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First record of the family Sialidae (Megaloptera) from Thailand and description of the female and putative larva of *Indosialis bannaensis*

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Abstract

Indosialis bannaensis is reported from northern Thailand marking the first record of the family, genus, and species from this country. The female and the probable larva of the species are described for the first time.

Key words: Neuropterida, *Austrosialis*, southeastern Asia, biodiversity

Introduction

The alderfly genus *Indosialis* Lestage consists of three uncommon species: *Indosialis minora* (Banks 1920), which is known from Singapore and possibly Malaysia (Lestage 1927; Liu *et al.* 2008), *I. bannaensis* Liu *et al.* (2006) from China and Vietnam, and *I. indicus* Liu *et al.* (2008) from India. In their phylogenetic analysis of the family Sialidae, Liu *et al.* (2015a) showed that *Indosialis* is sister to *Haplosialis* Navás of Madagascar. An additional fossil species, *Indosialis beskonakensis* Nel is known from the Oligo-Miocene of modern day Turkey (Nel 1988). Of the three extant species, a female has been described only for *I. minora* (Liu *et al.* 2008), and the larval stage for the genus is undescribed.

As part of an aquatic insect biodiversity study conducted in Thailand during 2002–2004, numerous larval and adult Megaloptera were collected from throughout the country, including several alderflies (Sialidae). We identified an adult male alderfly and associated females as *I. bannaensis* Liu, Yang & Hayashi. The larvae, which were co-collected with the adults, are presumed to be the larvae of this rare genus. The collection of *I. bannaensis* in Thailand represents the first record of the family, genus and species from this country. In this paper, we describe the female and putative larva of *I. bannaensis* for the first time.

Materials and methods

Dissection followed standard procedures (*i.e.*, Contreras-Ramos 1998). Specimens are preserved in 75% ethyl alcohol. Adult terminalia and entire larvae were prepared by clearing them in a cold, ~10% potassium hydroxide (KOH) solution for 8–10 h. Cleared terminalia and larval structures were rinsed with water and placed in microvials containing glycerine. Terminology follows Liu *et al.* (2015b). Collection acronyms are Iowa State University (ISU), and University of Missouri-Columbia (UMC), and Instituto de Biología, Universidad Nacional Autónoma de México (UNAM).

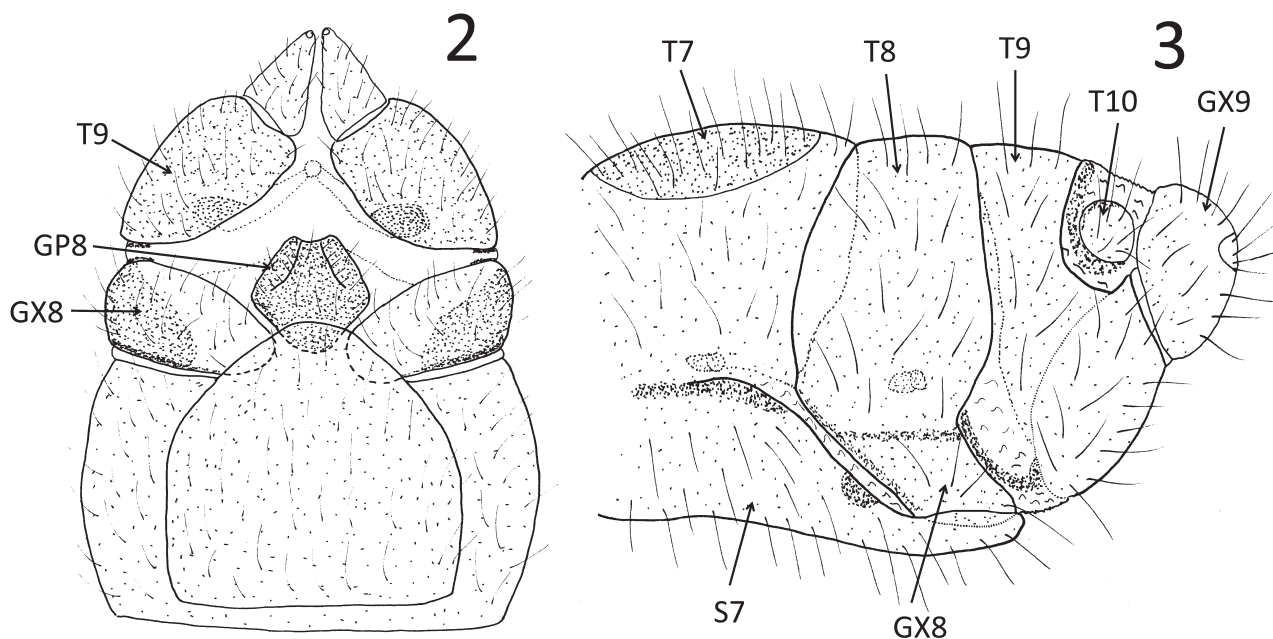
Systematics

Indosialis bannaensis Liu, Yang, and Hayashi (Figs. 1–11)

I. bannaensis Liu *et al.* 2006: 33–35. Liu *et al.* 2008: 48–51.



FIGURE 1. *Indosialis bannaensis*, female, lateral (photo: Robert W. Sites)



FIGURES 2–3. *Indosialis bannaensis*, female terminalia. 2. ventral. 3. lateral. GP8 (gonapophyses 8), GX8, 9 (gonocoxite 8, 9), T7–10 (tergum 7–10), S7 (sternum 7).

Description. Adult Female (Figs. 1–3): Head yellow with a few pale spots on dorsum; ocelli absent; clypeus brown, remainder of mouthparts yellow; antenna with scape and pedicel yellow, flagellum black [antennae broken in all specimens, number of flagellomeres unknown]; eyes black. Thorax yellow; legs with coxa, trochanter and femur yellow, but tibia, tarsus and tarsal claws brown. Wings dark brown; forewing length 10 mm, hindwing 9 mm; venation as in Liu *et al.* (2006). Abdomen brown; terminalia with seventh sternum broadly pentagonal in ventral view, covering proximal one-third of 8th gonapophysis; 8th gonocoxite divided into a pair of subtriangular lobes darkly sclerotized laterally becoming more membranous toward meson and overlapped by the 7th sternum; 8th gonapophysis diamond-shaped, heavily sclerotized and with posterior edge emarginate, bearing distinct, dark ridges that run from the posterior edges of emargination anteriorly for approximately one-half the length of the

sclerite; 9th tergite wrapping ventrally and connecting with the 9th gonocoxite, and bearing a darkly sclerotized area on anterior margin; 9th gonocoxite broadly triangular, lightly sclerotized, and with a small gonostylus distally; 10th tergum small and suboval.

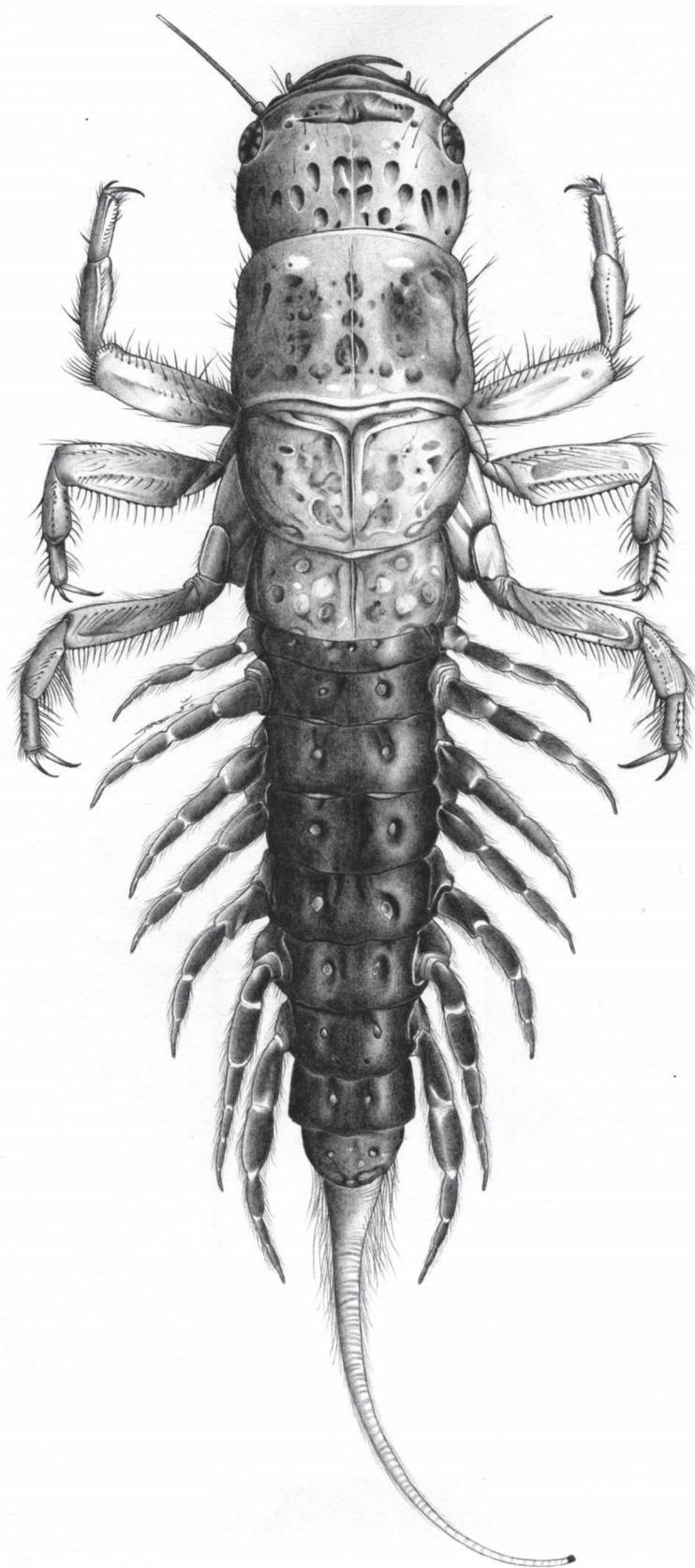


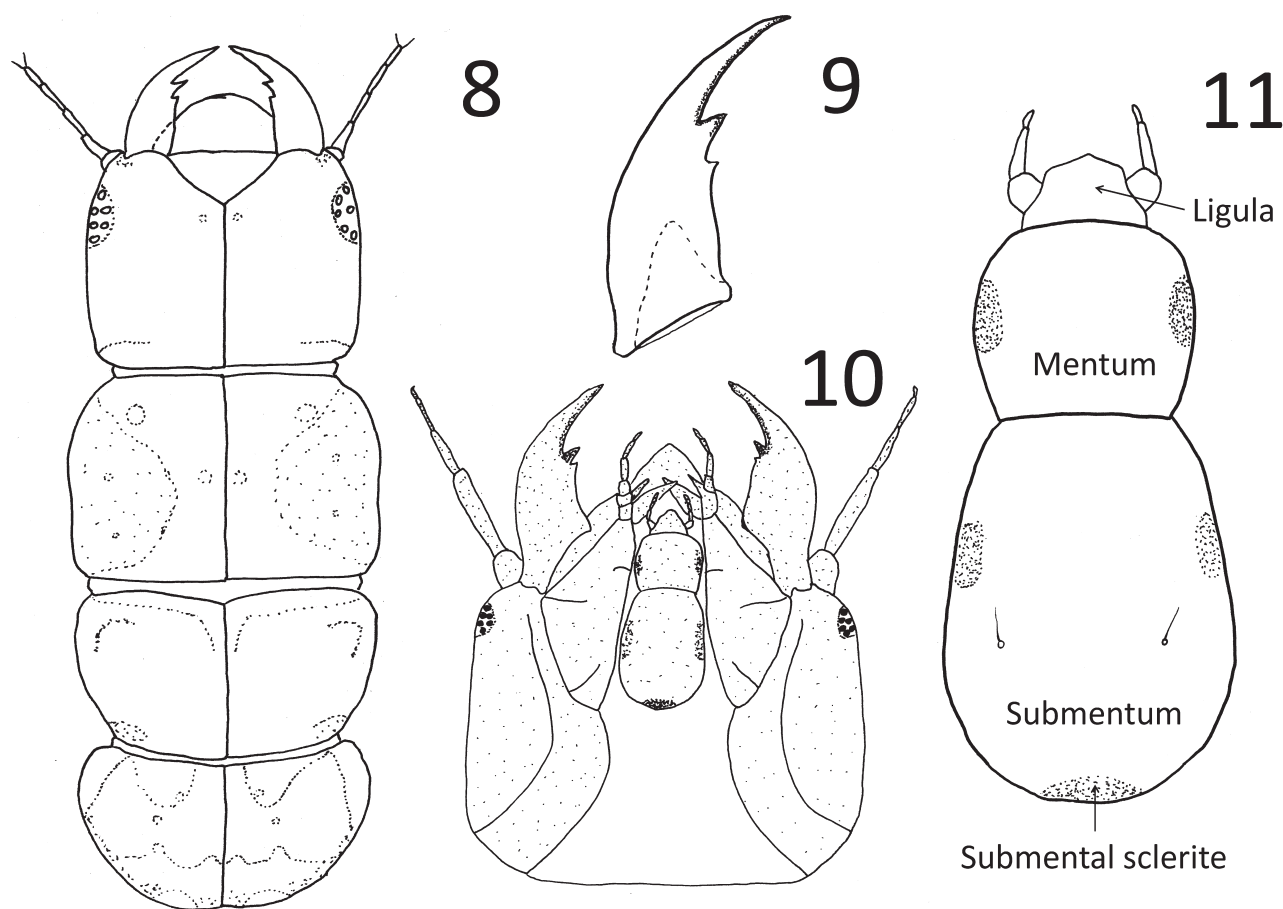
FIGURE 4. *Indosialis bannaensis*, larva, dorsal.



FIGURES 5–7. *Indosialis bannaensis* larva. 5. Habitus. 6. Head, dorsal. 7. Head, ventral.

Larva (Figs. 4–11): Total length: 15.4 mm (head and thorax 5.0 mm, abdomen 5.3 mm, terminal filament 5.1 mm). Head: width 2.0 mm, yellow to reddish brown and with irregularly spaced, small light yellow spots dorsally; antenna pale yellow. Mouthparts: mandibles symmetrical and darkly sclerotized apically and along the leading edge of the teeth, bearing two subapical teeth of which the posterior tooth is small and approximately one-half the height of the anterior tooth; remaining mouthparts orange to reddish-brown; frons broadly triangular; mentum and submentum fused, with margins rounded; submentum bearing prominent setae laterally on posterior one-half; a small oval sclerite present on posterior margin. Thorax: pronotum orange to reddish-brown and with dark brown saddles laterally and distinct yellowish reticulated pattern and spots; mesonotum somewhat cordate in shape and metanotum broadly oval, both orange to reddish brown and with distinct reticulated pattern of yellowish marks and spots; legs pale yellow and bearing long dense setae; tarsal claws reddish brown. Abdomen: dark purplish or blackish-brown dorsally and pale purplish brown ventrally; with paired, pale, comma-shaped marks on dorsum of

each segment; 7 pairs of pale brown lateral abdominal gills present with pale yellow intersegmental joints; terminal filament pale yellow and subequal in length to abdomen.



FIGURES 8–11. *Indosialis bannaensis* larval head and thorax. 8. Head and thorax, dorsal, 9. Left mandible, dorsal. 10. Head, ventral. 11. Ligula, mentum and submentum, ventral.

Material examined. THAILAND: Kalasin Province, Phu Pan Nat. Pk., 5.vi.1998, L-152, Sites, Simpson, Vitheepradit, slow stream w/ leaf pack, 5 larvae [UMC]. Loei Province, Phu Hin Ron Kla Nat. Park, Huai Man Daeng Noi @ trail, 16° 57' N 101° 03' E, 1600 m, 22.iv.2002, 2 larvae [ISU]; same, but 10.iv.2003, 2 larvae [1 ISU, 1 UNAM]; same, but 22.v.2002, 4 larvae [ISU]; same, but 21.x.2002, 2 larvae [ISU]; same, but 17.iii.2003, 1 larva [UNAM]; same, but 15.xi.2002, 1 larva [ISU]. Phitsanulok Province, Phu Hin Ron Kla Nat. Park, Man Daeng Noi, 16° 57' N 101° 03' E, 1600 m, 5.v–4.vi.03, malaise trap, 1 male, 1 female [ISU]; same, but 4–6.vii.2003, malaise trap, 2 females [ISU]; same, but Thung Salaeng Luang, 12.v.2004, Vitheepradit & Prommi, pan light trap, 1 female [UMC].

Diagnosis. Female: The adult female has striking yellow-orange body coloration with smoky-black wings. Terminalia are most readily distinguished by the heavily sclerotized, diamond-shaped 8th gonapophysis with an emarginated posterior edge and the 8th gonocoxite divided into a pair of partially sclerotized subtriangular lobes. The body is strongly setose. Larva: One large and one small subapical mandibular teeth, yellow-orange body coloration with weak maculation, and the configuration of the fused mentum and submentum that bears a small oval sclerite on the posterior margin appear to be strong diagnostic characteristics for this genus. Pupa: Unknown.

Distribution. The specimens of *I. bannaensis* we examined were all from Loei, Phitsanulok, and Kalasin provinces of northern Thailand (Fig. 12). This species is also known from China and Vietnam (Liu *et al.* 2006, 2008). Xingyue Liu (personal communication) indicated to us that he has examined specimens from Laos, and Chiang Mai and Nakhon-Ratchasima provinces in Thailand. These specimens have not been examined by us. Collectively, this information indicates that *I. bannaensis* is widely distributed in southeastern Asia. Larvae were collected from slow-flowing, sluggish streams. Nothing is known about this species biology.

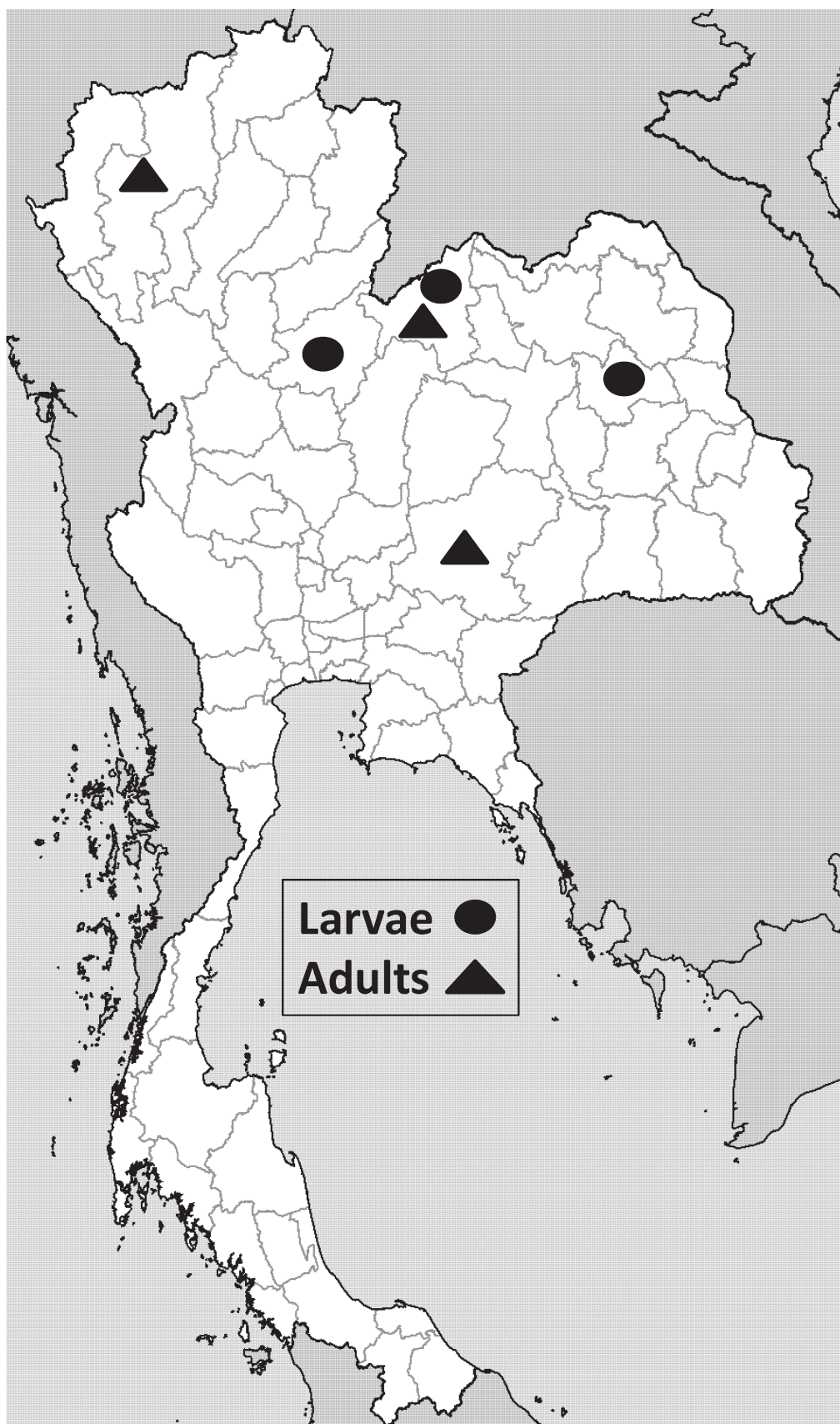


FIGURE 12. The known distribution of *Indosialis bannaensis* in Thailand. The records from Chiang Mai and Nakhon-Ratchasima Provinces are from Xingyue Liu (personal communication).

Discussion

This report of *I. bannaensis* from northern Thailand is the westernmost known distribution for this species, and in addition, it is the first documented occurrence of the family Sialidae and the genus *Indosialis* from Thailand. Xingyue Liu (personal communication) previously indicated this species also occurs in Laos.

In their revision of *Indosialis*, Liu *et al.* (2008) described a female from Malaysia that they considered to be *I. minora* (Banks), which previously had been known only from Singapore. Liu *et al.* (2008) also noted that their identification was assigned without an associated male and that its taxonomic status would be fully confirmed after a male was collected. Subsequently, Xingyue Liu (personal communication) examined a male specimen from that location and confirmed this species to be *I. minora*. The female we describe here, which was associated with a male specimen, is strikingly different from that illustrated for *I. minora*. Indeed, the female specimen illustrated by Liu *et al.* (2008) bears a closer morphological resemblance to the female of *Austrosialis* Tillyard than that of *I. bannaensis*. It is likely that *I. bannaensis* or possibly other species of *Indosialis* such as *I. minora* may eventually be found in southern Thailand, or elsewhere in southeastern Asia.

Acknowledgements

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