



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

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### Abstract

We describe a new cave-dwelling species, *Cyrtodactylus sanook* **sp. nov.**, from Tham Sanook, Chumphon Province, southern Thailand, characterized by a maximum SVL of 79.5 mm; 18–20 longitudinal rows of dorsal tubercles at midbody; a continuous series of enlarged femoral and precloacal scales, no femoral pores, three or four precloacal pores in males (no pores in females), no precloacal groove nor depression; 19–20 subdigital lamellae on 4<sup>th</sup> toe; transversally enlarged subcaudal plates; and 6–7 irregular pale narrow dorsal bands between limb insertions. It seems endemic to this cave and is the 7<sup>th</sup> Thai *Cyrtodactylus* species that is known only from a cave environment.

**Key words:** *Cyrtodactylus sanook*, Wat Tham Sanook, karst, Peninsular Thailand

### Introduction

Pursuing our ongoing taxonomic and zoogeographic review of the herpetofauna of the Thai-Malay Peninsula (see among others Ellis and Pauwels 2012, Grismer *et al.* 2012, Johnson *et al.* 2012 and Sumontha *et al.* 2012 for the most recent updates on local *Cyrtodactylus* species), we investigated many environments susceptible to harboring endemics, with a special emphasis on karst reliefs and caves. A nocturnal excursion in Tham Sanook, a cave situated at ground level within an isolated karst relief surrounded by plantations, secondary forest and human settlements, revealed a *Cyrtodactylus* species that we readily identified as new because it shows a peculiar color pattern and unique diagnostic scale morphology; it is hence described below.

### Material and methods

Measurements and meristic counts follow Grismer *et al.* (2012) and Sumontha *et al.* (2012). Paired meristic characters are given left/right. Numbers of supralabials and infralabial scales are counted from the largest scale immediately posterior to the dorsal inflection of the posterior portion of the upper jaw to the rostral and mental scales, respectively. The number of paravertebral tubercles was counted in a straight line immediately left of the vertebral column, between the limb insertions. The number of longitudinal rows of body tubercles was counted transversely across the center of the dorsum from one ventrolateral skin fold to the other. The number of longitudinal rows of ventral scales was counted transversely across the center of the abdomen from one ventrolateral skin fold to the other. The number of the subdigital lamellae beneath the 4<sup>th</sup> toe was counted from the base of the first phalanx to the claw. The total number of precloacal and femoral pores was combined as a single

meristic character referred to as the femoro-preloacal pores number. Measurements were taken with a Mitutoyo digital caliper to the nearest 0.1 mm. Morphological abbreviations: AG = axilla to groin length, taken from the posterior margin of the forelimb at its insertion point on the body to the anterior margin of the hind limb at its insertion point on the body; ED = eye diameter, the greatest horizontal diameter of the eye-ball; EE = eye to ear distance, from the anterior edge of the ear opening to the posterior edge of the eye-ball; EL = ear length, the greatest horizontal distance of the ear opening; EN = eye to nostril distance, from the anterior margin of the eye-ball to the posterior margin of the external nares; ES = eye to snout distance, from the anteriormost margin of the eye-ball to the tip of snout; FL = forearm length, taken on the dorsal surface from the posterior margin of the elbow while flexed 90° to the inflection of the flexed wrist; HD = head depth, the maximum height of head from the occiput to the throat; HL = head length, from the posterior margin of the retroarticular process of the lower jaw to the tip of the snout; HW = head width, measured at the angles of the jaws; IN = internarial distance, measured between the nares across the rostrum; IO = interorbital distance, measured between the anterior edges of the orbits; SVL = snout-vent length, taken from the tip of snout to the vent; TBL = tibia length, taken on the ventral surface from the posterior surface of the knee while flexed 90° to the base of the heel; TL = tail length, taken from the vent to the tip of the tail, original or regenerated; TW = tail width, taken at the base of the tail immediately posterior to the postloacal swelling. Museum acronyms: IRSNB: Institut Royal des Sciences naturelles de Belgique, Brussels; PSUZC-RT: Prince of Songkhla University Zoological Collection, Reptile Section, Songkhla; THNHM: Thailand Natural History Museum, National Science Museum, Technopolis, Pathum Thani.

## Systematics

### *Cyrtodactylus sanook* sp. nov.

(Figs. 1–6)

**Holotype.** Adult male (THNHM 22541) collected on 1<sup>st</sup> November 2012 by Montri Sumontha from Wat (= Temple) Tham Sanook and its cave Tham Sanook, Banna Subdistrict, Muang District, Chumphon Province, southern Thailand.

**Paratypes.** Two adult males (PSUZC-RT 2012.4 and QSMI 1165), same locality, date and collector as holotype.

**Diagnosis.** *Cyrtodactylus sanook* sp. nov. is distinguished from all other Sunda Shelf *Cyrtodactylus* by having the unique combination of a maximum SVL of 79.5 mm; 18–20 longitudinal rows of dorsal tubercles at midbody; a continuous series of enlarged femoral and preloacal scales, no femoral pores, three or four preloacal pores in males (no pores in females), no preloacal groove nor depression; 19–20 subdigital lamellae on 4<sup>th</sup> toe; transversally enlarged subcaudal plates; and six or seven irregular pale narrow dorsal bands between limb insertions.

**Description of the holotype.** SVL 73.8 mm. Head large, moderate in length (HL/SVL 0.30) and wide (HW/HL 0.62), somewhat flattened (HD/HL 0.37), distinct from neck, and triangular in dorsal profile. Lores concave; frontal and prefrontal regions deeply concave; canthus rostralis rounded; snout elongate (ES/HL 0.42), rounded in dorsal profile. Eye of moderate size (ED/HL 0.21). Ear opening elliptical, very small (EL/HL 0.06), obliquely oriented. Eye to ear distance larger than diameter of eye. Rostral rectangular, deeply divided dorsally, bordered posteriorly by left and right supranasals and internasal, bordered laterally by first supralabials. Nares bordered anteriorly by rostral, dorsally by 2/2 supranasals, posteriorly by 4/4 granular scales, ventrally by first supralabials; 13/14 supralabials, rectangular, extending to just beyond upturn of labial margins, tapering abruptly below midpoint of eye, 1<sup>st</sup> supralabial tallest; 10/10 infralabials; scales on rostrum and lores larger than granular scales on top of head and occiput, those on canthus rostralis largest; occipital scales intermixed with enlarged tubercles; large, bony frontal ridges bordering orbit confluent with bony, transverse, parietal ridge. Dorsal supraciliaries elongate and smooth. Mental triangular, bordered laterally by 1<sup>st</sup> infralabials and posteriorly by left and right trapezoidal postmentals which contact medially for approximately half their length; one row of slightly enlarged, elongate sublabials extending to 5<sup>th</sup> infralabial; small, granular, gular scales, abruptly transitioning on throat into large, flat, smooth, imbricate, pectoral and ventral scales.



**FIGURE 1.** Live adult male holotype of *Cyrtodactylus sanook* sp. nov. Photo. by O.S.G. Pauwels.

Body relatively short (AG/SVL 0.45) with moderately defined, atuberculate, ventrolateral folds. Dorsal scales small, granular, interspersed with large, trihedral, regularly arranged, keeled tubercles separated by no more than three granular scales at their base; tubercles extend from occiput to anterior part of tail. Tubercles on occiput and nape relatively small, those on body and anterior part of tail largest; approximately 20 rows of tubercles at midbody; approximately 30 paravertebral tubercles; 27 flat, imbricate, ventral scale rows between ventrolateral body folds, increasing in size towards midline of venter; ventral scales much larger than the dorsal scales. Precloacal scales large, smooth. No precloacal groove. Right hemipenis everted during specimen preservation preparation. Forelimbs moderately robust, relatively short (FL/SVL 0.17). No granular scales on dorsal surface of forelimbs, but slightly keeled, larger, scales. Palmar scales rounded. Digits well-developed, inflected at basal, interphalangeal joints. Subdigital lamellae nearly square proximal to joint inflection, only slightly expanded distal to inflection. Digits more narrow distal to joints. Claws well-developed, sheathed by a dorsal and ventral scale. Hind limbs more robust than forelimbs, moderate in length (TBL/SVL 0.20). Dorsal surface of hind limbs showing granular scales interspersed with large, keeled, trihedral tubercles. Ventral thigh and tibial scales flat, imbricate, smooth. One row of enlarged, flat, imbricate femoral scales extends from knee to knee through precloacal region where it is continuous with enlarged, precloacal scales. The row of enlarged femoro-precloacal scales is V-shaped and includes 15 poreless scales (left leg) + two pored scales + one poreless scale + two pored scales (precloacal region) + 14 poreless scales (right leg), thus a total of 34 femoro-precloacal scales and four precloacal pores. Enlarged femoral scales directly bordered anteriorly by smaller, imbricate, smooth scales, and posteriorly by granular scales. Plantar scales low, slightly rounded. Toes well-developed, inflected at basal, interphalangeal joints; subdigital lamellae proximal to joint inflection nearly square, only slightly expanded distal to inflection. Toes more narrow distal to joints. Claws well-developed, sheathed by a dorsal and ventral scale; 20/20 subdigital lamellae on 4<sup>th</sup> toe.

Tail original, 104.2 mm in length, 7.2 mm width at base, tapering to a point. Postcloacal scales flat, large, imbricate. Median row of subcaudal scales transversely enlarged. One poorly-developed, lateral postcloacal spur at the base of the hemipenial swelling on the left side, no spur on the right side. Additional morphometrical data on the holotype are provided in Table 1.

**TABLE 1.** Morphometric and meristic data for the type series of *Cyrtodactylus sanook* sp. nov. Paired meristic characters are given left/right. Measurements (in mm) are given for the left side. For the abbreviations, see Material and methods.

	Holotype THNHM 22541	Paratype PSUZC-RT 2012.4	Paratype QSMI 1165
Sex	Male	Male	Male
SL	13/14	14/14	15/14
IL	10/10	10/10	10/11
Tubercles on forelimbs	No	No	No
Tubercles on hind limbs	Yes	Yes	Yes
Tubercles on head and occiput	Yes	Yes	Yes
Tubercles on gular region	No	No	No
Tubercles on at least anterior third of tail	Yes	Yes	Yes
No. of paravertebral tubercles	30	29	29
No. of longitudinal rows of tubercles	20	19	18
No. of ventral scale rows	27	28	27
Enlarged median subcaudals	Yes	Yes	Yes
Proximal subdigital lamellae square	Yes	Yes	Yes
No. of subdigital lamellae on 4 <sup>th</sup> toe	20 (7+13)	20 (7+13)	19 (6+13)
Contact of posterior thigh scales abrupt	Yes	Yes	Yes
No. of enlarged femoral and precloacal scales	34 (15+5+14)	33 (15+5+13)	32 (13+5+14)
No. of femoro-precloacal pores	4	3	4
Precloacal groove	No	No	No
Precloacal depression	No	No	No
Patch of enlarged precloacal scales	Yes	Yes	Yes
SVL	73.8	79.5	72.9
TL	104.2	101.6 (only first 41.6 mm original)	95.7 (only first 36.7 mm original)
TW	7.2	7.8	7.7
FL	12.5	12.4	12.2
TBL	15.0	15.6	15.6
AG	33.4	35.2	32.1
HL	22.5	22.6	22.3
HW	13.9	15.3	14.3
HD	8.4	9.6	8.6
ED	4.8	5.5	5.4
EE	6.0	6.9	6.1
ES	9.5	9.6	9.1
EN	7.6	7.6	7.3
IO	6.5	6.8	6.5
EL	1.3	1.2	1.4
IN	2.2	2.3	2.4



**FIGURE 2.** Dorsal view of type series of *Cyrtodactylus sanook* **sp. nov.** before preservation (from top to bottom: holotype, paratype PSUZC-RT 2012.4, paratype QSMI 1165). Photo. by O.S.G. Pauwels.

**Coloration in life.** Ground color of body, head, limbs and tail dark brown; dark irregularly shaped markings on rostrum and top of head; wide dark band extending from postnasal region through eye onto occiput and onto the postnasal region on the other side of the head, on the nape this band is bordered above and below by thin contrasting yellow stripes; six irregular thin yellow transversal bands between limb insertions, three more such stripes above sacrum and anterior part of tail, followed by 10 white annuli not completely encircling the tail. Narrow dorsal yellow bands do not extend below mid-flank level; roundish yellow spots are irregularly disposed on the lower part of flanks. Upper surfaces of limbs bear smaller, irregularly arranged, yellow spots. Iris greenish bronze. Underside of head, venter, limbs and palms uniformly whitish; underside of tail marbled with yellow, white and black color.

**Variation.** The paratypes resemble the holotype in most aspects of morphology and coloration. PSUZC-RT 2012.4 shows a continuous series of enlarged femoro-precloacal scales, including 15 poreless scales (left leg) + two pored scales + two poreless scales + one pored scale (precloacal region) + 13 poreless scales (right leg), thus a total of 33 femoro-precloacal scales and three precloacal pores. QSMI 1165 shows a continuous series of enlarged femoro-precloacal scales, including 13 poreless scales (left leg) + two pored scales + one poreless scale + two pored scales (precloacal region) + 14 poreless scales (right leg), thus a total of 32 femoro-precloacal scales and four precloacal pores (Fig. 4). PSUZC-RT 2012.4 and QSMI 1165 show respectively three and two well-developed spurs on each side of the hemipenial swelling. Meristic and morphometric data of the paratypes are presented in Table 1. Two adult females, photographed *in situ* and released, were examined; they show a similar color pattern to males; both show a continuous series of enlarged femoro-precloacal scales, like males, but without precloacal pores (Fig. 5). Dorsal surface of regenerated part of tails of paratypes lack bands, but bear a poorly contrasted marbling pattern of grayish and whitish. Underside of regenerated part of tail in QSMI 1165 is uniformly grayish.



**FIGURE 3.** Ventral view of type series of *Cyrtodactylus sanook* **sp. nov.** before preservation (from upstairs to downstairs: holotype, paratype PSUZC-RT 2012.4, paratype QSMI 1165). Photo. by O.S.G. Pauwels.

**Distribution.** The species is so far known only from its type locality, and it is possibly endemic to Tham Sanook, Chumphon Province, Thailand.

**Natural history.** Fifteen individuals of the new species, including the type series, were encountered between 2000 and 2200 hrs, and it can thus be regarded as locally common. All were adults, except four subadults; no juveniles were encountered. They were found at the entrance of the cave and up to about 100 meters from the cave entrance, but always on or along the karst cliffs and boulders. The cave is surrounded by secondary forest with numerous lianas (Fig. 7). The individuals were all actively foraging on the leaf litter, on tree trunks and stumps, on large leaves, boulders, on karst cliff and on the temple cement walls (Fig. 4), at maximum one meter above the ground. One adult female was gravid with two eggs. The new species was found in strict syntopy with *Gehyra lacerata* (Wiegmann) (several individuals observed on the karst cliff), *Gekko gekko* (Linnaeus) (several hatched egg clutches found in holes within the karst cliff) (Gekkonidae) and a subadult *Trimeresurus venustus* Vogel (Viperidae) (the latter representing a major range extension northwards for that pitviper species). Specimens of the new species are slow and easy to approach and catch. They generally do not bite when handled unless they are manipulated too long.

**Etymology.** The specific epithet is a noun in apposition referring to the species' type locality. In Thai language, *sanook* means '(having) fun' and as such, the specific epithet is also a reference to the enormous pleasure that the authors take in discovering amazing reptiles and other animal diversity in Thailand and in making it known to others. We suggest the following common names: *Tuk kai sanook* (Thai), Sanook Bent-toed Gecko (English), *Cyrtodactyle sanouk* (French).



**FIGURE 4.** Detail of cloacal area of the male paratype QSMI 1165 of *Cyrtodactylus sanook* **sp. nov.** Note enlarged femoral and precloacal scales. Photo. by O.S.G. Pauwels.



**FIGURE 5.** Detail of cloacal area of an adult female *Cyrtodactylus sanook* **sp. nov.** (not collected). Note total absence of pores. Photo. by M. Sumontha.



**FIGURE 6.** Live adult male *Cyrtodactylus sanook* **sp. nov.** (not collected) *in situ* at Tham Sanook, Chumphon Province. Photo. by O.S.G. Pauwels.

## Comparisons

In their recent description of *Cyrtodactylus thochuensis*, Ngo and Grismer (2012) provided a comparative table compiling all other Indo-Chinese and Thai species showing preloacal pores but lacking femoral pores. To these should be added *Cyrtodactylus bidoupimontis* Nazarov, Poyarkov, Orlov, Phung, Nguyen, Hoang & Ziegler, 2012, *C. bugiamapensis* Nazarov, Poyarkov, Orlov, Phung, Nguyen, Hoang & Ziegler, 2012, and *C. surin* Chan-ard & Makchai, 2011, described from the Indo-Chinese region after the publication of the work of Ngo and Grismer (2012). Burmese and Peninsular Malaysian species were not included in the table provided by Ngo and Grismer (2012), but they should be taken into account in our comparisons, since the type-locality of *Cyrtodactylus sanook* **sp. nov.** is relatively close to both Myanmar and Peninsular Malaysia. From Malaysia, one should hence consider *Cyrtodactylus aurensis* Grismer, *C. durio* Grismer, Shahrul, Quah, Muin, Chan, Grismer & Norhayati, *C. pantiensis* Grismer, Chan, Grismer, Wood & Belabut, *C. payacola* Johnson, Quah, Anuar, Muin, Wood, Grismer, Greer, Chan, Ahmad, Bauer & Grismer, 2012, *C. stresemanni* Rösler & Glaw, 2008, *C. sworderi* (Smith) and *C. tiomanensis* Das & Jim in the comparison. From Myanmar, we should provide comparison with *C. brevidactylus* Bauer, 2002, *C. chrysopylos* Bauer, 2003, *C. mandalayensis* Mahony, 2009 and *C. wakeorum* Bauer, 2003 which also have preloacal pores but lack femoral pores.

Among all these species, *Cyrtodactylus sanook* **sp. nov.** can be distinguished, by possessing enlarged femoral scales, from *C. aurensis*, *C. brevidactylus*, *C. buchardi* David, Teynié & Ohler, *C. chauquangensis* Hoang, Orlov, Ananjeva, Johns, Hoang & Dau, *C. chrysopylos*, *C. cryptus* Heidrich, Rösler, Vu, Böhme & Ziegler, *C. durio*, *C. elok* Dring, *C. hontreensis* Ngo, Grismer & Grismer, *C. mandalayensis*, *C. nigriocularis* Nguyen, Orlov &



Darevsky, *C. pageli* Schneider, Nguyen, Schmitz, Kingsada, Auer & Ziegler, *C. pantiensis*, *C. pseudoquadrivirgatus* Rösler, Vu, Nguyen, Ngo & Ziegler, *C. stresemanni*, *C. sumonthai* Bauer, Pauwels & Chanhome, and *C. sworderi*. By its possession of enlarged subcaudal scales, *Cyrtodactylus sanook* **sp. nov.** is distinguished from *C. bidoupimontis*, *C. brevidactylus*, *C. buchardi*, *C. bugiamapensis*, *C. cattienensis* Geissler, Nazarov, Orlov, Böhme, Phung, Nguyen & Ziegler, *C. chauquangensis*, *C. cryptus*, *C. durio*, *C. irregularis* (Smith), *C. mandalayensis*, *C. martini* Ngo, *C. pantiensis*, *C. papilionoides* Ulber & Grossmann, *C. payacola*, *C. pseudoquadrivirgatus*, *C. quadrivirgatus* Taylor, *C. stresemanni*, *C. sworderi*, *C. wakeorum* and *C. ziegleri* Nazarov, Orlov, Nguyen & Ho (character state unknown in *C. chrysopylos*). By its possession of 18–20 longitudinal rows of dorsal tubercles at midbody, *Cyrtodactylus sanook* **sp. nov.** is distinguishable from *C. brevidactylus* (27), *C. buchardi* (25), *C. chrysopylos* (16), *C. condorensis* (Smith) (22–24), *C. durio* (16), *C. eisenmanae* Ngo (14), *C. elok* (5–10), *C. hontreensis* (14), *C. nigriocularis* (0), *C. pageli* (9–14), *C. pantiensis* (21–23), *C. papilionoides* (12–14), *C. quadrivirgatus* (24), *C. stresemanni* (13), *C. sumonthai* (12) and *C. wakeorum* (24). Its six or seven irregular pale narrow dorsal bands readily distinguish it from *Cyrtodactylus angularis* (W-shaped marks), *C. aurensis* (four narrow bands), *C. bidoupimontis* (blotches sometimes fused to form irregular wide bands), *C. brevidactylus* (blotches), *C. buchardi* (blotches), *C. bugiamapensis* (blotches), *C. chauquangensis* (three irregular bands), *C. durio* (blotches), *C. eisenmanae* (four narrow bands), *C. elok* (blotches), *C. hontreensis* (three broad bands), *C. intermedius* (Smith) (four or five bands), *C. irregularis* (blotches), *C. mandalayensis* (blotches), *C. nigriocularis* (0–4 bands), *C. oldhami* (Theobald) (four lines of spots), *C. pantiensis* (blotches), *C. papilionoides* (blotches), *C. paradoxus* Darevsky & Szczerbak (irregular narrow bands connected to a vertebral line), *C. payacola* (blotches), *C. peguensis* (Boulenger) (spots), *C. phuquocensis* Ngo, Grismer & Grismer (four or five broad bands), *C. quadrivirgatus* (stripes), *C. stresemanni* (longitudinally elongated blotches), *C. sumonthai* (three bands), *C. surin* (broad bands), *C. sworderi* (longitudinal lines of spots), *C. teynieii* (blotches), *C. thochuensis* (three or four irregular bands), *C. tiomanensis* (three bands) and *C. wakeorum* (five narrow bands) (Bauer, 2002, 2003; Rösler and Glaw, 2008; David *et al.*, 2011; Grismer, 2011; Ngo and Grismer, 2012). Its number of subdigital lamellae on 4<sup>th</sup> toe (19–20) does not overlap with those for *C. angularis* (Smith) (15 or 16), *C. brevidactylus* (10 or 11), *C. buchardi* (12), *C. condorensis* (14–16), *C. durio* (22), *C. eisenmanae* (22–24), *C. intermedius* (16–18), *C. irregularis* (14), *C. mandalayensis* (18), *C. martini* (22–24), *C. oldhami* (12–17), *C. pantiensis* (21–23), *C. papilionoides* (10–14), *C. peguensis* (16–18), *C. phuquocensis* (15–18), *C. sumonthai* (18), *C. surin* (18), *C. sworderi* (18), *C. thochuensis* (14–17), *C. wakeorum* (16) and *C. yangbayensis* (15–17). The number of precloacal pores of *Cyrtodactylus sanook* **sp. nov.** (3–4) does not overlap with those of *C. angularis* (six pores), *C. aurensis* (7–9), *C. brevidactylus* (8), *C. bugiamapensis* (7–11), *C. cattienensis* (6–8), *C. chauquangensis* (6–7), *C. chrysopylos* (10+1), *C. cryptus* (9–11), *C. durio* (two parallel rows of six pores each), *C. elok* (seven or eight), *C. hontreensis* (seven or eight), *C. intermedius* (8–10), *C. irregularis* (5–7), *C. mandalayensis* (5), *C. nigriocularis* (0–2), *C. pantiensis* (eight to nine), *C. payacola* (11–15), *C. peguensis* (7–9), *C. phuquocensis* (7–9), *C. pseudoquadrivirgatus* (5–9), *C. stresemanni* (10), *C. sumonthai* (2), *C. sworderi* (eight or nine), *C. teynieii* (14), *C. wayakonei* Nguyen, Kingsada, Rösler, Auer & Ziegler (6–8), *C. yangbayensis* (6–8) and *C. ziegleri* (5–8). It is to be noted that another Thai Peninsula endemic, also troglomorphic, *Cyrtodactylus thirakhupti* Pauwels, Bauer, Sumontha & Chanhome, 2004, shows a relatively similar dorsal pattern (although with only four narrow bands between limb insertions); it can however be easily distinguished from *C. sanook* **sp. nov.** by lacking precloacal pores in both sexes and by its possession of only 14 longitudinal rows of tubercles.

## Discussion

*Cyrtodactylus sanook* **sp. nov.** is the seventh Thai *Cyrtodactylus* species that is known only from a cave environment (the others six being *C. auribalteatus* Sumontha, Panitvong & Deen, *C. chanhomeae* Bauer, Sumontha & Pauwels, *C. dumnuui* Bauer, Kunya, Sumontha, Niyomwan, Pauwels, Chanhome & Kunya, *C. erythropros* Bauer, Kunya, Sumontha, Niyomwan, Panitvong, Pauwels, Chanhome & Kunya, *C. sumonthai* and *C. thirakhupti*) (Ellis and Pauwels, 2012). These species do not appear to show any morphological adaptation to cave environments and rather seem to be troglomenes. Six additional Thai species are known to frequent caves, but are not found exclusively in those environments: *C. astrum* Grismer, Wood, Quah, Anuar, Muin, Sumontha, Ahmad, Bauer, Wangkulangkul, Grismer & Pauwels, *C. interdigitalis* Ulber, *C. jarujini* Ulber, *C. lekaguli* Grismer, Wood,

Quah, Anuar, Muin, Sumontha, Ahmad, Bauer, Wangkulangkul, Grismer & Pauwels (the latter reported by Ellis and Pauwels in 2012 under *C. pulchellus* Gray), *C. papilionoides* and *C. tigroides* Bauer, Sumontha & Pauwels (Ellis and Pauwels, 2012; Grismer *et al.*, 2012).



**FIGURE 7.** Biotope of *Cyrtodactylus sanook* sp. nov. at the type locality. Photo. by O.S.G. Pauwels.

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#### APPENDIX. Comparative material examined.

*Cyrtodactylus aurensis*: see material listed in Grismer (2005, 2011); *C. durio*: see Grismer (2011); *C. elok*: see Grismer (2011); *C. intermedius*: IRSNB 17011, Nakhon Ratchasima, Thailand; *C. oldhami*: see Pauwels *et al.* (2000) and Grismer (2005); *C. pantiensis*: see Grismer (2011); *C. peguensis*: see Pauwels *et al.* (2000); *C. quadrivirgatus*: see Grismer (2011); *C. stresemanni*: see Grismer (2011); *C. sumonthai*: see Bauer *et al.* (2002); *C. sworderi*: see Grismer (2011); *C. thirakhupti*: see Pauwels *et al.* (2004); *C. thochuensis*: see Ngo and Grismer (2012); *C. tiomanensis*: see Grismer (2011).