the holotype. Herein, we present a new locality for this species, based on a single specimen collected in Pu Hoat Nature Reserve in August 2012.

The adult male lizard was found on the ground at midday on 3 August 2012, approximately 10 m from a large stream in evergreen forest in Pu

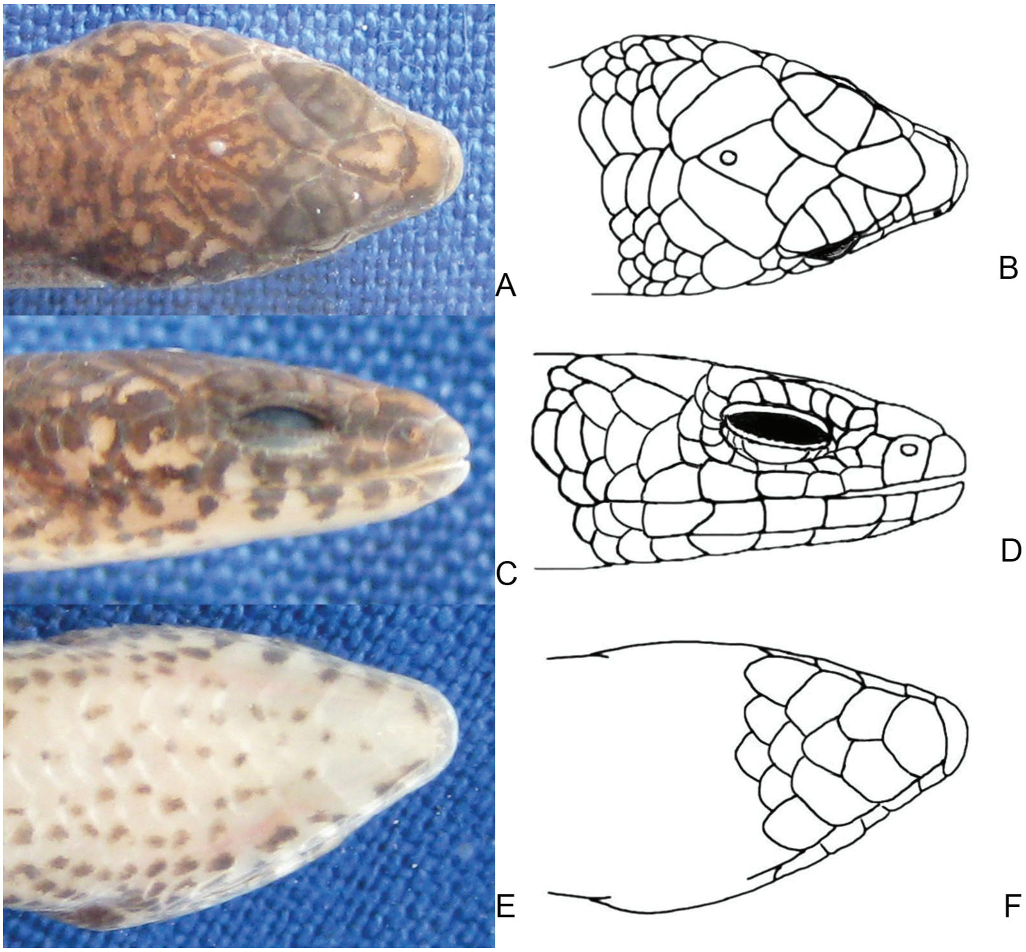

Figure 1. Head of *Scincella apraefrontalis* HDU03029: a–b, dorsal view; c–d, lateral view; e–f, ventral view. Photos by Thao Ngoc Hoang.

Table 1. Measurements (in mm) and selected morphological characters of *Scincella apraefrontalis* from Pu Hoat Nature Reserve compared with the holotype (Nguyen *et al.* 2010c).

	Pu Hoat Nature Reserve (HDU03029)	***Scincella apraefrontalis* holotype (IEBR A.0832)**
SVL	31.3	36.1
TaL	22.3 (unregenerated part only)	lost
AG	17.8	21.4
FlL	4.7	5.1
HlL	6.8	8.1
HL	5.1	5.5
HW	4.2	4.3
SVL/HW	7.45	8.40
HD	2.7	3.3
SL	1.8	2.4
STL	5.6	6.0
SFlL	10.0	11.9
ENL	1.0	0.9
EL	1.3	1.6
ETL	1.8	-
External ear opening	Absent	Absent
Digits on forelimb	5	5
Prefrontals	Absent	Absent
Supraoculars (L/R)	3/4	4/4
Nuchals (L/R)	3/3	2/3
Nasal fused to first supralabial	yes	yes
Supranasals	Absent	Absent
Loreals	1	1
Supraciliaries (L/R)	6/6	6/6
Supralabials (L/R)	6/6	6/6
Lower eyelid	Opaque window	Opaque window
Infralabials (L/R)	5/5	5/5
Midbody scale rows	18	18
Dorsal scale rows between lateral stripes	4	4
Dorsal scales in comparison to lateral scales	Larger	Larger
Paravertebral scales	48	52
Ventrals in transverse rows	50	50
Enlarged precloacals	2	2
Subdigital lamellae on 4th toe (L/R)	8/7	8/9
Limbs when adpressed	Separated	Separated
Longest finger reaching to eye	No	No

Hoat Nature Reserve, Que Phong District, Nghe An Province, Vietnam (19.750°N, 104.809°E, 714 m) by Vinh Quang Dau, Lam Thi Hong Le and Hai Thi Thanh Chau. The specimen (HDU03029) is deposited in the Zoological Department, Faculty of Natural Sciences, Hong Duc University, Thanh Hoa Province, Vietnam.

Measurements were made with a dial caliper to the nearest 0.1 mm. The following measurements were taken: snout-vent length (SVL);

Figure 2. *Scincella apraefrontalis* in Pu Hoat Nature Reserve (in life). Photo by Dau Quang Vinh.

axilla to groin length (AG); tail length (TaL); forelimb length (FlL); hind limb length (HlL); maximum head length (from tip of snout to posterior margin of parietal) (HL); maximum head width (HW); maximum head depth (HD); snout length (from tip of snout to anterior corner of eye) (SL); snout to tympanum length (to anterior margin of tympanic crease) (STL); snout-forelimb length (SFlL); eye to nostril length (to anterior corner of eye) (ENL); eye length (EL), and eye to tympanum length (from anterior border of tympanic crease to the posterior corner of eye) (ETL).

The following scalation characters need definition: nuchal scales (transversely broadened paravertebral scales behind parietals, twice the width of the subsequent paravertebral scales, counted on both sides); paravertebral scales (number of scales from posterior edge of parietals to a point above and opposite the vent); ventral scales (number of scales along the ventral midline, from and including the first gular scale between the second pair of chin shields, to the vent). Subdigital lamellae (number of lamellae under the first to fifth fingers and toes, including the terminal scale sheathing the claw) were counted on both sides. Scales in longitudinal series are numbered from anteriorly to posteriorly. The new specimen is described as follows.

Head longer than wide (HW/HL 82.4%), distinct from neck. Snout rounded anteriorly; rostral twice as wide as high, visible from above. Supranasals absent; frontonasal wider than long, in contact with rostral anteriorly, and with nasal, loreal, preocular, first supraciliary and frontal posterolaterally. Prefrontals absent. Frontal longer than wide, narrowed posteriorly, as long as distance to the snout; in contact with frontonasal, first supraciliary, first and second supraoculars, and frontoparietals. A pair of frontoparietals, in contact with each other anteriorly and with frontal, two (left) or three (right) posterior supraoculars, parietals and interparietal. Interparietal lozenge-shaped, between frontoparietals and parietals; parietal eye spot present as a small opaque white spot near posterior end of interparietal; parietals in contact with each other posterior to interparietal. Three pairs of nuchals.

Nostril in undivided nasal; nasal and first supralabial fused. Loreal single, in contact with

Figure 3. Locality records of *Scincella apraefrontalis*: Pu Hoat Nature Reserve (star) and Lang Son province (type locality; closed circle).

nasal, frontonasal, preocular, anterior presubocular, and second supralabial. Preocular single, in contact with a small part of frontonasal, anterior supraciliaries, anterior presubocular and loreal. Two presuboculars, anterior presubocular in contact with loreal, preocular, and second supralabial; posterior presubocular in contact with second and third supralabials. Supraoculars four (right), three (left), the reduction to three apparently due to fusion of second and third supraoculars of the normal four scales. Supraciliaries six, followed by an upper postocular that has entered the supraciliary row, and is in contact with the fourth supraocular and upper postsubocular, but separated from the parietal by a narrow scale posterior to the fourth supraocular (based on the definitions of head scalation provided by Taylor (1935), this narrow scale would be the last supraciliary, separated from the others by the intrusion of the upper postocular into the supraciliary row). Postsuboculars three, lowermost contacting fifth supralabial. Lower eyelid with an undivided opaque window, separated from supralabials by a row of small scales. External ear opening absent.

Supralabials six, first fused to nasal. Infralabials five. Mental rounded anteriorly, wider than long, in contact with the first infralabial and postmental, which is undivided; three pairs of enlarged chinshields, the anterior pair in medial contact; second pair widest, separated from each other by a single gular scale; last pair separated from each other by three gular scales.

SVL 31.2 mm; distal part of tail regenerated. Body slender (SVL/HW 7.45), slightly elongate (AGL/SVL 56.9%). Limbs short (FlL/SVL 15.0%; HlL/SVL 21.7%), pentadactyl; forelimbs and hindlimbs widely separated when adpressed ((FlL+HlL)/AGL 51.6%). Number of lamellae under the first to fifth fingers (in order): 4,6,7L/6R,5,5; under the first to fifth toes: 4,8,9,8L/7R,5.

Head shields and dorsal scales smooth. Scales on body dorsum hexagonal, overlapping, larger than lateral scales. Mid-body scales in 18 rows; lateral scales in 4 rows; paravertebral scales 48; ventral scales 50; medial pair of precloacals enlarged and overlapping the adjacent lateral precloacals. Median subcaudals wider than adjacent subcaudals. Tail thick at base, tail tip regenerated; 28 rows of subcaudals to the point of regeneration.

In life (Fig. 2), the following coloration was present: head shields and scales on dorsum and tail base bronze brown with some indistinct darker spots in anterior part of each scale; a dark streak from snout across eye to the tympanic depression; four dark streaks from below the eye extending down the upper and lower lip; laterally paler with four longitudinal dark brown stripes beginning posteriorly to the posterior end of the jaw, and extending to hindlimb; chin and throat with dark spots; venter and underside of tail base cream. In preservative (stored in 70% ethanol), the color is paler.

The specimen was identified as *S. apraefrontalis* by possessing the following diagnostic character states for the species (Nguyen *et al*. 2010c): supranasals absent; prefrontals absent; nasal and first supralabial fused; loreal single; supralabials six; infralabials five; lower eyelid with an undivided opaque window; external ear absent; longitudinal rows of scales at midbody 18, and limbs short, pentadactyl, widely separated when adpressed.

In general, the newly collected specimen agrees well (Table 1) with the description of *S. apraefrontalis* by Nguyen *et al.* (2010c), but differs slightly from it in having fewer paravertebral scale rows (48 *versus* 52 scales), and fewer lamellae under the fourth toe.

The new record extends the known distribution of the species approximately 265 km southwest of the type locality in Lang Son Province (Fig. 3). Like the holotype from Huu Lien Nature Reserve, the specimen from Pu Hoat Nature Reserve was found active during the daytime. It was found on the ground in evergreen forest at 714 m elevation, while the holotype was found among leaf litter on the ground of secondary limestone forest at an altitude of 200 m a.s.l. (Nguyen *et al.* 2010b). Our new record provides evidence that *Scincella apraefrontalis* is not endemic to limestone habitat, but until more data are available from additional localities, the habitat preferences of this species remain undefined. Further work is also needed to determine whether the distribution of the species is continuous between the two widely separated localities.

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Predation of an endemic Sri Lankan kangaroo lizard (*Otocryptis wiegmanni*) by a nephilid spider (*Nephilengys* sp.)

The classes Arachnida, Insecta, Crustacea and Chilopoda are considered predators of small vertebrates, including reptiles and amphibians (McCormick & Polis 1982). Among the four classes, Arachnida is most often recorded as preying on small reptiles and amphibians and arachnid predation may be a significant cause of mortality for natural populations of both groups (Bauer 1990; Armas 2000; Barbo *et al*. 2009; Maffei *et al*. 2010). The orb webs of spiders are highly effective, efficient and specialized for the capture various prey types (Herberstein & Tso 2000; Blackledge 2011). Blondheim & Werner (1989) and Schwammer & Baurecht (1988) reported several species of widow-spiders (*Latrodectus*, Theridiidae) preying on lizards (*Mesalina guttulata* and *Podarcis melisellensis*, Lacertidae), Bauer (1990) summarised predation of geckos (Gekkota) by spiders, and Armas & Alayón (1987) witnessed the lizards *Anolis porcatus* and *A. sagrei* (Dactyloidae) being preyed upon by the banded garden spider, *Argiope trifasciata* (Araneidae). We here report a predatory incident on an endemic Sri Lankan Kangaroo Lizard (*Otocryptis wiegmanni*) by a

Figure 1. An adult *Nephilengys* sp. preying on a juvenile *Otocryptis wiegmanni*: in the Sinharaja World Heritage Site.

nephilid spider (*Nephilengys* sp.) in the World Heritage site Singharaja.

Otocryptis wiegmanni is widely distributed throughout the wet zone and some parts of the intermediate zone of Sri Lanka from sea level up to 1300 m elevation (Somaweera & Somaweera 2009). It is found in both natural and anthropogenic habitats where there is adequate leaf litter, shade and moisture. Currently, there is evidence of four species of nephilid spiders living in Sri Lanka and there are no details on foraging behaviour and food preferences in their natural environment.

Predation was observed on 21 July 2014, during daytime (17 15h), at the Sinharaja World Heritage Site. We observed a juvenile *O. wiegmanni* trapped in a *Nephilengys* sp. web by the side of the foot trail (Martin's Lodge to Forest Entrance Trail). The web was suspended from two branches approximately one meter above the ground. The *Otocryptis* was struggling to escape, but failed. After a few seconds, a *Nephilengys* sp. came out of its hiding spot, then used its pedipalps and chelicerae and to grip and inject venom into the lizard (Fig. 1). The spider then attempted to move its prey but was unable to do so, presumably because of the relatively heavy weight of the *O. wiegmanni*. It took around 40 minutes for the venom to completely imobilize the prey, then a gradual discoloration signaling the beginning of liquefaction of the tissues surrounding the site of envenomation was observed. The *Nephilengys* sp. began feeding on the liquified parts of its prey using its suctorial apparatus. This entire process lasted around three hours. Predation events of spiders on lizards have rarely been recorded in the Sri Lankan literature, primarily due to the infrequency with which theyare encountered by observers in the field.

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Stream habitat relation to the occurrence of selective amphibian species along headwater streams in the Lower Dibang Valley, Arunachal Pradesh, India

Different taxa of amphibians have different habitat requirements and their occurrence along a stream will be affected by habitat variability and relative availability of particular habitat types. Habitat variability affecting amphibian occurrence along a stream is strongly associated with stream characteristics (Platts *et al.* 1983; Gillespie *et al.* 2004; Ficetola *et al.* 2011) and the availability of mesohabitats (runs, riffles and pools) (Fig. 1) can be used to classify streams at a spatial scale relevant to most lotic biota (Frissell *et al.* 1986). The change in headwater stream characteristics that influence amphibian occurrence has been observed by several authors (Platts *et al.* 1983; Gillespie *et al.* 2004; Stoddard *et al.* 2004; Buskirk 2005; Ficetola *et al.* 2011). However, such studies are rare in the Indian region.

A preliminary study was carried out in the Lower Dibang Valley district of Arunachal Pradesh (28°06’–28°23’ N, 95°49’–95°59’ E) to understand the occurrence of two amphibian species (*Xenophrys* sp. and *Amolops marmoratus*) in three headwater streams having different forest management practices at the stream reach level (Stoddard et al. 2004). The species were selected based on their presence in all the three streams. A 500 m long stream reach was selected from each of the three streams for data collection (Kratzer et al. 2006). Each was subdivided into 10 segments of 50 m for stream sampling and habitat characterization (USEPA 1997). Stream habitat diversity was estimated by measuring habitat transitions along a stream (Platts et al. 1983; Barbour et al. 1999). We counted the number of habitat changes from 0 (zero) meters (at the start of the transect) to 50 meters (at the end of the transect) for habitat transitions. The frequency of Large Woody Debris (LWD) or debris jams was estimated by tally marking along a stream channel. LWD of 10 cm or larger in diameter in contact with the stream water upstream were considered for tally marking (Platts et al. 1983; Barbour et al. 1999). The riparian vegetation along stream reaches was measured by Spherical densitometer (Lemmon 1956).

In our study, we found that habitat diversity along the three streams was positively related to the number of *Amolops marmoratus* encountered (Pearson product-moment correlations: $r = 0.505$, df = 29, $p < 0.01$). However, we did not detect any significant relationship between the number of *Xenophrys* sp. encountered with habitat transition ($r = 0.147$, df = 29, NS). *Amalops marmoratus* are associated with continuous fast flowing streams (IUCN Red list 2014) and large boulders provide increased surface area (riffles) and high riparian vegetation cover (40.63%) in Chinu Nullah relative to the other two stream reaches (Chuhu 21.8% and Chisi 37.5%). *Xenophrys* tadpoles are surface feeders

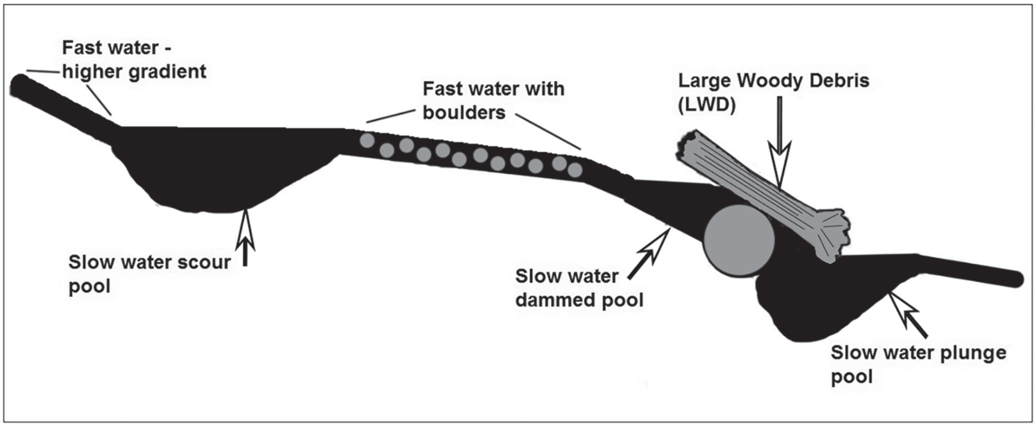

Figure 1. Schematic representation of different zones along a stream. (United States Forest Service 2009).

Table 1. Percentage of habitat composition, pool-riffle ratio, riparian vegetation cover (%) and number of large woody debris (LWD) in Chuhu, Chisi and Chinu stream reaches.

Stream	Chuhu	Chisi	Chinu
Habitat composition			
Run	0%	4.17%	7.14%
Pool	50%	45.83%	42.86%
Riffle	50%	50%	50%
Pool-riffle ratio	1:1	0.92:1	0.86:1
Riparian Vegetation cover (%)	21.8%	37.50%	40.63%
Number of LWD	61	34	34

(Duellman and Trueb, 1986) and are associated with streams having more pools and providing the most suitable habitats for food and development. Chuhu Nullah with a high pool to riffle ratio of 1:1 (Table 1) supported the most *Xenophrys* sp. Platts *et al.* (1983) suggested that streams with high pool to riffle ratios have can provide resting and feeding pools for aquatic organisms, which was consistent with *Xenophrys* sp. in this study. LWD along a stream results in the blockage of water and creates small dams (natural) as was observed in all the three streams surveyed. We found that the number of *A. marmoratus* was negatively related to LWD (Pearson product-moment correlations: r = - 0.42, df = 29, p < 0.01), although there was no significant relationship between frequency of LWD and the number of *Xenophrys* sp. encountered (r = 0.168, df = 29, NS) along the three stream reaches. *Amalops marmoratus* was associated with fast flowing streams and was negatively affected by increases in LWD at the stream reach level. On the other hand, LWD may have an indirect positive effect on *Xenophrys* sp. occurrence by providing small breeding pools for tadpoles. However, we did not detect any significant relationship between the number of *Xenophrys* sp. encountered and the frequency of LWD, probably due to low sample size in this preliminary study.

The results of this study show that amphibian occurrence along a stream is influenced directly and indirectly by stream characteristics (e.g., stream flow) enhanced by some biological factors (*viz.,* LWD) (Schuett-Hames *et al.* 1999). This is supported by earlier studies elsewhere (Knapp *et al.* 1998; Buskirk 2005; Ficetola *et al.* 2011; Seshadri 2014). Significantly, interaction between local biotic and abiotic factors was found to play an important role in amphibian occurrence in the area, as found in a study by Buskirk (2005). Future studies along headwater streams will be critical for understanding the influence of stream characteristics and related environmental factors on amphibian occurrence.

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First Train Collision Record for King Cobra *Ophiophagus hannah* (Cantor, 1836) in the Nilgiris, Tamil Nadu, Southern India

The King Cobra, *Ophiophagus hannah* (Cantor, 1836), is the longest venomous snake in the world, reaching a length of up to 5.85 m (Aagaard 1924). It is listed under Schedule II of the Indian Wildlife (Protection) Act 1972, Appendix II of CITES, and in the Vulnerable category by the IUCN (2010). Its population size has declined globally by at least 30% over an estimated three-generation period of 15–18 years (Stuart *et al*. 2012).

On 25 November 2015 at 11 15h during a field trip to the Kallar RF region, Nilgiris, Tamil Nadu, India, we observed a dead specimen of King Cobra *Ophiophagus hannah* on the hill train track between Mettupalayam and Coonoor near Adderly railway station (11.352270° N, 76.871376° E) (Fig. 1), The head portion of the specimen was found away from the track and rest of the body was found in between the tracks. The specimen was approximately 2.5 m in length from the severed point to tail tip (Fig. 2). The specimen was found in mixed deciduous forest (Champion & Seth 1968). In India, most of the reported railway line mortalities of wild animals concern large animals such as carnivores and ungulates (Kumar 1995; Johnsingh & Williams, 1999; Sarma *et al*. 2006). This present observation is the first record of a train kill for a King Cobra in this region. Snakes apparently use the warm surface of the tracks for thermoregulation (Das *et al*. 2007; Pragatheesh & Rajvanshi 2013) and some species of snakes adopt a stationary ‘freezing’ behaviour when a vehicle is approaching them (Andrews & Gibbons 2005). Either of these factors may be responsible for the death of the specimen observed.

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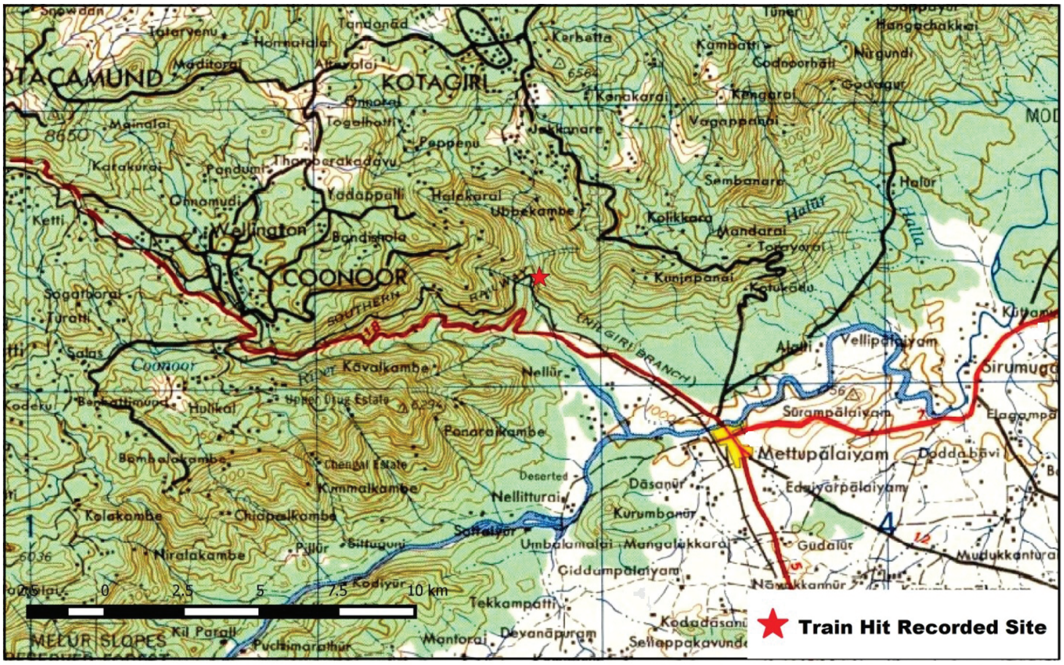

Figure 1. Map showing recorded site of King cobra, *Ophiophagus hannah* (Cantor, 1836), killed by train.

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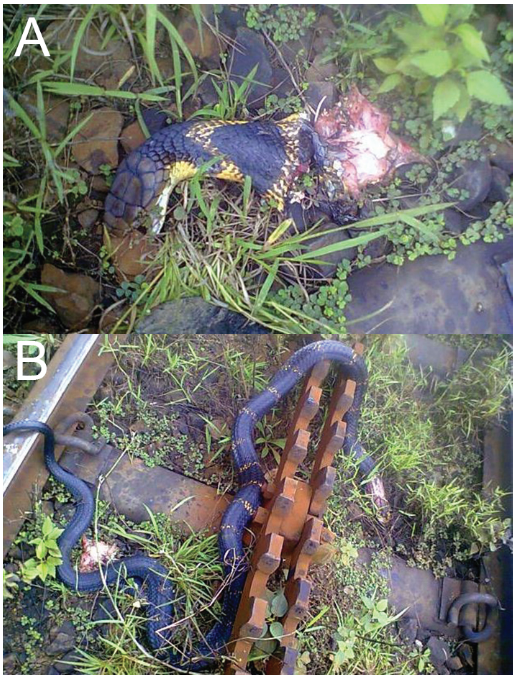

Figure 2. Railway line mortality of King cobra *Ophiophagus hannah* (Cantor 1836) in the Nilgirs, Tamil Nadu, Southern India. Photo Courtesy by. P. Saravanan

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Helminth records from *Gekko canaensis* and *Gekko vietnamensis* (Squamata: Gekkonidae) from Vietnam

Gekko canaensis was described from Cà Ná Cape, Vinh Commune (11°20.009”N, 108°52.224”E), Tuy Phong District, Binh Thuan Province, Vietnam by Ngo & Gamble (2011). *Gekko vietnamensis* was described from Túrc Dup Hill (10°22’35”N, 104°57’35”E), An Giang Province by Sang (2010). To our knowledge, there are no published reports of helminths for either species. The purpose of this note is to establish the initial helminth lists for *G. canaensis* and *G. vietnamensis*.

Three *G. canaensis* (mean SVL = 108.7 ± 9.3 SD, range = 98–115) collected from the type locality (no collection date available) and deposited in the herpetology collection of La Sierra University (LSUHC), Riverside, California as LSUHC 10425, 10429, 10432 and seven *G. vietnamensis* (mean SVL = 85.9 mm ± 6.4 SD, range = 73–93 mm) collected from the type locality (no collection date available) also deposited in LSUHC as LSUHC 10417–10419, 10437, 10509–10511 were examined. A lateral incision was made through the body wall and the digestive tract was removed. The esophagus, stomach, small and large intestines were opened longitudinally and searched for helminths using a dissecting microscope. The body cavity was also searched. Nematodes were cleared in lactophenol, placed on a microscope slide, coverslipped, and studied using a compound microscope. Adult nematodes were identified using Anderson *et al.* (2009); larval nematodes were identified using Alicata (1935).

One species of Nematoda, *Parapharyngodon maplestoni* was found in the large intestine of both *G. canaensis* and *G. vietnamensis*. Thirty-one *P. maplestoni* were found in *G. canaensis* (prevalence = number infected/number examined x 100) = 100%; mean intensity = mean number infected lizards = 10.3 ± 7.8, range = 4, 8, 19). Twelve *P. maplestoni* were found in *G. vietnamensis* (prevalence = 71%; mean intensity = 2.4 ± 1.1 SD, range = 1–4). In addition, eight *Physocephalus* sp. larvae were found in cysts in the stomach wall of *G. vietnamensis*; prevalence = 14%. Helminths were deposited in the Harold W. Manter Parasitology Laboratory (HWML) University of Nebraska, Lincoln, Nebraska as *P. maplestoni* in *G. canaensis* (HWML 92068) and in *G. vietnamensis* (HWML 92069); *Physocephalus* sp. in *G. vietnamensis* (HWML 92070).

Parapharyngodon maplestoni was described from the agamid *Calotes versicolor* from Myanmar (as Burma) by Chatterji (1933) and is widely distributed in lizards from South Asia (Goldberg & Bursey 2001) and Oceania (Goldberg *et al*. 2011). Encysted larvae of *Physocephalus* sp. in the gut wall are common in lizards (Goldberg *et al*. 1994, 1999, 2011; Goldberg & Bursey 2012). Development beyond larvae does not occur in lizards which function as paratenic (transport hosts); development to the *Physocephalus* adult occurs after larvae are eaten by a carnivore. *Parapharyngodon maplestoni* in *G. canaensis* and *G. vietnamensis* and *Physocephalus* sp. in *G. vietnamensis* are new host records.

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First report on the presence of *Amyda cartilaginea* (Boddaert, 1770) from Assam, India

Eight species of trionychid turtle are known to occur in India, including *Chitra indica*, *Lissemys punctata* (two sub species *punctata* and *andersonii*), *Nilssonia gangetica*, *N. hurum, N. leithii*, *N. nigricans*, *Pelochelys cantorii* and *Amyda cartilaginea* (Das 1990, 1996; Bhupathy *et al*. 1992; Frazier & Das 1994; Choudhury 1995; Datta 1998; Sengupta *et al*. 1998; Pawar & Choudhury 2000; Fritz *et al*. 2014). *Amyda cartilaginea* (Boddaert, 1770), though very rare (Ahmed *et al*. 2009), has a wide distribution and has been reported from Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Singapore, Thailand, Viet Nam, India and Bangladesh (Tana *et al*. 2000; Platt *et al*. 2007, 2012; Khan 2012; Kabir *et al*. 2015). *Amyda cartilaginea* inhabits freshwater bodies such as lowland rivers, ponds, canals, hill streams and possibly estuaries (Boulenger 1912; Moll 1976; Ahmed *et al.* 2009). The IUCN Red List of Threatened Animals lists the species as Vulnerable (Asian Turtle Trade Working Group 2000). This species is harvested for local, regional, and international consumption (van Dijk 1999). Large numbers are caught for rural consumption, while regional networks of hunters and traders supply restaurants and the international trade (Jenkins 1995; van Dijk 1999).

During a field visit to the Inner Line Reserve Forest (ILRF), Cachar district, Assam, we encountered a turtle near a narrow river channel at Dhalchera (24°26'46.11" N, 92°41'52.56" E) on 5 March 2011 (Fig. 1). The river channel flows from adjoining Phaisen Hill of Mizoram State, and joins two other rivers, namely the Dhaleswary and the Katakhal. Both of these rivers join the Barak River (see Das & Gupta 2011, 2015). Dhalchera is a small hamlet located inside the ILRF which, in turn, is contiguous with the forests of neighbouring Mizoram. The vegetation in the area is mainly tropical evergreen interspersed by tropical semi-evergreen forest in some patches. The once heavily forested tract is now degraded due to shifting cultivation and other anthropogenic activities. The turtle had

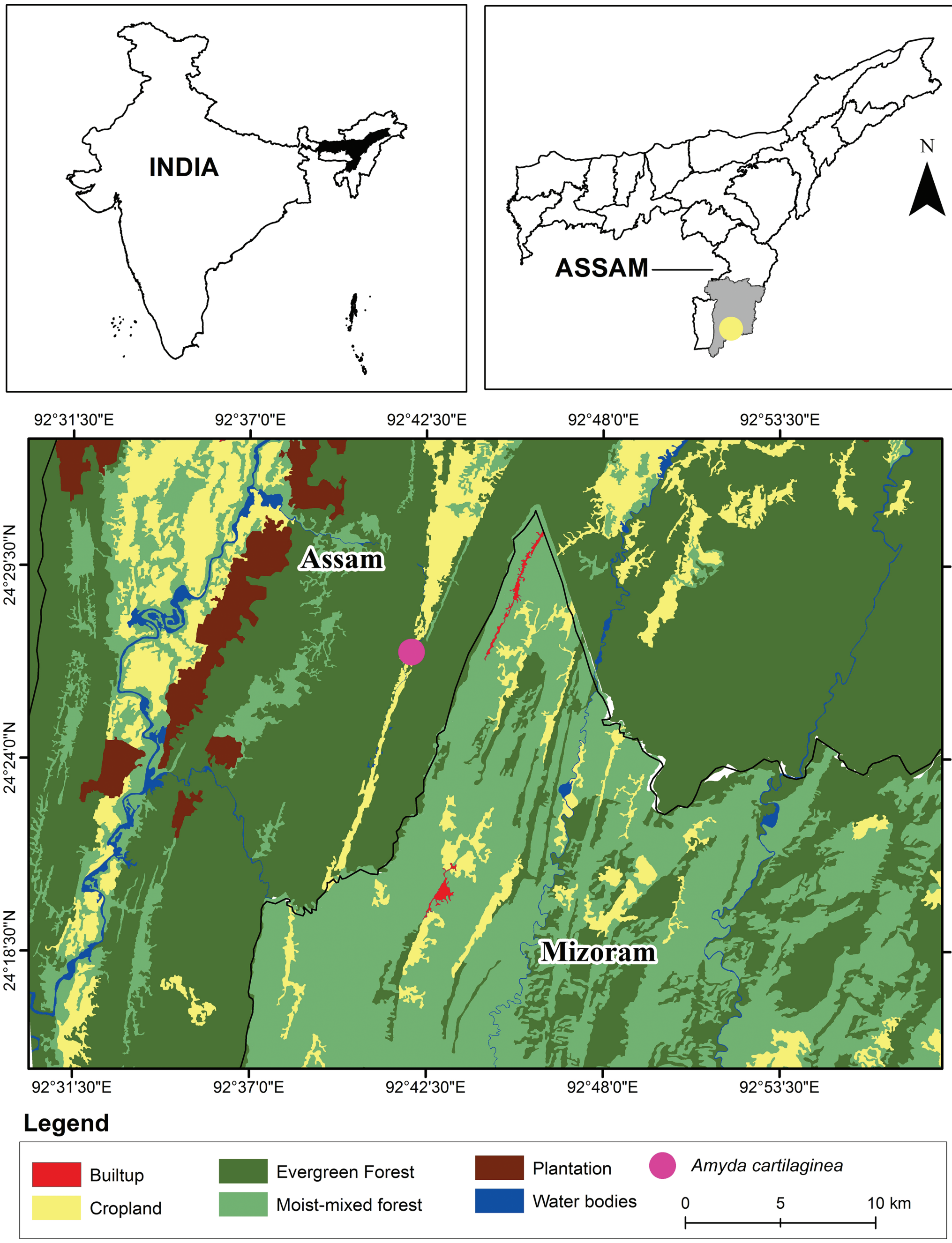

Figure 1. Map showing the location of *Amyda cartilaginea* collected near the Assam-Mizoram border in North-east India.

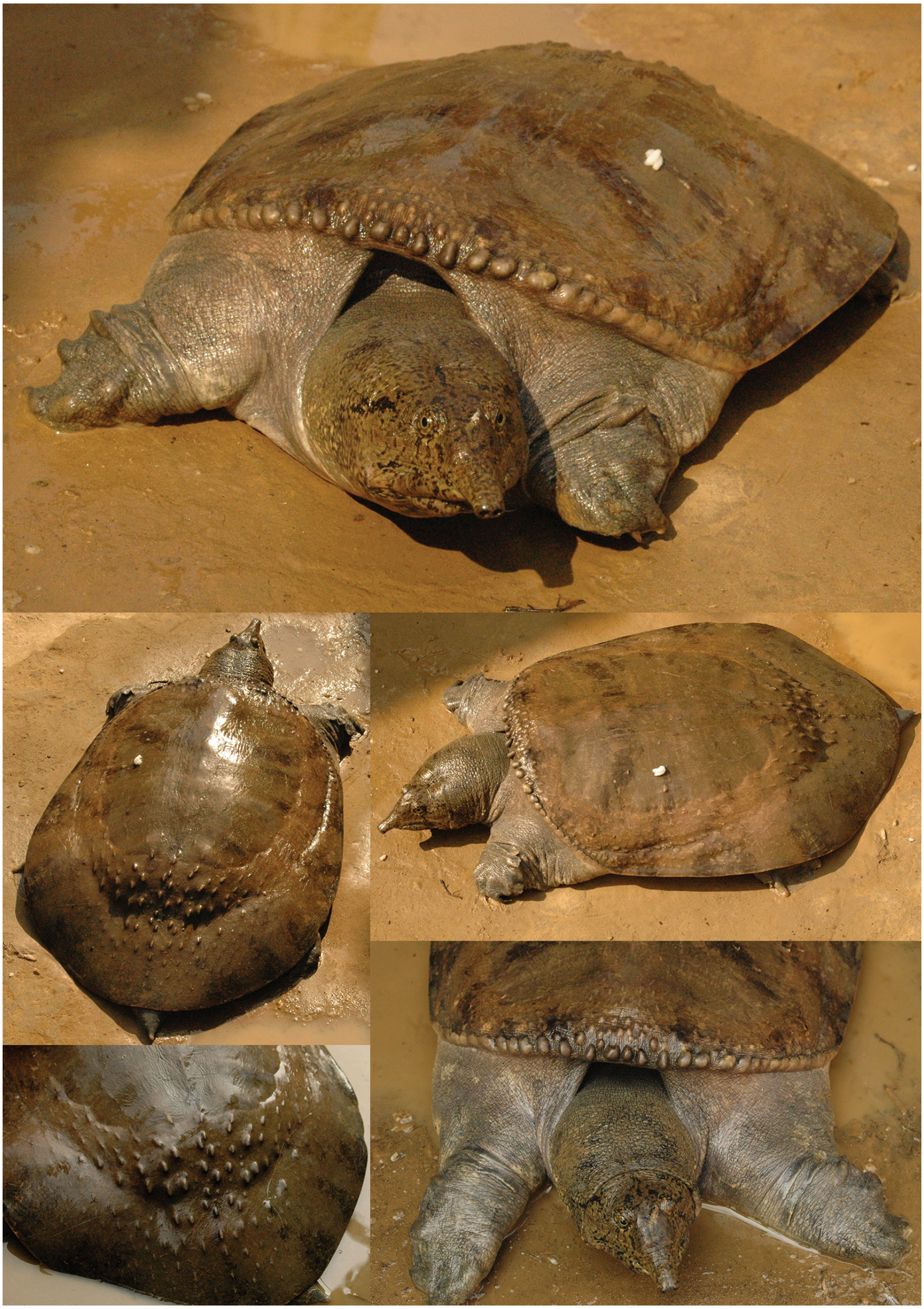

Figure 2. Multiple views of the Assam specimen of *Amyda cartilaginea*, illustrating the overall morphology of the specimen and in particular the diagnostic row of tubercles along the anterior edge of the carapace and indistinct yellow spots on the head.

been caught by locals to eat, but was rescued by an amateur naturalist (Pankaj Sharma), who happened to be present when the turtle was captured.

The specimen was identified as the Malayan softshell turtle (*Amyda cartilaginea*. Family Trionychidae: Trionychinae) based on a key provided by Ahmed *et al*. (2009), based on the presence of a distinct row of tubercles along the anterior edge of the carapace and a head with numerous indistinct yellow spots on an olive background (Fig. 2). Although Ahmed *et al*. (2009) mentioned a greenish or olive carapace with yellow and black speckling, in our specimen such speckling was not evident (Fig. 2). The long axis length of the carapace measured 370 mm, whereas its breadth was 320 mm. The circumference of the carapace was 1010 mm and that of the plastron was 260 mm. The length of the plastron including the tail was 410 mm. As the tail extended beyond the posterior border of the carapace it was probably a male (see Ahmed *et al*. 2009).

We were told that another individual of the same species had been caught in the previous year (2010) during the monsoon season when the river was full of water flowing from Mizoram. In India, *Amyda cartilaginea* has been reported from the Ngengpui river basin of Mizoram, in the extreme southern part of north-eastern India (Pawar & Choudhury 2000). It may also occur in Manipur and Nagaland bordering Myanmar (Ahmed *et al*. 2009). There are a few records of this species from Tamenglong Bazzar near the Makru River, Tamenglong District, Nambul River, Imphal (Anonymous 2008). Das & Gupta (2011) reported four species of trionychids (*Nilssonia gangetica, N. hurum, Chitra indica* and *Lissemys punctata*) from the Barak Valley, Assam. Recently they have also recorded two species of tortoises (*Indotestudo elongata, Manouria emys phayrei*) from 17 different locations in the Barak Valley region of Assam (Das & Gupta 2015). Our sighting of *A. cartilaginea* is the first from Assam. The earlier report of this species from the Ngengpui River basin of Mizoram is approximately 200 km from the present record. We speculate that this turtle migrated (or was washed downstream) from adjacent Mizoram and was found on the Assam-Mizoram border. Additional surveys as well as increased public awareness are needed to provide data on the status of *A. cartilaginea* in Assam (and extreme eastern India) and to implement conservation measures for its protection.

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