



## Descriptions of two new species of *Cyrtodactylus* Gray 1827 (Squamata : Gekkonidae) endemic to southern Vietnam

NGO VAN TRI<sup>1</sup> & AARON M. BAUER<sup>2,3</sup>

<sup>1</sup>Department of Environmental Management and Technology, Institute of Tropical Biology, Vietnamese Academy of Science and Technology, 85 Tran Quoc Toan Street, District 3, Hochiminh City, Vietnam

<sup>2</sup>Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA

<sup>3</sup>Corresponding author. E-mail: aaron.bauer@villanova.edu

### Abstract

Two new species of the gekkonid lizard genus *Cyrtodactylus* Gray, 1827 are described on the basis of voucher specimens collected in isolated mountains separated from the Truong Son Mountain Range, southern Vietnam. Both species were collected from shallow caves, as have been many of the recently described *Cyrtodactylus* from across Southeast Asia. Both species, *C. takouensis* **sp. nov.** from Ta Kou Nature Reserve, Binh Thuan Province and *C. huynhi* **sp. nov.** from Chua Chan Mountain, Dong Nai Province, are characterized by a small number of enlarged femoral scales separated from the precloacal scales by a large diastema. They may be distinguished from one another and from all other congeners by differences in rows of tubercles and ventral scales, subcaudal scalation and dorsal color pattern. These new taxa bring the number of currently recognized *Cyrtodactylus* species in Vietnam to twelve.

**Key words:** *Cyrtodactylus*, Gekkonidae, new species, description, southern Vietnam, cave-dwelling

### Introduction

The genus *Cyrtodactylus* Gray, 1827 is one of the most speciose gekkonid lizard groups and is a dominant component of the gecko fauna of much of tropical Asia and parts of Oceania. As recently as 2002 only about 70 species were recognized in *Cyrtodactylus*, inclusive of *Geckoella*, which has sometimes been considered a subgenus (Rösler 2000, 2001; Das & Lim 2000; Kluge 2001). New species of *Cyrtodactylus* continue to be discovered throughout the range of the genus (e.g., Sri Lanka, Batuwita & Bahir 2005; New Guinea, Günther & Rösler 2003; Kraus & Allison 2006; Kraus 2007), but the greatest rate of discovery has been in Southeast Asia, where recent discoveries in Malaysia (Das & Lim 2000; Grismer 2005, 2006; Grismer & Leong 2005; Youmans & Grismer 2006), Laos (David *et al.* 2004), Myanmar (Bauer 2002, 2003), and Thailand (Bauer *et al.* 2002, 2003; Pauwels *et al.* 2004) have increased the number of recognized species to approximately 90.

One of the regions of greatest discovery of new *Cyrtodactylus* has been Vietnam. Until 1997, only three species had been recorded for the country, *C. condorensis*, *C. intermedius* (subsequently confirmed for Vietnam by Ngo & Grismer 2006), and *C. irregularis*. Since then *C. paradoxus*, *C. phongnhakebangensis*, *C. nigriocularis*, *C. badenensis*, *C. cryptus*, *C. caovansungi*, *C. chauquangensis*, and a new species from central Vietnam have been described (Darevsky & Szczerbak 1997; Ziegler *et al.* 2002; Nguyen *et al.* 2006; Heidrich *et al.* 2007; Orlov *et al.* 2007; Hoang *et al.* 2007; Rösler *et al.* 2008), bringing the national total to 11 species, nearly all of which appear to have highly restricted distributions. Many of the newly described forms are associated with karst outcrops or limestone cave formations, which act as isolated habitat “islands” and appear to have promoted speciation within *Cyrtodactylus*. In Vietnam, pairs of limestone restricted species occur in

sympatry at both Phong Nha-Ke Bang National Park (Ziegler *et al.* 2002; Heidrich *et al.* 2007) and Ba Den Mountain (Nguyen *et al.* 2006). We here describe two additional Vietnamese *Cyrtodactylus*, both from shallow cave habitats in isolated granitic outlyers of the Truong Son Mountains in the south of the country.

## Material and methods

Voucher specimens were collected by hand during field surveys of isolated montane regions in southern Vietnam. Locality coordinates were recorded using a Garmin III GPS and notes regarding ecological parameters were taken in the field. Photographs were taken using a variety of digital cameras. Specimens were euthanized with chloroform and fixed and stored in 70–80% ethanol. All type specimens have been deposited in the Zoological Collection of the University of Natural Sciences (UNS) in Hochiminh City, Vietnam.

The following measurements (to the nearest 0.1 mm) were taken with calipers: snout-vent length (SVL; from tip of snout to vent), trunk length (TrunkL; distance from axilla to groin measured from posterior edge of forelimb insertion to anterior edge of hindlimb insertion), crus length (CrusL; from base of heel to knee); tail length (TailL; from vent to tip of tail), tail width (TailW; measured at widest point of tail); head length (HeadL; distance between retroarticular process of jaw and snout-tip), head width (HeadW; maximum width of head), head height (HeadH; maximum height of head, from occiput to underside of jaws), ear length (EarL; longest dimension of ear); forearm length (ForeaL; from base of palm to elbow); orbital diameter (OrbD; greatest diameter of orbit), nares to eye distance (NarEye; distance between anteriormost point of eye and nostril), snout to eye distance (SnEye; distance between anteriormost point of eye and tip of snout), eye to ear distance (EyeEar; distance from anterior edge of ear opening to posterior corner of eye), internarial distance (Internar; distance between nares), and interorbital distance (Interorb; shortest distance between left and right supraciliary scale rows). Measurements and scale counts are based on the right side of specimens unless otherwise noted. Scale counts and external observations of morphology were made using an XTJ 4700 dissecting microscope.

Comparisons were made with museum material in the collections of the Zoological Museum of Hanoi National University, Vinh University, the California Academy of Sciences (CAS), Institut Royal des Sciences Naturelles de Belgique (IRSNB), Chulalongkorn University Museum of Zoology (CUMZ), United States National Museum (USNM), and the Museum of Comparative Zoology (MCZ), as well as original published descriptions and illustrations provided in broader faunal and taxonomic treatments (e.g., Smith 1935; Taylor 1963; Hikida 1990; Ulber 1993; Darevsky & Szczerbak 1997; Das 1997, 2005; Manthey & Grossmann 1997; Chan-Ard *et al.* 1999; Das & Lim 2000; Malkmus *et al.* 2002; Ziegler *et al.* 2002; Bauer 2002, 2003; Bauer *et al.* 2002, 2003; David *et al.* 2004; Pauwels *et al.* 2004; Batuwita & Bahir 2005; Grismer 2005; Grismer & Leong 2005; Nguyen *et al.* 2006; Kraus & Allison 2006; Youmans & Grismer 2006; Grismer *et al.* 2007; Heidrich *et al.* 2007; Kraus 2007; Orlov *et al.* 2007; Hoang *et al.* 2007; Rösler *et al.* 2008).

### *Cyrtodactylus takouensis* sp. nov.

Figures 1–5

**Holotype.** Zoological Collection of the University of Natural Sciences, Hochiminh City (UNS) 0209; adult male; Hang To Cave (10°48.815'N, 107°53.718'E), Ta Kou Nature Reserve, Binh Thuan Province, southern Vietnam; collected by Ngo Van Tri on 14 March 2006.

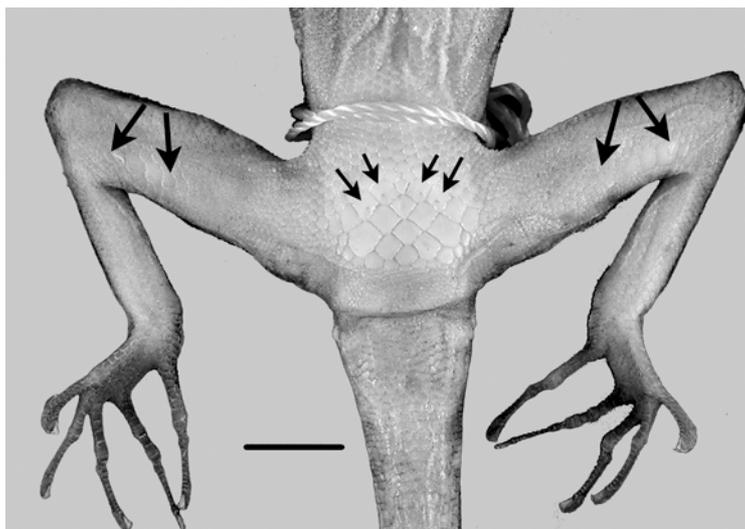
**Paratypes.** All paratypes were collected at the type locality by Ngo Van Tri. UNS 0211-0212, September 2003; UNS 0210, 0213, 12 November 2005; UNS 0214, 14 March 2006.

**Diagnosis.** A medium-sized *Cyrtodactylus* (SVL 74.7–81.1 mm), body slender, limbs and digits and tail long and slender (Fig. 1). *Cyrtodactylus takouensis* may be distinguished from all other congeners by the

combination of: two pairs of enlarged postmental scales, the first in broad contact with one another; dorsum with 9–10 rows of smooth tubercles; 39–40 ventral scales across belly between ventrolateral folds; no precloacal groove; a patch of enlarged precloacal scales with 3–4 precloacal pores arranged in an angular series with a single, poreless median scale in males; a series of 3–5 greatly enlarged femoral scales at distal end of thigh, separated from enlarged precloacal scales by most of length of femur (Fig. 2), one minute femoral pore in distal or penultimate enlarged femoral scale; 8 broad basal lamellae and 10–12 narrow distal lamellae beneath 4<sup>th</sup> toe of pes; median row of subcaudals transversely enlarged; dorsal pattern of five pale yellow bands, alternating with dark brown bands, between the nape and sacrum, a dark brown canthal stripe continuous with nuchal loop and bordered by a narrow, pale yellow edge that fades gradually into a mottled brownish crown, with scattered brown spots, and original portion of tail dark brown with series of narrow pale bands, proximal two yellow, more distal bands white.



**FIGURE 1.** Adult male holotype (USN 0209) of *Cyrtodactylus takouensis* **sp. nov.** from Ta Kou Nature Reserve, Binh Thuan province, Vietnam. Scale bar = 20 mm.



**FIGURE 2.** Cloacal and ventral surface of hindlimbs of holotype (USN 0209) of *Cyrtodactylus takouensis* **sp. nov.** showing the disposition of the enlarged precloacal and femoral scales and precloacal and femoral pores. Small arrows indicate precloacal pore-bearing scales. Large arrows indicate the proximal and distal ends of the enlarged femoral scale series. The distalmost enlarged femoral scale bears a single pore. Scale bar = 5 mm.

Among its Vietnamese congeners *Cyrtodactylus takouensis* **sp. nov.** differs from *C. cryptus* Heidrich *et al.*, 2007, *C. irregularis* (Smith, 1921), and a new species from central Vietnam (Rösler *et al.* 2008) in possessing transversely enlarged subcaudal scales, from *C. nigriocularis* Nguyen *et al.*, 2006, *C. badenensis* Nguyen *et al.*, 2006, *C. chauquangensis* Hoang *et al.*, 2007, *C. cryptus* and the new central Vietnamese species in possessing enlarged femoral scales, from *C. irregularis*, *C. intermedius* (Smith, 1917), *C. cryptus*, *C. caovansungi* Orlov *et al.*, 2007, *C. chauquangensis* and the new central Vietnamese species in its lower number of precloacal pores (3–4 versus 5 or more) in males, from *C. phongnhakebangensis* Ziegler *et al.*, 2002 in having a diastema between precloacal and femoral pores (versus a continuous series of 32–42 precloacal-femoral pores), from *C. irregularis*, *C. paradoxus* (Darevsky & Szczerbak, 1997), *C. badenensis*, and *C. chauquangensis* in its greater number of scales across mid-venter (39–40 versus 38 or fewer), from *C. cryptus* and the new central Vietnamese species in its lower number of scales across mid-venter (39–40 versus 41 or greater), and from *C. condorensis* (Smith, 1920) in a pattern of alternating light and dark bands (versus irregular spots or blotches).

Among other congeners *C. takouensis* may be distinguished from *C. annulatus* (Taylor, 1915), *C. aurensis* Grismer, 2005, *C. cavernicolus* (Inger & King, 1961), *C. fumosus* (Müller, 1895), *C. marmoratus* (Kuhl, 1831), *C. papuensis* (Brongersma, 1934), *C. philippinicus* (Steindachner, 1867), *C. pubisulcus* Inger, 1958, *C. pulchellus* Gray, 1827, *C. semenanjungensis* Grismer & Leong, 2005, *C. tiomanensis* Das & Lim, 2000, *C. rubidus* (Blyth, 1860), and *C. sadleiri* Wells & Wellington, 1985 by the absence of a precloacal groove, from *C. agusanensis* (Taylor, 1915), *C. gubernatoris* (Annandale, 1913), *C. ayeyarwadyensis* Bauer, 2003, *C. brevidactylus* Bauer, 2002, *C. annandalei* Bauer, 2003 [incorrectly coded as having transversely enlarged median subcaudal plates by Youmans & Grismer 2006 and Heidrich *et al.* 2007], *C. khasiensis* (Jerdon, 1870), *C. darmandvillei* (Weber, 1890), *C. elok* Dring, 1979, *C. gansi* Bauer, 2003, *C. lateralis* (Werner, 1896), *C. matsuii* Hikida, 1990, *C. quadrivirgatus* Taylor, 1962, *C. wakeorum* Bauer, 2003, *C. sworderi* (Smith, 1925), *C. yoshii* Hikida, 1990, *C. seribuatensis* Youmans & Grismer, 2005, *C. buchardi* David *et al.*, 2004, *C. serratus* Kraus, 2007, *C. adleri* Das, 1997, *C. gordongekkoi* (Das, 1993), and *C. wetariensis* (Dunn, 1927) by the presence of a single series of transversely enlarged median subcaudal scales, from *C. jellesmae* (Boulenger, 1897), *C. laevigatus* Darevsky, 1964, *C. sermowaiensis* (de Rooij, 1915) and *C. thirakhupti* Pauwels *et al.*, 2004, by the presence of precloacal pores in males, from *C. fraenatus* (Günther, 1864), *C. cracens* Batuwita & Bahir, 2005, *C. edwardtaylori* Batuwita & Bahir, 2005, *C. ramboda* Batuwita & Bahir, 2005, *C. subsolanus* Batuwita & Bahir, 2005, *C. soba* Batuwita & Bahir, 2005, *C. chrysopylos* Bauer, 2003, *C. ingeri* Hikida, 1990, *C. peguensis* (Boulenger, 1893), *C. malayanus* (de Rooij, 1915), *C. murua* Kraus & Allison, 2006, *C. sumonthai* Bauer *et al.*, 2002 and *C. tigroides* Bauer *et al.*, 2003 by the presence of enlarged femoral scales, from *C. feae* (Boulenger, 1893), *C. consobrinoides* (Annandale, 1905), *C. jarujini* Ulber, 1993, *C. loriae* (Boulenger, 1898), *C. angularis* (Smith, 1921), *C. louisiadensis* (de Vis, 1892), *C. malcolmsmithi* (Constable, 1949), *C. novae-guineae* (Schlegel, 1844), *C. papilionoides* Ulber & Grossmann, 1991, *C. tuberculatus* (Lucas & Frost, 1900), *C. variegatus* (Blyth, 1859), and *C. chanhomae* Bauer *et al.*, 2003, by the presence of a diastema between the enlarged femoral scales and femoral pores and the precloacal pores, from *C. aaroni* Günther & Rösler, 2003, *C. baluensis* (Mocquard, 1890), *C. consobrinus* (Peters, 1871), *C. derongo* Brown & Parker, 1973, *C. interdigitalis* Ulber, 1993, *C. mimikanus* (Boulenger, 1914), *C. russelli* Bauer, 2003, *C. aequalis* Bauer, 2003, *C. slowinskii* Bauer, 2002, *C. irianjayaensis* Rösler, 2001 and *C. redimiculus* King, 1962 by the presence of 9–10 longitudinal rows of dorsal tubercles (vs. 14 or more rows), from *C. biordinis* Brown & McCoy, 1980 by the presence of a single (when present at all), versus double row of femoral pores, and from *C. oldhami* (Theobald, 1876) by a banded (versus striped) dorsal pattern. We have excluded species of *Geckoella* from our comparisons, as well as other species sometimes assigned to *Cyrtodactylus* (e.g., Youmans & Grismer 2006) that we believe to be assignable to other genera.

**Description.** (Based on holotype, USN 0209) Adult male, SVL 80.4 mm. Head long (HeadL/SVL 0.28), relatively narrow (HeadW/HeadL 0.62), somewhat depressed (HeadH/HL 0.37), distinct from slender neck.

Lores and interorbital region weakly inflated, canthus rostralis especially prominent, frontonasal region strongly concave, Snout elongate (SnEye/HeadL 0.43), pointed, much longer than eye diameter (OrbD/SnEye 0.54); scales on snout and forehead small, granular, homogeneous; scales on snout larger than those on occipital region. Eye large (OrbD/HeadL 0.23); pupil vertical with crenulated margins; supraciliaries short, bearing minute conical spines posteriorly. Ear opening oval, large (EarL/HeadL 0.09); eye to ear distance equal to diameter of eye (EyeEar/OrbD 1.0). Rostral approximately 63% deep (1.7 mm) as wide (2.7 mm), incompletely divided (60%) by rostral groove; supranasals separated from each other by a single enlarged internasal; rostral in contact with supralabial I, supranasals and single internasal; nostrils round, each surrounded by supranasal, rostral, first supralabial and three enlarged postnasals; 2-3 rows of small scales separate orbit from supralabials. Mental triangular, wider (2.2 mm) than deep (2.0 mm); anterior pair of enlarged trapezoidal postmentals, each bordered anteromedially by mental, medially in broad contact with other postmental, bordered anterolaterally by first infralabial, laterally by second infralabial (left side only), posterolaterally by posterior triangular postmental, and posteriorly by three slightly enlarged chin scales; posterior postmentals separated from each other by chin scales. Supralabials to midorbital position 8 (right) to 9 (left); enlarged supralabials to angle of jaws 10 (right) to 11 (left); infralabials 10 (right) to 11 (left). Interorbital scale rows across narrowest point of frontal bone 17.

Body slender, relatively short (TrunkL/SVL 0.41) with distinct ventrolateral folds. Dorsal scales granular to weakly conical, intermixed with small tubercles (2-3 times size of adjacent scales) extending from occipital region on to back and tail base; each tubercle smooth; tubercles in approximately 10 rows at midbody, smaller on flanks, and smallest in occipital region. Ventral scales much larger than dorsal, smooth, relatively round, and subimbricate, largest posteriorly; midbody scale rows across belly to base of ventrolateral folds 39; gular region with relatively homogeneous, smooth scales. Enlarged rhomboidal patch of precloacal scales extending posteriorly from pore-bearing scales to approximately 2 mm anterior of cloacal lip; no precloacal groove present; four precloacal pores arranged in an angular series with a single median poreless scale separating two pores on each side; series of five variably-sized enlarged femoral scales at distal end of thigh, separated from enlarged precloacal scales by a wide diastema; distalmost (right) or penultimate (left) enlarged femoral scale bearing a minute pore. Scales of palms and soles smooth, flattened; ventral/preaxial limb surfaces with smooth, subimbricate scales; dorsal/postaxial limb surfaces with flattened to very weakly conical juxtaposed to subimbricate scales.

Fore and hindlimbs long, slender (ForeaL/SVL 0.16; CrusL/SVL 0.19). Digits moderately short, strongly inflected at basal interphalangeal joints, all bearing slightly curved claws; subdigital lamellae widened beneath basal phalanx to approximately half digital width (5-6-7-7-6 manus; 4-6-8-8-9 pes); narrow lamellae distal to digital inflection and not including ventral claw sheath (7-9-9-10-10 manus; 9-9-11-11-12 pes). One to several rows of small, non lamellar granules between basal and distal lamellar series on some digits; interdigital webbing present but weakly developed. Length of digits (manus; measurement in mm in parentheses): III(5.1) > IV(4.8) > II(4.5) > V(4.4) > I(4.1); (pes): IV(7.0) > V(6.8) > III(6.2) > II(5.1) > V(3.7).

Tail long, slender, tapering to tip; longer than snout vent length (tailL/SVL 1.13); original portion of tail (41.0 mm) segmented with 9 scale rows on each segment, two basalmost segments with 8 parasagittal rows of enlarged, smooth tubercles continuing from body dorsum; subcaudal scales forming a single median row of enlarged subimbricate plates approximately one half width of tail, three such plates per tail segment; dorsal caudal scales flat, smooth, rectangular with rounded posterior edge; a series of three enlarged, conical, laterally compressed cloacal spurs on each side of tail base, anterodorsalmost largest.

**Coloration (in preservative).** Dorsum with five relatively narrow cream bands between nape and groin (one on nape, four between axilla and groin), another across posterior part of sacrum, each alternating with a wider brown band with a darker, more well-defined posterior edge and a more diffuse and somewhat paler anterior edge. A dark brown canthal stripe from tip of snout, through ventral portion of orbit and above ear to form a complete nuchal loop. Crown of head cream with scattered brown pigment on parietal table and two

irregular dark brown spots at posterodorsal corner of orbits. Cream nape band extending anteriorly through ear to corner of mouth. Labial scales, especially anteriorly, very dark brown, particularly along labial margins. A cream to white streak between labials and canthal stripe from posterior border of nostril to last supralabial. Limbs and digits with alternating cream and mottled brown bands. Original portion of tail with alternating narrow cream and broad brown bands; banding indistinct on regenerated tail. Body venter pale cream with minute brown flecks on most scales, denser on neck and edges of jaws, flanks and limbs; palms and soles more darkly pigmented; tail venter, particularly regenerated portion, heavily suffused with brown pigment.

In life (Fig. 3) pale cream-colored dorsal regions of head and dorsum distinctly pale lemon yellow. Supraciliary scales bright yellow. Sacral band and anteriormost tail band pale lemon yellow, two more posterior bands bright white. Yellow markings on limbs duller than those of body. Venter whitish.



**FIGURE 3.** Holotype (USN 0209) adult male of *Cyrtodactylus takouensis* **sp. nov.** in life.

**Variation.** Variation in mensural and meristic characters among the type series are presented in Table 1. Paratypes UNS 0211–0212 (figs. 4–5) have a variant dorsal pattern in which the first and second yellow bands behind the axilla are fused dorsally. Among the paratypes only one of the male paratypes, UNS 0211, has a pair of minute femoral pores, like the holotype. Both precloacal and femoral pores are lacking in the female paratypes.



**FIGURE 4.** Paratype (USN 0212) adult female of *Cyrtodactylus takouensis* **sp. nov.** in life.

**TABLE 1.** Mensural and meristic data for the type series of *Cyrtodactylus takouensis*, **sp. nov.** Abbreviations as in materials and methods, all measurements in mm.

	UNS 0209 Holotype	UNS 0210 Paratype	UNS 0211 Paratype	UNS 0212 Paratype	UNS 0213 Paratype	UNS 0214 Paratype	min-max $\bar{x} \pm S.D.$
Sex	♂	♀	♂	♀	♂	♀	n=6
SVL	80.4	81.1	77.5	74.7	78.5	77.3	74.7–81.1 78.2±2.3
ForealL	12.8	12.4	11.9	11.9	12.1	11.9	11.9–12.8 12.2±0.4
CrusL	15.6	15.3	13.9	13.8	15.1	14.5	13.8–15.6 14.7±0.8
TailL	91.0	90.3	77.7	43.7	79.2	80.8	43.7–91.0 77.1±17.3
TailW	6.8	6.3	5.8	5.5	6.6	6.5	5.5–6.8 6.2±0.5
TrunkL	32.9	33.2	34.5	29.2	33.0	32.3	29.2–34.5 32.5±1.8
HeadL	22.3	22.1	21.9	21.5	22.3	21.1	21.1–22.3 21.9±0.5
HeadW	13.9	14.0	13.6	12.6	13.9	13.3	12.6–14.0 13.6±0.5
HeadH	8.2	7.9	7.7	7.5	8.1	8.1	7.5–8.2 7.9±0.3
OrbD	5.2	5.1	4.9	5.0	5.1	5.1	4.9–5.2 5.1±0.1
EyeEar	5.2	5.8	4.5	4.7(left)	5.4	5.0	4.5–5.8 5.1±0.5
SnEye	9.7	10.5	9.9	9.1	10.0	9.2	9.1–10.3 9.7±0.5
Interorb	5.9	5.8	6.4	5.2	6.2	5.9	5.2–6.4 5.9±0.4
EarL	2.0	2.1	1.4	1.3	2.0	1.8	1.3–2.1 1.8±0.3
Internar	2.1	2.1	2.5	1.9	2.1	2.1	1.9–2.5 2.1±0.2
TubRows	10	10	9	9	10	9	9–10 9.5±0.6
VenScales	39	39	40	39	39	40	39–40 39.3±0.5
Precloacal pores	4	0	4	0	3	0	3–4 (♂♂ only)
Femoral pores	1+1	0	1+1	0	0	0	0–2 (♂♂ only)
Subdigital scansors (manus)	I:5+7 II:6+9 III:7+9 IV:7+10 V:6+10	I:5+7 II:6+8 III:7+9 IV:7+10 V:5+10	I:5+7 II:6+7 III:7+8 IV:8+9 V:6+10	I:6+7 II:6+8 III:7+9 IV:7+9 V:7+8	I:6+7 II:7+8 III:6+8 IV:8+8 V:7+9	I:5+7 II:6+8 III:7+8 IV:7+10 V:6+9	—
Subdigital scansors (pes)	I:4+9 II:6+9 III:8+11 IV:8+11 V:9+12	I:5+11 II:6+11 III:8+11 IV:8+12 V:8+11	I:5+8 II:6+9 III:8+10 IV:8+11 V:8+12	— damaged	I:6+7 II:8+8 III:8+11 IV:8+10 V:9+11	I:4+8 II:6+8 III:8+11 IV:8+11 V:9+11	—



**FIGURE 5.** Dorsal pattern variation among members of the type series of *Cyrtodactylus takouensis* **sp. nov.** From left to right: USN 0211, 0213, 0212, 0210, 0209 (holotype), 0214. Note the asymmetrical patterns of USN 0211 (far left) and 0212 (third from left).



**FIGURE 6.** Habitat of *Cyrtodactylus takouensis* **sp. nov.** in Ta Kou Nature Reserve, Binh Thuan province, Vietnam during the rainy season.

**Etymology.** The specific epithet refers to Ta Kou Mountain, the type and only known locality for the new species. This is an isolated mountain that is not part of the main Truong Son Mountain Range that runs along the length of southern Vietnam. Local people in the area where *C. takouensis* occurs refer to this gecko as “*than lan nui*” or “*than lan da*” meaning gecko living on a mountain or in rocky areas. We suggest Ta Kou bent-toed gecko as the English common name for this species.

**Distribution and natural history.** All voucher specimens were collected during day at a depth of 7 m in Hang To cave in 7 m depth. The cave is located in deciduous forest (Fig. 6) at an elevation of 450 m a.s.l. Hang To cave is often disturbed in the dry season by visitors and pilgrims who go down the bottom of the cave to get fresh water that they believe will bring them luck. *Cyrtodactylus takouensis* **sp. nov.** is only found in the Ta Kou Nature Reserve (Fig. 7), an isolated mountain with the highest peak of about 662 m a.s.l. In paratype UNS 0211 the skin of the occiput and neck was torn as the result of a fall by the collector in the cave.



**FIGURE 7.** Map of southern Vietnam illustrating the type localities of *Cyrtodactylus takouensis* (circle) and *C. huynhi* (star). Base map from Central Intelligence Agency.

### *Cyrtodactylus huynhi* **sp. nov.**

Figures 8–11

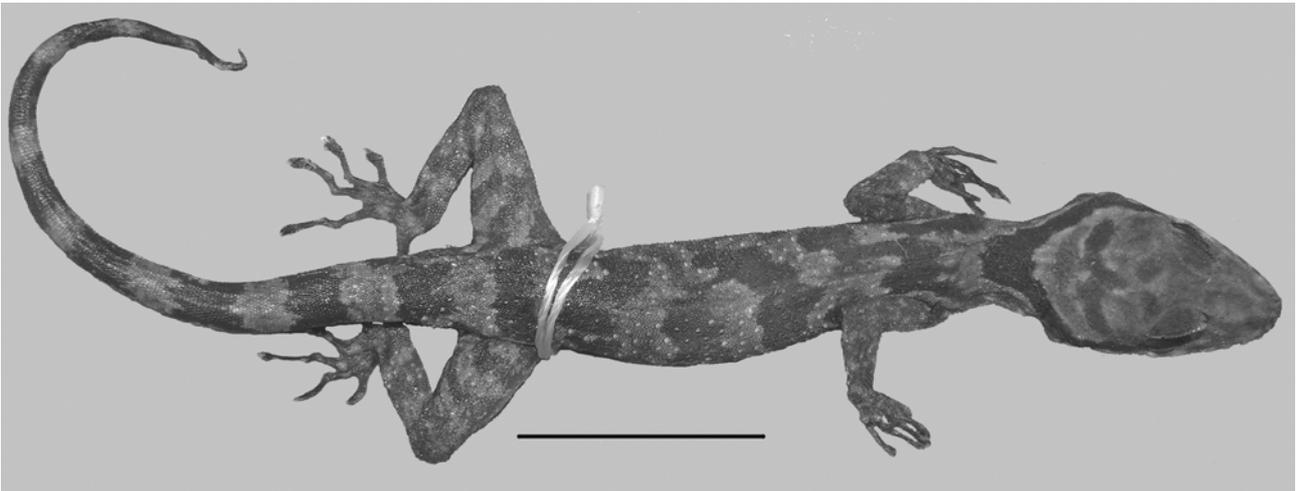
**Holotype.** UNS 0256; adult male; Chua Chan Mountain (10°57.595'N, 107°22.579'E), Xuan Truong commune, Xuan Loc district, Dong Nai Province, southeastern Vietnam, 300 m a.s.l.; collected by Ngo Van Tri, 28 December 2005.

**Paratypes.** UNS 0257; adult female; Chua Chan Mountain (10°55.806'N, 107°21.640'E), Suoi Cat commune, Xuan Loc district, Dong Nai province, southeastern Vietnam, ~70 m a.s.l.; collected by Ngo Van Tri, 27 December 2005. UNS 0215 and UNS 0325 (adult females); same locality as UNS 0257; collected by Ngo Van Tri, 31 December 2005. UNS 0326 (adult male) 0327 (subadult male) and UNS 0328 (adult female); same locality as UNS 0257; collected by Ngo Van Tri, August 2006.

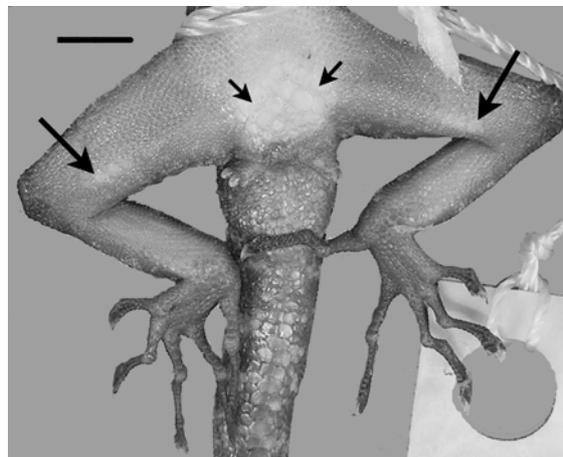
**Additional material.** UNS 0329 (adult male); Chua Chan Mountain (10°55.806'N, 107°21.640'E), Suoi Cat commune, Xuan Loc district, Dong Nai province, southeastern Vietnam, ~70 m a.s.l.; collected by Ngo Van Tri, 31 December 2005.

**Diagnosis.** A medium-sized *Cyrtodactylus*, adult snout-vent length 68.5–79.8 mm, body slender, limbs and digits relatively long, slender, original tail long. *Cyrtodactylus huynhi* **sp. nov.** may be distinguished from all of its congeners on the basis of the following combination of characters: no precloacal groove; two pairs of enlarged postmental scales, anterior pair in broad contact with one another, posterior pair separated by two enlarged chin granules; dorsal scalation with approximately 16–18 irregular rows of weakly keeled tubercles;

43–46 ventral scales across belly between ventrolateral folds; no precloacal groove; a patch of enlarged precloacal scales with 7–9 precloacal pores arranged in an angular series in males; a series of 3–5 enlarged femoral scales at distal end of thigh, separated from enlarged precloacal scales by a large diastema (Fig. 9); 1–5 femoral pores per thigh in males; 8–10 broad basal lamellae and 9–11 narrow distal lamellae beneath 4<sup>th</sup> toe of pes; subcaudal scales heterogeneous, with alternating series of single and paired median scales; dorsum light brown with 5–6 irregular broad dark brown bands between shoulder and sacrum, each bordered anteriorly and posteriorly by yellow to cream rows of tubercles; a prominent dark brown complete nuchal loop, tail with alternating light and dark brown banding.



**FIGURE 8.** Adult male holotype (USN 0256) of *Cyrtodactylus huynhi* **sp. nov.** from Chua Chan Mountain, Dong Nai province, southeastern Vietnam. Scale bar = 20 mm.



**FIGURE 9.** Cloacal and ventral surface of hindlimbs of holotype (USN 0256) of *Cyrtodactylus huynhi* **sp. nov.** showing the disposition of the enlarged precloacal and femoral scales and precloacal and femoral pores. Larger arrows indicate the extent of the enlarged femoral scale series (pores are minute and not clearly visible). Smaller arrows indicate lateral-most pore-bearing precloacal scales. Scale bar = 5 mm.

Among its Vietnamese congeners *Cyrtodactylus huynhi* **sp. nov.** differs from *C. nigriocularis*, *C. badensis*, *C. chauquangensis*, *C. caovansungi*, *C. paradoxus*, *C. condorensis*, *C. intermedius*, *C. phongnhakebangensis* and *C. takouensis* in lacking a single series on greatly enlarged median subcaudal scales, from *C. cryptus* and a new species from central Vietnam (Rösler *et al.* 2008) in possessing enlarged femoral scales, and from *C. irregularis* in its greater number of scale rows across mid-venter (43–46 versus 30–34).



**FIGURE 10.** Holotype (USN 0256) adult male *Cyrtodactylus huynhi* **sp. nov.** in life.



**FIGURE 11.** Paratype (USN 0257) adult female of *Cyrtodactylus huynhi* **sp. nov.** in life. This specimen exhibits a particularly bold dorsal pattern.

Among other congeners *C. huynhi* may be distinguished from *C. annulatus*, *C. aurensis*, *C. cavernicolus*, *C. fumosus*, *C. marmoratus*, *C. papuensis*, *C. philippinicus*, *C. pubisulcus*, *C. pulchellus*, *C. semenanjungensis*, *C. tiomanensis*, *C. rubidus*, and *C. saddleiri* by the absence of a precloacal groove, from *C. agusanensis*, *C. brevidactylus*, *C. elok*, *C. gansi*, *C. matsuii*, *C. sworderi*, *C. yoshii*, *C. buchardi* and *C. chrysopylos* by the presence of enlarged femoral scales, from *C. gordongekkoi*, *C. jellesmae*, *C. laevigatus* and *C. sermowaiensis* by the presence of precloacal pores in males, from *C. ayeyarwadyensis*, *C. lateralis*, *C. quadrivirgatus*, *C. adleri* and *C. irianjayaensis* by the presence of femoral pores, from *C. seribuatensis*, *C. serratus*, *C. loriae*, *C. angularis*, *C. malcolmsmithi*, *C. novaeguineae*, *C. papilionoides* and *C. variegatus* by the presence of a diastema between the enlarged femoral scales and femoral pores and the precloacal pores, from *C. gubernatoris*, *C. khasiensis*, *C. darmandvillei*, *C. wakeorum*, and *C. wetariensis* by a greater number of ventral scales across mid-body (43–46 versus  $\leq 40$ ), from *C. annandalei*, *C. interdigitalis* and *C. mimikanus* by a lower number of precloacal pores (8 versus 11 or more), from *C. derongo*, by the presence of 16–18 longitudinal rows of dorsal tubercles (versus 20 rows) and much smaller body size (maximum ~80 mm versus 120 mm SVL), from *C. biordinis* by the presence of a single versus double row of femoral pores, and from all other species by the lack of a single median row of transversely enlarged subcaudal plates.

**Description.** (Based on Holotype, UNS 0256) Adult male, SVL 68.5 mm. Head long (HeadL/SVL 0.28), relatively narrow (HeadW/HeadL 0.65), somewhat depressed (HeadH/HL 0.42), distinct from slender neck. Lores and interorbital region weakly inflated, canthus rostralis not especially prominent, frontal nasal region strongly concave, Snout elongate (SnEye/HeadL 0.43), rounded; longer than eye diameter (OrbD/SnEye ratio 0.55); scales on snout and forehead small, granular, homogeneous; scales on snout larger than those on occipital region. Eye large (OrbD/HeadL 0.24), pupil vertical with crenulated margins; supraciliary scales bearing minute conical spines posteriorly. Ear opening oval, moderate in size (EarL/HeadL 0.06); eye to ear distance greater than diameter of eye (EyeEar/OrbD 1.09).

Rostral 55% deep (1.6 mm) as wide (2.9 mm), incompletely divided (~30%) by rostral groove; supranasals separated from one another by a small pentagonal internasal scale. Rostral in contact with first supralabial, internasal, and supranasals only; nostril round, surrounded by supranasal, rostral, first supralabial and three enlarged postnasals; 2–3 rows of small scales separate orbit from supralabials. Mental triangular, wider (2.3 mm) than deep (1.75 mm); two pairs of enlarged postmentals, each five-sided anterior postmental bordered anteromedially by mental, medially in broad contact with other postmental, bordered anterolaterally by first infralabial, posterolaterally by posterior postmental, and posteriorly by a single enlarged round chin granule; posterior, roughly triangular, postmentals separated from each other by two enlarged chin granules. Supralabials to midorbit 8 (right) to 9 (left); enlarged supralabials to angle of jaws 11 (left and right); infralabials 9 (left) to 10 (right); interorbital scale rows across narrowest point of frontal bone 19.

Body slender, relatively short (TrunkL/SVL 0.41) with small but distinct ventrolateral folds. Dorsal scales granular to weakly conical, interspersed with approximately 16 irregular rows of small (3–5 times size of adjacent scales), weakly-keeled to conical tubercles extending from occipital region to tail base; tubercles smaller on flanks than dorsum, and smallest in occipital region. Ventral scales much larger than dorsals, smooth, relatively round, and subimbricate, largest posteriorly; midbody scale rows across belly to base of ventrolateral folds 44; gular region with relatively homogeneous, smooth scales. Enlarged circular patch of precloacal scales extending posteriorly from one row anterior to pore-bearing scale row to approximately 1 mm anterior of cloacal lip; no precloacal groove present; eight precloacal pores arranged in an angular series; series of 3 enlarged, round to oval femoral scales at distal end of thigh, separated from enlarged precloacal scales by a wide diastema; one (right) or two (left) minute femoral pores. Scales of plams and soles smooth, flattened; ventral/preaxial limb surfaces with smooth to weakly conical, subimbricate scales; dorsal/postaxial limb surfaces with granular to very weakly conical juxtaposed scales intermixed with small to moderate sized weakly keeled to conical tubercles (numerous on thighs and shanks).

Fore and hind limbs moderate (ForeL/SVL 0.15; CrusL/SVL 0.18); digits moderately short, strongly inflected at basal interphalangeal joints, all bearing slightly curved claws; subdigital lamellae widened

beneath basal phalanx to approximately half digital width; (6-7-6-7-7 manus; 9-6-7-9-9 pes); narrow lamellae distal to digital inflection and not including ventral claw sheath: 7-8-9-9-9 manus; 8-9-11-11-10 pes; interdigital webbing present but weakly developed. Length of digits (manus; measurement in mm in parentheses): IV(5.5) > III(5.3) > V(4.3) > II(4.2) > I(2.5); (pes): IV(6.6) > III(6.3) > V(5.9) > II(4.5) > I(2.6).

Tail longer than snout vent length (tailL/SVL 1.04), slender, tapering to tip; original portion of tail (48.9 mm) not obviously segmented, except for 2 basalmost segments where 8 parasagittal rows of enlarged, weakly keeled tubercles continue from the body dorsum; subcaudal scales smooth, imbricate, heterogeneous, with alternating series of single and paired enlarged median scales (i.e., not forming a single median row of transversely enlarged plates); dorsal caudal scales flat, smooth, hexagonal, with rounded posterior margins. Two small, rounded, slightly laterally compressed cloacal spurs on each side of tail base.

**Coloration (in preservative).** Dorsum pale brown with 5–6 irregular dark brown crossbands between shoulder and sacrum, each bordered anteriorly and posteriorly by a pale edge incorporating rows of whitish tubercles. Several crossbands strongly asymmetrical and partly fused with adjacent bands. A very dark brown, well-defined complete nuchal loop continuing anteriorly to posteroventral portion of orbit, no dark canthal stripe present. Nuchal loop bordered anteriorly and posteriorly by a narrow cream edge. Crown mottled brown on cream with a dark brown transverse marking across occiput and a similar, but fainter marking between occiput and nape. Two small, irregular, dark brown blotches on parietal table just behind frontal bone. Tip of snout darker than crown; labial scales mottled brown and white. Side of neck mottled brown with irregular whitish blotches extending to forearm insertion. Limbs and digits with alternating light and dark brown bands or blotches. Tail with alternating light and dark brown bands; dark bands somewhat wider than light; 10 dark bands from posterior edge of sacrum to tail tip. Body venter cream with minute brown flecks on most scales yielding a brownish suffusion, especially under limbs, on soles and palms, neck, and margins of flanks and jaws. Tail venter mottled brown and white; median scale rows predominantly paler than ventrolateral scales. In life (Figs. 10–11) dorsal pale margins of dark bands cream to yellow; tubercles cream colored. Nuchal loop blackish.

**Variation.** Variation in mensural and meristic characters among the type series are presented in Table 2. An adult male non-type, UNS 0329, has 5 enlarged femoral scales on each thigh, bearing 4 (right)-5(left) minute femoral pores. Other members of the type series have up to 4 femoral pores per thigh. Female paratypes have dimpled precloacal scales corresponding to the pored scales of males and in one instance (UNS 0328) corresponding dimples or pits are present in the enlarged femoral scales. Female paratypes also have very small cloacal spurs. Pattern variation is extensive among the paratypes. UNS 0257 is especially boldly patterned with strongly contrasting light and dark markings (Fig. 11); its limbs are more mottled and less banded than those of the holotype. Its venter is darker, especially the chin, which is light brown with only a few irregular pigmentless patches. UNS 0329 is particularly irregularly patterned with extensive fusion between adjacent dark dorsal bands and with weak contrast between the dorsal bands and the pale edging tubercles. Both UNS 0329 and UNS 0257 have 18, rather than 16 midbody scale rows.

**Etymology.** The specific epithet is derived from the name of Professor Dang Huy Huynh, the first director of the Institute of Ecology and Biological Resources (IEBR), Hanoi, who contributed greatly to the development of zoological research in Vietnam. The local common name for this species is the general “*than lan nui*” or “*than lan rung*” meaning gecko living on a mountain or in a forest. We suggest Huynh’s bent-toed gecko as the English common name of the species.

**Distribution and natural history.** The holotype was collected during daytime on 28 December 2005 in a 15 m deep cave in the isolated Chua Chan Mountain (highest peak ~836 m a.s.l.) (Fig. 7). The landscape surrounding the cave was secondary deciduous forest at an elevation of 300 m a.s.l. (Fig. 12) Paratype UNS 0257 was collected at 20h14 on 27 December 2005 at the entrance to a rocky cave; paratypes UNS 0215 and UNS 0325 were collected between 20h12 and 20h45 on 31 December 2005 at the same cave entrance, in an area of secondary deciduous forest at elevation about 70 m a.s.l. *Gekko gekko* (Linnaeus, 1758) and *Gehyra mutilata* (Wiegmann, 1834) were found in sympatry with *Cyrtodactylus huynhi* **sp. nov.**

**TABLE 2.** Mensural and meristic data for type series of *Cyrtodactylus huynhi* sp. nov. Abbreviations as in materials and methods, all measurements in mm.

	USN 0256	USN 0215	USN 0257	USN 0325	USN 0326	USN 0327	USN 0328	min-max
	Holotype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	$\bar{x} \pm S.D.$
Sex	♂	♀	♀	♀	♂	♂	♀	n=7
SVL	68.5	79.8	77.7	79.0	67.2	54.8	74.4	54.8–79.8
ForeL	10.0	10.6	10.7	10.6	10.7	7.6	11.4	71.6±8.9 7.6–11.4
CrusL	12.3	13.1	13.0	12.9	13.9	10.3	14.2	10.2±1.2 10.3–13.9
TailL	70.9	61.5	broken	73.2	78.6	29.1	51.7	12.8±1.3 29.1–78.6
TailW	5.1	5.8	5.2	5.2	5.3	5.2	5.4	60.8±18.2 5.1–5.8
TrunkL	28.2	32.7	31.4	33.8	25.5	20.3	31.5	5.3±0.2 20.3–33.8
HeadL	19.1	21.8	22.5	22.1	18.7	15.5	21.2	29.1±4.8 15.5–22.5
HeadW	12.5	13.9	14.2	13.8	12.1	10.2	13.3	20.1±2.5 10.2–14.2
HeadH	8.1	7.7	8.2	8.4	7.5	5.7	8.5	12.9±1.4 5.7–8.4
OrbD	4.5	5.0	4.9	4.9	5.0	3.5	5.2	7.7±1.0 3.5–5.2
EyeEar	4.9	5.8	6.8	5.5	4.5	3.8	6.0	4.7±0.6 3.8–6.8
SnEye	8.2	9.7	9.5	9.6	6.9	5.9	7.9	5.3±1.0 5.9–9.7
Interorb	5.1	6.1	7.3	6.0	4.9	4.4	5.6	8.2±1.5 4.4–7.3
EarL	1.1	1.7	1.6	1.3	1.1	0.8	1.4	5.6±0.9 0.8–1.7
Internar	2.0	2.5	2.0	2.4	1.4	1.2	2.2	1.3±0.3 1.2–2.5
TubRows	16	18	18	18	16	18	18	2.0±0.5 16–18
VenScales	44	44	43	46	46	44	45	17.4±1.0 43–46
Precloacal pores	8	(8 pitted scales)	(8 pitted scales)	0	7	9	(6 pitted scales)	44.6±1.1 7–9 (♂♂ only)
Femoral pores	2+1	0	0	0	2+2	4+4	(3+3 pitted scales)	3–8 (♂♂ only)
Subdigital scansors (manus)	I:6+7 II:7+8 III:6+9 IV:7+9 V:7+9	I:5+8 II:6+8 III:7+8 IV:6+8 V:7+9	I:7+7 II:7+8 III:7+8 IV:7+8 V:7+8	I:6+9 II:5+9 III:6+9 IV:6+10 V:7+9	I:5+7 II:7+7 III:6+10 IV:7+10 V:7+9	I:6+7 II:6+6 III:6+8 IV:6+9 V:6+7	I:7+7 II:5+8 III:6+9 IV:6+9 V:7+8	—
Subdigital scansors (pes)	I:9+8 II:6+9 III:7+11 IV:9+11 V:9+10	I:10+7 II:6+9 III:7+10 IV:8+10 V:9+10	I:9+7 II:6+9 III:7+9 IV:8+10 V:9+10	I:9+7 II:6+10 III:6+10 IV:8+9 V:8+10	I:8+8 II:6+9 III:6+9 IV:10+11 V:9+12	I:7+6 II:7+7 III:7+10 IV:8+9 V:9+10	I:7+6 II:7+8 III:9+8 IV:8+9 V:9+9	—



**FIGURE 12.** Habitat of *Cyrtodactylus huynhi* **sp. nov.** on Chua Chan Mountain, Dong Nai province, southeastern Vietnam.

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