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A new species of *Gekko* Laurenti, 1768 (Squamata: Gekkonidae) from Dong Nai Province, Southeastern Vietnam

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Abstract

A new endemic species of *Gekko*, *G. russelltraini*, is described from Chua Chan Mountain, an isolated granitic peak in the Xuan Loc district, Dong Nai province, southeastern Vietnam. The species is distinguished from its congeners by its moderate size (SVL 70.3–82.9 mm), 8–11 precloacal pores in males, 12–16 longitudinal rows of very weakly enlarged, smooth dorsal tubercles, 17–18 lamellae beneath digit IV of pes, and dorsal pattern of five to seven white vertebral blotches between nape and sacrum and four to seven pairs of short white bands on flanks between limb insertions. *Gekko russelltraini* is a member of a group of mid-sized Indochinese *Gekko* sharing similar habitus, scalation, and color pattern elements and is the seventh member of its genus confirmed for Vietnam.

Key words: *Gekko*, Gekkonidae, new species, granitic outcrop, Chua Chan Mountain, Vietnam

Introduction

The gekkotan fauna of Indochina is among the richest in the world and in the last decade the description of a large number of new species from the region, particularly Vietnam, has revealed that localized endemism occurs there on a previously unappreciated scale. The greatest number of new forms have been identified in the genera *Cyrtodactylus* (e.g., Heidrich *et al*. 2007; Ngo & Bauer 2008 and references cited therein) and *Cnemaspis* (Grismer & Ngo 2007; Grismer *et al*. 2008 and references therein), but Ziegler *et al.* (2008) recently described the new eublepharid gecko, *Goniurosaurus catbaensis* from Cát Bà Island, Hai Phong Province and Rösler *et al.* (2005) described *Gekko scientiadventura* from Phong Nha-Ke Bang, Quang Binh Province.

At least 12 species of the genus *Gekko* Laurenti occur in Indochina (Taylor 1962; Grossmann & Ulber 1990; Darevsky & Orlov 1994; Günther, 1994; Szczerbak & Nekrasova, 1993; Bobrov, 1995; Ota *et al.* 1995; Cox *et al*. 1998; Rösler *et al*. 2005; Bauer *et al.* 2008). Of these, at least six are known from Vietnam: *Gekko gecko* (Linnaeus), *G. palmatus* Boulenger, *G. ulikovskii* Darevsky & Orlov; *G. badenii* Szczerbak & Nekrasova, *G. grossmanni* Günther, and *Gekko scientiadventura* Rösler *et al.* (Bobrov & Semenov 2008), although the specific distinctness of *G. badenii* and *G. ulikovskii* has been called into question (Nguyen *et al.* 2009). *Gekko chinensis* Gray, has also been included in the Vietnamese fauna by Nguyen *et al*. (2005, 2009) and Rösler *et al.* (2005), but was excluded by Bobrov & Semenov (2008). In addition, Bourret (1937, 1939) reported *G. japonicus* (Schlegel) from Tonkin, Northern Vietnam, but this specimen has since been identified as a *G. palmatus* with an aberrant pattern of precloacal pores (Ota *et al*. 1995). The status of *G. japonicus* reported from Bắc Thái by Nguyen & Ho (1996) and Bắc Kạn by Nguyen *et al.* (2005) remains uncertain. Although Rösler *et al*. (2005) retained *G. japonicus* as a member of the Vietnamese fauna, it was not

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considered by Bobrov & Semenov (2008).

Several of the Vietnamese *Gekko* have broad distributions in southeast Asia, but several, most recently described taxa, are Vietnamese endemics, occupying very small areas (Bobrov & Semenov 2008), similar to many species of *Cyrtodactylus* (e.g., Ziegler *et al.* 2002[2003]; Nguyen *et al*. 2006; Heidrich *et al.* 2007; Hoang *et al.* 2007). We here describe another new species of the genus *Gekko* which is known only from Chua Chan Mountain (highest peak ~836 m a.s.l.), an isolated peak separated from the Truong Son Mountains, in the Xuan Loc District, Dong Nai Province, southeastern Vietnam.

Materials and methods

Field surveys during which specimens of the new species collected were conducted during December 2005 and November 2007. Voucher specimens were collected by hand. Geographic coordinates were recorded using a Garmin III GPS. Photographs were taken using a DMC-FZ30 digital camera. Specimens were euthanized with tricaine methanesulfonate (MS-222) following Conroy *et al.* (2009), fixed in 10% neutral buffered formalin, and stored in 75% ethanol. Liver samples for use in subsequent DNA sequencing were collected and stored in 95% ethanol. All type specimens are deposited in the Zoological Collection of the University of Natural Sciences (UNS) in Hochiminh City, Vietnam.

The following measurements were taken with a digital caliper following the methods of Bauer *et al*. (2002, 2003): crus length (CrusL); ear length (EarL); eye to ear distance (EyeEar); forearm length (ForeaL); head depth (HeadD); head length (HeadL); head width (HeadW); internarial distance (Internar); interorbital distance (shortest distance between left and right supercilliary scale rows) (Interorb); orbital diameter (OrbD); snout to eye distance (SnEye); snout-vent length (SVL); tail length (TailL); trunk length (TrunkL). Values are reported to the nearest 0.1 mm, but mensural ratios calculated from raw measurements are reported to the nearest 0.01 mm. Measurements and scale counts based on right side of animals unless otherwise noted. Scale counts and external observations on morphology were made using an Olympus SZ binocular dissecting microscope. Meristic values recorded were scale rows around midbody (MidBod); number of longitudinal rows of tubercles at midbody (TubRow); ventral scales across the venter between the ventrolateral folds at midbody (VentSc); number of chin scales bordering posterior margin of postmental scales (ChinSc); number of supralabials (SupraL); number of infralabials (InfraL); number of internasal scales between the supranasals (IntNas); number scales across narrowest point of frontal bone (FrontSc); number of interorbital scale rows (IntOrb); subdigital lamellae under digit I of pes (LamPesI); subdigital lamellae under digit IV of pes (LamPesIV); precloacal pores (PrecP); Whorl3: number of middorsal scales rows in the third caudal whorl.

Comparisons were made with material of congeneric species in the Zoological Museum of the National University of Hanoi and the Zoological Collection of University of Natural Sciences,as well as original published papers provided in broader faunal and taxonomic treatments (e.g., Taylor 1962, 1963; Zhou *et al*. 1982; Grossmann & Ulber 1990; Günther 1994; Szczerbak & Nekrasova 1993; Ota *et al*. 1995; Darevsky & Orlov 1994; Rösler *et al*. 2005; Bauer *et al*. 2008).

Systematics

***Gekko russelltraini* sp. nov.**
Plate 1.

Holotype. Zoological Collection of University of Natural Sciences in Hochiminh City (UNS) UNS 0293, adult male (Plate 1A); Southeastern Vietnam, Dong Nai Province, Xuan Loc district, Suoi Cat Commune, Chua Chan Mountain, approximately 100 m elevation (10°55.799'N, 107°21.766'E), collected by Ngo Van Tri, 28 December 2005.

Paratypes. UNS 0280, subadult male, UNS 0281, adult female; Southeastern Vietnam, Dong Nai Province, Xuan Loc district, Suoi Cat Commune, Chua Chan Mountain, (10˚57.591'N 107˚22.662'E), collected by Ngo Van Tri, 27 December 2005; UNS 0292, adult female; same locality and collector as UNS 0280, collected 28 December 2005; UNS 0294–0295, adult males; Southeastern Vietnam, Dong Nai Province, Xuan Loc district, Xuan Truong Commune, Chua Chan Mountain, approximately 304 m elevation (10°55.819'N 107°21.757'E), collected by Ngo Van Tri, 31 December 2005; UNS0358, 0360, adult females, UNS 0359, subadult male; same locality and collector as UNS 0294, 30 November 2007.

Etymology. The epithet *russelltraini* is a patronym honoring the former president (1978–1985) and chairman (1985–1994) of the World Wildlife Fund in the United States, Dr. Russell Train (born 1920), who has supported funding and fellowships for generations of biologists to participate in conservation programs around the world, and in Vietnam in particular. The name is masculine and formed in the genitive singular. We suggest the following common names: English — Russell Train's Marble Gecko and Vietnamese — Thằn lằn đá Russell Train.

Diagnosis. A medium sized *Gekko*, SVL to at least 82.9 mm. *Gekko russelltraini* **sp. nov.** may be distinguished from its congeners by the following combination of characteristics: Dorsum with 12–16 longitudinal rows of very weakly enlarged, smooth dorsal tubercles (Plate 1B); 90–101 scale rows around at midbody; 28–30 scale rows across venter between ventrolateral folds. Precloacal pores in a continuous series of 8–11 in males (Plate 1C), femoral pores absent. Digit IV of pes with 17–18 lamellae. Dorsal pattern of five to seven white vertebral blotches between nape and sacrum and four to seven pairs of short, sometimes irregular, white bands on flanks between limb insertions.

Gekko russelltraini **sp. nov.** may be distinguished from *G. subpalmatus* Günther, *G. melli* Vogt, *G. athymus* Brown & Alcala, *G. scientiadventura*, and *G. tawaensis* Okada by the presence of dorsal tubercles; from *G. tawaensis* Okada and *G. vertebralis* Toda *et al.* and *G. shibatai* Toda *et al.* by the presence of precloacal pores in males; from *G. vittatus* Houttuyn, *G. porosus* Taylor, *G. gigante* Brown & Alcala, *G. kikuchii* Oshima, *G. mindorensis* Taylor, *G. monarchus* (Schlegel), *G. romblon* Brown & Alcala, *G. palawanensis* Taylor, *G. ernstkelleri* Rösler *et al.*, and *G. crombota* Brown *et al.* by the lack of femoral pores in males; from *G. gecko*, *G. smithii* Gray, *G. albofasciolatus* Günther, *G. siamensis* Grossmann & Ulber, and *Gekko nutaphandi* Bauer *et al.* by its much smaller size (maximum 83 mm SVL versus 110 mm SVL and greater) and rostral participation in the nostril border, from *G. verreauxi* Tytler by much smaller size (83 versus 130 mm SVL) and smaller number of lamellae under digit IV of the pes (17–19 versus 21–22); from *G. chinensis*, *G. palmatus*, *G. similignum* Smith, and *G. ulikovskii* by its lower number of midbody scale rows (90–107 versus 118 or more); from *G. japonicus*, *G. swinhonis* Günther, *G. auriverrucosus* Zhou & Liu, *G. scabridus*, Liu & Zhou, *G. liboensis*, Zhou & Li, *G. taibaiensis* Song, and *G. wenxianensis* Zhou & Wang by a larger number of lamellae beneath digit IV of the pes (17–18 versus 9 or fewer); from *G. hokouensis* Pope and *G. yakuensis* Matsui & Okada by the presence of two (versus one) cloacal spur on each side of tail base; and from *G. badenii* by a lower number of precloacal pores (8–11 versus 14–18).

Gekko russelltraini is most similar to *G. petricolus* Taylor of Thailand and *G. grossmanni* Günther, a Vietnamese endemic known only from Khanh Hoa Province. The new species shares with both of these species a similar dorsal pattern with a yellowish background and series of whitish spots and very similar standard scalation counts. Together with *G. badenii* and *G. ulikovskii*, these three species constitute a putative clade within the genus (Günther 1994). Based on the type series, *G. russelltraini* is considerably smaller than *G. petricolus* (maximum SVL 83 mm versus 98 mm) and slightly smaller than *G. grossmanni* (maximum SVL 90 mm). It further differs from *G. grossmanni* in a lower number of precloacal pores (8–11 versus 12–14). It differs from both species in having a light purplish-brown venter (versus yellowish to dirty white in *G. petricolus* and whitish to gray in *G. grossmanni*) and in the details of dorsal pattern. Although all three species show variation in pattern, the mid-flank white markings in *G. russelltraini* are invariably elongated to form distinct vertical bars, either entire or broken (versus rounded, oval or rhomboidal spots in the other species) and the pale markings on the parietal table are typically fused to form a transverse bar (verses a series of small, discrete spots).

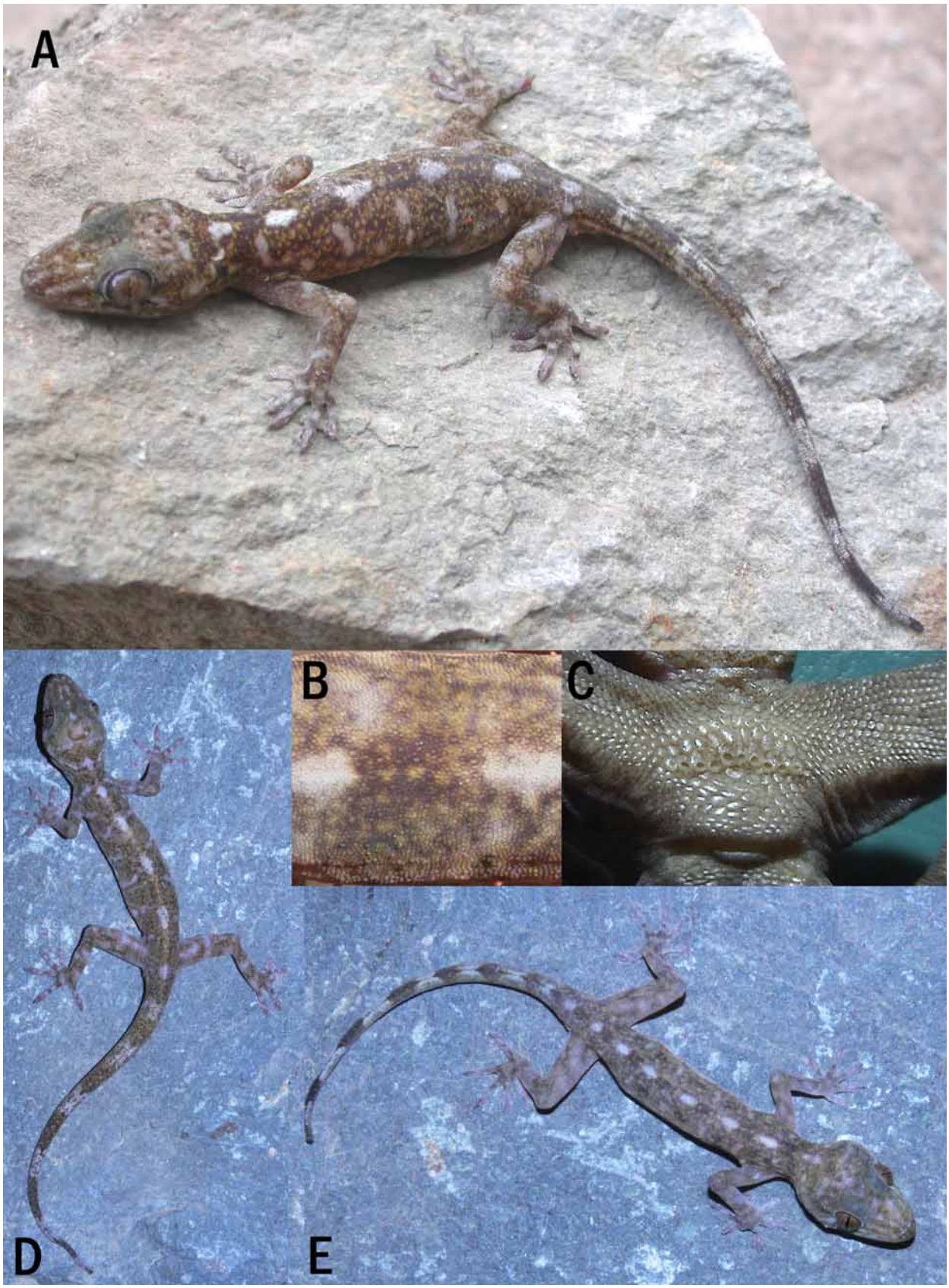

PLATE 1. *Gekko russelltraini* **sp. nov.** (A) Male holotype (UNS 0293) in life. (B) Dorsal scalation of holotype at midbody showing the rows of very small tubercular scales. (C) Ventral view of cloacal region and thighs of holotype illustrating the uninterrupted series of pore-bearing scales and the absence of enlarged femoral scales. (D) Female paratype (UNS 0358) and (E) Male paratype (UNS 0359) illustrating variation in dorsal color pattern.

Description. Based on holotype, UNS 0293, adult male. SVL 71.3 mm. Head relatively long (HeadL/SVL = 0.27) and wide (HeadW/HeadL = 0.70), somewhat depressed (HeadD/HeadL = 0.43); distinct from neck, snout taping, rounded at tip. Loreal and interorbital regions weakly inflated, frontonasal region strongly concave, snout elongate (SnEye/HeadL 0.45), pointed, longer than eye diameter (OrbD/SnEye = 0.58); scales on snout and forehead small, granular, homogeneous; scales on snout larger than those on occipital region except for scattered smooth tubercles (~ 2–3 times size of adjacent scales); 30 interorbital scale rows. Eye large (OrbD/HeadL = 0.26); pupil vertical with crenelated margins; superciliaries smooth, short, bearing several minute conical spines posteriorly. Ear opening obliquely oval, small (EarL/HeadL = 0.1); eye to ear distance longer than diameter of eye (EyeEar/OrbD = 1.28). Rostral quadrangular, much wider (2.6 mm) than high (1.2 mm), with a "Y"-shaped median groove. Enlarged supranasals in contact anteriorly, separated by a two small internasals in longitudinal series posteriorly, only anterior of these entirely between supranasals, posterior extending beyond supranasal border; rostral in contact with supralabial I and supranasals; nostrils round, each surrounded by supranasal, rostral, first supralabial and two enlarged postnasals; 3–4 rows of small scales separate orbit from supralabials. Mental triangular, wider (1.3 mm) than deep (1.0 mm); anterior pair postmentals elongated (2.3 mm long, 0.7 mm wide), each bordered anteromedially by mental, medially in broad contact with other postmental, bordered anterolaterally by first infralabial, laterally by second postmental, posteriorly by four enlarged chin scales; 13 (right) to 14 (left) supralabials, 13 sublabials on both sides; 17 interorbital scale rows.

Body slender, relatively short (TrunkL/SVL 0.43) with weak ventrolateral folds. Dorsal scales smooth, round, granular, juxtaposed; 101 scale rows around midbody, intermixed with enlarged, smooth tubercles (3–4 times size of adjacent scales, smaller on flanks, and smallest in occipital region) extending from occipital region to tail base; tubercles in 16 rows at midbody. Ventral scales much larger than dorsals, smooth, relatively round, and imbricate, largest posteriorly; 28 scale rows across venter between ventrolateral folds; gular region with relatively homogeneous, smooth scales. Ten precloacal pores arranged in a weakly anguled series; scale rows immediately anterior and posterior of pore-bearing scales somewhat enlarged; no enlarged femoral scales. Scales of palms and soles smooth, flattened, round, subimbricate without enlarged tubercles; scales on venter of fore and hind limbs with smooth, flattened, subimbricate scales.

Limbs long and slender (ForeaL/SVL 0.13; CrusL/SVL 0.18). Digits moderately dilated, all bearing slightly curved claws except the first finger and toe; number of broad lamellae beneath each digit (14–15–17–17–16 manus; 15–14–18–18–15 pes); one to two narrow lamellar rows at base of digits; interdigital webbing weakly developed. Length of digits (manus; measurement in mm in parentheses): IV(5.6) > II(4.9) > III(4.8) > V(4.7) > I(4.3); (pes): III(6.2) > IV(5.7) > II(5.5) > V(4.8) > I(4.7).

Original tail slender, tapering to tip; longer than snout vent length (TailL/SVL = 1.19). Tail base with two smooth cloacal spurs on each side. Tail segmented, each segment 11 dorsal scales rows and 4 transversely enlarged subcaudal scales in length; scales of tail dorsum heterogeneous — rectangular to pentagonal or hexagonal, juxtaposed. Tail venter of postpygal region with a single series of 78 transversely enlarged scales followed distally by a series of 10 pairs of scales under tail tip.

Coloration. In life body dorsum mottled golden mustard yellow on purplish-brown. More-or-less contiguous areas of solid purplish brown on nape and in paravertebral position. A series of six opalescent white markings along vertebral line from nape to sacrum, each somewhat longer than broad. Mid-flanks with series of white vertical bars (one on shoulder, four between axilla and groin) alternating with a series of small white spots near ventrolateral margin of flanks (four between axilla and groin) (Plate 1A). Head mottled like dorsum with a whitish cross bar across posterior portion of parietal table and roughly longitudinal grayish-white markings on canthal ridges and nasal region. Smaller, scattered whitish markings on crown, temple, and near rictus. Purplish-brown collar on occiput extending forward through orbit to lateral surface of snout. Iris beige to coppery brown. Limbs mottled and marked with regularly arranged whitish bars or spots. Metapodial and phalangeal joints with whitish markings, alternating with purplish-brown mottled interspaces. Tail with white bars alternating with longer purplish-brown bars. Six white bars on original tail. Venter light purplish brown, darker under chest and groin.

In life the overall color darkens or lightens depending on the ambient conditions. In preservative the dorsum of the holotype and most other voucher specimens is lighter than in life and white markings have faded to cream, beige, or brown.

Variation. Variation in mensural and meristic features is summarized in Table 1. The condition of the internasals differs in some paratypes: in UNS 0358 the supranasals are in contact along their entire length, whereas in UNS 0292 a single, relatively large, internasal separates the supranasals from one another, except at their junction with the rostral. Because this feature is variable even at a single locality we do not consider internasal presence or number to be diagnostically meaningful in this taxon. Color pattern is quite variable. White vertebral markings 6–7, pairs of white flank markings 4–6; white markings may be fused or fragmented and may be markedly asymmetrical (Plate 1D-E).

Natural history. All specimens were collected at night, between 20:00 and 21:45. The holotype and paratypes UNS 0280–UNS 0281 and UNS 0292 were collected on shrubs close to the entrance of a granitic cave on Chua Chan Mountain (Figs. 1–2). UNS 0281 and UNS 0292 are gravid and contain two eggs visible through the skin of the venter.

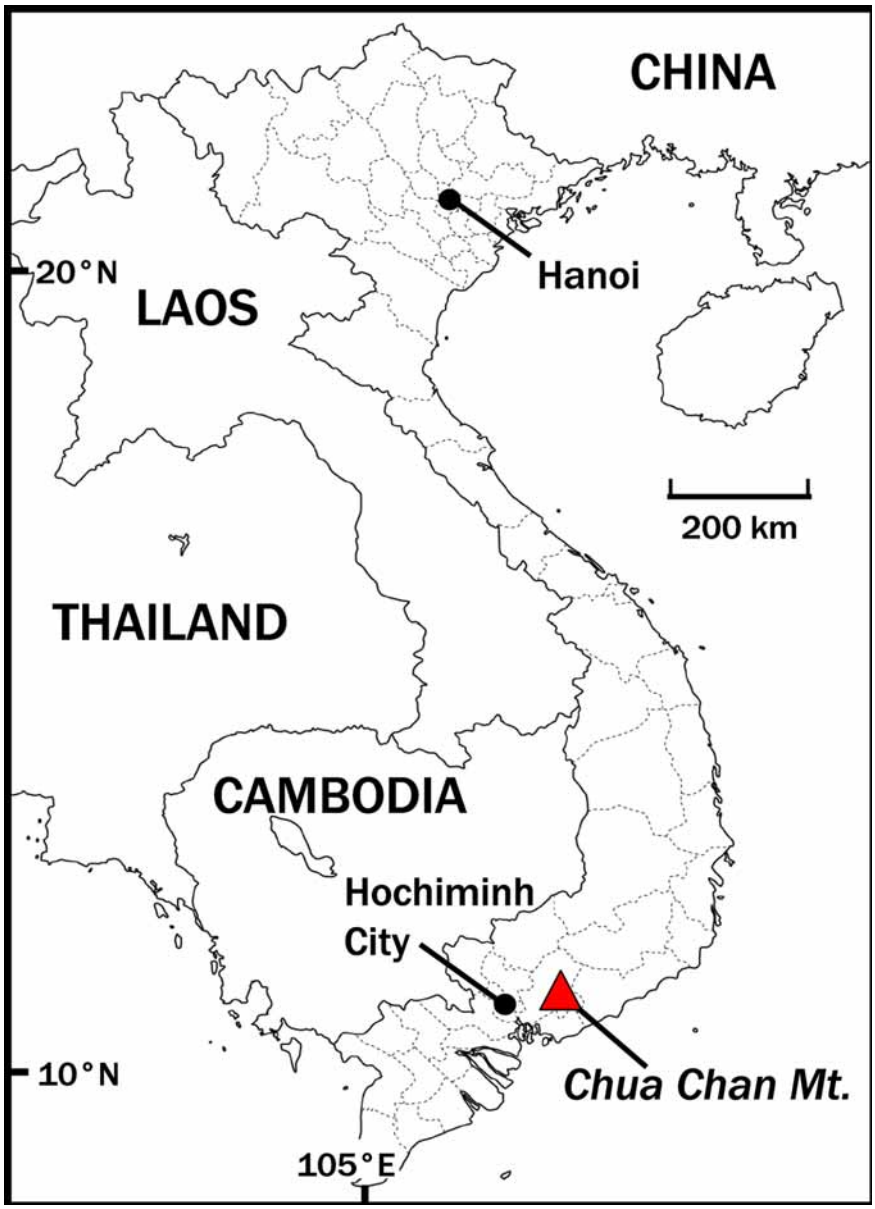

FIGURE 1. Map showing the type locality (red triangle) of *Gekko russelltraini* **sp. nov.**, Chua Chan Mountain, southeastern Vietnam.

TABLE 1. Mensural and meristic data for the type series of *Gekko russelltraini* **sp. nov.**

	Holotype UNS0293	Paratype UNS 0280	Paratype UNS 0294	Paratype UNS 0295	Paratype UNS 0359	Paratype UNS 0281	Paratype UNS 0292	Paratype UNS 0358	Paratype UNS 0360	Min – Max $\bar{x}$ ± S.D.
Sex	M	M	M	M	M	F	F	F	F	
SVL	71.3	70.3	77.5	82.9	66.5	76.7	71.7	75.8	70.3	66.5 – 82.9 73.7 ± 5.0
TailL	84.8	81.8	69.9	63.0	74.8	79.2	73.8	89.8	65.9	63.0 – 89.8 75.9 ± 8.8
HeadL	19.0	17.9	20.3	21.3	17.6	19.9	19.0	20.4	18.7	17.6 – 21.3 19.3 ± 1.2
HeadW	13.3	12.3	13.9	14.5	12.7	13.5	12.9	14.3	12.8	12.3 – 14.5 13.4 ± 0.8
HeadD	8.1	7.9	8.9	9.1	7.3	8.1	7.8	7.6	7.1	7.1 – 9.1 8.0 ± 0.7
SnEye	8.6	8.4	9.3	9.9	7.3	9.6	8.8	8.3	7.5	7.3 – 9.9 8.6 ± 0.9
OrbD	5.0	4.4	5.1	6.2	4.6	5.5	5.2	5.3	5.0	4.6 – 6.2 5.1 ± 0.5
EarL	1.9	2.0	1.9	2.2	1.9	2.0	2.3	2.2	2.1	1.9 – 2.3 2.1 ± 0.2
EyeEar	6.4	6.1	6.8	7.6	6.3	6.9	6.6	6.9	6.5	6.1 – 7.6 6.7 ± 0.4
Interorb	6.7	6.8	7.6	7.5	5.9	7.3	7.3	6.9	6.6	5.9 – 7.6 7.0 ± 0.5
Internar	1.8	1.7	2.0	2.2	2.0	1.8	1.7	2.3	1.9	1.7 – 2.3 1.9 ± 0.2
ForeaL	9.3	9.4	10.6	10.7	8.5	10.0	9.3	10.2	9.2	8.5 – 10.7 9.7 ± 0.7
CrusL	12.6	13.1	13.7	13.8	11.7	13.2	12.2	12.7	11.5	12.2 – 13.8 12.7 ± 0.8
TrunkL	31.0	33.8	35.1	37.1	29.7	33.1	30.7	32.9	30.0	29.7 – 37.1 32.6 ± 2.5
Midbod	101	101	107	96	93	92	91	97	90	90 – 107
TubRow	16	12	10	17	14	12	12	15	16	12 – 16
VentSc	28	28	28	28	30	30	28	28	29	28 – 30
ChinSc	7	5	6	6	7	7	5	7	6	5 – 7
SupraL	13/14	12/12	14/14	13/13	14/16	12/12	12/12	15/13	14/14	12–15/12–16
InfraL	13/13	14/13	13/13	12/12	12/12	12/13	12/12	12/12	12/11	12–13/11–13
IntNas	2	2	2	0	1	2	1	1	1	0 – 2
FrontSc	17	19	21	17	17	17	20	17	18	17 – 20
IntOrb	30	31	33	31	32	32	34	31	34	30 – 34
LamPesI	15	16	15	16	16	15	15	15	16	15 – 16
LamPesIV	18	19	17	17	18	17	18	18	17	17 – 19
PrecP	10	11	9	9	8	0	0	0	0	8 – 11
Whorl3	11	12	–	–	11	10	10	11	11	10 – 11

FIGURE 2. Habitat of *Gekko russelltraini* **sp. nov.** on Chua Chan Mountain, Dong Nai Province, southern Vietnam.

Discussion

Chua Chan Mountain is an isolated peak, well separated from the Truong Son mountain range. In addition to being the type locality of *G. russelltraini*, it is also the type (and only known) locality of the recently described *Cyrtodactylus huynhi* (Ngo & Bauer 2008). Such small apparent areas of endemism have precedence elsewhere in southern Vietnam. Ba Den Mountain in Tay Ninh Province, another isolated peak, approximately 140 km distant from Chua Chan Mountain, is likewise the sole locality of several geckos: *Gekko badenii* and two species of *Cyrtodactylus*, *C. badenensis* and *C. nigriocularis* (Nguyen et al. 2006). To date no comprehensive herpetofaunal diversity surveys have been conducted on Chua Chan Mountain, but three species of snakes: *Psammodynastes pulverulentus* (Boie), *Cryptelytrops albolabris* (Gray), and *Calloselasma rhodostoma* (Reinwardt in Boie) have been recorded there (Campden-Main 1970). Further investigations may reveal additional species of geckos, or other reptiles, that are unique to this isolated mountain.

Further sampling of members of the group including *G. russelltraini*, *G. petricolus*, *G. badenii*, *G. ulikovskii*, and *G. grossmanni* is required. At present, only *G. petricolus* is known to have a reasonably wide distribution in Thailand (Nabhitabhata *et al.* "2000" 2004), whereas all other species are restricted to single localities in southern Vietnam. The distance and habitat disjunctions between the members of this group of geckos strongly supports their specific distinctiveness despite their morphological similarity, although the possible synonymy of *G. badenii* and *G. ulikovskii* has been suggested (Nguyen *et al.* 2009). Genetic distinctiveness of those members of the group that have been sequenced (*G. ulikovskii*, *G. petricolus*, *G.g rossmanni*) also supports the validity of these allopatric forms (Bauer, Jackman & Greenbaum, unpublished data). Molecular phylogenetic data from *Gekko*, as well as from other gecko genera exhibiting extensive localized endemism in Vietnam (*Cnemaspis*, *Cyrtodactylus*) will certainly help to clarify the biogeographic history of the Truong Son Range and outlying isolated peaks.

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