

A new species of the genus *Pseudocalotes* (Squamata: Agamidae) from peninsular Thailand

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ABSTRACT.- A new species of the genus *Pseudocalotes* (*P. khaonanensis* n. sp.) from a cloud forest in peninsular Thailand is described. The holotype and paratype of the new species was discovered in San Yen, Khao Nan National Park, Nakhon Si Thammarat. This is the first time that a species of the genus *Pseudocalotes* has been recorded in peninsular Thailand. Morphological evidence is given which differentiates this species from others in the genus.

KEY WORDS.- New species, *Pseudocalotes*, peninsular Thailand.

INTRODUCTION

Pseudocalotes Fitzinger, 1843 was separated from the genus *Calotes* Cuvier, 1817 by Moody (1980). It is distinguished from *Calotes* Cuvier, 1817 in having weak limbs, from the *C. vericolor*- group in having mixed orientation of dorsal scales, and lacking spines on the head, from *Bronchocela* Kaup, 1827 in lacking a cheek skin fold, and in having short weak limbs. The genus *Pseudocalotes* consists of ten species in two groups: *P. floweri* (Boulenger, 1912)[Eastern Thailand and Cambodia], *P. microlepis* (Boulenger, 1888)[Northern Tenasserim, Burma; North and Western Thailand; Northern Laos and Southern China], *P. polani* (Bourret, 1939)[Southern Laos] and *P. breviceps* (Werner, 1904)[Northern Vietnam] of the Indochinese group and *P. dringi* (Hallermann and Bohme, 2000)[Peninsular Malaysia], *P. flavigula* (Smith, 1924)[Peninsular Malaysia], *P. larutensis* Hallermann and McGuire, 2001 [Peninsular Malaysia], *P. saravacensis* Inger and Stuebing, 1994 [Saeawak, East Malaysia], *P. sumatrana*

(Hubrecht, 1879)[Sumatra and Java, Indonesia] and *P. tympanistriga* (Gray, 1831)[Java, Indonesia] of the Sundaland group (Hallermann and Bohme, 2000; Hallermann and McGuire, 2001).

During the conduct of the BRT (Biodiversity Research and Training Program, Thailand) Expedition of the cloud forest of San Yen, Khao Nan National Park, Nakhon Si Thammarat Province, in April of 2007, we discovered two specimens of *Pseudocalotes* Fitzinger, an adult male and a juvenile of unknown sex. This is the first record of this genus in the peninsular Thailand and one of the specimens, the largest of its genus on record. There is no evidence of a specimen ever being collected in peninsular Thailand, even though *Pseudocalotes floweri* (Boulenger, 1921) was described as having a disjunct geographical distribution of Eastern Thailand and peninsular Malaysia, which infers a past continuous geographical distribution to include peninsular Thailand. This new species is undoubtedly closely allied to *P. microlepis* (Boulenger, 1888),

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but differs from it and others of the genus significantly morphologically. We describe it here as a new species on the basis of morphological evidence.

***Pseudocalotes khaonanensis* n. sp.**
(Figure 2-5)

Holotype. THNHM 11791: collected in upper montane scrub of Khao Nan National Park (UTM : 084549N, 993219E, 1316 M.), by T. Chan-ard, M. Cota, S. Makchai and S. Laoteow on April 17, 2007.

Paratype. THNHM 11792; field data as same as the holotype.

Diagnosis. A species of *Pseudocalotes*, the largest of the genus (SVL 104.5 mm), with

72 to 75 scales around the middle of the body. There are two tubercles posterior to and in line with the supraorbital ridge, dorsal and ventral scales are rhombic in shape. Gular is distinct in males. 9 nuchal crest spines connected to the indistinct dorsal crest of weakly keeled scales. Subdigital lamellae of the third toe is bicarinate, anterior and posterior borders of lamellae equally developed as seen in *P. dringi*.

Description of holotype. THNHM 11791. A mature male with SVL (Snout-Vent Length) of 104.5mm, TaL (Tail Length) of 120.5mm and TL (total length) of 225mm, making it the largest known *Pseudocalotes*.

The scales around midbody is 75. The rostral is wider (4.65 mm) than the mental, which is 73% of its width. The rostral is almost four times (4.65 mm) as wide as it is high (1.20 mm). The mental is only slightly more than 10% wider

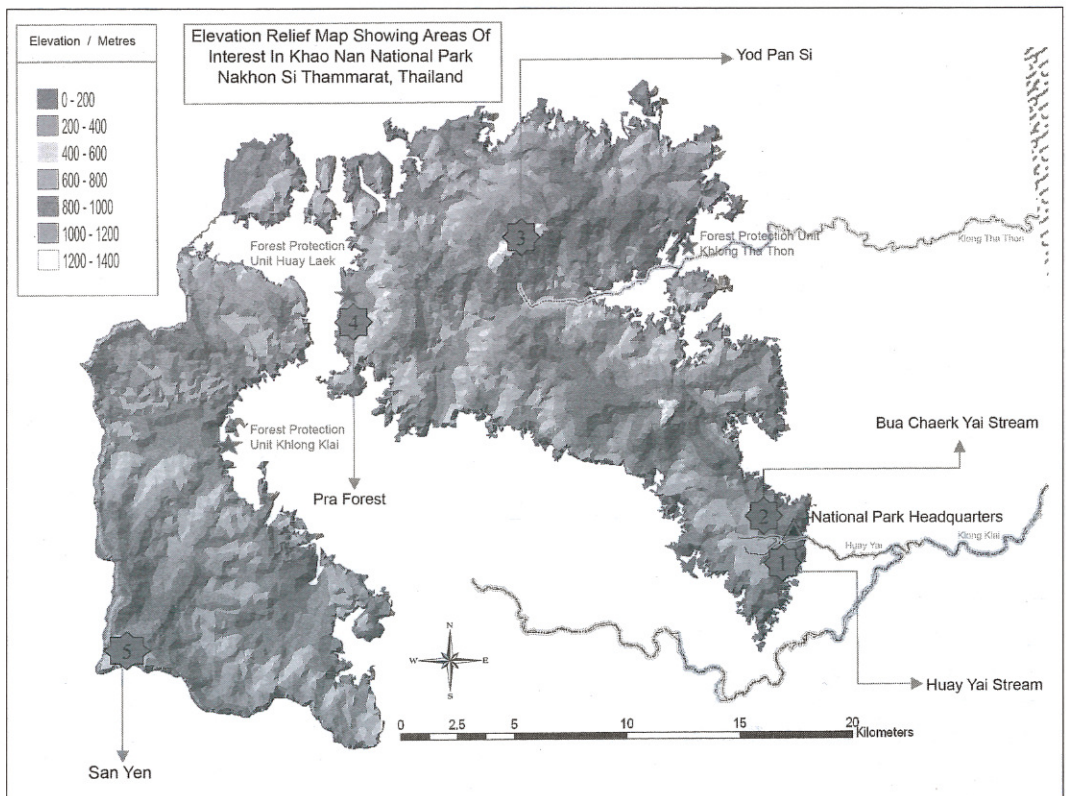


Figure 1 (a). Map of the locality in which the specimens were found, (b) geographical relief map of Khao Nan N.P.

(3.4mm) than it is high (3.0mm). There are 8 supralabials and 9 infralabials. There is a row of 9 enlarged scales starting posterior of the nasal, separated from the nasals by two equally sized scales, one on top of the other. There is a row of 6 enlarged scales below the infralabials at the jaw line as the lateral surface turns to the ventral surface; after the sixth scale, this row becomes indistinct from other scales. There are two tubercles posterior to and in line with the supraorbital ridge; one is placed above the ear opening and the other is mid way between the ear opening and the posterior of the eye orbit. 9 nuchal crest spines with the first and last being greatly reduced in size; between spines 3-4, 4-5, 5-6 and 6-7, there are smaller indistinct spines; between spines 7-8, there are two smaller indistinct flanking spines. On the dorsal surface of the tail, at the tail base, there are greatly enlarged, distinctly keeled scales that form a caudal crest extending posteriorly from the tail base for 19 scales before becoming indistinct from other scales on the tail. Under the tail base, there are 6 pairs of enlarged scales along the ventral median.

The top of the frontal region is covered with irregular shaped scales to the point where the frontal regions comes to the lateral edge, where there are enlarged scales making up this frontal/lateral border. Enlarged scales form an interorbital ridge. Scales in the gular region form rows becoming increasingly smaller towards the ventral median and posteriorly in the region of the dewlap, which in life and when preserved, is red in colour. Ear opening is anteriorly rounded with the posterior coming to a rounded point; it is situated in line mid way between the mouth opening and the eye orbit. Dorsal and ventral scales are rhombic in shape, appearing square-like at first glance until actually examined; they are very weakly keeled with the edge of the dorsal and lateral scales pointing ventrally and to the posterior. The

ventral scales are slightly larger than the lateral and dorsal scales; there edge points to the cloaca. There is an indistinct dorsal crest made up of weakly keeled scales, becoming more keeled at the posterior end of the scale with the posterior keel of the scale ends slightly raised.

Table1. Lamellae counts

	1	2	3	4	5
Forefeet	9	13	18	21	14
Hind feet	10	14	21	27	18

Lamellae counts for the fore and hind feet are numbered 1 to 5, with one being the inner most digit and 5 being the outer most.

Eye orbit is 5.05mm. Tympanum is 3.65 mm laterally across. Distance from the groin to the end of the fourth toe is 51.5mm. Foot length is 23.9mm.

Colouration in life. Base dorsal colouration of the adult male is a rust-brown colouration of the adult male is a rust-brown base, irregularly mixed with darker and lighter scales. The supralabial area is cream to white in colouration up to the nostril in the anterior portion of the snout to the eye orbit all the way past the tympanum to where the head is distinct from the neck. This supralabial cream to white colouration is broken up by dark rust brown lines radiating from the eye. There is alternate light rust brown to dark colouration banded in appearance at the supraorbital ridge, which is not related to the lines radiating from the eye through the orbital region. The infralabial region is for the most part cream to white in colouration, continuing the line radiation described in the supralabial region; in the gular region, this turns into more of a reticulated pattern to the dewlap, which is read with cream to white scales. Lines in the dewlap region are present, but nearly indistinct. The frontal region does not possess any distinct pattern, is mostly darker in colouration with irregular lighter coloured scales, sometimes together breaking up the dark base.



Figure 2. Adult male THNHM 11791 in life.



Figure 3. Juvenile THNHM 11792 in life.

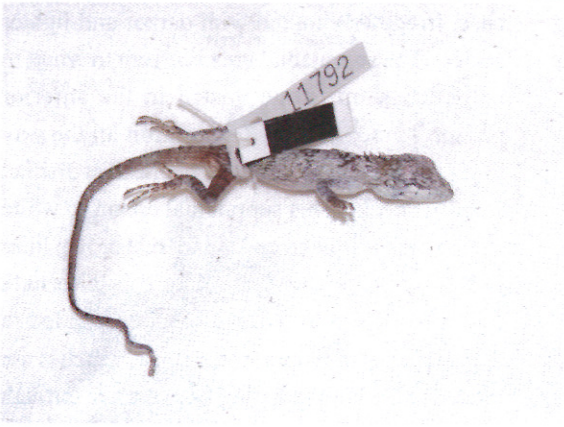


Figure 4. Juvenile THNHM 11792 in preservative.

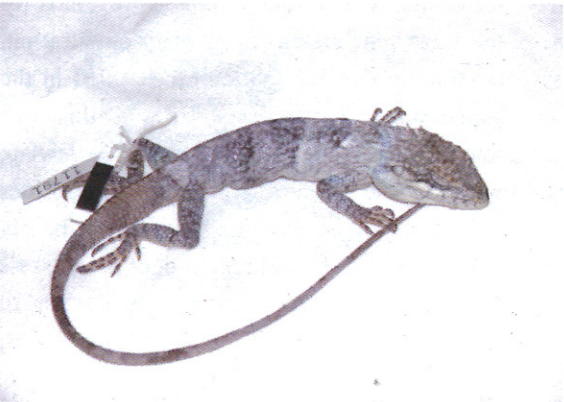


Figure 5. Adult male THNHM 11791 in preservative.

Larger scales in the occiput region, appear lighter in colouration. There is a dark eye stripe posterior of the orbit, almost black along the dorsal and ventral portion of the stripe with many lighter, rust brown scales irregularly placed in the middle portion of the stripe along with black scales. The tympanum is almost white in appearance. The nuchal area is the typical colouration of the body, a rust brown base irregularly mixed with darker and lighter scales. The body possesses three indistinct dark bands, the anterior most band from the dorsum 1/3 the distance to the venter, the middle band from the dorsum 2/3 the distance to the venter and the posterior most band from the dorsum reaching the venter. There is an indistinct dark band that is present over the hind legs across the dorsum, over the pelvic region. There are lighter indistinct bands at the anterior edge of the aforementioned darker bands, with the anterior indistinct lighter bands being progressively lighter. The irregular blotching of lighter and darker colouration gives the limbs and feet almost a reticulated appearance. The tail is banded with the lighter bands of normal base body colouration being slightly wider than the darker bands. It should be of particular note that the banding colouration of the tail is almost uniform, with very few lighter or darker scales breaking up the lighter and darker base colourations of the band.

The pattern and colouration of the juvenile is significantly different than that of the adult male. In fact, the only similarities that they appear to show in pattern are the supralabial and infralabial lines appearing to originate from the orbit, other lines radiating from the eye and the alternating light and dark coloration of the supraorbital ridge. The base colouration of the suprablabial and infralabial region is cream to white, but unlike the adult, the darker lines have a green tint to them. The bold eye stripe of the adult male only is present as a thin black line originating at the middle posterior part of the

eye passing above the tympanum and as in the adult, terminating where the head is distinct from the neck. The lower black line is also present, but is broken at the end of the labial region and continues again as a thin line passing under the tympanum and terminating at the where the head is distinct from the neck; colouration between the lines is a green with a dull yellow tint. The occiput region is an olive almost uniform colour. In the nuchal region, there is a reticulated pattern of a medium green and dull yellow making up the pattern with a base cream colouration. The three indistinct dark bands on the body are even less distinct in the juvenile and much smaller, with the posterior 2 of 3 bands on the body possibly going unnoticed unless one looking for it in comparison to the adult. The base colouration of the body is a green to dull yellow alternating with a slight rust brown colouration. The limbs and digits appear banded with small dark bands, whereas with the adult male they appeared reticulated in pattern. Unlike the banded tail of the adult, the juvenile's tail appears as a mottled pattern of lighter and darker shades with some rust brown blotches, with the terminal end of the tail appearing as a shade lighter than medium brown.

Colouration in preservative. Base colouration is gray for the adult and juvenile. Labials are light gray with the area between the supralabials and the eye orbit white. In the labial region there are some darker vertical lines. Immediately below the eye it is dark gray, almost black, which extends down from the eye to behind the last of the enlarged scales between the supralabials and the eye. The ridge on the lateral edges of the frontal area is off-white in colouration turning yellowish in the supraoculars ridge; on the supraocular ridge there are three dark spots. Fore and hind limbs, fingers and toes show banding, which is more indistinct on the feet and limbs than the fingers and toes. The lateral sides of the body have three indistinct

brown lines that extend down and posteriorly from the dorsal ridge; it has a anterior edge of off-white. Tail is a light olive brown with some indistinct light gray and brown banding.

Etymology. This species is named after the Khao Nan mountain range, where the specimens of this new species were discovered.

Comparison with other species:

Pseudocalotes khaonanensis is the largest of the genus, with 72 to 75 scales around the middle of the body, which is significantly more than all other species of the genus, except for *Pseudocalotes brevipes* and *Pseudocalotes floweri*. *Pseudocalotes microlepis* has a maximum number of mid body scales to the minimum number of mid body scales in *Pseudocalotes khaonanensis* n. sp.; however, *Pseudocalotes khaonanensis* n. sp. is significantly larger and has a more robust body anteriorly as well as a more robust head. It differs from *Pseudocalotes brevipes* by having no light spots at the elbows and knees, not having a fold in front of the shoulders in the limited number of specimens that exist, more infralabials, as well as having significantly more lamellae under the fourth toe. It differs from the closest species in geography, *Pseudocalotes dringi*, by having significantly more mid-body scales.

Natural History. *Pseudocalotes khaonanensis* sp. n. is an arboreal, diurnal species found on the stunted tree growth, of not more than 4 m in height, of the cloud forest possessing ca. 60%-70% canopy at high elevation. Trees at the location found had significant vascular epiphyte growth. Both specimens were found above 1,100m ASL.

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A Comparison of Vertical Bird Assemblages Between Abandoned Settlement Areas and Primary Dry Evergreen Forests in Western Protected Forest of Thailand

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ABSTRACT.- A Vertical stratification of the bird assemblage between abandoned settlement areas (ASA) and dry evergreen forests (DEF) was investigated in the western forest complex of Thailand, Natural World Heritage Site. The aim was to examine species diversity, vertical strata patterns, and niche breadth of individual bird species between disturbance and primary forests. A permanent line transect was used for the field survey. Our research presents the results of a first study on vertical stratification of bird assemblages between abandoned settlement areas and primary forests in Thailand. The study revealed 170 bird species. Diversity indices of vertical strata in the ASA tended to be lower than those in the DEF sites. However, the bird community in the DEF and ASA was classified into 3 major groups: ground level group, lower canopy group (1-5 m in the ASA and 1-15 m in the DEF) and upper canopy group (5->25 m in the ASA and 15->25 m in the DEF). Most species were relatively generalized in their behavior and used resources across broad ranges of microhabitats. The study also demonstrated that the ASA appeared to support less species richness than the DEF. The results of this study provide vital information in revealing patterns of assemblage structure and major factors in the maintenance of species diversity. Further research should concentrate on these species to determine resource use pattern, and investigate the effect of forest fragmentation on their movements. Furthermore, this study demonstrated that bird diversity showed a clear recovery pattern after human resettlement. Recommendations are given to limit human disturbances as much as possible to allow for maximum avian diversity to recover.

KEY WORDS.- Vertical habitats, birds, diversity, recovery, tropical forest.

INTRODUCTION

Acting as an interface between the biosphere and atmosphere, the tropical forest canopy shows marked differences in its physical and biological characteristics compared to the understorey. Light intensity, humidity, the capacity to retain water, the physical structure

of the environment, food resource availability, and species composition are factors that contribute to making the canopy a distinct component of a rain forest. The canopy is considered physically and biologically one of the most active components of tropical forests. More than half of the species present in a tropical forest may live in the canopy, and there are estimates that the bird biomass in the canopy may represent 60-70% of the total bird biomass in a tropical forest (Winkler and Preleuther, 2001).

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