

## ***Cyrtodactylus thirakhupti* (Squamata: Gekkonidae), a new cave-dwelling gecko from southern Thailand**

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### **Abstract**

A new cave-dwelling species of *Cyrtodactylus* is described from Khao Sonk in Surat Thani Province, southern peninsular Thailand. The new species is characterized by its slender body (snout-vent length to at least 80 mm) with a banded pattern, elongate tail and digits, low number (14) of rows of dorsal tubercles, absence of preloacal groove, and enlarged series of preloacal and femoral scales, all lacking pores. It is the third species of cave-dwelling *Cyrtodactylus* recorded from Thailand.

**Key words:** Thailand, Surat Thani, Reptilia, Gekkonidae, *Cyrtodactylus thirakhupti*, new species, taxonomy, cave-dwelling

### **Introduction**

The gekkonid genus *Cyrtodactylus* Gray, 1827 comprises more than 75 species distributed across tropical Asia from India to the Philippines, northeastern Australia, New Guinea, and the Solomon Islands (Rösler 2000, 2001; Das & Lim 2000; Kluge 2001; Wells 2002; Bauer 2002, 2003; Bauer *et al.* 2002, 2003; Günther & Rösler 2003). New species continue to be discovered throughout the range of the genus, but the greatest rate of discovery has been in Thailand and Myanmar, where three and nine species, respectively, have been

described in the last two years (Bauer 2002, 2003; Bauer *et al.* 2002, 2003). Two of the recently described Thai species, *C. chanhomeae* Bauer *et al.* and *C. sumonthai* Bauer *et al.* are believed to be restricted to cave environments and their immediate surroundings and the third, *C. tigroides* Bauer *et al.* is associated with limestone, although it has not been seen actually inside caves. In the course of our systematic inventories and zoogeographical studies of the herpetofauna of peninsular Thailand, we have focused on cave surveys and have identified an additional cave-dwelling *Cyrtodactylus* that is morphologically easily distinguishable from its congeners, and that we describe here as new.

### Materials and methods

The following measurements were taken with a Helios caliper (precision 0.05 mm) following the methods of Bauer *et al.* (2002, 2003): CrusL: crus length; EarL: ear length; Eye-Ear: eye to ear distance; ForeaL: forearm length; HeadH: head height; HeadL: head length; HeadW: head width; Internar: internarial distance; Interorb: interorbital distance; NarEye: nares to eye distance; OrbD: orbital diameter; SnEye: snout to eye distance; SVL: snout-vent length; TailL: tail length; TailW: tail width; TrunkL: trunk length. Measurements and scale counts based on right side of animals unless otherwise noted. Scale counts and external observations of morphology were made using a stereo dissecting microscope. Radiographs were prepared using a closed cabinet x-ray unit. Specimens were x-rayed at 35 kV for 25 sec and imaged on Polaroid type 72 film.

Comparisons were made with museum material in the collections of the California Academy of Sciences, San Francisco (CAS), Chulalongkorn University Museum of Zoology, Herpetological Section, Bangkok (CUMZ R), Institut Royal des Sciences Naturelles de Belgique, Brussels (IRSNB), Museum of Comparative Zoology, Cambridge, Massachusetts (MCZ), and United States National Museum, Washington, D.C. (USNM), as well as original published descriptions and descriptions provided in broader faunal and taxonomic treatments (e.g., Smith 1935; Taylor 1963; Szczerbak & Golubev 1986; Hikida 1990; Ulber 1993; Darevsky & Szczerbak 1997; Das 1997; Manthey & Grossmann, 1997; Das & Lim 2000; Malkmus *et al.* 2002; Bauer 2002, 2003; Bauer *et al.* 2002, 2003).

### *Cyrtodactylus thirakhupti* sp. nov.

Figures 1–3.

**Holotype.** — Chulalongkorn University Museum of Zoology (CUMZ) R 2003.120, adult female; Southern Thailand, Surat Thani Province, Thachana District, Tham Khao Sonk (= Cave of Sonk Mountain), 9°34'N 99°10'E, collected by Montri Sumontha, 27 June 2003.

**Paratypes.** — CUMZ R 2003.121, adult male; Institut Royal des Sciences Naturelles de Belgique (IRSNB) 2590, adult male; same data and collector as for holotype.



**FIGURE 1.** Adult female holotype of *Cyrtodactylus thirakhupti*, sp. nov. (CUMZ R 2003.120) from Tham Khao Sonk, Thachana District, Surat Thani Province, Thailand. Scale bar equals 10 mm. Photo by Aaron M. Bauer.



**FIGURE 2.** Specimen of *Cyrtodactylus thirakhupti*, sp. nov. in life, showing the long tail, elongate, slender limbs and digits, and characteristic dorsal banding pattern of the species. Photo by Montri Sumontha.

**Etymology.** — It is a pleasure to name this remarkable new species in honor of our great friend and colleague Prof. Dr Kumthorn Thirakhupt (Faculty of Science, Chulalongkorn University, Bangkok) in recognition of his contribution to Thai zoology, and for his dedication to the training of the future generation of Thai herpetologists and ecologists. The epithet is formed in the masculine genitive.

We suggest the following common names: Tuk kai Thirakhupt (Thai), Thirakhupt's bent toed gecko (English), *Cyrtodactyle de Thirakhupt* (French), Thirakhupts Bogenfingergecko (German), Kromvingergekko van Thirakhupt (Dutch).

**Definition.** — A moderately sized *Cyrtodactylus*, snout-vent length to at least 80 mm; body slender, limbs and digits long, slender, original tail very long; one pair of enlarged postmental scales in broad contact with one another; dorsal scalation with 14 rows of keeled tubercles; approximately 37 ventral scales across belly between weakly-developed ventrolateral folds; no precloacal groove, no precloacal or femoral pores in either sex; eight broad basal lamellae and 12 narrow distal lamellae beneath 4<sup>th</sup> toe of pes; median subcaudal scales enlarged to form broad transverse plates; dorsal pattern of yellowish bands with very dark brown borders on a lighter brown background.



**FIGURE 3.** Ventral view of groin and thighs of living male specimen of *Cyrtodactylus thirakhupti* illustrating the enlarged femoral and precloacal scales and lack of pores. Photo by Montri Sumontha.

**Description** (based on holotype, CUMZ R 2003.120). — Adult female. SVL 73.90 mm; TailL (tail original) 99.05 mm. Head relatively long (HeadL/SVL ratio 0.30), wide (HeadW/HeadL ratio 0.65), not markedly depressed (HeadH/HeadL ratio 0.44), distinct from slender neck. Lores and interorbital region weakly inflated, canthus rostralis not

especially prominent. Snout elongate (SnEye/HeadL ratio 0.40), pointed; longer than eye diameter (OrbD/SnEye ratio 0.63); scales on snout and forehead small, rounded, granular, homogeneous; scales on snout larger than those on occipital region. Eye large (OrbD/HeadL ratio 0.25); pupil vertical with crenelated margins; supraciliaries short, bearing small conical spines posteriorly. Ear opening vertically elliptical, relatively large (EarL/HeadL ratio 0.07); eye to ear distance subequal to diameter of eyes (EyeEar/OrbD ratio 1.07). Rostral much wider (3.15 mm) than deep (1.80 mm), incompletely divided dorsally. Two enlarged supranasals separated by a single internasal. Rostral in contact with supralabials I, nostrils, supranasals and internasal. Nostrils rounded, each surrounded by supranasal, rostral, first supralabial and four postnasals. At least three rows of small scales separate orbit from supralabials. Mental triangular, wider (2.85 mm) than deep (1.90 mm). A single pair of enlarged postmentals, each postmental bordered anteromedially by mental, anterolaterally by first infralabial, posterolaterally by an enlarged lateral chinshield, and posteriorly by 3 granules. Supralabials to midorbital position 9/9; enlarged supralabials to angle of jaws 14/13. Infralabials 10/9. Interorbital scale rows across narrowest point of frontal bone 22.

Body slender, elongate (TrunkL/SVL ratio 0.45) with extremely weakly developed, non-denticulate ventrolateral folds. Dorsal scales nearly homogeneous, conical; regularly distributed tubercles (4-5 times size of adjacent scales) extending from supra-auricular region on to back; each tubercle bearing a keel extending  $\frac{2}{3}$  to  $\frac{3}{4}$  along the tubercle; tubercles in approximately 14 rows at midbody, absent from lower parts of flanks. Ventral scales larger than dorsals, smooth, hexagonal and subimbricate, larger midventrally and much larger in precloacal region. Midbody scale rows across belly to base of ventrolateral folds 37. Gular region with relatively homogeneous, smooth scales.

Precloacal region with four sequential transverse rows of enlarged scales, each 3 to 5 times size of adjacent ventral scales. No precloacal pores. No precloacal groove. A continuous row of enlarged femoral scales, each about 3 times size of adjacent anterior femoral scales, extending along length of femur and continuous with the enlarged precloacal scales. No femoral pores.

Scales on palm and sole smooth, rounded. Scallation on dorsal surfaces of limbs similar to body dorsum with enlarged, conical tubercles interspersed among smaller scales. Fore and hindlimbs moderately long, slender (ForeaL/SVL ratio 0.16; CrusL/SVL ratio 0.21). Digits long, slender, strongly inflected at interphalangeal joints, all bearing robust, slightly recurved claws. Basal subdigital lamellae broad, rectangular, without scansorial surfaces (5-5-5-6-5 manus; 5-5-7-8-7 pes); narrow lamellae distal to digital inflection and not including ventral claw sheath: 8-8-10-10-10 (manus), 8-9-12-12-12 (pes); interdigital webbing absent. Relative length of digits: IV>III>II>V>I (manus); IV>III>V>II>I (pes). Original tail, long, gently tapering to pointed tip; longer than SVL (TailL/SVL ratio 1.34). Tail with enlarged median subcaudal plates.

**Osteology.** — Parietal bones paired; stapes imperforate. Phalangeal formula 2–3–4–5–3 for manus and 2–3–4–5–4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 38 post pygal caudal vertebrae in original tail of holotype (12.5 post pygal vertebrae to point of regeneration in IRSNB 2590; tail broken in first post pygal vertebra of CUMZ R 2003.121). Male paratypes with one pair of crescentic cloacal bones present, flared posterolaterally, at level of second to third pygal vertebrae (cloacal bones lacking in female holotype). Endolymphatic sacs not enlarged extracranially.

**Coloration** (in preservative). — Dorsal ground color brown, with transverse greyish bands, each outlined by a dark brown border. First band across nape, forming a collar joining the posterior upper border of the orbits. A second band on neck, four on the trunk, and one across the pygal region of the tail. Bands are somewhat asymmetrical and broken in places. Several smaller ocelli or partial bands located anterior and posterior to middle two body bands, each greyish outlined by dark brown. Dorsum of head brown, with irregular greyish markings. A greyish stripe, bordered above with dark brown, extends from lower posterior corner of orbit, passing above tympanum, to the band on neck. Supra- and infralabials brown, with diffuse greyish punctuations. Dorsal surfaces of limbs brown with irregular greyish markings outlined by dark brown borders. Tail color (dorsally and ventrally) consisting of alternating dark brown and light brown annuli, the former approximately twice the length of the latter. Dorsal coloration gradually fades on lower flanks, becoming whitish on belly, throat and undersides of limbs. Palms greyish. Coloration in life much brighter and more strongly contrasting. Dorsal ground color darker than in preservative. Dorsal transverse markings pale yellow, outlined by a very dark brown border. Dorsum of head darker than in preservative, bearing irregular yellow markings. Supraciliaries bright yellow. Labial scales white with darker speckling or suffusions in places. Iris dark with diffuse bronze markings; margins of pupil bordered by brown. Lower postorbital stripe whitish anterior to tympanum, becoming yellow before joining the yellow band on neck. Supra- and infralabials much lighter than in preservative. Color on dorsal surfaces of limbs as on body. Dorsum of digits purplish to white, palms dark grey. Tail with alternating dark brown and pale yellow (base only) or bright white (majority of tail) annuli.

**Variation.** — Comparative mensural data for the holotype and both paratypes are given in Table 1. Meristic characters of both paratypes mostly correspond to those of the holotype, and are mentioned hereafter if they differ. The adult male CUMZ 2003.121 is in poor state of preservation; enlarged supralabials to angle of jaws 14/14; infralabials 11/11; interorbital scale rows across narrowest point of frontal bone 19; midbody scale rows across belly to base of ventrolateral folds 38. The adult male IRSNB 2590, whose left hemipenis is partly everted, has most of its tail missing, and its postmentals are each bordered posteriorly by two granules; enlarged supralabials to angle of jaws 14/15; infralabials 11/11; interorbital scale rows across narrowest point of frontal bone 23; midbody scale rows across belly to base of ventrolateral folds 40. For both paratypes, basal subdigital

lamellae on manus 5 or 6, on pes 5 to 8, differing by at most one unit from the holotype for each finger; numbers of distal subdigital lamellae per finger also differing by at most one unit from the holotype. As in the female holotype, femoral and precloacal pores are absent. Color of paratypes in agreement with the description for the holotype.

**TABLE 1.** Mensural data for the type series of *Cyrtodactylus thirakhupti*, sp. nov. Abbreviations as in Materials and methods. All measurements in mm.

	CUMZ R 2003.120	CUMZ R 2003.121	IRSNB 2590
	holotype	paratype	paratype
Sex	female	male	male
SVL	73.90	72.00	79.60
ForeaL	12.10	11.90	11.95
CrusL	15.35	14.20	16.00
TailL	99.05	49.10, regenerated	5.90, broken
TailW	5.35	6.15	not applicable
TrunkL	33.20	32.40	32.35
HeadL	21.90	21.05	23.10
HeadW	14.20	13.40	14.65
HeadH	9.65	8.55	10.20
OrbD	5.50	6.10	6.15
EyeEar	5.90	5.65	6.40
SnEye	8.80	8.50	8.95
NarEye	6.80	6.70	7.00
Interorb	5.85	5.10	5.30
EarL	1.50	1.40	1.30
Internar	2.00	1.90	2.30

**Diagnosis.** — *Cyrtodactylus thirakhupti* can be distinguished from all congeners on the basis of the following combination of characters: body slender, limbs, digits and tail long, dorsal scalation with 14 rows of small keeled tubercles, 37-40 ventral scales across belly between weakly developed ventrolateral folds, no precloacal groove, precloacal pores and femoral pores absent in both sexes, femoral scales enlarged, median subcaudal scales enlarged to form broad transverse plates, and dorsal color pattern consisting of a series of dark-edged light bands.

The absence of both precloacal and femoral pores distinguishes *C. thirakhupti* from all species except most members of the subgenus *Geckoella*: *C. albofasciatus* (Boulenger), *C. collegalensis* (Beddome), *C. deccanensis* (Günther), *C. jeyporensis* (Beddome), *C. nebulosus* (Beddome), and *C. yakhuna* (Deraniyagala), the Indonesian species *C. jellesmae* (Boulenger) and *C. laevigatus* Darevsky, *C. paradoxus* (Darevsky & Szczerbak) of Vietnam, an undescribed species from Laos (David et al., submitted), and *C. sermowaiensis* (de Rooij) of New Guinea. It may be distinguished from all *Geckoella* by its gracile body, long slender tail and long digits, from *C. jellesmae*, *C. sermowaiensis*, and the Laotian species by its enlarged series of femoral scales, and from the remaining species by its color pattern (dark-edged, light transverse bands versus dark spots in *C. laevigatus* and transverse bands interrupted by a narrow vertebral stripe in *C. paradoxus*). Some specimens of the Thai/Myanmar species *C. oldhami* (Theobald) also lack pores (Smith 1935; Taylor 1963, Ulber 1993), but this species may be easily distinguished by its pattern of white spots and stripes. Although *C. feae* (Boulenger) of Myanmar was originally described as possessing pores, this has subsequently been called into question (see Bauer 2003). Regardless, it also differs markedly in color pattern from *C. thirakhupti*. *Cyrtodactylus derongo* Brown & Parker of New Guinea was described on the basis of females only and the condition of precloacal and femoral pores in males is unknown, but this species is much larger (to 112 mm SVL) than *C. thirakhupti* and differs markedly in color pattern and details of scalation. In general appearance the new species is most similar to the recently described *C. sumonthai* from Rayong Province, Thailand, which has only two tiny precloacal pores, which may be easily overlooked. However, this species lacks enlarged femoral scales and differs in details of color pattern.

**Distribution and Natural History.** — *Cyrtodactylus thirakhupti* is currently known only from its type locality, a single cave on a relatively isolated, forested, steep limestone hill near the beach. The foothill is at about 5 m asl. The cave is wet and inhabited by bats and is situated about 30 meters above the surrounding area, and is about 100 meters deep. The cave hall, where the types were caught, is about 30 meters wide and 20 meters high. The adult female CUMZ R 2003.120 was found at 20:15 hrs on the cave wall, one meter above the ground. CUMZ R 2003.121 was caught at about, 12 m from the cave entrance, 1.7 meters above the ground. IRSNB 2590 was caught at 21:00 hrs, 10 meters from the cave opening, 1.5 meters above the ground. On 27 June, only those three specimens and a fourth one (not caught) were seen. On the hill itself, we recorded seven other reptile species: *Calotes versicolor* (Daudin) –Agamidae, *Cnemaspis siamensis* (Smith), *Gehyra mutilata* (Wiegmann), *Gehyra fehlmanni* (Taylor), *Gekko gekko* (Linnaeus) – Gekkonidae, *Lycodon capucinus* Boie, *Ahaetulla prasina* (Boie) and *Rhabdophis subminiatus* (Schlegel) – Colubridae. The type specimens of *C. thirakhupti* were briefly kept in captivity, but did not thrive and died respectively on 28 July (CUMZ R 2003.120), 5 August (CUMZ R 2003.121) and 29 July 2003 (IRSNB 2590).



## Discussion

*Cyrtodactylus thirakhupti* is the fifteenth species of its genus to be recorded from Thailand, seven of which have been described within the last 15 years. The discovery of several new, relatively large and distinctive species of *Cyrtodactylus* in recent years suggests that much additional field work in Thailand is warranted. This is especially so of the extensive areas of limestone caves and outcrops that occur in many Thai provinces (Dunkley 1995). All of the most recently described species: *C. thirakhupti*, *C. sumonthai*, *C. chanhomeae*, and *C. tigroides* come from karstic areas as has *C. phongnhakebangensis* Ziegler *et al.*, a recently described species that inhabits primary forests on or near karst cliffs in Vietnam. All of these taxa share a characteristic gracile, long-limbed, large-eyed habitus and yellow markings and are probably closely related.

*Cyrtodactylus thirakhupti* is the fourth cave-dwelling member of its genus to be identified, following the Niah Cave gecko, *C. cavernicolus*, of Sarawak (Inger & King 1961; Harrison 1961, 1966; O'Shea 1985), *C. sumonthai* from Rayong Province, Thailand (Bauer *et al.* 2002), and *C. chanhomeae* from Saraburi Province, Thailand (Bauer *et al.* 2003). Like these species, it shows no obvious cave specializations and is almost certainly a troglophile or facultative cavernicole (*sensu* Chapman 1985), rather than a true cave obligate. The discontinuous nature of karstic landscapes in Thailand suggests that *C. thirakhupti* and other limestone-dwelling geckos, whether cave-limited or not, probably have very limited distributions. As a consequence the conservation status of the new species requires immediate attention. It will be important to search for it in suitable habitats in the neighbouring national parks of Khao Luang (Nakhon Si Thammarat Province), Kaeng Krung and Khao Sok (Surat Thani Province). Implementing conservation measures for this species is especially critical as such large, attractive *Cyrtodactylus* species with limited distributions are popular in the pet trade. Hence, we strongly suggest placing *C. thirakhupti* on the official list of protected Thai reptile species.

## Acknowledgments

Anchalee Aowphol and Kumthorn Thirakhupt (CUMZ), and Georges Coulon and Georges Lenglet (IRSNB) kindly provided working facilities. Robert C. Drewes and Jens V. Vindum (California Academy of Sciences), George Zug, Robert Wilson and Ken Tighe (United States National Museum) and James Hanken and José Rosado (Museum of Comparative Zoology, Harvard University) provided access to comparative material in their care. We thank Chucheep (Teak) Chimsunchart (Phetchaburi) for her kind support and Patrick David for allowing us to see his unpublished manuscript.

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